

City of Edmonton – Engineering Services

# Rossdale Power and Water Treatment Plant, Tier 2 Risk Assessment and Risk Management Plan

#### Prepared by:

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February 07, 2018 Project Number: 60443747

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# **Revision History**

Revision #	Date	Revised By:	Revision Description
0	November 27, 2017	Craig Harris	Draft
1	February 07, 2018	Craig Harris	Final
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Rpt-2018-02-07 Rossdale Tier 2 Risk Assessment-Risk Mgmt - 60443747



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February 07, 2018

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Dear Mrs. Dolen:

Project No: 60443747

Regarding: Rossdale Power and Water Treatment Plant Tier 2 Risk Assessment and Risk

**Management Plan** 

AECOM Canada Ltd. is pleased to provide this final report. If there are additional information requests, please do not hesitate to contact the undersigned.

Sincerely,

**AECOM Canada Ltd.** 

Craig Harris, M.Sc., P.Geol., R.P.Bio.

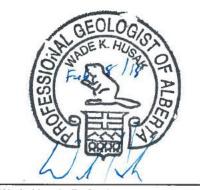
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# **Executive Summary**

The City of Edmonton retained AECOM to conduct a Risk Assessment (RA) as part of the proposed "*Touch the Water*" project. The Touch the Water projects includes recreational land use improvements along the northern banks of the North Saskatchewan River (NSR) between the new Walterdale Bridge and the Rossdale Emergency Response and Fire Station 21. These lands were part of an industrial power plant which served the City of Edmonton. The focus of the RA is the contamination along the river bank, taking into consideration potential contaminant migration from the EPCOR lands to the north. The intent of the RA is to evaluate the feasibility of insitu risk management for legacy contamination associated mainly with the historical power plant, rather than the more disruptive physical remediation. The results of the RA will support the design and construction of the Touch the Water Project and establish future monitoring requirements for the Risk Management Plan.

The broad scope of work for this Risk Assessment/ Risk Management Plan (RA /RMP) is captured in the following bullets:

- Collection and consolidation of all relevant historical investigation data
- Complete a Tier 2 pathway-receptor analysis (Problem Formulation)
- Preliminary Conceptual Model and Tier 2 strategy
- Phase II ESA Contaminant Distribution, Gap Analysis and Gap Closure
- Complete Exposure and Effects Assessment

The Rossdale Site has a long history of human occupation that dates back well before the 1800s when the local First Nation used the area. In1908, the north portion of the area was developed for the Edmonton Industrial Exhibition Grounds and the southwest corner was developed for the Electric Light and Waterworks. During the early 1900s the power plant was fuelled with coal arriving by rail. By 1937 stockpiled coal was evident along the north and west sides of the power plant. The eastern portion was the site was initially occupied by the John Walter Saw Mill and then later in the mid 1950's by the City of Edmonton as a fire training facility. In the early years burning in open pits for fire training purposes occurred in the south portion of the fire training facility. Over the years both the power plant and the waterworks continued to expand their respective building footprints and the Site gained substations and various out buildings associated with power generation and/or water collection and treatment. Areas on site, particularly along the bank of the NSR may have experienced significant filling either from off-site or on-site sources.

In summary, the historical activities that have potential to impact the soil and groundwater quality are:

- 1. Burial of ash from coal fire power generation
- 2. Stockpiled raw coal
- 3. Creosote timbers and piles as part of early building foundations and possibly to stabilize the river bank
- 4. Deposition of suspect quality fill
- 5. Storage of bulk fuels in either above ground or underground tanks
- 6. Burning in open pits for fire training purposes

This RA/ RMP will addresses what may be considered non-point sources listed above (1, 2, 3, and 4). Based on prior assessment work (Nichol's 2015) point source impacts, inclusive of storage of fuels in above and below ground tanks, do not require further remediation/ risk management. The contamination associated with the former burn pits (6) will be deferred, rather than being addressed herein. This is because there is a recognition that further characterization and physical remediation is required.

Based on the description of the land use, surrounding environment and hydrogeological setting, surface and groundwater use, the following receptor-pathway combinations are deemed relevant and applicable to the Rossdale Industrial lands and adjacent parkland.

- Domestic Use Aquifer (DUA)
- Direct soil human exposure: ingestion, dermal, dust inhalation
- Indoor vapour intrusion and inhalation
- Protection of groundwater for aquatic life
- Direct soil and groundwater exposure: plants and invertebrates

Relative to Human Health Protection, Contaminants of Concern in the Soil are:

- Arsenic and lead in the fill frequently exceed their respective direct human contact Tier 2 guidelines
- Benz[a]pyrene Total Potency Equivalents (B[a]P TPE) where the creosote pile was discovered (16-02) exceeds
  its direct human contact Tier 2 guideline
- Benz[k]fluoranthene, benz[b&j]fluoranthene and commonly B[a]P Index of Additive Cancer Risk (IACR) exceed their respective Tier 2 soil quality guidelines for protection of DUA
- Where the creosote pile was encountered several high molecular weight Polycyclic Aromatic Hydrocarbons
  (PAHs) are above their respective Tier 2 soil quality guidelines protective of DUA: B[a]P, benz[b&j]fluoranthene,
  benz[k]fluoranthene, benz[g,h,i]perylene, chrysene and B[a]P IACR

Relative to Ecological Protection, Contaminants of Concern in the Soil are:

- Barium and boron are most commonly observed above their respective Tier 2 eco-contact guidelines
- Arsenic, beryllium, copper, cobalt, chromium, lead, molybdenum, nickel, selenium, tin and zinc are also observed in one or more locations above their respective Tier 2 eco-contact guidelines
- Saturated paste boron is also present above its soil quality guideline protective of aquatic life
- Anthracene, benz[a]anthracene, benz[a]pyrene, fluoranthene, naphthalene, phenanthrene, pyrene are the most common PAH present above their respective soil quality guidelines protective of aquatic life
- Where the creosote pile was encountered, the above list of PAHs are found with the addition of acenaphthalene and fluorine and the magnitude of concentrations for anthracene and fluoranthene are such that their eco-contact guidelines are exceeded

Relative to the drinking water protection guidelines (DUA pathway), contaminants of concern in groundwater are:

- Manganese and Total Dissolved Solids (TDS) are almost always observed
- Nitrate and chloride are the second most frequent contaminants
- Boron is observed at TH10-1
- In a total metals analysis, iron is common

Relative to the guidelines for the protection of the freshwater aquatic life pathway, contaminants of concern in the groundwater are:

- Nitrate and chloride are the main anions observed
- Boron and selenium are the most frequent metalloids observed
- Much less frequent are aluminum, copper and mercury
- In a total metals analysis the list above expands to include: arsenic, cadmium, iron, lead, zinc and copper and mercury are more frequent
- Anthracene, benz[a]anthracene, benz[a]pyrene, fluoranthene, pyrene

The exposure point concentration (EPC) for both direct soil contact pathways were assessed based on the upper statistical bounds: the upper 95 % confidence limits on the mean and the 90<sup>th</sup> percentile. The rationale as follows:

- A mobile receptor has the ability to move around the site and, therefore, will experience an averaged direct contact soil exposure
- A sessile receptor, such as plants and soil invertebrates, is protected at the population level, and setting the
  acceptable EPC at the upper 90th percentile implies that less than 10 percent of the plant and soil invertebrate
  population may be adversely affected

The ratio of exposure relative to the soil quality guideline (SQG) is the Hazard Quotient, calculated as follows:

$$Hazard\ Quotient = EPC/SQG$$

In all cases the SQG for eco-contact and direct human contact is the respective guideline concentrations listed in Table A-3 of the Alberta Tier 1 Soil and Groundwater Guidelines. Based on the statistical upper bounds EPC, the following is concluded:

- The upper bounds EPC for arsenic and lead are lower than both SQG eco and human for these substances;
   therefore negligible ecological and human health risk is concluded
- The upper bounds EPC for B[a]P TPE is lower than SQG <sub>human</sub>; therefore negligible human health risk is concluded
- Barium and boron (saturated paste) upper bound EPCs are 2.2 and 2.7 times their respective SGG <sub>eco</sub>;
   therefore, these substances are carried into the risk management plan.

The groundwater mediated pathway was assessed further through the application of a contaminant mass flux loading estimate to the NSR. The flux assessment is intended as a broad order of magnitude check on the total mass flux of groundwater mediated contaminant transport to the NSR. The flux analysis suggests that the key groundwater contaminants most likely related to the Rossdale fill are:

- Boron and selenium
- Chloride and nitrate

Other contaminants are either not contributing a significant mass load (e.g. PAH) or are likely confounded by naturally elevated concentrations or entrained sediment in samples (e.g. aluminum / iron). With reference to Figures 10 through 13, the following points provide context to the mass flux estimates.

#### **Chloride**

- The pattern of the plume strongly suggests a source that may be related to road de-icing and/or stockpiling of cleared snow
- The magnitude of concentrations are not excessive (125 -550 mg/L)
- Total annual loading (1500 kg) is insignificant when compared to the annual discharge base flow in the NSR (~ 150 million m³ during low flow) = 0.1 μg Cl/L

#### Nitrate

- The pattern of the plume(s) potentially reflect historical (early 1900's) use of the property as the Edmonton Exhibition Grounds, which would have involved livestock and subsequent manure
- The magnitudes of concentrations are highest in the far west (TH10-1) and eastern extent of the former power plant (TH15-4), but are still only reaching 2 times the drinking water guideline
- Total annual loading would be negligible considering the annual discharge in the NSR (~ 10<sup>-6</sup> mg NO<sup>3</sup>/L)

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#### **Boron**

- It is recognized that boron in the fill is likely associated with scattered brick and coal; yet there is only one location adjacent to the NSR where boron is elevated in the groundwater (BH16-06)
- The magnitude of the dissolved, and total boron in this location is only marginally above the aquatic life guideline
- Total annual loading would be negligible considering the annual discharge in the NSR (~ 10<sup>-7</sup> mg B/L)

#### Selenium

- The pattern suggests multiple isolated plumes that are coincident with a historical source that may be related to the former hazardous waste storage (Area 4)
- The magnitude of the observed concentrations are all very minor, for example 1.3 to 9 μg/L above the aquatic life guideline
- $\bullet$  Total annual loading would be negligible considering the annual discharge in the NSR (~  $10^{-10}$  mg Se/L)

There is no evidence of elevated metals or PAH in the sediment chemical analysis from below the Rossdale Site. Further exposure and effects assessment of the groundwater pathway requires input from Alberta Environment and Parks (AEP).

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# 1. Introduction and Site Characterization

The City of Edmonton retained AECOM to conduct a Risk Assessment (RA) as part of the proposed "Touch the Water" project. The Touch the Water project includes recreational land use improvements along the northern banks of the North Saskatchewan River (NSR) between the new Walterdale Bridge and the Rossdale Emergency Response and Fire Station 21. These lands were part of an industrial power plant which served the City of Edmonton. The focus of the RA is the contamination along the river bank taking into consideration potential contaminates migration from the EPCOR lands to the north. The intent of the RA is to evaluate the feasibility of insitu risk management for legacy contamination associated mainly with the historical power plant, rather than the more disruptive physical remediation. The results of the RA will support the design and construction of the Touch the Water Project and establish future monitoring requirements for the Risk Management Plan

# 1.1 Scope of Work

The scope of work for this risk assessment and risk management plan was conceived following a preliminary review of background environmental assessment reports on the Rossdale Lands. The legal description of these lands as follows: 9469 Rossdale Road and 10155-96 Avenue NW. Plan NB, Block OT.

The broad scope of work for this project is captured in the following bullets:

- Collection and consolidation of all relevant historical investigation data
- Complete a Tier 2 pathway-receptor analysis (Problem Formulation)
- Preliminary Conceptual Model and Tier 2 strategy
- Phase II Environmental Site Assessment (ESA) Contaminant Distribution, Gap Analysis and Gap Closure
- Complete Exposure and Effects Assessment

# 1.2 Historical Document Review

The following two documents were reviewed in the preparation of this pathways analysis and risk management plan:

- Thurber Engineering Ltd. April 2013. Phase I Environmental Site Assessment 9469 Rossdale Road NW and 10155 – 96 Avenue NW Edmonton (Block OT Plan NB, Block C Plan 3641CL and Block OT Plan 5543KS). Submitted to City of Edmonton.
- Nichols Environmental (Canada) Ltd. February 2015. Phase II Environmental Site Assessment Rossdale Lands 9469 Rossdale Road NW & 10155-96 Avenue NW Block OT; Plan NB Edmonton, Alberta. Prepared for The City of Edmonton.

Subsequent to these initial document reviews, the desire for a more comprehensive electronic database to enable a thorough understanding of site conditions, necessitated the review and extraction of data from the following historical reports:

- Tier II Risk Assessment & Risk Management Plan
- a. Thurber Engineering Ltd. August 31, 2011. Environmental Soil Sampling Walterdale Bridge Replacement, 105 Street and North Saskatchewan River, Edmonton, Alberta.
- Thurber Engineering Ltd. September 25, 2012. Environmental Soil Sampling Bridge Abutment Characterization Program: Walterdale Bridge Replacement Project, Edmonton, Alberta.
- c. EBA, September 2001, Phase 2 Environmental Site Assessment Fire Hall Rossdale Emergency Response Site, 94 Avenue/101 Street, Edmonton, Alberta. With associated correspondence from EPCOR and Alberta Environment.
- d. EBA, January, 2002. Phase 3 Environmental Site Assessment Fire Hall Rossdale Emergency Response Site, 94 Avenue/101 Street, Edmonton, Alberta. With associated correspondence from EPCOR and Alberta Environment.
- e. EBA, May 2002. Additional Drilling, Sampling, and Testing Rossdale Emergency Response Department (ERD) Site, 94 Avenue/101 Street, Edmonton, Alberta. Submitted to EPCOR.
- EBA, December 8, 2003. Letter: RE: Spring 2003 Groundwater Monitoring Data, Rossdale Emergency Response Department (ERD) Site.
- EBA, January 20, 2005. Letter: RE: Groundwater Monitoring Summary June 2005, Rossdale Emergency Response Department (ERD) Site.
- h. Thurber Engineering Ltd. March 2, 2010. Phase II Environmental Site Assessment, Rossdale Power Generating Station, 9469 Rossdale Road and 10155 - 96 Avenue, Edmonton, Alberta.
- Thurber Engineering Ltd. November 22, 2013. Phase III Environmental Site Assessment Proposed EPCOR Water Quality Assurance Laboratory and Office Building, 9469 Rossdale Road NW, Edmonton, Alberta.
- Thurber Engineering Ltd. August 27, 1997. Soil Monitoring at Rossdale Power Generating Stations, Edmonton, Alberta.
- k. Thurber Environmental Consultants Ltd. September 30, 1999. Phase III Environmental Site Assessment EPCOR, Rossdale Generating Station, Edmonton, Alberta.
- Thurber Environmental Consultants Ltd. February 01, 2001. Monitoring Well Installation, Rossdale Power Plant, Edmonton, Alberta.
- m. Thurber Environmental Consultants Ltd. March 30, 2004. 2003 Groundwater Monitoring at EPCOR, Rossdale Generating Station, Edmonton, Alberta.
- n. Thurber Engineering Ltd. August 03, 2012. Soil Investigation Proposed Sodium Hypochlorite Building, 10155-96 Avenue, Edmonton, Alberta.
- o. Thurber Environmental Consultants Ltd. November 26, 1992. Preliminary Environmental Investigation, RE: Bottom Ash and Groundwater at the Rossdale Treatment Plant, Edmonton, Alberta.
- Stantec Consulting Ltd. March 12, 2010. Geotechnical Site Investigation, Rossdale Water Treatment Plant Dechlorination Project, 9469 Rossdale Road, Edmonton, Alberta.
- g. Stantec Consulting Ltd. December 21, 2011. Limited Environmental Site Assessment Proposed WTP Sodium Hypochlorite Building, Rossdale Water Treatment Plant, Edmonton, Alberta.
- Thurber March 2016. 2015 Groundwater Monitoring Report Former EPCOR Rossdale Power Generating station, 9469 Rossdale Road, Edmonton, Alberta.

#### 1.2.1 **Historical Activities Summary**

The Site has a history of human occupation that dates back well before the 1800s when the local First Nation used the area. The earliest records (1883) show the lands were originally controlled/owned by the Hudson's Bay Company but development did not occur until 1908, when the north portion of the Site was developed as the Edmonton Industrial Exhibition Grounds and the southwest corner was occupied by Electric Light and Waterworks. During this era, the eastern portion (Fire Station #21) was the site of the John Walter Saw Mill.

The earliest aerial photograph available is 1924 and shows further development of the power plant and water treatment plant. This included rail spurs developed along the western Site boundary and south of the power plant; sewage treatment lagoons north of the water treatment plant; the John Walter Saw Mill appears to be shut down.

Coal arriving by rail was used to generate electricity and fueled the water treatment plant. Stockpiled coal was evident along the north and west sides of the power plant in the 1937 aerial photograph.

The 1954 aerial photograph shows the Emergency Response Station (Watermark Building) onsite and the Rossdale Fire Station #21 east of the Site. There appears to be the fire training burn pit south of the buildings and adjacent to the river. Over the years both the power plant and the water treatment plant continued to expand their respective building footprints and the Site gained substations and various out buildings associated with power generation and/or water collection and treatment. Significant filling either from off-site or on-site sources (ash from coal fire power generation) is evident along the bank of the river and west of the high pressure treatment plant.

In summary, the historical activities that have the potential to impact the soil and groundwater quality are:

- Burial of ash from coal fire power generation
- Stockpiled raw coal
- Creosote timbers and piles as part of early building foundations and possibly to stabilize the river bank
- · Deposition of suspect quality fill
- Storage of bulk fuels in either above ground or underground tanks
- Burning in open pits for fire training purposes

# 1.3 Regulatory Framework

The current Alberta Environment and Parks (AEP) framework for the management of impacted sites provides for three management options: Tier 1, Tier 2, and Exposure Control, which are described as follows:

- Tier 1 remediation guidelines are generic and designed to protect environmentally sensitive sites and can, therefore, be used at most sites without modification. The Tier 1 approach is based on the assumption that all exposure pathways and receptors relevant to a particular land use are actually present. At Tier 1, exposure pathways that are part of the generic scenario for the applicable land use may not be screened out.
- The Tier 2 approach allows for the consideration of site-specific conditions through the modification of Tier 1 guidelines and / or removing exposure pathways that may not be applicable to the site. The Tier 2 approach allows the proponent to screen out certain exposure pathways and / or modify the Tier 1 guidelines on the basis of site conditions (i.e. calculation of site-specific Tier 2 guidelines).
- Exposure Control involves risk management through exposure barriers or administrative controls based on sitespecific risk assessment.

Within a given land use, a site will fall into a range of sensitivities due to differences in receptors and site conditions.

The above guidelines are contained in the following documents:

- Alberta Tier 1 Soil and Groundwater Remediation Guidelines, February 2, 2016
- Alberta Tier 2 Soil and Groundwater Remediation Guidelines, February 2, 2016

# 1.4 Land Use, Physiographic Setting and Hydrogeology

The purpose of this section of the risk assessment is to identify, based on the physical setting the applicable Alberta Environment and Parks (AEP) Tier I receptor-pathway combinations. The location of the plant in relation to the City of Edmonton is depicted in Figure 1.0.

#### 1.4.1 Land Use On-Site and Off-Site

The Rossdale Lands are zoned for Public Utility (PU) and are essentially considered Industrial Lands. In addition, the EPCOR controlled Lands are fenced to restrict general public access. As illustrated in Figure 1.0, the surrounding land use is as follows:

East Rossdale Emergency Response and Fire Station21 (Commercial)

West Walterdale Bridge and Metropolitan Recreation Zone A

South NSR

North Rossdale Lands are zoned as Public Utilities (PU) and EPCOR holds an Industrial Permit

The lands that are of particular interest to the City of Edmonton are the parkland zone between the Rossdale Lands and the NSR. This is the land targeted for the "*Touch the Water*" development. Along the eastern boundary 101 Street transects the EPCOR property from the City owned Rossdale Emergency Response and Fire Station 21. North of the EPCOR controlled lands, but south of 96 Avenue, lies John Ducey Park. Although this falls within the overall "Rossdale Lands", it is zoned as Metropolitan Recreation Zone A.

Within the EPCOR Industrial Lands the property is divided between the former Power Plant (west), electrical substation (north) and Water Plant (east). Industrial activities are described in the annual groundwater monitoring report Thurber March 2016 and detailed Figures 2 through 7 identify these different areas.

Due to the fact that the southern, northern and to some extent eastern boundary of the EPCOR Industrial Lands border on parkland land or residential use, a 30 metre (m) buffer is applied inside the EPCOR property along all of these boundaries.

# 1.4.2 Topography, Drainage and Surface Water

The Rossdale Lands lie within the floodplain of the NSR, but the land is raised, partially through fill, above the NSR by approximately 6 m. Surface drainage is generally directed to catch basins throughout the Industrial property, which ultimately discharge through outfalls into the NSR. The NSR forms the south boundary of the Rossdale Lands and is expected to be hydraulically connected to the saturated granular 'basal' deposits below the Site.

The NSR represents an important source of water and Thurber (March 2016) identified four surface water licences within 5 kilometres (km) of the site:

- Royal Mayfair Golf Club (upstream)
- University of Alberta (upstream)
- EPCOR (on site)
- Highlands Golf Club (downstream)

On an annual basis, the largest water user is EPCOR with greater than 149 million cubic metres (m³) drawn and greater than 106 million m³ returned. The University draws greater than 21 million m³ and returns roughly 20 million m³. To put this into perspective, mean annual discharge recorded between 2000 and 2014 at the Environment Canada flow station below Rossdale Power Plant ranges from a low of ~150 million m³ to a high of ~270 million m³.

## 1.4.3 Geology

The objective of this regional hydrogeological description is to establish knowledge of the important aquifers in the area. This section is developed from the review of Andriashek, L.D., 1988, Hydrogeological Consultants Ltd., 2001, and Kathol, C.P. and McPherson, R.A., 1975.

The bedrock in the area consists of the Cretaceous-aged Horseshoe Canyon Formation. The Horseshoe Canyon Formation consists of non-marine interbedded clayey sandstones, bentonitic mudstones and carbonaceous shale with scattered coal and bentonite beds of variable thickness. Based on cross sectional data in Kathol & McPherson, 1975, the bedrock may be encountered at some point between 10 to 15 m below grade in the location of interest.

The Rossdale Power and Water Treatment Plant is located within the North Saskatchewan River flood plain. Kathol & McPherson, 1975, mapped the entire area as a river terrace alluvial deposits consisting of sand and gravel. All of the quaternary deposit, including pre-glacial channels, tills and Glacial Lake Edmonton Silts are not present in this particular area of the river flood plain. The pre-glacial Stony Channel is mapped north of the Rossdale site.

The alluvial deposits within the hyporheic zone surrounding the NSR are considered a reliable and productive source of water. In fact, the EPCOR plant upstream draws domestic water from below the river within this hyporheic zone.

#### 1.4.3.1 Localized Geology

Based on the review and interpretation of the geological logs produced by Nichols and Thurber, the lithology displays some complexity, yet can be simplified into the following:

- Sand and Gravel fill with occasional descriptions of coal, cinders, brick, wood and concrete
- Clay fill characterized as clay, silt and sand sized fractions to a depth range of 3.0 to 5.0 m with occasional descriptions of coal, cinders, brick fragments, wood and concrete.
- Silt or sand (alluvium) to a depth range of 7.0 m to 9.0 m
- Gravel (alluvium) to a depth range of 10.0 m to 11.0 m
- Siltstone (bedrock) encountered between depths of 10.0 m to 15.0 m

This site-specific lithological description is consistent with the regional picture.

#### Soil Matrix Parameters

Numerous grain size analysis have completed throughout the years of investigation in the Rossdale Lands. The results are mixed, much as the site-specific geology. To generalize the clay fill would be best characterized as fine; however, the basal sand/gravel is best characterized as coarse.

The selection of grain size for surface related exposure pathways (*i.e.* vapour intrusion) is not straightforward. The shallow fill is sand and gravel in some areas, but clay dominated in other areas. Overall, a coarse grain selection is appropriate, with an allowance for site-specific modifications. In the Record of Site Condition attached to the Thurber report (March 2016), the coarse grained category is listed.

There are no records of organic carbon content that were identified in the listed background documents.

#### 1.4.3.2 Geological Cross Sections

Geological cross sections have been developed to help illustrate the lithology generalized above. The cross sections also contain detailed information on the elevation of the groundwater table and depth locations where soil contaminants have been observed. The cross section plan is presented in Figure 7 and the cross sections themselves are found on Figure 8.

## 1.4.4 Hydrogeological Model

#### 1.4.4.1 Water Table and Gradients

Thurber (March 2016) indicates the water table is generally restricted to the deeper sand, which is referred to herein as the 'basal' sands. This is coincident with a depth of between 9 to 10 m below grade within the Rossdale lands. The water level readings within the sentinel wells along the NSR (16-series), installed and monitored by City of Edmonton, provides corroboration with water at 7.3 to 11.5 m below grade. This is also coincident with what is considered the 'basal' alluvial sands. The water table contours for September 2016 are portrayed in Figure 9.

For the evaluation of mass flux (Appendix G), AECOM examined six pairs of horizontally off set wells to determine an appropriate horizontal gradient. The average gradient (i) was 0.02 toward the south-southeast.

Considering that the lower basal sands / gravels are the primary saturated geological unit and atop clay shale bedrock, there are no nested wells to evaluate vertical gradients. The predominant gradient governing risks to the NSR is the horizontal gradient.

#### 1.4.4.2 Hydraulic Conductivity

Thurber (March 2016) lists three hydraulic conductivity values, as follows:

MW99-2 in silt over sand lithology (proximal to MW16-05)
 2.7 x 10<sup>-8</sup> metres per second (m/sec)

MW99-3 in sand lithology
 7.0 x 10<sup>-6</sup> m/sec

• TH10-7 in sand lithology (proximal to MW14-17) 1.4 x 10<sup>-5</sup> m/sec

Hydraulic conductivity testing was completed by City of Edmonton staff on key sentinel wells. Results are summarized in Table A below and details are provided in Appendix E.

Table A: Summary of Hydraulic Conductivity for Sentinal Monitoring Locations

Well	Screened Lithology	Hydraulic Conductivity (m/s) June 2017	Hydraulic Conductivity (m/s) October 2017
14-15	Sand + Bedrock	6.4E-06	1.9E-05
14-17	Sand and Gravel + Bedrock	2.5E 06	7.5E-05
16-02	Gravel	1.5E-06	121
16-08	Sand and Gravel	1.1E-06	12
16-05	Sand and Gravel + Clay Shale	9.5E-07	120
16-07	Sand and Gravel	3.8E-07	12
16-06	Sand and Gravel + Clay Shale	3.3E-08	<b>I</b>

Note: Original estimates gathered June 29, 2017 using manual drawdown and manual recording of rising head. Data quality was sufficient for all but the rapidly recovering wells14-15 and 14-17. The October 2017 estimates were gathered using a slug to displace the water and transducer to record changing head pressure over time. The October estimates for 14-15 and 14-17 supersede the prior estimates shown with strikeout.

We note that south of the Low Pressure (LP) Plant between Thurber's (TH10-7) hydraulic conductivity estimate and the City's estimates at 14-15 and 14-17 are very close. Throughout other areas along the northern banks of the NSR, the hydraulic conductivity ranges between 10<sup>-6</sup> and 10<sup>-8</sup> m/sec; consistent with the Thurber data.

#### 1.4.4.3 Groundwater Users

Thurber (March 2016) provided a thorough analysis of the number and types of groundwater supply wells within a 5 km radius of the Site. The results returned 88 historical groundwater wells including domestic use, investigation use, irrigation use, stock use, industrial use and several with no use listed.

These wells are focused along the NSR valley and also through the Beverly and Stony buried valleys. It has not been verified if any of these wells currently exist.

# 1.5 Characteristics of Contamination

# 1.5.1 Preliminary Interpretation

The historical activity which led to the general, non-point source contamination is believed to be associated primarily with the burning of coal and subsequent deposition of ash in the early 1900s. The random distribution of bricks and other debris attributed to poor quality industrial fill is another non-point source of soil contamination. Based on field observations and review of borehole logs, thicker areas of suspect fill are found west of the former high pressure (HP) Plant and along the NSR. East of the LP Plant the suspect fill is roughly 3 m thick. There are also clear point source contamination areas, such as various underground fuel storage tanks, fire training burn pit(s) south of the Watermark Building. Creosote treated timber may also be a source, particularly west of the HP Plant.

The Nichols Phase II ESA (February 2015) provided an initial assessment and clarified the status of many of the point source areas. For consistency, AECOM will adopt Nichols Areas of Potential Concerns, or APECs, as summarized below in Table B.

Table B: Summary of Potential Areas of Environmental Concern

APEC	Description	Remedial Actions or Current Condition	Resolution	Recommendation
Area 1	Mercury spillage from instruments occurred at the former Northwestern Utility Ltd. (NUL) natural gas metering station on the Rossdale plant.	This area was remediated by NUL and Komex International Ltd. had conducted a post-remedial investigation. Certain discrete samples contained sufficient total mercury to trigger an exceedance of current Tier 1 guidelines.	Nichols 2015 follow-up investigation did not find any anomalous mercury in the soil and no further recommendations were provided.	No further work required. Not included in the current scope for risk assessment (RA).
Area 2	The decommissioned reactivator plant had been built on creosote treated timber piles that have remained in-situ post decommissioning.	Residual groundwater detection of dibenzofuran and dioxin continue to persist as of the latest Nichols 2015 groundwater testing	Considering the concentrations were compliant with Tier 1 guidelines and no future land disturbance is planned for this area, Nichols did not make any recommendation for further work.	There may be one additional groundwater monitoring event required in the future, but otherwise no further work required.
Area 3	This area refers to the two separate fire training burn pits that are present south of the Watermark building.	The shallower zone, which is present directly south of the Watermark building, was delineated further by Nichols 2015. The deeper burn pit has had some further assessment work directed through AECOM in 2014, but full characterization/delineation cannot be claimed	The City is planning to physically remove this accessible shallow impacted soil and will characterize and risk manage the deeper burn pit as per Fire Station 21 report.	Recognizing that additional characterization will be required, a decision was made to delay the RA for this area.
Area 4	Former machine shop, stores and hazardous materials area of the plant	Thurber March 2010 and November 2013 investigation, conducted in advance of the construction of the new water quality assurance laboratory, encountered fill typical of the Rossdale Plant with several PAHs and metals above Tier 1 <sup>(1)</sup> . Thurber (March 2016) indicates that soil (~6000 m³) within the footprint of the laboratory was excavated and transferred to a Class II Landfill.	Although this contaminated fill is EPCOR's responsibility, it is characteristic of the typical Rossdale fill and may contribute to groundwater contamination migrating toward NSR.	Due to the potential linkage to the groundwater condition and representativeness of the fill, this area is included in the RA, but under Area 5 (see below).
Area 5	Fill characteristic of the Rossdale Plant overall.	Predominantly fine, but some coarse grained fill with observation of debris, broken bricks, coal etc. Typically contains PAHs and metals above Tier 1.	Nichols 2015 identified the fact that the fill was more prevalent in southern portion of Rossdale lands	Included in RA.
Area 6	Fill between Pump House #2 and #1.	Fill with similar characteristics as Area 5, but visual evidence of ash (i.e. bottom ash).	No resolution – subject of RA	Included in RA.
Area 7	Former diesel UST along east side of Watermark Building.	Nichols 2015 investigated this area and found no evidence of residual petroleum hydrocarbons in soil or groundwater.	Area is clean	No further work required.

<sup>(1)</sup> TCE above Tier 1(soil) was discovered at 20 cm depth in TH10-10. Other test pits completed in 2013 did not repeat the TCE observation. EPCOR is risk managing this uncertainty by including TCE is the annual groundwater monitoring program. Thurber (March 2016) tested for TCE in the groundwater and it has never been detected. AECOM is not including TCE as contaminant of concern.

In summary, this RA will address Areas 4, 5 and 6. The principle objective is to assess the human and ecological risk associated with the poor quality fill generally understood to be present around the former HP Plant and decommissioned LP Plant. It is understood that filling of the Rossdale river bank occurred as far downstream as Area 3 immediately south of the Watermark Building, including ash deposits along the infilled banks of the NSR.

#### 1.5.2 Gap Closure Program

The geographical extent of the upland field gap closure program was limited to the areas immediately west and south of the former HP Plant, LP Plant and extending downstream just beyond the former Hazardous Waste Area 4. Due to the construction of the Walterdale Bridge, there were constraints on where borings and monitoring wells could be located west of the former HP Plant. This area is occupied as a construction laydown yard. A sediment sampling program was also executed which covered a wide geographical extent, from upstream at Terwillegar Park to downstream at the Riverdale community.

The objective of the upland program was to: (i) extend the investigation for the suspect bottom ash both upstream of Pump House #2 and downstream of Pump House #1; and (ii) establish a groundwater monitoring network to allow for a more definite conclusion regarding contaminant discharge to the NSR. The sediment sampling program was intended to evaluate whether the typical contaminants of concern in the Rossdale fill would be found in the sediments immediately below the Plant.

City of Edmonton staff executed both field programs, but the design of the programs was a collaborative effort among the City and AECOM technical staff. The overall program was accomplished over several site visits, and is sequentially summarized below.

On June 23, 2016 City of Edmonton completed a groundwater sampling program on select groundwater monitoring wells located east, west and south of the HP and LP Plants. Specifically Thurber TH10-7; TH12-7; TH15-4 and Nichol's 14-15 and 14-17. The following procedures occurred:

- Recorded water level readings on all the available wells, purging each with dedicated bailer, noting the rate of water recovery
- Groundwater quality testing was completed after the wells had 'settled' at least 30 to 40 minutes
- Water was transferred to a common bucket prior to being transferred into laboratory bottles with preservative, as required
- Field filtration occurred for dissolved metals prior to acidifying the water sample
- Common equipment was washed and rinsed with de-ionized water between samples
- Testing parameters included:
  - o Routine, major ions, nutrients
  - Dissolved metals
  - Polycyclic Aromatic Hydrocarbons (PAHs)

The field sampling sheet recording the static water levels for the June 23 2016 sampling event is attached in Appendix B.

On July 12/13, 2016 the City of Edmonton completed a drilling program to install the sentinel monitoring wells 16-04 through 16-08. Several days later on July 21, 2016 the City of Edmonton completed the remaining installations within the Walterdale Bridge construction laydown area: monitoring wells 16-01 through 16-03. For both drilling events the following procedures were followed:

- Staff used a subcontracted solid stem power auger to advance borings to between 10.5 and 13.5 metres below ground surface (mBGS).
- Lithologic logs were produced and detailed notes made of suspect debris or ash

- Soil samples were taken from representative lithologies throughout the boring and select samples at a minimum of three depth intervals were submitted for chemical testing, as follows:
  - Grain size, total metals and PAHs

These borehole logs are attached in Appendix A.

On July 14, 2016 the City of Edmonton completed the initial purging and development of the new monitoring wells 16-04 through 16-08. For monitoring wells 16-01 through 16-03, the purging event occurred on the same day as the installation. Development of these new wells, involved purging a minimum of three well volumes. No level reading or water samples were collected on these dates.

On July 22, 2016 the City of Edmonton completed groundwater sampling program on select groundwater monitoring wells located east of the LP Plant and downstream from Pump House #1: Specifically 16-04 through 16-08. The specific procedures described for the June 23, 2016 event were followed. The chemical testing program included:

- Routine, major ions, nutrients
- Dissolved & total metals
- PAHs

On July 26, 2016 the City of Edmonton completed groundwater sampling program on select groundwater monitoring wells located within the Walterdale Bridge construction laydown and upstream from Pump House #1: Specifically 16-01 through 16-03. The specific procedures described for the June 23, 2016 event were followed. The chemical testing program included:

- · Routine, major ions, nutrients
- Dissolved metals
- PAHs

On September 13, 2016 the City of Edmonton completed groundwater sampling program on all sentinel groundwater monitoring wells, including Nichol's 14-15, 14-17 and all City installed 16-01 through 16-08 wells. Procedures used were as follows:

- · Recorded water level readings on all the available wells, purging each with dedicated bailer
- Groundwater quality testing was completed after the wells had 'settled' at least 45 minutes
- Undisturbed water from a single bailer dip was transferred direct into laboratory supplied 1L amber glass bottle
- Testing parameters were limited to PAHs

All groundwater sampling field records from July and September 2016, complete with water level readings, are attached in Appendix B.

On November 15, 2016 the City staff completed a sediment sampling program throughout the NSR valley. The details on the methods, including photographs of the sediment sampling locations are provided in Appendix C. Very briefly, the following methods capture the essence of the methods:

- Sandy, silty clayey sediments from the upper 10 cm depth were collected, often in shallow (10 15 cm) water
- Sample locations from upstream at Terwillegar Park to downstream at the Riverdale community, and included two location immediately below the Rossdale area
- Common equipment used, a scoop and composite mixing bowl, were stainless steel and cleaned with Alconox and rinsed with deionized water between sample locations
- Sediment was composited and transferred into glass jars supplied by the laboratory

Sediment samples were submitted for analysis of total metals and PAHs

Between June 27 and July 05, 2017 the City of Edmonton completed groundwater sampling program on all sentinel groundwater monitoring wells. The specific procedures are as follows:

- Recorded water level readings on all the available wells, purging each with dedicated bailer
- Groundwater quality testing was completed after the wells had 'settled' at least 45 minutes
- Undisturbed water from a single bailer dip was transferred direct into laboratory supplied bottles
- Wells were allowed to 'settle' again before additional laboratory bottles were filled
- Field filtration and acidification occurred for dissolved and total metal analysis
- Testing parameters were:
  - o Routine, major ions, nutrients
  - Dissolved & total metals
  - o PAHs

# 1.5.3 Post Gap Closure Contaminant Characterization and Distribution

The interpretation is organized according to the contaminant categories: metals first and then Petroleum Hydrocarbons (PHCs) and PAHs. The interpretation refers to the following figures, which are attached to this report.

Figure 2: Soil Metal Distribution

Figure 3: Soil PAHs and BTEX, CCME F1 to F4 Distribution

Figure 4: Dissolved Metals, TDS and Nitrate Figure 5: Groundwater PAHs Distribution

Figure 6: Groundwater BTEX, CCME F1, F2 and F3 Distribution

#### 1.5.3.1 Metals in Soil

Table 1 presents a summary of the metal analytical results in soil from the site, including the applicable Tier 2 guidelines and pathways. Below is the general interpretation of the inorganics with hypothesis regarding their possible historical source. The detailed listing of inorganic contaminant s exceeding various Tier 2 pathways will be presented in Section 2.3.

#### Bottom Ash (Area 6) and Former Hazardous Waste Storage (Area 4)

Areas around the LP Plant, including bottom ash (Area 6), and former hazardous waste storage (Area 4), are most commonly characterized with elevated barium. The human health Tier 2 exceedances (shown in red on Figure 2) are attributed to arsenic. AECOM suspects that this metal pattern is attributed to the typical handling or deliberate deposition of ash and/or coal from the early coal powered era. Coal is commonly noted in the test pit logs from the Thurber TP13 series. The metal characterization at Area 4 is different: along with the elevated barium and arsenic, beryllium, molybdenum and selenium are also present above Tier 1. Boron (hot water soluble) is present above 10 milligrams per kilogram (mg/kg). Hot water soluble concentration at, or above this magnitude, have been interpreted as exceedances of the new Tier 1 saturated paste boron guidelines. This is based on existing data from other sites within the river valley where both hot water and saturated paste analysis methods have been completed. Elevated boron (>10 but < 30 mg/kg) is associated with the elevated barium and may ultimately be traced back to the coal ash or bricks noted in the test pit and borehole logs. Soil analysis from the installation of sentinel wells installed upstream and downstream of the Pump Houses (16-01 through 16-08) confirms that saturated paste boron is present at concentrations that exceed Tier 2 pathways for aquatic life and direct soil contact.

#### Burn Pits (Area 3)

Area 3 is shown to have periodic soil samples with elevated lead alone, or in some cases lead with barium. The lead is triggering the red human health Tier 2 exceedances in Figure 2 and exceedances are found as shallow as 0.5 m in this area. This elevated lead is not exclusively coincident with the elevated extractable PHC, but this is difficult to evaluate because both parameters were not always tested in the same samples and same depth interval. Evidence in other locations east of the LP Plant and between the Pump Houses suggest that elevated lead is also likely to be present in the general Rossdale fill.

#### 1.5.3.2 Metals, Anions, TDS and Nutrients in Groundwater

#### Bottom Ash (Area 6) and Former Hazardous Waste Storage (Area 4)

Routine parameters at Area 4 and Area 6 exceeding the drinking water and freshwater aquatic life guidelines in the groundwater are manganese, Total Dissolved Solids (TDS) and nitrate (Figure 4). In Area 4 the only dissolved trace metal in the groundwater above its Tier 1 guideline is selenium at TH12-7, TH15-3 and TH15-1. In terms of trace metals, groundwater quality west of the LP Plant differs. Toward the Walterdale Bridge, trace dissolved arsenic is observed above Tier 1 (TH12-2) and trace mercury (2 ppb above Tier 1) at TH12-6.

Recent 2016 and 2017 sampling in Area 6 (MW14-15 / 14-17) confirmed the general lack of elevated trace metals in the dissolved form. However, using a total acid digest procedure earth elements (iron/ aluminum) plus trace elements (arsenic, copper, lead and zinc) are present above their respective aquatic life or drinking water standards. Manganese concentrations are less affected by the total acid digest procedure. Recent 2016 / 2017 samples at Area 6 identified elevated chloride at MW14-15 and upstream at MW16-01/-02. Evidence of a chloride source in the former HP Plant area also turns up in TH10-4 and TH12-6. No other areas on the Rossdale Plant show elevated chloride. This may reflect undocumented storage of salt, or stockpiling of cleared snow in this area.

Downstream from Pump House #1, MW16-05 and 16-06 show evidence of dissolved selenium and boron, respectively. The selenium is consistent with groundwater findings from Area 4, and the dissolved boron is consistent with the saturated paste soil analysis described above. At the furthest downstream well (MW16-08) trace metals appear to clean up in the dissolved form and the anions and nutrient concentrations are compliant with Tier 1. Paired dissolved and total metal analysis downstream of Pump House #1 shows elevated earth elements (iron/ aluminum) plus trace elements (cadmium, copper, mercury) present above their respective aquatic life standards. Manganese, boron and selenium concentrations are less affected by the total acid digest procedure.

#### **Burn Pits (Area 3)**

In 2005, the groundwater associated with Area 3 was characterized with iron and manganese above both aquatic life and drinking water guidelines. More recent data is suggesting that, at least in the dissolved form, only TDS and manganese persist above their drinking water guidelines. Nichols 14-09 is an exception, where dissolved zinc and chloride are exceeding aquatic life guidelines.

Table 3 presents a summary of the metal analytical results in groundwater from the site, including the applicable guidelines and pathways.

#### 1.5.3.3 PAHs and PHCs in Soil

Table 2 presents a summary of the PAH and PHC analytical results in soil from the site, including the applicable guidelines and pathways. Below is the general interpretation of the organics with hypothesis regarding their possible historical source. The detailed listing of organic contaminant s exceeding various Tier 2 pathways will be presented in Section 2.3.

#### **Bottom Ash (Area 6)**

There is no indication that Area 6 has PHC impacts. The delineation and risk management issues identified in this area are related to the PAHs. AECOM has attempted to distinguish between the patterns and distribution of PAHs and relate this back to the historical activities/sources. The bottom ash is characterized with a higher number of overall PAHs and a higher frequency of the heavy molecular weight pyrogenic varieties that tend to trigger human health concerns. Elevated barium, boron, arsenic and lead appear as co-contaminants in the ash. The most recent drilling upstream and downstream from Nichol's Area 6 turned up a consistent pattern of PAH impacts and the field observations suggest that thin pockets of the bottom ash had likely been deposited all along the banks of the NSR. There is one exception to the PAH pattern: 16-02, in which an abandoned creosote pile was encountered. This is not considered representative of the general Rossdale fill.

#### Former Hazardous Waste Storage (Area 4)

The historical activities in this area are described as 'hazardous waste storage'. PAHs in shallow soils are a common occurrence in this area. The number of differing PAHs, plus the frequency and magnitude of the higher molecular weight pyrogenic variety suggest the source may be related to coal. Corroborating this hypothesis is the predominance of elevated arsenic and barium, along with several other metals. The Thurber test pit logs from the TP13 series often identify coal in the fill, but no ash. Overall, testholes within Area 4 display a very similar pattern and presence of metals compared to Area 6, but no bottom ash had been noted in the borehole logs from Area 4. There is one location (TH13-04) where PHC F3 was detected above 400 mg/kg and one other location (TH10-1) west of former HP plant where PHC F3 was also observed above 400 mg/kg.

#### **Burn Pits (Area 3)**

Significant gaps for PAH and PHC delineation are apparent in Figure 3. The original hypothesis is that there are two distinctly different burn area sources: one shallow source immediately south of the Watermark Building and one deeper source further south, along the river's edge. This hypothesis has some weaknesses in light of the more recent Nichols data. Perhaps they were once a single area, but after filling along the banks of the river, the sources appear to be separated.

#### 1.5.3.4 PAHs and PHCs in Groundwater

#### Bottom Ash (Area 6) and Former Hazardous Waste Storage (Area 4)

PHCs have been tested by Thurber in and around LP Plant and former HP Plant and in all cases, concentrations are either non-detectable, or compliant with Tier 1 guidelines.

In the area surrounding the LP Plant and former HP Plant, the groundwater contains trace amounts of anthracene, fluoranthene, pyrene, benz[a]anthracene and benz[a]pyrene above their Tier 1 guidelines. These Tier 1 exceedances are not consistently recorded year over year. For example, in monitoring wells east of the LP Plant the PAH parameters listed above were all detected at the same magnitude in August 2013. In 2015, all monitoring locations that had previously shown Tier 1 exceedances were less than method detection limits. Monitoring results west of the LP Plant display a similar pattern, although not as significant and not in the same years. AECOM suspects the amount of entrained suspended sediment in the sample influences the outcomes of the annual monitoring programs completed mainly by Thurber. The subsequent gap closure groundwater sampling completed by the City of Edmonton allowed much more time between purging and sampling to minimize the entrainment of suspended sediment.

Results from subsequent PAH testing in 2016 and 2017 confirmed this suspicion. There was a higher frequency of non-detections where previously PAH detection above Tier 1 had been observed. For example, in Nichol's MW14-17, two events in 2016 and one in 2017 have recorded less than method detection or less than Tier 1 guidelines. With reference to the series of sentinel monitoring wells positioned along the northern banks of the NSR upstream of Pump House # 1, MW16-02 and MW14-15 are still showing trace amount of PAHs related specifically to the creosote pile encountered and presence of bottom ash, respectively.

#### **Burn Pits (Area 3)**

In Area 3 the groundwater shows non-detections for both PAHs and PHCs. This is likely due to a combination of shallow finer grained unsaturated fill hosting some of the PHC and the fact that the deeper sand aquifer is in hydraulic connection with the river; consequently, it experiences a high flow.

Table 4 presents a summary of the PAH and PHC analytical results in groundwater including the applicable guideline and pathway.

#### 1.5.3.5 Sediment Results

The sediment chemistry results are tabulated and compared against the Canadian Council of Ministers of the Environment (CCME) sediment quality guidelines, both Interim Sediment Quality Guidelines (ISQG) and probable effects levels (PEL). This table is added to the technical memo forming Appendix C of this report. Very briefly the findings indicate:

- There was no significant variation in the level of metals or PAHs among the six different sediment sampling locations.
  - o All metal concentrations were below CCME ISQGs
  - 2-methylnaphthalene in all locations exceeded the CCME ISQG
  - No other PAHs exceeded CCME ISQG

The conclusion from this sediment programs is that the sediment along the NSR is relatively homogeneous with respect to the metal and PAH content. Furthermore, there is no indication that these contaminant groups are enriched in the sediment below the Rossdale lands.

# 2. Problem Formulation

# 2.1 Selection of Applicable Pathway-Receptor Combinations

As per the AEPs Tier 1 Soil and Groundwater Remediation Guidelines, Residential/Parkland Land Use includes campground areas and urban parks where the primary activity is residential or recreational activity.

The guidelines in Alberta are established using a scientifically defensible, risk-based approach. Numerical standards are established for various land use specific, generic pathway-receptor combinations. The pathway-receptor combination which is the most sensitive to that particular contaminant drives the generic Tier 1 numerical criteria.

The following pathway receptors are relevant and applicable under the generic Industrial/Parkland Tier 1 guidelines:

#### **Human Pathways**

- Protection of groundwater for Domestic Use Aguifers (DUA)
- Direct soil exposure: ingestion, dermal, dust inhalation
- Indoor vapour intrusion and inhalation

#### **Ecological Pathway**

- Protection of groundwater for aquatic life where water bodies lie within a 300 m radius
- Direct soil and groundwater exposure: plants and invertebrates

# 2.1.1 Rossdale Lands Pathway – Receptor Combination

Based on the description of the land use, surrounding environment and hydrogeological setting, surface and groundwater use, the following receptor-pathway combinations are deemed relevant and applicable to the Rossdale Industrial lands and adjacent parkland.

#### **Human Pathways**

- DUA <sup>a</sup>
- · Direct soil exposure: ingestion, dermal, dust inhalation
- Indoor vapour intrusion and inhalation

#### **Ecological Pathway**

- Protection of groundwater for aquatic life
- Direct soil and groundwater exposure: plants and invertebrates

<sup>&</sup>lt;sup>a</sup> Consistent with Record of Site Condition in Thurber March 2016

In summary, the primary receptor-pathways that drive the Tier 1 guidelines are considered operable on this site. Nevertheless, the data will be interpreted relative to the specific Tier 2 pathways to better understand the perceived human health or environmental risk.

# 2.2 Contaminants of Concern

#### 2.2.1 Soil

The tabulated data (Tables 1 and 2) displays the soil quality relative to the various human health and ecological Tier 2 numerical guidelines. The data are compared to the individual Tier 2 pathway numerical guidelines to help define the risk assessment objectives, and / or risk management strategy. This listing of contaminants excludes the extractable hydrocarbons at the former burn pits (Area 3). The following bullets capture the essential findings from the tabulated soil quality data:

Relative to Human Health Protection, Contaminants in the Soil are:

- Arsenic and lead in the fill frequently exceed their respective direct human contact Tier 2 guidelines
- Benz[a]pyrene Total Potency Equivalents (B[a]P TPE) where the creosote pile was discovered (16-02) exceeds its direct human contact Tier 2 guideline
- Benz[k]fluoranthene, benz[b&j]fluoranthene and commonly B[a]P Index of Additive Cancer Risk (IACR) exceed their respective Tier 2 soil quality guidelines for protection of DUA
- Where the creosote pile was encountered several high molecular weight PAHs are above their respective Tier 2 soil quality guidelines protective of DUA: B[a]P, benz[b&j]fluoranthene, benz[k]fluoranthene, benz[g,h,i] perylene, chrysene and B[a]P IACR

Relative to Ecological Protection, Contaminants in the Soil are:

- Barium and boron are most commonly observed above their respective Tier 2 eco-contact guidelines
- Arsenic, beryllium, copper, cobalt, chromium, lead, molybdenum, nickel, selenium, tin and zinc are also observed in one or more locations above their respective Tier 2 eco-contact guidelines
- Saturated paste boron is also present above its soil quality guideline protective of aquatic life
- Anthracene, benz[a]anthracene, benz[a]pyrene, fluoranthene, naphthalene, phenanthrene, pyrene are the most common PAH present above their respective soil quality guidelines protective of aquatic life
- Where the creosote pile was encountered, the above list of PAHs are found with the addition of
  acenaphthalene and fluorine and the magnitude of concentrations for anthracene and fluoranthene are such
  that their eco-contact guidelines are exceeded

#### 2.2.2 Groundwater

Relative to the drinking water protection guidelines (DUA pathway), contaminants of concern are:

- Manganese and TDS are almost always observed
- Nitrate and chloride are the second most frequent contaminants
- Boron is observed at TH10-1
- In a total metals analysis, iron is common

Relative to the guidelines for the protection of the freshwater aquatic life pathway, contaminants of concern are:

- Nitrate and chloride are the main anions observed
- Boron and selenium are the most frequent metalloids observed
- Much less frequent are aluminum, copper and mercury
- In a total metals analysis the list above expands to include: arsenic, cadmium, iron, lead, zinc and copper and mercury are more frequent
- Anthracene, benz[a]anthracene, benz[a]pyrene, fluoranthene, pyrene

# 2.3 Tier 2 Risk Assessment / Risk Management Plan (RA / RMP) Approaches

Table C summarizes where parameters exceed the Tier 2 guidelines distinguishing between guideline pathways designed to protect human and ecological receptors. The risk assessment and risk management approaches indicated are discussed in more detail in following sections.

Table C: Ecological and Human Health Pathway Receptor Tier 2 / Risk Management Approaches

Applicable Pathway-Receptor	Non-compliant Contaminants in Soil	Non-compliant Contaminants in Groundwater	Tier 2 RA / RMP Approach
Direct human soil contact	Arsenic, Lead (1)	NA .	Evaluate upper bound soil exposure using statistical analysis
Direct eco- soil contact	Barium, boron, arsenic, beryllium, copper, cobalt, chromium, lead, molybdenum, nickel, selenium, tin and zinc (1)	NA	Evaluate upper bound soil exposure using statistical analysis  Qualitative risk management through park maintenance and general landscaping
Protection of Groundwater for Aquatic Life	Anthracene, benz[a]anthracene, benz[a]pyrene, fluoranthene, naphthalene, phenanthrene, pyrene (2) Boron	Anthracene, benz[a]anthracene, benz[a]pyrene, fluoranthene, pyrene (3)  Nitrate and chloride  Boron, selenium (common) and aluminum, copper, mercury (rare)	Mass flux estimate/ Monitoring
Protection of Groundwater for Future Domestic Use	Benz[k]fluoranthene, benz[b&j]fluoranthene and B[a]P IACR <sup>(2)</sup>	B[a]P TPE <sup>(3)</sup> Manganese and TDS Nitrate and chloride Boron	Mass flux estimate/ Monitoring

<sup>(1)</sup> Point source creosote pile includes anthracene and fluoranthene above eco-contact and B[a]P TPE above human direct contact

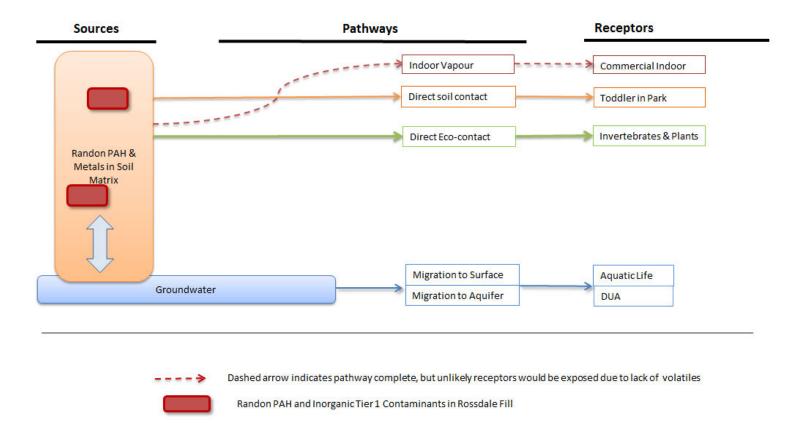
<sup>(2)</sup> Point source creosote pile includes acenaphthalene and fluorine above aquatic life; and, benz[a]pyrene, benz[g,h,i]perylene and chrysene above DUA

<sup>(3)</sup> Point source creosote pile (16-02) showed naphthalene above aquatic life and DUA, plus phenanthrene above aquatic life on July 22, 2016, but not repeated in subsequent groundwater testing

# 2.4 Conceptual Exposure Model

The pathway-receptors considered in this Tier 2 risk assessment are diagrammatically shown in Illustration 1. The pathways are reflective of those that are summarized in Table C above and each of the detailed soil and water quality Tables appended to this report.

Illustration 1: Conceptual Exposure Model, Rossdale Lands



# 3. Exposure and Hazard Assessment

# 3.1 Direct Soil Contact Pathway

Rather than assessing exposure based upon maximum measured concentrations, AECOM will evaluate exposure to a mobile receptor, such as a human, based on the 95<sup>th</sup> upper confidence limits on the mean (95UCLM). For sessile ecological receptors, the upper 90<sup>th</sup> rank percentile is the appropriately conservative exposure point concentration (EPC). The rationale for these upper bound EPCs as follows:

- A mobile receptor has the ability to move around the site and, therefore, will experience an averaged direct contact soil exposure
- A sessile receptor, such as plants and soil invertebrates, is protected at the population level, and setting the
  acceptable EPC at the upper 90th percentile implies that less than 10 percent of the plant and soil invertebrate
  population may be adversely affected

#### 3.1.1 Statistical Evaluation

The detailed methodologies and results from the statistical analysis of the database are attached in Appendix F. As discussed in Table B, point source petroleum hydrocarbon contamination related to the burn pits in Area 3 are not included in this RA. Consequently, an initial step in the database analysis was to determine a defensible means to identify which samples, and at which depths are indicative of the burn pits and remove them from the database. Appendix F, Table 2 list all the individual data points that have been removed and why. Briefly, analytoical data was removed if it displayed any of the following three characteristics:

- Elevated PHC with elevated lead
- Elevated PHC without the benefit of metal analysis
- Elevated lead without the benefit of PHC analysis (BH3 only)

The outcome was the removal of 18 data points all from Area 3. Data from the single creosote treated timber (16-02) was retained in the database.

The following Table D is summary of the human direct contact contaminant statistical analysis:

Table D: Summary Statistics for Direct Human Contact

Contaminant	SQG <sub>HH</sub> (mg/kg)	n	% non-detect	Maximum (mg/kg)	Mean (mg/kg)	Standard Deviation	90 <sup>th</sup> %ile (mg/kg)	95UCLM (mg/kg)
Arsenic	21	110	0%	65	8.2	7.67	9.8	9.8
Lead	140	125	2%	398	27.5	47.5	45.1	35.9
B[a]P TPE	5.3	104	0 %	24.83	0.44	2.46	0.347	1.26

Despite the fact that the maximum observed concentrations exceed the direct human contact Tier 2 guidelines (SQG <sub>HH</sub>), the upper limit statistical estimates are both much less than the SQG <sub>HH</sub>.

The following Table E is summary of the ecological direct contact contaminant statistical analysis:

Table E: Summary Statistics for Direct Ecological Contact

Contaminant	SQG <sub>ECO</sub> (mg/kg)	n	% non- detect	Maximum (mg/kg)	Mean (mg/kg)	Standard Deviation	90 <sup>th</sup> %ile (mg/kg)	95UCLM (mg/kg)
Arsenic	17	110	0%	65	8.2	7.67	9.8	9.8
Barium	500	125	0%	6620	596.8	1019	1122	802.6
Beryllium	5	125	10%	8.1	1.1	1.27	1.46	1.30
Chromium	64	125	0%	104	18.7	12.4	24.6	21.1
Cobalt	20	125	1%	21.2	8.75	2.93	10.5	9.2
Copper	63	125	0%	239	25.6	27.8	34.4	31.0
Lead	300	125	2%	398	27.5	47.5	45.1	35.9
Molybdenum	4	125	46%	9.4	1.64	1.53	2.4	1.9
Nickel	45	125	0%	68	26.5	8.3	34.6	28.0
Selenium	1	110	30%	1.3	0.45	0.21	0.70	0.48
Tin	5	124	32%	10.9	1.87	1.34	5.0	2.1
Zinc	200	125	0%	739	75.2	87.9	94.9	95.7
Boron (sat paste)	3.3	24	0%	22.5	4.12	4.98	9.01	6.26
Boron (HWS)		60	0%	37.5	10.42	9.388	27.6	12.34
B[a]P TPE	5.3	104	0%	24.83	0.44	2.46	0.347	1.26
CCME F3	300	40	47.5	487	163.1	111	211.8	138.6

Despite the fact that the maximum observed concentrations exceed the eco- contact Tier 2 guidelines (SQG  $_{ECO}$ ), the upper limit statistical estimates for all substances but barium and boron are less than the SQG  $_{ECO}$ .

The hot water soluble analysis of boron supports the contention that the average concentration of this substance is elevated within the fill surrounding the Rossdale Site.

#### 3.1.2 Risk Characterization

Tables D and E provides a summary of the Rossdale fill upper bound exposure (EPC) relative to the SQG <sub>HH</sub> and SQG <sub>ECO</sub> respectively. The ratio of exposure relative to the SQG is the Hazard Quotient, calculated as follows:

 $Hazard\ Quotient = EPC/SQG$ 

When the Hazard Quotient exceeds 1, this implies that receptor exposure to concentrations greater than the SQG may occur. This does not imply that an adverse effect to the receptor will occur. A quotient less than 1 implies that receptor exposure to concentrations greater than the SQG is unlikely to occur, therefore possible adverse effects are considered negligible. In all cases the SQG <sub>Eco/HH</sub> is the respective AEP guidelines for that pathway. To err on the side of caution, and to allow for human exposure from other routes not accessed, a soil allocation of 50% will be applied. Essentially, this means that a negligible exposure can only be assumed when the HQ is 0.5 or less. Risk characterization for the direct soil contact pathways are summarized in Table F.

Table F: Risk Characterization Summary: Direct Soil Contact
-------------------------------------------------------------

Substance	Upper Statistical Bound EPC	Hazard SQG Eco or SQG <sub>HH</sub> in mg/kg	Hazard Quotient	Comments / Conclusions
Arsenic	9.8 mg/kg	21 (SQG <sub>HH</sub> ) 17 (SQG <sub>ECO</sub> )	0.46 HH 0.58 ECO	Both receptors are predicted to experience low enough exposure to conclude a negligible risk
Barium	1122 mg/kg	500 (SQG <sub>ECO</sub> )	2.2	Exceeding 1, but roughly 2 times and elevated concentrations are sporadically distributed vertically and laterally, therefore, wide-spread adverse effects on vegetation or soil invertebrates are unlikely to be observed
Lead	35.9 mg/kg 45.1 mg/kg	140 (SQG <sub>HH</sub> ) 300 (SQG <sub>ECO</sub> )	0.25 HH 0.15 ECO	Both receptors are predicted to experience low enough exposure to conclude a negligible risk
Boron (sat paste)	9.01 mg/kg	3.3 (SQG <sub>ECO</sub> )	2.7	Exceeding 1 and also determined to be contaminant for aquatic life pathway.
B[a]P TPE	1.26 mg/kg	5.3 (SQG <sub>HH</sub> )	0.24	Human receptors are predicted to experience low enough exposure to conclude a negligible risk

In conclusion, barium and boron will be carried into the risk management plan. Boron upper limits are not only in excess of the eco-contact guidelines, but also those protective of aquatic life. The aquatic life pathway is discussed below.

## 3.1.3 Uncertainty

To address uncertainty with the variability of area-wide fill, risk practitioners commonly apply a statistical upper bound analysis. This is a very robust method of estimating the 'average' exposure point concentration, especially given the large dataset consolidated for the Rossdale site.

The application of the Tier 1 soil quality guidelines as the soil benchmark, or denominator in the hazard quotient ratio is conservative. These guidelines are designed to be protective for a wide range of terrestrial settings, and in fact are more appropriate for agricultural settings, rather than industrial settings.

The fact that the ratio of the upper bound exposure concentrations exceeds the soil quality benchmark does not automatically translate to certainty around the presence or degree of ecological impairment. However, when the upper bound exposure point concentration is less than the soil quality guideline, we can confidently state that the likelihood of ecological impairment will be very low. In other words, the ecological terrestrial risk would be negligible.

# 3.2 Groundwater Pathways

#### 3.2.1 Mass Flux Methods

The following paragraphs describe the methods applied to arrive at a mass flux estimate for contaminants of potential concern to the NSR. The flux assessment is limited to relevant hydrogeological information along the A-A' cross section line depicted in Figure 7, and is intended as a broad order of magnitude check on the total mass flux of groundwater mediated contaminant transport to the NSR.

Horizontal gradients were calculated for paired monitoring well data, where monitoring wells were oriented along the general groundwater flow pathway. Well pairs were only selected if groundwater elevations were determined on the same date. Horizontal gradient (i) was calculated using the equation below, and are presented in Table G.

$$i = \frac{\Delta h}{D}$$

Where

i = horizontal gradient (m/m)

 $\Delta h = absolute difference in groundwater elevation between paired monitoring wells (m)$ 

D = horizontal distance between paired monitoring wells (m)

Table G: Calculation of Horizontal Gradient

Paired Wells	∆h (m)	D (m)	i
BH16-01 →BH16-02 <sup>a</sup>	616.55m-615.52m = 1.03	26.603	0.0387
BH16-03 →A6:14-15 <sup>a</sup>	616.13m-615.83m = 0.3	32.656	0.0092
TH12-3→MW99-2 b	616.23m-615.43m = 0.8	73.267	0.0109
TH15-1→TH15-4 <sup>b</sup>	615.43m-615.16m = 0.27	35.868	0.0075
BH16-04→BH16-05 <sup>a</sup>	616.21m-614.88m = 1.33	21.682	0.0613
BH16-03 →A6:14-17 <sup>a</sup>	616.13m-616.06m = 0.07	37.171	0.0019
		Average	0.0216
		Maximum	0.0613

Notes: Groundwater elevation data sourced from; (a) City of Edmonton groundwater monitoring program (Sept 13, 2016) and (b) Thurber March 2016.

The geology of the Rossdale Lands consists of well-defined and ordered geologic units, which extend across the site in a relatively uniform manner. Site stratigraphy consists of fill, underlain by sand/silt, then a gravel layer, and finally carbonaceous clay shale bedrock. Observations of groundwater elevation indicate that groundwater is typically held within the gravel layer. For the purposes of calculating a specific discharge, AECOM have assumed that at any time during the year it is possible that the full thickness of the gravel layer may become saturated. The cross-sectional area of the gravel layer surrounding individual monitoring wells along the A-A' transect was measured using CADD software from the cross sections shown in Figure 7. The assessment was limited to include only the area between BH16-02 at the northwest extent, to BH16-08 at the southeast extent. Cross sectional areas were based on the midpoints between monitoring wells.

The flux model applied the average horizontal gradient (Table F) and well-specific estimated hydraulic conductivity (Table A) to calculate the Darcy velocity of groundwater moving through the saturated gravel unit as follows:

$$v = K \times i$$

Where:

 $v = Darcy \ velocity \ (m/day)$ 

K = well - specific hydraulic conductivity (m/day)

i = average horizontal gradient (m/m)

Specific discharge is calculated as:

$$q_0 = v (m/day) \times A(m^2)$$

Where:

 $q = Specific Discharge (m^3/day)$ 

 $v = Darcy \ velocity \ (m/day)$ 

A = Cross - sectional area of saturated gravel unit  $(m^2)$ 

The mass flux of contaminants to the NSR via groundwater mediated transport is; therefore, calculated for each monitoring well as:

$$J_i = C_i^x (mg/m^3) \times q_i(m^3/day)$$

Where:

 $J_i = Mass Flux of contamiant x at monitoring well i (mg/day)$ 

 $C_i = Concentration of contaminant x at monitoring well i <math>(mg/m^3)$ 

 $q_i$  = Specific discharge attributed to monitoring well i ( $m^3$ /day)

The total mass flux for each contaminant of potential concern is calculated as the sum of the flux derived from individual monitoring wells, and the percent contribution of each well to the total was also calculated. This provides site managers with a useful tool for focusing remedial planning and efforts to areas where the most potential for improvement lies.

#### 3.2.2 Mass Flux Results

The results from the mass flus calculations are summarized in Table H. The detailed calculation spreadsheet table is attached as Appendix G.

Table H Aquatic Life/ Drinking Water Exposure and Mass Flux Loading

Substance	Tier 2 Aquatic Life / DW Guideline (mg/L)	Maximum Concentration from Transect (mg/L)	Cumulative Mass Flux (kg/year)	Additional Interpretive Details
PAHs				
Anthracene	0.000012	0.000148 @ 16-02	2.0 x 10 <sup>-4</sup>	Maximum concentrations used have
Benzo[a]anthracene	0.000018	0.00006 @ 14-15	3.2 x 10 <sup>-4</sup>	been shown to be biased by entrained
Benzo[a]pyrene	0.000015	0.000072 @ 14-15	4.7 x 10 <sup>-4</sup>	sediment. Loading governed by rapid
Fluoranthene	0.00004	0.00023 @ 16-02	6.7 x 10 <sup>-4</sup>	hydraulic conductivity at 14-15 / 14-17 (Area 6).
Naphthalene	0.001	0.0023 @ 16-02	1.9 x 10 <sup>-3</sup>	(Alea o).
Phenanthrene	0.0004	0.0006 @ 16-02	1.5 x 10- <sup>3</sup>	Annual loadings generally around 1 mg
Pyrene	0.000025	0.0001 @ 16-02	8.0 x 10 <sup>-4</sup>	year, which is negligent.
B[a]P TPE	0.00001	0.00008 @ 14-15	5.0 x 10 <sup>-4</sup>	1
Metals				
Aluminum	0.05 pH dependant	0.21 @ 16-06	6.8 x 10 <sup>-2</sup>	Generally non-detect in dissolved form.  Not significant loading. Natural occurrence.
Boron	1.5	4.41 @ 16-06	6.57	Only area of non-compliance at 16-06 and coincident with known elevated soil source (Figure 12). Annual loading is negligible.
Copper	0.007	0.006 @ 16-07	3.0 x 10 <sup>-2</sup>	In dissolved form, a single Tier 1 exceedance in BH1 (Stantec) at Water Treatment Plant. Less than Tier 1 in all other wells (in dissolved form).
Manganese	0.05	2.86 @ 16-02	15.4	Wide spread source, but could be natural.
Iron	0.3	0.24 @ 16-06	0.17	Generally non-detect in dissolved form.  Not significant loading. Natural occurrence.
Mercury	0.000005	non-detected		
Selenium	0.001	0.0011 @ 16- 05/06	4.4 x 10 <sup>-3</sup>	Identified detections generally east of LF Plant (Figure 13) and magnitude of exceedance are very low. Annual loading of 4.4 mg is negligible.
Anions				
Chloride	120	422 @ 16-02	1501	Source focused east of LP Plant (Figure 10) and the magnitude of exceedances is relatively low. In context of annual discharge of NSR this loading is not significant.
Nitrate	3	10.4 @ 16-07	28.1	Appears to be wide-spread source (Figure 11). In context of annual discharge of NSR this loading is negligible.

In decreasing order of magnitude, chloride, nitrate, manganese and boron are the contaminants that are predicted to be contributing annual mass loadings measured in the 10 to1000 kilogram range. In Appendix G the calculation table indicates MW14-15 and 14-17 are contributing the bulk of the loading. However, this does not lead to the conclusion that this is the worst area in terms of source concentrations. In fact, source areas for these higher loading contaminants are distributed both west and east of the HP and LP power plants. The inferred extent of the groundwater plumes for chloride, nitrate, boron and selenium are depicted in Figures 10, 11, 12 and 13. The explanation for the higher relative contribution from Area 6 lies in the rapid hydraulic conductivity measured at these wells and the well just upgradient (TH10-7).

The flux analysis suggests that the key groundwater contaminants most likely related to the Rossdale fill are:

- Boron and selenium
- Chloride and nitrate

Other contaminants are either not contributing a significant mass load (e.g. PAH) or are likely confounded by naturally elevated concentrations or entrained sediment in samples (e.g. aluminum / iron). With reference to Figures 10 through 13, the following points provide context to the mass flux estimates.

### Chloride

- The pattern of the plume strongly suggests a source that may be related to road de-icing and/or stockpiling of cleared snow
- The magnitude of concentrations are not excessive (125 -550 mg/L)
- Total annual loading (1500 kg) is insignificant when compared to the annual discharge base flow in the NSR ( $\sim$  150 million m<sup>3</sup> during low flow) = 0.1  $\mu$ g Cl/L

### **Nitrate**

- The pattern of the plume(s) potentially reflect historical (early 1900's) use of the property as the Edmonton Exhibition Grounds, which would have involved livestock and subsequent manure
- The magnitudes of concentrations are highest in the far west (TH10-1) and eastern extent of the former power plant (TH15-4), but are still only reaching 2 times the drinking water guideline
- Total annual loading would be negligible considering the annual discharge in the NSR (~ 10<sup>-6</sup> mg NO3/L)

### Boron

- It is recognized that boron in the fill is likely associated with scattered brick and coal; yet there is only one location adjacent to the NSR where boron is elevated in the groundwater (BH16-06)
- The magnitude of the dissolved, and total boron in this location is only marginally above the aquatic life guideline
- Total annual loading would be negligible considering the annual discharge in the NSR (~ 10<sup>-7</sup> mg B/L)

### Selenium

- The pattern suggests multiple isolated plumes that are coincident with a historical source that may be related to the former hazardous waste storage (Area 4)
- The magnitude of the observed concentrations are all very minor, for example 1.3 to 9 μg/L above the aquatic life guideline
- Total annual loading would be negligible considering the annual discharge in the NSR (~ 10<sup>-10</sup> mg Se/L)

### 3.2.2.1 Uncertainty Analysis

Total inorganic groundwater concentrations reflect the highest concentrations of metals due to entrapped suspended sediment. This measure of total metals is not believed to be representative of actual sub-surface transport and breakout concentrations; nevertheless, these maximum total metal concentrations have been considered under this uncertainty analysis.

The total analysis results are available from all sentinel monitoring wells along this transect. When the total analysis is substituted into the mass flux calculation, the following differences are highlighted:

- Aluminum and iron mass flux increase three and two orders of magnitude, respectively,
  - o Aluminum mass flux of 0.068 kg/year, increases to the 18.1 kg/year
  - Iron mass flux increases from 0.17 kg/year to 53 kg/year
- All other metals mass flux estimates were within the same order of magnitude as the dissolved estimate, with the exception of manganese, who's total mass flux actually decrease the order of magnitude
- The following added trace metals are captured when a total analysis is run:
  - Arsenic show a mass flux of 9.3 x 10<sup>-4</sup> kg/ year
  - Cadmium show a mass flux of 4.6 x 10<sup>-4</sup> kg/ year
  - Lead shows a mass flux of 0.028 kg/ year
  - Silver shows a mass flux of 2.9 x 10⁻⁴ kg/ year
  - Zinc shows a mass flux of 0.11 kg/ year

In summary, this conservative estimate using maximum measured total metals analysis indicates a two to three order of magnitude increase in total annual mass loading for major earth elements (aluminum and iron), but loading for other elements are similar or reduced. It is highly unlikely that the total metals analysis would be representative of metal loadings to the NSR. If the total analysis were representative, then one would have expected to see a pattern of elevated metals in the sediment collected below the Rossdale Lands. Such a pattern was not evident in the data.

### 3.2.3 Proposed Aquatic Effects Approach

As part of the scope of work for the Tier 2 RA / RMP for Louise McKinney Park AECOM developed a preliminary aquatic effect program based upon aquatic toxicity bioassays on groundwater. The Rossdale Plant is in an analogous situation: contaminated groundwater adjacent to the NSR. This preliminary aquatic effects program was communicated to the City of Edmonton in February 2016. The City approached AEP with the toxicity testing notion and ultimately decided not to proceed at that time. This effects approach was initially recommended because it was considered to provide a direct quantitative measure of the potential adverse effects arising from groundwater that lies below the uplands portions of the sites. It is recognized that multiple confounding factors can complicate the interpretation of aquatic toxicity results. These confounding factors can be accounted for with a careful study design, including 'background' reference groundwater. A step wise approach to the testing was recommended (e.g. beginning with preliminary acute testing and only moving into chronic testing if results were favourable).

An alternative approach is to focus entirely on the exposure aspects within the receiving environment (e.g. NSR). This involves analytical quantification of the selected contaminants in the receiving environment. Interpretation of these types of results may be confounded by multiple inputs into the NSR. Consequently, it would be very difficult to attribute any single contaminant detection to the uplands.

At this point this future exposure and effects assessment has been left open ended. We welcome any input from AEP.

## 4. Risk Management Plan

### 4.1 Regulatory and Technical Considerations

With reference to AEP Exposure Control Guidelines (May 2016), the fundamental requirements of any risk management plan are captured in the following points:

- 1. Consider Current and Future Land Use
- 2. Consider Environmental Protection and Enhancement Act (EPEA)
- 3. Delineation and Source Control
- 4. Off Site Migration and Notification of Affected Properties
- 5. Safety Odours and Nuisance

Each of these fundamental requirements are discussed below.

### Item (1)

The current land use with consideration for anticipated future land use of the area within the Rossdale Lands (with particular emphasis on the margins along the NSR) has been taken into consideration. Re-development along the NSR margin of the Rossdale Lands is planned with the 'Touch the Water' project. This re-development is also linked to the Walterdale Bridge replacement. In a broad sense, the development will be re-establish the recreational/ parkland corridor along the north side of the NSR, adjacent to the Rossdale Lands. The RMP will require an update when the project design is finalized.

### Item (2)

There is no contravention of EPEA. Groundwater contamination is present and identified within the sentinel monitoring well network adjacent to the NSR. Despite this, there is no evidence to suggest that significant contaminant discharge is occurring and this conclusion is corroborated with sediment characterization data below the Rossdale site.

### Item (3)

In the traditional definition, we cannot declare that vertical and lateral delineation of 'contaminants' in the Rossdale fill has been achieved. Nor do we believe that traditional delineation is necessary, or even feasible. The approach taken herein is to treat the fill as an area-wide problem, rather than a point source of contamination. We fully recognize that point source contamination (e.g. Area 3) will require a traditional delineation and remediation approach. In the context of an area-wide problem, the Rossdale fill, and associated contaminant(s), are adequately characterized for the purposes of defining the required risk management plan. This is supported by the significant efforts to consolidate all available soil and groundwater quality data from a multitude of sources. The outcome from this is twofold: (i) a consolidated electronic database of soil and groundwater quality data; and (ii) a comprehensive drawing package displaying the pattern of contamination across the Rossdale lands.

All of the sources of contamination are historical. This is true for both the area-wide fill and point source Area 3.

### Item (4)

Other than the theoretical migration of contaminants to the NSR, there is no evidence of off-site migration affecting any other parcels of land. The two key stakeholders are EPCOR and the City of Edmonton.

<sup>&</sup>lt;sup>1</sup> Thurber (March 2016) Record of Site Condition makes statements indicating the source areas are delineated

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### Item (5)

There are no concerns about odours or other nuisance issues.

The documentation herein provides sufficient evidence to support the conclusion that in-situ risk management is a feasible approach to address the area-wide Rossdale fill and its associated soil and groundwater contamination. There may be very little net benefit to the receptors if a physical excavation remedial approach is pursued. Physical excavation of the NSR embankment along the Rossdale Lands is likely to be accompanied by significant risk related to the stability of the slope and enhanced mobilization of the contaminants.

### 4.2 Technical and Administrative Requirements

In accordance with the AEP Exposure Control Guidelines (May 2016), the following technical and administrative requirements will be addressed in the risk management plan:

- Mitigate and manage any potential for adverse effect to humans or the environment
- Monitor on-site and off-site conditions to assess effectiveness of the RMP
- Contingency plans to respond to adverse changes in conditions
- Manage contamination if disturbed by future activities
- Commitment from the land owner/ operator as it relates to long-term exposure control and associated monitoring

### 4.3 Rossdale Lands Preliminary RMP

### 4.3.1 Current and Future Risks

The Tier 2 risk assessment has evaluated all possible pathways through which the subsurface contamination may be exposed to humans or the environment (i.e. ecological receptors). The risk assessment has provided clear conclusions with regards to potential adverse effects. Under current, and foreseeable future land use, the risks to both humans and the terrestrial environment are considered to be *manageable*. Briefly, the risk assessment analysis resulted in the following risk management issues:

### In the soil

- Average upper bound concentrations of barium and boron in the Rossdale fill are exceeding their respective
  eco-contact guidelines by 2.2 and 2.7 times, respectively
- The upper bound concentration for boron is also exceeding the soil quality guidelines protective of aquatic life
- Concentrations of these metals are sporadically distributed vertically and laterally, therefore, wide-spread adverse effects on vegetation or soil invertebrates are unlikely to be observed

### In the groundwater

- Primary contaminants that are exceeding aquatic life guidelines and have the following criteria: (i) linked to the Rossdale fill, and (ii) estimated to be contributing the largest mass loading to the NSR, are chloride, nitrate, boron and selenium
- The dissolved and total concentrations are not excessive and each of these substances has a viable source with a inferred plume extent depicted in Figures 10 through 13
- In the context of the annual low-flow discharge from the NSR, the mass loadings are insignificant to negligible

### 4.3.2 Exposure Controls

There are no exposure controls in place, or assumed in the risk assessment conclusions. The conclusions with regards to *manageable* risk through the direct contact pathways (both human and ecological) are based on a reasonable statistical upper bounds exposure point concentration regardless of the depth of any specific sample. This is a reasonable approach when exposure to potentially impacted fill is the primary route of exposure.

AECOM cannot definitively conclude negligible ecological direct contact risk because of observed wide spread elevated barium and boron. There is no clear cut source zone that can be physically removed; therefore in-situ risk management is the best option.

In the context of the future "Touch the Water" development, there will be a construction management plan that will establish best management practises. The construction plan will also address bank stability and monitoring. Reclamation and final landscaping are also stipulated in the construction management plan. Best practises are to include imported clean top soil for any disturbed areas. Community gardens for consumption purposes should be avoided.

### 4.3.3 Future Ground Disturbance

The future re-development associated with the Walterdale Bridge and '*Touch the Water*' will result in ground disturbance. The design should incorporate minimal disturbance of the bank and construction environmental protection plans should follow best practises with regards to disturbed suspect contaminated soils. These best practices will cover aspects such as storm water run-off, slope stability, dust mitigation and appropriate handling and disposal of contaminated soils in accordance with EPEA and Provincial guidelines. All soil material disturbed within the Rossdale Lands, and adjacent riparian area, will be treated as contaminated and disposed of appropriately. Confirmatory soil sampling will be conducted for each disturbance area associated with the future redevelopment and imported backfill will be tested to ensure that soil quality meets AEP Tier 1.

The future construction activity may also influence or alter the degree to which the contaminants are mobilized into the groundwater. To monitor this situation all attempts should be made to preserve the physical integrity of the sentinel monitoring well network currently in place. Construction groundwater monitoring will be an important aspect of the re-development environmental protection plans.

### 4.3.4 Uncertainty and Monitoring

### 4.3.4.1 Groundwater Condition

There is a moderate degree of confidence in the conditions of the groundwater. Recent work has suggested that the groundwater sampling technique plays a significant role in whether or not PAHs, and to a lesser degree, dissolved metals are detected, and at what magnitude they are detected. Pending AEP input, there is an opportunity to further investigate the exposure or biological effects components of the groundwater to NSR pathway.

The City of Edmonton will commit to a groundwater monitoring program limited to the sentinel wells identified in this report: MW16-02, MW14-15/ 14-17, MW16-04, MW16-05, MW16-06, MW16-07 and MW16-08.

For two consecutive years the program will capture groundwater (base flow levels) after the summer months (early September) and following the spring snow melt and infiltration (late April to early May). The spring sampling event should immediately follow a significant melting period, but precede the river flood period in June. Due to the depth of the water and desire to minimize disturbance of the suspended sediment in these wells, bailers are the favoured method for sampling.

The intent would be to have this monitoring program continue throughout the construction phase of the 'Touch the Water' development. At the completion of the development, it is recommended that an additional two years of biannual sampling be completed. Providing the results of the post development monitoring continue to support the contention that the contamination is not varying, the program can be reduced.

The groundwater monitoring analytical program should include: PAHs, dissolved metals and major anions.

### 4.3.4.2 Reporting Commitments to Regulator

Monitoring during the construction phase would be completed as part of internal City of Edmonton due diligence. This work could possibly be incorporated into the contractor bid. After the completion of the development, a single report capturing the two consecutive (post development) years of bi-annual groundwater monitoring will be issued to the regulator. This report may be accompanied by a recommendation letter to rationalize, or cease the groundwater monitoring program.

There is also an opportunity to cooperate with EPCOR and have some portion of this monitoring, as described herein, incorporated into the EPCOR industrial permit requirements.

### 4.3.5 Contingency Planning

If the groundwater monitoring suggests that conditions are worsening, the City of Edmonton will do the following:

- Re-assessment of the groundwater data to validate the conditions are worsening
- Re-evaluation of more aggressive exposure controls or in-situ remedial technics targeted at those constituents that are showing increased mobility tendencies

# 4.4 City of Edmonton: Administrative Tracking of Risk Managed Properties

The tracking of risk managed properties and management of contaminated sites is administered through the Enviso Environmental Management System. The City of Edmonton has also implemented health and safety protocols which are handled through our Occupational Health and Safety system. These ensure worker safety when working on contaminated sites.

### 5. References

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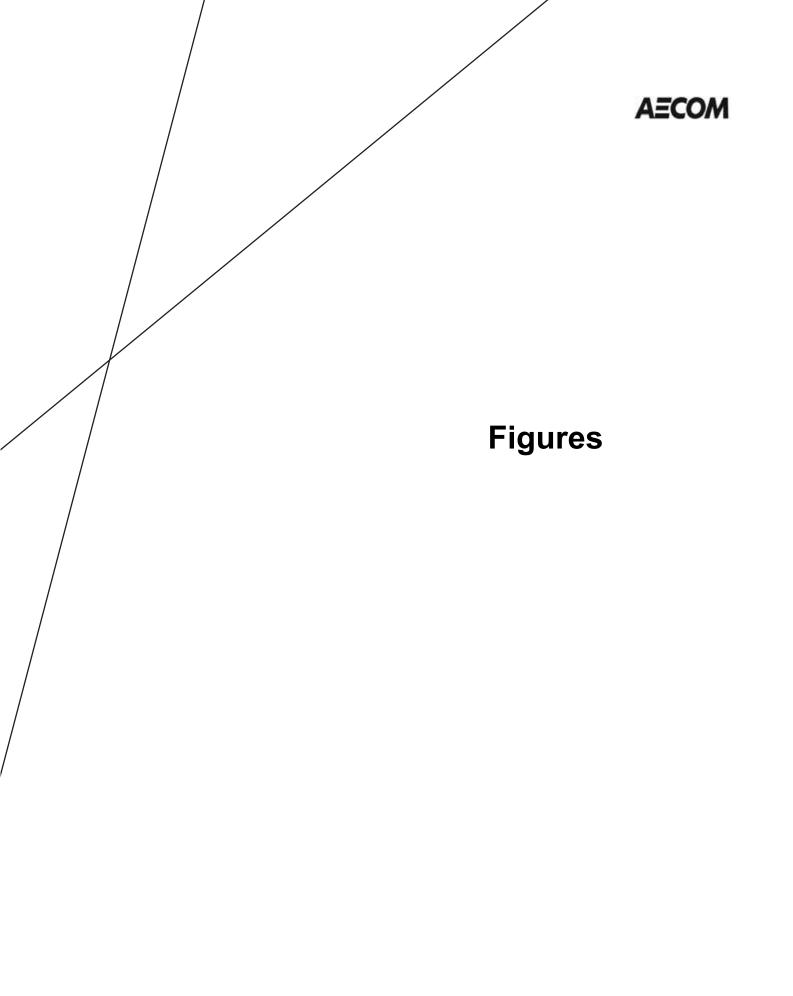
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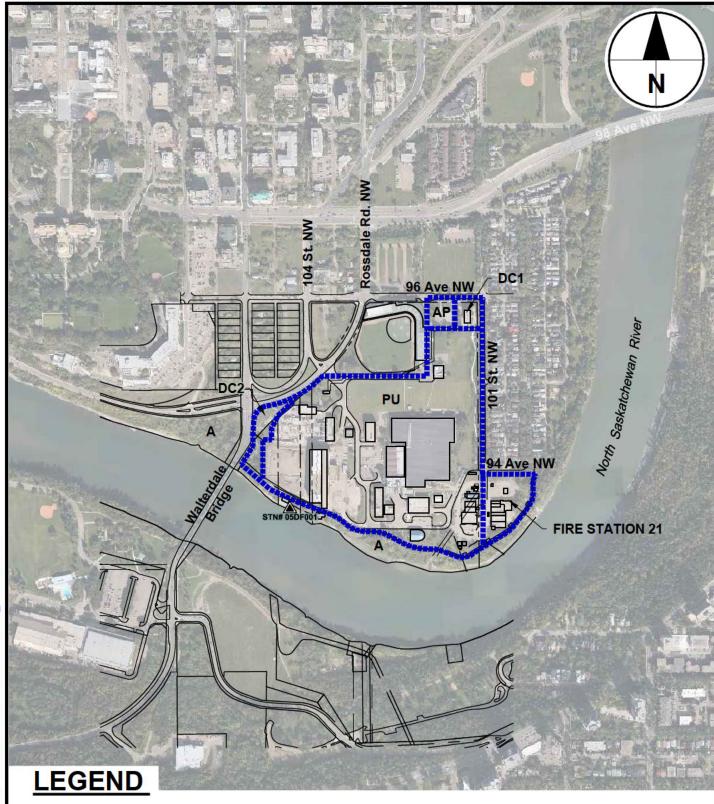
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A METROPOLITAN RECREATION ZONE

PU PUBLIC UTILITY

DC1 DIRECT DEVELOPMENT CONTROL PROVISION

DC2 SITE SPECIFIC DEVELOPMENT CONTROL PROVISION

AP PUBLIC PARK

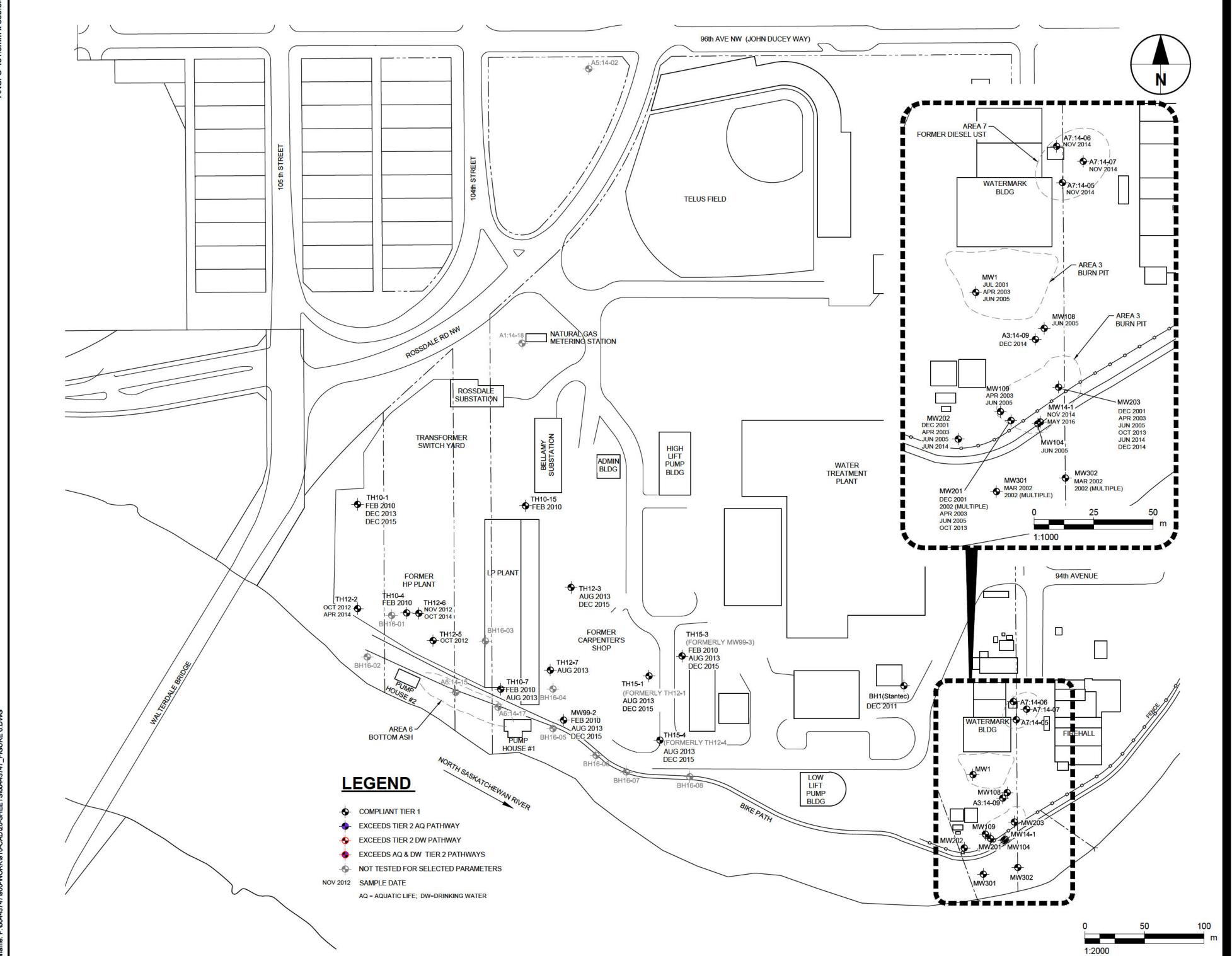
City of Edmonton Engineering Services Rossdale Plant AECOM 60443747 Date: Jan 30, 2018

LOCATION PLAN & ZONING

City of Edmonton Engineerii Rossdale Plant AECOM 60443747 Date: January 30, 2018

City of Edmonton Engineering S Rossdale Plant AECOM 60443747 Date: January 30, 2018

City of Edmonton Engineering S Rossdale Plant AECOM 60443747 Date: January 30, 2018



SITE PLAN GROUNDWATER BTEX, CCME F1, F2, F3 DISTRIBUTION

100

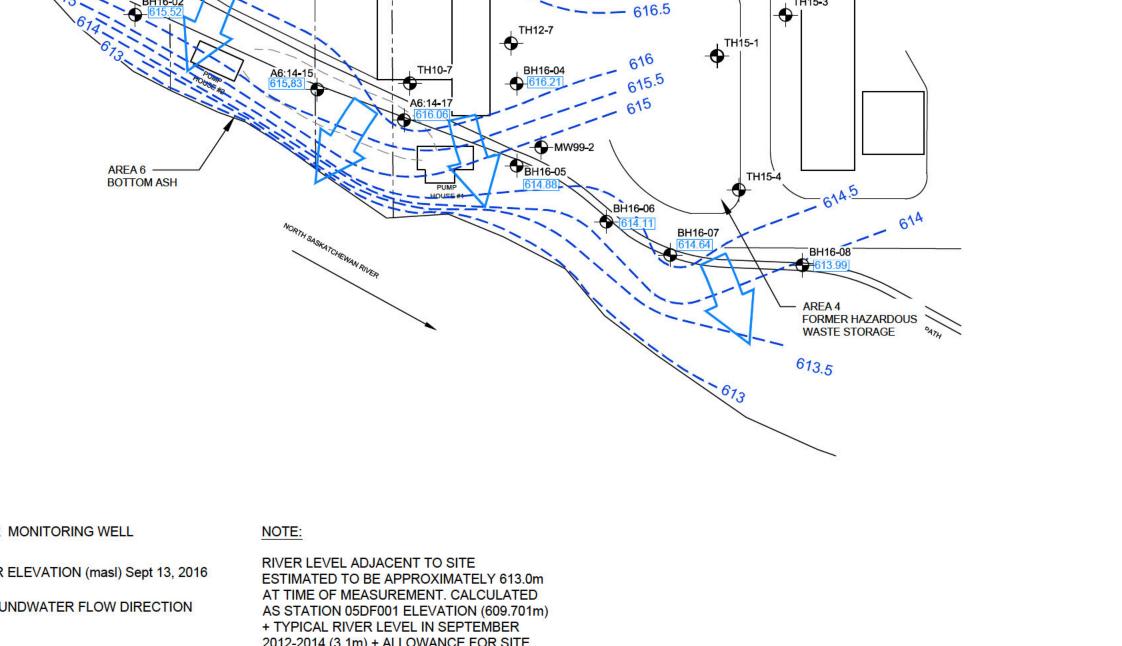
1:2000



# SITE PLAN GEOLOGICAL CROSS SECTION LOCATIONS

50

1:1000



TH12-3

TH15-3

## **LEGEND**

GROUNDWATER MONITORING WELL

GROUNDWATER ELEVATION (masl) Sept 13, 2016 INFERRED GROUNDWATER FLOW DIRECTION

630 - - - - GROUNDWATER ELEVATION CONTOURS

2012-2014 (3.1m) + ALLOWANCE FOR SITE BEING 1.7m UPSTREAM OF STATION (0.2m)

BH16-03 616.13

FORMER HP PLANT

TH12-6

TH12-2 676.5;

Figure 10

SITE PLAN: DISSOLVED METALS / TDS & ANIONS WITH INFERRED CHLORIDE GROUNDWATER PLUMES

City of Edmonton Engineering

Rossdale Plant AECOM 603443747 Date: January 30, 2018

Figure 11

# SITE PLAN: DISSOLVED METALS / TDS & ANIONS WITH INFERRED NITRATE GROUNDWATER PLUMES

City of Edmonton Engineering Rossdale Plant AECOM 603443747 Date: January 30, 2018

Figure 13

# SITE PLAN: DISSOLVED METALS / TDS & ANIONS WITH INFERRED SELENIUM GROUNDWATER PLUMES

City of Edmonton Engineering

Rossdale Plant AECOM 603443747 Date: January 30, 2018

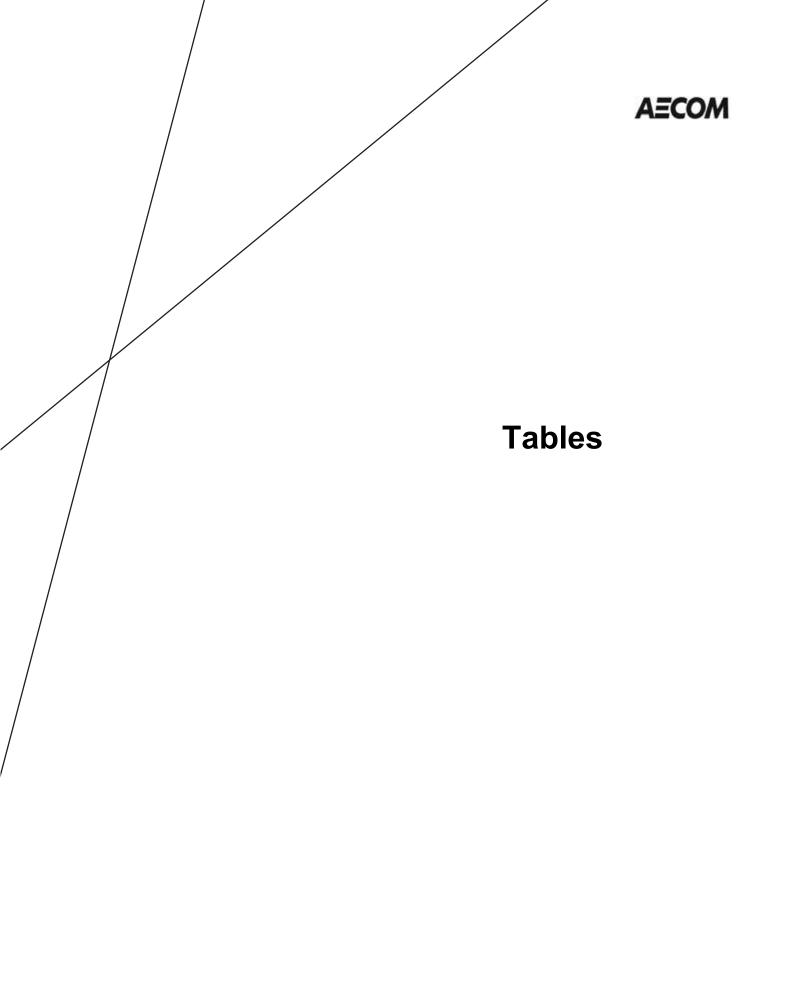


Table 1 - Soil Inorganic

Sample ID					Guideline <sup>1</sup>				А	rea 1: Natural Ga	as Metering Statio	on or Area 5 (Fill	)	
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine or Coarse)	<b>A1:</b> ′	14-18	A1: ·	14-19	<b>A1:</b> ′	14-20	LF-01
Laboratory Sample ID								4937575	4937576	4937577	4937578	4937580	4937581	4937582
Sample Date								11/19/2014	11/19/2014	11/19/2014	11/19/2014	11/19/2014	11/19/2014	11/19/2014
Sample Depth								1 m	1.5 m	1 m	1.5 m	1 m	1.5 m	
Soil Particle Size 4								Fine*	Fine*	Course*	Fine	Fine*	Fine*	
Metals														
Antimony (Sb)	mg/kg	0.20	-	-	-	-	20	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic (As)	mg/kg	0.20	21	-	-	-	17	4.40	5.80	3.30	6.7	6.4	5.1	6.2
Barium (Ba)	mg/kg	5.0	-	-	-	-	500	166	151	104.0	108	217	129	232
Beryllium (Be)	mg/kg	1.0	-	-	-	-	5	0.5	0.4	0.3	0.4	0.7	0.5	0.7
Cadmium (Cd)	mg/kg	0.50	14	-	-	-	10	0.19	0.17	0.11	0.15	0.27	0.17	0.26
Chromium (Cr)	mg/kg	0.50	220	-	-	-	64	12.4	13.4	06.4	11.5	17.7	12	13.6
Cobalt (Co)	mg/kg	1.0	-	-	-	-	20	6.6	8.3	4.9	7.1	10.4	7.4	9.9
Copper (Cu)	mg/kg	2.0	1,100	-	-	-	63	13.1	12.4	06.1	10.2	17.2	10.7	19.4
Lead (Pb)	mg/kg	5.0	140	-	-	-	300	25.3	07.6	<5.0	6.4	11.9	7	12.8
Mercury (Hg)	mg/kg	0.050	6.6	-	-	-	12	3.800	0.060	0.390	0.06	0.04	0.04	0.04
Molybdenum (Mo)	mg/kg	1.0	-	-	-	-	4	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.2
Nickel (Ni)	mg/kg	2.0	-	-	-	-	45	17.8	20.0	11.3	17.2	24.6	18.5	24.4
Selenium (Se)	mg/kg	0.50	80	-	-	-	1	0.30	0.3	0.4	<0.3	0.6	<0.3	<0.3
Silver (Ag)	mg/kg	1.0	-	-		-	20	0.1	0.1	<0.1	0.1	0.2	0.1	0.2
Thallium (TI)	mg/kg	0.50	1	-	•	-	1.4	0.13	0.15	0.1	0.12	0.18	0.13	0.2
Tin (Sn)	mg/kg	5.0	-	-	-	-	5	1.7	1.6	2.2	1.9	1.5	1.8	1.9
Uranium (U)	mg/kg	2.0	23	-	-	-	500	0.8	0.7	0.6	0.6	0.8	0.6	1.3
Vanadium (V)	mg/kg	1.0	-	-	-	-	130	21.0	25.2	13.6	21.7	31.5	21.8	25.2
Zinc (Zn)	mg/kg	10	-	-	-	-	200	49.0	42.0	22	35	64	36	57
Hexavalent Chromium	mg/kg	0.10	-	-	-	-	0.4	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
Barium (Barite)	NR	NR					-	-	-	-	-	-	-	-
Barium (Ba) [0.1CaCl <sub>2</sub> -Extractable]	mg/kg	5.0	-	-	-	-	250 <sup>2</sup>	20.1	18.5	24.7	20.3	21.9	23.8	-
Boron (B), Hot Water Ext. 3	mg/kg	1.0	-	-	-	-	-	1.43	0.78	0.44	0.69	5.9	3.96	2.2
Boron (B), Sat Paste	mg/kg	0.1	7500		118	5	3.3	-	-	-	-	-	-	-

1 - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remediation Guideline Values for Residential/Parkland Land Use - All Exposure Pathways. Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

- 2 Alberta Soil Remediation Guidelines for Barite: Environmental Health and Human Health (February 2008)
- 3 Hot Water Extractable Boron value is bolded and shaded green if the concentration is >10 mg/kg. See text for rationale.
- 4- Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECOM from comparison with lab sample descriptions and sub-surface investigation logs.

Table 1 - Soil Inorganic

Sample ID		Datastian			Guideline <sup>1</sup>					AREA 3	- Burn Pit(s) Sou	th of Watermark	Building		
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine or Coarse)	BH1/ MW1	ВН3	MW104	MW109	BH111	BH112	MW301	MW302
Laboratory Sample ID										L48003-4	L48003-8			L59834-1	L59834-2
Sample Date									2001	29-Oct-01	29-Oct-01			3/6/2002	3/6/2002
Sample Depth								7.0 m	0.5 m	6.0 m	7.6 m	1.5 m	1.5 m	2.7m	3.0 m
Soil Particle Size 4												*	*		
Metals															
Antimony (Sb)	mg/kg	0.20	-	-	-	-	20	-	-	-	-	-	-	-	-
Arsenic (As)	mg/kg	0.20	21	-	-	-	17	-	-	-	-	-	-	-	-
Barium (Ba)	mg/kg	5.0	-	-	•	-	500	271	346	254	237	314	302	354	251
Beryllium (Be)	mg/kg	1.0	-	-	•	-	5	1	<1	<1	<1	<1	<1	<1	<1
Cadmium (Cd)	mg/kg	0.50	14	-	•	-	10	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	<0.5
Chromium (Cr)	mg/kg	0.50	220	-	-	-	64	20.2	28.6	18.2	19.6	18.7	18.1	18.4	35.5
Cobalt (Co)	mg/kg	1.0	-	-	-	-	20	8	9	6	8	8	8	9	7
Copper (Cu)	mg/kg	2.0	1,100	-	-	-	63	25	29	16	17	21	19	17	14
Lead (Pb)	mg/kg	5.0	140	-	-	-	300	24	76	98	45	27	18	15	24
Mercury (Hg)	mg/kg	0.050	6.6	-	-	-	12	-	-	-		-	-		
Molybdenum (Mo)	mg/kg	1.0	-	-	-	-	4	1	<1	<1	<1	<1	<1	<1	1
Nickel (Ni)	mg/kg	2.0	-	-	-	-	45	23	23	22	23	22	24	26	29
Selenium (Se)	mg/kg	0.50	80	-	-	-	1	-	-	-	-	-	-		
Silver (Ag)	mg/kg	1.0	-	-	-	-	20	<1	<1	<1	<1			<1	<1
Thallium (TI)	mg/kg	0.50	1	-	-	-	1.4	<1	<1	<1	<1	<1	<1	<1	<1
Tin (Sn)	mg/kg	5.0	-	-	-	-	5	<5	<5	<5	<5	<5	<5	<5	<5
Uranium (U)	mg/kg	2.0	23	-	-	-	500	-	-	-	-	-	-		
Vanadium (V)	mg/kg	1.0	-	-	-	-	130	26	40	23	25	25	22	16	29
Zinc (Zn)	mg/kg	10	-	-	-	-	200	45	88.6	57.8	62.9	79.7	140	70	50
Hexavalent Chromium	mg/kg	0.10	-	-	-	-	0.4	-	-	-	-	-	-	-	-
Barium (Barite)	NR	NR					-	-	-	-	-	-	-	-	-
Barium (Ba) [0.1CaCl <sub>2</sub> -Extractable]	mg/kg	5.0	-	-	-	-	250 <sup>2</sup>	-	-	-	-	-	-	-	-
Boron (B), Hot Water Ext. 3	mg/kg	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron (B), Sat Paste	mg/kg	0.1	7500		118	5	3.3	-	-	-	-	-	-	-	-

1 - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remediation Guideline Values for F Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

- 2 Alberta Soil Remediation Guidelines for Barite: Environmental Health and Human Health (February 2008)
- 3 Hot Water Extractable Boron value is bolded and shaded green if the concentration is >10 mg/kg. See text for rationale.
- 4- Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECO

Table 1 - Soil Inorganic

Sample ID					Guideline <sup>1</sup>					AREA 3	- Burn Pit(s) Soเ	ıth of Watermark	s Building		
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine or Coarse)	BH124	BH 4 (Stantec)		A3: 14-08			A3: 14-09	
Laboratory Sample ID								L48859-4	Stantec	4916810	4916811	4916812	4916813	4949504	4916815
Sample Date								11/7/2001	2010	10/30/2014	10/30/2014	10/30/2014	10/30/2014	10/30/2014	10/30/2014
Sample Depth								1.0 m	2.7 - 3.7 m	0.5 m	1 m	2.5 m	0.5 m	1.0 m	3.1 m
Soil Particle Size 4									Fine*	Coarse*	Coarse*	Fine*	Fine*	Fine*	Coarse*
Metals			•												
Antimony (Sb)	mg/kg	0.20	-	-	-	-	20	-	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic (As)	mg/kg	0.20	21	-	-	-	17	-	6	4	6.5	5.8	3.1	4.1	5.1
Barium (Ba)	mg/kg	5.0	-	-	-	-	500	199	230	221	168	227	146	248	209
Beryllium (Be)	mg/kg	1.0	-	-	-	-	5	<1	<0.4	0.8	0.6	0.5	0.4	0.5	0.7
Cadmium (Cd)	mg/kg	0.50	14	-	-	-	10	<0.5	0.2	0.18	0.17	0.31	0.39	0.39	0.22
Chromium (Cr)	mg/kg	0.50	220	-	•	-	64	23.5	22	15.5	23.1	17.3	10.8	11.1	16.6
Cobalt (Co)	mg/kg	1.0	-	-	-	-	20	7	8	7.6	7.6	9	5.3	5.4	9.5
Copper (Cu)	mg/kg	2.0	1,100	-	•	-	63	14	21	19	15.5	15.6	21.8	19.7	34.4
Lead (Pb)	mg/kg	5.0	140	-	•	-	300	11	35	6.3	12.3	7.9	160	154	29.6
Mercury (Hg)	mg/kg	0.050	6.6	-	•	-	12		0.05	0.06	0.02	0.03	0.05	0.09	0.03
Molybdenum (Mo)	mg/kg	1.0	-	-	•	-	4	<1	1	1.2	1.2	<1.0	<1.0	1.2	<1.0
Nickel (Ni)	mg/kg	2.0	-	-	•	-	45	22	22	29.5	26.5	23.7	16	21.4	24.4
Selenium (Se)	mg/kg	0.50	80	-	•	-	1	-	<0.05	0.9	0.5	0.4	<0.3	<0.3	0.4
Silver (Ag)	mg/kg	1.0	-	-	•	-	20	<1	<1	0.1	<0.1	<0.1	<0.1	0.2	<0.1
Thallium (TI)	mg/kg	0.50	1	-	•	-	1.4	<1	<0.3	0.17	0.12	0.17	0.11	0.09	0.2
Tin (Sn)	mg/kg	5.0	-	-	-	-	5	<5	2	2	2	1.5	2.1	2.7	1.3
Uranium (U)	mg/kg	2.0	23	-	-	-	500	-	<1	1.4	1.2	0.9	0.6	0.7	0.9
Vanadium (V)	mg/kg	1.0	-	-	-	-	130	30	27	26.3	29	27	18.9	18.8	30.5
Zinc (Zn)	mg/kg	10	-	-	-	-	200	61.1	49	43	42	60	57	62	62
Hexavalent Chromium	mg/kg	0.10	-	-	-	-	0.4	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Barium (Barite)	NR	NR					-	-	-	-	-	-	-	-	-
Barium (Ba) [0.1CaCl <sub>2</sub> -Extractable]	mg/kg	5.0	-	-	•	-	250 <sup>2</sup>	-	-	21.6	18.8	23.5	37.5	37.7	17.2
Boron (B), Hot Water Ext. 3	mg/kg	1.0	-	-	•	-	-	-	-	0.91	1.14	0.42	1.22	1.31	8.83
Boron (B), Sat Paste	mg/kg	0.1	7500		118	5	3.3	-	-	-	-	-	-	-	-

1 - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remediation Guideline Values for F Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

- 2 Alberta Soil Remediation Guidelines for Barite: Environmental Health and Human Health (February 2008)
- 3 Hot Water Extractable Boron value is bolded and shaded green if the concentration is >10 mg/kg. See text for rationale.
- 4- Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECO

Table 1 - Soil Inorganic

Sample ID					Guideline <sup>1</sup>					AREA 3	- Burn Pit(s) Sou	ith of Watermark	Building		
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine or Coarse)	A3:1	4-10	A3:1	4-11		A3: ^	14-12	
Laboratory Sample ID								4916818	4916819	4916823	4916824	4916827	4916828	4949505	4916830
Sample Date								10/30/2014	10/30/2014	10/30/2014	10/30/2014	10/30/2014	10/30/2014	10/30/2014	10/30/2014
Sample Depth								1.0 m	1.5 m	1.0 m	2.0 m	1.0 m	1.5 m	3.1 m	4.6 m
Soil Particle Size 4								Fine*	Fine*	Fine*	Fine*	Fine*	Fine*	Fine*	Fine*
Metals															
Antimony (Sb)	mg/kg	0.20	-	-	-	-	20	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic (As)	mg/kg	0.20	21	-	-	-	17	5.2	7.1	6.4	5.4	5.3	5	5.7	5.6
Barium (Ba)	mg/kg	5.0	-	-	-	-	500	368	261	284	255	507	557	248	222
Beryllium (Be)	mg/kg	1.0	-	-	-	-	5	0.6	0.6	0.6	0.6	0.7	0.5	0.5	0.5
Cadmium (Cd)	mg/kg	0.50	14	-	-	-	10	0.43	0.25	0.25	0.21	0.66	1.83	0.27	0.22
Chromium (Cr)	mg/kg	0.50	220	-	-	-	64	14.3	14.9	19	13.4	14.9	14.6	16.4	14.7
Cobalt (Co)	mg/kg	1.0	-	-	-	-	20	7.3	9	10.1	7.8	8.2	7.9	8.8	8.4
Copper (Cu)	mg/kg	2.0	1,100	-	•	-	63	26.1	16.7	23	16.6	26.8	36.8	17.2	16.3
Lead (Pb)	mg/kg	5.0	140	-	-	-	300	87.5	13.2	25.4	16.1	309	1160	16.3	11.9
Mercury (Hg)	mg/kg	0.050	6.6	-	-	-	12	0.09	0.04	0.23	0.03	0.3	0.1	0.04	0.04
Molybdenum (Mo)	mg/kg	1.0	-	-	-	-	4	<1.0	<1.0	2.2	<1.0	2.3	1.2	1	<1.0
Nickel (Ni)	mg/kg	2.0	-	-	•	-	45	22.3	24.5	24.3	21.2	24.2	23	23.5	23
Selenium (Se)	mg/kg	0.50	80	-	-	-	1	0.4	0.3	0.4	<0.3	0.4	<0.3	<0.3	0.3
Silver (Ag)	mg/kg	1.0	-	-	-	-	20	<0.1	<0.1	<0.1	<0.1	0.2	0.2	0.2	<0.1
Thallium (TI)	mg/kg	0.50	1	-	-	-	1.4	0.17	0.17	0.2	0.16	0.17	0.16	0.19	0.17
Tin (Sn)	mg/kg	5.0	-	-	-	-	5	1.9	1.5	1.8	1.7	2.1	2	1.8	1.5
Uranium (U)	mg/kg	2.0	23	-	•	-	500	1.1	1	1.1	1	1.1	0.8	0.8	0.8
Vanadium (V)	mg/kg	1.0	-	-	-	-	130	24.6	26.5	26.5	23.3	24.2	24.8	26.8	25.7
Zinc (Zn)	mg/kg	10	-	-	-	-	200	106	61	65	49	123	138	60	50
Hexavalent Chromium	mg/kg	0.10	-	-	-	-	0.4	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Barium (Barite)	NR	NR					-	-	-	-	-	-	-	-	-
Barium (Ba) [0.1CaCl <sub>2</sub> -Extractable]	mg/kg	5.0	-	-	-	-	250 <sup>2</sup>	34.8	53.1	29.4	26.4	105	183	75.8	62.7
Boron (B), Hot Water Ext. 3	mg/kg	1.0	-	-	-	-	-	1.91	6.11	2.98	2.61	11.7	3.53	1.34	1.04
Boron (B), Sat Paste	mg/kg	0.1	7500		118	5	3.3	-	-	-	-	-	-	-	-

1 - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remediation Guideline Values for F Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

- 2 Alberta Soil Remediation Guidelines for Barite: Environmental Health and Human Health (February 2008)
- 3 Hot Water Extractable Boron value is bolded and shaded green if the concentration is >10 mg/kg. See text for rationale.
- 4- Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECO

Table 1 - Soil Inorganic

Sample ID					Guideline <sup>1</sup>			AREA 3 - Bu	rn Pit(s) South o Building	f Watermark		Walterdale I	Bridge Footing	s: East of Ross	dale Plant	
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine or Coarse)		A3: 14-13		TH11-1			TH12-13		
Laboratory Sample ID								4916834	4949506	4916837	819382-2	880471-2	880471-4	880471-6	880471-8	880471-10
Sample Date								10/30/2014	10/30/2014	10/30/2014	8/9/2011	7/6/2012	7/6/2012	7/6/2012	7/6/2012	7/6/2012
Sample Depth								0.5 m	1.5 m	6.1 m	0.05 m	1 m	3.0 m	5.0 m	7.0 m	9.0 m
Soil Particle Size 4								Fine*	Fine*	Fine*	Fine	Coarse	Fine	Fine	Coarse	Coarse
Metals			•													
Antimony (Sb)	mg/kg	0.20	-	-	-	-	20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic (As)	mg/kg	0.20	21	-	-	-	17	5.6	5	05.3	5.4	4.1	65	10	14	4.1
Barium (Ba)	mg/kg	5.0	-	-	-	-	500	257	172	250	174	179	229	187	1080	114
Beryllium (Be)	mg/kg	1.0	-	-	-	-	5	0.6	0.5	0.6	0.5	0.6	1.1	0.5	1.3	0.3
Cadmium (Cd)	mg/kg	0.50	14	-	-	-	10	0.25	0.15	0.23	0.23	0.14	0.16	0.24	0.46	0.11
Chromium (Cr)	mg/kg	0.50	220	-	-	-	64	18.9	13.9	14.7	16.3	11.2	27	13.3	12.5	8.1
Cobalt (Co)	mg/kg	1.0	-	-	-	-	20	8.3	7.4	8.6	8.8	6	12.5	8.3	8.3	5
Copper (Cu)	mg/kg	2.0	1,100	-	-	-	63	19.5	11.3	18.7	15	9	24	15	20	6
Lead (Pb)	mg/kg	5.0	140	-	-	-	300	222	12.1	010	116	9.2	18.7	9.8	22.4	4.5
Mercury (Hg)	mg/kg	0.050	6.6	-	-	-	12	0.04	0.03	0.05	0.04	0.02	0.04	0.03	0.03	0.04
Molybdenum (Mo)	mg/kg	1.0	-	-	-	-	4	1.7	<1.0	<1.0	<1	<1	<1	<1	2	<1
Nickel (Ni)	mg/kg	2.0	-	-	•	-	45	23	20.1	23.9	20.3	16.7	31.1	25.7	23.6	13.3
Selenium (Se)	mg/kg	0.50	80	-	•	-	1	0.4	0.3	<0.3	0.5	<0.3	0.6	0.8	1.1	<0.3
Silver (Ag)	mg/kg	1.0	-	-	•	-	20	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.3	0.5	<0.1
Thallium (TI)	mg/kg	0.50	1	-	•	-	1.4	0.15	0.13	0.16	0.13	0.08	0.17	0.19	0.39	<0.05
Tin (Sn)	mg/kg	5.0	-	-	-	-	5	1.7	1.7	1.5	2	2	1	1	3	2
Uranium (U)	mg/kg	2.0	23	-	•	-	500	0.9	0.5	0.9	1	0.6	1	1.4	1.4	<0.5
Vanadium (V)	mg/kg	1.0	-	-	-	-	130	25.5	23.8	26.0	28.5	18.2	47.8	21.7	25.2	14.6
Zinc (Zn)	mg/kg	10	-	-	-	-	200	64	46	056	103	33	80	47	50	27
Hexavalent Chromium	mg/kg	0.10	-	-	-	-	0.4	<0.10	<0.10	<0.10	-	<0.1	<0.1	<0.1	<0.1	<0.1
Barium (Barite)	NR	NR					-	-	-	-	-	26.7	23.2	4.1	3.7	19.3
Barium (Ba) [0.1CaCl₂-Extractable]	mg/kg	5.0	-	-	-	-	250 <sup>2</sup>	32	20.1	49.7	-	-	-	-	-	-
Boron (B), Hot Water Ext. <sup>3</sup>	mg/kg	1.0	-	-	-	-	-	1.77	1.51	4.41	4.5	1.4	3.2	5.1	5	3
Boron (B), Sat Paste	mg/kg	0.1	7500		118	5	3.3	-	-	-	-	-	-	-	-	-

1 - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remediation Guideline Values for F Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

- 2 Alberta Soil Remediation Guidelines for Barite: Environmental Health and Human Health (February 2008)
- 3 Hot Water Extractable Boron value is bolded and shaded green if the concentration is >10 mg/kg. See text for rationale.
- 4- Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECO

Table 1 - Soil Inorganic

Sample ID					Guideline <sup>1</sup>			Walterdale Bridge Footings: East of Rossdale Plant				Area Wide	Fill and Ha	zardous W	aste Storag	e: See Thu	ırber 1997
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine or Coarse)		TH12-14		BH119	тн	10-1	TH10-3	TH10-4	TH10-05	TH10-6
Laboratory Sample ID								880268-3	880268-4	880268-5	EBA	-	-	-	-	-	-
Sample Date								7/4/2012	7/4/2012	7/4/2012	2001	-	-	-	-	-	-
Sample Depth								2.0 m	3.0 m	4.0 m	0.75 m	2.3 m	3.8	0.4 m	0.75 m	1.5 m	2.2 m
Soil Particle Size 4								Fine	Fine	Fine	*	Fine	Coarse	Coarse	Coarse	Fine	Coarse
Metals																	
Antimony (Sb)	mg/kg	0.20	-	-	-	-	20	<0.2	<0.2	0.7	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic (As)	mg/kg	0.20	21	-	-	-	17	7.1	5	7.1	-	0.5	8	6.1	6	6.5	7.4
Barium (Ba)	mg/kg	5.0	-	-	-	-	500	179	233	281	441	449	505	377	614	303	196
Beryllium (Be)	mg/kg	1.0	-	-	-	-	5	0.7	0.5	1.2	<1	1.2	1	0.9	1.2	0.7	0.6
Cadmium (Cd)	mg/kg	0.50	14	-	•	-	10	0.12	0.23	0.44	<0.5	0.26	0.28	0.26	0.18	0.27	2
Chromium (Cr)	mg/kg	0.50	220	-	•	-	64	17.3	12.9	13.1	19.7	27.2	20.6	17.8	16	23.2	14.7
Cobalt (Co)	mg/kg	1.0	-	-	•	-	20	10	7.8	9.8	8	10.6	9.4	10	7.8	10.2	8
Copper (Cu)	mg/kg	2.0	1,100	-	•	-	63	14	15	17	20	24	14	16	19	18	13
Lead (Pb)	mg/kg	5.0	140	-	•	-	300	9.7	7.6	9.8	43	22.9	13.4	0.7	31	9.9	8.9
Mercury (Hg)	mg/kg	0.050	6.6	-	•	-	12	0.06	0.04	0.06	-	0.05	0.06	0.06	0.25	0.03	0.03
Molybdenum (Mo)	mg/kg	1.0	-	-	•	-	4	<1	<1	1	<1	<1	2	1	2	<1	<1
Nickel (Ni)	mg/kg	2.0	-	-	•	-	45	27.8	20.7	34.1	24	32.7	25.8	23.1	21.2	26.2	21.7
Selenium (Se)	mg/kg	0.50	80	-	•	-	1	0.4	0.3	0.6	-	0.6	0.6	0.6	0.6	0.5	<0.3
Silver (Ag)	mg/kg	1.0	-	-	-	-	20	<0.1	<0.1	<0.1		0.2	0.2	0.2	0.2	0.2	0.1
Thallium (TI)	mg/kg	0.50	1	-	-	-	1.4	0.18	0.12	0.33	<1	0.23	0.23	0.17	0.14	0.22	0.18
Tin (Sn)	mg/kg	5.0	-	-	-	-	5	2	1	2	<5	<1	<1	<1	1	<1	<1
Uranium (U)	mg/kg	2.0	23	-	-	-	500	0.5	0.6	0.7	-	1.4	1.3	1.3	1.9	0.8	0.7
Vanadium (V)	mg/kg	1.0	-	-	-	-	130	28.8	21.9	28.8	26	46.2	36.8	31.6	24	35.2	26.9
Zinc (Zn)	mg/kg	10	-	-	-	-	200	52	43	39	94.8	79	84	66	126	69	45
Hexavalent Chromium	mg/kg	0.10	-	-	-	-	0.4	<0.1	<0.1	<0.1	-	-	-	-	-	-	-
Barium (Barite)	NR	NR					-	26.3	21.8	29.7	-	-	-	-	-	-	-
Barium (Ba) [0.1CaCl <sub>2</sub> -Extractable]	mg/kg	5.0	-	-		-	250 <sup>2</sup>	-	-	-	-	-	-	-	-	-	-
Boron (B), Hot Water Ext. 3	mg/kg	1.0	-	-	-	-	-	2	0.5	1.1	-	-	-	-	-	-	-
Boron (B), Sat Paste	mg/kg	0.1	7500		118	5	3.3	-	-	-	-	-	-	-	-	-	-

1 - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remediation Guideline Values for F Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

- 2 Alberta Soil Remediation Guidelines for Barite: Environmental Health and Human Health (February 2008)
- 3 Hot Water Extractable Boron value is bolded and shaded green if the concentration is >10 mg/kg. See text for rationale.
- 4- Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECO

Table 1 - Soil Inorganic

Sample ID			Vanour Ecological -						Area	a 5 or 4: A	rea Wide	Fill and Ha	ızardous W	Vaste Stor	age: See	Γhurber 19	97	
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine or Coarse)	TH	10-7	TH10-10	M1 Dup of TH10-10 (1.5 m)	TH10-11	N1 Dup of TH10-11 (0.1 m)	TH10-12	TH10-13	TH10-14	TH10-15	TH10-16
Laboratory Sample ID								_	-	-	-	-	-	-	-	-	-	-
Sample Date								-	-	-	-	-	-	-	-	-	-	-
Sample Depth								1.5 m	2.7 m	1.5	m	0.3	3 m	1.5 m	0.6 m	0.3 m	0.7m	3.2 m
Soil Particle Size 4								Fine	Fine	Fine	Fine	Coarse	Coarse	Fine	Coarse	Coarse	Coarse	Coarse
Metals																		
Antimony (Sb)	mg/kg	0.20	-	-	-	-	20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic (As)	mg/kg	0.20	21	-	-	-	17	6.3	5.8	6.6	0.2	6.6	7.5	6.9	8.2	8.2	7.2	5.6
Barium (Ba)	mg/kg	5.0	-	-	-	-	500	354	284	382	353	620	730	402	1220	871	208	771
Beryllium (Be)	mg/kg	1.0	-	-	-	-	5	0.8	0.8	0.9	0.8	1	1.2	1.0	2.2	1.5	0.6	1.1
Cadmium (Cd)	mg/kg	0.50	14	-	-	-	10	0.26	0.27	0.28	0.26	0.43	0.34	0.26	0.35	0.27	0.17	0.15
Chromium (Cr)	mg/kg	0.50	220	-	-	-	64	19.1	23.8	19.2	19.6	22.1	24.1	23	24	17.2	14.0	0.8
Cobalt (Co)	mg/kg	1.0	-	-	-	-	20	8.5	9.5	9	8.9	8.2	9.3	9.8	11.4	9.1	6.9	5.9
Copper (Cu)	mg/kg	2.0	1,100	-	-	-	63	18	16	18	19	58	29	22	33	17	10	15
Lead (Pb)	mg/kg	5.0	140	-	-	-	300	14.6	10.2	26.7	15.4	39.6	73.1	19.7	398	46.2	7.9	23.2
Mercury (Hg)	mg/kg	0.050	6.6	-	-	-	12	0.09	0.06	0.16	0.18	0.7	0.74	0.44	5.0	1.06	0.05	1.32
Molybdenum (Mo)	mg/kg	1.0	-	-	-	-	4	<1	<1	1	<1	2	2	1	2	2	1	1
Nickel (Ni)	mg/kg	2.0	-	-	-	-	45	26.2	25.4	25.4	24.5	50.6	32.3	28.0	29.4	24.2	29.9	16.7
Selenium (Se)	mg/kg	0.50	80	-	-	-	1	0.4	<0.3	0.7	0.6	0.5	0.6	0.3	<0.3	0.4	<0.3	0.3
Silver (Ag)	mg/kg	1.0	-	-	-	-	20	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.3	0.1	0.2
Thallium (TI)	mg/kg	0.50	1	-	-	-	1.4	0.19	0.23	0.22	0.21	0.2	0.22	0.21	0.23	0.16	0.12	0.12
Tin (Sn)	mg/kg	5.0	-	-	-	-	5	<1	<1	<1	1	1	<1	<1	2	1	1	1
Uranium (U)	mg/kg	2.0	23	-	-	-	500	1.1	0.9	1.1	1	1.6	1.7	1.1	2.4	2.1	0.9	1.4
Vanadium (V)	mg/kg	1.0	-	-	-	-	130	30.1	39.7	33.3	33.9	27.8	31.4	38.3	36.7	28.3	24.9	21
Zinc (Zn)	mg/kg	10	-	-	-	-	200	59	61	71	73	100	77	66	85	76	37	37
Hexavalent Chromium	mg/kg	0.10	-	-	-	-	0.4	-	-	-	-	-	-	-	-	-	-	-
Barium (Barite)	NR	NR					-	-	-	-	-	-	-	-	-	-	-	-
Barium (Ba) [0.1CaCl <sub>2</sub> -Extractable]	mg/kg	5.0	-	-	-	-	250 <sup>2</sup>	•	-	-	1	-	-	-	-	-	1	-
Boron (B), Hot Water Ext. 3	mg/kg	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron (B), Sat Paste	mg/kg	0.1	7500		118	5	3.3	-	-	-	-	-	-	-	-	-	-	-

1 - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remediation Guideline Values for F Bold and shaded values exceed appropriate guideline

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- 2 Alberta Soil Remediation Guidelines for Barite: Environmental Health and Human Health (February 2008)
- 3 Hot Water Extractable Boron value is bolded and shaded green if the concentration is >10 mg/kg. See text for rationale.
- 4- Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECO

Table 1 - Soil Inorganic

Sample ID		Detection			Guideline <sup>1</sup>				Area 5 or	4: Area Wide	e Fill and Haza	rdous Waste S	Storage: See Th	urber 1997	
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine or Coarse)		TP13-1			TP13-2		TP1	13-3
Laboratory Sample ID								969470-1	969470-2	969470-3	969470-4	969470-5	969470-6	969470-7	969470-8
Sample Date									10/31/2013			10/31/2013		10/31	/2013
Sample Depth								0.1 m	0.6 m	1.3 m	0.1 m	1.6 m	3.1 m	0.8 m	1.5 m
Soil Particle Size 4								Coarse	Coarse	Fine	Coarse	Fine	Fine	Fine	Fine
Metals															
Antimony (Sb)	mg/kg	0.20	-	-	-	-	20	<0.2	0.7	<0.2	<0.02	<0.02	<0.02	0.2	<0.2
Arsenic (As)	mg/kg	0.20	21	-	-	-	17	6.2	6.6	6.2	4.2	6.1	6	5.8	6.7
Barium (Ba)	mg/kg	5.0	-	-		-	500	442	344	287	185	253	229	1030	240
Beryllium (Be)	mg/kg	1.0	-	-	•	-	5	0.9	0.8	0.7	0.5	0.6	0.5	1.8	0.5
Cadmium (Cd)	mg/kg	0.50	14	-	•	-	10	0.29	0.33	0.21	0.27	0.28	0.28	0.16	0.25
Chromium (Cr)	mg/kg	0.50	220	-	•	-	64	15.1	19.3	13.8	12.7	16	16.2	11.1	15.2
Cobalt (Co)	mg/kg	1.0	-	-	•	-	20	8.9	9.2	8.9	6	9.7	9.3	8.7	8.9
Copper (Cu)	mg/kg	2.0	1,100	-	-	-	63	28.4	49.1	18.6	79.4	19.1	17.2	18.1	18.3
Lead (Pb)	mg/kg	5.0	140	-	•	-	300	36.6	46.2	21.4	23.3	10.2	9.4	18.4	10.7
Mercury (Hg)	mg/kg	0.050	6.6	-	•	-	12	0.35	0.25	0.09	0.2	0.06	•	0.17	0.14
Molybdenum (Mo)	mg/kg	1.0	-	-		-	4	1.2	1.4	<1	1.3	<1	<1	2.3	<1
Nickel (Ni)	mg/kg	2.0	-	-	-	-	45	27.2	27.6	24.2	17.6	26.4	24.8	24.2	24.3
Selenium (Se)	mg/kg	0.50	80	-	-	-	1	0.4	0.4	0.4	<0.03	0.5	<0.03	0.5	0.5
Silver (Ag)	mg/kg	1.0	-	-	•	-	20	0.8	0.6	0.5	0.5	0.5	0.4	0.6	0.5
Thallium (TI)	mg/kg	0.50	1	-	•	-	1.4	0.15	0.16	0.15	0.1	0.17	0.16	0.13	0.19
Tin (Sn)	mg/kg	5.0	-	-	•	-	5	1.8	2.7	1.8	2.5	1.5	1.6	2.3	1.6
Uranium (U)	mg/kg	2.0	23	-	-	-	500	1.2	1.1	0.7	0.9	0.8	0.8	2.4	0.8
Vanadium (V)	mg/kg	1.0	-	-	-	-	130	27	28.4	25.9	18	28.7	28.5	23.2	26.7
Zinc (Zn)	mg/kg	10	-	-	-	-	200	79	102	65	67	67	56	45	70
Hexavalent Chromium	mg/kg	0.10	-	-	-	-	0.4	-	-	-	-	-	-	-	-
Barium (Barite)	NR	NR					-	-	-	-	-	-	-	-	-
Barium (Ba) [0.1CaCl <sub>2</sub> -Extractable]	mg/kg	5.0	-	-	1	-	250 <sup>2</sup>	19.7	12.7	21.9	22.8	19.9	20.3	14.6	16.8
Boron (B), Hot Water Ext. 3	mg/kg	1.0	-	-	,	-	-	7.9	8.84	6.52	3.17	13.2	6.1	22.2	13.7
Boron (B), Sat Paste	mg/kg	0.1	7500		118	5	3.3	-	-	-	-	-	-	-	-

1 - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remediation Guideline Values for F Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

- 2 Alberta Soil Remediation Guidelines for Barite: Environmental Health and Human Health (February 2008)
- 3 Hot Water Extractable Boron value is bolded and shaded green if the concentration is >10 mg/kg. See text for rationale.
- 4- Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECO

Table 1 - Soil Inorganic

Sample ID					Guideline <sup>1</sup>				Area 5	or 4: Area Wid	e Fill and Hazar	dous Waste Sto	rage: See Thurb	per 1997	
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine or Coarse)	TP1	13-4	TP13-5		TP13-6		TP1	13-7
Laboratory Sample ID								969470-10	969470-12	969470-15	969470-23	969470-24	969470-16	969470-25	969470-27
Sample Date								10/31/2013	10/31/2013	10/31/2013	11/1/2013	11/1/2013	10/31/2013	11/1/2013	11/1/2013
Sample Depth								0.1 m	1.6 m	2.1 m	1.5 m	3.5 m	3.9 m	0.1 m	1.5 m
Soil Particle Size 4								Coarse	Fine	Fine*	Fine	Fine	Coarse*	Coarse	Fine
Metals			•												
Antimony (Sb)	mg/kg	0.20	-	-	-	-	20	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic (As)	mg/kg	0.20	21	-	-	-	17	5.6	6.2	5.8	5.8	5.1	6.6	4.8	6
Barium (Ba)	mg/kg	5.0	-	-	-	-	500	452	271	247	338	234	271	242	617
Beryllium (Be)	mg/kg	1.0	-	-	-	-	5	0.8	0.6	0.7	0.6	0.7	0.7	0.5	1
Cadmium (Cd)	mg/kg	0.50	14	-	•	-	10	0.31	0.24	0.26	0.32	0.25	0.24	0.22	0.25
Chromium (Cr)	mg/kg	0.50	220	-	•	-	64	14.7	17.2	14.8	11.9	13.1	18.1	10.6	13.9
Cobalt (Co)	mg/kg	1.0	-	-	-	-	20	8	10.1	9.3	8.6	8.1	10.3	6.7	9.1
Copper (Cu)	mg/kg	2.0	1,100	-	•	-	63	34.3	19.8	18.2	22.6	17.4	21.1	32.8	18.2
Lead (Pb)	mg/kg	5.0	140	-	•	-	300	31.5	10.5	10.9	38.8	8.5	10.8	22.2	13.6
Mercury (Hg)	mg/kg	0.050	6.6	-	•	-	12	0.51	0.04	0.1	0.14	0.04	0.04	0.24	0.18
Molybdenum (Mo)	mg/kg	1.0	-	-	•	-	4	1.4	<1	<1	<1	<1	<1	1.2	1.8
Nickel (Ni)	mg/kg	2.0	-	-	•	-	45	23	28.5	26.3	22.2	23.8	27.8	20.5	24.5
Selenium (Se)	mg/kg	0.50	80	-	•	-	1	0.4	0.4	0.4	0.4	<0.3	0.4	<0.3	<0.3
Silver (Ag)	mg/kg	1.0	-	-	•	-	20	0.4	0.3	0.6	0.4	0.3	0.5	0.2	0.3
Thallium (TI)	mg/kg	0.50	1	-	•	-	1.4	0.15	0.16	0.17	0.14	0.16	0.19	0.12	0.17
Tin (Sn)	mg/kg	5.0	-	-	-	-	5	2.2	1.5	1.7	1.9	1.6	1.5	2.4	1.8
Uranium (U)	mg/kg	2.0	23	-	•	-	500	1.3	0.7	0.8	1.2	0.7	0.9	0.9	1.4
Vanadium (V)	mg/kg	1.0	-	-	-	-	130	23	30.8	28.6	21.9	24.1	31.3	18.9	26.2
Zinc (Zn)	mg/kg	10	-	-	-	-	200	81	67	74	95	55	65	55	60
Hexavalent Chromium	mg/kg	0.10	-	-	-	-	0.4	-	-	-	-	-	-	-	-
Barium (Barite)	NR	NR					-	-	-	-	-	-	-	-	-
Barium (Ba) [0.1CaCl <sub>2</sub> -Extractable]	mg/kg	5.0	-	-	1	-	250 <sup>2</sup>	25	12.7	18.3	24.3	25.5	10.7	20.9	41.6
Boron (B), Hot Water Ext. 3	mg/kg	1.0	-	-	-	-	-	3.63	16.6	12.8	11.7	6.58	1.62	4.17	6.78
Boron (B), Sat Paste	mg/kg	0.1	7500		118	5	3.3	-	-	-	-	-	-	-	-

1 - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remediation Guideline Values for F Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

- 2 Alberta Soil Remediation Guidelines for Barite: Environmental Health and Human Health (February 2008)
- 3 Hot Water Extractable Boron value is bolded and shaded green if the concentration is >10 mg/kg. See text for rationale.
- 4- Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECO

