



December 2016

REPORT ON

Airside Operations and Maintenance Centre, 2016 Post Remediation Monitoring and LTF Decommissioning, Edmonton International Airport

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REPORT



Report Number: 1657760

Distribution:

One Copy: Public Services and Procurement
Canada, Edmonton, Alberta

One Copy: Golder Associates Ltd., Edmonton,
Alberta





Executive Summary

Golder Associates Ltd. (Golder) was retained by Public Services and Procurement Canada (PSPC) in September 2016 to provide environmental services associated with the remediation of petroleum hydrocarbon (PHC) affected soils from the former underground storage tank (UST) area adjacent to the Airside Operations and Maintenance Centre (AOMC) at the Edmonton International Airport (EIA) (hereafter referred to as “the Site”).

Golder was initially retained in 2012 to complete remedial works at the Site. These remedial works included the excavation of 5,200 m³ of PHC impacted soil from the former UST area. The impacted soil was placed in a land treatment facility (LTF) on Site in order to reduce the PHC concentrations. Following land treatment, these soils would be disposed off Site at a Class II non-hazardous landfill.

As outlined in the remedial action plan (RAP) prepared by Pottinger Gaherty Environmental Consultants Ltd. (PGL) in February 2010, it was recommended that a post-remediation monitoring plan be implemented at the Site. The purpose of this report is to document the results of the 2016 post remediation monitoring program and the partial decommissioning of the LTF and the Soil Vapour Extraction (SVE) unit.

The scope of work for the 2016 post remediation monitoring was developed by Golder in consultation with PSPC and was outlined in our revised proposal dated September 16, 2016. In summary the scope of work included the following:

- Maintenance of the LTF including treatment and discharge of the runoff collecting in the sumps;
- Decommission the north cell of the LTF; and
- Decommission the SVE unit.

In addition, one groundwater sampling event was completed at the Site in May 2016 as part of the post remediation monitoring program. The results of this groundwater sampling event are also included herein.

The results of the 2016 post remediation monitoring and partial LTF / SVE unit decommissioning are summarized below:

- Based on the groundwater elevations measured, the interpreted direction of groundwater flow at the Site is towards the north-northwest. No free phase product was encountered during the sampling event.
- Reported concentrations of BTEX and PHC Fractions F1 and F2 at the AOMC building were below the applicable guidelines for groundwater samples submitted in May 2016, with the exception of monitoring wells BH32, BH50M, MW71-14, MW75-14 and MW76-14.
- Reported concentrations of benzene at monitoring wells BH35 and MW82-15 historically exceeded the applicable guideline in January 2016; however concentrations reduced to below the applicable guideline in May 2016.
- The available groundwater data indicates that natural attenuation processes are active and have resulted in stable and/or decreases in PHC concentrations. Based on the long-term nature of the PHC impacts, it is inferred that the groundwater PHC plume is stable under current conditions.



AOMC 2016 POST REMEDIATION MONITORING AND LTF DECOMMISSIONING, EDMONTON INTERNATIONAL AIRPORT

- Approximately 360,350 L of runoff was treated and discharged from the LTF.
- The north cell of the LTF was decommissioned. Impacted soil, including sump gravel, from the north cell was transferred to the south cell. All liner material was removed and disposed of at an appropriate off Site facility. The north cell was backfilled and graded using the fill materials from the north cell berms.
- The aboveground header-line piping and power to the SVE unit was disconnected in preparation for the removal of the SVE unit from the Site.

Based upon the results of the 2016 post remediation monitoring, the following summaries and recommendations are provided below:

- Residual PHC impacts are present within soil and groundwater at the Site. According to the RAP prepared by PGL in February 2010, the volume of impacted soil at the Site was originally approximately 47,000 m³. The source zone excavation completed in 2012 resulted in the removal of approximately 5,200 m³ of PHC impacted soil, leaving approximately 41,800 m³ of PHC impacted soil at the Site. However it should be noted that the remaining impacts at the Site extend beneath the AOMC building footprint and into the utility corridor to the west of the Site, parallel to 36th Street East, which contains an ATCO Pipelines high pressure natural gas pipeline. As a result, there is significant uncertainty in the volume of PHC impacted soil remaining at the Site.
- The anticipated coarse-grained material surrounding the ATCO Pipelines high pressure natural gas pipeline is likely acting as a preferential pathway for contaminant transport; however, groundwater monitoring completed to date indicates that these impacts have been delineated to the north and have not impacted soil and groundwater quality on the west side of 36th Street East. Due to the presence of the utility corridor and the AOMC building, it is not anticipated that additional remedial excavation be undertaken prior to future Site redevelopment. As a result, it is recommended that a monitored natural attenuation (MNA) strategy continue to be considered for the Site. Based upon the results from the MNA sampling completed to date, biodegradation processes are active at the Site and the groundwater PHC plume is stable under current conditions. It is recommended that bi-annual groundwater monitoring and sampling be completed to monitor the PHC concentrations and to monitor MNA parameters (i.e., nitrate, sulphate, dissolved iron, dissolved manganese, methane) as part of the MNA strategy. It is also recommended that an updated elevation survey of the monitoring wells at the Site be completed, due to the numerous repairs completed over the past few years.
- In order to aid the MNA strategy, natural bioremediation processes can be enhanced through the addition of amendments such as nutrients (e.g., phosphorous) and electron acceptors (e.g., oxygen, nitrate, iron, sulphate), referred to herein as an enhanced in situ bioremediation (EISB) approach. Biodegradation of PHCs occurs most rapidly under aerobic conditions (i.e., adding oxygen); however, at mature sites it is often beneficial to instead promote anaerobic conditions (e.g., adding nitrate or sulphate). The degree of success of EISB relies in large part on the effective delivery of amendments to the subsurface. Delivery approaches range from passive approaches (e.g., Waterloo Emitter) to more active delivery (e.g., groundwater injection/extraction recirculation systems). Alternatively, time to reach “closure concentrations” can be reduced by addressing source areas or high concentration areas, for example, using in-situ chemical oxidation via direction injection (e.g., Fenton’s reagent). However, before an enhanced MNA approach can



AOMC 2016 POST REMEDIATION MONITORING AND LTF DECOMMISSIONING, EDMONTON INTERNATIONAL AIRPORT

be selected, further investigation would be required to determine the updated Site conditions and the appropriate remediation goals.

- The north cell of the LTF has been decommissioned and impacted soil from the north cell has been transferred to the south cell. Based on the sampling completed in June 2015, PHC impacts remain in the soil located within the LTF with reported exceedances of benzene (0.40 mg/kg), ethylbenzene (2.7 mg/kg), and PHC Fractions F1 (280 mg/kg) and F2 (470 mg/kg). However, the concentrations have reduced to allow the impacted soil to be classified as non-hazardous. As a result, it is recommended that the soil located in the south cell be disposed of at an Alberta Class II non-hazardous landfill and the south cell of the LTF be decommissioned. It is also recommended that the runoff collecting in the LTF sump be treated and discharged prior to decommissioning the LTF. As a proactive measure during this work, it is recommended that the monitoring wells installed around the perimeter of the LTF be monitored and sampled after the decommissioning work is completed. In addition, it is recommended that the monitoring wells be decommissioned after groundwater quality results have been confirmed.
- Preliminary costs to complete the recommended future work are estimated to be between approximately \$550,000 and \$600,000 CDN (excluding GST). The preliminary cost estimate is based on the additional work required to monitor the residual PHC impacts present within soil and groundwater at the Site and to decommission the remaining portion of the LTF.



List of Acronyms

Acronyms	Description
AEP	Alberta Environment and Parks
AOMC	Airside Operations and Maintenance Centre
ASL	Above Sea Level
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
CCME	Canadian Council of Ministers of the Environment
CDWQ	Canadian Drinking Water Quality
DO	Dissolved Oxygen
DUA	Domestic Use Aquifer
EC	Electrical Conductivity
EIA	Edmonton International Airport
ERAA	Edmonton Regional Airport Authority
ESA	Environmental Site Assessment
FAP	Facility Alteration Permit
FCSAP	Federal Contaminated Sites Action Plan
FWAL	Freshwater Aquatic Life
GPS	Global Positioning System
ha	Hectares
HDPE	High Density Polyethylene
km	Kilometers
LTF	Land Treatment Facility
m ³	Cubic Meters
m bgs	Meters Below Ground Surface
m/s	Meters/Second
MNA	Monitored Natural Attenuation
mm	Millimeter
mg/L	Milligrams/ Litre
m ²	Square Meters
PGL	Pottinger Gaherty Environmental Consultants Ltd.
PHC	Petroleum Hydrocarbons
ppm	Parts Per Million
PSPC	Public Services and Procurement Canada
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance and Quality Control
RAP	Remedial Action Plan
RPD	Relative Percent Difference
RDL	Reported Detection Limit
SVE	Soil Vapour Extraction
UST	Underground Storage Tank



Table of Contents

1.0 INTRODUCTION	1
2.0 BACKGROUND.....	1
3.0 SCOPE OF WORK	3
4.0 APPLICABLE SOIL AND GROUNDWATER QUALITY GUIDELINES	3
4.1 Canadian Council of Ministers of the Environment.....	4
4.2 Federal Contaminated Sites Action Plan.....	4
4.3 Canadian Drinking Water Guidelines.....	4
4.4 Rationale for Selection of Criteria	4
4.4.1 AOMC Building	4
4.4.2 Land Treatment Facility	5
5.0 FIELD METHODOLOGY AND INVESTIGATION RESULTS	5
5.1 Facility Alteration Permits	5
5.2 Land Treatment Facility Maintenance and Decommissioning	5
5.2.1 Runoff Treatment and Discharge.....	5
5.2.2 LTF North Cell Decommissioning	6
5.3 Soil Vapour Extraction Unit Decommissioning.....	7
5.4 MNA Groundwater Monitoring and Sampling	7
5.4.1 Groundwater Conditions at AOMC Building.....	8
5.4.2 PHC Groundwater Analytical Results at AOMC Building	8
5.4.3 Historical MNA Parameter Groundwater Analytical Results at AOMC Building	8
5.4.4 MNA Assessment	10
6.0 QUALITY ASSURANCE / QUALITY CONTROL	11
7.0 CONCLUSIONS AND RECOMMENDATIONS	12
8.0 LIMITATIONS	14



TABLES

Table 1: LTF Runoff Water Chemistry Results

Table 2: Summary of Groundwater Elevations

Table 3: AOMC Building Groundwater Chemistry Results - Petroleum Hydrocarbons

Table 4: AOMC Building Groundwater Chemistry Results - MNA Parameters

Table 5: Quality Assurance/Quality Control Analysis

FIGURES

Figure 1: Site Location Plan

Figure 2: AOMC Building Monitoring Well Location Plan and Groundwater Exceedances

Figure 3: Land Treatment Facility (LTF) Location Plan

Figure 4: Soil Vapour Extraction (SVE) Unit Layout

APPENDICES

APPENDIX A

Health and Safety Plan

APPENDIX B

Facility Alteration Permits (FAP)

APPENDIX C

Site Photographs

APPENDIX D

Laboratory Certificates of Analysis

APPENDIX E

Mann-Kendall Trend Analyses



1.0 INTRODUCTION

Golder Associates Ltd. (Golder) was retained by Public Services and Procurement Canada (PSPC) in September 2016 to provide environmental services associated with the remediation of petroleum hydrocarbon (PHC) affected soils from a former underground storage tank (UST) area adjacent to the Airside Operations and Maintenance Centre (AOMC) at the Edmonton International Airport (EIA) (hereafter referred to as “the Site”). The Site location is presented on Figure 1.

Golder was initially retained in 2012 to complete remedial works at the Site. These remedial works included the excavation of 5,200 m³ of PHC impacted soil from the former UST area. The impacted soil was placed in a land treatment facility (LTF) on Site in order to reduce the PHC concentrations. Following land treatment, these soils would be disposed off Site at a Class II non-hazardous landfill

As outlined in the remedial action plan (RAP), it was recommended that a post-remediation monitoring plan be implemented at the Site. The purpose of this report is to document the results of the 2016 post remediation monitoring program and the partial decommissioning of the LTF and the Soil Vapour Extraction (SVE) unit.

2.0 BACKGROUND

The Site is located at the EIA, approximately 10 km south of Edmonton, Alberta. The Site is located in the northern portion of the EIA to the east of 36th Street East at a latitude of 53° 19' 12.7" North and a longitude of 113° 34' 10.7" West. The legal land description of the Site is Block A Plan 902 2386 in the northeast quarter section of 15-50-25-W4M.

The Site is completely fenced with an access gate along 36th Street East, which runs to the northwest of the Site. The AOMC building is situated within the central portion of the Site and occupies approximately 16% of the total Site area (19.7 ha). The remainder of the Site is paved except for some landscaped areas to the southeast of the building. The surrounding land uses include a parking lot to the northeast, undeveloped agricultural/marshland to the southeast and southwest, and 36th Street East followed by a parking lot and airline facilities to the northwest. The nearest waterbodies are the water hazards located at the RedTail Landing Golf Club, located approximately 1 km east of the Site.

The AOMC building was constructed in the 1960s. In 1998, a staff office space expansion was constructed on the southeast portion of the building. The Site has been used for equipment maintenance and fuelling since its construction. Prior to development, the Site was used for agricultural purposes.

Two steel gasoline and diesel USTs were installed at the Site during the original development in the 1960s. These USTs were decommissioned in 1980 by Transport Canada and were replaced by three fibreglass USTs and an associated pump island. In February 1998, during the installation of a new utility trench to the AOMC building, soil vapours beneath the asphalt surface ignited. In 2000, a Phase II Environmental Site Assessment (ESA) was completed at the Site to assess soil and groundwater quality in the vicinity of the original steel USTs¹. Exceedances of benzene, toluene, ethylbenzene, and xylenes (BTEX) were reported in soil and groundwater. The Phase II ESA also indicated that an explosive atmosphere may exist beneath the AOMC building. Additional environmental

¹ Reid Crowther & Partners Ltd., 2000. *Environmental Site Assessment, Airside Operations & Maintenance Centre, Edmonton International Airport*. July 2000.



AOMC 2016 POST REMEDIATION MONITORING AND LTF DECOMMISSIONING, EDMONTON INTERNATIONAL AIRPORT

investigation of these impacts was completed at the Site in 2001², 2002³, and 2009⁴. Approximately 47,000 m³ of PHC impacted soil was estimated to be present on Site. PHC impacted groundwater was also identified within the area of soil impacts. Groundwater impacts were estimated to cover an area of approximately 5,500 m².

The results of these investigations were used by Pottinger Gaherty Environmental Consultants Ltd. (PGL) to develop a RAP⁵ for the Site. As the EIA was considering replacement and relocation of the fuel USTs and associated infrastructure, remedial excavation and ex-situ treatment of heavily impacted contaminated soil was selected as a viable option. It was noted that at the completion of the remedial excavation, soil and groundwater contamination would remain at the Site. The objective of remediating the “source zone” was to minimize the potential for migration of contaminants off-Site. Excavation of the heavily impacted contaminated soil would increase the potential for remaining impacts to naturally degrade and reduce the potential for further off-Site migration of contaminants.

The LTF was constructed in the winter of 2010⁶. The LTF is located approximately 500 m east-southeast of the Site, parallel to Airport Perimeter Road within an agricultural field. The LTF consisted of two biopile cells with the dimensions of 91.5 m by 65 m. Perimeter berms were constructed around the cells to a height of 1.5 m and the entire LTF was lined with a geotextile fabric and geomembrane liner. An 8 m by 8 m sump, designed to collect runoff, was installed in each biopile cell to a depth of 2.0 metres below ground surface (m bgs).

As the PHC impacts identified at the Site extend beneath the AOMC building, a SVE unit was installed at the Site in March 2012⁷. The purpose of the SVE unit is to reduce the risk of migration of PHC vapours into the building and prevent PHC vapours from impacting workers inside the building. A significant decrease in discharge vapours has occurred since the installation of the SVE unit and the completion of the source zone excavation in 2012.

The source zone excavation was completed in autumn 2012, with approximately 5,200 m³ of PHC impacted soil being excavated, transported, and placed into the LTF. The excavation was completed to a depth of 6.0 m bgs and the excavation was lined with a 30-mil smooth high density polyethylene (HDPE) geomembrane and backfilled with clean fill. Results of the 2012 source zone excavation are presented under a separate cover⁸.

In January 2013, Golder advanced six boreholes, completed as groundwater monitoring wells, around the perimeter of the LTF to establish baseline soil conditions. Results of this investigation are presented under a separate cover⁹.

² Earth Tech Canada Inc., 2001. *Delineation Investigation, Airside Operations & Maintenance Centre, Edmonton International Airport*. January 2001.

³ Earth Tech Canada Inc., 2002. *Delineation Investigation, Airside Operations & Maintenance Centre, Edmonton International Airport*. May 2002.

⁴ Pottinger Gaherty Environmental Consultants Ltd., 2010. *Phase III Environmental Site Assessment Airside Operations and Maintenance Centre Edmonton International Airport Leduc County, AB*. February 2010.

⁵ Pottinger Gaherty Environmental Consultants Ltd., 2010. *Remedial Action Plan Airside Operations and Maintenance Centre Edmonton International Airport Leduc County, AB*. February 2010.

⁶ DST Consulting Engineers Inc., 2011. *EIA Land Treatment Facility 2010 Construction As-Built Report Edmonton International Airport Leduc County, AB*. March 2011.

⁷ Franz Environmental Inc., 2012. *System Installation at the AOMC Building, Edmonton International Airport, Leduc, Alberta*. April 2012.

⁸ Golder Associates Ltd., 2013. *Final Report on Airside Operations and Maintenance Centre (AOMC) Remedial Excavation Edmonton International Airport, Leduc County, Alberta*. February 2013.

⁹ Golder Associates Ltd., 2013. *Report on Airside Operations and Maintenance Centre Additional Investigation Edmonton International Airport, Leduc County, Alberta*. May 2013.



Golder completed post remediation investigation and monitoring events in 2013¹⁰, 2014¹¹, and 2015¹² which concluded that residual PHC impacts are present at the Site beneath the AOMC building footprint and extend northwest, west and southwest of the remedial excavation. It is likely that these impacts have entered the utility corridor to the west of the Site, parallel to 36th Street East, which contains an ATCO Pipelines high pressure natural gas pipeline. The anticipated coarse-grained material surrounding this pipeline is likely acting as a preferential pathway for contaminant transport; however, groundwater monitoring completed to date indicates that these impacts have been delineated to the north and have not impacted soil and groundwater quality on the west side of the roadway. Due to the presence of the utility corridor and the AOMC building, it is not anticipated that additional remedial excavation may occur prior to future Site redevelopment. As a result, it was recommended that a monitored natural attenuation (MNA) strategy be considered for the Site. Based upon the results from the MNA sampling completed to date, biodegradation processes are active at the Site and the groundwater PHC plume is stable under current conditions.

In 2015, a shallow soil sampling program was completed to assess the environmental quality of the soil placed in the LTF. Results indicated that PHC impacts remain in the soil located within the LTF with reported exceedances of benzene (0.40 mg/kg), ethylbenzene (2.7 mg/kg), and PHC Fractions F1 (280 mg/kg) and F2 (470 mg/kg). However, the concentrations have reduced to allow the impacted soil to be classified as non-hazardous. As a result, it was determined that the soil in the LTF could be disposed of at an Alberta Class II non-hazardous landfill and the LTF could be decommissioned.

3.0 SCOPE OF WORK

The scope of work for the 2016 post remediation monitoring was developed by Golder in consultation with PSPC and was outlined in our revised proposal dated September 16, 2016. In summary the scope of work included the following:

- Maintenance of the LTF including treatment and discharge of the runoff collecting in the sumps;
- Decommission the north cell of the LTF; and
- Decommission the SVE unit.

In addition, one groundwater sampling event was completed at the Site in May 2016 as part of the post remediation monitoring program. The results of this groundwater sampling event are also included herein.

4.0 APPLICABLE SOIL AND GROUNDWATER QUALITY GUIDELINES

As the EIA is located on federal land, the environmental quality of soil and groundwater at the Site falls under federal jurisdiction. The Canadian Council of Ministers of the Environment (CCME) and Federal Contaminated Sites Action Plan (FCSAP) guidelines were selected to evaluate the analytical results. These generic, risk-based guidelines account for risks to applicable receptors based on land use and soil type. The following sections outline the relevant federal guidelines and the rationale for selecting those guidelines.

¹⁰ Golder Associates Ltd., 2014. *Report on Airside Operations and Maintenance Centre Post Remediation Investigation Edmonton International Airport, Leduc County, Alberta*. June 2014.

¹¹ Golder Associates Ltd., 2015. *Report On Airside Operations and Maintenance Centre 2014 Post Remediation Monitoring Edmonton International Airport, Leduc County, Alberta*. March 2015.

¹² Golder Associates Ltd., 2016. *Report on Airside Operations and Maintenance Centre 2015 Post Remediation Monitoring Edmonton International Airport, Leduc County, Alberta*. April 2016.



4.1 Canadian Council of Ministers of the Environment

The CCME “*Canadian Environmental Quality Guidelines*” (CCME Guidelines¹³), provide soil, surface water, and sediment quality criteria for the assessment of federal sites impacted with contaminants.

4.2 Federal Contaminated Sites Action Plan

The FCSAP Guidelines¹⁴ are to be used in connection with groundwater investigation and remediation activities at federal contaminated sites. The FCSAP Guidelines follow a tiered framework, consistent with the Canadian Soil Quality Guidelines developed through the CCME. The tiers are:

- Tier 1: direct application of the generic numerical guidelines; specifically, application of the lowest guideline for any pathway.
- Tier 2: allows for the development of site-specific remediation objectives through the consideration of site-specific conditions, by modifying (within limits) the numerical guidelines based on site-specific conditions and focusing on exposure pathways and receptors that are applicable to the site.
- Tier 3: use of site-specific risk assessment to develop Site-Specific Remediation Objectives.

4.3 Canadian Drinking Water Guidelines

The guidelines for Canadian Drinking Water Quality (CDWQ Guidelines) were established by the Federal-Provincial-Territorial Committee on Drinking Water and published by Health Canada in October 2014¹⁵. Each guideline was established from current, published scientific research related to health effects, aesthetic effects, and operational considerations.

4.4 Rationale for Selection of Criteria

4.4.1 AOMC Building

The following rationale is provided to demonstrate the appropriate generic criteria selection for the Site:

- The Site is currently used as an airport equipment maintenance and fuelling center. Based on the land descriptions provided in the CCME Guidelines, the Site is classified as industrial land use.
- Based on the data collected during previous investigations the domestic use aquifer (DUA) pathway cannot be eliminated; however the freshwater aquatic life (FWAL) pathway can be eliminated.

Grain size analysis has been historically completed on representative soil samples collected from the Site. Based on the results, the soil at the Site predominantly consists of fine-grained silty clay underlain by coarse-grained sand. As the coarse-grained guidelines are typically more conservative, the coarse-grained criteria has been selected for the Site.

Based on soil grain size and applicable exposure pathways, the following guidelines were selected to assess groundwater quality at the Site:

¹³ Canadian Council of Ministers of the Environment (CCME), 1999. *Canadian Environmental Quality Guidelines*.

¹⁴ Federal Contaminated Sites Action Plan (FCSAP), 2015. *Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites*. November 2015.

¹⁵ Health Canada, 2014. *Guidelines for Canadian Drinking Water Quality – Summary Table*. October 2014.



- Groundwater analytical results were compared to the *FCSAP Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites* Tier 2 groundwater guidelines for coarse-grained soils and industrial land use, excluding the FWAL pathway (FCSAP Guidelines) and the *Health Canada Guidelines for Canadian Drinking Water Quality* (CDWQ Guidelines).

4.4.2 Land Treatment Facility

The following rationale is provided to demonstrate the appropriate generic criteria selection for the LTF:

- The LTF is located within an agricultural field. The agricultural land is used for growing crops and livestock does not access the land. Based on the land descriptions provided in the CCME Guidelines, the LTF is classified as agricultural land use for the protection of irrigation water.
- The LTF is underlain by predominantly fine-grained soil.

Grain size analysis has been historically completed on representative soil samples collected from the LTF. Based on the results, the soil at the LTF is predominantly classified as fine-grained, defined as soil with grain size less than 75 micrometres (μm). Therefore, the fine-grained criterion has been selected for the LTF.

Based on soil grain size and applicable exposure pathways, the following guidelines were selected to assess surface water quality at the LTF:

- Surface water analytical results were compared to the *CCME Canadian Water Quality Guidelines for the Protection Agricultural Water Uses* for Irrigation Water (CCME Surface Water Guidelines).

5.0 FIELD METHODOLOGY AND INVESTIGATION RESULTS

The following sections describe the field methodologies and investigation results for the completion of each task outlined in Section 3.0. A copy of the Health and Safety Plan is provided in Appendix A.

5.1 Facility Alteration Permits

The EIA is managed by the Edmonton Regional Airport Authority (ERAA). The ERAA utilizes an internal construction and development permitting process to ensure that any proposed work does not negatively impact airport operations or infrastructure. Therefore, prior to initiation of the decommissioning work at the LTF and SVE unit, Golder completed Facility Alteration Permit (FAP) applications. The FAP applications included a brief summary of the work to be completed and drawings showing the work area. The FAP application for the LTF decommissioning activities was submitted to the ERAA on September 1, 2016 and approval was received on September 7, 2016. The FAP application for the SVE decommissioning activities was submitted to the ERAA on September 21, 2016 and approval was received on September 26, 2016. A readily available copy of each approved FAP was kept on-Site by Golder at all times. A copy of the approved FAPs have been provided in Appendix B.

5.2 Land Treatment Facility Maintenance and Decommissioning

5.2.1 Runoff Treatment and Discharge

The LTF is located approximately 500 m east-southeast of the Site, parallel to Airport Perimeter Road within an agricultural field (refer to Figure 3). The LTF consisted of two biopile cells with the dimensions of 91.5 m by 65 m. Perimeter berms were constructed around the cells to a height of 1.5 m and the entire LTF was lined with a geotextile fabric and geomembrane liner. An 8 m by 8 m sump, designed to collect runoff, was installed in each



biopile cell to a depth of 2.0 m bgs. Approximately 5,200 m³ of PHC impacted soil was placed into the LTF as part of the remedial excavation. In September 2013, a silt fence was placed around the perimeter of the LTF to restrict small wildlife from accessing the LTF. In addition, in February 2014, a vertical 12" diameter slotted steel corrugated culvert was placed within the centre of each sump and backfilled with wash rock. A custom steel lockable cap was secured as a lid for each culvert and temporary fencing was placed around the sumps.

The placement of the impacted soil within the LTF necessitated the development of a water management plan. The runoff collecting in the sumps would require treatment and discharge due to the runoff potentially being affected by PHC impacted soil in the LTF. It was recognized that the surface water would require treatment and discharge on a regular basis depending on the amount of precipitation accrual at the LTF. Golder completed one runoff treatment and discharge event in September 2016. Golder retained Quantum Murray (QM Environmental) of Edmonton, Alberta to complete the water treatment and discharge event. QM Environmental used activated carbon filters to remove sediments and organic contaminants from the runoff prior to discharge. Photographs taken during field activities are presented in Appendix C.

As the treated runoff was to be discharged into the agricultural field in which the LTF is located, Golder collected a sample of the treated runoff (SW16-01) prior to the treatment and discharge event. Golder collected the treated runoff sample directly from the discharge hose and submitted the sample to Maxxam for laboratory analysis of BTEX, PHC Fractions F1 and F2, total metals, and routine chemistry parameters. Treated runoff water analytical results for the LTF are summarized in Table 1 and the laboratory certificates of analysis are provided in Appendix D. The reported concentrations of BTEX, PHC Fractions F1 and F2, total metals, and routine chemistry parameters were below the applicable guidelines and the treated runoff was determined to be suitable for discharge into the agricultural field.

The treatment and discharge event commenced on September 22, 2016 and ceased on September 26, 2016. Approximately 360,350 L of runoff was treated and discharged by QM Environmental during the treatment and discharge event.

5.2.2 LTF North Cell Decommissioning

The decommissioning of the LTF north cell occurred between September 22nd and October 4th, 2016. Upon removal of water from the north LTF sump, impacted soil and sump gravel from the north cell was transferred to the south cell using a CAT 328D excavator and a CAT 730 rock truck operated by QM Environmental. Impacted soil was spread evenly throughout the south cell and sloped to ensure runoff would collect in the sump.

All liner material was removed and disposed of at the MCL Waste Systems and Environmental Inc. (MCL) Leduc and District Regional Landfill. Each of the three liner layers was removed separately using a CAT 322C excavator to confirm that residual impacted soil was collected and transferred to the south cell. Following the removal of soil and liner material, Golder completed a visual assessment of the footprint of the north cell to identify any areas of staining and/or PHC odours. No areas of staining and/or PHC odours were identified and as a result, the north cell area was backfilled and roughly graded using fill materials from the north cell berms.



5.3 Soil Vapour Extraction Unit Decommissioning

The SVE unit is located within a 60 m long shipping container located adjacent to the northeast corner of the AOMC building and was installed by Franz Environmental Inc. (Franz) in March 2012. The SVE unit is divided into two sections: (i) the process room, which contains the mechanical equipment; and (ii) the mechanical control centre room, which contains the electrical panel and control system. Sub-slab vapours are drawn into the SVE unit by a sparge compressor (C-2201) through the sub-slab SVE inlet located on the southern wall of the SVE unit. Vapours travel through a vapour liquid separator (VLS-401) and a SVE blower (B-401) before passing through two vapour phase activated carbon drums (VPC-1601 and VPC-1602) prior to being discharged through the roof of the SVE unit. A detailed plan of the SVE unit is provided as Figure 4.

A significant decrease in discharge vapours has occurred since the installation of the SVE unit and the completion of the source zone excavation in 2012, as discharge vapours have decreased from 150 ppm upon initiation of the SVE unit in March 2012 to a maximum of 0.5 ppm in January 2015.

Based on the limited operation of the SVE unit during the autumn and winter months and the significant decrease in discharge vapours, it was requested that the SVE unit be decommissioned in order to allow it to be removed from the Site. The SVE decommissioning activities occurred on September 28, 2016. Golder retained QM Environmental to complete this work. QM Environmental retained a certified electrician from Commercial Industries Ltd. to disconnect the power to the SVE unit. QM Environmental disconnected the aboveground header-line piping at the base of the SVE unit, leaving the remaining piping attached to the AOMC building. It is understood that PSPC will be arranging for the removal of the SVE unit from the Site in the near future.

5.4 MNA Groundwater Monitoring and Sampling

Based on the groundwater monitoring and sampling data collected to date, Golder recommended that a MNA strategy be considered for on-going management of the remaining PHC impacts located at the Site. Natural attenuation comprises a number of subsurface processes whereby the mass, toxicity, mobility, volume, or concentration of the target chemical(s) is reduced without human intervention¹⁶. The most important of the natural attenuation processes for dissolved-phase PHCs is typically intrinsic biodegradation as it results in the in-situ destruction of PHCs (i.e., it actually reduces the mass of contaminants) via microbial processes rather than attenuation via dilution or phase transfer (to soil or soil gas). The recommended MNA strategy consists of groundwater sampling for PHCs and MNA indicator parameters at a limited number of key monitoring well locations to assess evidence of active biodegradation processes.

Golder completed a groundwater monitoring and sampling event at the Site on May 25 and 26, 2016. Groundwater samples were collected at twenty-two monitoring wells at the Site for PHCs (refer to Figure 2). Each monitoring well was monitored for combustible headspace vapour concentrations, depth to water, and thickness of free phase product, if present. Measurement of combustible vapour concentrations within each monitoring well was completed using a RKI Eagle combustible gas detector calibrated to hexane reference gas.

Following the monitoring activities, each monitoring well was purged of three well volumes or until dry using dedicated PVC tubing and a peristaltic pump. Electrical conductivity (EC), pH, temperature, dissolved oxygen (DO), and redox measurements of the purged water were recorded periodically during the purging process to

¹⁶ Alvarez, P. and W. A. Illman, 2006. Bioremediation and Natural Attenuation: Process Fundamentals and Mathematical Models, John Wiley & Sons.



determine that representative formation groundwater was sampled. Purge water from purging the monitoring wells was placed in clearly labelled drums and removed from Site for disposal by G&R Envirocore (G&R) of Lacombe, Alberta. Photographs taken during field activities are presented in Appendix C.

Groundwater samples were collected from each monitoring well in clean dedicated bottles provided by Maxxam Analytics Inc. (Maxxam) as per laboratory instructions (e.g., addition of appropriate preservatives and sample bottles for volatiles and semi-volatiles with no headspace). Groundwater samples were labelled, placed in a cooler with ice, and submitted to Maxxam for chemical analysis.

5.4.1 Groundwater Conditions at AOMC Building

Depth to groundwater at the Site ranged from 731.92 m above sea level (ASL) (BH62M) to 736.34 m ASL (BH48M). A summary of groundwater elevations is provided in Table 2. Based on the groundwater elevations measured, the interpreted direction of groundwater flow at the Site is towards the north-northwest. No free phase product was encountered.

5.4.2 PHC Groundwater Analytical Results at AOMC Building

Groundwater analytical results for the May 2016 sampling event are summarized in Table 3 and the laboratory certificates of analysis are provided in Appendix D. Groundwater samples during the May 2016 sampling event were collected from twenty-two monitoring wells at the Site, along with two blind duplicate samples for quality assurance/quality control (QA/QC) purposes, and submitted for chemical analysis of BTEX and PHC Fractions F1 and F2. Reported concentrations of all parameters analyzed in May 2016 were below the applicable guidelines for all groundwater samples submitted with the exception of the following:

- Concentrations of benzene exceeded the applicable guideline of 0.005 milligrams per litre (mg/L) in groundwater samples collected from monitoring wells BH32, BH50M, MW71-14, MW75-14, and MW76-14.
- Concentrations of toluene exceeded the applicable guideline of 0.06 mg/L in groundwater samples collected from monitoring wells MW75-14 and MW76-14.
- Concentrations of ethylbenzene exceeded the applicable guideline of 0.14 mg/L in groundwater samples collected from monitoring wells MW71-14, MW75-14 and MW76-14.
- Concentrations of xylenes exceeded the applicable guideline of 0.09 mg/L in groundwater samples collected from monitoring wells MW75-14 and MW76-14.

Based on these results, residual PHC impacts remain in groundwater at the Site along the northwest boundary of the Site at monitoring well MW71-14, along the western boundary of the Site at monitoring wells BH32, BH50M, and MW76-14, and along the southwest boundary of the historic excavation limits at monitoring well MW75-14.

5.4.3 Historical MNA Parameter Groundwater Analytical Results at AOMC Building

From March 2014 through January 2016, Golder completed six groundwater sampling events for MNA parameters including dissolved metals, total manganese, ferrous iron, chemical oxygen demand, total phosphorus, dissolved methane, and routine potability (including nitrate, sulphate, carbonate, sodium, chloride, pH, alkalinity, and total dissolved solids). Reported concentrations of all parameters historically analyzed were below the applicable guidelines for all groundwater samples submitted with the exception of the following:



AOMC 2016 POST REMEDIATION MONITORING AND LTF DECOMMISSIONING, EDMONTON INTERNATIONAL AIRPORT

- Concentration of dissolved aluminum exceeded the applicable guideline of 0.1 mg/L in groundwater sample MW75-14.
- Concentrations of dissolved arsenic exceeded the applicable guideline of 0.010 mg/L in groundwater samples collected from monitoring wells MW75-14 and MW76-14.
- Concentrations of dissolved barium exceeded the applicable guideline of 1.0 mg/L in groundwater samples collected from monitoring wells BH50M, MW75-14, MW76-14 and MW82-15.
- Concentrations of dissolved iron exceeded the applicable guideline of 0.3 mg/L in groundwater samples collected from monitoring wells BH32, BH35, BH50M, MW71-14, MW72-14, MW73-14, MW74-14, MW75-14, MW76-14, MW82-15, and MW83-15.
- Concentrations of dissolved manganese exceeded the applicable guideline of 0.05 mg/L in groundwater samples collected from monitoring wells BH32, BH35, BH50M, BH55M, MW71-14, MW72-14, MW73-14, MW74-14, MW75-14, MW76-14, MW82-15, and MW83-15.
- Concentrations of dissolved sodium exceed the applicable guideline of 200 mg/L in groundwater samples collected from monitoring wells BH35 and BH50M.
- Concentrations of dissolved uranium exceeded the applicable guideline of 0.02 mg/L in groundwater samples collected from monitoring wells BH35, MW72-14, and MW83-15.
- Concentrations of total dissolved solids (TDS) exceeded the applicable guideline of 500 mg/L in groundwater samples collected from monitoring wells BH32, BH35, BH50M, BH55M, MW71-14, MW72-14, MW73-14, MW74-14, MW75-14, MW76-14, MW82-15, and MW83-15.
- Concentrations of dissolved chloride exceeded the applicable guideline of 250 mg/L in groundwater samples collected from monitoring wells BH35, MW74-14, MW75-14, MW82-15 and MW83-15.

Concentrations of dissolved aluminum, dissolved arsenic, dissolved uranium, and TDS are often naturally elevated in the Edmonton region and are consistent with background soil conditions at the Site. In addition, dissolved barium is typically naturally occurring in soils containing sedimentary rocks or coal¹⁷. Trace coal was observed in the soil stratigraphy at the Site; therefore, it is anticipated that the dissolved barium exceedances reported at the Site are related to the soil conditions at the Site. Finally, the elevated concentrations of dissolved iron and dissolved manganese are likely associated with the degrading PHC concentrations at the Site (refer to Section 5.4.4). Therefore, these parameter exceedances do not represent an environmental concern for the Site.

The elevated concentrations of dissolved sodium and chloride observed historically in monitoring wells BH35, BH50M, MW74-14, MW75-14, MW82-15 and MW83-15 at the Site are likely related to de-icing processes during the winter. It is likely that these monitoring wells are acting as a preferential pathway to the subsurface. As a result, these parameters should continue to be monitored during future MNA parameter sampling events.

¹⁷ Canadian Council of Ministers of the Environment. 2013. Canadian soil quality guidelines for the protection of environmental and human health: Barium. In: Canadian environmental quality guidelines, Canadian Council of Ministers of the Environment, Winnipeg.



5.4.4 MNA Assessment

Multiple lines of evidence are typically used to assess biodegradation processes related to natural attenuation, including:

- Observed reduction in PHC concentrations over time at key monitoring wells.
- Overall stable/decreasing plume geometry and/or a lesser plume extent than would be expected given site hydrogeology.
- Patterns of geochemical indicator parameters which are indicative of microbially mediated reactions responsible for the biodegradation of PHCs.

Dissolved-phase PHC trends (BTEX and PHC Fractions F1 and F2) generally indicated either stable or “no-trend” determination based on Mann-Kendall analyses (refer to Appendix E). At monitoring well MW71-14, located immediately downgradient of the historical excavation limit, decreasing trends were noted for toluene. At monitoring well BH50M, located near the southwestern perimeter of the historical excavation limits, decreasing trends were noted for PHC Fraction F2 and at monitoring well BH35, located along the western boundary of the Site, decreasing trends were noted for ethylbenzene.

The microbially mediated reactions which convert PHCs to less harmful compounds involve the consumption of PHCs and other compounds (referred to as electron acceptors). Favoured electron acceptors, in order of consumption, are oxygen, nitrate (NO_3^-), manganese (Mn^{4+}), ferric iron (Fe^{3+}), sulphate (SO_4^{2-}), and carbon dioxide (CO_2). Based on consumption of these electron acceptors, geochemical parameters can be used to assess whether biodegradation processes are active and which are dominant (spatially and temporally). Direct evidence (e.g., depressed levels of dissolved oxygen, nitrate and sulphate; elevated dissolved manganese (Mn^{2+}), ferrous iron (Fe^{2+}) and methane) and/or indirect evidence (e.g., low oxidation reduction potential values) can be used to make this assessment via comparison to background locations.

Geochemical parameters were not analyzed during the 2016 sampling event; however, historical groundwater data, provided in Table 4, indicates that biological degradation of PHCs is likely occurring at the Site. The strongest evidence of intrinsic biodegradation of PHCs is the depressed concentrations of dissolved nitrate and elevated concentrations of manganese and ferrous iron (dissolved iron and HCL preserved Fe^{2+}). As a result, the dominant microbial processes appear to include the reduction of nitrate, manganese and iron. Although the relatively low sulphate concentrations (less than 10 mg/L) and elevated methane concentrations (greater than 0.5 mg/L) indicate that the sequential reduction processes have progressed to sulphate reduction and methanogenesis at some locations (e.g., BH32, BH50M, and MW76-14).

The available groundwater data indicates that natural attenuation processes are active and have resulted in stable and/or decreases in PHC concentrations. Based on the long-term nature of PHC-impacts (over 37 years), it is inferred that the groundwater PHC plume is stable under current conditions.

As a result, it is anticipated that conditions at the Site are favourable for an MNA remedial approach based on the remedial activities completed to date, the absence of free phase product at the Site (i.e., no evidence of sheen or in-well free product accumulations), and the active biodegradation processes discussed above. Future groundwater monitoring and sampling events would be required to substantiate that biodegradation of PHC is actually occurring as evidenced by decreases in PHC concentrations and/or a stable or decreasing dissolved-phase PHC plume.



6.0 QUALITY ASSURANCE / QUALITY CONTROL

Samples were collected using appropriate handling protocols and were placed in sample containers provided by Maxxam. All field tasks were completed in accordance with Golder's Field Technical Procedures. All field equipment involved in the sampling of groundwater was decontaminated between each sampling location in accordance with Golder's Technical Procedures. In addition, Golder also reviewed the summary of laboratory QA/QC data provided by Maxxam for surrogate spikes, matrix spikes and method blanks. The laboratory QA/QC data proved satisfactory and met all the QA/QC requirements. The laboratory certificates of analysis are provided in Appendix D and include a summary of the laboratory QA/QC.

The measure of the reproducibility or precision of the data was quantified by calculating the Relative Percent Difference (RPD). The RPD was calculated as follows:

$$RPD\% = \frac{[S - D]}{\frac{1}{2} (S + D)} \times 100$$

Where: RPD = Relative Percent Difference
S = sample value
D = duplicate or replicate value

Theoretically, the samples should have identical chemical concentrations (i.e., RPD = 0). However, due to factors such as sample matrix heterogeneity, natural variations or variations in sample collection, handling or analysis, a minor variation in chemical concentration may occur (i.e., RPD >0). Moreover, the reproducibility of replicate analyses at concentrations near the reported detection limit (RDL) can be poor, resulting in RPD values of greater than the allowable limits. Therefore, for duplicate concentrations greater than five times the detection limit, a relative percent difference value of +/- 30% is considered acceptable. For duplicate concentrations less than five times the detection limit, a value of +/- 2 detection limits is considered acceptable. RPD values greater than the project objectives suggest variability had been introduced through sample collection, sample handling, or sample analysis.

Two duplicate samples were collected during the groundwater monitoring event at the AOMC building. The blind duplicate groundwater samples were collected at the discretion of Golder field staff from monitoring wells with sufficient volumes of groundwater. The results of the duplicate analysis are provided in Table 5. The results indicate that for concentrations above five times the RDL, the relative percent differences were less than 30% for all parameters analyzed.



7.0 CONCLUSIONS AND RECOMMENDATIONS

The results of the 2016 post remediation monitoring and partial LTF / SVE unit decommissioning are summarized below:

- Based on the groundwater elevations measured, the interpreted direction of groundwater flow at the Site is towards the north-northwest. No free phase product was encountered during the sampling event.
- Reported concentrations of BTEX and PHC Fractions F1 and F2 at the AOMC building were below the applicable guidelines for groundwater samples submitted, with the exception of monitoring wells BH32, BH50M, MW71-14, MW75-14 and MW76-14.
- Reported concentrations of benzene at monitoring wells BH35 and MW82-15 historically exceeded the applicable guideline in January 2016; however concentrations reduced to below the applicable guideline in May 2016.
- The available groundwater data indicates that natural attenuation processes are active and have resulted in stable and/or decreases in PHC concentrations. Based on the long-term nature of the PHC impacts, it is inferred that the groundwater PHC plume is stable under current conditions.
- Approximately 360,350 L of runoff was treated and discharged from the LTF.
- The north cell of the LTF was decommissioned. Impacted soil including sump gravel from the north LTF cell was transferred to the south cell. All liner material was removed and disposed of at an appropriate off Site facility. The north cell was backfilled and graded using fill materials from the north cell berms.
- The aboveground header-line piping and power to the SVE unit was disconnected in preparation for the removal of the SVE unit.

Based upon the results of the 2016 post remediation monitoring, the following summaries and recommendations are provided below:

- Residual PHC impacts are present within soil and groundwater at the Site. According to the RAP prepared by PGL in February 2010, the volume of impacted soil at the Site was originally approximately 47,000 m³. The source zone excavation completed in 2012 resulted in the removal of approximately 5,200 m³ of PHC impacted soil, leaving approximately 41,800 m³ of PHC impacted soil at the Site. However it should be noted that the remaining impacts at the Site extend beneath the AOMC building footprint and into the utility corridor to the west of the Site, parallel to 36th Street East, which contains an ATCO Pipelines high pressure natural gas pipeline. As a result, there is significant uncertainty in the volume of PHC impacted soil remaining at the Site.
- The anticipated coarse-grained material surrounding the ATCO Pipelines high pressure natural gas pipeline is likely acting as a preferential pathway for contaminant transport; however, groundwater monitoring completed to date indicates that these impacts have been delineated to the north and have not impacted soil and groundwater quality on the west side of 36th Street East. Due to the presence of the utility corridor and the AOMC building, it is not anticipated that additional remedial excavation be undertaken prior to future Site redevelopment. As a result, it is recommended that a MNA strategy continue to be considered for the Site. Based upon the results from the MNA sampling completed to date, biodegradation processes are active at



the Site and the groundwater PHC plume is stable under current conditions. It is recommended that bi-annual groundwater monitoring and sampling be completed to monitor the PHC concentrations and to monitor MNA parameters (i.e., nitrate, sulphate, dissolved iron, dissolved manganese, methane) as part of the MNA strategy. It is also recommended that an updated elevation survey of the monitoring wells at the Site be completed, due to the numerous repairs completed over the past few years.

- In order to aid the MNA strategy, natural bioremediation processes can be enhanced through the addition of amendments such as nutrients (e.g., phosphorous) and electron acceptors (e.g., oxygen, nitrate, iron, sulphate), referred to herein as an enhanced in situ bioremediation (EISB) approach. Biodegradation of PHCs occurs most rapidly under aerobic conditions (i.e., adding oxygen); however, at mature sites it is often beneficial to instead promote anaerobic conditions (e.g., adding nitrate or sulphate). The degree of success of EISB relies in large part on the effective delivery of amendments to the subsurface. Delivery approaches range from passive approaches (e.g., Waterloo Emitter) to more active delivery (e.g., groundwater injection/extraction recirculation systems). Alternatively, time to reach "closure concentrations" can be reduced by addressing source areas or high concentration areas, for example, using in-situ chemical oxidation via direction injection (e.g., Fenton's reagent). However, before an enhanced MNA approach can be selected, further investigation would be required to determine the updated Site conditions and the appropriate remediation goals.
- The north cell of the LTF has been decommissioned and impacted soil from the north cell has been transferred to the south cell. Based on the sampling completed in June 2015, PHC impacts remain in the soil located within the LTF with reported exceedances of benzene (0.40 mg/kg), ethylbenzene (2.7 mg/kg), and PHC Fractions F1 (280 mg/kg) and F2 (470 mg/kg). However, the concentrations have reduced to allow the impacted soil to be classified as non-hazardous. As a result, it is recommended that the soil located in the south cell be disposed of at an Alberta Class II non-hazardous landfill and the south cell of the LTF be decommissioned. It is also recommended that the runoff collecting in the LTF sump be treated and discharged prior to decommissioning the LTF. As a proactive measure during this work, it is recommended that the monitoring wells installed around the perimeter of the LTF be monitored and sampled after the decommissioning work is completed. In addition, it is recommended that the monitoring wells be decommissioned after groundwater quality results have been confirmed.



AOMC 2016 POST REMEDIATION MONITORING AND LTF DECOMMISSIONING, EDMONTON INTERNATIONAL AIRPORT

The following table provides a preliminary cost estimate based on the recommended work required to monitor the residual PHC impacts present within soil and groundwater at the Site and decommission the remaining portion of the LTF in 2017. Preliminary costs to complete the recommended future work are estimated to be between approximately \$550,000 and \$600,000 CDN (excluding GST).

Task	Professional Fees	Contractor Costs	Analytical Costs	Disbursements	Totals
MNA Groundwater Monitoring and Sampling	\$7,000	\$4,000	\$12,000	\$5,000	\$28,000
LTF Decommissioning					
Runoff Treatment and Discharge	\$4,000	\$30,000	\$1,000	\$1,000	\$36,000
Soil Removal and Disposal	\$9,000	\$430,000	\$1,000	\$2,000	\$442,000
Liner and Sump Removal	\$3,000	\$31,000	-	\$1,000	\$35,000
Berm Removal and Site Grading	\$3,000	\$13,000	-	\$1,000	\$17,000
LTF Groundwater Sampling and Well Decommissioning	\$2,000	\$4,000	\$1,000	\$1,000	\$8,000
Reporting	\$9,000	-	-	\$1,000	\$10,000
Totals	\$37,000	\$512,000	\$15,000	\$12,000	\$576,000

Notes:

1. The above costs are intended to represent an estimate of costs for planning purposes.
2. The above costs are based on present value 2016 cost data.
3. Costs provided above do not include GST.
4. MNA Groundwater Monitoring and Sampling includes two sampling events and an elevation survey of the monitoring well.

8.0 LIMITATIONS

This report was prepared for the exclusive use of Public Services and Procurement Canada. The report, which specifically includes all tables, figures, and appendices, is based on data and information collected during the Site activities conducted by Golder Associates Ltd. and is based solely on the conditions of the property at the time of the Site field program and data obtained by Golder Associates Ltd. as described in this report.

The services performed as described in this report were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions.

Any use which a third party makes of this report, or any reliance on, or decisions to be made based on it, are the responsibilities of such third parties. Golder Associates Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The content of this report is based on information collected during our assessment, our present understanding of the Site conditions, and our professional judgement in light of such information at the time of this report. This report provides a professional opinion and therefore no warranty is either expressed, implied, or made as to the conclusions, advice and recommendations offered in this report. This report does not provide a legal opinion regarding compliance with applicable laws. With respect to regulatory compliance issues, it should be noted that regulatory statutes and the interpretation of regulatory statutes are subject to change. The findings and conclusions of this report are valid only as of the date of this report. If new information is discovered in future work, including excavations, borings, or other studies, Golder Associates Ltd. should be requested to re-evaluate the conclusions of this report, and to provide amendments as required.



AOMC 2016 POST REMEDIATION MONITORING AND LTF DECOMMISSIONING, EDMONTON INTERNATIONAL AIRPORT

CLOSURE

We trust the above meets your present requirements. If you have any questions or require additional details, please contact the undersigned.

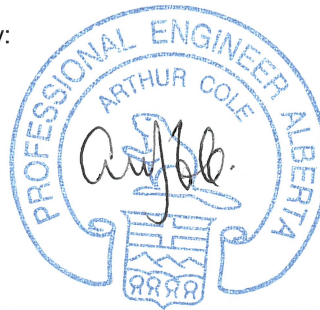
Sincerely,

GOLDER ASSOCIATES LTD.
APEGA Permit to Practice #05122

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RB/SF/AC/pls

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TABLES

Table 1
LTF Runoff Water Chemistry Results
Public Services and Procurement Canada
AOMC Building, Edmonton International Airport

Sample Identification			LTF-WS16-01	CCME Guidelines¹
Sample Collection Date			September 19, 2016	
Parameter	Units	RDL		
BTEX Parameters				
Benzene	mg/L	0.0004	<0.0004	NG
Toluene	mg/L	0.0004	<0.0004	NG
Ethylbenzene	mg/L	0.0004	<0.0004	NG
Xylenes (Total)	mg/L	0.0008	<0.0008	NG
Hydrocarbon Fractions				
PHC F1 (C6-C10) - BTEX	mg/L	0.10	<0.10	NG
PHC F2 (C10-C16)	mg/L	0.10	<0.10	NG
Total Metals				
Total Aluminum (Al)	mg/L	0.003	0.042	5
Total Antimony (Sb)	mg/L	0.0006	0.0024	NG
Total Arsenic (As)	mg/L	0.0002	0.040	0.1
Total Barium (Ba)	mg/L	0.01	0.046	NG
Total Beryllium (Be)	mg/L	0.001	<0.0010	0.1
Total Boron (B)	mg/L	0.02	0.11	0.5
Total Cadmium (Cd)	mg/L	0.00002	<0.000020	0.0051
Total Calcium (Ca)	mg/L	0.3	15	NG
Total Chromium (Cr)	mg/L	0.001	<0.0010	NG
Total Cobalt (Co)	mg/L	0.0003	<0.00030	0.05
Total Copper (Cu)	mg/L	0.0002	0.0023	0.2
Total Iron (Fe)	mg/L	0.06	0.073	5
Total Lead (Pb)	mg/L	0.0002	<0.00020	0.2
Total Lithium (Li)	mg/L	0.02	<0.020	2.5
Total Magnesium (Mg)	mg/L	0.2	7.9	NG
Total Manganese (Mn)	mg/L	0.004	0.0048	0.2
Total Molybdenum (Mo)	mg/L	0.0002	0.0033	0.01
Total Nickel (Ni)	mg/L	0.0005	0.0013	0.2
Total Phosphorus (P)	mg/L	0.1	<0.10	NG
Total Potassium (K)	mg/L	0.3	4.1	NG
Total Selenium (Se)	mg/L	0.0002	<0.00020	0.02
Total Silicon (Si)	mg/L	0.1	0.60	NG
Total Silver (Ag)	mg/L	0.0001	<0.00010	NG
Total Sodium (Na)	mg/L	0.5	5.8	NG
Total Strontium (Sr)	mg/L	0.02	0.15	NG
Total Sulphur (S)	mg/L	0.2	3.1	NG
Total Thallium (Tl)	mg/L	0.0002	<0.00020	NG
Total Tin (Sn)	mg/L	0.001	<0.0010	NG
Total Titanium (Ti)	mg/L	0.001	<0.0010	NG
Total Uranium (U)	mg/L	0.0001	0.00093	0.01
Total Vanadium (V)	mg/L	0.001	0.0046	0.1
Total Zinc (Zn)	mg/L	0.003	<0.0030	5
Calculated Parameters				
Anion Sum	meq/L	N/A	1.6	NG
Cation Sum	meq/L	N/A	1.7	NG
Hardness (CaCO3)	mg/L	0.5	70	NG
Ion Balance	N/A	0.01	1.1	NG
Dissolved Nitrate (NO3)	mg/L	0.044	<0.044	NG
Nitrate plus Nitrite (N)	mg/L	0.01	<0.020	NG
Dissolved Nitrite (NO2)	mg/L	0.033	<0.033	NG
Total Dissolved Solids	mg/L	10	86	500
Misc. Inorganics				
Conductivity	uS/cm	1	160	NG
pH	pH	N/A	9.64	NG
Anions				
Alkalinity (PP as CaCO3)	mg/L	0.5	14	NG
Alkalinity (Total as CaCO3)	mg/L	0.5	69	NG
Bicarbonate (HCO3)	mg/L	0.5	49	NG
Carbonate (CO3)	mg/L	0.5	17	NG
Hydroxide (OH)	mg/L	0.5	<0.50	NG
Dissolved Sulphate (SO4)	mg/L	1	9.1	NG
Dissolved Chloride (Cl)	mg/L	1	2.7	100
Nutrients				
Dissolved Nitrite (N)	mg/L	0.01	<0.010	NG
Dissolved Nitrate (N)	mg/L	0.01	<0.010	NG
Lab Filtered Elements				
Dissolved Calcium (Ca)	mg/L	0.3	15	NG
Dissolved Iron (Fe)	mg/L	0.06	<0.060	5
Dissolved Magnesium (Mg)	mg/L	0.2	7.9	NG
Dissolved Manganese (Mn)	mg/L	0.004	<0.0004	0.2
Dissolved Potassium (K)	mg/L	0.3	4	NG
Dissolved Sodium (Na)	mg/L	0.5	5.6	NG

Notes:

1. Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection Agricultural Water Uses for Irrigation Water, 1999.

NG - no guideline

RDL - reported detection limit

ppm - parts per million

mg/L - milligrams per litre

meq/L - milliequivalent per litre

uS/cm - microSiemens per centimeter

N/A - not applicable

BOLD indicates samples in exceedance of applicable guidelines.

Table should be read in conjunction with accompanying report.

Table 2
Summary of Groundwater Elevations
Public Services and Procurement Canada
AOMC Building, Edmonton International Airport

Well ID	Ground Elevation ¹ (mASL)	Top of Pipe Elevation ¹ (mASL)	Well Depth (mbgs)	Monitoring Date	Depth to Water (mbtoc)	Depth to Water (mbgs)	Groundwater Elevation (mASL)
BH32	734.72	734.55	2.79	30-May-13	0.43	0.60	734.12
				20-Sep-13	0.69	0.86	733.86
				4-Mar-14	frozen	-	-
				28-Aug-14	0.75	0.91	733.80
				23-Jul-15	0.48	0.65	734.07
				10-Sep-15	0.53	0.70	734.02
				20-Nov-15	1.01	1.18	733.54
				21-Jan-16	2.45	2.61	732.11
BH35	734.04	734.15	3.20	25-May-16	0.45	0.62	734.10
				4-Jun-13	0.37	0.26	733.78
				20-Sep-13	0.74	0.63	733.41
				4-Mar-14	frozen	-	-
				28-Aug-14	0.82	0.71	733.34
				23-Jul-15	0.39	0.28	733.76
				10-Sep-15	0.48	0.37	733.68
				20-Nov-15	1.14	1.03	733.01
MW46	733.96	733.91	2.91	21-Jan-16	2.19	2.08	731.97
				25-May-16	0.35	0.24	733.81
				4-Jun-13	0.10	0.16	733.81
				20-Sep-13	0.55	0.60	733.36
				4-Mar-14	frozen	-	-
				27-Aug-14	0.70	0.75	733.21
				23-Jul-15	0.22	0.28	733.69
				10-Sep-15	0.32	0.37	733.59
BH48M	737.51	736.93	6.81	20-Nov-15	0.98	1.04	732.93
				21-Jan-16	dry	-	-
				25-May-16	0.22	0.28	733.69
				31-May-13	0.57	1.15	736.36
				23-Sep-13	0.77	1.35	736.16
				6-Mar-14	2.51	3.09	734.42
				27-Aug-14	0.77	1.35	736.16
				21-Jul-15	0.56	1.14	736.37
BH50M	734.73	734.59	6.59	9-Sep-15	0.62	1.20	736.31
				19-Nov-15	1.06	1.64	735.87
				20-Jan-16	2.41	2.99	734.52
				26-May-16	0.59	1.17	736.34
				30-May-13	1.03	1.16	733.56
				19-Sep-13	1.05	1.18	733.54
				5-Mar-14	frozen	-	-
				28-Aug-14	1.34	1.47	733.25
BH54M	735.01	734.98	5.20	23-Jul-15	0.99	1.13	733.60
				9-Sep-15	0.90	1.03	733.69
				20-Nov-15	1.24	1.37	733.36
				21-Jan-16	2.47	2.61	732.12
				26-May-16	0.85	0.99	733.74
				29-May-13	0.57	0.59	734.42
				19-Sep-13	0.96	0.99	734.02
				5-Mar-14	2.79	2.81	732.20
BH55M	735.06	735.03	5.21	27-Aug-14	0.96	0.98	734.02
				23-Jul-15	0.62	0.65	734.36
				8-Sep-15	0.66	0.68	734.33
				18-Nov-15	1.10	1.12	733.88
				21-Jan-16	2.57	2.59	732.42
				26-May-16	0.60	0.62	734.39
				31-May-13	0.74	0.77	734.28
				23-Sep-13	0.90	0.93	734.13
BH57M	734.46	734.40	5.23	5-Mar-14	3.41	3.44	731.62
				27-Aug-14	1.14	1.17	733.89
				23-Jul-15	0.74	0.76	734.29
				9-Sep-15	0.64	0.67	734.39
				18-Nov-15	0.78	0.81	734.24
				20-Jan-16	3.06	3.09	731.96
				26-May-16	0.69	0.72	734.34
				29-May-13	0.66	0.72	733.74
BH58M	734.90	734.51	5.22	18-Sep-13	0.94	1.00	733.46
				5-Mar-14	covered	-	-
				27-Aug-14	1.07	1.13	733.33
				22-Jul-15	0.66	0.72	733.74
				8-Sep-15	0.68	0.74	733.72
				18-Nov-15	0.97	1.03	733.43
				22-Jan-16	covered	-	-
				25-May-16	0.59	0.65	733.81
BH59M	734.11	733.91	5.68	30-May-13	0.80	1.18	733.71
				19-Sep-13	1.33	1.71	733.18
				5-Mar-14	3.05	3.43	731.46
				27-Aug-14	1.34	1.73	733.17
				21-Jul-15	1.06	1.45	733.45
				9-Sep-15	1.37	1.76	733.14
				19-Nov-15	1.26	1.65	733.25
				20-Jan-16	2.80	3.18	731.72
BH62M	733.95	733.87	6.72	26-May-16	0.96	1.35	733.55
				30-May-13	1.25	1.44	732.66
				19-Sep-13	1.28	1.48	732.63
				5-Mar-14	2.78	2.97	731.13
				27-Aug-14	1.45	1.64	732.47
				21-Jul-15	1.44	1.63	732.47
				9-Sep-15	1.48	1.67	732.43
				19-Nov-15	1.47	1.66	732.45
BH63M	733.93	733.82	4.44	20-Jan-16	2.84	3.03	731.08
				26-May-16	1.34	1.54	732.57
				29-May-13	2.20	2.28	731.67
				18-Sep-13	1.63	1.71	732.24
				5-Mar-14	2.82	2.89	731.05
				27-Aug-14	2.65	2.73	731.22
				22-Jul-15	2.49	2.56	731.38
				8-Sep-15	2.23	2.31	731.64
				18-Nov-15	2.04	2.12	731.83
				22-Jan-16	2.94	3.01	730.93
				25-May-16	1.95	2.02	731.92
				29-May-13	1.87	1.99	731.95
				18-Sep-13	1.84	1.96	731.97
				5-Mar-14	2.85	2.96	730.97
				27-Aug-14	2.06	2.18	731.75
				22-Jul-15	1.88	2.00	731.93
				8-Sep-15	2.10	2.22	731.72
				18-Nov-15	2.05	2.17	731.77
				22-Jan-16	2.62	2.74	731.20
				25-May-16	1.55	1.67	732.27

Table 2
Summary of Groundwater Elevations
Public Services and Procurement Canada
AOMC Building, Edmonton International Airport

Well ID	Ground Elevation ¹ (mASL)	Top of Pipe Elevation ¹ (mASL)	Well Depth (mbgs)	Monitoring Date	Depth to Water (mbtoc)	Depth to Water (mbgs)	Groundwater Elevation (mASL)
BH64M	735.01	735.01	6.78	30-May-13	2.47	2.48	732.54
				19-Sep-13	1.94	1.95	733.07
				4-Mar-14	frozen	-	-
				27-Aug-14	2.62	2.62	732.39
				22-Jul-15	2.44	2.44	732.57
				9-Sep-15	2.43	2.43	732.58
				18-Nov-15	2.20	2.21	732.81
				20-Jan-16	2.62	2.62	732.39
BH65M	734.68	734.53	8.31	26-May-16	2.19	2.19	732.83
				28-May-13	3.00	3.15	731.53
				18-Sep-13	1.73	1.87	732.80
				5-Mar-14	frozen	-	-
				27-Aug-14	1.81	1.95	732.72
				22-Jul-15	2.13	2.27	732.40
				8-Sep-15	2.22	2.37	732.31
				18-Nov-15	2.23	2.37	732.31
MW71-14	734.07	733.96	4.92	22-Jan-16	2.96	3.11	731.57
				25-May-16	1.75	1.90	732.78
				4-Mar-14	3.18	3.29	730.78
				28-Aug-14	2.08	2.19	731.87
				23-Jul-15	2.10	2.21	731.86
				9-Sep-15	2.09	2.20	731.86
				19-Nov-15	1.84	1.95	732.11
MW72-14	734.13	734.07	6.03	21-Jan-16	3.14	3.25	730.81
				25-May-16	1.82	1.93	732.13
				4-Mar-14	5.20	5.26	728.87
				28-Aug-14	0.70	0.76	733.37
				23-Jul-15	0.55	0.61	733.52
				9-Sep-15	0.61	0.67	733.46
				19-Nov-15	1.10	1.16	732.97
MW73-14	734.19	734.04	6.02	21-Jan-16	2.57	2.63	731.50
				25-May-16	0.60	0.66	733.47
				4-Mar-14	2.74	2.88	731.31
				28-Aug-14	0.61	0.75	733.44
				23-Jul-15	0.52	0.66	733.52
				8-Sep-15	0.65	0.79	733.39
				19-Nov-15	1.06	1.20	732.98
MW74-14	734.97	734.87	4.99	21-Jan-16	2.44	2.59	731.60
				25-May-16	0.59	0.73	733.46
				28-Aug-14	0.47	0.57	734.40
				21-Jul-15	0.44	0.54	734.43
				10-Sep-15	0.76	0.86	734.11
				19-Nov-15	0.97	1.06	733.90
MW75-14	734.96	734.83	4.60	21-Jan-16	2.46	2.56	732.41
				26-May-16	0.65	0.74	734.23
				16-Sep-14	1.47	1.60	733.36
				21-Jul-15	0.51	0.64	734.32
				10-Sep-15	0.56	0.68	734.27
				20-Nov-15	0.84	0.97	733.99
MW76-14	734.83	734.72	5.67	20-Jan-16	2.54	2.66	732.30
				26-May-16	0.44	0.57	734.39
				4-Mar-14	2.72	2.83	732.00
				28-Aug-14	1.30	1.41	733.42
				21-Jul-15	1.04	1.14	733.69
				9-Sep-15	1.11	1.21	733.62
				20-Nov-15	1.15	1.25	733.58
MW82-15	NM	NM	5.57	20-Jan-16	2.67	2.78	732.05
				26-May-16	0.94	1.05	733.78
				21-Jul-15	0.34	-	-
				10-Sep-15	0.69	-	-
				20-Nov-15	0.94	-	-
MW83-15	NM	NM	5.90	21-Jan-16	2.29	-	-
				26-May-16	0.33	-	-
				22-Jul-15	1.98	-	-
				8-Sep-15	1.83	-	-
				18-Nov-15	1.64	-	-
MW1-13	735.65	736.70	5.80	22-Jan-16	2.60	-	-
				25-May-16	1.54	-	-
				3-Jun-13	6.69	5.65	730.00
				23-Sep-13	6.59	5.55	730.10
				28-Aug-14	6.42	5.37	730.28
MW2-13	735.56	736.46	5.93	6-Oct-15	3.23	2.19	733.46
				31-May-13	dry	-	-
				23-Sep-13	dry	-	-
				28-Aug-14	6.77	5.86	729.70
MW3-13	735.55	736.50	6.01	6-Oct-15	6.65	5.75	729.81
				31-May-13	dry	-	-
				23-Sep-13	dry	-	-
				28-Aug-14	dry	-	-
MW4-13	736.37	737.22	6.08	6-Oct-15	6.62	5.72	729.84
				4-Jun-13	6.67	5.82	730.55
				23-Sep-13	5.65	4.79	731.57
				28-Aug-14	5.40	4.55	731.82
MW5-13	736.70	737.60	5.95	6-Oct-15	4.90	4.05	732.32
				31-May-13	dry	-	-
				23-Sep-13	dry	-	-
				28-Aug-14	6.85	5.94	730.76
MW6-13	735.79	736.72	6.03	6-Oct-15	4.33	3.42	733.28
				31-May-13	4.13	3.20	732.59
				23-Sep-13	4.24	3.31	732.48
				28-Aug-14	2.40	1.47	734.32
MW7-13	735.79	736.72	6.03	6-Oct-15	2.85	1.91	733.88
				31-May-13	4.13	3.20	732.59
				23-Sep-13	4.24	3.31	732.48
				28-Aug-14	2.40	1.47	734.32

Notes:
1. Elevations surveyed by Golder in June 2013, March 2014, and September 2014.
mASL - metres above sea level
mbgs - metres below ground surface.
mbtoc - metres below top of casing.
NM - not measured
"- " - not available
Table to be read in conjunction with accompanying report.

Table 3
AOMC Building Groundwater Chemistry Results - Petroleum Hydrocarbons
Public Services and Procurement Canada
AOMC Building, Edmonton International Airport

Well ID	Sampling Date	Headspace Combustible Vapour (ppm)	Parameters					
			Benzene	Toluene	Ethylbenzene	Xylenes (Total)	PHC F1 (C6-C10) - BTEX	PHC F2 (C10-C16)
Units			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Reportable Detection Limit			0.0004	0.0004	0.0004	0.0008	0.1	0.1
CDWQ and FCSAP Guidelines			0.005 ¹	0.06 ¹	0.14 ¹	0.09 ¹	9.1 ²	3.1 ²
BH32	30-May-13	0	0.42	0.017	0.069	0.16	1.3	1.9
	20-Sep-13	5	0.82	0.010	0.066	0.11	0.70	0.56
	29-Aug-14	0	0.71	0.0087	0.047	0.15	0.48	0.77
	23-Jul-15	0	0.029	0.00069	0.0054	0.024	0.24	0.51
	10-Sep-15	45	0.18	0.0023	0.040	0.023	0.60	0.22
	20-Nov-15	0	1.3	0.0092	0.11	0.045	0.78	0.63
	22-Jan-16	0	3.7	0.023	0.10	0.13	0.49	1.2
25-May-16	5	0.19	0.0035	0.05	0.04	0.5	0.37	
BH35	4-Jun-13	0	0.018	<0.0004	0.0013	<0.0008	<0.10	<0.10
	20-Sep-13	0	0.19	0.0018	0.0071	0.0011	0.23	<0.10
	29-Aug-14	0	0.19	0.0019	0.0079	<0.0008	0.19	<0.10
	23-Jul-15	35	0.026	0.00053	0.00074	<0.0008	<0.10	<0.10
	10-Sep-15	0	0.0062	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	20-Nov-15	0	0.028	0.00057	0.0020	<0.0008	<0.10	<0.10
	22-Jan-16	0	0.065	0.00057	<0.0004	<0.0008	<0.10	<0.10
25-May-16	0	0.00049	<0.0004	<0.0004	<0.0008	<0.10	<0.10	
MW46	4-Jun-13	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	20-Sep-13	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	27-Aug-14	5	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	23-Jul-15	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	10-Sep-15	60	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	20-Nov-15	0	0.00097	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	25-May-16	95	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
BH48M	31-May-13	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	23-Sep-13	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	6-Mar-14	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	27-Aug-14	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	21-Jul-15	40	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	9-Sep-15	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	19-Nov-15	15	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
20-Jan-16	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10	
26-May-16	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10	
BH50M	30-May-13	30	0.35	0.0048	0.0085	0.018	0.22	0.26
	19-Sep-13	25	3.7	0.027	0.075	0.077	<0.10	0.16
	29-Aug-14	40	1.8	0.023	0.038	0.087	<0.10	0.19
	23-Jul-15	35	0.50	0.0058	0.013	0.024	<0.10	0.12
	9-Sep-15	450	1.6	0.017	0.023	0.034	0.12	<0.10
	20-Nov-15	350	1.5	0.028	0.037	0.050	<0.10	<0.10
	21-Jan-16	80	0.95	0.013	0.036	0.050	<0.10	<0.10
26-May-16	10	0.03	<0.0004	0.0021	0.003	<0.10	<0.10	
BH54M	29-May-13	5	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	19-Sep-13	10	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	0.14
	5-Mar-14	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	27-Aug-14	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	23-Jul-15	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	8-Sep-15	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	18-Nov-15	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
21-Jan-16	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10	
26-May-16	25	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10	
BH55M	31-May-13	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	23-Sep-13	10	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	5-Mar-14	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	29-Aug-14	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	22-Jul-15	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	9-Sep-15	20	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	18-Nov-15	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
20-Jan-16	5	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10	
26-May-16	20	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10	
BH57M	29-May-13	20	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	18-Sep-13	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	27-Aug-14	15	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	22-Jul-15	40	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	8-Sep-15	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	18-Nov-15	10	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
25-May-16	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10	
BH58M	30-May-13	260	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	19-Sep-13	30	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	5-Mar-14	20	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	27-Aug-14	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	21-Jul-15	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	9-Sep-15	10	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	19-Nov-15	10	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	20-Jan-16	5	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	26-May-16	5	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
BH59M	30-May-13	100	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	19-Sep-13	50	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	5-Mar-14	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	27-Aug-14	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	21-Jul-15	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	9-Sep-15	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	19-Nov-15	10	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	20-Jan-16	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
26-May-16	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10	
BH62M	29-May-13	20	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	18-Sep-13	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	5-Mar-14	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	27-Aug-14	10	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	22-Jul-15	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	8-Sep-15	5	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	18-Nov-15	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	22-Jan-16	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
25-May-16	5	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10	

Table 3
AOMC Building Groundwater Chemistry Results - Petroleum Hydrocarbons
Public Services and Procurement Canada
AOMC Building, Edmonton International Airport

Well ID	Sampling Date	Headspace Combustible Vapour (ppm)	Parameters					
			Benzene	Toluene	Ethylbenzene	Xylenes (Total)	PHC F1 (C6-C10) - BTEX	PHC F2 (C10-C16)
Units			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Reportable Detection Limit			0.0004	0.0004	0.0004	0.0008	0.1	0.1
CDWQ and FCSAP Guidelines			0.005 ¹	0.06 ¹	0.14 ¹	0.09 ¹	9.1 ²	3.1 ²
BH63M	29-May-13	10	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	18-Sep-13	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	5-Mar-14	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	27-Aug-14	10	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	22-Jul-15	40	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	8-Sep-15	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	18-Nov-15	10	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	22-Jan-16	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	25-May-16	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
BH64M	30-May-13	100	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	19-Sep-13	5	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	27-Aug-14	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	22-Jul-15	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	9-Sep-15	20	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	18-Nov-15	5	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	20-Jan-16	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	26-May-16	15	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
BH65M	28-May-13	20	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	18-Sep-13	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	27-Aug-14	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	22-Jul-15	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	8-Sep-15	25	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	18-Nov-15	5	<0.0004	0.00042	<0.0004	<0.0008	<0.10	<0.10
	22-Jan-16	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	25-May-16	10	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
MW71-14	4-Mar-14	3,400	0.019	0.0027	0.086	0.052	0.81	0.53
	29-Aug-14	20	0.081	0.0022	0.12	0.049	0.63	0.70
	23-Jul-15	480	0.11	0.0023	0.18	0.026	1.5	0.54
	9-Sep-15	240	0.040	0.00076	0.059	0.0057	0.52	0.17
	19-Nov-15	110	0.033	0.00064	0.049	0.0028	0.38	0.16
	21-Jan-16	110	0.037	0.00052	0.0039	0.0080	0.84	0.23
	25-May-16	65	0.11	0.0023	0.25	0.037	0.98	0.48
MW72-14	4-Mar-14	4,650	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	29-Aug-14	10	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	23-Jul-15	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	9-Sep-15	240	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	19-Nov-15	10	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	21-Jan-16	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	25-May-16	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
MW73-14	4-Mar-14	2,750	0.00041	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	29-Aug-14	25	0.00068	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	23-Jul-15	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	8-Sep-15	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	19-Nov-15	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	21-Jan-16	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	25-May-16	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
MW74-14	29-Aug-14	5	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	0.11
	21-Jul-15	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	10-Sep-15	30	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	19-Nov-15	5	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	21-Jan-16	45	0.0011	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	26-May-16	5	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
MW75-14	16-Sep-14	1,750	1.6	0.15	0.42	1.1	1.2	1.7
	21-Jul-15	130	0.12	0.47	0.57	0.57	2.7	2.2
	10-Sep-15	3,050	1.7	0.099	0.18	0.46	1.3	0.63
	20-Nov-15	10,250	2.0	0.11	0.23	0.65	0.60	1.2
	20-Jan-16	510	1.5	0.039	0.057	0.12	0.60	0.61
	26-May-16	150	2.1	0.15	0.55	0.99	2.2	2.4
MW76-14	4-Mar-14	2,750	0.24	0.042	0.033	0.11	0.19	0.15
	29-Aug-14	100	21	5.5	0.99	5.1	<0.10	2.3
	21-Jul-15	75	14	2.8	0.75	2.6	2.5	1.9
	9-Sep-15	610	14	3.6	0.97	3.6	0.41	2.0
	20-Nov-15	1,450	16	3.6	0.91	3.1	<0.10	1.6
	20-Jan-16	420	16	3.2	0.54	2.0	22	3.8
	26-May-16	50	19	3.1	0.84	2.4	<0.10	2
MW82-15	21-Jul-15	100	<0.0004	<0.0004	0.0026	<0.0008	0.46	0.58
	10-Sep-15	190	<0.0004	<0.0004	0.0021	<0.0008	0.69	0.60
	20-Nov-15	120	<0.0004	<0.0004	0.0034	<0.0008	0.73	0.61
	21-Jan-16	0	0.0088	0.0066	0.0061	0.015	0.64	0.67
	26-May-16	5	<0.0004	<0.0004	0.00043	<0.0008	0.2	0.3
MW83-15	22-Jul-15	15	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	8-Sep-15	15	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	18-Nov-15	65	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	22-Jan-16	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10
	25-May-16	0	<0.0004	<0.0004	<0.0004	<0.0008	<0.10	<0.10

Notes:

1. Health Canada Guidelines for Canadian Drinking Water Quality, October 2014.

2. Federal Contaminated Sites Action Plan Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites, Tier 2 Guidelines excluding the freshwater aquatic life pathway for coarse-grained soil and industrial land use, November 2015.