Table 1 - Soil Inorganic

Sample ID					Guideline <sup>1</sup>				Area 5 or 4: Ar	ea Wide Fill and	d Hazardous Wa	ste Storage: Se	e Thurber 1997	
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine or Coarse)	TP13-7		TP13-8			TP13-9	
Laboratory Sample ID								969470-28	969470-29	969470-31	969470-32	969470-34	969470-36	969470-37
Sample Date								11/1/2013	11/1/2013	11/1/2013	11/1/2013	11/1/2013	11/1/2023	11/1/2013
Sample Depth								3.0 m	0.1 m	1.5 m	2.3 m	0.1 m	1.5 m	3.0 m
Soil Particle Size 4								Coarse	Coarse	Coarse	Fine	Coarse	Coarse	Fine
Metals														
Antimony (Sb)	mg/kg	0.20	-	-	-	-	20	<0.2	0.2	0.5	0.9	0.4	0.3	<0.2
Arsenic (As)	mg/kg	0.20	21	-	-	-	17	5.4	4.1	18.8	32	4.6	11.9	4.5
Barium (Ba)	mg/kg	5.0	-	-	-	-	500	111	234	3230	6620	157	2110	201
Beryllium (Be)	mg/kg	1.0	-	-	-	-	5	0.4	0.5	3.5	6.5	0.4	3	0.5
Cadmium (Cd)	mg/kg	0.50	14	-	•	-	10	0.12	0.47	0.51	0.92	0.23	0.41	0.22
Chromium (Cr)	mg/kg	0.50	220	-	-	-	64	6.8	15.5	12.3	16.5	11.2	14	14.2
Cobalt (Co)	mg/kg	1.0	-	-	•	-	20	5.4	6.1	14.3	20.8	5.3	11	7.7
Copper (Cu)	mg/kg	2.0	1,100	-	-	-	63	8.5	193	24.1	73.4	239	23.6	17.5
Lead (Pb)	mg/kg	5.0	140	-	-	-	300	5.4	35.3	25.9	38.3	27.4	24.7	10
Mercury (Hg)	mg/kg	0.050	6.6	-	-	-	12	0.05	0.27	0.11	0.1	0.04	0.08	0.06
Molybdenum (Mo)	mg/kg	1.0	-	-	-	-	4	1	1.8	5.4	8.8	1.8	3.2	<1
Nickel (Ni)	mg/kg	2.0	-	-	•	-	45	13.9	28.1	35.1	49.4	20.8	29.7	21.2
Selenium (Se)	mg/kg	0.50	80	-	•	-	1	<0.3	<0.3	0.6	1	<0.3	0.8	0.3
Silver (Ag)	mg/kg	1.0	-	-	•	-	20	0.2	0.2	0.4	0.5	0.3	0.3	0.2
Thallium (TI)	mg/kg	0.50	1	-	•	-	1.4	0.09	0.08	0.31	0.75	0.06	0.27	0.174
Tin (Sn)	mg/kg	5.0	-	-	•	-	5	2.5	6.4	3.4	5.6	10.9	2.6	2
Uranium (U)	mg/kg	2.0	23	-	-	-	500	0.5	0.8	4.6	8.1	1.1	3.2	0.9
Vanadium (V)	mg/kg	1.0	-	-	•	-	130	18.2	17.1	34.7	56.8	16.4	34.6	24.1
Zinc (Zn)	mg/kg	10	-	-	-	-	200	28	90	40	51	57	72	54
Hexavalent Chromium	mg/kg	0.10	-	-	-	-	0.4	-	-	-	-	-	-	-
Barium (Barite)	NR	NR					-	-	-	-	-	-	-	-
Barium (Ba) [0.1CaCl <sub>2</sub> -Extractable]	mg/kg	5.0	-	-	•	-	250 <sup>2</sup>	19.7	20.6	45.6	3.9	21.9	3.8	3.5
Boron (B), Hot Water Ext. 3	mg/kg	1.0	-	-	-	-	-	6.56	6.02	14.9	27.6	5.86	27.8	20.7
Boron (B), Sat Paste	mg/kg	0.1	7500		118	5	3.3	-	-	-	-	-	-	-

1 - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remediation Guideline Values for F Bold and shaded values exceed appropriate guideline

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- 2 Alberta Soil Remediation Guidelines for Barite: Environmental Health and Human Health (February 2008)
- 3 Hot Water Extractable Boron value is bolded and shaded green if the concentration is >10 mg/kg. See text for rationale.
- 4- Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECO

Table 1 - Soil Inorganic

Sample ID					Guideline <sup>1</sup>				Area 5 or	4: Area Wide F	ill and Hazardou	us Waste St	orage: See	Thurber 199	)7	
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine or Coarse)		TP13-10		R3	TH97-1	TH97-2	TH97-3	TH97-4	TH97-5
Laboratory Sample ID								969470-39	969470-40	969470-41	969470-42	-	-	-	-	-
Sample Date								11/1/2013	11/1/2013	11/1/2013	11/1/2013	-	-	-	-	-
Sample Depth								0.75 m	2.4 m	3.0 m	R3	1.7 m	4.7 m	7.0 m	0.3m	6.2 m
Soil Particle Size 4								Coarse	Fine	Fine	Coarse	Fine*	Coarse*	Coarse*	Fine*	Coarse*
Metals			•													
Antimony (Sb)	mg/kg	0.20	-	-	-	-	20	0.8	<0.2	<0.2	0.6	-	-	-	-	-
Arsenic (As)	mg/kg	0.20	21	-	-	-	17	29.9	5.7	4	24.8	-	-	-	-	-
Barium (Ba)	mg/kg	5.0	-	-	-	-	500	6600	270	234	5800	295	107	342	493	2370
Beryllium (Be)	mg/kg	1.0	-	-	-	-	5	7.4	0.6	0.7	7.5	<1	<1	<1	<1	1
Cadmium (Cd)	mg/kg	0.50	14	-	-	-	10	0.88	0.24	0.27	0.82	<0.5	0.8	<0.5	<0.5	<0.5
Chromium (Cr)	mg/kg	0.50	220	-	-	-	64	14.4	15.8	17.3	14.6	32.4	39.3	104.0	40.7	93.4
Cobalt (Co)	mg/kg	1.0	-	-	-	-	20	21.2	8.8	8.8	20.8	2.0	2.0	<1	2.0	10.0
Copper (Cu)	mg/kg	2.0	1,100	-	-	-	63	27.1	18.6	23.2	25.5	21.0	12.0	09.0	33.0	27.0
Lead (Pb)	mg/kg	5.0	140	-	-	-	300	39	11.7	11.5	33.7	12.0	9.0	8.0	322	90.0
Mercury (Hg)	mg/kg	0.050	6.6	-	-	-	12	0.12	0.07	0.04	0.12	-	-	-	-	-
Molybdenum (Mo)	mg/kg	1.0	-	-	-	-	4	9.4	<1	<1	7.9	<1	2.0	6.0	<1	5
Nickel (Ni)	mg/kg	2.0	-	-	-	-	45	53.7	27	25.2	52.6	12.0	24.0	68.0	26.0	50
Selenium (Se)	mg/kg	0.50	80	-	-	-	1	1.3	<0.3	0.4	1.2	-	-	-	-	-
Silver (Ag)	mg/kg	1.0	-	-	-	-	20	0.5	0.2	0.2	0.5	<1	<1	<1	<1	<1
Thallium (TI)	mg/kg	0.50	1	-	-	-	1.4	0.6	0.17	0.18	0.59	<1	<1	<1	<1	<1
Tin (Sn)	mg/kg	5.0	-	-	-	-	5	4.6	1.5	1.6	3.5	<5	<5	<5	<5	<5
Uranium (U)	mg/kg	2.0	23	-	-	-	500	8.6	0.8	1	7.9	-	-	-	-	-
Vanadium (V)	mg/kg	1.0	-	-	-	-	130	50.8	28.2	29.7	51.8	34.0	18.0	39.0	32.0	41.0
Zinc (Zn)	mg/kg	10	-	-	-	-	200	43	64	66	46	739	38.2	52.5	81.8	100
Hexavalent Chromium	mg/kg	0.10	-	-	-	-	0.4	-	-	-	-	-	-	-	-	-
Barium (Barite)	NR	NR					-	-	-	-	-	-	-	-	-	-
Barium (Ba) [0.1CaCl <sub>2</sub> -Extractable]	mg/kg	5.0	-	-	-	-	250 <sup>2</sup>	45.9	12.9	10	44.4	-	-	-	-	-
Boron (B), Hot Water Ext. <sup>3</sup>	mg/kg	1.0	-	-	-	-	-	14.7	12	11	16.6	-	-	-	-	-
Boron (B), Sat Paste	mg/kg	0.1	7500		118	5	3.3	-	-	-	-	-	-	-	-	-

1 - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remediation Guideline Values for F Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

- 2 Alberta Soil Remediation Guidelines for Barite: Environmental Health and Human Health (February 2008)
- 3 Hot Water Extractable Boron value is bolded and shaded green if the concentration is >10 mg/kg. See text for rationale.
- 4- Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECO

Table 1 - Soil Inorganic

Sample ID Parameter	Units	Detection Limits	Guideline <sup>1</sup>					Area 5 or 4: Area Wide Fill and Hazardous Waste Storage: See Thurber 1997					Nichol's Background: Area 5			
			Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine or Coarse)	TH97-6	TH97-7	TH97-8	TH97-9	TH97-10	A5:14-01	A5:14-02	A5:14-03	A5:14-04
Laboratory Sample ID								-	-	-	-	-	-	-	-	-
Sample Date								-	-	-	-	-	10/27/2014	10/27/2014	10/27/2014	10/27/2014
Sample Depth								0.5 m	4.0 m	0.3 m	1.7 m	1.7 m	1.5	2.0	1.0	3.0
Soil Particle Size 4								Fine*	Coarse*	Fine*	Fine*	Fine*	Fine*	Fine*	Fine*	Fine*
Metals						•								•		
Antimony (Sb)	mg/kg	0.20	-	-	-	-	20	-	-	-	-	-	<0.02	<0.2	<0.2	<0.2
Arsenic (As)	mg/kg	0.20	21	-	-	-	17	-	-	-	-	-	5.5	5.5	6.9	6.3
Barium (Ba)	mg/kg	5.0	-	-	-	-	500	330	1150	218	325	274	194	198	189	328
Beryllium (Be)	mg/kg	1.0	-	-	-	-	5	<1	1	<1	<1	<1	0.4	0.4	0.6	0.8
Cadmium (Cd)	mg/kg	0.50	14	-	-	-	10	<0.5	<0.5	<0.5	0.8	<0.5	0.18	0.22	0.13	0.25
Chromium (Cr)	mg/kg	0.50	220	-	-	-	64	34.2	41.3	23.3	38	41.1	15.4	14.8	18.7	20.4
Cobalt (Co)	mg/kg	1.0	-	-	-	-	20	8	9	8	5	9	8.2	7.8	10.4	11.9
Copper (Cu)	mg/kg	2.0	1,100	-	-	-	63	23	36	18	21	25	18.4	17.2	20.6	23.9
Lead (Pb)	mg/kg	5.0	140	-	-	-	300	77	48	13	30	28	7.7	7.5	9.6	11.9
Mercury (Hg)	mg/kg	0.050	6.6	-	•	-	12	1	-	-	-	-	0.03	0.03	0.06	0.04
Molybdenum (Mo)	mg/kg	1.0	-	-	-	-	4	1	3	<1	<1	<1	<1.0	<1.0	<1.0	<1.0
Nickel (Ni)	mg/kg	2.0	-	-	-	-	45	20	26	16	25	28	23.4	21.7	33.4	34.8
Selenium (Se)	mg/kg	0.50	80	-	-	-	1	-	-	-	-	-	0.3	<0.3	0.4	0.4
Silver (Ag)	mg/kg	1.0	-	-	-	-	20	<1	<1	<1	<1	<1	<0.1	<0.1	<0.1	<0.1
Thallium (TI)	mg/kg	0.50	1	-	-	-	1.4	<1	<1	<1	<1	<1	0.16	0.15	0.2	0.25
Tin (Sn)	mg/kg	5.0	-	-	-	-	5	<5	<5	<5	<5	<5	1.8	1.7	1.7	1.4
Uranium (U)	mg/kg	2.0	23	-	-	-	500	-	-	-	-	-	0.7	0.6	0.7	0.6
Vanadium (V)	mg/kg	1.0	-	-	-	-	130	34	45	32.0	27	29	24	25.8	31.4	36.1
Zinc (Zn)	mg/kg	10	-	-	-	-	200	121	84.7	74	74	737	45	44	51	75
Hexavalent Chromium	mg/kg	0.10	-	-	-	-	0.4	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10
Barium (Barite)	NR	NR					-	-	-	-	-	-	5.3	17.7	6.2	31.9
Barium (Ba) [0.1CaCl <sub>2</sub> -Extractable]	mg/kg	5.0	-	-	•	-	250 <sup>2</sup>	ı	-	-	-	-	-	-	-	-
Boron (B), Hot Water Ext. 3	mg/kg	1.0	-	-	-	-	-		-	-	-	-	0.7	2.87	1.87	6.11
Boron (B), Sat Paste	mg/kg	0.1	7500		118	5	3.3	•	-	-	-	-	-	-	-	-

1 - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remediation Guideline Values for F Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

- 2 Alberta Soil Remediation Guidelines for Barite: Environmental Health and Human Health (February 2008)
- 3 Hot Water Extractable Boron value is bolded and shaded green if the concentration is >10 mg/kg. See text for rationale.
- 4- Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECO

Table 1 - Soil Inorganic

Sample ID					Guideline <sup>1</sup>					Area 6: B	ottom Ash & COE	Supplemental Inv	vestigation		
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine or Coarse)	A6:1	4-14		A6: 14-15			A6: 14-16	
Laboratory Sample ID								4922682	4922684	4922685	4922686	4949507	4922687	4949508	4922688
Sample Date								11/3/2014	11/3/2014	11/3/2014	11/3/2014	11/3/2014	11/3/2014	11/3/2014	11/3/2014
Sample Depth								3.5	5	3	6	6.5	1.5	2	2.5
Soil Particle Size 4								Fine	Fine*	Coarse*	Fine*	Fine*	Coarse*	Fine*	Fine*
Metals															
Antimony (Sb)	mg/kg	0.20	-	-	-	-	20	<0.2	<0.2	0.2	<0.2	<0.2	0.7	<0.2	0.2
Arsenic (As)	mg/kg	0.20	21	-	-	-	17	6.8	7	9.7	9	5.3	41	9.8	12.9
Barium (Ba)	mg/kg	5.0	-	-	-	-	500	469	325	856	702	284	1630	654	642
Beryllium (Be)	mg/kg	1.0	-	-	-	-	5	1	0.8	1.4	1.3	0.7	2.8	1.2	1.2
Cadmium (Cd)	mg/kg	0.50	14	-	-	-	10	0.26	0.3	0.33	0.33	0.16	3.16	0.6	0.42
Chromium (Cr)	mg/kg	0.50	220	-	-	-	64	15.3	19.2	13.8	16	13.8	19.2	17.2	13.7
Cobalt (Co)	mg/kg	1.0	-	-	-	-	20	9.5	10.3	9.1	10.6	7.5	11.7	8.9	9.3
Copper (Cu)	mg/kg	2.0	1,100	-	-	-	63	29.7	23.5	54.2	21.8	12.8	79.6	31.5	25.8
Lead (Pb)	mg/kg	5.0	140	-	-	-	300	28.7	13.5	34.2	16.3	7.1	148	43.4	49.8
Mercury (Hg)	mg/kg	0.050	6.6	-	-	-	12	0.39	0.11	0.27	0.09	0.06	1.15	1.07	0.5
Molybdenum (Mo)	mg/kg	1.0	-	-	-	-	4	1.1	1	1.5	2.5	1.1	4.5	1.4	1.9
Nickel (Ni)	mg/kg	2.0	-	-	-	-	45	25.9	28.4	25	26.4	28.1	38.2	40	26.2
Selenium (Se)	mg/kg	0.50	80	-	-	-	1	0.5	0.4	0.4	0.5	<0.3	0.7	0.5	0.6
Silver (Ag)	mg/kg	1.0	-	-	-	-	20	0.1	0.1	0.2	0.2	0.1	0.8	0.2	0.2
Thallium (TI)	mg/kg	0.50	1	-	-	-	1.4	0.23	0.25	0.27	0.26	0.15	0.97	0.26	0.29
Tin (Sn)	mg/kg	5.0	-	-	-	-	5	1.1	1.1	1.4	1.2	2.2	2.4	2	1.4
Uranium (U)	mg/kg	2.0	23	-	-	-	500	1.1	1	1.6	1.5	1	3.2	1.4	1.3
Vanadium (V)	mg/kg	1.0	-	-	-	-	130	27.7	32.3	27.3	31.5	23.1	34.2	26.7	26.9
Zinc (Zn)	mg/kg	10	-	-	-	-	200	72	73	88	67	41	147	73	69
Hexavalent Chromium	mg/kg	0.10	-	-	-	-	0.4	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Barium (Barite)	NR	NR					-	6.2	12	4.2	4.2	-	31.2	-	3.8
Barium (Ba) [0.1CaCl <sub>2</sub> -Extractable]	mg/kg	5.0	-	-	-	-	250 <sup>2</sup>	-	-	-	-	18.8	-	24.5	-
Boron (B), Hot Water Ext. 3	mg/kg	1.0	-	-	-	-	-	19.2	9.58	27.6	33.1	11.6	17.6	15.4	18.2
Boron (B), Sat Paste	mg/kg	0.1	7500		118	5	3.3	-	-	-	-	-	-	-	-

1 - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remediation Guideline Values for F Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

- 2 Alberta Soil Remediation Guidelines for Barite: Environmental Health and Human Health (February 2008)
- 3 Hot Water Extractable Boron value is bolded and shaded green if the concentration is >10 mg/kg. See text for rationale.
- 4- Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECO

Table 1 - Soil Inorganic

Sample ID					Guideline <sup>1</sup>					Area 6: B	ottom Ash & COE	: Supplemental Inv	restigation				
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine or Coarse)	A6: 14-16		<b>A6:</b> 1	14-17			BH16-01			
Laboratory Sample ID								4922689	89 4922691 4922692 4922693 4949509 5465503 5465504								
Sample Date								11/3/2014	11/3/2014	11/3/2014	11/3/2014	11/3/2014	7/21/2016	7/21/2016	7/21/2016		
Sample Depth								4.5	3.5	5.5	1.2-1.4	2.7-2.9	3.4-3.6				
Soil Particle Size 4								Fine*	Fine*	Coarse*	Fine*	Coarse*					
Metals						•											
Antimony (Sb)	mg/kg	0.20	-	-	-	-	20	<0.2	<0.2	0.3	0.3	<0.2	0.4	0.2	0.5		
Arsenic (As)	mg/kg	0.20	21	-	-	-	17	5.9	6.8	4.9	5.2	5.5	7.5	4.5	7.2		
Barium (Ba)	mg/kg	5.0	-	-	-	-	500	320	320	1460	1750	387	144	78	318		
Beryllium (Be)	mg/kg	1.0	-	-	-	-	5	0.7	0.7	2.2	2.6	0.7	0.5	0.3	0.8		
Cadmium (Cd)	mg/kg	0.50	14	-	-	-	10	0.25	0.29	0.09	0.11	0.16	0.17	0.1	0.23		
Chromium (Cr)	mg/kg	0.50	220	-	-	-	64	14.9	17.5	4.7	5	11.1	12.9	6.4	16.9		
Cobalt (Co)	mg/kg	1.0	-	-	-	-	20	8.9	10	5.6	6.5	6.6	6	4.5	8.2		
Copper (Cu)	mg/kg	2.0	1,100	-	-	-	63	21.7	20.7	12	13.9	11.9	12.8	6.3	17.2		
Lead (Pb)	mg/kg	5.0	140	-	-	-	300	16.5	18.3	7.5	8.4	<4.9	6.8	4.3	9.1		
Mercury (Hg)	mg/kg	0.050	6.6	-	-	-	12	0.08	0.06	0.06	0.06	0.02	0.06	<0.05	0.06		
Molybdenum (Mo)	mg/kg	1.0	-	-	-	-	4	1	<1.0	8.2	3.8	1.4	<1.0	<1.0	1		
Nickel (Ni)	mg/kg	2.0	-	-	-	-	45	23.5	28.9	17.4	18.6	27.9	19.5	12.5	26.3		
Selenium (Se)	mg/kg	0.50	80	-	-	-	1	0.3	0.4	1.2	0.8	<0.3	<0.3	<0.3	0.4		
Silver (Ag)	mg/kg	1.0	-	-	-	-	20	0.1	0.2	0.2	0.3	<0.1	<0.1	<0.1	<0.1		
Thallium (TI)	mg/kg	0.50	1	-	-	-	1.4	0.19	0.24	0.17	0.17	0.11	0.1	0.07	0.14		
Tin (Sn)	mg/kg	5.0	-	-	-	-	5	1.1	<1.0	2.3	2.3	3.1	<1.0	<1.0	<1.0		
Uranium (U)	mg/kg	2.0	23	-	-	-	500	0.9	0.9	4.9	4.7	1	0.6	<0.5	1		
Vanadium (V)	mg/kg	1.0	-	-	-	-	130	25.7	30.4	17	19.7	26.4	16.7	12	21.9		
Zinc (Zn)	mg/kg	10	-	-	-	-	200	53	74 11 13 27 41 28 6 <0.10 <0.10 <0.10 <0.10 <0.10 <0.10 <0.10								
Hexavalent Chromium	mg/kg	0.10	-	-	-	-	0.4	<0.10									
Barium (Barite)	NR	NR					-	9.7	28.2	16.2	7.7	-					
Barium (Ba) [0.1CaCl <sub>2</sub> -Extractable]	mg/kg	5.0	-	-	-	-	250 <sup>2</sup>	-	-	-	-	33.9					
Boron (B), Hot Water Ext. 3	mg/kg	1.0	-	-	-	-	-	29.6	9.56	37.5	30.9	3.42					
Boron (B), Sat Paste	mg/kg	0.1	7500		118	5	3.3	-	0.25 0.39								

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Table 1 - Soil Inorganic

Sample ID		<b>-</b>			Guideline <sup>1</sup>					Area 6: B	ottom Ash & COE	Supplemental Inv	vestigation		
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine or Coarse)		BH16-02		ВН1	6-03		BH16-04	
Laboratory Sample ID								5465506	5465507	5465508	5465509	5465510	5459364	5459365	5459366
Sample Date								7/21/2016     7/21/2016     7/21/2016       1.1-1.3     2.7-3.0     4.9-5.1				7/21/2016	7/21/2016	7/21/2016	7/21/2016
Sample Depth								1.1-1.3 2.7-3.0 4.9-5.1			1.2-1.4	1.9-2.1	0.6-0.8	1.5-1.6	2.2-2.4
Soil Particle Size 4								1.1-1.3							
Metals															
Antimony (Sb)	mg/kg	0.20	-	-	-	-	20	0.6	1.1	0.7	0.4	0.6	1.9	0.7	0.6
Arsenic (As)	mg/kg	0.20	21	-	-	-	17	7.7	9	7.5	6.8	7	9.4	8.1	9.3
Barium (Ba)	mg/kg	5.0	-	-	-	-	500	319	495	402	201	249	681	456	188
Beryllium (Be)	mg/kg	1.0	-	-	-	-	5	0.8	1.2	0.9	0.6	0.8	1.1	0.8	0.5
Cadmium (Cd)	mg/kg	0.50	14	-	-	-	10	0.23	0.31	0.25	0.21	0.25	0.28	0.25	0.22
Chromium (Cr)	mg/kg	0.50	220	-	-	-	64	14.1	18.1	21.3	19.2	14.5	23.1	21.1	17.9
Cobalt (Co)	mg/kg	1.0	-	-	-	-	20	7.1	9.2	8.7	6.7	7.7	9.4	9.4	8.1
Copper (Cu)	mg/kg	2.0	1,100	-	-	-	63	23	24.6	21	11	15.9	24.8	20.3	15.7
Lead (Pb)	mg/kg	5.0	140	-	-	-	300	13.1	29.8	23.5	8.3	15.4	27.7	15.6	7.6
Mercury (Hg)	mg/kg	0.050	6.6	-	-	-	12	0.09	0.85	0.19	0.1	0.13	0.85	0.28	0.05
Molybdenum (Mo)	mg/kg	1.0	-	-	-	-	4	1.2	1.3	1.1	<1.0	1.8	1.5	1.3	1
Nickel (Ni)	mg/kg	2.0	-	-	-	-	45	23.7	29.1	27.7	29.3	23.8	36.3	29.9	25.1
Selenium (Se)	mg/kg	0.50	80	-	-	-	1	0.4	0.4	0.4	<0.3	<0.3	0.5	0.4	0.3
Silver (Ag)	mg/kg	1.0	-	-	-	-	20	<0.1	<0.1	<0.1	0.1	<0.1	0.1	<0.1	<0.1
Thallium (TI)	mg/kg	0.50	1	-	-	-	1.4	0.14	0.15	0.14	0.11	0.14	0.18	0.17	0.14
Tin (Sn)	mg/kg	5.0	-	-	-	-	5	<1.0	6.9	1.1	<1.0	<1.0	5.5	1.2	<1.0
Uranium (U)	mg/kg	2.0	23	-	-	-	500	1	1.4	1.1	0.8	0.7	1.5	1	0.7
Vanadium (V)	mg/kg	1.0	-	-	-	-	130	21.4	25.1	26	18.8	21.7	26.1	25.7	23.1
Zinc (Zn)	mg/kg	10	-	-	-	-	200	55	89	72	44	69	81	76	60
Hexavalent Chromium	mg/kg	0.10	-	-	-	-	0.4				<0.10	<0.10	<0.10	<0.10	<0.10
Barium (Barite)	NR	NR					-					-	-	-	
Barium (Ba) [0.1CaCl <sub>2</sub> -Extractable]	mg/kg	5.0	-	-	-	-	250 <sup>2</sup>						44.9	35.2	38.2
Boron (B), Hot Water Ext. 3	mg/kg	1.0	-	-	-	-	-						-	-	-
Boron (B), Sat Paste	mg/kg	0.1	7500		118	5	3.3	2.99	6.22	9.98	0.63	3.79	0.84	2.94	2.14

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- 3 Hot Water Extractable Boron value is bolded and shaded green if the concentration is >10 mg/kg. See text for rationale.
- 4- Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECO

Table 1 - Soil Inorganic

Sample ID		<b>-</b>			Guideline <sup>1</sup>					Area 6: B	ottom Ash & COE	Supplemental Inv	estigation/		
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine or Coarse)		BH16-05			BH16-06		ВН1	6-07
Laboratory Sample ID								5459367	5459368	5459369	5459370	5459371	5459372	5459373	5459374
Sample Date								7/21/2016	7/21/2016	7/21/2016	7/21/2016	7/21/2016	7/21/2016	7/23/2016	7/23/2016
Sample Depth								0.5-0.7	3.5-3.7	5.6-5.8	0.6-0.8	2.9-3.1	5.2-5.4	1.0-1.2	1.8-2.0
Soil Particle Size 4															
Metals															
Antimony (Sb)	mg/kg	0.20	-	-	-	-	20	0.2	1.2	0.5	1.1	2	0.5	0.9	0.7
Arsenic (As)	mg/kg	0.20	21	-	-	-	17	5.6	9.2	7.5	9.4	11.5	7.5	7.4	8.1
Barium (Ba)	mg/kg	5.0	-	-	-	-	500	97	658	230	562	1450	232	322	421
Beryllium (Be)	mg/kg	1.0	-	-	-	-	5	0.3	1.3	0.4	1.2	2.3	0.5	0.6	0.8
Cadmium (Cd)	mg/kg	0.50	14	-	-	-	10	0.12	0.34	0.23	0.35	0.48	0.22	0.26	0.27
Chromium (Cr)	mg/kg	0.50	220	-	-	-	64	6.7	19.8	15.8	19.9	19.2	13.8	29.8	16.5
Cobalt (Co)	mg/kg	1.0	-	-	-	-	20	4.9	9.9	7.7	10.4	12.1	7.7	8.2	8.5
Copper (Cu)	mg/kg	2.0	1,100	-	-	-	63	7.8	52.7	14.6	33.2	66.7	22.6	20.3	30.2
Lead (Pb)	mg/kg	5.0	140	-	-	-	300	5.3	27.7	8.8	30.6	59.3	8.1	25.3	20
Mercury (Hg)	mg/kg	0.050	6.6	-	-	-	12	0.07	0.39	0.05	0.38	1.14	0.07	0.15	0.23
Molybdenum (Mo)	mg/kg	1.0	-	-	-	-	4	<1.0	1.6	<1.0	1.5	3.2	1.1	1	1.1
Nickel (Ni)	mg/kg	2.0	-	-	-	-	45	13.1	31.1	22.9	30.7	35.5	22.3	28.4	25.3
Selenium (Se)	mg/kg	0.50	80	-	-	-	1	<0.3	0.5	<0.3	0.4	0.6	<0.3	<0.3	0.4
Silver (Ag)	mg/kg	1.0	-	-	-	-	20	<0.1	0.1	<0.1	0.1	0.1	<0.1	<0.1	<0.1
Thallium (TI)	mg/kg	0.50	1	-	-	-	1.4	0.1	0.18	0.13	0.18	0.19	0.13	0.14	0.14
Tin (Sn)	mg/kg	5.0	-	-	-	-	5	<1.0	3	<1.0	2.4	4.1	<1.0	<1.0	2.5
Uranium (U)	mg/kg	2.0	23	-	-	-	500	<0.5	1.5	0.7	1.2	3.1	0.7	0.9	1.2
Vanadium (V)	mg/kg	1.0	-	-	-	-	130	10.2	26.9	22	26.6	32.8	20	23.6	23.8
Zinc (Zn)	mg/kg	10	-	-	-	-	200	33	99	58	97	134	58	94	75
Hexavalent Chromium	mg/kg	0.10	-	-	-	-	0.4	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Barium (Barite)	NR	NR					-	-	-	-	-	-	-	-	-
Barium (Ba) [0.1CaCl <sub>2</sub> -Extractable]	mg/kg	5.0	-	-	-	-	250 <sup>2</sup>	12	20.4	10.7	11.4	10.5	16.7	11.6	13.5
Boron (B), Hot Water Ext. 3	mg/kg	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron (B), Sat Paste	mg/kg	0.1	7500		118	5	3.3	0.76	11.9	5.42	6.39	22.5	6.75	0.39	2.32

1 - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remediation Guideline Values for F Bold and shaded values exceed appropriate guideline

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- 2 Alberta Soil Remediation Guidelines for Barite: Environmental Health and Human Health (February 2008)
- 3 Hot Water Extractable Boron value is bolded and shaded green if the concentration is >10 mg/kg. See text for rationale.
- 4- Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECO

Table 1 - Soil Inorganic

Sample ID					Guideline <sup>1</sup>			,	Area 6: Bottom As	sh & COE Supplen	nental Investigatio	n	
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine or Coarse)	вн	16-07		BH16-08		TH92-A
Laboratory Sample ID								5459375	5459376	5459377	5459378	5459379	Thurber
Sample Date								7/23/2016	7/23/2016	7/23/2016	7/23/2016	7/23/2016	1992
Sample Depth								4.6-4.8	6.1-6.3	0.5-0.8	3.6-3.8	5.0-5.2	3.8 - 4.6 m
Soil Particle Size 4													Coarse*
Metals			•										
Antimony (Sb)	mg/kg	0.20	-	-	-	-	20	1.3	0.5	0.6	1.1	0.7	-
Arsenic (As)	mg/kg	0.20	21	-	-	-	17	8.7	8.1	8.8	8.5	8.7	-
Barium (Ba)	mg/kg	5.0	-	-	-	-	500	445	284	340	242	488	1470
Beryllium (Be)	mg/kg	1.0	-	-	•	-	5	0.9	0.6	0.6	0.7	0.9	8.1
Cadmium (Cd)	mg/kg	0.50	14	-	-	-	10	0.25	0.27	0.28	0.23	0.28	1.1
Chromium (Cr)	mg/kg	0.50	220	-	•	-	64	21.2	20	20	25	17.5	7.3
Cobalt (Co)	mg/kg	1.0	-	-	-	-	20	8.2	9.3	9.1	9.4	8.8	20
Copper (Cu)	mg/kg	2.0	1,100	-	-	-	63	35.3	20.2	20.2	28	20.7	27.3
Lead (Pb)	mg/kg	5.0	140	-	-	-	300	25.4	9.9	13.6	33.8	16.4	54
Mercury (Hg)	mg/kg	0.050	6.6	-	-	-	12	0.23	0.06	0.33	0.12	0.37	-
Molybdenum (Mo)	mg/kg	1.0	-	-	-	-	4	1.2	<1.0	1	1.4	1.7	<2
Nickel (Ni)	mg/kg	2.0	-	-	-	-	45	26.3	27.7	28.7	34.2	26.8	39
Selenium (Se)	mg/kg	0.50	80	-	-	-	1	0.3	<0.3	<0.3	0.3	0.3	-
Silver (Ag)	mg/kg	1.0	-	-	-	-	20	<0.1	0.1	<0.1	0.1	0.1	-
Thallium (TI)	mg/kg	0.50	1	-	-	-	1.4	0.14	0.17	0.17	0.16	0.17	-
Tin (Sn)	mg/kg	5.0	-	-	-	-	5	1.9	<1.0	<1.0	1	<1.0	-
Uranium (U)	mg/kg	2.0	23	-	-	-	500	1.2	0.9	0.9	0.9	1.2	-
Vanadium (V)	mg/kg	1.0	-	-	-	-	130	24	27.1	25.5	26	25.1	40.9
Zinc (Zn)	mg/kg	10	-	-	-	-	200			76	75	72	55.7
Hexavalent Chromium	mg/kg	0.10	-	-	-	-	0.4	<0.10	<0.10	<0.10	<0.10	<0.10	-
Barium (Barite)	NR	NR					-	-	-	-	-	-	-
Barium (Ba) [0.1CaCl <sub>2</sub> -Extractable]	mg/kg	5.0	-	-	-	-	250 <sup>2</sup>	16.9	10.8	47.1	14.8	26.3	-
Boron (B), Hot Water Ext. 3	mg/kg	1.0	-	-	-	-	-	-	-	-	-	-	-
Boron (B), Sat Paste	mg/kg	0.1	7500		118	5	3.3	3.48	2.56	0.22	2.08	2.92	-

1 - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remediation Guideline Values for F Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

- 2 Alberta Soil Remediation Guidelines for Barite: Environmental Health and Human Health (February 2008)
- 3 Hot Water Extractable Boron value is bolded and shaded green if the concentration is >10 mg/kg. See text for rationale.
- 4- Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECO

Sample ID					Guideline <sup>1</sup>					Natural Gas	Metering Station	or Area 5 (fill)		,	AREA 3 - Burn P	it(s) South of Wa	atermark Buildin	g
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine/Coarse)	Tier 1 Subsurface Remediation Guidelines 3	A1: 14-18	A1: 14-19	A1: ·	14-20	LF-01	MW104	MW109	MW	/201	MW202
Laboratory Sample ID									4937576	4937577	4937580	4949503	4937582	L48003-4	L48003-8	L53452-1	L53452-2	L53452-3
Sample Date									19-Nov-2014	19-Nov-2014	19-Nov-2014	19-Nov-2014	19-Nov-2014	29-Oct-01	29-Oct-01	19-Dec-01	19-Dec-01	19-Dec-01
Sample Depth									1.5 m	1.0 m	1.0 m	1.5 m		6 m	7.6 m	6.8 m	12.9 m	8.7 m
Soil Particle Size 4									Fine	Course*	Fine*	Fine*						+
Petroleum Hydrocarbons																		
Benzene	mg/kg	0.0050	78	1.6	0.078	0.17	60/ 31		-	-	-	-	<0.005	0.06	0.04	<0.01	<0.01	<0.01
EthylBenzene	mg/kg	0.015	8,500	930	0.14	540	120/ 55		=	-	-	-	<0.01	0.28	0.74	0.04	0.05	<0.01
Styrene	mg/kg	0.050	10,000	220	210	0.8	-		-	-	-	-	-	-	-	-	-	-
Toluene	mg/kg	0.050	20,000	1,900	0.95	0.12	110/75		-	-	-	-	<0.04	0.02	0.04	0.01	<0.01	<0.01
o-Xylene	mg/kg	0.050	-	-	-	-	-		=	-	-	-	=	-	<u> </u>	-	-	-
m+p-Xylene	mg/kg	0.050	-	-	-	-	-		-	_	_	_	-	-	_	-	-	-
Xylenes	mg/kg	0.10	140,000	250	1.9	41	65/ 95		-	_	_	_	<0.03	1.2	3.3	0.15	0.27	<0.01
MTBE	mg/kg	NR	-	-	-	-	-		-	-	-	_	-	-	-	-	-	-
F1(C6-C10)	mg/kg	10	12,000	610	2,200	1,300	210/ 210	/ 30	-	_	_	_	<10	110	130	65	82	<5
F1-BTEX	mg/kg	10	-	-	-,	-	-	, , ,	-	-	-	-	<10	110	130	65	82	<5
F2 (C10-C16)	mg/kg	20	6,800	3,100	2,900	520	150/ 130	300/ 160	-	-	_	_	<50	7	350	160	67	<5
F2-Napth	mg/kg	NR	-	-	-	-	-	000/ 100	-	-	-	-	-	-	350	-	-	-
F3 (C16-C34)	mg/kg	20	15,000	-		-	1300/ 300	2600/ 600	-	_	_	_	<50	12000	11000	13000	2000	14
F3 -PAH	mg/kg	NR	-	-		-	-	2000/ 000	-	_	_	_	-	-	-	-	-	-
F4 (C34-C50)	mg/kg	20	21,000	-	-	-	5600/ 2800	10000/ 5600	=	_	_	_	<100	7700	8300	5800	920	<5
F4G-SG (GHH-Silica)	mg/kg	NR	-	-	-	-	-	10000/ 3000	<u>-</u>	-	_	_	-	20000	21000	20000	3300	200
Total Hydrocarbons		NR	-	-	<u> </u>	-			-	-		_	-	20000	20000	19000	3100	14
Polycyclic Aromatic Hydrocarbo	mg/kg	INK	-	-	_	-	-		-	-	-	-	-	20000	20000	19000	3100	14
		0.040	F 200	00.000		0.20			-0.05	-0.05	-0.05	-0.05				I	I	
Acenaph hene	mg/kg	0.010 0.010	5,300	99,000	<u> </u>	0.38	<u> </u>		<0.05 <0.05	<0.05 <0.05	<0.05 <0.05	<0.05 <0.05	-	-		-	-	-
Acenaphthylene Anthracene	mg/kg	0.010	24,000		<u> </u>	0.0056	2.5		<0.03	<0.03	0.007	<0.03	-		<u> </u>	-		
	mg/kg		-	-										-			-	-
Benz(a)anthracene	mg/kg	0.010 0.010	-	-	3.1	0.083 0.77	20		<0.01 <0.05	<0.01 <0.05	<0.01 <0.05	<0.01 <0.05	-	-	<0.1 <0.1	-	-	-
Benzo(a)pyrene	mg/kg								<0.05	<0.05	<0.05	<0.05	-	-				
Benzo(b&j)fluoranthene	mg/kg	0.010 0.010	-	-	63	-	<del>-</del>		<0.05	<0.05	<0.05	<0.05	-	-	0.1	-	-	-
Benzo(g,h,i)perylene	mg/kg				0.31	-	<u>-</u>					<0.05	-	-	0.4	-	-	-
Benzo(k)fluoranthene	mg/kg	0.010	-	-		-	-		<0.05	<0.05	<0.05		-	-	<0.1	-	-	-
Chrysene	mg/kg	0.010	-	-	19	-	-		<0.05	<0.05	<0.05	<0.05	-	-	0.4	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.010	2.500	-	2.1	- 0.020	-		<0.05	<0.05	<0.05	<0.05	-	-	<0.1	-	-	-
Fluoranthene	mg/kg	0.010	3,500	-	-	0.039	50		<0.01	<0.01	0.02	<0.01	-	-	-	-	-	-
Fluorene	mg/kg	0.010	2,700	220,000	-	0.34	-		<0.05	<0.05	<0.05	<0.05	-	-	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg	0.010	-	-	24	- 0.047	=		<0.05	<0.05	<0.05	<0.05	=	=	<0.1	-	-	=
Naphthalene	mg/kg	0.010	1,800	51	53	0.017	-		0.01	<0.010	0.013	<0.010	-	-	3.5	-	-	-
Phenanthrene	mg/kg	0.010	-	-	-	0.061	-		0.03	<0.01	0.03	0.01	-	-	0.8	-	-	-
Pyrene	mg/kg	0.010	2,100	=	-	0.04	=		<0.01	0.02	0.02	<0.01	=	=	0.4	-	-	=
IACR:Coarse	mg/kg	0.050	-	-	IACR < 1	-	-		<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-
IACR:Fine	mg/kg	0.050	-	-	IACR < 1	-	-		<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-
B(A)P Total Potency Equivalent	mg/kg	0.020	5.3	-		-	-		-	-	-	-	-	-	-	-	-	-
PCB	mg/kg																	<del> </del>
VOC Scan	mg/kg																	<u> </u>

Cells with "-" indicate that the associated parameter was not analyzed.

NR - Not Reported

Tables-Rossdale Plant - Gap Analysis 2016-05-25 Page 1 of 16

<sup>1 -</sup> Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remedia ion Guideline Values for Residential/Parkland Land Use - All Exposure Pathways Bold and shaded values exceed appropriate guideline

<sup>2-</sup> Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECOM from comparison with lab sample descriptions and sub-surface investigation logs.

<sup>3 -</sup> Subsoil guidelines apply to depths greater han 3m and provided when less conversative han Direct Soil Contact guidelines.

Sample ID					Guideline <sup>1</sup>						AREA	3 - Burn Pit(	s) South of W	atermark Build	ing			
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine/Coarse)	MW203	MW301	MW302	внз	BH112	BH124	BH1 / MW1	BH401	BH402	BH403	BH 4 (stantec)
Laboratory Sample ID								L53452-4					L48859-4					S69401
Sample Date								19-Dec-01	6-Mar-02	6-Mar-02	2001		7-Nov-01					2-Mar-10
Sample Depth								8.4 m	2.7m	3.0m	0.5 m	1.5 m	1 m					2.7 - 3.7 m
Soil Particle Size 4									Fine*	Fine*								Fine*
Petroleum Hydrocarbons																		
Benzene	mg/kg	0.0050	78	1.6	0.078	0.17	60/ 31	<0.01	<0.01	<0.01	0.14	0.02	<0.01	0.11	<0.01	<0.01	<0.01	<0.0050
EthylBenzene	mg/kg	0.015	8,500	930	0.14	540	120/ 55	<0.01	<0.01	<0.01	0.25	0.07	<0.01	6	<0.01	<0.01	<0.01	<0 010
Styrene	mg/kg	0.050	10,000	220	210	0.8	-	-	-	-	-	-	-	-	-	-	-	_
Toluene	mg/kg	0.050	20,000	1,900	0.95	0.12	110/75	<0.01	<0.01	<0.01	0.03	0.03	<0.01	0.89	<0.01	<0.01	<0.01	<0 020
o-Xylene	mg/kg	0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m+p-Xylene	mg/kg	0.050	-	-	-	_	-	-	-	-	-	-	-	-	-	-	-	_
Xylenes	mg/kg	0.10	140,000	250	1.9	41	65/ 95	<0.01	<0.01	<0.01	2.2	0.08	<0.01	5.5	<0.01	<0.01	<0.01	<0 040
MTBE	mg/kg	NR	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-
F1(C6-C10)	mg/kg	10	12,000	610	2,200	1,300	210/ 210	<5	<5	<5	_	<5	<5	93	<5	<5	<5	34
F1-BTEX	mg/kg	10	-	-	-,	-	-	<5	-	-	_	-	<5	-	-	-	-	34
F2 (C10-C16)	mg/kg	20	6,800	3,100	2,900	520	150/ 130	<5	<5	74	_	460	<5	1700	<5	7	130	-
F2-Napth	mg/kg	NR	-	-	-	-	-	-	-	-	_	-	-	-	-	-	-	_
F3 (C16-C34)	mg/kg	20	15,000	-		_	1300/ 300	26	91	2100	-	44,000	71	23,000	<5	<5	1800	4900
F3 -PAH	mg/kg	NR	-	-	-	_	-	-	-	-	_	-	-	-	-	-	-	-
F4 (C34-C50)	mg/kg	20	21,000	-	-	_	5600/ 2800	5	79	1700	_	37,000	<5	17,000	8	<5	3800	2600
F4G-SG (GHH-Silica)	mg/kg	NR	-	-	-	_	-	400	170	3900	_	100,000	200	42,000	-	-	-	12000
Total Hydrocarbons	mg/kg	NR	-	_		_		31	-	-	_	-	71	-	-	-	_	-
Polycyclic Aromatic Hydrocarbo		1417						31					7 1					1
Acenaph hene	mg/kg	0.010	5,300	99,000		0.38		_	I _	_	_	_	_	_		_		_
Acenaphthylene	mg/kg	0.010	-	-		-		_	_	-	_	_	_	_	_	_	_	_
Anthracene	mg/kg	0.0040	24,000	-	_	0.0056	2.5	_	_	-	_	_	-	_	_	_	_	-
Benz(a)anthracene	mg/kg	0.010	-	-	3.1	0.083	-	-	_	-	<0.1	_	-	-	-	-	_	-
Benzo(a)pyrene	mg/kg	0.010	-	_	3.4	0.77	20	-	_	-	<0.1	_	_	_	_	_	_	-
Benzo(b&j)fluoranthene	mg/kg	0.010	-	-	1.4	-	-	-	_	-	<0.1	-	-	_	_	_	_	-
Benzo(g,h,i)perylene	mg/kg	0.010	-	-	63	_		-	_	-	-	_	-	_	_	_	_	-
Benzo(k)fluoranthene	mg/kg	0.010	-	_	0.31	_		_	_	-	<0.1	_	_	_	_	_	_	_
Chrysene	mg/kg	0.010	-	-	19	_		-	_	-	-	-	-	_	_	_	_	-
Dibenz(a,h)anthracene	mg/kg	0.010	-	_	2.1	_		_	_	-	<0.1	_	_	_	_	_	_	-
Fluoranthene	mg/kg	0.010	3,500	-	-	0.039	50	-	-	-	-	_	-	-	-	-	_	-
Fluorene	mg/kg	0.010	2,700	220,000	_	0.34	-	-	_	-	_	_	-	-	-	-	_	-
Indeno(1,2,3-c,d)pyrene	mg/kg	0.010	-	-	24	-		_	_	-	<0.1	_	-	_	-	-	_	_
Naphthalene	mg/kg	0.010	1,800	51	53	0.017	<u> </u>	_	_	-	0.8	_	_		-		_	_
Phenanthrene	mg/kg	0.010	-	-	-	0.017	<u> </u>	-	-	-	0.8	_	-	-	-	-	_	-
Pyrene	mg/kg	0.010	2,100	-		0.001	<u>-</u>	-	-	-	0.3	-	-	-	-	-	-	-
IACR:Coarse	mg/kg	0.050	-	_	IACR < 1	-		_	_	-	-	-	-	-	-	-	-	-
IACR:Fine	mg/kg	0.050	-	-	IACR < 1	_		-	-	-	-	-	-	-	-	-	-	-
				-	IAUR < 1	-	•	-	-	<del>-</del>	<del>                                     </del>	<del>-</del>	-	<del>-</del>	-	<del>                                     </del>	-	-
B(A)P Total Potency Equivalent	mg/kg	0.020	5.3	-		-	-	-	-	-		-	-	-	-	-	-	-
PCB	mg/kg								1	-				1				+
VOC Scan	mg/kg									L	<u>l</u>			L		<u> </u>		

Cells with "-" indicate that the associated parameter was not analyzed.

<sup>1 -</sup> Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remedia ion Guideline Values for Resic Bold and shaded values exceed appropriate guideline

<sup>2-</sup> Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECOM from previous reports where provided and the state of the state

<sup>3 -</sup> Subsoil guidelines apply to depths greater than 3m and provided when less conversative han Direct Soil Contact guidelines.

Sample ID					Guideline <sup>1</sup>						ARI	EA 3 - Burn Pit(s) S	outh of Watermark	Building			
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine/Coarse)	MW	14-1		A3: 14-08			A3: 14-09		A3: -	14-09
Laboratory Sample ID								1036035-1	1036035-2	4916810	4916809	4916812	4916813	4916814	4916815	4916816	4916817
Sample Date								12-Oct-14	12-Oct-14	30-Oct-2014	30-Oct-2014	30-Oct-2014	30-Oct-2014	30-Oct-2014	30-Oct-2014	30-Oct-2014	30-Oct-2014
Sample Depth								6.7 m	8.1 m	0.5 m	2 m	2.5 m	0.5 m	1 m	3.1 m	8.3 m	9 m
Soil Particle Size 4										Coarse*	Fine*	Fine*	Fine*	Fine*	Coarse*	Coarse*	Coarse*
Petroleum Hydrocarbons																	
Benzene	mg/kg	0.0050	78	1.6	0.078	0.17	60/ 31	0.135	0.018	-	<0.005	-	-	<0 005	-	<0.005	-
EthylBenzene	mg/kg	0.015	8,500	930	0.14	540	120/ 55	0.57	<0.01	-	<0.010	-	-	<0 010	-	<0.010	-
Styrene	mg/kg	0.050	10,000	220	210	0.8	-	-	-	-	<0.010	-	-	<0 010	-	<0.010	-
Toluene	mg/kg	0.050	20,000	1,900	0.95	0.12	110/75	0 04	<0.04	-	<0.02	-	-	<0.02	-	<0.02	-
o-Xylene	mg/kg	0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m+p-Xylene	mg/kg	0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes	mg/kg	0.10	140,000	250	1.9	41	65/ 95	2.06	0.07	-	<0.03	-	-	< 0.03	-	< 0.03	-
MTBE	mg/kg	NR	-	-	-	-	=	-	-	=	-	-	-	-	-	-	-
F1(C6-C10)	mg/kg	10	12,000	610	2,200	1,300	210/ 210	60	<10	=	<10	-	-	<10	-	<10	-
F1-BTEX	mg/kg	10	-	-	-	-	-	57	<10	-	<10	-	-	<10	-	<10	-
F2 (C10-C16)	mg/kg	20	6,800	3,100	2,900	520	150/ 130	557	<50	-	<50	-	-	<50	-	<50	-
F2-Napth	mg/kg	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F3 (C16-C34)	mg/kg	20	15,000	_		-	1300/ 300	15400	66	-	<50	_	_	281	_	<50	_
F3 -PAH	mg/kg	NR	-	_		-	-	-	-	-	-	_	_	-	_	-	-
F4 (C34-C50)	mg/kg	20	21,000	_		_	5600/ 2800	14100	<100	-	<100	_	_	275	<u>-</u>	<100	_
F4G-SG (GHH-Silica)	mg/kg	NR	-	_		_	-	22500	<100	-	-	_	_	-	<u>-</u>	-	-
Total Hydrocarbons	mg/kg	NR	-	_	-	-		-	-	-	-	_	_	_	_	_	_
Polycyclic Aromatic Hydrocarbo		1413															
Acenaph hene	mg/kg	0.010	5,300	99,000	-	0.38	_	<0.5	<0.05	<0.05	_	<0.05	<0.05	<0.05	<0.05	_	<0.05
Acenaphthylene	mg/kg	0.010	-	-	_	-	-	<0.5	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05	_	<0.05
Anthracene	mg/kg	0.0040	24,000	_		0.0056	2.5	0.12	0.006	0.082	-	<0.003	0.041	0.066	0.003	_	<0.003
Benz(a)anthracene	mg/kg	0.010	-	-	3.1	0.083	-	0.12	0.01	0.080	-	<0.01	0.130	0.180	<0.01	_	<0.01
Benzo(a)pyrene	mg/kg	0.010	_	_	3.4	0.77	20	<0.5	<0.05	0.06	-	<0.05	0.12	0.15	<0.05	_	<0.05
Benzo(b&j)fluoranthene	mg/kg	0.010	-	-	1.4	-	-	<0.5	<0.05	0.07	-	<0.05	0.13	0.21	<0.05	_	<0.05
Benzo(g,h,i)perylene	mg/kg	0.010	-	-	63	-		<0.5	<0.05	<0.05	-	<0.05	0.08	0.1	<0.05	_	<0.05
Benzo(k)fluoranthene	mg/kg	0.010	-	_	0.31	-		<0.5	<0.05	<0.05	_	<0.05	0.06	0.08	<0.05	_	<0.05
Chrysene		0.010	-	-	19	-		<0.5	<0.05	0.07	-	<0.05	0.00	0.08	<0.05	_	<0.05
Dibenz(a,h)anthracene	mg/kg mg/kg	0.010		_	2.1	_		<0.5	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05	-	<0.05
Fluoranthene			3 500	-		0.030	50				-					-	
Fluoranmene	mg/kg	0.010	3,500 2,700	220,000	-	0.039 0.34	50 -	<b>0.2</b> <0.5	0.01 <0.05	<b>0.17</b> 0.05	-	0.01 <0.05	<b>0.17</b> <0.05	<b>0.3</b> <0.05	0.02 <0.05	-	0.01 <0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	0.010			24			<0.5	<0.05	<0.05		<0.05	0.06	0.05	<0.05		<0.05
	mg/kg		1 900	- 51		0.017	<del>-</del>				-					-	-
Naphthalene	mg/kg	0.010	1,800	51	53	0.017	-	4.79	0.152	0.062	-	0.017	0.011	0.042	<0.010	-	<0.010
Phenanthrene	mg/kg	0.010	- 2.400	-	-	0.061	-	1.19	0.08	0.24	-	0.04	0.14	0.23	0.01	-	0.01
Pyrene	mg/kg	0.010	2,100	-	- 14.00	0.04	-	0.76	0.02	0.14	-	0.02	0.19	0.29	0.02	-	0.02
IACR:Coarse	mg/kg	0.050	-	-	IACR < 1	-	-	0.3	0.003	0.097	-	<0.001	0.376	0.526	<0.001	-	<0.001
IACR:Fine	mg/kg	0.050	-	-	IACR < 1	-	-	-	-	0.187	-	<0.001	0.727	1.02	<0.001	-	<0.001
B(A)P Total Potency Equivalent	mg/kg	0.020	5.3	-		-	-	-	-	-	-	-	-	0.06	-	-	-
PCB	mg/kg																
VOC Scan	mg/kg																1

Tables-Rossdale Plant - Gap Analysis 2016-05-25 Page 3 of 16

<sup>1 -</sup> Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remedia ion Guideline Values for Resic Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

<sup>2-</sup> Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECOM from previous reports where provided and the state of the state

<sup>3 -</sup> Subsoil guidelines apply to depths greater than 3m and provided when less conversative han Direct Soil Contact guidelines.

NR - Not Reported

Sample ID					Guideline <sup>1</sup>						AREA 3 - Burn	Pit(s) South of Wat	ermark Building			
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine/Coarse)	A3:14-10				A3:14-11				
Laboratory Sample ID								4916818	4916819	4916820	4916821	4916822	4916823	4916824	4916825	4916826
Sample Date								30-Oct-2014	30-Oct-2014	30-Oct-2014	30-Oct-2014	30-Oct-2014	30-Oct-2014	30-Oct-2014	30-Oct-2014	30-Oct-2014
Sample Depth								1 m	1.5m	2 m	6.1 m	0.5 m	1 m	2 m	4.6 m	9.8 m
Soil Particle Size 4								Fine*	Fine*	Fine*	Coarse*	Fine*	Fine*	Fine*	Fine*	Coarse*
Petroleum Hydrocarbons																
Benzene	mg/kg	0.0050	78	1.6	0.078	0.17	60/ 31	-	-	<0.005	-	<0.005	-	-	<0.005	<0.005
EthylBenzene	mg/kg	0.015	8,500	930	0.14	540	120/ 55	-	-	<0.010	-	<0.010	-	-	<0.010	<0.010
Styrene	mg/kg	0.050	10,000	220	210	0.8	-	-	-	<0.010	-	<0.010	-	-	<0.010	<0.010
Toluene	mg/kg	0.050	20,000	1,900	0.95	0.12	110/75	-	-	<0.02	-	<0.02	-	-	<0.02	<0.02
o-Xylene	mg/kg	0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m+p-Xylene	mg/kg	0.050	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Xylenes	mg/kg	0.10	140,000	250	1.9	41	65/ 95	1	-	<0.03	-	<0.03	-	-	<0.03	<0.03
MTBE	mg/kg	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F1(C6-C10)	mg/kg	10	12,000	610	2,200	1,300	210/ 210	-	-	<10	-	<10	-	-	<10	<10
F1-BTEX	mg/kg	10	-	-	-	-	-	-	-	<10	-	<10	-	-	<10	<10
F2 (C10-C16)	mg/kg	20	6,800	3,100	2,900	520	150/ 130	-	-	<50	_	<50	-	_	<50	<50
F2-Napth	mg/kg	NR	-	-	-	_	-	-	-	-	-	-	-	-	-	-
F3 (C16-C34)	mg/kg	20	15,000	-	_	_	1300/ 300	_	_	<50	-	1,890	-	_	<50	<50
F3 -PAH	mg/kg	NR	-	-	_	_	-	_	_	-	-	-	-	_	-	-
F4 (C34-C50)	mg/kg	20	21,000	-		_	5600/ 2800	-	_	<100	-	1,230	-	_	<100	<100
F4G-SG (GHH-Silica)	mg/kg	NR	-	-		-	-	-	_	-	-	-	-	_	-	-
Total Hydrocarbons	mg/kg	NR	-	_		-	-	-	_	_	-	_	-	_	-	-
Polycyclic Aromatic Hydrocarbo		TAIX														
Acenaph hene	mg/kg	0.010	5,300	99,000		0.38		<0.05	<0.05	_	<0.05		<0.05	0.05	_	<0.05
Acenaphthylene	mg/kg	0.010	5,500	-		0.50	-	0.15	<0.05	_	<0.05	_	<0.05	<0.05	-	<0.05
Anthracene	mg/kg	0.0040	24,000	-		0.0056	2.5	0.292	0.026	_	<0.003	_	0.113	0.165	-	0.005
Benz(a)anthracene	mg/kg	0.010	24,000	-	3.1	0.083	-	0.292	0.040	-	<0.01	_	0.280	0.330	-	0.010
Benzo(a)pyrene	mg/kg	0.010	-	-	3.4	0.003	20	0.25	0.040	_	<0.05	_	0.30	0.33	-	<0.05
Benzo(b&j)fluoranthene	mg/kg	0.010	_	_	1.4	-	-	0.32	0.09	_	<0.05	_	0.26	0.33	_	<0.05
Benzo(g,h,i)perylene	mg/kg	0.010	-	-	63	_	-	0.16	<0.05	-	<0.05	-	0.06	0.08	-	<0.05
Benzo(k)fluoranthene		0.010	-	-	0.31	_	-	0.18	<0.05	_	<0.05	_	0.13	0.08	-	<0.05
` '	mg/kg		-								<0.05		•	0.18		
Chrysene Dibenz(a,h)anthracene	mg/kg	0.010 0.010	-	-	19 2.1	-	-	0.26 0.05	0.06	-		-	0.19		-	<0.05
, , ,	mg/kg		2 500	-			-		<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05
Fluoranthene	mg/kg	0.010	3,500	- 220,000	-	0.039	50	0.47	0.1	-	<0.01	-	0.4	0.54	-	0.03
Fluorene	mg/kg	0.010	2,700	220,000	- 24	0.34	-	<0.05	<0.05	-	<0.05	-	<0.05	0.06	-	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	0.010	4 000	-	24	- 0.047	-	0.21	<0.05	-	<0.05	-	0.11	0.13	-	<0.05
Naphthalene	mg/kg	0.010	1,800	51	53	0.017	-	0.048	0.057	-	0.01	-	0.026	0.022	-	<0.010
Phenanthrene	mg/kg	0.010	- 0.400	-	-	0.061	-	0.28	0.09	-	0.03	-	0.41	0.51	-	0.02
Pyrene	mg/kg	0.010	2,100	-	- 14.00	0.04	-	0.53	0.09	-	0.01	-	0.49	0.49	-	0.04
IACR:Coarse	mg/kg	0.050	-	-	IACR < 1	-	-	1.02	0.101	-	<0.001	-	0.799	1.02	-	0.003
IACR:Fine	mg/kg	0.050	-	-	IACR < 1	-	-	1.97	0.194	-	<0.001	-	1.54	1.97	-	0.006
B(A)P Total Potency Equivalent	mg/kg	0.020	5.3	-		-	-	0.15	-	-	-	-	0.08	0.10	-	-
PCB	mg/kg															
VOC Scan	mg/kg															

<sup>1 -</sup> Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remedia ion Guideline Values for Resic Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

<sup>2-</sup> Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECOM from previous reports where provided and the state of the state

<sup>3 -</sup> Subsoil guidelines apply to depths greater than 3m and provided when less conversative han Direct Soil Contact guidelines.

NR - Not Reported

Sample ID					Guideline <sup>1</sup>						AREA 3 - Burn	Pit(s) South of Wat	ermark Building			
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine/Coarse)	A3: 14-12					A3: 14-12		<b>A3</b> : 1	4-13
Laboratory Sample ID								4916827	4916828	4916829	4916830	4916831	4916832	4916833	4916834	4916835
Sample Date								30-Oct-2014	30-Oct-2014	30-Oct-2014	30-Oct-2014	30-Oct-2014	30-Oct-2014	30-Oct-2014	30-Oct-2014	30-Oct-2014
Sample Depth								1 m	1.5 m	3.8 m	4.6 m	6.9 m	7.5 m	10.5 m	0.5 m	3.8 m
Soil Particle Size 4								Fine*	Fine*	Fine*	Fine*	Coarse*	Coarse*	Bedrock*	Fine*	Fine*
Petroleum Hydrocarbons																
Benzene	mg/kg	0.0050	78	1.6	0.078	0.17	60/ 31	-	-	0.045	-	<0.005	<0 005	<0.005	-	<0.005
EthylBenzene	mg/kg	0.015	8,500	930	0.14	540	120/ 55	-	-	2.49	-	<0.010	<0 010	0.033	-	0.011
Styrene	mg/kg	0.050	10,000	220	210	0.8	-	-	-	<0.010	-	<0.010	<0 010	<0.010	-	<0.010
Toluene	mg/kg	0.050	20,000	1,900	0.95	0.12	110/75	-	-	1.81	-	0.03	<0.02	0.03	-	<0.02
o-Xylene	mg/kg	0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m+p-Xylene	mg/kg	0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes	mg/kg	0.10	140,000	250	1.9	41	65/ 95	-	-	28	-	<0.03	<0.03	0.31	-	0.06
MTBE	mg/kg	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F1(C6-C10)	mg/kg	10	12,000	610	2,200	1,300	210/ 210	-	-	1410	-	<10	<10	32	-	38
F1-BTEX	mg/kg	10	-	-	-	-	-	-	-	1380	-	<10	<10	32	-	38
F2 (C10-C16)	mg/kg	20	6,800	3,100	2,900	520	150/ 130	_	-	4540	-	<50	<50	217	_	278
F2-Napth	mg/kg	NR	-	-	-	_	-	-	-	-	-	-	-	-	-	-
F3 (C16-C34)	mg/kg	20	15,000	-	-	_	1300/ 300	-	-	21,000	-	<50	64	1,500	_	10,400
F3 -PAH	mg/kg	NR	-	-	-	_	-	-	-	-	-	-	-	-	_	-
F4 (C34-C50)	mg/kg	20	21,000	_		_	5600/ 2800	-	-	20,000	-	<100	<100	1,250	-	5,680
F4G-SG (GHH-Silica)	mg/kg	NR	-	_	_	_	-	-	_	-	-	-	-	,200	-	-
Total Hydrocarbons	mg/kg	NR	-	_	-	_		_	_	_	_	-	_	_	-	
Polycyclic Aromatic Hydrocarb		TVIC														
Acenaph hene	mg/kg	0.010	5,300	99,000	-	0.38		0.39	0.43	_	0.07	_	<0.05	<0.05	<0.05	_
Acenaphthylene	mg/kg	0.010	-	-	-	-		0.14	0.32	_	0.05	_	<0.05	<0.05	<0.05	_
Anthracene	mg/kg	0.0040	24,000	_	-	0.0056	2.5	1.41	0.766	-	0.057	-	<0.003	0.009	0.015	_
Benz(a)anthracene	mg/kg	0.010	-	_	3.1	0.083	-	1.660	0.650	-	0.080	-	<0.01	0.020	0.030	_
Benzo(a)pyrene	mg/kg	0.010	-	_	3.4	0.77	20	0.33	0.64	_	0.05	_	<0.05	<0.05	<0.05	_
Benzo(b&j)fluoranthene	mg/kg	0.010	-	_	1.4	-	-	0.37	0.42	_	0.07	_	<0.05	<0.05	0.05	_
Benzo(g,h,i)perylene	mg/kg	0.010	-	_	63	_		0.38	0.36	_	<0.05	_	<0.05	<0.05	<0.05	-
Benzo(k)fluoranthene	mg/kg	0.010	-	_	0.31	_		<0.05	0.17	_	<0.05	_	<0.05	<0.05	<0.05	_
Chrysene	mg/kg	0.010	-	_	19		-	1.81	1.32		0.1	<u>-</u>	<0.05	<0.05	<0.05	-
Dibenz(a,h)anthracene	mg/kg	0.010	-	_	2.1	-	-	0.15	0.07		<0.05	_	<0.05	<0.05	<0.05	-
Fluoranthene	mg/kg	0.010	3,500	-	-	0.039	50	1.28	1.02	_	0.14	-	<0.03	0.03	0.05	<u>-</u>
Fluorene	mg/kg	0.010	2,700	220,000	-	0.039	-	1.37	1.36	-	0.14	-	<0.05	<0.05	<0.05	-
Indeno(1,2,3-c,d)pyrene	mg/kg	0.010	-	-	24	- 0.54	-	0.29	0.24	_	<0.05	_	<0.05	<0.05	<0.05	-
Naphthalene	mg/kg	0.010	1,800	51	53	0.017	<u> </u>	0.957	19.6	_	6.22	-	0.036	0.858	<0.010	
Phenanthrene	mg/kg	0.010	-	-	-	0.017	<u> </u>	13.3	6.8	-	0.43	-	<0.01	0.656	0.04	-
Pyrene	mg/kg	0.010	2,100	-	<u> </u>	0.061	<u> </u>	10.4	3.56	<u>-</u>	0.43	-	0.01	0.09	0.06	-
IACR:Coarse	mg/kg	0.010	-	-	IACR < 1	-	<u>-</u>	1.08	1.36	_	0.096	<u> </u>	<0.01	0.006	0.045	-
IACR:Fine	mg/kg	0.050	-		IACR < 1	-	-	2.08	2.64	<u>-</u>	0.098	-	<0 001	0.008	0.045	-
				-	IAUR < I	-	•			-	0.104	-	<0 00 I	0.013	0.000	-
B(A)P Total Potency Equivalent	mg/kg	0.020	5.3	-		-	-	0.73	0.87	-	-	-	-	-	-	-
PCB	mg/kg															
VOC Scan	mg/kg															

Tables-Rossdale Plant - Gap Analysis 2016-05-25 Page 5 of 16

<sup>1 -</sup> Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remedia ion Guideline Values for Resic Bold and shaded values exceed appropriate guideline

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<sup>2-</sup> Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECOM from previous reports where provided and the state of the state

<sup>3 -</sup> Subsoil guidelines apply to depths greater than 3m and provided when less conversative han Direct Soil Contact guidelines.

NR - Not Reported

Sample ID					Guideline <sup>1</sup>			AREA 3 - Burn I	Pit(s) South of Wat	ermark Building			Walterda	lle Bridge			v	/alterdale Brid	ge
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine/Coarse)		A3: 14-13		TH11-1			TH12-13				TH12-14	
Laboratory Sample ID								4916836	4916837	4916838	819382-1	880471-2	880471-4	880471-6	880471-8	880471-10	880268-3	880268-4	880268-5
Sample Date								30-Oct-2014	30-Oct-2014	30-Oct-2014	9-Aug-2011	6-Jul-12	6-Jul-12	6-Jul-12	6-Jul-12	6-Jul-12	4-Jul-12	4-Jul-12	4-Jul-12
Sample Depth								5.3 m	6.1 m	7.5 m	4.5 m	1.0 m	3.0 m	5.0 m	7.0 m	9.0 m	2.0 m	3.0 m	4.0 m
Soil Particle Size 4								Fine*	Fine*	Fine*	Fine	Coarse	Fine	Fine	Coarse	Coarse	Fine	Fine	Fine
Petroleum Hydrocarbons												1		_					
Benzene	mg/kg	0.0050	78	1.6	0.078	0.17	60/ 31	<0 005	-	-	-	<0.005	<0.005	<0.005	<0 005	<0.005	<0.005	<0.005	<0.005
EthylBenzene	mg/kg	0.015	8,500	930	0.14	540	120/ 55	<0 010	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Styrene	mg/kg	0.050	10,000	220	210	0.8	-	<0 010	-	-	-	-	-	-	-	-	-	-	-
Toluene	mg/kg	0.050	20,000	1,900	0.95	0.12	110/ 75	<0.02	-	-	-	<0.02	<0.02	<0.02	<0 02	<0.02	<0.02	<0.02	<0.02
o-Xylene	mg/kg	0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m+p-Xylene	mg/kg	0.050	-	-	•	-	-	-	-	-	-	-	-	-	-	-	•	-	-
Xylenes	mg/kg	0.10	140,000	250	1.9	41	65/ 95	<0.03	-	-	-	< 0.03	< 0.03	< 0.03	<0.03	< 0.03	<0.03	< 0.03	< 0.03
MTBE	mg/kg	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F1(C6-C10)	mg/kg	10	12,000	610	2,200	1,300	210/ 210	<10	-	-	-	<10	<10	<10	<10	<10	<10	<10	<10
F1-BTEX	mg/kg	10	-	-	-	-	-	<10	-	-	-	-	-	-	-	-	-	-	-
F2 (C10-C16)	mg/kg	20	6,800	3,100	2,900	520	150/ 130	<50	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50
F2-Napth	mg/kg	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F3 (C16-C34)	mg/kg	20	15,000	-	-	-	1300/ 300	<50	-	-	-	<50	<50	<50	<50	<50	<50	<50	<50
F3 -PAH	mg/kg	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F4 (C34-C50)	mg/kg	20	21,000	-	-	-	5600/ 2800	<100	-	-	-	<100	<100	<100	<100	<100	<100	<100	<100
F4G-SG (GHH-Silica)	mg/kg	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Hydrocarbons	mg/kg	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polycyclic Aromatic Hydrocarbo	ons																		
Acenaph hene	mg/kg	0.010	5,300	99,000	-	0.38	-	-	<0.05	<0.05	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Acenaphthylene	mg/kg	0.010	-	-	•	-	-	ī	<0.05	<0.05	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	< 0.05
Anthracene	mg/kg	0.0040	24,000	-	-	0.0056	2.5	-	0.021	<0.003	0.01	0.004	0.011	<0.003	0.032	<0.003	0.005	0.004	<0.003
Benz(a)anthracene	mg/kg	0.010	-	-	3.1	0.083	-	=	0.04	<0.01	0.02	<0.01	0.020	<0.01	0.080	<0.01	<0.01	0.010	<0.01
Benzo(a)pyrene	mg/kg	0.010	-	-	3.4	0.77	20	i	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	0 07	<0.05	<0.05	<0.05	<0.05
Benzo(b&j)fluoranthene	mg/kg	0.010	-	-	1.4	-	-	i	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	0 01	<0.05	<0.05	<0.05	0.06
Benzo(g,h,i)perylene	mg/kg	0.010	-	-	63	-	-	i	<0.05	<0.05	<0.05	<0.05	< 0.05	<0.05	0 06	<0.05	<0.05	<0.05	<0.05
Benzo(k)fluoranthene	mg/kg	0.010	-	-	0.31	-	-	-	<0.05	<0.05	<0.05	< 0.05	< 0.05	<0.05	0 07	<0.05	<0.05	<0.05	<0.05
Chrysene	mg/kg	0.010	-	-	19	-	-	-	0.06	0.05	<0.05	<0.05	<0.05	<0.05	0.11	<0.05	<0.05	<0.05	<0.05
Dibenz(a,h)anthracene	mg/kg	0.010	-	-	2.1	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluoranthene	mg/kg	0.010	3,500	-	•	0.039	50	-	0.1	0.02	0.04	0.01	0.05	0.01	0.11	<0.01	0.02	0.02	0.01
Fluorene	mg/kg	0.010	2,700	220,000	-	0.34	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	0.010	-	-	24	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0 07	<0.05	<0.05	<0.05	<0.05
Naphthalene	mg/kg	0.010	1,800	51	53	0.017	-	-	0.069	0.033	0 011	0.022	<0.010	<0.010	0.201	<0.010	0.012	<0.010	0.034
Phenanthrene	mg/kg	0.010	-	-	-	0.061	-	-	0.1	0.07	0.04	0.02	0.04	0.01	0.16	<0.01	0.04	0.02	0.07
Pyrene	mg/kg	0.010	2,100	-	-	0.04	-	-	0.1	0.03	0.05	0.01	0.04	0.02	0.11	<0.01	0.02	0.02	0.02
IACR:Coarse	mg/kg	0.050	-	-	IACR < 1	-	-	-	0.098	0.003	-	<0.001	0.006	<0.001	0.353	<0.001	<0.001	0.003	0.043
IACR:Fine	mg/kg	0.050	-	-	IACR < 1	-	-	-	0.188	0.005	0 012	<0.001	0.012	<0.001	0.682	<0.001	<0.001	0.006	0.081
B(A)P Total Potency Equivalent	mg/kg	0.020	5.3	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB	mg/kg											1							<u> </u>
VOC Scan	mg/kg																		<u> </u>

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<sup>1 -</sup> Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remedia ion Guideline Values for Resic Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

<sup>2-</sup> Soil Particle Size classifications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECOM from the provided of the control of th

<sup>3 -</sup> Subsoil guidelines apply to depths greater than 3m and provided when less conversative han Direct Soil Contact guidelines.

NR - Not Reported

Sample ID					Guideline <sup>1</sup>							HP /	LP Plants &	Area Wide	e Fill: Thur	ber Repor	ts				
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine/Coarse)	TH	110-1	TH	10-3	TH10-4	TH10-05	тн	10-6		TH10-7			TH10-9	
Laboratory Sample ID									-	-		-	-	-	-	-	-	-		-	-
Sample Date									-	-		-	-	-	-	-	-	-		-	-
Sample Depth								0.1 m	2.3	0.4 m	1.6 m	0.75 m	1.5 m	0.6 m	1.3 m	2.3 m	Dup at 2.3 m	2.7 m	0.3 m	0.7 m	2.9 m
Soil Particle Size 4								Coarse	Fine	Coarse	Fine	Coarse	Fine		Fine	Fine	Fine	Fine	Fine	Fine	Fine
Petroleum Hydrocarbons																					
Benzene	mg/kg	0.0050	78	1.6	0.078	0.17	60/ 31	0.027	<0.004	-	<0 004	<0 004	<0.004	-	<0.004	-	-	<0 004	<0.004	-	-
EthylBenzene	mg/kg	0.015	8,500	930	0.14	540	120/ 55	0.01	<0.010	-	<0 010	<0 010	<0.010	-	<0.010	-	-	<0 010	<0.010	-	-
Styrene	mg/kg	0.050	10,000	220	210	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	mg/kg	0.050	20,000	1,900	0.95	0.12	110/75	0.042	<0.005	-	<0 005	<0 018	<0.005	-	<0.005	-	-	<0 005	0.012	-	-
o-Xylene	mg/kg	0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m+p-Xylene	mg/kg	0.050	-	-	-	-	-	-	-	-	-	-	-	-	_	-	-	-	-	_	-
Xylenes	mg/kg	0.10	140,000	250	1.9	41	65/ 95	0.05	<0.010	-	<0 010	0 02	<0.010	-	<0.010	-	-	<0 010	0.02	_	-
MTBE	mg/kg	NR	-	_	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F1(C6-C10)	mg/kg	10	12,000	610	2,200	1,300	210/ 210	<4	<4	-	<4	<4	<4	-	<4	-	-	<4	<4	-	-
F1-BTEX	mg/kg	10	-	_	-	-	-	_	-	_	-	-	_	-	_	-	-	_	-	_	-
F2 (C10-C16)	mg/kg	20	6,800	3,100	2,900	520	150/ 130	<10	<10	-	15	20	19	_	20	_	-	22	<10	_	-
F2-Napth	mg/kg	NR	-	-	-,	-	-	-	-	_	-	-	-	_		-	_	-	-	_	_
F3 (C16-C34)	mg/kg	20	15,000	_		-	1300/ 300	402	219	-	112	190	147	_	109	_	_	125	170	_	_
F3 -PAH	mg/kg	NR NR	-	_		-	-	-	-	_	-	-	-	_	-	_	_	-	-	_	_
F4 (C34-C50)	mg/kg	20	21,000	-	-	_	5600/ 2800	660	175	_	<20	190	<20	_	<20	_	_	<20	123	_	_
F4G-SG (GHH-Silica)	mg/kg	NR	-	_	<u> </u>	_	3000/ 2000	-	173	-	-	-	-	-	-	_	-	-	-	_	-
Total Hydrocarbons	mg/kg	NR	-	_		_			_	_	_	_	_	_	_		_	-	_		_
Polycyclic Aromatic Hydrocarbo		INIX		-	-		-	-			_	_					<u> </u>		_		
Acenaph hene	mg/kg	0.010	5,300	99,000		0.38				<0.05	_	<0.05	<0.05	<0.05		<0.05	<0.05	_	_	<0.05	<0.05
Acenaphthylene	mg/kg	0.010	-	-		- 0.36	<u> </u>			<0.05	-	<0.05	<0.05	<0.05	-	<0.05	<0.05	-	-	0.28	<0.05
Anthracene	mg/kg	0.0040	24,000	_	-	0.0056	2.5		_	0.005	_	0.015	<0.003	0.011	_	0.015	0.009	_	-	0.436	0.004
Benz(a)anthracene	mg/kg	0.010	-	-	3.1	0.083	-		_	<0.01	_	0.040	<0.003	0.011	-	0.030	0.020	_	-	1.030	0.030
Benzo(a)pyrene	mg/kg	0.010	-	-	3.4	0.083	20	-		<0.05	-	<0.05	<0.05	<0.05	-	<0.05	<0.05	-	-	0.76	<0.05
Benzo(b&j)fluoranthene	mg/kg	0.010	<u>-</u>	_	1.4	0.77	-		_	<0.05	-	0.05	<0.05	<0.05		<0.05	<0.05	_	-	1.06	<0.05
Benzo(g,h,i)perylene	mg/kg	0.010	-	-	63	-	<u> </u>	-	-	<0.05	-	<0.05	<0.05	<0.05		<0.05	<0.05	-	-	0.23	<0.05
				-	0.31	-		-	-		_		<0.05			<0.05	+	1		0.23	
Benzo(k)fluoranthene Chrysene	mg/kg	0.010	-	-	19	-	-	-	-	<0.05 <0.05	-	<0.05 0 08	<0.05	<0.05 <0.05	-	0.05	<0.05 <0.05	-	-	1.67	<0.05 0.07
	mg/kg	0.010	-	-	2.1	-	<u> </u>	-	<del>-</del>	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	<0.05	-	-	0.11	<0.07
Dibenz(a,h)anthracene	mg/kg		2 500	-		0.020	-	-	<u> </u>							1		1		-	
Fluoranthene	mg/kg	0.010	3,500	- 220,000	-	0.039	50	-	-	0.02	-	0.11	<0.01	0.05	-	0.05	0.03	-	-	2.81	0.02
Fluorene	mg/kg	0.010	2,700	220,000	- 24	0.34	-	-	-	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	<0.05	-	-	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	0.010	1,800	- 51	24 53	0.017	-	-	-	<0.05	-	<0.05	<0.05	<0.05	-	<0.05	<0.05	-	-	0.38	<0.05
Naphthalene	mg/kg	0.010		1		0.017	-	-	-	0.043	-	0.065	0.011	0.037	-	0.021	0.011	-	-	0.124	0.038
Phenanthrene	mg/kg	0.010	- 2.400	-	-	0.061	-	-	-	0.04	-	0.12	0.04	0.08	-	0.05	0.03	-	-	1.27	0.08
Pyrene	mg/kg	0.010	2,100	-	- 1000 4	0.04	-	-	-	- 0.004	-	0.11	<0.01	0.04	-	0.04	0.03	-	-	2.23	0.03
IACR:Coarse	mg/kg	0.050	-	-	IACR < 1	-	-	-	-	<0.001	-	0 06	<0.001	0.003	-	0.012	0.006	-	-	3.41	0.013
IACR:Fine	mg/kg	0.050	-	-	IACR < 1	-	-	-	-	<0.001	-	0.114	<0.001	0.006	-	0.024	0.012	-	-	6.59	0.026
B(A)P Total Potency Equivalent	mg/kg	0.020	5.3	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.20	-
РСВ	mg/kg																			<mdl< td=""><td></td></mdl<>	
VOC Scan	mg/kg																		< MDL		

Cells with "-" indicate that the associated parameter was not analyzed.

NR - Not Reported

Tables-Rossdale Plant - Gap Analysis 2016-05-25 Page 7 of 16

<sup>1 -</sup> Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remedia ion Guideline Values for Resic Bold and shaded values exceed appropriate guideline

<sup>2-</sup> Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECOM from previous reports where provided and the state of the state

<sup>3 -</sup> Subsoil guidelines apply to depths greater than 3m and provided when less conversative han Direct Soil Contact guidelines.

Sample ID					Guideline <sup>1</sup>			-	Plants & Ar Thurber Re				Areas	4 & 5: Haza	ardous Wa	ste Storago	e & Area W	ide Fill: Th	nurber Rep	orts		
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine/Coarse)		TH10-10	-	TH1	0-11	TH10-12		TH10-13			TH10-14			TH10-15	
Laboratory Sample ID									-	-		-	-	-				-				-
Sample Date									-	-		-	-	-				-			<u> </u>	-
Sample Depth								0.2 m	1.5 m	Dup at 1.5 m	0.76 m	3.6 m	1.5 m	0.7 m	1.6 m	Dup at 1.6 m	0.3 m	1.5 m	3.05 m	0.7 m	1.0 m	1.6 m
Soil Particle Size 4								Fine	Fine	Fine	Coarse	Fine	Fine	Coarse	Fine	Fine	Coarse	Coarse	Fine	Coarse	Fine	Fine
Petroleum Hydrocarbons																						
Benzene	mg/kg	0.0050	78	1.6	0.078	0.17	60/ 31	-	<0.004	<0.004	-	<0.004	<0.004	-	<0.004	<0.004	-	-	<0 004	-	<0.004	-
EthylBenzene	mg/kg	0.015	8,500	930	0.14	540	120/ 55	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	-	<0 010	-	<0.010	-
Styrene	mg/kg	0.050	10,000	220	210	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	mg/kg	0.050	20,000	1,900	0.95	0.12	110/75	-	< 0.005	< 0.005	-	< 0.005	<0.005	-	< 0.005	< 0.005	-	-	<0 005	-	0.013	-
o-Xylene	mg/kg	0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m+p-Xylene	mg/kg	0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes	mg/kg	0.10	140,000	250	1.9	41	65/ 95	-	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-	-	<0 010	-	0.02	-
MTBE	mg/kg	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F1(C6-C10)	mg/kg	10	12,000	610	2,200	1,300	210/ 210	-	<4	<4	-	<4	<4	-	<4	<4	-	-	<4	-	<4	-
F1-BTEX	mg/kg	10	-	-	-	_	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F2 (C10-C16)	mg/kg	20	6,800	3,100	2,900	520	150/ 130	-	13	16	-	15	17	-	14	19	-	-	19	-	17	-
F2-Napth	mg/kg	NR	-	-	-	_	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F3 (C16-C34)	mg/kg	20	15,000	_	-	_	1300/ 300	-	60	62	-	47	154	_	117	130	-	-	99	-	105	-
F3 -PAH	mg/kg	NR	-	_	-	_	-	-	-	-	-	-	-	_	-	-	-	_	-	-	-	-
F4 (C34-C50)	mg/kg	20	21,000	_	_	-	5600/ 2800	-	<20	<20	-	<20	<20	_	<20	<20	_	_	<20	_	<20	_
F4G-SG (GHH-Silica)	mg/kg	NR	-	-	_	-	-	-	-	-	-	-	-	_	-	-	_	-	120	_	120	-
Total Hydrocarbons	mg/kg	NR	-	_	_	_		_	_	_	-	_	-	_	_	_	_	_		-		_
Polycyclic Aromatic Hydrocarbo		TVIC																				
Acenaph hene	mg/kg	0.010	5,300	99,000	-	0.38	_	-	_	-	-	_	_	0.14	_	-	l _	<0.05	-	I _	-	<0.05
Acenaphthylene	mg/kg	0.010	-	-	-	- 0.56		_		-			-	0.05		-	-	<0.05	-	_	_	<0.05
Anthracene	mg/kg	0.0040	24,000	_	-	0.0056	2.5			_			_	0.472			_	0.003	-	_	_	<0.03
Benz(a)anthracene	mg/kg	0.010	-	-	3.1	0.0030	-	_	-	-	-		-	2.23	-	-	_	0.003	-	_	-	<0.01
Benzo(a)pyrene	mg/kg	0.010	-	-	3.4	0.063	20	-	-	-	-		-	1.88	-	-	-	<0.05	-	-	-	<0.05
` '''		0.010	-	-	1.4	-	20		-			-	-	1.72			-	<0.05		-		<0.05
Benzo(b&j)fluoranthene	mg/kg		-	-	63		-	-	-	-	-	-	-		-	-	-		-	-	-	<0.05
Benzo(g,h,i)perylene	mg/kg	0.010	-	-		-	-	-	-	-	-	-	-	0.7	-	-	-	<0.05	-	-	-	<b></b>
Benzo(k)fluoranthene	mg/kg	0.010	-	-	0.31	-	-	-	-	-	-	-	-	1.45	-	-	-	<0.05	-	-	-	<0.05
Chrysene Dibonz(a b)onthrocono	mg/kg	0.010	-	-	19	-	-	-	<del>-</del>	-	-	-	-	2 23	-	-	-	<0.05	-	-	-	<0.05
Dibenz(a,h)anthracene	mg/kg	0.010	2.500	-	2.1	0.000	-	-	<del>-</del>	-	-	-	-	0.32	-	-	-	<0.05	-	-	-	<0.05
Fluoranthene	mg/kg	0.010	3,500	-	-	0.039	50	-	-	-	-	-	-	4.35	-	-	-	0.03	-	-	-	<0.01
Fluorene	mg/kg	0.010	2,700	220,000	-	0.34	-	-	-	-	-	-	-	0.11	-	-	-	<0.05	-	-	-	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	0.010	-	-	24	-	-	-	-	-	-	-	-	0.91	-	-	-	<0.05	-	-	-	<0.05
Naphthalene	mg/kg	0.010	1,800	51	53	0.017	-	-	-	-	-	-	-	0.037	-	-	-	<0.010	-	-	-	0.29
Phenanthrene	mg/kg	0.010	-	-	-	0.061	-	-	-	-	-	-	-	2.12	-	-	-	0.01	-	-	-	0.05
Pyrene	mg/kg	0.010	2,100	-		0.04	-	-	-	-	-	-	-	3.82	-	-	-	0.04	-	-	-	0.01
IACR:Coarse	mg/kg	0.050	-	-	IACR < 1	-	-	-	-	-	-	-	-	7.54	-	-	-	0.01	-	-	-	<0.001
IACR:Fine	mg/kg	0.050	-	-	IACR < 1	-	-	-	-	-	-	-	-	14.6	-	-	-	0.019	-	-	-	<0.001
B(A)P Total Potency Equivalent	mg/kg	0.020	5.3	-		-	-	-	-	-	-	-	-	2.86	-	-	-	-	-	-	-	-
PCB	mg/kg							< MDL			< MDL			< MDL			< MDL			< MDL		
VOC Scan	mg/kg										< MDL		< MDL								< MDL	

Tables-Rossdale Plant - Gap Analysis 2016-05-25 Page 8 of 16

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<sup>2-</sup> Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECOM from previous reports where provided and the state of the state

<sup>3 -</sup> Subsoil guidelines apply to depths greater than 3m and provided when less conversative han Direct Soil Contact guidelines.

NR - Not Reported

Sample ID					Guideline <sup>1</sup>				Areas 4	& 5: Haza	rdous Waste	Storage & Ar	ea Wide Fill: T	hurber Report	s	Areas 4 &	5: Hazardous	Waste Storage Reports	& Area Wide F	ill: Thurber
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine/Coarse)		TH10-16		TH97-10	TH1	12-1	TH	12-2	TH	12-3		TH12-4	
Laboratory Sample ID									_	-	-	871136-1	871136-2	871136-3	871136-4	871136-5	871136-6	871136-7	871136-8	871136-9
Sample Date									-	-	-	5/16/2012	5/16/2012	5/16/2012	5/16/2012	5/16/2012	5/16/2012	5/16/2012	5/16/2012	5/16/2012
Sample Depth								0.7 m	1.6 m	3.2 m	1.7 m	1.0 m	1.5 m	1.5 m	2.3 m	0.75 m	1.5 m	0.75 m	1.5 m	1.5 m (dup)
Soil Particle Size 4								Coarse	Coarse	Coarse	Fine*	Fine	Fine	Fine	Fine	Coarse	Fine	Coarse	Fine	Fine
Petroleum Hydrocarbons								Course	Course	Course	1 1110	10	10	1	10	Godino	10	Godinos	10	1 1110
Benzene	mg/kg	0.0050	78	1.6	0.078	0.17	60/ 31	I .	_	<0.004	-		_	_	_	-	_			_
EthylBenzene	mg/kg	0.015	8,500	930	0.14	540	120/ 55	_	-	<0.010	-		_	_	_	_	-	-	_	-
Styrene	mg/kg	0.050	10,000	220	210	0.8	-	_	-		-		-	_	_	-	_	-	_	-
Toluene	mg/kg	0.050	20,000	1,900	0.95	0.12	110/ 75		-	<0.005	-		_	_		_	_	-	_	-
o-Xylene	mg/kg	0.050	-	-	- 0.93	-	-	-	-	-	-		-	-	_	-	-	-	_	-
•		0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m+p-Xylene Xylenes	mg/kg mg/kg	0.050	140,000	250	1.9	41	65/ 95	-	-	<0.010	-	-	-	-	-	-	-	-	-	-
·		NR						-		<0.010		-	-	-	-				-	
MTBE F1(C6-C10)	mg/kg	10	12,000	610	2,200	1,300	210/ 210	-	-	<4	-	-	-	-	-	-	-	-	-	-
` '	mg/kg				·										-				-	
F1-BTEX	mg/kg	10	-	- 0.400	-	-	450/400	-	-	-	-	-	-	-	-	-	-	-	-	-
F2 (C10-C16)	mg/kg	20 ND	6,800	3,100	2,900	520	150/ 130	-	-	23	-	-	-	-	-	-	-	-	-	-
F2-Napth	mg/kg	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F3 (C16-C34)	mg/kg	20	15,000	-	-	-	1300/ 300	-	-	135	-	-	-	-	-	-	-	-	-	-
F3 -PAH	mg/kg	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F4 (C34-C50)	mg/kg	20	21,000	-	-	-	5600/ 2800	-	-	<20	-	-	-	-	-	-	-	-	-	-
F4G-SG (GHH-Silica)	mg/kg	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Hydrocarbons	mg/kg	NR	-	•	-	-	-	-	-	-	-	•	-	-	-	-	-	-	-	-
Polycyclic Aromatic Hydrocarbo			T	1				1	ı	1			l	T .	l		1	1	T	
Acenaph hene	mg/kg	0.010	5,300	99,000	-	0.38	-	-	<0.05	-	<0.010	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Acenaphthylene	mg/kg	0.010	-	-	-	-	-	-	<0.05	-	<0.010	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Anthracene	mg/kg	0.0040	24,000	-	-	0.0056	2.5	-	0.004	-	<0.0040	0.068	0.006	0.004	<0.003	0.003	0.018	0.018	0.014	0.016
Benz(a)anthracene	mg/kg	0.010	-	-	3.1	0.083	-	-	<0.01	-	<0.010	0.12	0.02	0.01	<0.01	0.01	0.04	0.04	0.02	0.02
Benzo(a)pyrene	mg/kg	0.010	-	-	3.4	0.77	20	-	<0.05	-	0.013	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	<0.05	<0.05
Benzo(b&j)fluoranthene	mg/kg	0.010	-	-	1.4	-	•	-	<0.05	-	0.011	0.12	<0.05	<0.05	<0.05	<0.05	0.05	0.05	<0.05	<0.05
Benzo(g,h,i)perylene	mg/kg	0.010	-	-	63	-	-	-	<0.05	-	0.017	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(k)fluoranthene	mg/kg	0.010	-	-	0.31	-	•	-	<0.05	-	<0.010	0.08	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chrysene	mg/kg	0.010	-	-	19	-	-	-	<0.05	-	0.011	0.13	<0.05	<0.05	<0.05	<0.05	0.05	0.05	<0.05	<0.05
Dibenz(a,h)anthracene	mg/kg	0.010	-	-	2.1	-	-	-	<0.05	-	<0.010	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluoranthene	mg/kg	0.010	3,500	-	-	0.039	50	-	0.03	-	0.017	0.36	0.04	0.03	0.02	0.03	0.09	0.08	0.04	0.04
Fluorene	mg/kg	0.010	2,700	220,000	-	0.34	-	-	<0.05	-	<0.010	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	0.010	-	-	24	-	-	-	<0.05	-	<0.010	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Naphthalene	mg/kg	0.010	1,800	51	53	0.017	-	-	0.045	-	<0.010	0.025	0.25	0.018	<0.010	<0.010	0 018	<0.010	<0.010	<0.010
Phenanthrene	mg/kg	0.010	-	-	-	0.061	-	-	0.05	-	0.021	0.2	0.07	0.03	0.01	0.02	0.07	0.05	0.04	0.04
Pyrene	mg/kg	0.010	2,100	-	-	0.04	-	-	0.02	-	0.016	0.28	0.05	0.03	0.03	0.03	0.08	0.09	0.05	0.05
IACR:Coarse	mg/kg	0.050	-	-	IACR < 1	-	-	-	<0.001	-	<0.050	0.421	0.006	0.003	<0.001	0.003	0.051	0.066	0.006	0.006
IACR:Fine	mg/kg	0.050	-	-	IACR < 1	-	-	-	<0.001	-	0.063	0.814	0.012	0.006	<0.001	0.006	0.098	0.127	0.012	0.012
B(A)P Total Potency Equivalent	mg/kg	0.020	5.3	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCB	mg/kg							< MDL												1
VOC Scan	mg/kg									< MDL										1
Notos								•	•				•	•		•	•	•	•	

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<sup>1 -</sup> Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remedia ion Guideline Values for Resic Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

<sup>2-</sup> Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECOM from previous reports where provided and the state of the state

<sup>3 -</sup> Subsoil guidelines apply to depths greater than 3m and provided when less conversative han Direct Soil Contact guidelines.

NR - Not Reported

Sample ID					Guideline <sup>1</sup>					Areas	4 & 5: Hazardo	us Waste Stora	ge & Area Wide	Fill: Thurber R	eports		
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine/Coarse)	TP1	13-01	TP1	3-02	TP1:	3-03		TP1	3-04	
Laboratory Sample ID								969470-1	969470-3	969470-5	969470-6	969470-7	969470-9	969470-10	969470-11	969470-13	969470-14
Sample Date								10/31/2013	10/31/2013	10/31/2013	10/31/2013	10/31/2013	10/31/2013	10/31/2013	10/31/2013	10/31/2013	10/31/2013
Sample Depth								0.1 m	1.3 m	1.6 m	3.1 m	0.8 m	3.0 m	0.1 m	0.7 m	2.4 m	3.0 m
Soil Particle Size 4								Coarse	Fine	Fine	Fine	Fine	Fine	Coarse	Fine	Coarse*	Fine
Petroleum Hydrocarbons																	
Benzene	mg/kg	0.0050	78	1.6	0.078	0.17	60/ 31	<0.005	-	< 0.005	-	-	<0.005	<0.005	-	<0.005	-
EthylBenzene	mg/kg	0.015	8,500	930	0.14	540	120/ 55	<0.01	-	<0.01	-	-	<0.01	<0.01	-	<0.01	-
Styrene	mg/kg	0.050	10,000	220	210	0.8		-	-	-	-	-	-	-	-	-	=
Toluene	mg/kg	0.050	20,000	1,900	0.95	0.12	110/ 75	<0.02	-	<0.02	-	-	<0.02	<0.02	-	<0.02	-
o-Xylene	mg/kg	0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m+p-Xylene	mg/kg	0.050	-	-	-	-	-	-	-	-	-		-	-	-	-	-
Xylenes	mg/kg	0.10	140,000	250	1.9	41	65/ 95	<0.03	-	<0.03	-	-	<0.03	<0.03	-	< 0.03	-
MTBE	mg/kg	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F1(C6-C10)	mg/kg	10	12,000	610	2,200	1,300	210/ 210	<10	-	<10	-	-	<10	<10	<10	<10	-
F1-BTEX	mg/kg	10	-	-	-	-	-	<10	-	<10	-	-	<10	<10	<10	<10	-
F2 (C10-C16)	mg/kg	20	6,800	3,100	2,900	520	150/ 130	<50	-	<50	-	-	<50	<50	-	<50	-
F2-Napth	mg/kg	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F3 (C16-C34)	mg/kg	20	15,000	-	-	-	1300/ 300	<50	-	<50	-	-	<50	211	-	<50	-
F3 -PAH	mg/kg	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F4 (C34-C50)	mg/kg	20	21,000	-	-	_	5600/ 2800	<100	-	<100	_	-	<100	256	-	<100	-
F4G-SG (GHH-Silica)	mg/kg	NR	-	-	_	_	-	<100	_	<100	_	-	<100	509	-	<100	-
Total Hydrocarbons	mg/kg	NR	-	-		_	-	-	_	-	_	-	-	_	-	-	-
Polycyclic Aromatic Hydrocarbo																	
Acenaph hene	mg/kg	0.010	5,300	99,000	-	0.38	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	_	<0.05	-	<0.05
Acenaphthylene	mg/kg	0.010	-	-	_	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	_	<0.05	-	<0.05
Anthracene	mg/kg	0.0040	24,000	-	-	0.0056	2.5	-	0.011	<0.003	<0.003	0.045	<0.003	_	0.471	-	<0 003
Benz(a)anthracene	mg/kg	0.010	-	-	3.1	0.083	-	-	0.03	<0.01	<0.01	0.17	<0.01	_	0.79	-	<0.01
Benzo(a)pyrene	mg/kg	0.010	-	-	3.4	0.77	20	-	<0.05	<0.05	<0.05	0.15	<0.05	_	0.62	-	<0.05
Benzo(b&j)fluoranthene	mg/kg	0.010	-	_	1.4	-	-	-	<0.05	<0.05	<0.05	0.14	<0.05	_	0.55	_	<0.05
Benzo(g,h,i)perylene	mg/kg	0.010	_	_	63	_	-	-	<0.05	<0.05	<0.05	0.07	<0.05	_	0.22	_	<0.05
Benzo(k)fluoranthene	mg/kg	0.010	-	-	0.31	-	-	-	<0.05	<0.05	<0.05	0.13	<0.05	-	0.51	-	<0.05
Chrysene	mg/kg	0.010	-	_	19	_	_	-	0.06	<0.05	<0.05	0.18	<0.05	-	0.94	-	<0.05
Dibenz(a,h)anthracene	mg/kg	0.010	-	_	2.1	-	-	_	<0.05	<0.05	<0.05	<0.05	<0.05	_	0.06	_	<0.05
FI	mg/kg	0.010	3,500	-		0.039	50	_	0.05	<0.01	<0.01	0.25	<0.01	_	2.08	_	<0.01
Fluorantnene Fluorene	mg/kg	0.010	2,700	220,000	<u> </u>	0.039	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	-	0.15	-	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	0.010	-	-	24	-	-	-	<0.05	<0.05	<0.05	0.08	<0.05	-	0.13	-	<0.05
Naphthalene	mg/kg	0.010	1,800	51	53	0.017	-	0.145	0.145	0.016	0.011	0.095	0.095	-	0.27	-	0.19
Phenanthrene	mg/kg	0.010	-	-	-	0.017	<u> </u>	-	0.143	0.016	0.03	0.095	0.095	-	1.78	-	0.19
Pyrene	mg/kg	0.010	2,100	-	<u> </u>	0.061	-	-	0.15	<0.04	<0.03	0.19	<0.05	-	1.73	-	<0.01
IACR:Coarse	mg/kg	0.010	2,100	-	- IACR < 1	- 0.04	-	-	0.03	<0.01	<0.01	0.632	<0.01	-	2.56	-	<0.01
IACR:Coarse		0.050	-	-	IACR < 1	-	-	-	0.013	<0.001	<0.001	1.22	<0.001	-	4.94	-	<0.001
	mg/kg			-	IAUR < I	-	•	-	0.025	<0.001	<0.001		<0.001	-		· ·	<0.001
B(A)P Total Potency Equivalent	mg/kg	0.020	5.3	-		-	-	-	-	-	-	0.20	-	-	0.90	-	-
PCB	mg/kg								-								
VOC Scan	mg/kg															1	

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<sup>1 -</sup> Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remedia ion Guideline Values for Resic Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

<sup>2-</sup> Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECOM from previous reports where provided and the state of the state

<sup>3 -</sup> Subsoil guidelines apply to depths greater than 3m and provided when less conversative han Direct Soil Contact guidelines.

NR - Not Reported

Sample ID				,	Guideline <sup>1</sup>					Areas	4 & 5: Hazardo	us Waste Stora	ge & Area Wide	Fill: Thurber R	eports		
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine/Coarse)		TP13-05		TP13-06		TP1	3-07		TP1	3-08
Laboratory Sample ID								969470-17	969470-18	969470-20	969470-22	969470-25	969470-26	969470-27	969470-28	969470-30	969479-33
Sample Date								10/31/2013	10/31/2013	10/31/2013	11/1/2013	11/1/2013	11/1/2013	11/1/2013	11/1/2013	11/1/2013	11/1/2013
Sample Depth								0.1 m	0.8 m	3.0 m	0.75 m	0.1 m	0.7 m	1.5 m	3.0 m	0.7 m	3.1 m
Soil Particle Size 4								Coarse	Coarse	Fine	Coarse	Coarse	Fine	Fine	Coarse	Coarse	Fine
Petroleum Hydrocarbons	1																
Benzene	mg/kg	0.0050	78	1.6	0.078	0.17	60/ 31	<0.005	-	-	<0.005	<0 005	-	<0.005	-	-	-
EthylBenzene	mg/kg	0.015	8,500	930	0.14	540	120/ 55	<0.01	-	-	<0.01	<0.01	-	<0.01	-	-	-
Styrene	mg/kg	0.050	10,000	220	210	0.8	=	-	-	-	-	-	-	-	-	-	-
Toluene	mg/kg	0.050	20,000	1,900	0.95	0.12	110/75	<0.02	-	-	<0.02	<0.02	-	<0.02	-	-	-
o-Xylene	mg/kg	0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m+p-Xylene	mg/kg	0.050	-	-	-	-	=	-	-	-	-	-	-	-	-	-	-
Xylenes	mg/kg	0.10	140,000	250	1.9	41	65/ 95	<0.03	-	-	<0.03	<0.03	-	<0.03	-	-	-
MTBE	mg/kg	NR	-	-	-	-	-	-	_	-	-	-	-	-	_	-	_
F1(C6-C10)	mg/kg	10	12,000	610	2,200	1,300	210/ 210	<10	-	-	<10	<10	-	<10	_	-	_
F1-BTEX	mg/kg	10	-	_	-	-	-	<10	_	-	<10	<10	-	<10	_	_	_
F2 (C10-C16)	mg/kg	20	6,800	3,100	2,900	520	150/ 130	<50	_	_	<50	<50	_	<50	_	-	_
F2-Napth	mg/kg	NR	-	-	-,	-	-	-	-	-	-	-	_		_	-	_
F3 (C16-C34)	mg/kg	20	15,000	-	-	_	1300/ 300	487	_	_	<50	284	_	<50	-	_	_
F3 -PAH	mg/kg	NR	-	-	-	_	-	-	_	-	-	-	_	-	-	-	_
F4 (C34-C50)	mg/kg	20	21,000	_	-	_	5600/ 2800	591	_	_	<100	455	-	<100	-	_	_
F4G-SG (GHH-Silica)	mg/kg	NR	-	_	<u> </u>		-	967	_	_	<100	846	-	<100	<u> </u>		_
Total Hydrocarbons	mg/kg	NR	-	_	-	_		-	_	_	-	-	_	-		_	_
Polycyclic Aromatic Hydrocarb		IVIX	_	-			-	-	-	-	_	-	-	-	_		_
Acenaph hene	mg/kg	0.010	5,300	99,000	_	0.38			<0.05	<0.05	<u> </u>		<0.05		<0.05	<0.05	<0.05
Acenaphthylene	mg/kg	0.010	-	-	<u> </u>	- 0.36	<u> </u>	-	<0.05	<0.05	-	-	<0.05	-	<0.05	0.05	<0.05
Anthracene	mg/kg	0.010	24,000	-		0.0056	2.5	-	<0.003	0.052	-	-	0.014	-	<0.003	0.092	0.014
					3.1	0.0036	-	-		<0.01			0.014			0.092	0.014
Benz(a)anthracene	mg/kg	0.010	-	-	3.1		20	-	<0.01		-	-	<0.05	-	<0.01 <0.05		0 08
Benzo(a)pyrene	mg/kg	0.010		-		0.77		-	<0.05	<0.05	-	-		-		<0.05	
Benzo(b&j)fluoranthene	mg/kg	0.010 0.010	-	-	1.4 63	-	-	-	<0.05 <0.05	<0.05 <0.05	-	-	<0.05	-	<0.05 <0.05	0.05 <0.05	0 07 <0.05
Benzo(g,h,i)perylene	mg/kg		-	-		-	-	-			-	-	<0.05	-	<0.05		
Benzo(k)fluoranthene	mg/kg	0.010	-	-	0.31	-	-	-	<0.05	<0.05	-	-	<0.05	-		<0.05	<0.05
Chrysene	mg/kg	0.010	-	-	19	-	-	-	<0.05	<0.05	-	-	<0.05	-	<0.05	0.1	0.11
Dibenz(a,h)anthracene	mg/kg	0.010	2.500	-	2.1	- 0.000	-	-	<0.05	<0.05	-	-	<0.05	-	<0.05	<0.05	<0.05
Fluoranthene	mg/kg	0.010	3,500	-	-	0.039	50	-	0.03	<0.01	-	-	0.06	-	<0.01	0.29	0.13
Fluorene	mg/kg	0.010	2,700	220,000	- 04	0.34	-	-	<0.05	<0.05	-	-	<0.05	-	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	0.010	-	-	24	- 0.047	=	-	<0.05	<0.05	-	-	<0.05	-	<0.05	<0.05	<0.05
Naphthalene	mg/kg	0.010	1,800	51	53	0.017	-	-	0.29	0.17	-	-	0.029	-	<0.010	0.054	0.038
Phenanthrene	mg/kg	0.010	-	-	-	0.061	-	-	0.03	0.05	-	-	0.07	-	<0.01	0.26	0.1
Pyrene	mg/kg	0.010	2,100	-		0.04	-	-	0.03	<0.01	-	-	0.6	-	<0.01	0.27	0.13
IACR:Coarse	mg/kg	0.050	-	-	IACR < 1	-	-	-	<0.001	<0.001	-	-	0.006	-	<0.001	0.07	0.096
IACR:Fine	mg/kg	0.050	-	-	IACR < 1	-	-	-	<0.001	<0.001	-	-	0.012	-	<0.001	0.134	0.185
B(A)P Total Potency Equivalent		0.020	5.3	-		-	-	-	-	-	-	-	-	-	-	-	-
PCB	mg/kg																
VOC Scan	mg/kg															<u> </u>	

Tables-Rossdale Plant - Gap Analysis 2016-05-25 Page 11 of 16

<sup>1 -</sup> Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remedia ion Guideline Values for Resic Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

<sup>2-</sup> Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECOM from previous reports where provided and the state of the state

<sup>3 -</sup> Subsoil guidelines apply to depths greater than 3m and provided when less conversative han Direct Soil Contact guidelines.

NR - Not Reported

Sample ID					Guideline <sup>1</sup>				Areas 4 & 5:	Hazardous Was	te Storage & Are	ea Wide Fill: Th	nurber Report			Nichols Back	ground (Area 5	5)
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine/Coarse)		TP13-09			TP13-10		R5	A5:14-01	A5:14-02	A5:14-03	A5:14-04
Laboratory Sample ID								969470-34	969470-35	969470-37	969470-38	969470-39	969470-41	969470-43	-	-	-	-
Sample Date								11/1/2013	11/1/2013	11/1/2013	11/1/2013	11/1/2013	11/1/2013	11/1/2013	27-Oct-14	27-Oct-14	27-Oct-14	27-Oct-14
Sample Depth								0.1 m	0.75 m	3.0 m	0.1 m	0.75 m	3.0 m	R5	1.5 m	2.0 m	1.0 m	3.0 m
Soil Particle Size 4								Coarse	Coarse	Fine	Coarse	Coarse	Fine	Fine	Fine*	Fine*	Fine*	Fine*
Petroleum Hydrocarbons									•									
Benzene	mg/kg	0.0050	78	1.6	0.078	0.17	60/ 31	<0 005	-	-	<0.005	-	-	-	-	-	-	-
EthylBenzene	mg/kg	0.015	8,500	930	0.14	540	120/ 55	<0.01	-	-	<0.01	-	-	-	-	-	-	-
Styrene	mg/kg	0.050	10,000	220	210	0.8	-	-	-	-	-	1	-	-	-	-	-	-
Toluene	mg/kg	0.050	20,000	1,900	0.95	0.12	110/75	<0.02	-	-	<0.02	1	-	-	-	-	-	-
o-Xylene	mg/kg	0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m+p-Xylene	mg/kg	0.050	-	-	-	-	=	-	-	=	-	-	-	-	-	-	-	-
Xylenes	mg/kg	0.10	140,000	250	1.9	41	65/ 95	<0.03	-	=	<0.03	-	-	-	-	-	-	-
MTBE	mg/kg	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F1(C6-C10)	mg/kg	10	12,000	610	2,200	1,300	210/ 210	<10	-	-	<10	-	_	-	-	_	-	-
F1-BTEX	mg/kg	10	-	_	-	-	-	<10	_	-	<10	-	_	-	_	_	-	_
F2 (C10-C16)	mg/kg	20	6,800	3,100	2,900	520	150/ 130	<50	_	-	<50	-	_	-	_	_	_	_
F2-Napth	mg/kg	NR	-	-	-,	-	-	-	_	-	-	-	_	-	_	_	-	_
F3 (C16-C34)	mg/kg	20	15,000	-	_	-	1300/ 300	<50	_	-	61	-	_	-	_	<del> </del> -	_	-
F3 -PAH	mg/kg	NR	-	-	_	-	-	-	_	-	-	-	-	-	_	_	_	-
F4 (C34-C50)	mg/kg	20	21,000	-	-	_	5600/ 2800	<100	-	_	<100	-	-	-	_	_	-	-
F4G-SG (GHH-Silica)	mg/kg	NR	-	-	-	_	-	<100	_	_	<100	-	_	_	_	_	_	_
Total Hydrocarbons	mg/kg	NR	-	_	-	-	_	-	_	_	-	-	_	_	_		_	_
Polycyclic Aromatic Hydrocarbo		INIX			-		-	-	_	-	-	-	-	-	_		-	
Acenaph hene	mg/kg	0.010	5,300	99,000	_	0.38			<0.05	<0.05		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Acenaphthylene		0.010	-	99,000	-	-		_	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Acenaphinylene	mg/kg mg/kg	0.010	24,000	-	-	0.0056	2.5	-	0.048	<0.03	-	0 004	<0.003	0.003	<0.03	<0.03	<0.03	<0.003
Benz(a)anthracene		0.0040	24,000		3.1	0.0036	2.5		0.048	0.003		0.02	0.003	0.003	<0.003	<0.003	<0.003	<0.003
Benzo(a)pyrene	mg/kg	0.010	-	-	3.4	0.063	20	-	<0.05	<0.05	-	<0.05	<0.05	<0.04	<0.001	<0.001	<0.001	<0.001
Benzo(b&j)fluoranthene	mg/kg	0.010	-	_	1.4	-	-	-	0.13	<0.05	<u>-</u>	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(g,h,i)perylene	mg/kg mg/kg	0.010	-	-	63	-	-	-	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(k)fluoranthene		0.010	-	_	0.31	_	-	_	0.07	<0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
` '	mg/kg	0.010			19		-		0.07	0.06		<0.05	0.11	0.07	<0.05	<0.05	<0.05	<0.05
Chrysene Dibenz(a b)enthrocene	mg/kg		-	-	2.1	-	-	-			-							
Dibenz(a,h)anthracene	mg/kg	0.010	2 500	-		- 0.020	-	-	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluoranthene	mg/kg	0.010	3,500	- 220,000	-	0.039	50	-	0.25	0.01	-	0.02	0 02	0.03	<0.05	<0.05	<0.05	<0.05
Fluorene	mg/kg	0.010	2,700	220,000	-	0.34	-	-	<0.05	<0.05	-	<0.05	<0.05	<0.05	-	- 0.05	- 0.05	- 0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	0.010	4 000	-	24	- 0.047	-	-	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Naphthalene	mg/kg	0.010	1,800	51	53	0.017	-	-	0.12	0.038	-	0.182	0.037	0.054	0.01	<0.010	<0.010	<0.010
Phenanthrene	mg/kg	0.010	- 0.400	-	-	0.061	-	-	0.2	0.07	-	0.14	0.09	0.08	0.03	0.02	<0.01	0 01
Pyrene	mg/kg	0.010	2,100	-	-	0.04	-	-	0.18	0.03	-	0.03	0 04	0.05	<0.01	<0.01	<0.01	<0.01
IACR:Coarse	mg/kg	0.050	-	-	IACR < 1	-	=	-	0 356	0.01	-	0 006	0.015	0.016	<0.001	<0.001	<0.001	<0 001
IACR:Fine	mg/kg	0.050	-	-	IACR < 1	-	-	-	0.684	0.018	-	0 012	0 03	0.032	<0.001	<0.001	<0.001	<0 001
B(A)P Total Potency Equivalent	mg/kg	0.020	5.3	-		-	-	-	-	-	-	-	-	-	-	-	-	-
PCB	mg/kg															1		
VOC Scan	mg/kg																	
Notes:		-		•			<del>-</del>	-			-	•	•	-	•		-	

<sup>1 -</sup> Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remedia ion Guideline Values for Resic Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

<sup>2-</sup> Soil Particle Size classifications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECOM from the provided of the control of th

<sup>3 -</sup> Subsoil guidelines apply to depths greater than 3m and provided when less conversative han Direct Soil Contact guidelines.

NR - Not Reported

Sample ID					Guideline <sup>1</sup>						A	rea 6: Bottom As	h & Supplementa	I COE Investigation	on			
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine/Coarse)	A6:1	4-14	A6: 1	4-15		A6: ′	14-16			A6: 14-17	
Laboratory Sample ID								4922683	4922684	4922685	4922686	4922687	4922688	4922689	4922690	4922691	4922692	4922693
Sample Date								3-Nov-2014	3-Nov-2014	3-Nov-2014	3-Nov-2014	3-Nov-2014	3-Nov-2014	3-Nov-2014	3-Nov-2014	3-Nov-2014	3-Nov-2014	3-Nov-2014
Sample Depth								4.0 m	5.0 m	3.0 m	6.0 m	1.5 m	2.5 m	4.5 m	7.5 m	3.5 m	5.5 m	6.5 m
Soil Particle Size 4								Fine*	Fine*	Coarse*	Fine*	Course*	Fine*	Fine*	Course	Fine*	Coarse*	Fine*
Petroleum Hydrocarbons																		
Benzene	mg/kg	0.0050	78	1.6	0.078	0.17	60/ 31	-	-	-	-	-	-	-	-	-	-	-
EthylBenzene	mg/kg	0.015	8,500	930	0.14	540	120/ 55	-	-	-	-	-	-	-	-	-	-	-
Styrene	mg/kg	0.050	10,000	220	210	0.8	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	mg/kg	0.050	20,000	1,900	0.95	0.12	110/75	-	-	-	-	-	-	-	-	-	-	-
o-Xylene	mg/kg	0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m+p-Xylene	mg/kg	0.050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes	mg/kg	0.10	140,000	250	1.9	41	65/ 95	-	-	-	-	-	-	-	-	-	-	-
MTBE	mg/kg	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F1(C6-C10)	mg/kg	10	12,000	610	2,200	1,300	210/ 210	-	-	-	-	-	-	-	-	-	-	-
F1-BTEX	mg/kg	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F2 (C10-C16)	mg/kg	20	6,800	3,100	2,900	520	150/ 130	-	-	-	-	-	-	-	-	-	-	-
F2-Napth	mg/kg	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F3 (C16-C34)	mg/kg	20	15,000	_	-	_	1300/ 300	_	-	-	_	_	_	-	-	-	-	-
F3 -PAH	mg/kg	NR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F4 (C34-C50)	mg/kg	20	21,000	-	-	_	5600/ 2800	-	_	-	-	-	-	-	-	-	-	-
F4G-SG (GHH-Silica)	mg/kg	NR	-	_	_	_	-	-	_	-	-	-	-	-	-	-	-	-
Total Hydrocarbons	mg/kg	NR	-	_	-	_	-	-	_	-	-	-	-	-	-	-	-	_
Polycyclic Aromatic Hydrocarbo			1															
Acenaph hene	mg/kg	0.010	5,300	99,000	-	0.38	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Acenaphthylene	mg/kg	0.010	-	-	_	-	-	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Anthracene	mg/kg	0.0040	24,000	_	-	0.0056	2.5	0.078	0.102	0.153	0.004	0.058	0.061	<0.003	<0.003	0.012	<0.003	<0.003
Benz(a)anthracene	mg/kg	0.010	,	-	3.1	0.083	-	0.16	0.11	0.260	<0.01	0.060	0.250	<0.01	<0.01	0.020	<0.01	<0.01
Benzo(a)pyrene	mg/kg	0.010	-	_	3.4	0.77	20	0.15	0.14	0	<0.05	<0.05	0	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(b&j)fluoranthene	mg/kg	0.010	-	_	1.4	_	-	0.2	0.12	0.28	<0.05	0.09	0.34	<0.05	<0.05	0 05	<0.05	<0.05
Benzo(g,h,i)perylene	mg/kg	0.010	-	-	63	_	-	0.07	0.08	0.09	<0.05	<0.05	0.12	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(k)fluoranthene	mg/kg	0.010	-	_	0.31	_	-	0.12	0.09	0.15	<0.05	<0.05	0.16	<0.05	<0.05	<0.05	<0.05	<0.05
Chrysene	mg/kg	0.010	-	_	19	_	-	0.18	0.12	0.25	<0.05	0.09	0.27	<0.05	<0.05	<0.05	<0.05	<0.05
Dibenz(a,h)anthracene	mg/kg	0.010	-	_	2.1	_	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluoranthene	mg/kg	0.010	3,500	-	-	0.039	50	0.31	0.19	0.52	0 01	0.19	0.4	<0.01	<0.01	0.04	0.01	0.01
Fluorene	mg/kg	0.010	2,700	220,000	-	0.34	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	0.010	-	-	24	-	-	0.08	0.08	0.11	<0.05	<0.05	0.15	<0.05	<0.05	<0.05	<0.05	<0.05
Naphthalene	mg/kg	0.010	1,800	51	53	0.017	-	0.024	0.027	0.034	<0.00	0.075	0.019	0.019	<0.010	0.015	0.015	0.013
Phenanthrene	mg/kg	0.010	-	-	-	0.061	-	0.24	0.24	0.39	0 03	0.17	0.15	0.01	<0.01	0 06	0.03	0.03
Pyrene	mg/kg	0.010	2,100	-	-	0.04	-	0.29	0.21	0.52	0 02	0.15	0.46	<0.01	<0.01	0 04	0.01	0.01
IACR:Coarse	mg/kg	0.050	-	-	IACR < 1	-	-	0.64	0.464	0.849	<0 001	0.088	0.933	<0.001	<0.001	0.042	<0.001	<0.001
IACR:Fine	mg/kg	0.050	-	-	IACR < 1	_	-	1.23	0.896	1.64	<0 001	0.168	1.8	<0.001	<0.001	0.042	<0.001	<0.001
B(A)P Total Potency Equivalent	mg/kg	0.020	5.3	-		-	-	0.21	-	0.29	-	-	0.33	-	-	-	-	-
PCB	mg/kg																	
VOC Scan	mg/kg																	
Notes:		_				•			<u> </u>									

<sup>1 -</sup> Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remedia ion Guideline Values for Resic Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

<sup>2-</sup> Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECOM from previous reports where provided and the state of the state

<sup>3 -</sup> Subsoil guidelines apply to depths greater than 3m and provided when less conversative han Direct Soil Contact guidelines.

NR - Not Reported

Sample ID					Guideline <sup>1</sup>							Area 6: Bottom	Ash & Suppleme	ental COE Investi	gation			
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine/Coarse)		BH16-01			BH16-02		ВН1	6-03		BH16-04	
Laboratory Sample ID								5465503	5465504	5465505	5465506	5465507	5465508	5465509	5465510	5459364	5459365	5459366
Sample Date								21-Jul-2016	21-Jul-2016	21-Jul-2016	21-Jul-2016	21-Jul-2016	21-Jul-2016	21-Jul-2016	21-Jul-2016	21-Jul-2016	21-Jul-2016	21-Jul-2016
Sample Depth								1.2-1.4	2.7-2.9	3.4-3.6	1.1-1.3	2.7-3.0	4.9-5.1	1.2-1.4	1.9-2.1	0.6-0.8	1.5-1.6	2.2-2.4
Soil Particle Size 4								Fine*	Fine*	Fine*	Fine*	Fine*	Fine*	Fine*	Fine*	Fine*	Fine*	Fine*
Petroleum Hydrocarbons																		
Benzene	mg/kg	0.0050	78	1.6	0.078	0.17	60/ 31											
EthylBenzene	mg/kg	0.015	8,500	930	0.14	540	120/ 55											
Styrene	mg/kg	0.050	10,000	220	210	0.8	-											
Toluene	mg/kg	0.050	20,000	1,900	0.95	0.12	110/ 75											
o-Xylene	mg/kg	0.050	-	-	-	-	-											
m+p-Xylene	mg/kg	0.050	-	-	-	-	-											
Xylenes	mg/kg	0.10	140,000	250	1.9	41	65/ 95											
MTBE	mg/kg	NR	-	-	-	-	-											
F1(C6-C10)	mg/kg	10	12,000	610	2,200	1,300	210/ 210											
F1-BTEX	mg/kg	10	-	-	-	-	-											
F2 (C10-C16)	mg/kg	20	6,800	3,100	2,900	520	150/ 130											
F2-Napth	mg/kg	NR	-	-	2,500	-	-											
F3 (C16-C34)	mg/kg	20	15,000	-	_	_	1300/ 300											
F3 -PAH	mg/kg	NR	-	-	-	_	-											
F4 (C34-C50)	mg/kg	20	21,000	-	_	_	5600/ 2800											
F4G-SG (GHH-Silica)	mg/kg	NR	-	-	-	-	3000/ 2000											
Total Hydrocarbons		NR	-	-	-	-	-											
Polycyclic Aromatic Hydrocarb	mg/kg	INIX	-	-	-	_	-											
		0.010	5,300	99,000		0.38	-	<0.05	<0.05	<0.05	10.1	0.51	-0.0E	<0.05	40.0E	<0.05	<0.05	<0.05
Acenaph hene Acenaphthylene	mg/kg	0.010	5,300	99,000	-	0.30	-	<0.05	<0.05	<0.05	0.1	0.1	<0.05 <0.05	<0.05	<0.05 <0.05	<0.05	<0.05	<0.05
Anthracene	mg/kg mg/kg	0.010	24,000	-	-	0.0056	2.5	0.01	0.01	0.018	29.7	1.58	0.078	0.017	0.089	0.04	0.054	<0.03
		0.0040	-	-		0.0036	2.5	0.01	0.01	0.018	29.7	2.89	0.078	0.017	0.089	0.04	0.054	<0.003
Benz(a)anthracene	mg/kg	0.010	-	-	3.1 3.4	0.063	20	<0.05	<0.05	<0.05	16.5	2.59	0.13	<0.05	0.82	0.07	0.12	<0.01
Benzo(a)pyrene	mg/kg			-					1	+								
Benzo(b&j)fluoranthene	mg/kg	0.010 0.010	-	-	1.4 63	-	-	<0.05 <0.05	<0.05 <0.05	<0.05 <0.05	16.8 2.75	<b>2.21</b> 0.88	0.13 <0.05	0.05 <0.05	0.87 0.4	0.11 <0.05	0.14 <0.05	<0.05 <0.05
Benzo(g,h,i)perylene	mg/kg	0.010			0.31			<0.05	<0.05	<0.05	13.8	1.81	0.09	<0.05	0.4	0.05	0.05	<0.05
Benzo(k)fluoranthene	mg/kg	0.010	-	-	19	-	-	<0.05 <0.05	<0.05 <0.05	<0.05 0.07	13.8 26.8	2.72	0.09	<0.05 <0.05	1.24	0.07	0.1	<0.05 <0.05
Chrysene	mg/kg		-	•	2.1	-	-		1	+		0.37			-		<0.05	
Dibenz(a,h)anthracene	mg/kg	0.010	3,500	-				<0.05	<0.05 0.03	<0.05	1.6 <b>82.7</b>	0.37 <b>5.91</b>	<0.05 <b>0.4</b>	<0.05 <b>0.05</b>	0.16 <b>0.97</b>	<0 05 <b>0.16</b>	<0.05 <b>0.23</b>	<0.05
Fluoranthene	mg/kg	0.010		220,000	-	0.039	50	0.06 <0.05	<0.05	0.04			<0.05	<0.05	<0.05	<0.05	<0.05	<0.01 <0.05
Fluorene	mg/kg	0.010	2,700	220,000	- 24		-			<0.05	13.6	0.56						
Indeno(1,2,3-c,d)pyrene	mg/kg	0.010	1 900	- 51	24	- 0.017	-	<0.05	<0.05 0.032	<0.05 0.322	4 02	1.16	<0.05	<0.05	0.45	<0.05	0.06	<0.05
Naphthalene	mg/kg	0.010	1,800	51	53	0.017	-	0.012			3.51	0.181	0.081	<0.010	0.011	0.047	0.027	0.013
Phenanthrene	mg/kg	0.010	2 100	-	-	0.061	-	0.04 0.04	0.04	0.25	112 64.8	5.14 5.14	0.17 0.36	0.04	0.19 1.4	0.12	0.15 0.19	0.04
Pyrene IACR:Coarse	mg/kg	0.010	2,100	-	- IACD -1	0.04	-		0.03	0.05				0.06		0.14		<0.01
IACR:Coarse	mg/kg	0.050	-	-	IACR < 1	-	-	0.015	0.012	0.021	73.3	9.47	0.458	0.058	3.87	0 358	0.487	0.001
IACR:Fine	mg/kg	0.050	-	-	IACR < 1	-	-	0.03	0.023	0.041	142	18.3	0.884	0.11	7.49	0.69	0.941	0.002
B(A)P Total Potency Equivalent	mg/kg	0.020	5.3	-		-	-				23.2	3.4			1.1			
PCB	mg/kg																	
VOC Scan	mg/kg																	<u> </u>

<sup>1 -</sup> Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table A-3. Surface Soil Remedia ion Guideline Values for Resic Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

<sup>2-</sup> Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECOM from previous reports where provided and the state of the state

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NR - Not Reported

				•	Guideline 1						Area 6:	Bottom Ash & Supp	lemental COE Inve	estigation			
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine/Coarse)		BH16-05			BH16-06			ВН1	6-07	
Laboratory Sample ID								5459367	5459368	5459369	5459370	5459371	5459372	5459373	5459374	5459375	5459376
Sample Date								21-Jul-2016	21-Jul-2016	21-Jul-2016	21-Jul-2016	21-Jul-2016	21-Jul-2016	23-Jul-2016	23-Jul-2016	23-Jul-2016	23-Jul-2016
Sample Depth								0.5-0.7	3.5-3.7	5.6-5.8	0.6-0.8	2.9-3.1	5.2-5.4	1.0-1.2	1.8-2.0	4.6-4.8	6.1-6.3
Soil Particle Size 4								Coarse*	Fine*	Fine*	Fine*	Fine*	Fine*	Fine*	Fine*	Fine*	Fine*
Petroleum Hydrocarbons															•		
Benzene	mg/kg	0.0050	78	1.6	0.078	0.17	60/ 31										
EthylBenzene	mg/kg	0.015	8,500	930	0.14	540	120/ 55										
Styrene	mg/kg	0.050	10,000	220	210	0.8	-										
Toluene	mg/kg	0.050	20,000	1,900	0.95	0.12	110/75										
o-Xylene	mg/kg	0.050	-	-	-	-	-										
m+p-Xylene	mg/kg	0.050	-	-	-	-	-										
Xylenes	mg/kg	0.10	140,000	250	1.9	41	65/ 95										
MTBE	mg/kg	NR	-	-	-	-	-										
F1(C6-C10)	mg/kg	10	12,000	610	2,200	1,300	210/ 210										
F1-BTEX	mg/kg	10	-	-	-	-	-										
F2 (C10-C16)	mg/kg	20	6,800	3,100	2,900	520	150/ 130										
F2-Napth	mg/kg	NR	-	-	-	-	-										
F3 (C16-C34)	mg/kg	20	15,000	-	_	_	1300/ 300										
F3 -PAH	mg/kg	NR	-	-	_	-	-										
F4 (C34-C50)	mg/kg	20	21,000	-	-	-	5600/ 2800										
F4G-SG (GHH-Silica)	mg/kg	NR	-	-	_	-	-										
Total Hydrocarbons	mg/kg	NR	-	_		_	_										
Polycyclic Aromatic Hydrocarbon		1417															
Acenaph hene	mg/kg	0.010	5,300	99,000	-	0.38	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Acenaphthylene	mg/kg	0.010	-	-	-	-	-	<0.05	0.18	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Anthracene	mg/kg	0.0040	24,000	-	-	0.0056	2.5	0.039	0.301	0.003	0.153	0.125	<0.003	0.024	0.058	0.165	0.008
Benz(a)anthracene	mg/kg	0.010	-	-	3.1	0.083	-	0.08	0.79	<0.01	0.33	0.08	<0.01	0.12	0.1	0.24	<0.01
Benzo(a)pyrene	mg/kg	0.010	-	-	3.4	0.77	20	0.18	0.77	<0.05	0.27	<0.05	<0.05	0.13	0.09	0.12	<0.05
Benzo(b&j)fluoranthene	mg/kg	0.010	-	-	1.4	-	-	0.24	1.07	<0.05	0.44	0.09	<0.05	0.14	0.1	0.39	<0.05
Benzo(g,h,i)perylene	mg/kg	0.010	-	-	63	-	-	0.13	0.39	<0.05	0.12	<0.05	<0.05	0.06	<0.05	0.06	<0.05
Benzo(k)fluoranthene	mg/kg	0.010	-	_	0.31	-	-	0.14	0.74	<0.05	0.27	0.05	<0.05	0.1	0.07	0.23	<0.05
Chrysene	mg/kg	0.010	_	-	19	-	-	0.14	1.01	<0.05	0.43	0.13	<0.05	0.14	0.12	0.41	<0.05
Dibenz(a,h)anthracene	mg/kg	0.010	-	-	2.1	-	-	<0.05	0.14	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluoranthene	mg/kg	0.010	3,500	-	-	0.039	50	0.14	1.62	0 01	0.72	0.34	0.02	0.14	0.22	0.48	0.02
Fluorene	mg/kg	0.010	2,700	220,000	-	0.34	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	0.010	-	-	24	-	-	0.14	0.43	<0.05	0.16	<0.05	<0.05	0.07	<0.05	0.08	<0.05
Naphthalene	mg/kg	0.010	1,800	51	53	0.017	-	0.01	0.076	<0.010	0.055	0.112	<0.010	0.015	0.024	0.044	<0.010
· ·	mg/kg	0.010	-	-	-	0.061	-	0.07	0.42	0.02	0.47	0.21	0.02	0.07	0.18	0.28	0.04
Pyrene	mg/kg	0.010	2,100	-	-	0.04	-	0.14	1.33	0.01	0.54	0.21	0.01	0.16	0.2	0.37	0.02
IACR:Coarse	mg/kg	0.050	-	-	IACR < 1	-	-	0.715	3.78	<0.001	1.41	0.28	<0.001	0.504	0.362	1.15	0.001
IACR:Fine	mg/kg	0.050	-	-	IACR < 1	-	-	1.38	7.3	0.002	2.72	0.54	0.002	0.974	0.699	2.21	0.001
B(A)P Total Potency Equivalent	mg/kg	0.020	5.3	-	#101(\lambda)	-	-	1.00	1.1	0.002	0.40	0.01	0.002	0.014	0.000	0.22	0.302
РСВ	mg/kg																
VOC Scan	mg/kg																

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<sup>2-</sup> Soil Particle Size classifiications taken directly from previous reports where provided. Classfications with asterisk (\*) were generated by AECOM from previous reports where provided and the state of the state

<sup>3 -</sup> Subsoil guidelines apply to depths greater than 3m and provided when less conversative han Direct Soil Contact guidelines.

NR - Not Reported

Sample ID					Guideline <sup>1</sup>			Area 6: Bottom As	sh & Supplemental	COE Investigation	Area	a 7: Former Diesel	UST
Parameter	Units	Detection Limits	Human - Direct Soil Contact	Vapour Inhalation - Slab Building Type (Fine)	DUA (Coarse)	Aquatic Life (Coarse)	Ecological - Direct Soil Contact (Fine/Coarse)		BH16-08		A7: 14-05	A7: 14-06	A7: 14-07
Laboratory Sample ID								5459377	5459378	5459379	4916806	4916807	4916808
Sample Date								23-Jul-2016	23-Jul-2016	23-Jul-2016	28-Oct-2014	28-Oct-2014	28-Oct-2014
Sample Depth								0.5-0.8	3.6-3.8	5.0-5.2	3.8 m	9.8 m	2.3 m
Soil Particle Size 4								Fine*	Fine*	Fine*	Fine*	Coarse*	Fine*
Petroleum Hydrocarbons													
Benzene	mg/kg	0.0050	78	1.6	0.078	0.17	60/ 31		T	T	<0 005	<0.005	<0.005
EthylBenzene	mg/kg	0.015	8,500	930	0.14	540	120/ 55				<0.010	<0.010	<0.010
Styrene	mg/kg	0.050	10,000	220	210	0.8	-				<0.010	<0.010	<0.010
Toluene	mg/kg	0.050	20,000	1,900	0.95	0.12	110/75				<0.02	<0.02	<0.02
o-Xylene	mg/kg	0.050	-	-	-	-	-				-		-
·													
m+p-Xylene	mg/kg	0.050	-	-	-	-	-				-	-	-
Xylenes	mg/kg	0.10	140,000	250	1.9	41	65/ 95				<0.03	0.03	<0.03
MTBE	mg/kg	NR	-	-		-	-				-	-	-
F1(C6-C10)	mg/kg	10	12,000	610	2,200	1,300	210/ 210				<10	<10	<10
F1-BTEX	mg/kg	10	-	-	-	-	-				<10	<10	<10
F2 (C10-C16)	mg/kg	20	6,800	3,100	2,900	520	150/ 130				<50	<50	<50
F2-Napth	mg/kg	NR	-	-	-	-	-				-	-	-
F3 (C16-C34)	mg/kg	20	15,000	-	-	-	1300/ 300				<50	<50	<50
F3 -PAH	mg/kg	NR	-	-	-	-	-				-	-	-
F4 (C34-C50)	mg/kg	20	21,000	-	-	-	5600/ 2800				<100	<100	<100
F4G-SG (GHH-Silica)	mg/kg	NR	-	-	-	-	•				-	-	-
Total Hydrocarbons	mg/kg	NR	-	-	-	-	-				-	-	-
Polycyclic Aromatic Hydrocarbo	ons												
Acenaph hene	mg/kg	0.010	5,300	99,000	-	0.38	-	<0.05	<0.05	<0.05	-	-	-
Acenaphthylene	mg/kg	0.010	=	-	-	-	-	<0.05	<0.05	<0.05	=	-	-
Anthracene	mg/kg	0.0040	24,000	-	-	0.0056	2.5	0.056	0.076	0.024	=	-	-
Benz(a)anthracene	mg/kg	0.010	-	_	3.1	0.083	-	0.12	0.14	0.05	-	_	-
Benzo(a)pyrene	mg/kg	0.010	-	_	3.4	0.77	20	0.17	0.13	0.06	-	_	-
Benzo(b&j)fluoranthene	mg/kg	0.010	-	_	1.4	_	-	0.22	0.14	0.08	-	-	-
Benzo(g,h,i)perylene	mg/kg	0.010	-	_	63	_	-	0.11	0.06	<0.05	<u>-</u>	_	-
Benzo(k)fluoranthene	mg/kg	0.010	-	_	0.31	_	_	0.14	0.09	0.05	<u>-</u>	_	_
Chrysene	mg/kg	0.010	_	_	19	_	_	0.17	0.15	0.03	-	_	-
Dibenz(a,h)anthracene		0.010	-	_	2.1	_		<0.05	<0.05	<0.05	-	_	-
, . ,	mg/kg					0.030	50	0.22	0.33	0.09			
Fluoranthene Fluorene	mg/kg	0.010 0.010	3,500 2,700	220,000	-	0.039 0.34	50	<0.05	<0.05	<0.05	-	-	-
	mg/kg		· ·	1	- 24		-				-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg	0.010	4 000	- 54	24	- 0.047	-	0.12	0.06	<0.05	-	-	-
Naphthalene	mg/kg	0.010	1,800	51	53	0.017	-	0.025	0.014	0.023	-	-	-
Phenanthrene	mg/kg	0.010	- 0.400	-	-	0.061	-	0.13	0.26	0 06	-	-	-
Pyrene	mg/kg	0.010	2,100	-	-	0.04	-	0.2	0.26	0.08	=	-	-
IACR:Coarse	mg/kg	0.050	-	-	IACR < 1	-	-	0.722	0.491	0 26	=	-	=
IACR:Fine	mg/kg	0.050	-	-	IACR < 1	-	-	1.39	0.948	0.503	-	-	-
B(A)P Total Potency Equivalent	mg/kg	0.020	5.3	-		-	-				-	-	-
PCB	mg/kg												
VOC Scan	mg/kg												

Cells with "-" indicate that the associated parameter was not analyzed.

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<sup>3 -</sup> Subsoil guidelines apply to depths greater than 3m and provided when less conversative han Direct Soil Contact guidelines.