RDL - reported detection limit

ppm - parts per million

mg/L - milligrams per litre

BOLD indicates samples in exceedance of applicable guidelines.

Table should be read in conjunction with accompanying report.

Table 4
AOMC Building Groundwater Chemistry Results - MNA Parameters
Public Services and Procurement Canada
AOMC Building, Edmonton International Airport

Well ID	Sampling Date	Headspace Combustible Vapour (ppm)	Parameters																																
			Dissolved Aluminum (Al)	Dissolved Antimony (Sb)	Dissolved Arsenic (As)	Dissolved Barium (Ba)	Dissolved Beryllium (Be)	Dissolved Boron (B)	Dissolved Cadmium (Cd)	Dissolved Calcium (Ca)	Dissolved Chromium (Cr)	Dissolved Cobalt (Co)	Dissolved Copper (Cu)	Dissolved Iron (Fe)	Dissolved Lead (Pb)	Dissolved Lithium (Li)	Dissolved Magnesium (Mg)	Dissolved Manganese (Mn)	Dissolved Molybdenum (Mo)	Dissolved Nickel (Ni)	Dissolved Phosphorus (P)	Dissolved Potassium (K)	Dissolved Selenium (Se)	Dissolved Silicon (Si)	Dissolved Silver (Ag)	Dissolved Sodium (Na)	Dissolved Strontium (Sr)	Dissolved Sulphur (S)	Dissolved Thallium (Tl)	Dissolved Tin (Sn)	Dissolved Titanium (Ti)	Dissolved Uranium (U)	Dissolved Vanadium (V)	Dissolved Zinc (Zn)	
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
			Reportable Detection Limit	0.003	0.0006	0.0002	0.01	0.001	0.02	0.00002	0.3	0.001	0.0003	0.0002	0.06	0.0002	0.02	0.2	0.004	0.0002	0.0005	0.1	0.3	0.0002	0.1	0.0001	0.5	0.02	0.2	0.0002	0.001	0.001	0.0001	0.001	0.003
CDWQ and FCSAP Guidelines			0.1'	0.006'	0.010'	1.0'	NG	5'	0.005'	NG	0.05'	NG	1.0'	0.3'	0.010'	NG	NG	0.05'	NG	NG	NG	0.05'	NG	NG	200'	NG	NG	NG	NG	0.001	0.001	0.0001	0.001	0.003	
BH32	29-Aug-14	0	0.0051	<0.00060	0.0030	0.35	<0.0010	0.091	<0.000020	150	<0.0010	0.0027	0.00035	6.0	0.00028	0.041	31	1.9	0.0029	0.0070	<0.10	22	0.00054	12	<0.00010	160	0.86	8.1	<0.00020	<0.0010	0.0012	0.0058	<0.0010	<0.0030	
	23-Jul-15	0	0.0040	0.00096	0.0037	0.16	<0.0010	0.059	<0.000020	61	<0.0010	0.00072	0.0014	2.9	0.00029	<0.020	8.9	0.45	0.0030	0.0029	<0.10	16	0.00038	11	<0.00010	82	0.31	9.2	<0.00020	<0.0010	<0.0010	0.0030	<0.0010	0.0082	
	10-Sep-15	45	0.0047	0.00086	0.0028	0.13	<0.0010	0.047	<0.000020	53	<0.0010	0.00035	0.00040	1.6	0.00022	<0.020	7.8	0.27	0.0029	0.0022	<0.10	15	0.00036	9.6	<0.00010	66	0.27	8.7	<0.00020	<0.0010	<0.0010	0.0035	<0.0010	0.0044	
	20-Nov-15	0	0.0030	<0.00060	0.0067	0.54	<0.0010	0.044	<0.000020	170	<0.0010	0.00068	0.00035	20	0.00052	0.041	37	2.3	0.00061	0.0056	<0.10	14	0.00065	14	<0.00010	130	0.97	1.3	<0.00020	<0.0010	<0.0010	0.00073	<0.0010	0.0046	
	22-Jan-16	0	0.0041	<0.00060	0.0055	0.50	<0.0010	0.039	<0.000020	180	<0.0010	0.00072	<0.00020	27	0.00063	0.041	42	2.7	0.00061	0.0051	<0.10	11	0.0013	13	<0.00010	100	1.0	1.6	<0.00020	<0.0010	<0.0010	0.00082	<0.0010	0.0054	
BH35	29-Aug-14	0	0.0053	<0.00060	0.0077	0.48	<0.0010	0.091	<0.000020	170	<0.0010	0.0050	0.00055	34	0.00022	0.066	54	4.1	0.0024	0.0056	<0.10	16	0.00057	16	<0.00010	190	1.2	0.90	<0.00020	<0.0010	0.0013	0.0023	<0.0010	0.0044	
	23-Jul-15	55	0.0043	<0.00060	0.0051	0.44	<0.0010	0.11	<0.000020	140	<0.0010	0.0035	0.0015	10	<0.00020	0.032	1.0	2.2	0.0063	0.010	0.11	19	0.00043	9.7	<0.00010	290	0.96	33	<0.00020	<0.0010	<0.0010	0.0027	<0.0010	0.016	
	10-Sep-15	0	0.0038	<0.00060	0.0015	0.40	<0.0010	0.12	<0.000020	180	<0.0010	0.0026	0.0016	3.7	<0.00020	0.077	56	2.0	0.0040	0.0084	<0.10	16	0.00045	10	<0.00010	300	1.2	34	<0.00020	<0.0010	<0.0010	0.0023	<0.0010	0.022	
	20-Nov-15	0	0.0030	<0.00060	0.0034	0.46	<0.0010	0.074	<0.000020	200	<0.0010	0.0050	0.00054	15	<0.00020	0.084	63	3.9	0.0021	0.0079	<0.10	13	0.00036	13	<0.00010	190	1.3	18	<0.00020	<0.0010	<0.0010	0.016	<0.0010	0.022	
	22-Jan-16	0	0.0039	<0.00060	0.0061	0.56	<0.0010	0.056	<0.000020	200	<0.0010	0.0058	<0.00020	35	<0.00020	0.072	63	4.6	0.0016	0.0071	<0.10	10	0.00054	14	<0.00010	160	1.3	8.3	<0.00020	<0.0010	<0.0010	0.013	<0.0010	0.0062	
BH50M	29-Aug-14	40	0.0091	<0.00060	0.0036	0.52	<0.0010	0.084	<0.000020	79	<0.0010	0.0054	0.00048	12	<0.00020	0.030	16	1.3	0.0023	0.0034	<0.10	30	0.00046	6.3	<0.00010	210	0.57	1.0	<0.00020	<0.0010	<0.0010	0.00030	<0.0010	0.028	
	23-Jul-15	35	0.0034	<0.00060	0.0037	0.48	<0.0010	0.059	<0.000020	79	<0.0010	0.0017	0.00028	17	<0.00020	<0.020	13	0.98	0.0054	0.0015	0.25	32	0.00058	5.9	<0.00010	140	0.50	3.6	<0.00020	<0.0010	<0.0010	0.00012	<0.0010	<0.0030	
	9-Sep-15	450	0.0036	<0.00060	0.0052	1.4	<0.0010	0.12	<0.000020	170	<0.0010	0.0025	<0.00020	43	<0.00020	0.039	36	1.9	0.0016	0.0034	0.28	47	0.00086	9.5	<0.00010	240	1.3	2.2	<0.00020	<0.0010	<0.0010	0.00012	<0.0010	<0.0030	
	20-Nov-15	350	<0.0030	<0.00060	0.0030	1.2	<0.0010	0.10	<0.000020	160	<0.0010	0.0024	0.00029	28	<0.00020	0.041	38	1.5	0.0011	0.0021	0.18	42	0.00063	10	<0.00010	180	1.3	2.8	<0.00020	<0.0010	<0.0010	0.00022	<0.0010	0.0056	
	21-Jan-16	80	0.0047	<0.00060	0.0066	1.0	<0.0010	0.12	<0.000020	150	<0.0010	0.0019	<0.00020	23	<0.00020	0.042	37	1.2	0.0016	0.0024	0.18	36	0.00071	10	<0.00010	170	1.1	1.7	<0.00020	<0.0010	<0.0010	0.00029	<0.0010	0.0036	
BH55M	5-Mar-14	0	0.0040	<0.00060	0.00024	0.094	<0.0010	0.039	0.000010	64	<0.0010	<0.00030	0.0011	<0.060	<0.00020	0.023	17	<0.0040	0.0012	0.0010	<0.10	3.8	0.00038	6.4	<0.00010	36	0.35	7.7	<0.00020	<0.0010	<0.0010	0.0042	<0.0010	<0.0030	
	29-Aug-14	0	0.0074	<0.00060	0.00021	0.26	<0.0010	0.048	<0.000020	140	<0.0010	0.00053	0.0015	<0.060	<0.00020	0.028	26	0.043	0.00093	0.0013	<0.10	8.0	0.00041	7.5	<0.00010	19	0.50	46	<0.00020	<0.0010	<0.0010	0.0098	<0.0010	0.0078	
	22-Jul-15	0	0.0045	<0.00060	0.00025	-	<0.0010	-	0.000032	-	<0.0010	<0.00030	0.0013	<0.060	<0.00020	-	-	0.052	0.0011	0.0014	-	-	0.00028	-	<0.00010	-	-	-	<0.00020	<0.0010	<0.0010	0.0080	<0.0010	0.0040	
	9-Sep-15	20	0.0038	<0.00060	0.00033	0.21	<0.0010	0.049	<0.000020	110	<0.0010	<0.00030	0.0010	<0.060	<0.00020	0.029	22	<0.0040	0.00082	0.00087	<0.10	6.7	0.00033	9.0	<0.00010	18	0.45	30	<0.00020	<0.0010	<0.0010	0.0079	<0.0010	0.0040	
	18-Nov-15	0	0.0038	<0.00060	<0.00020	0.17	<0.0010	0.034	<0.000020	100	<0.0010	<0.00030	0.00090	<0.060	<0.00020	0.025	22	<0.0040	0.00070	0.00068	<0.10	5.6	0.00025	8.0	<0.00010	18	0.42	25	<0.00020	<0.0010	<0.0010	0.0069	0.0011	<0.0030	
MW71-14	20-Jan-16	5	0.0049	<0.00060	0.00021	0.13	<0.0010	0.040	0.000023	86	<0.0010	<0.00030	0.00064	<0.060	<0.00020	0.025	23	<0.0040	0.00074	0.0010	<0.10	4.1	<0.00020	8.2	<0.00010	18	0.42	17	<0.00020	<0.0010	<0.0010	0.0054	<0.0010	<0.0030	
	4-Mar-14	3,400	0.0039	<0.00060	0.00064	0.14	<0.0010	0.13	0.000034	130	<0.0010	0.0034	0.0012	0.13	0.0014	0.095	41	2.5	0.014	0.0070	0.12	5.5	<0.00020	8.7	<0.00010	44	1.1	17	<0.00020	0.0069	<0.0010	0.0070	<0.0010	0.014	
	29-Aug-14	20	0.0046	<0.00060	0.0014	0.42	<0.0010	0.097	0.000048	200	<0.0010	0.0059	0.00047	0.078	0.00045	0.11	72	3.3	0.0021	0.013	<0.10	12	0.00023	12	<0.00010	150									

Well ID	Sampling Date	Headspace Combustible Vapour (ppm)	Parameters																											
			HCL Preserved Iron (Fe+2 Ferrous)	Total Iron (Fe)	Total Manganese (Mn)	Total Phosphorus (P)	Methane	Calculated Methane	Anion Sum	Cation Sum	Hardness (CaCO3)	Ion Balance	Dissolved Nitrate (NO3)	Nitrate plus Nitrite (N)	Dissolved Nitrite (NO2)	Total Dissolved Solids	Total Chemical Oxygen Demand	Conductivity	pH	Alkalinity (pp as CaCO3)	Alkalinity (Total as CaCO3)	Bicarbonate (HCO3)	Carbonate (CO3)	Hydroxide (OH)	Dissolved Sulphate (SO4)	Dissolved Chloride (Cl)	Dissolved Nitrite (N)	Dissolved Nitrate (N)		
			mg/L	mg/L	mg/L	mg/L	L/m3	mg/L	meq/L	meq/L	mg/L	N/A	mg/L	mg/L	mg/L	mg/L	mg/L	uS/cm	pH	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
			Units	mg/L	mg/L	mg/L	L/m3	mg/L	meq/L	meq/L	mg/L	N/A	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	uS/cm	pH	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Reportable Detection Limit			0.05	0.06	0.004	0.003	0.005	0.003	N/A	N/A	0.5	0.01	0.044	0.01	0.033	10	5	1	N/A	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	1	0.01	0.01
CDWQ and FCSAP Guidelines			NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	45 ¹	NG	3 ¹	500 ¹	NG	NG	6.5 - 8.5 ¹	NG	NG	NG	NG	NG	NG	500 ¹	250 ¹	1 ¹	10 ¹	
BH32	29-Aug-14	0	7.9	11	1.5	0.17	1.2	0.81	17	18	510	1.0	0.13	0.042	0.039	930	79	1,600	7.44	<0.50	540	660	<0.50	<0.50	28	200	0.012	0.030		
	23-Jul-15	0	2.2	3.6	0.36	0.12	0.34	0.23	7.5	7.9	190	1.0	3.7	0.95	0.37	420	99	710	7.59	<0.50	290	350	<0.50	<0.50	30	40	0.11	0.84		
	10-Sep-15	45	1.6	2.1	0.28	0.035	0.37	0.24	6.4	6.6	170	1.0	5.9	1.4	0.30	350	56	580	7.75	<0.50	270	330	<0.50	<0.50	23	15	0.090	1.3		
	20-Nov-15	0	17	22	2.3	0.13	0.82	0.54	16	18	560	1.1	<0.044	<0.020	<0.033	870	90	1,600	7.39	<0.50	520	630	<0.50	<0.50	<1.0	190	<0.010	<0.010		
	22-Jan-16	0	27	28	2.6	0.23	1.3	0.86	16	18	620	1.1	0.23	0.052	<0.033	890	99	1,700	7.17	<0.50	480	590	<0.50	<0.50	0.71	230	<0.010	0.052		
BH35	29-Aug-14	0	35	56	4.6	0.49	0.38	0.25	22	23	640	1.1	0.048	0.011	<0.033	1,100	130	2,000	7.31	<0.50	800	970	<0.50	<0.50	<1.0	200	<0.010	0.011		
	23-Jul-15	55	6.6	12	2.1	0.20	0.065	0.043	25	24	530	0.99	3.0	0.73	0.15	1,300	30	2,400	7.43	<0.50	560	680	<0.50	<0.50	98	400	0.046	0.69		
	10-Sep-15	0	3.0	3.9	1.8	0.035	0.058	0.038	25	27	670	1.1	22	5.1	0.14	1,400	83	2,400	7.50	<0.50	710	870	<0.50	<0.50	92	310	0.043	5.1		
	20-Nov-15	0	14	18	3.8	0.065	0.074	0.049	22	25	760	1.1	<0.044	<0.020	<0.033	1,200	61	2,100	7.36	<0.50	750	910	<0.50	<0.50	48	230	<0.010	<0.010		
	22-Jan-16	0	33	58	4.8	0.24	0.26	0.17	22	24	770	1.1	<0.044	<0.020	<0.033	1,200	90	2,100	7.29	<0.50	780	950	<0.50	<0.50	25	210	<0.010	<0.010		
BH50M	29-Aug-14	40	12	26	1.7	0.46	15	9.9	15	16	260	1.0	<0.044	<0.010	<0.033	830	160	1,500	7.61	<0.50	470	570	<0.50	<0.50	7.0	200	<0.010	<0.010		
	23-Jul-15	35	18	24	1.2	0.43	14	9.2	14	13	250	0.91	<0.044	<0.010	<0.033	730	120	1,300	7.56	<0.50	430	530	<0.50	<0.50	5.2	180	<0.010	<0.010		
	9-Sep-15	450	37	40	1.6	0.27	12	7.8	18	25	580	1.3	<0.044	<0.020	<0.033	1,100	110	1,800	7.44	<0.50	620	750	<0.50	<0.50	5.1	220	<0.010	<0.010		
	20-Nov-15	350	26	30	3.0	0.22	9.4	6.2	19	21	560	1.1	<0.044	<0.020	<0.033	1,100	96	1,800	7.35	<0.50	650	800	<0.50	<0.50	4.7	200	<0.010	<0.010		
	21-Jan-16	80	22	26	1.3	0.24	9.5	6.2	19	20	530	1.1	<0.044	<0.020	<0.033	1,000	94	1,800	7.43	<0.50	650	790	<0.50	<0.50	2.5	200	<0.010	<0.010		
BH55M	5-Mar-14	0	0.14	-	9.1	2.3	0.0060	0.0040	6.8	6.2	230	0.92	14	3.1	<0.033	350	88	670	7.74	<0.50	230	280	<0.50	<0.50	30	48	<0.010	3.1		
	29-Aug-14	0	0.28	2.6	0.13	0.041	<0.005	<0.003	10	9.9	440	0.99	1.6	0.37	0.057	550	24	890	7.61	<0.50	290	360	<0.50	<0.50	150	39	0.017	0.35		
	22-Jul-15	0	<0.050	1.6	0.19	0.13	0.0080	0.0050	8.6	9.2	380	1.1	3.1	0.71	0.052	480	36	770	7.56	<0.50	300	370	<0.50	<0.50	96	19	0.016	0.69		
	9-Sep-15	20	<0.050	0.30	0.13	0.022	<0.005	<0.003	8.3	8.5	380	1.0	1.2	0.27	<0.033	440	8.9	730	7.80	<0.50	300	360	<0.50	<0.50	84	19	<0.010	<0.010		
	18-Nov-15	0	<0.050	0.42	0.16	0.018	<0.005	<0.003	7.3	7.9	350	1.1	0.43	0.096	<0.033	400	9.1	670	7.75	<0.50	270	330	<0.50	<0.50	69	14	<0.010	0.096		
MW71-14	20-Jan-16	5	<0.050	3.8	0.24	0.12	0.022	0.014	6.8	7.0	310	1.0	2.0	0.45	<0.033	360	17	630	7.63	<0.50	260	310	<0.50	<0.50	56	19	<0.010	0.45		
	4-Mar-14	3,400	-	-	8.9	2.3	0.055	0.036	13	12	490	0.89	0.050	0.011	<0.033	650	520	1,200	7.42	<0.50	550	670	<0.50	<0.50	65	35	<0.010	0.011		
	29-Aug-14	20	9.7	93	8.0	0.84	0.11	0.073	14	23	790	1.6	<0.044	<0.010	<0.033	870	130	1,200	7.15	<0.50	630	770	<0.50	<0.50	18	41	<0.010	<0.010		
	23-Jul-15	140	2.4	79	9.1	1.8	0.087	0.057	15	15	630	1.0	<0.044	<0.010	<0.033	750	240	1,300	7.29	<0.50	660	810	<0.50	<0.50	10	58	<0.010	<0.010		
	9-Sep-15	240	5.0	3.8	5.9	0.024	0.043	0.028	15	15	650	0.99	<0.044	<0.020	<0.033	730	61	1,300	7.24	<0.50	660	810	<0.50	<0.50	13	51	<0.010	<0.010		
MW72-14	19-Nov-15	110	0.32	2.1	2.1	0.022	0.032	0.021	8.3	8.8	220	1.1	0.70	0.30	0.45	440	63	780	7.34	<0.50	330	410	<0.50	<0.50	9.5	50	0.14	0.16		
	21-Jan-16	110	1.8	19	7.3	0.26	0.074	0.049	17	17	670	1.0	1.1	0.25	<0.033	880	82	1,400	7.43	<0.50	620	760	<0.50	<0.50	140	47	<0.010	0.25		
	29-Aug-14	10	0.17	4.8	2.6	0.18	0.096	0.063	21	21	770	0.98	0.055	0.012	<0.033	1,100	92	1,800	7.38	<0.50	790	960	<0.50	<0.50	190	47	<0.010	0.012		
	23-Jul-15	0	1.4	5.9	4.0	0.11	0.30	0.20	23	22	810	0.95	<0.044	<0.010	<0.033	1,200	94	1,900	7.23	<0.50	850	1,000	<0.50	<0.50	170	80	<0.010	<0.010		
	9-Sep-15	240	0.64	1.7	4.0	0.097	0.27	0.18	24	25	890	1.1	<0.044	<0.020	<0.033	1,300	76	2,000	7.35	<0.50	830	1,000	<0.50	<0.50	190	110	<0.010	<0.010		
MW73-14	19-Nov-15	10	0.17	1.8	3.8	0.032	0.012	0.0080	24	26	930	1.1	1.1	0.25	<0.033	1,300	77	2,000	7.50	<0.50	860	1,100	<0.50	<0.50	180	96	<0.010	0.25		
	21-Jan-16	0	0.090	4.4	0.42	0.060	0.0070	0.0050	20	19	760	0.95	2.5	0.56	<0.033	1,000	56	1,700	7.62	<0.50	760	920	<0.50	<0.50	160	67	<0.010	0.56		
	29-Aug-14	2,750	2.4	-	1.9	1.7	0.028	0.018	15	14	460	0.89	0.24	0.055	<0.033	840	48	1,400	7.48	<0.50	460	560	<0.50	<0.50	290	10	<0.010	0.055		
	29-Aug-14	25	0.48	11	1.3	0.22	0.018	0.012	16	16	570	0.99	<0.044	<0.010	<0.033	860	60	1,400	7.47	<0.50	530	650	<0.50	<0.50	220	21	<0.010	<0.010		
	23-Jul-15	0	0.68	7.1	1.3	0.066	0.036	0.024	15	15	530	0.95	<0.044	<0.																

Table 5
Quality Assurance/Quality Control Analysis
Public Services and Procurement Canada
AOMC, Edmonton International Airport

Sample Identification			BH62M	DUP16-01	Greater than 5 X RDL? ¹	Less than 2 X RDL? ²	RPD ³	MW74-14	DUP16-02	Greater than 5 X RDL? ¹	Within 2 X RDL? ²	RPD ³
Sample Collection Date			May 25, 2016					May 26, 2016				
Parameter	Units	RDL										
Hydrocarbons												
Benzene	ug/L	0.40	<0.40	<0.40	N	-	-	2,100	2,100	Y	N	0%
Toluene	ug/L	0.40	<0.40	<0.40	N	-	-	150	150	Y	N	0%
Ethylbenzene	ug/L	0.40	<0.40	<0.40	N	-	-	550	520	Y	N	6%
Xylenes (Total)	ug/L	0.80	<0.80	<0.80	N	-	-	990	960	Y	N	3%
F1 (C ₆ -C ₁₀) - BTEX	ug/L	100	<100	<100	N	-	-	2,200	1,900	Y	N	15%
F2 (C ₁₀ -C ₁₆)	mg/L	0.10	<0.10	<0.10	N	-	-	2.4	2.6	Y	N	8%

Notes:

RPD - Relative Percent Difference.

RDL - Reported Detection Limit by the Laboratory.

1. RPD is only calculated for results that are greater than 5 times the reported detection limit.
2. Applicable to results that are less than 5 times the reported detection limit.
3. Relative percent difference is only calculated for results where at least one result is greater than 5 times the detection limit.

mg/L - milligrams per litre

BOLD

indicates the percent difference is greater than 30% or not within 2 X RDL.

Table should be read in conjunction with accompanying report.



FIGURES

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LEGEND

SITE LOCATION

KEY MAP
NOT TO SCALE

REFERENCE(S)

IMAGE OBTAINED FROM GOOGLE EARTH © 2016 GOOGLE INC. USED WITH PERMISSION. GOOGLE AND GOOGLE LOGO ARE REGISTERED TRADEMARKS OF GOOGLE INC. IMAGERY DATE: OCTOBER 29, 2015. GOOGLE EARTH IMAGE IS NOT TO SCALE.

TOPOGRAPHIC MAPS 83H/5 OBTAINED FROM CanMatrix © 2000 HER MAJESTY THE QUEEN IN RIGHT OF CANADA. DEPARTMENT OF NATURAL RESOURCES. ALL RIGHTS RESERVED. DATUM: NAD 83, PROJECTION: UTM ZONE 12.

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CLIENT

Canada

PUBLIC SERVICES AND
PROCUREMENT CANADA

PROJECT

AOMC 2016 POST REMEDIATION MONITORING AND LTF
DECOMMISSIONING, EDMONTON INTERNATIONAL AIRPORT

TITLE

SITE LOCATION PLAN

CONSULTANT

Golder
Associates

YYYY-MM-DD	2016-12-12
PREPARED	AM
DESIGN	RB
REVIEW	SF
APPROVED	AC

PROJECT No.

CONTROL

Rev.

FIGURE

1657760

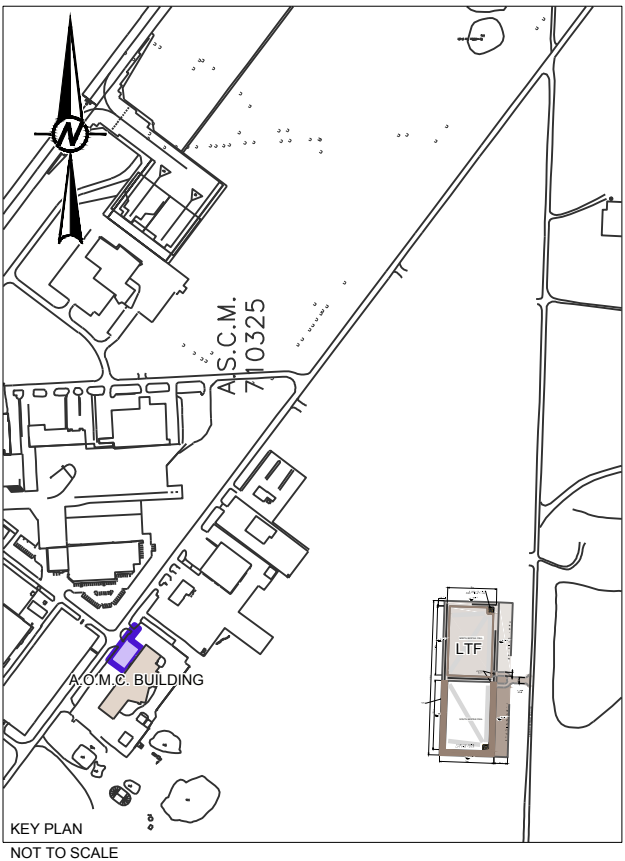
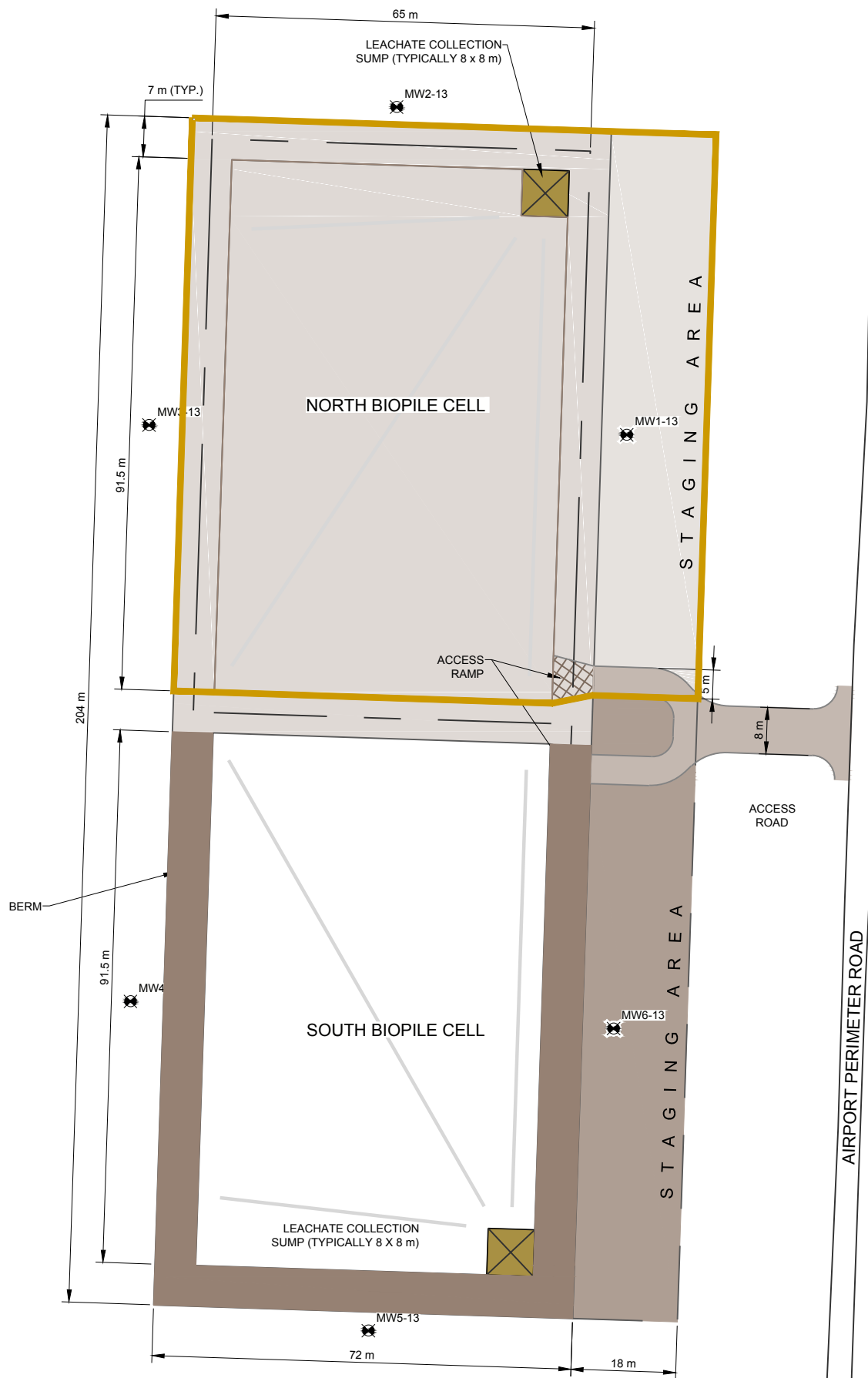
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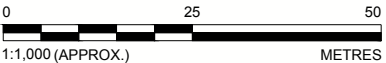
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM A3/B 28 mm

Path: \\golder\golder\Edmonton\CAD\PublicWorks\Canada\International\Airport_L_Edmonton_Albertain98_PROJECTS\165776002_PRODUCTION\1000\DWG | File Name: 1657760-1000-HM-0003.dwg



LEGEND	
	EXISTING MONITORING WELL LOCATION
	DECOMMISSIONED CELL

REFERENCE(S)
REPRODUCED FROM DST CONSULTING GROUP DRAWING 'LAND TREATMENT FACILITY SITE LAYOUT'. DRAWING No.: OE-ED-012268 C-2, DATED 25.08.2010.



CLIENT


PUBLIC SERVICES AND
PROCUREMENT CANADA

PROJECT

AOMC 2016 POST REMEDIATION MONITORING AND LTF
DECOMMISSIONING, EDMONTON INTERNATIONAL AIRPORT

TITLE

LAND TREATMENT FACILITY (LTF) LOCATION PLAN

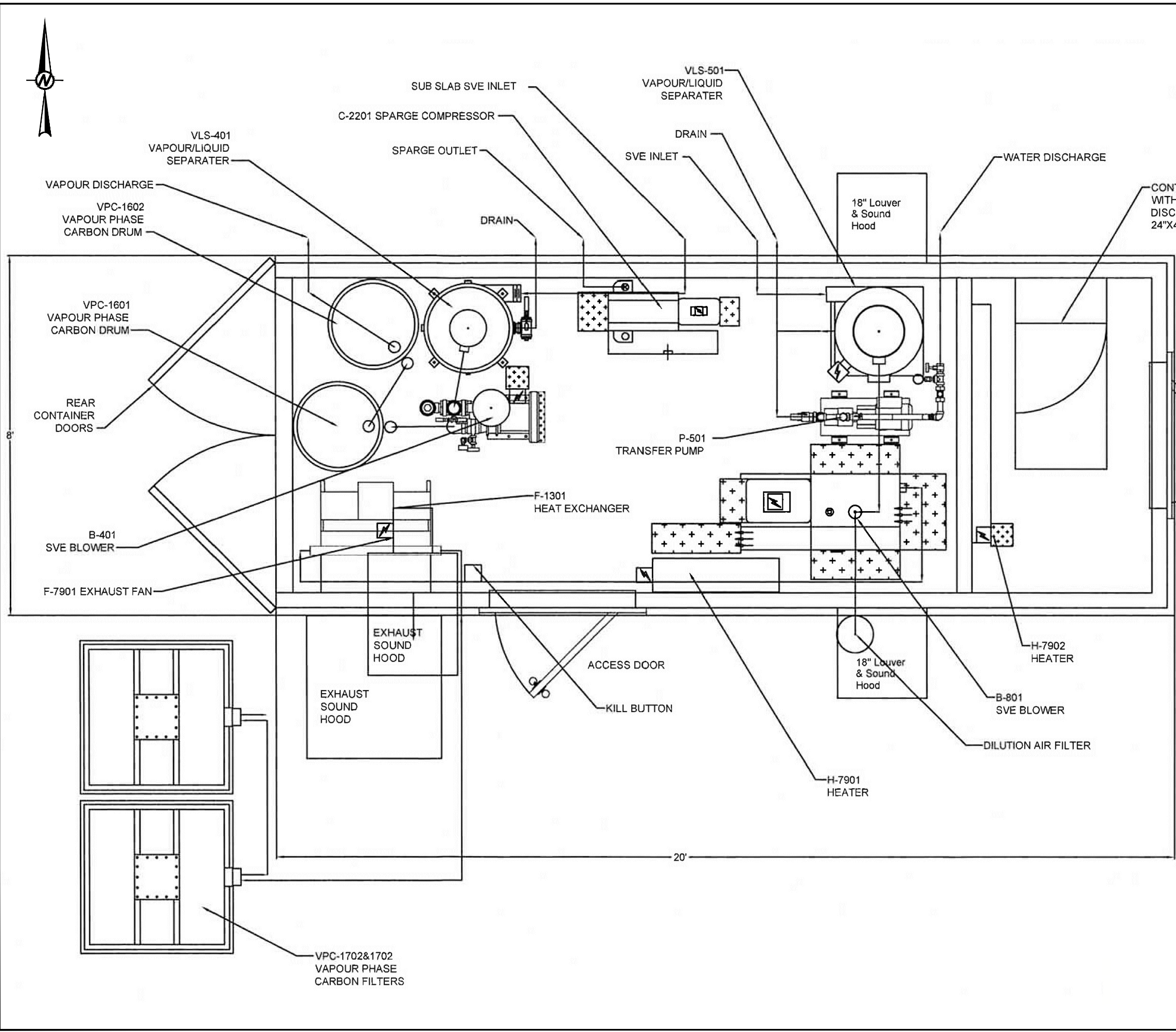
	CONSULTANT	YYYY-MM-DD	2016-12-12
	PREPARED	AM	
	DESIGN	RB	
	REVIEW	SF	
	APPROVED	AC	

PROJECT No. 1657760	CONTROL 1000-HM-0003	Rev. 0	FIGURE 3
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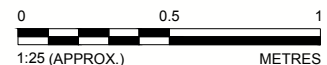
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM A3S B

28 mm

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REFERENCE(S)
ORIGINAL BASE PLAN DRAWN BY NEWTERRA. PROJECT NUMBER: RTS100627-02.