Sample ID	Units	Detection Limits	Guid	eline <sup>1</sup>	Area 1 Natural Gas Metering						Area 3 Fo	rmer Fire Training	Burn Pit(s)						HP and LP Plants, Area 4
Parameter			Potable	Aquatic Life (Coarse)	A1 14-18	MW1	MW104	MW108	MW109	MV	W201	MV	V202		MV	/203		A3 14-09	MW14-01
Laboratory Sample ID					4940170												4940175	4940174	
Sample Date					21-Nov-2014	21-Jun-2005	21-Jun-2005	21-Jun-2005	21-Jun-2005	21-Jun-2005	29-Oct-2013	21-Jun-2005	24-Jun-2014	21-Jun-2005	29-Oct-2013	24-Jun-2014	21-Nov-2014	21-Nov-2014	28-Sep-2015
Routine Water Chemistry																			
Alkalinity, Total (as CaCO <sub>3</sub> )	mg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	417	391	-
Bicarbonate (HCO <sub>3</sub> )	mg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	508	477	-
Carbonate (CO <sub>3</sub> )	mg/L	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<6	<6	-
Chloride (CI)	mg/L	0.4	250	120	-	-	-	-	-	-	-	-	-	-	-	-	18.7	159	-
Conductivity (EC)	μS/cm	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	831	1210	-
Hardness (as CaCO <sub>3</sub> )	mg/L	1	-	-	1360	-	-	-	-	-	-	-	-	-	-	-	489	470	-
Hydroxide (OH)	mg/L	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5	<5	-
Nitrate and Nitrite (as N) Nitrate (as N)	mg/L	0.010 0 01	10	3	-	-	-	-	-	-	-	<del>                                     </del>	-	-	<del>-</del>	-	1.01 1.01	1 6 1.59	-
Nitrate (as N) Nitrite (as N)	mg/L mg/L	0.005	10	0.6 2	-	-	-	-	-	-	-	-	-	-	-	-	1.01 <0.005	1.59 0.012	-
pH	IIIg/L	0.005	6.5-8.5	6.5-9	-	-	-	-	-	-	-	-	-	-	-	-	7.61	7.47	-
TDS (Calculated)	mg/L	1	500	0.5-9	-	-	-	-	-	-	-	<u> </u>	-	-	<del>-</del>	-	540	7.47	-
Sulphate (SO <sub>4</sub> )	mg/L	0.9	500	429 <sup>3</sup>	_		_	-	_	-	_	-	_	_	-	-	77.8	75.2	-
Calcium (Ca)	mg/L	0.2	-	-	-	-	-	-	-	-	-	-	_	-	-	-	146	140	-
Magnesium (Mg)	mg/L	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30.6	29.2	-
Potassium (K)	mg/L	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.3	5	-
Sodium (Na)	mg/L	0.4	200	-	-	-	-	-	-	-	-	-	-	-	-	-	15.4	126	-
Metals (Dissolved and Total as noted	l)				Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Total
Aluminum (AI)	mg/L	0.0020	-	0 05 4	<0.002	<0.01	<0.01	<0.01	<0.01	<0.01	<0.002	<0.01	<0.002	<0.01	<0.002	< 0.002	<0.002	< 0.002	4.38
Antimony (Sb)	mg/L	0.00020	0.006	-	<0 0002	<0.0004	0.0004	0.0004	0.0004	0.0004	<0.0002	0.0004	<0 0002	0.0006	<0.0002	<0 0002	<0.0002	0.0002	<0 0002
Arsenic (As)	mg/L	0.00020	0.01	0.005	0.0004	<0.0004	<0 0004	<0.0004	<0.0004	<0 0004	0.0002	<0.0004	<0.0002	<0.0004	<0.0002	<0.0002	<0.0002	0.0003	0.0026
Barium (Ba) Bervllium (Be)	mg/L	0.0010 0.0001	<u> </u>	-	0.459	0 08	0 082	0.062 <0.001	0.112 <0.001	0 069 <0.001	0.11 <0.0001	0 06 <0.001	0 098	0.082 <0.001	0.124 <0.0001	0.111 <0.0001	0.136	0.159	0.175 0 0002
Boron (B)	mg/L mg/L	0.0001	5	1.5	0.229	<0.001	0.06	<0.001	0.001	0.05	0.068	0.001	0.109	0.06	0.068	0.0001	0.091	0.099	0.055
Cadmium (Cd)	mg/L	0.0001	0.005	0.00037 5	0.000136	<0.001	<0.001	<0.0001	<0.0001	<0.001	0.00011	<0.0001	0.000014	<0.0001	<0.0001	<0.00001	<0.0001	0.00072	0.00007
Calcium (Ca)	mg/L	0.00001	-	0.00037	0.000130	103	106	90.1	108	96.7	122	87.1	126	110	128	113	146	140	134
Chromium (Cr)	mg/L	0.0005	-	0.0089	<0 0005	-	-	-	-	-	-	-	-	-	-	-	<0.0005	<0.0005	-
Cobalt (Co)	mg/L	0.0005	-	-	-	<0 002	<0.002	<0.002	<0 002	<0.002	0.0005	<0 002	<0 0001	<0.002	<0.0001	<0 0001	-	-	0 0025
Copper (Cu)	mg/L	0.0010	1	0.007	<0.001	<0 001	<0.001	<0.001	<0 001	<0.001	<0.001	<0.001	<0.001	0.002	<0 001	<0.001	<0.001	0.002	0.01
Iron (Fe)	mg/L	0.010	03	0.3	<0.01	0.34	0.322	0.452	1.13	0 263	0.01	0.489	<0.01	0.292	<0.01	<0.01	<0.01	<0.01	9.16
Lead (Pb)	mg/L	0.00010	0.01	0.007 <sup>6</sup>	<0 0001	< 0.0001	0.0001	< 0.0001	0.0001	<0 0001	< 0.0001	<0.0001	<0.0001	<0.0001	< 0.0001	<0.0001	<0.0001	< 0.0001	0 0063
Lithium (Li)	mg/L	NR	-	-	-	0.011	0 006	0.006	0.006	0 006	0.008	0.005	0 008	0.006	0 01	0 011	-	-	0.011
Magnesium (Mg)	mg/L	0 01	-	-	-	20.1	23.1	18.6	23.5	21.7	26.8	18.8	29	23.1	27.8	25.8	-	-	31
Manganese (Mn)	mg/L	0.0020	0.05 8	-	0.756	0.021	0.083	0.008	0.145	0 008	0.21	0.055	<0.005	0.009	<0.005	<0.005	0.008	0.548	0.306
Mercury (Hg)	mg/L	0 000005	0.001	0 000005	-	<0.0001	<0 0001	<0.0001	<0.0001	<0 0001		<0.0001	<0.000005	<0.0001	-	<0.000005	-	-	-
Molybdenum	mg/L	0.005	-	7	- 0.007	<0 005	<0.005	<0.005	<0 005	<0.005	<0.001	<0.005	<0.001	<0.005	<0.001	<0.001		- 0.004	<0.001
Nickel (Ni)	mg/L	0.0005	-	0.17 7	0.0037	<0 002	<0.002	<0.002	<0.002	<0.002	0.0007	<0.002	0.0008	<0.002	0.0007	<0.0005	0.0007	0.0024	0.008
Potassium (K) Selenium (Se)	mg/L mg/L	0.10 0.00020	0.05	0.001	0.0011	1.8 0.0011	<0 0004	1.4 0.0005	2.2 0.0006	1.7 <0.0004	0.0004	1.8 <0.0004	1.9 0.0002	1.8 <0.0004	2.1 0.0002	<0.0002	0.0005	0.0005	3 0 0003
Silver (Ag)	mg/L mg/L	0.00020	-	0.001	<0.00011	0.0011	<0 0004	<0.0005	<0.0006	<0 0004	<0.0004	<0.0004	<0.0002	<0.0004	<0.0002	<0.0002	<0.0005	<0.0005	0.0003
Sodium (Na)	mg/L	0.00001 NR	<u> </u>	0.0001		18.4	12.2	5 9	12	10	9.5	8.2	11.6	8.6	12.7	12.2		<0.00001	10.4
Strontium	mg/L	NR	-	-	-	-	-	-	-	-	0.51	-	0 607	-	0.601	0 569	_	-	0 596
Thallium	mg/L	0.00005	-	-	-	<0.0001	<0 0001	<0.0001	<0.0001	<0 0001	<0 00005	<0.0001	<0.00005	<0.0001	<0.00005	<0.00005	-	-	0.00011
Tin (Sn)	mg/L	0.001	-	-	-	<0.05	<0.05	< 0.05	<0.05	<0.05	<0.001	<0.05	<0.001	<0.05	<0.001	<0.001	-	-	<0.001
Titanium	mg/L	0.00050	-	-	-	<0 001	<0.001	<0.001	<0 001	<0.001	< 0.0005	<0 001	<0 0005	<0.001	<0.0005	< 0.0005	-	-	0 0504
Uranium (U)	mg/L	0.00050	0.02	0.015	0 0047	0.0024	0 0017	0.0014	0.0019	0 0014	0.0013	0.0013	0 0017	0.0015	0.0016	0.0015	0.0016	0.0019	0 0021
Vanadium	mg/L	0.00010	-	-	-	<0 001	<0.001	<0.001	<0 001	<0.001	0.0002	<0 001	<0 0001	<0.001	<0.0001	<0 0001	-	-	0 0106
Zinc (Zn)	mg/L	0.0030	5	0 03	0.003	0.005	0 009	0.004	0 01	0 009	<0.001	0.006	0 002	0.009	<0 001	<0.001	0.004	0.062	0 025
Chromium VI	mg/L	0.0100	-	-	<0.01	- 0.005	- 0.005	- 0.005	- 0.005	- 0.005	- 0.0005	0.005	0.0005	- 0.005	- 0.005	- 0.0005	<0.01	<0.01	- 0.0007
Chromium III	mg/L	0.0005	•	-	<0 0005	<0 005	< 0.005	< 0.005	<0 005	< 0.005	< 0.0005	<0 005	<0 0005	< 0.005	< 0.0005	<0 0005	< 0.0005	< 0.0005	0 0067

- 1 Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table B-3. Groundwater Remediation Guideline Values for Residential/Parkland All Water Uses
- 2 Nitrite (as N) Guideline based on chloride concentration (Environmental Quality Guidelines for Alberta Surface Waters, July 2014 Table 1.4)
- 3 Sulphate Guideline based on water hardness (Environmental Quality Guidelines for Alberta Surface Waters, July 2014 Table 1.7)
- 4 Aluminum Guideline based on water pH (Environmental Quality Guidelines for Alberta Surface Waters, July 2014 Table 1.1) and applies to dissolved Aluminum
- 5 Cadmium Guideline based on water hardness (Environmental Quality Guidelines for Alberta Surface Waters, July 2014 Table 1.3)
- 6 <u>Lead</u> Guideline based on water hardness (Environmental Quality Guidelines for Alberta Surface Waters, July 2014 Table 1.3)
- 7 Nickel Guideline based on water hardness (Environmental Quality Guidelines for Alberta Surface Waters, July 2014 Table 1.3); Equation = e<sup>(0.846(ln[hardness])+0.0584)</sup>
- 8 Manganese Aesthetic Objective. t is noted that the World Health Organization has established a human health guideline of 0.4 mg/L.

## NR = Not Reported

Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

Bold and underlined RPD percentages exceed appropriate values

Tables-Rossdale Plant - Gap Analysis 2016-05-25 Page 1 of 6

Sample ID	Units	Detection Limits	Guid	eline <sup>1</sup>							HP a	and LP Plants, Are	ea 4						
Parameter			Potable	Aquatic Life (Coarse)	MW14-01	MW99-1			MW99-2			MW	99-3	TH15-3 (re	eplace 99-3)	MW99-4	TH10-15	ТН	10-1
Laboratory Sample ID					1139764-1												724720-4	724720-5	
Sample Date					26-May-2016	1-Nov-2000	1-Nov-2000	4-Feb-2010	Aug 12 2013	28-Apr-2014	Dec 22 2015	1-Nov-2000	4-Feb-2010	9-Aug-2013	22-Dec-2015	1-Nov-2000	3-Feb-2010	3-Feb-2010	18-Dec-2013
Routine Water Chemistry																			
Alkalinity, Total (as CaCO <sub>3</sub> )	mg/L	5	-	-		416	475	445	387	410	439	267	279	410	430	264	484	571	747
Bicarbonate (HCO <sub>3</sub> )	mg/L	5	-	-		508	579	542	472	500	535	325	340	500	525	322	590	693	910
Carbonate (CO <sub>3</sub> )	mg/L	6	-	-		<6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6
Chloride (CI)	mg/L	0.4	250	120		48 2	98	20.2	45 3	30.8	33.3	115	13.4	21.1	46	63	38.7	144	72.8
Conductivity (EC)	μS/cm	1	-	-		932	942	959	944	967	996	914	615	933	1170	748	1060	1700	2010
Hardness (as CaCO <sub>3</sub> )	mg/L	1	-	-		445	489	455	461	431	469	367	309	434	618	401	579	903	901
Hydroxide (OH)	mg/L	5 0.010	<u> </u>	-		<5 5.27	<5 3.92	<5 6 68	<5 0.08	<5 5.43	<5 5 62	<5 0 288	<5 0.13	<5 3 84	<5 10.6	<5 1.55	<5 0.72	<5 16.7	<5 19 5
Nitrate and Nitrite (as N) Nitrate (as N)	mg/L mg/L	0.010	10	3		5.27	3.92	6.68	0.08	5.43	5.62	- 0 200	0.13	3.84	10.5	1.55	0.72	15.5	19.5
Nitrite (as N)	mg/L	0.005	1	0.6 2				<0.005	<0.005	<0.005	<0.005		<0.005	<0.005	0.112	-	0.055	1.25	<0.02
pH	- IIIg/L	0.003	6.5-8.5	6.5-9		7.4	7.12	7 69	7.84	7.84	7.7	7.84	7.93	7 68	7.93	7.26	7 83	7.55	7.64
TDS (Calculated)	mg/L	1	500	- 0.5-9		626	645	576	552	553	602	585	377	563	720	478	668	1030	1210
Sulphate (SO <sub>4</sub> )	mg/L	0.9	500	429 <sup>3</sup>		99 6	114	77.2	83 2	73	82.7	102	63.6	93.2	160	86.4	107	174	263
Calcium (Ca)	mg/L	0.2	-	-	112	119	136	124	77-	119		102	85.4		100	118	157	257	
Magnesium (Mg)	mg/L	0.2	-	-	23.7	36.1	36.4	35		32.4		27.4	23.3			25.7	45.3	63.6	
Potassium (K)	mg/L	0.4	-	-	1.8	4.9	5 2	4.2		5		5	2.1			2.3	3.4	6.2	
Sodium (Na)	mg/L	0.4	200	-	8.5	70.1	60.2	47.9		47.3		74 3	22.3			23.1	25.6	42.9	
Metals (Dissolved and Total as noted	)				Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved
Aluminum (Al)	mg/L	0.0020	-	0 05 4	<0 002	0.024	0.016	<0 002	<0.002	<0.002	<0 002	0 033	<0.002	<0 002	<0.002	0.039	<0 002	<0.002	<0.004
Antimony (Sb)	mg/L	0.00020	0.006	-	<0.0002	<0.005	<0.005	<0.0002	<0 0002	<0.0002	<0.0002	<0.005	<0.0002	0.0002	0.0002	<0.005	<0.0002	<0 0002	<0 0004
Arsenic (As)	mg/L	0.00020 0.0010	0.01	0.005	<0.0002 0.089	<0.01 0 0716	<0.01 0.0841	0.0005 0.081	0 0003 0.25	0.0003 0.074	0.0002 0.078	<0.01 0 253	0.0002 0.117	0.0005 0.087	0.0007 0.23	<0.01 0.124	0.0002 0.144	0.0013 0.066	0 0005 0 088
Barium (Ba) Bervllium (Be)	mg/L mg/L	0.0010		-	<0.0001	<0.0005	<0.0041	<0.001	<0.25	<0.001	<0.0001	<0.0005	<0.0001	<0.007	<0.23	<0.0005	<0.0001	<0.0001	<0.0002
Boron (B)	mg/L	0.0001	5	1.5	0.071	0.621	1.13	0.719	0 069	0.657	0.607	0.11	0.066	0.784	0 337	0.095	0.319	1.39	5.58
Cadmium (Cd)	mg/L	0.00001	0.005	0.00037 5	0.00003	<0 0005	<0.0005	0.00001	0.000011	0.000012	0.00001	<0 0005	<0 00001	0 000019	0.00001	<0.0005	0.00002	<0.00001	0.000021
Calcium (Ca)	mg/L	0.20	-	-	0.00000	-	-	0.0000	127	119	129	-	10 00001	119	174	-	-	-	256
Chromium (Cr)	mg/L	0.0005	-	0.0089	<0.0005	<0 0008	<0.0008	0.0016	<0 0005	<0.0005	<0.0005	<0 0008	0.0009	<0.0005	<0 0005	<0.0008	0.0026	0 0017	<0.001
Cobalt (Co)	mg/L	0.0005	-	-	0.0001	0.001	0.001	0.0014	0 0004	<0.0001	<0.0001	0 0015	0.0002	0.0011	0 0013	< 0.0007	<0.0001	<0 0001	<0 0002
Copper (Cu)	mg/L	0.0010	1	0.007	0 003	<0.001	0.004	<0 001	<0.001	0.003	0.001	0 002	< 0.001	<0 001	< 0.001	0.002	0.005	0 001	<0.002
Iron (Fe)	mg/L	0.010	0 3	0.3	0.01	0.016	0.019	<0.01	<0.01	0.02	<0.01	0 042	<0.01	<0.01	<0.01	0.017	<0 01	<0.01	0.02
Lead (Pb)	mg/L	0.00010	0.01	0.007 <sup>6</sup>	<0.0001	<0.002	<0.002	<0.0001	<0 0001	<0.0001	<0.0001	<0.002	<0.0001	<0.0001	<0 0001	<0.002	<0.0001	<0 0001	<0 0002
Lithium (Li)	mg/L	NR	-	-	0 008	0.03	0.023		0 016	0.035	0.063	0 021	0.013	0.032	0 022	0.01	0.028	0 029	0.02
Magnesium (Mg)	mg/L	0 01	-	-		-	-	-	34.7	32.4	35.4	-	-	33.4	44 5	-	-	-	63 9
Manganese (Mn)	mg/L	0.0020	0.05 8	- 0.000005	0 006	1.02	0.182	0.564	0.276	<0.005	<0.005	1.25	0.314	0.445	1.85	0.175	0.038	0 017	0 007
Mercury (Hg)	mg/L	0 000005	0.001	0 000005	z0.001	<0 0001	0.0005	<0.0001	<0 0001	<0.000005	<0.00005	<0 0001	<0.0001	<0.0001	<0.000005	<0.0001	<0.0001	<0 0001	<0.0001
Molybdenum	mg/L	0.005		0.477	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0 003	<0.001	<0.001	0 002	<0.001	<0.001	<0.001	<0.002
Nickel (Ni) Potassium (K)	mg/L mg/L	0.0005 0.10	-	0.17 7	0.0065	0.001	0.002	0.0036	0 0015 2.9	0.0022 5	0.0019 5.4	<0.001	<0.0005	0.0033 5.2	0 0074 4.5	<0.001	0.0011	<0 0005	0 001 5.6
Selenium (Se)	mg/L mg/L	0.10	0.05	0.001	0.0004	<0.004	<0.004	0 001	<0 0002	0.0011	0.0015	0.009	<0.0002	0.0016	0.0014	<0.004	<0.0002	0 0008	0 0032
Silver (Ag)	mg/L	0.00020	-	0.0001	<0.0004	<0.004	<0.004	<0.0001	<0 00002	<0.00011	<0.00013	<0.009	<0.0002	<0.0001	<0.0014	<0.004	<0.0002	<0.00001	<0 00002
Sodium (Na)	mg/L	0.00001 NR	-	-	\0.00001	-	-	-	26.7	47.3	52.1	-	-	44.9	32 8	-	-	-	106
Strontium	mg/L	NR	-	-	0.481	0.686	0.748	0.774	0 937	0.749	0 886	0.71	0.542	0.768	1.15	0.564	0.817	0 636	0.751
Thallium	mg/L	0.00005	-	-	<0.00005	< 0.004	<0.004	< 0.00005	<0 00005	<0.00005	< 0.00005	<0.004	<0 00005	< 0.00005	<0 00005	<0.004	< 0.00005	< 0.00005	<0 0001
Tin (Sn)	mg/L	0.001	-	-	<0 001	-	-	<0 001	<0.001	<0.001	<0 001	-	<0 01	<0 001	<0.001	-	<0 001	0 002	<0.002
Titanium	mg/L	0.00050	-	-	<0.0005	<0 0004	<0.0004	0.0019	<0 0005	<0.0005	<0.0005	<0 0004	0.0014	< 0.0005	<0 0005	<0.0004	0.0024	0 0024	<0.001
Uranium (U)	mg/L	0.00050	0.02	0.015	0.0015	-	-	0.0041	0 0077	0.0039	0.0046	-	0.002	0.0043	0.0159	-	0.0068	0 0042	0 007
Vanadium	mg/L	0.00010	-	-	<0.0001	0.002	0.002	0 006	0 0001	<0.0001	<0.0001	0 003	0.0033	0.0004	0 0002	<0.001	0.0084	0 0093	0 0002
Zinc (Zn) Chromium VI	mg/L	0.0030 0.0100	5	0 03	0 005	0.001	0.0062	0 002	<0.001	0.002	0 002	0 0012	<0.001	0.001	<0.001	0.0015	0.003	0 002	0 005
Chromium VI Chromium III	mg/L	0.0100	<u> </u>	-		-	-	-				-	-	-	+	-	-	-	+
Chiomium iii	mg/L	0.0005	•	-		<u> </u>	-	-			l			1	1		<u>-</u>	· -	

- 1 Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table B-3. Groundwater Rem
- 2 Nitrite (as N) Guideline based on chloride concentration (Environmental Quality Guidelines for Alberta Surface
- $3 \underline{\text{Sulphate}} \text{Guideline based on water hardness (Environmental Quality Guidelines for Alberta Surface Waters, July 2007)} \\$
- 4 <u>Aluminum</u> Guideline based on water pH (Environmental Quality Guidelines for Alberta Surface Waters, July 20
- 5 <u>Cadmium</u> Guideline based on water hardness (Environmental Quality Guidelines for Alberta Surface Waters, .
- 6 <u>Lead</u> Guideline based on water hardness (Environmental Quality Guidelines for Alberta Surface Waters, July 2 7 <u>Nickel</u> Guideline based on water hardness (Environmental Quality Guidelines for Alberta Surface Waters, July
- 8 Manganese Aesthetic Objective. t is noted that the World Health Organization has established a human healt

NR = Not Reported

Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

Bold and underlined RPD percentages exceed appropriate values

Tables-Rossdale Plant - Gap Analysis 2016-05-25 Page 2 of 6

Sample ID	Units	Detection Limits	Guid	eline <sup>1</sup>															
Parameter			Potable	Aquatic Life (Coarse)	ТН	10-1	TH10-4		тн	10-7		TH12-1 (TH1:	5-1 replaces)	TH12-2		TH12-3		TH12-4 (TH1	15-4 replaces)
Laboratory Sample ID							724720-1	724720-2	724720-3 (DUP)										
Sample Date					28-Apr-2014	22-Dec-2015	3-Feb-2010	3-Fel	o-2010	9-Aug-2013	28-Apr-2014	12-Aug-2013	22-Dec-2015	28-Apr-2014	9-Aug-2013	28-Apr-2014	22-Dec-2015	9-Aug-2013	28-Apr-2014
Routine Water Chemistry																			
Alkalinity, Total (as CaCO <sub>3</sub> )	mg/L	5	-	-	785	862	437	408	406	396	337	481	481	382	311	406	419	469	477
Bicarbonate (HCO <sub>3</sub> )	mg/L	5	-	-	957	1050	533	497	495	482	410	586	587	466	379	495	510	572	582
Carbonate (CO <sub>3</sub> )	mg/L	6	-	-	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6	<6
Chloride (CI)	mg/L	0.4	250	120	70.7	41.4	168	27 8	28.2	27.7	21 9	51.2	54.6	125	8.1	50.9	56.3	32.2	27.1
Conductivity (EC)	μS/cm	1	-	-	2050	1770	1420	918	913	881	768	1160	1160	1340	602	1030	1080	1140	1150
Hardness (as CaCO <sub>3</sub> )	mg/L	1	-	-	1010	891	677	466	466	453	372	557	580	542	310	485	556	579	558
Hydroxide (OH)	mg/L	5	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Nitrate and Nitrite (as N)	mg/L	0.010	-	-	17.3	7.61	3.64	3.92	3.96	3.77	3.48	8.19	7.13	0.94	1.52	7 91	5.95	13.4	10.5
Nitrate (as N)	mg/L	0 01	10	3	17.3	7.61	3.61	3.87	3.92	3.77	3.48	8.19	7.08	0.94	1.52	7.91	5.95	13.4	10.5
Nitrite (as N)	mg/L	0.005	1 0.5.0.5	0.6 2	<0.005	<0.005	0.028	0.049	0.044	<0 005	<0.005	<0.005	0.055	<0.005	<0.005	<0 005	0 006	<0.005	<0 005
pH	- "	0.1	6.5-8.5	6.5-9	7 8	7 66	7.64	7.79	7.77	7.72	7.99	7.44	7 86	7.86	7.62	7 89	7.8	7.44	7.76
TDS (Calculated) Sulphate (SO <sub>4</sub> )	mg/L	1 0.9	500	- 400.3	1270	1160	834	556	555	522	429	664	707	806	343	584	650	658	658
Calcium (Ca)	mg/L		500	429 <sup>3</sup>	277 292	179	115 191	87.1 129	87.1 129	64.3	48 6 104	88.3	105	170 156	24	78.2 136	111	96.9	103 158
Magnesium (Mg)	mg/L	0.2 0.2	<u> </u>	-	68.4		48.9	34 8	35.1		27			37		35			39.5
Potassium (K)	mg/L mg/L	0.2	-	-	4 3		46.9	4	4		2.8			8.6		3			3.4
Sodium (Na)	mg/L	0.4	200	-	88.1		43.8	28 6	28.6		22.2			79.7		36.4			39.8
Metals (Dissolved and Total as note		0.4	200		Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved
Aluminum (Al)	mg/L	0.0020		0 05 4	0.012	<0.002	0.019	<0.002	0.059	<0.002	0.01	<0.002	<0.002	<0.002	<0.002	0.002	<0.002	<0.002	<0.002
Antimony (Sb)	mg/L	0.00020	0.006	-	<0.0002	<0.0002	<0.0002	<0 0002	<0.0002	<0.0002	<0 0002	<0.0002	<0.0002	<0 0002	0.0002	<0.0002	<0 0002	<0.0002	<0.0002
Arsenic (As)	mg/L	0.00020	0.01	0.005	0.0003	0.0002	0.0003	0 0003	0.0003	<0.0002	<0 0002	<0.0002	0.0002	0 0023	<0.0002	<0.0002	<0 0002	<0.0002	<0.0002
Barium (Ba)	mg/L	0.0010	1	-	0.152	0.096	0.196	0.139	0.142	0.121	0.044	0.168	0.125	0.19	0.109	0.173	0.158	0.075	0.063
Beryllium (Be)	mg/L	0.0001	-	-	<0.0001	< 0.0001	<0.0001	<0 0001	<0.0001	<0.0001	<0 0001	< 0.0001	<0.0001	<0 0001	<0.0001	< 0.0001	<0 0001	<0.0001	<0.0001
Boron (B)	mg/L	0.002	5	1.5	5.17	5.5	0.311	0.372	0.002	0.41	0 353	0.462	0.395	0.37	0.212	1 04	0 311	1.11	1.5
Cadmium (Cd)	mg/L	0.00001	0.005	0.00037 5	0 000027	0 00002	0.00001	< 0.00001	<0.00001	0 000012	< 0.00001	0 00002	0.00002	0.000097	0.000014	0 000012	0.00008	0.000023	0 000018
Calcium (Ca)	mg/L	0 20	-	-	292	257	-		-	126	104	158	161	156	88.5	136	155	163	158
Chromium (Cr)	mg/L	0.0005	-	0.0089	<0.0005	< 0.0005	0.0006	0 0024	0.0024	< 0.0005	<0 0005	<0.0005	<0.0005	<0 0005	<0.0005	<0.0005	<0 0005	< 0.0005	<0.0005
Cobalt (Co)	mg/L	0.0005	-	-	<0.0001	<0.0001	<0.0001	<0 0001	<0.0001	<0.0001	<0 0001	<0.0001	0.0002	0 0009	<0.0001	<0.0001	0 0003	<0.0001	<0.0001
Copper (Cu)	mg/L	0.0010	1	0.007	<0.001	0.001	0 001	0.004	0.007	<0 001	0.001	<0.001	<0 001	<0.001	<0.001	<0 001	<0.001	<0.001	<0 001
Iron (Fe)	mg/L	0.010	03	0.3	<0.01	<0.01	0.06	<0.01	0.22	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Lead (Pb)	mg/L	0.00010	0.01	0.007 <sup>6</sup>	<0.0001	<0.0001	<0.0001	<0 0001	<0.0001	<0.0001	<0 0001	<0.0001	<0.0001	<0 0001	<0.0001	<0.0001	<0 0001	<0.0001	<0.0001
Lithium (Li)	mg/L	NR 0.04	-	-	0.019	0.018	0 028	0.023	0.024	0.023	0.02	0.019	0.026	0 022	0.01	0.018	0.02	0.019	0.019
Magnesium (Mg)	mg/L	0 01	- 8	-	68.4	60.6	- 0.000	- 0.005	- 0.040	33.5	27 <0.005	39.8	43.2	37 <b>0.152</b>	21.7	35	41.1	41.7	39.5
Manganese (Mn) Mercury (Hg)	mg/L	0.0020 0.00005	0.05 <sup>8</sup>	0 000005	0.023 <0.000005	0.006 <0 000005	0 006	<0.005 <0.0001	0.018 <0.0001	<0 005 <0.0001	<0.005	0.04 <0.0001	<b>0.29</b> 0 000005	<0.00005	<0.005 <0.0001	<0 005 <0 000005	<b>1.16</b> <0.000005	0.017 <0.0001	<0 005 <0 000005
Melcury (ng)  Molybdenum	mg/L	0.005	0.001	0 000005	<0.001	<0.001	<0 001	<0.001	<0.001	<0.0001	<0.00005	<0.001	0.001	0 001	<0.001	<0.000	<0.00005	<0.001	<0.000
Nickel (Ni)	mg/L mg/L	0.005		0.17 7	0.001	0.0011	<0.0005	<0.001	<0.001	<0.0005	<0.001	0.0019	0.001	0 007	0.001	0.0011	0 0025	0.001	0.002
Potassium (K)	mg/L	0.0005		0.17	43	4.4	<0.0005			4	2.8	33	5	8.6	2.2	3	2.9	3.8	3.4
Selenium (Se)	mg/L	0.00020	0.05	0.001	0.0022	0.0005	<0.0002	0 0003	0.0003	<0.0002	0 0004	0.0009	0.0007	<0 0002	0.0007	0 001	<0 0002	0.0006	0.0019
Silver (Ag)	mg/L	0.00020	-	0.0001	<0.0001	<0.0003	<0.0002	<0 00001	<0.00001	<0.0002	<0.0004	<0.00001	<0.0007	<0.0002	<0.0007	<0.00001	<0.0002	<0.0000	<0.0001
Sodium (Na)	mg/L	NR	-	-	88.1	104	-	-	-	29.6	22 2	35.9	49.8	79.7	12.1	36.4	32 9	38.8	39.8
Strontium	mg/L	NR	-	-	0.908	0.76	0 881	0.785	0.786	0 809	0.606	1 06	1.18	0 838	0.537	0.808	1.06	0.971	0.915
Thallium	mg/L	0.00005	-	-	<0.00005	<0.00005	0.00006	<0 00005	<0.00005	< 0.00005	<0 00005	<0.00005	<0.00005	0.00007	<0 00005	<0.00005	<0 00005	<0 00005	<0.00005
Tin (Sn)	mg/L	0.001	-	-	<0 001	<0 001	<0 001	<0.001	<0.001	<0 001	<0.001	<0.001	<0 001	<0.001	<0.001	<0 001	<0.001	<0.001	<0 001
Titanium	mg/L	0.00050	-	-	<0.0005	< 0.0005	0.0032	0 0018	0.0049	<0.0005	<0 0005	<0.0005	<0.0005	<0 0005	<0.0005	< 0.0005	<0 0005	< 0.0005	<0.0005
Uranium (U)	mg/L	0.00050	0.02	0.015	0.0095	0.0105	0.0047	0 0036	0.0042	0.0036	0 0027	0.0037	0.0046	0 0022	0.0023	0 004	0 0047	0.0044	0 004
Vanadium	mg/L	0.00010	-	-	0.0001	0.0002	0.0085	0 0074	0.0074	<0.0001	<0 0001	<0.0001	<0.0001	<0 0001	<0.0001	<0.0001	<0 0001	<0.0001	<0.0001
Zinc (Zn)	mg/L	0.0030	5	0 03	0.003	0.005	0 001	0.002	0.003	<0 001	0.002	<0.001	<0 001	0 002	<0.001	0 001	<0.001	<0.001	0 005
Chromium VI	mg/L	0.0100	-	-			-	-	-		ļ				ļ				
Chromium III	mg/L	0.0005	-	-		<u> </u>	-	-	-							L	İ		

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- 2 Nitrite (as N) Guideline based on chloride concentration (Environmental Quality Guidelines for Alberta Surface
- 3 Sulphate Guideline based on water hardness (Environmental Quality Guidelines for Alberta Surface Waters, J
- 4 <u>Aluminum</u> Guideline based on water pH (Environmental Quality Guidelines for Alberta Surface Waters, July 20
- 5 Cadmium Guideline based on water hardness (Environmental Quality Guidelines for Alberta Surface Waters, .
- 6 <u>Lead</u> Guideline based on water hardness (Environmental Quality Guidelines for Alberta Surface Waters, July 2
- 7 Nickel Guideline based on water hardness (Environmental Quality Guidelines for Alberta Surface Waters, July
- 8 Manganese Aesthetic Objective. t is noted that the World Health Organization has established a human healt

NR = Not Reported

Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

Bold and underlined RPD percentages exceed appropriate values

Tables-Rossdale Plant - Gap Analysis 2016-05-25 Page 3 of 6

Sample ID	Units	Detection Limits	Guid	eline <sup>1</sup>						Background				Area 6	- Coal Ash				HP Plant
Parameter			Potable	Aquatic Life (Coarse)	TH12-4 (TH1	5-4 replaces)	TH12-6	TH12-7	BH1 (Stantec)	A5 14-01		14-	-15			14	-17		BH16-01
Laboratory Sample ID						1145461-3				4940167	4940176	1145461-1	12118	01-4	4940177	1145461-2	1211	801-5	1151462-1
Sample Date					22-Dec-2015	23-Jun-2016	17-Oct-2014	9-Aug-2013	11-Dec-2011	21-Nov-2014	20-Nov-2014	23-Jun-2016	30-Jun	-2017	20-Nov-2014	23-Jun-2016	30-Ju	n-2017	26-Jul-2016
Routine Water Chemistry																			
Alkalinity, Total (as CaCO <sub>3</sub> )	mg/L	5	-	-	532		412	426	-	191	-	405	329		-	424	427		393
Bicarbonate (HCO <sub>3</sub> )	mg/L	5	-	-	648		503	520	-	233	-	494	401		-	517	520		479
Carbonate (CO <sub>3</sub> )	mg/L	6	-	-	<6		<6	<6	-	<6	-	<6	<6		-	<6	<6		<6
Chloride (CI)	mg/L	0.4	250	120	48.8		151	11.4	-	7.2	-	168	272		-	44	41.1		550
Conductivity (EC)	μS/cm	1	-	-	1310		1380	878	-	452	-	1410	1580		-	998	822		2540
Hardness (as CaCO <sub>3</sub> )	mg/L	1	-	-	690	627	623	321	-	239	548	702	809		428	521	476		1150
Hydroxide (OH)	mg/L	5	-	-	<5	<5	<5	<5	-	<5	-	<5	<5		-	<5	<5		<5
Nitrate and Nitrite (as N)	mg/L	0.010	-	-	10.8	9.7	4.01	3.73	-	0 27	-	3.79	3 89		-	1.21	0.28		7.02
Nitrate (as N)	mg/L	0 01	10	3	10.6	9.7	4	3.73	-	0 27	-	3.79	3.89		-	1.21	0.28	ļ	7.02
Nitrite (as N)	mg/L	0.005	1	0.6 <sup>2</sup>	0.183	<0.005	0.014	<0 005	-	<0.005	-	<0.005	<0.005		-	<0.005	<0.005		<0.02
pH	- "	0.1	6.5-8.5	6.5-9	7.59	7.78	7.81	7 68	-	7 91	-	7.85	7.9		-	7.94	7.98		7.74
TDS (Calculated)	mg/L	1	500	-	821	729	772	520	-	285	-	833	945		-	618	573		1400
Sulphate (SO <sub>4</sub> )	mg/L	0.9	500	429 <sup>3</sup>	161	113	104	57.5	-	61.9	-	127	132		-	100	76.4		132
Calcium (Ca)	mg/L	0.2	•	-		179	169		-	67.8	-	194	220		-	143	131		313
Magnesium (Mg)	mg/L	0.2	-	-		43 9	48.8		-	16.9	-	53.1	63 4.7		-	39.7	36.1		90.1
Potassium (K) Sodium (Na)	mg/L mg/L	0.4	200	-		3.8 39.1	4 5 47.5		-	2.3 13.7	-	4.3 44.1	4.7 54.6		-	3.8 32.8	3.5 28 9		6.2 78.2
Metals (Dissolved and Total as noted		0.4	200	_	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Total	Dissolved	Dissolved	Dissolved	Total	Dissolved
Aluminum (Al)	mg/L	0.0020		0 05 4	<0.002	<0.002	<0.002	<0.002	0 0096	0.004	<0.002	<0.002	0.008	4.96	<0.002	<0.002	0.002	7.83	0.238
Antimony (Sb)	mg/L	0.0020	0.006	-	<0.0002	<0.002	<0.0002	<0.0002	<0 0006	<0.0002	<0.002	<0.002	<0.000	0.0004	<0.002	<0.002	<0.002	0.0004	<0.0004
Arsenic (As)	mg/L	0.00020	0.01	0.005	<0.0002	<0 0002	<0.0002	<0.0002	0.00037	0.0003	0 0003	0.0002	<0.0002	0.0033	0.0002	0 0002	<0 0002	0.0057	0.0006
Barium (Ba)	mg/L	0.0010	1	-	0.067	0.077	0.158	0.113	0.11	0.124	0.103	0.104	0.117	0.278	0.103	0.104	0.101	0.58	0.322
Beryllium (Be)	mg/L	0.0001	-	-	<0.0001	<0 0001	<0.0001	<0.0001	<0 0010	-	-	<0.0001	<0.0001	0.0004	-	< 0.0001	<0 0001	0.0007	< 0.0002
Boron (B)	mg/L	0.002	5	1.5	0.791	0.983	0.556	0.637	0 044	0.028	0.44	0.457	0.572	0.598	0.411	0.306	0.361	0 371	0.653
Cadmium (Cd)	mg/L	0.00001	0.005	0.00037 5	0.00002	0.00003	0 00002	0 000027	< 0.025	0.00001	0.000022	0.00002	0.00002	0.0001	0 00003	0.00002	0.00004	0.00029	0.00006
Calcium (Ca)	mg/L	0 20	-	-	196		169	85.6	120	67.8	-		220	236	-		131	150	313
Chromium (Cr)	mg/L	0.0005	-	0.0089	<0.0005	<0 0005	<0.0005	<0.0005	0.0046	<0.0005	<0 0005	<0.0005	< 0.0005	0.007	< 0.0005	< 0.0005	<0 0005	0.0099	<0 001
Cobalt (Co)	mg/L	0.0005	-	-	<0.0001	<0 0001	<0.0001	0.0003	0.00057	-	-	<0.0001	0.0001	0.006	-	0 0002	0 0002	0.0071	0.001
Copper (Cu)	mg/L	0.0010	11	0.007	<0.001	<0.001	<0.001	<0.001	0.014	<0.001	<0.001	<0.001	0.002	0.012	<0.001	<0.001	0.002	0.019	0.002
Iron (Fe)	mg/L	0.010	03	0.3	<0.01	<0.01	<0.01	<0.01	<0.060	<0.01	<0.01	<0.01	<0.01	14.5	<0.01	<0.01	<0.01	26.6	0.41
Lead (Pb)	mg/L	0.00010	0.01	0.007 6	<0.0001	<0 0001	<0.0001	<0.0001	<0.00020	<0.0001	<0 0001	<0.0001	<0.0001	0.0077	<0.0001	<0.0001	<0 0001	0.0093	0.0003
Lithium (Li)	mg/L	NR 0.04	-	-	0.024	0.019	0.026	0.022	<0.020	-	-	0 027	0.031	0.035	-	0.024	0.022	0 027 41.6	0.036
Magnesium (Mg)	mg/L	0 01 0.0020	- 8	-	48.5 0.035	0.228	48.8 0.018	26 <b>0.488</b>	25 <b>0.25</b>	0.33	0.344	0 006	63 <b>0.017</b>	70.2 <b>0.911</b>	1.29	0.367	36.1 <b>0.774</b>	3.0	90.1 <b>3.08</b>
Manganese (Mn) Mercury (Hg)	mg/L mg/L	0.0020	0.05 <sup>8</sup> 0.001	0 000005	<0.00005	<0.00005	0.00007	<0.0001	0.25	-	- 0.344	<0.00005	<0.00005	0.911	1.29	<0.00005	<0.00005	3.0	<0.00005
Molybdenum	mg/L	0.005	-	-	<0.000003	<0.000	<0.001	<0.0001	0 007		-	<0.001	<0.000005	<0.001	-	<0.000	<0.00003	0 001	<0.000003
Nickel (Ni)	mg/L	0.005	-	0.17 7	0.0013	0 0028	0.0007	0.0016	0.0027	<0.0005	0 002	0.001	0.0065	0.0114	0.0015	0.001	0 0038	0.0187	0.0055
Potassium (K)	mg/L	0.0005		0.17	4.5	0 0020	4 5	4.7	3.4	-	-	0.002	4.7	6	0.0015	0 0017	3.5	4.9	6.2
Selenium (Se)	mg/L	0.00020	0.05	0.001	0.0016	0.0013	0.0004	0.0019	0.00049	0.0003	0.0006	0.0005	<0.0002	0.0003	<0.0002	<0.0002	<0 0002	0.0004	<0.0004
Silver (Aq)	mg/L	0.00020	-	0.0001	<0.0001	<0.0001	<0.0004	<0.0001	<0.00043	<0.0003	<0.0000	<0.00001	<0.0002	0.0008	<0.0002	<0.0002	<0.0002	0.00009	<0.0004
Sodium (Na)	mg/L	NR	-	-	43		47.5	78.8	11	-	-		54.6	57.5	-		28 9	30.2	78.2
Strontium	mg/L	NR	-	-	1.16	1.02	0.915	0 58	0.58	-	-	1.06	1 28	1 39	-	0.993	0 947	1.07	1.85
Thallium	mg/L	0.00005	-	-	<0.00005	< 0.00005	<0 00005	< 0.00005	<0.00020	-	-	<0.00005	<0.00005	0 00014	-	<0 00005	< 0.00005	0.00026	<0.00010
Tin (Sn)	mg/L	0.001	-	-	<0 001	<0.001	<0.001	<0 001	<0 0010	-	-	<0 001	<0 001	< 0.001	-	<0.001	<0.001	<0.001	<0 002
Titanium	mg/L	0.00050	-	-	<0.0005	<0 0005	<0.0005	<0.0005	<0 0010	-	-	<0.0005	<0.0005	0.101	-	<0.0005	<0 0005	0.187	0.0094
Uranium (U)	mg/L	0.00050	0.02	0.015	0.0062	0 004	0.0055	0.0039	0.0052	0.0012	0.0039	0.0055	0.0072	0.0086	0.0037	0 0053	0 0055	0.0069	0.0062
Vanadium	mg/L	0.00010	-	-	<0.0001	<0 0001	<0.0001	0.0001	<0 0010		-	<0.0001	<0.0001	0.0134	-	<0.0001	<0 0001	0.02	0.0009
Zinc (Zn)	mg/L	0.0030	5	0 03	<0 001	<0.001	<0.001	<0 001	<0 0030	0.004	0 001	<0.001	0.004	0.03	0.003	<0.001	0 004	0.043	0.004
Chromium VI	mg/L	0.0100	-	-		1	1		-	<0.01	<0.01				<0.01			<del> </del>	+
Chromium III	mg/L	0.0005	•	-		L	<u> </u>	1	-	<0.0005	<0 0005				<0.0005		ļ	Ļ	

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Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

Bold and underlined RPD percentages exceed appropriate values

Tables-Rossdale Plant - Gap Analysis 2016-05-25 Page 4 of 6

Sample ID	Units	Detection Limits	Guide	line <sup>1</sup>				LP Plant/ Area	6 - upstream						A	rea 6 - downstrea	m		
Parameter			Potable	Aquatic Life (Coarse)		BH16-02		BH16	-03		BH16	i-04		BH1	6-05			BH16-06	
Laboratory Sample ID					1151462-2	1211	801-1	1151462-3	1211	801-2	11509	79-9	11509	79-10	1211	801-3	1150979-11	1211	131-1
Sample Date					26-Jul-2016	30-Jui	1-2017	26-Jul-2016	30-Jui	n-2017	22-Jul-	2016	22-Jul	-2016	30-Jui	n-2017	22-Jul-2016	28-Jui	n-2017
Routine Water Chemistry																			
Alkalinity, Total (as CaCO <sub>3</sub> )	mg/L	5	-	-	396	408		384	352		399		424		422			525	
Bicarbonate (HCO <sub>3</sub> )	mg/L	5	-	-	483	497		469	430		486		517		515			639	
Carbonate (CO <sub>3</sub> )	mg/L	6	-	-	<6	<6		<6	<6		<6		<6		<6			<6	
Chloride (CI)	mg/L	0.4	250	120	392	422		31.4	41.8		44.6		34.5		30.8			41	
Conductivity (EC)	μS/cm	1	-	-	2180	2140		1110	959						830			1250	
Hardness (as CaCO <sub>3</sub> )	mg/L	1	-	-	915	1020		424	301		452		458		474		726	603	
Hydroxide (OH)	mg/L	5	-	-	<5	<5		<5	<5		<5		<5		<5			<5	
Nitrate and Nitrite (as N)	mg/L	0.010 0.01	-	3	4.29	3.89		2.02	0.51		1 83		2.54		1.85			2.47	
Nitrate (as N) Nitrite (as N)	mg/L	0.005	10 1		4.14	3.89			0.51		1 83		2.53		1.85			2.46 0.007	
pH	mg/L -	0.005	6.5-8.5	0.6 <sup>2</sup> 6.5-9	0.15 7.86	<0.02 7.89		0.113 8.02	<0.005 8.21		<0.005 7 91		0.011 7.84		<0.005 8.03		7 59	7.71	
TDS (Calculated)	mg/L	0.1	500	0.5-9	1240	1290		699	609		574		576		565		7 59	744	
Sulphate (SO <sub>4</sub> )	mg/L	0.9	500	429 <sup>3</sup>	164	176		193	126		97		76.2		78.7			122	
Calcium (Ca)	mg/L	0.2	-	423	254	274		125	88.4		123		132		138			166	
Magnesium (Mg)	mg/L	0.2	-	-	68.3	81		27 3	19.5		35		31.4		31.3			46	
Potassium (K)	mg/L	0.4	-	-	69	6.4		5.9	5.3		4.5		5.2		4.5			9.1	
Sodium (Na)	mg/L	0.4	200	-	115	81.1		85 6	116		31.1		42		28.2			45	
Metals (Dissolved and Total as noted	)				Dissolved	Dissolved	Total	Dissolved	Dissolved	Total	Diss	Total	Diss	Total	Dissolved	Total	Dissolved	Dissolved	Total
Aluminum (AI)	mg/L	0.0020	-	0 05 4	<0.004	0.046	0.98	<0.002	0 005	0.11	0.141	1.68	0.056	1.42	0 006	1.15	0.21	0.026	0.72
Antimony (Sb)	mg/L	0.00020	0.006	-	<0.0004	<0.0002	<0.0004	<0 0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0002	0 0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Arsenic (As)	mg/L	0.00020	0.01	0.005	0.0004	0.0003	0.001	0.0003	<0.0002	<0.0002	0.0003	0.0016	0.0009	0.003	0.0003	0.0015	0.0004	0.0002	0.0006
Barium (Ba) Bervllium (Be)	mg/L	0.0010 0.0001	<u>1</u>	-	0.277 <0.0002	0.279 <0.0001	0.352 <0.0002	0.121 <0.0001	0.116 <0.0001	0.125 <0.0001	0.089	0.141 0.0002	0.103	0.168 0.0001	0.13 <0.0001	0.163 <0.0001	0.081	0.088 <0.0001	0.114 <0.0001
Boron (B)	mg/L mg/L	0.0001	5	1.5	0.667	0.711	0.84	0 319	0.0001	0.305	0.466	0.0002	0.372	0.364	0.0001	0.348	4.41	1.79	1.86
Cadmium (Cd)	mg/L	0.0002	0.005	0.00037 5	0.007	0.00013	0.00023	0.00001	0.00002	0.00002	0.400	0.0001	0.00006	0.00013	0.00008	0.00026	0.00006	0 00022	0.00048
Calcium (Ca)	mg/L	0.00001	-	0.00037	254	274	321	125	88.4	88.7	123	138	132	141	138	142	0.00006	166	175
Chromium (Cr)	mg/L	0.0005	-	0.0089	<0.001	<0.0005	0 0019	<0.0005	<0.0005	<0.0005	<0.0005	0.0031	< 0.0005	0 0023	<0.0005	0.0022	<0.0005	<0.0005	0.0011
Cobalt (Co)	mg/L	0.0005	-	-	0.001	0.0014	0 0027	0.0007	0.0002	0.0003		0.0017		0 0024	0.0001	0.0022	1010000	0.0002	0 0008
Copper (Cu)	mg/L	0.0010	1	0.007	0.003	0.004	0.016	0 002	0 002	0.002	0.002	0.005	0.004	0.008	0 002	0.004	0.005	0.003	0.004
Iron (Fe)	mg/L	0.010	03	0.3	<0.02	0.08	2.42	<0.01	0.01	0.34	0.6	8.1	0.08	3.21	0.01	2.16	0 24	0.04	1.01
Lead (Pb)	mg/L	0.00010	0.01	0.007 <sup>6</sup>	< 0.0002	0.0001	0.002	<0 0001	< 0.0001	0.0001	0.0002	0.0016	0 0002	0 0026	< 0.0001	0.0022	0.0005	<0.0001	0 0018
Lithium (Li)	mg/L	NR	-	-	0.03	0.033	0.039	0.03	0 028	0 03		0.022		0 027	0 019	0.021		0.023	0.024
Magnesium (Mg)	mg/L	0 01	-	-	68.3	81	90 9	27 3	19.5	20.4	35	39.2	31.4	33	31.3	33.8		46	47
Manganese (Mn)	mg/L	0.0020	0.05 8		2.86	1.59	2.12	1.54	0.72	0.829	0.398	0.659	0.058	0.142	<0 005	0.113	0.264	0.354	0.498
Mercury (Hg)	mg/L	0 000005	0.001	0 000005	<0.00005	<0.00005	-0.000	<0.000005	<0.000005	0.007	<0 000005	0.000017	<0.00005	0.000062	<0.000005	0.002	<0 000005	<0.000005	0.001
Molybdenum Nickel (Ni)	mg/L	0.005 0.0005	<u>-</u>	- 0.47 7	<0.002	0.001	<0.002	0 013	0 007	0.007	0.0004	<0.001	0.0000	0 005	0 001	0.002	0.0000	0.001	0.001
Nickei (Ni) Potassium (K)	mg/L mg/L	0.0005		0.17 7	0.0045 6 9	0 0137 6.4	0.013 7.3	0.0059 5.9	0.0034 5.3	0.0009 5.5	0.0084 4 5	0.0062 5.1	0 0092 5.2	0 0078 5.7	0.0072 4.5	0.0057 4.9	0.0093	0.0081 9.1	0 0049 9.7
Selenium (Se)	mg/L	0.00020	0.05	0.001	<0.0004	<0.0002	<0 0004	0.0005	<0.0002	<0.0002	0.0004	0.0004	0.0011	0.0011	0.0009	0.0009	0.0011	0.0004	0 0003
Silver (Ag)	mg/L	0.00020	-	0.001	<0.0004	<0.0002	<0 00002	<0.0003	<0.0002	<0.0002	<0.0004	0.0004	<0.0011	0.00004	<0.0009	0.00002	<0.00011	<0.0004	<0 00001
Sodium (Na)	mg/L	NR	-		115	81.1	89.7	85 6	116	118	31.1	31.6	42	42.4	28.2	30.5		45	47 6
Strontium	mg/L	NR	-	-	1.85	1.68	1.88	1.2	0 854	0.851		0.873		0.798	0.729	0.733		1.1	1.05
Thallium	mg/L	0.00005	-	-	<0.00010	<0 00005	<0 0001	<0.00005	<0.00005	<0.00005		0 00008		0.00008	<0.00005	0.00006		0 00006	0.00009
Tin (Sn)	mg/L	0.001	-	-	<0.002	<0.001	<0.002	0 001	<0 001	<0 001		<0.001		0 003	<0 001	<0 001		<0.001	<0.001
Titanium	mg/L	0.00050			<0.001	0 0017	0 0283	<0 0005	<0.0005	0.0036		0.0574		0 0424	<0.0005	0.0365		0.0009	0 0199
Uranium (U)	mg/L	0.00050	0.02	0.015	0.0078	0 0088	0.01	0 004	0.0028	0.0029	0.0044	0.0044	0 0064	0 0065	0.0038	0.0044	0.0102	0.0061	0 0072
Vanadium	mg/L	0.00010	-	- 0.00	0.0003	0 0004	0 0032	0.0001	<0.0001	0.0004	0.007	0 0067	0.000	0 0044	0.0002	0.003	0.007	0.0002	0 0018
Zinc (Zn) Chromium VI	mg/L mg/L	0.0030 0.0100	<u>5</u>	0 03	0.011	800.0	0 017	0 004	0 003	0.002	0.007	0.012	0.006	0 017	0 006	0.012	0.007	0.008	0.011
Chromium VI Chromium III	mg/L mg/L	0.0100	-					1			+								
CHIOHIUH III	IIIg/∟	0.0003	-	-	ļL			1									l l		

- 1 Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table B-3. Groundwater Rem
- 2 Nitrite (as N) Guideline based on chloride concentration (Environmental Quality Guidelines for Alberta Surface
- $3 \underline{\text{Sulphate}} \text{Guideline based on water hardness (Environmental Quality Guidelines for Alberta Surface Waters, July 2007)} \\$
- 4 <u>Aluminum</u> Guideline based on water pH (Environmental Quality Guidelines for Alberta Surface Waters, July 20
- 5 <u>Cadmium</u> Guideline based on water hardness (Environmental Quality Guidelines for Alberta Surface Waters, .
- 6 <u>Lead</u> Guideline based on water hardness (Environmental Quality Guidelines for Alberta Surface Waters, July 2 7 <u>Nickel</u> Guideline based on water hardness (Environmental Quality Guidelines for Alberta Surface Waters, July
- 8 <u>Manganese</u> Aesthetic Objective. t is noted that the World Health Organization has established a human healt

# NR = Not Reported

Bold and shaded values exceed appropriate guideline

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Bold and underlined RPD percentages exceed appropriate values

Tables-Rossdale Plant - Gap Analysis 2016-05-25 Page 5 of 6

Sample ID	Units	Detection Limits	Guide	line <sup>1</sup>				Are	ea 4			
Parameter			Potable	Aquatic Life (Coarse)		BH1	16-07			ВН	16-08	
Laboratory Sample ID					11509	979-12	1211:	131-2	11509	79-13	1211	131-3
Sample Date					22-Ju	I-2016	28-Jur	n-2017	22-Ju	I-2016	28-Jui	n-2017
Routine Water Chemistry		<u> </u>										
Alkalinity, Total (as CaCO <sub>3</sub> )	mg/L	5	-	-	503		480		449		477	
Bicarbonate (HCO <sub>3</sub> )	mg/L	5	-	-	613		585		547		582	
Carbonate (CO <sub>3</sub> )	mg/L	6	-	-	<6		<6		<6		<6	
Chloride (CI)	mg/L	0.4	250	120	70.1		37.1		39.5		60.8	
Conductivity (EC)	µS/cm	1	•	-			1260				1200	
Hardness (as CaCO <sub>3</sub> )	mg/L	1	-	-	622		638		453		610	
Hydroxide (OH)	mg/L	5	-	-	<5		<5		<5		<5	
Nitrate and Nitrite (as N)	mg/L	0.010	-	-	6.42		10.4		0.22		2 95	
Nitrate (as N)	mg/L	0 01	10	3	5.43		10.4		0.22		2 92	
Nitrite (as N)	mg/L	0.005	1	0.6 <sup>2</sup>	0.985		0.01		< 0.005		0.028	
рН	-	0.1	6.5-8.5	6.5-9	7.77		7.56		7.79		7 57	
TDS (Calculated)	mg/L	1	500	-	790		736		573		713	
Sulphate (SO <sub>4</sub> )	mg/L	0.9	500	429 <sup>3</sup>	146		143		66.6		112	
Calcium (Ca)	mg/L	0.2	-	-	173		177		130		174	
Magnesium (Mg)	mg/L	0.2	-	-	46		47 5		31.5		42.7	
Potassium (K)	mg/L	0.4	-	-	5 2		4.4		2.9		3	
Sodium (Na)	mg/L	0.4	200	-	48.2		39 3		33.5		34.3	
Metals (Dissolved and Total as noted					Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
Aluminum (AI)	mg/L	0.0020	-	0 05 4	0.023	1.92	<0.002	1.05	<0.002	4.05	0.007	0.5
Antimony (Sb)	mg/L	0.00020	0.006	-	<0.0002	<0.0002	<0.0002	<0 0002	<0.0002	<0.0002	<0.0002	<0.0002
Arsenic (As)	mg/L	0.00020	0.01	0.005	<0.0002	0.0019	<0.0002	0 0009	<0.0002	0.0034	<0.0002	0.0003
Barium (Ba)	mg/L	0.0010	1	-	0.065	0.148	0.078	0.117	0.174	0.287	0.248	0.265
Beryllium (Be)	mg/L	0.0001 0.002	<u>-</u> 5	1.5	1.1	0.0002 1.05	<0.0001	<0 0001 1.36	0 222	0.0004 0.209	<0.0001 0.289	<0.0001 0.309
Boron (B)	mg/L			_								
Cadmium (Cd)	mg/L	0.00001 0.20	0.005	0.00037 5	0 00006	0.0001	0.00018 177	0.00022	0.0001	0.00024 149	0.00014 174	0 00023
Calcium (Ca) Chromium (Cr)	mg/L mg/L	0.0005	-	0.0089	173 <0.0005	193 0.0036	<0.0005	189 0 0025	130 <0.0005	0.0064	<0.0005	183 0.0008
Cobalt (Co)	mg/L	0.0005	-	0.0069	<0.0005	0.0036	0 0004	0.0016	<0.0005	0.0064	0.0008	0.0008
Copper (Cu)	mg/L	0.0003	1	0.007	0.002	0.0024	0.002	0.0010	<0.001	0.009	0.000	0.0012
Iron (Fe)	mg/L	0.010	03	0.3	0.03	5.34	0.02	2.59	<0.01	13.2	0.002	1.02
Lead (Pb)	mg/L	0.00010	0.01	0.007 <sup>6</sup>	<0.0001	0.0025	<0.0001	0.0012	<0.0001	0.0047	<0.0001	0.0006
Lithium (Li)	mg/L	NR	-	-	<b>30.0001</b>	0.0023	0.025	0.0012	VO.0001	0.019	0.017	0.019
Magnesium (Mg)	mg/L	0.01	-	-	46	51	47 5	49 6	31.5	36.5	42.7	43.7
Manganese (Mn)	mg/L	0.0020	0.05 8	-	1.1	1.42	1.05	1.26	1.39	1.92	2.09	2,26
Mercury (Hg)	mg/L	0 000005	0.001	0 000005	<0 000005	0.000063	<0.000005	0	<0.000005	0.000044	<0 000005	
Molybdenum	mg/L	0.005	-	-		<0.001	<0.001	<0.001		<0 001	<0.001	<0.001
Nickel (Ni)	mg/L	0.0005	-	0.17 7	0.0091	0.0083	0 0084	0 0067	0.0021	0.012	0.007	0.004
Potassium (K)	mg/L	0.10	-	-	5 2	5 9	4.4	4.7	2.9	3.9	3	33
Selenium (Se)	mg/L	0.00020	0.05	0.001	0.0003	0.0004	0 0004	0 0004	<0.0002	0.0003	<0.0002	<0.0002
Silver (Ag)	mg/L	0.00001	-	0.0001	<0.00001	0.00003	<0 00001	0.00001	<0.00001	0.00007	<0.00001	0 00001
Sodium (Na)	mg/L	NR	-	-	48.2	49.9	39 3	41 2	33.5	33.9	34.3	36.4
Strontium	mg/L	NR	-	-		1.24	1.22	1.17		0.949	1.16	1.12
Thallium	mg/L	0.00005	-	-		0.00011	<0 00005	0.00007		0.00016	<0.00005	0 00005
Tin (Sn)	mg/L	0.001	-	-		0.002	<0.001	<0.001		0.001	<0.001	<0.001
Titanium	mg/L	0.00050		-		0.0584	< 0.0005	0 037		0.0763	<0.0005	0.0094
Uranium (U)	mg/L	0.00050	0.02	0.015	0.0075	0.0076	0 0065	0.0077	0.0031	0.0036	0.0035	0.0041
Vanadium	mg/L	0.00010		-	2.227	0.0065	<0.0001	0.0036	0.007	0.0131	<0.0001	0.0014
Zinc (Zn)	mg/L	0.0030	5	0 03	0.007	0.015	0.006	0.01	0 007	0.033	0.005	0.007
Chromium VI	mg/L	0.0100	-	-								
Chromium III Notes	mg/L	0.0005	-	-		l					l	

- 1 Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table B-3. Groundwater Rem
- 2 Nitrite (as N) Guideline based on chloride concentration (Environmental Quality Guidelines for Alberta Surface
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Bold and underlined RPD percentages exceed appropriate values

Tables-Rossdale Plant - Gap Analysis 2016-05-25 Page 6 of 6

Sample ID	Units	Detection Limits	Guide	eline <sup>1</sup>	Are	a 2 Former Reactiv	vator					Area 3 Forme	er Fire Training Bur	rn Pit(s)				
Parameter			Potable	Aquatic Life (Coarse)	C1	C6	<b>C</b> 7		MW1		MW104	MW108	MW	V109			MW201	
Laboratory Sample ID					4940171	4940172	4940173											
Sample Date					21-Nov-2014	21-Nov-2014	21-Nov-2014	27-Jul-2001	14-Apr-2003	21-Jun-2005	21-Jun-2005	21-Jun-2005	14-Apr-2003	21-Jun-2005	14-Dec-2001	2002	14-Apr-2003	21-Jun-2005
Dissolved Petroleum Hydrocarbons																		
Benzene	mg/L	0 0010	0.005	0.074	-	-	-	<0.0005	<0.0005	<0 0005	<0.0005	<0.0005	<0.0005	<0.0005	<0 0005	<0.0005	<0 0005	<0.0005
Toluene	mg/L	0.000	0.024	0 021	-	-	-	< 0.0005	< 0.0005	<0 0005	<0.0005	< 0.0005	< 0.0005	<0.0005	<0 0005	<0.0005	<0 0005	0.003
EthylBenzene	mg/L	0.001	0.0016	41	-	-	-	<0.0005	<0.0005	<0.005	<0.005	< 0.005	<0.0005	<0.005	<0 0005	<0.0005	<0 0005	<0.005
Xylenes	mg/L	0.001	0.02	2.9	-	-	-	0.001	<0.0005	<0 0005	<0.0005	< 0.0005	<0.0005	<0 0005	0.002	<0.0005	<0 0005	<0.0005
MTBE	ug/L	NR	0.015	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F1(C6-C10)	mg/L	0.100	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
F1-BTEX	mg/L	0.100	2.2	9.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F2 (C10-C16)	mg/L	0.100	1.1	1.3	-	-	-	-	<0.05	< 0.05	<0.05	<0.05	<0.05	< 0.05	000	< 0.05	<0.05	< 0.05
F3 (C16-C34)	mg/L	0.100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F3+ C34+	mg/L	0.100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polycyclic Aromatic Hydrocarbons																		
Acenaphthene	ug/L	0.100	1.4	5.8	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	ug/L	0.100	-	-	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-
Acridine	ug/L	0.100			<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-
Anthracene	ug/L	0.005	-	0 012	<0 005	< 0.005	<0 005	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	ug/L	0.010	-	0.018	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	ug/L	0.008	-	0.015	<0 008	<0.008	<0 008	-	-	-	-	-	-	-	-	-	-	-
Benzo(b&j)fluoranthene	ug/L	0.100	-	-	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	ug/L	0.050	-	-	<0.05	< 0.05	<0.05	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	ug/L	0.100	-	-	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-
Chrysene	ug/L	0.100	-	-	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-
Dibenzo(a,h)anthracene	ug/L	0.050	-	-	<0.05	<0.05	<0.05	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	ug/L	0.010	-	0.04	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-	-
Fluorene	ug/L	0.100	0.94	3	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	ug/L	0.050	-	-	<0.05	<0.05	<0.05	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	ug/L	0.100	0.47	1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	ug/L	0.100	-	0.4	<0.1	<0.1	<0.1	-	-	-	-	-	-	-	-	-	-	-
Pyrene	ug/L	0.010	0.71	0 025	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-	-
Quinoline	ug/L	0.300			<0.3	<03	<0.3	-	-	-	-	-	-	-	-	-	-	-
B(A)P Total Potency Equivalent	ug/L	0.010	0.01	-	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-	-

### Notes

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Bold and underlined RPD percentages exceed appropriate values

Tables-Rossdale Plant - Gap Analysis 2016-05-25 Page 1 of 7

<sup>1 -</sup> Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table B-3. Groundwater Remediation Guideline Values for Residential/Parkland - All Water Uses

Sample ID	Units	Detection Limits	Guid	eline <sup>1</sup>						A	Area 3 Former Fire	Training Burn Pit(	(s)						
Parameter			Potable	Aquatic Life (Coarse)	MW201		MW	/202					MW203				MW3	<b>301</b>	MW302
Laboratory Sample ID															4940175	4965591			
Sample Date					29-Oct-2013	14-Dec-2001	14-Apr-2003	21-Jun-2005	24-Jun-2014	14-Dec-2001	14-Apr-2003	21-Jun-2005	29-Oct-2013	24-Jun-2014	21-Nov-2014	18-Dec-2014	18-Mar-02	2002	18-Mar-02
Dissolved Petroleum Hydrocarbons																			
Benzene	mg/L	0 0010	0 005	0.074	<0.001	<0.0005	<0 0005	<0.0005	<0.001	<0.0005	<0.0005	<0.0005	<0.001	<0.001	-	<0.001	<0.0005	<0.0005	<0 0005
Toluene	mg/L	0.000	0 024	0.021	<0.001	<0.0005	<0 0005	0.001	<0.001	< 0.0005	<0.0005	<0.0005	<0.001	<0.001	-	<0 0005	<0.0005	<0.0005	<0 0005
EthylBenzene	mg/L	0.001	0.0016	41	<0.001	<0.0005	<0 0005	<0.005	<0.001	<0.0005	<0.0005	< 0.005	<0.001	<0.001	-	<0.001	<0.0005	<0.0005	<0 0005
Xylenes	mg/L	0.001	0.02	2.9	<0.001	<0.0005	<0 0005	<0.0005	<0.001	< 0.0005	<0.0005	< 0.0005	<0.001	<0.001	-	< 0.002	<0.0005	<0.0005	<0 0005
MTBE	ug/L	NR	0 015	10	ī	-	ı	i	-	-	-	-	-	-	-	ı			
F1(C6-C10)	mg/L	0.100	-	-	<0.2	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.2	<0.2	-	<0.1	<0.1	<0.1	<0.1
F1-BTEX	mg/L	0.100	2.2	9.8	-	-	-	-	-	-	-	-	-	-	-	<0.1			
F2 (C10-C16)	mg/L	0.100	1.1	1.3	<0.2	<0.05	< 0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.2	<02	-	<0.1	<0.05	<0.05	<0.05
F3 (C16-C34)	mg/L	0.100	-	-	0.3	-	-	-	-	-	-	-	0.4		-	0.3			
F3+ C34+	mg/L	0.100	-	-	-	-	-	-	-	-	-	-	-	-	-	0.7			
Polycyclic Aromatic Hydrocarbons																			
Acenaphthene	ug/L	0.100	1.4	5.8	ı	-	1	1	<0.1	-	-	-	-	<0.1	<0.1	ı	-	-	-
Acenaphthylene	ug/L	0.100	-	-	-	-	-	-	<0.1	-	-	-	-	<0.1	<0.1	-	-	-	-
Acridine	ug/L	0.100			-	-	-	-	<0.1	-	-	-	-	<0.1	<0.1	-	-	-	-
Anthracene	ug/L	0.005	-	0.012	-	-	-	-	<0.005	-	-	-	-	< 0.005	<0.005	-	-	-	-
Benzo(a)anthracene	ug/L	0.010	-	0.018	-	-	-	-	<0 01	-	-	-	-	<0.01	<0.01		-	-	-
Benzo(a)pyrene	ug/L	0.008	-	0.015	-	-	-	-	<0.008	-	-	-	-	<0.008	<0.008	-	-	-	-
Benzo(b&j)fluoranthene	ug/L	0.100	-	-	-	-	-	-	<0.1	-	-	-	-	<0.1	<0.1		-	-	-
Benzo(g,h,i)perylene	ug/L	0.050	-	-	-	-	ı	1	<0.05	-	-	-	-	<0.05	<0.05	ı	-	-	-
Benzo(k)fluoranthene	ug/L	0.100	-	-	-	-	1	1	<0.1	-	-	-	-	<0.1	<0.1	•	-	-	-
Chrysene	ug/L	0.100	-	-	-	-	ı	1	<0.1	-	-	-	-	<0.1	<0.1	ı	-	-	-
Dibenzo(a,h)anthracene	ug/L	0.050	-	-	-	-	ı	1	<0.05	-	-	-	-	<0.05	<0.05	ı	-	-	-
Fluoranthene	ug/L	0.010	-	0.04	-	-	1	1	<0 01	-	-	-	-	<0.01	0 02	•	-	-	-
Fluorene	ug/L	0.100	0.94	3	-	-	-	-	<0.1	-	-	-	-	<0.1	<0.1	-	-	-	-
Indeno(1,2,3-cd)pyrene	ug/L	0.050	-	-	-	-	=	=	<0.05	=	-	-	-	<0.05	<0.05	-	-	-	-
Naphthalene	ug/L	0.100	0.47	1	-	-	=	=	<0.1	=	-	-	-	<0.1	<0.1	-	-	-	-
Phenanthrene	ug/L	0.100	-	0.4	-	-	-	-	<0.1	-	-	-	-	<0.1	<0.1	•	-	-	-
Pyrene	ug/L	0.010	0.71	0.025	-	-	-	-	<0 01	-	-	-	-	0.01	0 01	-	-	-	-
Quinoline	ug/L	0.300			-	-	=	=	<0.3	=	-	-	-	<03	<0.3	-	-	-	-
B(A)P Total Potency Equivalent	ug/L	0.010	0.01	-	-	-	-	-	<0 01	-	-	-	-	<0.01	<0.01	-	-		

Notes

Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

Bold and underlined RPD percentages exceed appropriate values

Benzo(b)fluoranthene <0

<sup>1 -</sup> Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table B-3. Groundwater Rem

Sample ID	Units	Detection Limits	Guid	eline <sup>1</sup>		Area 3	Former Fire Train	ning Burn Pit(s)						Area 4 & 5 Ti	hurber Reports				
Parameter			Potable	Aquatic Life (Coarse)	MW302	A3 ·	14-09	MW	14-01		MW	/99-2		MW99-3	TH15-3 (re	eplace 99-3)	TH10-15		TH <sub>1</sub>
Laboratory Sample ID						4940174	4965590		1139764-1										
Sample Date					2002	21-Nov-2014	18-Dec-2014	19-Nov-2014	26-May-2016	4-Feb-2010	Aug 12 2013	28-Apr-2014	Dec 22 2015	4-Feb-2010	9-Aug-2013	22-Dec-2015	4-Feb-2010	4-Feb-2010	18-Dec-2013
Dissolved Petroleum Hydrocarbons																			
Benzene	mg/L	0 0010	0 005	0.074	<0.0005	-	<0 001	<0.0001	<0 001	<0 001	<0.001	<0.001	<0 001	<0.001	<0.001	<0 001	<0.001	<0.001	<0 001
Toluene	mg/L	0.000	0 024	0.021	<0 0005	-	<0 0005	<0.0001	<0.0004	<0 001	<0.001	<0.001	<0.0004	<0.001	<0.001	<0.0004	<0.001	<0.001	<0 001
EthylBenzene	mg/L	0.001	0.0016	41	<0 0005	-	<0 001	<0.0001	<0.0010	<0 001	<0.001	<0.001	<0 001	<0.001	<0.001	<0 001	<0.001	<0.001	<0 001
Xylenes	mg/L	0.001	0.02	2.9	<0 0005	-	<0 002	<0.0001	<0 001	<0 004	<0.001	<0.001	<0 001	<0.004	<0.001	<0 001	0 004	0.003	0.004
MTBE	ug/L	NR	0 015	10		-	-	-		-	-			-	-		-	-	-
F1(C6-C10)	mg/L	0.100	-	-	<0.1	-	<0.1	<0.2		<0.2	<0.2	<0.2		<0.2	<0.2		<0.2	<0.2	<0.2
F1-BTEX	mg/L	0.100	2.2	9.8		-	<0.1	-	<0.1	<0.2	<0.2	<0.2	< 01	<0.2	<0.2	< 01	<0.2	<0.2	<0.2
F2 (C10-C16)	mg/L	0.100	1.1	1.3	<0.05	-	<0.1	<02	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<02	<0.1	<0.1	-	<0.1
F3 (C16-C34)	mg/L	0.100	-	-		-	<0.1	-		<0.1	<0.1	<0.1		<0.1	<0.1		<0.1	-	<0.1
F3+ C34+	mg/L	0.100	-	-		-	0.3	-		<0.1	<0.1	<0.1		<0.1	<0.1		0.1	-	0.1
Polycyclic Aromatic Hydrocarbons																			
Acenaphthene	ug/L	0.100	1.4	5.8	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1
Acenaphthylene	ug/L	0.100	-	-	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1
Acridine	ug/L	0.100			-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	<0.1
Anthracene	ug/L	0.005	-	0.012	-	< 0.005	-	<0.005	<0 005	0.012	<0.005	<0.005	<0 005	0.007	<0.005	<0.005	0.007	-	0.026
Benzo(a)anthracene	ug/L	0.010	-	0.018	-	<0 01	-	<0.01	<0.01	0 01	0 010	0.010	<0.01	<0.01	<0.01	<0 01	<0.01	-	0.050
Benzo(a)pyrene	ug/L	0.008	-	0.015	-	<0.008	-	<0.008	<0 008	0.014	<0.008	0.013	<0 008	<0.008	<0.008	<0.008	<0.008	-	0.075
Benzo(b&j)fluoranthene	ug/L	0.100	-	-	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1
Benzo(g,h,i)perylene	ug/L	0.050	-	-	-	<0 05	-	<0.05	<0.05	<0.05	<0.05	< 0.05	<0 05	<0.05	<0.05	<0 05	<0.05	-	0.070
Benzo(k)fluoranthene	ug/L	0.100	-	-	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1
Chrysene	ug/L	0.100	-	-	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1
Dibenzo(a,h)anthracene	ug/L	0.050	-	-	-	<0.05	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	-	<0.05
Fluoranthene	ug/L	0.010	-	0.04	-	<0 01	-	<0.01	<0.01	0 04	0 020	0.020	<0 01	0.03	<0.01	<0 01	0.01	-	0.100
Fluorene	ug/L	0.100	0.94	3	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1
Indeno(1,2,3-cd)pyrene	ug/L	0.050	-	-	-	<0 05	-	<0.05	<0.05	<0.05	<0.05	< 0.05	<0 05	<0.05	<0.05	<0 05	<0.05	-	0.070
Naphthalene	ug/L	0.100	0.47	1	-	<0.1	-	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	-	<0.1
Phenanthrene	ug/L	0.100	-	0.4	-	<0.1	-	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	-	<0.1
Pyrene	ug/L	0.010	0.71	0.025	-	<0 01	-	<0.01	<0.01	0 05	0 050	0.030	<0 01	0.04	0.01	<0 01	0.01	-	0.110
Quinoline	ug/L	0.300			-	<0.3	-	<03	<0.3	<0.3	<0.3	<03	<0.3	<0.3	<03	<0.3	<0.3	-	<0.3
B(A)P Total Potency Equivalent	ug/L	0.010	0.01	-	-	<0.01	-	<0.01	<0.01	0.02	<0.01	0.010	<0 01		<0.01	<0 01	<0.01	-	0.090

Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

Bold and underlined RPD percentages exceed appropriate values

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<sup>1 -</sup> Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table B-3. Groundwater Rem

Sample ID	Units	Detection Limits	Guide	eline <sup>1</sup>							Area	a 4 & 5 Thurber Re	ports						
Parameter			Potable	Aquatic Life (Coarse)	0-1		TH10-4	TH10-7	Dup TH10-7	TH	10-7	TH12-1 (TH15	5-1 replaces)	TH12-2		TH12-3		TH12-4 (TH1	15-4 replaces)
Laboratory Sample ID																			
Sample Date					28-Apr-2014	22-Dec-2015	4-Feb-2010	4-Feb-2010	4-Feb-2010	9-Aug-2013	28-Apr-2014	12-Aug-2013	22-Dec-2015	28-Apr-2014	9-Aug-2013	28-Apr-2014	22-Dec-2015	9-Aug-2013	28-Apr-2014
Dissolved Petroleum Hydrocarbons																			
Benzene	mg/L	0 0010	0 005	0.074	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0 001	<0.001	<0.001	<0.001
Toluene	mg/L	0.000	0 024	0.021	<0.001	<0.0004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0004	<0.001	<0.001	<0 001	<0.0004	<0.001	<0.001
EthylBenzene	mg/L	0.001	0.0016	41	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0 001	<0.001	<0.001	<0.001
Xylenes	mg/L	0.001	0.02	2.9	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0 001	<0.001	<0.001	<0.001
MTBE	ug/L	NR	0 015	10			-	-	-	-		-			-			-	
F1(C6-C10)	mg/L	0.100	-	-	<0.2		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.2	<0.2	<0.2		<0.2	<0.2
F1-BTEX	mg/L	0.100	2.2	9.8	<0.2	< 01	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	< 01	<0.2	<0.2	<0.2	<.01	<0.2	<0.2
F2 (C10-C16)	mg/L	0.100	1.1	1.3	<0.2	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.2	<0.2	<0.2	<0.1	<0.2	<0.2
F3 (C16-C34)	mg/L	0.100	-	-	<0.1		<0.1	<0.1	<0.1	<0.1	0.2	<0.1		<0.1	<0.1	<0.1		<0.1	<0.1
F3+ C34+	mg/L	0.100	-	-	<0.1		<0.1	<0.1	<0.1	<0.1	0.9	<0.1		<0.1	<0.1	<0.1		<0.1	<0.1
Polycyclic Aromatic Hydrocarbons																			
Acenaphthene	ug/L	0.100	1.4	5.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	ug/L	0.100	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acridine	ug/L	0.100			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	ug/L	0.005	-	0.012	<0.005	<0.005	0.006	<0.005	0.006	<0 005	<0.005	<0.005	<0 005	<0.005	0.014	0.005	<0.005	0.009	<0.005
Benzo(a)anthracene	ug/L	0.010	-	0.018	0.020	<0 01	<0.01	<0.01	<0 01	<0.01	<0.01	<0 01	<0.01	0.020	0.090	0.060	<0 01	0.04	<0.01
Benzo(a)pyrene	ug/L	0.008	-	0.015	0.023	<0.008	<0 008	0.016	<0.008	<0 008	<0.008	<0.008	<0 008	0.029	0.130	0.065	<0.008	0.053	0.008
Benzo(b&j)fluoranthene	ug/L	0.100	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.10	0.10	<0.1	0.10	<0.1
Benzo(g,h,i)perylene	ug/L	0.050	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.060	<0.05	<0.05	<0.05	<0.05
Benzo(k)fluoranthene	ug/L	0.100	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.10	<0.1	<0.1	<0.1	<0.1
Chrysene	ug/L	0.100	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.10	0.10	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	ug/L	0.050	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluoranthene	ug/L	0.010	-	0.04	0.050	<0 01	0 01	0.01	0 01	<0.01	<0.01	<0 01	<0 01	0.05	0.13	0.12	<0 01	0.07	0.01
Fluorene	ug/L	0.100	0.94	3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	ug/L	0.050	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.08	<0.05	<0 05	0.05	<0.05
Naphthalene	ug/L	0.100	0.47	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	ug/L	0.100	-	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.10	0.10	<0.1	<0.1	<0.1
Pyrene	ug/L	0.010	0.71	0.025	0.050	0.010	0 02	0.02	0 01	<0 01	0.01	0.01	<0 01	0.09	0.17	0.18	<0 01	0.10	0.01
Quinoline	ug/L	0.300			<03	<03	<0.3	<03	<03	<0.3	<03	<03	<0.3	<03	<03	<0.3	<0.3	<03	<03
B(A)P Total Potency Equivalent	ug/L	0.010	0.01	-	0.030	<0 01	<0 01	0.02	<0 01	<0 01	<0.01	<0 01	<0 01	0.03	0.17	0.08	<0 01	0.07	<0 01

Bold and shaded values exceed appropriate guideline

Cells with "-" indicate that the associated parameter was not analyzed.

Bold and underlined RPD percentages exceed appropriate values

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<sup>1 -</sup> Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table B-3. Groundwater Rem

Sample ID	Units	Detection Limits	Guid	eline <sup>1</sup>		Area	4 & 5 Thurber Rep	ports						Area 6				
Parameter			Potable	Aquatic Life (Coarse)	TH12-4 (TH1	5-4 replaces)	TH12-6	TH12-7	BH1 (Stantec)	A5 14-01		14	l-15			14	-17	
Laboratory Sample ID						1145461-3				4940167	4940176	1145461-1	1151462-9	1211801-4	4940177	1145461-2	1151462-10	1211801-5
Sample Date					22-Dec-2015	6-Jun-16	17-Oct-2014	9-Aug-2013	11-Dec-2011	21-Nov-2014	20-Nov-2014	6-Jun-16	20-Sep-16	30-Jun-2017	20-Nov-2014	6-Jun-16	20-Sep-16	30-Jun-2017
Dissolved Petroleum Hydrocarbons																		
Benzene	mg/L	0 0010	0 005	0.074	<0.001		<0.001	<0 001	<0 0004	-	-				-			
Toluene	mg/L	0.000	0 024	0.021	<0.0004		<0.001	<0 001	<0 0004	-	-				-			
EthylBenzene	mg/L	0.001	0.0016	41	<0.001		<0.001	<0 001	<0 0004	-	-				-			
Xylenes	mg/L	0.001	0.02	2.9	<0.001		<0.001	<0 001	<0 0008	-	-				-			
MTBE	ug/L	NR	0 015	10				-	-	-	-				-			
F1(C6-C10)	mg/L	0.100	-	-			<0.2	<0.2	<0.1	-	-				-			
F1-BTEX	mg/L	0.100	2.2	9.8	<.01		<0.2	<0.2		-	-				-			
F2 (C10-C16)	mg/L	0.100	1.1	1.3	<0.1		<0.2	<0.2	<0.1	-	-				-			
F3 (C16-C34)	mg/L	0.100	-	-			<0.1	<0.1	<0.1	-	-				-			
F3+ C34+	mg/L	0.100	-	-			<0.1	<0.1	<0.1	-	-				-			
Polycyclic Aromatic Hydrocarbons																		
Acenaphthene	ug/L	0.100	1.4	5.8	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	ug/L	0.100	-	-	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acridine	ug/L	0.100			<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	ug/L	0.005	-	0.012	<0.005	<0.005	< 0.005	0.055	-	< 0.005	0.035	<0 005	<0 005	0.009	<0 005	<0 005	<0 005	<0 005
Benzo(a)anthracene	ug/L	0.010	-	0.018	<0.01	<0.01	<0.01	0.12	-	<0.01	0.06	<0.01	<0.01	0.02	0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene	ug/L	0.008	-	0.015	<0.008	<0.008	<0.008	0.133	-	<0.008	0.072	<0 008	<0 008	0.016	0.02	<0 008	<0 008	<0 008
Benzo(b&j)fluoranthene	ug/L	0.100	-	-	<0.1	<0.1	<0.1	0 20	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	ug/L	0.050	-	-	<0.05	<0.05	<0.05	0 07	-	< 0.05	< 0.05	<0.05	<0.05	<0.05	< 0.05	< 0.05	<0.05	< 0.05
Benzo(k)fluoranthene	ug/L	0.100	-	-	<0.1	<0.1	<0.1	0.10	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	ug/L	0.100	-	-	<0.1	<0.1	<0.1	0.10	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	ug/L	0.050	-	-	<0.05	<0.05	<0.05	< 0.05	-	< 0.05	< 0.05	<0.05	<0.05	<0.05	< 0.05	<0.05	<0.05	< 0.05
Fluoranthene	ug/L	0.010	-	0.04	<0.01	<0.01	<0.01	0.33	-	<0.01	0.09	<0.01	<0.01	0.02	0.03	<0.01	<0.01	<0.01
Fluorene	ug/L	0.100	0.94	3	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	ug/L	0.050	-	-	<0.05	<0.05	<0.05	0.10	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Naphthalene	ug/L	0.100	0.47	1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	ug/L	0.100	-	0.4	<0.1	<0.1	<0.1	0 30	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	ug/L	0.010	0.71	0.025	<0.01	<0.01	<0.01	0.30	-	<0.01	0.1	<0.01	<0.01	0.02	0.04	<0.01	<0.01	<0.01
Quinoline	ug/L	0.300			<0.3	<0.3	<0.3	<0.3	-	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
B(A)P Total Potency Equivalent	ug/L	0.010	0.01	-	<0.01		<0.01	0.19	-	<0.01	0.08		<0.01	0.02	0.02		<0.01	<0.01
Notes				•			•				•		•	•				

Bold and shaded values exceed appropriate guideline
Cells with "-" indicate that the associated parameter was not analyzed.

Bold and underlined RPD percentages exceed appropriate values

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<sup>1 -</sup> Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table B-3. Groundwater Rem

Sample ID	Units	Detection Limits	Guide	line <sup>1</sup>		Area 7												
Parameter			Potable	Aquatic Life (Coarse)	A7 14-05	A7 14-06	A7 14-07	BH1	16-01		BH16-02			BH16-03		ВН	16-04	BH16-05
Laboratory Sample ID					4940168	4940169	4965589	1151462-1	1160993-1	1151462-2	1160993-2	1211801-1	1151462-3	1160993-3	1211801-2	1150979-9	1151462-4	1150979-10
Sample Date					21-Nov-2014	21-Nov-2014	18-Dec-2014	26-Jul-2016	20-Sep-2016	26-Jul-2016	20-Sep-2016	30-Jun-2017	26-Jul-2016	20-Sep-2016	30-Jun-2017	22-Jul-2016	20-Sep-2016	22-Jul-2016
Dissolved Petroleum Hydrocarbons																		
Benzene	mg/L	0 0010	0 005	0.074	<0 001	<0.001	<0 001	-		-			-			-		-
Toluene	mg/L	0.000	0 024	0.021	<0 001	<0.001	<0.0005	-		-			-			-		-
EthylBenzene	mg/L	0.001	0.0016	41	<0 001	<0.001	<0 001	-		-			-			-		-
Xylenes	mg/L	0.001	0.02	2.9	<0 001	<0.001	<0 002	-		-			-			-		-
MTBE	ug/L	NR	0 015	10	-	-	-	-		-			-			-		-
F1(C6-C10)	mg/L	0.100	-	-	<0.2	<0.2	<0.1	-		•			-			i		-
F1-BTEX	mg/L	0.100	2.2	9.8	<0.2	<0.2	<0.1	-		ı			-			ı		-
F2 (C10-C16)	mg/L	0.100	1.1	1.3	<0.2	<0.2	<0.1	-		•			-			•		-
F3 (C16-C34)	mg/L	0.100	-	-	<0.1	<0.1	<0.1	-		ı			-			ı		-
F3+ C34+	mg/L	0.100	-	-	<0.1	<0.1	0.3	-		•			-			•		-
Polycyclic Aromatic Hydrocarbons																		
Acenaphthene	ug/L	0.100	1.4	5.8	-	-	-	<0.1	<0.1	1.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	ug/L	0.100	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acridine	ug/L	0.100			-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	ug/L	0.005	-	0.012	-	-	-	0.014	<0.005	0.148	<0 005	0.014	<0.005	<0.005	<0.005	0.007	0.005	0.01
Benzo(a)anthracene	ug/L	0.010	-	0.018	-	-	-	0.02	<0.01	0.05	<0 01	0 01	<0 01	<0.01	<0.01	<0.01	<0 01	<0.01
Benzo(a)pyrene	ug/L	0.008	-	0.015	-	-	-	0.011	<0.008	0.031	<0 008	0.013	<0.008	<0.008	<0.008	<0.008	<0.008	0 009
Benzo(b&j)fluoranthene	ug/L	0.100	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	ug/L	0.050	-	-	-	-	-	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(k)fluoranthene	ug/L	0.100	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	ug/L	0.100	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	ug/L	0.050	-	-	-	-	-	<0.05	< 0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	< 0.05
Fluoranthene	ug/L	0.010	-	0.04	-	-	-	0.03	<0.01	0.23	<0 01	0.05	<0 01	0.01	<0.01	<0.01	0.04	0.02
Fluorene	ug/L	0.100	0.94	3	-	-	-	<0.1	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	ug/L	0.050	-	-	-	-	-	<0.05	<0.05	<0.05	<0 05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Naphthalene	ug/L	0.100	0.47	1	-	-	-	<0.1	<0.1	2.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	ug/L	0.100	-	0.4	-	-	-	<0.1	<0.1	0.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	ug/L	0.010	0.71	0.025	-	-	-	0.03	<0.01	0.17	<0 01	0.04	<0 01	0.01	<0.01	<0.01	0.04	0.02
Quinoline	ug/L	0.300			-	-	-	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<03	<0.3	<0.3
B(A)P Total Potency Equivalent	ug/L	0.010	0.01	-	-	-	-	0.01	<0.01	0.04	<0 01	0 01	<0 01	<0.01	<0 01	<0.01	<0 01	<0.01

Bold and shaded values exceed appropriate guideline
Cells with "-" indicate that the associated parameter was not analyzed.

Bold and underlined RPD percentages exceed appropriate values

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<sup>1 -</sup> Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table B-3. Groundwater Rem

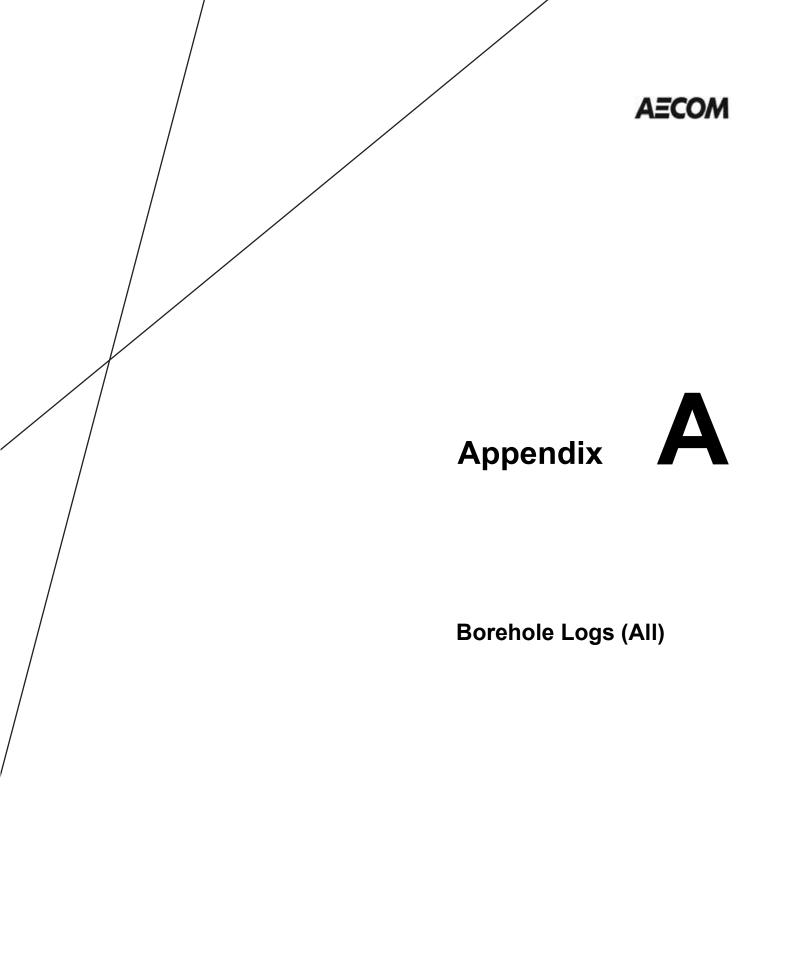
Sample ID	Units	Detection Limits	Guid	eline <sup>1</sup>										
Parameter			Potable	Aquatic Life (Coarse)	BH1	6-05		BH16-06			BH16-07		16-	-08
Laboratory Sample ID					1151462-5	1211801-3	1150979-11	1151462-6	1211131-1	1150979-12	1151462-7	1211131-2	1151462-8	1211131-3
Sample Date					20-Sep-2016	30-Jun-2017	22-Jul-2016	20-Sep-2016	28-Jun-2017	22-Jul-2016	20-Sep-2016	28-Jun-2017	20-Sep-2016	28-Jun-2017
Dissolved Petroleum Hydrocarbons														
Benzene	mg/L	0 0010	0 005	0.074			-			-				
Toluene	mg/L	0.000	0 024	0.021			-			-				
EthylBenzene	mg/L	0.001	0.0016	41			-			-				
Xylenes	mg/L	0.001	0.02	2.9			-			-				
MTBE	ug/L	NR	0 015	10			-			-				
F1(C6-C10)	mg/L	0.100	-	-			-			-				
F1-BTEX	mg/L	0.100	2.2	9.8			-			-				
F2 (C10-C16)	mg/L	0.100	1.1	1.3			-			-				
F3 (C16-C34)	mg/L	0.100	-	-			-			-				
F3+ C34+	mg/L	0.100	-	-			-			-				
Polycyclic Aromatic Hydrocarbons														
Acenaphthene	ug/L	0.100	1.4	5.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	ug/L	0.100	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acridine	ug/L	0.100			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	ug/L	0.005	-	0.012	<0 005	<0.005	0.006	< 0.005	0.009	<0.005	<0.005	< 0.005	<0.005	<0.005
Benzo(a)anthracene	ug/L	0.010	-	0.018	<0.01	<0 01	<0 01	<0 01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene	ug/L	0.008	-	0.015	<0 008	<0.008	0.009	<0.008	0.014	<0.008	<0.016	<0.008	<0.008	<0.008
Benzo(b&j)fluoranthene	ug/L	0.100	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	ug/L	0.050	-	-	<0.05	<0 05	<0 05	<0 05	<0 05	<0.05	<0.05	< 0.05	<0.05	<0.05
Benzo(k)fluoranthene	ug/L	0.100	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	ug/L	0.100	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	ug/L	0.050	-	-	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluoranthene	ug/L	0.010	-	0.04	<0.01	<0 01	0.01	<0 01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	ug/L	0.100	0.94	3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	ug/L	0.050	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Naphthalene	ug/L	0.100	0.47	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	ug/L	0.100	-	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	ug/L	0.010	0.71	0.025	<0.01	<0 01	0 01	<0 01	0 02	<0.01	<0.01	<0.01	<0.01	<0.01
Quinoline	ug/L	0.300			<0.3	<0.3	<0.3	<0.3	<0.3	<03	<03	<0.3	<0.3	<0.3
B(A)P Total Potency Equivalent	ug/L	0.010	0.01	-	<0.01	<0 01	<0 01	<0 01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01

Bold and shaded values exceed appropriate guideline
Cells with "-" indicate that the associated parameter was not analyzed.

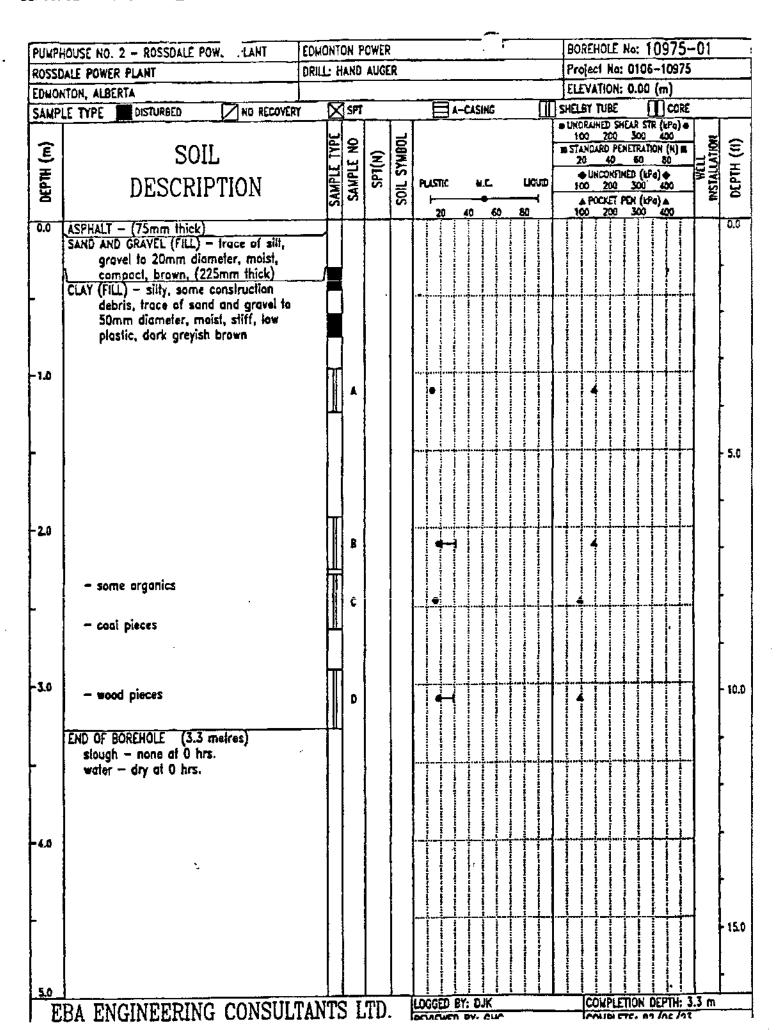
Bold and underlined RPD percentages exceed appropriate values

Tables-Rossdale Plant - Gap Analysis 2016-05-25 Page 7 of 7

<sup>1 -</sup> Alberta Tier 1 Soil and Groundwater Remediation Guidelines (February 2, 2016), Table B-3. Groundwater Rem

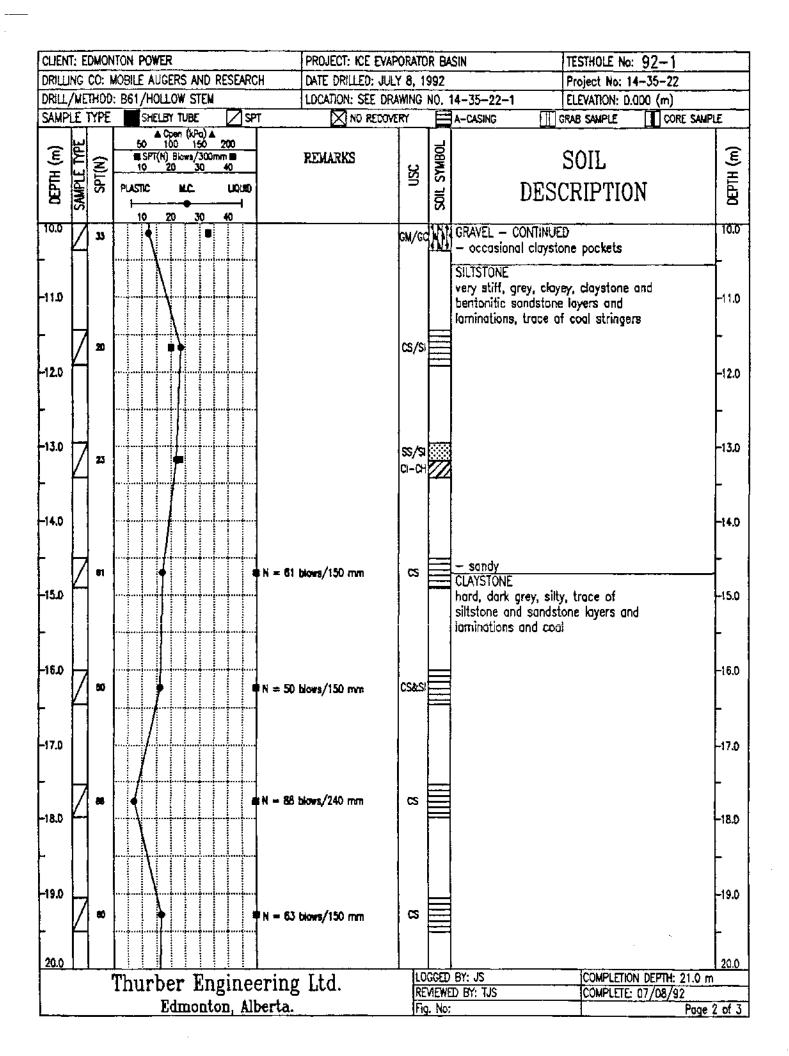


09:43



		AOBILE AUG					)R 84	1	TESTHOLE No: 92-1		
DRILL/MET	RILLING CO: MOBILE AUGERS AND RESEARCH DATE DRILLED: JU RILL/METHOD: B61/HOLLOW STEM LOCATION: SEE DI						· _ ¬¬¬				
		<del></del>			LOCATION: SEE D						
SAMPLE T	YPE		TUBE	SPT     SPT	NO RECCO	VERY	Ε	A-CASING GRAB SAMPLE CORE SAMP	LÉ		
DEPTH (m) SAMPLE TYPE	SPT(N)	# SPT(N 10 PLASTIC	20 30	200 mm = 40 LIQUID	REMARKS	DSN	SOIL SYMBOL	SOIL DESCRIPTION	DEРТН (m)		
-1.0 Z	10					a		CLAY (FILL) stiff to very stiff, brown—grey, silty, sandy, trace of gravel and organics	-1.0		
-2.0 / - / -3.0	7					SP	0000		-2.0 -3.0		
-4.0 Z	11			894	= 0.05 <b>%</b>	G-GH		CLAY stiff, brown, silty, trace of fine sand	-4.0 -5.0		
-6.0 Z	10			504	= 0.0%	<b>a</b> a		— заябу, occasional coal specs	6.0		
-7.0 Z	12					SP	0000 0000	SAND	7.0		
-9.0				<b>W</b>	= 60 blows	GP	64 t	,	-8.0 -9.0		
]					Seepage	1	}				
10.0		<u>                                     </u>		<u> </u>		GM/Gr			10.0		
	Thurber Engineering Ltd.							D BY: JS COMPLETION DEPTH: 21.0 m  ED BY: TJS COMPLETE: 07/08/92			
<u></u>				on, Alber			, No	Poge	1 of 3		

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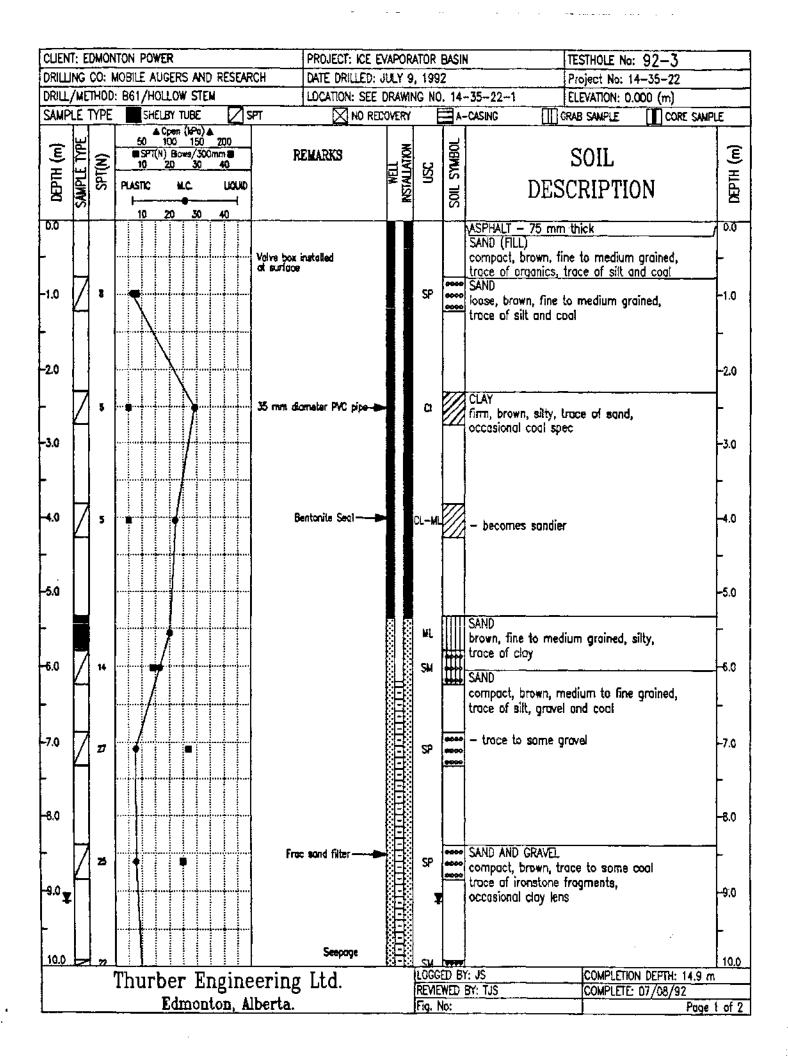


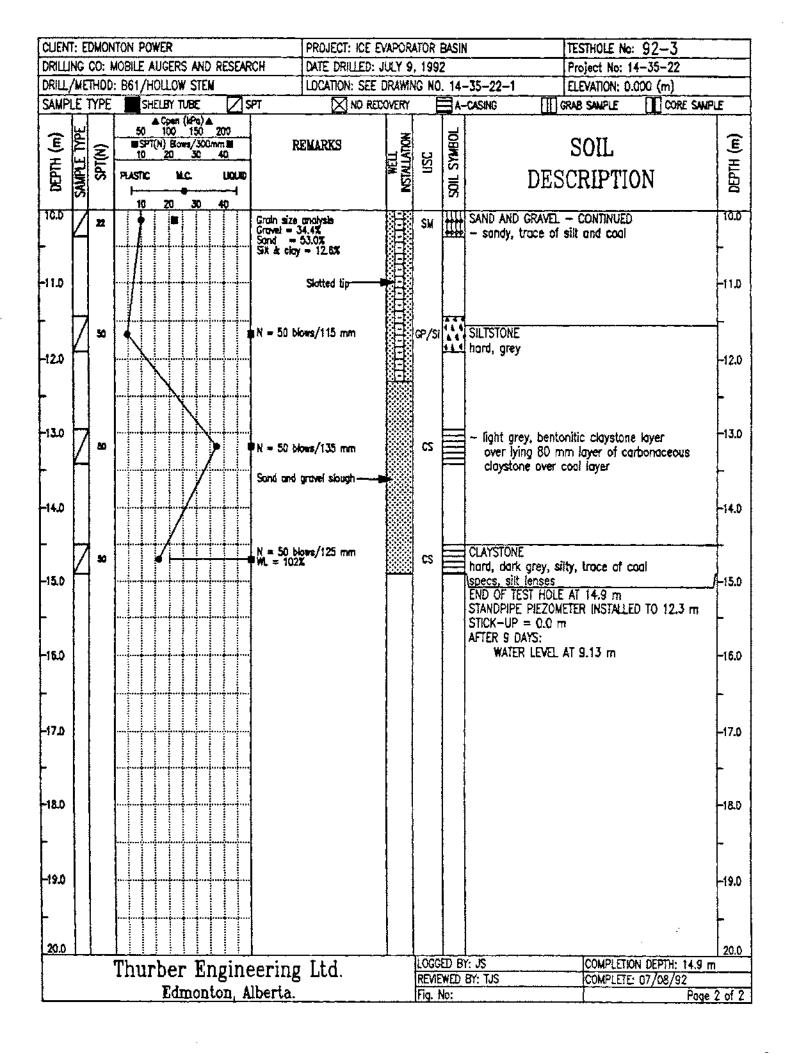
			iton power		PROJECT: ICE EVAP			SIN TESTHOLE No: 92-1	
-			MOBILE AUGERS AND F	RESEARCH	DATE DRILLED: JULY	Project No: 14-35-22			
SAMP!			: B61/HOLLOW STEN	SPT	LOCATION: SEE DRA			4-35-22-1   ELEVATION: 0.000 (m)   A-CASING	F
	SAMPLE TYPE !	1	A Coen (kPa) A	200	REMARKS	OSO	SOIL SYMBOL	SOIL DESCRIPTION	ОЕРТН (м)
20.0	S		10 20 30	40		<u> </u>	S	OLAVOTONIC CONTINUED	20.0
-21.0	7	es.		■ N = 63	bioes/150 mm	SS		CLAYSTONE - CONTINUED  - corbonaceous claystone, sandy SANDSTONE, hard, light grey, bentonitic	-21.0
-								END OF TEST HOLE AT 21.0 m AT COMPLETION: HOLE SLOUGHED IN UPON THE REMOVAL OF STEM AUGERS	-
-22.0									-22.0 -
-23.0									-23.0 -
-24.0									-24.0 -
-25.0									-25.0
-26.0									-25.0
27.0									-27.0
-28.0							: :		-28.0
-29.0									-29.0
30.0			Thurber En	dineering	- [+4	ĮL0	GGED	BY: JS COMPLETION DEPTH: 21.0 m	30.0
				giireering on, Alberta.	bu.	RE	VIEW	D BY: TJS COMPLETE: 07/08/92	
<u> </u>			FUIITOTIN	nn' whatig.		įri	j. No:	Page	) हा ह

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CLIENT: EDMONTON POWER	PROJECT: ENV. PRE	UMIN	ARY AUDIT-ROSSDALE	E TESTHOLE No: 92-2B	
DRILLING CO: MOBILE AUGERS AND RESEARCH	DATE DRILLED: JULY			Project No: 14-35-20	
DRILL/METHOD: B61/SOLID STEM	LOCATION: SEE DRAY			ELEVATION: 0.000 (m)	
SAMPLE TYPE SHELBY TUBE SPT	NO RECOVE	RY	A-CASING I	GRAB SAMPLE CORE SA	WPLE
▲ Cpen (kPa) ▲ 50 100 150 200	DEL CADITIO	님			
50 100 150 200  SPT (N) Blows/300 mm  10 20 30 40	REMARKS	SYMBOL	S	SOIL	<u>E</u>
E SPT (N) Blows/300 mm ■ 10 20 30 40  PLASTIC M.C. LIQUID  PLASTIC M.C. LIQUID			DESC	RIPTION	ОЕРТН (m)
\sigma  \cdot \display \dinploy \display \display \display \display \display \display \display \display \		SO		IVII IIOIN	5
0.0 20 30 40			CLAY (FILL)		0.0
			brown, very silty, trace o	of fine sand,	
			coal		Ī
-1.D					- 1.0
					1,0
					-
			SAND (FILL)	10 2 1 1	
-2.0			black—brown, fine to me of coal chips	dium grained, trace	- 2.0
	:		CLAY (FILL)		
<u> </u>			brown, very silty, sandy,	trace of	-
			pebbles, coal		, ,
- 3.0					- 3.0
			SAND (FILL), brown to bl	ack, clayey, trace	
		•	of pebbles, brick pieces GRAVEL AND SAND (FILL)		_
-4.0			brown, fine to medium of SAND (FILL), loose, brow	rained	4.0
			SAND (FILL), loose, brow	n-black, fine to	
- 11			medium grained, trace o material"	of ast like	<u> </u>
			SILT (FILL), brown, sandy		_
-5.0			- concrete pieces		- 5.0
			[		
			SAND (FILL) brown, fine to medium g	rained eilty	
60			biomi, fine to inequality	irumou, sirty	- <b>6</b> .0
6.0			CLAY (FILL), brown to blo	ack, very silty,	- 0.0
			trace of gravel, brick pie		_/-
			SAND brown, fine to medium g	rained silty	
7.0			promi, nue to illegion y	poniou, any	- 7.0
			GRAVEL AND SAND		
			brown, fine to medium g	rained	}
-8.D			ESIB AT *** A** 1.5 - 5 - 5 - 5		- 8.0
			END OF TEST HOLE AT 8. AUGER REFUSAL AT 8.2 r		
			AUGUN NEFUSAL AF 0.2 I	II ON ZODDEE	
-9,0					- 9.0
-    -  - - - - - - - - - - - - - - -				·	-
					40.0
Thurbox Engironmental Con	paultanta I ta	1   [[(	L DGGED BY: TC	COMPLETION DEPTH: 8.2 r	10.0 n
Thurber Environmental Con		⊥. RE	EVIEWED BY: NHF	COMPLETE: 07/17/92	
Edmonton, Alberta		<u> Fi</u>	g. <b>No</b> :	Pag	e i of 1





CLIENT: EDMONTON POWER	PROJECT: ENV. PREI	JMNARY AUDIT-ROSSDALE TESTHOLE No: 92—A					
DRILLING CO: MOBILE AUGERS AND RESEARCH		RILLED: JULY 17, 1992 Project No: 14-35-20					
DRILL/METHOD: B61/SOLID STEM	LOCATION: SEE DRAV			EVATION: 0.000 (m)			
SAMPLE TYPE SHELBY TUBE SPT    SPT	⊠ no recover EMARKS		■a-casing	SAMPLE TOORE SAMPL	(m)		
E SPÎ (N) Blows/300 mm R R	DIMANIC	SOIL SYMBOL	DESCRI		ОЕРТН (		
0.0		07	OLEV (THI)		0.0		
_			CLAY (TILL) brown, silty, sandy, trace of coal — black oily looking coal laye		0.0		
-1.0			- black only looking could laye	; ;	- 1.0		
-2.0			SAND (FILL) brown, fine to medium grains CLAY TILL (FILL) brown, silty, sandy, trace of coal		- 2.0		
-3.0			<ul><li>rubble, brick, cancrete pie</li><li>brick pieces, wood chips, :</li></ul>		- 3.0		
-4.D			SAND (FILL) brown, fine to medium graine organics, "ash like material"		- 4.0		
-5.0			COAL AND SAND (FILL)		- 5.0		
-6.D			Ibrown, silty, black coal piece - oxide stained clay layer SAND (FILL) medium grey, fine to mediun silty, trace of small coal piec	grained,	- 6.D -		
_7. <b>0</b>					- 7.0		
-8.0			CLAY TILL (FILL) brown, silty, very sandy, trac coal stringers, wet sand pock		- 8.0		
-9.0			GRAVEL AND SAND brown, silty, fine to medium	sand	- 9.0		
Thurber Environmental Con	Free water	i Jic	END OF TEST HOLE AT 10.7	m COMPLETION DEPTH: 10.7 m	10.0		
Edmonton, Alberta.	Surrains LtC		VIEWED BY: NHF	COMPLETE: 07/17/92 Page 1			

CUEM			, , - <del></del>	<del></del>	JECT: SOIL MONITORING — ROSSDALE TEST HOLE NO: TH97-					
			ADIAN GEOLOGICAL DRILLING	RIG/METHOD: B61/SC	OLID S	KETE	M AUGER PROJECT NO: 14-35-43 ELEVATION:	$\dashv$		
DATE I SAMPI			16 JUNE 1997 SHELBY TUBE SPT	NO RECOVERY	<u> </u>		A-CASING GRAB SAMPLE CORE	$\dashv$		
Ê	SAMPLE TYPE F	9	■ HEADSPACE ppmv ■ Sy 80 160 240 320  PLASTIC M.C. UQUID We	mbols for	nsc	SOIL SYMBOL I	SOIL	ELEYATION (11.1)		
- 0.0			10 20 30 40				TOPSOIL & CLAY, dark brown to black, silty, sandy, grass covered	.0		
1.0	I	5					CLAY (TILL-LIKE) dark brown, sandy, silty, coal specks, occasional pebbles, pieces of brick	1.0		
		6					· · · ·	-2.0		
3,0								·3.0		
4.0	П	я			CL Z		CLAY brown, fine grained sandy  Z	-4,0		
5.0		10			SM I	ΡΟΡΦ	Coccasional sand ionisca	-5.0		
6.0		11		c	CL-CIZ	7	dark brown, silty, sandy, sand pockets,	-6.0		
- 0.0		12			Cí Z	77	r F	V.V		
7.0		13					7 7 7	-7.0		
- - - - - 8.0		14						-8.0		
9,0								-9.0		
- - - 10.0		16						10.0		
Τhι	ır	bei	r Environmental Con	sultants Ltd		GED	D BY: TRL COMPLETION DEPTH: 10.2 m VED BY: DMB COMPLETE: 97/06/16	_		
			Edmonton, Alberta,			No:		2		
97/08/25	10:44	AK (AP	w ]					_		

CLIENT: EPCOR	PROJECT: SOIL MON				NO: TH97-1
DRILL CO: CANADIAN GEOLOGICAL DRILLING	RIG/METHOD: B61/	SOLID	STEA		0: 14-35-43
DATE DRILLED: 16 JUNE 1997				ELEVATION:	
SAMPLE TYPE SHELBY TUBE SPT	∭ NO RECOVE	RY		A-CASING GRAB SAMPLE	CORE
	mbols for ell Backfill	nsc	SOIL SYMBOL	SOIL DESCRIPTI	SLEVATION(m)
10.0					10.0
- 11.0				END OF TEST HOLE AT 10.2m ON COMPLETION: BACKFILLED WITH CUTTINGS	-  -  -  11.0  -  -
- 12.0					- 12.0
13.0					- 13.0 
- 14.0					
- 15.0					15.0
- 16.0	į				
- 17.0					- - - - - - - - - - - - - - - - - - -
- 18.0					
<b>- 19.0</b>					- - - - - - - - - - - - - - - - - - -
20.0		, lin	Մը <b>ք</b> ը	BY TRI PONDIT	
Thurber Environmental Con	sultants Lte	띎.b	VIEW	ED BY: DMB COMPLE	TE: 97/06/16
Edmonton, Alberta.			. No:		Page 2 of 2

CLIEN				PROJECT: SOIL MONITO			TEST HOLE NO: TH97-2	
				RIG/METHOD: B61/SOL	ID STE	M AUGER	PROJECT NO: 14-35-43	
			16 JUNE 1997				ELEVATION:	
SAMP	<u>LE</u>	TYPE	SHELBY TUBE 🖊 SPT	NO RECOVERY		A-CASING ∭ G	RAB SAMPLE TO CORE	
DEPTH(m)	SAMPLE TYPE	SAMPLE NO	80 180 240 320 -	mbols for	SOIL SYMBOL		SOIL CRIPTION	ELEVATION(m)
_ 0.0 _				Cl	-CI <b>ZZZ</b>	ASPHALT TOPSOIL/CLAY, dark b sandy, organic	rown to black, silty,	0.0
1.0	П	5		SF	P 000	-pieces of brick SAND light brown, finc to m	nodium grained.	-1.0
- - - - - 2.0	ın	6				trace of silt	,	-2,0
		7						- 2,5°
3.0 : -	11	8						-3.0
4,0	ŢĪ	9				-becomes silty, trac	e of coal, till-like,	-4.0
5,0		10				-occasional pebble		- - - - - - - - - -
- - - -	П	11						
₩ 1		12						├-6.0  -  -
7.0	111	13						-7.0
8.0	11	11						-8.0
		15		G	M SINII	GRAVEL silty, sandy, coal spe	ecks	
- 9.0 - -		16						0,e- - - -
F 10.0								= = 10.0
		bei	Environmental Cons	sultants Ltd.	REVIEW	D BY: TRL /ED BY: DMB	COMPLETION DEPTH: 10.2 r COMPLETE: 97/06/16	n .
97/08/25	10:5	GANI (PP)	Edmonton, Alberta.		Fig. No	J.	+ rage	1 of 2

CLIENT: EPCOR	PROJECT: SOIL MONI			TEST HOLE NO: TH97-2		
DRILL CO: CANADIAN GEOLOGICAL DRILLING	RIG/METHOD: B61/S	OLLO	PROJECT NO: 14-35-43			
DATE DRILLED: 16 JUNE 1997			<u>-</u> -		ELEVATION:	
SAMPLE TYPE SHELBY TUBE SPT	No recover     No recover	RY	<u> </u>	A-CASING [[] G	RAB SAMPLE CORE	
HILD SO SO 40	mbols for ll Backfill	OSU	SOIL SYMBOL		SOIL CRIPTION	ELEVATION(m)
10.0				CUB OF TEXT HALE AT	10.5	-10.0
— 11.0				END OF TEST HOLE AT ON COMPLETION: BACKFILLED WITH CUTI		11.0
12.0						12.0
13.0						13.0
- 14.0						- - - - - - - - - - - - - - - - - - -
15.0						15.0
16.0						16.0
17.0		•				
18.0						- 18.0
19.0						
20.0	71 ' *'	, 10	GGFn	BY: TRI	COMPLETION DEPTH: 10.2 m	20,0
Thurber Environmental Con	suitants Lto				COMPLETE: 97/06/16	
Edmonton, Alberta.		Fig	. No	,	Poge 2	2 of 2

CLIEN	T: E	PCOI	R	PROJECT: SOIL MONT				ST HOLE NO: TH97-3	
			VADIAN GEOLDGICAL DRILLING	RIG/METHOD: B61/S	OLID	STEA	AUGER PR	OJECT NO: 14-35-43	
			: 16 JUNE 1997					EVATION:	
SAMP	LE	TYPI	SHELBY TUBE SPT	NO RECOVER	řΥ	_=	A-CASING GRAB	SAMPLE CORE	
DEPTH(m)	SAMPLE TYPE		60 160 240 320	mbols for ll Backfill	OSO	SOIL SYMBOL		DIL RIPTION	ELEVATION(m)
. 0.0		,		C	CL-CI		ASPHALT SAND (FILL) dark brown CLAY (TILL-LIKE), dark b sandy, coal specks, piec		0.0
- 1.0	П	5					<b></b> , <b>-</b> ,		E 1.0 - - -
- 2.0		6							
- - - - - - - - - - - - - - - - - - -					SM	PPPP	SAND (TILL—LIKE) dark brown, silty, fine to coal specks	o medium grained	- - 3.0
- - - - - - - -		9					-occasional gravel		- - - - - - - - - - - - - - - - - - -
- - - - - - - - - - - - - - - - - - -		10							- - 5,0
6,0		11			-				- - - 6.0
0.0	1	12			\$P	0000	-becomes light brown, coal specks	trace of silt &	0.V
- 7.0 -		13							7.0 
8.0	П	14							-8.0 8.0
9.0		15							- - - - - - - - - - - -
	Tì.	16					-becomes gravelly		
10.0		↓ L			1 10	GGFN	BY; TRL	COMPLETION DEPTH: 10.2 m	<u> –10,(</u>
Ini	ır	pe:	r Environmental Cons	suitants Lto	$1.ert\widetilde{\mathbb{R}}$	VIEW	ED BY: DMB	COMPLETE: 97/06/16	
97/08/25			Edmonton Alberta	<del></del>		ı. No		Page 1	of 2

CLIENT: EPCOR	PROJECT: SOIL MON			TEST HOLE NO: TH97-3			
DRILL CO: CANADIAN GEOLOGICAL DRILLING	RIG/METHOD: 861/	SOLID	STEN	A AUGER	PROJECT NO: 14-35-43		
DATE DRILLED: 16 JUNE 1997					ELEVATION:		
SAMPLE TYPE SHELBY TUBE SPT	₩ NO RECOVE	RY		A-CASING [[[	GRAB SAMPLE CORE		
PLASTIC M.C. UQUID Y	ymbols for Yell Backfill	osn	TOBMUS TIOS	DES	SOIL CRIPTION	ELEVATION(m)	
10.0				END OF TEST HOLE	AT 40.0	- 10.0	
				END OF TEST HOLE , ON COMPLETION: BACKFILLED WITH CU		11.0	
12.0						12.0	
13.0						13.0	
14.0							
- 15.0 - 15.0						-15.0 15.0 	
16.0							
E 17.0						17.0	
18.0						18. <b>0</b>	
19.0							
20.0						-20,0	
Thurber Environmental Con	nsultants Lt		GGED VIEWI . No		COMPLETION DEPTH: 10.2 n COMPLETE: 97/06/16 Page	2 of 2	
97/08/25 9051AU (PHAYI)	······	. 1110	, 10	<u> </u>	, , , , ,	- VI L	

CLIEN	LIENT: EPCOR PROJECT: SOIL MONITORING — ROSSDALE TEST HOLE NO: TH97—4									
DRILL	00:	CAN	VADIAN GEOLOGICAL DRILLING	8G/METHOD: B61/	SOLID	STEW	1 AUGER PR	ROJECT NO: 14-35-43		
DATE	DRIL	LED:	16 JUNE 1997				EL	EVATION:		
SAMP	LE	TYPE	SHELBY TUBE SPT	NO RECOVE	RY		A-CASING GRAI	B SAMPLE CORE		
		SAMPLE NO	M HEADSPACE ppmv M 80 160 240 320  PLASTIC M.C. LIQUID Well	ibols for Backfill	OSC	SOIL SYMBOL	!	OIL RIPTION	ELEVATION(m)	
- 0.0		7-1	10 20 30 40				TOPSOIL, black, grass co	overed	0.0	
Ė		23					To contract of the grade of	,,,,,,	E l	
- - - -	П	4					CLAY (TILL-LIKE), block silty, sandy, topsoil, pie		-	
1,0		5					CLAY brown, very silty, sandy	eand nackets	1.0 -	
ŧ							blowing very since, admay	, saila pockets	-	
-		6						1	-	
2.0		ľ							2.0	
									E	
ŀ	П	7							-	
Ē									-	
3.0									-3.0	
<u>.</u>	11	8							Ė I	
[-									-	
<u>-</u>										
<b>⊢</b> 4.0	F	9			ļ					
Ę									- -	
Ę		10							-	
- - 5.0	1	1 10					SAND		5 <b>.</b> 0	
ŧ "							light brown, silty		E "	
-		11			SM	<b>000</b> 0			-	
Ē										
6.0									-6.0	
-	П	12							-	
Ē									-	
Ė										
7.0		13					-becomes titl-like, fine	e to medium	7.0	
-		1					grained, coal specks		-	
E		14							-	
8.0	1	1 '*							8,0	
Ė									<u> </u>	
F	Ь	15							-	
Ē									-	
9.0									-9.0	
ŧ	押	16							<u> </u>	
F	1								<u> </u>	
F 10.0									- 10.0	
		ho	r Environmental Cons	ultanta It	A LO	GGED	BY: TRL	COMPLETION DEPTH: 10.2 m	- 6474	
1,111	ΤŢ	N C I		urtants bu	117		ED BY: DMB	COMPLETE: 97/06/16		
97/08/25	10:51	AU (API	Edmonton, Alberta.		JFi c	. No:		Page 1	of 2	

CLIENT: EPCOR	PROJECT: SOIL MON			TEST HOLE NO: TH97-4		
DRILL CO: CANADIAN GEOLOGICAL DRILLING	RIG/METHOD: B61/	SOLID	PROJECT NO: 14-35-43			
DATE DRILLED: 16 JUNE 1997					ELEVATION:	
SAMPLE TYPE SHELBY TUBE SPT	⊠ NO RECOVE	RY .		A-CASING III G	RAB SAMPLE	
	mbols for ell Backfill	OSD	SOIL SYMBOL		SOIL CRIPTION	ELEVATION(π)
10.0				<del>-,</del>		-10.0
				END OF TEST HOLE AT ON COMPLETION: BACKFILLED WITH CUT		11.0
F_ 12.0						- - - - - - - - - - - - - - - - - - -
13.0						13.0
14.0						14.0
	,					
E_16.0						16.0
17.0						17.0
18.0						18.0
19.0	,	;				19.0
Thurber Environmental Con	anltant Ti	ا ہے	GGED	BY; TRL	COMPLETION DEPTH: 10.2 m	<u>} -20.0</u> 1
murber Environmental Con	suntants Lt	u.₪	VIEW	ED BY: DMB	COMPLETE: 97/06/16	
Edmonton, Alberta.		Fig	. No	;	Page	2 of 2

CLIENT	: E	PCO	₹								PROJE	CT: SOR	L MON	ITORIN	√G -	ROSSDALE	TES	T HOLE N	o: THS	77-5	
DRILL	00:	CVI	<b>I</b> ADIAN	GEC	)L0(	SICA	L D	RILU	ING		RIG/M	ETHOD:	B61/3	SOLID	STEN	AUGER	PR	OJECT NO:	14-35-	-43	
DATE I	DRIL	LED:	16 J	JNE	199	97					1						ELI	VATION:		***	
SAMPI	E	TYPE		SH	(ETB,	Y TU	8E		∕ s	PT .		NO R	RECOVE	RY		A-CASING	GRAB	SAMPLE	Πc	ORE	
DEРТН(m)	SAMPLE TYPE	SAMPLE NO	8 PLASI		160	2. I.C.	ppm 40	_320	QUID H		mbol ell Ba		- 1	OSO	SOIL SYMBOL	]	S( DESCR	)IL IPTIC	)N		ELEVATION(m)
- 0.0	11 11	1 2	<u> </u>		70	T .	7.05	7	-							VASPHALT					0.0
<del> -</del>  -  -  -		4												CL-CI		COAL (FILL), b trace of clay CLAY (FILL), b	rown to blo	ick, silty,	sandy,		1 1 1 1 1
- 1.0 - - - -	111	5														coal, occasio	onal gravei	ox pieces	oi onck		1.0 - - -
- 2,0	ш	6																			
		7					Y									becomes b	rown, very :	silty, fine	grained		
- 3.0 -		8																			-3.0
4.0		9		0																	4.0 E
5.0		10		94-10-																	-5.0
		11												5M	<b>999</b> 9	SAND brown, silty,	fine grained	<u> </u>			- - - -
6.0	л	12															•				6.0 - - -
7.0		13												GM	4 N F	GRAVEL brown, silty,	coal specks	3			
8.0		14				- C															-8.0
†  -  -  -		15	ļ																		- - - - -
9.0		16																			9.0
10.0		h ==	. 17-	<u> </u>					1 - 1		11		T J.	ما ا	GGED	BY: TRL		COMPLETE	ON DEPTE	<del> ; 10.2 m</del>	
$\mu$ nt	LI'	ne)	r Fl							l Con	SUIU	ants	ьt	$\mathfrak{U}_{RE}$	YIEWI	O BY: DMB		COMPLETE			
97/08/25	10.52	AM (PP)	ልኝ)		Ed	m	ont	<u>on</u>	<u>, A</u> ]	<u>berta.</u>				Fig	j. No:						1 of 2

CUENT				_			PROJECT: SOIL				TEST HOLE NO: TH	97-5
DRILL	CO	: CAN	IADIAN GEO	)LOGICAL I	DRILLING		RIG/METHOD: 8	361/SOLIC	PROJECT NO: 14-35	-43		
DATE	DRII	LLED:	16 JUNE	1997							ELEVATION:	
SAMPI	LE	TYP8	SH	ielby tube	SP1	-	⊠ NO RE	COVERY	Ш	A-CASING [	GRAB SAMPLE	CORE
OEPTH(m)	SAMPLE TYPE	SAMPLE NO	PLASTIC	ADSPACE ppr 160 240 M.C.	LIQU:0	•	mbols for Il Backfill	osn	SOIL SYMBOL	DES	SOIL SCRIPTION	ELEVATION(m)
10.0	┝		10	20 30	40				╁┈			10.0
11.0										END OF TEST HOLE ON COMPLETION: BACKFILLED WITH C		11.0
12.0	ļ											- 
13.0	i											13.0
- 												14.0
<b>1</b> 5.0	,											
16.0 -												-16.0
- - - 17,0 -												
18.0												- 18.0
- 19,0 - 19												
20.0												20.0
Thu	ır			ironm Edmon	ental	Con: erta	sultants	Ltd.	OGGEL EVIEWI g. No	D BY: TRL ED BY: DMB	COMPLETION DEPT COMPLETE: 97/06	TH: 10.2 m
97/00/25	10.5	ZANI (FIFE	(M)				<del></del>	<u>'</u>	4:	·	1	

CLIENT: EPCOR	PROJECT: SOIL MONITOR	est hole no: TH97-6	
DRILL CO: CANADIAN GEOLOGICAL DRILLING	RIG/METHOD: B61/SOLIC	D STEM AUGER P	ROJECT NO: 14-35-43
DATE DRILLED: 17 JUNE 1997			LEVATION:
SAMPLE TYPE SHELBY TUBE SPT	NO RECOVERY	A-CASINGCRU	AB SAMPLE  CORE
芒	ymbols for ell Backfill	≿	OIL SEPTION
- 0.0 = 1	GM	ASPHALT	/- 0.0
		GRAVEL, brown to black coal, pieces of brick CLAY (TILL-LIKE)	
- 1.0 III 5		light brown—black, silty of coal & organics	y, sandy, traces1.0
2.0			-2.0
5.0		END OF TEST HOLE AT A ON COMPLETION: BACKFILLED WITH CUTTIN	E
-4.0			- - 4.0
- 5.0			
6.0			- - 
7.0			
B.0			-8.0
9.0			-9.0 
Thurber Environmental Con	sultants Ltd.	OGGEO BY: TRL	COMPLETION DEPTH: 2.5 m
Edmonton, Alberta.	<u> </u>	ig. No:	Page 1 of 1
Thurber Environmental Con	suntants Ltd.	ieviewed by; dmb	COMPLETE: 97/08/17

CLIEN.					PROJECT: SOIL MO				
			VADIAN GEOLOGICAL DR	KILLING	RIG/METHOD: B61,	/SOLID	STEN		
L			16 JUNE 1997		No special			ELEVATION:	
SAMP	LE T	ITPE E	SHELBY TUBE	SPT	⊠ NO RECOV	EKY	E	A-CASING GRAB SAMPLE CORE	
DEPTH(m)	SAMPLE TYPE	SAMPLE NO	■ HEADSPACE ppmv 80 180 240 PLASTIC M.C.	uquid ₩ <sub>€</sub>	mbols for ell Backfill	OSC	SOIL SYMBOL	SOIL DESCRIPTION	ELEVATION(m)
- 0.0		Ι.	10 20 30	40	<del></del>			NASPHALT /	_ 0,0
- - - - -						CL-CI		GRAVEL (FILL), brown, sandy, silty	-
1,0	l li	5						dark brown, silty, sandy, coal specks, pieces of brick	— −1.Ø
- - - - 2.0		6							- - - - 2.0
} } } } } }	П	7							- - - -
- 3.0 -		8				SM	<b>ቀ</b> ቀፍቀ		
- - - - - - - - - -						NIE		brown, silty, coul specks	- - - - - 4,0
T.V								END OF TEST HOLE AT 4m ON COMPLETON: BACKFILLED WITH CUTTINGS	- <del>-</del> -
5.0									_ 
									 - - - - - - - <b>-6.0</b>
5.0 - - -									
7.0									-7.0
8.0									- - - 
- - - -									- - - - -
9.0									- <b>9.0</b>
10.0					71 , *,	<u>ا</u> مال	GGET	D BY: TRL   COMPLETION DEPTH: 3.4 m	
Įľhι	ır	bei	r Environme	ental Con	suitants Lt			ED BY: DMB COMPLETE: 97/06/16	
97/08/25	30:50	OU TRES	<u>Edmont</u>	<u>on, Alberta.</u>			, No		of 1

CLIEN								PROJECT: SOIL				TEST HOLE NO: TH97	
			iadian ge		L DRI	LUNG		RIG/METHOD: E	361/SOUI	STE	M_AUGER	PROJECT NO: 14-35-43	}
			17 JUNE			_		<u> </u>		<u></u> _		ELEVATION:	
SAMP	LE	TYPE		SHELBY TU	JBE _		PY	⊠ no re	COVERY	<u>_</u>	A-CASING	∏ GRAB SAMPLE ∏ CORI	<u> </u>
ОЕРТН(т)	SAMPLE TYPE	SAMPLE NO	80 PLASTIC	HEADSPACE 180 2 M.C.		■ 320 LIQUID —-{ 40	-	mbols for	osn	SOIL SYMBOL	DE	SOIL SCRIPTION	ELEVATION(m)
- 0.0		2 3	1 1	1.0V V		1	<del> </del>		CI	ZZ	GRAVEL (FILL), bro	own, silty, sandy	0.0
	1	3									CLAY (TILL-LIKE)	sandy, coal specks,	
- 1.0		5											-1,0 - - - - -
- - 2.0		6											2.0
- - - - - - - - - -											END OF TEST HOLD ON COMPLETION: BACKFILLED WITH (		-3.0
- 4.0													-1.0 -1.0
5,0 - 5,0 - 5,0													
6.0													-6.0
- 7.0 7.0							••						-7.0
8.0													
9.0	•												-9.0 
10.0											1	1220-0-0	-10.0
Thi	ır	bei	r Env	iron	me	nta	l Con	sultants	Ltd	OGGE	D BY: TRL	COMPLETION DEPTH:	
[`							<u>Iberta.</u>			ig. No		COMPLETE: 97/06/17	Page 1 of 1
97/08/25	10:5	SADI (PP)	W1)	E CHILL	חזזורר	/11. E	TOCI (U.			ig. NC	<i></i>		rage roll

CUENT: EPCOR	PROJECT: SOIL MONIT			ST HOLE NO: TH97-9		
DRILL CO: CANADIAN GEOLOGICAL DRILLING	RIG/METHOD: 861/SC	olíd s	TEM		ROJECT NO: 14-35-43	
DATE DRILLED: 17 JUNE 1997			_		<u>Evation:</u>	
SAMPLE TYPE SHELBY TUBE SPT	⊠ NO RECOVERY	<u>′                                    </u>	벌	A-CASING	8 SAMPLE CORE	
HIATIN M.C. UQUID We.	mbols for	OSC	SOIL SYMBOL		OIL RIP'I'ION	ELEVATION(m)
0.0 III 2 III 3 II		+	┪	\ASPHALT		0.0
H 3 H 4 H 1 H 1 H 1 H 1 H 1 H 1 H 1 H 1 H 1		cı z	ZZ	CLAY (THE-LIKE) ( full dark brown, silty, sandy specks, pieces of brick	y, gravelly, coal	-
- 1.0 III 5		CI Z	7	-sand layer 100mm th	nick at 1.0m	-1.0
ш 6				light brown, silty, sandy	<b>f</b>	لسفينياب
2.0						2.0 
- 3.0				END OF TEST HOLE AT 2 ON COMPLETION: BACKFILLED WITH CUTTIN		-3.0
4.0						- - - - - - - - - - -
5.0						-5,0
7.0						-7.0
8.0						
9.0						g.o
10.0				·		10.0
Thurber Environmental Cons	sultants Ltd	LOGO PEVI	ED.	BY: TRU	COMPLETION DEPTH: 2.5 m COMPLETE: 97/06/17	
Edmonton, Alberta.		Fig.	No:	3 31, 0m3	Page 1	of 1