CLIENT
Canada PUBLIC SERVICES AND
PROCUREMENT CANADA

PROJECT
AOMC 2016 POST REMEDIATION MONITORING AND LTF
DECOMMISSIONING, EDMONTON INTERNATIONAL AIRPORT

TITLE
SOIL VAPOUR EXTRACTION (SVE) UNIT LAYOUT

CONSULTANT	YYYY-MM-DD	2016-12-12
	PREPARED	AM
	DESIGN	RB
	REVIEW	SF
	APPROVED	AC



IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
28 mm



APPENDIX A

Health and Safety Plan



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

1.0 CONTACTS LIST SUMMARY

1.1 Emergency Contacts

Contact	Number
First aid Phone number	911
Ambulance	911
Fire	911
Police	911
Golder Crisis Hotline (from within Canada)	1-866-249-0439
Golder Media Relations	604-296-6845
Local Electrical Authority	Fortis - 310-9473
Provincial Poison Control Centre	1-800-332-1414
Roadside Assistance	Shawn Blowers 780-989-7701
Royal Sun Alliance Travel Insurance (policy #1057978)	819-566-1898 (collect anywhere) or 1-866-870-1898
Spills Reporting	ESRD 1 800 222-6514

Hospital name	Address	Phone	Level of Care Available
Leduc Community Hospital	4210 - 48 Street, Leduc AB	780-986-7711	Emergency

1.2 Golder Contacts

	Name	Office Name	Office	Cell	Home
Project Manager	Steven Fiddler	Edmonton	+1 (780) 930-5478	+1 (780) 984-6600	
Project Director	Arthur Cole	Edmonton	+1 (780) 930-8636	+1 (780) 554-4581	
	Steven Fiddler	Edmonton	+1 (780) 930-5478	+1 (780) 984-6600	
	Arthur Cole	Edmonton	+1 (780) 930-8636	+1 (780) 554-4581	
	Rebecca Boyce	Edmonton	+1 (780) 930-4498	+1 (780) 983-7289	
	Pamela Wescott Mike	Edmonton	+1 (780) 930-6792	+1 (587) 338-4054 587-701-7311	
Client	Public Works and Government Services Canada				

1.3 Missed Check-in Contacts

	Name	Phone	Cell
Project Manager	Steven Fiddler	+1 (780) 930-5478	+1 (780) 984-6600
Project Director	Arthur Cole	+1 (780) 930-8636	+1 (780) 554-4581
Other	Jonathan Smith	+1 (403) 216-8951	+1 (403) 470-7993
Other	Glenna Ravensborg	+1 (780) 930-2853	+1 (780) 690-3834



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

1.4 Client and Site Contacts

	Number
Site field cell phone	780 983-7289
Nearest Golder office	Canada - Edmonton
Phone	+1 (780) 483 3499
Fax	+1 (780) 483 1574
Email	

Role	Name	Number
Contact person on site	EIA - Myndy Machan	780-890-8954/780-908-7965
Golder overall site supervisor:	Rebecca Boyce	Office: +1 (780) 930-4498 Cell: +1 (780) 983-7289
Golder Alternate Site supervisor	Pamela Wescott Micheal	Office: +1 (780) 930-6792 Cell: +1 (587) 338-4054 701-7311
Quantum Murray Site supervisor	Dustin	780 993-7748
	Justin	780 903-8906

1.5 Subcontractor Contacts

Name	Subcontractor key staff	Phone
Quantum Murray	Matt Prier / Shawn Hughes	403 880-0977 / 780-467-8881
Maxxam Analytics	Alaina Hunter	780 577-7100

You have the right to refuse any work you feel is unsafe, or that you are not trained to do. Choose to work safely and in compliance with all HSE requirements.

2.0 PROJECT PROPOSAL DETAILS

Project/Proposal Number	1657760	Start Date	Sep 19, 2016	End Date	Sep 30, 2016
Project Title	Landfarm Decommissioning_EIA				
Client Name	Public Works and Government Services Canada				

Brief description of project and scope of works (include any hazardous activities, if known)

Supervising the decommissioning of the north cell at the LTF. Includes sump water treatment, transferring impacted soil to the south cell, removal of liner and associated infrastructure and backfilling and grading. Supervising the disconnecting of the SVE unit located at the AOMC building.

3.0 GOLDER TEAM

Name	Office	Contact number (cell phone)	Office Phone	Role
Steven Fiddler	Edmonton	+1 (780) 984-6600	+1 (780) 930-5478	
Arthur Cole	Edmonton	+1 (780) 554-4581	+1 (780) 930-8636	
Rebecca Boyce	Edmonton	+1 (780) 983-7289	+1 (780) 930-4498	
Pamela Wescott	Edmonton	+1 (587) 338 4054	+1 (780) 930-6792	

Project Manager (PM)



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

- Appoint a competent site supervisor and alternate. For sites with multiple Golder projects/disciplines at work, coordinate with the overall site supervisor
- Oversee/develop hazard controls including work instructions and
- Assign only adequately trained and competent employees to the project

Site Supervisor

- The site supervisor is responsible for the safety of all Golder employees, subcontractors, visitors and public on the parts of the site under Golder control.
- Communicate all site hazards to affected parties, in real time, as hazards, conditions and employees change.
- Ensure that work is undertaken in accordance with the hazard controls included in this HaSEP.

Contractor

- All plant and equipment is maintained in a safe working condition
- All plant and equipment are to be registered/licensed and electrical equipment tagged and tested
- Potential hazards are to be controlled (e.g., cage over rotating parts)
- You will report any identified hazards to the Golder Associates field staff member

Field Staff

- Inspect your worksite and equipment before starting work
- Apply the controls outlined in this HaSEP
- Look out for the safety of yourself and others
- Report unsafe acts, conditions and incidents to the site supervisor

4.0 CLIENT/SITE LOCATION DETAILS

4.1 Client/Site Location Details

Project location map (paste URL here)	https://maps.google.com/maps?q=53.320466,-113.569064&ll=53.320108,-113.56842&spn=0.011177,0.01929&num=1&t=h&z=16
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4.1.1 Site Description

If the project is near another Golder Office, has the local Office been notified of the work? ☒ Yes ☐ No

Site Name	AOMC LTF		
Address	Airport Perimeter Road, Edmonton International Airport		
Coordinates			
Description	Field west of Airport Perimeter Road.		
Access info			
Previous land uses			
Site Receptors that maybe impacted by the proposed work			
Additional Info			
HSE Induction / orientation provider	<input checked="" type="checkbox"/> Golder	<input type="checkbox"/> Client	<input type="checkbox"/> Contractor
Site Contact Numbers	Field cell phone	780 983-7289	Satellite phone
	Other		
Nearest Golder office	Canada - Edmonton	Address	16820 107 Avenue, Edmonton, Alberta, Canada T5P 4C3



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

Opening days and hours		Email	Error! Hyperlink reference not valid.
Phone	+1 (780) 483 3499	Fax	+1 (780) 483 1574
Google Maps			



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

5.0 SUBCONTRACTOR DETAILS

Has Golder been assigned the role of Principal Contractor? * ☒ Yes ☐ No

Name	Subcontractor key staff	Phone	Subcontractor activities	Risk Assessment Supplied	Method Statement Supplied	Approved Golder subcontractor?
Quantum Murray	Matt Prier	403 880-0977	decommissioning contractor	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Maxxam Analytics	Alaina Hunter	780 577-7100	laboratory	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

5.1 Welfare / Hygiene Facilities

The following issues should be considered when planning welfare provision including: the work to be carried out; the associated health risks; duration and number of different locations; number of people working at different locations and distances from welfare facilities.

Describe the project's welfare facilities below:

Facility	Yes	No	Describe alternate arrangements:
Toilets available?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Rest areas available?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Washing facilities available?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Drinking water available?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Area for changing and storing clothes available?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Mode of transportation to site available?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Smoking permitted on site?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	outside gate

6.0 PERMITS AND APPROVALS

☒ Are permits and approvals required for this project? (e.g Client supplied Permit, Hot Works Permit, Mobile Treatment Permit etc.)

Permit or Approval	Permit arranged by		
Edmonton International Airport Facility Alteration Permit	<input checked="" type="checkbox"/> Golder	<input checked="" type="checkbox"/> Client	<input type="checkbox"/> Other

7.0 CHECK-IN SYSTEM

7.1 Check-in contacts

	Primary	Secondary
Name	Steven Fiddler	Jenny Musijowski
Phone/Email	Office: +1 (780) 930-5478 Cell: +1 (780) 984-6600 Email: Steven_Fiddler@golder.com	Office: +1 780 930-8648 Cell: Email: Jenny_Musijowski@golder.com
Check-in frequency*	Start and End of Day	If Steven cannot be contacted
By phone	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
By email	<input type="checkbox"/>	<input type="checkbox"/>
By SMS	<input checked="" type="checkbox"/>	<input type="checkbox"/>
On site	<input type="checkbox"/>	<input type="checkbox"/>

7.2 Missed Check-in Procedure

Within 2 hours of missed check-in time:

1. Attempt to contact employee
2. Contact accommodation or other project personnel to determine last contact with employee
3. Notify Project Manager.
4. Project manager to determine timing of further action, based on project details.

Within 4 hours of scheduled call-in time:

1. Contact client and request assistance to locate employee.
2. Notify Project Director, Office Manager, and local authorities (as appropriate)



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

3. Initiate Crisis Response Plan (as appropriate)

☐ Does missed check-in procedure for this project deviate from the standard procedure?



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

8.0 CHEMICALS AND CONTAMINANTS

8.1 Possible Contaminants or Chemical Exposures

☒ Additional contaminants likely to be encountered during this project (consider previous land uses)

Contaminant Name	PHCs - Gasoline and Diesel		
Exposure routes	Skin Contact, Vapours		
Flash point		Odour threshold	
Explosive limits	LEL		UEL
Occupational Exposure Limits	TWA	300	STEL 500
		Ceiling	
<input type="checkbox"/> Air Monitoring Required			
Exposure Controls	Wear nitrile gloves when handling soil, wash with soap and water		
Medical Surveillance, if required			
Additional Info			



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

9.0 RISK REGISTER

9.1 Risk Register

Header key:

- PA: Persons Affected
- IC: Initial Consequence
- IL: Initial Likelihood
- IR: Initial Risk
- RC: Residual Consequence
- RL: Residual Likelihood
- RR: Residual Risk
- AC: Additional controls

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Contaminated water or soil	Handling contaminants	Employee	3	3	9	Reference D&G CANHSE224 Chemical Safety · Understand the hazards of the contaminants present. · Consult MSDS, labels and other available information. Determine material compatibilities. Minimize manual handling of the contaminant. Stay out of areas where contaminant is present if possible. · Know where first aid and emergency response equipment is (shower/eyewash). Spill kit and eyewash station located in the field truck, as well as on site buildings. Participate in the medical surveillance program based on the type of contact, and the extent of potential exposure (concentration, frequency and duration) · Use chemical resistant gloves, and safety glasses.	3	2	6	



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Driving	Traffic and road conditions (e.g. heavy equipment traffic)	Employee	5	3	15	Check weather conditions before travelling. Inspect your vehicle before use. Plan travel route and verify road conditions where possible. Obtain written driving directions prior to travel. Allow sufficient travel time to reach destination. Obey all traffic signs and signals. Reduce speed in construction areas. Contact the owner if traveling on a private road. Verify and follow the rules of the road (speed limit, type of vehicles, rules on passing, signage, method of communication with other vehicles). Always carry the following emergency equipment: cell phone, flashlight, emergency road kit.	5	1	5	



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Driving	Vehicle-Animal Collisions	Employee	4	2	8	Be alert for wildlife or domestic animals near the road, particularly at dusk, dawn and night. Look ahead across the road from shoulder to shoulder. If you see wildlife on the road, slow down and pass carefully, they may suddenly bolt onto the road. Watch for wildlife warning signs that indicate an area of increased animal population. Take extra precaution when traveling through these areas. Use high beams whenever possible and watch roadside ditches for animals or for reflections from animal eyes. Be aware some animals move in groups and more may be near the road than can be readily seen. If the animal enters the path of the vehicle, do not swerve into the ditch or into on-coming traffic in an attempt to avoid a collision. Brake firmly if an animal is standing on, or crossing the road. Do not assume the animal will move out of your way. In the event of a collision, contact local Fish & Wildlife office or Department of Transportation if animal is still alive or if the carcass is a danger to traffic.	3	1	3	
General	Electrical energy	Electrocution	Employee	5	2	10	<ul style="list-style-type: none"> All electrical equipment to be CSA approved. Routinely inspect electrical equipment to look for damaged components. Lockout and tag out all defective equipment, before working in or around equipment and before performing maintenance on or cleaning an electrical system. Do not enter areas with high voltage equipment without permission, an escort, and following lockout procedures. Use personal locks. 	4	2	8	

HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Pinch points	Pinch points	Employee	5	4	20	<ul style="list-style-type: none"> Eliminate or guard pinch points where possible. Clearly identify pinch points. Train all workers in the area of the pinch points and guards that are in use. Establish a communication plan. 	3	2	6	
General	Slips, trips and falls	Slips, trips and falls	Employee	4	3	12	<ul style="list-style-type: none"> Use care and attention when walking. Establish level pedestrian footpaths where possible. Level out work areas where possible. Choose a route free of obstacles and slippery or soft ground. Walk, don't run, in a controlled manner. Avoid making sudden changes in direction and speed. Wear appropriate construction safety boots that offer good support and have a good tread. Relay hazard to others, clear or mark and report the potential hazard. Keep your workspace clean, tidy and free of slipping hazards. If any equipment or materials need to be stored, designate pre-approved locations, out of traffic areas. 	3	3	9	
Tasks	Electrical/Mechanical room access	Energized equipment	Employee	4	3	12	<ul style="list-style-type: none"> Stand well clear of energized equipment. No loose clothing to be worn and all long hair to be tied back. Golder employees are not permitted within 1 m of energized elements. Make sure room lighting is sufficient or use a flashlight. 	4	1	4	
Tasks	Electrical/Mechanical room access	Moving parts (mechanical elements i.e. motors, fans, hydraulic pistons, etc.)	Employee	4	3	12	<ul style="list-style-type: none"> Assess room to identify moving elements. Stand well clear of equipment in operation. No loose clothing to be worn and all long hair to be tied back. Golder employees not permitted within 1 m of moving elements. Make sure room lighting is sufficient or use flashlight. 	4	1	4	

HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
Work Environment	Working in or near public spaces	Dust	Employee	2	3	6	Consult with neighbouring properties prior to commencing work where dust is likely to be an issue (N.B. this may be the client's responsibility). Identify potential sensitive receptors prior to commencement of work. If present, consult with potential receptors and modify procedures or timing to reduce impact. Monitor dust generation visually and apply water suppression techniques if required and permissible within water restrictions. Consider covering the fence (if present) with shade cloth to limit dust.	2	2	4	
							If the work involves earth works (including ground penetration) any excavated material shall be prevented from exiting the site. This can be achieved by the following (actions to be based on risk at each site): - Erecting sediment control around the perimeter of the area (particularly on the low side of the site) and around open storm water systems. - Retaining a vegetated border on the site which can filter low levels of sediments in runoff - Ensuring that they are stored in areas away from the drainage flow and never place stockpiles in gutters or on nature strips. - Limiting stockpiles of topsoil to less than 2 metres in height and return to excavation as soon as possible. - Cover loads of potentially contaminated soil during transportation off site.	2	2	4	
Work Environment	Working in or near public spaces	Off-site contamination	Employee	3	3	9					



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
Work Environment	Working near moving vehicles	Struck by heavy vehicle	Employee	5	3	15	Be aware of vehicle blind spots. Vehicle operator must activate horn twice before reversing. Back up alarm must also be functional. Maintain eye contact with vehicle operator. Wear reflective clothing. Understand the rules of the site regarding vehicles and pedestrians.	5	1	5	

HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
Work Environment	Working near moving vehicles	Struck by light vehicle	Employee	5	3	15	Prepare a traffic management plan for the work area if regular vehicle movements are present on the work area. Place a vehicle (or other physical barrier) between yourself and moving vehicles. The physical barrier needs to be appropriate for the size and speed of the vehicles operating in the area. Set up work areas away from vehicle traffic as far as practicable and in such a manner to minimize interaction with traffic. As a general rule: - further than 3 metres from vehicles moving at >80km/h - 1.2 -3 metres from vehicles moving at between 60-80 km/h. - 1.3 metres from vehicles moving at <40 km/h Ensure you are clear of moving vehicles before using mobile phones. Schedule activities to avoid peak traffic times. Never conduct work or walk behind a reversing vehicle. Ideally do not walk behind any vehicle, moving or not. If working adjacent to roads ensure signage is placed to warn vehicles of your presence. The signage must be placed at sufficient distance to allow vehicle operators to safely adjust speed or path of travel. Signage to warn motorists shall comply with the requirements of the relevant regulatory authority. Follow site rules and use pedestrian pathways. High visibility clothing shall be worn at all times and reflective clothing shall be worn in low light conditions or as required by the client. Persons engaged to control traffic shall be registered or approved by the relevant regulatory authority. If the work is on or adjacent to a mine haul road: - Request the client closes the road to all traffic - Do not commence work without approved berm or physical barrier in place. Communicate agreed controls to everyone in the vicinity, particularly operators of mobile equipment and vehicles.	5	1	5	
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HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
Work Environment	Working near moving vehicles	Struck by objects	Employee	3	3	9	When transporting loads on vehicles, secure the load low and/or behind cargo barriers. Snatch straps, chains, cables and winches must be certified for the load they are used for and attached to certified and rated points on the vehicles. An exclusion zone must be established and marked where there is risk of dropped objects. As a guide the exclusion zone should be 1.5 the height of the vehicle or component. Pre start inspection of vehicles to be undertaken. Any faults to vehicle or ancillary equipment shall be reported. The relevant equipment shall be tagged out and not used if faulty. Safety glasses shall be worn to protect against flying particles or objects.	3	2	6	



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
Work Environment	Working on a contaminated site	Contaminants - general	Employee	3	2	6	Where exposure to chemicals may occur, use monitoring devices to quantify the exposure (i.e. a photoionisation detector to monitor for vapour exposure). Avoid unnecessary contact with chemicals and contaminated materials. Personal protective equipment including nitrile gloves shall be worn when handling soils or ground water. Where other gloves are required nitrile gloves shall be worn under these. Ensure facilities with soap and detergent is available for regular hand washing. Ensure environmentally safe disposal of all contaminated soils, water and/or contaminated clothing and PPE (e.g. into barrels for treatment and disposal). Refer local legislation or Environmental Group for more information. A minimum of one first aid trained person shall be on site at all times work is being undertaken. Ensure emergency access and egress is maintained at all times. As some gases are heavier than air, entry into all excavations deeper than 1.2 m is strictly prohibited due to it being classified a potential confined space.	2	2	4	

HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
Work Environment	Working on a contaminated site	Flammable / combustible gases and liquids	Employee	4	3	12	<p>All hazardous areas, defined as areas where flammable atmospheres are likely to be present must be designated and identified on a site plan. Review this plan on entry to the site. All employees working in hazardous areas (as defined by the site) must be an approved Contractor.</p> <p>Electrical and battery-powered equipment and equipment capable of producing a local source of ignition (e.g. flame, static electricity, friction, heat, spark, exhaust) are not permitted unless approved by the permit and certified as intrinsically safe (documented evidence required). Some examples of such equipment are power tools, portable radios, mobile phones, pagers, calculators and water quality meters. As some gases are heavier than air, entry into all excavations deeper than 1.2 m is strictly prohibited due to it being classified a potential confined space.</p> <p>Monitoring of flammable gases in ambient air (the breathing zone) will be undertaken where ground penetrating work is being performed or where any work is undertaken in enclosed areas. Work shall cease if vapour concentration exceeds 20% LEL. All personnel to evacuate at least 30m upwind. Contact Project Manager for advice. Flame retardant clothing shall be worn. Synthetic clothing such as vests, raincoats, polar fleece jumpers must not be worn as they can produce a spark.</p>	4	2	8	

HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
Work Environment	Working on a contaminated site	Vehicles	Employee	5	3	15	Where possible, request the client close the area to vehicle traffic. Where closure of the site is not possible, physical barriers must be established if working near vehicles. Traffic cones are not sufficient. Consider scheduling work during low traffic periods. High visibility clothing must be worn at all times and reflective clothing to be worn in low light conditions.	3	2	6	
General	Fueling	Fire, explosion	Employee	4	3	12	Fuelling must occur only when the equipment is turned off and all sources of ignition isolated or cooled off. No smoking while refueling. Do not use cell phone while fuelling. Bond and ground all fuel containers with the equipment before refueling. Refuel on a flat, stable and well ventilated area. Chock the vehicle/equipment before refueling to prevent movement. When fuelling from a gas can, wear protective eye wear and rubber gloves. Consider the size and weight of a full gas can. Reduce the size if possible. Use proper lifting techniques fare larger, heavier gas cans.	4	1	4	
General	Fueling	Fuel spill or fire	Environment	2	4	8	Refuel vehicles at commercial or designated fueling sites whenever possible. Refuel vehicles on level ground, away from waterways. Have spill kit and drip tray readily available. Position drip pan underneath the fill spout to collect any drips or spills. Ground the vehicle and containers to prevent sparking. Replace and seal fill cap and seal fuel canister after refueling.	2	2	4	



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Pick-up truck	Ergonomics	Employee	3	4	12	Long hours sitting in a pick-up truck can cause fatigue and stiffness. Stop, get out, stretch and walk regularly, as weather and site conditions permit. Where possible, set up the seat to support good body posture (knees and hips remain at 75-90 degrees; arms slightly bent when gripping the wheel; entire forefoot placed on each pedal; back of seat and lumbar support to follow the contour of your spine).	3	1	3	
General	Pick-up truck	off-road driving	Employee	5	3	15	Use 4x4. Stay on designated trails. Take a Defense Driving Course with off-road content.	5	2	10	
General	Pick-up truck	Parking on side of the road	Employee	5	4	20	Use barrier vehicle, pylons, or road signs. Check local regulations for requirements. Pull over as far as possible from the road or park in a pull out/rest area. Turn on 4 way flashers if the stop will be short. 4 way flasher operation will drain the battery unless the engine is running. Wear a high visibility vest.	5	2	10	



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Pick-up truck	Unsafe driving practices	Employee	5	3	15	Drivers must have a valid drivers license. Driver abstracts may be reviewed for company vehicle drivers, based on client/project specific requirements. Provide training on driving and loading a pick-up truck. Drive within your abilities; driver training and/or training on the project specific journey management plan may be required prior to travel. Extra caution must be taken when reversing. Use a spotter if possible. The spotter must communicate back-up instructions clearly and stand out of the way of a moving vehicle. Honk twice when reversing and once when moving forward from a stop. Cold weather and exhaust can reduce visibility. Reverse into parking spaces when possible. Check weather and routes before departure. Obtain written driving directions prior to travel. In poor weather delay departure. When arranging transport request suitable vehicle that is equipped with seatbelts, roll bar (where applicable), spare tire, winter tires, scraper, communication equipment, first aid kit, fire extinguisher. Conduct and document a preuse inspection of the vehicle including fluid levels and check that the load is secure, stable and well balanced. Carry extra windshield washer fluid is expecting to enter a dirty road area. Provide details of your planned route to your check-in contact person. Check personal communication devices daily to verify they are working. Do not use electronic devices such as cell phones or blackberries while driving. Do not undertake other distracting activities while driving (e.g. eating, programming a GPS, reading a map). Utilize flame arrestors in internal combustion engine when driving on sites where explosive atmospheres exist.	5	1	5	
Date: September 15, 2016 Project No: 4657760											

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HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Fatigue	Fatigue	Employee	4	3	12	Create and record in the HaSEP the fatigue management plan for the project. For high risk situations or if signs and symptoms of fatigue are apparent, perform a Fatigue Risk Assessment for Work Schedules and include it as part of the fatigue management plan. Reference D&G CANHSE238 Fatigue for a description of high risk situations.	3	2	6	
General	Fatigue	Operating a vehicle	Employee	4	3	12	Employees are not to operate a vehicle or mobile equipment if fatigued. Create and record in the HaSEP the fatigue management plan for project related vehicle operation. For high risk situations or if signs and symptoms of fatigue are apparent, perform a Fatigue Risk Assessment for Work Schedules and include it as part of the fatigue management plan. Reference the Fatigue D&G for a description of high risk situations.	3	2	6	
General	Noise	Noise	Employee	4	5	20	Conduct dosimeter testing to establish noise levels. Install insulation or other noise dampening techniques where possible. Wear hearing protection when noise reduction is not possible. · Establish job rotation. · Undergo annual hearing checks.	3	4	12	
General	Site Security (small site)	Site security (small site)	Employee	2	4	8	Prevent access to the worksite through the use of barricades, cones, tape and signs.	2	2	4	
General	Using hand tools and portable equipment	Correct tool used incorrectly	Employee	3	3	9	Read operating manual before using a tool. Verify manufacturer's safe operating pressures for hydraulic hoses, valves, pipes, and filters. If unsure how to use a piece of equipment, seek advice from your Project Manager or Site Supervisor. Project Manager or Site Supervisor should verify that competent persons are operating power tools.	2	2	4	



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Using hand tools and portable equipment	Damaged tools	Employee	4	3	12	Check handles and heads on hammers, sledges, shovels, picks, mattocks, and other such tools for splinters, soundness, and adequate sharpness. Remove from service and tag all tools having defects that will impair their strength or render them unsafe.	2	2	4	
General	Using hand tools and portable equipment	Electrical	Employee	5	2	10	Ensure power tools have been electrically tested and have a tag stating the due date of the next test. All power tools used outdoors must be properly grounded or double insulated. Patched, oil soaked, worn or frayed electrical cords must not be used. All extension cords should be of heavy duty sheathed insulation. Check all extension cords before use. Do not use if the insulation is cut or is taped up showing a repair. Dispose of damaged cords and use a new one. Sockets and plugs of electrical extension cords should be designed and used in a manner that prevents water ingress. If in use outdoors or in a wet environment, plugs must be equipped with a Ground Fault Interrupter (GFI). Unplug and properly store tools that are not in use.	5	1	5	

HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Using hand tools and portable equipment	Ergonomics	Employee	3	3	9	Consider ergonomic factors such as the weight of the tool, the handle texture, size and shape, vibration and your posture when using and carrying tools. Choose tools that prevent bending at the wrist and reduce gripping pressure. Where possible keep the load close to your body with its weight distributed evenly across the body (i.e. held in two hands). If load is too heavy, ask for help. Where the work is physically demanding: - Avoid exclusively using one hand or muscle group when using tools. - Rotate different people through the task. - Break the task up over the day.	3	2	6	
General	Using hand tools and portable equipment	Explosive atmosphere	Employee	5	3	15	Use only intrinsically safe tools in locations where sources of ignition may cause fire or explosion.	3	2	6	
General	Using hand tools and portable equipment	Flying objects	Employee	3	2	6	Wear safety glasses or goggles when using equipment that has the potential to eject particles or substances. This may include non powered hand tools where there is a risk of flying rock fragments.	2	2	4	
General	Using hand tools and portable equipment	Use of incorrect tool	Employee	3	2	6	Before starting work, determine the risk associated with using the incorrect tool. Obtain the correct tool wherever possible. Do not attempt to modify a tool to undertake a task that it was not designed to do.	2	2	4	



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
General	Using hand tools and portable equipment	Using hand and portable powered tools	Employee	3	3	9	Reference Directive and Guideline CANHSE243 Hand and Portable Powered Tools. Indicate the power sources used to power tools (eg. Pneumatic, Electrical, Explosive) and any required safeguards (e.g. GCFI). List all tools here and attach a Work Instruction for each tool. Identify here the PPE that is required for each tool. List here the necessary training to operate the tools.	3	1	3	
General	Remediation work	Waste generation	Environment	3	5	15	All samples become waste when they are no longer required. Collect only the number of samples required to meet project excellence demands. Avoid collecting extra samples that may be contaminated or cannot be preserved to ensure analytical quality. Dispose appropriately at approved facilities. Review handling, treatment and disposal requirements. Do not treat waste samples without appropriate permit or approval. Dispose in accordance with local regulatory requirements.	3	2	6	



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
Work Environment	Heavy machinery	Struck by heavy machinery	Employee	5	4	20	Remember: the operator of the heavy equipment has limited field of vision. Never approach an operational piece of equipment until the operator is aware of your presence and your desire to approach, and has signaled the OK to advance. The operator may want to finish a task before shutting down to let you approach. Use a radio for communication whenever possible. Stand in a safe location well outside the maximum extended reach of the shovel, dragline or excavator arm and out of the way of other mobile equipment. Once the operator signals the OK, the movement of the equipment should stop before you advance (e.g. lowering of the bucket to the ground). Check with the site superintendent/foreman as to the practices on-site for securing equipment before approaching.	5	1	5	
							Determine the nature of the dust/soot and if possible dust/soot levels. Situate working area upwind of dust or soot generating equipment. Where possible, maintain or delineate a downwind temporary work area to limit public access to the worksite. Conduct industrial hygiene testing to determine dust levels if more than a nuisance dust. Determine source of the dust/soot and apply engineering controls to reduce levels where possible. Controls include, applying water or dust suppression liquids, ventilation system with dust capture and working upwind of the source. Use N95 respirator if required. Wear safety glasses or safety goggles.	3	3	9	
Work Environment	Dust	Dust (or airborne soot)	Employee	3	5	15					



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

Risk Group	Initial Risk	Hazard	PA	IC	IL	IR	Controls	RC	RL	RR	AC
Work Environment	Excavations	Engulfment	Employee	5	4	20	Never enter an excavation deeper than 1.2 m unless it has been properly shored or sloped. People working in an excavation should not work in isolation. Another person should be present in the immediate area and acting as a spotter where possible. Keep vehicle traffic, equipment and the edge of the spoil piles as far as practically possible and at least 1 m from the edge of the excavation, farther for deep excavations. Use access ramp to enter or leave an excavation.	5	2	10	
Work Environment	Excavations	Falling, tripping	Employee	4	5	20	Set up physical barriers to prevent falls into excavations. Make sure emergency procedures have been developed. Rescue equipment and personnel should be readily available on-site.	4	2	8	



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

10.0 PERSONAL PROTECTIVE EQUIPMENT

Item	Required	Provided by Golder	Provided by Client	Specific Requirement
Coveralls				
General	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Gloves				
Cut resistant	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Chemical resistant	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	nitrile
Head Protection				
Hard Hat	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Hearing Protection				
Disposable foam ear plugs	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	if required
High Visibility Clothing				
Orange	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Safety Footwear				
Safety boots	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Eye Protection				
Impact resistant safety goggles or glasses	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
General Protection				
Sun cream or block	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

11.0 TRAINING

It is up to the Project Manager to arrange for the following training e.g. Confined Spaces.

Course Name	Employee Name or Role
First Aid/CPR	Pamela Wescott, Rebecca Boyce
WHIMIS	Pamela Wescott, Rebecca Boyce

Golder H&S reads 182

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12.0 INCIDENT AND EMERGENCY MANAGEMENT

12.1 Additional Client / Site Reporting Procedures (if ticked provide applicable details in the text box and/or attach relevant documents to this HaSEP.)

Report all incidents to PM who will inform Client.

12.2 First Aid Arrangements

Method of communication	Phone	911
	Radio channel	



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)

Location of first aid kit	Field Truck
First Aider(s)	Rebecca Boyce, Pam Wescott

12.3 Fire Safety

Location of fire extinguishers	Field Truck Tailgate
Location of assembly point	Muster Points indicated on fence at AOMC Building

12.4 Site Emergency

- ☒ Site emergency procedures available
- ☒ Site owner will provide emergency procedures induction/site induction

13.0 HSE PLAN CONTROL

It is the responsibility of the Project Manager to ensure that this HaSEP is prepared and the contents communicated at the pre-start / toolbox meeting to all project staff, Golder or subcontractor, with a copy held on site. The HaSEP has been reviewed or prepared by the Project Manager.

If the project site is remote from the home office, this HaSEP is to be reviewed and approved by the local Golder office whether in another country, province or city.

Role	Name (printed)	Date	Signature
Prepared by	Rebecca Boyce	September 15, 2016	RLB
Reviewed and Approved by	Steven Fiddler	September 16, 2016	[Signature]
Other			

13.1 Golder Sign-off

Signing below indicates you have read and agree to comply with the information contained in this document.

Date	Name	Company	Signature
Sept 19/16	Rebecca Boyce	Golder	RLB
Sept 19/16	Shaun Hughes	QMENU	[Signature]
Sept. 19/16	Matt Prier	QMENU	[Signature]
Sept 21/16	Holly Polden	TC	Holly Polden
Sept 21/16	Justin Derkach	QMENU	[Signature]
Sept 21/16	Dustin Francois	QMENU	[Signature]
Sept 21/16	Bregina Morrison	QMENU	[Signature]
Sept 30/16	Michael Matherson	Golder	[Signature]



14.0 ONSITE CHANGES AND REVIEW

15.0 INSPECTIONS AND SITE VISITS

15.1 Inspections

15.2 Inspections and Site Visits

30/31



HEALTH AND SAFETY ENVIRONMENT PLAN (HASEP)



4. Merge onto AB-2 S

5.5 km



5. Take exit 516 toward AB-2A/Wetaskiwin

800 m



6. Continue onto AB-2A

1.4 km

Follow 50 St to Athapaskan Dr

3 min (1.5 km)



7. Turn left onto 50 St

1.4 km



8. Turn right onto Athapaskan Dr

Destination will be on the right

34 m

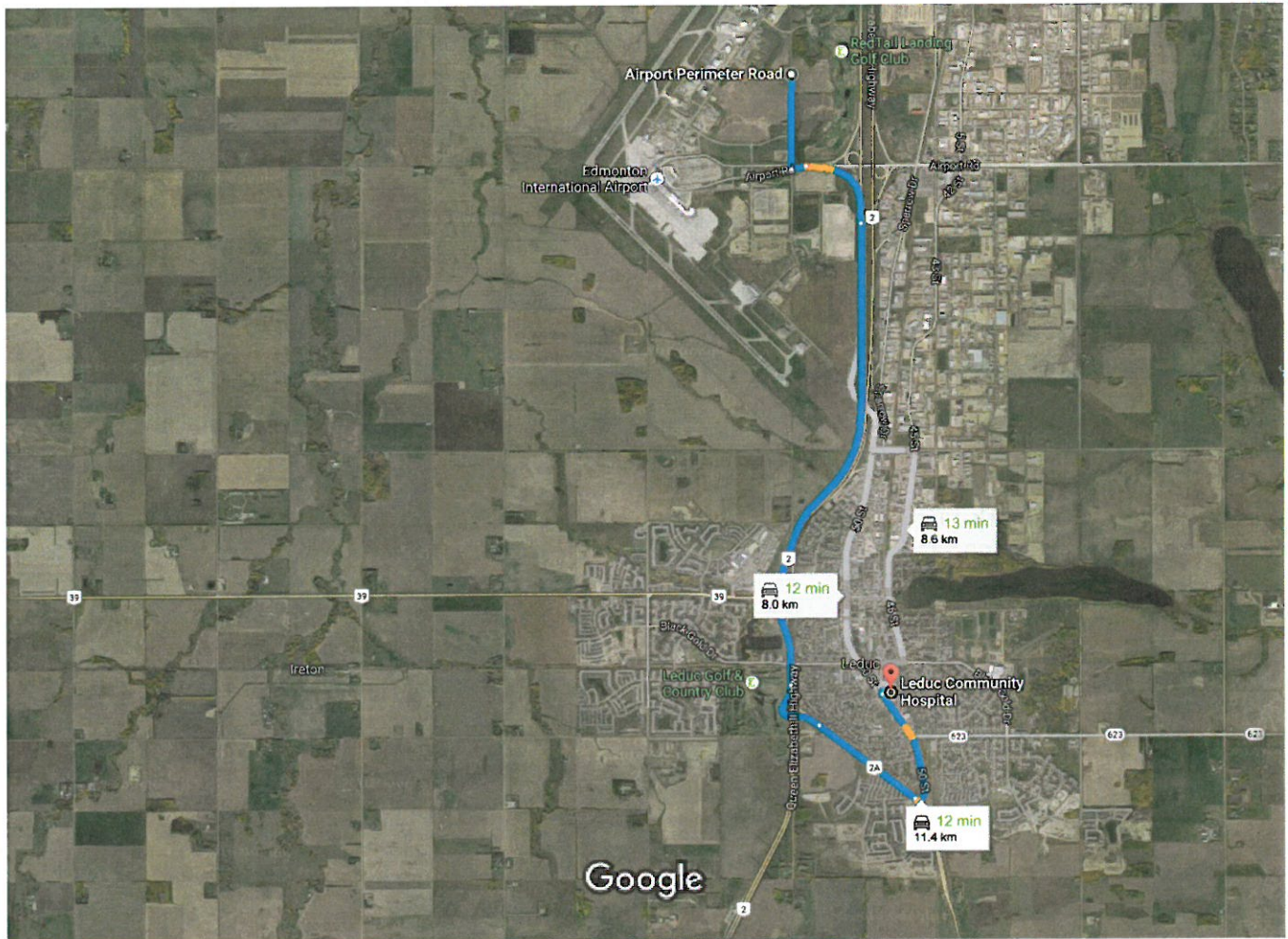
Leduc Community Hospital

4210 48 St, Leduc, AB T9E 5Z3

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.



Airport Perimeter Road, Calmar, AB T0C 0V0 Drive 11.4 km, 12 min
to Leduc Community Hospital, Leduc, AB



Imagery ©2016 Google, Map data ©2016 Google 1 km

Airport Perimeter Road

Calmar, AB T0C 0V0

Get on AB-2 S

- | | | |
|---|--|----------------|
| ↑ | 1. Head south on Airport Perimeter Rd toward 45 Ave E | 4 min (2.3 km) |
| ↩ | 2. Turn left onto Airport Rd | 1.1 km |
| ⤴ | 3. Use the right lane to take the ramp to Leduc/Red Deer | 160 m |
| | | 1.1 km |

Continue on AB-2 S to Leduc

5 min (7.7 km)



APPENDIX B

Facility Alteration Permits (FAP)

EDMONTON INTERNATIONAL AIRPORT FACILITY ALTERATION PERMIT

07/09/2016

Golder Associates Ltd.
16820 107 Avenue, Edmonton, Alberta T5P 4C3

Attention: Steven Fiddler

RE: Facility Alteration Permit Application FAP2016-094

Submitted to Edmonton Airports on: 01/09/2016

For the Purpose of:
Decommissioning of the north biopile cell at the land treatment facility located adjacent to Airport Perimeter Road

Located at:
Airport Perimeter Road NE 1/4 15-50-25-4

Has been: Approved

The following conditions have been placed upon your project and must be adhered to throughout the duration of the project or as indicated below. Failure to do so may result in cancellation of the permit and withdrawal of approval by Edmonton Airports.

Conditions of Approval

1. Final deliverables as outlined on the corporate.flyeia.com/your-business-airport/construction-and-maintenance website must be provided to Edmonton Airports within 60 days of project completion.
2. Applicant must notify Edmonton Airports' upon substantial completion of project

The approval of the Facility Alteration Permit by Edmonton Airports does not release the Applicant from applying to the Authorities having jurisdiction for all necessary approval, nor does approval by Edmonton Airports guarantee approval of said project by the Authorities having Jurisdiction.

If the work as outlined in the original application has not been started within six months from date of approval, this approval is considered null and void. A complete re-submission by the Applicant and approval by Edmonton Airports will then be required before construction can commence.

Any approved Facility Alteration Permits whose construction period extends beyond one year (365 days) will be required to apply for a permit renewal.

A variance in duration for permit expirations and renewals may be approved by Edmonton Airports in some instances. Contact Technical Services (FAP@flyeia.com) for more information.

Your Edmonton Airports' representative for this project is:

Corinne Kozak - Edmonton Airports

Contact email: ckozak@flyeia.com

Contact phone number: 780-890-8582

The Edmonton Airports' representative must be contacted within 48 hours of receiving this application or prior to construction, what ever the shorter period of time is.

For after hours contact, please call the EIA Duty manager at 780-890-8327

Any concerns of questions may be directed to Edmonton Airports' Technical Services departments at 780-890-8433 or FAP@flyeia.com

Yours truly,

Edmonton Airports


Steve Rumley
Vice President
Infrastructure

Risk Assessment: 3

 File Attachment

TERMS AND CONDITIONS

- This permit conveys permission to undertake the alteration described herein. This permit does not constitute an assessment, evaluation, or warranty of any kind or nature by Edmonton Airports of the quality of materials, design and construction employed in the performance of the work to be done by the Applicant, and Edmonton Airports assumes no responsibility for the consequences thereof.
- This permit does not constitute a warranty of any kind or nature by Edmonton Airports of the location of any underground utilities. Any locates of underground utilities completed by Edmonton Airports is done so in good faith and with the best information available. Edmonton Airports assumes no responsibility for the consequences thereof. It is assumed and recommended that the Applicant conduct a complete utility locate for the entire site, by a third party prior to any excavation.
- In the performance of the work the Applicant shall conform with all federal, provincial, municipal and local laws, regulations, bylaws or Codes, which are applicable to Edmonton Airports.
- The Applicant shall also observe and obey (and compel its officers, employees, agents and contractors to observe and obey) the rules and regulations of Edmonton Airports now in effect which are applicable to the performance of the work, and such further applicable rules and regulations which may from time to time during the said performance be promulgated by Edmonton Airports for reasons of safety, health, preservation of property or maintenance of a good and orderly appearance of the facility or for the safe and efficient operation of the facility.
- The Applicant shall indemnify and hold harmless, Edmonton Airports, its directors, officers, agents and employees, against and from (a) the risk of injuries (including wrongful death) or damage direct or consequential, to it or them or to it or their property arising out of or in connection with the performance of the work, and (b) the risk of claims and demands by third persons including the legal costs incurred by Edmonton Airports on a solicitor and his own client basis to defend such claims or demands, arising or alleged to arise out of the performance of the work and to the conditions of the leased premises during the performance of the work and following the completion of the work, whether such risks arise out of acts or omissions of the Applicant, its contractors or otherwise.
- The Applicant shall pay all claims lawfully made against it by contractors, subcontractors, suppliers and workmen, and all claims lawfully made against it by other third persons arising out of or in connection with or because of the performance of the work and the conditions of the leased premises during the performance of the work, and shall cause all contractors and subcontractors to pay all such claims lawfully made against them.
- No changes or revisions shall be made to the work authorized by this permit without prior approval of the Assigned Edmonton Airports' Technical Services department and its designated official.
- Edmonton Airports reserves the right to halt or suspend the work should the terms or conditions of the Facility Alteration Permit not be complied with.
- The Applicant shall notify the Assigned Edmonton Airports' representative not less than two days prior to the commencement of the work and shall complete the same within the number of days specified in Part 1 of this Facility Alteration Permit application. The Applicant shall advise the Assigned Edmonton Airports' representative when the work is substantially complete. Upon substantial completion of the work the Applicant shall deposit with the Assigned Edmonton Airports' representative one copy of the drawing(s) showing the as-built facilities in electronic CADD and pdf formats. If record drawings are not submitted within 60 days of project completion, a charge will be levied against the Applicant which the Applicant promises to pay, based on Edmonton Airports' cost to have the record drawings completed for the project.
- In the performance of the work, the Applicant shall not do or permit to be done any act affecting the operation of any existing plumbing, heating, fire-alarm, sewage, drainage, water supply, electrical sprinkler, ventilating, refrigerating, fuel, or communication system at the facility, or other such service system threat, including all pipes, tubes, lines, mains, wires, conduits, equipment and fixtures, except with the express written approval of the Assigned Edmonton Airports' Technical Services department, its resident engineer, or its designated official.
- Prior to the commencement of the work and throughout the performance thereof, the Applicant shall erect and maintain at its own expense in or about the space such barriers, shields and other suitable protective devices for the protection of the public and others and their property. The work shall be performed in such a manner as will cause the minimum inconvenience to members of the public and others at the facility.

Must Be Posted at Construction Site



EDMONTON INTERNATIONAL AIRPORT

Facility Alteration Permit Notice

FAP2016-094

Approved for:

Decommissioning of the north biopile cell at the land treatment facility located adjacent to Airport Perimeter Road

Issued To:

Golder Associates Ltd.

Date of Issue

07/09/2016

Expiry date

07/09/2017

A handwritten signature in blue ink, appearing to read 'Adam Schuster', is written over a horizontal line.

Edmonton Airports' Authorization

This Permit is Valid only when used in accordance with conditions of the signed approval letter from Edmonton Airports and must be displayed at the construction site and must be produced when asked for by a representative of the Edmonton Regional Airports Authority

EDMONTON INTERNATIONAL AIRPORT FACILITY ALTERATION PERMIT

26/09/2016

Golder Associates Ltd.
16820 107 Avenue, Edmonton, Alberta T5P 4C3

Attention: Steven Fiddler

RE: Facility Alteration Permit Application FAP2016-107

Submitted to Edmonton Airports on: 21/09/2016

For the Purpose of:
Decommissioning of the soil vapour extraction unit located at the AOMC building.

Located at:
8th Avenue, Airport Service Road (AOMC Building)

Has been: Approved

The following conditions have been placed upon your project and must be adhered to throughout the duration of the project or as indicated below. Failure to do so may result in cancellation of the permit and withdrawal of approval by Edmonton Airports.

Conditions of Approval

1. Final deliverables as outlined on the corporate.flyeia.com/your-business-airport/construction-and-maintenance website must be provided to Edmonton Airports within 60 days of project completion.
2. Applicant must notify Edmonton Airports' upon substantial completion of project

The approval of the Facility Alteration Permit by Edmonton Airports does not release the Applicant from applying to the Authorities having jurisdiction for all necessary approval, nor does approval by Edmonton Airports guarantee approval of said project by the Authorities having Jurisdiction.

If the work as outlined in the original application has not been started within six months from date of approval, this approval is considered null and void. A complete re-submission by the Applicant and approval by Edmonton Airports will then be required before construction can commence.

Any approved Facility Alteration Permits whose construction period extends beyond one year (365 days) will be required to apply for a permit renewal.

A variance in duration for permit expirations and renewals may be approved by Edmonton Airports in some instances. Contact Technical Services (FAP@flyeia.com) for more information.

Your Edmonton Airports' representative for this project is:

Corinne Kozak - Edmonton Airports

Contact email: ckozak@flyeia.com

Contact phone number: 780-890-8582

The Edmonton Airports' representative must be contacted within 48 hours of receiving this application or prior to construction, what ever the shorter period of time is.

For after hours contact, please call the EIA Duty manager at 780-890-8327

Any concerns of questions may be directed to Edmonton Airports' Technical Services departments at 780-890-8433 or FAP@flyeia.com

Yours truly,

Edmonton Airports


Steve Rumley *for*
Vice President
Infrastructure

Risk Assessment: 3

 File Attachment

TERMS AND CONDITIONS

- This permit conveys permission to undertake the alteration described herein. This permit does not constitute an assessment, evaluation, or warranty of any kind or nature by Edmonton Airports of the quality of materials, design and construction employed in the performance of the work to be done by the Applicant, and Edmonton Airports assumes no responsibility for the consequences thereof.
- This permit does not constitute a warranty of any kind or nature by Edmonton Airports of the location of any underground utilities. Any locates of underground utilities completed by Edmonton Airports is done so in good faith and with the best information available. Edmonton Airports assumes no responsibility for the consequences thereof. It is assumed and recommended that the Applicant conduct a complete utility locate for the entire site, by a third party prior to any excavation.
- In the performance of the work the Applicant shall conform with all federal, provincial, municipal and local laws, regulations, bylaws or Codes, which are applicable to Edmonton Airports.
- The Applicant shall also observe and obey (and compel its officers, employees, agents and contractors to observe and obey) the rules and regulations of Edmonton Airports now in effect which are applicable to the performance of the work, and such further applicable rules and regulations which may from time to time during the said performance be promulgated by Edmonton Airports for reasons of safety, health, preservation of property or maintenance of a good and orderly appearance of the facility or for the safe and efficient operation of the facility.
- The Applicant shall indemnify and hold harmless, Edmonton Airports, its directors, officers, agents and employees, against and from (a) the risk of injuries (including wrongful death) or damage direct or consequential, to it or them or to it or their property arising out of or in connection with the performance of the work, and (b) the risk of claims and demands by third persons including the legal costs incurred by Edmonton Airports on a solicitor and his own client basis to defend such claims or demands, arising or alleged to arise out of the performance of the work and to the conditions of the leased premises during the performance of the work and following the completion of the work, whether such risks arise out of acts or omissions of the Applicant, its contractors or otherwise.
- The Applicant shall pay all claims lawfully made against it by contractors, subcontractors, suppliers and workmen, and all claims lawfully made against it by other third persons arising out of or in connection with or because of the performance of the work and the conditions of the leased premises during the performance of the work, and shall cause all contractors and subcontractors to pay all such claims lawfully made against them.
- No changes or revisions shall be made to the work authorized by this permit without prior approval of the Assigned Edmonton Airports' Technical Services department and its designated official.
- Edmonton Airports reserves the right to halt or suspend the work should the terms or conditions of the Facility Alteration Permit not be complied with.
- The Applicant shall notify the Assigned Edmonton Airports' representative not less than two days prior to the commencement of the work and shall complete the same within the number of days specified in Part 1 of this Facility Alteration Permit application. The Applicant shall advise the Assigned Edmonton Airports' representative when the work is substantially complete. Upon substantial completion of the work the Applicant shall deposit with the Assigned Edmonton Airports' representative one copy of the drawing(s) showing the as-built facilities in electronic CADD and pdf formats. If record drawings are not submitted within 60 days of project completion, a charge will be levied against the Applicant which the Applicant promises to pay, based on Edmonton Airports' cost to have the record drawings completed for the project.
- In the performance of the work, the Applicant shall not do or permit to be done any act affecting the operation of any existing plumbing, heating, fire-alarm, sewage, drainage, water supply, electrical sprinkler, ventilating, refrigerating, fuel, or communication system at the facility, or other such service system threat, including all pipes, tubes, lines, mains, wires, conduits, equipment and fixtures, except with the express written approval of the Assigned Edmonton Airports' Technical Services department, its resident engineer, or its designated official.
- Prior to the commencement of the work and throughout the performance thereof, the Applicant shall erect and maintain at its own expense in or about the space such barriers, shields and other suitable protective devices for the protection of the public and others and their property. The work shall be performed in such a manner as will cause the minimum inconvenience to members of the public and others at the facility.

Must Be Posted at Construction Site



EDMONTON INTERNATIONAL AIRPORT

Facility Alteration Permit Notice

FAP2016-107

Approved for:

Decommissioning of the soil vapour extraction unit located at the AOMC building.

Issued To:

Golder Associates Ltd.

Date of Issue

26/09/2016

Expiry date

26/09/2017

A handwritten signature in blue ink, appearing to read 'D. Schuster', is written over a horizontal line.

Edmonton Airports' Authorization

This Permit is Valid only when used in accordance with conditions of the signed approval letter from Edmonton Airports and must be displayed at the construction site and must be produced when asked for by a representative of the Edmonton Regional Airports Authority



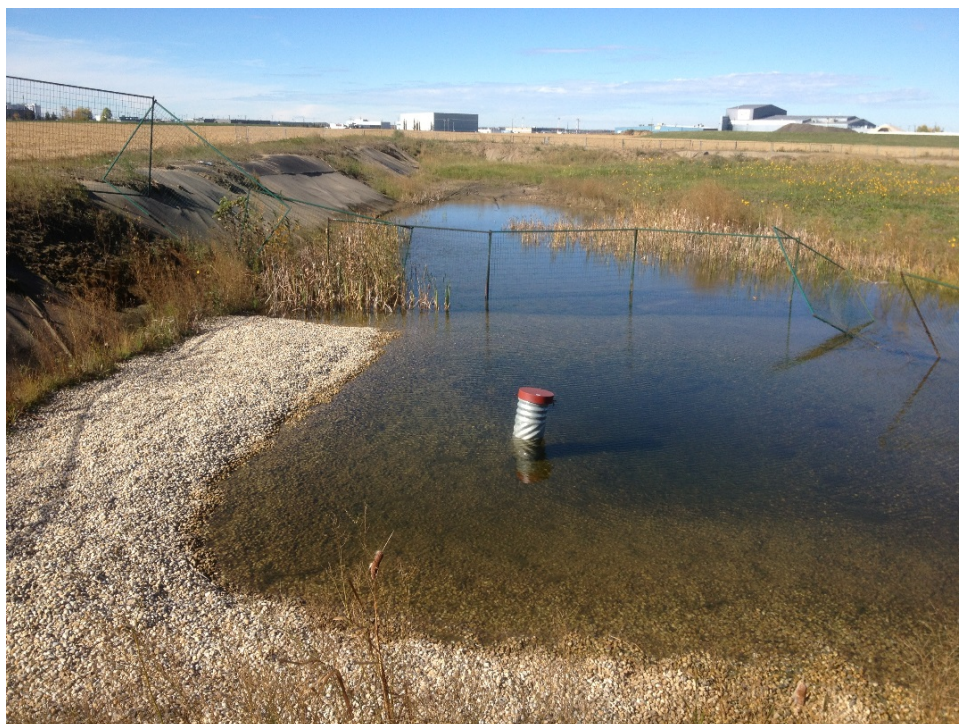
APPENDIX C

Site Photographs



APPENDIX C

Site Photographs



Photograph 1: South sump of the LTF prior to pump and treat activities.



Photograph 2: South sump after pump and treat activities.



APPENDIX C

Site Photographs



Photograph 3: North sump prior to decommissioning activities.



Photograph 4: North sump after pump and treat activities.



APPENDIX C

Site Photographs



Photograph 5: North cell of the LTF prior to decommissioning activities.



Photograph 6: Removing soil from the north cell.



APPENDIX C

Site Photographs



Photograph 7: Removing gravel from the north sump.



Photograph 8: North sump prior to backfilling.



APPENDIX C

Site Photographs



Photograph 9: Removing the top geotextile liner.



Photograph 10: Removing the second liner.



APPENDIX C

Site Photographs



Photograph 11: Removing the liner from the berm and spreading soil in the north cell.



Photograph 12: North cell after decommissioning activities.



APPENDIX D

Laboratory Certificates of Analysis

GOLDER DATA QUALITY REVIEW CHECKLISTSite Location: EIASampling Date: May 25, 2016Golder Project Number: 1529387Laboratory: Maxxam EdmontonLab Submission Number: B640846

Was the Cooler Received at the lab under a sealed and intact custody seal?	<u>Yes</u>
Was proper chain of custody of the samples documented and kept?	<u>Yes</u>
Were sample temperatures acceptable when they reached lab?:	<u>Yes</u>
Were all samples analyzed and extracted within hold times?:	<u>Yes</u>
Has lab warranted all tests were in statistical control in CoA?:	<u>Yes</u>
Was sufficient sample provided for the requested analysis?	<u>Yes</u>
Has lab warranted all samples were analyzed with limited headspace present?:	<u>Yes</u>

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?


	Yes	No	NA	Comments
Surrogate Recovery	X			All laboratory QC results are within acceptance criteria.
Method Blank Concentration	X			
Laboratory Duplicate RPD	X			
Matrix Spike Recovery	X			
Blank Spike Recovery	X			

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

	Yes	No	NA	Comments
Field Blank Concentration			X	All field QC samples are within alert limits.
Trip Blank Concentration			X	
Field Duplicate RPD	X			

Is data considered reliable (Yes/No/Suspect)?: Yes

If answer is "No" or "Suspect", describe and provide rationale:

Data Reviewed by (Print): Jenny MusijowskiData Reviewed by (Signature): Date: June 3, 2016

Your Project #: 1529387-6000
Site Location: EIA
Your C.O.C. #: M013266, M013265

Attention: Steven Fiddler

GOLDER ASSOCIATES LTD
16820-107 AVE
EDMONTON, AB
CANADA T5P 4C3

Report Date: 2016/06/02

Report #: R2190513

Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B640846

Received: 2016/05/25, 16:39

Sample Matrix: Water
Samples Received: 12

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
BTEX/F1 in Water by HS GC/MS/FID	12	N/A	2016/05/29	AB SOP-00039	CCME CWS/EPA 8260c m
CCME Hydrocarbons in Water (F2; C10-C16)	4	2016/05/27	2016/05/28	AB SOP-00040 / AB SOP-00037	CCME PHC-CWS m
CCME Hydrocarbons in Water (F2; C10-C16)	7	2016/05/30	2016/05/31	AB SOP-00040 / AB SOP-00037	CCME PHC-CWS m
CCME Hydrocarbons in Water (F2; C10-C16)	1	2016/06/02	2016/06/02	AB SOP-00040 / AB SOP-00037	CCME PHC-CWS m

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

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

Encryption Key

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

Alaina Hunter, Dip. BioSci, Project Manager, Environmental

Email: AHunter@maxxam.ca

Phone# (780)577-7139

=====

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

Maxxam Job #: B640846
Report Date: 2016/06/02

GOLDER ASSOCIATES LTD
Client Project #: 1529387-6000
Site Location: EIA
Sampler Initials: JC

AT1 BTEX AND F1-F2 (WATER)

Maxxam ID		OR8585	OR8586	OR8587	OR8588		OR8589		
Sampling Date		2016/05/25 10:30	2016/05/25 11:00	2016/05/25 11:00	2016/05/25 11:20		2016/05/25 12:20		
COC Number		M013266	M013266	M013266	M013266		M013266		
	UNITS	MW83-15	BH62M	DUP16-01	BH63M	QC Batch	BH57M	RDL	QC Batch
Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	8281214	<0.10	0.10	8281200
Volatiles									
Benzene	ug/L	<0.40	<0.40	<0.40	<0.40	8280739	<0.40	0.40	8280739
Toluene	ug/L	<0.40	<0.40	<0.40	<0.40	8280739	<0.40	0.40	8280739
Ethylbenzene	ug/L	<0.40	<0.40	<0.40	<0.40	8280739	<0.40	0.40	8280739
m & p-Xylene	ug/L	<0.80	<0.80	<0.80	<0.80	8280739	<0.80	0.80	8280739
o-Xylene	ug/L	<0.40	<0.40	<0.40	<0.40	8280739	<0.40	0.40	8280739
Xylenes (Total)	ug/L	<0.80	<0.80	<0.80	<0.80	8280739	<0.80	0.80	8280739
F1 (C6-C10) - BTEX	ug/L	<100	<100	<100	<100	8280739	<100	100	8280739
F1 (C6-C10)	ug/L	<100	<100	<100	<100	8280739	<100	100	8280739
Surrogate Recovery (%)									
1,4-Difluorobenzene (sur.)	%	100	99	101	100	8280739	101	N/A	8280739
4-Bromofluorobenzene (sur.)	%	129	123	124	123	8280739	123	N/A	8280739
D4-1,2-Dichloroethane (sur.)	%	105	101	103	103	8280739	105	N/A	8280739
O-TERPHENYL (sur.)	%	105	108	100	98	8281214	95	N/A	8281200
RDL = Reportable Detection Limit									
N/A = Not Applicable									

Maxxam Job #: B640846
Report Date: 2016/06/02

GOLDER ASSOCIATES LTD
Client Project #: 1529387-6000
Site Location: EIA
Sampler Initials: JC

AT1 BTEX AND F1-F2 (WATER)

Maxxam ID		OR8590	OR8591		OR8592	OR8593	OR8594		
Sampling Date		2016/05/25 12:50	2016/05/25 13:20		2016/05/25 13:50	2016/05/25 14:15	2016/05/25 14:45		
COC Number		M013266	M013266		M013266	M013266	M013266		
	UNITS	BH65M	MW46	QC Batch	BH35	BH32	MW71-14	RDL	QC Batch
Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	8281214	<0.10	0.37	0.48	0.10	8281200
Volatiles									
Benzene	ug/L	<0.40	<0.40	8280739	0.49	190	110	0.40	8280739
Toluene	ug/L	<0.40	<0.40	8280739	<0.40	3.5	2.3	0.40	8280739
Ethylbenzene	ug/L	<0.40	<0.40	8280739	<0.40	53	250	0.40	8280739
m & p-Xylene	ug/L	<0.80	<0.80	8280739	<0.80	38	37	0.80	8280739
o-Xylene	ug/L	<0.40	<0.40	8280739	<0.40	2.1	<0.40	0.40	8280739
Xylenes (Total)	ug/L	<0.80	<0.80	8280739	<0.80	40	37	0.80	8280739
F1 (C6-C10) - BTEX	ug/L	<100	<100	8280739	<100	500	980	100	8280739
F1 (C6-C10)	ug/L	<100	<100	8280739	<100	780	1400	100	8280739
Surrogate Recovery (%)									
1,4-Difluorobenzene (sur.)	%	101	97	8280739	100	103	100	N/A	8280739
4-Bromofluorobenzene (sur.)	%	126	119	8280739	127	128	129	N/A	8280739
D4-1,2-Dichloroethane (sur.)	%	105	103	8280739	108	108	109	N/A	8280739
O-TERPHENYL (sur.)	%	101	94	8281214	96	95	93	N/A	8281200
RDL = Reportable Detection Limit									
N/A = Not Applicable									

Maxxam Job #: B640846
Report Date: 2016/06/02

GOLDER ASSOCIATES LTD
Client Project #: 1529387-6000
Site Location: EIA
Sampler Initials: JC

AT1 BTEX AND F1-F2 (WATER)

Maxxam ID		OR8604	OR8605		
Sampling Date		2016/05/25 15:20	2016/05/25 15:50		
COC Number		M013265	M013265		
	UNITS	MW72-14	MW73-14	RDL	QC Batch
Ext. Pet. Hydrocarbon					
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	0.10	8281214
Volatiles					
Benzene	ug/L	<0.40	<0.40	0.40	8280739
Toluene	ug/L	<0.40	<0.40	0.40	8280739
Ethylbenzene	ug/L	<0.40	<0.40	0.40	8280739
m & p-Xylene	ug/L	<0.80	<0.80	0.80	8280739
o-Xylene	ug/L	<0.40	<0.40	0.40	8280739
Xylenes (Total)	ug/L	<0.80	<0.80	0.80	8280739
F1 (C6-C10) - BTEX	ug/L	<100	<100	100	8280739
F1 (C6-C10)	ug/L	<100	<100	100	8280739
Surrogate Recovery (%)					
1,4-Difluorobenzene (sur.)	%	101	104	N/A	8280739
4-Bromofluorobenzene (sur.)	%	124	129	N/A	8280739
D4-1,2-Dichloroethane (sur.)	%	104	107	N/A	8280739
O-TERPHENYL (sur.)	%	95	102	N/A	8281214
RDL = Reportable Detection Limit					
N/A = Not Applicable					

Maxxam Job #: B640846
Report Date: 2016/06/02

GOLDER ASSOCIATES LTD
Client Project #: 1529387-6000
Site Location: EIA
Sampler Initials: JC

GENERAL COMMENTS

Results relate only to the items tested.

Maxxam Job #: B640846
Report Date: 2016/06/02

GOLDER ASSOCIATES LTD
Client Project #: 1529387-6000
Site Location: EIA
Sampler Initials: JC

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8280739	SES	Matrix Spike [OR8605-02]	1,4-Difluorobenzene (sur.)	2016/05/29		98	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/05/29		127	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/05/29		107	%	70 - 130
			Benzene	2016/05/29		95	%	70 - 130
			Toluene	2016/05/29		83	%	70 - 130
			Ethylbenzene	2016/05/29		95	%	70 - 130
			m & p-Xylene	2016/05/29		91	%	70 - 130
			o-Xylene	2016/05/29		90	%	70 - 130
			F1 (C6-C10)	2016/05/29		79	%	70 - 130
			1,4-Difluorobenzene (sur.)	2016/05/29		98	%	70 - 130
8280739	SES	Spiked Blank	4-Bromofluorobenzene (sur.)	2016/05/29		123	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/05/29		106	%	70 - 130
			Benzene	2016/05/29		91	%	70 - 130
			Toluene	2016/05/29		80	%	70 - 130
			Ethylbenzene	2016/05/29		90	%	70 - 130
			m & p-Xylene	2016/05/29		87	%	70 - 130
			o-Xylene	2016/05/29		85	%	70 - 130
			F1 (C6-C10)	2016/05/29		77	%	70 - 130
			1,4-Difluorobenzene (sur.)	2016/05/29		100	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/05/29		127	%	70 - 130
8280739	SES	Method Blank	D4-1,2-Dichloroethane (sur.)	2016/05/29		106	%	70 - 130
			Benzene	2016/05/29	<0.40		ug/L	
			Toluene	2016/05/29	<0.40		ug/L	
			Ethylbenzene	2016/05/29	<0.40		ug/L	
			m & p-Xylene	2016/05/29	<0.80		ug/L	
			o-Xylene	2016/05/29	<0.40		ug/L	
			Xylenes (Total)	2016/05/29	<0.80		ug/L	
			F1 (C6-C10) - BTEX	2016/05/29	<100		ug/L	
			F1 (C6-C10)	2016/05/29	<100		ug/L	
			Benzene	2016/05/29	NC		%	40
			Toluene	2016/05/29	NC		%	40
			Ethylbenzene	2016/05/29	NC		%	40
			m & p-Xylene	2016/05/29	NC		%	40
			o-Xylene	2016/05/29	NC		%	40
			Xylenes (Total)	2016/05/29	NC		%	40
8281200	GG3	Matrix Spike	F1 (C6-C10) - BTEX	2016/05/29	NC		%	40
			F1 (C6-C10)	2016/05/29	NC		%	40
			O-TERPHENYL (sur.)	2016/05/28		99	%	50 - 130
8281200	GG3	Spiked Blank	F2 (C10-C16 Hydrocarbons)	2016/05/28		103	%	50 - 130
			O-TERPHENYL (sur.)	2016/05/28		101	%	50 - 130
8281200	GG3	Method Blank	F2 (C10-C16 Hydrocarbons)	2016/05/28		104	%	70 - 130
			O-TERPHENYL (sur.)	2016/05/28		98	%	50 - 130
8281200	GG3	RPD	F2 (C10-C16 Hydrocarbons)	2016/05/28	<0.10		mg/L	
			F2 (C10-C16 Hydrocarbons)	2016/05/28	NC		%	40
8281214	GG3	Matrix Spike	O-TERPHENYL (sur.)	2016/05/31		94	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/05/31		78	%	50 - 130
8281214	GG3	Spiked Blank	O-TERPHENYL (sur.)	2016/05/31		94	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/05/31		97	%	70 - 130
8281214	GG3	Method Blank	O-TERPHENYL (sur.)	2016/05/31		93	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/05/31	<0.10		mg/L	

Maxxam Job #: B640846
Report Date: 2016/06/02

GOLDER ASSOCIATES LTD
Client Project #: 1529387-6000
Site Location: EIA
Sampler Initials: JC

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC					Date				
Batch	Init	QC Type	Parameter		Analyzed	Value	Recovery	UNITS	QC Limits
8281214	GG3	RPD	F2 (C10-C16 Hydrocarbons)		2016/05/31	NC		%	40
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.									
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.									
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.									
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.									
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.									
NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).									

Maxxam Job #: B640846
Report Date: 2016/06/02

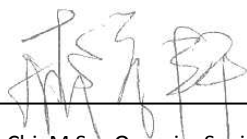
GOLDER ASSOCIATES LTD
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VALIDATION SIGNATURE PAGE

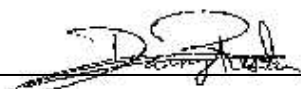
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Anna Koksharova, M.Sc., Organics Senior Analyst



Bert Chi, M.Sc., Organics Senior Analyst



Daniel Reslan, cCT, QP, Organics Supervisor

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

Invoice Information		Report Information (if differs from invoice)		Project Information		Turnaround Time (TAT) Required	
Company: <u>Golder Associates</u>		Company: _____		Quotation #: _____		<input checked="" type="checkbox"/> 5 - 7 Days Regular (Most analyses)	
Contact Name: <u>Steven Fidler</u>		Contact Name: _____		P.O. #/ AFE#: _____		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS	
Address: <u>16820 107 Ave</u>		Address: _____		Project #: <u>1529387-6000</u>		Rush TAT (Surcharges will be applied) <input type="checkbox"/> Same Day <input type="checkbox"/> 2 Days <input type="checkbox"/> 1 Day <input type="checkbox"/> 3-4 Days	
Phone: <u>780-483-3499 / 780-984-6600</u>		Phone: _____		Site Location: <u>EIA</u>		Date Required: _____	
Email: <u>sfidler@golder.com</u>		Email: <u>CSMDataQuality@golder.com</u>		Site #: _____		Rush Confirmation #: _____	
Copies: <u>jchamula@golder.com</u>		Copies: _____		Sampled By: <u>J. Chamula</u>			

Laboratory Use Only				Analysis Requested												Regulatory Criteria																																																																											
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Sample Identification		Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	# of containers	BTEX F1	VOC	BTEX F1-F2	BTEX F1-F4	Routine Water	Regulated Metals	Total	Dissolved	Salinity	Sieve (75 micron)	Texture (% Sand, Silt, Clay)	Basic Class II Landfill	BTEX, PVC, FI, FA
1	MW 83-15	-	2016/05/25	10:30	6W	4													X
2	BH 62M	-		11:00		4													X
3	DUP 16-01	-		11:00		4													X
4	BH 63M	-		11:20		4													X
5	BH 57M	-		12:20		4													X
6	BH 65M	-		12:50		4													X
7	MW 46	-		13:20		4													X
8	BH 35	-		13:50		4													X
9	BH 32	-		14:15		4													X
10	MW 71-14	-		14:45		4													X

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

Relinquished by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)	Received by: (Signature/ Print)	DATE (YYYY/MM/DD)	Time (HH:MM)	Maxxam Job #
<u>J. Chamula</u>	<u>2016/05/25</u>	<u>16:30</u>	<u>Delaneym Kerrichor</u>	<u>2016/05/25</u>	<u>16:39</u>	<u>B640846 GM4</u>

Invoice Information		Report Information (if differs from invoice)		Project Information		Turnaround Time (TAT) Required	
Company: <u>Goldel Associates</u>		Company: _____		Quotation #: _____		<input checked="" type="checkbox"/> 5 - 7 Days Regular (Most analyses)	
Contact Name: <u>Steven Fiddler</u>		Contact Name: _____		P.O. #/ AFE#: _____		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS	
Address: <u>16820 187 Ave</u>		Address: _____		Project #: <u>1529387-6000</u>		Rush TAT (Surcharges will be applied)	
<u>Edmonton, AB T5P4C3</u>		_____		Site Location: <u>EIA</u>		<input type="checkbox"/> Same Day <input type="checkbox"/> 2 Days <input type="checkbox"/> 1 Day <input type="checkbox"/> 3-4 Days	
Phone: <u>780-483-3499/780-984 6600</u>		Phone: _____		Site #: _____		Date Required: _____	
Email: <u>SFiddler@golder.com</u>		Email: <u>CSM@borequality.com</u>		Site #: _____		Rush Confirmation #: _____	
Copies: <u>jchamula@golder.com</u>		Copies: <u>jchamula@golder.com</u>		Sampled By: <u>J Chamula</u>			

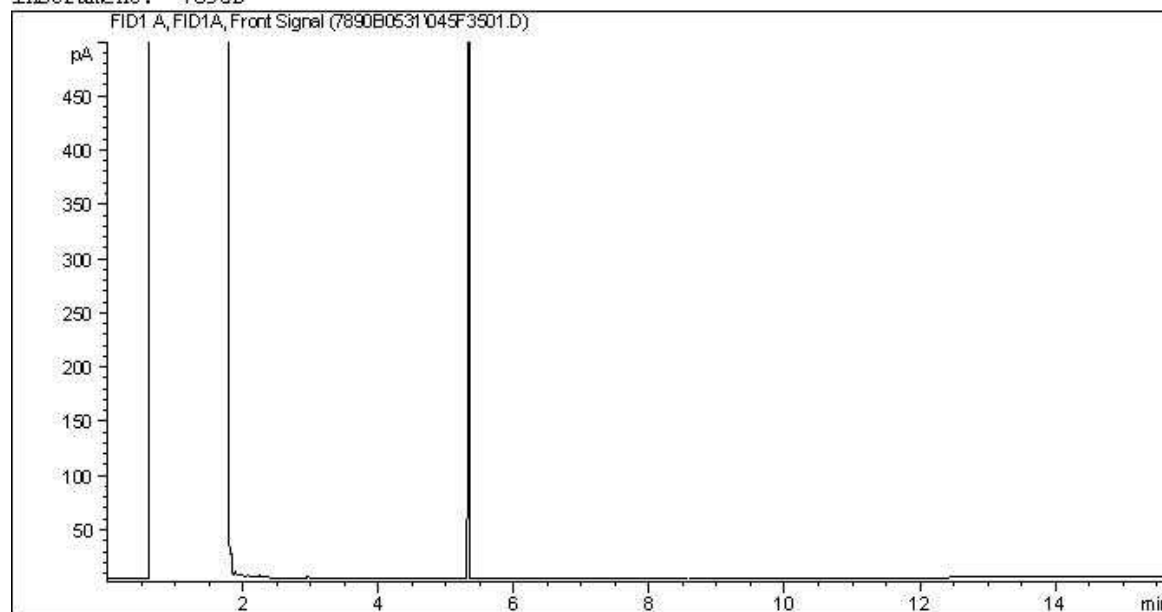
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Sample Identification				Depth (Unit)		Date Sampled (YYYY/MM/DD)		Time Sampled (HH:MM)		Matrix		<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>1</td> <td>MW 72-14</td> <td>-</td> <td>2016/05/25</td> <td>15:20</td> <td>GW</td> <td>4</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>MW 73-14</td> <td>-</td> <td>↓</td> <td>15:50</td> <td>↓</td> <td>4</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>7</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>8</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>9</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>10</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>												1	MW 72-14	-	2016/05/25	15:20	GW	4																								2	MW 73-14	-	↓	15:50	↓	4																								3																														4																														5																														6																														7																														8																														9																														10																														HOLD - DO NOT ANALYZE	
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Please indicate Filtered, Preserved or Both (F, P, F/P) →