CLIEN						PROJECT: SOI				TEST HOLE NO: $ H97-10 $	<u> </u>
			ADIAN GEO		RIШNG	RIG/METHOD:	B61/SOLID	STEA	A AUGER	PROJECT NO: 14-35-43	
			17 JUNE					_		ELEVATION:	
SAMP	LE	TYPE	SH	ELBY TUBE	SP1	T 💹 NO F	RECOVERY	<u> </u>	ACASING [	GRAB SAMPLE CORE	
DEPTH(π.)	SAMPLE TYPE	SAMPLE NO	PLASTIC	ADSPACE ppm 160 240 M.C.	ПСИID	Symbols for Well Backfill	\( \tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\tilde{\	SOIL SYMBOL	DES	SOIL CRIPTION	ELEVATION(m)
0.0	#	2	10	20 30	40				TOPSOIL, black, silty	sandy clay arass	_ 0.0
- - - - - - -							CI	772		rk brown, silty, sandy	
- 1.0 - - - -	1	5					CLCI	2/2	CLAY		-1.0
2.0		6							light brown, very si sand	lty, fine grained	
- - - 3.0									END OF TEST HOLE A ON COMPLETION: BACKFILLED WITH CU		-3.0
- - - - - - - - - - -											-4,0
- <b>5</b> ,0 -											-5.0
6.0											
7,0											7.0
5.0 8.0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	•										-8.0
9,0											
F 10.0											E 10.0:
		bei		ronm Edmon		Consultants	⊢ ∟ւα. 🚾		BY: TRL ED 8Y: DM8	COMPLETION DEPTH: 2.5 COMPLETE: 97/06/17	
97/08/25	10:50	XVI (PPN	(A))	пантан	<u> </u>	ietra.	<u> </u>	4. i40;	<u> </u>	l Pay	e i Ol 1

# **Test Hole logs**

TH97-1.1

0 to 0.8 m Fill, top soil and clay, dark brown to black, silty, sandy, grass

covered

0.8 to 1.75m Sand fill, light brown, some clay nodules

TH97-1.2

0 to 0.8 m Fill, top soil and clay, dark brown to black, silty, sandy, grass

covered

0.8 to 1.75m Sand fill, light brown, some clay nodules

TH97-1.3

0 to 0.8 m Fill, top soil and clay, dark brown to black, silty, sandy, grass

covered

0.8 to 1.75m Sand fill, light brown, some clay nodules

TH97-4.1

0 to 0.45m Top soil, black grass covered

0.45 to 0.5 m Clay, Till-like, black to dark brown, silty, sandy

TH97-4.2

0 to 0.45m Top soil, black grass covered

0.45 to 0.5 m Clay, Till-like, black to dark brown, silty, sandy, hit large piece

of concrete

TH97-4.3

0 to 0.45m Top soil, black grass covered

0.45 to 0.5 m Clay, Till-like, black to dark brown, silty, sandy

TH97-5.1

0 to 0.05 m Asphalt

0.05 to 0.5 Fill mixed, gravel over silty black fill over clay

TH97-5.2

0 to 0.05 m Asphalt

0.05 to 0.5 m Clay fill, with occasional brick chip, ash pocket, silty, sandy

gravel over silty black fill over clay

TH97-5.3

0 to 0.05 m Asphalt

0.05 to 0.5 Clay fill, with occasional brick chip, ash pocket, silty, sandy

gravel over silty black fill over clay

TH97-5	5.4	
	0 to 0.05 m 0.05 to 0.5 m	Asphalt Silty black fill, trace clay, some sand, some pieces of red wood.
TH97-5	5.5	
(	0 to 0.07m 0.07 to 0.3 m 0.3 to 0.5m 0.5 to 0.75 m	Asphalt Gravel, 0.025m, rounded Fill, Black to dark brown, gravelly, sandy, some ash Clay fill, brown, soft, silty
TUOZ E	- 6	
	0 to 0.07 m 0.07 to 0.3m	Asphalt Gravel, 0.025m, crushed, some sand, some silt, occasional clay pocket
(	0.3 to 0.75 m	Clay fill, silty, occasional gravel, brick pieces, sand pocket, grey with black and brown stringers Note: solvent odour when auger first removed
TH97-5	5.61	
(	0 to 0.1 m 0.1 to 0.3 m 0.3 to 0.75 m	Asphalt Gravel, brown, 0.02m in diameter, sandy Clay, Fill, dark grey, silty, some sand pocket
TH97-5	5.62	
(	0 to 0.1 m 0.1 to 0.3 m 0.3 to 0.4 m 0.4 to 0.75 m	Asphalt Gravel Silt, light brown, possible ash Clay, black, some coal, silty, some sand pockets
TH97-5	5.7	
(	0 to 0.07 m 0.07 to 0.3 0.3 to 0.5 m 0.5 to 0.75 m	Asphalt Gravel, 0.025 m top size, some sand, some silt Fill, black, silty, some ash, some clay, occasional brick chip. Clay fill, grey with brown mottling, some brick chips, occasional sand pocket
TH97-5	5.8	
(	0 to 0.1 m 0.1 to 0.3 m 0.3 to 0.5 m 0.5 to 0.75	Asphalt Gravel, 0.025 m, rounded Sand fill, gravelly, dark brown Clay fill, brown, silty, occasional brick chip
TH97-5	5.9	
	0 to 0.1 m 0.1 to 0.3 m	Asphalt Gravel, 0.025 m crushed, sandy

0.3 to 0.75 m	Fill, clayey, dark grey to black, some coal powder, some sand
TH97-5.10  0 to 0.150 m 0.150 to 0.25 m 025 to 0.35 m 0.35 to 0.55 m 0.55 to 0.75 m	Asphalt Gravel, brown, sandy Sand, brown, some silt, occasional gravel Clay, brown, silty, some sand, some gravel Coal, black powder, some cinders and ash
<b>TH97-5.11</b> 0 to 0.1 m 0.1 to 0.25 m 0.25 to 0.75 m	Asphalt Gravel, 0.019m crushed, sandy Clay fill, sandy, silty, some sand pockets
TH97-5.12 0 to 0.15 m 0.15 to 0.2 m 0.2 to 0.3 m 0.3 to 0.6 m 0.6 to 0.75 m	Asphalt Gravel Sand, brown, some silt Coal, powder, fill, occasional gravel Sand, dark brown to black, some coal powder
<b>TH97-5.13</b> 0 to 0.2 m 0.2 to 0.75 m	Asphalt Gravel, brown, 0.019 m crushed, sandy
<b>TH97-5.14</b> 0 to 0.175 m 0.175 to 0.275 m 0.275 to 0.75 m	Asphalt Gravel, 0.012 m crushed Clay, dark brown to black, silty, some sand pockets, coal powder pocket
TH97-5.15 0 to 0.25 m 0.25 to 0.3 m 0.3 to 0.45 m 0.45 to 0.75 m	Asphalt Gravel, 0.019 crushed, some sand Fill, pink brick and some gravel Clay, grey, silty, some sand
<b>TH97-5.16</b> 0 to 0.2 m 0.2 to 0.75 m	Asphalt Gravel, 0.019 crushed, brown, dry, sandy
<b>TH97-7.1</b> 0 to 0.5 m 0.5 to 1.75m	Gravel fill Clay and sand

Ŧ		_	7	7	^
- 1	М.	31	/-	1.	Z

0 to 0.5 m Gravel fill

0.5 to 1.75m Clay, pieces of brick and sand fill

## TH97-7.3

0 to 0.05 m Asphalt 0.05 to 0.5 m Gravel fill

0.5 to 0.9 m black silty fill, refusal at 0.9 m

# TH97-7.4

0 to 0.05 m Gravel, brown and black, occasional piece of wire, fibreglass,

some sand no odour

0.05 to 2 m Clay fill, brown, silty, some sand, occasional gravel, coal chips

# TH97-7.5

0 to 0.07 m Asphalt 0.07 to 0.2 m Gravel

0.2 to 2 m Interbedded sand and clay, light brown, medium grained sand

with some silt and low plastic brown clay. Probable fill

#### TH97-7.6

0 to 0.07 m Asphalt 0.07 to 0.2 Gravel

0.2 to 1 m Sand, brown, medium grained, some silt 1 to 2 m Clay, brown, sandy, silty, moist to wet

### TH97-10.1

0.to 0.3 m Top soil, black silty, sandy, clayey, grass 0.3 to 1.5 m Fill clayey, some coal

1.5 to 1.75 m Clay, brown, silty, some sand

#### TH97-10.2

0 to 0.3 Top soil, black silty, sandy, clayey, grass 0.3 to 1.5 m Clay till-like fill

1.5 to 1.75 m sand, silty

### TH97-10.3

0 to 0.3 m Top soil, black silty, sandy, clayey, grass

0.3 to 1.75m Clay till-like fill

SOIL DESCRIPTION  REMARKS SOIL DESCRIPTION  REMARKS SOIL DESCRIPTION  SAND brown, readium to fine, sitty  Some interbedded lenses  GRAVEL AND SAND brown, fine sondy	SAMPLE TYPE BACKFILL TY	PE BENTONTE	PEA GRAVEL SLO		A-CASING ☐ GRAB SAMPLE ☐ CORE SA GROUT ☐ DRILL CUTTINGS ☐ SAND
Excovated with hydrovac  SAND brown, medium to fine, sitty  SILT light brown, trace fine sand, clayey  SILT light brown, trace fine sand, clayey  Fight brown, trace fine sand, clayey  GRAYEL AND SAND brown, munded gravel up to 50mm, medium to fine sitty sand, trace coal SILT brown, fine sandy  GRAYEL AND SAND brown, rounded gravel up to 75mm, medium to fine sitty sand, trace coal		#SPT (N) Blows/300 mms 10 20 30 40 PLASTIC M.C. LIG	■ REMARKS		
SILT light brown, trace fine sand, clayey  -5.0  - same interbedded lenses  -7.0  GRAVEL AND SAND brown, rounded gravel up to 50mm, medium to fine sitty sand, trace coal SILT brown, fine sandy GRAVEL AND SAND brown, rounded gravel up to 75mm, medium	- 1.0 - 2.0	10 20 30 40			uncertain
- same interbedded lenses  - same interbedded lenses  - same interbedded lenses  - same interbedded lenses  - GRAVEL AND SAND  brown, rounded gravel up to 50mm, medium  to fine sitty sand, trace coal  SILT  brown, fine sandy  GRAVEL AND SAND  brown, rounded gravel up to 75mm, medium				00000000000000000000000000000000000000	1
GRAVEL AND SAND brown, rounded gravel up to 50mm, medium to fine silty sand, trace coal SILT brown, fine sandy  GRAVEL AND SAND brown, rounded gravel up to 75mm, medium				30000000000000000000000000000000000000	- same interbedded lenses
711 171					brown, rounded gravel up to 50mm, medium to fine sitty sand, trace coal SILT brown, fine sandy GRAVEL AND SAND brown, rounded gravel up to 75mm, medium

CLIENT: EPCOR			PROJECT: ROS	SDALE N	ONITO	RING	
DRILLING CO.: CANADIAN			DATE DRILLED:				
DRILL METHOD: B61/ S	OLID STEM AUGER		LOCATION: SEE		<del></del>		
	HELBY TUBE	SPT	⊠ NQ RI			_	-CASING GRAB SAMPLE CORE SAMPLE
	entonite 🗀	PEA GRAVEL	∭ sro∧	<del>}</del> H		GF	ROUT DRILL CUTTINGS SAND
124   50	CPEN (kPo) ▲ 100 150 200 N) Blows/300 mm ■ 20 30 40	R	EMARKS	SLOTTED IEZOMETER	)SN	SYMBOL	SOIL DESCRIPTION
	M.C. EIQU	D		SLC		SOIL	DESCRIPTION \( \frac{2}{2} \)
10.0	20 30 40						GRAVEL AND SAND — CONTINUED = 615
11.0							CLAYSHALE alive green—grey, silty, some interbedded bentonitic sandstone
12.0				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			END OF TEST HOLE AT 12.2m ON COMPLETION: - Slough to 9.91m
13.0							- Water to 9.91m Groundwater elevation November 15,2000 616.08m
14.0							
15.0							610
16.0							-604 -604
17.0							
18.0							
19.0							
- 20.0	<u></u>			<del>_</del>		EU D	BY; TDC COMPLETION DEPTH: 12.2 m
Thurber Env.	ironment	al Con	sultants	Ltd.	REVIE	WED	D BY: DMB   COMPLETE: 06/10/00
01/01/30 11:56AV (THURPIEZ)	Edmonton	<u>Alberta.</u>	<del></del>		Fìg.		Page 2 of

CLIENT: EPCOR	Canadian Geologica!	<u>_,</u>	PROJECT: ROSS  DATE DRILLED:				HOLE NO: MW99-2 PROJECT NO: 14-35-79				
	: B61/ SOLID STEM A		LOCATION: SEE				ELEVATION: 625.02 (m)				
SAMPLE TYPE	<del>'</del>	SPT SPT	NO REC				AB SAMPLE CORE S	МА			
	PE BENTONITE	F. PEA GRAV	<u></u>		GR		ILL CUTTINGS SAND	_			
DEPTH(m) SAMPLE TYPE SPT(N)	DESTIC M.C.    CPEN (kPa)   A	200 100 = 40 40 = 40 UQUID = 40	REMARKS	WELL INSTALLATION USC	SOIL SYMBOL		SOIL CRIPTION				
- 1.0		Excava with hy	ited ydrovac			uncert <b>ain</b>					
- 3.0				KAKKK		SILT brown, fine sands, o lenses	occasional fine sand	_			
- 4.0											
- 6.0				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1							
7.0				- 53 - 63 - 63 - 63 - 63 - 63 - 63 - 63 - 6		SAND brown,med to fine, occasional fine rour					
8.0						gravel and <b>sand</b>					
9.0							oly up to 75mm coarse lity sand, moist				
10.0	· Environme		71 1	-    -	GED B	SANDSTONE Y: TDC	COMPLETION DEPTH: 10	0.7			
	11 '	retal Ca		1 + 21 1000	/ULU D	11 100	COMPLETE: 06/10/00				

CLIENT: EPCOR	PROJECT: ROSSDALE MOI		HOLE NO: MW99-2					
DRILLING CO.: CANADIAN GEOLOGICAL	DATE DRILLED: 6 OCTOBS		PROJECT NO: 14-35-79					
DRILL METHOD: B61/ SOLID STEM AUGER	LOCATION: SEE DRAWING		ELEVATION: 625.02 (m)					
SAMPLE TYPE SHELBY TUBE SPT	NO RECOVERY	A-CASING 0	RAB SAMPLE CORE SAMPLE					
BACKFILL TYPE SENTONITE PEA GRAVEL	SLOUGH	<b>₽</b> GROUT □ □	ORILL CUTTINGS SAND					
▲ CPEN (kPa) ▲ 50 100 150 200	EMARKS WELL INSTALLATION	)	SOIL CRIPTION					
10.0		light blue — grey,	fine grained, 615.0					
— 11.0		bentonitic SANDSTONE — CON END OF HOLE AT 1 ON COMPLETION: — Slough to 8.6m — DRY	0.67m					
12.0		Groundwater eleval November 15,2000						
13.0			612.0					
14.0								
15.0			—610.0 - - - - - -					
— 16.0								
18.0			- 607.0 					
F_19.0			—605.0 - - -					
Thurshon Environmental Con	aultanta [1d]	LOGGED BY: TDC	COMPLETION DEPTH: 10.7 m					
Thurber Environmental Con	L	REVIEWED BY: DMB	COMPLETE: 06/10/00 Page 2 of 2					
Edmonton, Alberta.	<u></u>	Fig. No:	Poge 2 of 2					

1.0 10 30 30 40  Lexawated with hydrovac  SILT brown, fine sandy, accasional fine grained sand lenses  5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0 5.0	CLIENT: EP					 PROJECT: ROS					HOLE NO:	MW99-3		
AMPLE TYPE SHELTS TURE IN PROCESSES IN PROCE						 								
ACKFILL TYPE PRATORITE   PAC GROVEL   SOLUTION   SOLUTI						 		1G 14-					ı F	
A SPEN (PS) A SPEN						 		<u>E</u>						
Lo Excavated  2.0 SLT prown, fine sandy, occasional fine grained sand lenses  5.0 SAND brown, coarse to medium grained, trace sitt  6.0 GRAYEL AND SAND brown, rounded gravel, up to 75mm medium to 8	T 1	Į	▲ CPEN (kPo) ▲ 50 100 150 200			 <u></u>			SYMBOL		SOIL			
Excavated with hydrovac  SILT brown, fine sandy, occasional fine grained and lenses  5.0  SAND brown, coarse to medium grained, trace sit  GRAVEL AND SAND brown, rounded gravel, up to 75mm medium brown, rounded gravel, up to 75mm medium	0.0		10	20 30	40					:-		- 1111		
3.0  3.1 SILT brown, fine sandy, accasianal fine grained sand lenses  4.0  5.0  5.0  5.0  5.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  7.0  6.0  6	- 1.0									uncertain			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
SILT brown, fine sandy, occasional fine grained sond lenses  5.0  5.0  5.0  5.0  5.0  5.0  5.0  5.	- 2.0	,				rac								
SAND brown, coarse to medium grained, trace silt  GRAVEL AND SAND brown, rounded gravel, up to 75mm medium	- 3.0									brown, fine sandy, o	occasional fir	ne grained		
SAND brown, coarse to medium grained, trace silt  GRAVEL AND SAND brown, rounded gravel, up to 75mm medium	- 4.0 - 5.0	:								,				
9.0  GRAVEL AND SAND brown, course to medium grained, trace silt  GRAVEL AND SAND brown, rounded gravel, up to 75mm medium	- 6.0													
B.0  9.0  9.0  GRAVEL AND SAND brown, coarse to medium grained, trace silt  GRAVEL AND SAND brown, rounded gravel, up to 75mm medium	- 7.0												<u> </u>	
GRAVEL AND SAND brown, rounded gravel, up to 75mm medium	- 8.0									brown, coarse to m	edium graine	ed, trace		
10.0   1   1   1   1   1   1   1   1   1											vel un to 75	inm medium	••••••••••••••••••••••••••••••••••••••	
burber Environmental Consultants Itd LUGGED BY: DC COMPLETION DEPTH: 12.2 m		-				 <del></del>		Loca	VED IN	<u> </u>			<u>E</u>	
nurber Environmental Consultants Ltd. Reviewed BY: DMB COMPLETE: 06/10/00 Edmonton, Alberta, Fig. No: Page 1	ľhurb	er				ultants	Ltd	REVIE	WED	BY: DMB		: 06/10/00		

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CUENT: EPCOR	?	· · · · · · · · · · · · · · · · · · ·	PROJECT: ROSS	PROJECT: ROSSDALE MONITORING WELLS HOLE NO: MW99									
DRILLING CO.:	CANADIAN GEOLOGICAL	· ·	DATE DRILLED: (	осто	BER 2	000	PRO	PROJECT NO: 14-35-79					
DRILL METHOD	: B61/ SOLID STEM AL	JGER	LOCATION: SEE	DRAWIN	G 14-	-35-		ELEVATION: 624.97 (m)					
SAMPLE TYPE	SHELBY TUBE	SPT	⊠ NO REC		E	<del></del>	CASING GRAB						
BACKFILL TY		PEA GRAVE	r IIII stong	) , <del></del> .		GR	OUT ORILL	DRILL CUTTINGS SAND					
DEPTH(m) SAMPLE TYPE SPT(N)	DESTIC M.C.  DESTICATION APPLICATION APPL	200 I	REMARKS	WELL INSTALLATION	nsc	TOBMILS YINBOL	SC DESCR	OIL APTIO	N 	ELEVATION(m)			
11.0				10010			to fine silty sand GRAVEL AND SAND - C	ONTINUED		614.0			
— 12.0							light grey, silty, fresh END OF TEST HOLE AT ON COMPLETION:	12.19m		613.0 			
13.0							<ul> <li>Slough to 10.50m</li> <li>Water to 9.83m</li> <li>Groundwater elevation</li> <li>November 15, 2000 61</li> </ul>	5 <b>.67m</b>		-612.			
14.0										- - - - - - - - - - - - - - - - - - -			
15.0										610			
- 15.0					;					609			
17.0										604			
					:					607			
19.0										- 60x			
20.0										<u> </u>			
	· Environme	ental Cor	sultants	Ltd	1066	ED B	Y: TDC		N DEPTH: 12.2 n	n			
Than ber		on, Alberta		· u .	Fig. N		RI: NWR	COMPLETE:		2 of 2			
01/01/30 11:56AN (7HU	<u>EUHIOHU</u> अन्त्रः	m, Albe <u>ita</u>			[19, 1	10.			1 000				

CLIENT: EPCOR	PROJECT: ROSSDALE MONITORING WELLS	HOLE NO: MW99-4
DRILLING CO.: CANADIAN GEOLOGICAL	DATE DRILLED: 5 OCTOBER 2000	PROJECT NO: 14-35-79
DRILL METHOD: B61/ SOLID STEM AUGER	LOCATION: SEE DRAWING 14-35-79-1	ELEVATION: 625.02 (m)
SAMPLE TYPE SHELBY TUBE SPT	NO RECOVERY A-CASING	
BACKFILL TYPE BENTONITE PEA GR	AVEL SLOUGH GROUT	DRILL CUTTINGS SAND
The stric ship is the strict of the strict	REMARKS NSC OSC SYMBOL SYMBOL	SOIL DESCRIPTION
1.0	— not — pos	ATED WITH HYDRO VAC able to log soil type or types sibly fill, some bricks and concrete in hydro vac hole
2.0	SILT brown zones	, fine sandy, occasional clayey CL
3.0		
4.0		
5.0		
6.0		
7.0		n, large to medium grained, silty, fine rounded gravel
8.0	5.41=1.41 I I I I I I I	a, fine sandy, occasional clayey CL
9.0	SS = 80 SS = 100 SS = 10	
10.0		
Thurber Environmental C	Consultants Ltd LOGGED BY: TDC	COMPLETION DEPTH: 15.2 m
Transor milyiroilliloilloil	ta. Fig. No:	B COMPLETE: 05/10/00 Page

CLIENT: EPCOR	PROJECT: ROSSDALE M		HOLE NO: MW99-4						
DRILLING CO.: CANADIAN GEOLOGICAL	DATE DRILLED: 5 OCTO			PROJECT NO: 14-35-79					
DRILL METHOD: B61/ SOLID STEM AUGER	LOCATION: SEE DRAWIN	G 14-35-		ELEVATION: 625.02 (m)					
SAMPLE TYPE SHELBY TUBE SPT	NO RECOVERY			GRAB SAMPLE CORE SAMPLE					
BACKFILL TYPE BENTONITE : PEA GRAVEL	IIII SLOUGH	GF	iour 🔲 i	ORILL CUTTINGS	SAND				
HEATIC M.C. LIQUID  10 20 30 40  10 20 30 40	EMARKS NSIALLATION	USC SOIL SYMBOL	DES	SOIL CRIPTIC	1	ELEVATION(m)			
11.0 - 12.0			GRAVEL AND SAND brown rounded gro & large grained sil		nm visible	615.0 614.0 612.0			
- 15.0 - 15.0			CLAYSHALE light grey, silty, fre END OF TEST HOLE ON COMPLETION: - Slough to 10.67 - Water to 10.94r Groundwater eleval November 15, 200	E AT 15.24m 7m n tions		610.0			
17.0						-608.0			
18.0					- 	<del>-6</del> 07.0			
19.0						-606.0			
	aultanta Ita	LOGGED B	Y: TDC		N DEPTH: 15.2 m				
Thurber Environmental Con	surrattis Lta.	REVIEWED	BY: DMB	COMPLETE:	: 05/10/00				
Edmonton, Alberta.		Fig. No:			Page 2 o	of 2			

9	€ Sta	antec	BOREHOLE RECORD										BH1						
C	CLIENTEPCOR											PROJECT No.1101							00
	OCATION	S											BH SIZE 150 mm						
D.	ATES (mm/	/dd/yy): BORING	<u> </u>		WA		LEVEL	Dry (	Feb 12	, 201		<u></u> 2	DATUM <u>Geodetic</u>						
(1)	(m)		P	-		SA	AMPLES		∃~			DRAII		HEAR 00	STREN		- kPa 20		
DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT		m	3ER	ÆRY	D.W.	MONITOR WELL/ PIEZOMETER			+			35		Wp	W	WL
DE	ELEV		STRA		TYPE	NUMBER	RECOVERY	N-VALUE OR RQD %	EZON				T & A		BERG L Pa	IMIT	S	0 1	<b>⊣</b> k
				+	$\rightarrow$	_		-0	MON	STAN	NDARI	) PEN	ETRAT	I NOI	TEST,				
- 0 -	625.217 625.07	_ASPHALT (0.15 m).		$\vdash$			mm			1	0 2	20	30 4	40 5	50 6	0 7	0 8	0	90
	025.07	FILL: Clay with sand and gravel.																	
		<ul> <li>occasional bricks, wood pieces, asphalt and cobbles encountered.</li> </ul>																	E I
-1-		- frost to approximately 1.8 m.																	-
																			E
2																			-
- 2 -																			E
									8556 1550										H
- 3 -																			E
	621.82				SS	1	0	7		•									
		Stiff brown low plastic CLAY (CL) trace to some sand, trace silt,		Į (	BS	2						* 0							
- 4 -		occasional coal fragments.			SS	3	50	11			<b>•</b> 0								E
		- SS3: loose brown sand lenses, trace gravel.		X	BS	4						<b>⊙</b> +							E
				V.	SS	5	152	6				Ö							
- 5 -	C10.00			X	BS	6						0							
L =	619.88	Loose brown silty SAND (SM).	////	M	SS	7	460	8											E
	619.42	- fine grained, damp.  End of borehole at 5.8 m.			30	1	400	G	A-350		O.								E
- 6 -		Upon completion borehole damp with																	E
		slough to 5.3 m 25mm standpipe installed to 5.3 m,																	
7 -		lower 3.0 m hand slotted and packed in																	E E
		sand, upper portion backfilled with cuttings and bentonite sealed.																	E
- 8 -																			E E
																			E
																			E
- 9 -																			
-																			E
10																			
-10-							1					1	1	Distri	Li			1	
	Groundwater table   Appld  Mar 4 2010 10:16:23																		

9	€ Sta	antec	В	OR	EH(	OL	E RE	COF	RD							BH	12		
C	LIENT	EPCOR										_	PRO	OJEC:	Г No.	1 <u>101</u>	4631	6.80	<u>00</u>
	OCATION		ject											SIZE		150	0 mm	1	52
D	ATES (mm/	/dd/yy): BORING			WA	TER	LEVEL	Dry (	Feb 12	, 201		<del></del> .		TUM			detic		-8.
<u>-</u>	(E)		Ь	-		SA	MPLES		- <b>-</b> -		UNI 50		ED SH		STREN 15		- kPa 20		
DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT		ш	<b>JER</b>	ERY	UE D%	MONITOR WELL/ PIEZOMETER			-				A CONTRACTOR OF THE PARTY OF TH	Wp	W	WL
DEP	LEV		TRA		TYPE	NUMBER	RECOVERY	N-VALUE OR RQD %	TOR	1000000			· & A			LIMIT		0	<b>→</b>
	ш		S	_		Z	8	20	MON	C.Susania Carl						BLOW	IS/0.3	3m (	
- 0 -	625.627	Transary 1	المراجعة	-			mm	<u> </u>	××× ××	10	0 2	0 3	0 4	0 5	0 6	0 7	70 8	30	90
-	625.58	TOPSOIL: brown to black (0.05 m).  FILL: Clay with gravel and sand.																	
- :-		- brown, loose, damp to moist.																	F
- 1 -		<ul> <li>occasional bricks, wood pieces, and cobbles encountered.</li> </ul>						1	<b>***</b>										F
-	624.13	- frost to approximately 0.9 m.		100															
		Loose brown SAND (SC) clayey, damp to moist.		$\delta$	BS	1						<b>&gt;</b>							
- 2 -		- clayey, damp to moist.																	-
																			E
-		- becomes black with some silt below		X	BS	2						0							=======================================
- 3 -	622.43	2.7 m.	,,,,	V	SS	3	200	8				0							F
		Firm brown sandy low plastic CLAY (CL).			33	5	200	6				, , , , , , , , , , , , , , , , , , ,							
		(CL).		V	DC	4													
- 4 -				()	BS	4						∷l⊖⋆							=
																			E
_ :		- sample SS5 was to friable to take a pocket pen reading.			SS	5	100	6		•		0							=
- 5 -	620.43	Loose brown fine grained silty SAND																	E
		(SM).		$\delta$	BS	6						) 							E
- 6 -		- damp to moist.																	Ė
- 0		- top 0.05 m of sample SS7 was slough.			SS	7	100	7			0								
_ [	619.03	End of borehole at 6.6 m.			30	7	100												H
- 7 <del>-</del>		Upon completion borehole open and																	:
		damp 25 mm standpipe installed to 6.6 m,																	
		lower 3.0 m hand slotted and packed in																	E
- 8 -		sand, upper portion backfilled with cuttings and bentonite sealed.																	E
																			E
																			E
- 9 -																			-
																			E
-																			F
-10-	72			577				<u> </u>		11111								1111	
	Groundw Appld	water table <u>*</u> Mar 4 2010 10:16:24																	

g	€ Sta	antec	ВС	)R	EH	OL	E RE	COF	RD							BH	13		
C	LIENT	EPCOR											PR	OJEC'	T No.1	1 <u>101</u>	4631	6.80	0
	OCATION	Rossdale Dechlorination Proj	ject											SIZE			) mm		500
D	ATES (mm	/dd/yy): BORING2/3/10	_	_	WA	TER	LEVEL	Dry (	(Feb 12	, 201	0)		DA	TUM		Geo	detic	Ů	-
	Ê		5			SA	MPLES		7						STREN				
(m)	ONO		PLOT			œ	<b>*</b>	ш%	ER	lacksquare	5	0	10	0	15	0	20	0	
DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA		TYPE	NUMBER	RECOVERY	N-VALUE OR RQD %	MONITOR WELL/ PIEZOMETER	WAT	ER CO	NTENT	ſ & A'	TTERE	BERG I	LIMIT	W <sub>P</sub> 'S ├──	W	WL
	EE		STR		F	Š	REC	N-V	IEZO	Pocl	ket P	eneti	romete	er kF	a)			*	1
	****		++	-		$\vdash$	mm		- 5	51.72					TEST,	2011			20
- 0 -	624.849	¬TOPSOIL (0.10 m).	7///	-	$\square$	$\vdash$	Han	s:	<b>XX X</b>	1	0 2	20 3	80 4	HO 5	50 6	50 7	0 8	30 9	90
1	624.73	FILL: Dark brown clay with some gravel				'													E
	1	and sand.																	F
- 1 -		<ul> <li>occasional bricks, wood and cobbles encountered.</li> </ul>		X	BS	1			<b>***</b>		a							لللله	F
-		- frost to approximately 0.9 m.																	E
	1	ETATO MAR		995.	20		150												H
- 2 -	1	- becomes grey to black with trace			SS	2	460	10				D: : : :					*		E
- 4		organics from 1.8 to 1.9 m.																	E
	622.15			$\delta$	BS	3					r	*							E
1	022.13	Soft to firm brown low plastic CLAY					[												E
- 3 -	1	(CL).			SS	4	355	4											E
	1	- some sand.			30	4	333	-					1						E
1	1			17	Ш	<u></u>	<u> </u>												E
- 4 -				Ŏ	BS	5	<u> </u>			11113	<b>†</b>	<del>   </del>	0 ::						
1						'													E
	1				20	<u></u>													F
- 5 -	619.79	77			SS	6	405	4		•		.Ox							F
}		Very loose to loose brown fine grained silty SAND (SM) to SILT.		V	70	-	<u> </u>												-
		- trace clay, damp to moist.		$\Diamond$	BS	7	<u> </u>				0								E
- 6 -	1	1000 a				'													E
-	1				SS	8	460	4			0								E
	1				30	0	400	4			Ÿ								F
_ ;				17	Ш	<u></u>	<u> </u>												E
- 7 -		- BS9: Sand: 25.2%, Silt/Clay: 74.8%		Ŏ	BS	9	<u> </u>				0								F
																			E
1					SS	10	460	7			0								F
- 8 -	616.75	F 1-ft1-1-at01m		_	SU	10	100		2000										ŧ
}	1	End of borehole at 8.1 m. Upon completion borehole damp with				'													E
}		slough to 7.9 m.				'													E
- 9 -	1	-25mm standpipe installed to 7.9 m, lower 3.0 m hand slotted and packed in				'													E
<del>]</del>	1	sand, upper portion backfilled with				'													E
	1	cuttings and bentonite sealed.				'													F
-10	,							n'											Ė
	Occupati								ļ										
!	App'd	water table ₹ Mar 4 2010 10:16:24							ļ										

g	€ Sta	antec	В	OREH	OL	E RE	COI	RD							BH	14		
C	LIENT	EPCOR										PR	OJEC'	г No.	11 <u>01</u>	4631	6.8	00
	OCATION		ject								<del>-</del> 3		SIZE			) mm		
D	ATES (mm/	/dd/yy): BORING	_	W/	ATER	LEVEL	Dry	(Feb 12	, 2010	0)		DA	TUM		Geo	detic	<u>:</u>	-8
	( <u>m</u>		10		SA	AMPLES	0.5-	7								- kPa		
H(m)	OL	OCU DECEDIDATION	A PLOT		œ	.R	ш%	WELL		50	)	10	0	15	0	20	in and a second	
DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA	TYPE	NUMBER	RECOVERY	N-VALUE OR RQD %	MONITOR WELL/ PIEZOMETER	WATE	R COI	NTENT	' & A'	TTERE	BERG I	JIMIT	W <sub>P</sub> S —	W -0	WL
_			STI	F	N	REC	A B	PIEZ	C. Solden Bresse				er kP			- 10 .	,	ŗ
	622.901					mm	3	ž	STAN					EST, 60 6	ner res	s/0.3 0 8		90
0 -	022.701	FILL: Clay with gravel and sand and											Ĭ					F
- 1 - 14		occasional cobbles hydrovaced to 3.0 m.																E
1		- strong hydrocarbon odours at 1.8 m.																E
1 -		- oil on water surface (water from																E
_	1	hydrovac) frost to approximately 1.8 m.																E
		active of the second																:
2 -																		<u> </u>
Ħ																		Ė
7	620.20	T' - 4 - 4'CC1 1 lectic CT AV																i F
3 -		Firm to stiff brown low plastic CLAY (CL).		V DC														E
		- black with strong hydrocarbon odours		≬ BS	1							D: : : :	*					E
5 60		from 2.7 to 3.7 m.																E
- 4 -		<ul> <li>becomes sandy, frequent rust stained fissures, occasional coal fragments, trace</li> </ul>		SS	2	460	13					*						E
ļ		gravel.		V	1 101	100					Ĭ							Ė
- 7	618.30	T 1 CANTO (OM) to OH T		∛ BS	3					1	Ż : : :							E
- 5 -	1	Loose brown silty SAND (SM) to SILT sand is fine grained		SS	4	460	8		•	0:								E
5		- little to some clay, damp						1										E
				∛ BS	5		et .				0							F
-																		Ė
6-		- wet with groundwater seepage at 6.1		CC		0000	623	1										F
	1	m.		SS	6	460	8		•		O							E
		- SS6: Silt: 53.5%, Clay: 18.2% - medium grained with gravel, frequent																E
- 7 -		coal seams.		BS	-						101							ŧ
	615.40	- BS8: Gravel: 16.1%, Sand:53.5%,	/ <b>■=</b> =	∑ BS	8				О									E
	615.30	Silt/Clay: 30.4%  COAL: black, moist.	100	SS	9	300	15			•								F
- 8 -		Compact brown, GRAVEL.	10															E
- -	1	- some sand, trace to little clay, frequent	74 - 25	V DC	10		-											E
		coal seams, damp to moist	00	∛ BS	10		<u></u>			3								Ė
9 -			50				Z:											-
H			00	SS	11	200	16			•	9							E
			10	580 8														E
-10-			19	V	1													F
	Groundy	water table <u>▼</u>																
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9	ે Sta	antec	ВС	DREH	OL	E RE	COF	RD									Bł	14		
C	LIENT	EPCOR												PR	OJEC	T No	1 <u>101</u>	4631	16.8	<u>30</u> 0
L	OCATION		ject								7200		30		I SIZI		15	0 mn	n	
D.	ATES (mm	/dd/yy): BORING2/3/10		WA			Dry (	Feb 12	, 2	201		n In I	-		TUM			odeti		_
(u	N(m)		LOT		SA	MPLES		∃ <sub>∞</sub>			·	50			00 00		50	- kPa	00	
DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	TYPE	NUMBER	RECOVERY	N-VALUE OR RQD %	MONITOR WELL/ PIEZOMETER	P	ocl	ket	Pe	neti	romet	er k				W	₩ <sub>L</sub>
10						mm		ž.	S		NDAI 0	ر 20						70 :	3m 80	90
-10-			36	X BS	12						) : :								Tiii	
- 4	612.20		00																	
-11-		End of borehole at 10.7 m. Upon completion borehole wet with																		
		slough to 7.9 m.																		
		- 25 mm standpipe installed to 7.9 m, lower 3.0 m hand slotted and packed in																		
-12-		sand, upper portion backfilled with cuttings and bentonite sealed.						2												
		- groundwater reading taken on Feb 12,																		
10		2010 was dry to bottom of standpipe (Note: standpipe was only installed to																		:::
-13-		top of slough at 7.9 m)																		
-14-																				<u> </u>
																				E E
-15-								3												
- 4																				
16																				:::E
-16-																				
<u> </u>																				
-17-								2												
-18-																				
- 4																				
- -19-																				
15																				
-20-	%			Sel .		17			-											:::
	Grounds	water table ₹ Mar 4 2010 10:16:24																		

g	€ Sta	antec	ВС	DREH	OL	E RE	COF	₹D							вн	5		
C	LIENT	EPCOR										PRC	ОЈЕСТ	No.1	1014	46 <u>31</u>	6.8	00
	OCATION		ect										SIZE	3 <del>- 1</del>		mm		
		/dd/yy): BORING2/3/10	5	WA	ATER	LEVEL	8.95	meters	(Feb	12, 2	<u>0</u> 10)		ГUМ	0	Geo	detic	3	
8	100000		-	2,	SA	AMPLES		Pagestra		UNI	RAINE	D SH	EAR S	TRENC	GTH -	kPa	4	
(m)	n)NC		PLO.	7	Ī		ľ	HE -		50	)	100	0	150	)	200	0	
DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	TYPE	NUMBER	RECOVERY	N-VALUE OR RQD %	MONITOR WELL/ PIEZOMETER	יש איי	ים מים	יייניטייי	ר א	TERBE	no I	тмтт(	Wp	W	WL
	ELE)		STR	<b>~</b>	NCM	ECO	4. A	EZO	1000000				r kPa		TMTTE		4	k
			"	_		_	-0	MO	11.500 WHINESE				ON TE		BLOWS	3/0.3	m (	
- 0 -	623.368		-777			mm	100	NO 100	1	0 2	30	40	50	60	7(	0 80	0	90
-	623.25	TOPSOIL (0.12 m).			'	!												
		FILL: Clay with gravel and sand occasional bricks, wood pieces and			'	!												H
- 1		concrete chunks encountered.			'	!												
- 1 -	1	- frequent asphalt chunks.			'	!												
		- frost to approximately 0.9 m.			'	!												E
					'	!											1	i E
2 -					'	!												=
	1				'	!												: [ ]
<u>.</u>	620.67				'	!												F
		Very stiff to stiff olive brown low plastic			'	!												
3 -	1	CLAY (CL).		∛ BS	1						0	*					iii	F
	1	- sandy with occasional gravel occasional rust stained fissures.		V													ıiii'	E
D uu	1	- moist.					l										1	
- <b>4</b> -				SS	2	460	16				g.	444			*		1111	<u>:</u> E
	1			V	100		<del></del>										ı iiii	i F
	1			∛ BS	3	ļ!	<u> </u>				O: *						(	F
	1	- sample SS4 hit a rock.		SS	4	0	12			• c								:-
- 5 -	618.17				<u>.</u>	-												F
14 12 12 12		Loose brown silty SAND (SM) to SILT.		BS	5					0								E
	1	<ul> <li>sand is fine grained, little to some clay, damp.</li> </ul>		V				日										E
- 6 -	1	-																1
	1	- SS6: Sand: 44.4%, Silt: 58.9%, Clay:		SS	6	460	8		•	0								ŧ
<u> </u>		16.7%			ESS.	- Colonia	0.000											F
7		- becomes moist below 6.7 m.		V 3.6		<u> </u>												:F
- 7 -	1			ŏ BS	7	<u> </u>					0							E
																		E
H	615.47	- trace coal, becomes wet with		SS	8	460	27											:
- 8 -		\groundwater seepage below 7.6 m.	20	SS	0	400	21				•						H	+
		Dense brown GRAVEL (GW).	50														ıiii.	Ė
75 6 <del>6</del> 9	1	- some sand and clay, occasional coal pockets, wet.	36	$\lozenge$ BS	9					0								E
9 -		potato, not	50															E
7	(12.07		36	00	10	150	25											T.
	613.97	Very stiff grey CLAY SHALE.		SS	10	460	35				)   	•					1	E
-		Dense brown GRAVEL (GW).	30															i F
-10-	5						Ē.	100200	1111		!!!!!	11111	11111	шш	!!!!!	!!!!!	1117	==
	Groundy	vater table <u>▼</u>																
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9	s Sta	antec	ВС	REH	OL	E RE	COF	RD							вн	15		
C	LIENT	EPCOR										PRO	)JECT	No.	1101	4631	6.8	00
L	OCATION		ject						- 10 March 1	2750 - 2 50 T D - 250	_	ВН	SIZE		150	mm	1	
D.	ATES (mm	/dd/yy): BORING2/3/10		WA		LEVEL	8.95 1	meters	(Feb				ГUМ			detic		<u></u>
(1	(m)		<u>10</u>	5	SA	MPLES	24	- I.		UND 50	RAINE	ED SH		STREN 15		kPa 20		
DEPTH(m)	ATIO	SOIL DESCRIPTION	TA PI	ш	ER.	ERY	UE D%	WEL						3		Wp	W	W <sub>T</sub> .
DEP	ELEVATION(m)		STRATA PLOT	TYPE	NUMBER	RECOVERY	N-VALUE OR RQD %	MONITOR WELL/ PIEZOMETER		R CON					IMIT	s į——	0	⊢ī د
	ш		S .	- 13 - 3	_	22	20	MON	11.50000011000000	IDARD					BLOW	S/0.3	m	
-10-	2	- some sand, clayey, occasional coal	10	∦ BS	11	mm		LAO'A		0 20	3(	) 4(	5	0 6	0 7	0 8	0	90
-		pockets, wet.	50	A 35														
	CARDON MONTH		20															E
-11-	612.37	Highly weathered grey CLAY SHALE	10															:-
		(BEDROCK).		V DC	12													
1		- damp		∛ BS	12													
-12-	611.17		且															i E
_		End of borehole at 12.2 m. Upon completion borehole wet with																E
12		slough to 9.0 m.																
-13-		<ul> <li>25mm standpipe installed to 9.0 m,</li> <li>lower 3.0 m hand slotted and packed in</li> </ul>																
- 6g		sand, upper portion backfilled with cuttings and bentonite sealed.																
-14-		cuttings and bemonite seared.																ii E
																		E
- 1																		E
-15-								3										<u>: F</u>
-16-																		: [
<u> </u>																		E
-17-																		
-1/-																		
-18-																		::-
																		E
G 60																		E
-19-																		<u>:</u>  -
_																		
																		E
-20-	b)		1 1	kirk	h			1		::::1	::::1	::::	::::					-
	Groundy Appld	water table \( \frac{\frac{1}{2}}{2} \) Mar 4 2010 10:16:25																

PHASE	3 ENVIRONMENTAL SITE ASSESS	SMENT	EPCOR									BOREHOLE	NO: 510002	27-3	301
	DALE ERD		DRILL:	SOLID	STE	M AU	IGER						NO: 5100027		
	NTON, ALBERTA	_	<u> </u>										: 618.24 m		
	LE TYPE SHELBY TUBE	DISTURBED		SPLIT		N		NO REC	OVERY			ASING	CORE		
BACK	FILL TYPE BENTONITE	PEA GRAVEL	Щ	SLOUG	H		4 1	GROUT			<b>∕</b> DRIL	L CUTTINGS	SAND		
Depth(m)	SOIL DESCRIPT	ION	SAMPLE TYPE	RUN NO	SPT(N)	SOIL SYMBOL	<b>■</b> G	ROCARB ASOLINE	VAPOL	JR (ppr	n) <b>■</b>		TES & MENTS	П	Depth(ft)
- 0.0	SAND — silty, dry, loose, brov	vn						0 10	JU 1	U	0	Pipe stickup	o = 0.82 metres	$\Box$	_ 0.0
E	,,,,,,							٠							Ē
Ė															Ē
1.0								•							<u>-</u>
E	CLAY — silty, moist, low plast	ic													= 50
E															5.0 
2.0								•							·E
Ē															
E								•							<u> </u>
3.0	1100														10.0
Ė	- stiff							٠							E
ĒĀ															: <b>T</b>
4.0	SAND AND GRAVEL — saturate	ed							+						Ė
Ė								*							Ė
F															15.0
5.0															E
Ė															<u>.</u>
-								•	+					<del>-</del>	F
6.0	END OF BOREHOLE (5.79 m														20.0
Ė	slough — 5.33 metres at 9 water — 3.73 metres at 7														E 2010
Ē	Monitoring well installed to	5.79m													E
7.0	,														E
Ė															E
Ē															25.0
8.0															E
Ē															Ē
Ē															E
9.0															30.0
Ė															E 30.0
E															E
10.0															Ē
Ė															Ē
Ē															35.0
11.0															E
Ė															E
Ē															Ē
12.0	D. Buguine	~~~~~				<u> </u>	1000	D BY:	DM			ICOMD!	ETION DEPTH: 5.	70	<u>F</u>
[ E	BA ENGINEERING	I'ANTS	3 L'	ľD.	.		NED B					ETE: 02/03/06	73 11	1	
M /NE /15	EDMONTON 03:26PM (ENV12)						o: 510		-01				age	1 of 1	

PHASE	3 ENVIRONMENTAL SITE ASSES	SSMENT	EPCOR								BOREHOLE	NO: 510002	27-3	02
ROSSE	DALE ERD		DRILL:	SOLID	STE	M AU	IGER				PROJECT N	NO: 5100027		
EDMON	NTON, ALBERTA										ELEVATION:	: 617.25 m		
SAMP	LE TYPE SHELBY TUBE	DISTURBED	$\boxtimes$	SPLIT	SP00	N		NO RECOVE	RY	A CA	SING	CORE		
BACK	FILL TYPE BENTONITE	PEA GRAVEL		SLOUG	H		4 1	GROUT		DRILL	L CUTTINGS	SAND		
S Depth(m)	SOIL DESCRIP	TION	SAMPLE TYPE	RUN NO	SPT(N)	SOIL SYMBOL	l	ROCARBON ASOLINE VAIO	POUR (pp		COM	ES & MENTS = 0.79 metres	7	S Depth(ft)
1.0 	CLAY — silty  — saturated  SAND AND GRAVEL — saturated  SAND AND GRAVEL — saturated  slough — 4.57 metres at water — 3.86 metres at Monitoring well installed to	metres) 0 hrs. 7 days to 5.49m		4 T.	TID.		LOGGE	D BY: DM				TION DEPTH: 5.	49 m	5.0
E	BA ENGINEERING	CONSUL	TANTS	j L'	ſIJ.			VED BY: C				TE: 02/03/06	.5 111	
02/06/12 /	EDMONTO						o: 51000					age '	of 1	
UZ/UU/12 L	MACHINE (CREEK)													

PHASE	3 ENVIRONMENTAL SITE ASSES	SMENT	EPCOR									BOREHOLI	E NO: 510002	27-3	303
ROSSE	ALE ERD		DRILL:	SOLI	) STE	M AU	JGER					PROJECT	NO: 5100027		
EDMON	NTON, ALBERTA											ELEVATION	l: 615.59 m		
SAMPL	LE TYPE SHELBY TUBE	DISTURBED	$\boxtimes$	SPLIT	SP00	N		NO REC	OVERY	1	A CA	ASING	CORE		
BACK	FILL TYPE BENTONITE	PEA GRAVEL		SL0U	GH		4 ^	GROUT			DRIL	L CUTTINGS	SAND		
Depth(m)	SOIL DESCRIP'	TION	SAMPLE TYPE	RUN NO	SPT(N)	SOIL SYMBOL	<b>■</b> G	ROCARBO ASOLINE	VAPOL	JR (pp	[ppm] <b>◆</b> m) ■ 4	СОМ	TES &		Depth(ft)
- 0.0 - 1.0 - 1.0 - 1.0 - 3.0 - 4.0 - 5.0 - 6.0 - 7.0 - 8.0	SAND — silty, organic at sur gravel, dry, brown — moist — some clay — saturated COAL — saturated SAND AND GRAVEL — silty, consultated — saturated — sa	obbles, metres) 0 hrs. 7 days						0 10	0 1	03	10	Pipe sticku	p = 0.77 metres		\$\frac{1}{2}\$ 5.0 \$\frac{1}{2}\$ 10.0 \$\frac{1}{2}\$ 15.0 \$\frac{1}{2}\$ 20.0 \$\frac{1}{2}\$ 15.0
11.0		0010111	D 13100				LOCCI	D BY:	WH			COMDI	ETION DEPTH: 4	27 m	35.0
E:	BA ENGINEERING	CONSUL	I'ANTS	3 L	TD.			NED BY					ETE: 02/03/06	.∠/ [[	'
02/0E/12 0	EDMONTO						o: 510		-03				Page	1 of 1	
UZ/UD/12 U	13.23FM (CRV12)														

PHASE	3 ENVIRONMENTAL SITE ASSES	SMENT	EPCOR								BOREHOLE	NO: 510002	7-3	04
ROSSE	ALE ERD		DRILL:	SOLIC	) STE	M AU	IGER				PROJECT N	NO: 5100027		
EDMON	NTON, ALBERTA										ELEVATION:	: 615.99 m		
SAMPL	E TYPE SHELBY TUBE	DISTURBED	$\boxtimes$	SPLIT	SP00	N		NO RECO	/ERY	A CA	SING	CORE		
BACK	FILL TYPE BENTONITE	PEA GRAVEL		SL0U0	GH		4 1	GROUT		DRILL	L CUTTINGS	SAND		
Depth(m)	SOIL DESCRIP'	ΓΙΟΝ	SAMPLE TYPE	RUN NO	SPT(N)	SOIL SYMBOL		ASOLINE V		(ppm) ◆ ppm) ■ 4 10	COM	ES & MENTS	7	Depth(ft)
1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	SAND — silty, organic at surclay, moist, loose, bro  — some clay  — saturated SAND AND GRAVEL — silty, some saturated, grey  END OF BOREHOLE (3.96 moles) slough — none at 0 hrs. water — 2.57 metres at 1 Monitoring well installed to 1 moles and 1 moles are 1 moles at 1 moles and 2 moles are 1 moles at 2 mole	ome clay, metres) 7 days										= 0.79 metres		10.0 10.0 10.0 10.0 10.0 10.0 10.0 10.0
E	BA ENGINEERING	TANTS	S L'	TD.			D BY: W VED BY:				TION DEPTH: 3. TE: 02/03/06	эь т		
	EDMONTON, ALBERTA					L		o: 5100			COIVIFLE		age	1 of 1
02/06/12 0	3:30PW (ENV12)	י, הטטטונוא					. 19. 110	5.000	, OT			ı	Jyu	. 🗤

PHASE	3 ENVIRONN	MENTAL SITE ASSESS	SMENT	EPCOR					E	BOREHOLE	NO: 510002	7-40	10
ROSSE	ALE ERD			DRILL:	SOLI	) STE	M AU	GER	F	PROJECT N	0: 5100027		
EDMON	NTON, ALBER	TA							E	LEVATION:			
SAMPL	E TYPE	SHELBY TUBE	DISTURBED	X	SPLIT	SP00	N	NO RECOVERY	A CASIN	G	CORE		
BACK	TILL TYPE	BENTONITE	PEA GRAVEL	$\overline{\mathbb{m}}$	SL0U	GH		<b>▲</b> *GROUT	DRILL C	UTTINGS	SAND		
							Ι.						
<u>ب</u>		SOIL		IYPE	0		SYMBOL			Mom	DO 0	ا ک ا	(£)
Depth(m)					RUN NO	SPT(N)	SYN	◆HYDROCARBON VAPOUR	(ppm)◆	NOT	ES &	BACKFILL	Depth(ft)
Dep		DESCRIPT	TON	SAMPLE	8	SP	SOIL	■ GASOLINE VAPOUR (p		COMN	MENTS	BAC	Оер
				S			SS	10 100 10	4	001111	121110		
- 0.0	ASPHALT —	(40mm thick)						10 100 10	10			///	_ 0.0
E		( Torrito timotic)											-
E	FILL				1			•					- -
1.0													-
-	SAND - sil	ty, dry, brown											- - -
-		,,,,			1			7					5.0
_ 2.0													-
=					1								-
-													-
_ 3.0												_	
J.U				1								10.0	
<u> </u>								1004					
E				1			•					<u>-</u>	
— 4.0 =								1000				-	
_													
-								<b>*</b>					15.0
5.0													_
Ē					1			•					-
-									1011				-
6.0								<b>-</b>	roicorrira-				
E													
-	– moist								****				<u>-</u>
- 7.0	FND OF BO	REHOLE (6.86 n	netres)					•				///	- -
Ē ,,,		none at 0 hrs.	1011 00)										-
-	water -	dry at 0 hrs.											
Ē ,	Note: E	Backfilled at compl	etion.										
8.0													<u>-</u>
É													-
E													-
9.0													30.0
E													<u>-</u>
Ė													-
10.0													
Ē													-
-													
11.0									184				<u>-</u>
E													-
Ė													<u>-</u> -
- 12.0													<u>-</u> -
F.	BA ENG	HINEERING	CONSUL	rants	S I.	ΠŢ		LOGGED BY: DM			TION DEPTH: 6.	86 m	
"	LITO	, ALBERTA		ם כ		ļ	REVIEWED BY: DM Fig. No: 5100027-05		COMPLE	TE: 02/03/18	age 1	of 1	
02/06/12 0	13:32PW (ENV12)	EDMION ION	, ALDUNIA					11g. 190. 3100027-03				uye I	UI I

PHASE	3 ENVIRONMENTAL SITE ASSE	ESSMENT	EPCOR				[	BOREHOLE NO: 5100	027-40	02
ROSSE	DALE ERD		DRILL: S	OLID S	STEM A	UGER	ſ	PROJECT NO: 5100027	'	
EDMON	NTON, ALBERTA						- [	ELEVATION:		
SAMPL	LE TYPE SHELBY TUBE	DISTURBED	⊠s	PLIT SF	POON	NO RECOVERY	A CASIN	NG CORE		
BACK	FILL TYPE BENTONITE	PEA GRAVEL	S	LOUGH		GROUT	DRILL C	CUTTINGS SAND		
			ш							
Œ	SOI	[,	I J	9 2	-   E	◆HYDROCARBON VAPOU		MOTEC 0.	_ ა	(tt)
oth(				RUN NO	SPI(N)	◆HYDROCARBON VAPOU	JR (ppm)◆	NOTES &	BACKFILL DETAILS	Depth(ft)
Depth(m)	DESCRIF	PTION	SAMPLE	S   2		■ GASOLINE VAPOUR	(ppm) <b>■</b>	COMMENTS	A B	Del
			S		U.	10 100 10	10			
- 0.0	ASPHALT - (40mm thick)									0.0
E	FILL									<u>-</u>
E						<b>*</b>				-
<u> </u>	SAND — silty, dry, brown									<del>-</del>
E										- - - 5.0
-										
2.0										<u>-</u> -
-			H			7				<u>-</u>
F										<u>-</u> -
_ 3.0										 10.0
E										_
-										-
- - 4.0										<u>-</u>
-										<del>-</del>
E										15.0
- 5.0										<u>-</u>
5.0										-
_										<u>-</u>
Ė										- - -
6.0										20.0
E										<u>-</u> -
<u> </u>	END OF BODELIOLE /0.00					•				-
7.0 	END OF BOREHOLE (6.86 slough — none at 0 hrs									<u>-</u>
E	water — dry at 0 hrs.	•								- 05.0
E	Note: Backfilled at con	npletion.								25.0
8.0										-
Ė										<u>-</u>
Ē										<u>-</u>
9.0										 30.0
Ė										=
Ė										=
10.0										<u>-</u>
E										<u>-</u>
Ē										35.0
11.0										-
Ė										<u>-</u> -
Ē							******			<u>-</u> -
12.0						LOCCED DV: DV		COMPLETION DEDTU	6.06 :	-
E	BA ENGINEERING	CONSUL'	ΓANTS	LT	D.	LOGGED BY: DM REVIEWED BY: DM		COMPLETION DEPTH:		
	EDMONT(	ON, ALBERTA				Fig. No: 5100027-0	)6	55 22, 55/	Page 1	of 1
02/06/12 [	03:33PN (ENV12)					<del>-</del>		•		

PHASE	3 ENVIRONN	MENTAL SITE ASSES	SMENT	EPCOR					BC	DREHOLE NO: 510	00027-40	03
ROSSE	ALE ERD			DRILL:	SOLI	) STE	M AU	GER	PR	ROJECT NO: 510002	27	
EDMON	NTON, ALBER	TA							EL	EVATION:		
SAMPI	LE TYPE	SHELBY TUBE	DISTURBED	X	SPLIT	SP00	N	NO RECOVERY	A CASING	CORE		
BACK	TILL TYPE	BENTONITE	PEA CRAVEL		SL0U	GH		GROUT	DRILL CU	TTINGS SAND		
Depth(m)		SOIL DESCRIPT		SAMPLE TYPE	RUN NO	SPT(N)	SOIL SYMBOL	◆HYDROCARBON VAPOUR (pp  ■ GASOLINE VAPOUR (ppm)  10 100 10 10 10	) <b>■</b> 4	NOTES & COMMENTS	BACKFILL DETAILS	Depth(ft)
- 0.0	ASPHALT -	(40mm thick)						10 100 10 10	,			0.0
<u>-</u>	FILL			Z				•				- - - -
1.0												-
E												- - - 5.0
Ė												_ 5.0
2.0									-111111			<u>.</u>
E												-
Ė												-
3.0												10.0
E												-
E												-
4.0												- -
Ē	SAND - sil	ty, dry, brown										_
E		,,,,										15.0
5.0												-
Ē	FND OF BO	REHOLE (5.33 n	netres)								///	-
E		none at 0 hrs.	netros)									- - -
6.0	water -	dry at 0 hrs.										20.0
E	Note: E	Backfilled at comp	letion.									-
E												-
7.0												<u> </u>
Ē												- -
E												25.0
8.0												-
E												-
Ė												<u>-</u>
9.0												
Ē												_ 50.0
Ē												-
10.0												-
Ē												-
Ē												35.0
11.0												- <u>-                                  </u>
Ē												<u>-</u> -
E												-
12.0	D. Bria		00310111	n 4 3 tm²	<u> </u>	mr.		LOGGED BY: DM		COMPLETION DEPTH		-
Ľ.	RA ENC	HINEERING		l'AN'I'S	s L	TD.		REVIEWED BY: DM		COMPLETE: 02/03,		
02/06/12 0	03:34PW (ENV12)	EDMONTON	I, ALBERTA					Fig. No: 5100027–07			Page 1	of 1

PHASE		EPCOR					DREHOLE NO: 5100027-404
		DRILL:	SOLI	) STE	M AU		ROJECT NO: 5100027
	ITON, ALBER <u>TA</u>						EVATION:
	E TYPE SHELBY TUBE DISTURBED			SP00	V	NO RECOVERY A CASING	
BACKE	ILL TYPE BENTONITE PEA GRAVEL	Щ	SL0U	GH		GROUT DRILL CUT	TTINGS SAND
Depth(m)	SOIL DESCRIPTION	SAMPLE TYPE	RUN NO	SPT(N)	SOIL SYMBOL	◆HYDROCARBON VAPOUR (ppm)◆  ■ GASOLINE VAPOUR (ppm) ■  10 100 10 4	NOTES & COMMENTS  BACKFILL DETAILS  Depth(ft)
- 0.0	FILL - grass, roots, (30mm thick)					10 100 10 10	0.0
-	CLAY — silty, dry, firm, brown						
1.0		Z	l				
_ -							5.0
2.0		Z					
	SAND — silty, trace of rock, loose, dark	Z				•	
3.0							10.0
-						• • • • • • • • • • • • • • • • • • • •	
-							
4.0							
-							15.0
3.0		Z	] ]			4	
<u>-</u> -							
_ 							
							20.0
_ _			1				
- - - - - 7.0							
-							
9.0							25.0
8.0		Z					
<u> </u>							
-						•	
9.0	04112 4112 021151						30.0
_	SAND AND GRAVEL — slight hydrocarbon odo	ur					
-							
— 10.0							
<u>-</u>	moist						
	END OF BOREHOLE (10.36 metres) slough — none at 0 hrs.						35.0
11.0	water — dry at 0 hrs.						
<u>-</u>	Note: Backfilled at completion.						
12.0							
$\mathbf{E}$	BA ENGINEERING CONSULT.	ANTS	S L	TD.		LOGGED BY: DM REVIEWED BY: DM	COMPLETION DEPTH: 10.36 m COMPLETE: 02/03/18
	EDMONTON, ALBERTA				L	Fig. No: 5100027–08	Page 1 of 1
02/06/12 0	3:35PM (ENV12)					*	

PHASE	3 ENVIRONMENTAL SITE ASSESS	SMENT	EPCOR				E	BOREHOLE	No: 51000	27-40	05
ROSSE	DALE ERD		DRILL: SOI	LID STE	M AU	GER	F	PROJECT I	NO: 5100027		
EDMON	NTON, ALBERTA						E	ELEVATION	:		
SAMPL	E TYPE SHELBY TUBE	DISTURBED	SPL	IT SPOC	IN	NO RECOVERY	A CASIN	IG	CORE		
BACK	FILL TYPE BENTONITE	PEA GRAVEL	SLO	UGH		GROUT	DRILL C	UTTINGS	SAND		
			W		٦						
Depth(m)	SOIL		SAMPLE TYPE	2	SYMBOL			NOT	TES &		Depth(ft)
pth	DECCDIDA	ווחזי	MPLE TY	SPT(N)	S	◆HYDROCARBON VAPOUR				BACKFILL DETAILS	pth
De	DESCRIPT	ION	SAM	:   0,	SOIL	■ GASOLINE VAPOUR (pp	om)∎	COM	MENTS	@ <u></u>	ے ا
			0,		0,	10 100 10	10				
- 0.0	FILL - grass, roots, (30mm										0.0
-	CLAY — silty, trace of sand a	ınd gravel,									<u>-</u>
	dry, brown										<u>-</u>
— 1.0 -											<u>-</u>
_											_ 5.0
Ē											=
2.0											-
_	CAND										-
-	SAND — silty, dry, brown					•					<u> </u>
3.0											10.0
Ē											<u>-</u>
-							844				-
E — 4.0							******				<u>-</u> -
E						•					<u>-</u>
-											15.0
- 5.0											<u>-</u>
=											<u>-</u>
F							**********				<u>-</u>
E — 6.0											<u>-</u>
- 0.0											20.0
_											<u>-</u>
- 7.0											<u>-</u>
- 7.0											<u>-</u>
-											 25.0
-											_ 23.0
— 8.0 =											<u>-</u>
E											<u>-</u> -
E						•					-
9.0											
_											<u>-</u>
-						The state of the s					-
10.0											<u> </u>
-	TND OF BODELIOLE /10.76					•					<u>-</u>
E	END OF BOREHOLE (10.36 slough — none at 0 hrs.	metres)									35.0
11.0	water — dry at 0 hrs.						*				<u>-</u>
E	Note: Backfilled at compl	etion.									<u> </u>
-	, i										<u> </u>
12.0								00115	ETION SESTING	0.70	<u>-</u> -
E	BA ENGINEERING	CONSUL	<b>FANTS</b>	LTD		LOGGED BY: DM REVIEWED BY: DM			ETION DEPTH: 1 ETE: 02/03/18	U.36 m	1
	EDMONTON				L	Fig. No: 5100027–09		CONTL		Page 1	of 1
02/06/12 [	3:37PM (ENV12)	,				J. 121 21222. 30				- 3 - 1	

	3 ENVIRONMENTAL SITE ASSESSMEN	IT E	PCOR						_			BOREHOLE	NO: 15232	2-201
ROSSD	ALE ERD SITE/94 AVE. AND 101 ST	D	RILL: S	SOLIC	) STE	M AU	GER					PROJECT N	NO: 0105-01-	15232.2
	ON, ALBERTA	S	OUTH 0				109					ELEVATION.		
		DISTURBED		SPLIT	SPOOL	N		O REC	OVERY		∏a ca'	SING	CORE	
BACKF	TILL TYPE BENTONITE :	PEA GRAVEL		SLOUG	H		(	ROUT			DRILL	CUTTINGS	SAND	-
Depth(m)	SOIL DESCRIPTIO	N	SAMPLE TYPE	RUN NO	SPT(N)	SOIL SYMBOL		SOLINE	0n Vap Vapou 30 10	•••	i) <b>=</b>		ES & MENTS	₩ELL INSTALLATION Depth(m)
0.0	TOPSOIL - (150mm thick)								=			Pipe sticku	p = 0.0 metres	0.0
1.0	SILT — clayey, trace of sand, dry medium plastic, light brown		N					4493	955 1111 1111 1111	**************************************	· oo iii			
- 2.0 E	TOPSOIL — damp, dark brown						:422		:4	. 443888				
3.0	SILT (TILL) — sandy, some clay, gravel, oxides, damp, low t plastic			:			6 65 En	- c-111		691X6	. 3			
4.0	CLAY (TILL) — silty, some sand, r medium to high plastic	noist,					- 64 (1 <b>6</b> 274)		* intention	********				
-									•					
5.0 -	TOPSOIL — organics, damp, dark	brown					4. 6900	4.44	•	ا تحد				5.0
6.0	<ul> <li>clayey, gravelly</li> <li>SAND — silty, rootlets, hydrocarb</li> <li>moist, grey</li> </ul>	on odour,					-0-600001 		•	******				
E 7.0			Z				1077			e est em				
-									•	,				
E 8.0							e costa	· (->>)	,,,,	- 50 1030	· » 11(£			
	– wet		E						•					
<u> </u>	,,,,,						6-10-20	1 2 2 2			**			
9.0	ODV.5	* 1 1							•					
¥	GRAVEL — silty, sandy, some clay hydrocarbon odour, moist,		-				6-6-380	(-(3))		o esta	0 1112			<b>F ¥</b>
10.0							\$1.5000M	(*)	*****	- 663000	**			10.0
F			Z				0.4440			- 441.00				
E 11.0							6 65-20	4- (-5))	2123	ojis				
<u> </u>							t tom	100	•	· •••: :				
12.0								\$ -3.2		*******				
E							(- <b>(</b> 200	4.400	*****	o sina	- 011II			
E 13.0	END OF BOREHOLE (12.95 met	res)					t tout		<b>_</b> ::					
E	slough — 10.06 metres at 0	hrs.					:420	4.4	***************************************	445.00				[
13.0	water - 9.66 metres on Dec.						6 (6)30			03103				[
	Monitoring well installed to 10	1.61m								*1111				
E 15.0														15,0
	BA ENGINEERING CO	)NSULT	ANTS	<u> </u>	ΠŢ		LOGGI						ETION DEPTH:	12.95 m
ן "	EDMONTON, A		. 34 1 1 1	- L		•			Y∙ WH 232-C	11		COMPL	ETE: 01/12/06	Page 1 of 1
01/12/11	OESTRI (EMISN)	TOTAL					11.14.11	<del>5. 15</del>	LUL	' 1				TOYO I VI I

		MENTAL SITE ASSES		EPCOR									BOREHOLE		<u>32–202 </u>
		TE/94 AVE. AND 10	of ST.			D STE								NO: 0105-0	1-15232.2
	NTON, ALBER		- Anna ranco	WEST OF							. h		ELEVATION		
	LE TYPE	SHELBY TUBE	DISTURBED			SPDO	N		_	OVERY		∏A CA		CORE	
BAUKI	TILL TYPE	BENTONITE	PEA GRAVEL	<u> </u>	SLOU	GH		<u>[4:]</u> (	ROUT	· · -	<u> </u>		. CUTTINGS	SAND	<del></del> _
LENGTH(m) (along axis)		SOIL DESCRIP		SAMPLE TYPE	RUN NO	SPT(N)	SOIL SYMBOL	<b>■</b> G/		VAPOU	OUR (pp IR (ppm) 3 10	}■		TES & MENTS	WELL INSTALLATION
0.0	SILT - sar	ndy, some clay, do	imp, low							<u> </u>	ĬÏ		Pipe sticki	up = 0.0 met	es d
1.0 2.0 3.0 4.0 5.0 6.0	– organ – some CLAY (TILL grav	nics, trace of tops e clay, lighter brow ) — silty, some so el, oxides, moist,	vn and, trace of					Colorate State of Colorate Sta	(44)	nineningamen kernekarangan miningan segiman berahajir sejiman danahakan perahajir sejiman 3 - 3 - 3 - 3 - 3 - 3 - 3 - 3 - 3 - 3 -	**************************************	indian magnama, managaman, managaman managaman managaman, pamagan angaman managaman			
9.0	plasi		oatuvatod.					6 4000		* 552	. 318	701 H			
10.0	SANU - SI   brow	ilty, trace of clay, m	suluroleu,					é	, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	A41					
11.0		silty, sandy, claye tic, brown	y, wet, low	2				6-3 E3 6-3 E3 6-0900	(498	\$ 35.5 \$ 25.5 \$	: u	÷÷			
13.0	slough water -	OREHOLE (12.19 — 11.76 metres o - 10.87 metres or ing well installed t	at 0 hrs. n Dec. 7, 2001					0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	27.1	200 M	9120				
E	BA ENG	GINEERING	CONSULT	rant:	SI	TD.		LOGGE REVIEN						ETION DEPTH ETE: 01/12/	
			N, ALBERTA				- 1			232-0	)2		COMPL	<u> </u>	Page 1 c
61/12/11 (	OCESTPN (DWISM)							_							

PHASE 3 ENVIRONMENTAL SITE ASSESSMENT	EPCOR	· -· ·	BOREHOLE NO 15232-203
ROSSDALE ERD SITE/94 AVE. AND 101 ST	DRILL SOLID STEM A		PROJECT NO: 0105-01-15232.2
EDM TON, ALBERTA	<del></del>	EAST OF BOREHOLE #201	ELEVATION:
SAMIFICE TYPE SHELBY TUBE DISTURBED	SPLIT SPOON	NO RECOVERY A CASIN	
BACKFILL TYPE BENTONITE PEA GRAVEL	SLOUGH	GROUT DRILL O	CUTTINGSSAND
SOIL DESCRIPTION	SAMPLE TYPE RUN NO SPT(N) SOIL SYMBOL	TO 100 10 10 10 10 10 10 10 10 10 10 10 10	NOTES & STOMMOD  WELL NSTALLATION  WELL NSTALLATION
TOPSOIL — dry, (150mm thick)  SILT — clayey, trace of sand, dry, low to medium plastic, light brown  TOPSOIL — damp, dark  CLAY AND TOPSOIL — wood, roots, oxides, medium to high plastic		6 1 5 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	
- 3.0  - 4.0 CLAY — silty, trace of sand and gravel, oxides, sticky, slight hydrocarbon odour, moist, firm, high plastic, grey brown mottled, slight staining	N N		5.0
SitT — sandy, clayey, trace of gravel, slight hydrocarbon odour, moist, soft, low to medium plastic, slight staining — less sandy			
9.0 GRAVEL — sitly, sendy, some clay, slight hydrocarbon odour, moist, free water, slight staining	N	CO CO COMPANY OF THE CONTROL OF THE	10.0 I 10.0
END OF BOREHOLE (12.95 metres) slough - 9.45 metres at 0 hrs. water - 9.51 metres on Dec. 7, 2001 Monitoring well installed to 11.11m		6 X1 6 (4)33 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	15.0
EBA ENGINEERING CONSUL	ጥለህጥር ነጥነ	LOCGED BY: WH	COMPLETION DEPTH: 12.95 m
		REVIEWED BY: WH	COMPLETE: 01/12/06
EDMONTON, ALBERTA		Fig No: 15232-03	Page 1 of 1

PHASE	3 ENVIRONMENTAL SITE ASSE	SSMENT	EPCOR							BOREHOLE	E NO: 152	32-204
	Dale erd site/94 ave. and 1	01 ST	·		) STEI					PROJECT	NO: 0105-0	1-15232,2
	NTON, ALBERTA						E, 2.5m E (	<del></del>		ELEVATION	l	
	LE TYPE SHELBY TUBE	DISTURBED			SPOO	<u> </u>	NO RECO		∭A CA		CORE	
BACKI	FILL TYPE BENTONITE	PEA GRAVEL	Щ	SEOU	GH		GROUT		<b>∕</b> DRIL1	CUTTINGS	SAND	
LENGTH(m) (along axis)	SOII DESCRIF		SAMPLE TYPE	RUN NO	SPT(N)	SOIL SYMBOL	◆HYDROCARBON ■ GASOLINE V 10 100	APOUR (ppr	. 1		TES & MENTS	WELL INSTALLATION
10	CLAY (TILL) — silty, some s oxides, damp, very fi medium plastic, brow	rm, low to	z				be-200 L (1)	201.00 • 201.00		Pipe sticku	up = 0.0 metr	res (
3.0 4.0 5.0	SAND — silty, trace of grav loose, brown	el, damp,						0 -981 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0 -941 0				
7.0 - 7.0 - 8.0	CLAY (TILL) — silty, some sorganics, damp to me plastic, brown — slight organic adour,  SAND — silty, slight hydrocomoist, grey	grey	2									
9.0 10.0 11.0 12.0 14.0	Monitoring well installed	to 12.38m	in 2				64680 44 22	**************************************	X			
E 15.0	EBA ENGINEERIN	G CONSUL	TANT	S I	TD		LOGGED BY. REVIEWED BY	r wh	I		LETION DEPTH LETE: 01/12,	/07
0174474	EDMONT	<u>ON, ALBERTA</u>	<u> </u>				Fig. No. 152	32-04				Page 1

PHASE	3 ENMRONMENTAL SITE ASSESS	MENT	EPCO	R									BOREHOL	.E NO: 15	232-2	05
ROSSD	ale erd site/94 ave. and 101	ST	DRILL	: S	OLID	STE	JAU	GER					PROJECT	NO: 0105-	-01-152	32.2
	ON, ALBERTA							Y FIRE	HALL				ELEVATIO			
	E TYPE SHELBY TUBE	DISTURBED				SPOOL	1	<u> </u>		OVERY		∐a ca!		CORE		
BACKF	ILL TYPE BENTONITE	PEA GRAVEL	[	<u>   </u>   \$	LOUG	H		<u>.</u> 0	ROUT			DRILL	CUTTINGS	SAND		
LENGTH(m) (along axis)	SOIL DESCRIPT	'ION		SAMPLE TYPE	RUN NO	SPT(N)	SOIL SYMBOL		SOLINE	0n Vap : Vapou		) <b>=</b>		OTES &	WELL	Depth(m)
0.0	VASPHALT - (100mm thick)							- 1					Pipe stict	kup = 0.0 m	netres 🔥	0.0
3.0	SAND AND GRAVEL CLAY (TILL) — silty, some sar moist, firm, medium pla TOPSOIL — silty, sandy, some moist, black brown CLAY (TILL) — silty, sandy, co deposits, oxides, damp firm, grey brown — sand pocket SAND — silty, trace of clay, r  CLAY (TILL) — silty, sandy, m topsoil, oxides, moist, f plastic — very sandy, trace of gravisible topsoil	astic clay, damp to irbonaceous to moist, moist ixed with firm, low				•			(con)		6 34X					
7.0	SAND — silty, trace of clay, r	moist, brown		N				com:	6-6-137	Yumman Am	*****					5.0
9.0 10.0 11.0 12.0 14.0	GRAVEL AND CLAY (TILL) — si oxides, moist, soft, me — increasing gravel  CLAY (TILL) — gravelly, silty, moist to wet, free water	sandy, er, soft, grey	TT A 16					6 com	6 (493) 6 (493)	0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.		01181 01181 01181 01181 01181 01181 01181	ICOM	Pletion Dei	PTH: 15.2	10.0 ¥
E	BA ENGINEERING	CONSUL	TAN	TT:	S L	TD				: WH				PLETE: 01/		т 111
	EDMONTON	V <u>ALBERTA</u>								232-0						e 1 of 2
01/12/11	OZJZPN (DWISN)															

										ONTON POWER	PROJECT: ROSSDALE PH				BOREHOLE NO: TH10-1	
			_							search Ltd.	DATE DRILLED: January 2				PROJECT NO: 14-35-168	_
		THOE	: N	5 Ti						_	LOCATION: See Drawing #	#14-35-168-1	1	<del> </del>	ELEVATION: 625.832 (m)	
SAME			_		_		GRA BEN		MPLI	E SAND		<u></u> .				
BAGK	.riLL 	, TYPE	_		_!		BEN	IIUN	112	<u>⊡</u> SANU			1			T
DEPTH (m)	SAMPLE TYPE						pmv)				REMARKS	WELL	INSTALLATION		SOIL RIPTION	
0		:	<u>0</u>	4	:	- 60 -:	;	80	140	-Frozen to 1.5m -Lab sample		Ш		ASPHALT SAND AND GRAVEL (FI		ŧ
-1	Ш									7				dark brown, trace silt, gra	avél up to 20mm diameter	-6
									120	2				CLAY (FILL) brown, silty, some sand,	trace gravel, occasional coal	+
∙2									100	-i.ab sample				·	- G	Ĭ.,
									.:	2 mm souther				-dark brown, trace wood	SAND /EILL	
-3	Ш								Δ···					COAL, CINDERS, AND Some bolts and clay	DAND (FILL)	****
-4	П								110	<sub>2</sub> -Lab sample				SILT, SAND, AND CLAY	(FILL)	ببلليب
	щ									<b>.</b>				brown, trace bricks, cinde	ers, and coal	
-5	Ш								Δ					SILT brown, sandy, trace clay		
-6												ß L		to a set of order of the		
•									\					-trace coal, more clay -becomes very sandy		1.1.1.1
-7																1
-8														SAND AND GRAVEL		-
				-1-						END OF TEST H	OLE AT 9.9m FION: (Below ground surface)		10.240.000.000	medium to coarse graine	a sand	1
-9						- 1			.)	-Slough at 9.1m Monitoring well in WATER LEVEL I -Feb 3, 2010 = 9	BELOW GROUND SURFACE:					
10					;				:						PONDIETON DEPT. AA.	- - - -
				ı.	<b>T</b> 4	<b>-</b> 11	رطا	e e	• ص	NGINEER	NG LTD.	PREPARE		SED BY: MFH	COMPLETION DEPTH: 9.9 m COMPLETION DATE: 21/1/10	
										ENVIRONMENTAL		REVIEWE			Page	

	-1110			. 4	1131				eparch I #4 # PAT	E DOILLED: January 40, 0040		Abo Inches	
	/h/=	THOE								E DRILLED: January 18, 2010 ATION: See Drawing #14-35-1		PROJECT NO: 14-35-168	
		TYPE	/. IVI	J (10				III AU LIAMA		ATION: See Drawing #14-35-1	68-1 	ELEVATION:	·
DEPTH (m)	SAMPLETYPE				PACE	(ррп	ı <b>v</b> }∆			REMARKS	DE	SOIL SCRIPTION	
0			20	40		60	_ 80	Δ 210	-Frozen to 1.4m  -Lab sample  -Slight hydrocarbon odor	шт	ASPHALT SAND (FILL), brown \up to 15mm diamete SAND, black, occasi CLAY (FILL) dark brown, sandy, t	onal gravel	
2								Δ.	-Lab sample		TOPSOIL, brown - b SAND, brown, mediu SILT brown, clayey, trace	ım grained	_/
3								Δ					
4								110					
;	II				0			110			-100mm thick sand se	eam	
;								150			END OF TEST HOLE	EAT 6.1m	
											UPON COMPLETION -No slough -No water	<b>1</b> ;	1
													11111111
	-												
0											<u> </u>		
									VOINEERING L'	TD. PREPAR	OGGED BY: MFH RED BY: MFH	COMPLETION DEPTH: 6.1 m COMPLETION DATE: 18/1/10	

CLIEN	≬T:∃	EPC(	OR (	GΕI	VEF	(AT	101	NΙΝ	C/E	DMC	NTON POWER	PROJECT	: ROSSDALE PI	HASE II E	SA			BOREHOLE NO: TH10-4	
DRILL	.ING	COI	VIP/	ΝY	: M	lobi	le /	\ug	ers 8	k Re	search Ltd.	DATE DRI	LLED: January 1	8, 2010				PROJECT NO: 14-35-168	
DRILL	/ME	THO	D:	M5	Tr⊔						· · · · · · · · · · · · · · · · · · ·	LOCATION	N: See Drawing t	<b>#14-35-</b> 1	68-1			ELEVATION: 625.051 (m)	
SAME							<u>ш</u>			MPLE					-				
BACK	FILL	TYF	E			2	<u> </u>	DRIL	LCL	MITTI	G\$ BENTO	NITE	SAND SAND			SLOUGH			
DEРТΗ (m)	SAMPLE TYPE			HÉA				(ייותב				REMAR	RKS		WELL INSTAL! ATION	DES		OIL RIPTION	El EVATION (m)
0	П		20		40		60	À	80	-	-Frozen to 1.4m -Very faint organic	odour				ASPHALT SAND AND GRAVEL of brown - black, gravel of	(FIL	.L) o 15mm diameter	1
I	Ϊ								<u>.</u>	À	-Lab sample					\-black SAND (FILL) medium to fine grained		aca coal occasional	/ E-62
	1			-					Δ							pebbles SILT	_	el and pebbles, occasional	62
									<u>.</u>										
	Ш									Δ						-cłay, occasionał pebbi	les		62
	П							Δ											62
					4					190	7					-fine sandy, trace coal, to 100mm thick	00	casional sand interbedded	62
	П							Δ.		: : :						SILT AND SAND fine grained sand			
	П									4	7					-trace oxide pockets ar	nd d	coal	6'
					4					3						-dark brown			6
																SAND brown, coarse grained			
											END OF TEST HO UPON COMPLETI -Slough at 9.1m -Water at 9.1m Monitoring well ins WATER LEVEL 88 -Feb 3, 2010 = 9.0	ON: (Below talled ELOW GRO	ground surface)						67
			:	:			:	:	:	1									上
0			<u>:</u>								ENGINEERII ENVIRONMENTAL			PREP	AREC	GED BY: MFH  BY: MFH		COMPLETION DEPTH: 9.9 m	<u></u>
								••••						REVIE	WEL	BY: NHF		Page	<i>i</i> 1 (

							ONTON POWER	PROJECT: ROSSDALE PHASE	ll ESA		BOREHOLE NO: TH10-5	
							esearch Ltd.	DATE DRILLED: January 18, 20			PROJECT NO: 14-35-168	
DRILL/M							•	LOCATION: See Drawing #14-35	5-168-1		ELEVATION:	
SAMPLE	TYPE		Į	∭G	RAB	Sampl	<u>,Ę</u>			<del></del>		
DEPTH (m)	מטונו הר וויב	△.HEA0 20 4	SPACE	E (ppn 60	nv).△ 81			REMARKS			SOIL RIPTION	DEPTH (m)
- 0		: :	: :		: :	:	-Frozen to 1.4m			ASPHALT		7-0
			<b>A</b>	Δ Δ Δ	4		-Lab sample			SAND AND GRAVEL (FI brown, medium to fine gr 20mm diameter -concrete SAND (FILL) brown, fine grained, some occasional coal inclusions CLAY brown to dark brown, son silty, trace roots -dark brown to brown -silty to very silty, occasional coal inclusions -dark brown to brown -dark brown to brown -silty to very silty, occasional coal inclusions -dark brown to brown -silty to very silty, occasional coal inclusions -dark brown to brown -silty to very silty, occasional coal inclusions -dark brown to brown -silty to very silty, occasional coal inclusions -dark brown to brown -silty to very silty, occasional coal inclusions -dark brown to brown -silty to very silty, occasional coal inclusions -dark brown to brown -dark brown -dark brown to brown -dark brown -d	e silt, trace organics, s	- 1-1-1-1-1-2-1-3-3-1-3-1-1-1-1-1-1-1-1-1-
-4				<b>A</b>						-occasional cobbles up to interbedded up to 100mm	30mm diameter, sand , trace oxides and coal	5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	ĺ,			Δ		;			-	SILT	<del></del>	_{
-7				4					_	clayey  SAND, brown, coarse grai  END OF TEST HOLE AT  UPON COMPLETION:  -No slough  -No water		6 7
10							NGINEERIN	IG LTD. PRE	D LOGGE PARED B	Y: MFH 0	COMPLETION DEPTH: 6.1 m COMPLETION DATE: 18/1/10	- 10

BOREHOLE LOG 14-35-168.GPJ THRBR AB.GDT 19/2/10-LIBRARY.GLB

<del></del>		ONTON POWERPROJECT: ROSSDALE PHASE		BOREHOLE NO: TH10-6
	NY: Mobile Augers & Re			PROJECT NO: 14-35-168  ELEVATION:
SAMPLE TYPE	M2.5 Track / Solid Stem A	·	<u>≻100-1</u>	ELGVATION.
DEPTH (m) SAMPLE TYPE	HEADSPACE (ppπn) Δ	REMARKS		SOIL CRIPTION
0	40 60 80	-Frozen to 1.4m	CLAY (FILL) dark brown, trace brick gravel COAL (FILL)	s and debris, occasional
-1		-Lab sample	COAL (FILL) black, trace gravel and	oxides -
	Δ	-Lab sample	CLAY (FILL) brown, trace rootlets an	Ē.
2		-Lab sample	SAND (FILL), brown, c SILT brown, sandy, clayey, t	
Δ.				- 
				,
<b>II</b>				
II A				- - - - - - - -
<u>II</u>	3		END OF TEST HOLE / UPON COMPLETION: -No slough -No water	
				ings and bentonite chips at
				  -  -  -  -  -
				# # # # # # # #
0				- - - - - - -
<u>× 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</u>	A TLU IDDED	ENGINEERING LTD.	FIELD LOGGED BY: MFH	COMPLETION DEPTH: 6.1 m
		ENVIRONMENTAL - MATERIALS	PREPARED BY: MFH REVIEWED BY: NHF	COMPLETION DATE: 20/1/10 Page 1

			NERATION INC/EDM		PROJECT: ROSSDALE F			BOREHOLE NO: TH10-7	
			/: Mobile Augers & R		DATE DRILLED: January	<del>- · · · · · · · · · · · · · · · · · · ·</del>		PROJECT NO: 14-35-168	
		TYPE	.5 Track / Solid Stem	-	LOCATION: See Drawing	#14-35-168-1		ELEVATION: 625.468 (m)	
		L TYPE	DRILL CUTTI		ONITE SAND	THE COLUMN TWO IS NOT	SLOUGH		
			<u> </u>	NO BUILD	MILE COMPO	<u>[]]]]</u>	SLOUGH		
DEPTH (m)	SAMPLE TYPE	△ HEA 20	.DSPACE (ppmv) ∆ 40 60 80		REMARKS		1	SOIL CRIPTION	
0		Δ		-Frozen to 1.2m			SAND, CLAY, AND GR	AVEL (FILL)	7.
							\dark brown, trace organ CLAY (FILL)	1ICS	√Ę,
1	Ш	Δ					very silty, trace oxides a	and gravel, occasional coal	-
•		<b>A</b>		-Lab sample			-trace bricks and glass (	debris	111111111111111111111111111111111111111
2	11.	Δ		-Lab sample					
}	11.	۵		-Lab sample			SILT brown, sandy, some da coal	y, trace pebbles, occasional	-{- - - - -
	II a								
) 									<u> </u>
5		Δ					-very sandy		F
	Π	A					SAND brown, fine grained		
3	Щ.	Δ					SILT brown, sandy, trace clay		أعديها
,							own, own, said var		11111
							SAND CHAVEL AND	ODDI EC	4
	-			END OF TEST HOL UPON COMPLETIC -Slough at 8.8m	.E AT 9.9m DN: (Below ground surface)		SAND, GRAVEL, AND Coobbles up to 100mm dia	ameter	
				Monitoring well insta	LOW GROUND SURFACE:				1311111
0					<del></del>		· · · · · · · · · · · · · · · · · · ·		<u> </u>
			THURBER 5	NGINEERIA	IG LTD.		ED BY: MFH	COMPLETION DEPTH: 9.9 m	
			GEDTECHNICAL . F			PREPARED I		COMPLETION DATE: 20/1/10 Page	

									_					PROJECT: ROSSDALE F			BOREHOLE NO: TH10-9	
				_	_				_	_			search Lid.	DATE DRILLED: January			PROJECT NO: 14-35-168 ELEVATION:	
		ETH( TYP		IVK						_	em <i>e</i> Sami			LOCATION: See Drawing	#14-30-100-1		ELEVATION:	
DEPTH (m)	SAMPLE TYPE		Δ	HE		SPA	CE	<del>(</del> pp	eriv)	}.Δ	•		<u>.                                    </u>	REMARKS			SOIL RIPTION	
0			<u>20</u>	:	41	) :	<u> </u>	60 :	:	<b>8</b> 0	<u> </u>	+	-Frozen to 0.	5m		SAND AND GRAVEL (F.	ILL)	
		1	į	-							1	3Q	-Lab sample			brown, gravel up to 15m	m diameter	Ė
I							Δ						-Lab sample			COAL (FILL), black CLAY (FILL) brown, silty, trace oxides	and coal	7
	П						Δ									-some brick pieces		11.4.1.4
	П						····											1.4.1.1.1
	.11.	-1-3								12			-Lab sample			SILT brown, sandy, occasiona	al oxides	
	11							Δ										
								Δ										
	1								<b>A</b>									
	JL						•••		 A							-very sandy END OF TEST HOLE AT	Г 6.2m	\[ \frac{1}{2}
																	gs and bentonite chips at	
																surface		111111
						-16												
																		-
		1	ij	Ā		T	н	ال	R!	91	EP	E	NGINE	ERING LTD.	FIELD LOG PREPARED	GED BY: MFH	COMPLETION DEPTH: 6.2 m COMPLETION DATE: 22/1/10	
		4												TAL . MATERIALS	REVIEWED		Page	e 1

ORILL/I	/ME	THOD			_			ğtıs	o u	esearch Ltd.		MILLO		PP∩   FCT NC) - 14 25 160	
SAMPL		-11100		~ 1	THE	k / 9	مزامة	4 Ch	-m Δι		DATE DRILLED: January 22		<u> </u>	PROJECT NO: 14-35-168	
		TYPE	. 17	ijι					em Au Bampl	_	LOCATION: See Drawing #1	4-35-100-1		ELEVATION:	
DEPTH (m)	SAMPLE TYPE	4			SPA	CE (	ррт	v)Δ			REMARKS			SOIL CRIPTION	
0	I		0	4	0		<u>c</u>	80	1	-Frozen to 0.5m -Lab sample			CLAY (FILL) brown - black, some silt gravel	, sand, and debris, trace	
1	112												-black, more brick debris	s	
	П					;				-Lab sample			-trace concrete debris		
·	П	Δ									,	,	SILT brown, trace sand and c	lay	•
, <u> </u> 	Ш	Δ.	;										-dark brown, trace wood	I	
	П	Δ											-light brown		
ſ		Δ											-sandy to very sandy, me	edium to fine grained sand	
Ī	4	4													
		<b>A</b>											END OF TEST HOLE AT UPON COMPLETION: -No slough -No water Backfilled with drill cutting	T 6.1m gs and bentonite chips at	
					1								surface	go and bentonine Chips at	
}															
2				:						· · · · · · · · · · · · · · · · · · ·	- I -	NEL D. LOSS	50.0% M(2)	OOLON TELEVISION	
			e P							NGINEERIN	JG LTD.	REPARED B		COMPLETION DEPTH: 6.1 m COMPLETION DATE: 22/1/10	_

														PROJECT: ROSSDALE				BOREHOLE NO: TH10-	
													search Ltd.	DATE DRILLED: Januar				PROJECT NO: 14-35-10	68
ORILI	_			: M	15 ]	Γu								LOCATION: See Drawing	g #14-35-	168-1		ELEVATION:	
AM	PLE	TY	PE				L	<u>[]]</u>	GR/	4B 8	AMP	LE							
DEРТН (m)	SAMPLE TYPE			ΔHI			ACI							REMARKS				SOIL SRIPTION	
0	$\frac{1}{1}$		:	: - - -	:	<u>40</u> :	:	60	:	80			-Frozen (o 0.3 -Lab sample	ām			SAND AND GRAVEL (F	ILL)	- (
1		1				Δ							-Lab sample				dark brown, trace debris CLAY (FILL) black, some gravel, sand and coal	d, and debris, trace oxides	
		] ]				Δ													
						ΔΔ			······································										
	П					900	Δ						-Lab sample				SILT brown, some sand and d	lay	_
						Δ											·	,	
	П	 					Δ										very sandy END OF TEST HOLE AT UPON COMPLETION: -No slough -No water	T 6.1m	
																		gs and bentonite chips at	
					···														7 4 1 4 7
0_		Ì	;			:	:	-	:	:	:								ŧ
0	1.				l L	<u>:</u> T	<u>:</u> -	<u>.</u>		<u>:</u> Bi	<u>:</u> EA		NGINEE	RING LTD.		FIELD LOG	GED BY: MFH BY: MFH	COMPLETION DEPTH: 6.1 m	
						G	<b>£</b> 0	TEC	ни	II C	AL .	ĘJ	NVIRONMENT	AL . MATERIALE		REVIEWED			age 1

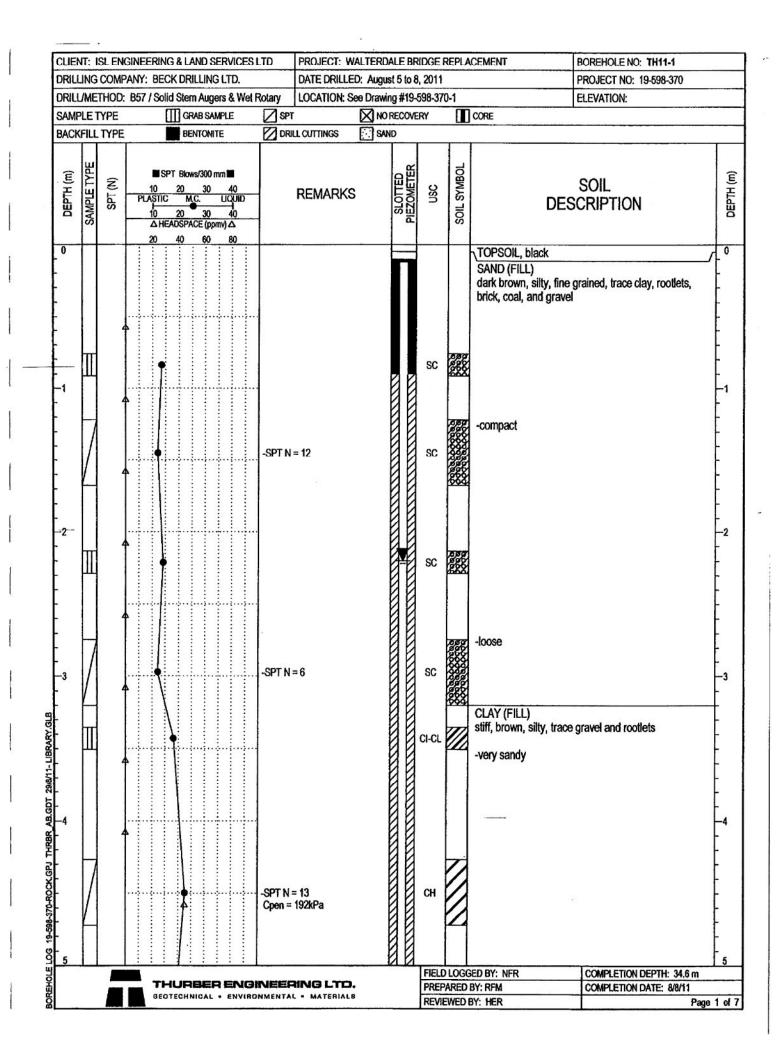
							_						ONTON POWER esearch Ltd.	PROJECT: ROSSD	<del></del>	· · · · · · · · · · · · · · · · · · ·	BOREHOLE NO: TH10-12	
DRILL										<u> </u>				DATE DRILLED: Ja LOCATION: See Dr		•	PROJECT NO: 14-35-168	
AME					<i>n</i> u	710					S SAI		*	LOCATION, See DI	awng #14-30-100-	<u></u>	ELEVATION:	_
DEPTH (m)	SAMPLE TYPE						PAC	Œ(	фит	nv) 2	Δ			REMARKS		DES	SOIL SCRIPTION	
0	+	+-	: 2	0	:	40 :	:	64	0	:	80 :	:	-Frozen to 1.0m			ASPHALT		
•		],			Δ	***************************************							-organic odour			CLAY (FILL) brown, some gravel up	o to 15mm diameter	
1												-40 <u>0</u>	,-Lab sample					
2								Δ		- 1 )		104	-Slight odour			-trace oxides and brick	s, occasional coal	_
3		-				************	Δ									dark brown, some san -100mm thick sand ler -clayey, trace sand, oc	se	
ļ	III.					Δ										-less clay		
5	Ш						2	Σ								-very sandy		
,	Ш						Δ									:		
3							4	Y								END OF TEST HOLE / UPON COMPLETION: -No slough -No water Backfilled with drill cutti		
								***************************************								surface	ngo am oumonino empe	
												-						
																o o		
0			<u>:</u>	:	-			:	:	<u> </u>	:	$\perp$		<u></u>	Turk B. Co.			
					ı								NGINEERIN		PREPARED	GED BY: MFH BY: MFH	COMPLETION DEPTH: 6.1 m COMPLETION DATE: 19/1/10	
					1	GE	ПŢ	EÇ	ни	ICA	ı ·	EN	AVIADNMENTAL .	MATERIALE	REVIEWED	BY: NHF	Pag	

												ONTON POWER	PROJECT: ROSSDALE PH			BOREHOLE NO: TH10-13	
									·			search Ltd.	DATE DRILLED: January 2		<u>.</u>	PROJECT NO: 14-35-168	
RILL	/ME	TH	OD;	М	2.5	Tra						Augers	LOCATION: See Drawing #	14-35-168-1		ELEVATION:	
AMP	LE	TYF	E					] G	RAE	SAI	MPLE						
DEPTH (m)	SAMPLE TYPE								πv) ,				REMARKS			SOIL RIPTION	
	Ш	H	<u>2</u> 1	) ;		10 <u> </u>	:	60 :	:	<u>80</u> :	:	-Frozen to 1.1m			SAND AND GRAVEL (F	ILL)	-
1			4	;								-Lab sample			brown, gravel up to 20m SAND (FILL) dark brown, some silt, tra -red wood	m diameter	
!	11			!								-Lab sample			SILT brown, some sand, trace	oxides and gravel	
	П				<u>^</u>										-less oxides and gravel		
	TI4	Δ			• • • •												1 1 1 1 3 1 4 4
		Z													-sandy		
															-very sandy		
			Δ					:	:						SAND brown, silty		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	:														END OF TEST HOLE AT UPON COMPLETION: (I -Slough at 6.0m -No water	Below ground surface)	
															Backfilled with drill cutting surface	gs and bentonite chips at	-
																	4 2 4 1 1 2 1
	:			}									,	:			
0																	-
J					ī								·		GED BY: MFH	COMPLETION DEPTH: 6.1 m	
		į			į							ENGINEER!		PREPARED		COMPLETION DATE: 20/1/10	
		- 1	П			GE	OT	ECF	(NI)	UAL	• !	ENVIRONMENTAL	MATCHIALS	REVIEWED	BY: NHF	Pa	ge 1

							search Ltd.	PROJECT: ROSSDALE P		<del></del>	PROJECT NO: 14-35-16	
		THOD:						LOCATION: See Drawing			ELEVATION:	
AMPL					GRAB S						ECLY/AIION.	
DEPTH (m)	SAMPLE TYPE		HEADSF					REMARKS			SOIL CRIPTION	
	Щ	<u>20</u> ∆	40	60	80		-Frozën to 1.1 -Lab sample	m		SAND AND GRAVEL (I brown, some silt and gr	FILL) ravel up to 15mm diameter	
I										SAND (FILL) some silt and brick piec	es, trace gravel	
		Δ.	-				-Lab sample			SILT brown, some clay, trace	e sand	
	4						-ran sampe			-sandy, Irace coal		
T	Π.	A								-very sandy		
	I .		Δ									
	Ι,	Δ										
	I I	Δ							i	END OF TEST HOLE A' UPON COMPLETION: -No slough	T 6.1m	
										-No water	gs and bentonite chips at	
												Ė
							NOB ITE	RING LTD.		GED BY; MFH	COMPLETION DEPTH: 6.6 m	
			Œ	ОТЕСН	NICAL	M E1	VIRONMENTA	L • MATERIALS	PREPARED REVIEWED		COMPLETION DATE: 20/1/10 Pag	_

CLIEN	П: Е	PCOR (	BENER	RATIO	NI NC	C/EDMC	ONTON POWER	PROJECT: ROSSDALE PH	ASE II ESA			BOREHOLE NO: TH10-15	
DRILL	ING	COMPA	NY: N	lobile	Auge	ers & Re	search Ltd.	DATE DRILLED: January 19	, 2010			PROJECT NO: 14-35-168	
DRILL	/ME	THOD: I	√15 Tru			Stern Au		LOCATION: See Drawing #	4-35-168-	1	. ,	ELEVATION: 625,605 (m)	
SAME	LE T	YPE				B SAMPLE			····			<u> </u>	
BACK	FILL	TYPE		$\mathbb{Z}$	DRIL	LOUTTIN	GS BENTO	NITE SAND		Ш,	SLOUGH	·	
DEPTH (m)	SAMPLE TYPE		HEADSF					REMARKS	WELL	INSTALLATION		OIL RIPTION	ELEVATION (m)
0 1 2 3 4 5 7 6 7 7 8 9 10 10 10 10 10 10 10 10 10 10 10 10 10		Δ Δ	40	2		80	-Slough at 8.8m -Water at 8.8m	ION: (Below ground surface)			ASPHALT SAND AND GRAVEL (FI dark brown, gravel up to CLAY (FILL) brown, trace coal and del SILT brown, sandy, trace pebb -some clay -300mm sandler layer -trace to some sand -some sand, more clay SAND brown, medium to fine gr SAND brown, medium to fine gr	bris, occasional oxides eles ained, silty	624
10-14-02-188							Monitoring well ins	ELOW GROUND SURFACE:	<u> </u>				616
3										_	GED BY: MFH	COMPLETION DEPTH: 9.9 m	
Ž							ENGINEERI ENVIRONMENTAL		PREPAR			COMPLETION DATE: 19/1/10	
<u> </u>				e u Ti	- UH NI		- JAINDRING NIAL	- min thutdle 9	REVIEW	ED	BY; NHF	Page	e 1_of '

		EPCOR GENERATION INC/ED		PROJECT: ROSSDALI	Clarent Control of the Control of th	BOREHOLE NO: TH10-16	
		G COMPANY: Mobile Augers &	The second secon	DATE DRILLED: Janua	The state of the s	PROJECT NO: 14-35-168	
		ETHOD: M5 Truck / Solid Stem		LOCATION: See Draw	ng #14-35-168-1	ELEVATION:	
AMF	STE.	TYPE GRAB SAM	PLE .				
DEPTH (m)	SAMPLE TYPE	△HEADSPACE (ppmv) △ 20 40 60 80		REMARKS		SOIL DESCRIPTION	DEPTH (m)
)	m	Δ	-Frozen to 1.6m		-\ASPHALT		-0
1		Δ	-Lab sample		SAND AND GRA brown, gravel up	VEL (FILL) to 15mm diameter, trace silt	1-1
		Δ	-Lab sample		COAL (FILL) black, trace cinde	rs	-2
<b>3</b>	Щ.	Δ	-Lab sample		COAL AND SANE black - dark brown	O (FILL) n, medium grained sand, occasional	3
	П.	Δ			gravel -brown, medium to	o fine grained	-4 -2
,		Δ			SILT brown, sandy		5
	Π.	Δ					-6
1100		Δ			-very sandy END OF TEST HO UPON COMPLETI -No slough -No water Backfilled with drill surface	DLE AT 6.2m ION: cuttings and bentonite chips at	
Visionin	20				our root		- 8
	•••						9
		THURBER	NGINEERIN	NG LTD.	FIELD LOGGED BY: MFH PREPARED BY: MFH	COMPLETION DEPTH: 6.2 m	- - - 10
	10		NVIRONMENTAL .		REVIEWED BY: NHF	COMPLETION DATE: 19/1/10 Page	



			& LAND SERVICE ORILLING LTD.	SLTD	PROJECT: V					LACEMENT	BOREHOLE NO: TH11-1	
			Stem Augers & We	t Rotary	DATE DRILLI LOCATION: S				-		PROJECT NO: 19-598-370	
SAMPLE			GRAB SAMPLE	SP1		NC NC				CORE	ELEVATION:	
BACKFILL			BENTONITE		LL CUTTINGS	SA				□ oour		
DEPTH (m) SAMPLE TYPE	SPT (N)	10 PLASTIC 10 A HEAR	Biows/300 mm  20 30 40  M.C. LIQUID  20 30 40  SPACE (ppmv) △  40 60 80		REMARKS		SLOTTED	OSC	SOIL SYMBOL	DE	SOIL ESCRIPTION	
5		۵		-Cpen =	: 144kPa			CI				
6		Δ	<b>)</b>	-SPT N =	= 14 144kPa			СН		-trace coal and brick	•	
,		<i>,</i>		-Cpen = 1	144kPa			СІ		-till - like -very stiff, sandy, till -	- like	
				-SPT N = Cpen = 1			8 8	CI				
		}						CI		SAND		
		•		-SPT N = ;	21			SM	9999999999	compact, brown to ligi grained, trace clay an	ht brown, silty, very fine to fine d brick	
		) Tp-11 11	RBER ENGI	NEED:	NG:			SC	LOGG	CIAY IENSES	ained, trace gravel, oxides, and	-
		GEOTEC	INICAL . ENVIRO	MENTAL	MATERIALS	•				BY: RFM	COMPLETION DATE: 8/8/11	
							- 1	REVIE	WEDE	BY: HER	Page	e 2 c

CLIENT: ISL ENGINEERING & LAND SERVICES LTD PROJECT: WALTERDALE BRIDGE REPLACEMENT BOREHOLE NO: TH11-1 DRILLING COMPANY: BECK DRILLING LTD. DATE DRILLED: August 5 to 8, 2011 PROJECT NO: 19-598-370 DRILL/METHOD: B57 / Solid Stem Augers & Wet Rotary LOCATION: See Drawing #19-598-370-1 **ELEVATION:** SAMPLE TYPE GRAB SAMPLE SPT NO RECOVERY CORE BACKFILL TYPE BENTONITE DRILL CUTTINGS SAND SAMPLE TYPE DEPTH (m) SPT Blows/300 mm SYMBOL SPT (N) DEPTH (m) nsc SOIL REMARKS DESCRIPTION 10 10 **GRAVEL AND SAND** very dense, brown, silty, coarse grained sand, trace coal and oxides -SPT N = 54 -Seepage -11 -Cpen = 120kPa GC 12 -SPT N = 46 **CLAY SHALE** light grey, massive, slightly weathered CH 13 -13 Start coring at 13.26m -Fractured and rubbled at GP GRAVEL 0/43 13.26m No recovery 0/0 **CLAY SHALE** 0/20 extremely weak, fresh, grey, occasional rock 14 0/91 -silty, trace cemented siltstone inclusions Rubble from 14.27 - 14.41m Core breaks at 14.48m, 22/78 14.59m, 14.77m, 14.84m, and 14.87m -Fractured and rubbled from -brown 14.89 - 15.04m FIELD LOGGED BY: NFR COMPLETION DEPTH: 34.6 m THURBER ENGINEERING LTD. PREPARED BY: RFM COMPLETION DATE: 8/8/11 GEOTECHNICAL . ENVIRONMENTAL . MATERIALS REVIEWED BY: HER Page 3 of 7

CLIENT:	ISL EN	GINEERING & LAND SERVICES L	TD PROJECT: WALTERD	ALE B	RIDGE F	REPLA	CEMENT	BOREHOLE NO: TH11-1	
		PANY: BECK DRILLING LTD.	DATE DRILLED: Augus					PROJECT NO: 19-598-370	
		B57 / Solid Stem Augers & Wet F						ELEVATION:	
SAMPLE	TYPE	GRAB SAMPLE	SPT NO	RECOV	ERY		CORE		6
BACKFIL	LTYPE	BENTONITE	DRILL CUTTINGS SAN	<b>1</b> D					
DEPTH (m) SAMPLE TYPE	SPT (N)	■SPT Blows/300 mm  10 20 30 40  PLASTIC M.C. LIQUID  10 20 30 40  △HEADSPACE (ppmv) △  20 40 60 80	REMARKS	SLOTTED PIEZOMETER	OSC	SOIL SYMBOL	1	SOIL CRIPTION	
-16	21/93	>>	-Core breaks at 15.23m and 15.34m -Rubble from 15.38 - 15.44m -Fractured and rubbled from 15.65 - 15.87m -Joint at 15.87m at 70° TCA, planar, rough -Joint at 15.96m at 80° TCA, planar, rough -Core breaks at 16.02m, 16.33m, 16.39m, and 16.46m				-carbonaceous -highly carbonaceous w	ith coal	
-17	40/98 0/82	*	-Fractured and rubbled from 16.55 - 16.80m, parallel disks -Rubble from 16.95 - 17.00m -Joint at 17.19m at 70° TCA, planar, rough -Joint at 17.27m at 80° TCA, undulating, rough -Joint at 17.41m at 80° TCA, undulating, rough -Joint at 17.50m at 80° TCA, undulating, rough -Joint at 17.50m at 80° TCA, undulating, rough -Large rubble from 17.82 - 18.21m				CLAY SHALE extremely weak, fresh, s SANDSTONE, extreme CLAY SHALE	grey, fine grained, clayey, silty	
	38/97	»	-Core breaks at 18.34m, 18.54m, 18.58m, and 18.91m				SANDSTONE extremely weak, fresh, r shale inclusions, trace s	nedium to fine grained, clay iltstone inclusions	
-19			-Rubble from 18.99 - 19.06m  -Core breaks at 19.15m 19.18m, and 19.25m  -Rubble from 19.34 - 19.38m  -Joint at 19.41m at 80° TCA, undulating, rough  -Joint at 19.50m at 70° TCA, planar, smooth  -Core breaks at 19.55m and 19.85m  -Rubble from 19.92 - 20.00m				CLAY SHALE very weak, fresh, brown -trace siltstone inclusion		1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
I					FIELD	LOGG	SED BY: NFR	COMPLETION DEPTH: 34.6 m	20
		THURBER ENGI			PREPA	RED	BY: RFM	COMPLETION DATE: 8/8/11	
		GEOTECHNICAL . ENVIRON	IMENTAL . MATERIALS		REVIE	WED	BY: HER	Page	4 0

CLIENT: ISL ENGINEERING & LAND SERVICES LTD PROJECT: WALTERDALE BRIDGE REPLACEMENT BOREHOLE NO: TH11-1 DRILLING COMPANY: BECK DRILLING LTD. DATE DRILLED: August 5 to 8, 2011 PROJECT NO: 19-598-370 DRILL/METHOD: B57 / Solid Stem Augers & Wet Rotary LOCATION: See Drawing #19-598-370-1 **ELEVATION:** SAMPLE TYPE GRAB SAMPLE SPT NO RECOVERY CORE BACKFILL TYPE DRILL CUTTINGS SAND BENTONITE SYMBOL DEPTH (m) SPT Blows/300 mm DEPTH (m) Ê SOIL SAMPLET USC REMARKS SPT DESCRIPTION SOIL 10 20 30 40 △ HEADSPACE (ppmv) △ -Core breaks at 20.04m and -extremely weak 26/88 20.09m -Fractured and rubbled from 20.18 - 20.39m very weak Core breaks at 20.53m, SILTSTONE 20.58m, and 20.90m very weak, fresh, light grey, trace clay shale inclusions **CLAY SHALE** -Rubble from 20.94 - 20.98m -21 and 21.08 - 21.13m very weak, fresh, brown, silty -Fractured and rubbled from Siltstone, weak to very weak, fresh, cemented 21.20 - 21.52m -highly carbonaceous, trace coal inclusions 33/80 Core breaks at 21.77m 21.81m, and 22.67m 22 -22 Siltstone, very weak, fresh, trace coal inclusions SANDSTONE very weak, fresh, fine grained, trace coal inclusions Joint at 22.82m at 80° TCA extremely weak -Core breaks at 22.87m, -medium to fine grained 22.90m, 23.10m, and 23.16m -23 67/99 -Joint at 23.54m at 70° TCA, undulating, rough -Core breaks at 23.66m -Fractured and rubbled from **CLAY SHALE** 23.73 - 23.81m and 23.91 extremely weak, fresh, silty 24.31m -very weak -24 SANDSTONE extremely weak, fresh, fine grained, silty, clayey, Core breaks at 24.52m and trace day shale inclusions and coal inclusions 24.61m 32/94 Rubble from 24.86 - 24.88m FIELD LOGGED BY: NFR COMPLETION DEPTH: 34.6 m THURBER ENGINEERING LTD. PREPARED BY: RFM COMPLETION DATE: 8/8/11 GEOTECHNICAL . ENVIRONMENTAL . MATERIALS REVIEWED BY: HER Page 5 of 7

		GINEERING & LA		LTD	PROJECT: WALTER				ACEMENT	BOREHOLE NO: TH11-1	
		PANY: BECK DR			DATE DRILLED: Aug					PROJECT NO: 19-598-370	
		B57 / Solid Sten			LOCATION: See Draw			70-1		ELEVATION:	
SAMPLE			AB SAMPLE	SPT		RECOV	ERY		CORE		
BACKFILI	L TYPE	BEI	NTONITE	DRIL	LCUTTINGS 🔄 SA	ND					
DEPTH (m) SAMPLE TYPE	SPT (N)	■ SPT Blow  10 20 PLASTIC M  10 20  △ HEADSPAI  20 40	30 40 C. LIQUID 30 40		REMARKS	SLOTTED	OSC	SOIL SYMBOL	DES	SOIL SCRIPTION	
-26	7/82		>»I	25.02m, -Fracture 25.13 - 2	eaks at 24,99m, and 25.08m ad and rubbled from 5.35m, 25.43 - 26.23m, 4 - 26.47m				CLAY SHALE extremely weak, fresh -bentonitic from 25.52 -bentonitic from 26.16 -trace coal inclusions	- 25.92m	
27				-Rubble for	aks at 26.55m rom 26.66 - 26.70m d and rubbled from 7.21m, 27.29 - 27.75m, i - 28.15m				-very weak, brown - gre	ey, silty, fine sandy	
28	15/92	<b>\</b>	>>	Core breeze	iks at 28,22m				-extremely weak		-
29	-			-Joints from 30° TCA, of -Core breat 28.64m, 28 -Fractured	m 28.23 - 28.34m at closed iks at 28.56m, 3.70m, and 28.74m and rubbled from 15m, 29.26 - 29.53m,				-very weak		
0	0/89		>> <b>••</b>						-slightly bentonitic from 2 -carbonaceous from 29.4		
V 11	_	. : <u>  : : :</u>	::::1	_		Щ,	EIEI D :		550 450		3
		THURB	ER ENGIN	JEERIF	NG LTD.				D BY: NFR	COMPLETION DEPTH: 34.6 m	
		GEOTECHNIC	AL . ENVIRON	MENTAL .	MATERIALS		PREPAR			COMPLETION DATE: 8/8/11	
						- 1	KEVIEW	VED BY	Y: HER	Pay	ne 6 of

CLIEN	VT:	ISL EN	GINEERING & LAND SERVICES	LTD	PROJECT: W	ALTERD	ALE BR	IDGE R	EPLA	CEMENT B	OREHOLE NO: TH11-1	
DRILL	ING	COME	PANY: BECK DRILLING LTD.		DATE DRILLE	D: Augu:	st 5 to 8	, 2011		P	ROJECT NO: 19-598-370	
	_		: B57 / Solid Stem Augers & Wet		LOCATION: Se						LEVATION:	
		TYPE	GRAB SAMPLE	Ø SPT		⊠ NO		RY		CORE		
BACK	FILI	L TYPE	BENTONITE	DRIL	L CUTTINGS	SAN	ID T					
DEPTH (m)	SAMPLE TYPE	SPT (N)	■SPT Blows/300 mm  10 20 30 40  PLASTIC M.C. LICUID  10 20 30 40  △ HEADSPACE (ppmv) △  20 40 60 80		REMARKS		SLOTTED PIEZOMETER	nsc	SOIL SYMBOL		SOIL CRIPTION	(m) UT000
-31		35/99	*	30.08m, 30.17m -Fracture 30.23 - 3 -Joint at undulatir -Core bro 30.52m, 30.75m,	eaks at 30.03m, 30.11m, 30.15r ad and rubbled a 30.33m at 70° 19, rough eaks at 30.41m, 30.58m, 30.69r 30.96m, and 31	n, and from TCA, n,				Sandstone extremely weak, fresh, g -fine sandy from 30.75 -		-3
-32		44/100	>>	-Core bre 32.14m, -Joint at slightly u -Core bre 32.35m,	ed and rubbled f 1.87m eaks at 31.94m, and 32.16m 32.23m at 80° 1 ndulating, smoo eaks at 32.27m, 32.44m, 32.48n 32.67m, and 32	ΓCA, oth				-weak -very weak		-3
33		28/97	<b>&gt;</b>	-Joint at 3 closed -Fracture	d and rubbled f 3.04m, 33.03 - 1 - 33.52m 33.56m at 50° 1 d and rubbled f 3.84m 33.84m at 60° 1	33,22m, FCA, From				Calcite, very weak to me Siltstone very weak to medium st		-3
34				planar, si -Core bre 34.05m, 3 34.44m WATER I GROUND		n, and			-	extremely weak, fresh, t  END OF TEST HOLE A  UPON COMPLETION: Backfilled with drill cuttir	AY SHALE INTERBEDDED race siltstone Inclusions	
<u> </u>					***			FIELD	LOGO	SED BY: NFR	COMPLETION DEPTH: 34.6 m	13
		=	THURBER ENG							BY: RFM	COMPLETION DATE: 8/8/11	
			GEOTECHNICAL . ENVIRO	NMENTAL	. MATERIALS			REVIE	WED	BY: HER	Page	7

	CATIO	NRossdale Water Treatment Plant m/dd/yy): BORINGNovember 2	25, 2011 -		W	ATED I EXT	EL			Bore N E		Coordinat	123310766 res
		ntractor : All Service	3.	no N		d : Solid Stem		Logge	1 By : R		uiii i	100	
T		nuacioi .		U	VICTIO	20.00.000000000	PLES	Ворре	, <u> </u>		9. 2		
5	ELEVATION(m)	SOIL DESCRIPTION		STRATA PLOT	TYPE	NUMBER	SAMPLE	LAB SAMPLING	VAPOUR LEVEL GASTECH (ppm)	VAPOUR LEVEL PID (ppm)	WATER LEVEL		WELL NSTRUCTION DETAILS
ŧ		\ ASPHALT (100 mm)	r <b>9</b>	***					-		9 9	81 T T	Flush Mount Road
1		SAND AND GRAVEL FILL; brown (200 mm)		▓									51 mm Diam, Sch
l		CLAY FILL; some silt and sand; occasional grave	l and	▓									40 Solid PVC
1		debris (concrete, asphalt, bricks, timber); dark brov	×	▓									Bentonite
1		,,,,		▓									
		SAND and GRAVEL FILL: some clay; dark brow	n	$\bowtie$									
I		CLAY FILL; some silt and sand, occasional grave	Ω	$\overset{**}{\otimes}$									
L		debris (concrete, asphalt, bricks, timber); dark brov	wn	▓									
		SILT (ML); some clay; brown loose; low plastic											
l					I AC		37 - 40m	*/DTS/	10				
					AS	1	3 / - 40 m	*(BTX)	10				
					AS	2	43 - 46m		5				
		SILT (ML); sandy; some clay; brown; loose to cor											
		low plastic	прасі,		AS	3	52 - 55m		< 5				
		- becomes sandier below 5 5 m (fine grained sand											
		Street and district to a sea of concerning and the second of the second and the s			AS	4	58 - 61 m	*(BTX)	5				
					AS	5	64 - 67m		10				
													12001
l					AS	6	73 - 76m		10				Sand 51 mm Diam, Sch
						1			0.000				40 Slotted PVC
					AS	7	82 - 85m	-	15				
l		- at 8 5 m : 150 mm silty sand seam			AS	1	82 - 83 m		Б				:
		52			AS	8	88 - 91 m		20				:
ŀ		SAND and GRAVEL; rounded and angular gravel	10 KG	$\frac{1}{2}$									
		occasional cobbles; interbedded with silty sandy (	23	0	AS	9	98 - 101 m	-	20		₹		
		dark brown; very dense		0					3. Table				. D. C.
		- seepage at 10 4 m	5	0	AS	10	104 - 107m	*(BTX)	30				51 mm Diam, Sch 40 Solid PVC
				) (									Fill
			5	0	AS	11	11 3 - 11 6 m		60		1		8
		End of borehole at 11 6 m due to refusal / practical	further										
		auger penetration Upon completion water at 9 1 m with slough to 9 8	3 m										
		* BTX = Sample submitted to laboratory for analy	100 V 2004										
		BTEX F1-F4											
l													
l													
l													

STANTEC MONITOR WELL DETAILED WITH DEPTH 123310766 ESAR BH LOG.GPJ MASTERI.GDT 1220/11

CL EN	T	EPCOR GENERAT ON NC/EDMONTON POWER	PROJ	ECT ROSSDALE POWER PLANT WELL NSTALLA	T ON BOREHOLE NO TH	12-1
DR LL	NG	G COMPANY Mobile Augers & Research Ltd	DATE	DR LLED October 23 2012	PROJECT NO 14-35	5-185
DR LL	/ME	THOD M5 Truck / Hollow Stem Augers	LOCA	T ON See Drawing #14-35-185-1	ELEVAT ON 625 11	(m)
SAMP	LE	TYPE				
BACK	FLL	L TYPE GROUT BENTON 1	ΓE	SAND		
DEPTH (m)	SAMPLE TYPE	REMARKS	WELL NSTALLAT ON	SOIL DESCRIPT	ION	ELEVAT ON (m)
0 11 2 8 9 10 10 10 10 10 10 10 10 10 10 10 10 10				CLAY (FILL) brown, s ty, sandy, trace grave -dark brown - b ack, some grave, br ck, and org  CLAY (TILL) brown, s ty, sandy, trace ox des, grave, and co  GRAVEL AN COBBLES s ty, sandy, c ay  SAND AND GRAVEL med um gra ned, very s ty  END OF TEST HOLE AT 10.2m UPON COMPLETION:		-624 -623 -622 -621 -621 -619 -618 -617 -616
BOREHOLE LOG 14-35-185 GPJ HRBR AB GD 3/18/13-L BRARY-NEW LOGO GLB				-Trace s ough -Trace water Mon tor ng we nsta ed WATER LEVEL BELOW GROUND SURFACE: -November 30, 2012 = 9.66m		613
OLE			357	F ELD LOGGED BY EMS	COMPLET ON DEPTH 10 2 m	W.
REH				PREPARED BY RTB	COMPLET ON DATE 10/23/12	Apr. 10 101
8		THURBER ENGINEERING LTD.		REV EWED BY NHF		Page 1 of 1

CL EN	IT	EPCOR GENERAT ON NC/EDMONTON POWER	PRO	JECT ROSSDALE POWER PLANT WELL INSTALLA	T ON BOREH	HOLE NO TH12-2
DR LL	NG.	G COMPANY Mobile Augers & Research Ltd	DATI	E DR LLED October 24 2012	PROJE	ECT NO 14-35-185
DR LL	/ME	ETHOD M5 Truck / Hollow Stem Augers	LOC	AT ON See Drawing #14-35-185-1	ELEVA	T ON 625 05 (m)
SAMP						
BACK	FLI	L TYPE GROUT BENTON	TE	SAND		
DEPTH (m)	SAMPLE TYPE	REMARKS	WELL NSTALLAT ON	SOIL DESCRIPT	TON	ELEVAT ON (m)
-1 -2 -3 -5 -6				SAND (FILL) b ack sh brown, s ty, organ c sta ned, some broce  CLAY (FILL) b ack sh brown, s ty, sandy, organ c sta ned, tra		-624 -623 -622 -622
0 10 T1				GRAVEL brown, s ty, sandy, trace cobb es  SAND very s ty, med um gra ned		-616 615 614
BOREHOLE LOG 14-36-185 GPJ HRBR AB GD 3/18/13-L BRARY-NEW LOGO GLB				END OF TEST HOLE AT 11.7m UPON COMPLETION: (Be ow ground surface) -No s ough -Water at 11.4m Mon tor ng we nsta ed		-613 -612 -611
HOLE		<u></u>		F ELD LOGGED BY EMS	COMPLET ON DEP	
N N		THIRDER CAICIAISCRIAIC ITS		PREPARED BY RTB REV EWED BY NHF	COMPLET ON DAT	E 10/24/12 Page 1 of 1
מ		THURBER ENGINEERING LTD.		NET LITED DI WIII	l	raye i U

CL ENT EPCOR GENERAT ON NC/EDMONTON POWER	PROJE	ECT ROSSDALE POWER PLANT WELL NSTALLA	TON	BOREHOLE NO TH12	2-3
DR LL NG COMPANY Mobile Augers & Research Ltd	DATE	DR LLED October 25 2012		PROJECT NO 14-35-	185
DR LL/METHOD M5 Truck / Hollow Stem Augers	LOCAT	T ON See Drawing #14-35-185-1		ELEVAT ON 624 93 (r	m)
SAMPLE TYPE					
BACKF LL TYPE GROUT BENTON TO	E	SAND SLOUGH			
SAMPLE TYPE SAMPLE TYPE SAMPLE TYPE	WELL NSTALLAT ON	SOIL DESCRIPT	ION		ELEVAT ON (m)
-1 -2 -3 -4 -5		CLAY (FILL) b ack sh brown, s ty, sandy, some br ck chunks	, trace grav	/e	-624 -623 -621 -620 -619
		SAND brown, very s ty, f ne gra ned			-618 -617
_9 _9 _9		GRAVEL s ty			616
10	-	END OF TEST HOLE AT 9.9m UPON COMPLETION: (Be ow ground surface) -S ough at 9.8m -Water at 8.2m Mon tor ng we nsta ed WATER LEVEL BELOW GROUND SURFACE: -February 12, 2013 = 8.70m		ON DEPTH 99 m	-614 -613 -612 -611
		PREPARED BY RTB		ON DEPTH 99 m ON DATE 10/25/12	
THURBER ENGINEERING LTD.		REV EWED BY NHF	JOIVIF LET	OR DATE 10/23/12	Page 1 of 1

CL EN	IT I	EPCOR GENERAT ON NC/EDMONTON POWER	PROJ	JECT ROSSDALE POWER PLANT WELL NSTALLA	T ON BOREHOLE NO TH	12-4
DR LL	NG	COMPANY Mobile Augers & Research Ltd	DATE	E DR LLED October 23 2012	PROJECT NO 14-35	5-185
DR LL	/ME	THOD M5 Truck / Hollow Stem Augers	LOCA	AT ON See Drawing #14-35-185-1	ELEVAT ON 625 07	(m)
SAMP	LE 1	TYPE			·	
BACK	FLL	TYPE GROUT BENTON	TE	SAND SLOUGH		
DEPTH (m)	SAMPLE TYPE	REMARKS	WELL NSTALLAT ON	SOIL DESCRIPT	ION	ELEVAT ON (m)
1			•	TOPSOIL, brown, s ty, sandy CLAY (TILL) brown, s ty, sandy, trace grave and ox des		-624 -623
-3						-622
4						-621
6						-620 619
<b>-7</b>						618
8						617
9				GRAVEL brown, s ty		  616
11 11 12 12 12 12 12 12 12 12 12 12 12 1				SAND very s ty, med um to coarse gra ned, trace grav	е	615
<b>−11</b>				END OF TEST HOLE AT 11.4m		614
				UPON COMPLETION: (Be ow ground surface) -S ough at 11.3m -Water at 10.7m Mon tor ng we nsta ed WATER LEVEL BELOW GROUND SURFACE: -November 19, 2012 = 9.91m		-613 -612
13						611
15	3 - 4		<del>'                                    </del>	F ELD LOGGED BY EMS	COMPLET ON DEPTH 114 m	
				PREPARED BY RTB	COMPLET ON DATE 10/23/12	April 20 4-14-20
8		THURBER ENGINEERING LTD.		REV EWED BY NHF		Page 1 of 1

CL EN	Т	EPCOR GENERAT ON NC/EDMONTON POWER	PROJ	ECT ROSSDALE POWER PLANT WELL INSTALLA	T ON BOREHOL	E NO TH12-5
DR LL	NG	COMPANY Mobile Augers & Research Ltd	DATE	DR LLED October 24 2012	PROJECT	NO 14-35-185
DR LL	/ME	ETHOD M5 Truck / Hollow Stem Augers	LOCA	T ON See Drawing #14-35-185-1	ELEVAT C	N 625 05 (m)
SAMP	LE:	TYPE				
BACK	F LL	L TYPE GROUT BENTON	TE	SAND		
DEPTH (m)	SAMPLE TYPE	REMARKS	WELL NSTALLAT ON	SOIL DESCRIPT	ION	ELEVAT ON (m)
BOREHOLE LOG 14-35-186 GPJ 18/13-L BRARK-NEW LOGO GLB  1				GRAVEL (FILL) brown, crushed, s ty  CLAY (FILL) b ack sh brown, some br ck ch ps and grave, tra  COAL, b ack CLAY (FILL) brown, s ty, sandy, trace br ck nc us ons, coa,  CLAY AND GRAVEL brown s ty, trace cobb es  SAND AND GRAVEL brown, s ty, med um gra ned		-624 -623 -621 -620 -619 -617 -616 -616
10G 14-35-185 GPJ HR				END OF TEST HOLE AT 13.3m UPON COMPLETION: (Be ow ground surface) -No s ough -Water at 12.2m (October 24, 2012) Mon tor ng we nsta ed		-612 -611
OLE .			<del>'                                    </del>	F ELD LOGGED BY EMS	COMPLET ON DEPTH	13 3 m
REH				PREPARED BY RTB	COMPLET ON DATE	AND A STATE OF THE PARTY OF THE
8		THURBER ENGINEERING LTD.		REV EWED BY NHF		Page 1 of 1

CL EN	F EPCOR GENERAT ON NC/EDMONTON POWER	PROJ	NECT ROSSDALE POWER PLANT WELL INSTALLATION BOREHOLE NO 1	TH12-6
DR LL	NG COMPANY Mobile Augers & Research Ltd	DATE	E DR LLED October 24 2012 PROJECT NO 14-	-35-185
DR LL	METHOD M5 Truck / Hollow Stem Augers	LOCA	AT ON See Drawing #14-35-185-1 ELEVAT ON 624	92 (m)
SAMPI	E TYPE			
BACKE	LL TYPE GROUT BENTON TE		SAND	
DEPTH (m)	REMARKS REMARKS	WELL NSTALLAT ON	SOIL DESCRIPTION	ELEVAT ON (m)
1			GRAVEL (FILL) brown, s ty  CLAY (FILL) b ack sh brown, s ty, sandy, some br cks, trace grave and ox des	-624
-3			-brown, occas ona brick inclusions	
5				621 620
-6 -7			GRAVEL AND SAND	
8			dark brown, s ty, med um gra ned sand, trace cobb es  SAND ght brown, very s ty, med um to f ne gra ned, trace grave	-617
9 1000 GLB	T		END OF TEST HOLE AT 10.2m	-616 
3D 3/18/13-L BRARY-NEW LOGO GLB			UPON COMPLETION: (Be ow ground surface) -S ough at 10.0m -Water at 9.9m Mon tor ng we nsta ed WATER LEVEL BELOW GROUND SURFACE: -February 12, 2013 = 8.80m	-614 -613
BOREHOLE LOG 14-35-185 GPJ HRBR AB GD 17-11-11-11-11-11-11-11-11-11-11-11-11-1				-612 -611
961				
크 <u>- 15</u> 벨		89	F ELD LOGGED BY EMS COMPLET ON DEPTH 10 2 m	-610
유	<b></b>		PREPARED BY RTB COMPLET ON DATE 10/24/12	
BOR	THURBER ENGINEERING LTD.		REV EWED BY NHF	Page 1 of 1

CL EN	IT	EPCOR GENERAT ON NC/EDMONTON POWER	PRO	JECT ROSSDALE POWER PLANT WELL INSTALLA	T ON BOREHOLE NO TH	12-7
DR LL	NG	G COMPANY Mobile Augers & Research Ltd	DAT	E DR LLED October 23 2012	PROJECT NO 14-3	5-185
		THOD M5 Truck / Solid & Hollow Stem Augers	LOC	AT ON See Drawing #14-35-185-1	ELEVAT ON 625 23	(m)
SAMP						
BACK	FLL	TYPE GROUT BENTON	TE	SAND SLOUGH		T:
DEPTH (m)	SAMPLE TYPE	REMARKS	WELL NSTALLAT ON	SOIL DESCRIPT	ION	ELEVAT ON (m)
-1				GRAVEL (FILL) organ c sta ned, concrete and br ck ch ps		-625 -624
-3 -4 -6		-Moved hole and continued drilling due to concrete		BENTONITE AND SAND		-623 -622 -621 -621 -619
BOREHOLE LOG 14-35-185 GFJ HRBR AB GD 3/18/13-1 BRARKYARW LOGO GLB 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				END OF TEST HOLE AT 9.9m UPON COMPLETION: (Be ow ground surface) -S ough at 7.6m Mon tor ng we nsta ed n recomp et on of MW!		617 -616 -615 -614 -612 -611
7		_	307	F ELD LOGGED BY EMS	COMPLET ON DEPTH 99 m	V41
2		THURBER ENGINEERING LTD.		PREPARED BY RTB REV EWED BY NHF	COMPLET ON DATE 10/23/12	Page 1 of 1

TOTAL CONTRACTOR OF THE PARTY O	THOD: M11 YPE  PL	▲ RECOVERY % ▲ 20 40 60 80 ■ RQD % ■ 20 40 60 80	Id. DATE DRILLED: LOCATION: N59  CORE  DISCONTINUI			9	PROJECT NO: 19 ELEVATION: 623	
SAMPLE TYPE TO	ROD/AEC	☐ GRAB SAMPLE [  A RECOVERY % A  20 40 50 80  ■ RQQ % ■  20 40 60 80	<b>Т</b> ] сон∈	32031.212, L.	)2000.E	······································	LEPATION CO.	
DEPTH (m) SAMPLE TYPE	ROD/REC	▲ RECOVERY % ▲ 20 40 60 80 ■ RQD % ■ 20 40 60 80				···········		<del></del>
	PU	20 40 50 80 MRQD % M 20 40 60 80	DISCONTINUI			i l		
0		STIC M.C. LIQUID 10 20 30 40	DESCRIPTION		nsc	SOIL SYMBOL	SOIL / ROCK DESCRIPTION	EI EVATION (m)
1	s see a dependent on the	10 20 30 40		Alleria	-		SAND (FILL), light brown, fine grained, sifty CLAY (FILL) black organic stained, silty, trace gravel and rod-brown - black, some organic inclusions / streat gravel, concrete chips, and brick fragments	[-62
2 11								6
III								: : -64
а 📙							CLAY brown, very silty	
4			-No sampling from 3.5 - 1.	3.3m				- 6: -
.5	AUTOCOCCA.							-6
6								6
.7								6
B								- 6
								6
9								-  -  -
10				FIELD LOGGED PREPARED BY		)C	COMPLETION DEPTH: 30.5 m	

וואםרו			INEERING & LAND SERVICES						
			ANY: Mobile Augers & Research M11 XLT / Solid Stem Augers	<del></del>	D: July 4 & 5, 20			PROJECT NO: 19-598	
		TYPE	GRAB SAMPLE	LOCATION: N	15932831.212, ES	12995.2	9	ELEVATION: 623,66 (n	n)
DEPTH (m)	SAMPLE TYPE	RQD/REC	ARECOVERY % ▲  20 40 60 80  ■ RQD % ■  20 40 60 80  PLASTIC M.C. LIQUID  10 20 30 40	DISCONTINE DESCRIP		SC	SOILSYMBOL	SOIL / ROCK DESCRIPTION	
-11									1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
12			·						اساساسة ده منسانده منده
13				The state of the s			}		
14	TO STATE OF THE PARTY OF THE PA	40/94		-Start coring at 13.31m -Fractured and rubbled 13.72m -Rubble from 14.13 - 14 14.21 - 14.25m	from 13.31 -	cs ss		CLAY SHALE, extremely weak, fresh, black, highly carbonaceous with coal inclusions -light grey, silty  SANDSTONE, very weak, fresh, bentonitic, trace coal inclusions	
15		45/75	•	-Core break at 14.30m -Joint at 14.40m at 85° undulating, smooth -Core break at 14.57m -Fractured and rubbled 15.06m				CLAY SHALE extremely weak to very weak, fresh, grey - brown, silty, occasional coal stringers	
16				-Core breaks at 15.56m -Joint at 15.70m at 40° smooth -Joint at 15.75m at 80° smooth -Core breaks at 15.88m 16.04m, and £6.18m	TCA, planar, TCA, stepped,	CS		-brown, occasional siltstone and sandstone inclusion	
17		48/90		Joint at 16.23m at 80° undulating, rough Fractured and rubbled 16.39m Core break at 16.43m Joint at 16.45m at 80°	from 16.37 -	SS		SANDSTONE extremely weak, fresh, grey, medium to fine grained bentonitic, trace siltstone and clay shale inclusions CLAY SHALE	
18				Joint at 16.66m at 80° undulating, rough -Rubble from 16.76 - 16 16.86 - 16.92m -Core break at 17.00m -Rubble from 17.30 - 17 17.44 - 17.46m	5.78m and			extremely weak, fresh, brown, sity -slightly bentonitic from 17.38 - 17.50m -sittstone clasts -occasional sittstone inclusions -sandstone laminations from 17.63 - 17.69m	+ 1 - + +
19		49/57		-Fractured and rubbled 17.54m -Rubble from 17.59 - 17 -Joint at 17.75m at 80° smooth -Core breaks at 17.78m	7.63m TCA, planar, and 17.84m	CS		-carbonaceous from 19.65 - 20.32m, some coal	
20				Joint at 17.89m at 70°	TCA, FIELD LOGGED	BY: TO	C	COMPLETION DEPTH: 30.5 m	-
					PREPARED BY:			COMPLETION DATE: 7/5/12	

			NEERING & LAND SERVICES LTI	<u>}</u>				VENUE 11 (	PROJECT NO: 19-598-37	
			NY: Mobile Augers & Research Lb		·					
)AILL	ME	THOD: N	A11 XLT / Solid Stern Augers	LOCATION: N5	932831.212, E3	2995,29	<del>}</del> 		ELEVATION: 623.66 (m)	
AMP	LE T	YPE	GRAB SAMPLE [	CORE			<del>-</del>	box - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 1		- <b>T</b>
DEPTH (π)	SAMPLE TYPE	RQD/REC	▲ RECOVERY % ▲  20 40 50 80  ■ ROD % ■  20 40 60 80  PLASTIC M.C. LIQUID	DISCONTINU DESCRIPTI		osn	SOIL SYMBOL	SOIL / R DESCRIP		C) CVATION (H)
20 21		58/97	136.4	Core break at 16.53m	nom 18.14 -			inclusions -grey, trace coal inclusions		-6
22				Joint at 18.69m at 70° T rough Joint at 18.81m at 70° T undulating, smooth Joint at 19.35m at 80° T rough	CA,	SS		SANDSTONE, extremely weat trace coal inclusions CLAY SHALE, extremely weat siltstone and sandstone inclus	ık, fresh, silty, trace sions	·
23		61/98		-Core breaks at 19.45m; -Joints from 19.50 - 19.6 TCA, curved, smooth, rui -Fractured and rubbled fi 19.96m	1m at 40° bble infilled rom 19.61 -	cs		-trace cemented siltstone class- -some sandstone inclusions fi SANDSTONE, extremely wea	rom 22.11 - 22.31m	-6
			149.1	-Loss of drilling water cin 19.81m -Joint at 19.97m at 40° T rough -Core breaks at 20.09m, 20.26m	CA, curved,	SS		coal inclusions -some clay shale inclusions fr CLAY SHALE extremely weak, fresh, brown	, silty	ر در مسلمات المراد در در در
24		20/100		-Joint at 20.37m at 90° 1 undulating, rough -Rubble from 20.57 - 20. -Core break at 21.01m -Joint at 21.15m at 80° 1	60m	COAL CS		-becomes very weak, carbona- extremely weak, trace coal in -bentonitic chunks Coal from 24.52 - 24.59m		
25		19/33		rough -Joint at 21.61m at 85° 1 undulating, rough -Joint at 21.80m at 70° 1 undulating, rough	rca, rca,	BE CS		-highly bentonitic -bentonitic from 24,73 - 24,80 -trace bentonite inclusions	)m	<u>, , , , , , , , , , , , , , , , , , , </u>
26		51/92	196.1	-Rubble from 21.80 - 21Joint at 21.90m at 80° 1 undulating, rough -Core break at 22.09m -Joint at 22.41m at 50° 1 smooth	rca,	SS-CS		SANDSTONE AND CLAY SHextremely weak, fresh, trace		
27			57.1	-Core break at 22.49m -Joint at 22.64m at 70° 1 smooth -Rubble from 22.69 - 22. -Joint at 23.15m at 80° 1 undulating, rough	78m FCA,	CS BE CS		clasts and coal inclusions SILTSTONE, very weak to we calcareous larminations CLAY SHALE extremely weak, fresh, brown	eak, cemented, trace	
28				Joint at 23.24m at 70° undulating, rough -Core breaks at 23.50m, 23.55m, 23.59m, and 23 -Rubble from 23.65 - 23. Joints from 23.70 - 23.8	, 23.53m, 3.61m .68m 13m at 30°	COAL		BENTONITE, extremely weal CLAY SHALE extremely weak, fresh, carbo inclusions Coal from 27.76 - 27.80m	k, fresin	
29		57/89	•	TCA, undulating, smooth -Loss of drilling water cir 23.8m -Fractured and rubbled f 24.39m, 24.52 - 24.59m 24.69m -Core break at 24.80m	rculation at from 23.98 - , and 24.59 -	CS		grey - green, bentonitic -sandstone leminations from -very weak, brown, silty, trace		
30				-Fractured and rubbled f	FIELD LOGGED	RY. Tr	YC.	י גיראוט בדותי	N DEPTH: 30.5 m	Ŀ
			<b></b>	L						
					PREPARED BY	: XW		COMPLETION	N DATE: 7/5/12	

DRILL	ING (	COMPA	ANY: Mobile Augers & Research	ı Ud	PROJECT: WALTERDALE BI DATE DRILLED: July 4 & 5, 2				PROJECT NO: 19	598-970
			M11 XLT / Solid Stem Augers		LOCATION: N5932831,212, E		 29		ELEVATION: 623.	
SAMP	A		GRAB SAMPLE						ELEVATION, 023.	<b>X</b> (III)
DЕРТН (m)	SAMPLE TYPE	RQD/REC	A RECOVERY % ▲  20 40 60 80  ■ RQD % ■  20 40 60 90  PLASTIC M.C. LIQUID		DISCONTINUITIES DESCRIPTION	DSC	SOIL SYMBOL	SOIL / DESCRI		
30		··	10 20 30 40	25.81		-			1988 CALLES	
-31				-Core -Rubi -Join rough -Join undu -Frac 26.99	ble from 26.02 - 26.32m break at 26.40m ble from 26.52 - 26.54m t at 26.56m at 40° TCA, curved, 1 I at 26.63m at 60° TCA, lating, rough tured and rubbled from 26.86 - bream ard 27.11 - 27.35m t at 27.65m at 80° TCA,			END OF TEST HOLE AT 30 UPON COMPLETION: Backfilled with bentonite chi		5
32				undu -Core -Frac 28.16 -Join	lating, rough b break at 27.70m tured and rubbled from 27.76 -					- - - - - - -
-33				-Rubi 28.50 -Join smoo -Core 28.81 -Frac 29.11	ble from 28.32 - 28.40m and ) - 28.56m t at 28.56m at 60° TCA, planar, bh b breaks at 28.62m, 28.76m, lm, 28.83m, 28.90m, and 28.94m tured and rubbled from 29.00 - lm	الماسية الماسي				
-35				smox -Cons -Join undu -Join smox	break at 29.63m tat 29.68m at 70° TCA, lating, smooth tat 29.87m at 80° TCA, planar,	(A) - 10 - 10 - 10 - 10 - 10 - 10 - 10 - 1				
-36		:		- A-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-				i		·
-37							NEOLE IV			
-38										- - - - - - - - - - -
-39										- - - - - - - - - - - - - - - - - - -
40		ļ			FIELD LOGGE	) 28Y: TI	DC	COMPLETI	ON DEPTH: 30.5 m	
					PREPARED BY			COMPLETI	ON DATE: 7/5/12	/

REMARKS  SOIL DESCRIPTION  AND (FILL) black, clayery, trace gravel, occasional oxides  silty  CLAY (FILL) black with grey motions, some high plastic clay posters, wood chips, oxides, gravel, and coal.  Trace topscill  Trace topscill  Trace brick chips and organics	CLIENT: ISL EN	IGINEERING & LAND SERV	/ICES LTD	PROJECT	: WALTERDALE B	RIDGE R	tEP	LACEMENT	BOREHOLE NO: TH12-13	
MENERT TYPE    COMPLICATION   COMPLETION   C	DRILLING COM	PANY: Mobile Augers & Re	search Ltd.							
REMARKS  SOIL DESCRIPTION  SAND (FILL) Strate brick  The converted and coal  The converted and coal  REMARKS  REMARKS  REMARKS  REMARKS  SOIL DESCRIPTION  SAND (FILL) black clayery, trace gravel, occasional oxides  silty  CLAY (FILL) black with grey motiling, some high plastic day pockets, trace organic pockets, wood chips, coddes, gravel, and coal  trace topscil  The chrown, silty, sandy, till - like  SAND (FILL) brownish black, medium grained, very silty, some day, trace oxides, concisional gravel brick  SAND  The chastist brown, light brown silt and day lenses, trace brick  SAND  The chastist brown, light brown silt and day lenses, trace brick  SAND  The chastist brown, light brown silt and day lenses, trace brick  SAND  The chastist brown, light brown silt and day lenses, trace brick  SAND  The chastist brown, light brown silt and day lenses, trace brick  SAND  The chastist brown, light brown silt and day lenses, trace brick  SAND  The chastist brown, light brown silt and day lenses, trace brick  SAND  The chastist brown, light brown silt and day lenses, trace brick  SAND  The chastist brown, light brown silt and day lenses, trace brick  The chastist brown, light brown silt and day lenses, trace brick  SAND  The chastist brown, light brown silt and day lenses, trace brick  The chastist brown, light brown silt and day lenses, trace brick  SAND  The chastist brown silt and day lenses, trace brick  The chastist brown silt and day lenses, trace brick  The chastist brown silt and day lenses, trace brick  The chastist brown silt and day lenses, trace brick  The chastist brown silt and day lenses, trace brick  The chastist brown silt and day lenses, trace brick  The chastist brown silt and day lenses, trace brick  The chastist brown silt and day lenses, trace brick  The chastist brown silt and day lenses, trace brick  The chastist brown silt and day lenses, trace brick  The chastist brown silt and day lenses, trace brick  The chastist brown silt and trace brick  The chastist brown silt and trace brick  The chastis	DRILL/METHOD			LOCATION	v: See Drawing #19	-598-370	<b>)</b> 1		ELEVATION:	·····
REMARKS  REM	SAMPLE TYPE									
SAND (FILL) black, clayery, trace gravel, cocasional oxides  CLAY (FILL) black with grey motiling, some high plastic day pookets trace organic pookets, wood chips, oxides, gravel, and coal  -trace brick chips and organics  -trace brick chips and organics  -trace brick trace brick  SAND (FILL) black with grey motiling, some high plastic day pookets, trace oxides, oxides, gravel, and coal  -trace brick chips and organics  -trace brick trace brick  SAND (FILL) brown, silty, sandy, till - like  -black, trace brick  SAND (FILL) brown, silty, sandy, till - like  -black, trace oxides, occasional gravel  -black trace brick  SAND (FILL) brown, silty, sandy, till - like  -brown, silty, sandy, till - like  -black trace brick  SAND (FILL) brown, silty, sandy, till - like  -brown, silty, sandy, till - like  -black trace brick  SAND (FILL) brown, silty, sandy, till - like  -brown, silty, sandy, till - like  -brown, silty, sandy, till - like  -black trace brick  SAND (FILL) brown, silty, sandy, till - like  -brown, silty, sandy, till - like  -black trace brick  SAND (FILL) brown, silty, sandy, till - like  -brown, silty, sandy, till - like  -black trace brick  SAND (FILL) brown, silty, sandy, till - like  -brown, silty, sandy, till - li	BACKFILL TYPE	DRILL CUTTIN	œs ∭isro∩	UGH						-1
Black, clayery, trace gravel, occasional oxides  sity  CLAY (FILL) black with prey motting, some high plastic day poxiests, trace organic poctets, wood chips, oxides, gravel, and coal  -trace brick chips and organics  -trace brick chips and organics  -brown, silly, sandy, till - like  -black, trace brick  SAND (FILL) brownish black, medium grained, very sitly, some clay, trace oxides, occasional gravel  -blackish brown, light brown sit and day lenses, trace brick  SAND brownish black, medium grained, very sitly, trace gravel and coal  FRED LOGGED BY: BMS  OCMPLETION DEPTH: 13.5 m				REMAR	KS	SLOTTED	PIEZOMETER	DESC		DEPTH (m)
CLAY (FILL) black with grey mottling, same high plastic day pockets, wace organic pockets, wood chips, oxides, gravel, and coal -trace topsoil -trace brick chips and organics -brown, silty, sandy, till - like -brown, silty, sandy, till - like -black, trace brick  SAND (FILL) brownish black, medium grained, very sitty, some clay, trace oxides, occasional gravel -black stace brick  SAND -brownish black, medium grained, very sitty, some clay, trace oxides, occasional gravel -black stace brick  SAND -brownish black, medium grained, very sitty, trace gravel and coal  FIELD LOGGED BY: SUS - PREPARED BY: AVAL - COMPLETION DEPTH: 10.5 m - PREPARED BY: AVAL - COMPLETION DEPTH: 10.5 m - PREPARED BY: AVAL - COMPLETION DEPTH: 10.5 m - PREPARED BY: AVAL - COMPLETION DEPTH: 10.5 m			-					black, clayey, trace grave	el, occasional oxides	
black with grown motiting, same high plastic day pockets, trace organic pockets, wood chips, oxides, gravel, and coal  -trace topscil  -trace topscil  -trace brick chips and organics  -trace brick  SAND (FILL)  brownish black, medium grained, very sity, some clay, trace oxides, occasional gravel  -trace brick  SAND brown, light brown sitt and day lenses, trace brick  SAND brownish black, medium grained, very sity, trace gravel and coal  PELD LOGGED BY: BMS   COMPLETION DEPTH: 10.5 m    PREPARED BY: AND   COMPLETION DATE: 7/8/12	1   11   1							-silty		1
-trace torick chips and organics -trace brick chips and organics -brown, silty, sandy, till - like -black, trace brick -black, medium grained, very silty, some clay, trace oxides, occasional gravel -blackish brown, light brown silt and day lenses, trace brick -blackish brown, light brown silt and day lenses, trace brick -blackish brown, light brown silt and day lenses, trace brick -blackish brown, light brown silt and day lenses, trace brick -blackish brown, light brown silt and day lenses, trace brick -blackish brown, light brown silt and day lenses, trace brick -blackish brown light brown silt and day lenses, trace brick -blackish brown light brown silt and day lenses, trace brick -blackish brown light brown silt and day lenses, trace brick -blackish brown light brown silt and day lenses, trace brick -blackish brown light brown silt and day lenses, trace brick -blackish brown light brown silt and day lenses, trace brick -blackish brown light brown silt and day lenses, trace brick -blackish brown light brown silt and bay lenses, trace brick -blackish brown light brown silt and bay lenses, trace brick -blackish brown light brown silt and bay lenses, trace brick -blackish brown light brown silt and bay lenses, trace brick -blackish brown light brown silt and bay lenses, trace brick -blackish brown light brown silt and bay lenses, trace brick -blackish brown light brown silt and bay lenses, trace brick -blackish brown light brown brites light brown silt and bay lenses, trace brick -blackish brown light brown brick -black l	-2   11   3							black with grey mottling, pockets, trace organic po	some high plastic clay ockets, wood chips, oxides,	2
-brown, silty, sandy, till - like  -brown, silty, sandy, till - like  -black, trace brick  SAND (FILL) brownish black, medium grained, very silty, some clay, trace oxides, occasional gravel -blackish brown, light brown silt and clay lenses, trace brick  SAND  BAND  FIELD LOGGED BY: EMS  COMPLETION DEPTH: 10.5 m  COMPLETION DEPTH: 10.5 m  COMPLETION DATE: 7/6/12	3 1							-trace topsoil		3
-brown, sitty, sandy, titl - like  -black, trace brick  SAND (FILL) brownish black, medium grained, very sitty, some clay, trace oxides, occasional gravel  -blackish brown, light brown sitt and clay lenses, trace brick  SAND brownish black, medium grained, very sitty, trace gravel and coal  FIELD LOGGED BY: BMS  COMPLETION DEPTH: 10.5 m  PREPARED BY: AKL  COMPLETION DATE: 7/6/12	4      4						NNNNN	-trace brick chips and or	ganics	4
SAND (FILL) brownish black, medium grained, very sitty, some clay, trace oxides, occasional gravel  -blackish brown, light brown sit and clay lenses, trace brick  SAND brownish black, medium grained, very sitty, trace gravel and coal  FIELD LOGGED BY: EMS COMPLETION DEPTH: 10.5 m PREPARED BY: AKL COMPLETION DATE: 7/6/12	-5 <u>II</u> 2							-brown, silty, sandy, till -	like	- - - - - -
SAND (FILL) brownish black, medium grained, very sitty, some clay, trace oxides, occasional gravel  -blackish brown, light brown silt and clay lenses, trace brick  SAND  brownish black, medium grained, very sitty, trace gravel and coal  FIELD LOGGED BY: EMS  COMPLETION DEPTH: 10.5 m  PREPARED BY: AKL  COMPLETION DATE: 7/6/12	-6							-black, trace brick		- E
FIELD LOGGED BY: EMS  COMPLETION DEPTH: 10.5 m  PREPARED BY: AKL  COMPLETION DATE: 7/6/12	7   11   2							brownish black, medium	grained, very sitty, some sional gravel	7 
brownish black, medium grained, very sifty, trace gravel and coal  PIELD LOGGED BY: EMS  COMPLETION DEPTH: 10.5 m  PREPARED BY: AKL  COMPLETION DATE: 7/6/12	-B T							trace brick	own silt and day lenses,	8
PIELD LOGGED BY: EMS COMPLETION DEPTH: 10.5 m PREPARED BY: AKL COMPLETION DATE: 7/6/12	- <b>9</b>							brownish black, medium	grained, very silty, trace	. 9
PREPARED BY: AKL COMPLETION DATE: 7/6/12	10				LEIELA LAGAEA PI	/ GUE	14	Locator	ETION DEGTE: 40 F	<u> </u>
		<b></b>								<u>.</u>
		THURBER ENGINES	ERING LTD:		REVIEWED BY:			5500		e 1 i

CLIE	NT: ISL ENGINEERING & LAND SERVICES LTD	PROJECT: WALTERDA	LE BRIDGE REPLACE	MENT SOREHOLE NO: TH12-13	
	LING COMPANY: Mobile Augers & Research Ltd.	DATE DRILLED: July 6,	2012	PROJECT NO: 19-598-970	
	L/METHOD: M5 / Solid Stem Augers	LOCATION: See Drawin	g #19-598-370-1	ELEVATION:	
	PLE TYPE GRAB SAMPLE				
BACK	KFILL TYPE ORILL CUTTINGS I S	OUGH			
DEPTH (m)	△ A HEADSPACE (ppmv) △	REMARKS	SLOTTED PIEZOMETER	SOIL DESCRIPTION	DEPTH (m)
10	20 40 60 90		SAN trace	D AND GRAVEL, rusty brown - black, some slit, e coal	10
11			UPC -Skot -Tra	OOF TEST HOLE AT 10.5m ON COMPLETION: (Below ground surface) ugh at 10.0m ce of water vdpipe piezometer installed	-31
- 12					-12
-13					-13
14					14
-15 -					-15
-16					16
17					-17
-18					18
-19					-19
20					- 20
			ED BY: EMS	COMPLETION DEPTH: 10.5 m	
	AR	PREPARED		COMPLETION DATE: 7/6/12	pe 2 of
	THUMBER ENGINEERING LTD.	REVIEWED!	5Y:	Pag	pe 2 Of

CL	JEN	T:	SL ENG	GINEERING & LAND SERVICES L	TD	PROJECT: W	ALTERO/	ALE BRI	DGE P	EPLA(	CEMENT	BOREHOLE NO: TH12-14	
DF	31LT1	NG	COMP	ANY: Mobile Augers & Research	Ltd.	DATE DRILLE	D: July 4	to 6, 20	12			PROJECT NO: 19-598-37	0
DF	NILL/	ME	THOD:	M11 XLT / Solid Stem Augers		LOCATION: N	5933098.	849, E3	3044.7	79		ELEVATION: 627.72 (m)	
S/	MPL	£Ί	YPE	[[[]] GRAB SAMPLE	SPT	·	ODF	E					
BA	CKF	 }[L	TYPE	BENTONITÉ	DRII	L CUTTINGS							
177) 1740	UEP IN (III)	SAMPLE TYPE	RQD/REC	A RECOVERY % ▲  20 40 60 80  ■ROD % ■  20 40 60 80  PLASTIC M.C. LIQUID  10 20 30 40		CONTINUI ESCRIPTIO		SLOTTED PIEZOMETER	nsc	SOIL SYMBOL	SOIL / F DESCRII		ELEVATION (m)
0									CI		TOPSOIL AND CLAY (FILL) dark brown - black, some sitt gravel, concrete chunks, asp and wood fibers	, trace roottets, coal, halt chunks, garbage,	-627
-t		II.	   	•					ÇI	Z	-dark brown with light brown	strips	<u>+</u>
-2		$\coprod$	     	•					CI	72	-light brown, silty, trace coan occasional oxides	se sand and coal,	-626
1 1 1 1		4		<b>)</b>	-SPT N	= 13			CL		SILT (FILL) compact, brown, trace fine s	and	-625
-3		<u> </u>							CL		SILT compact, brown, fine sandy,	some coal inclusions	-624
-4	.	4		· ·	-SPT N	= 14			CL				- - -
819.09 -5	  -  -  -	П	1						aL	77			623
-ROCK-NEW LOGO, GLB		4			-SPT N	= 15			ML		-trace fine sand and iron star- -some gravel from 5.79 - 6.2		622
ULAR LIBRARY		П		<b> </b>					CL		Some grand nome of the		-
1 6/22/12 REG		7			-SPT N	= 19			ML				-621
RBR A8 GD	,	II		•					ML	<u>m</u>			620
BORE-OLE LOG 19-599-379-2013-ROCK GPJ THRIBR AB GOT 872/12- REGULAR LIBRARY-ROC		4			-SPT N	= 23			SC	500 800 800 800 800 800 800 800 800 800	SAND, compact, brown - bla grained, silty, occasional fine		619
598-370-2012	- 1.	II		•					OL	11111	SILT brown, some black fine coal	and rounded gravel	- - - - -
1901 197	0						GENT		DV. 12	350g	GRAVEL AND SAND dense, grey - brown, mediur		-618
쥚							FIELD L			F1100		N DEPTH: 24.5 m N DATE: 7/6/12	
Š				THURBER ENGINEERING LT	D.		REVIEW				OWIFECTIO		1 of 4
<u></u>				STANDARD CHANGE COUNTY EL	-				+				

			INEERING & LAND SERVICES		PROJECT: WALTER			PEPLA		
			ANY: Mobile Augers & Research M11 XLT / Solid Stem Augers	•	DATE DRILLED: July			770	PROJECT NO: 19-59	
		TYPE	MITAL! / SOIKI STETI AUGEIS	<b>∏</b> SPT	LOCATION: N593309		33044.7		ELEVATION: 627.72	m)
		TYPE	BENTONITE		CUTTINGS	Une	··	_ ~	The second second section is the second seco	
	SAMPLE TYPE	RQD/REC	▲ RECOVERY % ▲  20 40 60 80  ■ RQD % ■  20 40 50 66  PLASTIC M.C. LIQUID	DISC	CONTINUITIES SCRIPTION	SLOTTED PIEZOMETER	nsc	SOILSYMBOL	SOIL / ROCK DESCRIPTION	EI EVATION (m)
10	-/		10 20 30 40	-SPT N =	42	7-6	SC	100	silty sand, trace coal flecks	
-11	I						CI	222	GRAVEL AND CLAY brown - black, rounded to angular gravel in silty da with some fine coal	y 61
-12	Z π			-SPT N =	50 for 150mm		СЅ		CLAY SHALE very hard, dark brown, silty, carbonaceous, some coal stringers - dark grey, massive	61
13									Takik giey, messive	
-14		16/100		-Core bre 13.22m, -Fracture 13.43 - 1: 13.81 - 1:	ing at 13.05m taks at 13.10m, 13.30m, and 13.38m d and rubbled from 3.46m, 13.51 - 13.74 5.01m, 15.39 - 15.50 5.67m, and 15.74 -			The state of the s	CLAY SHALE I extremely weak, fresh, grey, silty, cemented siltstol inclusions I soft wet zone -cemented siltstone clasts	10 ,
-15		9/77				***************************************	E B P L C C CO GRADOCO	V1 12 V7.1	-occasional cemented sittstone inclusions	6
- 16		65/89	<b>-</b>	undutatin -Rubble ( -Core bro	15.85m at 50° TCA, ig, rough from 15.85 - 15.92m saks at 15.97m, 16.08m,16.29m, and		cs	The second secon	-occasional coal inclusions	6
-17				16.42m -Fracture 16.52 - 1 -Core bro -Fracture 17.33 - 1	ed and rubbled from 6.57m eak at 16.62m ed and rubbled from 7.64m		:	2. Table 1.	-dark brown, carbonaceous	6
- 18		38/88		40° TCA -Rubble -Core bro -Joint at undulatin	om 17.64 - 17.73m at , irregular, rough from 17.73 - 17.79m aak at 17.90m 17.96m at 80° TCA, ng, rough	<b>t</b>			-becomes grey - green and bentonitic from 18.21 -	Ē
19				18.07m -Fracture 18.10 - 1 -Joint at stepped,	18.18m at 80° TCA,		CS SS CS		-very weak, dark brown, carbonaceous, occasiona coal inclusions Siltstone, very weak, fresh, cemented -brown Sandstone, very weak, fresh	
20				18.21 - 1	8.25m					
					PREF	LOGGER PARED BY EWED BY	: XW	KL/TC	COMPLETION DATE: 7/6/12	Page 2

,			SINEERING & LAND SERVICES ANY: Mobile Augers & Research		PROJECT: WALT				ACTIVITIATE	PROJECT NO: 19-598-	
			M11 XLT / Solid Stem Augers		LOCATION: N593			79		ELEVATION: 627.72 (n	
		TYPE	GRAB SAMPLE	SPT	<u> </u>	CORE		-			
		TYPE	BENTONITE	· <del></del>	LL CUTTINGS			<b></b>	and the second s		<u></u>
			▲ RECOVERY % ▲			6					]
DEPTH (m)	SAMPLE TYPE	RQD/REC	20 40 60 80  #RQD % ##  20 40 60 80  PLASTIC M.C. LIQUID  10 20 30 40		CONTINUITIE ESCRIPTION		nsc	SOIL SYMBOL	SOIL / F DESCRI		
20		83/100		-Joint a planar,	18.58m at 80° TC/	4,	SS	: 7:2 7:2	Sandstone, very weak, fresh	 	<u> </u>
				-Clay in	filling from 18.58 -	1					į.
			•	18.64m -Core b	reaks at 18.73m and	a !					- 6
21				18.83m							ļ. Ī
. 1		]		Joint et	t 18.92m at 80° TC/ smooth	۹,			-occasional sandstone inclus	sions	ļ
			•	-Core b	reaks at 19.06m,	_			1 1 4		Ė
		}		-Fractu	, 19.25m, and 19.27 red and rubbled from	′πι.   n			; * *		6
2		! !			19.49m reaks at 19.55m and		00				-
			<u>!</u>	19.66m		ļ	CS	17. 11.1 17. 11.1	-occasional siltstone inclusio	ns	-
					red and rubbled from 19.93m	n					Ë
	ı		!	-Joint a	t 19.98m at 75° TC/	۸. أ					-
3	ł	59/97	• •	planar, Joint a	rougn t 20.15m at 80° TC/	ι			-trace coal inclusions		ŀ
	ł			undulati	ing, smooth red and rubbled from			2			-
			ļ	20.25 -	20.43m						-
	ŀ		•	-Core b	reaks at 20.53m and	d	1		-light brown		-1
4	1		Ì	Joint a	1 20.97m at 60° TC/	۹,	1		SANDSTONE, extremely we	ak frash arau traca	
		l	\	irregula Core b	r, rough reaks at 21.19m,		SS		coal and siltstone inclusions	an, ilesii, grey, ilace	-
			•	21.31m	, 21.55m, and 21.59				END OF TEST HOLE AT 24	.5m	····[
			•	50° TC	from 21,64 - 21.74m A, undulating, smoo	th			UPON COMPLETION:		-6
5					t 21.74m at 70° TC/ ing, smooth	۹,			Standpipe piezometer install (drilled to 11.8m depth)	ed in adjacent test note	Ė
				-Joint a	l 21.79m at 80° TC/	۹,			WATER LEVEL BELOW GF	OUND SURFACE:	ļ.
		:		plenar, -Core b	smooth reaks at 21.85m.	ļ Ē			-July 6, 2012 = Dry -August 17, 2012 = 11.6m		_
6				21.92m	, 22,00m, and 22,12				-August 11, 2012 = 11.011		'
-				22,18 -	ed and rubbled from 22.24m	n		-			-
					t 22.39m at 70° TC/ ing, rough	۹,	}				ŀ
				-Joint at	22.46m at 75° TC/	λ					-  -
7		İ			ing, smooth reak at 22.51m			Ì			-
				-Fractur	red and rubbled from 22.89m and 22.97 -						ŀ
				23.35m			[				<u> -</u>
					t 23.39m at 70° TC/ ing, rough	٠			İ		-
8				-Core b	reak at 23.43m						ļ.
				Joint at planar,	t 23.51m at 80° TC/ smooth	•					<u></u>
				-Joint at	t 23.72m at 80° TC/ ing, smooth	۹,			<u> </u>		<u></u>
9				-Core b	reak at 23.75m						-!
				-Rubble	from 23,89 - 23,91) t 24,05m at 80° TC/	m A.					ŀ
				irregula	r, rough		1				ļ
				-Joint at partially	l 24.12m at 60° TC/ closed	٩.					
0					reaks at 24.26m and						
						1.D LOGGEO		CL/TD		N DEPTH: 24.5 m	
			THURBER ENGINEERING D		<b>├</b>	EPARED BY			COMPLETIC	N DATE: 7/6/12	ige 3

2 - 2 - 2			INEERING & LAND SERVICES		PROJECT: WALTER	DALE BF	IDGE !	TEPLA	CEMENT	BOREHOLE NO:	TH12-14
			ANY: Mobile Augers & Research	Ltd.	DATE DRILLED: July					PROJECT NO: 19	
1	· · · · · · · · · · · · · · · · · · ·		M11 XLT / Solid Stem Augers		LOCATION: N593309		33044.7	79		ELEVATION: 627.	72 (m)
SAME	LE 3	TYPE	i∭ GRAB SAMPLE	∑ SPI	г <u>Ш</u> с	ORE					
BACK	FIЦ	TYPE	BENTONITE BENTONITE	DAI	IT CALLINGS						
S DEPTH (m)	SAMPLE TYPE	RQD/REC	A RECOVERY % A  20 40 50 80  ■ RQD % ■  20 40 60 80  PLASTIC M.C. LKQUID  10 20 30 40		SCONTINUITIES DESCRIPTION	SLOTTED PIEZOMETER	osn	SOIL SYMBOL		/ ROCK RIPTION	ELEVATION (m)
: : : :-31											
-32											- <b>596</b>
-33											- <b>595</b>
-34 -35 -35							AND AND AND AND AND AND AND AND AND AND				- <b>594</b> - <b>593</b>
25 25 25 25 25 25 25 25 25 25 25 25 25 2								\$6 \$5.0 \tag{5.0}			<b>- 592</b>
-37		The second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second secon						A			-591 -590
36 37 38 39 39 39 40						AND DESCRIPTION OF THE PERSON OF	OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF TH				
864 501 40	3					LOGGE		KL/TD		TION DEPTH: 24.5 m	- -588
<u> </u>				<b>T</b> O		ARED BY			- COMPLE	INTERNET	Page 4 of
ل			THURBER ENGINEERING L	IQ.		-4764 01	. I (##F)				, 4ge 7 VI

		EPCOR		PROJECT: WQALOB PHASE III ESA		BOREHOLE NO:	0.670,000,000,000
		G COMPANY: Macroe Construct	2500	DATE DRILLED: October 31, 2013		PROJECT NO: 1	14-35-187
				OCATION: See Drawing #14-35-187-1		ELEVATION:	
AMF	LET	TYPE GRAB SAM	PLE		12		To the
DEPTH (m)	SAMPLE TYPE	20 40 60 80		REMARKS	90.070 S	SOIL SCRIPTION	
0	Щ	Δ	-Lab sample		CLAY (FILL) brown, gravelly, son sand, occasional co	ne silt, trace brick, wood, an ncrete chunks	d -
1			 -Lab sample				
	Ш				POSSIBLE SILT clayey, trace gravel END OF TEST PIT UPON COMPLETIC -No slough -No water	AT 1.3m DN:	
2					Backfilled with spoil		-
3	1						- - - - -
4	3						- - - -
	3						- - - - -
5	3						-
6							-
				FIELD LOGGED BY: M PREPARED BY: MFH		OMPLETION DEPTH: 1.3 m OMPLETION DATE: 10/31/13	vei
		THURBER ENGIN	IFFRILE IFF	REVIEWED BY: BHM	ļ (C	MIFLETION DATE. 10/31/13	Page 1

	NT: EPCOR		PROJECT: WQALOB PHASE III ESA	<b>(</b>	BOREHOLE NO: TP	
	ING COMPANY: Macroe		DATE DRILLED: October 31, 2013		PROJECT NO: 14-3	5-187
			ation LOCATION: See Drawing #14-35-187	-1	ELEVATION:	
SAME	PLE TYPE (	GRAB SAMPLE		T&		Fig.
DEPTH (m)	SAMPLE TYPE  A HEADSPACE (b)  20 40 60	omv)∆ 80	REMARKS	DI	SOIL ESCRIPTION	
0		-Lab sam	ple	SAND AND GRAV brown, trace brick	EL (FILL) and concrete	-
1						-
2		-Lab sam	pple	SILT (FILL) brown, some day,	trace concrete, wood, and sand	
				-trace coal  SILT brown, some clay,	trace sand and coal	
3		-Lab sam	pple			
4						
	<u> </u>			END OF TEST PITUPON COMPLETI -No slough -No water		
5				Backfilled with spo	il	
6						F
-			FIELD LOGGED BY:		OMPLETION DEPTH: 4.5 m	76
			PREPARED BY: MFF REVIEWED BY: BHI	C. 2	OMPLETION DATE: 10/31/13	

200000	NT: EPCOR		PROJECT: WQALOB PHASE III ESA		BOREHOLE NO: 1	
	LING COMPANY: Macroe C		DATE DRILLED: October 31, 2013		PROJECT NO: 14	-35-187
			tion LOCATION: See Drawing #14-35-187-1		ELEVATION:	
SAME	PLE TYPE G	RAB SAMPLE		14		Po
DEPTH (m)	SAMPLE TYPE AND THE ADSPACE (bb)	nv)∆ 80	REMARKS	D	SOIL ESCRIPTION	
0	<u> </u>	00		CLAY (FILL) gravelly, sandy, so organics and conc	ome silt, trace brick, occasional rete	-
1		-Lab sam	ole	SILT (FILL) brown, some clay, CLAY (FILL) trace wood	occasional gravel	  - -
2		-Lab sam	ple + Duplicate Z1	SILT (FILL) brown, clayey, trac	ce gravel	- - - -
		-2.5m aba avoid and	doned steel raw waste line, adjusted test pit to continued	-sand pockets		- - - - - -
3			ole	SILT brown, trace sand	and clay	-
4				-sandy		- - - -
	<b>T</b>			END OF TEST PITUPON COMPLETION Slough		-
5				Backfilled with spo	il	1
6			FIELD LOGGED BY: MFH	le le	COMPLETION DEPTH: 4.5 m	-
			PREPARED BY: MFH		COMPLETION DATE: 10/31/13	
	THID	BER ENGINEERING LTD.	REVIEWED BY: BHM	7 10	remember plantet transportuni (Protestationer) – p. 1907. – 1907. Sec.	Page 1

	NT: EPCOR			PROJECT: WQALOB PHASE III ESA	4	BOREHOLE NO: TP13-4				
		: Macroe Construction	222	DATE DRILLED: October 31, 2013		PROJECT NO: 14-35-				
				OCATION: See Drawing #14-35-187	7-1	ELEVATION:				
SAME	LE TYPE	GRAB SAMP	.E				P.			
DEPTH (m)	SAMPLE TYPE TYPE TYPE TYPE TYPE TYPE TYPE TYPE		REMARKS  ΔHEADSPACE (ppmv)-Δ							
0		40 60 80	-Lab sample		SAND, GRAVEL, A brown, silty, trace	AND CLAY (FILL) wood and concrete	-			
1			-Lab sample		CLAY (FILL) some brick and cor	ncrete, trace sand and gravel	-			
	<u> </u>   4		·-Lab sample		SILT brown, some sand	and day	-			
2			-Lab sample		SAND brown, medium gra	ained, trace silt, occasional coal				
3			-Lab sample		SILT brown, trace sand	and clay	-			
4			-Lab sample							
5					-trace coal  END OF TEST PITUPON COMPLETITO -No slough -No water Backfilled with spo	ON:	-			
6										
-	100 00 00 00 00 00 00 00 00 00 00 00 00		10	FIELD LOGGED BY:	77 CONTROL - 1 P. 22	COMPLETION DEPTH: 4.5 m	7/6			
				PREPARED BY: MFI REVIEWED BY: BH	2012	OMPLETION DATE: 10/31/13				

Commence and the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of the contract of t				PROJECT: WQALOB PHASE III ESA		BOREHOLE NO: TP13		
	1000 2000			DATE DRILLED: October 31, 2013		PROJECT NO: 14-35-1		
				on LOCATION: See Drawing #14-35-187-	1	ELEVATION:		
SAME	LE TYPE	E ∭ GRA	B SAMPLE		P:		10	
DEPTH (m)	SAMPLE TYPE	△HEADSPACE (ppmv) 20 40 60	Δ	SOIL SCRIPTION				
0		20 40 00	-Lab sample	)	SAND AND GRAVE some brick and con	EL (FILL) crete	- ( - - -	
1			-Lab sample	}	COAL (FILL)			
2			-Lab sample	)	SILT brown, some sand a	and clay, trace oxides		
	<u> </u>				SAND brown, medium grai	ined, some silt, trace coal	- - - - -	
3			-Lab sample		SILT some sand and clay	v, trace oxides	-	
4					-more clay and fine	sand	- - - - -	
5	<u></u>				-sandy  END OF TEST PIT UPON COMPLETION -No slough -No water Backfilled with spoil	ON:		
6				FIELD LOGGED BY:		DMPLETION DEPTH: 4.6 m	F,	
				PREPARED BY: MFH	CC	OMPLETION DATE: 10/31/13		

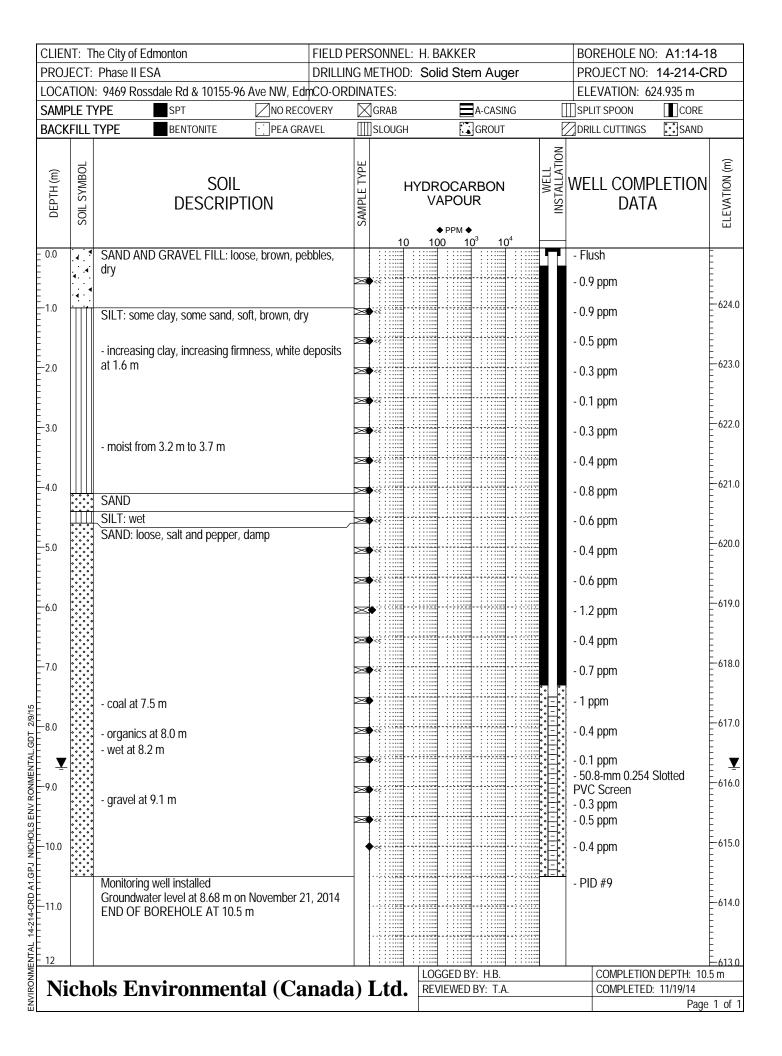
	ENT: EPCOR	PROJECT: WQALOB PHASE III ESA		BOREHOLE NO: TP13-6				
	LING COMPANY: Macroe Construction	DATE DRILLED: November 1, 2013		PROJECT NO: 14-35-187				
	L/METHOD: Komatsu PC270LC / Bucket Excava	ation LOCATION: See Drawing #14-35-187-	1	ELEVATION:				
SAMP	IPLE TYPE GRAB SAMPLE		P	T	20			
DEPTH (m)	△ △ HEADSPACE (ppmv) △	REMARKS  DES						
0	20 40 60 80		SAND AND GRAVEL some concrete, brick,	(FILL) clay, roots, and organics	- (			
1	-Lab sam	ple	COAL (FILL) some clay chunks and	debris				
	-Lab sam	ple	SILT brown, some sand, cla	ıy, and gravel				
2			-dark brown, more org -brown, clayey, trace s	N				
3								
4	-Lab sam	ple	-coal seam and coarse SAND, brown, medium \oxides and coal flecks END OF TEST PIT AT	n to coarse grained, trace				
F			UPON COMPLETION -No slough -No water Backfilled with spoil					
5								
6		FIELD LOGGED BY:		PLETION DEPTH: 4.0 m	(			
		PREPARED BY: MFH REVIEWED BY: BHM	COME	PLETION DATE: 11/1/13 Page 1	_			

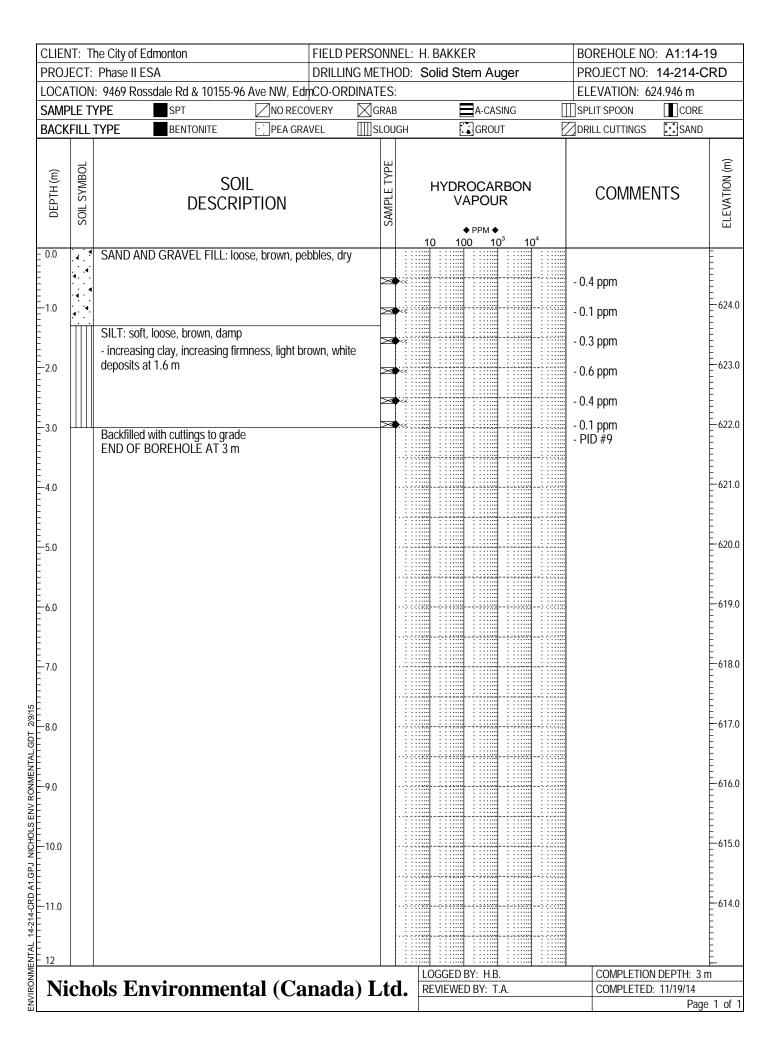
		EPCOR		A CONTRACTOR OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF TH	ALOB PHASE III ESA	BOREHOLE NO: TP13-7					
		COMPANY: Macroe Construc			November 1, 2013	PROJECT NO: 14-3	5-187				
		THOD: Komatsu PC270LC / B		n LOCATION: See	Drawing #14-35-187-1		ELEVATION:				
200000000000000000000000000000000000000		TYPE GRAB SAN	APLE			0011					
DEPTH (m)	SAMPLE TYPE	△HEADSPACE (ppmv)△ 20 40 60 80		REMA	RKS		SOIL DESCRIPTION				
0	П	Δ	-Lab sample	9		SAND AND GRA some clay chunk	NVEL (FILL) s, brick, concrete, and roots	-			
1		_	-Lab sample -Adjusted tes	st pit to avoid duct	line and continued	SILT (FILL) brown, some sar	nd and clay				
	П	Δ	···-Lab sample			-red concrete		- - - -			
2		Δ				SILT sandy, trace coa	Ī	-			
3	П	Δ	····-Lab sample			SAND brown, coarse gr	rained, silty, some coal and oxides	-			
		Δ				SILT brown, sandy, tra	ace oxides, coal, and clay				
4						END OF TEST F UPON COMPLE -No slough -No water Backfilled with sp	TION:	-			
5											
6								-			
			10°1		FIELD LOGGED BY: MFH	1/2	COMPLETION DEPTH: 4.0 m	78			
		THURBER ENGI			PREPARED BY: MFH REVIEWED BY: BHM		COMPLETION DATE: 11/1/13	Page 1			

Parameter and the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second secon				ALOB PHASE III ESA	BOREHOLE NO: PROJECT NO: 14					
				: November 1, 2013	<u>S</u>					
		PC270LC / Bucket Excava	tion LOCATION: See	e Drawing #14-35-187-1		ELEVATION:				
SAMP	PLE TYPE [	GRAB SAMPLE			Tz					
DEPTH (m)	SAMPLE TYPE TYPE TYPE TYPE TYPE TYPE TYPE TYPE	1.4/A (S)	REMA	ARKS	I	SOIL DESCRIPTION				
0	20 40	60 80 -Lab sam	ple		SAND AND GRA dark brown, som	AVEL (FILL) ne silt and clay	-			
1		-Lab sam	ple		SAND (FILL) some brick, trace	e gravel				
	<b> </b>    4	-Lab sam	ple		-occasional coal		-			
2		-Lab sam	ple		SILT sandy		-			
3		-Lab sam	ple + Duplicate R5		-trace oxides		- - - - - - -			
4							-			
E	<u> </u>				-occasional coal		-			
5					SAND, brown, fill END OF TEST F UPON COMPLE -No slough -No water	ne grained, very silty PIT AT 5.4m ETION:	-			
6					Backfilled with sp		-			
				FIELD LOGGED BY: MFH	16	COMPLETION DEPTH: 5.4 m	18			
				PREPARED BY: MFH REVIEWED BY: BHM	-	COMPLETION DATE: 11/1/13	Page 1			

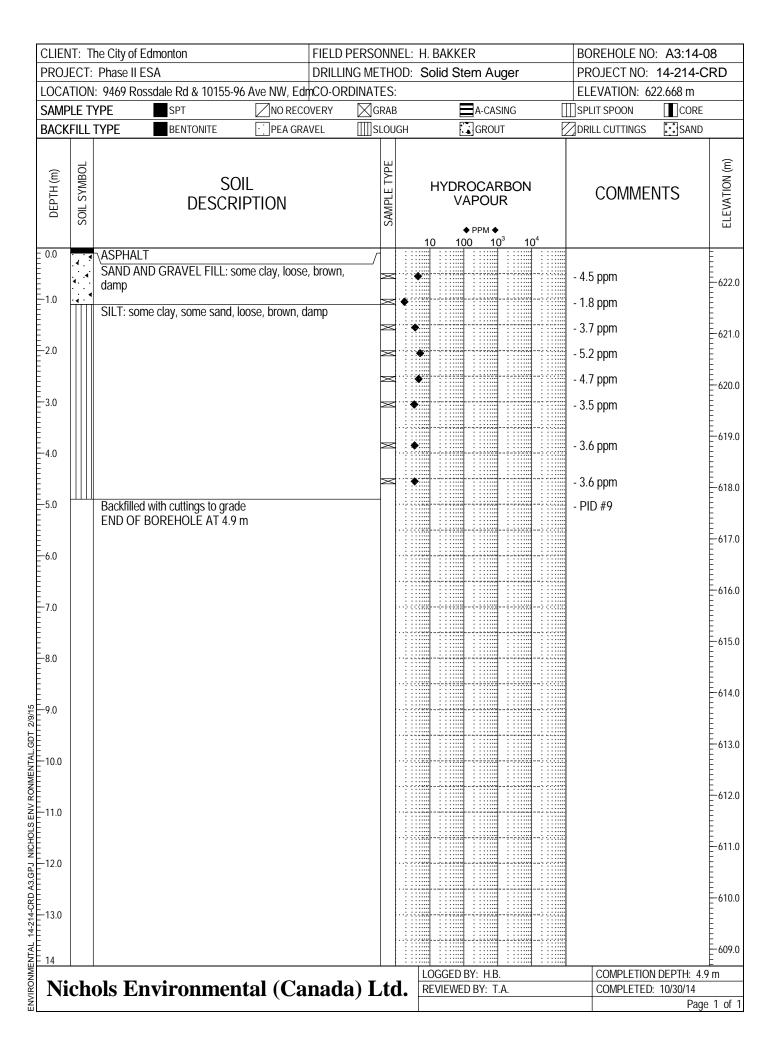
200000	X14-00 DX	EPCOR		ALOB PHASE III ESA	BOREHOLE NO: TP13-9			
		GCOMPANY: Macroe Construction		November 1, 2013	PROJECT NO: 14-35-187			
Saturday Manager	V1 V F 1 V 1 V V	ETHOD: Komatsu PC270LC / Bucket Excava	tion LOCATION: See	Drawing #14-35-187-1		ELE	/ATION:	
SAME	PLE T	TYPE GRAB SAMPLE			To To			
DEPTH (m)	SAMPLE TYPE	Zi lendoi Aoe (ppiliv)Zi	REMA	RKS	С	SOIL DESCRIPTIO	N	
0		20 40 60 80 -Lab samp	ole		SAND AND GRA brown, trace orga and clay	VEL (FILL) anics, occasional br	ick, concrete,	-
1		-Lab samo	ole		SAND , GRAVEL brown, brick, con-	AND CLAY (FILL) crete, and debris		
2		-Lab samp	ole		SAND AND SILT brown, some day trace coal and gra	chunks, bricks, na	ils, and wood,	
		<b>A</b>			SILT (FILL) brown, occasiona brick	l oxides, coal, conc	erete chunks, ar	nd -
3		-Lab samç	ole		brown, sandy, tra	ce oxides and coal		
4					SAND brown, very silty, oxides and oxide SILT, brown, san END OF TEST P UPON COMPLETION -No slough -No water Backfilled with sp	dy, trace oxides IT AT 4.0m TION:	ined, some	
5								
6				FIELD LOGGED BY: MFH	- 1	COMPLETION DEPTH		-
				PREPARED BY: MFH		COMPLETION DATE:		
		THURBER ENGINEERING LTD.		REVIEWED BY: BHM			P	age 1

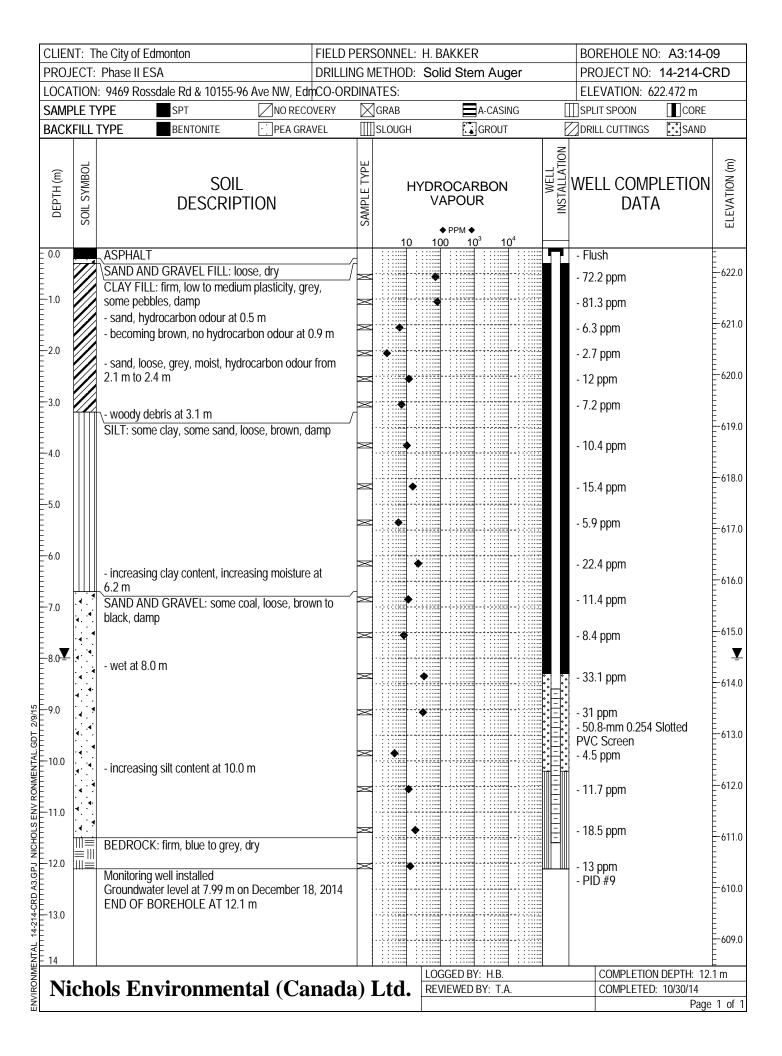
	IT: EPO	NR. (5019-) 54, 11			ALOB PHASE III ESA	BOREHOLE NO: TP13-1					
		OMPANY: Macroe Constructi	7.00		November 1, 2013	PROJECT NO: 14-35-187					
		HOD: Komatsu PC270LC / Bu		LOCATION: See	Drawing #14-35-187-1		E	LEVATION:			
AMP	LE TYF	PE	LE I			T&			19		
DEPTH (m)	SAMPLE TYPE  SAMPLE TYPE  A HEADSPACE (ppmv) \( \Delta \)			REMA	RKS	[	SOIL DESCRIPTION				
0	1	20 40 60 80	-Lab sample	;		SAND AND GRAbrown, trace to s		nd roots	- (		
1			-Lab sample	+ Duplicate R3		SAND (FILL) brown, some wo	od debris and sil	t, occasional coal			
2						SILT (FILL) brown, sandy, so	ome wood pieces	, occasional oxide:	5 -		
	<u>∏</u>		-Lab sample			-some clay, occa	asional coal chun	ks			
3			···-Lab sample			SILT brown, some da	y and sand, trace	e oxides and grave	-		
4						SAND brown, very silty, oxides and coal SILT, brown, sar END OF TEST F UPON COMPLE -No slough -No water Backfilled with sp	ndy PIT AT 4.0m ETION:	ce clay, occasiona			
5											
6							1				
					FIELD LOGGED BY: MFH	- 1	COMPLETION DE		Viti		
		THURBER ENGIN			PREPARED BY: MFH REVIEWED BY: BHM		COMPLETION DAT		age 1		

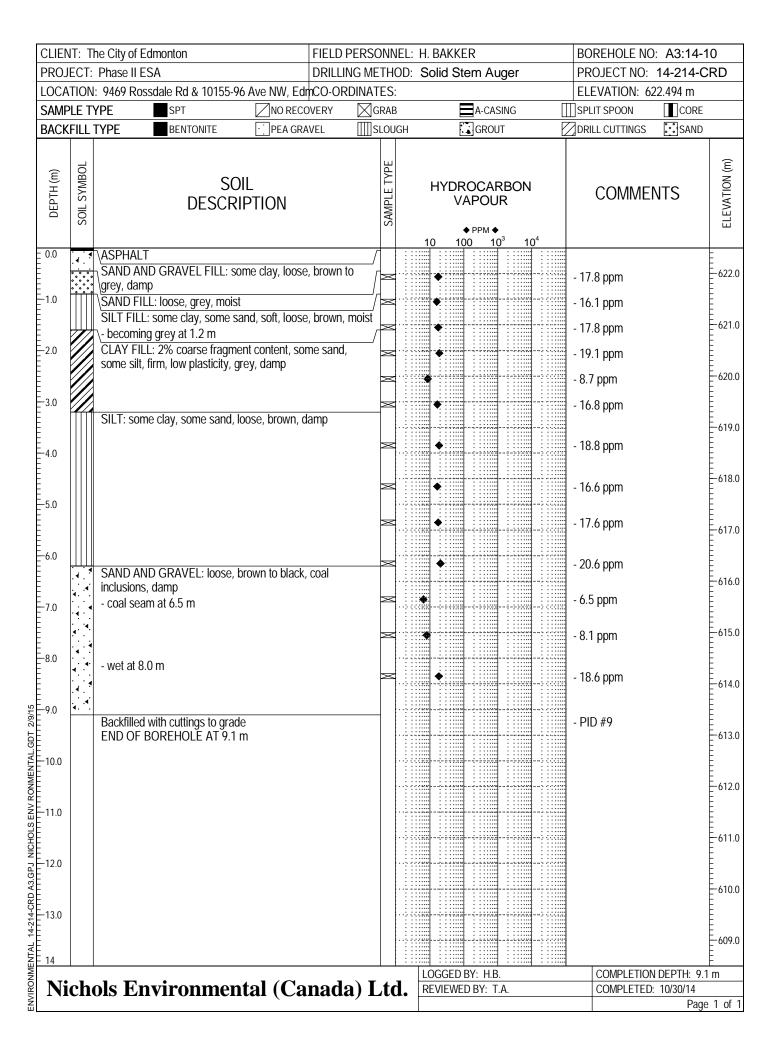


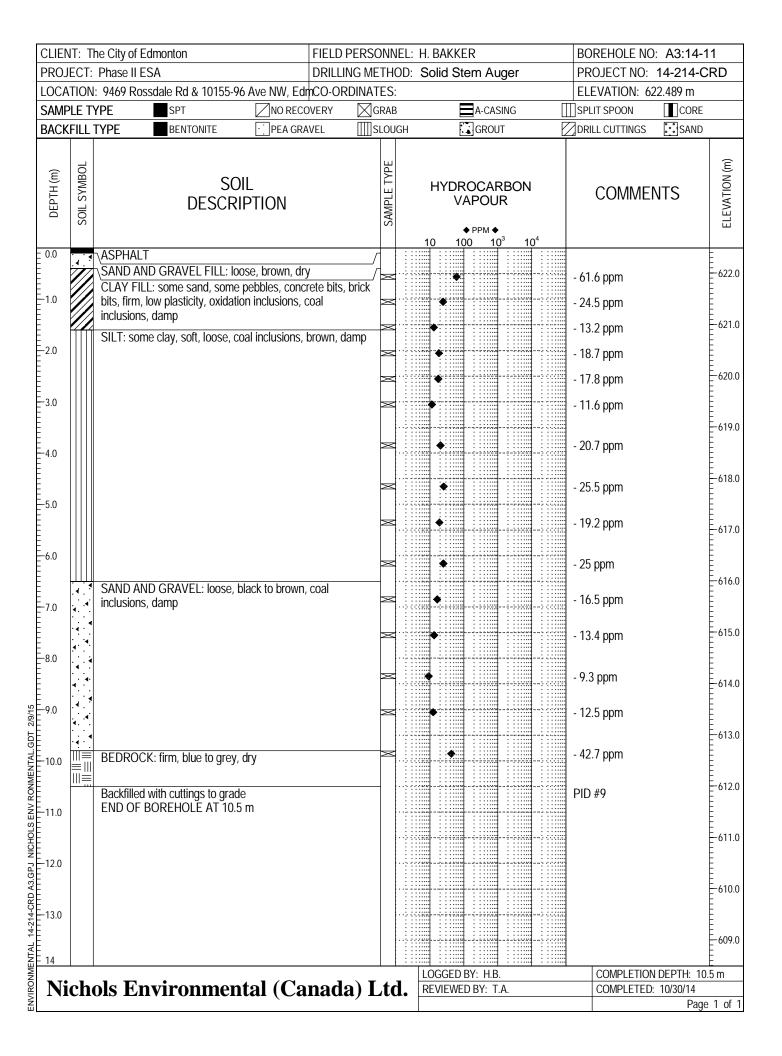


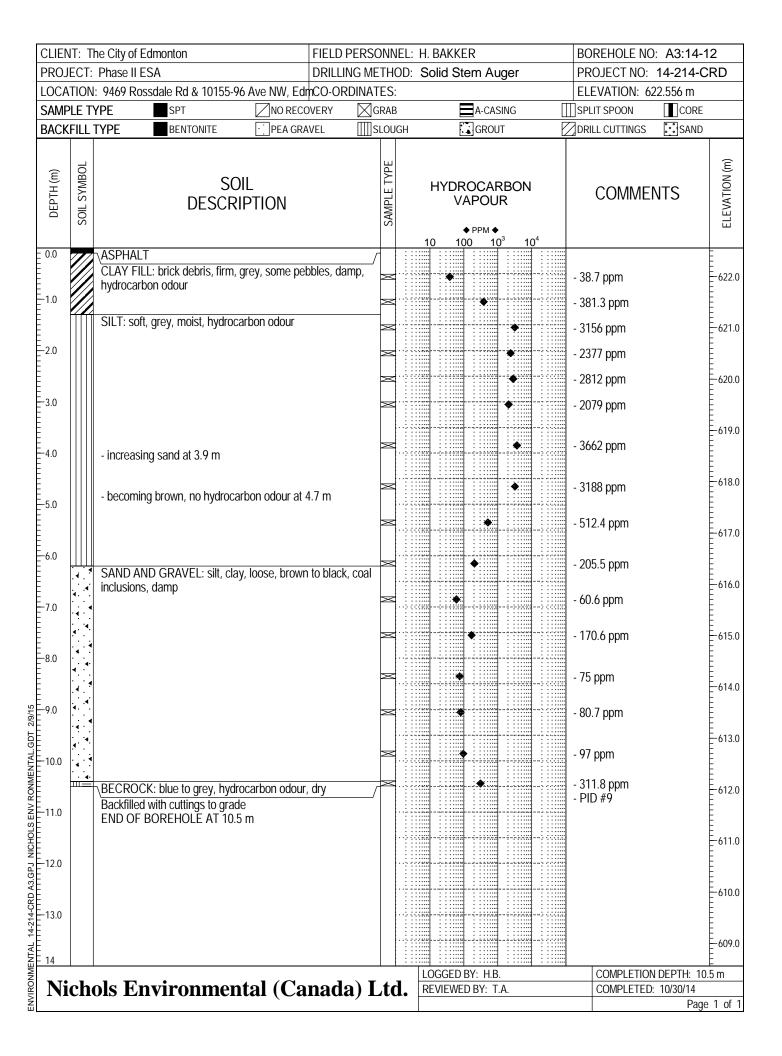
CLIE	3					SONNEL: H. BAKKER						BOREHOLE NO: A1:14-20			20	
PRO	JECT:	Phase II ESA		DRILLING MI	ETH(								PROJECT NO:	14-214-C	RD	
LOC	ATION	l: 9469 Rossdale Rd & 10155-96	6 Ave NW, Edm	CO-ORDINA	ΓES:								ELEVATION: 625.068 m			
SAM	PLE T	YPE SPT	✓ NO RECOV	/ERY 🖂	GRAB	RAB A-CASING					SPLIT SPOON CORE					
BAC	KFILL	TYPE BENTONITE	: PEA GRAV	/EL	SLOU	GH		[	GRO	UT				RILL CUTTINGS	SAND	
DEPTH (m)	SOIL SYMBOL	SO DESCRI		SAMPLE TYPE	HYDROCARBON VAPOUR  PPPM   10 100 103 104					<b>)</b> <sup>4</sup>	COMMENTS			ELEVATION (m)		
- 0.0		SAND AND GRAVEL FILL: loc	ose, brown, peb	bles, dry					: : : : : : : : : : : : : : : : : : : :							-625.0 -
Ė	1				$\triangleright$	<b>&gt;</b> << : :						:::::	- (	0.1 ppm		E
-1.0	1.															Ė
E 1.0		SILT: some sand, some clay, s	oft, loose, brow	n, damp	×	><< : : :							- (	0.1 ppm		-624.0
<u> </u>		- increasing clay, increasing firr deposits at 1.6 m	mness, light bro	wn, white	×		:::::: :::::::::::::::::::::::::::::::						- I	Non-Detect		
-2.0 -		- bone fragments at 1.8 m			$\times$								ا - ا	Non-Detect		623.0
Ė					$\times$								- [	Non-Detect		E
3.0	ШШ	Backfilled with cuttings to grade	<u> </u>		×	><< ; ;						:::::	- (	0.5 ppm		622.0
Ė		END OF BOREHOLE AT 3 m	-								rrawi		- I	PID #9		
Ė,,									: : : : : : : : : : : : : : : : : : : :							Ē
<del>-</del> 4.0						****										621.0
E																-
Ė.,																Ė
<del></del> 5.0																620.0
E																-
Ė																Ė
<del>-</del> 6.0							:::::		**************************************			> 4448				619.0
E						;;;	::::					> : : : : :				E
Ė																Ė
<del>-</del> 7.0																618.0
F																E
/9/15																Ė
~ <del> </del> -8.0									•		}-}	3 ((())				617.0
PAL.G																E
ME - -									: : : : : :							Ė
NO - 9.0						****						> : : : : :				616.0
EN-						; ;;										Ė
HOLS																F
<u>Ş</u>																615.0
1.GPJ											rrani	2333				Ė
14-214-CRD A1.GPJ NICHOLS ENV RONMENTAL.GDT 2/9/15																Ė.
5 11.0 11.0						****	:::::				> > > > > = = = = = = = = = = = = = = =	> 4448				614.0
14-2																E
ENVIRONMENTAL 12 12 12 1																Ė.
NA -	<u> </u>		. •	<b>-</b> \ -		•			BY: H.I				1	COMPLETION		m
N N	ich	ols Environmen	tal (Cai	nada) I	∠tc	1.	REV	IEWE	D BY:	T.A.				COMPLETED:		. 1 -5 6
<u> </u>												Page	e 1 of 1			



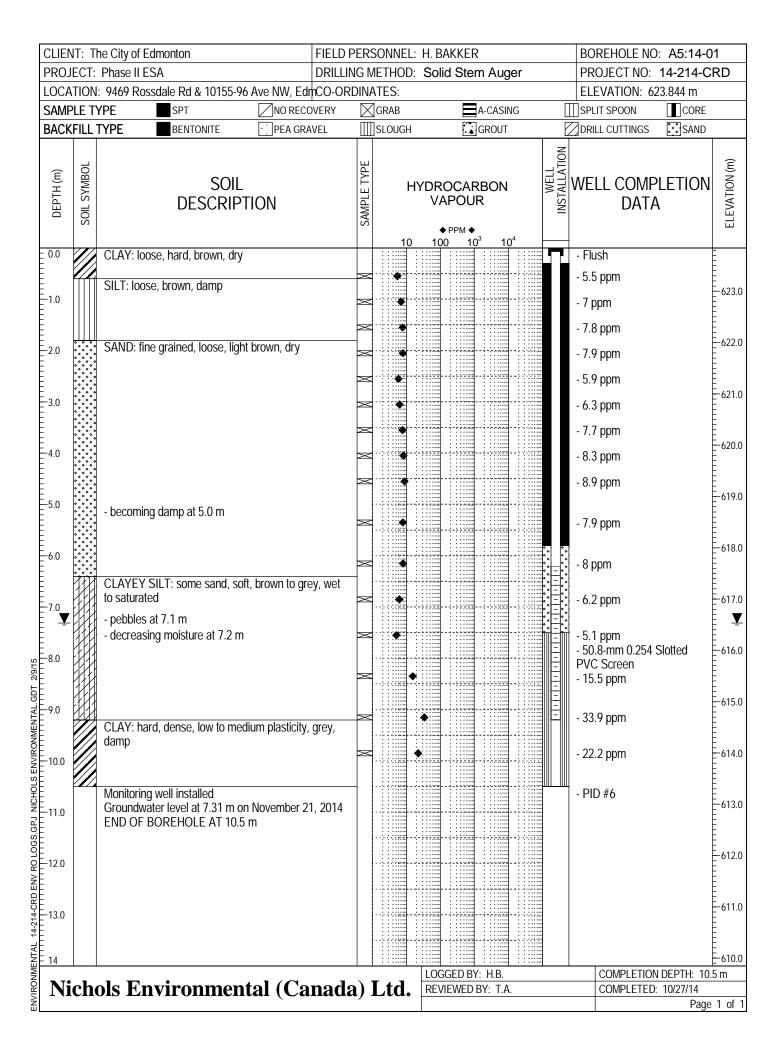


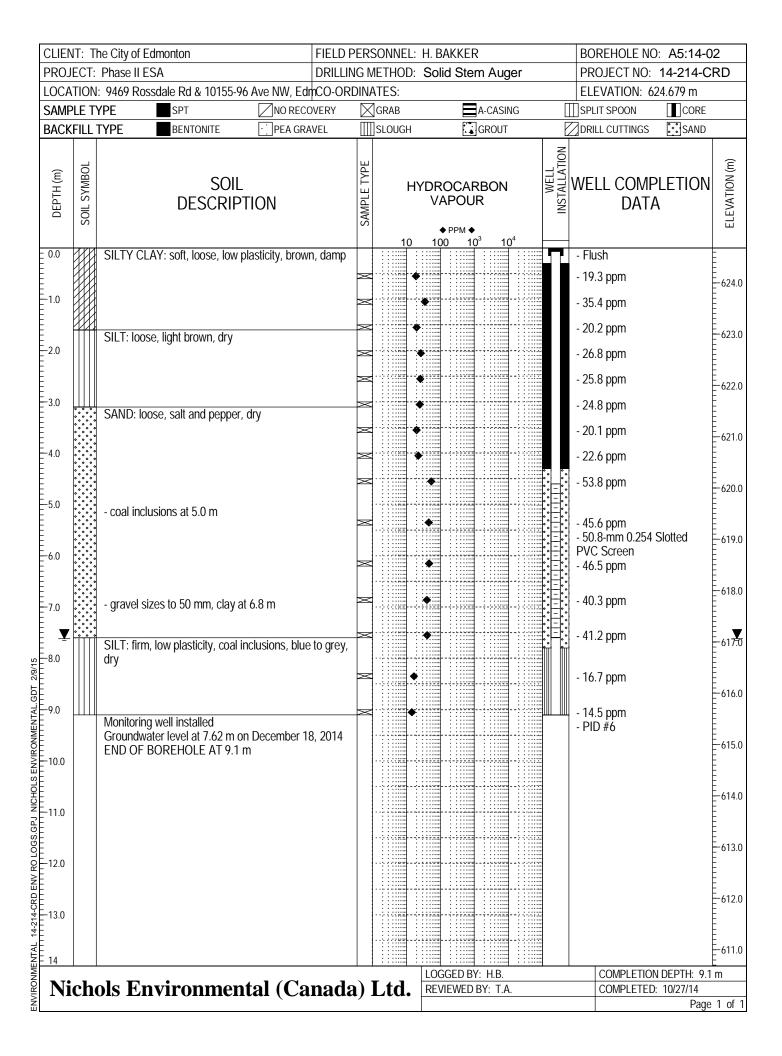


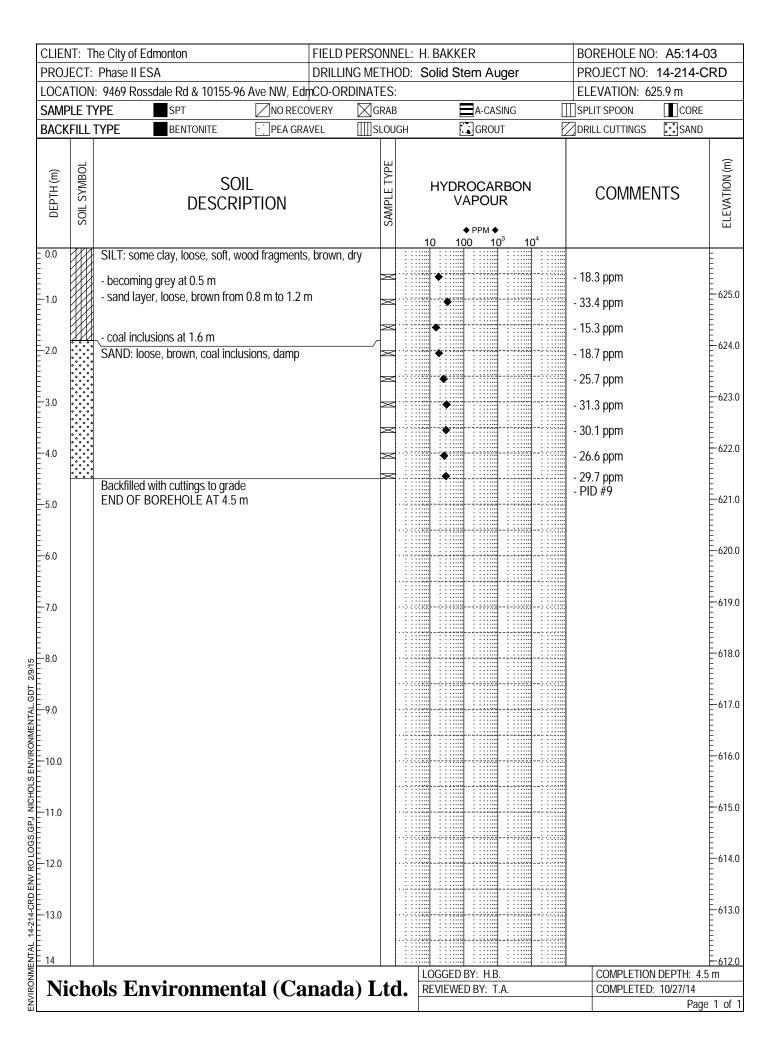


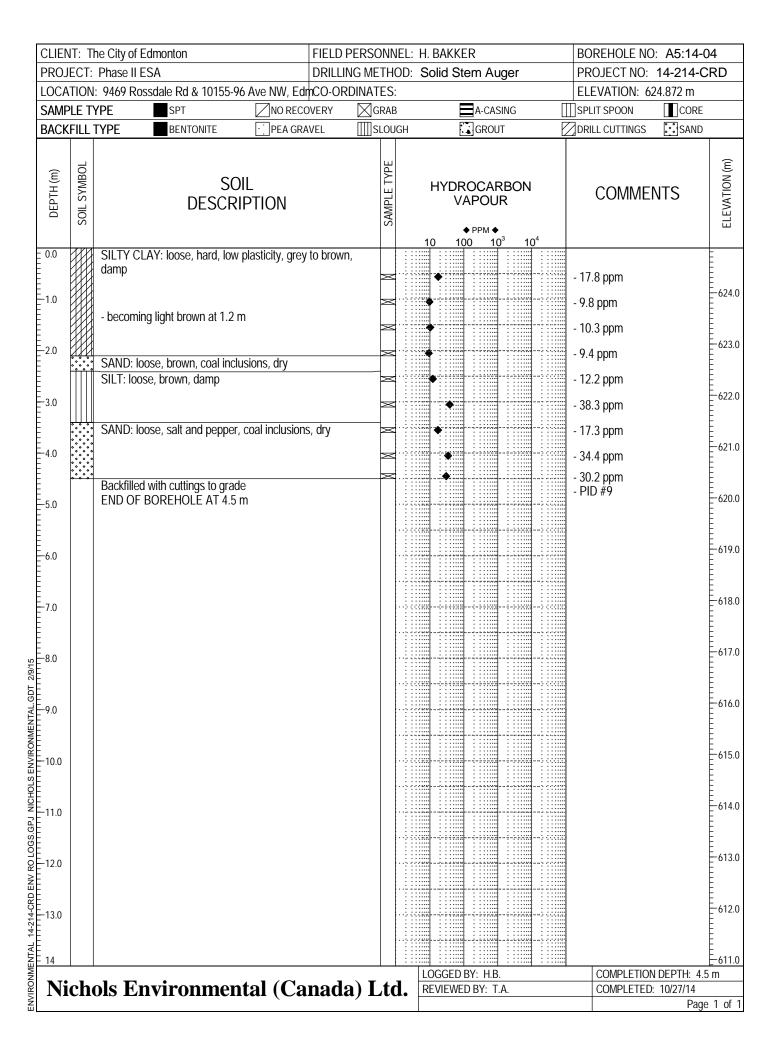


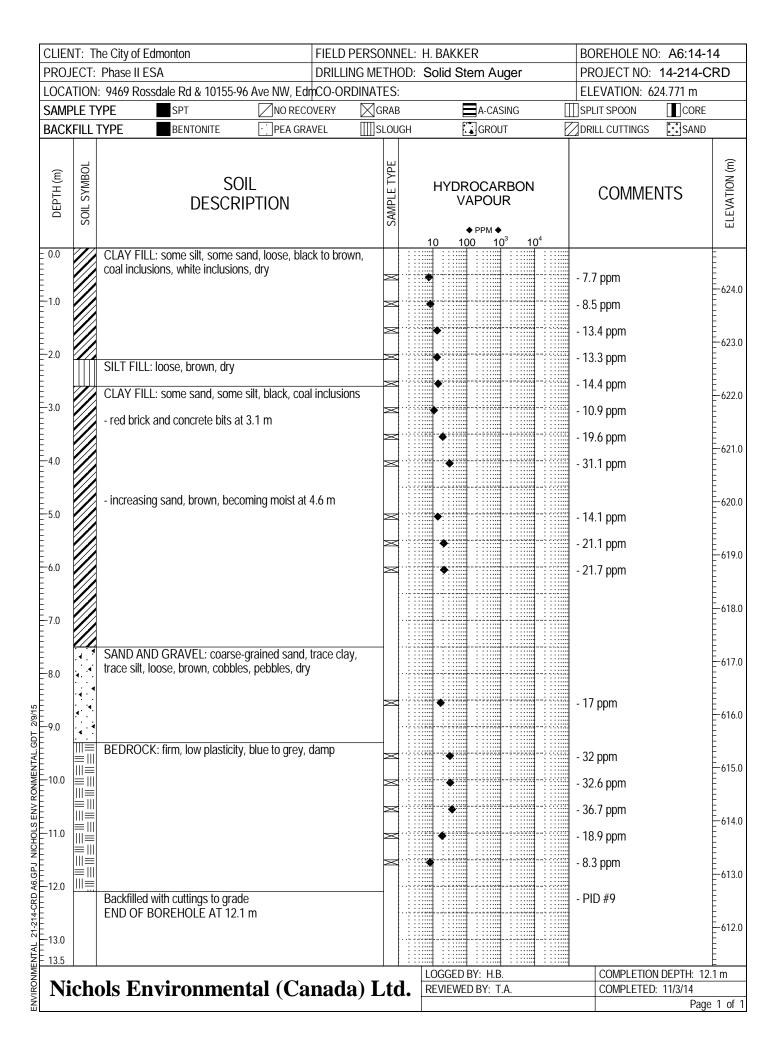
		ne City of E			PERSO							BOREHOL			
		Phase II E	SA ssdale Rd & 10155-96		NG MET		טי: ס	oila S	otern A	vuger		PROJECT ELEVATION			CKD
	PLE T		SPT	NO RECOVERY	GF				■A-C	ASING		SPLIT SPOOM		CORE	
	FILL		BENTONITE	PEA GRAVEL	SI. ∭SL		 H		GRO			DRILL CUTTI		SAND	
DEPTH (m)	SOIL SYMBOL		SOI DESCRII	PTION		SAMPLE TYPE	1	`	PROCAVAPO	UR ◆ .	N 10 <sup>4</sup>	СОМ	MEN	ITS	EI EVVATIONI (m)
0.0 -1.0 -1.0 -2.0 -3.0 -4.0 -5.0 -6.0 -7.0 -8.0		- increasi - decreasi hydrocarl  SILT: loo	ng sand, increasing mosing sand, decreasing soon odour at 3.6 m se, wood debris, grey, ang clay, increasing mo	pebbles, coarse fragmosture at 2.8 m  iilt, black to grey,  damp  isture, orange at 7.3 n  ny, some silt, loose, co	n				100	10	10	- 43.9 ppm - 35.6 ppm - 36.5 ppm - 5.4 ppm - 39.8 ppm - 45.7 ppm - 229.3 ppm - 47.2 ppm - 48.5 ppm - 40.9 ppm - 31.5 ppm - 27 ppm			-62 -62 -61 -61
-8.0 -9.0 -10.0		Backfilled	s, brown to black, mois  I with cuttings to grade BOREHOLE AT 9.1 n			M .		•				- 9.7 ppm - 16.6 ppm - PID #9			-61 -61
-10.0 -11.0 -12.0 -13.0															61
14							1 ::::::	0005	D DV ::	D		00: 50:	TION	DEDTI! -	<u> </u>
Ni	cha	ole Fr	nvironment	al (Canad	a) I	t A			D BY: H. /ED BY:					DEPTH: 9 10/30/14	.1 m
T 41					u, 11	·u	·• 💾					33//// [1			ge 1

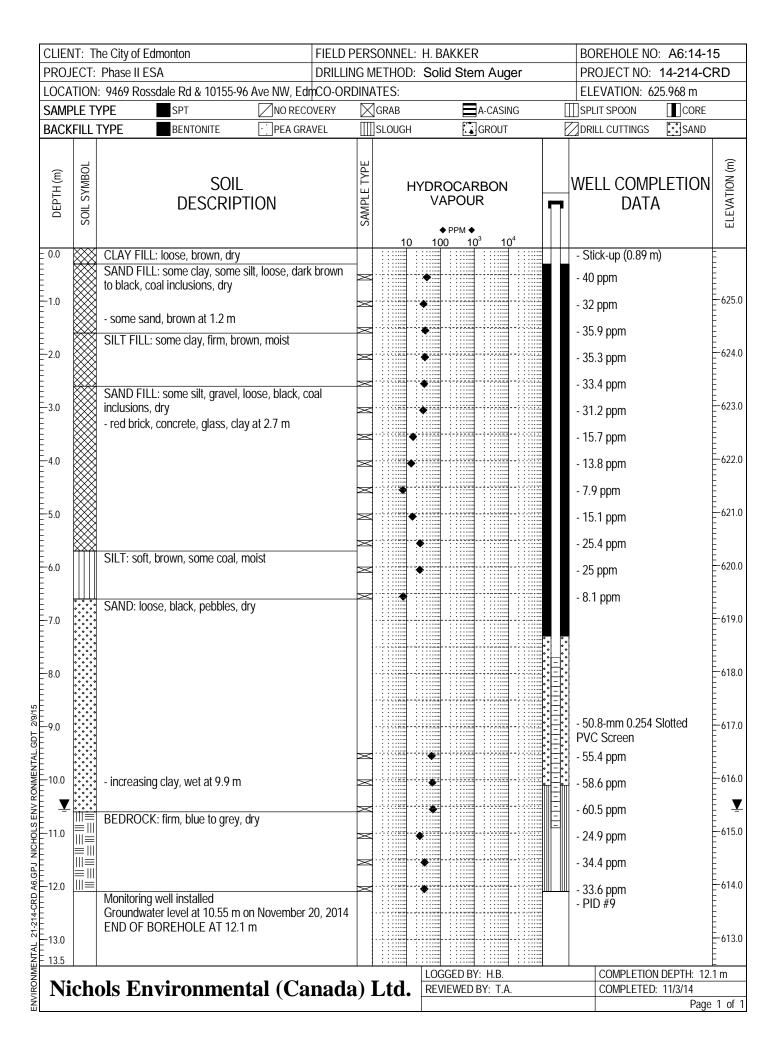




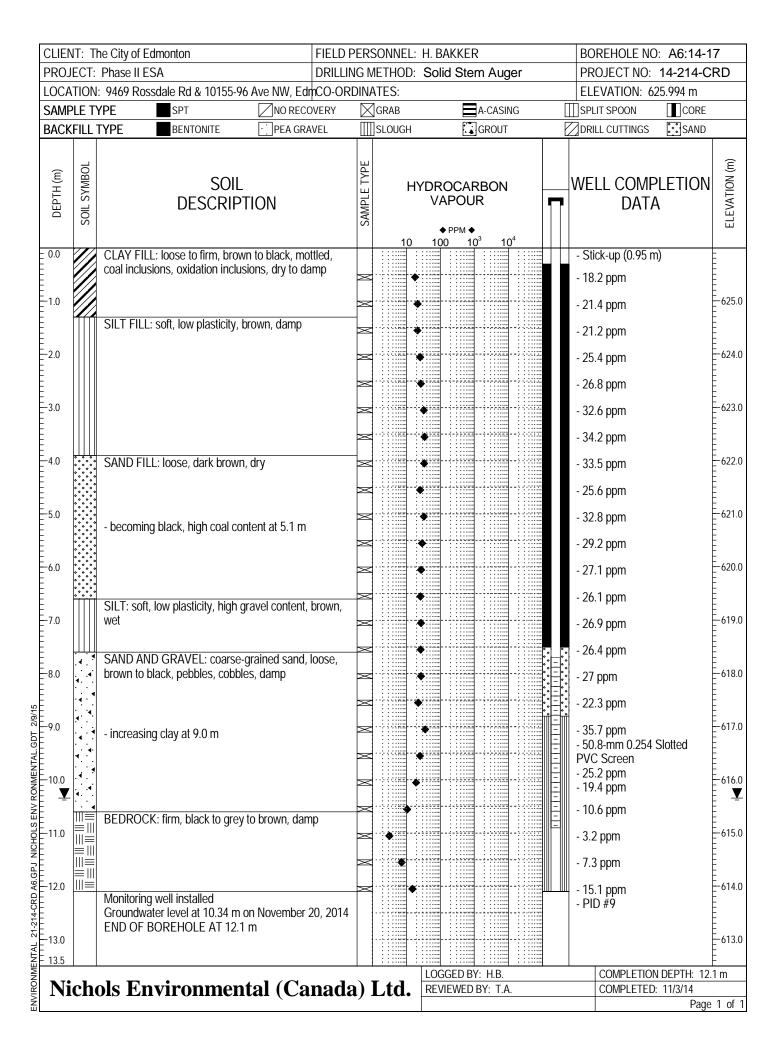


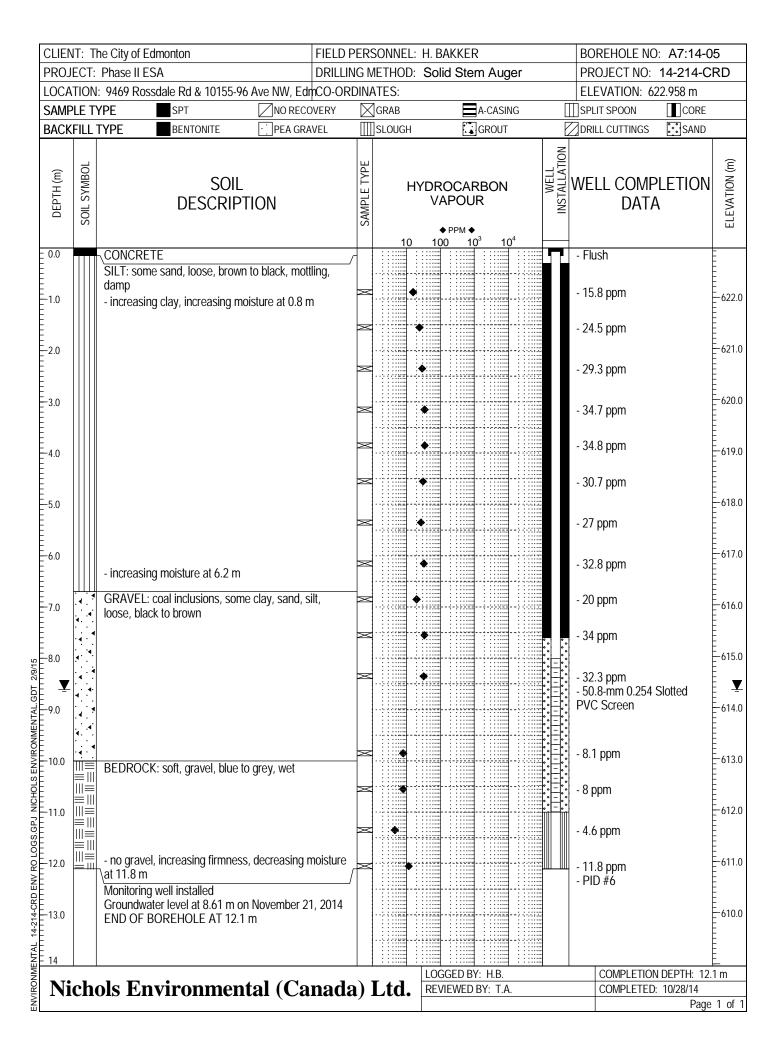


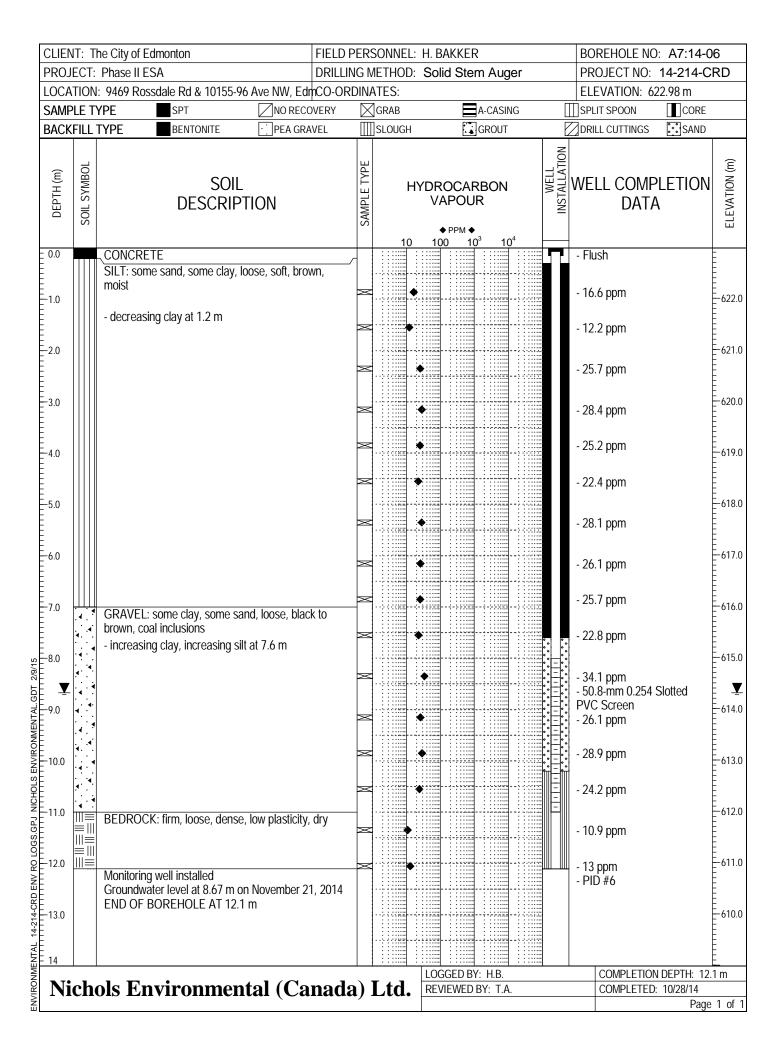


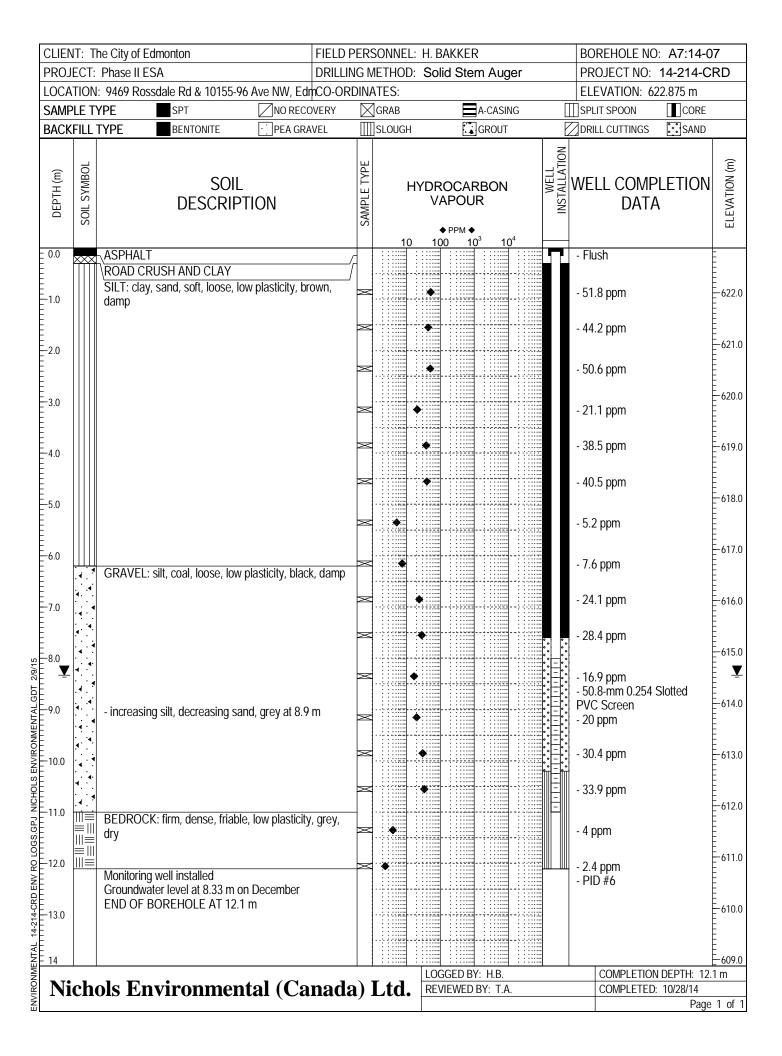


			Edmonton		ELD PERSC							_		): A6:14	
		Phase II			RILLING ME		טי: 3	olia S	iem A	uger				<b>14-214-</b> 24.932 m	CKD
SAMP			ossdale Rd & 10155-96	NO RECOVER					A-C	A CINIC	Г	ELEVA ∭SPLIT SP		24.932 M	г
SAIVIP BACK			BENTONITE	PEA GRAVEL			11		GRO		L	DRILL CL		SANI	
DACK	FILL	ITPE	BENTONITE	PEA GRAVEL	. [[[]3	LOUG	іП		GRU	JU I		ZJURILL CU	JITINGS	€ SAIVI	<u> </u>
DEPTH (m)	SOIL SYMBOL		SOI DESCRI			SAMPLE TYPE		V	APOI ◆ PPM	<b>•</b> .	<b>N</b> 10⁴	CC	OMME	NTS	(w) NOIL V/11 II
0.0		CLAY F	ILL: loose, brown, dry			<b>×</b>		•				- 42.5 pp	om		
-1.0			L: some sand, some cl	•	•	<b>×</b>		•			**************************************	- 50.4 pp	m		-62
			ILL: loose, brown to bla n inclusions, brick, mas		lS, √	×.		•				- 44.8 pp	om		Ė
-2.0			L: some sand, soft, bro		glass,	⊠.		•				- 46.7 pp	m		E-62
		•	ILL: loose, black, slag,	ash, dry		₩.		•			W2 ( ( ( ) )	- 50.8 pp	m		Ė
-3.0						<b>×</b>	->	•				- 36 ppm	1		E-62
						×.		•				- 22.2 pp	m		Ē
-4.0		OU T						•			##> / / / / / / / / / / / / / / / / / /	- 19.9 pp	m		-62
		SIL1: SO	me clay, soft, brown, d	amp		⊠.		***				- 34.3 pp	m		Ē
-5.0						<b>×</b>		•		**		- 43.2 pp	m		-62
		- some s	sand at 5.4 m			₩.		•				- 49.2 pp	m		Ē
-6.0						<b>×</b>		***				- 38.2 pp	m		E-61
		CANDA	ND GRAVEL: coarse-o	arained cand loos	o brown	<b>×</b>		•				- 47.9 pp	m		Ė
-7.0			pebbles, cobbles, dam		SC, DIOWII	⊠.		•				- 41.2 pp	m		6
						⋈.		•				- 51.4 pp	m		E
-8.0						₩.		•				- 33.2 pp	m		E-6'
	•					₩.		•		*******	v	- 32.3 pp	m		Ė
-9.0		- increas	sing clay at 8.7 m			⋈.		•			##	- 24.9 pp	m		6
						<b>×</b>		•				- 20.4 pp	m		Ė
-10.0						<b>×</b>	***************************************	•				- 16.1 pp	om		E-6'
			d with cuttings to grade BOREHOLE AT 10.5			-				494	WI> < < < < < < < < < < < < < < < < < <	- PID #9			
-11.0		LIND OI	DONLINGLE AT 10.3	111						**********					<u>-6</u>
										***********	##> 444EE				Ē,
-12.0															-6
						-									Ė
-13.0						-									<u>-</u> 6
13.5							L	OGGED				CON	MPLETION	N DEPTH: 1	F 10.5 m
Ni	cho	ols E	nvironmen	tal (Cana	ada) L	td	. R	EVIEWE	D BY:	T.A.		CON	//PLETED		ge 1









CLIEN	NT:	EPCOR			PROJE	CT:	GROUNDWATER WELL INSTALLATION		BOREHOLE NO:	TH15-1
DRILI	ING	COMPANY: Mo	bile Augers & Resear	rch Ltd.	DATE	DRIL	LED: December 17, 2015		PROJECT NO: 1	10490
DRILL	_/ME	THOD: Track / S	olid Stem Augers		LOCAT	TION:	: N5933987.91, E334458.68		ELEVATION: 62	5.27 (m)
SAME	PLE	TYPE		10						
BACK	FILI	TYPE	BENTONITE	SAND			SLOUGH			
DEPTH (m)	SAMPLE TYPE		REMARKS		WELL		SOIL DESCRIPT	TON		ELEVATION (m)
1 2		-Frozen to 0.2m				Cl da	LAY ark brown, silty, trace light brown clay, grave	l, oxides, and	topsoil	-624 -623 -622
4						CL	AND ottled light brown - dark brown, medium grai LAY own, silty, sandy, some sand lenses, trace s		osoil, trace oxide	-621
7	3	-Seepage			2002 					-619 -618 618
BOREHOLE LOG 10490.GPJ THRBR AB.GDT 2/23/16. LIBRARY-NEWLOGO- N.E.GLB  1 1 1 1 0 6  1 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0 1 0							ark brown, some gravel ND OF TEST HOLE AT 12.2m			-616 -615 -614 613
10G 10490. GPJ THRBR AB.GDT						UF -SI -W Mc W/ -D	PON COMPLETION: (Below ground surface slough at 9.8m Vater at 8.1m onitoring well installed (ATER LEVEL BELOW GROUND SURFACI December 17, 2015 = 10.1m	E:		-612 611
HOLE					.57 .57		FIELD LOGGED BY: JLM	COMPLETION	TWO SECURE AND ADDRESS OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE P	S-2
SORE			THURBER ENGINEERING	ITD			PREPARED BY: RTB REVIEWED BY: NHF	COMPLETION	JATE: 12/1//15	Page 1 of 1
			DAINATE ELECTIVE AND ADDRESS OF				Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Contro			-

CLIEN	T: E	EPCOR	PROJE	ECT:	GROUNDWATER WELL INSTALLATION		BOREHOLE NO: T	H15-3
DRILLI	NG	COMPANY: Mobile Augers & Research Ltd.	DATE	DRII	LLED: December 17, 2015		PROJECT NO: 10	490
DRILL	MET	THOD: Track / Solid Stem Augers	LOCA	TION	N: N5934000.26, E334480.88		ELEVATION: 624.	87 (m)
SAMPI								
BACKE	ILL	TYPE BENTONITE SA	ND		SLOUGH			
DEPTH (m)	SAMPLE TYPE	REMARKS	SLOTTED PIEZOMETER		SOIL DESCRIPT	TION		ELEVATION (m)
-1 -2 -3 -4 -5	4	Frozen to 0.3m		C da	OPSOIL ark brown, silty clay ELAY ark brown, silty, trace silt lenses and gravel brown, sandy, some sand lenses			-624 -623 -622 -621 -620
UBRARY-NEW LOGO - N E.GLB 6 8 8 11 11 11 11 11 11 11 11 11 11 11 11	-4	Seepage		-d	dark brown, some gravel			-618 -617 -616 -615
BOREHOLE LOG 10490.GPJ THRBR AB.GDT 2/23/16. LIBRARY-NEWLOGGO- N.E.GLB 11 11 11 11 11 11 11 11 11 11 11 11 11				-V -W W	ND OF TEST HOLE AT 12.2m IPON COMPLETION: (Below ground surface Blough at 10.5m Water at 8.3m Ionitoring well installed WATER LEVEL BELOW GROUND SURFACE December 17, 2015 = 9.5m  FIELD LOGGED BY: JLM		DEPTH: 12.2 m	-613 -612 -611 -611
Prince					PREPARED BY: RTB	COMPLETION	DO SECURIO DE LOS ADRIGIOSES.	
BOR		THURBER ENGINEERING LTD.			REVIEWED BY: NHF	John Echon C	AND THE RESERVE AND THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON	Page 1 of 1

CLIEN	IT:	EPCOR	PROJE	CT:	GROUNDWATER WELL INSTALLATION		BOREHOLE NO:	TH15-4
DRILL	INC	COMPANY: Mobile Augers & Research Ltd.	DATE	DRIL	LED: December 17, 2015		PROJECT NO:	10490
DRILL	/ME	ETHOD: Track / Solid Stem Augers	LOCAT	ΓΙΟΝ	I: N5933945.21, E334469.18		ELEVATION: 62	25.21 (m)
SAMF	LE	TYPE						
BACK	FILI	L TYPE BENTONITE SA	ND		SLOUGH			
DEPTH (m)	SAMPLE TYPE	REMARKS	SLOTTED PIEZOMETER	_	SOIL DESCRIPT	TION		ELEVATION (m)
-1 -1 -2 -3 -4 -1 -5	3	-Frozen to 0.2m		CI	LAY (FILL)  ark brown, trace black topsoil and light brown  LAY (TILL)  ottled light brown - dark brown, trace silt len		ım	-624 -624 -623 -622 -621 -620
BOREHOLE LOG 10490, GPJ THRBR AB, GDT 2/23/16, LBFARY-NEW LOGO- N E.GLB  1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				S/ lig	AND pht brown, medium grained, trace oxides and AND AND GRAVEL rown - red, some clay lenses, trace coal  ND OF TEST HOLE AT 12.2m PON COMPLETION: (Below ground surface Blough at 10.5m) Vater at 9.9m onitoring well installed			618 -617 -616 -614 -613
14 14 15 15 15 15 15 15 15 15 15 15 15 15 15					/ATER LEVEL BELOW GROUND SURFACI December 17, 2015 = 10.0m	E.,		-611
OLE		_	387 381	7	FIELD LOGGED BY: JLM	COMPLETION	The Artist Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of	Ū.
SPEH					PREPARED BY: RTB	COMPLETION	DATE: 12/17/15	Do 4 d
B		THURBER ENGINEERING LTD.			REVIEWED BY: NHF			Page 1 of

Rossd	a e P ant 7	Ter 2 R	A/RMP				9469	9 Ros	sda e	Road		BOR	EHOLE NO	: 16-01		
Susta	nab e Dev	e opme	ent				UTN	1ZON	VE: - 1	15933	031.137 E33147.678	PRO	JECT NO:	174602		
STAR	T DATE: :	2016/07	7/21				931	+36+1	19			ELE	VATION: 62	25.224 m		
SAMP	LE TYPE		Shelby	Tube	$\angle$	Drive Sam	ple		<b>∑</b> Aug	er Sar	THE RESERVE TO THE PROPERTY OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF THE PERSON OF	A Cas		Core		le
<b>BACK</b>	FILL TYPE		BENT	ON TE	5.	PEA GRAV	<b>VEL</b>		SLO	DUGH	GROUT	DR LL	CUTT NGS	SAN	D	
Depth (m)	PLASTIC	nit Weight (I	LIQUID	0.05 ▲ Compr 100	essive Stre 200 dard Penetr	s (%) ◆ 15 0.20 ngth(kPa) ▲ 300 400 ation (N) ■ 0 80	SAMPLETYPE	SPT (N)	nsc	SOLSYMBOL	SOI DESCRII		N		SLOTTED	ELEVAT ON (m)
_ 0 - - - - -							X				FILL BROWN CL I - Sandy, some grave, some cay - Br ck p eces, no odour - at 0.5 m, G ass p eces, br ck c					- -625 - - - -
_1 - - - - -							X		F		- at 1.2 m, Coa p eces, cayey of - at 1.6 m, Sandy f , trace grave			damp,		- -624 - - - -
<b>2</b>											- at 2.2 to 3.4 m, Some s t, som	ne cay,	no doour, co	oa		- - -623
- - -3 - -							X				CLAY FILL DARK BROWN	CI	DAMP			- - - - -622
4											- S ty, some sand, trace grave, - Coa p eces - at 4.0 to 5.8 m, H gh p ast c ca	med un	n p ast c	ces		- - - - - - - -621
- - - - - 5									F							- - - - - - - -620
- - - - - - - - - - - - - - - - - - -										20 20 20 20 20 20 20 20 20 20 20 20 20 2	- at 5.8 m, Brown, sandy, trace - at 6.1 to 6.8 m, Rough dr ng,  SAND BROWN SM - Trace s t, trace grave, med um - Coa dust, dark brown streaks	grave	у	es t		619
8	<b>J</b> m	YOF T	10			nsportat or				00000000000000000000000000000000000000	- at 7.8 m, Some fine grave , fine LOGGED BY DD REV EWED BY TD	(	d um gra ne COMPLET ON COMPLET ON	DEPTH		
	الالح				Lingin	eeer ng S	OI V C	00 OB	OL UIT							1 of 2

Rossd	a e P ant	Ter 2 R	A/RMP				946	9 Ros	ssda e	Road		ВО	REHOLE NO	: 16-01	
Susta	nab e De	ve opme	nt				UTI	M ZOI	NE: - N	N5933	031.137 E33147.678	PR	OJECT NO:	174602	
STAR	T DATE:	2016/07	7/21				931	+36+	19			ELI	EVATION: 62	25.224 m	
SAMP	LE TYPE		Shelb	y Tube		/ Drive Sar	nple		<b>⊠</b> Aug	ger Sar	nple No Recovery	∭A C	asing	Cored	Sample
BACK	FILL TYP	E	BENT	ON TE		PEA GRA	VEL		SLO	OUGH	GROUT	DR	LL CUTT NGS	SAND	
Depth (m)	PLASTIC	M.C.	LIQUID	0.05 ▲ Com 100	0.10 npressive S 200 andard Pen	ates (%) ◆ 0.15 0.20  Strength(kPa) ▲ 300 400  netration (N)	SAMPLE TYPE	SPT (N)	OSC	SOLSYMBOL		SOIL CRIPTIC	DN		SLOTTED P EZOMETER ELEVAT ON (m)
8 -9 <b>⊻</b> -10	20	40 60	80	■Sla 20	indard Pen 40	etration (N) 60 80			SM	\$2828282828	brown, s ty - c ayey pockets SAND BROWN SM  - at 8.9 m, Mo st to wet  SAND AND GRAVEL B - C ayey s ty pockets, coa p - Max mum d ameter at 60 m  SAND BROWN SM - Trace s t, trace grave , me - Coa dust, dark brown stre	ROWN o eces, dan	IP  SP-GP Vrk brown pock	VET	-615
-12 -13 -14									BE		CLAY SHALE GREY S ty, h gh p ast c, carbonad  End of ho e at 12.8 m - S ough at 8.8 m from surfa - Water at top of s ough - 50 mm d ameter pvc we r - 1.5 m mach ne s otted sect - F ush mount protector - So d stem auger	ceous, coa	p et on	MP	-612 -611
16 <b>(</b>	<b>J</b> m		ıfo:	n	Tr Eng	ransportat o	on De	epartm ces Se	nent ect on		LOGGED BY DD REV EWED BY TD		COMPLET ON COMPLET ON		16/07/21
						· ·									Page 2 of

FILL BROWN DAMP  Clave y, sardy, trace to some s.t  CLAY FILL BROWN GLOH DAMP  Sty, trace to some s.t  CLAY FILL BROWN GLOH DAMP  Sty, trace som, med um to the pt past c. Back streaks, no odour  at 0.9 m, Dark brown to back, trace to some sand, med um past c, coa peoss, poss be topso intermixed  - at 1.8 m, Red brick peces, glass, wire, nais, concrete peces, trace grave, coa peoss, medium past c.  - at 2.1 m, Fraith or attempt had refuse at 2.1 m, moved dring to away the underlying the peces, trace grave and sand, medium past c, brown to dark brown, brick, concrete, coa  - at 2.7 m, Medium past c, brown to dark brown, brick, concrete, coa  - at 3.8 to 4.5 m, Wood peces, strong creesste odour, cay first thrown, brick peces  - at 4.5 m, Cay firstly, trace grave and sand, medium to high past c, back streaks, brick  - at 5.8 to 7.5 m, Sandstone peces, carbonaceous shale peces, sity, medium past c, brown to dark brown, brick peces  - at 7.5 to 8.0 m, Brown cay firstly, sty, some sand, trace grave, hard no nerator kell back materia  - at 7.5 to 8.0 m, Brown cay firstly, sty, some sand, trace grave, hard no nerator kell back materia  - at 7.5 to 8.0 m, Brown cay firstly, sty, some sand, trace grave, coan peces, carbonaceous shale peces, sty, medium past c, brown, darm, rectured to the peces, sty, medium past c, brown, darm, rectured to the peces, sty, medium past c, brown, darm, rectured to the peces, sty, medium past c, brown, darm, rectured to the peces, sty, medium past c, brown to dark brown, brick peces at 2.1 m, moved driven to the peces, strong crees at 2.1 m, moved driven to the peces, strong crees, steed to the peces, strong crees, sty, sty, trace grave and sand, medium past c, brown to dark brown, brick peces, strong crees, steed to the peces, strong crees, steed to the peces, strong crees, steed to the peces, strong crees, steed to the peces, strong crees, steed to the peces, strong crees, steed to the peces, strong crees, steed to the peces, strong crees, steed to the peces, strong crees, steed to the pece	Rossd	a e P ant 7	Ter 2 R	A / RMP			9	9469 F	Rossda e	Road		BC	REHOLE NO	): 16-02		
SAMPLE TYPE  Shorton Team (Shorton Company)  Short Sample  Shorton Type (Shorton Company)  Short Sample  Short Shorton Type (Shorton Company)  Short Shorton Type (Shorton Company)  Short Shorton Type (Shorton Company)  Short Shorton Type (Shorton Company)  According (Shorton Company)  Short Shorton Type (Shorton Company)  Short Shorton Type (Shorton Company)  Short Shorton Type (Shorton Company)  Short Shorton Type (Shorton Company)  Short Shorton Type (Shorton Company)  Short Shorton Type (Shorton Company)  Short Shorton Type (Shorton Company)  Short Shorton Type (Shorton Company)  Short Short Short Shorton Type (Shorton Company)  Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Short Sh	Susta	nab e Dev	e opme	nt				UTM Z	ONE: -	N5933	8004.079 E33130.905	PR	OJECT NO:	174602		
BECKFILL TYPE  BENTON TE  PAGE DISTORTE  PAGE DISTO	STAR	T DATE:	2016/07	7/21			9	931+3	6+19			EL	EVATION: 62	23.037 m		
A MULTIS MORE (1987) A 20 00 00 00 00 00 00 00 00 00 00 00 00	SAMP	LE TYPE		Shelby	Tube	<b>∠</b> Dr	rive Samp	ole	<b>⊠</b> Au	ger Sar	nple No Recovery	□ A C	asing	Cored	Sampl	le
FILL BROWN DAMP  Clave y, sandy, trace to some sit  CLAY FILL BROWN CHCH DAMP  Sity, trace to some sit  CLAY FILL BROWN CHCH DAMP  Sity, trace and, med unto thigh pastic  Back streaks, no odour  at 0.9 m, Davisor and, trace to some sand, med unit pastic, coal peces, gass, wre, nais, concrete peces, trace grave, coal peces, possible topso intermixed  - at 1.8 m, Red brick peces, gass, wre, nais, concrete peces, trace grave, coal peces, medium pastic, coal peces, strong crecipited and direction and the red object.  - at 2.1 m, First ho e attempt had refuse at 2.1 m, moved of right on one of the peces, trace grave, coal peces, strong crecipited and right on any of the color, and the red object.  - at 2.7 m, Medium pastic, brown to dark brown, brick, coal peces, strong crecipited and the pastic, brown to dark brown, brick, peces.  - at 3.8 to 4.5 m, Wood pieces, strong crecipited and the pastic, brown to dark brown, brick peces.  - at 3.8 to 7.5 m, Sandstone peces, carbonaceous shale peces, sity, medium pastic, brown, damp, red brick chips, trace grave, hard no nerator. We back mater a  - at 7.5 to 8.0 m, Brown cay firstly, some sand, trace grave, coal peces, carbonaceous shale peces, sity, medium pastic, brown, damp, red brick chips, trace grave, hard no nerator. We back mater a  - at 7.5 to 8.0 m, Brown cay firstly, some sand, trace grave, coal peces, carbonaceous shale peces, sity, medium pastic, brown, damp, red brick chips, trace grave, hard no nerator. We back mater a  - at 7.5 to 8.0 m, Brown cay firstly, some sand, trace grave, coal peces, carbonaceous shale peces, strong creased and medium pastic.  - at 7.5 to 8.0 m, Brown cay firstly, sty, some sand, trace grave, coal peces, carbonaceous shale peces, trace grave, coal peces, carbonaceous shale peces, trace grave, coal peces, carbonaceous shale peces, trace grave, coal peces, carbonaceous shale peces, trace grave, coal peces, carbonaceous shale peces, trace grave, coal peces, carbonaceous shale peces, trace grave, coal peces, carbonaceous shale peces, trac	BACK	FILL TYPE		BENTO	ON TE	∵ PI	EA GRAV	EL	SL	OUGH	GROUT	DR	LL CUTT NGS	SAN	)	
-at 7.5 to 8.0 m, Brown cay f , s ty, some sand, med um to high past c -at 7.5 to 8.0 m, Brown cay f , s ty, some sand, med um to high past c -at 7.5 to 8.0 m, Brown cay f , s ty, some sand, trace to some sand, med um past c, brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark brown to dark	Depth (m)	PLASTIC	18 2 M.C.	LIQUID	0.05  ▲ Compre	0.10 0.15 essive Strength 200 300 ard Penetration	0.20 n(kPa) ▲ 0 400	SAMPLE TYPE	SPT (N)	SO L SYMBOL			ON		SLOTTED	ELEVAT ON (m)
- at 5.8 to 7.5 m, Sandstone p eces, carbonaceous sha e p eces, s ty, med um p ast c, grey - brown, damp, red brick chips, trace grave, hard not nerator in keing need to be ack matter a grave, coa  - at 7.5 to 8.0 m, Brown cay f , s ty, some sand, trace grave, coa  Transportation Department Engineeering Services Section  Transportation Department Engineeering Services Section	-1 -2 -3 -4	20	40 60	80			80				- Grave y, sandy, trace to som CLAY FILL BROWN CI-S ty, trace sand, med um to - B ack streaks, no odour - at 0.9 m, Dark brown to b ac med um p ast c, coa p eces, p  - at 1.8 m, Red br ck p eces, p  - at 2.1 m, F rst ho e attempt the dr rg to avo d bur ed object.  - at 2.7 m, Med um p ast c, broconcrete, coa  - at 3.8 to 4.5 m, Wood p eces f, s ty, trace grave and sand dark brown, br ck p eces  - at 4.5 m, C ay f, s ty, trace	ne s t -CH h gh p a k, trace oss b e g ass, w es, med nad refu own to c s, strong , med u	e to some sand topso nterm re, na s, cond um p ast c isa at 2.1 m, r dark brown, br	crete moved r ck, our, c ay wn to		-622 -621 -620 -619
Transportat on Department Eng neeer ng Serv ces Sect on    COMPLET ON DEPTH   10 70 m	-7							$\times$			p eces, s ty, med um p ast c, g ch ps, trace grave, hard no ne - at 7.5 to 8.0 m, Brown c ay grave, coa	rey - br erator k	own, damp, re se b ack mater , some sand, t	ed brick ra	ψ	-617 616
Eng neeer ng Serv ces Sect on REV EWED BY TD COMPLET ON DATE 2016/07/21		THEON	YOF	4-	× .	Transc	nortat on	Dono	rtment				COMPLET ON	DEPTH 1	0 70 m	
	F		Of	TO											16/07/2	21
Page 1		<b>7</b> '''	<b>—</b> 11												Page	1 of 2

Rossd	la e P ant 7	Ter 2 R	A/RMP					946	9 Ros	sda e	Road		ВО	REHOLE NO	: 16-02	
Susta	nab e Dev	e opmei	nt					UTI	M ZON	NE: -	N5933	004.079 E33130.905		OJECT NO:	6.00.170.700.100.000.0013	
STAR	T DATE:	2016/07	/21					931	+36+1	19			ELI	EVATION: 62	23.037 m	
SAMP	LE TYPE		Shelby	y Tube		Driv	e Sam	ple		<b>⊠</b> Au	ger Sar	nple ■No Recovery	MA C	asing	Cored	Sample
BACK	FILL TYPE	Ε	BENT	ON TE		PE	A GRAV	VEL		SL	OUGH	GROUT	DR	LL CUTT NGS	SAND	
Depth (m)	PLASTIC	nit Weight (k 18 2 M.C.	LIQUID	0.05 ▲ Corr 100	pressive S 200 andard Per	0.15 Strength(k 300 netration (l	0.20 Pa) ▲ 400 N) ■	SAMPLE TYPE	SPT (N)	OSC	SOLSYMBOL	SC DESCR	DIL RIPTIC	ON		SLOTTED P EZOMETER
- 8 	20	40 60	80	20	40	60	80			GP BE		GRAVEL BROWN GP - Some sand, max mum d ame - Rust sta ned - at 8.3 m, Ho e S ough ng n  -at 9.1 to 9.9 m, Rust sta ned dust  CLAY SHALE GREY - Sty, trace benton te, h gh p a	s ty - c	0 mm	coa	61
—11 —12 —13 —14 —15												End of ho e at 10.7 m  - S ough at 8.4 m from surface - Water at top of s ough - 50 mm d ameter pvc we nst - 1.5 m mach ne s otted sect of - St ck-up protector - So d stem auger	ta ed to	P. P. Derocolous		-61 -61 61 61 61 61 61
16		:	111		: : :	1 1	: :	ò				LOGGED BY DD		COMPLET ON	DEDTH 4	70 m
	dm	Ön	to	<b>n</b>		ranspo						REV EWED BY TD		COMPLET ON		
7	<b>7</b> 111				Eng	neee	ny S	el V C	<i>1</i> 00 00	OL UII				20		Page 2 o

F GRAVEL FILL BROWN GP DAMP - Some sand, some s t  CLAY FILL BROWN CI-CH DAMP-MOIST - S ty, trace sand, med um to h gh p ast c - F ter c oth separat ng grave f from c ay at 0.3 m  - at 0.9 to 1.6 m, C ay f , s ty, sandy, trace grave , ow p ast c, dark brown, coa, poss b e tops o pockets	Rossd	a e Pant	Ter 2 R	A / RMP				9469	9 Ross	sda e l	Road		BOF	REHOLE NO	: 16-03		
SAMPLE TYPE  BENTON TE  PAGE CHANGE  PAGE CH	Susta	nab e Dev	e opme	nt				UTN	/ ZON	IE: - N	N5933	013.202 E33209.886	PRO	DJECT NO:	174602		
BACKFILL TYPE  Sention TE  PEA GRAVEL  SOIL  DESCRIPTION  SOIL  DESCRIPTION  GRAVEL FILL BROWN GP DAMP  - Some sand, some s1  - A 10 to 1 6m, Cap' f, st, stard grave f more and grave from a comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparating from the comparat	STAR	T DATE:	2016/07	7/21				931-	+36+1	9			ELE	VATION: 62	25.211 m		
And the Wage (Nov.) A 2	SAMP	LE TYPE		Shelby	Tube		Drive Sam	ple		X Aug	ger Sar	Total State of Additional State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State	A Ca	sing			е
Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Section   Sect	BACK	FILL TYP	=	BENT	ON TE	· .	PEA GRA	VEL		SLO	DUGH	GROUT	<b></b> ✓ DR L	L CUTT NGS	SAND	)	
FROWN CHOLD DAMP Some sand, some sit CLAY FILL BROWN CHOLD DAMP MOIST - Sult I BROWN CHOLD DAMP MOIST - Sult I BROWN CHOLD DAMP MOIST - Sult I BROWN CHOLD DAMP MOIST - Sult I BROWN CHOLD DAMP MOIST - Sult I BROWN CHOLD DAMP MOIST - at 0.9 to 1.6 m, Cay f , s ty, sandy, trace grave, ow pastc, dark brown, or cap posse to topso pockets - at 1.6 to 3.7 m, Cay f , s ty, trace to some sand, medium pastc, brown to dark brown, or cap pecks, damp  CLAY BROWN CHOLD DAMP - Very s ty, (Cay and S t), medium to high pastc, s t - at 7.0 to 7.4 m, Cay pockets - at 7.0 to 7.4 m, Cao pockets, trace cay, sand partings - at 7.0 to 7.4 m, Cao pockets, trace cay, sand partings - at 7.0 to 7.4 m, Cao pockets, trace cay, sand partings - SAND BROWN SP DAMP - Medium graned, cayey pockets - at 7.6 m, Grave y, rough dring, s ty, cay enses, rust - Medium graned, cayey pockets - at 7.6 m, Grave y, rough dring, s ty, cay enses, rust - Medium graned, cayey pockets - at 7.6 m, Grave y, rough dring, s ty, cay enses, rust - Medium graned, cayey pockets - at 7.6 m, Grave y, rough dring, s ty, cay enses, rust - Medium graned, cayey pockets - at 7.6 m, Grave y, rough dring, s ty, cay enses, rust - Medium graned, cayey pockets - at 7.6 m, Grave y, rough dring, s ty, cay enses, rust - Medium graned, cayey pockets - at 7.6 m, Grave y, rough dring, s ty, cay enses, rust - Medium graned, cayey pockets - at 7.6 m, Grave y, rough dring, s ty, cay enses, rust - Medium graned, cayey pockets - at 7.6 m, Grave y, rough dring, s ty, cay enses, rust - Medium graned, cayey pockets - at 7.6 m, Grave y, rough dring, s ty, cay enses, rust - Medium graned, cayey pockets - at 7.6 m, Grave y, rough dring, s ty, cay enses, rust - Medium to 1 m, s 1 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s 2 m, s	Depth (m)	PLASTIC	M.C.	LIQUID	0.05  ▲ Compr 100  ■ Stand	0.10 0.1 ressive Strer 200 dard Penetra	15 0.20 agth(kPa) ▲ 300 400 ation (N) ■	SAMPLE TYPE	SPT (N)	OSO	SOLSYMBOL			N		SLOTTED P EZOMETER	ELEVAT ON (m)
CLAY BROWN CI-CH DAMP-MOIST - S ly, frace sand, med um to high past c - Fer codh separating grave if from cay at 0.3 m - at 0.5 to 1.6 m, Cay f , s ly, sandy, trace grave, ow past c, dark brown, coa , poss be topso pockets  - at 1.6 to 3.7 m, Cay f , s ly, trace to some sand, med um past c, brown to dark brown, brick peces, coa specks, damp  - at 1.6 to 3.7 m, Cay f , s ly, trace to some sand, med um past c, brown to dark brown, brick peces, coa specks, damp  - at 0.8 to 1.6 m, Cay f , s ly, trace to some sand, med um past c, brown to dark brown, brick peces, coa specks, damp  - at 0.8 to 1.6 m, Cay f , s ly, trace to some sand, med um past c, brown to dark brown, brick peces, coa specks, damp  - at 0.8 to 1.6 m, Cay f , s ly, trace to some sand, med um past c, brown to dark brown, brick peces, coa specks, damp  - at 0.8 to 1.6 m, Cay f , s ly, trace to some sand, med um past c, brown to dark brown, brick peces, coa specks, damp  - at 0.8 to 1.6 m, Cay f , s ly, trace to some sand, med um past c, brown to dark brown, brick peces, coa specks, damp  - at 0.8 to 1.6 m, Cay f , s ly, trace to some sand, med um past c, brown to dark brown, brick peces, coa specks, damp  - at 0.8 to 1.6 m, Cay f , s ly, trace to some sand, med um past c, store to some sand, med um past c, store to some sand, med um past c, store to some sand, med um past c, store to some sand, med um past c, store to some sand, med um past c, store to some sand, med um past c, store to some sand, med um past c, store to some sand, med um past c, store to some sand, med um past c, store to some sand, med um past c, store to some sand, med um past c, store to some sand, med um past c, store to some sand, med um past c, store to some sand, med um past c, store to some sand, med um past c, store to some sand, med um past c, store to some sand, med um past c, store to some sand, med um past c, store to some sand, med um past c, store to some sand, med um past c, store to some sand, med um to high past c, store to some sand, med um to some sand, med um to	_ 0				: : :					F			GP	DAMP		П	- 005
p ast c, dark brown, coa , poss be topso pockets  -at 1.8 to 3.7 m, Cay f , s ty, trace to some sand, med um past c, brown to dark brown, brick peess, coa specks, damp  -at 1.8 to 3.7 m, Cay f , s ty, trace to some sand, med um past c, brown to dark brown, brick peess, coa specks, damp  -at 1.8 to 3.7 m, Cay f , s ty, trace to some sand, med um past c, s t past past c, brown to dark brown, brick peess, coa specks, damp  -at 1.8 to 3.7 m, Cay f , s ty, trace to some sand, med um past c, s t past past c, s type sand, amp past c, s type sand, samp past c, s type sand, samp past c, s type sand, samp past c, mo st s t pockets  -at 6.6 m, Damp to mo st, sand part ngs, s t part ngs -at 7.0 to 7.4 m, Coa pockets, trace c ay, sand part ngs  -at 7.0 to 7.4 m, Coa pockets, trace c ay, sand part ngs  -at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust  -at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust -at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust -at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust -at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust -at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust -at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust -at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust -at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust -at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust -at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust -at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust -at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust -at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust -at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust -at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust -at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust -at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust -at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust	-							X				CLAY FILL BROWN CI-C-S ty, trace sand, med um to he F ter c oth separating grave f	gh p as from o	t c cay at 0.3 m			625  - - - - -
past c, brown to dark brown, brick peess, coal specks, damp  CLAY BROWN CHCH DAMP - Very's ty, (C ay and S t), medium to high past c, sit partings, damp  CCH DAMP - Very's ty, (C ay and S t), medium to high past c, sit partings, damp  CCH DAMP - Very's ty, (C ay and S t), medium to high past c, sit partings, damp  CCH DAMP - Medium to high past c, most sit pockets  - at 6.6 m, Damp to most, sand partings, sit partings - at 7.0 to 7.4 m, Coal pockets, trace clay, sand partings - at 7.0 to 7.4 m, Coal pockets, trace clay, sand partings  Transportation Department  Transportation Department Engineeering Services Section  REVIEWED BY DD COMPLET ON DEPTH 1120 m REVIEWED BY TD COMPLET ON DEPTH 1120 m REVIEWED BY TD COMPLET ON DETE 201600721	-1 - - - -							X				p ast c, dark brown, coa, poss b	e tops	o pockets			- -624 -
CLAY BROWN CI-CH DAMP - Very s ty, (C ay and S t), med um to high plastic, s t partings, damp  SILT and CLAY CI-CH DAMP - Med um to high plastic, most s t pockets  - at 6.6 m, Damp to most, sand partings, s t partings - at 7.0 to 7.4 m, Coal pockets, trace c ay, sand partings - at 7.0 to 7.4 m, Coal pockets, trace c ay, sand partings  SAND BROWN SP DAMP - Med um graned, cayey pockets - at 7.6 m, Grave y, rough dring, s ty, cay enses, rust  Transportation Department Engineeering Services Section  Engineeering Services Section  Engineeering Services Section  Engineeering Services Section	- - -2 -							X		F		p ast c, brown to dark brown, br	trace to ck pec	some sand, es, coa spe	med um cks,		- - - - -623
-Very s ty, (C ay and S t), med um to h gh p ast c, s t partngs, damp  -62  -63  SILT and CLAY CI-CH DAMP - Med um to h gh p ast c, mo st s t pockets  -at 6.6 m, Damp to mo st, sand partngs, s t partngs -at 7.0 to 7.4 m, Coa pockets, trace c ay, sand partngs -at 7.0 to 7.4 m, Coa pockets, trace c ay, sand partngs -at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust  Transportat on Department Eng neeer ng Serv ces Section  Transportat on Department Eng neeer ng Serv ces Section	- - - - - -3							X									
partngs, damp  C-CH  Partngs, damp  C-CH  SILT and CLAY CI-CH DAMP  - Med um to h gh p ast c, mo st s t pockets  - at 6.6 m, Damp to mo st, sand partngs, s t partngs  - at 7.0 to 7.4 m, Coa pockets, trace cay, sand partngs  - at 7.0 to 7.4 m, Coa pockets, trace cay, sand partngs  - at 7.0 to 7.4 m, Coa pockets, trace cay, sand partngs  - at 7.0 to 7.4 m, Graph pockets  - at 7.6 m, Grave y, rough dr ng, s ty, cay enses, rust  - COMPLET ON DEPTH 11 20 m  REV EWED BY TD  COMPLET ON DEPTH 11 20 m  REV EWED BY TD  COMPLET ON DATE 2016/07/21	-																-622 - - - - - -
SILT and CLAY CI-CH DAMP - Med um to high plastic, most sit pockets  - at 6.6 m, Damp to most, sand partings, sit partings - at 7.0 to 7.4 m, Coal pockets, trace clay, sand partings - at 7.0 to 7.4 m, Coal pockets, trace clay, sand partings - at 7.6 m, Grave y, rough dring, sit, clay enses, rust  Transportation Department Engineeering Services Section    Completion Department   Completio	-4 - - - -									C-CH			um to	ngnpastc,	SI		- 621 -
- Med um to h gh p ast c, mo st s t pockets  - at 6.6 m, Damp to mo st, sand part ngs, s t part ngs  - at 7.0 to 7.4 m, Coa pockets, trace c ay, sand part ngs  - at 7.0 to 7.4 m, Coa pockets, trace c ay, sand part ngs  - Albert Carryof  Transportation Department Engineeering Services Section  LOGGED BY DD  REV EWED BY TD  COMPLET ON DEPTH 11 20 m  REV EWED BY TD  COMPLET ON DATE 2016/07/21																	- - - - - 620
- at 6.6 m, Damp to mo st, sand part ngs, s t part ngs - at 7.0 to 7.4 m, Coa pockets, trace c ay, sand part ngs - at 7.0 to 7.4 m, Coa pockets, trace c ay, sand part ngs - at 7.0 to 7.4 m, Coa pockets, trace c ay, sand part ngs - 61s - 8  SAND BROWN SP DAMP - Med um gra ned, c ayey pockets - at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust - 1 to GGED BY DD - 1 to GOMPLET ON DEPTH 11 20 m - 1 to GOMPLET ON DEPTH 11 20 m - 1 to GOMPLET ON DEPTH 11 20 m - 1 to GOMPLET ON DEPTH 11 20 m - 1 to GOMPLET ON DEPTH 11 20 m - 1 to GOMPLET ON DEPTH 11 20 m - 1 to GOMPLET ON DATE 2016/07/21	- - - - - - - - -							X						kets			
SAND BROWN SP DAMP  - Med um gra ned, c ayey pockets  - at 7.6 m, Grave y, rough dr ng, s ty, c ay enses, rust  Transportat on Department Eng neeer ng Serv ces Sect on  REV EWED BY TD  COMPLET ON DATE 2016/07/21								X		CLS		- at 6.6 m, Damp to mo st, sand	l part nç	gs, s t part n	gs		619 - - - - - -
- Med um gra ned, cayey pockets - at 7.6 m, Grave y, rough dr ng, s ty, cay enses, rust  Transportat on Department Eng neeer ng Serv ces Sect on  ENGRED BY DD COMPLET ON DEPTH 11 20 m  REV EWED BY TD COMPLET ON DATE 2016/07/21	7 													ay, sand pa	rt ngs		- - -618
REV EWED BY TD COMPLET ON DATE 2016/07/21	- 8											- Med um gra ned, c ayey pocke - at 7.6 m, Grave y, rough dr	ts ng, s ty	90 8	N)	100	
Engineeering services section The Solid Engineering services section Page 1 of		THE	YOF	10	١.												
	7	Am				Eng n	eeer ng S	el V O	es 500	CL OIT				Join LET OF			

Rossda e Pant Ter 2 RA / RMP		9469 Rossd	la e Road	[	BOREHOLE NO: 16-03	
Susta nab e Deve opment		UTM ZONE	: - N5933	013.202 E33209.886	PROJECT NO: 174602	
START DATE: 2016/07/21		931+36+19			ELEVATION: 625.211 m	
SAMPLE TYPE Shelb	y Tube Drive Sam	nple	Auger San	nple ■No Recovery	A Casing Core	d Sample
BACKFILL TYPE BENT	ON TE PEA GRA	VEL	SLOUGH	GROUT	OR LL CUTT NGS SAN	D
Wet Unit Weight (kN/m²) A  16 18 20 22  PLASTIC M.C. LIQUID	◆ Soil Sulphates (%) ◆ 0.05 0.10 0.15 0.20  ▲ Compressive Strength(kPa) ▲ 100 200 300 400  ■ Standard Penetration (N)		USC SO L SYMBOL	SOIL DESCRIPT	TON	SLOTTED P EZOMETER ELEVAT ON (m)
20 40 60 80  8  9 ▼  -10  -11  -12  -13	20 40 60 80		RSA  BB  BB	sta ned enses, damp to mo st SAND BROWN SP DAMP  - at 8.4 m, Sand and Grave, c ayer dr ng, c ay nterm xed, some rust se  - at 9.7 m, Water seepage, free water  - at 9.7 m, Water seepage, free water  - Soy h gh p ast c  - Carbonaceous, coa p eces  End of ho e at 11.2 m  - Sough at 9.6 m from surface at coal water at top of sough  - 50 mm d ameter pvc we nstated  - 1.5 m mach ne sotted sect on  - St ck-up protector  - So d stem auger	ys ty enses, rough stanng, damp to most ster  BROWN CH DAMP	617
Edmontor	Transportat o Eng neeer ng S	n Departmen Serv ces Sect	ut on	LOGGED BY DD REV EWED BY TD	COMPLET ON DEPTH COMPLET ON DATE 20	

ASPHALT BLACK SAND BROWN SP DAMP -Grave y trace st trace cay -Max mum dameter at 25 mm CLAY PILL BROWN CI DAMP -S y, some sand, trace grave , med um p ast c -Brick peess at 0.9 to 1.7 m, B ack coa peess, no odour  CLAY -CLAY FILL BROWN CI DAMP -S y, trace to some sand, med um p ast c -Brick peess at 0.9 to 1.7 m, B ack coa peess, no odour  CLAY -CLAY FILL BROWN CI DAMP -S y, trace to some sand, med um p ast c -Dark brown st y cay intermixed, white sity streaks - at 2.9 to 3.2 m, Some sand er enses, med um to high pasts, brown - at 3.2 m, Coa dust, sity cay, brown, med um p ast c  -62  -63  -64  -65  -65  -66  -67  -68  -68  -69  -69  -69  -69  -69  -69	Rossd	a e P ant	Ter 2 F	RA/RMP			9469	9 Ross	sda e l	Road		BOREHOLE NO	): 16-04
SAMPLE TYPE  BENTON TE  PEAGRAVEL    Set Substitution Number   Section Te   Peagraphy   Section   Section Te   Peagraphy    Susta	nab e Dev	e opme	ent			UTN	/ ZON	E: - N	15932	2980.611 E33254.217	PROJECT NO:	174602	
SACKFILL TYPE  SENTONTE  PEA GRAVEL  SOIL  DESCRIPTION  SOIL  DESCRIPTION  SOIL  DESCRIPTION  SAST  ASPHALT BLACK  SAMD BROWN CI DAMP  Six years and are enses, medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut personal medium plast c  - Brut persona	STAR	T DATE:	2016/0	7/12			931-	+36+1	9			<b>ELEVATION:</b> 6	25.277 m
And the towners (then) A solutions (p) 4 solutions (p) 4 solutions (p) 4 solutions (p) 4 solutions (p) 4 solutions (p) 4 solutions (p) 4 solutions (p) 5 solutions (p) 5 solutions (p) 5 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solutions (p) 6 solut	SAMP	LE TYPE		Shelby	Tube	✓ Drive San	nple		Aug	er Sar	mple No Recovery	A Casing	Cored Sample
1	BACK	FILL TYP	E	BENTO	ON TE	PEA GRA	VEL	[	SLC	DUGH	GROUT	DR LL CUTT NGS	SAND
ASPHALT BLACK SAND BROWN SP DAMP	Depth (m)	16	18	20 22	0.05 0.10 ▲ Compressive 100 200	0.15 0.20 e Strength(kPa) ▲ 0 300 400	SAMPLE TYPE	SPT (N)	nsc	SOLSYMBOL			SLOTTED P EZOMETER ELEVAT ON (m)
SAND BROWN SP DAMP -Grave y, trace s t, trace cay -face y, trace s t, trace cay read unit past c -face y, trace s t, trace cay read unit past c -face y, trace s t, trace cay read unit past c -face y, trace s t, trace cay read unit past c -face y, trace s t, trace cay read unit past c -face y, trace s t, trace cay read unit past c -face y, trace s t, trace cay read unit past c -face y, trace s t, trace cay read unit past c -face y, trace s t, trace cay read unit past c -face y, trace s t, trace cay read unit past c -face y, trace s t, trace cay read unit past c -face y, trace s and, med unit past c -face y, trace s and, med unit past c -face y, trace s and, med unit past c -face y, trace s and, trace y, trace s and, med unit past c -face y, trace s and, med unit past c -face y, trace s and, trace y, trace s and, med unit past c -face y, trace s and, trace y, trace s and, trace y, trace y, trace s and, trace y, trace s and, trace y, trace s and, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y, trace y,	^	20	40 60	80			-		VCDM		AODUALT DI AOK		
S, Iy, trace to some sand, med um p ast c  - Dark brown s ty cay intermixed, white is ty streaks - at 2.3 m, Sandy enses, trace fine grave, coa streaks, coa peces, damp, poss by brick peces - at 2.9 to 3.2 m, some sand er enses, med um to high past c, trown - at 3.2 m, Coa dust, sity cay, brown, med um past c  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Cay and Sit ke  - at 4.6 to 5.3 m, Very sity, Ca	. 0 						X		SA		SAND BROWN SP - Grave y, trace s t, trace c ay - Max mum d ameter at 25 mm CLAY FILL BROWN CI - S ty, some sand, trace grave - Br ck p eces	DAMP , med um p ast c	-625 624
- at 2.9 to 3.2 m, Some sand er enses, med um to high past c, brown - at 3.2 m, Coal dust, sity cay, brown, med um past c  - at 4.6 to 5.3 m, Very sity, Clay and Sit is some cay, trace sand, med um past c - at 4.6 to 5.3 m, Very sity, Clay and Sit is some cay, trace sand, med um past c - No odour  CLAY and Sit. T BROWN Cl DAMP - Trace sand, coal dust, no odour  CLAY and sit. T BROWN Cl DAMP - Trace sand, coal dust, no odour  Transportation Department Engineeering Services Section  REVIEWED BY ID COMPLETION DEPTH 11 40 m REVIEWED BY ID COMPLETION DEPTH 11 40 m REVIEWED BY ID COMPLETION DATE 2016/07/12	-2						X				- S ty, trace to some sand, med - Dark brown s ty c ay nterm xe - at 2.3 m, Sandy enses, trace	d um p ast c ed, wh te s ty streak f ne grave, coa str	-623
SILT BROWN CI DAMP - Some cay, trace sand, med um p ast c - No odour  CLAY and SILT BROWN CI DAMP - Trace sand, coa dust, no odour  Transportat on Department Engineeering Services Section  LOGGED BY DD COMPLET ON DEPTH 11 40 m REV EWED BY TD COMPLET ON DATE 2016(07/1/12)	<b>-3</b>						X		F		- at 2.9 to 3.2 m, Some sand e p ast c, brown	r enses, med um to	2
SILT BROWN CI DAMP - Some cay, trace sand, med um p ast c - No odour  CLAY and SILT BROWN CI DAMP - Trace sand, coa dust, no odour  Transportat on Department Engineeering Services Section  LOGGED BY DD COMPLET ON DEPTH 11 40 m REV EWED BY TD COMPLET ON DATE 2016(07/1/12)	-4						X						
- Some c ay, trace sand, med um p ast c - No odour  CLAY and SILT BROWN CI DAMP - Trace sand, coa dust, no odour  Transportation Department Engineeering Services Section  LOGGED BY DD COMPLET ON DEPTH 11 40 m REV EWED BY TD COMPLET ON DATE 2016/07/12	-5											ay and Sit ke	
Transportat on Department Eng neeer ng Serv ces Sect on REV EWED BY TD COMPLET ON DATE 2016/07/12	-6								CLS		- Some cay, trace sand, med u - No odour CLAY and SILT BROWN	CI DAMP	
Transportat on Department Eng neeer ng Serv ces Sect on REV EWED BY TD COMPLET ON DATE 2016/07/12							X						—619 —
Transportat on Department Eng neeer ng Serv ces Sect on EV EWED BY TD COMPLET ON DEPTH 11 40 m  REV EWED BY TD COMPLET ON DATE 2016/07/12	- <b>7</b>								М				
Eng neeer ng Serv ces Sect on REV EWED BY TD COMPLET ON DATE 2016/07/12		THEC	TYOF	1 _	3 0	Transportet	n De	nort-	nt	, ,	LOGGED BY DD	COMPLET OF	N DEPTH 11 40 m
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		7'''											Page 1 of