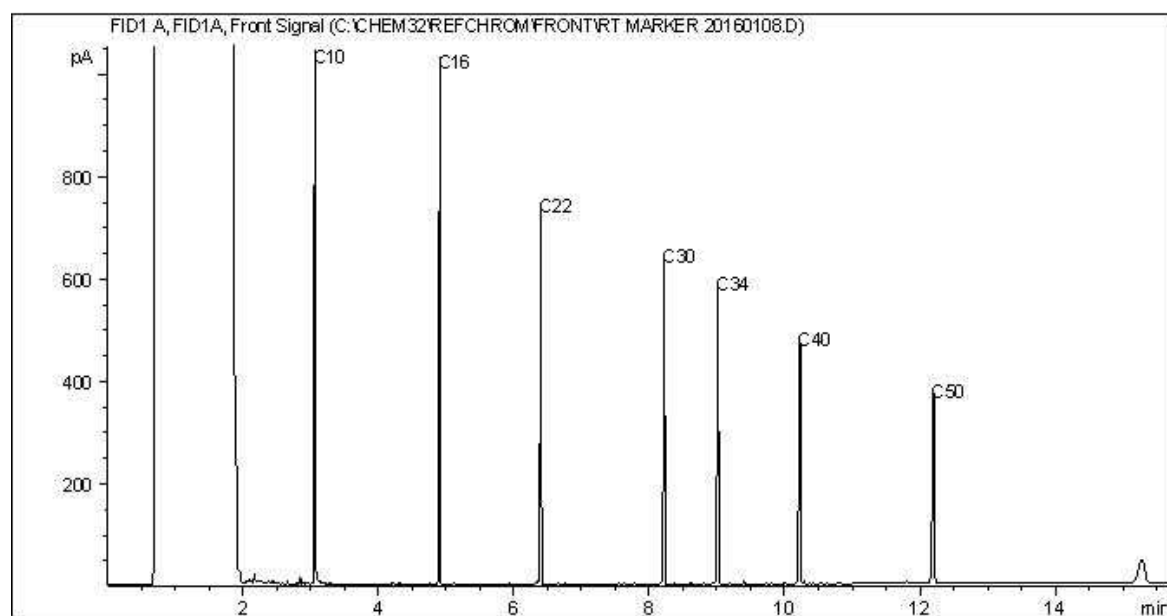
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<u>Jes Chamula</u>	<u>2016/05/25</u>	<u>16:30</u>	<u>ONE Delaney M Kanichar</u>	<u>2016/05/25</u>	<u>16:39</u>	<u>B640846 GM4</u>

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: 7890B



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

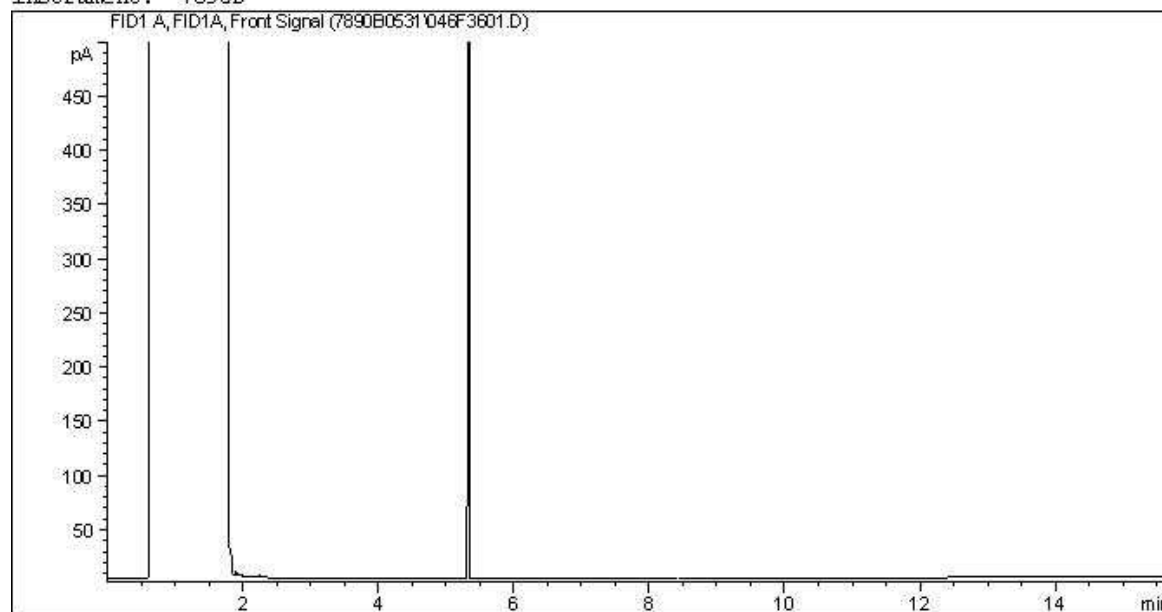
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Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Page 1 of 1

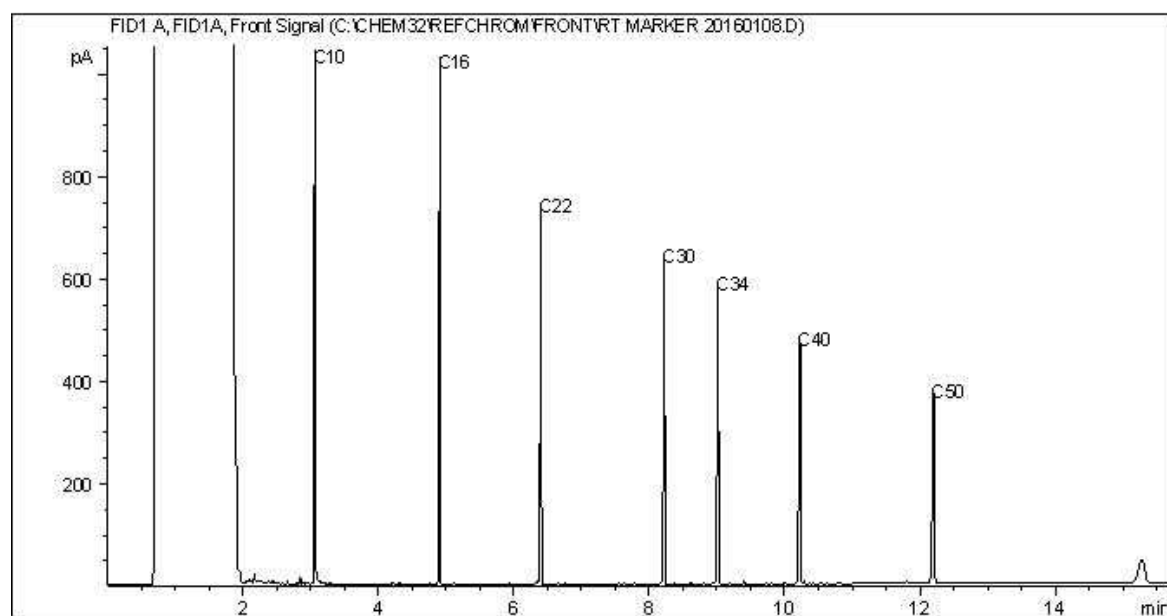
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CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: 7890B



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

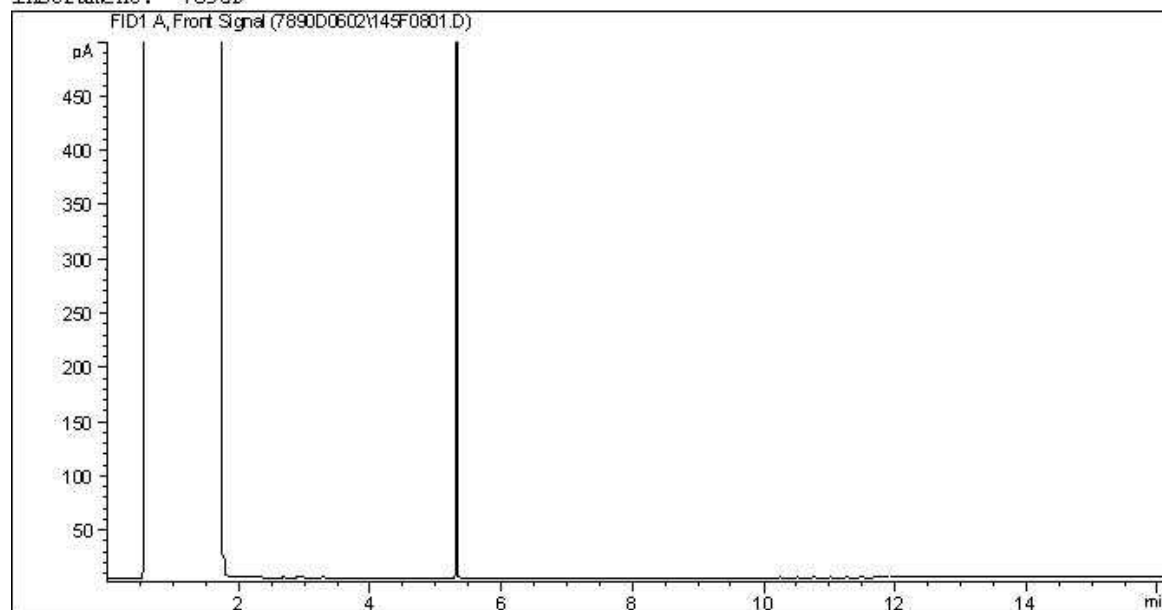
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Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Page 1 of 1

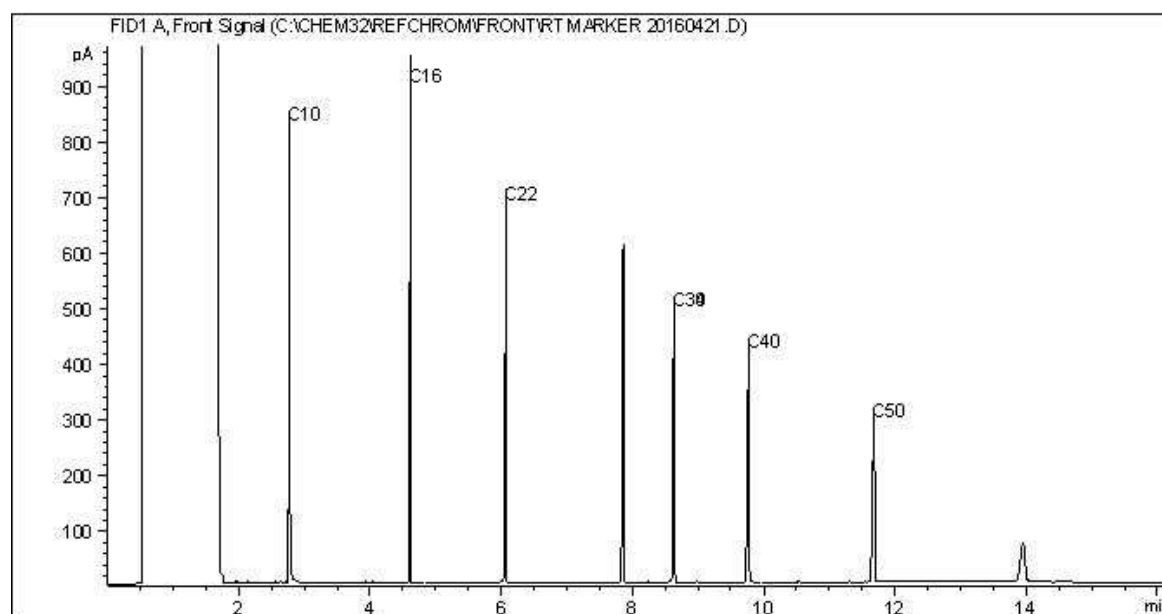
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: 7890D



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

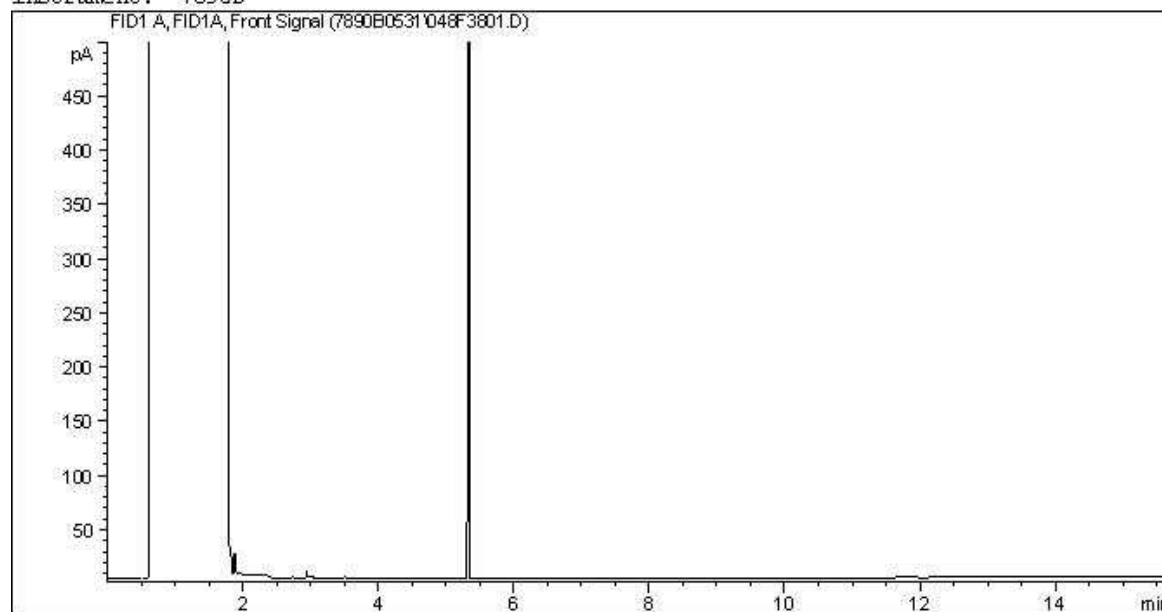
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Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Page 1 of 1

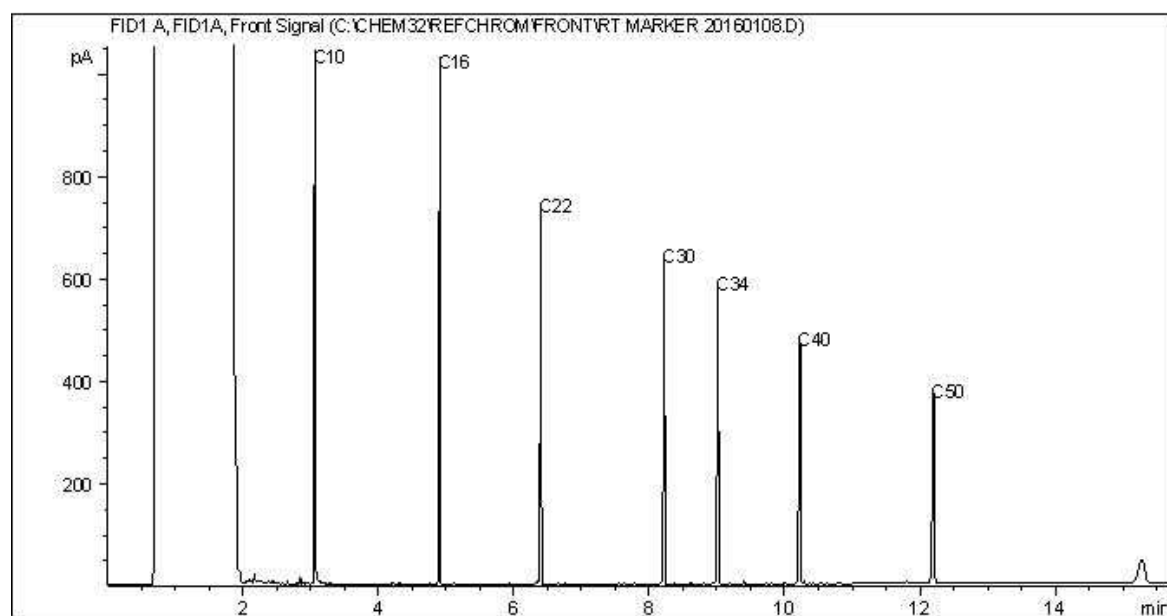
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CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: 7890B



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline: C4 - C12
Varsol: C8 - C12
Kerosene: C7 - C16

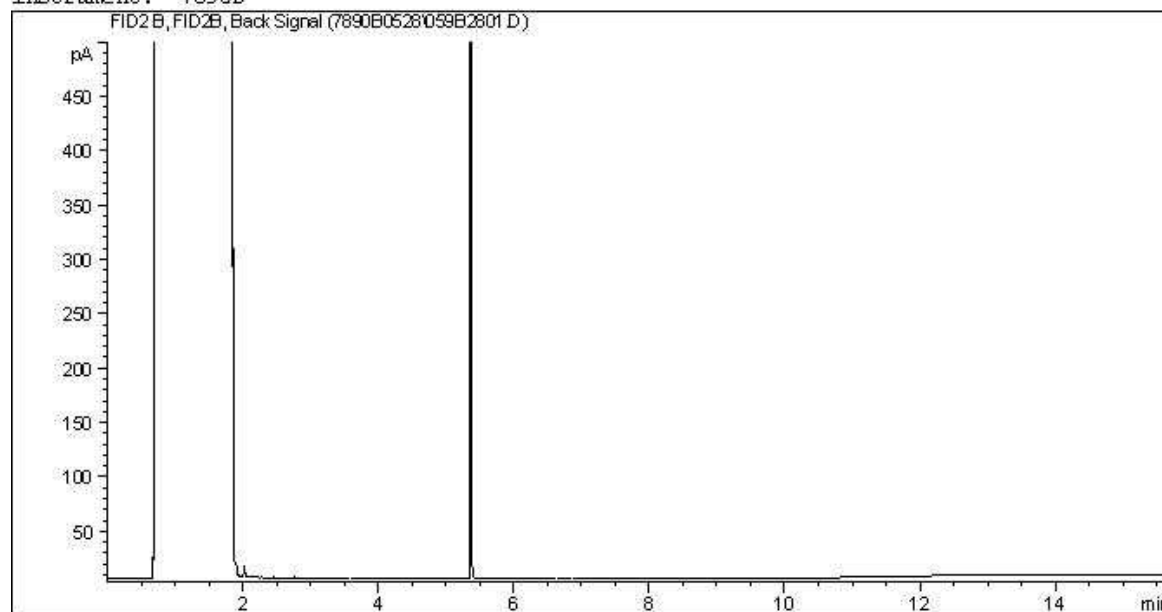
Diesel: C8 - C22
Lubricating Oils: C20 - C40
Crude Oils: C3 - C60+

Page 1 of 1

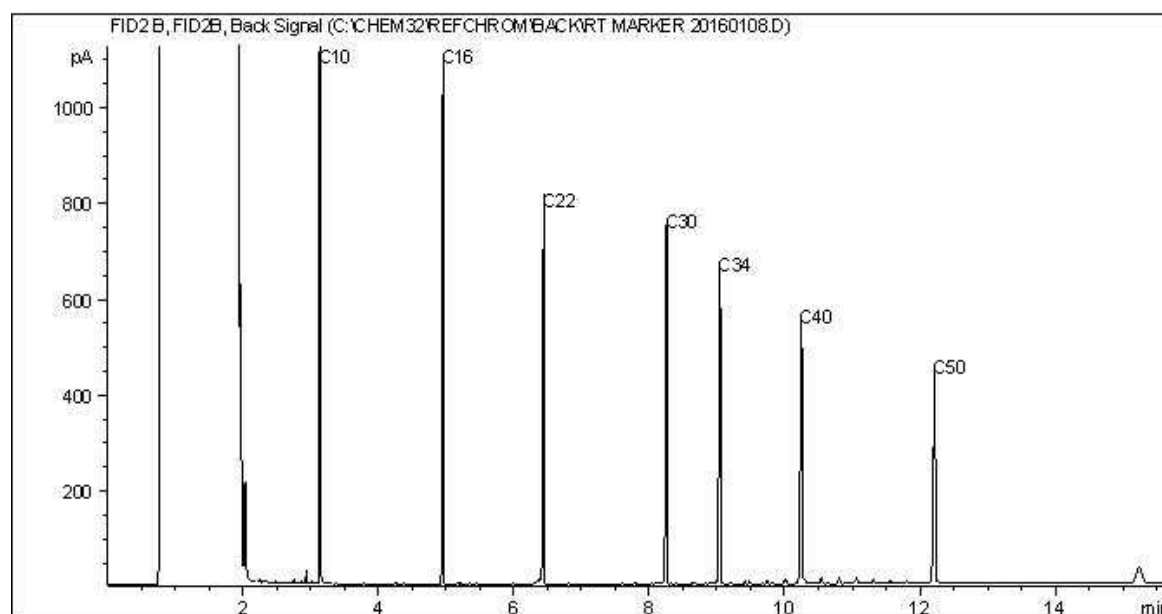
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CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: 7890B



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline: C4 - C12
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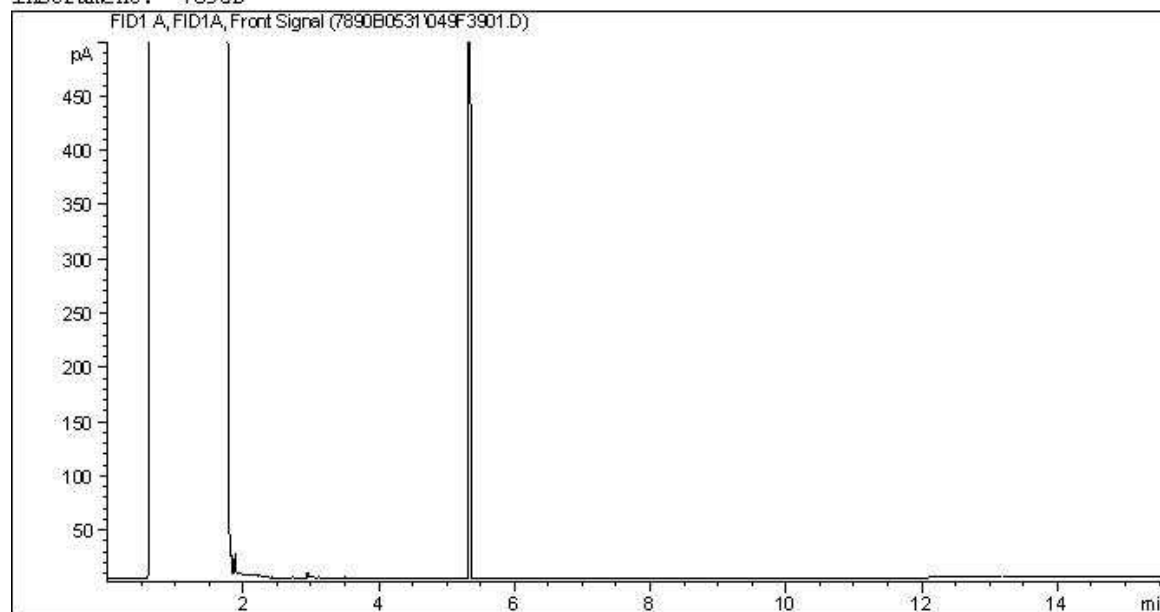
Diesel: C8 - C22
Lubricating Oils: C20 - C40
Crude Oils: C3 - C60+

Page 1 of 1

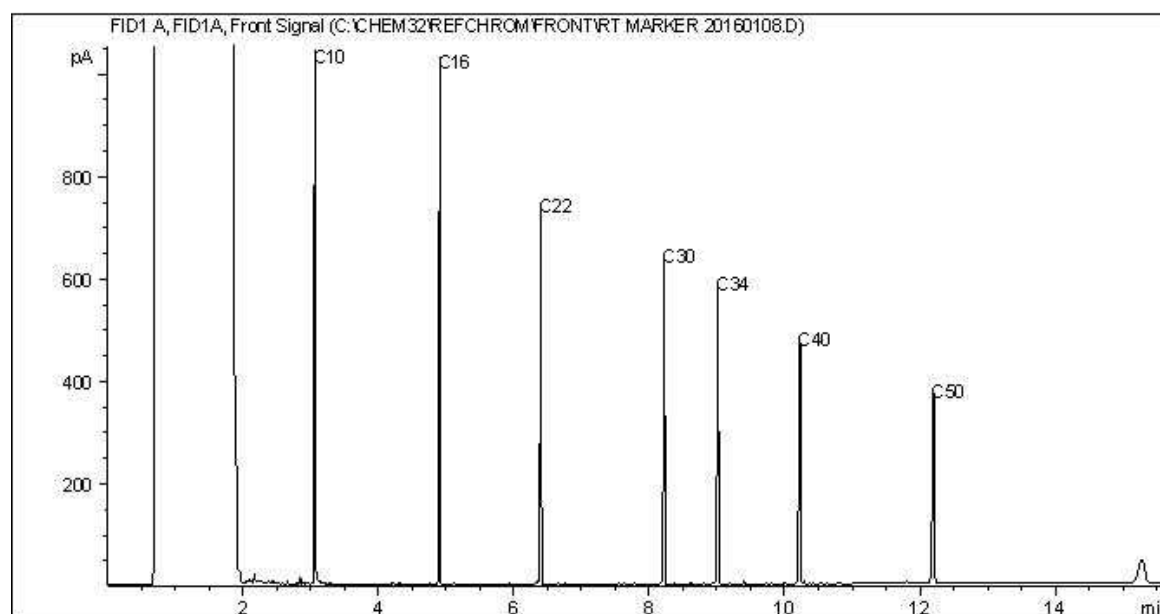
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CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: 7890B



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

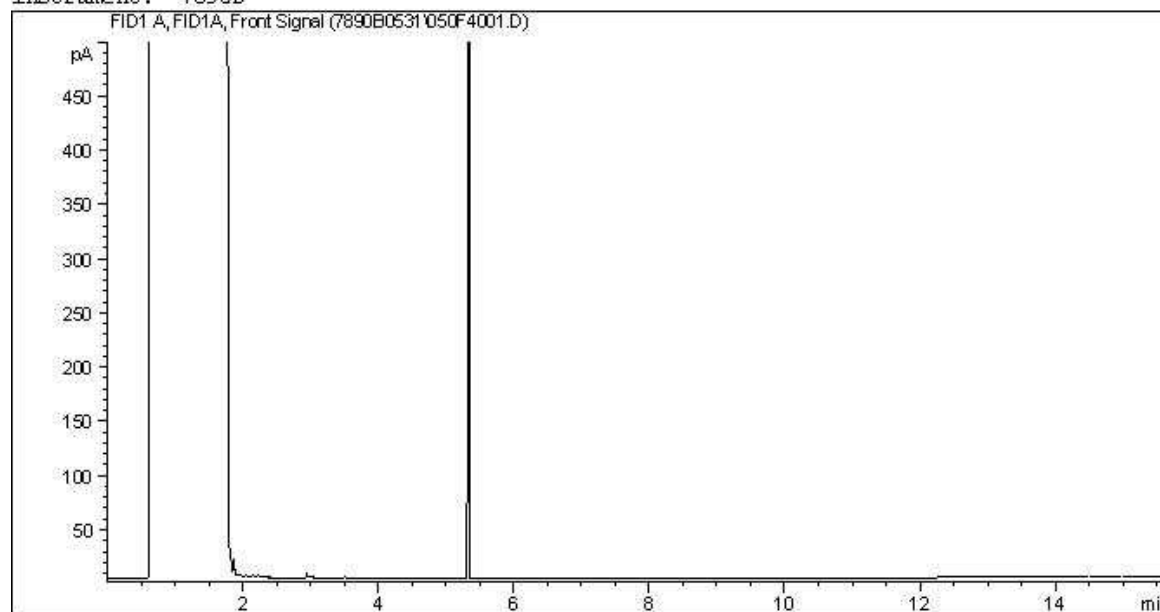
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Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
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Page 1 of 1

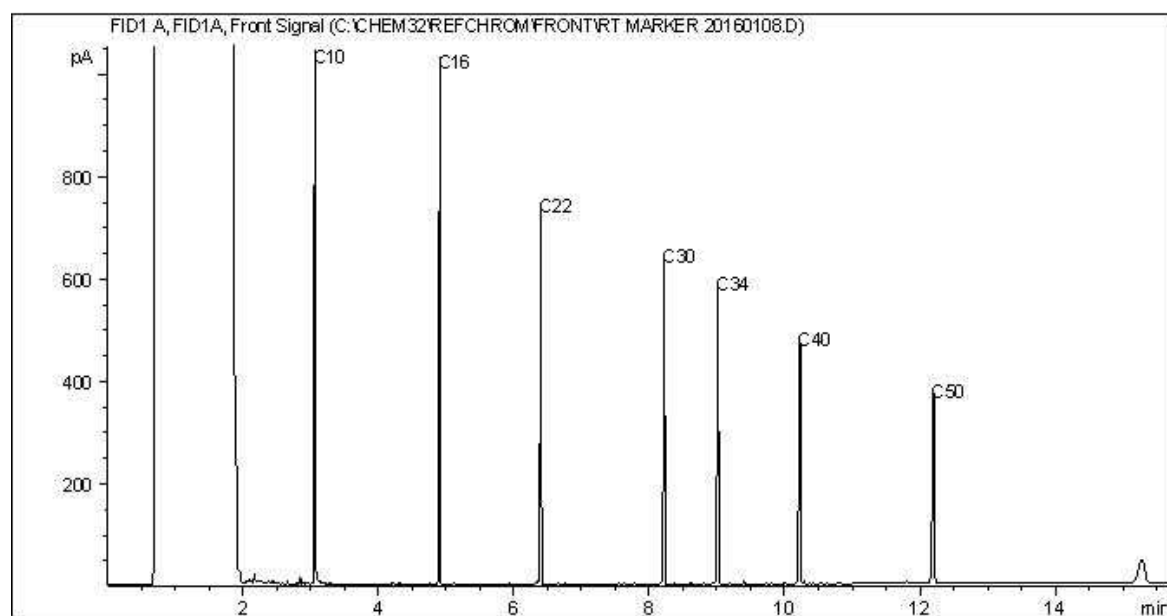
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CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: 7890B



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline: C4 - C12
Varsol: C8 - C12
Kerosene: C7 - C16

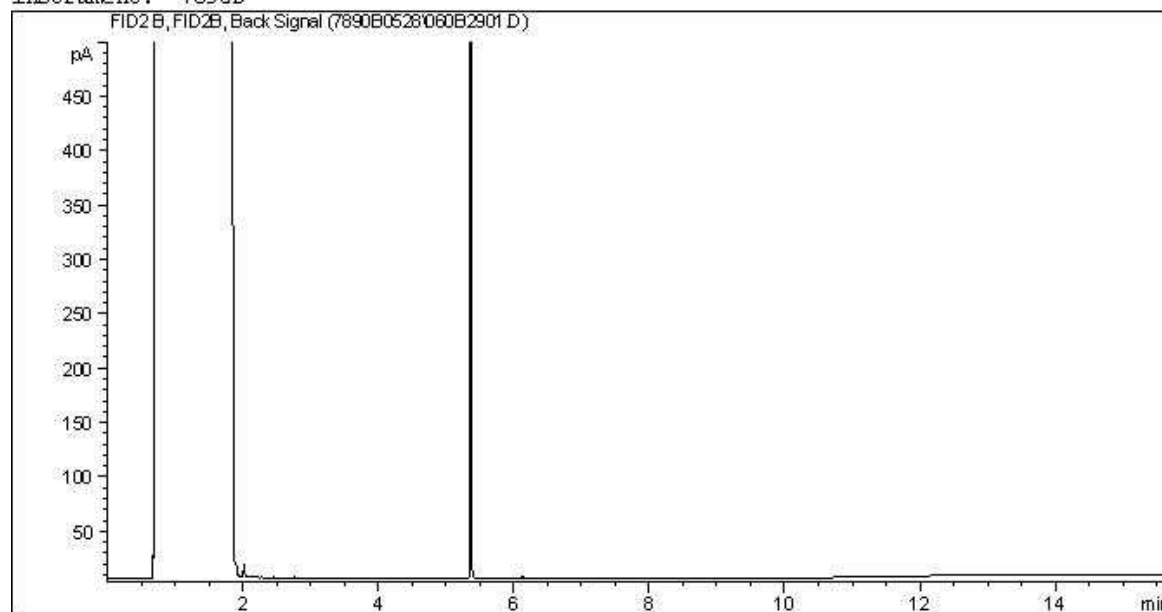
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Lubricating Oils: C20 - C40
Crude Oils: C3 - C60+

Page 1 of 1

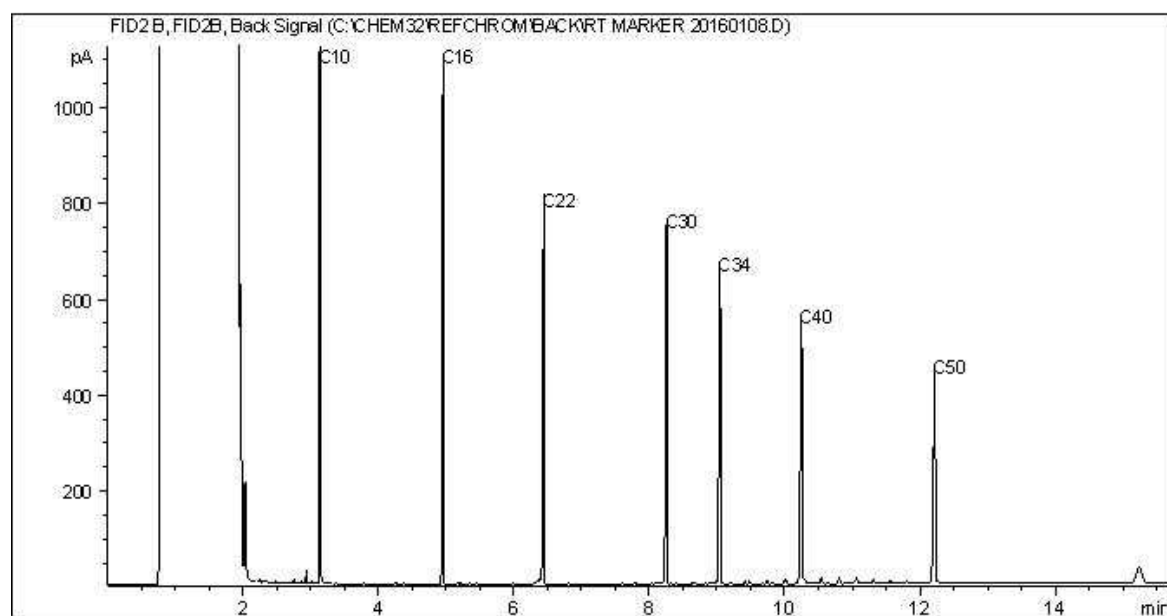
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CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: 7890B



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

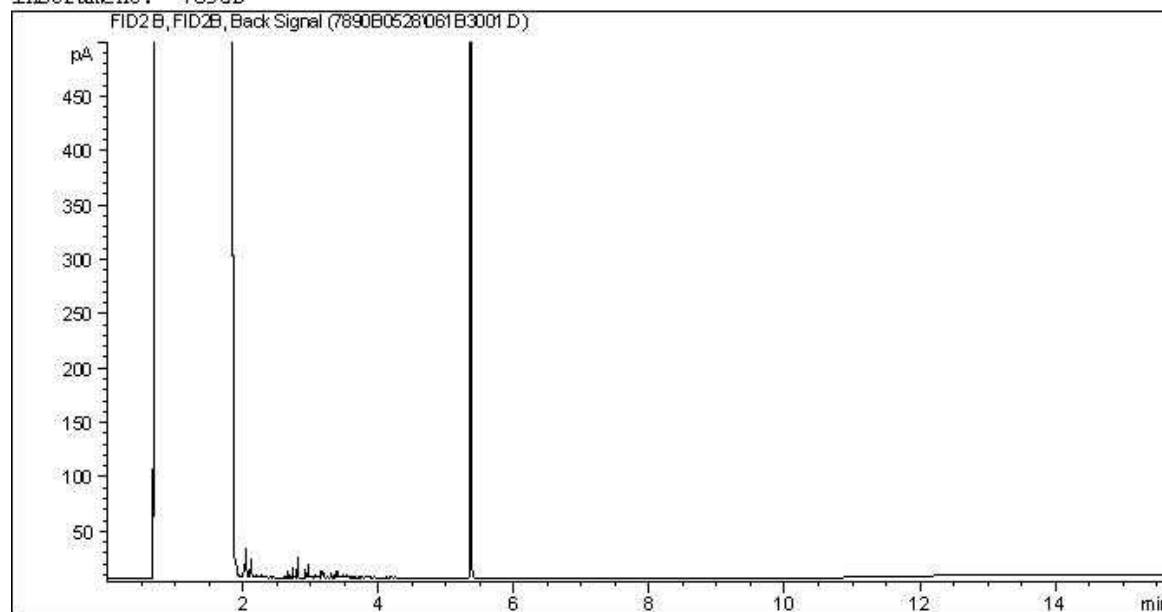
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Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Page 1 of 1

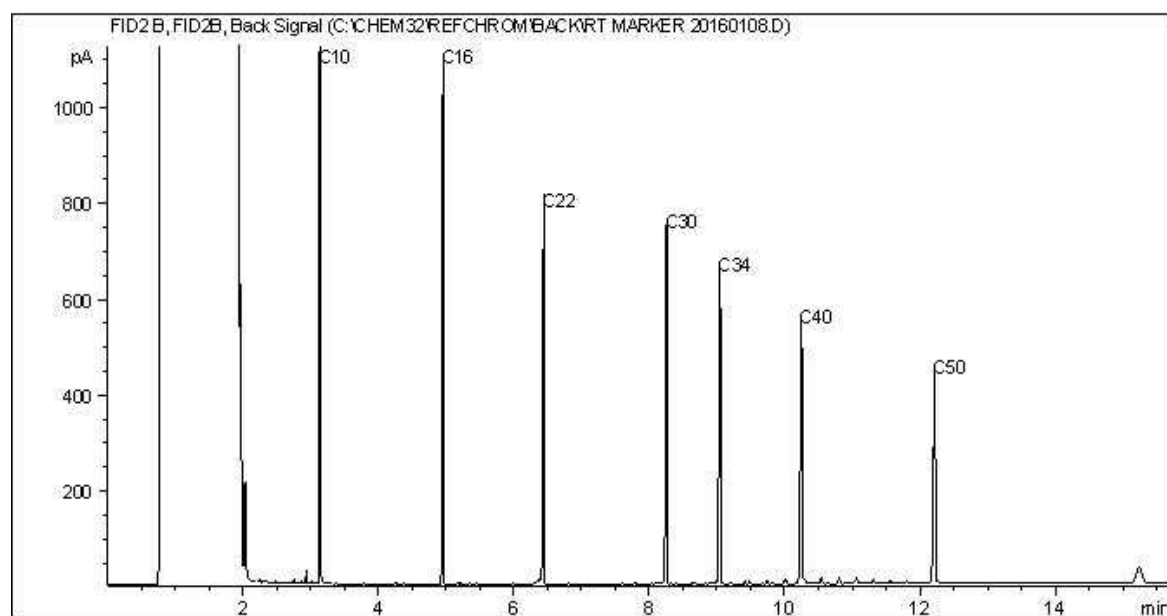
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CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: 7890B



Carbon Range Distribution - Reference Chromatogram



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Gasoline: C4 - C12
Varsol: C8 - C12
Kerosene: C7 - C16

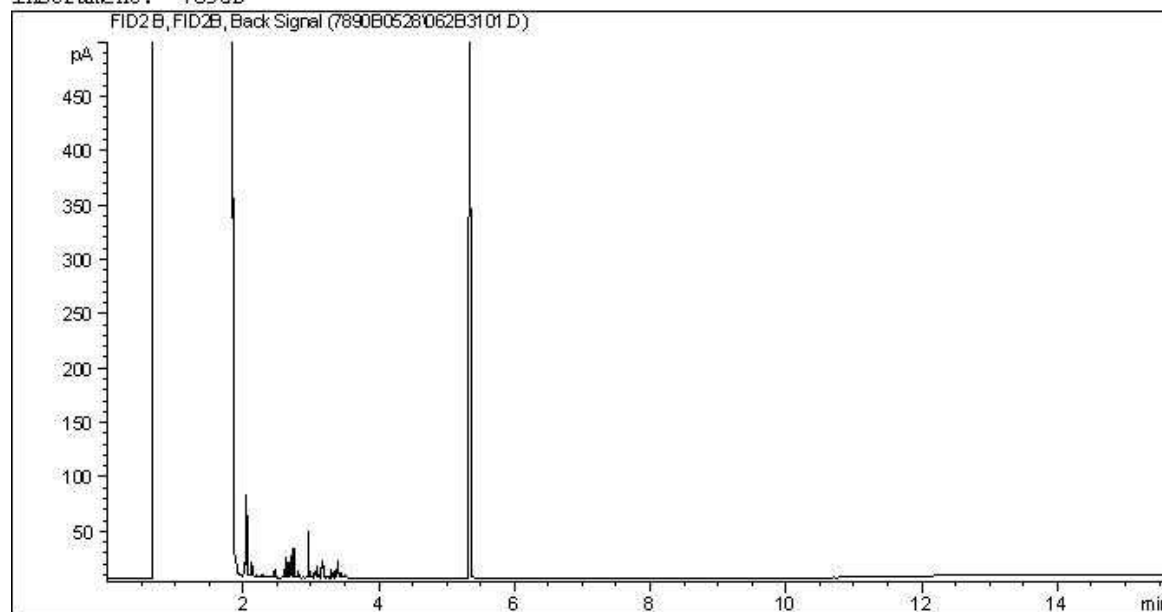
Diesel: C8 - C22
Lubricating Oils: C20 - C40
Crude Oils: C3 - C60+

Page 1 of 1

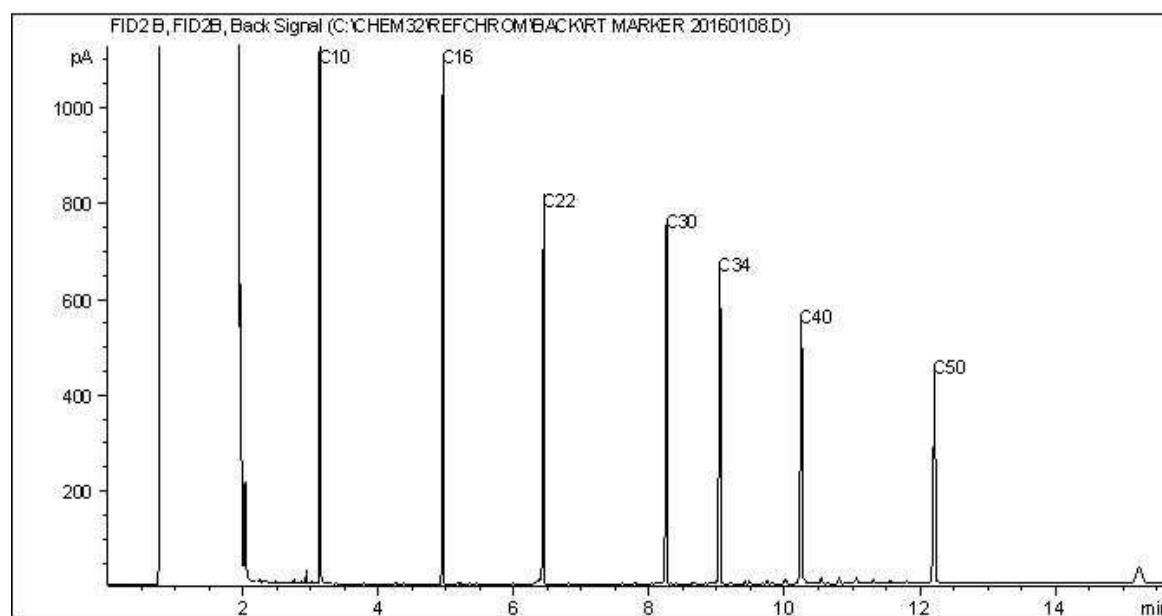
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CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: 7890B



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

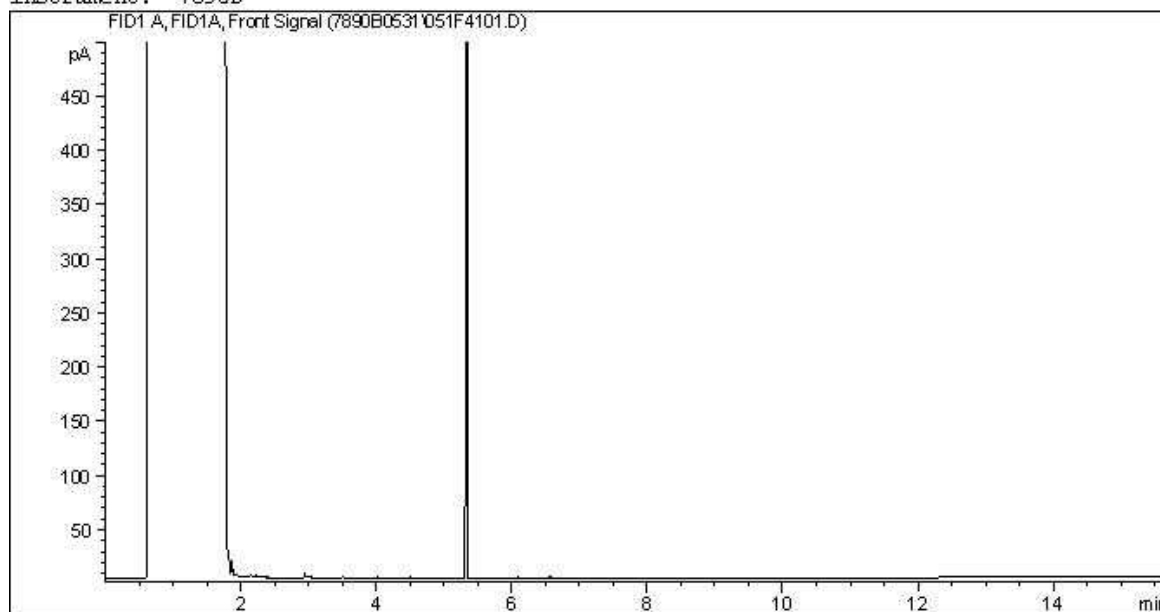
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Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Page 1 of 1

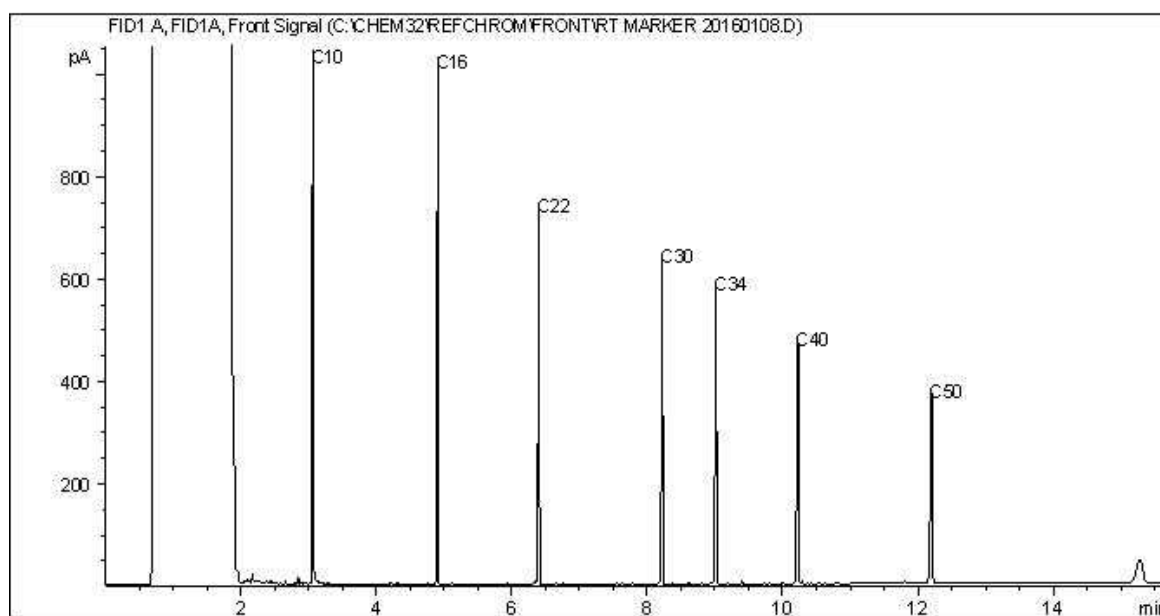
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CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

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Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

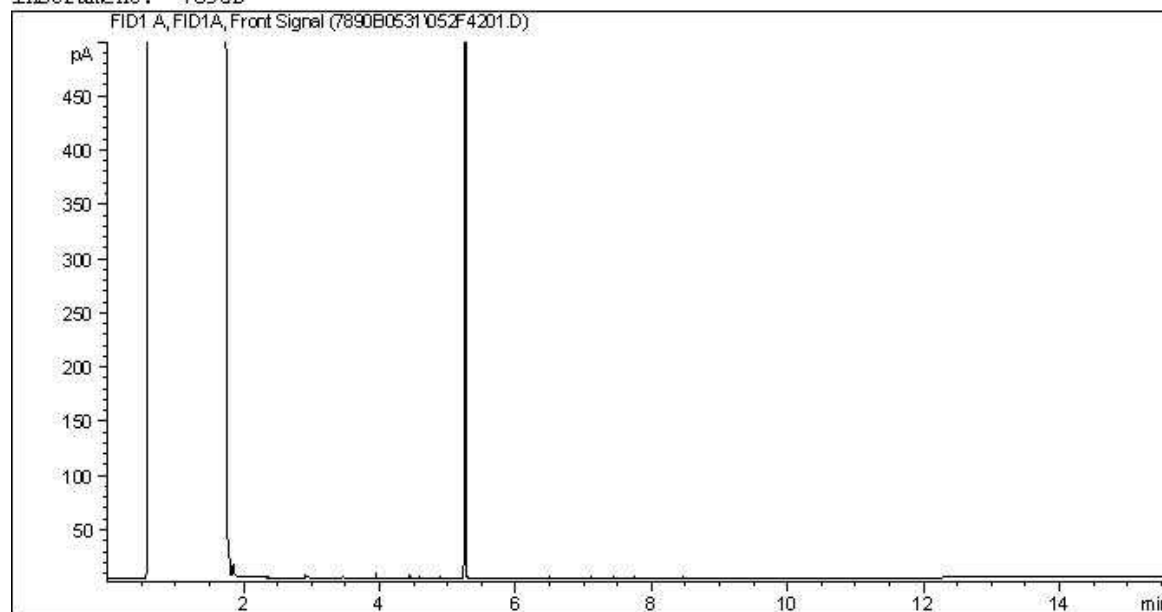
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Page 1 of 1

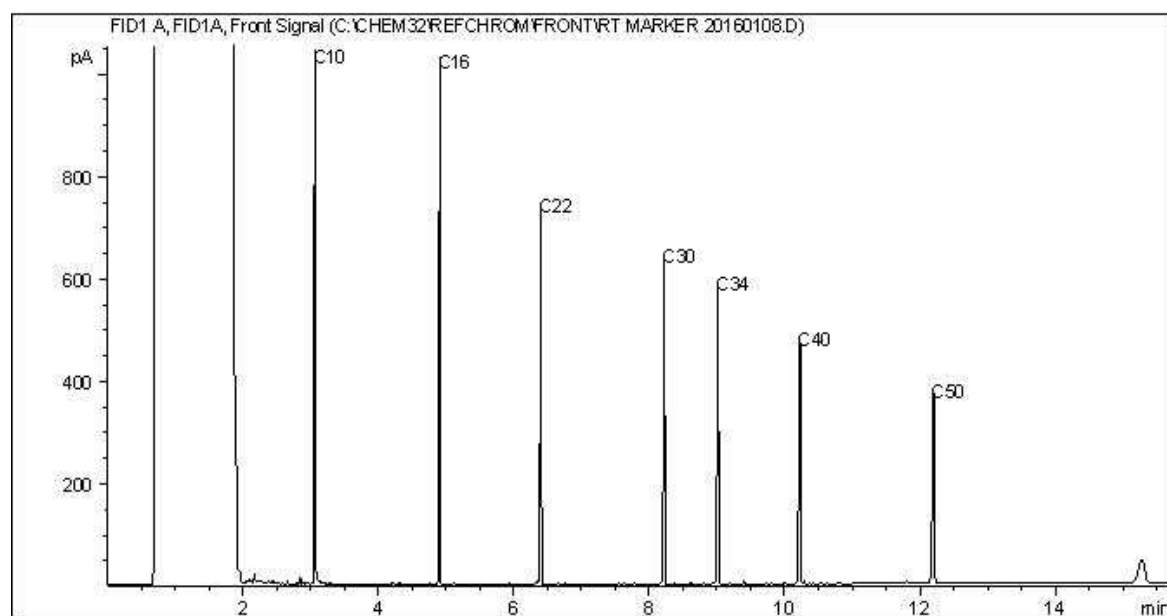
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CCME Hydrocarbons in Water (F2; C10-C16) Chromatogram

Instrument: 7890B



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

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Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Page 1 of 1

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GOLDER DATA QUALITY REVIEW CHECKLISTSite Location: EIASampling Date: May 26, 2016Golder Project Number: 1529387Laboratory: Maxxam EdmontonLab Submission Number: B641208

Was the Cooler Received at the lab under a sealed and intact custody seal?	<u>Yes</u>
Was proper chain of custody of the samples documented and kept?	<u>Yes</u>
Were sample temperatures acceptable when they reached lab?:	<u>Yes</u>
Were all samples analyzed and extracted within hold times?:	<u>Yes</u>
Has lab warranted all tests were in statistical control in CoA?:	<u>Yes</u>
Was sufficient sample provided for the requested analysis?	<u>Yes</u>
Has lab warranted all samples were analyzed with limited headspace present?:	<u>Yes</u>

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?


	Yes	No	NA	Comments
Surrogate Recovery	X			All laboratory QC results are within acceptance criteria.
Method Blank Concentration	X			
Laboratory Duplicate RPD	X			
Matrix Spike Recovery	X			
Blank Spike Recovery	X			

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

	Yes	No	NA	Comments
Field Blank Concentration			X	All field QC samples are within alert limits.
Trip Blank Concentration			X	
Field Duplicate RPD	X			

Is data considered reliable (Yes/No/Suspect)?: Yes

If answer is "No" or "Suspect", describe and provide rationale:

Data Reviewed by (Print): Jenny MusijowskiData Reviewed by (Signature): Date: October 27, 2016

Your Project #: 1529387-6000
Site Location: E/A
Your C.O.C. #: m013257, m013258

Attention: Steven Fiddler

GOLDER ASSOCIATES LTD
16820-107 AVE
EDMONTON, AB
CANADA T5P 4C3

Report Date: 2016/06/03

Report #: R2190985

Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B641208

Received: 2016/05/26, 16:14

Sample Matrix: Water
Samples Received: 12

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
BTEX/F1 in Water by HS GC/MS/FID	12	N/A	2016/05/31	AB SOP-00039	CCME CWS/EPA 8260c m
CCME Hydrocarbons in Water (F2; C10-C16)	1	2016/05/30	2016/05/30	AB SOP-00040 / AB SOP-00037	CCME PHC-CWS m
CCME Hydrocarbons in Water (F2; C10-C16)	11	2016/05/31	2016/06/02	AB SOP-00040 / AB SOP-00037	CCME PHC-CWS m

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

Encryption Key

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

Alaina Hunter, Dip. BioSci, Project Manager, Environmental

Email: AHunter@maxxam.ca

Phone# (780)577-7139

=====

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

Maxxam Job #: B641208
Report Date: 2016/06/03

GOLDER ASSOCIATES LTD
Client Project #: 1529387-6000
Site Location: E/A
Sampler Initials: JC

Sample Details/Parameters	Result	RDL	UNITS	MU	Extracted	Analyzed	By	Batch
OS0658 BH59M Sampling Date 2016/05/26 09:45 Matrix W PETROLEUM HYDROCARBONS (CCME) Ext. Pet. Hydrocarbon F2 (C10-C16 Hydrocarbons) <0.10 0.10 mg/L N/A 2016/05/31 2016/06/02 GG3 8281738 O-TERPHENYL (sur.) 103 50 - 130 % N/A 2016/05/31 2016/06/02 GG3 8281738 VOLATILE ORGANICS BY GC-MS (WATER) Volatiles Benzene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 Toluene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 Ethylbenzene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 m & p-Xylene <0.80 0.80 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 o-Xylene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 Xylenes (Total) <0.80 0.80 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 F1 (C6-C10) - BTEX <100 100 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 F1 (C6-C10) <100 100 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 1,4-Difluorobenzene (sur.) 100 70 - 130 % N/A 2016/05/31 2016/05/31 SES 8281710 4-Bromofluorobenzene (sur.) 96 70 - 130 % N/A 2016/05/31 2016/05/31 SES 8281710 D4-1,2-Dichloroethane (sur.) 118 70 - 130 % N/A 2016/05/31 2016/05/31 SES 8281710								
OS0659 BH58M Sampling Date 2016/05/26 10:10 Matrix W PETROLEUM HYDROCARBONS (CCME) Ext. Pet. Hydrocarbon F2 (C10-C16 Hydrocarbons) <0.10 0.10 mg/L N/A 2016/05/31 2016/06/02 GG3 8281738 O-TERPHENYL (sur.) 99 50 - 130 % N/A 2016/05/31 2016/06/02 GG3 8281738 VOLATILE ORGANICS BY GC-MS (WATER) Volatiles Benzene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 Toluene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 Ethylbenzene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 m & p-Xylene <0.80 0.80 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 o-Xylene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 Xylenes (Total) <0.80 0.80 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 F1 (C6-C10) - BTEX <100 100 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 F1 (C6-C10) <100 100 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 1,4-Difluorobenzene (sur.) 102 70 - 130 % N/A 2016/05/31 2016/05/31 SES 8281710 4-Bromofluorobenzene (sur.) 97 70 - 130 % N/A 2016/05/31 2016/05/31 SES 8281710 D4-1,2-Dichloroethane (sur.) 116 70 - 130 % N/A 2016/05/31 2016/05/31 SES 8281710								
OS0660 BH48M Sampling Date 2016/05/26 10:30 Matrix W PETROLEUM HYDROCARBONS (CCME) Ext. Pet. Hydrocarbon F2 (C10-C16 Hydrocarbons) <0.10 0.10 mg/L N/A 2016/05/31 2016/06/02 GG3 8281738 O-TERPHENYL (sur.) 98 50 - 130 % N/A 2016/05/31 2016/06/02 GG3 8281738 VOLATILE ORGANICS BY GC-MS (WATER) Volatiles Benzene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 Toluene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 Ethylbenzene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 m & p-Xylene <0.80 0.80 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 o-Xylene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 Xylenes (Total) <0.80 0.80 ug/L N/A 2016/05/31 2016/05/31 SES 8281710								

Maxxam Job #: B641208
Report Date: 2016/06/03

GOLDER ASSOCIATES LTD
Client Project #: 1529387-6000
Site Location: E/A
Sampler Initials: JC

Sample Details/Parameters	Result	RDL	UNITS	MU	Extracted	Analyzed	By	Batch
OS0663 MW75-14 Sampling Date 2016/05/26 12:20 Matrix W PETROLEUM HYDROCARBONS (CCME) Ext. Pet. Hydrocarbon F2 (C10-C16 Hydrocarbons) 2.4 0.10 mg/L +/- 0.96 O-TERPHENYL (sur.) 99 50 - 130 % N/A VOLATILE ORGANICS BY GC-MS (WATER) Volatiles Benzene 2100(1) 4.0 ug/L N/A Toluene 150 0.40 ug/L N/A Ethylbenzene 550 0.40 ug/L N/A m & p-Xylene 980 0.80 ug/L N/A o-Xylene 12 0.40 ug/L N/A Xylenes (Total) 990 0.80 ug/L N/A F1 (C6-C10) - BTEX 2200 100 ug/L N/A F1 (C6-C10) 6100 100 ug/L N/A 1,4-Difluorobenzene (sur.) 98 70 - 130 % N/A 4-Bromofluorobenzene (sur.) 100 70 - 130 % N/A D4-1,2-Dichloroethane (sur.) 119 70 - 130 % N/A								
OS0664 DUP16-02 Sampling Date 2016/05/26 12:20 Matrix W PETROLEUM HYDROCARBONS (CCME) Ext. Pet. Hydrocarbon F2 (C10-C16 Hydrocarbons) 2.6 0.10 mg/L +/- 1.0 O-TERPHENYL (sur.) 101 50 - 130 % N/A VOLATILE ORGANICS BY GC-MS (WATER) Volatiles Benzene 2100(1) 4.0 ug/L N/A Toluene 150 0.40 ug/L N/A Ethylbenzene 520 0.40 ug/L N/A m & p-Xylene 950 0.80 ug/L N/A o-Xylene 12 0.40 ug/L N/A Xylenes (Total) 960 0.80 ug/L N/A F1 (C6-C10) - BTEX 1900 100 ug/L N/A F1 (C6-C10) 5600 100 ug/L N/A 1,4-Difluorobenzene (sur.) 98 70 - 130 % N/A 4-Bromofluorobenzene (sur.) 101 70 - 130 % N/A D4-1,2-Dichloroethane (sur.) 118 70 - 130 % N/A								
OS0665 BH50M Sampling Date 2016/05/26 13:15 Matrix W PETROLEUM HYDROCARBONS (CCME) Ext. Pet. Hydrocarbon F2 (C10-C16 Hydrocarbons) <0.10 0.10 mg/L N/A O-TERPHENYL (sur.) 104 50 - 130 % N/A VOLATILE ORGANICS BY GC-MS (WATER) Volatiles Benzene 30 0.40 ug/L +/- 4.2 Toluene <0.40 0.40 ug/L N/A Ethylbenzene 2.1 0.40 ug/L +/- 0.48 m & p-Xylene 2.5 0.80 ug/L +/- <RDL o-Xylene 0.49 0.40 ug/L +/- <RDL								
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.								

Maxxam Job #: B641208
Report Date: 2016/06/03

GOLDER ASSOCIATES LTD
Client Project #: 1529387-6000
Site Location: E/A
Sampler Initials: JC

Sample Details/Parameters	Result	RDL	UNITS	MU	Extracted	Analyzed	By	Batch
OS0665 BH50M Sampling Date 2016/05/26 13:15 Matrix W VOLATILE ORGANICS BY GC-MS (WATER) Volatiles Xylenes (Total) 3.0 0.80 ug/L +/- 0.89 2016/05/31 2016/05/31 SES 8281710 F1 (C6-C10) - BTEX <100 100 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 F1 (C6-C10) <100 100 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 1,4-Difluorobenzene (sur.) 102 70 - 130 % N/A 2016/05/31 2016/05/31 SES 8281710 4-Bromofluorobenzene (sur.) 96 70 - 130 % N/A 2016/05/31 2016/05/31 SES 8281710 D4-1,2-Dichloroethane (sur.) 116 70 - 130 % N/A 2016/05/31 2016/05/31 SES 8281710								
OS0666 MW76-14 Sampling Date 2016/05/26 13:45 Matrix W PETROLEUM HYDROCARBONS (CCME) Ext. Pet. Hydrocarbon F2 (C10-C16 Hydrocarbons) 2.0 0.10 mg/L +/- 0.82 2016/05/31 2016/06/02 GG3 8281738 O-TERPHENYL (sur.) 100 50 - 130 % N/A 2016/05/31 2016/06/02 GG3 8281738 VOLATILE ORGANICS BY GC-MS (WATER) Volatiles Benzene 19000(1) 40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 Toluene 3100(1) 40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 Ethylbenzene 840 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 m & p-Xylene 1800 0.80 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 o-Xylene 610 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 Xylenes (Total) 2400 0.80 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 F1 (C6-C10) - BTEX <100 100 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 F1 (C6-C10) 21000 100 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 1,4-Difluorobenzene (sur.) 94 70 - 130 % N/A 2016/05/31 2016/05/31 SES 8281710 4-Bromofluorobenzene (sur.) 98 70 - 130 % N/A 2016/05/31 2016/05/31 SES 8281710 D4-1,2-Dichloroethane (sur.) 120 70 - 130 % N/A 2016/05/31 2016/05/31 SES 8281710								
OS0667 BH54M Sampling Date 2016/05/26 14:20 Matrix W PETROLEUM HYDROCARBONS (CCME) Ext. Pet. Hydrocarbon F2 (C10-C16 Hydrocarbons) <0.10 0.10 mg/L N/A 2016/05/31 2016/06/02 GG3 8281738 O-TERPHENYL (sur.) 101 50 - 130 % N/A 2016/05/31 2016/06/02 GG3 8281738 VOLATILE ORGANICS BY GC-MS (WATER) Volatiles Benzene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 Toluene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 Ethylbenzene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 m & p-Xylene <0.80 0.80 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 o-Xylene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 Xylenes (Total) <0.80 0.80 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 F1 (C6-C10) - BTEX <100 100 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 F1 (C6-C10) <100 100 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 1,4-Difluorobenzene (sur.) 99 70 - 130 % N/A 2016/05/31 2016/05/31 SES 8281710 4-Bromofluorobenzene (sur.) 99 70 - 130 % N/A 2016/05/31 2016/05/31 SES 8281710 D4-1,2-Dichloroethane (sur.) 113 70 - 130 % N/A 2016/05/31 2016/05/31 SES 8281710								

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

Maxxam Job #: B641208
Report Date: 2016/06/03

GOLDER ASSOCIATES LTD
Client Project #: 1529387-6000
Site Location: E/A
Sampler Initials: JC

Sample Details/Parameters	Result	RDL	UNITS	MU	Extracted	Analyzed	By	Batch
OS0671 BH55M Sampling Date 2016/05/26 14:50 Matrix W PETROLEUM HYDROCARBONS (CCME) Ext. Pet. Hydrocarbon F2 (C10-C16 Hydrocarbons) <0.10 0.10 mg/L N/A 2016/05/31 2016/06/02 GG3 8281738 O-TERPHENYL (sur.) 102 50 - 130 % N/A 2016/05/31 2016/06/02 GG3 8281738 VOLATILE ORGANICS BY GC-MS (WATER) Volatiles Benzene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 Toluene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 Ethylbenzene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 m & p-Xylene <0.80 0.80 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 o-Xylene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 Xylenes (Total) <0.80 0.80 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 F1 (C6-C10) - BTEX <100 100 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 F1 (C6-C10) <100 100 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 1,4-Difluorobenzene (sur.) 105 70 - 130 % N/A 2016/05/31 2016/05/31 SES 8281710 4-Bromofluorobenzene (sur.) 95 70 - 130 % N/A 2016/05/31 2016/05/31 SES 8281710 D4-1,2-Dichloroethane (sur.) 109 70 - 130 % N/A 2016/05/31 2016/05/31 SES 8281710								
OS0672 BH64M Sampling Date 2016/05/26 15:20 Matrix W PETROLEUM HYDROCARBONS (CCME) Ext. Pet. Hydrocarbon F2 (C10-C16 Hydrocarbons) <0.10 0.10 mg/L N/A 2016/05/31 2016/06/02 GG3 8281738 Dup.F2 (C10-C16 Hydrocarbons) <0.10 0.10 mg/L N/A 2016/05/31 2016/06/02 GG3 8281738 O-TERPHENYL (sur.) 100 50 - 130 % N/A 2016/05/31 2016/06/02 GG3 8281738 Dup.O-TERPHENYL (sur.) 106 50 - 130 % N/A 2016/05/31 2016/06/02 GG3 8281738 VOLATILE ORGANICS BY GC-MS (WATER) Volatiles Benzene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 Toluene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 Ethylbenzene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 m & p-Xylene <0.80 0.80 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 o-Xylene <0.40 0.40 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 Xylenes (Total) <0.80 0.80 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 F1 (C6-C10) - BTEX <100 100 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 F1 (C6-C10) <100 100 ug/L N/A 2016/05/31 2016/05/31 SES 8281710 1,4-Difluorobenzene (sur.) 100 70 - 130 % N/A 2016/05/31 2016/05/31 SES 8281710 4-Bromofluorobenzene (sur.) 96 70 - 130 % N/A 2016/05/31 2016/05/31 SES 8281710 D4-1,2-Dichloroethane (sur.) 117 70 - 130 % N/A 2016/05/31 2016/05/31 SES 8281710								

Maxxam Job #: B641208
Report Date: 2016/06/03

GOLDER ASSOCIATES LTD
Client Project #: 1529387-6000
Site Location: E/A
Sampler Initials: JC

GENERAL COMMENTS

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

Package 1	9.7°C
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Results relate only to the items tested.

Maxxam Job #: B641208
Report Date: 2016/06/03

GOLDER ASSOCIATES LTD
Client Project #: 1529387-6000
Site Location: E/A
Sampler Initials: JC

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8281710	SES	Matrix Spike	1,4-Difluorobenzene (sur.)	2016/05/30		102	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/05/30		97	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/05/30		118	%	70 - 130
			Benzene	2016/05/30		107	%	70 - 130
			Toluene	2016/05/30		97	%	70 - 130
			Ethylbenzene	2016/05/30		99	%	70 - 130
			m & p-Xylene	2016/05/30		98	%	70 - 130
			o-Xylene	2016/05/30		100	%	70 - 130
			F1 (C6-C10)	2016/05/30		78	%	70 - 130
8281710	SES	Spiked Blank	1,4-Difluorobenzene (sur.)	2016/05/31		101	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/05/31		96	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/05/31		118	%	70 - 130
			Benzene	2016/05/31		109	%	70 - 130
			Toluene	2016/05/31		97	%	70 - 130
			Ethylbenzene	2016/05/31		100	%	70 - 130
			m & p-Xylene	2016/05/31		98	%	70 - 130
			o-Xylene	2016/05/31		103	%	70 - 130
			F1 (C6-C10)	2016/05/31		91	%	70 - 130
8281710	SES	Method Blank	1,4-Difluorobenzene (sur.)	2016/05/31		100	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/05/31		96	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/05/31		117	%	70 - 130
			Benzene	2016/05/31	<0.40		ug/L	
			Toluene	2016/05/31	<0.40		ug/L	
			Ethylbenzene	2016/05/31	<0.40		ug/L	
			m & p-Xylene	2016/05/31	<0.80		ug/L	
			o-Xylene	2016/05/31	<0.40		ug/L	
			Xylenes (Total)	2016/05/31	<0.80		ug/L	
			F1 (C6-C10) - BTEX	2016/05/31	<100		ug/L	
			F1 (C6-C10)	2016/05/31	<100		ug/L	
			Benzene	2016/05/31	NC		%	40
			Toluene	2016/05/31	NC		%	40
			Ethylbenzene	2016/05/31	NC		%	40
			m & p-Xylene	2016/05/31	NC		%	40
8281721	SHM	Matrix Spike	O-TERPHENYL (sur.)	2016/05/30		107	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/05/30		NC	%	50 - 130
			O-TERPHENYL (sur.)	2016/05/30		103	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/05/30		110	%	70 - 130
			O-TERPHENYL (sur.)	2016/05/30		106	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/05/30	<0.10		mg/L	
			F2 (C10-C16 Hydrocarbons)	2016/05/30	NC		%	40
8281738	GG3	Matrix Spike [OS0666-01]	O-TERPHENYL (sur.)	2016/06/02		99	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/06/02		NC	%	50 - 130
8281738	GG3	Spiked Blank	O-TERPHENYL (sur.)	2016/06/02		101	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/06/02		105	%	70 - 130
8281738	GG3	Method Blank	O-TERPHENYL (sur.)	2016/06/02		96	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/06/02	<0.10		mg/L	

Maxxam Job #: B641208
Report Date: 2016/06/03

GOLDER ASSOCIATES LTD
Client Project #: 1529387-6000
Site Location: E/A
Sampler Initials: JC

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC				Date				
Batch	Init	QC Type	Parameter	Analyzed	Value	Recovery	UNITS	QC Limits
8281738	GG3	RPD [OS0672-01]	F2 (C10-C16 Hydrocarbons)	2016/06/02	NC		%	40
<p>Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.</p> <p>Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.</p> <p>Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.</p> <p>Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.</p> <p>Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.</p> <p>NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).</p> <p>NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).</p>								

Maxxam Job #: B641208
Report Date: 2016/06/03

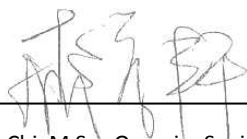
GOLDER ASSOCIATES LTD
Client Project #: 1529387-6000
Site Location: E/A
Sampler Initials: JC

VALIDATION SIGNATURE PAGE

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



Anna Koksharova, M.Sc., Organics Senior Analyst



Bert Chi, M.Sc., Organics Senior Analyst



Poonam Sharma, cCT, Organics Senior Analyst

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

Invoice Information		Report Information (if differs from invoice)		Project Information		Turnaround Time (TAT) Required	
Company: <u>Golder Associates</u>		Company: _____		Quotation #: _____		<input checked="" type="checkbox"/> 5 - 7 Days Regular (Most analyses)	
Contact Name: <u>Steven Fidler</u>		Contact Name: _____		P.O. #/ A/E #: _____		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS	
Address: <u>16820 107 Ave T5P 4C5</u>		Address: _____		Project #: <u>1529387-6000</u>		Rush TAT (Surcharges will be applied)	
Edmonton AB T5K 0T8		_____		Site Location: <u>EIA</u>		<input type="checkbox"/> Same Day <input type="checkbox"/> 2 Days <input type="checkbox"/> 1 Day <input type="checkbox"/> 3-4 Days	
Phone: <u>780-4833499 / 780-984-6600</u>		Phone: _____		Site #: _____		Date Required: _____	
Email: <u>sfidler@golder.com</u>		Email: <u>CSM DataQuality@golder.com</u>		Sampled By: <u>J. Chamulak</u>		Rush Confirmation #: _____	
Copies: <u>jchamula@golder.com</u>		Copies: _____		_____		_____	

Laboratory Use Only				Analysis Requested												Regulatory Criteria																																															
<table border="1"> <tr> <td>Seal Present</td> <td>YES</td> <td>NO</td> <td>Cooler ID</td> </tr> <tr> <td>Seal Intact</td> <td><input checked="" type="checkbox"/></td> <td></td> <td>Temp 9 10 10</td> </tr> <tr> <td>Cooling Media</td> <td></td> <td></td> <td></td> </tr> </table>				Seal Present	YES	NO	Cooler ID	Seal Intact	<input checked="" type="checkbox"/>		Temp 9 10 10	Cooling Media				Depot Reception				<table border="1"> <tr> <td># of containers</td> <td>BTEX F1</td> <td>VOC</td> <td>BTEX F1-F2</td> <td>BTEX F1-F4</td> <td>Routine Water</td> <td>Regulated Metals</td> <td>Total</td> <td>Dissolved</td> <td>Mercury</td> <td>Salinity 4</td> <td>Sieve (75 micron)</td> <td>Texture (% Sand, Silt, Clay)</td> <td>Basic Class II Landfill</td> <td>BTEX, PHC, FI, F2</td> </tr> <tr> <td></td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>												# of containers	BTEX F1	VOC	BTEX F1-F2	BTEX F1-F4	Routine Water	Regulated Metals	Total	Dissolved	Mercury	Salinity 4	Sieve (75 micron)	Texture (% Sand, Silt, Clay)	Basic Class II Landfill	BTEX, PHC, FI, F2		<input type="checkbox"/>	<input type="checkbox"/>													<input checked="" type="checkbox"/> AT1/CCME <input type="checkbox"/> Drinking Water <input type="checkbox"/> Saskatchewan <input type="checkbox"/> D50 (Drilling Waste) <input type="checkbox"/> Other: _____	
Seal Present	YES	NO	Cooler ID																																																												
Seal Intact	<input checked="" type="checkbox"/>		Temp 9 10 10																																																												
Cooling Media																																																															
# of containers	BTEX F1	VOC	BTEX F1-F2	BTEX F1-F4	Routine Water	Regulated Metals	Total	Dissolved	Mercury	Salinity 4	Sieve (75 micron)	Texture (% Sand, Silt, Clay)	Basic Class II Landfill	BTEX, PHC, FI, F2																																																	
	<input type="checkbox"/>	<input type="checkbox"/>																																																													
Sample Identification				Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	HOLD - DO NOT ANALYZE												Special Instructions																																											
1	BH 59 M	-	2016/05/26	9:45	CSW	4																																																									
2	BH 58 M	-		10:10		4																																																									
3	BH 48 M	-		10:30		4																																																									
4	MW 74-14	-		11:15		4																																																									
5	MW 82-15	-		11:40		4																																																									
6	MW 75-14	-		12:20		4																																																									
7	DUP 16-02	-		12:20		4																																																									
8	BH 50 M	-		13:15		4																																																									
9	MW 76-14	-		13:45		4																																																									
10	BH 54 M	-		14:20		4																																																									
Please indicate Filtered, Preserved or Both (F, P, F/P)																																																															
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<u>J. Chamulak</u>		<u>2016/05/26</u>		<u>16:10</u>		<u>JOSH KINASBURY</u>		<u>2016/05/26</u>		<u>16:14</u>		<u>B641208JWF</u>																																																			

Invoice Information				Report Information (if differs from invoice)				Project Information				Turnaround Time (TAT) Required																																																																																													
Company : <u>Golder Associates.</u>				Company:				Quotation #:				<input checked="" type="checkbox"/> 5 - 7 Days Regular (Most analyses)																																																																																													
Contact Name: <u>Steven Fiddler</u>				Contact Name:				P.O. #/ AFE#:				PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS																																																																																													
Address: <u>16820 107 Ave</u> <u>Edmonton AB T5P4C3</u>				Address:				Project #: <u>529387-6000</u>				Rush TAT (Surcharges will be applied)																																																																																													
Phone: <u>780 483 3499 / 780 984 6600</u>				Phone:				Site Location: <u>EIA</u>				<input type="checkbox"/> Same Day <input type="checkbox"/> 2 Days <input type="checkbox"/> 1 Day <input type="checkbox"/> 3-4 Days																																																																																													
Email: <u>sfiddler@golder.com</u>				Email: <u>CSMDataQuality@golder.com</u>				Site #:				Date Required:																																																																																													
Copies: <u>jchenula@golder.com</u>				Copies:				Sampled By: <u>J. Chenula</u>				Rush Confirmation #:																																																																																													
Laboratory Use Only						Analysis Requested										Regulatory Criteria																																																																																									
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	YES	NO	Cooler ID																																																																																																						
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Sample Identification				Depth (Unit)	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix									Special Instructions																																																																																									
1	BH 55 M			-	2016/05/26	1450	ECW	4								X																																																																																									
2	BH 64 M			-	↓	1520	↓	4								X																																																																																									
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<u>[Signature]</u>				2016/05/26		16:10		<u>[Signature]</u>				2016/05/26		16:14		B641208 JWP																																																																																									

GOLDER DATA QUALITY REVIEW CHECKLISTSite Location: PWGSC - EIASampling Date: September 19, 2016Golder Project Number: 1657760Laboratory: Maxxam EdmontonLab Submission Number: B681163

Was the Cooler Received at the lab under a sealed and intact custody seal?	<u>Yes</u>
Was proper chain of custody of the samples documented and kept?	<u>Yes</u>
Were sample temperatures acceptable when they reached lab?:	<u>Yes</u>
Were all samples analyzed and extracted within hold times?:	<u>Yes</u>
Has lab warranted all tests were in statistical control in CoA?:	<u>Yes</u>
Was sufficient sample provided for the requested analysis?	<u>Yes</u>
Has lab warranted all samples were analyzed with limited headspace present?:	<u>Yes</u>

Are All Laboratory QC Within Acceptance Criteria (Yes, No, Not Applicable)?