Rossd	la e Pant 1	Ter 2 R	A/RMP				946	9 Ros	ssda e	Road		ВО	REHOLE NO	: 16-04	
Susta	nab e Dev	e opmei	nt				_				980.611 E33254.217		OJECT NO:	And are a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a selected as a select	
STAR	T DATE: 2	2016/07	/12				931	+36+	19			ELI	EVATION: 62	25.277 m	
SAMP	LE TYPE		Shelb	y Tube		/ Drive Sa	mple		<b>⊠</b> Au	ger Sar	nple No Recovery	∭A C	asing	Cored	Sample
BACK	FILL TYPE		BENT	ON TE	[-	PEA GR	AVEL		SL	OUGH	GROUT	DR	LL CUTT NGS	SAND	
Depth (m)	PLASTIC	nit Weight (k 18 2	LIQUID	0.05 ▲ Com 100	0.10 pressive SI 200 Indard Pene	ates (%) ◆ 0.15 0.20 trength(kPa) ▲ 300 40 etation (N) ■	SAMPLE TYPE	SPT (N)	OSC	SOLSYMBOL		SOIL RIPTIO	ON		SLOTTED P EZOMETER ELEVAT ON (m)
-10 -11 -11 -12 -13 -14	20	40 60	80	20	40	60 80			BE		SAND and GRAVEL BRO - Trace s t, max mum d ame - Dark brown pockets, b ack odour  - at 9.4 to 10.1 m, Mo st to v sta ned enses  CLAY SHALE GREY C - S ty, h gh p ast c - Green nc us ons  End of ho e at 11.4 m  - S ough at 10.0 m from surfac - 50 mm d ameter pvc we r - 1.5 m mach ne s otted sect - St ck-up protector - So d stem auger	eter at 60 c sta n ng f	from coa, coa free water, ru  //P	dust, no	617
16															
		YOF	40			ansportat					LOGGED BY DD		COMPLET ON		
7	الالك				Eng	neeer ng	Serv	ces Se	ect on		REV EWED BY TD		COMPLET ON	DATE ZU	Page 2 of :
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Rosso	la e Pant	Ter 2 R	A/RMP				946	9 Ros	sda e	Road		BO	REHOLE NO	: 16-05		
Susta	nab e Dev	e opme	ent				UTN	/ ZON	IE: -1	N5932	954.169 E33253.902	PRO	OJECT NO:	174602		
STAR	T DATE:	2016/07	7/12				931	+36+1	9			ELE	VATION: 62	25.038 m		
SAMP	LE TYPE		Shelby	Tube	$\angle$	Drive Sam	ple		X Aug	ger Sar	CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CANADA CA	A Ca	sing	Cored	The State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the State of the S	le
BACK	FILL TYPE	Ε	BENT	ON TE	5.	PEA GRAV	/EL		SLO	OUGH	GROUT	<b></b>	L CUTT NGS	SAND	)	
Depth (m)	▲ Wet U 16  PLASTIC  20	nit Weight (I 18 M.C.	kN/m³) ▲ 20 22 LIQUID 80	0.05 ▲ Compri 100	essive Stre 200 dard Penetr	ss (%)	SAMPLETYPE	SPT (N)	nsc	SOLSYMBOL	SO DESCRI		DΝ		SLOTTED P EZOMETER	ELEVAT ON (m)
_ 0 _							X		F		CLAY FILL DARK BROWN - S ty, some sand, trace grave, - Coa specks and p eces, br ck	p eces	m p ast c			-
- - -1							X		F		SAND FILL BROWN SP - Trace to some s t, f ne gra ned - Br ck p eces, c ay pockets nter					- - - - - -624
- - - - - - 2							X		F		CLAY FILL DARK BROWN - S ty, trace to some sand, trace - Br ck p eces, b ack coa specks - at 1.7 to 2.1 m, Coa dust and	grave	, med um p	ast c		- - - - - - - - - - - - - - - - - - -
									F		SAND FILL BROWN SF - Trace s t, f ne gra ned - Coa dust	P D	AMP			- - - - -
3 3							X				CLAY FILL BROWN CI - S ty, trace sand, med um p ast - Random coa p eces, br ck p ec - at 3.2 to 4.3 m, Trace sand, tr	ces		tum		- - -622
-							X		F		p ast c, dark brown, coa p eces, p eces, me ted s ag p eces, g as	coa d	ust, sma sa			
-4 - - -							X				CLAY - CLAY FILL BROWN		)AMP			621 
- - - - -5									С		- Poss b e f , s ty, trace sand, n - Sand er enses		**			- - - - -
											- at 5.0 to 5.2 m, Sand enses, t		T.			- - - - -
The same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the same of the sa							X				CLAY BROWN CI DAMP - Very s ty, med um p ast c, non - Coa dust, s t er enses - at 5.9 to 6.1 m, Very s ty, (Ca	f	S t) brown			- - - - 619
							X		С		- at 6.1 m, C ay, very s ty to s t - at 6.3 m, Sand er enses, s t	y, brow enses,	vn, damp damp	'		-
-6 7 7											- at 6.7 to 7.4 m, C ay, very s ty dust	, trace	sand, damp	, coa	* . ·	- 618 -
- 8							X				SAND & GRAVEL BROWN T DAMP - Trace to some s t, trace ox des			GRSA		
	THE CIT	YOF	4-		Trai	nsportat or	n De	partme	ent		LOGGED BY DD		COMPLET ON			
t	dm	<b>O</b> I	ITOI	1		neeer ng S					REV EWED BY TD		COMPLET ON	DATE 20°		
					E. P. Carlo	97.0									Page	1 of 2

Rosso	la e P ant 7	Ter 2R	A/RMP					9469	9 Ros	sda e	Road		BC	REHOLE NO	: 16-05		
	nab e Dev						_					954.169 E33253.902		ROJECT NO:	A STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STATE OF THE STA		_
	T DATE:							931-	+36+1	19			EL	EVATION: 62	25.038 m		
SAMP	LE TYPE		Shelb	y Tube	[	Drive	Samp	ole		Aug	ger Sar	nple No Recovery	∭A C	Casing	Cored	Sample	
	FILL TYPE	3	BENT	ON TE	Ī	PEA	GRAV	/EL		SLO	OUGH	GROUT	DR	LL CUTT NGS	SAND	)	
Depth (m)	PLASTIC	nit Weight (k 18 2 M.C.	LIQUID	0.05 ▲ Com 100 ■ Sta	0.10 pressive S 200 indard Pen	ates (%) ◆ 0.15 0 Strength(kPr 300 netration (N)	.20 a) ▲ 400	SAMPLE TYPE	SPT (N)	USC	SOLSYMBOL		SOIL RIPTIO	ON			ELEVAT ON (m)
- 8 	20	40 60	80	20	40		80	X		GRSA		SAND & GRAVEL BROW DAMP  - at 8.6 to 9.4 m, Mo st to we compare the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the st	CH DAI past c	tt e free water MP enton t c, dam			:16
												- S ough at 10.4 m from surfa - Water at top of s ough - 50 mm d ameter pvc we radius - 1.5 m mach ne s otted sectal - St ck-up protector - So d stem auger	nsta ed to	No. 20 Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the		6	614
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Rossd	a e P ant 1	Ter 2 F	RA/RMP			946	9 Ross	sda e	Road		BOREHOLE NO	: 16-06	
Susta	nab e Dev	e opme	ent			UTN	/ ZON	IE: - 1	N5932	2935.805 E33282.292	PROJECT NO:	174602	
	T DATE: 2	2016/0	7/12			931	+36+1	2002-16-V			ELEVATION: 62		
	LE TYPE		Shelby	ACCOUNT OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PAR	Drive Sam	100000	- 31	X Aug		CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR	A Casing	Cored Sample	
BACK	FILL TYPE		BENTO	ON TE	PEA GRA	VEL		SLO	OUGH	GROUT	DR LL CUTT NGS	SAND	
Depth (m)	▲ Wet Ur 16	nit Weight (	(kN/m³) ▲ 20 22	0.05 0.10 ▲ Compressive 100 200	ohates (%) ◆ 0.15 0.20 e Strength(kPa) ▲ 0 300 400 denetration (N)	SAMPLE TYPE	SPT (N)	nsc	SOLSYMBOL	SOII DESCRIF		SLOTTED P EZOMETER	ELEVAT ON (m)
_ 0	20	40 60	80	20 40	60 80			OR	3333	TOPSOIL BROWN OR	DAMP		_
- - - - - - - -						X		E		- S ty, some sand, some c ay - Root f bres	DAMP ned um p ast c		-624
						X		F		SAND FILL BROWN SP - Trace to some s t, f ne gra ned CLAY FILL BROWN CL-CI - S ty, some sand, trace grave, c - Coa p eces, br ck p eces, concr p eces	DAMP - DRY  DAMP  ow to med um p as ete motar p eces, v	tc wood	-623
- - - -3						X		Ę		- at 2.9 to 3.7 m, B ack ash ke n sand, no odour, med um p ast c, o br ck, meta, brown c ay umps			-622 -
4						X				- at 3.7 to 4.4 m, C ay f , some s to dark brown, g ass	sand, med um p as	t c, brown	- <mark>621</mark>
- - - - - - - - - 5						X				- at 4.4 to 4.6 m, Poss b e Ash, d p ast c, coa specks, br ck p eces, - at 4.6 to 5.1 m, Dark brown w th p ast c, poss b e ash nterm xed, b	na s, g ass, damp h b ack nterm xed,	1	-620
						X		М		SILT BROWN MI DAMI - Some cay, med um p ast c - Coa dust			
- 6 						X		SM		SAND BROWN SM D -Trace to some s t, f ne gra ned SILT & CLAY BROWN CI - Med um p ast c, s t er enses	DAMP		-619 - - - - - - - - - - - - -
-6 7 8								CLS					- - - - - - - - - - - - - - - - - - -
	THEOT	YOF	4-	2 (	Transportat o	n Do	nartm	ent	14/1/1	LOGGED BY DD	COMPLET ON	DEPTH 11 80 m	
6		Of	<b>itor</b>	Er	ng neeer ng S					REV EWED BY TD	COMPLET ON	DATE 2016/07/12	
												Page 1	1 of 2

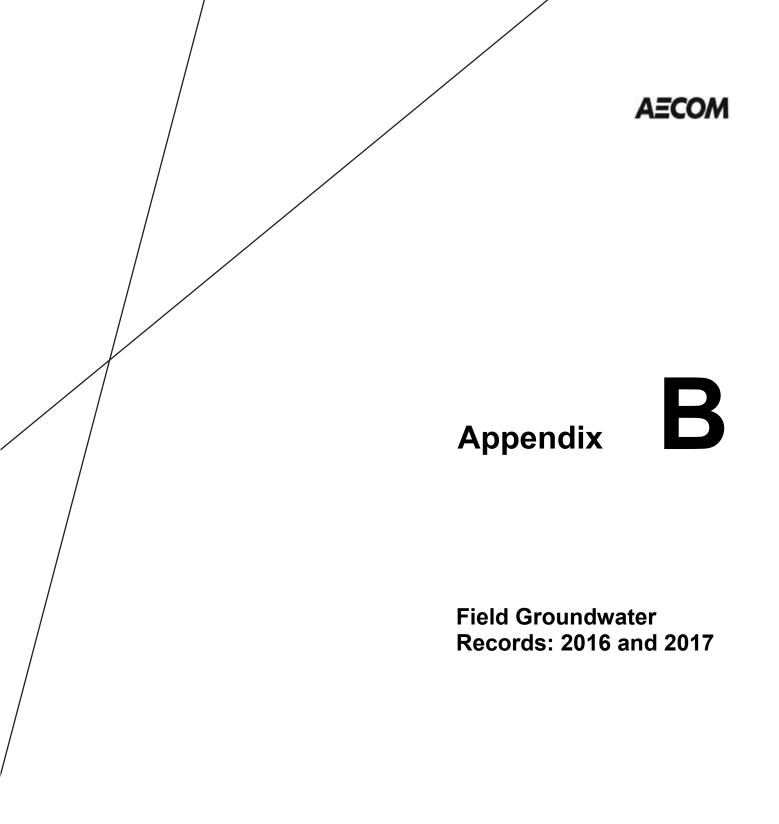
Rossd	a e Pant T	er 2 R	A / RMP				946	9 Ros	sda e l	Road		BOREHOLE NO	: 16-06
Susta	nab e Dev	e opmei	nt				UTI	M ZOI	NE: - N	N5932	935.805 E33282.292	PROJECT NO:	174602
STAR	T DATE: 2	2016/07	/12				931	+36+	19			ELEVATION: 62	4.831 m
SAMP	LE TYPE		Shelby	y Tube	$\angle$	Drive Sam	ple		Aug			A Casing	Cored Sample
BACK	FILL TYPE		BENT	ON TE	· .	PEA GRA	VEL		SLO	DUGH	GROUT	DR LL CUTT NGS	SAND
Depth (m)	PLASTIC	it Weight (ki 18 2 M.C.	LIQUID	0.05 ▲ Compr 100	200 dard Penetra	15 0.20 ngth(kPa) ▲ 300 400 ation (N) ■	SAMPLETYPE	SPT (N)	OSC	SOLSYMBOL	SOII DESCRIF		SLOTTED P EZOMETER ELEVAT ON (m)
- 8 10 11 12 13 14 15 16		40 60	80	20	40 6	0 80			BE		SILT & CLAY BROWN CI - at 8.1 m, Coa p eces  SAND & GRAVEL BROWN - Trace s t, grave up to 70 mm d - at 8.6 m, Coa p eces / dust  - at 9.7 to 11.2 m, Rust staned,  - at 9.7 to 11.2 m, Rust staned,  - at 11.4 to 11.8 m, Grey c ay sh benton te  End of ho e at 11.8 m  - S ough at 10.8 m from surface a Water at top of s ough - 50 mm d ameter pvc we nstaned - 1.5 m mach ne s otted sect on - St ck-up protector - So d stem auger	most to wet  DAMP  a e, h gh p ast c, tr	616 617 618 619 611 611 611
	THEOT	YOF	40		Tran	nsportat o	n De	partm	ent		LOGGED BY DD		DEPTH 11 80 m
	dm	On	TOI	1	Eng n	eeer ng S	ervo	es Se	ect on		REV EWED BY TD	COMPLET ON	DATE 2016/07/12
					6,000	57.0						Page 2 of	

Rossd	a e P ant	Ter 2 F	RA / RMP				946	9 Ros	sda e	Road		BOREHOLE NO	: 16-07	
Susta	nab e De	ve opm	ent				UTN	/ ZON	NE: -1	N5932	924.179 E33302.086	PROJECT NO:	174602	
STAR	T DATE:	2016/0	7/13				931-	+36+1	19			ELEVATION: 62	25.606 m	
N. S. S. S. S. S. S. S. S. S. S. S. S. S.	LE TYPE		Shelby	VIII VIII VIII VIII VIII VIII VIII VII		Drive Sam		- 2	∑ Au	-		A Casing	Cored Sam	ple
BACK	FILL TYP	E	BENT	ON TE	·.	PEA GRA	VEL		∭SL(	OUGH	GROUT	DR LL CUTT NGS	SAND	
Depth (m)	▲ Wet	Unit Weight 18 M.C.	(kN/m³) ▲ 20 22 LIQUID	0.05 ▲ Compre 100	oil Sulphates 0.10 0.15 essive Streng 200 3 lard Penetrat	5 0.20 gth(kPa) ▲ 300 400	SAMPLE TYPE	SPT (N)	USC	SOLSYMBOL	SOIL DESCRIP		SLOTTED	P EZOMETER ELEVAT ON (m)
_ 0	20	40 6	0 80	20	40 60		0,		OR	3333	TODOOU PROWN OR I	DAMD		
-							×		OK		- S ty, some sand, some cay - Root f bres CLAY FILL BROWN CI	DMAP .		- - - - -625
							X				- S ty, trace to some sand, trace g - Concrete p eces, coa specks, br - at 0.5 m, Trace sand, med um to charcoa, coa, br ck, g ass	ck p eces, g ass p h gh p ast c, pos	o eces s b e	
- - - - - - - 2									F		-at 1.0 to 1.7 m, Coa / charcoa, p eces, med um p ast c, trace grave - at 1.7 to 2.4 m, C ay f , s ty, sor med um p ast c, brown, coa, poss	e , brown me sand, trace f n		- 624 -
											- at 2.4 to 3.5 m, S ty, some sand to dark brown, coa p eces, br ck p		, brown	- - - -623 - -
- - - - - - -							×		СО		CHARCOAL BLACK DAMP - F ne gra ned CLAY FILL DARK BROWN - Grave y, some sand, med um p a	CI DMAP		- -622 - -
- - - - - - - 5							X		F		- Br ck, rounded grave	isto day i		- - - -621 - -
- - - - - - - -														- - -620
7							X		С		CLAY BROWN CI DAMF - S ty to very s ty, med um p ast c - Sandy enses, s ty enses, coa d			- - - - -619
							X		SP	000000000000000000000000000000000000000	SAND BROWN SP D - F ne gra ned, s ty enses	AMP		- - - -618 -
E	Transporta Eng neeer ng									100	LOGGED BY DD REV EWED BY TD		DEPTH 12 30 I	

Rossd	a e Pant	Ter 2 R	A/RMP				946	9 Ros	sda e	Road		BO	REHOLE NO	: 16-07			
Susta	nab e Dev	e opme	nt				UTN	/ ZON	VE: -1	N5932	924.179 E33302.086	PRO	DJECT NO:	174602			
STAR	T DATE:	2016/07	7/13				931	+36+1	19			ELE	VATION: 62	25.606 m			
SAMP	LE TYPE		Shelb	y Tube	<b>∠</b> Dr	rive Sam	ple		<b>⊠</b> Au	ger Sar	nple No Recovery	A Ca	sing	Cored	Sample		
BACK	FILL TYPI	Ε,	BENT	ON TE	· PE	EA GRA	VEL		SLO	OUGH	GROUT	DR L	L CUTT NGS	SAND			
Depth (m)	▲ Wet U	nit Weight (k	(N/m³) ▲ 20 22	0.05 ▲ Comp 100	oil Sulphates (% 0.10 0.15 ressive Strength 200 300 dard Penetration	0.20 (kPa) ▲ 0 400	SAMPLE TYPE	SPT (N)	OSC	SO L SYMBOL	SC DESCR	DIL RIPTIC	Ν		SLOTTED P EZOMETER	ELEVAT ON (m)	
_ 8	20	40 60	80	20	40 60	80				00	SAND BROWN SP	DAME	•				
-10 -11 -12 -13									BE CO BE		- at 8.2 to 8.4 m, Med um to c grave, brown, coa dust, damp SAND & GRAVEL BROWN - Max mum d ameter at 40 mm - at 9.1 m, Mo st to wet, ncrea - at 9.7 m, Wet, trace free water - at 10.5 to 11.3 m, Free water - at 10.5 to 11.3 m, Free water - at 10.5 to 11.3 m, Free water - Sty, h gh p ast c COAL BLACK DAMP - Sty, trace benton te, h gh p ast c - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te, h gh p ast - Sty, trace benton te,	SP n SP n SP n SP n SP n SP n SP n SP n	DAMP sture with design and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and intermal and inte	epth		-617 -616 -615	
-14 15 15											LOCCED BY DD		COMPLET ON	DEDTU 47		-611 -610	
	THE CIT	YOF	40	•	Transp	ortat o	n De	partm	ent		LOGGED BY DD		COMPLET ON				
C	dm	OI			Eng nee	er ng S	erv c	es Se	ect on		REV EWED BY TD		COMPLET ON	DATE 201	The Control of the Control		
					Est-ma <sup>2</sup>									REV EWED BY TD COMPLET ON DATE 2016/07/13  Page 2 of 3			

Rossd	a e P ant 7	Ter 2 R	A / RMP				946	9 Ros	sda e	Road		BOREHOLE NO	: 16-08
Susta	nab e Dev	e opme	nt				UTN	/ ZON	IE: -1	N5932	2920.439 E33344.449	PROJECT NO:	174602
STAR	T DATE:	2016/07	7/13				931-	+36+1	9			ELEVATION: 62	5.376 m
SAMP	LE TYPE		Shelby	Tube		Drive Sam	ple		XAug	ger Sar	mple No Recovery	A Casing	Cored Sample
BACK	FILL TYPE	Ε	BENT	ON TE	5.	PEA GRA	VEL		SLO	OUGH	GROUT	DR LL CUTT NGS	SAND
Depth (m)	PLASTIC	nit Weight (I	LIQUID	0.05 ▲ Compr 100	essive Stree 200 dard Penetra	s (%) • 15 0.20 ngth(kPa) • 300 400 ation (N) • 80 80	SAMPLETYPE	SPT (N)	nsc	SOLSYMBOL	SOI DESCRII		SLOTTED P EZOMETER ELEVAT ON (m)
_ 0 _ _ _ _ _ _ _ _ _ _							X		OR		- S ty, some sand, some c ay - Root f bres	DAMP  CI-CH DAMP  med um to h gh p as m xed, ght brown s	tc t
									F		- at 1.4 m, Br ck p eces  - at 2.3 to 3.1 m, Very s ty, tra-	ce sand, brown, dar	np -623
-3									E		- at 2.9 to 3.1 m, Med um p ast of SAND FILL BROWN SP - Trace grave, med um graned selection of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of the control of	DAMP sand CH DAMP med um to h gh p as , w re , wood pe ces	
- - - - - - - 5									E		- at 4.5 to 5.5 m, S ty, trace to med um p ast c, damp, coa spec	some sand, trace gr	-621
- - - - - - - - - - -											- at 5.5 to 6.8 m, Br ck p eces, d med um p ast c	lark brown, some sa	-620 
-6 -7 -8							X				SILT& CLAY BROWN C - Trace sand, med um p ast c	I DAMP	-619 619 
- - - - - - - 8									CLS		- at 7.6 m, S t ke, trace to som	e cay, trace sand	- 618 - - - -
	dm	YOF	4-	X.,	Tran	nsportat o	n De	partme	ent		LOGGED BY DD		DEPTH 13 40 m
t	om	OI	TOI	1		eeer ng S					REV EWED BY TD	COMPLET ON	DATE 2016/07/13
				_	1000	10							Page 1 of 2

Rossd	a e P ant 7	Fer 2 R	A / RMP				9469	9 Ros	sda e	Road		BOREHOLE NO	16-08	
Susta	nab e Dev	e opme	nt				UTN	/ ZON	VE: - 1	N5932	2920.439 E33344.449	PROJECT NO:	174602	
STAR	T DATE: :	2016/07	7/13				931-	+36+1	9			ELEVATION: 62	5.376 m	
SAMP	LE TYPE		Shelby	y Tube		Drive Sam	ple		<b>⊠</b> Au	ger Sar	mple No Recovery	A Casing	Cored Sa	mple
BACK	FILL TYPE		BENT	ON TE	3.	PEA GRAV	/EL		SL	OUGH	GROUT	DR LL CUTT NGS	SAND	
Depth (m)	16 PLASTIC	M.C.	cN/m³) ▲ 20 22  LIQUID 80	0.05 ▲ Comp 100	ressive Stren	5 0.20 gth(kPa) ▲ 300 400 tion (N) ■	SAMPLETYPE	SPT (N)	OSU	SOLSYMBOL	SOI DESCRII		SIOTHE	P EZOMETER ELEVAT ON (m)
-10 -11 -12 -13	20	40 60	80						SP GRSA GP COAL BE		SILT& CLAY BROWN C  - at 8.4 to 8.9 m, F ne gra ned sizes  SAND BROWN SP DAW - Trace grave , med um gra ned - B ack sma coa p eces  SAND & GRAVEL BROWN - Max mum d ameter at 40 mm - Coa enses  GRAVEL BROWN GP - Some sand  - at 11.3 m, Ho e s ough ng n  COAL BLACK WET CLAY SHALE BROWN-DARK - S ty, h gh p ast c, dark brown r - Carbonaceous  End of ho e at 13.4 m  - S ough at 11.3 m from surface at 15.5 m mach ne s otted sect on - St ck-up protector - So d stem auger	GRSA DAMP  WET  BROWN CH  Interm xed  at comp et on t comp et on	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	-617 -616 -616 -613 -611 -610
16 <b>E</b>	<b>J</b> m	Öſſ	<b>tor</b>	1	Tran Eng ne	sportat or	n Dep	partme	ent ct on		LOGGED BY DD REV EWED BY TD	COMPLET ON	DATE 2016/0	07/13
		_		_									Pa	age 2 of



Project #

174602

CITY OF EDMONTON - , ENGINEERING SERVICES

G0255

## **FIELD DATA SHEET**

STANDPIPES	STATUS	Base of Well from Surface(m)	Date	Water Elev (m)	Water level (m)	Comments
TH 10-7	Operational	7.61 m	June 23, 2016		Dry	Dry at 7.61 m from surface
TH 12-7	Not Found					
ΙΠ ΙΖ-1	NOT FOUND					
TH 15-4	Operational	11.38	June 23, 2016		10.43	Slow to moderate rate of recovery
TH 14-15	Operational	10.69	June 23, 2016		9 53	Slow to moderate rate of recovery
TII 4 4 4 7	0	40.50	h 00 0040		0.00	
TH 14-17	Operational	10.58	June 23, 2016		9 30	Slow to moderate rate of recovery
_						
_	_		_			
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#### Note:

- 1) All water levels from surface and in meters
- 2) All wells sampled with a bailer. Water too far below surface for low flow pump.
- 3) Minimum three well volumes taken out during purging.
- 4) Dissolved metals field filtered in the field with preservative added

INSTRUMENTATION LOCATIONS Rossdale Monitoring Wells

Project #

174602

G0255

CITY OF EDMONTON - , ENGINEERING SERVICES

FIELD DATA SHEET 3/16

1						٠٠٠٠٠٠٠٠	
STANDPIPES	STATUS	Base of Well from Surface(m)	Date Sampled	Water Elev (m)	Water level from surface(m)	Water level from syrface(m)	Comments
TH 10-7	Operational	7.61 m	June 23, 2016		Dry		Dry at 7.61 m from surface
<u> </u>							
TH 12-7	Not Found			+	ļ		
					10.10		Of the second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second second se
TH 15-4	Operational	11.38	June 23, 2016		10,43		Slow to moderate rate of recovery
TH 14-15	Operational	10.69	June 23, 2016		9.53	100	Slow to moderate rate of recovery
		10.00		-	-	, , ,	
TH 14-17	Operational	10.58	June 23, 2016		9.30	9.43	Slow to moderate rate of recovery
16-01	Operational	11.9	July 26, 2016		9.00	8-64	Slow Recovery
16-02	Operational	9.6	July 26, 2016		6,90	705SA	Slow Recovery
			·				
16-03	Operational	10,5	July 26, 2016		9.02	9-08	Slow Recovery
		ļ			(A) (A)	() 57	<u> </u>
16-04	Operational	11	` July 22, 2016		9.07	4.07	
16-05	Operational	10.1	July 22, 2016		10 3 <b>5</b>	10.16	
16-06	Operational	11.4	July 22, 2016		10 9;	10.72	
10.07						W 75 5	
16-07	Operational	11.7	July 22, 2016		: 624 :	10.97	·
16-08	Operational	12.3	July 22, 2016			11.39	
			·				
	,						

#### Note:

- 1) All water levels from surface and in meters
- 2) All wells sampled with a bailer. Water too far below surface for low flow pump.
- 3) Minimum three well volumes taken out during purging.
- 4) Dissolved metals field filtered in the field with preservative added

Ben.

CITY OF EDMONTON - , ENGINEERING SERVICES

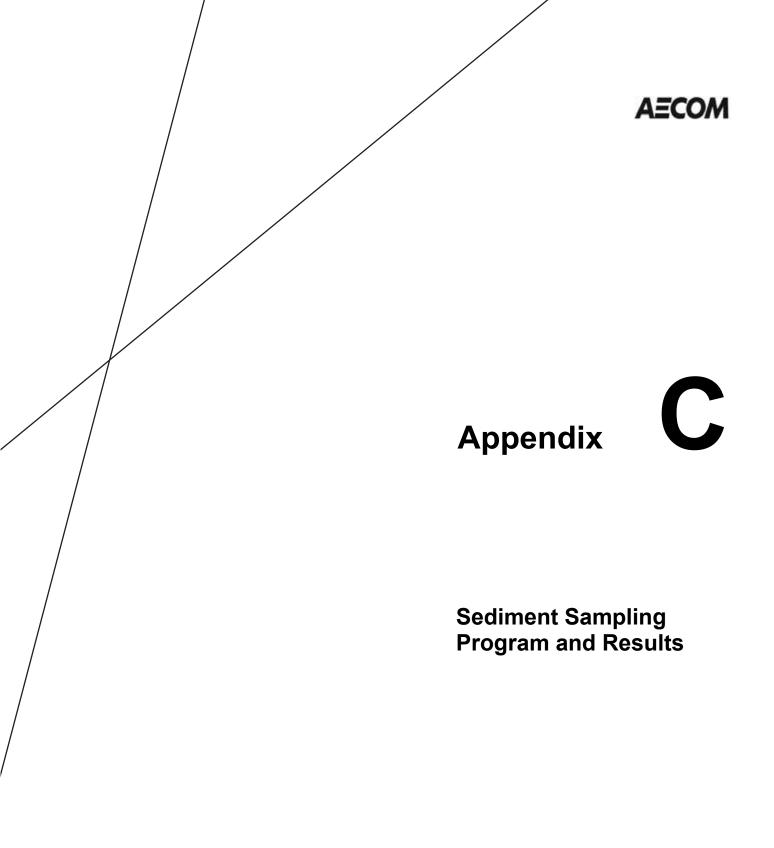
G0285

## **FIELD DATA SHEET**

STANDPIPES	STATUS	Base of Well from Surface(m)	Water Elev (m)	Water level from surface( m)	Water level from surface( m)	Water level from surface( m) Date	Water level from surface( m) Date	Comments
							Date	
				June 27, 2017	June 29, 2017	July 5, 2017		
TH 10-7	Operational	7.61 m						Dry at 7.61 m from surface
TH 12-7	Not Found							
TH 15-4	Operational	11.38						Clause madagete rate of recovery
11113-4	Operational	11.30						Slow to moderate rate of recovery
TH 14-15	Operational	10.69			9.200	9.260		Very quick recovery
TH 14-17	Operational	10.58			8.935	8.980		Very quick recovery
16-01	Operational	11.9						Slow recovery
16-02	Operational	9.6			6.575			Good recovery
16-03	Operational	10.5						Slow recovery
16-04	Operational	11						
	.,							
16-05	Operational	10.1			9.515			Slow to moderate recovery
16-06	Operational	11.4		9.620				Slow recovery
16-07	Operational	11.7		9.548				Good recovery
16-08	Operational	12.3		10.255				Good recovery
								•

#### Note:

- 1) All water levels from surface and in meters
- 2) All wells sampled with a bailer. Water too far below surface for low flow pump.
- 3) Minimum three well volumes taken out during purging.
- 4) Dissolved metals field filtered in the field with preservative added



#### INTEGRATED INFRASTRUCTURE SERVICES Business Planning & Support Engineering Services Section

Edmonton, AB T5S 0G9 Tel.: 780.496.6770



edmonton.ca

City of Edmonton 11004 - 190 Street NW

### Memorandum

Date: November 18, 2016 File: 931-36-17:22232

TO: Tami Dolen

COPY TO: File

FROM: Dale Durham

SUBJECT: North Saskatchewan River Sediment Sampling

Dale Durham and Yi-Chuan Li of the City of Edmonton collected sediment samples from six locations within/along the North Saskatchewan River on Nov. 15, 2016 by. The samples were collected using a stainless steel scoop and placed in a stainless steel mixing bowl. Three scoops per location were blended in the bowl prior to filling the jars and bag. Between sampling events the equipment was cleaned using Alconox and demineralized water and then rinsed using river water. The attached figure shows the sample locations and the following provides photos and a brief description of the general observations at each sample location.

#### 1. SED16-01

- The sample was taken within the soil structure form 0.0 cm to 10 cm at water depth of 10 cm.
- The top bank at this location was moderately steep and approximately 2.0 m high. The bottom bank was gently sloped and was 1.5 m from the base of the top bank to the water's edge.
- The slope into the river was also gently sloped.
- An outfall was located approximately 200 to 300 m upstream and one directly across the river.
- The sediment sample is described as silty sand with clay laminations, fine grained.





SED16-01

#### 2. SED16-02

- The sample was taken within the soil structure form 0.0 cm to 10 cm at water depth of 10 cm.
- The top bank at this location was moderately steep and approximately 10.0 m high. The bottom bank was gently sloped and was 1.5 m from the base of the top bank to the water's edge.
- The slope into the river was gradual to steeper at this location.
- The confluence to Whitemud Creek was approximately 500 m upstream.
- The sediment sample is described as sand, silty trace clay, fine grained.







SED16-02

#### 3. SED16-03

- The sample was taken within the soil structure form 0.0 cm to 10 cm at water depth of 20 cm.
- The top bank at this location was moderately steep and approximately 10.0 m high with chunks of concrete along the base and extending into the river.
- The slope into the river was steep.
- The sediment sample is described as sand, fine grained, some silt, trace clay.



SED16-03

#### 4. SED16-04

- The sample was taken from within the soil structure form 0.0 cm to 10 cm approximately 0.5 m from the water's edge.
- The top bank at this location was moderately steep and approximately 9.0 m high. The bottom bank was gently sloped and was approximately 7.0 m from the base of the top bank to the water's edge.
- The slope into the river was also gentle. An outfall was not observed upstream.
- The sediment sample is described as a silt and sand, trace clay, fine grained



SED16-04

#### 5. SED16-05

- The sample was taken within the soil structure form 0.0 cm to 10 cm at water depth of 15 cm.
- The top bank at this location was moderately steep and approximately 9.0 m high. The bottom bank was gently sloped and was 1.5 m from the base of the top bank to the water's edge.
- Areas of gravel were noted along the shoreline.
- The slope into the river was also gently to moderate.
- An out fall was noted 30 to 40 m upstream and one noted 10 m downstream. The water in the downstream outfall was at a trickle
- sand and silt, trace clay, fine grained.
- The sediment sample is described as a sand and silt, trace clay, fine grained.



SED16-05

#### 6. SED16-06

- The sample was taken within the soil structure form 0.0 cm to 10 approximately 0.5 m from the water's edge.
- The top bank at this location was moderately sloped and approximately 2.0 m high. The bottom bank was gently sloped and was 2.0 m from the base of the top bank to the water's edge.
- The slope into the river was also gently. An outfall was not observed upstream.
- The sediment sample is described as sand and silt, trace clay, fine grained.



SED16-06

The samples were submitted to Exova Laboratories for PAH and metal analysis on November 16, 2016. I trust the above mentioned meets your requirements. Please do not hesitate to contact me if you have any questions or concerns.

#### Dale Durham

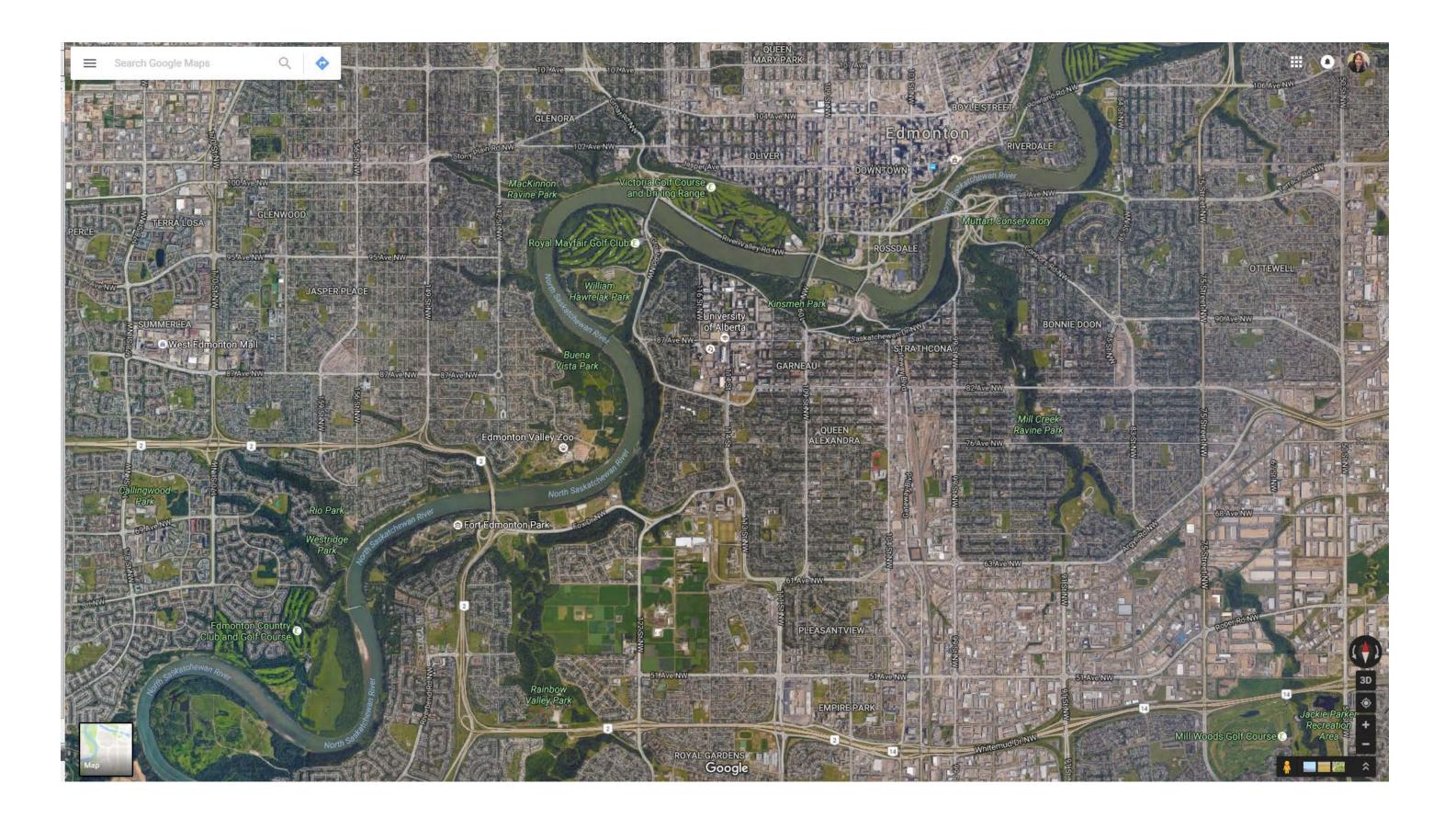
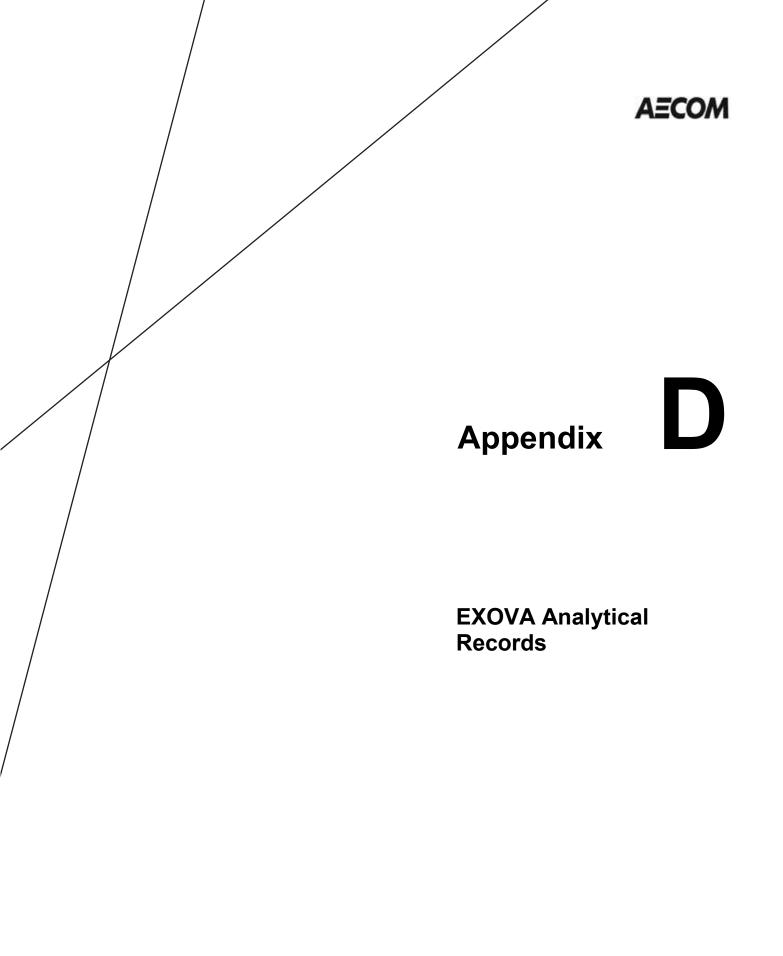


Table **CI**: North Saskatchewan River Sediment Analysis Results

December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December   December							McKinnon	Walterdale		
City   D    SED16-01   SED16-02   SED16-02   SED16-04   SED16-05   SED16-0				Location	Terwilligar	Fox Dr NW			Rossdale	Riverdale
METALS								•		
METALS										
METALS			CCME							
Beron (sat paste)	METALS	Units			11/13/2010	11/13/2010	11/ 13/2010	11/13/2010	11/ 13/2010	11/13/2010
Antimony mg/kg mg/kg mg/kg mg/kg	-	OTIILS	1000	7 22	<0.05	<0.05	0.06	<0.05	0.37	<0.05
Arsenic mg/kg mg/kg mg/kg mg/kg mg/kg larger mg/kg beryllium mg/kg chrombum mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger mg/kg larger larger larger mg/kg larger larger larger mg/kg larger large	-	ma/ka								
Barium   mg/kg   5.2 3   160   14   12.4   13.3   13.6   12.4   11.8   11.0   11.0   12.4   11.8   11.0   11.0   11.0   12.4   13.3   13.6   12.4   11.8   11.6   11.8   11.5   11.9   11.0   11.0   12.4   13.3   13.6   12.4   11.8   11.8   12.4   13.3   13.6   12.4   11.8   11.8   12.4   13.3   13.6   12.4   11.8   12.4   13.3   13.6   12.4   11.8   12.4   13.3   13.6   12.4   11.8   12.4   13.3   13.6   12.4   11.8   12.4   13.3   13.6   12.4   11.8   12.4   13.3   13.6   12.4   11.8   12.4   13.3   13.6   12.4   11.8   12.4   13.3   13.6   12.4   13.8   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   12.4   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8   13.6   13.8	,		7 24	41.6						
Beryllium			7.27	41.0						
Cadmium         mg/kg         0.7         4.2         0.19         0.16         0.15         0.22         0.18         0.15           Chromium         mg/kg         52.3         160         14         12.4         13.3         13.6         12.4         11.8           Cobper         mg/kg         18.7         108         10.7         8.7         8.9         12.2         9.8         7.8           Lead         mg/kg         30.2         112         5.9         5.3         5.7         6.3         5.5         4.9           Mercury         mg/kg         0.13         0.7         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05         <0.05										
Chromium         mg/kg         52.3         160         14         12.4         13.3         13.6         12.4         11.8           Cobalt         mg/kg         18.7         108         10.7         6.3         6         7.1         6.5         6.1           Copper         mg/kg         30.2         112         5.9         5.3         5.7         6.3         5.5         4.9           Mercury         mg/kg         0.13         0.7         <0.05	3		0.7	12						
Cobalt         mg/kg         ng/kg         6.7         6.3         6         7.1         6.5         6.1           Copper         mg/kg         30.2         112         5.9         5.3         5.7         6.3         5.5         4.9           Mercury         mg/kg         0.13         0.7         <0.05			_							
Copper         mg/kg         18.7         108         10.7         8.7         8.9         12.2         9.8         7.8           Lead         mg/kg         30.2         112         5.9         5.3         5.7         6.3         5.5         4.9           Mercury         mg/kg         0.13         0.7         <0.05			32.3	100						
Lead         mg/kg         30.2         112 b         5.9         5.3         5.7         6.3         5.5         4.9           Mercury         mg/kg         0.13         0.7         <0.05		0 0	10 7	100						
Mercury										
Molybdenum   mg/kg										
Nicke  mg/kg   18.9   17.5   17.2   20.1   18.2   16.9	,		0.13	<u>0.7</u>						
Selenium   mg/kg	-				_					
Silver         mg/kg          <0.1         <0.1         <0.1         <0.1         <0.1         <0.1         <0.1         <0.1         <0.1         <0.1         <0.1         <0.1         <0.1         <0.1         <0.09         0.12         0.11         0.09           Tin         mg/kg         4.0         <1.0										
Thallium         mg/kg         0.11         0.1         0.09         0.12         0.11         0.09           Tin         mg/kg         4.1.0         <1.0										
Tin         mg/kg         4         4.1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <1.0         <					_					-
Uranium         mg/kg         mg/kg         0.7         0.7         0.6         0.8         0.7         0.6           Vanadium         mg/kg         124         271         54         51.3         18.3         20.5         17.5         17.4           Zinc         mg/kg         124         271         54         51         50         57         49         47           PAHS         Moisture         %         30.7         28.3         27.7         29.7         27.9         24.4           Naphthalene         mg/kg         0.0346         0.391         0.018         0.015         0.018         0.033         0.026         0.013           2-Methylnaphthalene         mg/kg         0.00587         0.128         <0.0050										
Vanadium         mg/kg Zinc         ng/kg PAHs         124         271         54         51         50         57         49         47           Moisture         %         30.7         28.3         27.7         29.7         27.9         24.4           Maphthalene         mg/kg         0.0346         0.391         0.018         0.015         0.018         0.033         0.026         0.013           2-Methylnaphthalene         mg/kg         0.0201         0.201         0.037         0.026         0.034         0.063         0.05         0.026           Acenaphthylene         mg/kg         0.0057         0.128         <0.0050					-					-
Zinc PAHs         mg/kg Moisture         124         271         54         51         50         57         49         47           Moisture Naphthalene         % Mog/kg         0.0346         0.391 0.201         0.018 0.015         0.018 0.015         0.018 0.033         0.026 0.0033         0.026 0.005 0.0050         0.018 0.0033         0.026 0.005 0.0050         0.018 0.005 0.0050         0.018 0.0050         0.018 0.005 0.0050         0.018 0.0050         0.018 0.0050         0.018 0.0050         0.018 0.0050         0.018 0.0050         0.018 0.0050         0.0050 0.0050         0.0050 0.0050 0.0050         0.0050 0.0050 0.0050         0.0050 0.0050 0.0050         0.0050 0.0050 0.0050 0.0050         0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0										
PAHs   Moisture   %										
Moisture         %         30.7         28.3         27.7         29.7         27.9         24.4           Naphthalene         mg/kg         0.0346         0.391         0.018         0.015         0.018         0.033         0.026         0.013           2-Methylnaphthalene         mg/kg         0.0201         0.201         0.037         0.026         0.034         0.063         0.05         0.026           Acenaphthylene         mg/kg         0.00587         0.128         <0.0050		mg/kg	124	<u>271</u>	54	51	50	57	49	47
Naphthalene         mg/kg         0.0346         0.391         0.018         0.015         0.018         0.033         0.026         0.013           2-Methylnaphthalene         mg/kg         0.0201         0.201         0.037         0.026         0.034         0.063         0.05         0.026           Acenaphthylene         mg/kg         0.00587         0.128         <0.0050										
2-Methylnaphthalene         mg/kg         0.0201         0.201         0.037         0.026         0.034         0.063         0.05         0.026           Acenaphthylene         mg/kg         0.00587         0.128         <0.0050										
Acenaphthylene         mg/kg         0.00587         0.128         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050										
Acenaphthene         mg/kg         0.00671         0.0889         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.0050         < 0.050         < 0.050 <th< td=""><td>,</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>	,									
Fluorene         mg/kg         0.0212         0.144 0.0867         <0.0050 0.544         <0.0050 0.037         <0.0050 0.0039         <0.0059 0.0039         <0.0050 0.0047         <0.0050 0.0047           Anthracene         mg/kg         0.0469         0.245 0.0245         <0.0030 0.0030         <0.0050 0.0030         <0.0050 0.0050         <0.0050 0.0050 0.0050         <0.0050 0.0050 0.0050 0.0050         <0.0500 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.0050 0.005	, ,									
Phenanthrene         mg/kg         0.0867         0.544 0.245         0.037         0.028         0.039         0.059         0.047         0.023           Anthracene         mg/kg         0.0469         0.245 0.045         <0.0030			0.00671	0.0889						
Anthracene         mg/kg         0.0469         0.245         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.0030         <0.001         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <	Fluorene									
Fluoranthene         mg/kg         0.113         1.494         <0.01         <0.01         0.013         0.01         <0.01         <0.01           Pyrene         mg/kg         0.153         1.398         0.012         0.013         0.018         0.019         0.015         <0.01	Phenanthrene		0.0867	0.544	0.037	0.028	0.039		0.047	0.023
Pyrene         mg/kg         0.153         1.398         0.012         0.013         0.018         0.019         0.015         <0.01           Benzo(a)anthracene         mg/kg         0.0748         0.693         <0.01	Anthracene		0.0469	0.245	< 0.0030	< 0.0030	< 0.0030	< 0.0030	< 0.0030	<0.0030
Benzo(a)anthracene         mg/kg         0.0748         0.693 (0.01)         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.01         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <	Fluoranthene		0.113		<0.01	< 0.01	0.013	0.01	< 0.01	< 0.01
Chrysene         mg/kg         0.108         0.846         0.021         0.018         0.023         0.032         0.032         0.023         0.014           Benzo(a)pyrene         mg/kg         0.0888         0.763         <0.0050	Pyrene		0.153		0.012	0.013	0.018	0.019	0.015	< 0.01
Benzo(a)pyrene         mg/kg         0.0888         0.763         <0.0050         0.0058         0.0087         0.0095         0.0067         <0.0050           Indeno(1,2,3-c,d)pyrene         mg/kg          <0.050	Benzo(a)anthracene	mg/kg	0.0748	0.693	< 0.01	< 0.01	< 0.01	< 0.01		< 0.01
Indeno(1,2,3-c,d)pyrene         mg/kg         <0.050	Chrysene		0.108	0.846	0.021	0.018		0.032		
Dibenzo(a,h)anthracene         mg/kg         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050	Benzo(a)pyrene	mg/kg	0.0888	0.763	< 0.0050	0.0058	0.0087	0.0095	0.0067	< 0.0050
Dibenzo(a,h)anthracene         mg/kg         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050	Indeno(1,2,3-c,d)pyrene	mg/kg		-	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Benzo(g,h,i)perylene         mg/kg         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050	Dibenzo(a,h)anthracene	mg/kg			< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Benzo(k)fluoranthene         mg/kg         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050					< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
Benzo(b+j)fluoranthene         mg/kg         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050         <0.050						< 0.050				< 0.050
IACR_Coarse mg/kg 0.003 0.003 0.004 0.004 0.003 <0.001					< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050
	IACR_Fine	mg/kg			0.005	0.005	0.007	0.009	0.006	0.001



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#### **Report Transmission Cover Page**

Bill To: City of Edmonton Project:

> ID: 506-327

Lot ID: 1139764 Control Number: C0012469

Report To: City of Edmonton 11404 - 60th Avenue

RMP- Rossdale Name:

Date Received: May 26, 2016 Jun 21, 2016 Date Reported:

T6H 1J5

Location: LSD:

Firestn #21

D927378 C#4791974 Line #17

Report Number: 2106069

Attn: Tami Dolen

Edmonton, AB, Canada

P.O.: Acct code:

Sampled By: DO

Company: COE

Contact & Affiliation	Address	Delivery Commitments
Tami Dolen	11404 - 60th Avenue	On [Lot Verification] send
City of Edm - Finance Dept.	Edmonton, Alberta T6H 1J5	(COA, COC) by Email - Multiple Reports By Agreement
	Phone: (780) 496-6782 Fax: null	On [Report Approval] send
	Email: tami.dolen@edmonton.ca	(COC, Test Report) by Email - Merge Reports
		On [Report Approval] send
		(Test Report) by Email - Single Report
		On [Lot Approval and Final Test Report Approval] send
		(COC, Test Report, Invoice) by Email - Merge Reports

#### **Notes To Clients:**

• Dioxins and Furans analysis was performed by a subcontract laboratory. See attached 4 page report PR161590.

Exova T: +1 (780) 438-5522 7217 Roper Road NW F: +1 (780) 434-8586 Edmonton, Alberta E: Edmonton@exova.com T6B 3J4, Canada W: www.exova com



#### **Analytical Report**

Bill To: City of Edmonton

Project: ID:

1139764 Lot ID:

Report To: City of Edmonton

506-327 RMP- Rossdale Name:

Control Number: C0012469

11404 - 60th Avenue Edmonton, AB, Canada

Location: Firestn #21 Date Received: May 26, 2016 Jun 21, 2016

T6H 1J5

LSD:

Date Reported:

Attn: Tami Dolen

P.O.:

Report Number: 2106069

Sampled By:

DO Company: COE Acct code:

**Reference Number** 

1139764-1

D927378 C#4791974 Line #17

Sample Date

May 26, 2016

Sample Time

NA

**Sample Location** 

Sample Description 14-1 / Water / 13.5°C

Matrix Water Nominal Detection Analyte Units Results Results Results Limit Metals Dissolved Silicon Dissolved 4.22 0.05 mg/L Sulfur Dissolved mg/L 20.6 0.3 Dissolved < 0.002 0.002 Aluminum mg/L Dissolved < 0.0002 Antimony mg/L 0.0002 Arsenic Dissolved mg/L < 0.0002 0.0002 Barium Dissolved mg/L 0.089 0.001 Beryllium Dissolved < 0.0001 0.0001 mg/L **Bismuth** Dissolved mg/L < 0.0005 0.0005 Boron Dissolved 0.071 0.002 mg/L Cadmium Dissolved 0.00003 0.00001 mg/L Chromium Dissolved < 0.0005 0.0005 mg/L Cobalt Dissolved 0.0001 0.0001 mg/L Copper Dissolved mg/L 0.003 0.001 Lead Dissolved mg/L < 0.0001 0.0001 Dissolved Lithium mg/L 0.008 0.001 Molybdenum Dissolved < 0.001 0.001 mg/L Nickel Dissolved mg/L 0.0065 0.0005 Selenium Dissolved mg/L 0.0004 0.0002 Silver Dissolved mg/L < 0.00001 0.00001 Dissolved Strontium 0.481 0.001 mg/L Thallium Dissolved < 0.00005 0.00005 mg/L Tin Dissolved < 0.001 mg/L 0.001 Titanium Dissolved mg/L < 0.0005 0.0005 Uranium Dissolved 0.0015 0.0005 mg/L Dissolved < 0.0001 Vanadium mg/L 0.0001 Dissolved 0.005 0.001 Zinc mg/L Subsample Field Filtered Field Filtered **Routine Water** Calcium Dissolved 112 0.2 mg/L Magnesium Dissolved mg/L 23.7 0.2 Sodium Dissolved 8.5 0.4 mg/L Potassium Dissolved mg/L 1.8 0.4 Iron Dissolved mg/L 0.01 0.01 Dissolved 0.006 0.005 Manganese mg/L Mono-Aromatic Hydrocarbons - Water 0.001 Benzene mg/L < 0.001



Report Number: 2106069

#### **Analytical Report**

Bill To: City of Edmonton Project:

Lot ID: 1139764 Report To: City of Edmonton ID: 506-327 Control Number: C0012469

**Sample Location** 

11404 - 60th Avenue RMP- Rossdale Name: May 26, 2016 Date Received: Edmonton, AB, Canada Location: Firestn #21 Date Reported: Jun 21, 2016 T6H 1J5

LSD:

Attn: Tami Dolen P.O.: D927378 C#4791974 Line #17

Sampled By: DO Acct code:

Company: COE

**Reference Number** 1139764-1 Sample Date May 26, 2016 Sample Time NA

Sample Description 14-1 / Water / 13.5°C

Matrix Water

Analyte		Units	Results	Results	Results	Nominal Detection
	one Weter Centinued	Ullits	Results	Kesuits	Resuits	Limit
Mono-Aromatic Hydrocarb	ons - water - Continued		-0.0004			0.0004
Toluene		mg/L	<0.0004			0.0004
Ethylbenzene		mg/L	<0.0010			0.0010
Total Xylenes (m,p,o)		mg/L	<0.001			0.001
Volatile Petroleum Hydroca	arbons - Water					
F1 -BTEX		mg/L	<0.1			0.1
F1 C6-C10		mg/L	<0.1			0.1
F2 C10-C16		mg/L	<0.1			0.1
Polycyclic Aromatic Hydro	carbons - Water					
Naphthalene		ug/L	<0.1			0.1
Quinoline		ug/L	<0.3			0.3
Acenaphthylene		ug/L	<0.1			0.1
Acenaphthene		ug/L	<0.1			0.1
Fluorene		ug/L	<0.1			0.1
Phenanthrene		ug/L	<0.1			0.1
Acridine		ug/L	<0.1			0.1
Anthracene		ug/L	< 0.005			0.005
Fluoranthene		ug/L	<0.01			0.01
Pyrene		ug/L	<0.01			0.01
Benzo(a)anthracene		ug/L	<0.01			0.01
Chrysene		ug/L	<0.1			0.1
Benzo(b)fluoranthene		ug/L	<0.1			0.1
Benzo(b+j)fluoranthene		ug/L	<0.1			0.1
Benzo(k)fluoranthene		ug/L	<0.1			0.1
Benzo(a)pyrene		ug/L	<0.008			0.008
Indeno(1,2,3-c,d)pyrene		ug/L	< 0.05			0.05
Dibenzo(a,h)anthracene		ug/L	< 0.05			0.05
Benzo(g,h,i)perylene		ug/L	< 0.05			0.05
CB(a)P	Carcinogenic Potency Equivalent	ug/L	<0.01			0.01
PAH - Water - Surrogate Re						
Nitrobenzene-d5	PAH - Surrogate	%	122			23-130
2-Fluorobiphenyl	PAH - Surrogate	%	107			30-130
p-Terphenyl-d14	PAH - Surrogate	%	109			18-137
Subcontracted Analysis						
Subcontractor Report Id	Pacific Rim		PR161590			

T: +1 (780) 438-5522 7217 Roper Road NW F: +1 (780) 434-8586 Edmonton, Alberta E: Edmonton@exova.com T6B 3J4, Canada W: www.exova com



Lot ID: 1139764

#### **Analytical Report**

Bill To: City of Edmonton Project:

Report To: City of Edmonton ID: 506-327

Control Number: C0012469 11404 - 60th Avenue RMP- Rossdale Name: Date Received: May 26, 2016 Edmonton, AB, Canada Location: Firestn #21 Jun 21, 2016 Date Reported: LSD: T6H 1J5 Report Number: 2106069

Attn: Tami Dolen P.O.: D927378 C#4791974 Line #17

Sampled By: DO Acct code:

Company: COE

Anthony Weuman Approved by:

> Anthony Neumann, MSc Laboratory Operations Manager

# Page 4 of 4

Lot ID: 1139764

#### **Methodology and Notes**

Bill To: City of Edmonton Project:

Report To: City of Edmonton ID:

506-327 Control Number: C0012469 11404 - 60th Avenue RMP- Rossdale Name: Date Received: May 26, 2016 Edmonton, AB, Canada Location: Firestn #21 Date Reported: Jun 21, 2016 T6H 1J5 LSD: Report Number: 2106069

Attn: Tami Dolen P.O.: D927378 C#4791974 Line #17

Sampled By: DO Acct code:

Company: COE

Method of Analysis				
Method Name	Reference	Method	Date Analysis Started	Location
BTEX-CCME - Water	US EPA	* Volatile Organic Compounds in Various Sample Matrices Using Equilibrium Headspace Analysis/Gas Chromatography Mass Spectrometry, 5021/8260	27-May-16	Exova Calgary
Metals ICP-MS (Dissolved) in water	US EPA	* Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	27-May-16	Exova Edmonton
Metals Trace (Dissolved) in water	APHA	<ul> <li>* Inductively Coupled Plasma (ICP) Method, 3120 B</li> </ul>	27-May-16	Exova Edmonton
PAH - Water	AESRD	Carcinogenic PAHs Toxic Potency Equivalence (as B(a)P TPE), PAHw	27-May-16	Exova Calgary
PAH - Water	US EPA	<ul> <li>Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry, 8270</li> </ul>	27-May-16	Exova Calgary
Sublet to Pacific Rim Labs	Ext. Lab	See attached test report,	06-Jun-16	Pacific Rim Laboratories Inc.

<sup>\*</sup> Reference Method Modified

#### References

**AESRD** Alberta Tier 1 Soil and Groundwater Remediation Guidelines Standard Methods for the Examination of Water and Wastewater **APHA** APHA/USEPA Standard Methods For Water/ Environmental Protection Agency

Ext. Lab **External Laboratory** 

**US EPA** US Environmental Protection Agency Test Methods

#### Comments:

• Dioxins and Furans analysis was performed by a subcontract laboratory. See attached 4 page report PR161590.

Please direct any inquiries regarding this report to our Client Services group. Results relate only to samples as submitted.

The test report shall not be reproduced except in full, without the written approval of the laboratory.

#### SAMPLE RECEIPT FORM / CHEMICAL ANALYSIS FORM

FILE #: PR161590 CLIENT: Exova

7217 Roper Road NW

Edmonton, AB T6B 3J4

Phone: (780) 438-5522 Fax: (780) 434-8586

Email: Edmonton@exova.com

RECEIVED BY: J. Wiebe DATE/TIME: May 27, 2016 (9:45 a.m.)

CONDITION: okay, 15.6°C

# of Containers	Sample Type	Sample (Client Codes)	Lab Codes	Test Requested
1	Water	1139764-1 Sample Date: May 26, 2016 Site ID: 14-1 Description: Water	PR161590	PCDD/F

STORAGE: Stored at 4°C.

ANALYTES: HRGC/HRMS analysis for polychlorinated dibenzo(p)dioxins and dibenzofurans (PCDD/F).

SPECIAL INSTRUCTIONS: None.

#### **METHODOLOGY**

Reference Method: PCDD/F: SOP LAB01; EPA Method 1613b

Data summarized in Data Report Attached

Report sent to: Client Services Date: June 20, 2016

Comments: Results relate only to items tested.

David Hope PChem, CEO



# **DATA REPORT**

 Client:
 Exova
 Contact:
 Client Services

 Client ID:
 1139764-1
 Date Extracted:
 01-Jun-16

 PRL ID:
 PR161590
 Date Analysed:
 16-Jun-16

DIOXINS	Conc.	DL	Surrogate Recoveries
Congeners	pg/L	pg/L	%
2,3,7,8-TCDD	ND	1	68
Total TCDD	ND	1	
1,2,3,7,8-PeCDD	ND	2	76
Total PeCDD	2.9	2	
1,2,3,4,7,8-HxCDD	ND	2	84
1,2,3,6,7,8-HxCDD	ND	2	86
1,2,3,7,8,9-HxCDD	ND	2	92
Total HxCDD	ND	2	_
1,2,3,4,6,7,8-HpCDD	ND	3	76
Total HpCDD	ND	3	
OCDD	ND	4	44
	23	Total Dic	xin TEQ

I-T	I-TEQs					
(ND=0)	(ND=DL)					
pg/L ND	pg/L					
ND	1					
ND	1					
ND	0.2					
ND	0.2					
ND	0.2					
ND	0.03					
ND	0.004					
0.00	2.63					

WHO-TE	Qs (2005
(ND=0)	(ND=DL)
pg/L ND	pg/L
ND	1
ND	2
ND	0.2
ND	0.2
ND	0.2
ND	0.03
ND	0.0012
0.00	3.63

FURANS	1	DL	Surrogate Recoveries
Congeners	pg/L	pg/L	%
2,3,7,8-TCDF	ND	1	58
Total TCDF	ND	1	
1,2,3,7,8-PeCDF	ND	2	80
2,3,4,7,8-PeCDF	ND	2	78
Total PeCDF	ND	2	
1,2,3,4,7,8-HxCDF	ND	2	88
1,2,3,6,7,8-HxCDF	ND	2	94
1,2,3,7,8,9-HxCDF	ND	2	74
2,3,4,6,7,8-HxCDF	ND	2	90
Total HxCDF	ND	2	
1,2,3,4,6,7,8-HpCDF	ND	3	78
1,2,3,4,7,8,9-HpCDF	ND	3	64
Total HpCDF	ND	3	
OCDF	ND	4	) <del>=</del> (
		Total Fu	ran TEQ

I-TEQs		
(ND=0)	(ND=DL)	
pg/L ND	pg/L	
ND	0.1	
ND	0.1	
ND	1	
ND	0.2	
ND	0.03	
ND	0.03	
ND	0.004	
0.00	2.06	

WHO-TEQs (2005)		
(ND=0)	(ND=DL)	
pg/L	pg/L	
ND	0.1	
ND	0.06	
ND	0.6	
ND	0.2	
ND	0.03	
ND	0.03	
ND	0.0012	
0.00	1.62	

Total PCDD/PCDF Toxic Equivalent	0.00	4.70	0.00	5.25
TO DESCRIPTION OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY OF THE PROPERTY	100000000000000000000000000000000000000	2.88(18030)	The state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the state of the s	74070000

ND - none detected

Form Name: DOC18 Data Report DxW 01-Feb-07 DGH



# **QC REPORT - BLANK**

 Client:
 Exova
 Contact:
 Client Services

 Client ID:
 BLANK
 Date Extracted:
 01-Jun-16

 PRL ID:
 DF160472B
 Date Analysed:
 16-Jun-16

DIOXINS	Conc.	DL	Surrogate Recoveries
Congeners	pg/L	pg/L	%
2,3,7,8-TCDD	ND	1	58
Total TCDD	ND	1	
1,2,3,7,8-PeCDD	ND	2	80
Total PeCDD	ND	2	
1,2,3,4,7,8-HxCDD	ND	2	94
1,2,3,6,7,8-HxCDD	ND	2	84
1,2,3,7,8,9-HxCDD	ND	2	35
Total HxCDD	ND	2	
1,2,3,4,6,7,8-HpCDD	ND	3	86
Total HpCDD	ND	3	1
OCDD	ND	4	48
	23	Total Dic	xin TEQ

I-TEQs		
(ND=0)	(ND=DL)	
pg/L	pg/L	
ND	1	
ND	1	
ND	0.2	
ND	0.2	
ND	0.2	
ND	0.03	
ND	0.004	
0.00	2.63	

WHO-TEQs (2005		
(ND=0)	(ND=DL)	
pg/L	pg/L	
ND	1	
ND	2	
ND	0.2	
ND	0.2	
ND	0.2	
ND	0.03	
ND	0.0012	
0.00	3.63	

FURANS	1	DL	Surrogate Recoveries
Congeners	pg/L	pg/L	%
2,3,7,8-TCDF	ND	1	46
Total TCDF	ND	1	
1,2,3,7,8-PeCDF	ND	2	94
2,3,4,7,8-PeCDF	ND	2	80
Total PeCDF	ND	2	
1,2,3,4,7,8-HxCDF	ND	2	96
1,2,3,6,7,8-HxCDF	ND	2	102
1,2,3,7,8,9-HxCDF	ND	2	86
2,3,4,6,7,8-HxCDF	ND	2	100
Total HxCDF	ND	2	
1,2,3,4,6,7,8-HpCDF	ND	3	92
1,2,3,4,7,8,9-HpCDF	ND	3	70
Total HpCDF	ND	3	
OCDF	ND	4	=3 (S <del>=</del> 6
·		Total Fu	ran TEQ

I-TEQs		
(ND=0)	(ND=DL	
pg/L ND	pg/L	
ND	0.1	
ND	0.1	
ND	1	
ND	0.2	
ND	0.03	
ND	0.03	
ND	0.004	
0.00	2.06	

WHO-TEQs (2005)		
(ND=0)	(ND=DL)	
pg/L	pg/L	
ND	0.1	
ND	0.06	
ND	0.6	
ND	0.2	
ND ND ND	0.2	
	0.2	
	0.2	
ND	0.03	
ND	0.03	
ND	0.0012	
0.00	1.62	

				×
Total PCDD/PCDF Toxic Equivalent	0.00	4.70	0.00	5.25

ND - none detected

Form Name: DOC18 Data Report DxW 01-Feb-07 DGH



#### Acronyms used in reporting dioxins and furans:

TCDD = Tetrachlorodibenzo-p-dioxin	TCDF = Tetrachlorodibenzofuran
PeCDD = Pentachlorodibenzo-p-dioxin	PeCDF = Pentachlorodibenzofuran
HxCDD = Hexachlorodibenzo-p-dioxin	HxCDF = Hexachlorodibenzofuran
HpCDD = Heptachlorodibenzo-p-dioxin	HpCDF = Heptachlorodibenzofuran
OCDD = Octachlorodibenzo-p-dioxin	OCDF = Octachlorodibenzofuran

Acceptable recoveries for surrogates	EPA 1	613
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<sup>13</sup> C <sub>12</sub> -2,3,7,8-TCDD	25	164
<sup>13</sup> C <sub>12</sub> -1,2,3,7,8-PeCDD	25	181
<sup>13</sup> C <sub>12</sub> -1,2,3,4,7,8-HxCDD	32	141
<sup>13</sup> C <sub>12</sub> -1,2,3,6,7,8-HxCDD	28	130
<sup>13</sup> C <sub>12</sub> -1,2,3,4,6,7,8-HpCDD	23	140
<sup>13</sup> C <sub>12</sub> -OCDD	17	157
<sup>13</sup> C <sub>12</sub> -2,3,7,8-TCDF	24	169
<sup>13</sup> C <sub>12</sub> -1,2,3,7,8-PeCDF	24	185
<sup>13</sup> C <sub>12</sub> -2,3,4,7,8-PeCDF	21	178
<sup>13</sup> C <sub>12</sub> -1,2,3,4,7,8-HxCDF	26	152
<sup>13</sup> C <sub>12</sub> -1,2,3,6,7,8-HxCDF	26	123
<sup>13</sup> C <sub>12</sub> -1,2,3,7,8,9-HxCDF	29	147
<sup>13</sup> C <sub>12</sub> -2,3,4,6,7,8-HxCDF	28	136
<sup>13</sup> C <sub>12</sub> -1,2,3,4,6,7,8-HpCDF	28	143
<sup>13</sup> C <sub>12</sub> -1,2,3,4,7,8,9-HpCDF	26	138



	calibrating,	Invoice to:			Report To	o:							Report	Regulatory
	advising	Company:	City of Edmar	ton	Company:						-11		Results	Requirement
w.exova.com	ED 120-02	Address:	11004- 190 St	reet	Address:								E-Mail	HCDWQG
oject Informa	tion		Edmonton, 45	?									Mail	Ab Tier 1
oject ID:	506.327	Attention:	Tami Dolen		Attention:						-		Online	SPIGEC
oject Name:	RMP-Rossdale	Phone:	780 496-678	2	Phone:								Fax	BCCSR
oject Location:	Firstn Hal	Cell:			Cell:		-2						PDF	Other (list below)
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-		RUSH Prior	rity						-				May	26,2016
Emergen	cy (contact lab for turnaround and	d pricing)	When "ASAP" is requested, turn aroun						4				Company:	(OE
-	-2 working days (100% surcharge	).	priority, with pricing and turn around to the lab prior to submitting RUSH samp			S S	8F12W	1	Turans					
Urgent 2	3 working days (50% surcharge)		RUSH, please indicate in the special in	structions.		ģ	12	6	7				This secti	on for Lab use only
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Special instru	ctions/Commenta (please include cont	act information inch	uding pn. + if different from acove).	1		Ê	CME	12 1	2	+ +			-	
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Site I.D.	Sample Description	start end	Date/Time Sampled	Matrix	Method	<b>↓</b>		(√ relev					deficiencie	Indicate any sample were not packaged we     Indicate any samples received in Exova supp     Indicate any samples
Site I.D.	Sample Description	start end	Date/Time Sampled	Matrix	Method			(√ relev					deficiencie	Indicate any sample were not packaged we     Indicate any sample received in Exova supp     Indicate any sample were not clearly labele     Indicate any sample
Site I.D.	Sample Description	start end	Date/Time Sampled	Matrix	Method	<b>→</b>		(√ relev					deficiencie	Indicate any sample were not packaged we     Indicate any sample received in Exova supp     Indicate any sample were not clearly labele     Indicate any sample
Site I.D.	Sample Description	start end	Date/Time Sampled	Matrix	Method	<b>↓</b>		(√ relev					deficiencie	1. Indicate any sample were not packaged we 2. Indicate any samples received in Exova supp 3. Indicate any sample were not clearly labele 4. Indicate any sample received within the requoid time or temp. 5. Indicate any missing
Site I.D.	Sample Description	start end	Date/Time Sampled	Matrix	Method	<b>→</b>		(√ relev					deficiencie	1. Indicate any sample were not packaged we 2. Indicate any samples received in Exova supp 3. Indicate any sample were not clearly labele 4. Indicate any sample received within the rephold time or temp.
Site I.D.	Sample Description	start end	Date/Time Sampled	Matrix	Method			(√ relev					deficiencie	1. Indicate any sample were not packaged we 2. Indicate any samples received in Exova supp 3. Indicate any sample were not clearly labele 4. Indicate any sample received within the rephold time or temp. 5. Indicate any missing extra samples 6. Indicate any sample
Site I.D.	Sample Description	start end	Date/Time Sampled	Matrix	Method	<b>↓</b>		(√ relev					deficiencie	1. Indicate any sample were not packaged we 2. Indicate any samples received in Exova supp 3. Indicate any sample were not clearly labele 4. Indicate any sample received within the rephold time or temp. 5. Indicate any missing extra samples 6. Indicate any sample were received broken
Site I.D.	Sample Description	start end	Date/Time Sampled	Matrix	Method			(√ relev					deficiencie	1. Indicate any sample were not packaged we 2. Indicate any samples received in Exova supp 3. Indicate any sample were not clearly labele 4. Indicate any sample received within the rephold time or temp. 5. Indicate any missing extra samples 6. Indicate any sample were received broken 7. Indicate any sample
Site I.D.	Sample Description	start end	Date/Time Sampled	Matrix	Method			(√ relev					deficiencie	1. Indicate any sample were not packaged we 2. Indicate any sample received in Exova supp 3. Indicate any sample were not clearly labele 4. Indicate any sample received within the rechold time or temp. 5. Indicate any missing extra samples 6. Indicate any sample were received broken 7. Indicate any sample where sufficient volum not received
Site I.D.	Sample Description	start end	Mayab, Lo/6	Matrix	Sampling Method Dailler			(√ relev					deficiencie	1. Indicate any sample were not packaged were rost packaged were rost packaged were received in Exova supple were not clearly labeled.  3. Indicate any sample were not clearly labeled.  4. Indicate any sample received within the rechold time or temp.  5. Indicate any missing extra samples.  6. Indicate any sample were received broken.  7. Indicate any sample where sufficient volument received.  8. Indicate any sample.
Site I.D.  14 - 1	Sample Description  Water	start end in cm m	May 26, 10/6	Matrix Water  Lot: 11	Sampling Method bailes	COC		(√ relev	ant sar	Ship	ping:		deficiencie number,	1. Indicate any sample were not packaged we 2. Indicate any sample received in Exova supp 3. Indicate any sample were not clearly labele 4. Indicate any sample received within the rechold time or temp. 5. Indicate any missing extra samples 6. Indicate any sample were received broken 7. Indicate any sample where sufficient volume.
Site I.D.  J4-1  omission of this Conditions (h	Sample Description  Water	start end in cm m	May 26, 10/6	Matrix Water  Lot: 11	Sampling Method Dailler	COC		(√ relev	ant sar	Ship # and	ping:	coolers	deficiencie number,	1. Indicate any sample were not packaged we 2. Indicate any sample received in Exova supp 3. Indicate any sample were not clearly labele 4. Indicate any sample received within the rechold time or temp. 5. Indicate any missing extra samples 6. Indicate any sample were received broken 7. Indicate any sample where sufficient volum not received 8. Indicate any sample received in an inapprocontainer

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Lot ID: 1145461

Report Number: 2113209

#### **Report Transmission Cover Page**

Bill To: City of Edmonton

Report To: City of Edmonton ID: 506-327

Project:

Control Number: C0079742 11404 - 60th Avenue Rossdale RMP Name: Date Received: Jun 23, 2016 Edmonton, AB, Canada Location: 9469 Rossdale Rd. Date Reported: Jul 4, 2016

LSD: T6H 1J5

Attn: Tami Dolen P.O.: D927378 C#-4816245 L3

Sampled By: DD Acct code:

Company: CoE

Contact & Affiliation	Address	Delivery Commitments
Tami Dolen	11404 - 60th Avenue	On [Lot Verification] send
City of Edm - Finance Dept.	Edmonton, Alberta T6H 1J5	(COA, COC) by Email - Multiple Reports By Agreement
	Phone: (780) 496-6782 Fax: null	On [Report Approval] send
	Email: tami.dolen@edmonton.ca	(COC, Test Report) by Email - Merge Reports
		On [Report Approval] send
		(Test Report) by Email - Single Report
		On [Lot Approval and Final Test Report Approval] send
		(COC, Test Report, Invoice) by Email - Merge Reports

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#### **Analytical Report**

Bill To: City of Edmonton

Project: 506-327 ID:

Lot ID: 1145461

Report To: City of Edmonton 11404 - 60th Avenue

Rossdale RMP Name: Location: 9469 Rossdale Rd. Control Number: C0079742 Date Received: Jun 23, 2016 Date Reported: Jul 4, 2016

T6H 1J5

LSD:

Report Number: 2113209

Attn: Tami Dolen P.O.:

Edmonton, AB, Canada

Sampled By: DD Acct code:

Company: CoE

**Reference Number** Sample Date Sample Time

1145461-1 Jun 23, 2016

NA

D927378 C#-4816245 L3

1145461-2 Jun 23, 2016

1145461-3 Jun 23, 2016

**Sample Location** 

14-15 / Water /

NA 14-17 / Water / NA

**Sample Description** 

14.0°C

14.0°C

TH15-4 / Water / 14.0°C

			14.0 C	14.0 C	14.0 C	
		Matrix	Water	Water	Water	
Analyte		Units	Results	Results	Results	Nominal Detectio
Metals Dissolved						
Silicon	Dissolved	mg/L	5.88	5.37	5.90	0.05
Sulfur	Dissolved	mg/L	42.2	33.3	37.7	0.3
Mercury	Dissolved	mg/L	< 0.000005	< 0.000005	< 0.000005	0.000005
Aluminum	Dissolved	mg/L	< 0.002	< 0.002	< 0.002	0.002
Antimony	Dissolved	mg/L	< 0.0002	< 0.0002	< 0.0002	0.0002
Arsenic	Dissolved	mg/L	0.0002	0.0002	< 0.0002	0.0002
Barium	Dissolved	mg/L	0.104	0.104	0.077	0.001
Beryllium	Dissolved	mg/L	<0.0001	<0.0001	< 0.0001	0.0001
Bismuth	Dissolved	mg/L	< 0.0005	< 0.0005	< 0.0005	0.0005
Boron	Dissolved	mg/L	0.457	0.306	0.983	0.002
Cadmium	Dissolved	mg/L	0.00002	0.00002	0.00003	0.00001
Chromium	Dissolved	mg/L	< 0.0005	< 0.0005	< 0.0005	0.0005
Cobalt	Dissolved	mg/L	<0.0001	0.0002	< 0.0001	0.0001
Copper	Dissolved	mg/L	<0.001	<0.001	<0.001	0.001
Lead	Dissolved	mg/L	<0.0001	<0.0001	< 0.0001	0.0001
Lithium	Dissolved	mg/L	0.027	0.024	0.019	0.001
Molybdenum	Dissolved	mg/L	<0.001	<0.001	<0.001	0.001
Nickel	Dissolved	mg/L	0.0020	0.0017	0.0028	0.0005
Selenium	Dissolved	mg/L	0.0005	< 0.0002	0.0013	0.0002
Silver	Dissolved	mg/L	<0.0001	< 0.00001	< 0.00001	0.00001
Strontium	Dissolved	mg/L	1.06	0.993	1.02	0.001
Thallium	Dissolved	mg/L	< 0.00005	< 0.00005	< 0.00005	0.00005
Tin	Dissolved	mg/L	<0.001	<0.001	<0.001	0.001
Titanium	Dissolved	mg/L	< 0.0005	< 0.0005	< 0.0005	0.0005
Uranium	Dissolved	mg/L	0.0055	0.0053	0.0040	0.0005
Vanadium	Dissolved	mg/L	<0.0001	<0.0001	< 0.0001	0.0001
Zinc	Dissolved	mg/L	<0.001	<0.001	<0.001	0.001
Subsample	Field Filtered	-	Lab Filtered	Lab Filtered	Lab Filtered	
Routine Water						
рН			7.85	7.94	7.78	
Temperature of observed pH		°C	21.7	21.7	21.6	
Electrical Conductivity	at 25 °C	uS/cm	1410	998	1220	1
Calcium	Dissolved	mg/L	194	143	179	0.2
Magnesium	Dissolved	mg/L	53.1	39.7	43.9	0.2
Sodium	Dissolved	mg/L	44.1	32.8	39.1	0.4

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#### **Analytical Report**

Bill To: City of Edmonton

Project: ID:

Lot ID: 1145461

Report To: City of Edmonton

506-327 Rossdale RMP Name:

Control Number: C0079742 Jun 23, 2016 Date Received:

11404 - 60th Avenue Edmonton, AB, Canada

Location:

9469 Rossdale Rd.

Date Reported: Jul 4, 2016

T6H 1J5 Attn: Tami Dolen LSD:

D927378 C#-4816245 L3

Report Number: 2113209

P.O.:

Sampled By: DD Company: CoE Acct code:

**Reference Number** Sample Date

1145461-1 Jun 23, 2016

1145461-2 Jun 23, 2016 1145461-3

Sample Time

NA

NA

Jun 23, 2016 NA

**Sample Location** 

**Sample Description** 14-15 / Water / 14-17 / Water /

TH15-4 / Water /

			14.0°C	14.0°C	14.0°C	
		Matrix	Water	Water	Water	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Routine Water - Continue	ed					
Potassium	Dissolved	mg/L	4.3	3.8	3.8	0.4
Iron	Dissolved	mg/L	<0.01	<0.01	<0.01	0.01
Manganese	Dissolved	mg/L	0.006	0.367	0.228	0.005
Chloride	Dissolved	mg/L	168	44.0	61.4	0.4
Nitrate - N		mg/L	3.79	1.21	9.70	0.01
Nitrite - N		mg/L	< 0.005	< 0.005	< 0.005	0.005
Nitrate and Nitrite - N		mg/L	3.79	1.21	9.70	0.01
Sulfate (SO4)	Dissolved	mg/L	127	100	113	0.9
Hydroxide		mg/L	<5	<5	<5	
Carbonate		mg/L	<6	<6	<6	
Bicarbonate		mg/L	494	517	587	
P-Alkalinity	as CaCO3	mg/L	<5	<5	<5	5
T-Alkalinity	as CaCO3	mg/L	405	424	482	5
Total Dissolved Solids	Calculated	mg/L	833	618	729	1
Hardness	Dissolved as CaCO3	mg/L	702	521	627	
Ionic Balance	Dissolved	%	102	101	100	
Polycyclic Aromatic Hyd	rocarbons - Water					
Naphthalene		ug/L	<0.1	<0.1	<0.1	0.1
Quinoline		ug/L	<0.3	<0.3	< 0.3	0.3
Acenaphthylene		ug/L	<0.1	<0.1	<0.1	0.1
Acenaphthene		ug/L	<0.1	<0.1	<0.1	0.1
Fluorene		ug/L	<0.1	<0.1	<0.1	0.1
Phenanthrene		ug/L	<0.1	<0.1	<0.1	0.1
Acridine		ug/L	<0.1	<0.1	<0.1	0.1
Anthracene		ug/L	< 0.005	< 0.005	< 0.005	0.005
Fluoranthene		ug/L	<0.01	<0.01	<0.01	0.01
Pyrene		ug/L	<0.01	<0.01	<0.01	0.01
Benzo(a)anthracene		ug/L	<0.01	<0.01	<0.01	0.01
Chrysene		ug/L	<0.1	<0.1	<0.1	0.1
Benzo(b)fluoranthene		ug/L	<0.1	<0.1	<0.1	0.1
Benzo(b+j)fluoranthene		ug/L	<0.1	<0.1	<0.1	0.1
Benzo(k)fluoranthene		ug/L	<0.1	<0.1	<0.1	0.1
Benzo(a)pyrene		ug/L	<0.008	<0.008	<0.008	0.008
Indeno(1,2,3-c,d)pyrene		ug/L	< 0.05	< 0.05	<0.05	0.05
		<u> </u>				

ug/L

< 0.05

< 0.05

< 0.05

0.05

Dibenzo(a,h)anthracene

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#### **Analytical Report**

Bill To: City of Edmonton

Project:

506-327

Lot ID: 1145461 C0079742

Report To: City of Edmonton 11404 - 60th Avenue

Name: Location:

ID:

Rossdale RMP 9469 Rossdale Rd.

Date Received: Jun 23, 2016 Date Reported: Jul 4, 2016

T6H 1J5

Edmonton, AB, Canada

LSD:

Control Number:

Attn: Tami Dolen

P.O.:

Acct code:

D927378 C#-4816245 L3

Report Number: 2113209

Sampled By: DD

Company: CoE

**Reference Number** Sample Date

**Sample Description** 

1145461-1

1145461-2

1145461-3

Sample Time **Sample Location**  Jun 23, 2016 NA

Jun 23, 2016 NA

Jun 23, 2016

NA

14-15 / Water / 14.0°C

14-17 / Water / 14.0°C

TH15-4 / Water /

Water

14.0°C

		Matrix	Water	Water	Water	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Polycyclic Aromatic H	ydrocarbons - Water - Continue	ed				_
Benzo(g,h,i)perylene		ug/L	< 0.05	< 0.05	< 0.05	0.05
CB(a)P	Carcinogenic Potency Equivalent	ug/L	<0.01	<0.01	<0.01	0.01
PAH - Water - Surroga	te Recovery					
Nitrobenzene-d5	PAH - Surrogate	%	110	107	111	23-130
2-Fluorobiphenyl	PAH - Surrogate	%	86	85	86	30-130
p-Terphenyl-d14	PAH - Surrogate	%	118	110	129	18-137

Approved by:

Anthony Neumann, MSc Laboratory Operations Manager

tothery Weuman

# Page 4 of 4

#### **Methodology and Notes**

Bill To: City of Edmonton

Project: ID:

Lot ID: 1145461

Report To: City of Edmonton

Name:

Control Number: C0079742

11404 - 60th Avenue Edmonton, AB, Canada Rossdale RMP 9469 Rossdale Rd.

506-327

Date Received: Jun 23, 2016

T6H 1J5

Location: LSD:

Date Reported: Jul 4, 2016

Attn: Tami Dolen

P.O.:

Report Number: 2113209

Sampled By: DD

Acct code:

D927378 C#-4816245 L3

Company: CoE

Method of Analysis				
Method Name	Reference	Method	Date Analysis Started	Location
Alkalinity, pH, and EC in water	APHA	* Alkalinity - Titration Method, 2320 B	27-Jun-16	Exova Edmonton
Alkalinity, pH, and EC in water	APHA	* Conductivity, 2510 B	27-Jun-16	Exova Edmonton
Alkalinity, pH, and EC in water	APHA	* pH - Electrometric Method, 4500-H+ B	27-Jun-16	Exova Edmonton
Anions (Routine) by Ion Chromatography	APHA	<ul> <li>* Ion Chromatography with Chemical Suppression of Eluent Cond., 4110 B</li> </ul>	27-Jun-16	Exova Edmonton
Approval-Edmonton	APHA	Checking Correctness of Analyses, 1030 E	24-Jun-16	Exova Edmonton
Chloride in Water	APHA	<ul> <li>* Automated Ferricyanide Method, 4500-CI-</li> <li>E</li> </ul>	27-Jun-16	Exova Edmonton
Mercury (Dissolved) in water	APHA	<ul> <li>Cold Vapour Atomic Absorption</li> <li>Spectrometric Method, 3112 B</li> </ul>	27-Jun-16	Exova Edmonton
Metals ICP-MS (Dissolved) in water	US EPA	<ul> <li>Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8</li> </ul>	27-Jun-16	Exova Edmonton
Metals Trace (Dissolved) in water	APHA	Hardness by Calculation, 2340 B	27-Jun-16	Exova Edmonton
Metals Trace (Dissolved) in water	APHA	<ul> <li>* Inductively Coupled Plasma (ICP)</li> <li>Method, 3120 B</li> </ul>	27-Jun-16	Exova Edmonton
PAH - Water	AESRD	Carcinogenic PAHs Toxic Potency Equivalence (as B(a)P TPE), PAHw	27-Jun-16	Exova Calgary
PAH - Water	US EPA	<ul> <li>Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry, 8270</li> </ul>	27-Jun-16	Exova Calgary

<sup>\*</sup> Reference Method Modified

#### References

**AESRD** Alberta Tier 1 Soil and Groundwater Remediation Guidelines APHA Standard Methods for the Examination of Water and Wastewater APHA/USEPA Standard Methods For Water/ Environmental Protection Agency **US EPA** US Environmental Protection Agency Test Methods

#### Comments:

Please direct any inquiries regarding this report to our Client Services group. Results relate only to samples as submitted.

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www.exov	ua com		Company:	U004-190.	Chest	Company						-	I SECTION AND ADDRESS OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PARTY OF THE PA	/		-
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ALC: NO.	nformatio		Attentions	Tami Dolen		Attention:		-			-		Online		SPIGEC	
Project iD		506.327	1,000,000,000	496-6782				-					Fax		BCCSR	-
Project N		Rossolale RMP 1469 Rossolale Rd.	Phone: Cell:	110-6182	S.	Phone: Cell:						-	PDF	/	Other (list below)	
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P	Priority 1-2	(contact lab for turnaround and working days (100% surcharge) working days (50% surcharge)		When "ASAP" is requested, turn around to priority, with pricing and turn around to the lab prior to submitting RUSH samp RUSH, please indicate in the special in	ime to match. P ples. If not all se	lease contact	of Containers	00					Compar This se		OF Lab use only	
Date	e Required	fe.	Sign	ature:			Co	-33					Date/Tir	ne st	amp: 3:55	
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1 14-	-15	/ Water		June 23,2016	water	LFP	4	VV						1	. Indicate any samples	that
	-17	1 water.		June 23, 2016	water	EFP	4	VV						V	were not packaged well	k s
3 THIS		-DRY			Water	LFP		-	/					_	2. Indicate any samples	
4 [117		- 0		1	Water	UP		7						- 7	eceived in Exova suppli	es
	5-4	water		Jun 23,2016	water	EFP	A	VV			-	-		_	I. Indicate any samples	
6						1	-		12		1	-	10.5		vere not clearly labeled	
7						Briker	-				11				<ol> <li>Indicate any samples eceived within the requ</li> </ol>	
8							-								old time or temp.	
9	-				-		-							_	<ol> <li>Indicate any missing extra samples</li> </ol>	DF
10																4550
12		TE 1 1 1 1 2 1 1 1	-											_	<ol> <li>Indicate any samples were received broken</li> </ol>	that
13														7	. Indicate any samples	8
14														- ×	where sufficient volume not received	
15														8	I. Indicate any samples	
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#### **Report Transmission Cover Page**

Bill To: City of Edmonton Project:

Lot ID: 1149573

Report To: City of Edmonton

Control Number: C0079746

11404 - 60th Avenue

Date Received: Jul 15, 2016

Edmonton, AB, Canada

Date Reported: Jul 21, 2016 Report Number: 2118402

T6H 1J5

D927378 (C-Release#); 4816245

Attn: Tami Dolen P.O.: Sampled By: Acct code:

ID:

Name:

LSD:

Location:

Company:

Contact & Affiliation	Address	Delivery Commitments
Tami Dolen	11404 - 60th Avenue	On [Lot Verification] send
City of Edm - Finance Dept.	Edmonton, Alberta T6H 1J5	(COA, COC) by Email - Multiple Reports By Agreement
	Phone: (780) 496-6782 Fax: null	On [Report Approval] send
	Email: tami.dolen@edmonton.ca	(COC, Test Report) by Email - Merge Reports
		On [Report Approval] send
		(Test Report) by Email - Single Report
		On [Lot Approval and Final Test Report Approval] send
		(COC, Test Report, Invoice) by Email - Merge Reports

506.327

Rossdale RMP

**Notes To Clients:** 

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#### **Analytical Report**

Bill To: City of Edmonton

Project: ID:

Lot ID: 1149573

Report To: City of Edmonton 11404 - 60th Avenue

506.327 Rossdale RMP Name:

Control Number: C0079746

Edmonton, AB, Canada

Date Received: Jul 15, 2016 Date Reported: Jul 21, 2016

T6H 1J5

LSD:

Report Number: 2118402

Attn: Tami Dolen

P.O.: Acct code:

Location:

Sampled By: Company:

**Reference Number** Sample Date 1149573-1

1149573-2 Jul 12, 2016 1149573-3

Sample Time

Jul 12, 2016 NA

D927378 (C-Release#); 4816245

NA

Jul 12, 2016

**Sample Location** 

Sample Description BH16-04 / 0.6-0.8 /

BH16-04 / 1.5-1.6 / BH16-04 / 2.2-2.4 /

NA

Matrix Soil Soil Soil

Analyte		Units	Results	Results	Results	Nominal Detection
Metals Strong Acid Dig	gestion					
Boron	Saturated Paste	mg/L	0.84	2.94	2.14	0.05
Antimony	Strong Acid Extractable	mg/kg	1.9	0.7	0.6	0.2
Arsenic	Strong Acid Extractable	mg/kg	9.4	8.1	9.3	0.2
Barium	Strong Acid Extractable	mg/kg	681	456	188	1
Beryllium	Strong Acid Extractable	mg/kg	1.1	0.8	0.5	0.1
Cadmium	Strong Acid Extractable	mg/kg	0.28	0.25	0.22	0.01
Chromium	Strong Acid Extractable	mg/kg	23.1	21.1	17.9	0.5
Cobalt	Strong Acid Extractable	mg/kg	9.4	9.4	8.1	0.1
Copper	Strong Acid Extractable	mg/kg	24.8	20.3	15.7	1
Lead	Strong Acid Extractable	mg/kg	27.7	15.6	7.6	0.1
Mercury	Strong Acid Extractable	mg/kg	0.85	0.28	0.05	0.05
Molybdenum	Strong Acid Extractable	mg/kg	1.5	1.3	1.0	1
Nickel	Strong Acid Extractable	mg/kg	36.3	29.9	25.1	0.5
Selenium	Strong Acid Extractable	mg/kg	0.5	0.4	0.3	0.3
Silver	Strong Acid Extractable	mg/kg	0.1	<0.1	<0.1	0.1
Thallium	Strong Acid Extractable	mg/kg	0.18	0.17	0.14	0.05
Tin	Strong Acid Extractable	mg/kg	5.5	1.2	<1.0	1
Uranium	Strong Acid Extractable	mg/kg	1.5	1.0	0.7	0.5
Vanadium	Strong Acid Extractable	mg/kg	26.1	25.7	23.1	0.1
Zinc	Strong Acid Extractable	mg/kg	81	76	60	1
Salinity						
% Saturation		%	57	52	42	
Barite Soil Analysis						
Barium	Extractable	mg/kg	44.9	35.2	38.2	0.05
Water Soluble Parame	eters					
Chromium (VI)	Water Soluble	mg/kg	<0.10	<0.10	<0.10	0.1
Polycyclic Aromatic H	lydrocarbons - Soil					
Naphthalene	Dry Weight	mg/kg	0.047	0.027	0.013	0.010
Acenaphthylene	Dry Weight	mg/kg	< 0.05	< 0.05	< 0.05	0.05
Acenaphthene	Dry Weight	mg/kg	< 0.05	< 0.05	< 0.05	0.05
Fluorene	Dry Weight	mg/kg	< 0.05	<0.05	< 0.05	0.05
Phenanthrene	Dry Weight	mg/kg	0.12	0.15	0.04	0.01
Anthracene	Dry Weight	mg/kg	0.040	0.054	< 0.003	0.003
Fluoranthene	Dry Weight	mg/kg	0.16	0.23	<0.01	0.01
Pyrene	Dry Weight	mg/kg	0.14	0.19	< 0.01	0.01

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#### **Analytical Report**

Bill To: City of Edmonton

Project:

1149573 Lot ID:

Report To: City of Edmonton

ID: Name:

Control Number: C0079746 Date Received:

11404 - 60th Avenue Edmonton, AB, Canada

Jul 15, 2016 Jul 21, 2016

T6H 1J5

Location: LSD:

Date Reported:

Attn: Tami Dolen

P.O.:

Report Number:

Sampled By:

Acct code:

2118402

Company:

**Reference Number** 

1149573-1 Jul 12, 2016

D927378 (C-Release#); 4816245

1149573-2 Jul 12, 2016 1149573-3

Sample Date Sample Time

NA

NA

Jul 12, 2016 NA

Sample Location

BH16-04 / 0.6-0.8 /

506.327

Rossdale RMP

BH16-04 / 1.5-1.6 / BH16-04 / 2.2-2.4 /

Sample Description

m

m

m

Matrix Soil Soil Soil Nominal Detection Units Results Results Results Analyte Limit Polycyclic Aromatic Hydrocarbons - Soil - Continued 0.07 0.12 <0.01 0.01 Benzo(a)anthracene Dry Weight mg/kg Chrysene Dry Weight mg/kg 0.11 0.14 < 0.05 0.05 Benzo(b+j)fluoranthene Dry Weight mg/kg 0.11 0.14 < 0.05 0.05 Benzo(k)fluoranthene Dry Weight mg/kg 0.07 0.10 < 0.05 0.05 Benzo(a)pyrene Dry Weight 0.07 0.10 < 0.05 0.05 mg/kg Dry Weight Indeno(1,2,3-c,d)pyrene mg/kg < 0.05 0.06 < 0.05 0.05 Dry Weight < 0.05 Dibenzo(a,h)anthracene mg/kg < 0.05 < 0.05 0.05 Benzo(g,h,i)perylene Dry Weight mg/kg < 0.05 < 0.05 < 0.05 0.05 IACR\_Coarse Index of Additive Cancer 0.358 0.487 0.001 0.001 Risk 0.690 0.002 IACR\_Fine Index of Additive Cancer 0.941 0.001 Risk PAH - Soil - Surrogate Recovery 108 23-130 Nitrobenzene-d5 PAH - Surrogate % 110 109 2-Fluorobiphenyl PAH - Surrogate % 106 102 104 30-130 p-Terphenyl-d14 PAH - Surrogate % 112 113 117 18-137

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#### **Analytical Report**

Bill To: City of Edmonton

Project:

Lot ID: 1149573

Report To: City of Edmonton

506.327 ID: Rossdale RMP Name:

Control Number: C0079746

11404 - 60th Avenue Edmonton, AB, Canada

Date Received: Jul 15, 2016

T6H 1J5

Location: LSD:

Date Reported: Jul 21, 2016 Report Number: 2118402

Attn: Tami Dolen

P.O.: D927378 (C-Release#); 4816245

Sampled By: Acct code:

Company:

**Reference Number** 

Sample Date

1149573-4 Jul 12, 2016

1149573-5 Jul 12, 2016

1149573-6 Jul 12, 2016

Sample Time Sample Location

NA

NA

NA

Sample Description BH16-05 / 0.5-0.7 /

BH16-05 / 3.5-3.7 /

BH16-05 / 5.6-5.8 /

m m m Matrix Soil Soil Soil

		IVICUIX		3011	3011	
Analyte		Units	Results	Results	Results	Nominal Detectio Limit
Metals Strong Acid Dig	gestion					
Boron	Saturated Paste	mg/L	0.76	11.9	5.42	0.05
Antimony	Strong Acid Extractable	mg/kg	0.2	1.2	0.5	0.2
Arsenic	Strong Acid Extractable	mg/kg	5.6	9.2	7.5	0.2
Barium	Strong Acid Extractable	mg/kg	97	658	230	1
Beryllium	Strong Acid Extractable	mg/kg	0.3	1.3	0.4	0.1
Cadmium	Strong Acid Extractable	mg/kg	0.12	0.34	0.23	0.01
Chromium	Strong Acid Extractable	mg/kg	6.7	19.8	15.8	0.5
Cobalt	Strong Acid Extractable	mg/kg	4.9	9.9	7.7	0.1
Copper	Strong Acid Extractable	mg/kg	7.8	52.7	14.6	1
Lead	Strong Acid Extractable	mg/kg	5.3	27.7	8.8	0.1
Mercury	Strong Acid Extractable	mg/kg	0.07	0.39	0.05	0.05
Molybdenum	Strong Acid Extractable	mg/kg	<1.0	1.6	<1.0	1
Nickel	Strong Acid Extractable	mg/kg	13.1	31.1	22.9	0.5
Selenium	Strong Acid Extractable	mg/kg	<0.3	0.5	<0.3	0.3
Silver	Strong Acid Extractable	mg/kg	<0.1	0.1	<0.1	0.1
Thallium	Strong Acid Extractable	mg/kg	0.10	0.18	0.13	0.05
Tin	Strong Acid Extractable	mg/kg	<1.0	3.0	<1.0	1
Uranium	Strong Acid Extractable	mg/kg	<0.5	1.5	0.7	0.5
Vanadium	Strong Acid Extractable	mg/kg	10.2	26.9	22.0	0.1
Zinc	Strong Acid Extractable	mg/kg	33	99	58	1
Salinity						
% Saturation		%	32	55	43	
Barite Soil Analysis						
Barium	Extractable	mg/kg	12.0	20.4	10.7	0.05
Water Soluble Paramet	ters					
Chromium (VI)	Water Soluble	mg/kg	<0.10	<0.10	<0.10	0.1
Polycyclic Aromatic Hy	ydrocarbons - Soil					
Naphthalene	Dry Weight	mg/kg	0.010	0.076	< 0.010	0.010
Acenaphthylene	Dry Weight	mg/kg	< 0.05	0.18	< 0.05	0.05
Acenaphthene	Dry Weight	mg/kg	< 0.05	< 0.05	< 0.05	0.05
Fluorene	Dry Weight	mg/kg	< 0.05	<0.05	< 0.05	0.05
Phenanthrene	Dry Weight	mg/kg	0.07	0.42	0.02	0.01
Anthracene	Dry Weight	mg/kg	0.039	0.301	0.003	0.003
Fluoranthene	Dry Weight	mg/kg	0.14	1.62	0.01	0.01
Pyrene	Dry Weight	mg/kg	0.14	1.33	0.01	0.01

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#### **Analytical Report**

Bill To: City of Edmonton

Project: ID:

Lot ID: 1149573

Report To: City of Edmonton 11404 - 60th Avenue

Rossdale RMP Name:

506.327

Control Number: C0079746 Date Received: Jul 15, 2016

Edmonton, AB, Canada T6H 1J5

Location: LSD:

Date Reported: Jul 21, 2016

Attn: Tami Dolen

P.O.:

Acct code:

D927378 (C-Release#); 4816245

Report Number: 2118402

Sampled By: Company:

> **Reference Number** Sample Date

1149573-4 Jul 12, 2016

NA

1149573-5 Jul 12, 2016

1149573-6 Jul 12, 2016

Sample Time **Sample Location** 

NA

NA

Sample Description BH16-05 / 0.5-0.7 /

BH16-05 / 3.5-3.7 / m

BH16-05 / 5.6-5.8 / m

m

		Matrix	Soil	Soil	Soil	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Polycyclic Aromatic Hydr	ocarbons - Soil - Continued					
Benzo(a)anthracene	Dry Weight	mg/kg	0.08	0.79	<0.01	0.01
Chrysene	Dry Weight	mg/kg	0.14	1.01	< 0.05	0.05
Benzo(b+j)fluoranthene	Dry Weight	mg/kg	0.24	1.07	< 0.05	0.05
Benzo(k)fluoranthene	Dry Weight	mg/kg	0.14	0.74	< 0.05	0.05
Benzo(a)pyrene	Dry Weight	mg/kg	0.18	0.77	< 0.05	0.05
Indeno(1,2,3-c,d)pyrene	Dry Weight	mg/kg	0.14	0.43	< 0.05	0.05
Dibenzo(a,h)anthracene	Dry Weight	mg/kg	< 0.05	0.14	< 0.05	0.05
Benzo(g,h,i)perylene	Dry Weight	mg/kg	0.13	0.39	< 0.05	0.05
IACR_Coarse	Index of Additive Cancer Risk		0.715	3.78	<0.001	0.001
IACR_Fine	Index of Additive Cancer Risk		1.38	7.30	0.002	0.001
PAH - Soil - Surrogate Re	covery					
Nitrobenzene-d5	PAH - Surrogate	%	103	102	111	23-130
2-Fluorobiphenyl	PAH - Surrogate	%	105	107	111	30-130
p-Terphenyl-d14	PAH - Surrogate	%	114	108	120	18-137

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#### **Analytical Report**

Company:

Bill To: City of Edmonton

Project:

Lot ID: 1149573

Report To: City of Edmonton

506.327 ID: Rossdale RMP Name:

Control Number: C0079746

11404 - 60th Avenue Edmonton, AB, Canada

Date Received:

Jul 15, 2016

T6H 1J5

Location: LSD:

Date Reported: Jul 21, 2016

Attn: Tami Dolen

P.O.:

Report Number: 2118402

Sampled By:

Acct code:

**Reference Number** Sample Date

1149573-7 Jul 12, 2016

D927378 (C-Release#); 4816245

1149573-8 Jul 12, 2016

1149573-9 Jul 12, 2016

Sample Time

NA

NA

NA

**Sample Location** 

Sample Description BH16-06 / 0.6-0.8 /

BH16-06 / 2.9-3.1 / BH16-06 / 5.2-5.4 /

m

m

m

		Matrix	Soil	Soil	Soil	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Metals Strong Acid Dig	gestion					
Boron	Saturated Paste	mg/L	6.39	22.5	6.75	0.05
Antimony	Strong Acid Extractable	mg/kg	1.1	2.0	0.5	0.2
Arsenic	Strong Acid Extractable	mg/kg	9.4	11.5	7.5	0.2
Barium	Strong Acid Extractable	mg/kg	562	1450	232	1
Beryllium	Strong Acid Extractable	mg/kg	1.2	2.3	0.5	0.1
Cadmium	Strong Acid Extractable	mg/kg	0.35	0.48	0.22	0.01
Chromium	Strong Acid Extractable	mg/kg	19.9	19.2	13.8	0.5
Cobalt	Strong Acid Extractable	mg/kg	10.4	12.1	7.7	0.1
Copper	Strong Acid Extractable	mg/kg	33.2	66.7	22.6	1
Lead	Strong Acid Extractable	mg/kg	30.6	59.3	8.1	0.1
Mercury	Strong Acid Extractable	mg/kg	0.38	1.14	0.07	0.05
Molybdenum	Strong Acid Extractable	mg/kg	1.5	3.2	1.1	1
Nickel	Strong Acid Extractable	mg/kg	30.7	35.5	22.3	0.5
Selenium	Strong Acid Extractable	mg/kg	0.4	0.6	< 0.3	0.3
Silver	Strong Acid Extractable	mg/kg	0.1	0.1	<0.1	0.1
Thallium	Strong Acid Extractable	mg/kg	0.18	0.19	0.13	0.05
Tin	Strong Acid Extractable	mg/kg	2.4	4.1	<1.0	1
Uranium	Strong Acid Extractable	mg/kg	1.2	3.1	0.7	0.5
Vanadium	Strong Acid Extractable	mg/kg	26.6	32.8	20.0	0.1
Zinc	Strong Acid Extractable	mg/kg	97	134	58	1
Salinity						
% Saturation		%	52	60	51	
Barite Soil Analysis						
Barium	Extractable	mg/kg	11.4	10.5	16.7	0.05
Water Soluble Parame	eters					
Chromium (VI)	Water Soluble	mg/kg	<0.10	<0.10	<0.10	0.1
Polycyclic Aromatic H	ydrocarbons - Soil					
Naphthalene	Dry Weight	mg/kg	0.055	0.112	< 0.010	0.010
Acenaphthylene	Dry Weight	mg/kg	< 0.05	< 0.05	< 0.05	0.05
Acenaphthene	Dry Weight	mg/kg	< 0.05	< 0.05	< 0.05	0.05
Fluorene	Dry Weight	mg/kg	< 0.05	<0.05	< 0.05	0.05
Phenanthrene	Dry Weight	mg/kg	0.47	0.21	0.02	0.01
Anthracene	Dry Weight	mg/kg	0.153	0.125	< 0.003	0.003
Fluoranthene	Dry Weight	mg/kg	0.72	0.34	0.02	0.01
Pyrene	Dry Weight	mg/kg	0.54	0.21	0.01	0.01

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#### **Analytical Report**

Bill To: City of Edmonton

Project:

Lot ID: 1149573

Report To: City of Edmonton 11404 - 60th Avenue ID: Name:

Rossdale RMP

506.327

Control Number: C0079746 Date Received: Jul 15, 2016

Edmonton, AB, Canada

Location:

Date Reported: Jul 21, 2016

T6H 1J5

LSD:

Attn: Tami Dolen Sampled By:

P.O.: Acct code: Report Number: 2118402

Company:

**Reference Number** Sample Date

1149573-7 Jul 12, 2016

D927378 (C-Release#); 4816245

1149573-8 Jul 12, 2016

m

1149573-9

Sample Time

NA NA

Jul 12, 2016

NA

**Sample Location** 

Sample Description BH16-06 / 0.6-0.8 /

BH16-06 / 2.9-3.1 / BH16-06 / 5.2-5.4 /

m

m Soil

		Matrix	Soil	Soil	Soil	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Polycyclic Aromatic Hydr	ocarbons - Soil - Continued					
Benzo(a)anthracene	Dry Weight	mg/kg	0.33	0.08	<0.01	0.01
Chrysene	Dry Weight	mg/kg	0.43	0.13	< 0.05	0.05
Benzo(b+j)fluoranthene	Dry Weight	mg/kg	0.44	0.09	< 0.05	0.05
Benzo(k)fluoranthene	Dry Weight	mg/kg	0.27	0.05	< 0.05	0.05
Benzo(a)pyrene	Dry Weight	mg/kg	0.27	< 0.05	< 0.05	0.05
Indeno(1,2,3-c,d)pyrene	Dry Weight	mg/kg	0.16	< 0.05	< 0.05	0.05
Dibenzo(a,h)anthracene	Dry Weight	mg/kg	< 0.05	< 0.05	< 0.05	0.05
Benzo(g,h,i)perylene	Dry Weight	mg/kg	0.12	< 0.05	< 0.05	0.05
IACR_Coarse	Index of Additive Cancer Risk		1.41	0.280	<0.001	0.001
IACR_Fine	Index of Additive Cancer Risk		2.72	0.540	0.002	0.001
PAH - Soil - Surrogate Re	covery					
Nitrobenzene-d5	PAH - Surrogate	%	116	107	103	23-130
2-Fluorobiphenyl	PAH - Surrogate	%	107	99	108	30-130
p-Terphenyl-d14	PAH - Surrogate	%	114	68	118	18-137

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#### **Analytical Report**

Bill To: City of Edmonton

Project: ID:

506.327 Rossdale RMP

1149573 Lot ID:

Report To: City of Edmonton 11404 - 60th Avenue

Name:

Control Number: C0079746

Edmonton, AB, Canada

Date Received:

Jul 15, 2016

T6H 1J5

Location: LSD:

Date Reported:

Jul 21, 2016

Attn: Tami Dolen P.O.:

Report Number: 2118402

Sampled By: Company:

Acct code:

1149573-10

D927378 (C-Release#); 4816245

1149573-11

1149573-12

**Reference Number** Sample Date

Jul 13, 2016 NA

m

Soil

Jul 13, 2016 NA

Jul 13, 2016 NA

m

Soil

Sample Time Sample Location

Matrix

Sample Description BH16-07 / 1.0-1.2 /

BH16-07 / 4.6-4.8 / BH16-07 / 1.8-2.0 /

m Soil

Nominal Detection Units Results Analyte Results Results Limit **Metals Strong Acid Digestion** 0.39 2.32 3.48 0.05 Boron Saturated Paste mg/L 0.9 0.7 0.2 Antimony Strong Acid Extractable mg/kg 1.3 Arsenic Strong Acid Extractable mg/kg 7.4 8.1 8.7 0.2 Barium Strong Acid Extractable mg/kg 322 421 445 1 0.6 0.9 0.1 Beryllium Strong Acid Extractable mg/kg 0.8 Cadmium Strong Acid Extractable 0.26 0.27 0.25 0.01 mg/kg Chromium Strong Acid Extractable mg/kg 29.8 16.5 21.2 0.5 Cobalt Strong Acid Extractable mg/kg 8.2 8.5 8.2 0.1 Copper Strong Acid Extractable mg/kg 20.3 30.2 35.3 1 Lead Strong Acid Extractable 25.3 20.0 25.4 0.1 mg/kg Strong Acid Extractable 0.15 0.23 0.23 0.05 Mercury mg/kg 1.0 1.2 Molybdenum Strong Acid Extractable mg/kg 1.1 1 Nickel Strong Acid Extractable mg/kg 28.4 25.3 26.3 0.5 Selenium Strong Acid Extractable mg/kg < 0.3 0.4 0.3 0.3 Silver Strong Acid Extractable mg/kg < 0.1 < 0.1 <0.1 0.1 Thallium 0.14 0.05 Strong Acid Extractable mg/kg 0.14 0.14 Tin Strong Acid Extractable mg/kg <1.0 2.5 1.9 1 Uranium Strong Acid Extractable mg/kg 0.9 1.2 1.2 0.5 Vanadium 23.6 23.8 24.0 0.1 Strong Acid Extractable mg/kg Zinc Strong Acid Extractable mg/kg 94 75 77 1 Salinity % Saturation % 47 45 48 **Barite Soil Analysis** Extractable 16.9 0.05 Barium mg/kg 11.6 13.5 Water Soluble Parameters Chromium (VI) Water Soluble < 0.10 < 0.10 < 0.10 0.1 mg/kg Polycyclic Aromatic Hydrocarbons - Soil Naphthalene Dry Weight mg/kg 0.015 0.024 0.044 0.010 Acenaphthylene Dry Weight mg/kg < 0.05 < 0.05 < 0.05 0.05 Dry Weight < 0.05 < 0.05 < 0.05 0.05 Acenaphthene mg/kg Fluorene Dry Weight < 0.05 < 0.05 < 0.05 0.05 mg/kg Phenanthrene Dry Weight 0.07 0.18 0.28 0.01 mg/kg Anthracene Dry Weight mg/kg 0.024 0.058 0.165 0.003 0.22 0.48 0.01 Fluoranthene Dry Weight 0.14 mg/kg Dry Weight 0.37 Pyrene mg/kg 0.16 0.20 0.01

7217 Roper Road NW Edmonton, Alberta T6B 3J4, Canada

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#### **Analytical Report**

Bill To: City of Edmonton

Project:

506.327

1149573 Lot ID:

Report To: City of Edmonton 11404 - 60th Avenue ID: Name:

Rossdale RMP

Control Number: C0079746 Date Received: Jul 15, 2016

Edmonton, AB, Canada

Location:

Date Reported: Jul 21, 2016

T6H 1J5

LSD:

Attn: Tami Dolen

P.O.:

Report Number: 2118402

Sampled By: Company: Acct code:

**Reference Number** 

1149573-10

D927378 (C-Release#); 4816245

1149573-11

1149573-12

Sample Date Sample Time Jul 13, 2016 NA

Jul 13, 2016 NA

Jul 13, 2016

Sample Location

Sample Description BH16-07 / 1.0-1.2 /

BH16-07 / 1.8-2.0 / BH16-07 / 4.6-4.8 /

NA

m m

m

Matrix Soil Soil Soil Nominal Detection Units Results Results Results Analyte Limit Polycyclic Aromatic Hydrocarbons - Soil - Continued 0.24 0.01 Benzo(a)anthracene Dry Weight 0.12 0.10 mg/kg Chrysene Dry Weight mg/kg 0.14 0.12 0.41 0.05 Benzo(b+j)fluoranthene Dry Weight mg/kg 0.14 0.10 0.39 0.05 Benzo(k)fluoranthene Dry Weight mg/kg 0.10 0.07 0.23 0.05 Benzo(a)pyrene Dry Weight 0.13 0.09 0.12 0.05 mg/kg Dry Weight 0.08 Indeno(1,2,3-c,d)pyrene mg/kg 0.07 < 0.05 0.05 Dry Weight <0.05 Dibenzo(a,h)anthracene mg/kg < 0.05 < 0.05 0.05 Benzo(g,h,i)perylene Dry Weight mg/kg 0.06 < 0.05 0.06 0.05 IACR\_Coarse Index of Additive Cancer 0.504 0.362 1.15 0.001 Risk 0.974 IACR\_Fine Index of Additive Cancer 0.699 2.21 0.001 Risk PAH - Soil - Surrogate Recovery 103 108 23-130 Nitrobenzene-d5 PAH - Surrogate % 114 2-Fluorobiphenyl PAH - Surrogate % 107 105 111 30-130 120 p-Terphenyl-d14 PAH - Surrogate % 120 122 18-137

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## **Analytical Report**

Bill To: City of Edmonton

Project: ID:

506.327

Lot ID: 1149573

Report To: City of Edmonton 11404 - 60th Avenue

Name: Location: Control Number: C0079746 Date Received: Jul 15, 2016

Edmonton, AB, Canada

Rossdale RMP

Date Reported: Jul 21, 2016

T6H 1J5

LSD: P.O.:

Report Number: 2118402

Attn: Tami Dolen Sampled By:

Acct code:

Company:

**Reference Number** Sample Date

1149573-13 Jul 13, 2016

D927378 (C-Release#); 4816245

1149573-14 Jul 13, 2016 1149573-15 Jul 13, 2016

Sample Time

NA

NA

NA

**Sample Location** 

Sample Description BH16-07 / 6.1-6.3 /

BH16-08 / 0.5-0.8 / BH16-08 / 3.6-3.8 /

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m

m

		Matrix	Soil	Soil	Soil	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Metals Strong Acid Dig	gestion					-
Boron	Saturated Paste	mg/L	2.56	0.22	2.08	0.05
Antimony	Strong Acid Extractable	mg/kg	0.5	0.6	1.1	0.2
Arsenic	Strong Acid Extractable	mg/kg	8.1	8.8	8.5	0.2
Barium	Strong Acid Extractable	mg/kg	284	340	242	1
Beryllium	Strong Acid Extractable	mg/kg	0.6	0.6	0.7	0.1
Cadmium	Strong Acid Extractable	mg/kg	0.27	0.28	0.23	0.01
Chromium	Strong Acid Extractable	mg/kg	20.0	20.0	25.0	0.5
Cobalt	Strong Acid Extractable	mg/kg	9.3	9.1	9.4	0.1
Copper	Strong Acid Extractable	mg/kg	20.2	20.2	28.0	1
Lead	Strong Acid Extractable	mg/kg	9.9	13.6	33.8	0.1
Mercury	Strong Acid Extractable	mg/kg	0.06	0.33	0.12	0.05
Molybdenum	Strong Acid Extractable	mg/kg	<1.0	1.0	1.4	1
Nickel	Strong Acid Extractable	mg/kg	27.7	28.7	34.2	0.5
Selenium	Strong Acid Extractable	mg/kg	<0.3	<0.3	0.3	0.3
Silver	Strong Acid Extractable	mg/kg	0.1	<0.1	0.1	0.1
Thallium	Strong Acid Extractable	mg/kg	0.17	0.17	0.16	0.05
Tin	Strong Acid Extractable	mg/kg	<1.0	<1.0	1.0	1
Uranium	Strong Acid Extractable	mg/kg	0.9	0.9	0.9	0.5
Vanadium	Strong Acid Extractable	mg/kg	27.1	25.5	26.0	0.1
Zinc	Strong Acid Extractable	mg/kg	71	76	75	1
Salinity						
% Saturation		%	56	51	54	
Barite Soil Analysis						
Barium	Extractable	mg/kg	10.8	47.1	14.8	0.05
Water Soluble Parame	ters					
Chromium (VI)	Water Soluble	mg/kg	<0.10	<0.10	<0.10	0.1
Polycyclic Aromatic H	ydrocarbons - Soil					
Naphthalene	Dry Weight	mg/kg	<0.010	0.025	0.014	0.010
Acenaphthylene	Dry Weight	mg/kg	<0.05	< 0.05	< 0.05	0.05
Acenaphthene	Dry Weight	mg/kg	<0.05	< 0.05	< 0.05	0.05
Fluorene	Dry Weight	mg/kg	< 0.05	< 0.05	< 0.05	0.05
Phenanthrene	Dry Weight	mg/kg	0.04	0.13	0.26	0.01
Anthracene	Dry Weight	mg/kg	0.008	0.056	0.076	0.003
Fluoranthene	Dry Weight	mg/kg	0.02	0.22	0.33	0.01
Pyrene	Dry Weight	mg/kg	0.02	0.20	0.26	0.01

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# **Analytical Report**

Bill To: City of Edmonton

Project: ID:

506.327

Lot ID: 1149573

Report To: City of Edmonton 11404 - 60th Avenue

Rossdale RMP Name:

Control Number: C0079746 Date Received: Jul 15, 2016

Edmonton, AB, Canada

Location:

Date Reported: Jul 21, 2016

T6H 1J5

LSD:

Report Number: 2118402

Attn: Tami Dolen Sampled By:

P.O.: Acct code:

D927378 (C-Release#); 4816245

Company:

**Reference Number** Sample Date

1149573-13 Jul 13, 2016 1149573-14 Jul 13, 2016 1149573-15 Jul 13, 2016

Sample Time

NA

NA

NA

Sample Location

Sample Description BH16-07 / 6.1-6.3 /

BH16-08 / 0.5-0.8 / BH16-08 / 3.6-3.8 /

m

m

m

		Matrix	Soil	Soil	Soil	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Polycyclic Aromatic Hydr	ocarbons - Soil - Continued					
Benzo(a)anthracene	Dry Weight	mg/kg	<0.01	0.12	0.14	0.01
Chrysene	Dry Weight	mg/kg	< 0.05	0.17	0.15	0.05
Benzo(b+j)fluoranthene	Dry Weight	mg/kg	< 0.05	0.22	0.14	0.05
Benzo(k)fluoranthene	Dry Weight	mg/kg	<0.05	0.14	0.09	0.05
Benzo(a)pyrene	Dry Weight	mg/kg	<0.05	0.17	0.13	0.05
Indeno(1,2,3-c,d)pyrene	Dry Weight	mg/kg	< 0.05	0.12	0.06	0.05
Dibenzo(a,h)anthracene	Dry Weight	mg/kg	< 0.05	< 0.05	< 0.05	0.05
Benzo(g,h,i)perylene	Dry Weight	mg/kg	< 0.05	0.11	0.06	0.05
IACR_Coarse	Index of Additive Cancer Risk		0.001	0.722	0.491	0.001
IACR_Fine	Index of Additive Cancer Risk		0.002	1.39	0.948	0.001
PAH - Soil - Surrogate Re	covery					
Nitrobenzene-d5	PAH - Surrogate	%	94	105	108	23-130
2-Fluorobiphenyl	PAH - Surrogate	%	107	111	106	30-130
p-Terphenyl-d14	PAH - Surrogate	%	120	124	118	18-137



## **Analytical Report**

Bill To: City of Edmonton Project: Lot ID: 1149573

Report To: City of Edmonton ID: 506.327 Control Number: C0070746

Report To: City of Edmonton ID: 506.327 Control Number: C0079746

11404 - 60th Avenue Name: Rossdale RMP Date Received: Jul 15, 2016

Edmonton, AB, Canada Location: Date Reported: Jul 21, 2016
T6H 1J5 LSD: Report Number: 2118402

Attn: Tami Dolen P.O.: D927378 (C-Release#); 4816245

Sampled By: Acct code:

Company:

Reference Number 1149573-16
Sample Date Jul 13, 2016
Sample Time NA

Sample Location

Sample Description BH16-08 / 5.0-5.2 /

m

Matrix Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Metals Strong Acid Di	gestion					
Boron	Saturated Paste	mg/L	2.92			0.05
Antimony	Strong Acid Extractable	mg/kg	0.7			0.2
Arsenic	Strong Acid Extractable	mg/kg	8.7			0.2
Barium	Strong Acid Extractable	mg/kg	488			1
Beryllium	Strong Acid Extractable	mg/kg	0.9			0.1
Cadmium	Strong Acid Extractable	mg/kg	0.28			0.01
Chromium	Strong Acid Extractable	mg/kg	17.5			0.5
Cobalt	Strong Acid Extractable	mg/kg	8.8			0.1
Copper	Strong Acid Extractable	mg/kg	20.7			1
Lead	Strong Acid Extractable	mg/kg	16.4			0.1
Mercury	Strong Acid Extractable	mg/kg	0.37			0.05
Molybdenum	Strong Acid Extractable	mg/kg	1.7			1
Nickel	Strong Acid Extractable	mg/kg	26.8			0.5
Selenium	Strong Acid Extractable	mg/kg	0.3			0.3
Silver	Strong Acid Extractable	mg/kg	0.1			0.1
Thallium	Strong Acid Extractable	mg/kg	0.17			0.05
Tin	Strong Acid Extractable	mg/kg	<1.0			1
Uranium	Strong Acid Extractable	mg/kg	1.2			0.5
Vanadium	Strong Acid Extractable	mg/kg	25.1			0.1
Zinc	Strong Acid Extractable	mg/kg	72			1
Salinity						
% Saturation		%	47			
Barite Soil Analysis						
Barium	Extractable	mg/kg	26.3			0.05
Water Soluble Parame	eters					
Chromium (VI)	Water Soluble	mg/kg	<0.10			0.1
Polycyclic Aromatic H	lydrocarbons - Soil					
Naphthalene	Dry Weight	mg/kg	0.023			0.010
Acenaphthylene	Dry Weight	mg/kg	< 0.05			0.05
Acenaphthene	Dry Weight	mg/kg	< 0.05			0.05
Fluorene	Dry Weight	mg/kg	<0.05			0.05
Phenanthrene	Dry Weight	mg/kg	0.06			0.01
Anthracene	Dry Weight	mg/kg	0.024			0.003
Fluoranthene	Dry Weight	mg/kg	0.09			0.01
Pyrene	Dry Weight	mg/kg	0.08			0.01



Nominal Detection

## **Analytical Report**

Bill To: City of Edmonton Project: Lot ID: 1149573

Report To: City of Edmonton ID: 506.327 Control Number: C0079746 11404 - 60th Avenue Rossdale RMP Name: Date Received: Jul 15, 2016

Edmonton, AB, Canada Location: Date Reported: Jul 21, 2016 T6H 1J5 LSD: Report Number: 2118402

Attn: Tami Dolen P.O.: D927378 (C-Release#); 4816245

Sampled By: Acct code:

Company:

**Reference Number** 1149573-16 Sample Date Jul 13, 2016 Sample Time NA

**Sample Location** 

Sample Description BH16-08 / 5.0-5.2 /

m

Matrix Soil Units **Analyte** Results Results Results

					Limit
Polycyclic Aromatic Hydr	ocarbons - Soil - Continued				
Benzo(a)anthracene	Dry Weight	mg/kg	0.05		0.01
Chrysene	Dry Weight	mg/kg	0.08		0.05
Benzo(b+j)fluoranthene	Dry Weight	mg/kg	0.08		0.05
Benzo(k)fluoranthene	Dry Weight	mg/kg	0.05		0.05
Benzo(a)pyrene	Dry Weight	mg/kg	0.06		0.05
Indeno(1,2,3-c,d)pyrene	Dry Weight	mg/kg	< 0.05		0.05
Dibenzo(a,h)anthracene	Dry Weight	mg/kg	< 0.05		0.05
Benzo(g,h,i)perylene	Dry Weight	mg/kg	< 0.05		0.05
IACR_Coarse	Index of Additive Cancer Risk		0.260		0.001
IACR_Fine	Index of Additive Cancer Risk		0.503		0.001
PAH - Soil - Surrogate Re	covery				
Nitrobenzene-d5	PAH - Surrogate	%	113		23-130
2-Fluorobiphenyl	PAH - Surrogate	%	104		30-130
p-Terphenyl-d14	PAH - Surrogate	%	123		18-137

Approved by:

Anthony Neumann, MSc Laboratory Operations Manager

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# Page 13 of 13 **EXOVO**

# **Methodology and Notes**

Bill To: City of Edmonton Project: Lot ID: 1149573

 Report To:
 City of Edmonton
 ID:
 506.327
 Control Number:
 C0079746

 11404 - 60th Avenue
 Name:
 Rossdale RMP
 Date Received:
 Jul 15, 2016

Edmonton, AB, Canada Location: Date Reported: Jul 21, 2016
T6H 1J5 LSD: Report Number: 2118402

Attn: Tami Dolen P.O.: D927378 (C-Release#); 4816245

Sampled By: Acct code:

Company:

Method of Analysis				
Method Name	Reference	Method	Date Analysis Started	Location
1:5 Water Soluble Extraction	APHA	* Colorimetric Method, 3500-Cr B	18-Jul-16	Exova Edmonton
1:5 Water Soluble Extraction	McKeague	<ul> <li>Soluble Salts in Extracts of 1:5 Soil:Water Mixtures, 3.23</li> </ul>	18-Jul-16	Exova Edmonton
Barium (Extractable) in soil (0.1 M CaCl2)	Ab Env	Analytical Method for Extractable Barium, FEB 2009	18-Jul-16	Exova Edmonton
Metals ICP (Hot Block) in soil	EPA	* Sample Preparation Procedure for Spectrochemical Determination of Total Recoverable Elements, October 1999, 200.2	18-Jul-16	Exova Edmonton
Metals ICP (Hot Block) in soil	US EPA	<ul> <li>Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8</li> </ul>	18-Jul-16	Exova Edmonton
PAH - Soil	AESRD	Index of Additive Cancer Risk (IACR), PAHs	17-Jul-16	Exova Calgary
PAH - Soil	US EPA	<ul> <li>Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry, 8270</li> </ul>	17-Jul-16	Exova Calgary
Saturated Paste in General Soil	Carter	<ul> <li>* Electrical Conductivity and Soluble Ions, Chapter 15</li> </ul>	18-Jul-16	Exova Edmonton

<sup>\*</sup> Reference Method Modified

## References

Ab Env Alberta Environment, Soil Quality Guidelines for Barite

AESRD Alberta Tier 1 Soil and Groundwater Remediation Guidelines

APHA Standard Methods for the Examination of Water and Wastewater

Carter Soil Sampling and Methods of Analysis.

EPA Environmental Protection Agency Test Methods - US

McKeague Manual on Soil Sampling and Methods of Analysis

US EPA US Environmental Protection Agency Test Methods

#### Comments:

Please direct any inquiries regarding this report to our Client Services group.

Results relate only to samples as submitted.

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BH16-94	1.5-	1.6 July 12/16	Soil	6006	4 VV				were not packaged well
BH 16-04		2.4 July 12/16	Soll	Brab	4 UV				2. Indicate any samples not
BH16-05	0.5	0.7 July 12/14	Soil	Grab	4 4				received in Exova supplies
BH16-05	3.5-	3.7 July 12/16	Soil	Brah	4 VV				3. Indicate any samples tha
BH16-05	5.6-	58 July 12/11	- Soil	Grab	4 4				were not clearly labeled
BH16-06	0.6-		Soil	Gab	4 VV				Indicate any samples no
BH16-06	2.9-	31 July 12/16	Soil	Gas	4 11				received within the required hold time or temp.
BH16-56	52	5.4 July 12/16	Soil	Grab	4 VV				5. Indicate any missing or
BH16-07	1.0-	1-2 July 13/16	Soil		4 4				extra samples
BH 16-107	1-8-		501	Grab	411				6. Indicate any samples tha
BH16-07		4.8 July 13/16		Erab	4 VV				were received broken
BH11-07	6.1-	63 July 13/16		Grah	4 11				7. Indicate any samples
B416-08	05-	0-8 July 13/16		Gala	ILVV				where sufficient volume wa not received
BH16-08	3.6-	3.8 July 13/16	Soil	Gal	4 1/				8. Indicate any samples
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				166											Market Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street, Street,
															Indicate any samples no received within the require
		-													<ol> <li>Indicate any samples n received within the require hold time or temp.</li> </ol>
															<ol> <li>Indicate any samples n received within the require hold time or temp.</li> </ol>
															Indicate any samples or received within the require hold time or temp.     Indicate any missing or extra samples
															Indicate any samples or received within the require hold time or temp.     Indicate any missing or extra samples
															Indicate any samples n received within the require hold time or temp.     Indicate any missing or extra samples     Indicate any samples the were received broken
2															4. Indicate any samples no received within the require hold time or temp. 5. Indicate any missing or extra samples 6. Indicate any samples the were received broken 7. Indicate any samples
2.															4. Indicate any samples or received within the require hold time or temp. 5. Indicate any missing or extra samples 6. Indicate any samples the were received broken 7. Indicate any samples where sufficient volume wont received 8. Indicate any samples 8. Indicate any samples
2 3 1 5 Jubmission	of this form acknowledges acceptance			d Terms	ndicate lot # o	r affix barcod	Se here				Sih	ipping:		COD Y/ N	4. Indicate any samples not received within the require hold time or temp. 5. Indicate any missing or extra samples 6. Indicate any samples the were received broken 7. Indicate any samples where sufficient volume who is received 8. Indicate any samples 8. Indicate any samples
3 4 5 5 submission	of this form acknowledges acceptancions (http://www.exova.com/about/terr			i Terms Ir	ndicate lot # o	r affix barcoo	se here	0			-	ipping:	-		4. Indicate any samples no received within the require hold time or temp. 5. Indicate any missing or extra samples 6. Indicate any samples the were received broken 7. Indicate any samples where sufficient volume winot received 8. Indicate any samples received in an inappropria
nd Conditi		ns-and-cond		d Terms	ndicate lot # o	r affix barcoc	se here	8			# a		of coole		4. Indicate any samples no received within the require hold time or temp. 5. Indicate any missing or extra samples 6. Indicate any samples the were received broken 7. Indicate any samples where sufficient volume we not received 8. Indicate any samples received in an inappropriat container

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Lot ID: 1150979

Report Number: 2120174

## **Report Transmission Cover Page**

Report To: City of Edmonton

Bill To: City of Edmonton Project:

> ID: 506.327

Control Number: C0079745 11404 - 60th Avenue Name: Rossdale RMA Date Received: Jul 22, 2016 Edmonton, AB, Canada Location: Date Reported: Aug 2, 2016

LSD: T6H 1J5

Attn: Tami Dolen P.O.: D927378 C-4816245 Acct code:

Sampled By: TLD Company: CoE

Contact & Affiliation	Address	Delivery Commitments
Tami Dolen	11404 - 60th Avenue	On [Lot Verification] send
City of Edm - Finance Dept.	Edmonton, Alberta T6H 1J5	(COA, COC) by Email - Multiple Reports By Agreement
	Phone: (780) 496-6782 Fax: null	On [Report Approval] send
	Email: tami.dolen@edmonton.ca	(COC, Test Report) by Email - Merge Reports
		On [Report Approval] send
		(Test Report) by Email - Single Report
		On [Lot Approval and Final Test Report Approval] send
		(COC, Test Report, Invoice) by Email - Merge Reports

#### **Notes To Clients:**

• ICP-MS total nickel results were less than dissolved metal results for sample(s) 1150979-9, 10 and 12. Total metals were analyzed from the metals bottle and dissolved from the field filtered bottle. Results were verified.

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# **Analytical Report**

Bill To: City of Edmonton

Project:

Lot ID: 1150979

Report To: City of Edmonton

ID: 506.327

Control Number: C0079745

11404 - 60th Avenue Edmonton, AB, Canada

Rossdale RMA Name:

Date Received: Jul 22, 2016

T6H 1J5

Location: LSD:

Date Reported: Aug 2, 2016

Attn: Tami Dolen

P.O.:

Report Number: 2120174

Sampled By: TLD

Acct code:

D927378 C-4816245

Company: CoE

**Reference Number** Sample Date 1150979-1

1150979-2

1150979-3

Sample Time

Jul 21, 2016 NA

Jul 21, 2016 NA

Jul 21, 2016 NA

**Sample Location** 

Sample Description BH16-01 / 1.2-1.4 /

BH16-01 / 2.7-2.9 /

BH16-01 / 3.4-3.6 /

4.2°C

4.2°C

4.2°C

Soil Matrix Soil Soil

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Metals Strong Acid Dige	estion					
Boron	Saturated Paste	mg/L	0.25	0.39	0.98	0.05
Antimony	Strong Acid Extractable	mg/kg	0.4	0.2	0.5	0.2
Arsenic	Strong Acid Extractable	mg/kg	7.5	4.5	7.2	0.2
Barium	Strong Acid Extractable	mg/kg	144	78	318	1
Beryllium	Strong Acid Extractable	mg/kg	0.5	0.3	0.8	0.1
Cadmium	Strong Acid Extractable	mg/kg	0.17	0.10	0.23	0.01
Chromium	Strong Acid Extractable	mg/kg	12.9	6.4	16.9	0.5
Cobalt	Strong Acid Extractable	mg/kg	6.0	4.5	8.2	0.1
Copper	Strong Acid Extractable	mg/kg	12.8	6.3	17.2	1
Lead	Strong Acid Extractable	mg/kg	6.8	4.3	9.1	0.1
Mercury	Strong Acid Extractable	mg/kg	0.06	< 0.05	0.06	0.05
Molybdenum	Strong Acid Extractable	mg/kg	<1.0	<1.0	1.0	1
Nickel	Strong Acid Extractable	mg/kg	19.5	12.5	26.3	0.5
Selenium	Strong Acid Extractable	mg/kg	<0.3	<0.3	0.4	0.3
Silver	Strong Acid Extractable	mg/kg	<0.1	<0.1	<0.1	0.1
Thallium	Strong Acid Extractable	mg/kg	0.10	0.07	0.14	0.05
Tin	Strong Acid Extractable	mg/kg	<1.0	<1.0	<1.0	1
Uranium	Strong Acid Extractable	mg/kg	0.6	<0.5	1.0	0.5
Vanadium	Strong Acid Extractable	mg/kg	16.7	12.0	21.9	0.1
Zinc	Strong Acid Extractable	mg/kg	41	28	61	1
Salinity						
% Saturation		%	38	33	51	
Water Soluble Paramete	ers					
Chromium (VI)	Water Soluble	mg/kg	<0.10	<0.10	<0.10	0.1
Polycyclic Aromatic Hyd	drocarbons - Soil					
Naphthalene	Dry Weight	mg/kg	0.012	0.032	0.322	0.010
Acenaphthylene	Dry Weight	mg/kg	< 0.05	< 0.05	< 0.05	0.05
Acenaphthene	Dry Weight	mg/kg	< 0.05	< 0.05	< 0.05	0.05
Fluorene	Dry Weight	mg/kg	< 0.05	< 0.05	< 0.05	0.05
Phenanthrene	Dry Weight	mg/kg	0.04	0.04	0.25	0.01
Anthracene	Dry Weight	mg/kg	0.010	0.010	0.018	0.003
Fluoranthene	Dry Weight	mg/kg	0.06	0.03	0.04	0.01
Pyrene	Dry Weight	mg/kg	0.04	0.03	0.05	0.01
Benzo(a)anthracene	Dry Weight	mg/kg	0.02	0.02	0.03	0.01
Chrysene	Dry Weight	mg/kg	< 0.05	< 0.05	0.07	0.05

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# **Analytical Report**

Bill To: City of Edmonton

Project:

Lot ID: 1150979

Report To: City of Edmonton

ID: Name:

Control Number: C0079745

11404 - 60th Avenue Edmonton, AB, Canada Rossdale RMA

506.327

Date Received: Jul 22, 2016

T6H 1J5

Location:

Date Reported: Aug 2, 2016

Attn: Tami Dolen

LSD: P.O.:

Report Number: 2120174

Sampled By: TLD

Company: CoE

Acct code:

**Reference Number** Sample Date

1150979-1 Jul 21, 2016

D927378 C-4816245

1150979-2 Jul 21, 2016

1150979-3 Jul 21, 2016

Sample Time

NA

NA

NA

**Sample Location** 

Sample Description BH16-01 / 1.2-1.4 /

4.2°C

BH16-01 / 2.7-2.9 /

BH16-01 / 3.4-3.6 / 4.2°C

Soil

4.2°C Soil

Soil

		Matrix	Soil	Soil	Soil	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Polycyclic Aromatic Hydr	ocarbons - Soil - Continued					
Benzo(b+j)fluoranthene	Dry Weight	mg/kg	< 0.05	< 0.05	< 0.05	0.05
Benzo(k)fluoranthene	Dry Weight	mg/kg	<0.05	< 0.05	< 0.05	0.05
Benzo(a)pyrene	Dry Weight	mg/kg	< 0.05	< 0.05	< 0.05	0.05
Indeno(1,2,3-c,d)pyrene	Dry Weight	mg/kg	<0.05	< 0.05	< 0.05	0.05
Dibenzo(a,h)anthracene	Dry Weight	mg/kg	<0.05	< 0.05	< 0.05	0.05
Benzo(g,h,i)perylene	Dry Weight	mg/kg	<0.05	< 0.05	< 0.05	0.05
IACR_Coarse	Index of Additive Cancer Risk		0.015	0.012	0.021	0.001
IACR_Fine	Index of Additive Cancer Risk		0.030	0.023	0.041	0.001
PAH - Soil - Surrogate Rec	covery					
Nitrobenzene-d5	PAH - Surrogate	%	93	100	104	23-130
2-Fluorobiphenyl	PAH - Surrogate	%	86	89	90	30-130
p-Terphenyl-d14	PAH - Surrogate	%	101	102	104	18-137

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## **Analytical Report**

Bill To: City of Edmonton

Project:

Lot ID: 1150979

Report To: City of Edmonton

506.327 ID: Rossdale RMA Name:

Control Number: C0079745

11404 - 60th Avenue Edmonton, AB, Canada

Location:

Date Received: Jul 22, 2016 Date Reported: Aug 2, 2016

T6H 1J5

LSD:

Report Number: 2120174

Attn: Tami Dolen

P.O.:

Sampled By: TLD Company: CoE

Acct code:

D927378 C-4816245

**Reference Number** Sample Date Sample Time Sample Location

1150979-4 Jul 21, 2016

1150979-5 Jul 21, 2016

1150979-6 Jul 21, 2016

NA

NA

NA

Sample Description BH16-02 / 1.1-1.3 /

BH16-02 / 2.7-3.0 /

BH16-02 / 4.9-5.1 /

4.2°C

4.2°C

4.2°C

		Matrix	Soil	Soil	Soil	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Metals Strong Acid Dige	estion					
Boron	Saturated Paste	mg/L	2.99	6.22	9.98	0.05
Antimony	Strong Acid Extractable	mg/kg	0.6	1.1	0.7	0.2
Arsenic	Strong Acid Extractable	mg/kg	7.7	9.0	7.5	0.2
Barium	Strong Acid Extractable	mg/kg	319	495	402	1
Beryllium	Strong Acid Extractable	mg/kg	0.8	1.2	0.9	0.1
Cadmium	Strong Acid Extractable	mg/kg	0.23	0.31	0.25	0.01
Chromium	Strong Acid Extractable	mg/kg	14.1	18.1	21.3	0.5
Cobalt	Strong Acid Extractable	mg/kg	7.1	9.2	8.7	0.1
Copper	Strong Acid Extractable	mg/kg	23.0	24.6	21.0	1
Lead	Strong Acid Extractable	mg/kg	13.1	29.8	23.5	0.1
Mercury	Strong Acid Extractable	mg/kg	0.09	0.85	0.19	0.05
Molybdenum	Strong Acid Extractable	mg/kg	1.2	1.3	1.1	1
Nickel	Strong Acid Extractable	mg/kg	23.7	29.1	27.7	0.5
Selenium	Strong Acid Extractable	mg/kg	0.4	0.4	0.4	0.3
Silver	Strong Acid Extractable	mg/kg	<0.1	<0.1	<0.1	0.1
Thallium	Strong Acid Extractable	mg/kg	0.14	0.15	0.14	0.05
Tin	Strong Acid Extractable	mg/kg	<1.0	6.9	1.1	1
Uranium	Strong Acid Extractable	mg/kg	1.0	1.4	1.1	0.5
Vanadium	Strong Acid Extractable	mg/kg	21.4	25.1	26.0	0.1
Zinc	Strong Acid Extractable	mg/kg	55	89	72	1
Salinity						
% Saturation		%	45	49	52	
Water Soluble Paramete	ers					
Chromium (VI)	Water Soluble	mg/kg	<0.10	<0.10	<0.10	0.1
Polycyclic Aromatic Hyd	drocarbons - Soil					
Naphthalene	Dry Weight	mg/kg	3.51	0.181	0.081	0.010
Acenaphthylene	Dry Weight	mg/kg	0.10	0.10	< 0.05	0.05
Acenaphthene	Dry Weight	mg/kg	10.1	0.51	< 0.05	0.05
Fluorene	Dry Weight	mg/kg	13.6	0.56	< 0.05	0.05
Phenanthrene	Dry Weight	mg/kg	112	5.14	0.17	0.01
Anthracene	Dry Weight	mg/kg	29.7	1.58	0.078	0.003
Fluoranthene	Dry Weight	mg/kg	82.7	5.91	0.40	0.01
Pyrene	Dry Weight	mg/kg	64.8	5.14	0.36	0.01
Benzo(a)anthracene	Dry Weight	mg/kg	29.7	2.89	0.13	0.01
Chrysene	Dry Weight	mg/kg	26.8	2.72	0.17	0.05

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## **Analytical Report**

Bill To: City of Edmonton

Project: ID:

Lot ID: 1150979

Report To: City of Edmonton 11404 - 60th Avenue

Name:

506.327 Rossdale RMA

Control Number: C0079745 Date Received:

Edmonton, AB, Canada

Location:

Date Reported: Aug 2, 2016

Jul 22, 2016

T6H 1J5 Attn: Tami Dolen

LSD:

D927378 C-4816245

Report Number: 2120174

Sampled By: TLD Company: CoE

P.O.:

Acct code:

**Reference Number** Sample Date

1150979-4 Jul 21, 2016

1150979-5 Jul 21, 2016

1150979-6 Jul 21, 2016

Sample Time

NA

NA

NA

Sample Location

Sample Description BH16-02 / 1.1-1.3 /

BH16-02 / 2.7-3.0 / 4.2°C 4.2°C

BH16-02 / 4.9-5.1 /

Matrix

Soil

4.2°C Soil

		Matrix	Soil	Soil	Soil	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Polycyclic Aromatic Hydr	ocarbons - Soil - Continued					
Benzo(b+j)fluoranthene	Dry Weight	mg/kg	16.8	2.21	0.13	0.05
Benzo(k)fluoranthene	Dry Weight	mg/kg	13.8	1.81	0.09	0.05
Benzo(a)pyrene	Dry Weight	mg/kg	16.5	2.51	0.10	0.05
Indeno(1,2,3-c,d)pyrene	Dry Weight	mg/kg	4.02	1.16	< 0.05	0.05
Dibenzo(a,h)anthracene	Dry Weight	mg/kg	1.60	0.37	< 0.05	0.05
Benzo(g,h,i)perylene	Dry Weight	mg/kg	2.75	0.88	< 0.05	0.05
IACR_Coarse	Index of Additive Cancer Risk		73.3	9.47	0.458	0.001
IACR_Fine	Index of Additive Cancer Risk		142	18.3	0.884	0.001
PAH - Soil - Surrogate Re	covery					
Nitrobenzene-d5	PAH - Surrogate	%	110	98	106	23-130
2-Fluorobiphenyl	PAH - Surrogate	%	97	87	94	30-130
p-Terphenyl-d14	PAH - Surrogate	%	128	119	95	18-137

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## **Analytical Report**

Bill To: City of Edmonton

Project:

Lot ID: 1150979

Report To: City of Edmonton

506.327 ID:

Control Number: C0079745

11404 - 60th Avenue Edmonton, AB, Canada

Rossdale RMA Name:

Date Received: Jul 22, 2016

T6H 1J5

Location: LSD:

Date Reported: Aug 2, 2016

Attn: Tami Dolen

P.O.:

Report Number: 2120174

Sampled By: TLD

Company: CoE

Acct code:

**Reference Number** Sample Date

1150979-7 Jul 21, 2016

D927378 C-4816245

1150979-8 Jul 21, 2016

Sample Time

NA NA

**Sample Location** 

Sample Description BH16-03 / 1.2-1.4 /

Soil

BH16-03 / 1.9-2.1 /

4.2°C 4.2°C

Matrix

Soil

			3011	3011		
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Metals Strong Acid Dige	estion					
Boron	Saturated Paste	mg/L	0.63	3.79		0.05
Antimony	Strong Acid Extractable	mg/kg	0.4	0.6		0.2
Arsenic	Strong Acid Extractable	mg/kg	6.8	7.0		0.2
Barium	Strong Acid Extractable	mg/kg	201	249		1
Beryllium	Strong Acid Extractable	mg/kg	0.6	0.8		0.1
Cadmium	Strong Acid Extractable	mg/kg	0.21	0.25		0.01
Chromium	Strong Acid Extractable	mg/kg	19.2	14.5		0.5
Cobalt	Strong Acid Extractable	mg/kg	6.7	7.7		0.1
Copper	Strong Acid Extractable	mg/kg	11.0	15.9		1
Lead	Strong Acid Extractable	mg/kg	8.3	15.4		0.1
Mercury	Strong Acid Extractable	mg/kg	0.10	0.13		0.05
Molybdenum	Strong Acid Extractable	mg/kg	<1.0	1.8		1
Nickel	Strong Acid Extractable	mg/kg	29.3	23.8		0.5
Selenium	Strong Acid Extractable	mg/kg	<0.3	<0.3		0.3
Silver	Strong Acid Extractable	mg/kg	0.1	<0.1		0.1
Thallium	Strong Acid Extractable	mg/kg	0.11	0.14		0.05
Tin	Strong Acid Extractable	mg/kg	<1.0	<1.0		1
Uranium	Strong Acid Extractable	mg/kg	0.8	0.7		0.5
Vanadium	Strong Acid Extractable	mg/kg	18.8	21.7		0.1
Zinc	Strong Acid Extractable	mg/kg	44	69		1
Salinity						
% Saturation		%	35	48		
Water Soluble Paramete	ers					
Chromium (VI)	Water Soluble	mg/kg	<0.10	<0.10		0.1
Polycyclic Aromatic Hyd	drocarbons - Soil					
Naphthalene	Dry Weight	mg/kg	< 0.010	0.011		0.010
Acenaphthylene	Dry Weight	mg/kg	< 0.05	< 0.05		0.05
Acenaphthene	Dry Weight	mg/kg	< 0.05	< 0.05		0.05
Fluorene	Dry Weight	mg/kg	< 0.05	< 0.05		0.05
Phenanthrene	Dry Weight	mg/kg	0.04	0.19		0.01
Anthracene	Dry Weight	mg/kg	0.017	0.089		0.003
Fluoranthene	Dry Weight	mg/kg	0.05	0.97		0.01
Pyrene	Dry Weight	mg/kg	0.06	1.40		0.01
Benzo(a)anthracene	Dry Weight	mg/kg	0.03	0.93		0.01
Chrysene	Dry Weight	mg/kg	< 0.05	1.24		0.05

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## **Analytical Report**

Bill To: City of Edmonton

Project:

Lot ID: 1150979

Report To: City of Edmonton

ID:

Control Number: C0079745

11404 - 60th Avenue Edmonton, AB, Canada

Rossdale RMA Name:

506.327

Date Received: Jul 22, 2016

T6H 1J5

Location: LSD:

Date Reported: Aug 2, 2016

Attn: Tami Dolen

P.O.:

Sampled By: TLD

Report Number: 2120174

Company: CoE

Acct code:

**Reference Number** Sample Date

1150979-7 Jul 21, 2016

D927378 C-4816245

1150979-8 Jul 21, 2016

Sample Time

NA

NA

**Sample Location** 

Sample Description BH16-03 / 1.2-1.4 /

BH16-03 / 1.9-2.1 /

4.2°C

4.2°C

		Matrix	Soil	Soil		
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Polycyclic Aromatic Hydr	ocarbons - Soil - Continued					
Benzo(b+j)fluoranthene	Dry Weight	mg/kg	0.05	0.87		0.05
Benzo(k)fluoranthene	Dry Weight	mg/kg	< 0.05	0.79		0.05
Benzo(a)pyrene	Dry Weight	mg/kg	< 0.05	0.82		0.05
Indeno(1,2,3-c,d)pyrene	Dry Weight	mg/kg	< 0.05	0.45		0.05
Dibenzo(a,h)anthracene	Dry Weight	mg/kg	< 0.05	0.16		0.05
Benzo(g,h,i)perylene	Dry Weight	mg/kg	< 0.05	0.40		0.05
IACR_Coarse	Index of Additive Cancer Risk		0.058	3.87		0.001
IACR_Fine	Index of Additive Cancer Risk		0.110	7.49		0.001
PAH - Soil - Surrogate Re	covery					
Nitrobenzene-d5	PAH - Surrogate	%	92	100		23-130
2-Fluorobiphenyl	PAH - Surrogate	%	90	90		30-130
p-Terphenyl-d14	PAH - Surrogate	%	101	106		18-137

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## **Analytical Report**

Bill To: City of Edmonton

Project:

Lot ID: 1150979

Report To: City of Edmonton

ID: 506.327 Name: Rossdale RMA

Control Number: C0079745

11404 - 60th Avenue Edmonton, AB, Canada

Location:

Date Received: Jul 22, 2016

T6H 1J5

LSD:

Date Reported: Aug 2, 2016

Attn: Tami Dolen

P.O.:

Report Number: 2120174

Sampled By: TLD

F.O..

Acct code:

D927378 C-4816245

ampled by. TEB ACC

Company: CoE

Reference Number Sample Date Sample Time 1150979-9 Jul 22, 2016 1150979-10

1150979-11

NA

Jul 22, 2016 NA Jul 22, 2016 NA

Sample Location

Sample Description BH16-04 / 4.2°C

BH16-05 / 4.2°C

BH16-06 / 4.2°C

		Sample Description	BH16-04 / 4.2°C	BH16-05 / 4.2°C	BH16-06 / 4.2°C		
		Matrix	Water	Water	Water		
Analyte		Units	Results	Results	Results	Nominal Detection Limit	
Metals Dissolved							
Mercury	Dissolved	mg/L	< 0.000005	< 0.000005	< 0.000005	0.000005	
Aluminum	Dissolved	mg/L	0.141	0.056	0.210	0.002	
Antimony	Dissolved	mg/L	< 0.0002	0.0002	< 0.0002	0.0002	
Arsenic	Dissolved	mg/L	0.0003	0.0009	0.0004	0.0002	
Barium	Dissolved	mg/L	0.089	0.103	0.081	0.001	
Boron	Dissolved	mg/L	0.466	0.372	4.41	0.002	
Cadmium	Dissolved	mg/L	0.00006	0.00006	0.00006	0.00001	
Chromium	Dissolved	mg/L	< 0.0005	< 0.0005	< 0.0005	0.0005	
Copper	Dissolved	mg/L	0.002	0.004	0.005	0.001	
Lead	Dissolved	mg/L	0.0002	0.0002	0.0005	0.0001	
Nickel	Dissolved	mg/L	0.0084	0.0092	0.0093	0.0005	
Selenium	Dissolved	mg/L	0.0004	0.0011	0.0011	0.0002	
Silver	Dissolved	mg/L	< 0.00001	< 0.00001	< 0.00001	0.00001	
Uranium	Dissolved	mg/L	0.0044	0.0064	0.0102	0.0005	
Zinc	Dissolved	mg/L	0.007	0.006	0.007	0.001	
Subsample	Field Filtered	-	Field Filtered	Field Filtered			
Routine Water							
рН			7.91	7.84	7.59		
Temperature of observed		°C	21.2	21.2	21.0		
рН	_						
Electrical Conductivity	at 25 °C	uS/cm	949	957		1	
Calcium	Dissolved	mg/L	123	132		0.2	
Magnesium	Dissolved	mg/L	35.0	31.4		0.2	
Sodium	Dissolved	mg/L	31.1	42.0		0.4	
Potassium	Dissolved	mg/L	4.5	5.2		0.4	
Iron	Dissolved	mg/L	0.60	0.08	0.24	0.01	
Manganese	Dissolved	mg/L	0.398	0.058	0.264	0.005	
Chloride	Dissolved	mg/L	44.6	34.5		0.4	
Nitrate - N		mg/L	1.83	2.53		0.01	
Nitrite - N		mg/L	<0.005	0.011		0.005	
Nitrate and Nitrite - N		mg/L	1.83	2.54		0.01	
Sulfate (SO4)	Dissolved	mg/L	97.0	76.2		0.9	
Hydroxide		mg/L	<5	<5			
Carbonate		mg/L	<6	<6			
Bicarbonate		mg/L	486	517			
P-Alkalinity	as CaCO3	mg/L	<5	<5		5	

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## **Analytical Report**

Bill To: City of Edmonton

Project:

Lot ID: 1150979

Report To: City of Edmonton

506.327 ID:

Control Number: C0079745

11404 - 60th Avenue Edmonton, AB, Canada

Rossdale RMA Name:

Date Received: Jul 22, 2016

T6H 1J5

Location:

Date Reported: Aug 2, 2016

Attn: Tami Dolen

LSD:

P.O.:

Report Number: 2120174

Sampled By: TLD

Acct code:

Company: CoE

**Reference Number** Sample Date

1150979-9 Jul 22, 2016 NA

D927378 C-4816245

1150979-10 Jul 22, 2016 1150979-11 Jul 22, 2016

Sample Time

NA

NA

**Sample Location Sample Description** 

BH16-04 / 4.2°C

BH16-05 / 4.2°C

BH16-06 / 4.2°C

		Matrix	Water	Water	Water	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Routine Water - Continue	ed					2
T-Alkalinity	as CaCO3	mg/L	399	424		5
Total Dissolved Solids	Calculated	mg/L	574	576		1
Hardness	Dissolved as CaCO3	mg/L	452	458	726	
Ionic Balance	Dissolved	%	92	99		
Polycyclic Aromatic Hyd	rocarbons - Water					
Naphthalene		ug/L	<0.1	<0.1	<0.1	0.1
Quinoline		ug/L	<0.3	<0.3	< 0.3	0.3
Acenaphthylene		ug/L	<0.1	<0.1	<0.1	0.1
Acenaphthene		ug/L	<0.1	<0.1	<0.1	0.1
Fluorene		ug/L	<0.1	<0.1	<0.1	0.1
Phenanthrene		ug/L	<0.1	<0.1	<0.1	0.1
Acridine		ug/L	<0.1	<0.1	<0.1	0.1
Anthracene		ug/L	0.007	0.010	0.006	0.005
Fluoranthene		ug/L	<0.01	0.02	0.01	0.01
Pyrene		ug/L	<0.01	0.02	0.01	0.01
Benzo(a)anthracene		ug/L	<0.01	<0.01	<0.01	0.01
Chrysene		ug/L	<0.1	<0.1	<0.1	0.1
Benzo(b)fluoranthene		ug/L	<0.1	<0.1	<0.1	0.1
Benzo(b+j)fluoranthene		ug/L	<0.1	<0.1	<0.1	0.1
Benzo(k)fluoranthene		ug/L	<0.1	<0.1	<0.1	0.1
Benzo(a)pyrene		ug/L	<0.008	0.009	0.009	0.008
Indeno(1,2,3-c,d)pyrene		ug/L	< 0.05	< 0.05	< 0.05	0.05
Dibenzo(a,h)anthracene		ug/L	< 0.05	< 0.05	< 0.05	0.05
Benzo(g,h,i)perylene		ug/L	<0.05	< 0.05	< 0.05	0.05
CB(a)P	Carcinogenic Potency Equivalent	ug/L	<0.01	<0.01	<0.01	0.01
PAH - Water - Surrogate	Recovery					
Nitrobenzene-d5	PAH - Surrogate	%	99	103	125	23-130
2-Fluorobiphenyl	PAH - Surrogate	%	97	96	96	30-130
p-Terphenyl-d14	PAH - Surrogate	%	106	120	114	18-137

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## **Analytical Report**

Bill To: City of Edmonton

Project:

Lot ID: 1150979

Report To: City of Edmonton

ID:

Control Number: C0079745

11404 - 60th Avenue Edmonton, AB, Canada

Rossdale RMA Name:

506.327

Date Received: Jul 22, 2016

T6H 1J5

Location: LSD:

Date Reported: Aug 2, 2016

Attn: Tami Dolen

P.O.:

Sampled By: TLD

Report Number: 2120174

Company: CoE

Acct code:

**Reference Number** Sample Date

1150979-9 Jul 22, 2016

D927378 C-4816245

1150979-10

1150979-12

Sample Time

NA

Jul 22, 2016 NA

Jul 22, 2016 NA

**Sample Location Sample Description** 

BH16-04 / 4.2°C

BH16-05 / 4.2°C

BH16-07 / 4.2°C

		Matrix	Water	Water	Water	
Analyte		Units	Results	Results	Results	Nominal Detection
Metals Total						2
Aluminum	Total	mg/L	1.68	1.42	1.92	0.02
Calcium	Total	mg/L	138	141	193	0.2
Iron	Total	mg/L	8.10	3.21	5.34	0.05
Magnesium	Total	mg/L	39.2	33.0	51.0	0.2
Manganese	Total	mg/L	0.659	0.142	1.42	0.005
Potassium	Total	mg/L	5.1	5.7	5.9	0.4
Silicon	Total	mg/L	9.01	9.41	9.80	0.05
Sodium	Total	mg/L	31.6	42.4	49.9	0.4
Sulfur	Total	mg/L	35.2	27.6	53.3	0.3
Mercury	Total	mg/L	0.000017	0.000062	0.000063	0.000005
Antimony	Total	mg/L	< 0.0002	0.0003	< 0.0002	0.0002
Arsenic	Total	mg/L	0.0016	0.0030	0.0019	0.0002
Barium	Total	mg/L	0.141	0.168	0.148	0.001
Beryllium	Total	mg/L	0.0002	0.0001	0.0002	0.0001
Bismuth	Total	mg/L	< 0.0005	< 0.0005	< 0.0005	0.0005
Boron	Total	mg/L	0.434	0.364	1.05	0.002
Cadmium	Total	mg/L	0.00010	0.00013	0.00010	0.00001
Chromium	Total	mg/L	0.0031	0.0023	0.0036	0.0005
Cobalt	Total	mg/L	0.0017	0.0024	0.0024	0.0001
Copper	Total	mg/L	0.005	0.008	0.006	0.001
Lead	Total	mg/L	0.0016	0.0026	0.0025	0.0001
Lithium	Total	mg/L	0.022	0.027	0.030	0.001
Molybdenum	Total	mg/L	<0.001	0.005	<0.001	0.001
Nickel	Total	mg/L	0.0062	0.0078	0.0083	0.0005
Selenium	Total	mg/L	0.0004	0.0011	0.0004	0.0002
Silver	Total	mg/L	0.00003	0.00004	0.00003	0.00001
Strontium	Total	mg/L	0.873	0.798	1.24	0.001
Thallium	Total	mg/L	0.00008	0.00008	0.00011	0.00005
Tin	Total	mg/L	<0.001	0.003	0.002	0.001
Titanium	Total	mg/L	0.0574	0.0424	0.0584	0.0005
Uranium	Total	mg/L	0.0044	0.0065	0.0076	0.0005
Vanadium	Total	mg/L	0.0067	0.0044	0.0065	0.0001
Zinc	Total	mg/L	0.012	0.017	0.015	0.001

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# **Analytical Report**

Bill To: City of Edmonton

Project:

Lot ID: 1150979

Report To: City of Edmonton

ID: Name:

Control Number: C0079745 Date Received:

11404 - 60th Avenue Edmonton, AB, Canada Rossdale RMA

506.327

Jul 22, 2016

T6H 1J5

Location:

Date Reported: Aug 2, 2016

Attn: Tami Dolen

LSD: P.O.:

Report Number: 2120174

Sampled By: TLD Company: CoE

Acct code:

**Reference Number** Sample Date

1150979-12 Jul 22, 2016

Sample Time

NA

D927378 C-4816245

**Sample Location Sample Description** 

BH16-07 / 4.2°C

Matrix

Water

		Matrix	vvater			
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Polycyclic Aromatic H	ydrocarbons - Water					
Naphthalene		ug/L	<0.1			0.1
Quinoline		ug/L	<0.3			0.3
Acenaphthylene		ug/L	<0.1			0.1
Acenaphthene		ug/L	<0.1			0.1
Fluorene		ug/L	<0.1			0.1
Phenanthrene		ug/L	<0.1			0.1
Acridine		ug/L	<0.1			0.1
Anthracene		ug/L	< 0.005			0.005
Fluoranthene		ug/L	<0.01			0.01
Pyrene		ug/L	<0.01			0.01
Benzo(a)anthracene		ug/L	<0.01			0.01
Chrysene		ug/L	<0.1			0.1
Benzo(b)fluoranthene		ug/L	<0.1			0.1
Benzo(b+j)fluoranthene	Э	ug/L	<0.1			0.1
Benzo(k)fluoranthene		ug/L	<0.1			0.1
Benzo(a)pyrene		ug/L	<0.008			0.008
Indeno(1,2,3-c,d)pyren	e	ug/L	< 0.05			0.05
Dibenzo(a,h)anthracen	e	ug/L	< 0.05			0.05
Benzo(g,h,i)perylene		ug/L	< 0.05			0.05
CB(a)P	Carcinogenic Potency	ug/L	<0.01			0.01
	Equivalent					
PAH - Water - Surroga	•					
Nitrobenzene-d5	PAH - Surrogate	%	95			23-130
2-Fluorobiphenyl	PAH - Surrogate	%	89			30-130
p-Terphenyl-d14	PAH - Surrogate	%	106			18-137

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## **Analytical Report**

Bill To: City of Edmonton

Project:

Lot ID: 1150979

Report To: City of Edmonton

ID: Name: 506.327 Rossdale RMA

D927378 C-4816245

Control Number: C0079745 Date Received: Jul 22, 2016

11404 - 60th Avenue Edmonton, AB, Canada

Location:

P.O.:

Date Reported: Aug 2, 2016

T6H 1J5

LSD:

Report Number: 2120174

Attn: Tami Dolen Sampled By: TLD

Company: CoE

Acct code:

**Reference Number** Sample Date

1150979-12 Jul 22, 2016 1150979-13

Sample Time

NA

Jul 22, 2016 NA

**Sample Location Sample Description** 

BH16-07 / 4.2°C

BH16-08 / 4.2°C

		Matrix Water		Water		
Analyte		Units	Results	Results	Results	Nominal Detectio Limit
Metals Dissolved						
Mercury	Dissolved	mg/L	<0.000005	<0.000005		0.000005
Aluminum	Dissolved	mg/L	0.023	< 0.002		0.002
Antimony	Dissolved	mg/L	< 0.0002	<0.0002		0.0002
Arsenic	Dissolved	mg/L	< 0.0002	<0.0002		0.0002
Barium	Dissolved	mg/L	0.065	0.174		0.001
Boron	Dissolved	mg/L	1.10	0.222		0.002
Cadmium	Dissolved	mg/L	0.00006	0.00010		0.00001
Chromium	Dissolved	mg/L	< 0.0005	< 0.0005		0.0005
Copper	Dissolved	mg/L	0.002	<0.001		0.001
Lead	Dissolved	mg/L	<0.0001	< 0.0001		0.0001
Nickel	Dissolved	mg/L	0.0091	0.0021		0.0005
Selenium	Dissolved	mg/L	0.0003	< 0.0002		0.0002
Silver	Dissolved	mg/L	<0.00001	<0.00001		0.00001
Uranium	Dissolved	mg/L	0.0075	0.0031		0.0005
Zinc	Dissolved	mg/L	0.007	0.007		0.001
Subsample	Field Filtered		Lab Filtered	Field Filtered		
Routine Water						
рН			7.77	7.79		
Temperature of observed pH		°C	21.1	21.7		
Electrical Conductivity	at 25 °C	uS/cm	1280	874		1
Calcium	Dissolved	mg/L	173	130		0.2
Magnesium	Dissolved	mg/L	46.0	31.5		0.2
Sodium	Dissolved	mg/L	48.2	33.5		0.4
Potassium	Dissolved	mg/L	5.2	2.9		0.4
Iron	Dissolved	mg/L	0.03	<0.01		0.01
Manganese	Dissolved	mg/L	1.10	1.39		0.005
Chloride	Dissolved	mg/L	70.1	39.5		0.4
Nitrate - N		mg/L	5.43	0.22		0.01
Nitrite - N		mg/L	0.985	< 0.005		0.005
Nitrate and Nitrite - N		mg/L	6.42	0.22		0.01
Sulfate (SO4)	Dissolved	mg/L	146	66.6		0.9
Hydroxide		mg/L	<5	<5		
Carbonate		mg/L	<6	<6		
Bicarbonate		mg/L	613	547		
P-Alkalinity	as CaCO3	mg/L	<5	<5		5

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# **Analytical Report**

Bill To: City of Edmonton

Project:

Lot ID: 1150979

Report To: City of Edmonton

ID: Name:

Control Number: C0079745

11404 - 60th Avenue Edmonton, AB, Canada Rossdale RMA

Date Received: Jul 22, 2016

T6H 1J5

Location:

Date Reported: Aug 2, 2016

Attn: Tami Dolen

LSD: P.O.:

D927378 C-4816245

Report Number: 2120174

Sampled By: TLD

Company: CoE

Acct code:

**Reference Number** Sample Date

1150979-12

1150979-13

Sample Time

Jul 22, 2016 NA

Jul 22, 2016 NA

506.327

**Sample Location Sample Description** BH16-07 / 4.2°C

BH16-08 / 4.2°C

		Matrix	Water	Water		
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Routine Water - Continue	ed					
T-Alkalinity	as CaCO3	mg/L	503	449		5
Total Dissolved Solids	Calculated	mg/L	790	573		1
Hardness	Dissolved as CaCO3	mg/L	622	453		
Ionic Balance	Dissolved	%	95	92		

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## **Analytical Report**

Bill To: City of Edmonton

Project: 506.327 ID:

Lot ID: 1150979

Report To: City of Edmonton 11404 - 60th Avenue

Name:

Control Number: C0079745

Edmonton, AB, Canada

Rossdale RMA Location:

Date Received: Jul 22, 2016 Date Reported: Aug 2, 2016

T6H 1J5

LSD:

Attn: Tami Dolen

P.O.:

Report Number: 2120174

Sampled By: TLD Company: CoE

Acct code:

**Reference Number** Sample Date

1150979-13 Jul 22, 2016

Sample Time

NA

D927378 C-4816245

**Sample Location Sample Description** 

BH16-08 / 4.2°C

Matrix

Water

		Watrix	vvalei			Nominal Detection
Analyte		Units	Results	Results	Results	Limit
Metals Total						
Aluminum	Total	mg/L	4.05			0.02
Calcium	Total	mg/L	149			0.2
Iron	Total	mg/L	13.2			0.05
Magnesium	Total	mg/L	36.5			0.2
Manganese	Total	mg/L	1.92			0.005
Potassium	Total	mg/L	3.9			0.4
Silicon	Total	mg/L	13.4			0.05
Sodium	Total	mg/L	33.9			0.4
Sulfur	Total	mg/L	23.7			0.3
Mercury	Total	mg/L	0.000044			0.000005
Antimony	Total	mg/L	< 0.0002			0.0002
Arsenic	Total	mg/L	0.0034			0.0002
Barium	Total	mg/L	0.287			0.001
Beryllium	Total	mg/L	0.0004			0.0001
Bismuth	Total	mg/L	< 0.0005			0.0005
Boron	Total	mg/L	0.209			0.002
Cadmium	Total	mg/L	0.00024			0.00001
Chromium	Total	mg/L	0.0064			0.0005
Cobalt	Total	mg/L	0.0041			0.0001
Copper	Total	mg/L	0.009			0.001
Lead	Total	mg/L	0.0047			0.0001
Lithium	Total	mg/L	0.019			0.001
Molybdenum	Total	mg/L	<0.001			0.001
Nickel	Total	mg/L	0.0120			0.0005
Selenium	Total	mg/L	0.0003			0.0002
Silver	Total	mg/L	0.00007			0.00001
Strontium	Total	mg/L	0.949			0.001
Thallium	Total	mg/L	0.00016			0.00005
Tin	Total	mg/L	0.001			0.001
Titanium	Total	mg/L	0.0763			0.0005
Uranium	Total	mg/L	0.0036			0.0005
Vanadium	Total	mg/L	0.0131			0.0001
Zinc	Total	mg/L	0.033			0.001

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Lot ID: 1150979

## **Analytical Report**

Bill To: City of Edmonton Project:

Report To: City of Edmonton ID: 506.327 Control Number: C0079745

11404 - 60th Avenue Name: Rossdale RMA

Data Received: Jul 23, 2016

Title 4 - 60th Avenue Name: Rossdale RMA Date Received: Jul 22, 2016
Edmonton, AB, Canada Location: Date Reported: Aug 2, 2016
T6H 1J5 LSD: Report Number: 2120174

Attn: Tami Dolen P.O.: D927378 C-4816245

Sampled By: TLD Acct code:

Company: CoE

Approved by:

Anthony Neumann, MSc Laboratory Operations Manager

Anthony Weuman

7217 Roper Road NW Edmonton, Alberta T6B 3J4, Canada

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# **Methodology and Notes**

Bill To: City of Edmonton

Project: ID:

Lot ID: 1150979

Report To: City of Edmonton

Name:

Control Number: C0079745

11404 - 60th Avenue Edmonton, AB, Canada Rossdale RMA

D927378 C-4816245

506.327

Date Received: Jul 22, 2016

T6H 1J5

Location: LSD:

Date Reported: Aug 2, 2016

Attn: Tami Dolen

P.O.:

Report Number: 2120174

Sampled By: TLD Company: CoE Acct code:

Method of Analysis		
Method Name	Reference	Method Date Analysis Location Started
1:5 Water Soluble Extraction	APHA	Colorimetric Method, 3500-Cr B 26-Jul-16 Exova Edmonton
1:5 Water Soluble Extraction	McKeague	Soluble Salts in Extracts of 1:5 Soil:Water 26-Jul-16 Exova Edmonton Mixtures, 3.23
Alkalinity, pH, and EC in water	APHA	Alkalinity - Titration Method, 2320 B 26-Jul-16 Exova Edmonton
Alkalinity, pH, and EC in water	APHA	Conductivity, 2510 B 26-Jul-16 Exova Edmonton
Alkalinity, pH, and EC in water	APHA	pH - Electrometric Method, 4500-H+ B 26-Jul-16 Exova Edmonton
Anions (Routine) by Ion Chromatography	APHA	Ion Chromatography with Chemical 26-Jul-16 Exova Edmonton Suppression of Eluent Cond., 4110 B
Approval-Edmonton	APHA	Checking Correctness of Analyses, 1030 26-Jul-16 Exova Edmonton E
Chloride in Water	APHA	Automated Ferricyanide Method, 4500-Cl- 26-Jul-16 Exova Edmonton E
Mercury (Dissolved) in water	APHA	Cold Vapour Atomic Absorption 26-Jul-16 Exova Edmonton Spectrometric Method, 3112 B
Mercury (Total) in water	US EPA	Determination of Hg in Sediment by Cold 26-Jul-16 Exova Edmonton Vapor Atomic Absorption Spec, 245.5
Metals ICP (Hot Block) in soil	EPA	Sample Preparation Procedure for 26-Jul-16 Exova Edmonton Spectrochemical Determination of Total Recoverable Elements, October 1999, 200.2
Metals ICP (Hot Block) in soil	US EPA	Determination of Trace Elements in 26-Jul-16 Exova Edmonton Waters and Wastes by ICP-MS, 200.8
Metals ICP-MS (Dissolved) in water	US EPA	Determination of Trace Elements in 26-Jul-16 Exova Edmonton Waters and Wastes by ICP-MS, 200.8
Metals ICP-MS (Total) in water	US EPA	Determination of Trace Elements in 26-Jul-16 Exova Edmonton Waters and Wastes by ICP-MS, 200.8
Metals Trace (Dissolved) in water	APHA	Hardness by Calculation, 2340 B 26-Jul-16 Exova Edmonton
Metals Trace (Dissolved) in water	APHA	Inductively Coupled Plasma (ICP) 26-Jul-16 Exova Edmonton Method, 3120 B
Metals Trace (Total) in water	APHA	Inductively Coupled Plasma (ICP) 26-Jul-16 Exova Edmonton Method, 3120 B
PAH - Soil	AESRD	Index of Additive Cancer Risk (IACR), 25-Jul-16 Exova Calgary PAHs
PAH - Soil	US EPA	Semivolatile Organic Compounds by Gas 25-Jul-16 Exova Calgary Chromatography/Mass Spectrometry, 8270
PAH - Water	AESRD	Carcinogenic PAHs Toxic Potency 25-Jul-16 Exova Calgary Equivalence (as B(a)P TPE), PAHw
PAH - Water	US EPA	Semivolatile Organic Compounds by Gas 25-Jul-16 Exova Calgary Chromatography/Mass Spectrometry, 8270
Saturated Paste in General Soil	Carter	Electrical Conductivity and Soluble Ions, 26-Jul-16 Exova Edmonton Chapter 15

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Lot ID: 1150979

## **Methodology and Notes**

Bill To: City of Edmonton Project:

Report To: City of Edmonton ID: 506.327

Control Number: C0079745 11404 - 60th Avenue Rossdale RMA Name: Date Received: Jul 22, 2016 Edmonton, AB, Canada Location: Date Reported: Aug 2, 2016 T6H 1J5 LSD: Report Number: 2120174

Attn: Tami Dolen P.O.: D927378 C-4816245

Sampled By: TLD Acct code:

Company: CoE

\* Reference Method Modified

#### References

**AESRD** Alberta Tier 1 Soil and Groundwater Remediation Guidelines APHA Standard Methods for the Examination of Water and Wastewater APHA/USEPA Standard Methods For Water/ Environmental Protection Agency

Carter Soil Sampling and Methods of Analysis.

Environmental Protection Agency Test Methods - US **EPA** McKeague Manual on Soil Sampling and Methods of Analysis **US EPA** US Environmental Protection Agency Test Methods

#### Comments:

• ICP-MS total nickel results were less than dissolved metal results for sample(s) 1150979-9, 10 and 12. Total metals were analyzed from the metals bottle and dissolved from the field filtered bottle. Results were verified.

> Please direct any inquiries regarding this report to our Client Services group. Results relate only to samples as submitted.

The test report shall not be reproduced except in full, without the written approval of the laboratory.

XOVA Testing, calibrating,	Invoice to:	Description of	150	Report T	0:	50				1 8			Rep	ort	Regulatory	
advising advising	Company	City of Edi	nonton	Company									Res		Requirement	
www.exova.com ED 120-02	Address:		street.	Address:									E-Ma	ail	HCDWQG	
Project Information		17001 110	Office										Mail		Ab Tier 1	
Project ID: 506. 327	Attention:	Tami Dolen		Attention:									Onfin	ne	SPIGEC	
Project Name: Rossolalc RHP	Phone:	780 496-67	182	Phone:									Fax		BCCSR	
Project Location:	Cell:	100		Cell:									PDF		Other (list below)	
egal Location:	Fax:	A GE		Fax:									Exce	el	THE THE	
O/AFE#: C-4816245 L4	E-mail: 7	tami doleneedma	non. Ca	E-mail 1:									QA/	QC		
Proj. Acct. Code:	Agreement ID			E-mail 2:									Sam	iple Cu	stody (please print)	
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	RUSH Priority	ý il			П											
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Priority 1-2 working days (100% surcharge)	3	priority, with pricing and turn around the lab prior to submitting RUSH say			120	V	)	J					and the State of			
Urgent 2-3 working days (50% surcharge)		RUSH, please indicate in the special		- prompte	talne	1		10					This section for Lab use only			
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Date Required:	Signal			5 N Z M 2 +							Date	Cities.	Starries.			
Special Instructions/Comments (please include contact	I information includi	ng ph. # if different from above	):		Number	走	3	M	4				1			
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	Depth start end	Sala Mara Sanada d	1.7	Sampling	1,1			Enter							the space allotted any s by the corresponding	
Site I.D. Sample Description	in cm m	Date/Time Sampled	Matrix	Method	$\downarrow$		(A te	ievant	sam	pies c	elow)		num			
BH16-01	1-2-1-4	July 21/16	Soil	Gras	4	VV									1. Indicate any samples the	
2 BH16-01	2.7-2.9	July 21/16	Soil	Grab	4	1	1								were not packaged well	
3 BH16-07 3.4-3.6	4850	July 21/16	Soil	Grab	4	VI									2. Indicate any samples not	
4 BH16-02	1.1-1-3	July 21/16	Soil	Grab	4	VV									received in Exova supplies	
BH16-D2	2.7-3-0	July 2/16	Soil	Grab	4	V .	1								3. Indicate any samples tha	
6 BX16-02	4.9-5.1	Jaky 21/16	Doil	Graus	3	VV									were not clearly labeled	
7 BH16-03	1.2-1.4	July 21/16	Soil	Grab	4	VI									<ol><li>Indicate any samples not received within the required</li></ol>	
BH16-03	1.9-2.1	Tuly 21/16	Soil	Grab	4	VI									hold time or temp.	
9 BH16-04		July 22/16	6W	Bailer			V	14	1						5. Indicate any missing or	
0 BH16-05		July 22/16	BW	Bailer			V	_	V	V .				_	extra samples	
1 BH16-06			6W	Buler	3			V	V	7		2			6. Indicate any samples the	
2 BH16-07		July 22/16,	SW	Bailer	7		V	56	1				1		were received broken	
3 84 16-08		July 22/16	BW	Bailer	14		V	1	~						<ol><li>Indicate any samples where sufficient volume wa</li></ol>	
4			1												not received	
5			Lot: 1	150070	CO	C .		L					2		<ol> <li>Indicate any samples received in an inappropriat</li> </ol>	
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lease indicate any potentially hazardous sampl	les	CELL OF THE								Temp	recen	ved:	Delive	ery Meth		

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# **Report Transmission Cover Page**

Bill To: City of Edmonton Project: Lot ID: 1160993 ID:

Report To: City of Edmonton Control Number: C0098534 11004 - 190th Street Name: Date Received: Sep 16, 2016

Edmonton, AB, Canada Location: Sep 20, 2016 Date Reported: T5S 0G9 LSD: Report Number: 2132650

Attn: Tami Dolen P.O.: D927378 (C-Release#)

Sampled By: Tami Dolen Acct code:

Company: City of Edmonton

Contact & Affiliation	Address	Delivery Commitments
Tami Dolen	11004 - 190th Street	On [Lot Verification] send
City of Edm - Finance Dept.	Edmonton, Alberta T5S 0G9	(COA, COC) by Email - Multiple Reports By Agreement
Fax: null	Phone: (780) 496-6782 Fax: null	On [Report Approval] send
	Email: tami.dolen@edmonton.ca	(Test Report) by Email - Single Report
		On [Report Approval] send
		(COC, Test Report) by Email - Merge Reports
		On [Lot Approval and Final Test Report Approval] send
		(COC, Test Report) by Email - Merge Reports

#### **Notes To Clients:**

• Due to limited sample volume for PAH analysis, the detection limit of Benzo(a)pyrene for the sample #7 was increased.

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# **Analytical Report**

Bill To: City of Edmonton Project: Lot ID: 1160993 Report To: City of Edmonton ID:

Control Number: C0098534 11004 - 190th Street Name: Date Received: Sep 16, 2016 Edmonton, AB, Canada Location: Sep 20, 2016

Date Reported: LSD: T5S 0G9 Report Number: 2132650

Attn: Tami Dolen P.O.: D927378 (C-Release#)

Sampled By: Tami Dolen Acct code:

Company: City of Edmonton

**Reference Number** 1160993-1 1160993-2 1160993-3 Sample Date Sep 13, 2016 Sep 13, 2016 Sep 13, 2016 Sample Time NA NA NA

**Sample Location** 

Sample Description 16-01 / Water / 6.8C 16-02 / Water / 6.8C 16-03 / Water / 6.8C

		Matrix	Water	Water	Water	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Polycyclic Aromatic H	ydrocarbons - Water					
Naphthalene		ug/L	<0.1	<0.1	<0.1	0.1
Quinoline		ug/L	<0.3	<0.3	<0.3	0.3
Acenaphthylene		ug/L	<0.1	<0.1	<0.1	0.1
Acenaphthene		ug/L	<0.1	<0.1	<0.1	0.1
Fluorene		ug/L	<0.1	<0.1	<0.1	0.1
Phenanthrene		ug/L	<0.1	<0.1	<0.1	0.1
Acridine		ug/L	<0.1	<0.1	<0.1	0.1
Anthracene		ug/L	< 0.005	< 0.005	< 0.005	0.005
Fluoranthene		ug/L	<0.01	<0.01	0.01	0.01
Pyrene		ug/L	<0.01	<0.01	0.01	0.01
Benzo(a)anthracene		ug/L	<0.01	<0.01	<0.01	0.01
Chrysene		ug/L	<0.1	<0.1	<0.1	0.1
Benzo(b)fluoranthene		ug/L	<0.1	<0.1	<0.1	0.1
Benzo(b+j)fluoranthene	•	ug/L	<0.1	<0.1	<0.1	0.1
Benzo(k)fluoranthene		ug/L	<0.1	<0.1	<0.1	0.1
Benzo(a)pyrene		ug/L	<0.008	< 0.008	<0.008	0.008
Indeno(1,2,3-c,d)pyrene	e	ug/L	< 0.05	< 0.05	< 0.05	0.05
Dibenzo(a,h)anthracen	e	ug/L	< 0.05	< 0.05	< 0.05	0.05
Benzo(g,h,i)perylene		ug/L	< 0.05	< 0.05	< 0.05	0.05
CB(a)P	Carcinogenic Potency Equivalent	ug/L	<0.01	<0.01	<0.01	0.01
PAH - Water - Surroga	te Recovery					
Nitrobenzene-d5	PAH - Surrogate	%	94	99	102	23-130
2-Fluorobiphenyl	PAH - Surrogate	%	103	106	106	30-130
p-Terphenyl-d14	PAH - Surrogate	%	74	55	66	18-137

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Report Number: 2132650

## **Analytical Report**

Bill To: City of Edmonton Project: Lot ID: 1160993 Report To: City of Edmonton ID:

Control Number: C0098534 11004 - 190th Street Name: Date Received: Sep 16, 2016 Edmonton, AB, Canada Location: Date Reported: Sep 20, 2016 LSD: T5S 0G9

Attn: Tami Dolen P.O.: D927378 (C-Release#)

Sampled By: Tami Dolen Acct code:

Company: City of Edmonton

**Reference Number** 1160993-4 1160993-5 1160993-6 Sample Date Sep 13, 2016 Sep 13, 2016 Sep 13, 2016 Sample Time NA NA NA

**Sample Location** 

**Sample Description** 16-04 / Water / 6.8C 16-05 / Water / 6.8C 16-06 / Water / 6.8C

		Matrix	Water	Water	Water	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Polycyclic Aromatic Hy	ydrocarbons - Water					
Naphthalene		ug/L	<0.1	<0.1	<0.1	0.1
Quinoline		ug/L	<0.3	<0.3	<0.3	0.3
Acenaphthylene		ug/L	<0.1	<0.1	<0.1	0.1
Acenaphthene		ug/L	<0.1	<0.1	<0.1	0.1
Fluorene		ug/L	<0.1	<0.1	<0.1	0.1
Phenanthrene		ug/L	<0.1	<0.1	<0.1	0.1
Acridine		ug/L	<0.1	<0.1	<0.1	0.1
Anthracene		ug/L	0.005	< 0.005	< 0.005	0.005
Fluoranthene		ug/L	0.04	<0.01	<0.01	0.01
Pyrene		ug/L	0.04	<0.01	<0.01	0.01
Benzo(a)anthracene		ug/L	<0.01	<0.01	<0.01	0.01
Chrysene		ug/L	<0.1	<0.1	<0.1	0.1
Benzo(b)fluoranthene		ug/L	<0.1	<0.1	<0.1	0.1
Benzo(b+j)fluoranthene	•	ug/L	<0.1	<0.1	<0.1	0.1
Benzo(k)fluoranthene		ug/L	<0.1	<0.1	<0.1	0.1
Benzo(a)pyrene		ug/L	<0.008	<0.008	<0.008	0.008
Indeno(1,2,3-c,d)pyrene	e	ug/L	<0.05	< 0.05	< 0.05	0.05
Dibenzo(a,h)anthracen	e	ug/L	<0.05	< 0.05	< 0.05	0.05
Benzo(g,h,i)perylene		ug/L	<0.05	< 0.05	< 0.05	0.05
CB(a)P	Carcinogenic Potency Equivalent	ug/L	<0.01	<0.01	<0.01	0.01
PAH - Water - Surrogat	•					
Nitrobenzene-d5	PAH - Surrogate	%	101	94	105	23-130
2-Fluorobiphenyl	PAH - Surrogate	%	100	102	106	30-130
p-Terphenyl-d14	PAH - Surrogate	%	71	75	69	18-137

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Lot ID: 1160993

Report Number: 2132650

# **Analytical Report**

Bill To: City of Edmonton Project:

Report To: City of Edmonton ID: Control Number: C0098534 11004 - 190th Street Name: Date Received: Sep 16, 2016 Edmonton, AB, Canada Location: Date Reported: Sep 20, 2016

LSD: T5S 0G9

Attn: Tami Dolen P.O.: D927378 (C-Release#)

Sampled By: Tami Dolen Acct code:

Company: City of Edmonton

**Reference Number** 1160993-7 1160993-8 1160993-9 Sample Date Sep 13, 2016 Sep 13, 2016 Sep 13, 2016 Sample Time NA NA NA

**Sample Location** 

**Sample Description** 16-07 / Water / 6.8C 16-08 / Water / 6.8C 14-15 / Water / 6.8C

		Matrix	Water	Water	Water	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Polycyclic Aromatic Hy	drocarbons - Water					
Naphthalene		ug/L	<0.1	<0.1	<0.1	0.1
Quinoline		ug/L	<0.3	<0.3	<0.3	0.3
Acenaphthylene		ug/L	<0.1	<0.1	<0.1	0.1
Acenaphthene		ug/L	<0.1	<0.1	<0.1	0.1
Fluorene		ug/L	<0.1	<0.1	<0.1	0.1
Phenanthrene		ug/L	<0.1	<0.1	<0.1	0.1
Acridine		ug/L	<0.1	<0.1	<0.1	0.1
Anthracene		ug/L	< 0.005	< 0.005	< 0.005	0.005
Fluoranthene		ug/L	<0.01	<0.01	<0.01	0.01
Pyrene		ug/L	<0.01	<0.01	<0.01	0.01
Benzo(a)anthracene		ug/L	<0.01	<0.01	<0.01	0.01
Chrysene		ug/L	<0.1	<0.1	<0.1	0.1
Benzo(b)fluoranthene		ug/L	<0.1	<0.1	<0.1	0.1
Benzo(b+j)fluoranthene		ug/L	<0.1	<0.1	<0.1	0.1
Benzo(k)fluoranthene		ug/L	<0.1	<0.1	<0.1	0.1
Benzo(a)pyrene		ug/L	<0.016	< 0.008	<0.008	0.008
Indeno(1,2,3-c,d)pyrene		ug/L	< 0.05	< 0.05	< 0.05	0.05
Dibenzo(a,h)anthracene	•	ug/L	< 0.05	< 0.05	< 0.05	0.05
Benzo(g,h,i)perylene		ug/L	< 0.05	< 0.05	< 0.05	0.05
CB(a)P	Carcinogenic Potency Equivalent	ug/L	<0.01	<0.01	<0.01	0.01
PAH - Water - Surrogat	•					
Nitrobenzene-d5	PAH - Surrogate	%	95	95	91	23-130
2-Fluorobiphenyl	PAH - Surrogate	%	96	97	99	30-130
p-Terphenyl-d14	PAH - Surrogate	%	68	70	70	18-137

## **Analytical Report**

Bill To: City of Edmonton Project: Lot ID: 1160993

Report To: City of Edmonton ID: Control Number: C0098534

Report To: City of Edmonton ID: Control Number: C0098534

11004 - 190th Street Name: Date Received: Sep 16, 2016

Edmonton, AB, Canada Location: Date Reported: Sep 20, 2016

Edmonton, AB, Canada Location: Date Reported: Sep 20, 2016
T5S 0G9 LSD: Report Number: 2132650

Attn: Tami Dolen P.O.: D927378 (C-Release#)

Sampled By: Tami Dolen Acct code:

Company: City of Edmonton

Reference Number 1160993-10
Sample Date Sep 13, 2016
Sample Time NA

Sample Description 14-17 / Water / 6.8C

**Sample Location** 

Matrix Water

		Matrix	vvater			
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Polycyclic Aromatic H	ydrocarbons - Water					
Naphthalene		ug/L	<0.1			0.1
Quinoline		ug/L	<0.3			0.3
Acenaphthylene		ug/L	<0.1			0.1
Acenaphthene		ug/L	<0.1			0.1
Fluorene		ug/L	<0.1			0.1
Phenanthrene		ug/L	<0.1			0.1
Acridine		ug/L	<0.1			0.1
Anthracene		ug/L	< 0.005			0.005
Fluoranthene		ug/L	<0.01			0.01
Pyrene		ug/L	<0.01			0.01
Benzo(a)anthracene		ug/L	<0.01			0.01
Chrysene		ug/L	<0.1			0.1
Benzo(b)fluoranthene		ug/L	<0.1			0.1
Benzo(b+j)fluoranthene	e	ug/L	<0.1			0.1
Benzo(k)fluoranthene		ug/L	<0.1			0.1
Benzo(a)pyrene		ug/L	<0.008			0.008
Indeno(1,2,3-c,d)pyren	e	ug/L	< 0.05			0.05
Dibenzo(a,h)anthracen	e	ug/L	< 0.05			0.05
Benzo(g,h,i)perylene		ug/L	< 0.05			0.05
CB(a)P	Carcinogenic Potency	ug/L	<0.01			0.01
B. II. W	Equivalent					
PAH - Water - Surroga	•					
Nitrobenzene-d5	PAH - Surrogate	%	98			23-130
2-Fluorobiphenyl	PAH - Surrogate	%	104			30-130
p-Terphenyl-d14	PAH - Surrogate	%	78			18-137

Approved by:

Chris Swyngedouw, PhD, PChem Technology Transfer Consultant

C. Sujugeolowo?





# **Methodology and Notes**

Bill To: City of Edmonton Project: Lot ID: 1160993 Report To: City of Edmonton ID:

Control Number: C0098534 11004 - 190th Street Name: Date Received: Sep 16, 2016

Edmonton, AB, Canada Location: Date Reported: Sep 20, 2016 T5S 0G9 LSD: Report Number: 2132650

Attn: Tami Dolen P.O.: D927378 (C-Release#)

Sampled By: Tami Dolen Acct code:

Company: City of Edmonton

Method of Analysis				
Method Name	Reference	Method	Date Analysis Started	Location
PAH - Water	AESRD	Carcinogenic PAHs Toxic Potency Equivalence (as B(a)P TPE), PAHw	16-Sep-16	Exova Calgary
PAH - Water	US EPA	<ul> <li>Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry, 8270</li> </ul>	16-Sep-16	Exova Calgary
		* Reference Method Modified		

References

**AESRD** Alberta Tier 1 Soil and Groundwater Remediation Guidelines

**US EPA** US Environmental Protection Agency Test Methods

#### **Comments:**

• Due to limited sample volume for PAH analysis, the detection limit of Benzo(a)pyrene for the sample #7 was increased.

Please direct any inquiries regarding this report to our Client Services group. Results relate only to samples as submitted.

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xova	Testing. calibrating.	Invoice to			1	Report 1			B	185			Repo		Regulatory Requirement
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Special Instructi	ons/Comments (please include cor	ntact information in	ncloding ph. # If Giffe	rent from aboves.			Number								
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Site I.D.	Sample Description	start e	m	ne Sampled	Matrix	Method		- (4	Televali	vant samples below)		nur	mber.	1. Indicate any samples th	
16-01	water		Sept	13,2016	woth	BANK	-	-			-		_		were not packaged well
16-02				7			L	-					-		2. Indicate any samples no
16-03							1	-					_		received in Exova supplies
16-04							1						-		3. Indicate any samples t
16-05							1								were not clearly labeled
16-06			121	ă .	U AL		1	$\perp$	_			-		_	4. Indicate any samples r
16-07			The second second				1					-		-	received within the requir
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0 14-17-						.4						-		-	Indicate any samples     were received broken
1 2															7. Indicate any samples
6.1															where sufficient volume not received
_												-			B. Indicate any samples
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# **Report Transmission Cover Page**

Bill To: City of Edmonton

Project: ID:

Lot ID: 1172582

Report To: City of Edmonton

ID: 506.327 Name: Rossdale

Control Number: C005058/

11004 - 190th Street Edmonton, AB, Canada Name: Rossdale RMP Location:

Date Received: Nov 16, 2016 Date Reported: Nov 22, 2016

T5S 0G9

LSD:

ate Reported: Nov 22,

Attn: Tami Dolen

P.O.: D927378 (C-

Report Number: 2149547

Sampled By:

Release#4816245 L4)

Company:

Acct code:

Contact & Affiliation	Address	Delivery Commitments			
Tami Dolen	11004 - 190th Street	On [Lot Verification] send			
City of Edm - Finance Dept.	Edmonton, Alberta T5S 0G9	(COA, COC) by Email - Multiple Reports By Agreement			
	Phone: (780) 496-6782 Fax: null	On [Report Approval] send			
	Email: tami.dolen@edmonton.ca	(Test Report) by Email - Single Report			
		On [Report Approval] send			
		(COC, Test Report) by Email - Merge Reports			
		On [Lot Approval and Final Test Report Approval] send			
		(COC, Test Report, Invoice) by Email - Merge Reports			

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## **Analytical Report**

Bill To: City of Edmonton

Report To: City of Edmonton

11004 - 190th Street

Edmonton, AB, Canada

T5S 0G9

Attn: Tami Dolen

Sampled By:

Company:

Project:

ID: 506.327

Name:

Rossdale RMP

Location: LSD: P.O.:

D927378 (C-

Release#4816245 L4)

Acct code:

Lot ID: 1172582

Control Number: C005058/

Date Received: Nov 16, 2016 Date Reported: Nov 22, 2016

Report Number: 2149547

**Reference Number** Sample Date Sample Time **Sample Location** 

1172582-1 Nov 15, 2016

1172582-2 Nov 15, 2016

1172582-3 Nov 15, 2016

NA

NA

NA

Sample Description SED16-01 / Silty Sand / 0.0-10 / cm

SED16-02 / Silty Sand / 0.0-10 / cm

SED16-03 / Silty Sand / 0.0-10 / cm

Matrix Soil Soil Soil

tion	Units	Results	Results	Results	Nominal Detecti Limit
tion					
Saturated Paste	mg/L	< 0.05	<0.05	0.06	0.05
Strong Acid Extractable	mg/kg	0.3	0.2	0.2	0.2
Strong Acid Extractable	mg/kg	5.6	5.4	5.1	0.2
Strong Acid Extractable	mg/kg	140	122	118	1
Strong Acid Extractable	mg/kg	0.4	0.3	0.4	0.1
Strong Acid Extractable	mg/kg	0.19	0.16	0.16	0.01
Strong Acid Extractable	mg/kg	14.0	12.4	13.3	0.5
Strong Acid Extractable	mg/kg	6.7	6.3	6.0	0.1
Strong Acid Extractable	mg/kg	10.7	8.7	8.9	1
Strong Acid Extractable	mg/kg	5.9	5.3	5.7	0.1
Strong Acid Extractable	mg/kg	< 0.05	< 0.05	< 0.05	0.05
Strong Acid Extractable	mg/kg	<1.0	<1.0	<1.0	1
Strong Acid Extractable	mg/kg	18.9	17.5	17.2	0.5
Strong Acid Extractable	mg/kg	<0.3	<0.3	<0.3	0.3
Strong Acid Extractable	mg/kg	<0.1	<0.1	<0.1	0.1
Strong Acid Extractable	mg/kg	0.11	0.10	0.09	0.05
Strong Acid Extractable	mg/kg	<1.0	<1.0	<1.0	1
Strong Acid Extractable	mg/kg	0.7	0.7	0.6	0.5
Strong Acid Extractable	mg/kg	19.5	17.3	18.3	0.1
Strong Acid Extractable	mg/kg	54	51	50	1
	%	44	48	42	
S					
Water Soluble	mg/kg	<0.10	<0.10	<0.10	0.1
Soil % Moisture	% by weight	30.70	28.30	27.70	
ocarbons - Soil					
Dry Weight	mg/kg	0.018	0.015	0.018	0.010
Dry Weight	mg/kg	0.037	0.026	0.034	0.010
Dry Weight	mg/kg	< 0.0050	< 0.0050	< 0.0050	0.0050
Dry Weight	mg/kg	< 0.0050	< 0.0050	< 0.0050	0.0050
Dry Weight	mg/kg	< 0.0050	< 0.0050	< 0.0050	0.0050
Dry Weight	mg/kg	0.037	0.028	0.039	0.010
Dry Weight	mg/kg	< 0.0030	< 0.0030	< 0.0030	0.0030
Dry Weight	mg/kg	<0.01	<0.01	0.013	0.010
	Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid Extractable Strong Acid 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Extractable mg/kg Strong Acid Extractable mg/kg Strong Acid Extractable mg/kg Strong Acid Extractable mg/kg Strong	Strong Acid Extractable mg/kg 5.6  Strong Acid Extractable mg/kg 140  Strong Acid Extractable mg/kg 0.4  Strong Acid Extractable mg/kg 0.19  Strong Acid Extractable mg/kg 14.0  Strong Acid Extractable mg/kg 14.0  Strong Acid Extractable mg/kg 6.7  Strong Acid Extractable mg/kg 10.7  Strong Acid Extractable mg/kg 5.9  Strong Acid Extractable mg/kg <0.05  Strong Acid Extractable mg/kg <1.0  Strong Acid Extractable mg/kg <1.0  Strong Acid Extractable mg/kg <0.3  Strong Acid Extractable mg/kg <0.3  Strong Acid Extractable mg/kg <0.1  Strong Acid Extractable mg/kg <0.1  Strong Acid Extractable mg/kg <0.1  Strong Acid Extractable mg/kg <1.0  Strong Acid Extractable mg/kg <1.0  Strong Acid Extractable mg/kg <1.0  Strong Acid Extractable mg/kg <1.5  Strong Acid Extractable mg/kg <1.5  Strong Acid Extractable mg/kg <1.5  Strong Acid Extractable mg/kg <0.10  Soil % Moisture % by weight 30.70  Ocarbons - Soil  Dry Weight mg/kg <0.0050  Dry Weight mg/kg <0.0050  Dry Weight mg/kg <0.0050  Dry Weight mg/kg <0.0050  Dry Weight mg/kg <0.0050  Dry Weight mg/kg <0.0050  Dry Weight mg/kg <0.0050  Dry Weight mg/kg <0.0050  Dry Weight mg/kg <0.0050  Dry Weight mg/kg <0.0037  Dry Weight mg/kg <0.0037  Dry Weight mg/kg <0.0030	Strong Acid Extractable         mg/kg         5.6         5.4           Strong Acid Extractable         mg/kg         140         122           Strong Acid Extractable         mg/kg         0.4         0.3           Strong Acid Extractable         mg/kg         0.19         0.16           Strong Acid Extractable         mg/kg         14.0         12.4           Strong Acid Extractable         mg/kg         6.7         6.3           Strong Acid Extractable         mg/kg         10.7         8.7           Strong Acid Extractable         mg/kg         5.9         5.3           Strong Acid Extractable         mg/kg         <0.05	Strong Acid Extractable         mg/kg         5.6         5.4         5.1           Strong Acid Extractable         mg/kg         140         122         118           Strong Acid Extractable         mg/kg         0.4         0.3         0.4           Strong Acid Extractable         mg/kg         0.19         0.16         0.16           Strong Acid Extractable         mg/kg         14.0         12.4         13.3           Strong Acid Extractable         mg/kg         6.7         6.3         6.0           Strong Acid Extractable         mg/kg         10.7         8.7         8.9           Strong Acid Extractable         mg/kg         5.9         5.3         5.7           Strong Acid Extractable         mg/kg         <0.05

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# **Analytical Report**

Bill To: City of Edmonton

T5S 0G9

Report To: City of Edmonton

ID: 506.327

11004 - 190th Street Edmonton, AB, Canada Name: Location: LSD:

Project:

Rossdale RMP

Control Number: C005058/ Date Received: Nov 16, 2016 Date Reported: Nov 22, 2016

Lot ID: 1172582

Report Number: 2149547

Attn: Tami Dolen

P.O.:

PAH - Surrogate

D927378 (C-Release#4816245 L4)

Sampled By: Company:

p-Terphenyl-d14

Acct code:

**Reference Number** Sample Date Sample Time Sample Location

1172582-1 Nov 15, 2016 NA

1172582-2 Nov 15, 2016

1172582-3 Nov 15, 2016

NA

NA

**Sample Description** 

%

SED16-01 / Silty Sand / 0.0-10 / cm

SED16-02 / Silty Sand / 0.0-10 / cm

103

SED16-03 / Silty Sand / 0.0-10 / cm

98

18-137

Matrix Soil Soil Soil Nominal Detection Units Results Results Results Analyte Limit Polycyclic Aromatic Hydrocarbons - Soil - Continued 0.012 0.013 0.018 Pyrene Dry Weight 0.010 mg/kg Benzo(a)anthracene Dry Weight mg/kg < 0.01 < 0.01 <0.01 0.010 Chrysene Dry Weight mg/kg 0.021 0.018 0.023 0.010 Benzo(a)pyrene Dry Weight mg/kg < 0.0050 0.0058 0.0087 0.0050 Indeno(1,2,3-c,d)pyrene Dry Weight < 0.050 < 0.050 < 0.050 mg/kg 0.050 mg/kg Dibenzo(a,h)anthracene Dry Weight < 0.050 < 0.050 < 0.050 0.050 Dry Weight < 0.050 Benzo(g,h,i)perylene mg/kg < 0.050 < 0.050 0.050 Benzo(k)fluoranthene Dry Weight mg/kg < 0.050 < 0.050 < 0.050 0.050 Benzo(b+j)fluoranthene Dry Weight mg/kg < 0.050 < 0.050 < 0.050 0.050 Index of Additive Cancer 0.003 0.003 0.004 0.001 IACR\_Coarse Risk IACR Fine Index of Additive Cancer 0.005 0.005 0.007 0.001 Risk 104 Nitrobenzene-d5 PAH - Surrogate % 121 99 23-130 2-Fluorobiphenyl PAH - Surrogate % 99 106 106 30-130

94



#### **Analytical Report**

Bill To: City of Edmonton

Report To: City of Edmonton

11004 - 190th Street

Edmonton, AB, Canada T5S 0G9

Attn: Tami Dolen

Sampled By:

Company:

Project:

ID: 506.327

Name: Location: Rossdale RMP

LSD:

P.O.: D927378 (C-

Release#4816245 L4)

Acct code:

Lot ID: 1172582

Control Number: C005058/

Date Received: Nov 16, 2016 Date Reported: Nov 22, 2016

Report Number: 2149547

**Reference Number** Sample Date Sample Time **Sample Location** 

**Sample Description** 

1172582-4 Nov 15, 2016 NA

1172582-5 Nov 15, 2016

1172582-6 Nov 15, 2016

NA

NA

SED16-04 / Silty

SED16-05 / Silty

SED16-06 / Silty

Sand / 0.0-10 / cm

Sand / 0.0-10 / cm

Sand / 0.0-10 / cm

		Matrix	Soil	Soil	Soil	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Metals Strong Acid Dige	stion					
Boron	Saturated Paste	mg/L	< 0.05	0.37	< 0.05	0.05
Antimony	Strong Acid Extractable	mg/kg	0.3	0.3	<0.2	0.2
Arsenic	Strong Acid Extractable	mg/kg	6.0	5.4	5.1	0.2
Barium	Strong Acid Extractable	mg/kg	151	119	110	1
Beryllium	Strong Acid Extractable	mg/kg	0.4	0.3	0.3	0.1
Cadmium	Strong Acid Extractable	mg/kg	0.22	0.18	0.15	0.01
Chromium	Strong Acid Extractable	mg/kg	13.6	12.4	11.8	0.5
Cobalt	Strong Acid Extractable	mg/kg	7.1	6.5	6.1	0.1
Copper	Strong Acid Extractable	mg/kg	12.2	9.8	7.8	1
Lead	Strong Acid Extractable	mg/kg	6.3	5.5	4.9	0.1
Mercury	Strong Acid Extractable	mg/kg	< 0.05	< 0.05	< 0.05	0.05
Molybdenum	Strong Acid Extractable	mg/kg	<1.0	<1.0	<1.0	1
Nickel	Strong Acid Extractable	mg/kg	20.1	18.2	16.9	0.5
Selenium	Strong Acid Extractable	mg/kg	0.3	<0.3	<0.3	0.3
Silver	Strong Acid Extractable	mg/kg	<0.1	<0.1	<0.1	0.1
Thallium	Strong Acid Extractable	mg/kg	0.12	0.11	0.09	0.05
Tin	Strong Acid Extractable	mg/kg	<1.0	<1.0	<1.0	1
Uranium	Strong Acid Extractable	mg/kg	0.8	0.7	0.6	0.5
Vanadium	Strong Acid Extractable	mg/kg	20.5	17.5	17.4	0.1
Zinc	Strong Acid Extractable	mg/kg	57	49	47	1
Salinity						
% Saturation		%	49	45	43	
Water Soluble Paramete	rs					
Chromium (VI)	Water Soluble	mg/kg	<0.10	<0.10	<0.10	0.1
Soil % Moisture						
Moisture	Soil % Moisture	% by weight	29.70	27.90	24.40	
Polycyclic Aromatic Hyd	Irocarbons - Soil					
Naphthalene	Dry Weight	mg/kg	0.033	0.026	0.013	0.010
2-Methylnaphthalene	Dry Weight	mg/kg	0.063	0.050	0.026	0.010
Acenaphthylene	Dry Weight	mg/kg	< 0.0050	< 0.0050	< 0.0050	0.0050
Acenaphthene	Dry Weight	mg/kg	<0.0050	<0.0050	< 0.0050	0.0050
Fluorene	Dry Weight	mg/kg	0.0059	<0.0050	< 0.0050	0.0050
Phenanthrene	Dry Weight	mg/kg	0.059	0.047	0.023	0.010
Anthracene	Dry Weight	mg/kg	< 0.0030	< 0.0030	< 0.0030	0.0030
Fluoranthene	Dry Weight	mg/kg	0.010	<0.01	<0.01	0.010

## Page 4 of 5

#### **Analytical Report**

Bill To: City of Edmonton

ID: 506.327 Lot ID: 1172582

Report To: City of Edmonton

Name:

Project:

Control Number: C005058/

11004 - 190th Street Edmonton, AB, Canada

Location:

Date Received: Nov 16, 2016 Date Reported: Nov 22, 2016

T5S 0G9

LSD:

PAH - Surrogate

Report Number: 2149547

Attn: Tami Dolen

P.O.:

D927378 (C-Release#4816245 L4)

Rossdale RMP

Sampled By: Company:

p-Terphenyl-d14

Acct code:

**Reference Number** Sample Date 1172582-4

1172582-5

1172582-6

Sample Time

Nov 15, 2016 NA

Nov 15, 2016 NA

Nov 15, 2016 NA

SED16-04 / Silty

SED16-05 / Silty

96

SED16-06 / Silty

**Sample Location Sample Description** 

Sand / 0.0-10 / cm

Sand / 0.0-10 / cm

Sand / 0.0-10 / cm

96

Inthony Weuman

18-137

		Matrix	Soil	Soil	Soil	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Polycyclic Aromatic Hydr	ocarbons - Soil - Continued					_
Pyrene	Dry Weight	mg/kg	0.019	0.015	<0.01	0.010
Benzo(a)anthracene	Dry Weight	mg/kg	<0.01	<0.01	<0.01	0.010
Chrysene	Dry Weight	mg/kg	0.032	0.023	0.014	0.010
Benzo(a)pyrene	Dry Weight	mg/kg	0.0095	0.0067	< 0.0050	0.0050
Indeno(1,2,3-c,d)pyrene	Dry Weight	mg/kg	< 0.050	< 0.050	< 0.050	0.050
Dibenzo(a,h)anthracene	Dry Weight	mg/kg	< 0.050	< 0.050	< 0.050	0.050
Benzo(g,h,i)perylene	Dry Weight	mg/kg	< 0.050	< 0.050	< 0.050	0.050
Benzo(k)fluoranthene	Dry Weight	mg/kg	< 0.050	< 0.050	< 0.050	0.050
Benzo(b+j)fluoranthene	Dry Weight	mg/kg	< 0.050	< 0.050	< 0.050	0.050
IACR_Coarse	Index of Additive Cancer Risk		0.004	0.003	<0.001	0.001
IACR_Fine	Index of Additive Cancer Risk		0.009	0.006	0.001	0.001
Nitrobenzene-d5	PAH - Surrogate	%	114	108	108	23-130
2-Fluorobiphenyl	PAH - Surrogate	%	104	101	94	30-130

94

Approved by:

Anthony Neumann, MSc Laboratory Operations Manager

# Page 5 of 5

#### **Methodology and Notes**

Bill To: City of Edmonton

ID:

Lot ID: 1172582

Report To: City of Edmonton

Name:

Project:

Control Number: C005058/ Date Received:

11004 - 190th Street Edmonton, AB, Canada

Rossdale RMP Location:

506.327

Nov 16, 2016 Nov 22, 2016

T5S 0G9

LSD:

Date Reported:

Report Number: 2149547

Attn: Tami Dolen

P.O.: D927378 (C-Release#4816245 L4)

Sampled By:

Acct code:

Company:

Method of Analysis				
Method Name	Reference	Method	Date Analysis Started	Location
1:5 Water Soluble Extraction	APHA	* Colorimetric Method, 3500-Cr B	17-Nov-16	Exova Edmonton
1:5 Water Soluble Extraction	McKeague	<ul> <li>Soluble Salts in Extracts of 1:5 Soil:Water Mixtures, 3.23</li> </ul>	17-Nov-16	Exova Edmonton
Metals ICP (Hot Block) in soil	EPA	<ul> <li>* Sample Preparation Procedure for Spectrochemical Determination of Total Recoverable Elements, October 1999, 200.2</li> </ul>	17-Nov-16	Exova Edmonton
Metals ICP (Hot Block) in soil	US EPA	<ul> <li>Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8</li> </ul>	17-Nov-16	Exova Edmonton
PAH - Sediment	AESRD	Index of Additive Cancer Risk (IACR), PAHs	20-Nov-16	Exova Calgary
PAH - Sediment	US EPA	<ul> <li>Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry, 8270</li> </ul>	20-Nov-16	Exova Calgary
Saturated Paste in General Soil	Carter	<ul> <li>* Electrical Conductivity and Soluble Ions, Chapter 15</li> </ul>	17-Nov-16	Exova Edmonton
		+ D (		

<sup>\*</sup> Reference Method Modified

#### References

**AESRD** Alberta Tier 1 Soil and Groundwater Remediation Guidelines APHA Standard Methods for the Examination of Water and Wastewater

Carter Soil Sampling and Methods of Analysis.

**EPA** Environmental Protection Agency Test Methods - US Manual on Soil Sampling and Methods of Analysis McKeague **US EPA** US Environmental Protection Agency Test Methods

#### Comments:

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Project ID:	506.32		Atten	tions	Tami Dolen	an l	Attention:				_/						Online	SPIGEC
Project Name:	Kosable k	MP	Phon	e:	780 717 7	156	Phone:				/						Fax	BCCSR
Project Location:			Cell:				Cell:			/	H						PDF	Other (list below)
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SEDI6-01	Silty	Sand	0.0	10	NOV15,2016	Soil	Grab	3	/		1					П		Indicate any samples the were not packaged well
56016-02 56016-03			++			+		3	4	И		+				$\vdash$		were not packaged with
257			-					3	~	V		+		_	-	$\vdash$		<ol><li>Indicate any samples no received in Exova supplies</li></ol>
SEDILOY		_	N.		0	+-		3	V	7	7	+	$\vdash$	-	-	$\vdash$		received in Exova supplie
SED 1605	-	X-	14	4	110			3		7	1	+	-	-	+	$\vdash$		<ol><li>Indicate any samples to were not clearly labeled</li></ol>
SEDIOOG			V	W	¥	A.	W.	3	V	V	7	-	-		+	$\vdash$	_	
			-			-		+		-		+	-		-	$\vdash$		<ol> <li>Indicate any samples received within the requirements.</li> </ol>
			-			-		-		-		-			-	$\vdash$		hold time or temp.
			-				-	+		-	-	+				$\vdash$	-	<ol><li>Indicate any missing or extra samples</li></ol>
							-	╀				-	-		-	$\vdash$	- 2	extra samples
			+	-				-		-					-	Н		<ol> <li>Indicate any samples t were received broken</li> </ol>
			-			+		+	- 1			+			-			
										+		+				H		<ol> <li>Indicate any samples where sufficient volume v</li> </ol>
										-		-			-	$\vdash$		not received 8. Indicate any samples
bmission of this fo					nd Terms	7 994	105000	200	- 1				Sh	ipping	:	CO	D Y/ N	received in an inappropris
d Conditions (http	o://www.exova.c	om/about/terms	-and-cond	litions/)	L		72582 <sup>©</sup>						-	nd size		olers		71176
ease indicate an	y potentially h	azardous samp	oles										Ter	np. rec	1	-	Delivery Met	hod: Herno
ge	of	0	- L	nn	50587	11111111		1 11			5 215			1	4		Waybill:	011

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#### **Report Transmission Cover Page**

Bill To: City of Edmonton

Project:

Lot ID: 1211131

11004 - 190th Street

ID:

Control Number: C0069979

Edmonton, AB, Canada

Rossdale RMP n: 9469 Rossdale Rd Date Received: Jun 28, 2017

T5S 0G9

Location: LSD: P.O.:

Name:

Date Reported: Jul 7, 2017

Sampled By: Da;e Durham

Attn: Tami Dolen

D927378 C#4816245

Report Number: 2202024

Company: City of Edmonton

Line 3

Acct code: 21195

Contact & Affiliation	Address	Delivery Commitments
Tami Dolen	11004 - 190th Street	On [Lot Verification] send
City of Edm - Finance Dept.	Edmonton, Alberta T5S 0G9	(COA, COC) by Email - Multiple Reports By Agreement
	Phone: (780) 496-6782 Fax: null	On [Report Approval] send
	Email: tami.dolen@edmonton.ca	(Test Report) by Email - Single Report
		On [Report Approval] send
		(COC, Test Report) by Email - Merge Reports
		On [Lot Approval and Final Test Report Approval] send
		(Invoice) by Email - Single Report

#### **Notes To Clients:**

• Some ICP-MS total metal results were less than dissolved metal results for sample(s) 1211131-1 to 3. Total metals were analyzed from the metals bottle and dissolved from the field filtered bottle. Results were verified.

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## **Analytical Report**

Bill To: City of Edmonton

Project: ID:

Lot ID: 1211131

11004 - 190th Street Edmonton, AB, Canada

Rossdale RMP Name:

9469 Rossdale Rd

D927378 C#4816245

Control Number: C0069979 Date Received: Jun 28, 2017

T5S 0G9 Attn: Tami Dolen Location: LSD:

Date Reported: Jul 7, 2017

Sampled By: Da;e Durham

P.O.:

Report Number: 2202024

Company: City of Edmonton

Line 3

21195 Acct code:

**Reference Number** 1211131-1 Sample Date Jun 28, 2017 Sample Time NA

1211131-2 Jun 28, 2017

1211131-3 Jun 28, 2017

**Sample Location** 

NA

NA

		Sample Description	16-06 / 14.5°C	16-07 / 14.5°C	16-08 / 14.5°C	
		Matrix	Water	Water	Water	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Metals Dissolved						Limit
Silicon	Dissolved	mg/L	7.20	5.82	6.12	0.05
Sulfur	Dissolved	mg/L	40.7	47.5	37.2	0.3
Mercury	Dissolved	mg/L	<0.00005	<0.00005	< 0.000005	0.000005
Aluminum	Dissolved	mg/L	0.026	<0.002	0.007	0.002
Antimony	Dissolved	mg/L	< 0.0002	<0.0002	< 0.0002	0.0002
Arsenic	Dissolved	mg/L	0.0002	< 0.0002	< 0.0002	0.0002
Barium	Dissolved	mg/L	0.088	0.078	0.248	0.001
Beryllium	Dissolved	mg/L	<0.0001	<0.0001	<0.0001	0.0001
Bismuth	Dissolved	mg/L	< 0.0005	< 0.0005	< 0.0005	0.0005
Boron	Dissolved	mg/L	1.79	1.33	0.289	0.002
Cadmium	Dissolved	mg/L	0.00022	0.00018	0.00014	0.00001
Chromium	Dissolved	mg/L	< 0.0005	< 0.0005	< 0.0005	0.0005
Cobalt	Dissolved	mg/L	0.0002	0.0004	0.0008	0.0001
Copper	Dissolved	mg/L	0.003	0.002	0.002	0.001
Lead	Dissolved	mg/L	<0.0001	<0.0001	< 0.0001	0.0001
Lithium	Dissolved	mg/L	0.023	0.025	0.017	0.001
Molybdenum	Dissolved	mg/L	0.001	<0.001	<0.001	0.001
Nickel	Dissolved	mg/L	0.0081	0.0084	0.0070	0.0005
Selenium	Dissolved	mg/L	0.0004	0.0004	< 0.0002	0.0002
Silver	Dissolved	mg/L	< 0.00001	< 0.00001	< 0.00001	0.00001
Strontium	Dissolved	mg/L	1.10	1.22	1.16	0.001
Thallium	Dissolved	mg/L	0.00006	< 0.00005	< 0.00005	0.00005
Tin	Dissolved	mg/L	<0.001	<0.001	<0.001	0.001
Titanium	Dissolved	mg/L	0.0009	< 0.0005	< 0.0005	0.0005
Uranium	Dissolved	mg/L	0.0061	0.0065	0.0035	0.0005
Vanadium	Dissolved	mg/L	0.0002	<0.0001	< 0.0001	0.0001
Zinc	Dissolved	mg/L	0.008	0.006	0.005	0.001
Subsample	Field Filtered		Field Filtered	Field Filtered	Field Filtered	
Metals Total						
Aluminum	Total	mg/L	0.72	1.05	0.50	0.02
Calcium	Total	mg/L	175	189	183	0.2
Iron	Total	mg/L	1.01	2.59	1.02	0.05
Magnesium	Total	mg/L	47.0	49.6	43.7	0.2
Manganese	Total	mg/L	0.498	1.26	2.26	0.005
Potassium	Total	mg/L	9.7	4.7	3.3	0.4
Silicon	Total	mg/L	9.04	8.27	7.52	0.05

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#### **Analytical Report**

Bill To: City of Edmonton

11004 - 190th Street

Edmonton, AB, Canada

T5S 0G9 Attn: Tami Dolen

Sampled By: Da;e Durham

Company: City of Edmonton

Project:

ID: Name:

Rossdale RMP

Location: LSD:

P.O.:

9469 Rossdale Rd

D927378 C#4816245 Line 3

Acct code: 21195 Lot ID: 1211131

Control Number: C0069979 Date Received: Jun 28, 2017 Date Reported: Jul 7, 2017

Report Number: 2202024

**Reference Number** Sample Date Sample Time **Sample Location** 

**Sample Description** 

1211131-1 Jun 28, 2017 NA

16-06 / 14.5°C

1211131-2 Jun 28, 2017

16-07 / 14.5°C

1211131-3 Jun 28, 2017

NA

NA

16-08 / 14.5°C

		Matrix	Water	Water	Water	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Metals Total - Continued						
Sodium	Total	mg/L	47.6	41.2	36.4	0.4
Sulfur	Total	mg/L	43.3	48.7	39.6	0.3
Antimony	Total	mg/L	< 0.0002	< 0.0002	< 0.0002	0.0002
Arsenic	Total	mg/L	0.0006	0.0009	0.0003	0.0002
Barium	Total	mg/L	0.114	0.117	0.265	0.001
Beryllium	Total	mg/L	< 0.0001	< 0.0001	< 0.0001	0.0001
Bismuth	Total	mg/L	< 0.0005	< 0.0005	< 0.0005	0.0005
Boron	Total	mg/L	1.86	1.36	0.309	0.002
Cadmium	Total	mg/L	0.00048	0.00022	0.00023	0.00001
Chromium	Total	mg/L	0.0011	0.0025	0.0008	0.0005
Cobalt	Total	mg/L	0.0008	0.0016	0.0012	0.0001
Copper	Total	mg/L	0.004	0.003	0.002	0.001
Lead	Total	mg/L	0.0018	0.0012	0.0006	0.0001
Lithium	Total	mg/L	0.024	0.026	0.019	0.001
Molybdenum	Total	mg/L	0.001	<0.001	< 0.001	0.001
Nickel	Total	mg/L	0.0049	0.0067	0.0040	0.0005
Selenium	Total	mg/L	0.0003	0.0004	< 0.0002	0.0002
Silver	Total	mg/L	<0.00001	0.00001	0.00001	0.00001
Strontium	Total	mg/L	1.05	1.17	1.12	0.001
Thallium	Total	mg/L	0.00009	0.00007	0.00005	0.00005
Tin	Total	mg/L	<0.001	<0.001	< 0.001	0.001
Titanium	Total	mg/L	0.0199	0.0370	0.0094	0.0005
Uranium	Total	mg/L	0.0072	0.0077	0.0041	0.0005
Vanadium	Total	mg/L	0.0018	0.0036	0.0014	0.0001
Zinc	Total	mg/L	0.011	0.010	0.007	0.001
Zirconium	Total	mg/L	<0.001	<0.001	< 0.001	0.001
Routine Water						
pН			7.71	7.56	7.57	
Temperature of observed pH	I	°C	22.2	22.4	22.5	
Electrical Conductivity	at 25 °C	μS/cm	1250	1260	1200	1
Calcium	Dissolved	mg/L	166	177	174	0.2
Magnesium	Dissolved	mg/L	46.0	47.5	42.7	0.2
Sodium	Dissolved	mg/L	45.0	39.3	34.3	0.4
Potassium	Dissolved	mg/L	9.1	4.4	3.0	0.4
Iron	Dissolved	mg/L	0.04	0.02	0.01	0.01

#### **Analytical Report**

Bill To: City of Edmonton

Project: ID:

Lot ID: 1211131

11004 - 190th Street Edmonton, AB, Canada

Rossdale RMP Name:

9469 Rossdale Rd

Control Number: C0069979 Date Received: Jun 28, 2017

T5S 0G9

Location:

Date Reported: Jul 7, 2017

Attn: Tami Dolen

LSD: P.O.: Report Number: 2202024

Sampled By: Da;e Durham

D927378 C#4816245

Company: City of Edmonton

Acct code:

Line 3 21195

**Reference Number** Sample Date **Sample Location** 

1211131-1 Jun 28, 2017

1211131-2 Jun 28, 2017

1211131-3 Jun 28, 2017

Sample Time

NA

NA

NA

		Sample Description	16-06 / 14.5°C	16-07 / 14.5°C	16-08 / 14.5°C	
		Matrix	Water	Water	Water	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Routine Water - Continue	ed					
Manganese	Dissolved	mg/L	0.354	1.05	2.09	0.005
Chloride	Dissolved	mg/L	41.0	37.1	60.8	0.4
Nitrate - N		mg/L	2.46	10.4	2.92	0.01
Nitrite - N		mg/L	0.007	0.010	0.028	0.005
Nitrate and Nitrite - N		mg/L	2.47	10.4	2.95	0.01
Sulfate (SO4)	Dissolved	mg/L	122	143	112	0.9
Hydroxide		mg/L	<5	<5	<5	
Carbonate		mg/L	<6	<6	<6	
Bicarbonate		mg/L	639	585	582	
P-Alkalinity	as CaCO3	mg/L	<5.0	<5.0	<5.0	5
T-Alkalinity	as CaCO3	mg/L	525	480	477	5
Total Dissolved Solids	Calculated	mg/L	744	736	713	1
Hardness	Dissolved as CaCO3	mg/L	603	638	610	
Ionic Balance	Dissolved	%	99	102	100	
Polycyclic Aromatic Hyd	rocarbons - Water					
Naphthalene		μg/L	<0.1	<0.1	<0.1	0.1
Quinoline		μg/L	<0.3	<0.3	<0.3	0.3
Acenaphthylene		μg/L	<0.1	<0.1	<0.1	0.1
Acenaphthene		μg/L	<0.1	<0.1	<0.1	0.1
Fluorene		μg/L	<0.1	<0.1	<0.1	0.1
Phenanthrene		μg/L	<0.1	<0.1	<0.1	0.1
Acridine		μg/L	<0.1	<0.1	<0.1	0.1
Anthracene		μg/L	0.009	< 0.005	< 0.005	0.005
Fluoranthene		μg/L	0.02	<0.01	<0.01	0.01
Pyrene		μg/L	0.02	<0.01	<0.01	0.01
Benzo(a)anthracene		μg/L	0.01	<0.01	<0.01	0.01
Chrysene		μg/L	<0.1	<0.1	<0.1	0.1
Benzo(b)fluoranthene		μg/L	<0.1	<0.1	<0.1	0.1
Benzo(b+j)fluoranthene		μg/L	<0.1	<0.1	<0.1	0.1
Benzo(k)fluoranthene		μg/L	<0.1	<0.1	<0.1	0.1
Benzo(a)pyrene		μg/L	0.014	< 0.008	<0.008	0.008
Indeno(1,2,3-c,d)pyrene		μg/L	< 0.05	< 0.05	< 0.05	0.05
Dibenzo(a,h)anthracene		μg/L	< 0.05	< 0.05	< 0.05	0.05
Benzo(g,h,i)perylene		μg/L	< 0.05	< 0.05	< 0.05	0.05
CB(a)P	Total Potency Equivalents	μg/L	0.02	<0.01	<0.01	0.01

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#### **Analytical Report**

Bill To: City of Edmonton

11004 - 190th Street

Edmonton, AB, Canada

T5S 0G9

Attn: Tami Dolen Sampled By: Da;e Durham

Company: City of Edmonton

Project:

ID:

P.O.:

Rossdale RMP Name:

Location: LSD:

9469 Rossdale Rd

D927378 C#4816245

Line 3 Acct code: 21195 Lot ID: 1211131

Control Number: C0069979 Date Received: Jun 28, 2017

Jul 7, 2017 Date Reported:

Report Number: 2202024

**Reference Number** 1211131-1 1211131-2 1211131-3 Sample Date Jun 28, 2017 Jun 28, 2017 Jun 28, 2017 Sample Time NA NA NA

**Sample Location Sample Description** 16-06 / 14.5°C

16-07 / 14.5°C

16-08 / 14.5°C

		Matrix	Water	Water	Water	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
PAH - Water - Surroga	te Recovery					
Nitrobenzene-d5	PAH - Surrogate	%	108	101	109	50-140
2-Fluorobiphenyl	PAH - Surrogate	%	84	82	87	50-140
p-Terphenyl-d14	PAH - Surrogate	%	90	87	93	50-140

Approved by:

Darlene Lintott, MSc Consulting Scientist

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## **Quality Control**

Bill To: City of Edmonton

11004 - 190th Street

Edmonton, AB, Canada

T5S 0G9 Attn: Tami Dolen

Sampled By: Da;e Durham

Company: City of Edmonton

Project: ID:

LSD:

P.O.:

Name: Rossdale RMP

Location: 9469 Rossdale Rd

D927378 C#4816245 Line 3

Acct code: 21195

Lot ID: 1211131

Control Number: C0069979

Date Received: Jun 28, 2017

Date Reported: Jul 7, 2017

Report Number: 2202024

Metals Dissolved						
Blanks	Units	Measured	Lower Limit	Upper Limit		Passed QC
Silicon	mg/L	0.0087	-0.04	0.05		yes
Sulfur	mg/L	-0.0079	-0.3	0.2		yes
Mercury	μg/L	-0.0002939	-0.038000	0.064000		yes
Aluminum	μg/L	0.370064	-2	2		yes
Antimony	μg/L	-0.0374078	-0.2	0.2		yes
Arsenic	μg/L	-0.000669005	-0.2	0.2		yes
Barium	μg/L	0.0186776	-1	1		yes
Beryllium	μg/L	-0.00287629	-0.0	0.1		yes
Bismuth	μg/L	-0.0304948	-1.5	1.5		yes
Boron	μg/L	1.25688	-2	2		yes
Cadmium	μg/L	0.00166886	-0.01	0.01		yes
Chromium	μg/L	-0.00172112	-0.3	0.3		yes
Cobalt	μg/L	0.0266511	-0.1	0.1		yes
Copper	μg/L	0.171869	-1	1		yes
Lead	μg/L	0.00308971	-0.1	0.1		yes
Lithium	μg/L	0.111217	-1	1		yes
Molybdenum	μg/L	-0.1138	-1	1		yes
Nickel	μg/L	0.0130044	-0.5	0.5		yes
Selenium	μg/L	-0.000121049	-0.2	0.2		yes
Silver	μg/L	0.0232901	-0.10	0.10		yes
Strontium	μg/L	0.0101963	-1	1		yes
Thallium	μg/L	-0.000306791	-0.05	0.05		yes
Tin	μg/L	-0.0442404	-1	1		yes
Titanium	μg/L	0.00719536	-0.5	0.5		yes
Uranium	μg/L	-0.00201195	-0.5	0.5		yes
Vanadium	μg/L	-0.00111297	-0.1	0.1		yes
Zinc	μg/L	0.0824789	-0	2		yes
Date Acquired: June 2	9, 2017					
Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Sulfur	mg/L	791	802	10	0.1	yes
Mercury	mg/L	< 0.000005	< 0.000005	10	0.000030	yes
Date Acquired: June 3	0, 2017					
Control Sample	Units	Measured	Lower Limit	Upper Limit		Passed QC
Mercury	mg/L	0.000431	0.000310	0.000490		yes
Aluminum	μg/L	981	938	1092		yes
Antimony	μg/L	37.5	35.2	43.0		yes
Arsenic	μg/L	41.9	36.7	43.3		yes
Barium	μg/L	198	191	214		yes
Beryllium	μg/L	19.2	17.3	22.1		yes
Bismuth	μg/L	99.6	98.5	113.5		yes
Boron	μg/L	390	344	434		yes
Cadmium	μg/L	2.13	1.86	2.25		yes

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## **Quality Control**

Bill To: City of Edmonton

11004 - 190th Street

Edmonton, AB, Canada

T5S 0G9 Attn: Tami Dolen

Sampled By: Da;e Durham

Company: City of Edmonton

Project: ID:

P.O.:

Name: Rossdale RMP

Location: LSD:

9469 Rossdale Rd

D927378 C#4816245

Line 3 Acct code: 21195 Lot ID: 1211131

Control Number: C0069979
Date Received: Jun 28, 2017
Date Reported: Jul 7, 2017

Metals Dissolved					
Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed Q0
Chromium	μg/L	104	92.2	110.2	ye
Cobalt	μg/L	20.8	18.0	21.1	ye
Copper	μg/L	207	189	214	ye
Lead	μg/L	18.9	18.4	22.0	ye
Lithium	μg/L	186	175	223	ye
Molybdenum	μg/L	210	187	226	ye
Nickel	μg/L	103	94.3	106.5	ye
Selenium	μg/L	38.2	35.8	43.0	ye
Silver	μg/L	18.9	18.40	22.00	ye
Strontium	μg/L	204	180	216	ye
Thallium	μg/L	9.72	9.30	11.10	ye
Tin	μg/L	201	180	220	ye
Titanium	μg/L	103	92.4	110.4	ye
Uranium	μg/L	95.1	92.7	107.5	ye
Vanadium	μg/L	20.8	18.0	22.0	ye
Zinc	μg/L	210	183	219	ye
Date Acquired:	June 29, 2017				
Mercury	mg/L	0.000105	0.000091	0.000109	ye
Date Acquired:	June 30, 2017				
Mercury	mg/L	0.000021	0.000015	0.000025	ye
Aluminum	μg/L	53	45	55	ye
Antimony	μg/L	1.9	1.8	2.3	ye
Arsenic	μg/L	2.2	1.8	2.2	ye
Barium	μg/L	10	9	11	ye
Beryllium	μg/L	1.0	0.9	1.1	ye
Bismuth	μg/L	4.6	4.1	5.5	ye
Boron	μg/L	21	18	22	ye
Cadmium	μg/L	0.10	0.09	0.11	ye
Chromium	μg/L	5.4	4.5	5.5	ye
Cobalt	μg/L	1.1	0.9	1.1	ye
Copper	μg/L	11	9	11	ye
Lead	μg/L	1.0	0.9	1.1	ye
Lithium	μg/L	10	9	11	ye
Molybdenum	μg/L	10	9	10	ye
Nickel	μg/L	5.3	4.4	5.5	ye
Selenium	μg/L	1.9	1.7	2.2	ye
Silver	μg/L	0.94	0.84	1.08	ye
Strontium	μg/L	10	9	11	ye:
Thallium	μg/L	0.49	0.47	0.56	ye
Tin	μg/L	10	9	11	ye
Titanium	μg/L	5.3	4.5	5.5	ye:
Uranium	μg/L	4.7	4.5	5.5	ye:

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## **Quality Control**

Bill To: City of Edmonton

T5S 0G9

Attn: Tami Dolen

Edmonton, AB, Canada

11004 - 190th Street

ID: Rossdale RMP

Name: Location:

Project:

9469 Rossdale Rd LSD:

Sampled By: Da;e Durham P.O.: D927378 C#4816245

Line 3 Company: City of Edmonton Acct code: 21195 Control Number: C0069979 Date Received: Jun 28, 2017 Date Reported: Jul 7, 2017 Report Number: 2202024

Lot ID: 1211131

Metals Dissolved	d - Continued				
Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Vanadium	μg/L	1.0	0.9	1.1	yes
Zinc	μg/L	11	9	11	yes
Date Acquired:	June 29, 2017				
Silicon	mg/L	9.72	8.98	10.78	yes
Sulfur	mg/L	154	138.5	155.3	yes
Date Acquired:	June 29, 2017				
Silicon	mg/L	2.03	1.88	2.24	yes
Sulfur	mg/L	10.3	9.2	11.0	yes
Date Acquired:	June 29, 2017				
Silicon	mg/L	0.21	0.18	0.22	yes
Sulfur	mg/L	3.1	2.7	3.2	yes
Date Acquired:	June 29, 2017				

#### M

Metals Total					
Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	mg/L	-0.0003	-0.01	0.02	yes
Calcium	mg/L	0.0041	-0.1	0.1	yes
Iron	mg/L	0.0034	-0.01	0.02	yes
Magnesium	mg/L	-0.0059	-0.04	0.04	yes
Manganese	mg/L	-0.0001	-0.003	0.003	yes
Potassium	mg/L	0.0541	-0.1	0.2	yes
Silicon	mg/L	0.0019	-0.03	0.04	yes
Sodium	mg/L	0.1518	-0.1	0.2	yes
Sulfur	mg/L	-0.0066	-0.1	0.2	yes
Antimony	μg/L	-0.000944605	-0.2	0.2	yes
Arsenic	μg/L	0.00111674	-0.2	0.2	yes
Barium	μg/L	0.0755408	-1	1	yes
Beryllium	μg/L	0.00735893	-0.1	0.1	yes
Bismuth	μg/L	0.00831525	-0.5	0.5	yes
Boron	μg/L	0.934706	-1	3	yes
Cadmium	μg/L	-0.00246864	-0.007	0.012	yes
Chromium	μg/L	0.0431897	-0.7	0.3	yes
Cobalt	μg/L	0.00104545	-0.1	0.1	yes
Copper	μg/L	0.244594	-1	1	yes
Lead	μg/L	0.00907442	-0.1	0.1	yes
Lithium	μg/L	0.141414	-1	1	yes
Molybdenum	μg/L	0.0723408	-1	1	yes
Nickel	μg/L	0.0899349	-0.5	0.5	yes
Selenium	μg/L	0.00549299	-0.2	0.2	yes
Silver	μg/L	-0.00224465	-0.02	0.10	yes
Strontium	μg/L	0.0610237	-1	1	yes

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## **Quality Control**

Bill To: City of Edmonton

11004 - 190th Street ID:

Edmonton, AB, Canada Name: R T5S 0G9 Location: 9

Attn: Tami Dolen LSD:

Sampled By: Da;e Durham

Company: City of Edmonton

Project:

P.O.:

Name: Rossdale RMP

Location: 9469 Rossdale Rd

D927378 C#4816245

Line 3 Acct code: 21195 Lot ID: 1211131

Control Number: C0069979
Date Received: Jun 28, 2017
Date Reported: Jul 7, 2017

Metals Total - Continue Blanks	Units	Measured	Lower Limit	Upper Limit		Passed QC
Thallium	μg/L	0.00379659	-0.05	0.05		yes
Tin	μg/L	0.0240731	-1	1		yes
Titanium	μg/L	0.126644	-0.5	0.5		yes
Uranium	μg/L	0.00219358	-0.5	0.5		yes
Vanadium	μg/L	0.0213877	-0.1	0.1		ye
Zinc	μg/L	0.917124	-0	1		ye
Zirconium	μg/L	0.0062674	-1	1		ye
Date Acquired: June 29						·
Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Aluminum	mg/L	0.21	0.21	15	0.03	yes
Calcium	mg/L	55.7	55.8	15	0.6	yes
Iron	mg/L	1.77	1.75	15	0.20	yes
Magnesium	mg/L	19.0	19.0	15	0.40	yes
Manganese	mg/L	0.169	0.168	15	0.010	yes
Potassium	mg/L	71.3	71.0	15	1.2	yes
Silicon	mg/L	4.73	4.71	15	0.10	yes
Sodium	mg/L	189	189	15	1.2	yes
Sulfur	mg/L	72.2	72.6	15	0.1	yes
Antimony	μg/L	<0.2	<0.2	15	0.4	yes
Arsenic	μg/L	0.9	0.7	15	0.4	yes
Barium	μg/L	117	110	15	2	ye
Beryllium	μg/L	<0.1	<0.1	15	0.2	ye
Bismuth	μg/L	<0.5	<0.5	15	1.1	ye
Boron	μg/L	1360	1350	15	4	ye
Cadmium	μg/L	0.22	0.20	15	0.022	ye
Chromium	μg/L	2.5	2.1	15	1.1	yes
Cobalt	μg/L	1.6	1.5	15	0.2	yes
Copper	μg/L	3	2	15	2	yes
Lead	μg/L	1.2	1.1	15	0.2	ye
Lithium	μg/L	26	26	15	2	ye
Molybdenum	μg/L	<1	<1	15	2	yes
Nickel	μg/L	6.7	6.2	15	1.1	yes
Selenium	μg/L	0.4	0.4	15	0.4	yes
Silver	μg/L	0.01	0.01	15	0.22	yes
Strontium	μg/L	1170	1140	15	2	yes
Thallium	μg/L	0.07	0.07	15	0.11	yes
Tin	μg/L	<1	<1	15	2	yes
Titanium	μg/L	37.0	32.8	15	1.1	ye
Uranium	μg/L	7.7	7.6	15	1.1	ye
Vanadium	μg/L	3.6	3.5	15	0.2	ye
Zinc	μg/L	10	11	15	2	yes
Zirconium	μg/L	<1	1	15	2	yes

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## **Quality Control**

Bill To: City of Edmonton

11004 - 190th Street

Edmonton, AB, Canada

T5S 0G9 Attn: Tami Dolen

Sampled By: Da;e Durham

Company: City of Edmonton

Project: ID:

Name: Rossdale RMP

Location: 9469 Rossdale Rd LSD:

P.O.: D927378 C#4816245

Line 3

Acct code: 21195

Lot ID: 1211131

Control Number: C0069979

Date Received: Jun 28, 2017

Date Reported: Jul 7, 2017

Client Sample Rep	olicates Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria Pas	ssed Q(
Date Acquired:	June 29, 2017					
Control Sample	Units	Measured	Lower Limit	<b>Upper Limit</b>	Pas	ssed Q(
Aluminum	mg/L	4.08	3.61	4.45		ye
Calcium	mg/L	53.2	47.9	57.9		ye
Iron	mg/L	2.11	1.91	2.27		ye
Magnesium	mg/L	19.8	18.14	22.14		ye
Manganese	mg/L	0.525	0.472	0.568		ye
Potassium	mg/L	53.3	46.8	56.8		ye
Silicon	mg/L	2.11	1.90	2.30		ye
Sodium	mg/L	53.6	47.6	57.6		ye
Sulfur	mg/L	10.4	9.2	11.2		ye
Antimony	μg/L	12.3	10.8	13.2		ye
Arsenic	μg/L	12.4	11.3	12.9		ye
Barium	μg/L	61	54	68		ye
Beryllium	μg/L	6.1	4.9	6.8		ye
Bismuth	μg/L	31.5	26.2	35.8		ye
Boron	μg/L	127	102	139		ye
Cadmium	μg/L	0.65	0.567	0.687		ye
Chromium	μg/L	31.3	26.5	33.7		ye
Cobalt	μg/L	6.2	5.2	6.8		ye
Copper	μg/L	63	53	67		ye
Lead	μg/L	6.4	5.2	7.1		ye
Lithium	μg/L	65	53	77		ye
Molybdenum	μg/L	62	56	66		ye
Nickel	μg/L	31.9	28.9	33.1		ye
Selenium	μg/L	12.8	9.9	13.5		ye
Silver	μg/L	6.40	5.39	7.13		ye
Strontium	μg/L	62	54	69		ye
Thallium	μg/L	3.27	2.81	3.89		ye
Tin	μg/L	65	56	66		ye
Titanium	μg/L	31.2	26.6	35.7		ye
Uranium	μg/L	31.4	25.7	36.3		ye
Vanadium	μg/L	6.2	5.1	7.2		ye
Zinc	μg/L	66	53	67		ye
Zirconium	μg/L	63	53	67		ye
Date Acquired:	June 29, 2017	00	00	O1		yo
		40.0	27.5	40.4		
Antimony	μg/L /	40.6	37.5	43.1		ye
Arsenic	μg/L	40.3	36.5	43.5		ye
Barium	μg/L	199	186	216		ye
Beryllium	μg/L "	18.9	17.1	21.9		ye
Bismuth	μg/L "	98.1	91.3	106.3		ye
Boron	μg/L	380	343	436		ye

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## **Quality Control**

Bill To: City of Edmonton

T5S 0G9

11004 - 190th Street

ID:

Project:

Lot ID: 1211131

Edmonton, AB, Canada

Rossdale RMP Name: Location: 9469 Rossdale Rd Control Number: C0069979 Jun 28, 2017 Date Received: Date Reported: Jul 7, 2017

Report Number: 2202024

Attn: Tami Dolen

LSD: P.O.:

D927378 C#4816245

Sampled By: Da;e Durham Company: City of Edmonton

Line 3

Acct code: 21195

Metals Total - Co	ontinued				
Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Cadmium	μg/L	2.06	1.915	2.205	yes
Chromium	μg/L	101	90.0	110.0	yes
Cobalt	μg/L	20.4	18.1	21.7	yes
Copper	μg/L	202	189	214	yes
Lead	μg/L	20.5	18.0	24.0	yes
Lithium	μg/L	191	173	222	yes
Molybdenum	μg/L	198	189	225	yes
Nickel	μg/L	101	90.0	110.0	yes
Selenium	μg/L	42.0	37.2	43.6	yes
Silver	μg/L	20.4	18.00	22.00	yes
Strontium	μg/L	199	171	231	yes
Thallium	μg/L	9.78	9.16	10.96	yes
Tin	μg/L	203	190	218	yes
Titanium	μg/L	104	93.2	107.0	yes
Uranium	μg/L	99.0	90.2	109.0	yes
Vanadium	μg/L	20.0	16.9	22.1	yes
Zinc	μg/L	203	183	218	yes
Date Acquired:	June 29, 2017				
Antimony	μg/L	12.0	10.8	13.2	yes
Arsenic	μg/L	12.6	10.8	13.2	yes
Barium	μg/L	60	55	67	yes
Beryllium	μg/L	5.8	5.2	6.5	yes
Bismuth	μg/L	30.1	27.5	33.5	yes
Boron	μg/L	118	108	132	yes
Cadmium	μg/L	0.64	0.560	0.692	yes
Chromium	μg/L	31.0	27.0	33.0	yes
Cobalt	μg/L	6.2	5.4	6.6	yes
Copper	μg/L	63	54	66	yes
Lead	μg/L	6.3	5.4	6.6	yes
Lithium	μg/L	59	53	66	yes
Molybdenum	μg/L	60	54	66	yes
Nickel	μg/L	31.3	27.0	33.0	yes
Selenium	μg/L	12.2	10.3	13.4	yes
Silver	μg/L	6.24	5.40	6.60	yes
Strontium	μg/L	61	54	66	yes
Thallium	μg/L	3.06	0.00	6.00	yes
Tin	μg/L	62	54	66	yes
Titanium	μg/L	31.7	27.0	33.0	yes
Uranium	μg/L	30.7	27.0	33.0	yes
Vanadium	μg/L	6.2	5.4	6.6	yes
Zinc	μg/L	63	57	66	yes
Zirconium	μg/L	62	54	66	yes

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## **Quality Control**

Bill To: City of Edmonton

11004 - 190th Street

Edmonton, AB, Canada

T5S 0G9 Attn: Tami Dolen

Sampled By: Da;e Durham

Company: City of Edmonton

Project:

ID: Name: Rossdale RMP

Location: 9469 Rossdale Rd

LSD: P.O.:

D927378 C#4816245

Line 3

Acct code: 21195

Lot ID: 1211131
Control Number: C0069979
Date Received: Jun 28, 2017
Date Reported: Jul 7, 2017

Metals Total - Co	ontinued				
Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Date Acquired:	June 29, 2017				
Antimony	μg/L	2.0	1.8	2.2	yes
Arsenic	μg/L	2.0	1.7	2.2	yes
Barium	μg/L	10	9	11	yes
Beryllium	μg/L	1.0	0.8	1.1	yes
Bismuth	μg/L	5.0	4.8	5.7	yes
Boron	μg/L	20	17	23	yes
Cadmium	μg/L	0.11	0.089	0.113	yes
Chromium	μg/L	5.1	4.6	5.4	yes
Cobalt	μg/L	1.0	0.9	1.1	yes
Copper	μg/L	10	9	11	yes
Lead	μg/L	1.0	0.9	1.1	yes
Lithium	μg/L	10	9	11	yes
Molybdenum	μg/L	10	9	11	yes
Nickel	μg/L	5.0	4.5	5.5	yes
Selenium	μg/L	2.0	1.6	2.2	yes
Silver	μg/L	1.04	0.89	1.13	yes
Strontium	μg/L	10	9	11	yes
Thallium	μg/L	0.50	0.47	0.57	yes
Tin	μg/L	10	9	11	yes
Titanium	μg/L	4.9	4.2	5.7	yes
Uranium	μg/L	5.0	4.7	5.6	yes
Vanadium	μg/L	1.0	0.9	1.2	yes
Zinc	μg/L	10	9	11	yes
Zirconium	μg/L	11	9	11	yes
Date Acquired:	June 29, 2017				
Aluminum	mg/L	19.7	18.80	20.60	yes
Calcium	mg/L	249	236.0	263.6	yes
Iron	mg/L	9.72	9.16	10.24	yes
Magnesium	mg/L	97.5	92.78	104.72	yes
Manganese	mg/L	2.43	2.290	2.590	yes
Potassium	mg/L	255	234.2	261.8	yes
Silicon	mg/L	10.1	9.13	10.93	yes
Sodium	mg/L	254	228.8	269.4	yes
Sulfur	mg/L	152	135.5	165.3	yes
Date Acquired:	June 29, 2017				
Aluminum	mg/L	4.01	3.49	4.47	yes
Calcium	mg/L	51.6	46.5	56.5	yes
Iron	mg/L	2.06	1.87	2.27	yes
Magnesium	mg/L	19.8	18.05	22.07	yes
Manganese	mg/L	0.518	0.466	0.568	yes

#### **Quality Control**

Bill To: City of Edmonton Pr

11004 - 190th Street ID:

Edmonton, AB, Canada

T5S 0G9 Attn: Tami Dolen

Sampled By: Da;e Durham

Company: City of Edmonton

Project:

P.O.:

Name: Rossdale RMP

Location: 9469 Rossdale Rd LSD:

D927378 C#4816245

Line 3

Acct code: 21195

Lot ID: 1211131

Control Number: C0069979

Date Received: Jun 28, 2017

Date Reported: Jul 7, 2017

Report Number: 2202024

Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
Potassium	mg/L	52.0	45.4	55.5	yes
Silicon	mg/L	2.08	1.93	2.24	yes
Sodium	mg/L	52.2	45.9	55.9	yes
Sulfur	mg/L	10.2	9.3	11.3	yes
Date Acquired: Ju	ıne 29, 2017				
Aluminum	mg/L	0.41	0.36	0.44	yes
Calcium	mg/L	5.4	4.8	5.8	yes
Iron	mg/L	0.22	0.19	0.25	yes
Magnesium	mg/L	2.1	1.84	2.20	yes
Manganese	mg/L	0.055	0.047	0.059	yes
Potassium	mg/L	5.4	4.7	5.7	yes
Silicon	mg/L	0.21	0.17	0.23	yes
Sodium	mg/L	5.5	4.8	5.6	yes
Sulfur	mg/L	3.1	2.8	3.3	yes
Date Acquired: Ju	ıne 29, 2017				

#### PAH - Water - Surrogate Recovery

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Nitrobenzene-d5	%	113.61	23	130	yes
2-Fluorobiphenyl	%	75.97	30	130	yes
p-Terphenyl-d14	%	88.7	18	137	yes
Date Acquired:	July 06, 2017				

## Polycyclic Aromatic Hydrocarbons -

Water					
Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Naphthalene	ng/mL	0	-0.1	0.1	yes
Quinoline	ng/mL	0	-0.1	0.1	yes
Acenaphthylene	ng/mL	0	-0.1	0.1	yes
Acenaphthene	ng/mL	0	-0.1	0.1	yes
Fluorene	ng/mL	0	-0.1	0.1	yes
Phenanthrene	ng/mL	0	-0.1	0.1	yes
Acridine	ng/mL	0	-0.1	0.1	yes
Anthracene	ng/mL	0	-0.005	0.005	yes
Fluoranthene	ng/mL	0	-0.01	0.01	yes
Pyrene	ng/mL	0	-0.01	0.01	yes
Benzo(a)anthracene	ng/mL	0	-0.01	0.01	yes
Chrysene	ng/mL	0	-0.1	0.1	yes
Benzo(b)fluoranthene	ng/mL	0	-0.1	0.1	yes
Benzo(b+j)fluoranthene	ng/mL	0	-0.1	0.1	yes
Benzo(k)fluoranthene	ng/mL	0	-0.1	0.1	yes
Benzo(a)pyrene	ng/mL	0	-0.008	0.008	yes

0.002

yes

10

## **Quality Control**

Bill To: City of Edmonton Project:

> 11004 - 190th Street ID:

Edmonton, AB, Canada Name: T5S 0G9 Location:

LSD: Attn: Tami Dolen

Sampled By: Da;e Durham P.O.:

Line 3 Company: City of Edmonton

Acct code: 21195

Rossdale RMP

9469 Rossdale Rd

D927378 C#4816245

Lot ID: 1211131

Control Number: C0069979 Date Received: Jun 28, 2017 Date Reported: Jul 7, 2017

Report Number: 2202024

Polycy	clic Aromatic Hydrocarbons -	
14/0404	Continued	

Water - Continued Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Indeno(1,2,3-c,d)pyrene	ng/mL	0	-0.05	0.05	yes
Dibenzo(a,h)anthracene	ng/mL	0	-0.05	0.05	yes
Benzo(g,h,i)perylene	ng/mL	0	-0.05	0.05	yes
Date Acquired: July 06	, 2017				·
Calibration Check	Units	% Recovery	Lower Limit	Upper Limit	Passed QC
Naphthalene	ng/mL	102.40	80	120	yes
Quinoline	ng/mL	95.62	80	120	yes
Acenaphthylene	ng/mL	99.20	80	120	yes
Acenaphthene	ng/mL	97.40	80	120	yes
Fluorene	ng/mL	96.40	80	120	yes
Phenanthrene	ng/mL	90.20	80	120	yes
Acridine	ng/mL	113.60	80	120	yes
Anthracene	ng/mL	98.60	80	120	yes
Fluoranthene	ng/mL	102.00	80	120	yes
Pyrene	ng/mL	101.60	80	120	yes
Benzo(a)anthracene	ng/mL	103.80	80	120	yes
Chrysene	ng/mL	103.40	80	120	yes
Benzo(b)fluoranthene	ng/mL	101.00	80	120	yes
Benzo(b+j)fluoranthene	ng/mL	101.00	80	120	yes
Benzo(k)fluoranthene	ng/mL	103.20	80	120	yes
Benzo(a)pyrene	ng/mL	107.60	80	120	yes
Indeno(1,2,3-c,d)pyrene	ng/mL	91.00	80	120	yes
Dibenzo(a,h)anthracene	ng/mL	84.00	80	120	yes
Benzo(g,h,i)perylene	ng/mL	81.00	80	120	yes
Date Acquired: July 06	, 2017				

## **Routine Water**

**Electrical Conductivity** 

Units	Measured	Lower Limit	Upper Limit		Passed QC
mg/L	0.0048	-0.2	0.2		yes
mg/L	0.003	-0.1	0.1		yes
mg/L	-0.0376	-0.4	0.4		yes
mg/L	-0.08281	-0.4	0.4		yes
mg/L	0.0022	-0.01	0.01		yes
mg/L	0	-0.004	0.004		yes
mg/L	0.2	-0.4	0.4		yes
mg/L	0	-0.01	0.01		yes
mg/L	0	-0.005	0.005		yes
June 29, 2017					
icates Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
	7.57	7.54	0	0.10	yes
	mg/L mg/L mg/L mg/L mg/L mg/L mg/L mg/L	mg/L       0.0048         mg/L       0.003         mg/L       -0.0376         mg/L       -0.08281         mg/L       0.0022         mg/L       0         mg/L       0.2         mg/L       0         mg/L       0         mg/L       0         June 29, 2017       0         icates       Units       Replicate 1	mg/L       0.0048       -0.2         mg/L       0.003       -0.1         mg/L       -0.0376       -0.4         mg/L       -0.08281       -0.4         mg/L       0.0022       -0.01         mg/L       0       -0.004         mg/L       0.2       -0.4         mg/L       0       -0.01         mg/L       0       -0.01         mg/L       0       -0.005         June 29, 2017         icates       Units       Replicate 1       Replicate 2	mg/L         0.0048         -0.2         0.2           mg/L         0.003         -0.1         0.1           mg/L         -0.0376         -0.4         0.4           mg/L         -0.08281         -0.4         0.4           mg/L         0.0022         -0.01         0.01           mg/L         0         -0.004         0.004           mg/L         0.2         -0.4         0.4           mg/L         0         -0.01         0.01           mg/L         0         -0.05         0.005           June 29, 2017         2017         Replicate 1         Replicate 2         % RSD Criteria	mg/L         0.0048         -0.2         0.2           mg/L         0.003         -0.1         0.1           mg/L         -0.0376         -0.4         0.4           mg/L         -0.08281         -0.4         0.4           mg/L         0.0022         -0.01         0.01           mg/L         0         -0.004         0.004           mg/L         0.2         -0.4         0.4           mg/L         0         -0.01         0.01           mg/L         0         -0.01         0.01           mg/L         0         -0.005         0.005           June 29, 2017         2017         Replicate 1         Replicate 2         % RSD Criteria         Absolute Criteria

6.85

6.86

dS/m

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## **Quality Control**

Bill To: City of Edmonton

Project: 11004 - 190th Street ID:

Lot ID: 1211131

Edmonton, AB, Canada

Rossdale RMP 9469 Rossdale Rd

D927378 C#4816245

Control Number: C0069979 Date Received: Jun 28, 2017 Date Reported: Jul 7, 2017

T5S 0G9

LSD: Attn: Tami Dolen Sampled By: Da;e Durham P.O.:

Report Number: 2202024

Company: City of Edmonton

Line 3

Acct code: 21195

Name:

Location:

Routine Water - Contin	ued					
Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Calcium	mg/L	706	716	10	0.6	yes
Magnesium	mg/L	918	925	10	0.7	yes
Sodium	mg/L	1960	1980	10	1.2	yes
Potassium	mg/L	9.9	9.9	10	1.2	yes
Iron	mg/L	<0.1	<0.1	10	0.05	yes
Manganese	mg/L	<0.05	< 0.05	10	0.010	yes
Chloride	mg/L	60.8	60.2	10	0.5	yes
Nitrate - N	mg/L	<0.01	<0.01	10	0.01	yes
Nitrite - N	mg/L	<0.005	< 0.005	10	0.010	yes
Hydroxide	mg/L	<5	<5	10		yes
Carbonate	mg/L	<6	<6	10	6	yes
Bicarbonate	mg/L	293	294	10	6	yes
P-Alkalinity	mg/L	<5.0	<5.0	10	5.0	yes
T-Alkalinity	mg/L	241	242	10	5.0	yes
Date Acquired: June 29	9, 2017					
Control Sample	Units	Measured	Lower Limit	<b>Upper Limit</b>		Passed QC
рН		9.19	8.90	9.44		yes
Electrical Conductivity	dS/m	2.76	2.600	2.858		yes
Calcium	mg/L	245	230.0	260.0		yes
Magnesium	mg/L	97.5	92.3	102.0		yes
Sodium	mg/L	255	233.3	257.3		yes
Potassium	mg/L	253	233.0	263.0		yes
Iron	mg/L	9.87	8.91	10.20		yes
Manganese	mg/L	2.44	2.240	2.540		yes
Nitrate - N	mg/L	10.2	9.58	10.58		yes
Nitrite - N	mg/L	10.1	9.460	10.600		yes
Nitrate and Nitrite - N	mg/L	20.3	19.27	20.97		yes
P-Alkalinity	mg/L	519	441.0	591.0		yes
T-Alkalinity	mg/L	978	962.0	1034.0		yes
Date Acquired: June 29	9, 2017					
рН		6.87	6.78	6.96		yes
Electrical Conductivity	dS/m	0.078	0.071	0.085		yes
Calcium	mg/L	52.4	44.9	56.9		yes
Magnesium	mg/L	20.2	17.9	22.0		yes
Sodium	mg/L	53.0	47.7	55.5		yes
Potassium	mg/L	52.8	45.8	55.8		yes
Iron	mg/L	2.11	1.89	2.25		yes
Manganese	mg/L	0.525	0.468	0.552		yes
Chloride	mg/L	83.1	74.9	86.9		yes
Nitrate - N	mg/L	4.89	4.51	5.26		yes
Nitrite - N	mg/L	5.05	4.548	5.352		yes
Nitrate and Nitrite - N	mg/L	9.94	9.07	10.43		yes

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## **Quality Control**

Bill To: City of Edmonton

Project: ID:

Lot ID: 1211131

11004 - 190th Street Edmonton, AB, Canada

Rossdale RMP Name: Location: 9469 Rossdale Rd Control Number: C0069979 Date Received: Jun 28, 2017

T5S 0G9 Attn: Tami Dolen

LSD:

Date Reported: Jul 7, 2017 Report Number: 2202024

Sampled By: Da;e Durham

P.O.: Company: City of Edmonton

D927378 C#4816245 Line 3

Acct code: 21195

Routine Water - 0	Continued				
Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed QC
P-Alkalinity	mg/L	50.8	22.4	67.4	yes
T-Alkalinity	mg/L	120	115.0	139.0	yes
Date Acquired:	June 29, 2017				
Calcium	mg/L	5.4	4.6	5.7	yes
Magnesium	mg/L	2.0	1.8	2.2	yes
Sodium	mg/L	5.4	4.7	5.7	yes
Potassium	mg/L	5.3	4.5	5.5	yes
Iron	mg/L	0.22	0.19	0.24	yes
Manganese	mg/L	0.054	0.046	0.056	yes
Chloride	mg/L	14.6	13.3	16.5	yes
Nitrate - N	mg/L	0.50	0.43	0.58	yes
Nitrite - N	mg/L	0.503	0.453	0.567	yes
Nitrate and Nitrite	- N mg/L	1.00	0.92	1.10	yes
Date Acquired:	June 29, 2017				

#### **Methodology and Notes**

Bill To: City of Edmonton

Project: ID: Lot ID: 1211131

11004 - 190th Street Edmonton, AB, Canada

Rossdale RMP

D927378 C#4816245

Control Number: C0069979

Date Received: Jun 28, 2017

Jul 7, 2017

T5S 0G9 Attn: Tami Dolen Name: Location: LSD:

9469 Rossdale Rd Date Reported:

Sampled By: Da;e Durham

P.O.:

Report Number: 2202024

Company: City of Edmonton

Line 3

Acct code: 21195

Method Name	Reference	Method	Date Analysis Started	Location
Alkalinity, pH, and EC in water	APHA	* Alkalinity - Titration Method, 2320 B	29-Jun-17	Exova Edmonton
Alkalinity, pH, and EC in water	APHA	* Conductivity, 2510 B	29-Jun-17	Exova Edmonton
Alkalinity, pH, and EC in water	APHA	* pH - Electrometric Method, 4500-H+ B	29-Jun-17	Exova Edmonton
Anions (Routine) by Ion Chromatography	APHA	<ul> <li>* Ion Chromatography with Chemical Suppression of Eluent Cond., 4110 B</li> </ul>	29-Jun-17	Exova Edmonton
Approval-Edmonton	APHA	Checking Correctness of Analyses, 1030 E	29-Jun-17	Exova Edmonton
Chloride in Water	APHA	<ul> <li>* Automated Ferricyanide Method, 4500-CI-</li> <li>E</li> </ul>	29-Jun-17	Exova Edmonton
Mercury (Dissolved) in water	APHA	<ul> <li>Cold Vapour Atomic Absorption</li> <li>Spectrometric Method, 3112 B</li> </ul>	30-Jun-17	Exova Edmonton
Metals ICP-MS (Dissolved) in water	US EPA	<ul> <li>Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8</li> </ul>	29-Jun-17	Exova Edmonton
Metals ICP-MS (Total) in water	US EPA	<ul> <li>Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8</li> </ul>	29-Jun-17	Exova Edmonton
Metals Trace (Dissolved) in water	APHA	Hardness by Calculation, 2340 B	29-Jun-17	Exova Edmonton
Metals Trace (Dissolved) in water	APHA	<ul> <li>* Inductively Coupled Plasma (ICP) Method, 3120 B</li> </ul>	29-Jun-17	Exova Edmonton
Metals Trace (Total) in water	APHA	<ul> <li>* Inductively Coupled Plasma (ICP)</li> <li>Method, 3120 B</li> </ul>	29-Jun-17	Exova Edmonton
PAH - Water	AESRD	Carcinogenic PAHs Toxic Potency Equivalence (as B(a)P TPE), PAHw	06-Jul-17	Exova Calgary
PAH - Water	US EPA	<ul> <li>Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry, 8270</li> </ul>	06-Jul-17	Exova Calgary

<sup>\*</sup> Reference Method Modified

#### References

AESRD Alberta Tier 1 Soil and Groundwater Remediation Guidelines
APHA Standard Methods for the Examination of Water and Wastewater
APHA/USEPA Standard Methods For Water/ Environmental Protection Agency

#### US EPA US Environmental Protection Agency Test Methods

#### Comments:

• Some ICP-MS total metal results were less than dissolved metal results for sample(s) 1211131-1 to 3. Total metals were analyzed from the metals bottle and dissolved from the field filtered bottle. Results were verified.

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 W: www.exova com



## **Methodology and Notes**

Bill To: City of Edmonton Project

11004 - 190th Street Edmonton, AB, Canada

T5S 0G9

Attn: Tami Dolen

Sampled By: Da;e Durham

Company: City of Edmonton

Project: ID:

P.O.:

Name: Rossdale RMP

LSD:

Location: 9469 Rossdale Rd

D927378 C#4816245

Acct code: 21195

Lot ID: 1211131

Control Number: C0069979

Date Received: Jun 28, 2017

Date Reported: Jul 7, 2017

Report Number: 2202024

Please direct any inquiries regarding this report to our Client Services group.

Results relate only to samples as submitted.

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and the last	ct ID:		Attentions	Tami Do	en	Attention:						/	7	Online		SPIGEC	1
	ct Name:	Rossdale RMP	Phone:	Tami Do 780496	6282	Phone:				,	/		T	Fax		BCCSR	
	ct Location:	9469 RossdaleRo	Cell:	100-116	0.70-	Cell:				/				PDF	1	Other (list below)	
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#### Report Transmission Cover Page

Bill To: City of Edmonton

Project ID:

Lot ID: 1211801

11004 - 190th Street Edmonton, AB, Canada Project Name: Rossdale RMP 9469 Rossdale Rd. Project Location:

Control Number: C0096715 Date Received: Jun 30, 2017

T5S 0G9

LSD:

Attn: Tami Dolen

P.O.:

Date Reported: Oct 18, 2017

Sampled By: Dale Durham

4816245(L3)

D927378 C#

Company: City of Edmonton

Proj. Acct. code: 21195 Report Number: 2232401

Contact	Company	Address
Tami Dolen	City of Edmonton	11004 - 190th Street
		Edmonton, AB T5S 0G9
		Phone: (780) 496-6782 Fax:
		Email: tami.dolen@edmonton.ca
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Delivery	Format	Deliverables
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Email - Multiple Reports By Agreement	PDF	COC / COA
Email - Single Report	PDF	Invoice
Email - Single Report	Standard Crosstab	Test Report

#### Notes To Clients:

- Jul 10, 2017 -Some ICP-MS total metal results were less than dissolved metal results for sample(s) 1211801-2 and 3. Total metals were analyzed from the metals bottle and dissolved from the field filtered bottle. Results were verified.
- Jul 10, 2017 -Some ICP-MS total metal results were less than dissolved metal results for samples 1211801-1 to 5. The results were verified and are within expected measurement uncertainty.
- The ion balance was outside the range 90 110% for samples 1211801-3 and 5. Cations were analyzed from a field filtered container Jul 11, 2017 and anions from a routine container. All parameters in each container have been confirmed.
- Oct 18, 2017 Report was issued to correct the Total Potency Equivalents result on sample 3 previously reported as 0.03 ug/L on Test Report 2202828 2232401.

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#### **Analytical Report**

Bill To: City of Edmonton

11004 - 190th Street

Edmonton, AB, Canada

T5S 0G9

Attn: Tami Dolen

Sampled By: Dale Durham Company: City of Edmonton Project ID:

Project Name:

Rossdale RMP Project Location: 9469 Rossdale Rd.

LSD: P.O.:

D927378 C#

4816245(L3)

Proj. Acct. code: 21195 Lot ID: 1211801

Control Number: C0096715 Date Received: Jun 30, 2017

Date Reported: Oct 18, 2017

Report Number: 2232401

1211801-3 **Reference Number** 1211801-1 1211801-2 Sample Date Jun 30, 2017 Jun 30, 2017 Jun 30, 2017 Sample Time NA NA NA

**Sample Location** 

**Sample Description** 

16-02 / Water / 16.9°C

16-03 / Water /

16-05 / Water /

16.9°C 16.9°C

		Matrix	Water	Water	Water	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Metals Dissolved						
Silicon	Dissolved	mg/L	6.51	4.91	6.61	0.05
Sulfur	Dissolved	mg/L	58.8	42.0	26.2	0.3
Mercury	Dissolved	mg/L	<0.00005	<0.00005	< 0.000005	0.000005
Aluminum	Dissolved	mg/L	0.046	0.005	0.006	0.002
Antimony	Dissolved	mg/L	<0.0002	< 0.0002	< 0.0002	0.0002
Arsenic	Dissolved	mg/L	0.0003	< 0.0002	0.0003	0.0002
Barium	Dissolved	mg/L	0.279	0.116	0.130	0.001
Beryllium	Dissolved	mg/L	<0.0001	<0.0001	< 0.0001	0.0001
Bismuth	Dissolved	mg/L	< 0.0005	< 0.0005	< 0.0005	0.0005
Boron	Dissolved	mg/L	0.711	0.281	0.342	0.002
Cadmium	Dissolved	mg/L	0.00013	0.00002	0.00008	0.00001
Chromium	Dissolved	mg/L	< 0.0005	< 0.0005	< 0.0005	0.0005
Cobalt	Dissolved	mg/L	0.0014	0.0002	0.0001	0.0001
Copper	Dissolved	mg/L	0.004	0.002	0.002	0.001
Lead	Dissolved	mg/L	0.0001	< 0.0001	< 0.0001	0.0001
Lithium	Dissolved	mg/L	0.033	0.028	0.019	0.001
Molybdenum	Dissolved	mg/L	0.001	0.007	0.001	0.001
Nickel	Dissolved	mg/L	0.0137	0.0034	0.0072	0.0005
Selenium	Dissolved	mg/L	< 0.0002	< 0.0002	0.0009	0.0002
Silver	Dissolved	mg/L	< 0.00001	< 0.00001	<0.00001	0.00001
Strontium	Dissolved	mg/L	1.68	0.854	0.729	0.001
Thallium	Dissolved	mg/L	< 0.00005	< 0.00005	< 0.00005	0.00005
Tin	Dissolved	mg/L	<0.001	<0.001	<0.001	0.001
Titanium	Dissolved	mg/L	0.0017	< 0.0005	< 0.0005	0.0005
Uranium	Dissolved	mg/L	0.0088	0.0028	0.0038	0.0005
Vanadium	Dissolved	mg/L	0.0004	< 0.0001	0.0002	0.0001
Zinc	Dissolved	mg/L	0.008	0.003	0.006	0.001
Subsample	Field Filtered	· ·	Lab Filtered	Lab Filtered	Lab Filtered	
Metals Total						
Aluminum	Total	mg/L	0.98	0.11	1.15	0.02
Calcium	Total	mg/L	321	88.7	142	0.2
Iron	Total	mg/L	2.42	0.34	2.16	0.05
Magnesium	Total	mg/L	90.9	20.4	33.8	0.2
Manganese	Total	mg/L	2.12	0.829	0.113	0.005
Potassium	Total	mg/L	7.3	5.5	4.9	0.4
Silicon	Total	mg/L	9.04	5.24	9.21	0.05
Sodium	Total	mg/L	89.7	118	30.5	0.4
Sulfur	Total	mg/L	65.6	44.1	26.7	0.3

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#### **Analytical Report**

Bill To: City of Edmonton

11004 - 190th Street Edmonton, AB, Canada

T5S 0G9

Attn: Tami Dolen Sampled By: Dale Durham

Company: City of Edmonton

Project ID:

Project Name:

Rossdale RMP Project Location: 9469 Rossdale Rd.

LSD: P.O.:

D927378 C#

4816245(L3)

Proj. Acct. code: 21195 Lot ID: 1211801

Control Number: C0096715 Jun 30, 2017 Date Received:

Date Reported: Oct 18, 2017

Report Number: 2232401

Reference Number 1211801-1 1211801-2 1211801-3 Sample Date Jun 30, 2017 Jun 30, 2017 Jun 30, 2017 Sample Time NA NA NA

Sample Location

**Sample Description** 16-02 / Water /

16-03 / Water /

16-05 / Water /

			16.9°C	16.9°C	16.9°C	
		Matrix	Water	Water	Water	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Metals Total - Continued						Liiii
Antimony	Total	mg/L	< 0.0004	<0.0002	<0.0002	0.0002
Arsenic	Total	mg/L	0.001	< 0.0002	0.0015	0.0002
Barium	Total	mg/L	0.352	0.125	0.163	0.001
Beryllium	Total	mg/L	< 0.0002	< 0.0001	< 0.0001	0.0001
Bismuth	Total	mg/L	<0.001	< 0.0005	< 0.0005	0.0005
Boron	Total	mg/L	0.840	0.305	0.348	0.002
Cadmium	Total	mg/L	0.00023	0.00002	0.00026	0.00001
Chromium	Total	mg/L	0.0019	< 0.0005	0.0022	0.0005
Cobalt	Total	mg/L	0.0027	0.0003	0.0022	0.0001
Copper	Total	mg/L	0.016	0.002	0.004	0.001
Lead	Total	mg/L	0.002	0.0001	0.0022	0.0001
Lithium	Total	mg/L	0.039	0.030	0.021	0.001
Molybdenum	Total	mg/L	< 0.002	0.007	0.002	0.001
Nickel	Total	mg/L	0.013	0.0009	0.0057	0.0005
Selenium	Total	mg/L	< 0.0004	< 0.0002	0.0009	0.0002
Silver	Total	mg/L	< 0.00002	< 0.00001	0.00002	0.00001
Strontium	Total	mg/L	1.88	0.851	0.733	0.001
Thallium	Total	mg/L	<0.0001	< 0.00005	0.00006	0.00005
Tin	Total	mg/L	< 0.002	<0.001	< 0.001	0.001
Titanium	Total	mg/L	0.0283	0.0036	0.0365	0.0005
Uranium	Total	mg/L	0.010	0.0029	0.0044	0.0005
Vanadium	Total	mg/L	0.0032	0.0004	0.0030	0.0001
Zinc	Total	mg/L	0.017	0.002	0.012	0.001
Zirconium	Total	mg/L	< 0.002	<0.001	<0.001	0.001
Routine Water		-				
рН			7.89	8.21	8.03	
Temperature of observed pH		°C	21.3	21.5	21.7	
Electrical Conductivity	at 25 °C	μS/cm	2140	959	830	1
Calcium	Dissolved	mg/L	274	88.4	138	0.2
Magnesium	Dissolved	mg/L	81.0	19.5	31.3	0.2
Sodium	Dissolved	mg/L	81.1	116	28.2	0.4
Potassium	Dissolved	mg/L	6.4	5.3	4.5	0.4
Iron	Dissolved	mg/L	0.08	0.01	0.01	0.01
Manganese	Dissolved	mg/L	1.59	0.720	<0.005	0.005
Chloride	Dissolved	mg/L	422	41.8	30.8	0.4
Nitrate - N		mg/L	3.89	0.51	1.85	0.01
Nitrite - N		mg/L	<0.02	<0.005	<0.005	0.005



#### **Analytical Report**

Bill To: City of Edmonton

Project ID:

Lot ID: 1211801

11004 - 190th Street

Project Name:

Rossdale RMP Control Number: C0096715

Edmonton, AB, Canada

Project Location: 9469 Rossdale Rd. Date Received: Jun 30, 2017

T5S 0G9

LSD:

Date Reported: Oct 18, 2017

Attn: Tami Dolen

P.O.:

D927378 C#

Report Number: 2232401

Sampled By: Dale Durham

4816245(L3)

Company: City of Edmonton

Proj. Acct. code: 21195

Reference Number 1211801-1 1211801-2 1211801-3 Sample Date Jun 30, 2017 Jun 30, 2017 Jun 30, 2017 Sample Time NA NA NA

Sample Location

16-02 / Water /

16-03 / Water /

16-05 / Water /

		Sample Description	16-02 / Water / 16.9°C	16-03 / Water / 16.9°C	16-05 / Water / 16.9°C	
		Matrix	Water	Water	Water	
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Routine Water - Continue	ed					
Nitrate and Nitrite - N		mg/L	3.89	0.51	1.85	0.01
Sulfate (SO4)	Dissolved	mg/L	176	126	78.7	0.9
Hydroxide		mg/L	<5	<5	<5	
Carbonate		mg/L	<6	<6	<6	
Bicarbonate		mg/L	497	430	515	
P-Alkalinity	as CaCO3	mg/L	<5.0	<5.0	<5.0	5
T-Alkalinity	as CaCO3	mg/L	408	352	422	5
Total Dissolved Solids	Calculated	mg/L	1290	609	565	1
Hardness	Dissolved as CaCO3	3 mg/L	1020	301	474	
Ionic Balance	Dissolved	%	100	103	98	
Polycyclic Aromatic Hyd	rocarbons - Water					
Naphthalene		μg/L	<0.1	<0.1	<0.1	0.1
Quinoline		μg/L	<0.3	<0.3	<0.3	0.3
Acenaphthylene		μg/L	<0.1	<0.1	<0.1	0.1
Acenaphthene		μg/L	<0.1	<0.1	<0.1	0.1
Fluorene		μg/L	<0.1	<0.1	<0.1	0.1
Phenanthrene		μg/L	<0.1	<0.1	<0.1	0.1
Acridine		μg/L	<0.1	<0.1	<0.1	0.1
Anthracene		μg/L	0.014	< 0.005	< 0.005	0.005
Fluoranthene		μg/L	0.05	<0.01	<0.01	0.01
Pyrene		μg/L	0.04	<0.01	<0.01	0.01
Benzo(a)anthracene		μg/L	0.01	<0.01	<0.01	0.01
Chrysene		μg/L	<0.1	<0.1	<0.1	0.1
Benzo(b)fluoranthene		μg/L	<0.1	<0.1	<0.1	0.1
Benzo(b+j)fluoranthene		μg/L	<0.1	<0.1	<0.1	0.1
Benzo(k)fluoranthene		μg/L	<0.1	<0.1	<0.1	0.1
Benzo(a)pyrene		μg/L	0.013	<0.008	<0.008	0.008
Indeno(1,2,3-c,d)pyrene		μg/L	< 0.05	< 0.05	< 0.05	0.05
Dibenzo(a,h)anthracene		μg/L	< 0.05	< 0.05	< 0.05	0.05
Benzo(g,h,i)perylene		μg/L	< 0.05	< 0.05	< 0.05	0.05
CB(a)P	Total Potency Equivalents	μg/L	0.01	<0.01	<0.01	0.01
PAH - Water - Surrogate	•					
Nitrobenzene-d5	PAH - Surrogate	%	115	121	102	50-140
2-Fluorobiphenyl	PAH - Surrogate	%	82	83	81	50-140
p-Terphenyl-d14	PAH - Surrogate	%	84	83	86	50-140

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#### **Analytical Report**

Bill To: City of Edmonton

11004 - 190th Street

Edmonton, AB, Canada

T5S 0G9

Attn: Tami Dolen

Sampled By: Dale Durham Company: City of Edmonton Project ID:

Project Name:

Rossdale RMP Project Location: 9469 Rossdale Rd.

LSD: P.O.:

D927378 C#

4816245(L3)

Proj. Acct. code: 21195 Lot ID: 1211801

Control Number: C0096715 Date Received: Jun 30, 2017

Date Reported: Oct 18, 2017

Report Number: 2232401

Reference Number 1211801-4 1211801-5 Sample Date Jun 30, 2017 Jun 30, 2017 Sample Time NA NA

Sample Location

**Sample Description** 14-15 / Water /

16.9°C

14-17 / Water / 16.9°C

Matrix Water Water

		IVIALITA	vvalei	vvalei		
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Metals Dissolved						
Silicon	Dissolved	mg/L	5.87	5.36		0.05
Sulfur	Dissolved	mg/L	44.1	25.5		0.3
Mercury	Dissolved	mg/L	< 0.000005	< 0.000005		0.000005
Aluminum	Dissolved	mg/L	0.008	0.002		0.002
Antimony	Dissolved	mg/L	< 0.0002	<0.0002		0.0002
Arsenic	Dissolved	mg/L	< 0.0002	<0.0002		0.0002
Barium	Dissolved	mg/L	0.117	0.101		0.001
Beryllium	Dissolved	mg/L	<0.0001	<0.0001		0.0001
Bismuth	Dissolved	mg/L	< 0.0005	< 0.0005		0.0005
Boron	Dissolved	mg/L	0.572	0.361		0.002
Cadmium	Dissolved	mg/L	0.00002	0.00004		0.00001
Chromium	Dissolved	mg/L	< 0.0005	< 0.0005		0.0005
Cobalt	Dissolved	mg/L	0.0001	0.0002		0.0001
Copper	Dissolved	mg/L	0.002	0.002		0.001
Lead	Dissolved	mg/L	<0.0001	<0.0001		0.0001
Lithium	Dissolved	mg/L	0.031	0.022		0.001
Molybdenum	Dissolved	mg/L	<0.001	<0.001		0.001
Nickel	Dissolved	mg/L	0.0065	0.0038		0.0005
Selenium	Dissolved	mg/L	< 0.0002	< 0.0002		0.0002
Silver	Dissolved	mg/L	<0.0001	<0.0001		0.00001
Strontium	Dissolved	mg/L	1.28	0.947		0.001
Thallium	Dissolved	mg/L	< 0.00005	< 0.00005		0.00005
Tin	Dissolved	mg/L	<0.001	<0.001		0.001
Titanium	Dissolved	mg/L	< 0.0005	< 0.0005		0.0005
Uranium	Dissolved	mg/L	0.0072	0.0055		0.0005
Vanadium	Dissolved	mg/L	<0.0001	<0.0001		0.0001
Zinc	Dissolved	mg/L	0.004	0.004		0.001
Subsample	Field Filtered		Lab Filtered	Lab Filtered		
Metals Total						
Aluminum	Total	mg/L	4.96	7.83		0.02
Calcium	Total	mg/L	236	150		0.2
Iron	Total	mg/L	14.5	26.6		0.05
Magnesium	Total	mg/L	70.2	41.6		0.2
Manganese	Total	mg/L	0.911	3.00		0.005
Potassium	Total	mg/L	6.0	4.9		0.4
Silicon	Total	mg/L	16.0	18.8		0.05
Sodium	Total	mg/L	57.5	30.2		0.4
Sulfur	Total	mg/L	47.1	26.1		0.3

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#### **Analytical Report**

Bill To: City of Edmonton

11004 - 190th Street

Edmonton, AB, Canada

T5S 0G9

Attn: Tami Dolen Sampled By: Dale Durham

City of Edmonton Company:

Project ID:

Project Name:

Project Location: 9469 Rossdale Rd.

LSD: P.O.:

D927378 C#

Rossdale RMP

4816245(L3)

Proj. Acct. code: 21195

1211801 Lot ID:

Control Number: C0096715 Date Received: Jun 30, 2017

Date Reported: Oct 18, 2017

Report Number: 2232401

Reference Number 1211801-4 1211801-5 Sample Date Jun 30, 2017 Jun 30, 2017 Sample Time NA NA

Sample Location

**Sample Description** 14-15 / Water /

14-17 / Water / 16.9°C

16.9°C

Matrix Water Water Nominal Detection Analyte Units Results Results Results Limit **Metals Total - Continued** Antimony Total 0.0004 0.0004 0.0002 mg/L 0.0057 0.0002 Arsenic Total mg/L 0.0033 **Barium** Total mg/L 0.278 0.580 0.001 Beryllium Total 0.0004 0.0007 0.0001 mg/L **Bismuth** Total mg/L <0.0005 < 0.0005 0.0005 Boron Total 0.598 0.371 0.002 mg/L Cadmium Total mg/L 0.00010 0.00029 0.00001 Chromium Total mg/L 0.0070 0.0099 0.0005 Cobalt Total 0.0060 0.0071 0.0001 mg/L Total Copper mg/L 0.012 0.019 0.001 Total 0.0077 0.0093 Lead mg/L 0.0001 Lithium Total mg/L 0.035 0.027 0.001 Molybdenum Total mg/L < 0.001 0.001 0.001 Nickel Total mg/L 0.0114 0.0187 0.0005 Selenium Total 0.0003 0.0004 0.0002 mg/L Silver Total mg/L 0.00008 0.00009 0.00001 Strontium Total mg/L 1.39 1.07 0.001 Thallium Total mg/L 0.00014 0.00026 0.00005 Tin Total < 0.001 < 0.001 0.001 mg/L Titanium Total 0.101 0.187 0.0005 mg/L Uranium Total 0.0069 0.0086 0.0005 mg/L Vanadium Total 0.0134 0.0200 0.0001 mg/L Zinc Total 0.030 0.043 0.001 mg/L Zirconium Total mg/L 0.002 0.003 0.001 **Routine Water** рΗ 7.90 7.98 °C Temperature of observed 21.6 21.6 **Electrical Conductivity** at 25 °C μS/cm 1580 822 1 Calcium Dissolved 220 131 0.2 mg/L Dissolved 36.1 0.2 Magnesium mg/L 63.0 Sodium Dissolved 54.6 28.9 mg/L 0.4 Potassium Dissolved mg/L 4.7 3.5 0.4 Iron Dissolved mg/L < 0.01 < 0.01 0.01 Dissolved 0.774 0.005 Manganese mg/L 0.017 Chloride Dissolved 272 41.1 0.4 mg/L Nitrate - N mg/L 3.89 0.28 0.01 Nitrite - N mg/L < 0.005 < 0.005 0.005



#### **Analytical Report**

Bill To: City of Edmonton

Project ID:

Lot ID: 1211801

11004 - 190th Street Edmonton, AB, Canada Project Name: Project Location: Control Number: C0096715 Date Received: Jun 30, 2017

T5S 0G9

LSD:

Date Reported: Oct 18, 2017

Attn: Tami Dolen

Company: City of Edmonton

P.O.:

Report Number: 2232401

Sampled By: Dale Durham

D927378 C# 4816245(L3)

Rossdale RMP

9469 Rossdale Rd.

Proj. Acct. code: 21195

1211801-5

Sample Date Sample Time

1211801-4 Jun 30, 2017

Jun 30, 2017

NA

NA

Sample Location

Reference Number

14-15 / Water /

14-17 / Water /

**Sample Description** 16.9°C

16.9°C

Matrix

Water Water

		Matrix	Water	Water		
Analyte		Units	Results	Results	Results	Nominal Detection Limit
Routine Water - Continue	ed					
Nitrate and Nitrite - N		mg/L	3.89	0.28		0.01
Sulfate (SO4)	Dissolved	mg/L	132	76.4		0.9
Hydroxide		mg/L	<5	<5		
Carbonate		mg/L	<6	<6		
Bicarbonate		mg/L	401	520		
P-Alkalinity	as CaCO3	mg/L	<5.0	<5.0		5
T-Alkalinity	as CaCO3	mg/L	329	427		5
Total Dissolved Solids	Calculated	mg/L	945	573		1
Hardness	Dissolved as CaCO3	mg/L	809	476		
Ionic Balance	Dissolved	%	108	96		
Polycyclic Aromatic Hyd	rocarbons - Water					
Naphthalene		μg/L	<0.1	<0.1		0.1
Quinoline		μg/L	<0.3	<0.3		0.3
Acenaphthylene		μg/L	<0.1	<0.1		0.1
Acenaphthene		μg/L	<0.1	<0.1		0.1
Fluorene		μg/L	<0.1	<0.1		0.1
Phenanthrene		μg/L	<0.1	<0.1		0.1
Acridine		μg/L	<0.1	<0.1		0.1
Anthracene		μg/L	0.009	< 0.005		0.005
Fluoranthene		μg/L	0.02	<0.01		0.01
Pyrene		μg/L	0.02	<0.01		0.01
Benzo(a)anthracene		μg/L	0.02	<0.01		0.01
Chrysene		μg/L	<0.1	<0.1		0.1
Benzo(b)fluoranthene		μg/L	<0.1	<0.1		0.1
Benzo(b+j)fluoranthene		μg/L	<0.1	<0.1		0.1
Benzo(k)fluoranthene		μg/L	<0.1	<0.1		0.1
Benzo(a)pyrene		μg/L	0.016	< 0.008		0.008
Indeno(1,2,3-c,d)pyrene		μg/L	< 0.05	< 0.05		0.05
Dibenzo(a,h)anthracene		μg/L	< 0.05	< 0.05		0.05
Benzo(g,h,i)perylene		μg/L	< 0.05	< 0.05		0.05
CB(a)P	Total Potency Equivalents	μg/L	0.02	<0.01		0.01
PAH - Water - Surrogate	Recovery					
Nitrobenzene-d5	PAH - Surrogate	%	113	115		50-140
2-Fluorobiphenyl	PAH - Surrogate	%	81	83		50-140
p-Terphenyl-d14	PAH - Surrogate	%	83	84		50-140

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#### **Analytical Report**

Bill To: City of Edmonton

11004 - 190th Street Edmonton, AB, Canada

T5S 0G9

Attn: Tami Dolen

Company: City of Edmonton

Sampled By: Dale Durham

Project ID:

Project Name: Rossdale RMP

Project Location: 9469 Rossdale Rd.

LSD: P.O.:

D927378 C# 4816245(L3)

Proj. Acct. code: 21195

Lot ID: 1211801

Control Number: C0096715

Date Received: Jun 30, 2017

Date Reported: Oct 18, 2017

Report Number: 2232401

Approved by:

Randy Neumann, BSc Vice President

RLDeunson

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## **Quality Control**

Bill To: City of Edmonton

11004 - 190th Street

Edmonton, AB, Canada

T5S 0G9

Attn: Tami Dolen

Sampled By: Dale Durham

LSD: P.O.:

Project ID:

Project Name: Rossdale RMP Project Location:

9469 Rossdale Rd.

D927378 C# 4816245(L3)

21195

Proj. Acct. code: Company: City of Edmonton

Lot ID: 1211801

Control Number: C0096715 Date Received: Jun 30, 2017 Date Reported: Oct 18, 2017

Silicon         mg/L         0.0011         -0.03         -0.3         0.2         yes           Sulfur         mg/L         -0.007395         -0.038000         0.0540000         yes           Alurminum         μg/L         -0.0751335         -2         2         2         yes           Antimony         μg/L         -0.0263396         -0.2         0.2         yes           Arsenic         μg/L         -0.1575437         -1         1         1         yes           Benlum         μg/L         0.00590329         -1.5         1.5         yes         yes           Bismuth         μg/L         0.00390329         -1.5         1.5         yes         yes           Cadmium         μg/L         0.00766559         -0.01         0.01         yes         yes           Cobalt         μg/L         0.0112938         -0.3         0.3         3         yes           Cobalt         μg/L         0.0112939         -0.1         0.1         yes         yes           Lead         μg/L         0.0144037         -0.1         0.1         yes         yes           Lead         μg/L         0.01940000         -1         1	Metals Dissolved						
Sulfur   mg/L   -0.023   -0.3   0.2   yes	Blanks	Units	Measured	Lower Limit	Upper Limit		Passed QC
Mercury	Silicon	mg/L	0.0011	-0.04	0.05		yes
Aluminum         μg/L         -0.0751335         -0.2         2         yes           Antimony         μg/L         -0.0283396         -0.2         0.2         yes           Arsenic         μg/L         -4.55657-005         -0.2         0.2         yes           Barlium         μg/L         0.007564987         -1         1         1         yes           Beryllium         μg/L         0.00469987         -0.0         0.1         yes           Bismuth         μg/L         0.00380329         -1.5         1.5         yes           Cadmium         μg/L         0.00766659         -0.01         0.01         yes           Chomium         μg/L         0.00144037         -0.1         0.1         yes           Cobalt         μg/L         0.0112938         -0.3         0.3         yes           Cobalt         μg/L         0.01497294         -1         1         1         yes           Lead         μg/L         0.00144037         -0.1         0.1         yes           Lead         μg/L         0.001928113         -0.1         0.1         yes           Molybdenum         μg/L         0.0384339         -1	Sulfur	mg/L	-0.023	-0.3	0.2		yes
Antimony         μg/L         0.0283396         -0.2         0.2         yes         yes           Barlum         μg/L         -0.0778437         -1         1         1         -9         yes           Beryllum         μg/L         0.00764997         -0.0         0.1         -9         yes           Bismuh         μg/L         0.00649987         -0.0         0.1         -9         yes           Boron         μg/L         0.00766559         -0.01         0.01         yes         yes           Chomium         μg/L         0.00142938         -0.3         0.3         yes         yes           Cobalt         μg/L         0.00144037         -0.1         0.1         -0.1         yes           Copper         μg/L         0.0149379         -0.1         0.1         -0.1         yes           Lead         μg/L         0.00144037         -0.1         0.1         -0.1         yes           Lead         μg/L         0.00144037         -0.1         0.1         -0.1         yes           Lead         μg/L         0.0018813         -0.1         0.1         1         yes           Klichal         μg/L         0.0485	Mercury	μg/L	-0.001395	-0.038000	0.064000		yes
Arsenic         μg/L         -4.55657e-005         -0.2         0.2         Use           Barum         μg/L         0.0175437         -1         1         1         yes           Beryllium         μg/L         0.00649987         -0.0         0.1         yes           Bismuth         μg/L         0.00390329         -1.5         1.5         yes           Boron         μg/L         -0.000766559         -0.01         0.01         yes           Cadmium         μg/L         0.0112938         -0.3         0.3         yes           Cobalt         μg/L         0.0144037         -0.1         0.1         yes           Copper         μg/L         0.0149234         -1         1         1         yes           Lead         μg/L         -0.019284         -1         1         1         yes           Lehium         μg/L         -0.0408504         -1         1         1         yes           Molybdenum         μg/L         -0.0488049         -1         1         1         yes           Silver         μg/L         -0.00382776         -0.10         0.10         yes         yes           Silver         μg/L <td>Aluminum</td> <td>μg/L</td> <td>-0.0751335</td> <td>-2</td> <td>2</td> <td></td> <td>yes</td>	Aluminum	μg/L	-0.0751335	-2	2		yes
Barium	Antimony	μg/L	0.0263396	-0.2	0.2		yes
Beryllium	Arsenic	μg/L	-4.55657e-005	-0.2	0.2		yes
Bismuth   μg/L   0.00390329   -1.5   1.5   yes	Barium	μg/L	0.0175437	-1	1		yes
Boron   pig/L   0.978382   -2   2   2   yes   Cadmium   pig/L   0.000766559   -0.01   0.01   yes   Chromium   pig/L   0.0112938   -0.3   0.3   0.3   yes   Cobalt   pig/L   0.01142938   -0.3   0.3   0.3   yes   Cobalt   pig/L   0.01142934   -1   1   1   yes   Lead   pig/L   0.0197294   -1   1   1   yes   Lead   pig/L   0.00128113   -0.1   0.1   yes   Lithium   pig/L   0.00128113   -0.1   1   1   yes   Molybdenum   pig/L   0.0408504   -1   1   1   yes   Molybdenum   pig/L   0.05848439   -1   1   1   yes   Nickel   pig/L   0.0387482   -0.5   0.5   yes   Selenium   pig/L   0.00188408   -0.2   0.2   yes   Silver   pig/L   0.00188408   -0.2   0.2   yes   Silver   pig/L   0.00188408   -0.2   0.2   yes   Silver   pig/L   0.00188408   -0.2   0.05   yes   Strontium   pig/L   0.0191809   -1   1   1   yes   Thallium   pig/L   0.0187627   -0.05   0.05   yes   Tifanium   pig/L   0.0187627   -0.05   0.05   yes   Uranium   pig/L   0.0172362   -0.5   0.5   yes   Uranium   pig/L   0.000897901   -0.5   0.5   yes   Viranium   pig/L   0.000799609   -0.1   0.1   0.1   yes   Viranium   pig/L   0.000799609   -0.1   0.1   0.1   yes   Viranium   pig/L   0.000799609   -0.1   0.1   0.1   yes   Viranium   pig/L   0.00079609   -0.1   0.1   0.1   yes   Viranium   pig/L   0.00079609   -0.1   0.1   0.1   0.0   yes   Viranium   pig/L   0.00079609   -0.1   0.1   0.1   0.0   yes   Viranium   pig/L   0.00079609   -0.1   0.1   0.1   0.0   yes   Viranium   pig/L   0.00079609   -0.1   0.1   0.0   0.0   yes   Viranium   pig/L   0.00079609   -0.1   0.1   0.0   0.0   yes   Viranium   pig/L   0.00079609   -0.1   0.1   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0	Beryllium	μg/L	0.00649987	-0.0	0.1		yes
Cadmium         μg/L         -0.000766559         -0.01         0.01         yes           Chromium         μg/L         0.0112938         -0.3         0.3         yes           Cobalt         μg/L         0.00144037         -0.1         0.1         yes           Copper         μg/L         0.0197294         -1         1         1         yes           Lead         μg/L         0.0408504         -1         1         1         yes           Lithium         μg/L         0.0488604         -1         1         1         yes           Molybdenum         μg/L         0.0548439         -1         1         1         yes           Nickel         μg/L         0.0387482         -0.5         0.5         yes           Selenium         μg/L         0.00188408         -0.2         0.2         yes           Silver         μg/L         0.000362776         -0.10         0.10         yes           Strontium         μg/L         0.0191809         -1         1         1         yes           Trainium         μg/L         0.0172362         -0.5         0.5         yes           Uranium         μg/L         0.01	Bismuth	μg/L	0.00390329	-1.5	1.5		yes
Chromium         μg/L         0.0112938         -0.3         0.3         yes           Cobalt         μg/L         0.00144037         -0.1         0.1         yes           Copper         μg/L         0.0197294         -1         1         1         yes           Lead         μg/L         0.0408504         -1         1         1         yes           Molybdenum         μg/L         0.0408504         -1         1         1         yes           Nickel         μg/L         0.0548439         -1         1         1         yes           Selenium         μg/L         0.0387482         -0.5         0.5         yes           Selenium         μg/L         -0.00382776         -0.10         0.10         yes           Sitvontium         μg/L         -0.00382776         -0.10         0.10         yes           Strontium         μg/L         -0.00587627         -0.05         0.5         yes           Tin         μg/L         -0.161877         -1         1         1         yes           Uranium         μg/L         0.000887901         -0.5         0.5         yes           Vanadium         μg/L	Boron	μg/L	0.978382	-2	2		yes
Cobalt         µg/L         0.00144037         -0.1         0.1         yes           Copper         µg/L         0.0197294         -1         1         1         yes           Lead         µg/L         -0.00128113         -0.1         0.1         0.1         yes           Lithium         µg/L         0.0408504         -1         1         1         yes           Molybdenum         µg/L         0.0488439         -1         1         1         yes           Nickel         µg/L         0.0387482         -0.5         0.5         yes           Selenium         µg/L         0.00188408         -0.2         0.2         yes           Silver         µg/L         -0.00382776         -0.10         0.10         yes           Strontium         µg/L         -0.00587627         -0.5         0.05         yes           Tin         µg/L         -0.161877         -1         1         yes           Uranium         µg/L         0.00887901         -0.5         0.5         yes           Vanadium         µg/L         0.00987901         -0.5         0.5         yes           Vanadium         µg/L         0.24453	Cadmium	μg/L	-0.000766559	-0.01	0.01		yes
Copper         µg/L         0.0197294         -1         1         1         yes           Lead         µg/L         -0.00128113         -0.1         0.1         0.1         yes           Lithium         µg/L         0.0408504         -1         1         1         yes           Molybdenum         µg/L         0.0548439         -1         1         1         yes           Selenium         µg/L         0.0387482         -0.5         0.5         yes           Selenium         µg/L         0.00188408         -0.2         0.2         yes           Silver         µg/L         -0.00382776         -0.10         0.10         yes           Strontium         µg/L         -0.00382776         -0.05         0.05         yes           Thallium         µg/L         -0.0038277         -0.05         0.05         yes           Tinnium         µg/L         -0.0038277         -0.05         0.05         yes           Uranium         µg/L         -0.00789609         -0.1         0.1         yes           Uranium         µg/L         0.000799609         -0.1         0.1         yes           Date Acquirect:         July 04, 2017 <td>Chromium</td> <td>μg/L</td> <td>0.0112938</td> <td>-0.3</td> <td>0.3</td> <td></td> <td>yes</td>	Chromium	μg/L	0.0112938	-0.3	0.3		yes
Lead         µg/L         -0.00128113         -0.1         0.1         yes           Lithirum         µg/L         0.0408504         -1         1         1         yes           Molybdenum         µg/L         0.0548439         -1         1         1         yes           Nickel         µg/L         0.0387482         -0.5         0.5         yes           Selenium         µg/L         -0.00362776         -0.10         0.10         yes           Silver         µg/L         -0.000362776         -0.10         0.10         yes           Sitrontium         µg/L         -0.000587627         -0.05         0.05         yes           Thallium         µg/L         -0.00587627         -0.5         0.05         yes           Tin         µg/L         -0.161877         -1         1         1         yes           Uranium         µg/L         0.000897901         -0.5         0.5         yes           Vanadium         µg/L         0.000799809         -0.1         0.1         yes           Zinc         µg/L         0.24453         -0         2         WRD Criteria         Passed CC           Silicon         mg/L	Cobalt	μg/L	0.00144037	-0.1	0.1		yes
Lithium         µg/L         0.0408504         -1         1         1         yes           Molybdenum         µg/L         0.0548439         -1         1         1         yes           Nickel         µg/L         0.0387482         -0.5         0.5         yes           Selenium         µg/L         0.00188408         -0.2         0.2         yes           Silver         µg/L         -0.000362776         -0.10         0.10         yes           Strontium         µg/L         -0.00587627         -0.05         0.05         yes           Thallium         µg/L         -0.00587627         -0.5         0.05         yes           Titanium         µg/L         -0.161877         -1         1         1         yes           Titanium         µg/L         0.0172362         -0.5         0.5         yes         yes           Vanadium         µg/L         0.000799699         -0.1         0.1         yes         yes           Zinc         July 04, 2017         2         2         % RSD Criteria         Absolute Criteria         Passed QC           Silicon         mg/L         3.62         3.59         10         0.01         yes <td>Copper</td> <td>μg/L</td> <td>0.0197294</td> <td>-1</td> <td>1</td> <td></td> <td>yes</td>	Copper	μg/L	0.0197294	-1	1		yes
Molybdenum         µg/L         0.0548439         -1         1         yes           Nickel         µg/L         0.0387482         -0.5         0.5         yes           Selenium         µg/L         0.00188408         -0.2         0.2         yes           Silver         µg/L         -0.000362776         -0.10         0.10         yes           Strontium         µg/L         0.0191809         -1         1         1         yes           Strontium         µg/L         -0.000587627         -0.05         0.05         yes           Tin         µg/L         -0.161877         -1         1         1         yes           Titanium         µg/L         0.0172362         -0.5         0.5         yes           Uranium         µg/L         0.000399001         -0.5         0.5         yes           Vanadium         µg/L         0.024453         -0         2         yes           Zinc         µg/L         0.24453         -0         2         yes           Date Acquired:         July 04, 2017         T         Replicate 1         Replicate 2         % RSD Criteria         Absolute Criteria         Passed QC           Silicon	Lead	μg/L	-0.00128113	-0.1	0.1		yes
Molybdenum   μg/L   0.0548439   -1   1   1   yes   Nicke   μg/L   0.0387482   -0.5   0.5   yes   Selenium   μg/L   0.00188408   -0.2   0.2   yes   Silver   μg/L   -0.000362776   -0.10   0.10   yes   Strontium   μg/L   -0.000362776   -0.10   0.10   yes   Strontium   μg/L   -0.000587627   -0.05   0.05   yes   Thallium   μg/L   -0.00587627   -0.05   0.05   yes   Titanium   μg/L   -0.161877   -1   1   1   yes   Titanium   μg/L   0.0172362   -0.5   0.5   yes   Uranium   μg/L   0.000897901   -0.5   0.5   yes   Uranium   μg/L   0.000987901   -0.5   0.5   yes   Vanadium   μg/L   0.000799609   -0.1   0.1   yes   Vanadium   μg/L   0.024453   -0   2   yes   Vanadium   μg/L   0.024453   -0   2   yes   Vanadium   μg/L   0.024453   -0   0   2   yes   Vanadium   μg/L   0.0172362   0.5   0.5   yes   Vanadium   μg/L   0.000799609   -0.1   0.1   0.1   yes   Vanadium   μg/L   0.000799609   0.1   0.1   0.1   yes   Vanadium   μg/L   0.000050   0.2   0.2   Vanadium   0.2   yes   Vanadium   μg/L   0.24453   0.0   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2   0.2	Lithium		0.0408504	-1	1		yes
Nickel         μg/L         0.0387482         -0.5         0.5         yes           Selenium         μg/L         0.00188408         -0.2         0.2         yes           Silver         μg/L         -0.00362776         -0.10         0.10         yes           Strontium         μg/L         0.0191809         -1         1         1         yes           Thallium         μg/L         -0.00587627         -0.05         0.05         yes         yes           Tin         μg/L         -0.161877         -1         1         yes         yes           Uranium         μg/L         0.0072362         -0.5         0.5         yes         yes           Vanadium         μg/L         0.000799609         -0.1         0.1         yes         yes           Zinc         μg/L         0.24453         -0         2         yes         yes           Date Acquired:         July 04, 2017         2         Replicate         % RSD Criteria         Absolute Criteria         Passed OC           Silicon         mg/L         3.62         3.59         10         0.01         yes           Sulfur         mg/L         3.62         3.59         10	Molybdenum		0.0548439	-1	1		yes
Selenium         μg/L         0.00188408         -0.2         0.2         yes           Silver         μg/L         -0.00362776         -0.10         0.10         yes           Strontium         μg/L         0.0191809         -1         1         1         yes           Thallium         μg/L         -0.00587627         -0.05         0.05         yes           Tin         μg/L         -0.161877         -1         1         1         yes           Titanium         μg/L         0.0172362         -0.5         0.5         yes         yes           Uranium         μg/L         0.000897901         -0.5         0.5         yes         yes           Vanadium         μg/L         0.000897901         -0.5         0.5         yes         yes           Date Acquired:         July 04, 2017         0.24453         -0         2         yes         yes           Date Acquired:         July 04, 2017         T         Replicate 2         % RSD Criteria         Absolute Criteria         Passed OC           Silicon         mg/L         3.62         3.59         10         0.01         yes           Silicon mg/L         11.8         11.8	Nickel		0.0387482	-0.5	0.5		yes
Silver         μg/L         -0.000362776         -0.10         0.10         yes           Strontium         μg/L         0.0191809         -1         1         1         yes           Thallium         μg/L         -0.000587627         -0.05         0.05         yes           Tin         μg/L         -0.161877         -1         1         1         yes           Titanium         μg/L         0.0172362         -0.5         0.5         0.5         yes           Vanadium         μg/L         0.00087901         -0.5         0.5         0.5         yes           Vanadium         μg/L         0.000799609         -0.1         0.1         yes           Date Acquired:         July 04, 2017         0.24453         -0         2         yes           Client Sample Replicates         Units         Replicate 1         Replicate 2         % RSD Criteria         Absolute Criteria         Passed OC           Silicon         mg/L         3.62         3.59         10         0.01         yes           Sulfur         mg/L         1.18         11.8         10         0.01         yes           Aluminum         μg/L         <0.000005	Selenium		0.00188408	-0.2	0.2		yes
Strontium         μg/L         0.0191809         -1         1         yes           Thallium         μg/L         -0.000587627         -0.05         0.05         yes           Tin         μg/L         -0.161877         -1         1         yes           Titanium         μg/L         0.0172362         -0.5         0.5         yes           Uranium         μg/L         0.000897901         -0.5         0.5         yes           Vanadium         μg/L         0.000897901         -0.1         0.1         yes           Vanadium         μg/L         0.000799609         -0.1         0.1         yes           Zinc         μg/L         0.24453         -0         2         yes           Date Acquired:         July 04, 2017         V         V         V         V         V         Yes           Silicon         mg/L         3.62         3.59         10         0.01         yes           Sulfur         mg/L         3.62         3.59         10         0.01         yes           Mercury         mg/L         40.00005         <0.00005	Silver		-0.000362776	-0.10	0.10		yes
Thallium         μg/L         -0.000587627         -0.05         0.05         yes           Tin         μg/L         -0.161877         -1         1         1         yes           Titanium         μg/L         0.0172362         -0.5         0.5         0.5         yes           Uranium         μg/L         0.000897901         -0.5         0.5         yes           Vanadium         μg/L         0.000799609         -0.1         0.1         yes           Zinc         μg/L         0.24453         -0         2         yes           Date Acquired:         July 04, 2017         Vanadium         July 04, 2017         Vanadium         Absolute Criteria         Passed OC           Silicon         mg/L         3.62         3.59         10         0.01         yes           Sulfur         mg/L         11.8         11.8         10         0.01         yes           Mercury         mg/L         <0.000005	Strontium		0.0191809	-1	1		yes
Tin         µg/L         -0.161877         -1         1         1         yes           Titanium         µg/L         0.0172362         -0.5         0.5         9.5         yes           Uranium         µg/L         0.000897901         -0.5         0.5         9.5         yes           Vanadium         µg/L         0.000799609         -0.1         0.1         9.5         9.5         9.5           Zinc         µg/L         0.24453         -0         2         2         9.5         9.5           Date Acquired:         July 04, 2017         8         8.5         -0         2         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5         9.5 <t< td=""><td>Thallium</td><td></td><td>-0.000587627</td><td>-0.05</td><td>0.05</td><td></td><td>yes</td></t<>	Thallium		-0.000587627	-0.05	0.05		yes
Titanium         μg/L         0.0172362         -0.5         0.5         yes           Uranium         μg/L         0.000897901         -0.5         0.5         yes           Vanadium         μg/L         0.000799609         -0.1         0.1         yes           Zinc         μg/L         0.24453         -0         2         best control         yes           Date Acquired:         July 04, 2017         Valid         Valid         Nation         Nation         Absolute Criteria         Passed QC           Silicon         mg/L         3.62         3.59         10         0.01         yes           Sulfur         mg/L         11.8         11.8         10         0.01         yes           Aluminum         μg/L         4.0000005         <0.000005	Tin		-0.161877	-1	1		yes
Uranium         μg/L         0.000897901         -0.5         0.5         yes           Vanadium         μg/L         0.000799609         -0.1         0.1         0.1         yes           Zinc         μg/L         0.24453         -0         2         yes         yes           Date Acquired:         July 04, 2017         Verificates	Titanium		0.0172362	-0.5	0.5		yes
Vanadium         μg/L         0.000799609         -0.1         0.1         yes           Zinc         μg/L         0.24453         -0         2         yes           Date Acquired:         July 04, 2017         Value	Uranium	μg/L	0.000897901	-0.5	0.5		yes
Date Acquired:         July 04, 2017           Client Sample Replicates         Units         Replicate 1         Replicate 2         % RSD Criteria         Absolute Criteria         Passed QC           Silicon         mg/L         3.62         3.59         10         0.01         yes           Sulfur         mg/L         11.8         11.8         10         0.01         yes           Mercury         mg/L         <0.000005	Vanadium		0.000799609	-0.1	0.1		yes
Client Sample Replicates         Units         Replicate 1         Replicate 2         % RSD Criteria         Absolute Criteria         Passed QC           Silicon         mg/L         3.62         3.59         10         0.01         yes           Sulfur         mg/L         11.8         11.8         10         0.01         yes           Mercury         mg/L         <0.000005	Zinc	μg/L	0.24453	-0	2		yes
Silicon         mg/L         3.62         3.59         10         0.01         yes           Sulfur         mg/L         11.8         11.8         10         0.1         yes           Mercury         mg/L         <0.00005	Date Acquired: July 04						
Sulfur         mg/L         11.8         11.8         11.8         10         0.1         yes           Mercury         mg/L         <0.00005	Client Sample Replicates	Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Mercury         mg/L         <0.000005         <0.000005         10         0.000030         yes           Aluminum         μg/L         7         7         10         11         yes           Antimony         μg/L         0.3         0.3         10         0.4         yes           Arsenic         μg/L         0.7         0.7         10         0.4         yes           Barium         μg/L         266         269         10         2         yes           Beryllium         μg/L         <0.1	Silicon	mg/L	3.62	3.59	10	0.01	yes
Aluminum       μg/L       7       7       10       11       yes         Antimony       μg/L       0.3       0.3       10       0.4       yes         Arsenic       μg/L       0.7       0.7       10       0.4       yes         Barium       μg/L       266       269       10       2       yes         Beryllium       μg/L       <0.1	Sulfur	mg/L	11.8	11.8	10	0.1	yes
Antimony       μg/L       0.3       0.3       10       0.4       yes         Arsenic       μg/L       0.7       0.7       10       0.4       yes         Barium       μg/L       266       269       10       2       yes         Beryllium       μg/L       <0.1	Mercury	mg/L	<0.000005	< 0.000005	10	0.000030	yes
Arsenic       μg/L       0.7       0.7       10       0.4       yes         Barium       μg/L       266       269       10       2       yes         Beryllium       μg/L       <0.1	Aluminum	μg/L	7	7	10	11	yes
Barium         μg/L         266         269         10         2         yes           Beryllium         μg/L         <0.1	Antimony	μg/L	0.3	0.3	10	0.4	yes
Barium         μg/L         266         269         10         2         yes           Beryllium         μg/L         <0.1	Arsenic	μg/L	0.7	0.7	10	0.4	yes
Bismuth         μg/L         <0.5         <0.5         10         1.1         yes           Boron         μg/L         190         193         10         4         yes           Cadmium         μg/L         0.01         0.02         10         0.02         yes           Chromium         μg/L         <0.5	Barium		266	269	10	2	yes
Boron         μg/L         190         193         10         4         yes           Cadmium         μg/L         0.01         0.02         10         0.02         yes           Chromium         μg/L         <0.5	Beryllium	μg/L	<0.1	<0.1	10	0.2	yes
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Bismuth	μg/L	<0.5	<0.5	10	1.1	yes
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Boron	μg/L	190	193	10	4	yes
Cobalt $\mu g/L$ 0.1 0.1 10 0.2 yes Copper $\mu g/L$ 2 2 10 2 yes	Cadmium	μg/L	0.01	0.02	10	0.02	yes
Cobalt $\mu g/L$ 0.1 0.1 10 0.2 yes Copper $\mu g/L$ 2 2 10 2 yes	Chromium		<0.5	<0.5	10		yes
Copper µg/L 2 2 10 2 yes	Cobalt		0.1	0.1	10	0.2	yes
	Copper		2	2	10		yes
	Lead	μg/L	<0.1	<0.1	10	0.2	yes

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## **Quality Control**

Bill To: City of Edmonton

11004 - 190th Street

Edmonton, AB, Canada

T5S 0G9

Attn: Tami Dolen

Sampled By: Dale Durham

LSD: P.O.:

Project ID:

Project Name: Rossdale RMP Project Location:

9469 Rossdale Rd.

D927378 C#

4816245(L3) Proj. Acct. code: 21195

Company: City of Edmonton

Lot ID: 1211801

Control Number: C0096715 Date Received: Jun 30, 2017

Date Reported: Oct 18, 2017

Metals Dissolved -	Continued					
Client Sample Replic		Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Lithium	μg/L	1	1	10	2	yes
Molybdenum	μg/L	1	1	10	2	yes
Nickel	μg/L	2.0	1.9	10	1.1	yes
Selenium	μg/L	<0.2	<0.2	10	0.4	yes
Silver	μg/L	<0.01	<0.01	10	0.22	yes
Strontium	μg/L	194	195	10	2	yes
Thallium	μg/L	<0.05	<0.05	10	0.11	yes
Tin	μg/L	<1	<1	10	2	yes
Titanium	μg/L	<0.5	<0.5	10	1.1	yes
Uranium	μg/L	1.9	1.9	10	1.1	yes
Vanadium	μg/L	1.4	1.3	10	0.2	yes
Zinc	μg/L	1	<1	10	2	yes
Date Acquired: J	luly 04, 2017					
Control Sample	Units	Measured	Lower Limit	Upper Limit		Passed QC
Mercury	mg/L	0.000392	0.000310	0.000490		yes
Aluminum	μg/L	976	938	1092		yes
Antimony	μg/L	37.0	35.2	43.0		yes
Arsenic	μg/L	40.0	36.7	43.3		yes
Barium	μg/L	196	191	214		yes
Beryllium	μg/L	18.5	17.3	22.1		yes
Bismuth	μg/L	102	98.5	113.5		yes
Boron	μg/L	369	344	434		yes
Cadmium	μg/L	2.08	1.86	2.25		yes
Chromium	μg/L	99.9	92.2	110.2		yes
Cobalt	μg/L	19.8	18.0	21.1		yes
Copper	μg/L	201	189	214		yes
Lead	μg/L	20.2	18.4	22.0		yes
Lithium	μg/L	187	175	223		yes
Molybdenum	μg/L	206	187	226		yes
Nickel	μg/L	98.9	94.3	106.5		yes
Selenium	μg/L	41.3	35.8	43.0		yes
Silver	μg/L	20.3	18.40	22.00		yes
Strontium	μg/L	207	180	216		yes
Thallium	μg/L	9.95	9.30	11.10		yes
Tin	μg/L	204	180	220		yes
Titanium	μg/L	101	92.4	110.4		yes
Uranium	μg/L	97.1	92.7	107.5		yes
Vanadium	μg/L	20.3	18.0	22.0		yes
Zinc	μg/L	207	183	219		yes
Date Acquired: J	July 04, 2017					
Mercury	mg/L	0.000097	0.000091	0.000109		yes
Date Acquired:	July 07, 2017					
Mercury	mg/L	0.000019	0.000016	0.000026		yes

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## **Quality Control**

Bill To: City of Edmonton

11004 - 190th Street Edmonton, AB, Canada

T5S 0G9

Attn: Tami Dolen

Company: City of Edmonton

Sampled By: Dale Durham

LSD: P.O.:

Project ID:

Project Name: Rossdale RMP Project Location:

9469 Rossdale Rd.

D927378 C#

4816245(L3)

Proj. Acct. code: 21195 Lot ID: 1211801

Control Number: C0096715 Date Received: Jun 30, 2017

Date Reported: Oct 18, 2017

pper Limit Pass		Lower Limit	sured	NA.	Units	Control Sample
55	'	45	52	IVI	μg/L	Aluminum
2.3		1.8	2.0		μg/L	Antimony
2.2		1.8	2.0		μg/L	Arsenic
11		9	10		μg/L	Barium
1.1		0.9	1.0		μg/L	Beryllium
5.5		4.1	4.8		μg/L	Bismuth
22		18	20		μg/L	Boron
0.11		0.09	0.10		μg/L	Cadmium
5.5		4.5	4.9		μg/L	Chromium
1.1		0.9	1.0		μg/L	Cobalt
11		9	1.0		μg/L	Copper
1.1		0.9	1.0		μg/L	Lead
11		9	10		μg/L	Lithium
10		9	10		μg/L	Molybdenum
5.5		4.4	5.0		μg/L	Nickel
2.2		1.7	2.0		μg/L	Selenium
1.08		0.84	1.02		μg/L	Silver
11		9	10		μg/L	Strontium
0.56		0.47	0.48		μg/L	Thallium
11		9	10		μg/L	Tin
5.5		4.5	5.2		μg/L	Titanium
5.5		4.5	5.1		μg/L	Uranium
1.1		0.9	1.0		μg/L	Vanadium
11		9	10		μg/L	Zinc
					July 04, 2017	Date Acquired:
10.78		8.98	9.89		mg/L	Silicon
155.3		138.5	149		mg/L	Sulfur
					July 04, 2017	Date Acquired:
2.24		1.88	2.06		mg/L	Silicon
11.0		9.2	10.3		mg/L	Sulfur
					July 04, 2017	Date Acquired:
0.22		0.18	0.20		mg/L	Silicon
3.2		2.7	3.0		mg/L	Sulfur
<del></del>					July 04, 2017	Date Acquired:

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Aluminum	mg/L	-0.0021	-0.02	0.02	yes
Calcium	mg/L	0.0005	-0.1	0.1	yes
Iron	mg/L	0.0026	-0.01	0.02	yes
Magnesium	mg/L	0.0044	-0.04	0.04	yes
Manganese	mg/L	0.0002	-0.003	0.003	yes
Potassium	mg/L	0.0269	-0.1	0.2	yes

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## **Quality Control**

Bill To: City of Edmonton

11004 - 190th Street

Edmonton, AB, Canada

T5S 0G9

Attn: Tami Dolen Sampled By: Dale Durham

Company: City of Edmonton

Project ID:

Project Name: Project Location:

Rossdale RMP 9469 Rossdale Rd.

LSD: P.O.:

D927378 C#

4816245(L3)

Proj. Acct. code: 21195 Lot ID: 1211801

Control Number: C0096715 Date Received: Jun 30, 2017

Date Reported: Oct 18, 2017

Metals Total - Conti	nued					
Blanks	Units	Measured	Lower Limit	Upper Limit		Passed QC
Silicon	mg/L	0.0038	-0.03	0.04		yes
Sodium	mg/L	0.0479	-0.1	0.2		yes
Sulfur	mg/L	0.0121	-0.1	0.2		yes
Antimony	μg/L	0.00706541	-0.2	0.2		yes
Arsenic	μg/L	-0.00205007	-0.2	0.2		yes
Barium	μg/L	-0.0408934	-1	1		yes
Beryllium	μg/L	0.00132115	-0.1	0.1		yes
Bismuth	μg/L	0.0139491	-0.5	0.5		yes
Boron	μg/L	1.15223	-1	3		yes
Cadmium	μg/L	5.44696e-005	-0.007	0.012		yes
Chromium	μg/L	0.0449845	-0.7	0.3		yes
Cobalt	μg/L	0.000298394	-0.1	0.1		yes
Copper	μg/L	0.135701	-1	1		yes
Lead	μg/L	0.0108744	-0.1	0.1		yes
Lithium	μg/L	0.0546642	-1	1		yes
Molybdenum	μg/L	0.140863	-1	1		yes
Nickel	μg/L	0.0199199	-0.5	0.5		yes
Selenium	μg/L	0.00199623	-0.2	0.2		yes
Silver	μg/L	0.000882559	-0.02	0.10		yes
Strontium	μg/L	-0.00987118	-1	1		yes
Thallium	μg/L	0.00672063	-0.05	0.05		yes
Tin	μg/L	-0.0203606	-1	1		yes
Titanium	μg/L	0.0420428	-0.5	0.5		yes
Uranium	μg/L	0.00782242	-0.5	0.5		yes
Vanadium	μg/L	-0.00472496	-0.1	0.1		yes
Zinc	μg/L	0.63986	-0	1		yes
Zirconium	μg/L	0.0242266	-1	1		yes
Date Acquired: Ju	ly 06, 2017					
Client Sample Replica	tes Units	Replicate 1	Replicate 2	% RSD Criteria	Absolute Criteria	Passed QC
Aluminum	mg/L	<0.1	<0.1	15	0.03	yes
Calcium	mg/L	<1	<1	15	0.6	yes
Iron	mg/L	0.4	0.4	15	0.20	yes
Magnesium	mg/L	<1	<1	15	0.40	yes
Manganese	mg/L	<0.02	< 0.02	15	0.010	yes
Potassium	mg/L	33	33	15	1.2	yes
Silicon	mg/L	13.1	13.2	15	0.10	yes
Sodium	mg/L	1590	1590	15	1.2	yes
Sulfur	mg/L	49	49	15	0.1	yes
Antimony	μg/L	<0.2	<0.2	15	0.4	yes
Arsenic	μg/L	0.8	0.7	15	0.4	yes
Barium	μg/L	184	181	15	2	yes
Beryllium	μg/L	<0.1	<0.1	15	0.2	yes
Bismuth	μg/L	<0.5	<0.5	15	1.1	yes
Boron	μg/L	172	169	15	4	yes

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## **Quality Control**

Bill To: City of Edmonton

11004 - 190th Street

Edmonton, AB, Canada

T5S 0G9

Attn: Tami Dolen

Company: City of Edmonton

Sampled By: Dale Durham

LSD: P.O.:

Project ID:

Project Name: Rossdale RMP Project Location:

9469 Rossdale Rd.

D927378 C# 4816245(L3)

Proj. Acct. code: 21195 Lot ID: 1211801

Control Number: C0096715 Date Received: Jun 30, 2017

Date Reported: Oct 18, 2017

Metals Total - Con	tinued					
Client Sample Replic	ates Units	Replicate 1	Replicate 2	% RSD Criteria	<b>Absolute Criteria</b>	Passed QC
Cadmium	μg/L	0.07	0.07	15	0.022	yes
Chromium	μg/L	1.0	0.8	15	1.1	yes
Cobalt	μg/L	0.7	0.6	15	0.2	yes
Copper	μg/L	1	1	15	2	yes
Lead	μg/L	0.5	0.4	15	0.2	yes
Lithium	μg/L	65	65	15	2	yes
Molybdenum	μg/L	<1	<1	15	2	yes
Nickel	μg/L	1.9	1.7	15	1.1	yes
Selenium	μg/L	<0.2	<0.2	15	0.4	yes
Silver	μg/L	0.02	<0.01	15	0.22	yes
Strontium	μg/L	560	541	15	2	yes
Thallium	μg/L	< 0.05	< 0.05	15	0.11	yes
Tin	μg/L	<1	<1	15	2	yes
Titanium	μg/L	15.7	14.5	15	1.1	yes
Uranium	μg/L	2.0	1.9	15	1.1	yes
Vanadium	μg/L	1.7	1.5	15	0.2	yes
Zinc	μg/L	7	6	15	2	yes
Zirconium	μg/L	<1	<1	15	2	yes
Date Acquired:	July 06, 2017					
Control Sample	Units	Measured	Lower Limit	Upper Limit		Passed QC
Aluminum	mg/L	3.72	3.61	4.45		yes
Calcium	mg/L	49.2	47.9	57.9		yes
Iron	mg/L	2.08	1.91	2.27		yes
Magnesium	mg/L	19.7	18.14	22.14		yes
Manganese	mg/L	0.510	0.472	0.568		yes
Potassium	mg/L	50.1	46.8	56.8		yes
Silicon	mg/L	2.03	1.90	2.30		yes
Sodium	mg/L	50.6	47.6	57.6		yes
Sulfur	mg/L	9.9	9.2	11.2		yes
Antimony	μg/L	12.1	10.8	13.2		yes
Arsenic	μg/L	12.2	11.3	12.9		yes
Barium	μg/L	62	54	68		yes
Beryllium	μg/L	6.0	4.9	6.8		yes
Bismuth	μg/L	32.5	26.2	35.8		yes
Boron	μg/L	128	102	139		yes
Cadmium	μg/L	0.65	0.567	0.687		yes
Chromium	μg/L	31.0	26.5	33.7		yes
Cobalt	μg/L	6.2	5.2	6.8		yes
Copper	μg/L	63	53	67		yes
Lead	μg/L	6.5	5.2	7.1		yes
Lithium	μg/L	60	53	77		yes
Molybdenum	μg/L	61	56	66		yes
Nickel	μg/L	31.4	28.9	33.1		yes
Selenium	μg/L	12.3	9.9	13.5		yes

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# **Quality Control**

Bill To: City of Edmonton

11004 - 190th Street

Edmonton, AB, Canada

T5S 0G9

Attn: Tami Dolen
Sampled By: Dale Durham

Company: City of Edmonton

Project ID:

Project Name: Rossdale RMP
Project Location: 9469 Rossdale Rd.

LSD: P.O.:

D927378 C#

4816245(L3)

Proj. Acct. code: 21195

Lot ID: 1211801

Control Number: C0096715

Date Received: Jun 30, 2017

Date Reported: Oct 18, 2017

Report Number: 2232401

ontrol Sample	Units	Measured	Lower Limit	Upper Limit	Passed (
Silver	μg/L	6.27	5.39	7.13	:
Strontium	μg/L	62	54	69	,
Thallium	μg/L	3.42	2.81	3.89	
Tin	μg/L	63	56	66	
Titanium	μg/L	29.6	26.6	35.7	
Uranium	μg/L	32.2	25.7	36.3	
Vanadium	μg/L	6.1	5.1	7.2	
Zinc	μg/L	65	53	67	
Zirconium	μg/L	60	53	67	
Date Acquired:	July 06, 2017				
Antimony	μg/L	40.2	37.5	43.1	
Arsenic	μg/L	40.8	36.5	43.5	
Barium	μg/L	196	186	216	
Beryllium	μg/L	19.5	17.1	21.9	
Bismuth	μg/L	98.1	91.3	106.3	
Boron	μg/L	402	343	436	
Cadmium	μg/L	2.14	1.915	2.205	
Chromium	μg/L	101	90.0	110.0	
Cobalt	μg/L	20.6	18.1	21.7	
Copper	μg/L	204	189	214	
Lead	μg/L	20.3	18.0	24.0	
Lithium	μg/L	192	173	222	
Molybdenum	μg/L	204	189	225	
Nickel	μg/L	103	90.0	110.0	
Selenium	μg/L	40.0	37.2	43.6	
Silver	μg/L	20.5	18.00	22.00	
Strontium	μg/L	204	171	231	
Thallium	μg/L	9.75	9.16	10.96	
Tin	μg/L	202	190	218	
Titanium	μg/L	99.7	93.2	107.0	
Uranium	μg/L	99.6	90.2	109.0	
Vanadium	μg/L	20.2	16.9	22.1	
Zinc	μg/L	206	183	218	
Date Acquired:	July 06, 2017				
Antimony	μg/L	12.2	10.8	13.2	
Arsenic	μg/L	12.3	10.8	13.2	
Barium	μg/L	60	55	67	
Beryllium	μg/L	6.1	5.2	6.5	
Bismuth	μg/L	30.9	27.5	33.5	
Boron	μg/L	126	108	132	
Cadmium	μg/L	0.66	0.560	0.692	
Chromium	μg/L	31.3	27.0	33.0	
Cobalt	μg/L	6.3	5.4	6.6	
Copper	μg/L	63	54	66	

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# **Quality Control**

Bill To: City of Edmonton

11004 - 190th Street Edmonton, AB, Canada

T5S 0G9

Attn: Tami Dolen

Sampled By: Dale Durham

LSD: P.O.:

Rossdale RMP Project Name: Project Location:

9469 Rossdale Rd.

D927378 C#

Proj. Acct. code: 21195

4816245(L3)

Company: City of Edmonton

Project ID:	Lot ID:	1211801
-------------	---------	---------

Control Number: C0096715 Date Received: Jun 30, 2017

Date Reported: Oct 18, 2017 Report Number: 2232401

ontrol Sample	Units	Measured	Lower Limit	Upper Limit	Passed C
Lead	μg/L	6.3	5.4	6.6	у
Lithium	μg/L	61	53	66	у
Molybdenum	μg/L	61	54	66	у
Nickel	μg/L	31.7	27.0	33.0	у
Selenium	μg/L	11.9	10.3	13.4	у
Silver	μg/L	6.22	5.40	6.60	У
Strontium	μg/L	62	54	66	У
Thallium	μg/L	3.15	0.00	6.00	}
Tin	μg/L	64	54	66	}
Titanium	μg/L	29.7	27.0	33.0	У
Uranium	μg/L	31.1	27.0	33.0	}
Vanadium	μg/L	6.1	5.4	6.6	У
Zinc	μg/L	63	57	66	)
Zirconium	μg/L	60	54	66	)
Date Acquired:	July 06, 2017				
Antimony	μg/L	2.1	1.8	2.2	y
Arsenic	μg/L	2.1	1.7	2.2	· · · · · · · · · · · · · · · · · · ·
Barium	μg/L	10	9	11	· · · · · · · · · · · · · · · · · · ·
Beryllium	μg/L	1.0	0.8	1.1	y
Bismuth	μg/L	5.2	4.8	5.7	y
Boron	μg/L	21	17	23	· ·
Cadmium	μg/L	0.10	0.089	0.113	<u> </u>
Chromium	μg/L	5.3	4.6	5.4	<u>'</u>
Cobalt	μg/L	1.1	0.9	1.1	<u>'</u>
Copper	μg/L	11	9	11	<u>'</u>
Lead	μg/L	1.1	0.9	1.1	,
Lithium	μg/L	10	9	11	,
Molybdenum	μg/L	10	9	11	)
Nickel	μg/L	5.3	4.5	5.5	,
Selenium	μg/L	2.0	1.6	2.2	,
Silver	μg/L	1.05	0.89	1.13	,
Strontium	μg/L	10	9	11	,
Thallium	μg/L	0.53	0.47	0.57	)
Tin	μg/L	10	9	11	)
Titanium	μg/L	5.4	4.2	5.7	)
Uranium	μg/L	5.3	4.7	5.6	)
Vanadium	μg/L	1.1	0.9	1.2	)
Zinc	μg/L	11	9	11	)
Zirconium	μg/L	10	9	11	
Date Acquired:	July 06, 2017				
Aluminum	mg/L	19.3	18.80	20.60	y
Calcium	mg/L	247	236.0	263.6	, )
Iron	mg/L	9.79	9.16	10.24	)
Magnesium	mg/L	97.2	92.78	104.72	, )

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#### **Quality Control**

Bill To: City of Edmonton

11004 - 190th Street

Edmonton, AB, Canada

T5S 0G9

Attn: Tami Dolen

Company: City of Edmonton

Sampled By: Dale Durham

LSD: P.O.:

Project ID:

Project Name: Rossdale RMP Project Location:

9469 Rossdale Rd.

D927378 C# 4816245(L3)

Proj. Acct. code: 21195 Lot ID: 1211801

Control Number: C0096715 Date Received: Jun 30, 2017

Date Reported: Oct 18, 2017

Report Number: 2232401

ontrol Sample	Units	Measured	Lower Limit	Upper Limit	Passed Q0
Manganese	mg/L	2.39	2.290	2.590	ye
Potassium	mg/L	251	234.2	261.8	yes
Silicon	mg/L	10.1	9.13	10.93	ye
Sodium	mg/L	248	228.8	269.4	ye
Sulfur	mg/L	151	135.5	165.3	yes
Date Acquired: Ju	ly 06, 2017				
Aluminum	mg/L	3.80	3.49	4.47	yes
Calcium	mg/L	50.3	46.5	56.5	yes
Iron	mg/L	2.13	1.87	2.27	yes
Magnesium	mg/L	20.4	18.05	22.07	yes
Manganese	mg/L	0.525	0.466	0.568	yes
Potassium	mg/L	50.8	45.4	55.5	yes
Silicon	mg/L	2.07	1.93	2.24	yes
Sodium	mg/L	50.6	45.9	55.9	yes
Sulfur	mg/L	10.2	9.3	11.3	yes
Date Acquired: Ju	ly 06, 2017				
Aluminum	mg/L	0.39	0.36	0.44	yes
Calcium	mg/L	5.2	4.8	5.8	yes
Iron	mg/L	0.23	0.19	0.25	yes
Magnesium	mg/L	2.1	1.84	2.20	yes
Manganese	mg/L	0.054	0.047	0.059	yes
Potassium	mg/L	5.2	4.7	5.7	ye
Silicon	mg/L	0.21	0.17	0.23	ye
Sodium	mg/L	5.2	4.8	5.6	ye
Sulfur	mg/L	3.1	2.8	3.3	yes

### PAH - Water - Surrogate Recovery

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Nitrobenzene-d5	%	109.49	23	130	yes
2-Fluorobiphenyl	%	84.05	30	130	yes
p-Terphenyl-d14	%	81.76	18	137	yes
Date Acquired:	July 05, 2017				

# Polycyclic Aromatic Hydrocarbons -

Blanks	Units	Measured	Lower Limit	Upper Limit	Passed QC
Naphthalene	ng/mL	0	-0.1	0.1	yes
Quinoline	ng/mL	0	-0.1	0.1	yes
Acenaphthylene	ng/mL	0	-0.1	0.1	yes
Acenaphthene	ng/mL	0	-0.1	0.1	yes
Fluorene	ng/mL	0	-0.1	0.1	yes
Phenanthrene	ng/mL	0	-0.1	0.1	yes
Acridine	ng/mL	0	-0.1	0.1	yes

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**Passed QC** 

yes

yes yes yes yes yes yes yes yes

yes

yes

yes

yes

yes

yes

yes

yes

yes

yes

yes

yes

yes

Passed QC

#### **Quality Control**

Bill To: City of Edmonton

11004 - 190th Street

Project Name: Project Location:

Project ID:

Rossdale RMP 9469 Rossdale Rd. Control Number: Date Received:

**Upper Limit** 

0.005

0.01

0.05

Lot ID: 1211801 C0096715 Jun 30, 2017

T5S 0G9 LSD: Tami Dolen P.O.:

D927378 C#

Date Reported: Oct 18, 2017 Report Number: 2232401

Sampled By: Dale Durham

Attn:

Company: City of Edmonton

Edmonton, AB, Canada

Measured

0

0

0

94.48

102.40

101.60

102.00

97.20

97.00

101.00

104.00

104.20

102.40

105.20

118.60

119.00

107.60

113.20

102.60

99.40

102.40

4816245(L3)

21195 Proj. Acct. code:

Polycyclic Aromatic Hydrocarbons -
Water - Continued

Blanks	Units
Anthracene	ng/mL
Fluoranthene	na/ml

Fluoranthene	ng/mL
Pyrene	ng/mL
Benzo(a)anthracene	ng/mL
Chrysene	ng/mL
Benzo(b)fluoranthene	ng/mL
Benzo(b+j)fluoranthene	ng/mL
Benzo(k)fluoranthene	ng/mL
Benzo(a)pyrene	ng/mL

Benzo(g,h,i)perylene ng/mL July 05, 2017 Date Acquired:

Indeno(1,2,3-c,d)pyrene

Dibenzo(a,h)anthracene

**Calibration Check** 

Naphthalene

Quinoline

Pyrene

Chrysene

Benzo(a)anthracene

Benzo(b)fluoranthene

Benzo(k)fluoranthene

Indeno(1,2,3-c,d)pyrene

Benzo(a)pyrene

0	-0.01	0.01
0	-0.01	0.01
0	-0.1	0.1
0	-0.1	0.1
0	-0.1	0.1
0	-0.1	0.1
0	-0.008	0.008
0	-0.05	0.05
0	-0.05	0.05

**Lower Limit** 

-0.005

-0.01

-0.05

% Recovery 101.80

Acenaphthylene ng/mL Acenaphthene ng/mL Fluorene ng/mL Phenanthrene ng/mL Acridine ng/mL Anthracene ng/mL Fluoranthene ng/mL

ng/mL

ng/mL

Units

ng/mL

ng/mL

ng/mL ng/mL ng/mL ng/mL Benzo(b+j)fluoranthene ng/mL ng/mL ng/mL

ng/mL

Dibenzo(a,h)anthracene ng/mL Benzo(g,h,i)perylene ng/mL Date Acquired: July 05, 2017

it	Upper Limit	Lower Limit
20	120	80
20	120	80

80 120 80 120 80 120 80 120 80 120 80 120 80 120

80

80

80

80

80

80

80

80

80

80

120

yes yes yes yes yes yes yes yes yes

#### **Routine Water**

Blanks	Units	Measured	Lower Limit	Upper Limit
Calcium	mg/L	0.0129	-0.2	0.2
Magnesium	mg/L	-0.0037	-0.1	0.1
Sodium	mg/L	-0.0167	-0.4	0.4
Potassium	mg/L	-0.0384	-0.4	0.4
Iron	mg/L	0.0028	-0.01	0.01
Manganese	mg/L	0.0004	-0.004	0.004

Passed QC yes yes yes yes yes yes Exova 7217 Roper Road NW Edmonton, Alberta T6B 3J4, Canada

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### **Quality Control**

Bill To: City of Edmonton

11004 - 190th Street Edmonton, AB, Canada

T5S 0G9

P.O.: Attn: Tami Dolen Sampled By: Dale Durham

Company: City of Edmonton

Project ID:

LSD:

Project Name: Rossdale RMP Project Location: 9469 Rossdale Rd.

D927378 C# 4816245(L3)

Proj. Acct. code: 21195 Lot ID: 1211801

Control Number: C0096715 Date Received: Jun 30, 2017 Date Reported: Oct 18, 2017

Report Number: 2232401

Blanks         Units         Measured         Lower Limit         Upper Limit           Chloride         mg/L         0.33         -0.4         0.4           Nitrate - N         mg/L         0         -0.01         0.01           Nitrite - N         mg/L         0         -0.005         0.005           Date Acquired:         July 04, 2017         Client Sample Replicates         Units         Replicate 1         Replicate 2         % RSD Criteria         Absolute Criteria           pH         11.6         11.6         0           Electrical Conductivity         dS/m         31.3         31.0         10         0           Calcium         mg/L         49.7         49.6         10         0         0           Magnesium         mg/L         7.3         7.3         10         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0 <th></th> <th></th>		
Nitrate - N         mg/L         0         -0.01         0.01           Nitrite - N         mg/L         0         -0.005         0.005           Date Acquired:         July 04, 2017         Replicate 1         Replicate 2         % RSD Criteria         Absolute Criteria           pH         11.6         11.6         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0		Passed QC
Nitrite - N         mg/L         0         -0.005         0.005           Date Acquired:         July 04, 2017         Replicate 1         Replicate 2         % RSD Criteria         Absolute Criteria           PH         11.6         11.6         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0		yes
Date Acquired:         July 04, 2017           Client Sample Replicates         Units         Replicate 1         Replicate 2         % RSD Criteria         Absolute Criteria           pH         11.6         11.6         0           Electrical Conductivity         dS/m         31.3         31.0         10         0           Calcium         mg/L         49.7         49.6         10         10         0           Magnesium         mg/L         7.3         7.3         10         10         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0		yes
Client Sample Replicates         Units         Replicate 1         Replicate 2         % RSD Criteria         Absolute Criteria           pH         11.6         11.6         0         0           Electrical Conductivity         dS/m         31.3         31.0         10         0           Calcium         mg/L         49.7         49.6         10         10           Magnesium         mg/L         7.3         7.3         10         10           Sodium         mg/L         14.0         14.0         10         10		yes
pH     11.6     11.6     0       Electrical Conductivity     dS/m     31.3     31.0     10       Calcium     mg/L     49.7     49.6     10       Magnesium     mg/L     7.3     7.3     10       Sodium     mg/L     14.0     14.0     10		
Electrical Conductivity       dS/m       31.3       31.0       10       0         Calcium       mg/L       49.7       49.6       10         Magnesium       mg/L       7.3       7.3       10         Sodium       mg/L       14.0       14.0       10	eria	Passed QC
Calcium       mg/L       49.7       49.6       10         Magnesium       mg/L       7.3       7.3       10         Sodium       mg/L       14.0       14.0       10	0.10	yes
Magnesium         mg/L         7.3         7.3         10           Sodium         mg/L         14.0         14.0         10	.002	yes
Sodium mg/L 14.0 14.0 10	0.6	yes
·	0.7	yes
Potassium mg/l 1.2 1.2 1.0	1.2	yes
1 0 tasses and 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.2	yes
Iron mg/L <0.01 <0.01 10	0.05	yes
Manganese mg/L <0.005 <0.005 10	.010	yes
Chloride mg/L 2.6 2.7 10	0.5	yes
Nitrate - N mg/L <0.10 <0.10 10	0.01	yes
Nitrite - N mg/L <0.05 <0.05 10	.010	yes
Hydroxide mg/L <5 <5 10		yes
Carbonate mg/L <6 <6 10	6	yes
Bicarbonate mg/L 430 427 10	6	yes
P-Alkalinity mg/L <5.0 <5.0 10	5.0	yes
T-Alkalinity mg/L 352 350 10	5.0	yes
Date Acquired: July 05, 2017		
Control Sample Units Measured Lower Limit Upper Limit		Passed QC
pH 9.14 8.90 9.44		yes
Electrical Conductivity dS/m 2.72 2.600 2.858		yes
Calcium mg/L 245 230.0 260.0		yes
Magnesium mg/L 95.7 92.3 102.0		yes
Sodium mg/L 247 233.3 257.3		yes
Potassium mg/L 249 233.0 263.0		yes
Iron mg/L 9.67 8.91 10.20		yes
Manganese mg/L 2.39 2.240 2.540		yes
Nitrate - N mg/L 10.2 9.58 10.58		yes
Nitrite - N mg/L 10.0 9.460 10.600		yes
Nitrate and Nitrite - N mg/L 20.2 19.27 20.97		yes
P-Alkalinity mg/L 500 441.0 591.0		yes
T-Alkalinity mg/L 1010 962.0 1034.0		yes
Date Acquired: July 05, 2017		
pH 6.86 6.78 6.96		yes
Electrical Conductivity dS/m 0.078 0.071 0.085		yes
Calcium mg/L 52.2 44.9 56.9		yes
Magnesium mg/L 19.6 17.9 22.0		yes
Sodium mg/L 51.5 47.7 55.5		yes
Potassium mg/L 52.0 45.8 55.8		yes

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# **Quality Control**

Bill To: City of Edmonton

11004 - 190th Street Edmonton, AB, Canada

T5S 0G9

Attn: Tami Dolen

Company: City of Edmonton

Sampled By: Dale Durham

LSD: P.O.:

Project ID:

Project Name: Rossdale RMP Project Location:

9469 Rossdale Rd.

D927378 C# 4816245(L3)

Proj. Acct. code: 21195 Lot ID: 1211801

Control Number: C0096715 Date Received: Jun 30, 2017

Date Reported: Oct 18, 2017

Report Number: 2232401

outine Water - Contir	nued				
Control Sample	Units	Measured	Lower Limit	Upper Limit	Passed Q
Iron	mg/L	2.08	1.89	2.25	ye
Manganese	mg/L	0.512	0.468	0.552	ує
Chloride	mg/L	81.2	74.9	86.9	ye
Nitrate - N	mg/L	4.79	4.51	5.26	ує
Nitrite - N	mg/L	4.94	4.548	5.352	ує
Nitrate and Nitrite - N	mg/L	9.73	9.07	10.43	ує
P-Alkalinity	mg/L	52.4	22.4	67.4	ye
T-Alkalinity	mg/L	122	115.0	139.0	ye
Date Acquired: July 0	5, 2017				
Calcium	mg/L	5.2	4.6	5.7	ye
Magnesium	mg/L	1.9	1.8	2.2	ye
Sodium	mg/L	5.2	4.7	5.7	ye
Potassium	mg/L	5.2	4.5	5.5	ye
Iron	mg/L	0.23	0.19	0.24	ye
Manganese	mg/L	0.052	0.046	0.056	ye
Chloride	mg/L	14.6	13.3	16.5	ye
Nitrate - N	mg/L	0.48	0.43	0.58	ye
Nitrite - N	mg/L	0.504	0.453	0.567	ye
Nitrate and Nitrite - N	mg/L	0.99	0.92	1.10	y



#### Methodology and Notes

Bill To: City of Edmonton

Project ID: Project Name: Rossdale RMP Lot ID: 1211801

11004 - 190th Street Edmonton, AB, Canada

Project Location: 9469 Rossdale Rd. Control Number: C0096715 Date Received: Jun 30, 2017

T5S 0G9 Tami Dolen

Company: City of Edmonton

LSD: P.O.:

Oct 18, 2017

Attn: Sampled By: Dale Durham

D927378 C# 4816245(L3)

Proj. Acct. code: 21195 Report Number: 2232401

Date Reported:

#### **Method of Analysis** Method Name Method Date Analysis Reference Location Started Alkalinity, pH, and EC in water **APHA** \* Alkalinity - Titration Method, 2320 B Jul 5, 2017 Exova Edmonton Alkalinity, pH, and EC in water **APHA** \* Conductivity, 2510 B Jul 5, 2017 Exova Edmonton Alkalinity, pH, and EC in water APHA \* pH - Electrometric Method, 4500-H+ B Jul 5, 2017 Exova Edmonton Anions (Routine) by Ion **APHA** \* Ion Chromatography with Chemical Jul 4, 2017 Exova Edmonton Chromatography Suppression of Eluent Cond., 4110 B Approval-Edmonton **APHA** Checking Correctness of Analyses, 1030 Jul 5, 2017 Exova Edmonton Ε Chloride in Water **APHA** \* Automated Ferricyanide Method, 4500-Cl-Exova Edmonton Jul 4, 2017 Ε Mercury (Dissolved) in water **APHA** \* Cold Vapour Atomic Absorption Jul 7, 2017 Exova Edmonton Spectrometric Method, 3112 B Metals ICP-MS (Dissolved) in water **US EPA** Determination of Trace Elements in Jul 4, 2017 Exova Edmonton Waters and Wastes by ICP-MS, 200.8 Metals ICP-MS (Total) in water **US EPA** Determination of Trace Elements in Jul 4, 2017 Exova Edmonton Waters and Wastes by ICP-MS, 200.8 Metals Trace (Dissolved) in water **APHA** Hardness by Calculation, 2340 B Jul 4, 2017 Exova Edmonton Metals Trace (Dissolved) in water **APHA** \* Inductively Coupled Plasma (ICP) Jul 4, 2017 Exova Edmonton Method, 3120 B Metals Trace (Total) in water **APHA** Inductively Coupled Plasma (ICP) Jul 4, 2017 Exova Edmonton Method, 3120 B PAH - Water **AFSRD** Carcinogenic PAHs Toxic Potency Jul 5, 2017 **Exova Calgary** Equivalence (as B(a)P TPE), PAHw PAH - Water **AESRD** Carcinogenic PAHs Toxic Potency Oct 18, 2017 **Exova Calgary** Equivalence (as B(a)P TPE), PAHw PAH - Water **US EPA** Semivolatile Organic Compounds by Gas Jul 5, 2017 **Exova Calgary** Chromatography/Mass Spectrometry, PAH - Water **US EPA** Semivolatile Organic Compounds by Gas Oct 18, 2017 **Exova Calgary** Chromatography/Mass Spectrometry, 8270

#### \* Reference Method Modified

#### References

**AESRD** Alberta Tier 1 Soil and Groundwater Remediation Guidelines APHA Standard Methods for the Examination of Water and Wastewater APHA/USEPA Standard Methods For Water/ Environmental Protection Agency **US EPA** US Environmental Protection Agency Test Methods

### **Comments:**

- Jul 10, 2017 -Some ICP-MS total metal results were less than dissolved metal results for sample(s) 1211801-2 and 3. Total metals were analyzed from the metals bottle and dissolved from the field filtered bottle. Results were verified.
- Jul 10, 2017 -Some ICP-MS total metal results were less than dissolved metal results for samples 1211801-1 to 5. The results were verified and are within expected measurement uncertainty.
- The ion balance was outside the range 90 110% for samples 1211801-3 and 5. Cations were analyzed from a field filtered container • Jul 11, 2017 -

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#### **Methodology and Notes**

Bill To: City of Edmonton Project ID: Lot ID: 1211801

11004 - 190th StreetProject Name:Rossdale RMPControl Number:C0096715Edmonton, AB, CanadaProject Location:9469 Rossdale Rd.Date Received:Jun 30, 2017T5S 0G9LSD:Date Reported:Oct 18, 2017

Attn: Tami Dolen P.O.: D927378 C# Report Number: 2232401

Sampled By: Dale Durham 4816245(L3)

Company: City of Edmonton Proj. Acct. code: 21195

and anions from a routine container. All parameters in each container have been confirmed.

• Oct 18, 2017 - Report was issued to correct the Total Potency Equivalents result on sample 3 previously reported as 0.03 ug/L on Test Report

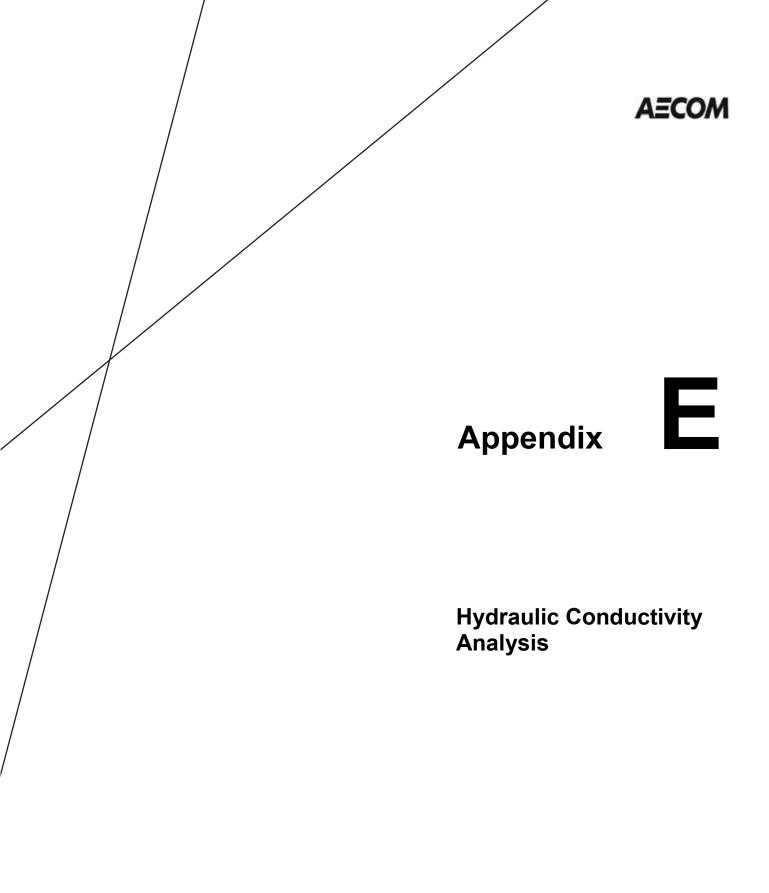
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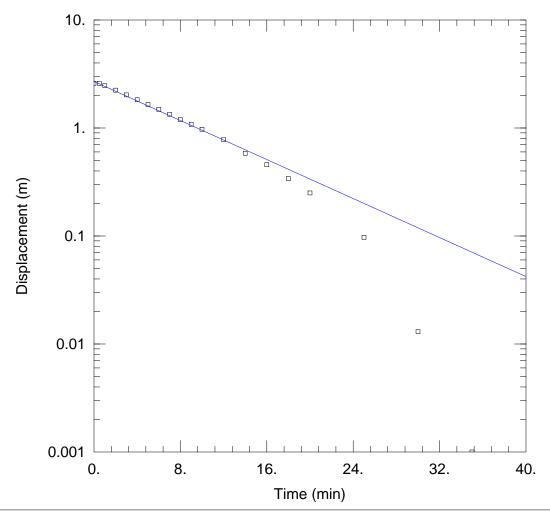
Please direct any inquiries regarding this report to our Client Services Group or to the Operations Manager at the coordinates indicated at the top left of this page.

Results relate only to samples as submitted.

The test report shall not be reproduced except in full, without the written approval of the laboratory.

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Data Set: O:\...\Rossdale\_16-02.aqt

Date: <u>10/30/17</u> Time: <u>10:</u>37:51

# **PROJECT INFORMATION**

Company: AECOM
Client: City of Edmonton
Project: 60443747
Location: Edmonton
Test Well: 16-02

Test Date: 6/29/2017

**AQUIFER DATA** 

Saturated Thickness: 1.9 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (16-02)

Initial Displacement: 2.59 m

Total Well Penetration Depth: 9.6 m

Casing Radius: 0.025 m

Static Water Column Height: 3.325 m

Screen Length: 1.5 m Well Radius: 0.025 m

**SOLUTION** 

Aguifer Model: Confined Solution Method: Bouwer-Rice

K = 1.538E-6 m/sec y0 = 2.693 m

Data Set: O:\Projects\60443747\400-Technical\Hydraulic Conductivity (Slug Tests Results)\Working Files\Rossdale Date: 10/30/17

Time: 10:38:06

#### PROJECT INFORMATION

Company: AECOM Client: City of Edmonton Project: 60443747 Location: Edmonton Test Date: 6/29/2017 Test Well: 16-02

#### **AQUIFER DATA**

Saturated Thickness: 1.9 m Anisotropy Ratio (Kz/Kr): 1.

### SLUG TEST WELL DATA

Test Well: 16-02

X Location: 33130.905 m Y Location: 5933004.079 m

Initial Displacement: 2.59 m

Static Water Column Height: 3.325 m

Casing Radius: 0.025 m Well Radius: 0.025 m
Well Skin Radius: 0.025 m
Screen Length: 1.5 m
Total Well Penetration Depth: 9.6 m

No. of Observations: 20

	Observation	n Data		
Time (min)	Displacement (m)	Time (min)	Displacement (m)	
0.5	2.59	10.	0.97	
1.	2.468	12.	0.78	
2.	2.238	14.	0.582	
3.	2.025	16.	0.457	
4.	1.828	18.	0.34	
5.	1.648	20.	0.25	
6.	1.485	25.	0.097	
7.	1.338	30.	0.013	
8.	1.195	35.	0.001	
9.	1.08	40.	0.	

### SOLUTION

Slug Test

Aquifer Model: Confined Solution Method: Bouwer-Rice

In(Re/rw): 4.261

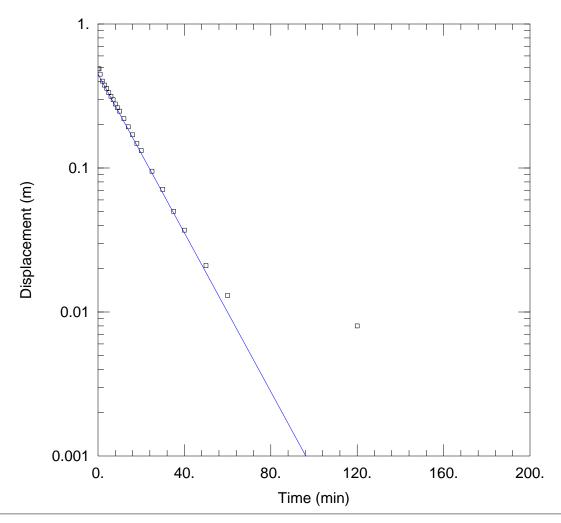
#### VISUAL ESTIMATION RESULTS

#### **Estimated Parameters**

Parameter Estimate 1.538E-6 2.693 K m/sec y0 m

K = 0.0001538 cm/sec

 $T = K*b = 2.923E-6 \text{ m}^2/\text{sec} (0.02923 \text{ sq. cm/sec})$ 



Data Set: O:\...\Rossdale\_16-05.aqt

Date: 10/30/17 Time: 10:38:18

# PROJECT INFORMATION

Company: AECOM
Client: City of Edmonton
Project: 60443747
Location: Edmonton
Test Well: 16-05

Test Date: 6/29/2017

**AQUIFER DATA** 

Saturated Thickness: 2. m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (16-05)

Initial Displacement: 0.488 m

Total Well Penetration Depth: 10.1 m

Casing Radius: 0.025 m

Static Water Column Height: 0. m

Screen Length: 1.5 m Well Radius: 0.025 m

**SOLUTION** 

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 9.457E-7 m/sec y0 = 0.4491 m

Data Set: O:\Projects\60443747\400-Technical\Hydraulic Conductivity (Slug Tests Results)\Working Files\Rossdale Date: 10/30/17

Time: 10:38:31

# PROJECT INFORMATION

Company: AECOM Client: City of Edmonton Project: 60443747 Location: Edmonton Test Date: 6/29/2017 Test Well: 16-05

### **AQUIFER DATA**

Saturated Thickness: 2. m Anisotropy Ratio (Kz/Kr): 1.

#### SLUG TEST WELL DATA

Test Well: 16-05

X Location: 33253.902 m Y Location: 5932954.169 m

Initial Displacement: 0.488 m Static Water Column Height: 0. m

Casing Radius: 0.025 m Well Radius: 0.025 m
Well Skin Radius: 0.025 m
Screen Length: 1.5 m
Total Well Penetration Depth: 10.1 m

No. of Observations: 23

	Observation	on Data		
Time (min)	Displacement (m)	Time (min)	Displacement (m)	
0.5	0.488	<del>14.</del>	0.193	
1.	0.448	16.	0.17	
2.	0.401	18.	0.148	
3.	0.376	20.	0.132	
4.	0.358	25.	0.095	
5.	0.333	30.	0.071	
6.	0.315	35.	0.05	
7.	0.298	40.	0.037	
8.	0.278	50.	0.021	
9.	0.262	60.	0.013	
10.	0.248	120.	0.008	
12.	0.22			

#### SOLUTION

Slug Test

Aquifer Model: Confined

Solution Method: Bouwer-Rice

In(Re/rw): 4.29

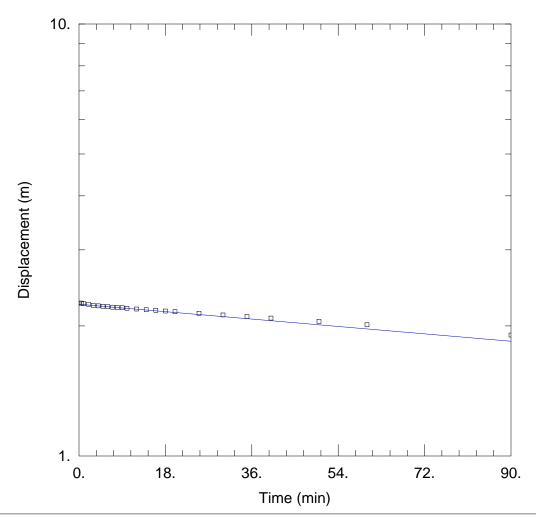
#### VISUAL ESTIMATION RESULTS

#### **Estimated Parameters**

Parameter Estimate K y0 9.457E-7 m/sec 0.4491

K = 9.457E-5 cm/sec

 $T = K*b = 1.891E-6 \text{ m}^2/\text{sec} (0.01891 \text{ sq. cm/sec})$ 



Data Set: O:\...\Rossdale\_16-06.aqt

Date: 10/30/17 Time: 10:38:43

# PROJECT INFORMATION

Company: AECOM
Client: City of Edmonton
Project: 60443747
Location: Edmonton
Test Well: 16-06

Test Date: 6/27/2017

#### **AQUIFER DATA**

Saturated Thickness: 3. m Anisotropy Ratio (Kz/Kr): 1.

# WELL DATA (16-06)

Initial Displacement: 2.258 m

Total Well Penetration Depth: 11.4 m

Casing Radius: 0.025 m

Static Water Column Height: 1.78 m

Screen Length: 1.5 m Well Radius: 0.025 m

### **SOLUTION**

Aquifer Model: Confined

Solution Method: Bouwer-Rice

K = 3.319E-8 m/sec

y0 = 2.245 m

Data Set: O:\Projects\60443747\400-Technical\Hydraulic Conductivity (Slug Tests Results)\Working Files\Rossdale Date: 10/30/17

Time: 10:38:53

#### PROJECT INFORMATION

Company: AECOM Client: City of Edmonton Project: 60443747 Location: Edmonton Test Date: 6/27/2017 Test Well: 16-06

#### **AQUIFER DATA**

Saturated Thickness: 3. m Anisotropy Ratio (Kz/Kr): 1.

#### SLUG TEST WELL DATA

Test Well: 16-06

X Location: 33282.292 m Y Location: 5932935.805 m

Initial Displacement: 2.258 m

Static Water Column Height: 1.78 m

Casing Radius: 0.025 m Well Radius: 0.025 m
Well Skin Radius: 0.025 m
Screen Length: 1.5 m
Total Well Penetration Depth: 11.4 m

No. of Observations: 23

	Observation	on Data		
Time (min)	Displacement (m)	Time (min)	Displacement (m)	
0.5	2.258	<del>14.</del>	2.18	
1.	2.252	16.	2.173	
2.	2.245	18.	2.165	
3.	2.23	20.	2.158	
4.	2.226	25.	2.138	
5.	2.22	30. 35.	2.12	
6.	2.216	35.	2.102	
7.	2.21	40.	2.085	
8.	2.206	50.	2.048	
9.	2.203	60.	2.012	
10.	2.198	90.	1.905	
12.	2.188			

#### SOLUTION

Slug Test

Aquifer Model: Confined

Solution Method: Bouwer-Rice

In(Re/rw): 4.358

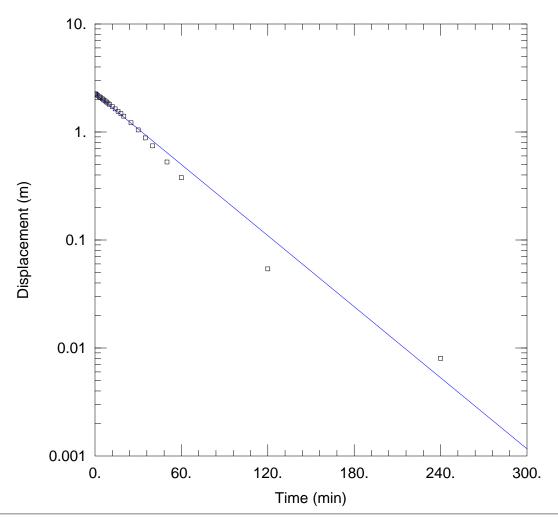
#### VISUAL ESTIMATION RESULTS

# Estimated Parameters

**Parameter** Estimate K y0 3.319E-8 m/sec 2.245

K = 3.319E-6 cm/sec

 $T = K*b = 9.956E-8 \text{ m}^2/\text{sec} (0.0009956 \text{ sq. cm/sec})$ 



Data Set: O:\...\Rossdale\_16-07.aqt

Date: 10/30/17 Time: 10:39:04

### PROJECT INFORMATION

Company: AECOM
Client: City of Edmonton
Project: 60443747
Location: Edmonton
Test Well: 16-07

Test Date: 6/27/2017

#### **AQUIFER DATA**

Saturated Thickness: 3.8 m Anisotropy Ratio (Kz/Kr): 1.

# WELL DATA (16-07)

Initial Displacement: 2.252 m

Total Well Penetration Depth: 11.7 m

Casing Radius: 0.025 m

Static Water Column Height: 1.752 m

Screen Length: 1.5 m Well Radius: 0.025 m

### **SOLUTION**

Aguifer Model: Confined

Solution Method: Bouwer-Rice

K = 3.834E-7 m/sec

y0 = 2.272 m

Data Set: O:\Projects\60443747\400-Technical\Hydraulic Conductivity (Slug Tests Results)\Working Files\Rossdale Date: 10/30/17

Time: 10:39:17

#### PROJECT INFORMATION

Company: AECOM Client: City of Edmonton Project: 60443747 Location: Edmonton Test Date: 6/27/2017 Test Well: 16-07

#### **AQUIFER DATA**

Saturated Thickness: 3.8 m Anisotropy Ratio (Kz/Kr): 1.

### SLUG TEST WELL DATA

Test Well: 16-07

X Location: 33302.086 m Y Location: 5932924.179 m

Initial Displacement: 2.252 m

Static Water Column Height: 1.752 m

Casing Radius: 0.025 m Well Radius: 0.025 m
Well Skin Radius: 0.025 m
Screen Length: 1.5 m
Total Well Penetration Depth: 11.7 m

No. of Observations: 24

	Observatio	n Data		
Time (min)	Displacement (m)	Time (min)	Displacement (m)	
0.5	2.252	14.	1.635	
1.	2.222	16.	1.555	
2.	2.167	18.	1.478	
3.	2.117	20.	1.4	
4.	2.075	25.	1.215	
5.	2.027	30.	1.044	
6.	1.98	35.	0.88	
7.	1.939	40.	0.744	
8.	1.893	50.	0.527	
9.	1.85	60.	0.377	
10.	1.803	120.	0.054	
12.	1.72	240.	0.008	

#### SOLUTION

Slug Test

Aquifer Model: Confined

Solution Method: Bouwer-Rice

In(Re/rw): 4.372

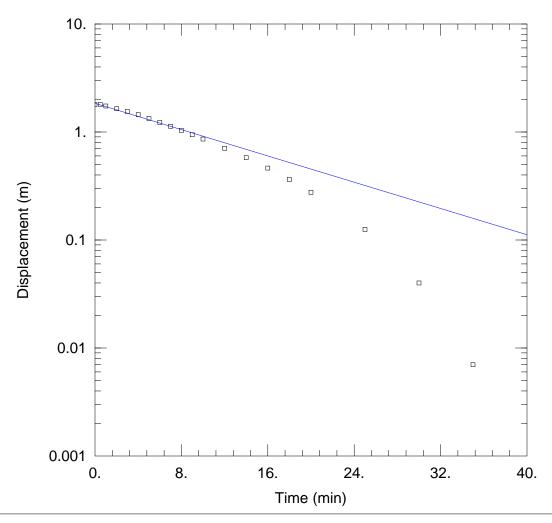
#### VISUAL ESTIMATION RESULTS

# Estimated Parameters

Parameter Estimate K y0 3.834E-7 m/sec 2.272

K = 3.834E-5 cm/sec

 $T = K*b = 1.457E-6 \text{ m}^2/\text{sec} (0.01457 \text{ sq. cm/sec})$ 



Data Set: O:\...\Rossdale\_16-08.aqt

Date: 10/30/17 Time: 10:39:28

# PROJECT INFORMATION

Company: AECOM Client: City of Edmonton Project: 60443747 Location: Edmonton Test Well: 16-08

Test Date: 6/27/2017

**AQUIFER DATA** 

Saturated Thickness: 3.9 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (16-08)

Initial Displacement: 1.795 m Static Water Column Height: 2.545 m

Total Well Penetration Depth: 12.3 m Screen Length: 1.5 m Well Radius: 0.025 m

Casing Radius: 0.025 m

**SOLUTION** 

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 1.07E-6 m/sec

y0 = 1.84 m

Data Set: O:\Projects\60443747\400-Technical\Hydraulic Conductivity (Slug Tests Results)\Working Files\Rossdale Date: 10/30/17

Time: 10:39:36

#### PROJECT INFORMATION

Company: AECOM Client: City of Edmonton Project: 60443747 Location: Edmonton Test Date: 6/27/2017 Test Well: 16-08

### **AQUIFER DATA**

Saturated Thickness: 3.9 m Anisotropy Ratio (Kz/Kr): 1.

### SLUG TEST WELL DATA

Test Well: 16-08

X Location: 33344.449 m Y Location: 5932920.439 m

Initial Displacement: 1.795 m

Static Water Column Height: 2.545 m

Casing Radius: 0.025 m Well Radius: 0.025 m
Well Skin Radius: 0.025 m
Screen Length: 1.5 m
Total Well Penetration Depth: 12.3 m

No. of Observations: 20

	Observatio	n Data		
Time (min)	Displacement (m)	Time (min)	Displacement (m)	
0.5	1.795	10.	0.86	
1.	1.74	12.	0.705	
2.	1.64	14.	0.578	
3.	1.545	16.	0.463	
4.	1.447	18.	0.363	
5.	1.332	20.	0.276	
6.	1.225	25.	0.125	
7.	1.127	30.	0.04	
8.	1.033	35.	0.007	
9.	0.943	40.	0.	

### SOLUTION

Slug Test

Aquifer Model: Confined Solution Method: Bouwer-Rice

In(Re/rw): 4.4

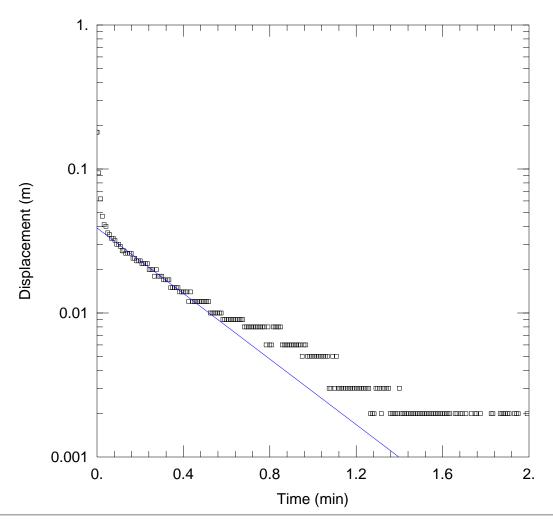
#### VISUAL ESTIMATION RESULTS

#### **Estimated Parameters**

Parameter Estimate 1.07E-6 K m/sec y0 1.84 m

K = 0.000107 cm/sec

 $T = K*b = 4.173E-6 \text{ m}^2/\text{sec} (0.04173 \text{ sq. cm/sec})$ 



Data Set: O:\...\Rossdale\_14-15\_v2.aqt

Date: 11/03/17 Time: 12:22:04

# PROJECT INFORMATION

Company: AECOM
Client: City of Edmonton
Project: 60443747
Location: Edmonton
Test Well: 14-15
Test Date: 9/14/2017

#### **AQUIFER DATA**

Saturated Thickness: 4. m Anisotropy Ratio (Kz/Kr): 1.

# WELL DATA (14-15)

Initial Displacement: 0.18 m

Static Water Column Height: 1.302 m

Total Well Penetration Depth: 10.9 m

Screen Length: 3.2 m Well Radius: 0.025 m

Casing Radius: 0.025 m

# **SOLUTION**

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 1.928E-5 m/sec y0 = 0.03895 m

Data Set: O:\Projects\60443747\400-Technical\Hydraulic Conductivity (Slug Tests Results)\Working Files\Rossdale Date: 11/03/17 Time: 12:22:15

### PROJECT INFORMATION

Company: AECOM Client: City of Edmonton Project: 60443747 Location: Edmonton Test Date: 9/14/2017 Test Well: 14-15

### **AQUIFER DATA**

Saturated Thickness: 4. m Anisotropy Ratio (Kz/Kr): 1.

#### SLUG TEST WELL DATA

Test Well: 14-15

X Location: 0. m Y Location: 0. m

Initial Displacement: 0.18 m

Static Water Column Height: 1.302 m

Casing Radius: 0.025 m
Well Radius: 0.025 m
Well Skin Radius: 0.025 m
Screen Length: 3.2 m
Total Well Penetration Depth: 10.9 m

No. of Observations: 241

	Observation	on Data	
Time (min)	Displacement (m)	Time (min)	Displacement (m)
0.	0.18	1.008	0.005
0.008333	0.094	1.017	0.005
0.01667 0.025	0.062 0.047	1.025 1.033	0.005 0.005
0.03333	0.041	1.042	0.005
0.04167	0.04	1.05	0.005
0.05	0.036	1.058	0.005
0.05833	0.035	1.067	0.005
0.06667	0.033	1.075	0.003
0.075	0.033	1.083	0.003
0.08333 0.09167	0.032 0.03	1.092 1.1	0.005 0.003
0.09107	0.03	1.108	0.005
0.1083	0.029	1.117	0.003
0.1167	0.027	1.125	0.003
0.125	0.027	1.133	0.003
0.1333	0.026	1.142	0.003
0.1417	0.026	1.15	0.003
0.15 0.1583	0.026 0.026	1.158 1.167	0.003 0.003
0.1667	0.020	1.175	0.003
0.175	0.024	1.183	0.003
0.1833	0.023	1.192	0.003
0.1917	0.023	1.2	0.003
0.2	0.023	1.208	0.003
0.2083	0.022	1.217	0.003
0.2167 0.225	0.022 0.022	1.225 1.233	0.003 0.003
0.2333	0.022	1.242	0.003
0.2417	0.02	1.25	0.003
		=	

Time (min)	Displacement (m)	Time (min)	Displacement (m) 0.003
0.25	0.02	1.258	
0.2583	0.02	1.267	0.002
0.2667	0.018	1.275	0.002
0.275	0.02	1.283	0.002
0.2833	0.018	1.292	0.003
0.2917	0.018	1.3	0.003
0.3	0.018	1.308	0.003
0.3083	0.017	1.317	0.002
0.3167	0.017	1.325	0.003
0.325	0.017	1.333	0.003
0.3333	0.017	1.342	0.003
0.3417	0.015	1.35	0.003
0.35	0.015	1.358	0.002
0.3583 0.3667 0.375	0.015 0.015	1.367 1.375 1.383	0.002 0.002
0.3833 0.3917	0.015 0.014 0.014	1.363 1.392 1.4	0.002 0.002 0.003
0.4	0.014	1.408	0.002
0.4083	0.014	1.417	0.002
0.4167	0.014	1.425	0.002
0.425	0.012	1.433	0.002
0.4333	0.014	1.442	0.002
0.4417	0.012	1.45	0.002
0.45	0.012	1.458	0.002
0.4583	0.012	1.467	0.002
0.4667	0.012	1.475	0.002
0.475	0.012	1.483	0.002
0.4833	0.012	1.492	0.002
0.4917	0.012	1.5	0.002
0.5	0.012	1.508	0.002
0.5083	0.012	1.517	0.002
0.5167	0.012	1.525	0.002
0.5107 0.525 0.5333	0.01 0.01	1.533 1.542	0.002 0.002
0.5417 0.55 0.5583	0.01 0.01	1.55 1.558 1.567	0.002 0.002 0.002
0.5667 0.575	0.01 0.01 0.01	1.575 1.583	0.002 0.002 0.002
0.5833	0.009	1.592	0.002
0.5917	0.009	1.6	0.002
0.6	0.009	1.608	0.002
0.6083	0.009	1.617	0.002
0.6167	0.009	1.625	0.002
0.625	0.009	1.633	0.002
0.6333	0.009	1.642	0.
0.6417	0.009	1.65	0.
0.65	0.009	1.658	0.002
0.6583	0.009	1.667	0.002
0.6667	0.009	1.675	0.
0.675	0.009	1.683	0.002
0.6833	0.008	1.692	0.002
0.6917	0.008	1.7	0.
0.7	0.008	1.708	0.002
0.7083	0.008	1.717	0.
0.7167	0.008	1.725	0.
0.725	0.008	1.733	0.002
0.7333	0.008	1.742	0.
0.7417	0.008	1.75	0.002
0.75	0.008	1.758	0.002
0.7583	0.008	1.767	0.
0.7667	0.008	1.775	0.002
0.775	0.008	1.783	0.
0.7833	0.006	1.792	0.
0.7917	0.008	1.792	0. 0.

Time (min) 0.8 0.8083 0.8167 0.825 0.8333 0.8417 0.85 0.8583 0.8667 0.875 0.8833 0.8917 0.9 0.9083 0.9167 0.925 0.9333 0.9417 0.95 0.9583 0.9667 0.975 0.9833 0.9917 1.	Displacement (m)  0.006 0.006 0.008 0.008 0.008 0.008 0.008 0.006 0.006 0.006 0.006 0.006 0.006 0.006 0.006 0.006 0.006 0.006 0.006 0.006 0.006 0.006 0.006 0.005 0.005 0.005 0.005	Time (min) 1.808 1.817 1.825 1.833 1.842 1.85 1.858 1.867 1.875 1.883 1.892 1.9 1.908 1.917 1.925 1.933 1.942 1.95 1.958 1.967 1.975 1.983 1.992 2.	Displacement (m)  0. 0. 0.002 0.002 0. 0. 0. 0. 0. 0. 0. 0. 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002	
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# SOLUTION

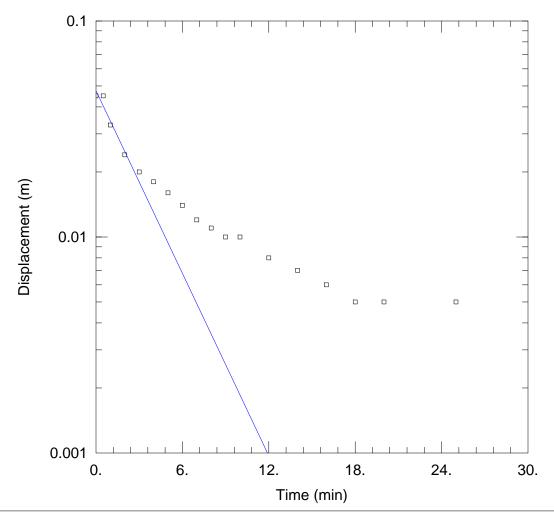
Slug Test Aquifer Model: Confined Solution Method: Bouwer-Rice In(Re/rw): 4.518

# **VISUAL ESTIMATION RESULTS**

# **Estimated Parameters**

Parameter	Estimate	
K	1.928E-5	m/sec
v0	0.03895	m

K = 0.001928 cm/sec  $T = K*b = 7.71E-5 \text{ m}^2/\text{sec} (0.771 \text{ sq. cm/sec})$ 



Data Set: O:\...\Rossdale\_14-17\_v2.aqt

Date: 10/30/17 Time: 10:37:11

# PROJECT INFORMATION

Company: AECOM
Client: City of Edmonton
Project: 60443747
Location: Edmonton
Test Well: 14-17
Test Date: 9/14/2017

#### **AQUIFER DATA**

Saturated Thickness: 3. m Anisotropy Ratio (Kz/Kr): 1.

# WELL DATA (14-17)

Initial Displacement: 0.045 m

Total Well Penetration Depth: 10.9 m

Casing Radius: 0.025 m

Static Water Column Height: 1.665 m

Screen Length: 3.2 m Well Radius: 0.025 m

### **SOLUTION**

Aquifer Model: Confined

Solution Method: Bouwer-Rice

K = 2.535E-6 m/sec

y0 = 0.04756 m

Data Set: O:\Projects\60443747\400-Technical\Hydraulic Conductivity (Slug Tests Results)\Working Files\Rossdale Date: 10/30/17

Time: 10:37:31

#### PROJECT INFORMATION

Company: AECOM Client: City of Edmonton Project: 60443747 Location: Edmonton Test Date: 9/14/2017 Test Well: 14-17

### **AQUIFER DATA**

Saturated Thickness: 3. m Anisotropy Ratio (Kz/Kr): 1.

#### SLUG TEST WELL DATA

Test Well: 14-17 X Location: 0. m Y Location: 0. m

Initial Displacement: 0.045 m

Static Water Column Height: 1.665 m

Casing Radius: 0.025 m Well Radius: 0.025 m
Well Skin Radius: 0.025 m
Screen Length: 3.2 m
Total Well Penetration Depth: 10.9 m

No. of Observations: 17

	Observatio	n Data		
Time (min)	Displacement (m)	Time (min)	Displacement (m)	
0.5	0.045	9.	0.01	
1.	0.033	10.	0.01	
2.	0.024	12.	0.008	
3.	0.02	14.	0.007	
4.	0.018	16.	0.006	
5.	0.016	18.	0.005	
6.	0.014	20.	0.005	
7.	0.012	25.	0.005	
8.	0.011			

### **SOLUTION**

Slug Test Aquifer Model: Confined Solution Method: Bouwer-Rice

In(Re/rw): 4.502

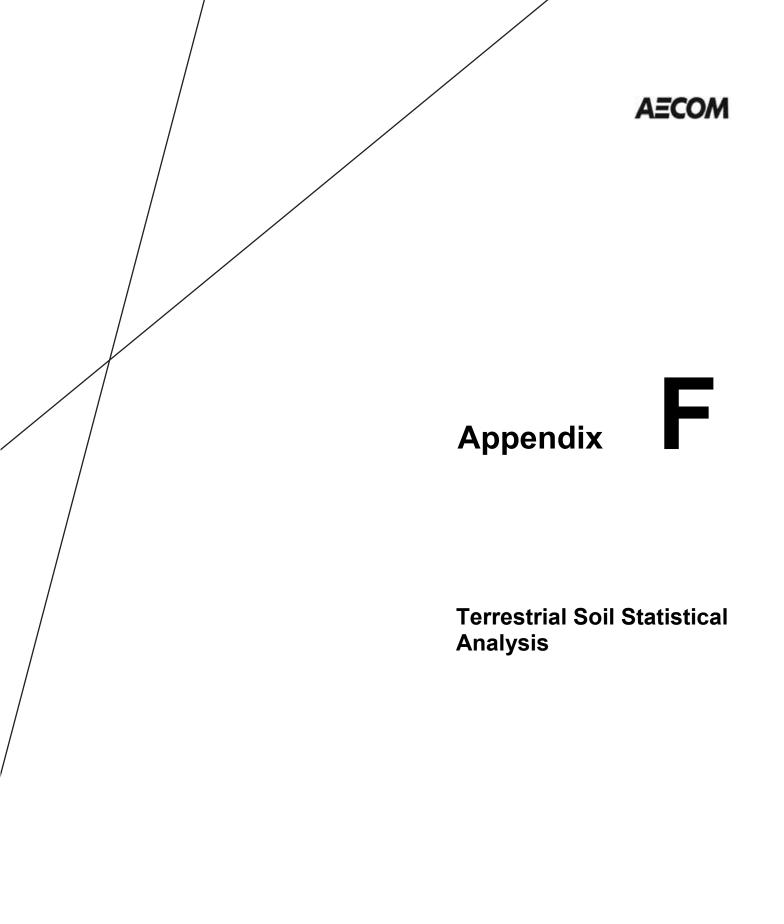
#### VISUAL ESTIMATION RESULTS

### **Estimated Parameters**

**Parameter** Estimate 2.535E-6 0.04756 m/sec y0

K = 0.0002535 cm/sec

 $T = K*b = 7.606E-6 \text{ m}^2/\text{sec} (0.07606 \text{ sg. cm/sec})$ 





# **Appendix F: Terrestrial Soil Data Analysis**

The following Appendix provides a statistical analysis of soil quality data designed specifically for the derivation of summary statistics, including 95% Upper Confidence Limits of the mean (UCL95), used to inform site managers for the potential risks to human or ecological health. The specific objective of the statistical analysis of soil data at the site is to characterize typical concentrations that would be encountered by mobile receptors (i.e. humans) and sessile ecological receptors coming in contact with broadly distributed contaminated fill associated with disposition of spent bottom ash, bulk coal storage, historical placement of suspect fill, or historical hazardous waste storage.

Historical information presented in the Tier 2 Risk Assessment Report indicates the presence of other confined point sources of soil contamination, such as creosote timbers and piles as part of early building foundations, storage of bulk fuels in either above ground or underground tanks, and burning in open pits for fire training purposes.

# 1. Dataset Preparation

In order to generate summary statistics which are useful for the description of the broadly distributed contamination associated with fill material a method of discerning broad contamination from those areas affected by a known point sources (specifically burn pits located in Area 3) is required. As a first step, the inorganics, petroleum hydrocarbon, and PAH data were merged into a single dataset. A description of the complete dataset is provided in Table 1.

Table 1

	n
Sample Locations	101
Individual Samples	218
Samples with PHC Data	70
Samples with PAH Data	114
Samples with Inorganics Data	141
Samples with Complete Dataset	10

While the dataset has a sufficiently large number of samples to make it suited to a statistical analysis, there are very few samples (n=10) where metals, PAHs and PHCs have been analyzed concurrently. An additional complication is the fact that individual sample locations tend to switch between analysis of metals, PAHs and PHCs with depth. As a result of these limitations in the dataset, a statistical identification of source using a multivariate approach is not recommended, as it would potentially mischaracterize data.

Information presented in a May 26, 2016 letter from AECOM to Tami Dolen (Re: Rossdale Plant Tier 2 Risk Management Plan: Preliminary Interpretation and Gap Analysis) identified bottom ash samples as being characterized by a more diverse PAH signature and higher frequency of heavy molecular weight PAHs. These samples are often also associated with elevated concentrations of barium, boron and arsenic. In contrast to this, soils collected from the burn pits are typically characterized by elevated concentrations of CCME F3 and F4 petroleum hydrocarbon fractions, and a single high concentration of lead (Pb). The characteristics of elevated concentrations of Pb, and F3 and F4 PHC fractions will therefore be the primary indicator of point source contamination associated with the burn pits.

Quantile-quantile (Q-Q) plots were used to examine the F3 and lead concentration data for the complete dataset. Q-Q plots are particularly useful for exploring the possibility of sub-populations within a dataset. A Q-Q plot with kinks, where some proportion of the data does not follow the trend, is often an indicator of sub-populations within a dataset. When the graphical interpretation of the Q-Q plot is corroborated with qualitative land use, or historical activities, the Q-Q plot can be a used to identify sub-populations which should be handled separately.

Q-Q plots of the concentration of lead and CCME F3 in soils are presented below (Figure 1 and 2 respectively). In both plots the concentration data is highly skewed, however a distinct kink in the distributions can be discerned. In the case of Pb, the distribution indicates a possible sub-population of increased concentration occurring in the upper ~10% where concentrations



exceed ~72 mg/kg. In the case of F3 petroleum hydrocarbons, the Q-Q plot shows an obvious kink in the distribution at concentrations exceeding 487 mg/kg.

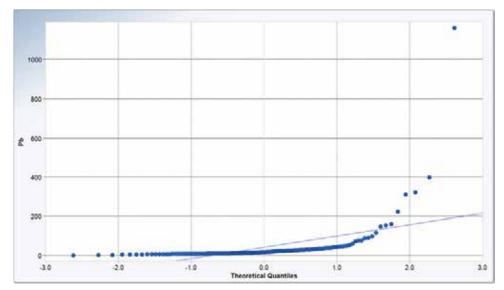


Figure 1: Quantile-quantile plot of Pb concentration measured in soils from the Rossdale Site (complete dataset).

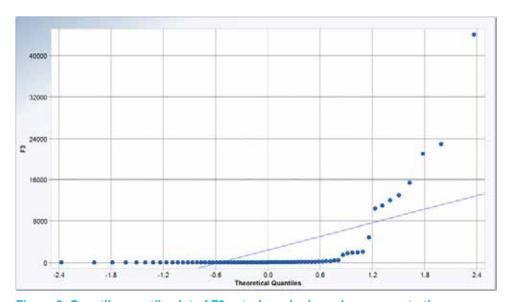


Figure 2: Quantile-quantile plot of F3 petroleum hydrocarbon concentration measured in soils from the Rossdale Site (complete dataset).

Identification of data points which are suspected to originate from a defined point source are therefore based on identification of values that exceed 72 mg Pb /kg and/or 487 mg F3 /kg, in concert with qualitative information on the sample location, sample depth, and condition of adjacent samples. A description of the samples identified as being attributable to point sources of contamination, and the rationale for their removal from the dataset is presented in Table 2.



Table 2: Samples identified, and removed from dataset as being influenced by point source activities in the burn pit area.

Sample ID	Area	Depth (m)	Rationale for Exclusion
MW 104	3	6	Elevated concentrations of F3 and F4 PHCs and lead. Collected from southern Area 3 deep burn pit.
MW 109	3	7.6	Elevated concentrations of F3 and F4 PHCs. Collected from southern Area 3 deep burn pit.
MW 201 (6.8)	3	6.8	Elevated concentration of F3 and F4 PHCs. Collected from southern Area 3 deep burn pit.
MW201 (12.9)	3	12.9	Elevated concentration of F3 PHC. Collected from southern Area 3 deep burn pit.
MW 302	3	3	Elevated concentration of F3 and F4 PHCs. Collected south of the southern burn pit on the eastern property boundary.
внз	3	0.5	No PHC data reported. Elevated concentrations of Pb. Collected from shallow northern area 3 burn pit. Lead is assumed to be attributable to burn pit activities.
BH112	3	1.5	Elevated concentration of F3 and F4 PHCs. No metals data reported.  Collected from shallow northern area 3 burn pit.
BH1	3	unknown	
BH403	3	Unknown	Elevated concentration of F3 and F4 PHCs. No metals data reported.  Collected from shallow northern area 3 burn pit.
BH4(Stantec)	3	2.7	Elevated concentration of F3 and F4 PHCs. Collected from south of Watermark Bldg. outside of burn pits. No metals data reported.
MW 14-1	3	6.7	Elevated concentration of F3 and F4 PHCs. Collected from southern Area 3 deep burn pit. No metals data reported.
14-09 (0.5)	3	0.5	Elevated concentration of Pb. Sample collected midway between the northern and southern burn pits in Area 3.
14-09 (1)	3	1	Elevated concentration of Pb. Sample collected midway between the northern and southern burn pits in Area 3. PHC not elevated.
14-10	3	1	Elevated concentration of Pb. Sample collected midway between the northern and southern burn pits in Area 3.
14-11	3	0.5	Elevated concentration of F3 and F4 PHCs. No metals data reported.  Collected from shallow northern area 3 burn pit.
14-12	3	1-10.5 m	Soils collected from sampling location 14-12 in the northern area 3 burn pit show elevated concentrations of Pb and petroleum hydrocarbons at depths of 1, 1.5, and 3.8 meters. Concentrations decrease from 4.6 to 7.5 meters below ground surface, but petroleum hydrocarbons are elevated at a depth of 10.5 meters. All observations from this location are segregated from the dataset.
14-13 (0.5)	3	0.5	Elevated concentration of Pb (222 mg/kg). No PHC data reported for this depth. Collected from southern Area 3 burn pit.
14-13 (3.8)	3	3.8	Elevated concentrations of F3 and F4 PHCs. No metals data reported.  Collected from southern Area 3 burn pit.

Based on the observations of elevated PHC F3 hydrocarbons and/or Pb concentrations in soil, in concert with the fact that these samples were all located within or near the defined area 3 burn pits, a total of 24 samples were segregated from the dataset. The remaining dataset (n=194) retains 29 samples collected from Area 3, however these samples are suspected to be representative of general fill placement at the site, rather than point source activities conducted in the burn pits.



# 2. Statistical Test of Single Population

It is AECOM's hypothesis that fill of questionable origin and environmental quality (possibly containing spent bottom ash) has been widely distributed across the site. After elimination of suspected burn pit influenced soils (as described in the preceding section) the available dataset consists of soil data collected from two general areas:

- 1. Soils collected in the vicinity of the former power plant, and;
- 2. Soil collected from south of the watermark building.

Information presented in the Tier 2 report suggests that considerable filling historically occurred in both areas. In order to take full advantage of the dataset, and generate summary statistics which are generally applicable to the site, soil data from these two areas will be combined.

# 3. Derivation of Summary Statistics

The specific objective of the statistical analysis of soil data at the site is to characterize typical concentrations that would be encountered by mobile receptors (i.e. humans) and sessile ecological receptors. Due to the nature of the random deposition of fill, there has been no segregation of the database with depth: soil quality from the entire stratigraphic record will be included in the analysis. The dataset consists of all soil data retained after segregation of burn pit soils as described above (Table 2).

# i) Methodology

# (1) Uncensored Datasets

Calculating an upper confidence limit on environmental data that does not have ND values is largely influenced by the number of observations (n) and the skewness of the data. For data sets where the number of observations is less than twenty (n < 20) bootstrap re-sampling techniques are unlikely to capture the breadth of the sample population shape, and are likely to return inaccurate estimates of the UC95. Under these circumstances either a normal or gamma distribution is assumed based on the strongest goodness of fit statistic provided by ProUCL (i.e. larger R-squared value). ProUCL does not include suitable methods for computation of 95% UCLs based on lognormal distributions, so non-normal (i.e. skewed) distributions are assumed to resemble a gamma distribution. Based on the selected distribution, the 95% Student's-t UCL or 95% Adjusted Gamma UCL was carried forward for normal and gamma distributions, respectively. For datasets without non-detect values and a sample size of  $n \ge 20$ , bootstrap re-sampling techniques are the best way to compute a UCL95 from skewed data (Helsel, 2012). This is known a the Bias Corrected Accelerated Bootstrap (BCA).

# (2) Censored Datasets

In the past, regulatory guidance in environmental sciences supported the use of substitution methods for handing data below reportable limits of detection (ND values). However, substitution methods have been shown to result in poor estimates and incorrect statistical tests (Helsel, 2012). Substitution methods do not provide adequate coverage for UCLs computed on censored data, even when censoring levels are as low as 10% <sup>(1)</sup> and based on this study the US EPA have stated that "it is strongly recommended to avoid the use of the DL/2 method....even when the percentage of NDs if as low as 5-10%"<sup>(2)</sup>. Accordingly, AECOM did not use substitution methods in this statistical analysis.

Two recommended non-substitution methods for handling non-detects are; (a) the Kaplan-Meier procedure (KM), and; (b) Robust Regression on Order Statistics (ROS).

<sup>&</sup>lt;sup>1</sup> Singh, A., Maichle, R., and Lee, S. 2006. On the Computation of a 95% Upper Confidence Limit of the Unknown Population Mean Based Upon Data Sets with Below Detection Limit Observations. EPA/600/R-06/022, March 2006. Available at: <a href="http://www.epa.gov/osp/hstl/tsc/softwaredocs.htm">http://www.epa.gov/osp/hstl/tsc/softwaredocs.htm</a>

<sup>&</sup>lt;sup>2</sup> USEPA 2012 ProUCL Version 4.1 User Guide (Draft). EPA/600/r-07/041. US Environmental Protection Agency, Office of Research and Development, Washington, DC. Available at http://www.epa.gov/osp/hstl/tsc/ProUCL\_v4.1\_user.pdf.



- a. Kaplan-Meier: The KM procedure is a nonparametric method thereby not requiring transformations or assumptions of distribution, and is the standard in medical and industrial statistics for estimating a mean of censored data<sup>(3)</sup>. KM was determined to be the most reliable method for computing the UCL95 of concentration data<sup>(1)</sup>. The KM method was not developed for use where a single censoring value (i.e. one reportable detection limit) exists in the population. In this case, the KM estimates of the mean will be equal to the mean based on DL substitution. AECOM have used KM methods for datasets with multiple detections limits.
- b. Robust Regression on Order Statistics (ROS): The ROS procedure is the most suitable method for datasets with a single detection limit <sup>(4)</sup>. ROS uses regression on a probability plot to estimate distributional parameters, usually in log units. Individual estimates are then predicted from the line, and retransformed back into original units. No transformation of the estimated summary statistics occurs. The imputed values are then used collectively with the detected data to compute summary statistics. This is the preferred method for datasets with a single censoring level.

Calculation of summary statistics, including 95% UCLs, for datasets with NDs is based on the number of censoring levels as described above, as well as the percentage of the dataset being censored. For datasets where less than 40% of the observations are censored, the BCA method is used. BCA intervals are recommended for general use for datasets where the degree of censoring is low (<40%) however the method breaks down when the degree of censoring is high (≥40%) <sup>(1)</sup>. Under these circumstances the median value, which is used to make the adjustment for skewness, is difficult/impossible to determine <sup>(1)</sup>. Therefore, AECOM have elected to use BCA Bootstrap UCL95s for datasets where the degree of censoring is low (<40%), and 95% Percentile Bootstrap UCLs where 40% or more of the observations are NDs.

Table 3 summarizes the results from the statistical analysis. The human health and ecological Tier 2 direct contact soil quality guidelines are identified with red and green highlights, respectively. On site maximum and upper bounds concentrations (90<sup>th</sup> percentile or UCL 95) are also highlighted in red or green.

To be included in the risk assessment the upper statistical bound concentration must exceed the appropriate soil quality guideline. The analysis indicates that, in the random fill identified at the Rossdale Site, the following substances will be included in the quantitative exposure and risk management:

- § For human direct contact: none of the calculate upper bounds exceed.
- § For ecological direct contact: barium and boron.

<sup>&</sup>lt;sup>3</sup> Klein and Moeschberger, 2003; as cited in Denis R. Helsel. 2009. Summing Nondetects: Incorporating Low-Level contaminants in Risk Assessment. Integrated Environmental Assessment and Management. Vol.6, No. 3, pp. 361-366.

<sup>&</sup>lt;sup>4</sup> Helsel D.R. 2005. Nondetects and data analysis: Statistics for censored environmental data. Hoboken (NJ). John Wiley & Sons, 250p.



Table 3: Calculated descriptive statistics (mg/kg) for soil data used to characterize broadly distributed fill of questionable origin/quality.

Contaminant F3 (C16-C34)	Tier 2 HH	Tier 2 Eco Contact	n	n Detected	% ND	Max.	Mean	50	90th Nile	UCL95	Method	
	15000	300	40	21	47.5%	487	163.1	111	211.8	138.6	3	
Acenaphthene	5300	-	104	4	96%	10.1	2.7	0.989	0.050	N/A	3	
Anthracene	24000	2.5	104	72	31%	29.7	0.493	2.912	0.121	0.919	4.	
Benzo(a)pyrene	-	20	104	33	68%	16.5	0.826	1.639	0.231	0.577	- 5	
Fluoranthene	3500	50	104	84	19%	82.7	1.307	8.123	0.456	2.691	4	
Fluorene	2700		100	6	94%	13.6	2.422	1.358	0.050	0.472	3	
Naphthalene	1800		105	79	25%	3.51	0.106	0.344	0.149	0.199	- 6	
Pyrene	2100	-	103	86	17%	64.8	1.044	6.399	0.490	3.31	6	
B(A)P Total Potency Equiv	5.3		104	104	0%	24.83	0.439	2.464	0.347	1.26	2	
Antimony (Sb)		20	110	40	64%	2	0.365	0.334	0.700	0.417	3	
Arsenic (As)	21	17	110	110	0%	65	8.199	7.677	9.820	9.806	2	
Barium (Ba)	- 3	500	125	125	0%	6620	596.8	1019	1122	802.6	2	
Beryllium (Be)	8.	5	125	113	10%	8.1	1.068	1,271	1.460	1.303	6	
Cadmium (Cd)	14	10	125	113	10%	3.16	0.322	0.34	0.500	0.404	6	
Chromium (Cr)	220	64	125	125	0%	104	18.73	12.39	24.64	21.07	2	
Cobalt (Co)	-	20	125	124	1%	21.2	8.755	2.936	10.52	9.252	6	
Copper (Cu)	1100	63	125	125	0%	239	25.56	27.78	34.36	31.01	2	
Lead (Pb)	140	300	125	123	2%	398	27.53	47.5	45.08	35.88	4	
Mercury (Hg)	6.6	12	109	108	1%	5	0.272	0.633	0.548	0.416	6	
Molybdenum (Mo)		4	125	68	46%	9.4	1.642	1.532	2.420	1.894	3	
Nickel (Ni)		45	125	125	0%	68	26.52	8.311	34.56	27.97	2	
Selenium (Se)	80	1	110	77	30%	1.3	0.449	0.207	0.700	0.485	4	
Silver (Ag)		20	122	74	39%	0.8	0.213	0.16	0.800	0.241	4	
Thallium (TI)	1	1.4	124	109	12%	0.97	0.191	0.121	1.000	0.213	4	
Tin (Sn)		6	124	84	32%	10.9	1.87	1.336	5.000	2.071	4	
Uranium (U)	23	500	110	107	3%	8.6	1.374	1.392	2.130	1.665	6	
Vanadium (V)	1.	130	125	125	0%	56.8	27.61	7.756	36.5	28.81	2	
Zinc (Zn)	G .	200	125	125	0%	739	75.16	87.87	94.9	95.66	2	
Hexavalent Chromium		0.4	63	0	100%	<0.1	N/A	N/A	0.100	N/A		
Barium (Ba)(0,1CaCl2-Ext	-	250 2	60	60	0%	53.1	22.45	11.79	44.5	25.16	2	
Boron (B), Sat Paste	7500	3.3	24	24	0%	22.5	4.118	4.984	9.01	6.256	2	
Boron (B), HWS			60	60	0%	37.5	10.42	9.388	27.60	12.34	2	

#### Methods:

- 2. 95% BCA Bootstrap UCL
- 3. 95% KM Percentile Bootstrap UCL
- 4. 95% KM (BCA) UCL
- 5. Log ROS 95% Percentile Bootstrap UCL
- 6. Log ROS 95% (BCA) Bootstrap UCL



Appendix G

**Mass Flux Calculations** 

Appendix G: Mass flux calculations for monitoring wells located along the bank of the North Saskatchwean River, Rossdale Plant Site

			BH16-02			14-15						14-17		BH16-05					
Hydraulic Conductivity (m/sec) k=			1.5E-06			1.9E-05						7.5E-05		9.5E-07					
Darcy Velocity (m/day) v=		-	2.870E-03			3.546E-02						1.400E-01			1.765E-03				
Area of Saturated Gravel (m²) A=				2.690E+02					2.030E+02					2.240E+02					
Specific Discharge (m³/day) q=	day) q= 5.396E-01					3	60	9.538E+00	8.8	100		Ø	2.841E+01	200	<b>7</b> 3		100	3.953E-01	-
Routine Water Chemistry	Conc. (mg/L)	mg/m3	J (mg/day)	J (kg/year)	% Cont.	Conc. (mg/L)	mg/m3	J (mg/day)	J (kg/year)	% Cont.	Conc. (mg/L)	mg/m3	J (mg/day)	J (kg/year)	% Cont.	Conc. (mg/L)	mg/m3	J (mg/day)	J (kg/year)
Chloride (CI)	422	422000	2.28E+05	8.31E+01	5.5%	272	272000	2.59E+06	9.47E+02	63.1%	44	44000	1.25E+06	4.56E+02	30.4%	34.5	34500	1.36E+04	4.98E+00
Nitrate (as N)	4.14	4140	2.23E+03	8.15E-01	2.9%	3.89	3890	3.71E+04	1.35E+01	48.1%	1.21	1210	3.44E+04	1.25E+01	44.6%	2.53	2530	1.00E+03	3.65E-01
Dissolved Metals						æ				÷			(4) (4) (4) (4) (4) (4) (4) (4) (4) (4)						*
Aluminum (AI)	0.046	46	2.48E+01	9.06E-03	13.2%	0.008	8	7.63E+01	2.79E-02	40.6%	0.002	2	5.68E+01	2.07E-02	30.3%	0.056	56	2.21E+01	8.08E-03
Boron (B)	0.711	711	3.84E+02	1.40E-01	2.1%	0.572	572	5.46E+03	1.99E+00	30.3%	0.411	411	1.17E+04	4.26E+00	64.9%	0.372	372	1.47E+02	5.37E-02
Manganese (Mn)	2.86	2860	1.54E+03	5.63E-01	3.7%	0.344	344	3.28E+03	1.20E+00	7.8%	1.29	1290	3.67E+04	1.34E+01	86.8%	0.058	58	2.29E+01	8.37E-03
Copper (Cu)	0.004	4	2.16E+00	7.88E-04	2.7%	0.002	2	1.91E+01	6.96E-03	23.5%	0.002	2	5.68E+01	2.07E-02	70.0%	0.004	4	1.58E+00	5.77E-04
Iron (Fe)	0.08	80	4.32E+01	1.58E-02	9.3%	0.01	10	9.54E+01	3.48E-02	20.6%	0.01	10	2.84E+02	1.04E-01	61.2%	0.08	80	3.16E+01	1.15E-02
Selenium (Se)	0.0004	0.4	2.16E-01	7.88E-05	1.8%	0.0006	0.6	5.72E+00	2.09E-03	47.0%	0.0002	0.2	5.68E+00	2.07E-03	46.6%	0.0011	1.1	4.35E-01	1.59E-04
PAHs					*	8 8				Š		9	584				(A)		Û
Anthracene	0.000148	0.148	7.99E-02	2.91E-05	14.2%	0.000035	0.035	3.34E-01	1.22E-04	59.4%	0.000005	0.005	1.42E-01	5.19E-05	25.3%	0.00001	0.01	3.95E-03	1.44E-06
Benzo(a)anthracene	0.00005	0.05	2.70E-02	9.85E-06	3.0%	0.00006	0.06	5.72E-01	2.09E-04	64.2%	0.00001	0.01	2.84E-01	1.04E-04	31.9%	0.00001	0.01	3.95E-03	1.44E-06
Benzo(a)pyrene	0.000031	0.031	1.67E-02	6.11E-06	1.3%	0.000072	0.072	6.87E-01	2.51E-04	53.7%	0.00002	0.02	5.68E-01	2.07E-04	44.4%	0.000009	0.009	3.56E-03	1.30E-06
Fluoranthene	0.00023	0.23	1.24E-01	4.53E-05	6.7%	0.00009	0.09	8.58E-01	3.13E-04	46.5%	0.00003	0.03	8.52E-01	3.11E-04	46.1%	0.00002	0.02	7.91E-03	2.89E-06
Naphthalene	0.0023	2.3	1.24E+00	4.53E-04	24.2%	0.0001	0.1	9.54E-01	3.48E-04	18.6%	0.0001	0.1	2.84E+00	1.04E-03	55.5%	0.0001	0.1	3.95E-02	1.44E-05
Phenanthrene	0.0006	0.6	3.24E-01	1.18E-04	7.7%	0.0001	0.1	9.54E-01	3.48E-04	22.7%	0.0001	0.1	2.84E+00	1.04E-03	67.6%	0.0001	0.1	3.95E-02	1.44E-05
Pyrene	0.00017	0.17	9.17E-02	3.35E-05	4.2%	0.0001	0.1	9.54E-01	3.48E-04	43.5%	0.00004	0.04	1.14E+00	4.15E-04	51.8%	0.00002	0.02	7.91E-03	2.89E-06
B[a]P TPE	0.00004	0.04	2.16E-02	7.88E-06	1.6%	0.00008	0.08	7.63E-01	2.79E-04	56.1%	0.00002	0.02	5.68E-01	2.07E-04	41.7%	0.00001	0.01	3.95E-03	1.44E-06

Appendix G: Mass flux calculations for monitoring wells located along the bank of the North Saskatchwean River, Rossdale Plant Site

			BH16-06			BH16-07											
Hydraulic Conductivity (m/sec) k=	8			3.3E-08				3.8E-07									
Darcy Velocity (m/day) v=				6.194E-05			ĺ	7.155E-04									
Area of Saturated Gravel (m <sup>2</sup> ) A=		1.770E+02						2.100E+02				1.350E+02					
Specific Discharge (m³/day) q=			105	1.096E-02	9			255	1.503E-01	CI		2.696E-01					
Routine Water Chemistry	% Cont.	Conc. (mg/L)	mg/m3	J (mg/day)	J (kg/year)	% Cont.	Conc. (mg/L)	mg/m3	J (mg/day)	J (kg/year)	% Cont.	Conc. (mg/L)	mg/m3	J (mg/day)	J (kg/year)	% Cont.	Total (kg/year)
Chloride (CI)	0.33%	41	41000	4.50E+02	1.64E-01	0.01%	70.1	70100	1.05E+04	3.84E+00	0.26%	60.8	60800	1.64E+04	5.98E+00	0.4%	1501.37
Nitrate (as N)	1.30%	2.46	2460	2.70E+01	9.84E-03	0.03%	10.4	10400	1.56E+03	5.70E-01	2.03%	2.92	2920	7.87E+02	2.87E-01	1.0%	28.14
Dissolved Metals		ξ.					· 3-						X.		£	÷	
Aluminum (AI)	11.79%	0.21	210	2.30E+00	8.40E-04	1.23%	0.023	23	3.46E+00	1.26E-03	1.84%	0.007	7	1.89E+00	6.89E-04	1.0%	6.85E-02
Boron (B)	0.82%	4.41	4410	4.83E+01	1.76E-02	0.27%	1.33	1330	2.00E+02	7.29E-02	1.11%	0.289	289	7.79E+01	2.84E-02	0.4%	6.57
Manganese (Mn)	0.05%	0.354	354	3.88E+00	1.42E-03	0.01%	1.1	1100	1.65E+02	6.03E-02	0.39%	2.09	2090	5.63E+02	2.06E-01	1.3%	1.54E+01
Copper (Cu)	1.95%	0.005	5	5.48E-02	2.00E-05	0.07%	0.006	6	9.02E-01	3.29E-04	1.11%	0.002	2	5.39E-01	1.97E-04	0.7%	2.96E-02
Iron (Fe)	6.81%	0.24	240	2.63E+00	9.60E-04	0.57%	0.03	30	4.51E+00	1.65E-03	0.97%	0.01	10	2.70E+00	9.84E-04	0.6%	1.69E-01
Selenium (Se)	3.57%	0.0011	1.1	1.21E-02	4.40E-06	0.10%	0.0004	0.4	6.01E-02	2.19E-05	0.49%	0.0002	0.2	5.39E-02	1.97E-05	0.4%	4.45E-03
PAHs							*						(A)				
Anthracene	0.70%	0.000009	0.009	9.87E-05	3.60E-08	0.02%	0.000005	0.005	7.51E-04	2.74E-07	0.13%	0.000005	0.005	1.35E-03	4.92E-07	0.2%	2.05E-04
Benzo(a)anthracene	0.44%	0.00001	0.01	1.10E-04	4.00E-08	0.01%	0.00001	0.01	1.50E-03	5.48E-07	0.17%	0.00001	0.01	2.70E-03	9.84E-07	0.3%	3.25E-04
Benzo(a)pyrene	0.28%	0.000014	0.014	1.53E-04	5.60E-08	0.01%	0.000008	0.008	1.20E-03	4.39E-07	0.09%	0.000008	0.008	2.16E-03	7.87E-07	0.2%	4.67E-04
Fluoranthene	0.43%	0.00002	0.02	2.19E-04	8.00E-08	0.01%	0.00001	0.01	1.50E-03	5.48E-07	0.08%	0.00001	0.01	2.70E-03	9.84E-07	0.1%	6.74E-04
Naphthalene	0.77%	0.0001	0.1	1.10E-03	4.00E-07	0.02%	0.0001	0.1	1.50E-02	5.48E-06	0.29%	0.0001	0.1	2.70E-02	9.84E-06	0.5%	1.87E-03
Phenanthrene	0.94%	0.0001	0.1	1.10E-03	4.00E-07	0.03%	0.0001	0.1	1.50E-02	5.48E-06	0.36%	0.0001	0.1	2.70E-02	9.84E-06	0.6%	1.53E-03
Pyrene	0.36%	0.00002	0.02	2.19E-04	8.00E-08	0.01%	0.00001	0.01	1.50E-03	5.48E-07	0.07%	0.00001	0.01	2.70E-03	9.84E-07	0.1%	8.01E-04
B[a]P TPE	0.29%	0.00002	0.02	2.19E-04	8.00E-08	0.02%	0.00001	0.01	1.50E-03	5.48E-07	0.11%	0.00001	0.01	2.70E-03	9.84E-07	0.2%	4.97E-04

#### **About AECOM**

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