	Yes	No	NA	Comments
Surrogate Recovery	X			All laboratory QC results are within acceptance criteria.
Method Blank Concentration	X			
Laboratory Duplicate RPD	X			
Matrix Spike Recovery	X			
Blank Spike Recovery	X			

Are All Field QC Samples Within Alert Limits (Yes, No, Not Applicable)?

	Yes	No	NA	Comments
Field Blank Concentration			X	No field QC samples were collected.
Trip Blank Concentration			X	
Field Duplicate RPD			X	

Is data considered reliable (Yes/No/Suspect)?: Yes

If answer is "No" or "Suspect", describe and provide rationale:

Data Reviewed by (Print): Jenny MusijowskiData Reviewed by (Signature): Date: September 27, 2016

Your Project #: 1657760, AOMC

Site Location: EIA

Your C.O.C. #: M17812

Attention: Steven Fiddler

GOLDER ASSOCIATES LTD
16820-107 AVE
EDMONTON, AB
CANADA T5P 4C3

Report Date: 2016/09/21

Report #: R2265485

Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B681163

Received: 2016/09/19, 14:44

Sample Matrix: Water

Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO ₃ ,HCO ₃ ,OH	1	N/A	2016/09/20	AB SOP-00005	SM 22 2320 B m
BTEX/F1 in Water by HS GC/MS/FID	1	N/A	2016/09/20	AB SOP-00039	CCME CWS/EPA 8260c m
Cadmium - low level CCME (Total)	1	N/A	2016/09/20	AB WI-00065	Auto Calc
Chloride by Automated Colourimetry	1	N/A	2016/09/20	AB SOP-00020	SM 22 4500-Cl G m
Conductivity @25C	1	N/A	2016/09/20	AB SOP-00005	SM 22 2510 B m
CCME Hydrocarbons in Water (F2; C10-C16)	1	2016/09/20	2016/09/20	AB SOP-00040 / AB SOP-00037	CCME PHC-CWS m
Hardness	1	N/A	2016/09/20	AB WI-00065	Auto Calc
Elements by ICP-Dissolved-Lab Filtered	1	N/A	2016/09/20	AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICP - Total	1	2016/09/20	2016/09/20	AB SOP-00014 / AB SOP-00042	EPA 200.7 CFR 2012 m
Elements by ICPMS - Total	1	2016/09/20	2016/09/20	AB SOP-00014 / AB SOP-00043	EPA 200.8 R5.4 m
Ion Balance	1	N/A	2016/09/20	AB WI-00065	Auto Calc
Sum of cations, anions	1	N/A	2016/09/20	AB WI-00065	Auto Calc
Nitrate and Nitrite	1	N/A	2016/09/20	AB WI-00065	Auto Calc
Nitrate + Nitrite-N (calculated)	1	N/A	2016/09/20	AB WI-00065	Auto Calc
Nitrogen, (Nitrite, Nitrate) by IC	1	N/A	2016/09/20	AB SOP-00023	SM 22 4110 B m
pH @25°C	1	N/A	2016/09/20	AB SOP-00005	SM 22 4500 H+ B m
Sulphate by Automated Colourimetry	1	N/A	2016/09/20	AB SOP-00018	SM 22 4500-SO ₄ E m
Total Dissolved Solids (Calculated)	1	N/A	2016/09/20	AB WI-00065	Auto Calc

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

Your Project #: 1657760, AOMC

Site Location: EIA

Your C.O.C. #: M17812

Attention: Steven Fiddler

GOLDER ASSOCIATES LTD
16820-107 AVE
EDMONTON, AB
CANADA T5P 4C3

Report Date: 2016/09/21

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CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B681163

Received: 2016/09/19, 14:44

Encryption Key

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

Alaina Hunter, Dip. BioSci, Project Manager, Environmental

Email: AHunter@maxxam.ca

Phone# (780)577-7139

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

Maxxam Job #: B681163
Report Date: 2016/09/21

GOLDER ASSOCIATES LTD
Client Project #: 1657760, AOMC
Site Location: EIA
Sampler Initials: RB

Sample Details/Parameters	Result	RDL	UNITS	MU	Extracted	Analyzed	By	Batch
PN8028 LTF-WS16-01								
Sampling Date	2016/09/19							
Matrix	W							
Sample #	LTF-WS16-01							
RESULTS OF CHEMICAL ANALYSES OF WATER								
Calculated Parameters								
Anion Sum	1.6	N/A	meq/L	N/A	2016/09/20	2016/09/20		8402300
Cation Sum	1.7	N/A	meq/L	N/A	2016/09/20	2016/09/20		8402300
Hardness (CaCO ₃)	70	0.50	mg/L	N/A	2016/09/20	2016/09/20		8402298
Ion Balance	1.1	0.010	N/A	N/A	2016/09/20	2016/09/20		8402299
Dissolved Nitrate (NO ₃)	<0.044	0.044	mg/L	N/A	2016/09/20	2016/09/20		8402301
Nitrate plus Nitrite (N)	<0.020	0.020	mg/L	N/A	2016/09/20	2016/09/20		8402302
Dissolved Nitrite (NO ₂)	<0.033	0.033	mg/L	N/A	2016/09/20	2016/09/20		8402301
Calculated Total Dissolved Solids	86	10	mg/L	N/A	2016/09/20	2016/09/20		8402304
Misc. Inorganics								
Conductivity	160	1.0	uS/cm	+/- 15	2016/09/20	2016/09/20	MA4	8403952
pH	9.64	N/A	pH	+/- 0.140	2016/09/20	2016/09/20	MA4	8403948
Low Level Elements								
Total Cadmium (Cd)	<0.020	0.020	ug/L	N/A	2016/09/20	2016/09/20		8403291
Anions								
Dissolved Chloride (Cl)	2.7	1.0	mg/L	+/- <RDL	2016/09/20	2016/09/20	KD5	8403321
Alkalinity (PP as CaCO ₃)	14	0.50	mg/L	+/- 2.8	2016/09/20	2016/09/20	MA4	8403951
Alkalinity (Total as CaCO ₃)	69	0.50	mg/L	+/- 3.2	2016/09/20	2016/09/20	MA4	8403951
Bicarbonate (HCO ₃)	49	0.50	mg/L	+/- 18	2016/09/20	2016/09/20	MA4	8403951
Carbonate (CO ₃)	17	0.50	mg/L	N/A	2016/09/20	2016/09/20	MA4	8403951
Hydroxide (OH)	<0.50	0.50	mg/L	N/A	2016/09/20	2016/09/20	MA4	8403951
Dissolved Sulphate (SO ₄)	9.1	1.0	mg/L	+/- 1.9	2016/09/20	2016/09/20	KD5	8403326
Nutrients								
Dissolved Nitrite (N)	<0.010	0.010	mg/L	N/A	2016/09/20	2016/09/20	LMD	8404246
Dup.Dissolved Nitrite (N)	<0.010	0.010	mg/L	N/A	2016/09/20	2016/09/20	LMD	8404246
Dissolved Nitrate (N)	<0.010	0.010	mg/L	N/A	2016/09/20	2016/09/20	LMD	8404246
Dup.Dissolved Nitrate (N)	<0.010	0.010	mg/L	N/A	2016/09/20	2016/09/20	LMD	8404246
PETROLEUM HYDROCARBONS (CCME)								
Ext. Pet. Hydrocarbon								
F2 (C10-C16 Hydrocarbons)	<0.10	0.10	mg/L	N/A	2016/09/20	2016/09/20	PK4	8401562
O-TERPHENYL (sur.)	106	50 - 130	%	N/A	2016/09/20	2016/09/20	PK4	8401562
ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)								
Elements								
Total Aluminum (Al)	0.042	0.0030	mg/L	+/- 0.012	2016/09/20	2016/09/20	APY	8404154
Total Antimony (Sb)	0.0024	0.00060	mg/L	+/- 0.0011	2016/09/20	2016/09/20	APY	8404154
Total Arsenic (As)	0.040	0.00020	mg/L	+/- 0.0065	2016/09/20	2016/09/20	APY	8404154
Total Barium (Ba)	0.046	0.010	mg/L	+/- <RDL	2016/09/20	2016/09/20	PM5	8404156
Dup.Total Barium (Ba)	0.047	0.010	mg/L	+/- <RDL	2016/09/20	2016/09/20	PM5	8404156
Total Beryllium (Be)	<0.0010	0.0010	mg/L	N/A	2016/09/20	2016/09/20	APY	8404154
Total Boron (B)	0.11	0.020	mg/L	+/- <RDL	2016/09/20	2016/09/20	PM5	8404156
Dup.Total Boron (B)	0.11	0.020	mg/L	+/- <RDL	2016/09/20	2016/09/20	PM5	8404156
Total Calcium (Ca)	15	0.30	mg/L	+/- 1.5	2016/09/20	2016/09/20	PM5	8404156
Dup.Total Calcium (Ca)	15	0.30	mg/L	+/- 1.5	2016/09/20	2016/09/20	PM5	8404156
Total Chromium (Cr)	<0.0010	0.0010	mg/L	N/A	2016/09/20	2016/09/20	APY	8404154
Total Cobalt (Co)	<0.00030	0.00030	mg/L	N/A	2016/09/20	2016/09/20	APY	8404154
Total Copper (Cu)	0.0023	0.00020	mg/L	+/- 0.00050	2016/09/20	2016/09/20	APY	8404154
Total Iron (Fe)	0.073	0.060	mg/L	+/- <RDL	2016/09/20	2016/09/20	PM5	8404156
Dup.Total Iron (Fe)	0.072	0.060	mg/L	+/- <RDL	2016/09/20	2016/09/20	PM5	8404156
Total Lead (Pb)	<0.00020	0.00020	mg/L	N/A	2016/09/20	2016/09/20	APY	8404154
Total Lithium (Li)	<0.020	0.020	mg/L	N/A	2016/09/20	2016/09/20	PM5	8404156
Dup.Total Lithium (Li)	<0.020	0.020	mg/L	N/A	2016/09/20	2016/09/20	PM5	8404156
Total Magnesium (Mg)	7.9	0.20	mg/L	+/- 0.66	2016/09/20	2016/09/20	PM5	8404156

Maxxam Job #: B681163
Report Date: 2016/09/21

GOLDER ASSOCIATES LTD
Client Project #: 1657760, AOMC
Site Location: EIA
Sampler Initials: RB

Sample Details/Parameters	Result	RDL	UNITS	MU	Extracted	Analyzed	By	Batch
PN8028 LTF-WS16-01								
Sampling Date 2016/09/19								
Matrix W								
Sample # LTF-WS16-01								
ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)								
Elements								
Dup.Total Magnesium (Mg)	8.1	0.20	mg/L	+/- 0.68	2016/09/20	2016/09/20	PM5	8404156
Total Manganese (Mn)	0.0048	0.0040	mg/L	+/- <RDL	2016/09/20	2016/09/20	PM5	8404156
Dup.Total Manganese (Mn)	0.0049	0.0040	mg/L	+/- <RDL	2016/09/20	2016/09/20	PM5	8404156
Total Molybdenum (Mo)	0.0033	0.00020	mg/L	+/- 0.00058	2016/09/20	2016/09/20	APY	8404154
Total Nickel (Ni)	0.0013	0.00050	mg/L	+/- <RDL	2016/09/20	2016/09/20	APY	8404154
Total Phosphorus (P)	<0.10	0.10	mg/L	N/A	2016/09/20	2016/09/20	PM5	8404156
Dup.Total Phosphorus (P)	<0.10	0.10	mg/L	N/A	2016/09/20	2016/09/20	PM5	8404156
Total Potassium (K)	4.1	0.30	mg/L	+/- 0.45	2016/09/20	2016/09/20	PM5	8404156
Dup.Total Potassium (K)	4.2	0.30	mg/L	+/- 0.46	2016/09/20	2016/09/20	PM5	8404156
Total Selenium (Se)	<0.00020	0.00020	mg/L	N/A	2016/09/20	2016/09/20	APY	8404154
Total Silicon (Si)	0.60	0.10	mg/L	+/- <RDL	2016/09/20	2016/09/20	PM5	8404156
Dup.Total Silicon (Si)	0.62	0.10	mg/L	+/- <RDL	2016/09/20	2016/09/20	PM5	8404156
Total Silver (Ag)	<0.00010	0.00010	mg/L	N/A	2016/09/20	2016/09/20	APY	8404154
Total Sodium (Na)	5.8	0.50	mg/L	+/- 0.75	2016/09/20	2016/09/20	PM5	8404156
Dup.Total Sodium (Na)	5.9	0.50	mg/L	+/- 0.76	2016/09/20	2016/09/20	PM5	8404156
Total Strontium (Sr)	0.15	0.020	mg/L	+/- <RDL	2016/09/20	2016/09/20	PM5	8404156
Dup.Total Strontium (Sr)	0.15	0.020	mg/L	+/- <RDL	2016/09/20	2016/09/20	PM5	8404156
Total Sulphur (S)	3.1	0.20	mg/L	+/- 0.21	2016/09/20	2016/09/20	PM5	8404156
Dup.Total Sulphur (S)	3.2	0.20	mg/L	+/- 0.21	2016/09/20	2016/09/20	PM5	8404156
Total Thallium (Tl)	<0.00020	0.00020	mg/L	N/A	2016/09/20	2016/09/20	APY	8404154
Total Tin (Sn)	<0.0010	0.0010	mg/L	N/A	2016/09/20	2016/09/20	APY	8404154
Total Titanium (Ti)	<0.0010	0.0010	mg/L	N/A	2016/09/20	2016/09/20	APY	8404154
Total Uranium (U)	0.00093	0.00010	mg/L	+/- 0.00012	2016/09/20	2016/09/20	APY	8404154
Total Vanadium (V)	0.0046	0.0010	mg/L	+/- 0.0018	2016/09/20	2016/09/20	APY	8404154
Total Zinc (Zn)	<0.0030	0.0030	mg/L	N/A	2016/09/20	2016/09/20	APY	8404154
Lab Filtered Elements								
Dissolved Calcium (Ca)	15	0.30	mg/L	+/- 0.99	2016/09/20	2016/09/20	PM5	8404445
Dup.Dissolved Calcium (Ca)	15	0.30	mg/L	+/- 0.98	2016/09/20	2016/09/20	PM5	8404445
Dissolved Iron (Fe)	<0.060	0.060	mg/L	N/A	2016/09/20	2016/09/20	PM5	8404445
Dup.Dissolved Iron (Fe)	<0.060	0.060	mg/L	N/A	2016/09/20	2016/09/20	PM5	8404445
Dissolved Magnesium (Mg)	7.9	0.20	mg/L	+/- 0.43	2016/09/20	2016/09/20	PM5	8404445
Dup.Dissolved Magnesium (Mg)	7.9	0.20	mg/L	+/- 0.43	2016/09/20	2016/09/20	PM5	8404445
Dissolved Manganese (Mn)	<0.0040	0.0040	mg/L	N/A	2016/09/20	2016/09/20	PM5	8404445
Dup.Dissolved Manganese (Mn)	<0.0040	0.0040	mg/L	N/A	2016/09/20	2016/09/20	PM5	8404445
Dissolved Potassium (K)	4.0	0.30	mg/L	+/- 0.32	2016/09/20	2016/09/20	PM5	8404445
Dup.Dissolved Potassium (K)	4.0	0.30	mg/L	+/- 0.32	2016/09/20	2016/09/20	PM5	8404445
Dissolved Sodium (Na)	5.6	0.50	mg/L	+/- <RDL	2016/09/20	2016/09/20	PM5	8404445
Dup.Dissolved Sodium (Na)	5.7	0.50	mg/L	+/- <RDL	2016/09/20	2016/09/20	PM5	8404445
VOLATILE ORGANICS BY GC-MS (WATER)								
Volatiles								
Benzene	<0.40	0.40	ug/L	N/A	2016/09/21	2016/09/21	HG3	8404610
Toluene	<0.40	0.40	ug/L	N/A	2016/09/21	2016/09/21	HG3	8404610
Ethylbenzene	<0.40	0.40	ug/L	N/A	2016/09/20	2016/09/20	HG3	8402414
m & p-Xylene	<0.80	0.80	ug/L	N/A	2016/09/20	2016/09/20	HG3	8402414
o-Xylene	<0.40	0.40	ug/L	N/A	2016/09/20	2016/09/20	HG3	8402414
Xylenes (Total)	<0.80	0.80	ug/L	N/A	2016/09/20	2016/09/20	HG3	8402414
F1 (C6-C10) - BTEX	<100	100	ug/L	N/A	2016/09/20	2016/09/20	HG3	8402414
F1 (C6-C10)	<100	100	ug/L	N/A	2016/09/20	2016/09/20	HG3	8402414
1,4-Difluorobenzene (sur.)	101	70 - 130	%	N/A	2016/09/20	2016/09/20	HG3	8402414
4-Bromofluorobenzene (sur.)	97	70 - 130	%	N/A	2016/09/20	2016/09/20	HG3	8402414
D4-1,2-Dichloroethane (sur.)	97	70 - 130	%	N/A	2016/09/20	2016/09/20	HG3	8402414

Maxxam Job #: B681163
Report Date: 2016/09/21

GOLDER ASSOCIATES LTD
Client Project #: 1657760, AOMC
Site Location: EIA
Sampler Initials: RB

GENERAL COMMENTS

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

Package 1	10.0°C
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Sample PN8028, BTEX/F1 in Water by HS GC/MS/FID: Test repeated.

Results relate only to the items tested.

Maxxam Job #: B681163
Report Date: 2016/09/21

GOLDER ASSOCIATES LTD
Client Project #: 1657760, AOMC
Site Location: EIA
Sampler Initials: RB

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8401562	PK4	Matrix Spike	O-TERPHENYL (sur.)	2016/09/18		99	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/09/18		95	%	50 - 130
8401562	PK4	Spiked Blank	O-TERPHENYL (sur.)	2016/09/18		99	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/09/18		98	%	70 - 130
8401562	PK4	Method Blank	O-TERPHENYL (sur.)	2016/09/18		96	%	50 - 130
			F2 (C10-C16 Hydrocarbons)	2016/09/18	<0.10		mg/L	
8401562	PK4	RPD	F2 (C10-C16 Hydrocarbons)	2016/09/18	NC		%	40
8402414	HG3	Matrix Spike	1,4-Difluorobenzene (sur.)	2016/09/19		99	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/09/19		99	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/09/19		108	%	70 - 130
			Ethylbenzene	2016/09/19		90	%	70 - 130
			m & p-Xylene	2016/09/19		89	%	70 - 130
			o-Xylene	2016/09/19		91	%	70 - 130
			F1 (C6-C10)	2016/09/19		84	%	70 - 130
8402414	HG3	Spiked Blank	1,4-Difluorobenzene (sur.)	2016/09/19		96	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/09/19		100	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/09/19		105	%	70 - 130
			Ethylbenzene	2016/09/19		80	%	70 - 130
			m & p-Xylene	2016/09/19		79	%	70 - 130
			o-Xylene	2016/09/19		81	%	70 - 130
			F1 (C6-C10)	2016/09/19		100	%	70 - 130
8402414	HG3	Method Blank	1,4-Difluorobenzene (sur.)	2016/09/19		97	%	70 - 130
			4-Bromofluorobenzene (sur.)	2016/09/19		101	%	70 - 130
			D4-1,2-Dichloroethane (sur.)	2016/09/19		108	%	70 - 130
			Ethylbenzene	2016/09/19	<0.40		ug/L	
			m & p-Xylene	2016/09/19	<0.80		ug/L	
			o-Xylene	2016/09/19	<0.40		ug/L	
			Xylenes (Total)	2016/09/19	<0.80		ug/L	
			F1 (C6-C10) - BTEX	2016/09/19	<100		ug/L	
			F1 (C6-C10)	2016/09/19	<100		ug/L	
8402414	HG3	RPD	Ethylbenzene	2016/09/19	NC		%	40
			m & p-Xylene	2016/09/19	NC		%	40
			o-Xylene	2016/09/19	NC		%	40
			Xylenes (Total)	2016/09/19	NC		%	40
			F1 (C6-C10) - BTEX	2016/09/19	NC		%	40
			F1 (C6-C10)	2016/09/19	NC		%	40
8403321	KD5	Matrix Spike	Dissolved Chloride (Cl)	2016/09/20		105	%	80 - 120
8403321	KD5	Spiked Blank	Dissolved Chloride (Cl)	2016/09/20		103	%	80 - 120
8403321	KD5	Method Blank	Dissolved Chloride (Cl)	2016/09/20	<1.0		mg/L	
8403321	KD5	RPD	Dissolved Chloride (Cl)	2016/09/20	NC		%	20
8403326	KD5	Matrix Spike	Dissolved Sulphate (SO4)	2016/09/20		102	%	80 - 120
8403326	KD5	Spiked Blank	Dissolved Sulphate (SO4)	2016/09/20		102	%	80 - 120
8403326	KD5	Method Blank	Dissolved Sulphate (SO4)	2016/09/20	<1.0		mg/L	
8403326	KD5	RPD	Dissolved Sulphate (SO4)	2016/09/20	NC		%	20
8403948	MA4	Spiked Blank	pH	2016/09/20		100	%	97 - 103
8403948	MA4	RPD	pH	2016/09/20	0.21		%	N/A
8403951	MA4	Spiked Blank	Alkalinity (Total as CaCO3)	2016/09/20		100	%	80 - 120
8403951	MA4	Method Blank	Alkalinity (PP as CaCO3)	2016/09/20	<0.50		mg/L	
			Alkalinity (Total as CaCO3)	2016/09/20	<0.50		mg/L	
			Bicarbonate (HCO3)	2016/09/20	<0.50		mg/L	
			Carbonate (CO3)	2016/09/20	<0.50		mg/L	
			Hydroxide (OH)	2016/09/20	<0.50		mg/L	

Maxxam Job #: B681163
Report Date: 2016/09/21

GOLDER ASSOCIATES LTD
Client Project #: 1657760, AOMC
Site Location: EIA
Sampler Initials: RB

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8403951	MA4	RPD	Alkalinity (PP as CaCO ₃)	2016/09/20	NC		%	20
			Alkalinity (Total as CaCO ₃)	2016/09/20	NC		%	20
			Bicarbonate (HCO ₃)	2016/09/20	NC		%	20
			Carbonate (CO ₃)	2016/09/20	NC		%	20
			Hydroxide (OH)	2016/09/20	NC		%	20
8403952	MA4	Spiked Blank	Conductivity	2016/09/20		99	%	90 - 110
8403952	MA4	Method Blank	Conductivity	2016/09/20	<1.0		uS/cm	
8403952	MA4	RPD	Conductivity	2016/09/20	NC		%	20
8404154	APY	Matrix Spike	Total Aluminum (Al)	2016/09/20		95	%	80 - 120
			Total Antimony (Sb)	2016/09/20		103	%	80 - 120
			Total Arsenic (As)	2016/09/20		101	%	80 - 120
			Total Beryllium (Be)	2016/09/20		101	%	80 - 120
			Total Chromium (Cr)	2016/09/20		103	%	80 - 120
			Total Cobalt (Co)	2016/09/20		101	%	80 - 120
			Total Copper (Cu)	2016/09/20		97	%	80 - 120
			Total Lead (Pb)	2016/09/20		98	%	80 - 120
			Total Molybdenum (Mo)	2016/09/20		110	%	80 - 120
			Total Nickel (Ni)	2016/09/20		101	%	80 - 120
			Total Selenium (Se)	2016/09/20		NC	%	80 - 120
			Total Silver (Ag)	2016/09/20		102	%	80 - 120
			Total Thallium (Tl)	2016/09/20		98	%	80 - 120
			Total Tin (Sn)	2016/09/20		102	%	80 - 120
			Total Titanium (Ti)	2016/09/20		102	%	80 - 120
			Total Uranium (U)	2016/09/20		102	%	80 - 120
			Total Vanadium (V)	2016/09/20		106	%	80 - 120
			Total Zinc (Zn)	2016/09/20		NC	%	80 - 120
8404154	APY	Spiked Blank	Total Aluminum (Al)	2016/09/20		98	%	80 - 120
			Total Antimony (Sb)	2016/09/20		94	%	80 - 120
			Total Arsenic (As)	2016/09/20		99	%	80 - 120
			Total Beryllium (Be)	2016/09/20		97	%	80 - 120
			Total Chromium (Cr)	2016/09/20		102	%	80 - 120
			Total Cobalt (Co)	2016/09/20		102	%	80 - 120
			Total Copper (Cu)	2016/09/20		102	%	80 - 120
			Total Lead (Pb)	2016/09/20		100	%	80 - 120
			Total Molybdenum (Mo)	2016/09/20		103	%	80 - 120
			Total Nickel (Ni)	2016/09/20		101	%	80 - 120
			Total Selenium (Se)	2016/09/20		99	%	80 - 120
			Total Silver (Ag)	2016/09/20		99	%	80 - 120
			Total Thallium (Tl)	2016/09/20		97	%	80 - 120
			Total Tin (Sn)	2016/09/20		97	%	80 - 120
			Total Titanium (Ti)	2016/09/20		99	%	80 - 120
			Total Uranium (U)	2016/09/20		99	%	80 - 120
			Total Vanadium (V)	2016/09/20		103	%	80 - 120
			Total Zinc (Zn)	2016/09/20		98	%	80 - 120
8404154	APY	Method Blank	Total Aluminum (Al)	2016/09/20	<0.0030		mg/L	
			Total Antimony (Sb)	2016/09/20	<0.00060		mg/L	
			Total Arsenic (As)	2016/09/20	<0.00020		mg/L	
			Total Beryllium (Be)	2016/09/20	<0.0010		mg/L	
			Total Chromium (Cr)	2016/09/20	<0.0010		mg/L	
			Total Cobalt (Co)	2016/09/20	<0.00030		mg/L	
			Total Copper (Cu)	2016/09/20	<0.00020		mg/L	
			Total Lead (Pb)	2016/09/20	<0.00020		mg/L	

Maxxam Job #: B681163
Report Date: 2016/09/21

GOLDER ASSOCIATES LTD
Client Project #: 1657760, AOMC
Site Location: EIA
Sampler Initials: RB

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Molybdenum (Mo)	2016/09/20	0.00028, RDL=0.00020		mg/L	
			Total Nickel (Ni)	2016/09/20	<0.00050		mg/L	
			Total Selenium (Se)	2016/09/20	<0.00020		mg/L	
			Total Silver (Ag)	2016/09/20	<0.00010		mg/L	
			Total Thallium (Tl)	2016/09/20	<0.00020		mg/L	
			Total Tin (Sn)	2016/09/20	<0.0010		mg/L	
			Total Titanium (Ti)	2016/09/20	<0.0010		mg/L	
			Total Uranium (U)	2016/09/20	<0.00010		mg/L	
			Total Vanadium (V)	2016/09/20	<0.0010		mg/L	
			Total Zinc (Zn)	2016/09/20	<0.0030		mg/L	
8404154	APY	RPD	Total Selenium (Se)	2016/09/20	1.6		%	20
8404156	PM5	Matrix Spike [PN8028-02]	Total Barium (Ba)	2016/09/20		103	%	80 - 120
			Total Boron (B)	2016/09/20		105	%	80 - 120
			Total Calcium (Ca)	2016/09/20		101	%	80 - 120
			Total Iron (Fe)	2016/09/20		104	%	80 - 120
			Total Lithium (Li)	2016/09/20		100	%	80 - 120
			Total Magnesium (Mg)	2016/09/20		103	%	80 - 120
			Total Manganese (Mn)	2016/09/20		100	%	80 - 120
			Total Phosphorus (P)	2016/09/20		99	%	80 - 120
			Total Potassium (K)	2016/09/20		102	%	80 - 120
			Total Silicon (Si)	2016/09/20		97	%	80 - 120
			Total Sodium (Na)	2016/09/20		96	%	80 - 120
			Total Strontium (Sr)	2016/09/20		95	%	80 - 120
8404156	PM5	Spiked Blank	Total Barium (Ba)	2016/09/20		102	%	80 - 120
			Total Boron (B)	2016/09/20		104	%	80 - 120
			Total Calcium (Ca)	2016/09/20		100	%	80 - 120
			Total Iron (Fe)	2016/09/20		102	%	80 - 120
			Total Lithium (Li)	2016/09/20		100	%	80 - 120
			Total Magnesium (Mg)	2016/09/20		102	%	80 - 120
			Total Manganese (Mn)	2016/09/20		101	%	80 - 120
			Total Phosphorus (P)	2016/09/20		99	%	80 - 120
			Total Potassium (K)	2016/09/20		100	%	80 - 120
			Total Silicon (Si)	2016/09/20		96	%	80 - 120
			Total Sodium (Na)	2016/09/20		96	%	80 - 120
			Total Strontium (Sr)	2016/09/20		95	%	80 - 120
			Total Sulphur (S)	2016/09/20		95	%	80 - 120
8404156	PM5	Method Blank	Total Barium (Ba)	2016/09/20	<0.010		mg/L	
			Total Boron (B)	2016/09/20	<0.020		mg/L	
			Total Calcium (Ca)	2016/09/20	<0.30		mg/L	
			Total Iron (Fe)	2016/09/20	<0.060		mg/L	
			Total Lithium (Li)	2016/09/20	<0.020		mg/L	
			Total Magnesium (Mg)	2016/09/20	<0.20		mg/L	
			Total Manganese (Mn)	2016/09/20	<0.0040		mg/L	
			Total Phosphorus (P)	2016/09/20	<0.10		mg/L	
			Total Potassium (K)	2016/09/20	<0.30		mg/L	
			Total Silicon (Si)	2016/09/20	<0.10		mg/L	
			Total Sodium (Na)	2016/09/20	<0.50		mg/L	
			Total Strontium (Sr)	2016/09/20	<0.020		mg/L	
			Total Sulphur (S)	2016/09/20	<0.20		mg/L	
8404156	PM5	RPD [PN8028-02]	Total Barium (Ba)	2016/09/20	NC		%	20
			Total Boron (B)	2016/09/20	4.1		%	20

Maxxam Job #: B681163
Report Date: 2016/09/21

GOLDER ASSOCIATES LTD
Client Project #: 1657760, AOMC
Site Location: EIA
Sampler Initials: RB

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Total Calcium (Ca)	2016/09/20	2.3		%	20
			Total Iron (Fe)	2016/09/20	NC		%	20
			Total Lithium (Li)	2016/09/20	NC		%	20
			Total Magnesium (Mg)	2016/09/20	2.9		%	20
			Total Manganese (Mn)	2016/09/20	NC		%	20
			Total Phosphorus (P)	2016/09/20	NC		%	20
			Total Potassium (K)	2016/09/20	2.2		%	20
			Total Silicon (Si)	2016/09/20	3.6		%	20
			Total Sodium (Na)	2016/09/20	2.0		%	20
			Total Strontium (Sr)	2016/09/20	2.9		%	20
			Total Sulphur (S)	2016/09/20	1.7		%	20
8404246	LMD	Matrix Spike [PN8028-01]	Dissolved Nitrite (N)	2016/09/20		96	%	80 - 120
			Dissolved Nitrate (N)	2016/09/20		98	%	80 - 120
8404246	LMD	Spiked Blank	Dissolved Nitrite (N)	2016/09/20		99	%	80 - 120
			Dissolved Nitrate (N)	2016/09/20		100	%	80 - 120
8404246	LMD	Method Blank	Dissolved Nitrite (N)	2016/09/20	<0.010		mg/L	
			Dissolved Nitrate (N)	2016/09/20	<0.010		mg/L	
8404246	LMD	RPD [PN8028-01]	Dissolved Nitrite (N)	2016/09/20	NC		%	20
			Dissolved Nitrate (N)	2016/09/20	NC		%	20
8404445	PM5	Matrix Spike [PN8028-01]	Dissolved Calcium (Ca)	2016/09/20		95	%	80 - 120
			Dissolved Iron (Fe)	2016/09/20		101	%	80 - 120
			Dissolved Magnesium (Mg)	2016/09/20		102	%	80 - 120
			Dissolved Manganese (Mn)	2016/09/20		100	%	80 - 120
			Dissolved Potassium (K)	2016/09/20		100	%	80 - 120
			Dissolved Sodium (Na)	2016/09/20		93	%	80 - 120
8404445	PM5	Spiked Blank	Dissolved Calcium (Ca)	2016/09/20		95	%	80 - 120
			Dissolved Iron (Fe)	2016/09/20		101	%	80 - 120
			Dissolved Magnesium (Mg)	2016/09/20		102	%	80 - 120
			Dissolved Manganese (Mn)	2016/09/20		100	%	80 - 120
			Dissolved Potassium (K)	2016/09/20		100	%	80 - 120
			Dissolved Sodium (Na)	2016/09/20		95	%	80 - 120
8404445	PM5	Method Blank	Dissolved Calcium (Ca)	2016/09/20	<0.30		mg/L	
			Dissolved Iron (Fe)	2016/09/20	<0.060		mg/L	
			Dissolved Magnesium (Mg)	2016/09/20	<0.20		mg/L	
			Dissolved Manganese (Mn)	2016/09/20	<0.0040		mg/L	
			Dissolved Potassium (K)	2016/09/20	<0.30		mg/L	
			Dissolved Sodium (Na)	2016/09/20	<0.50		mg/L	
8404445	PM5	RPD [PN8028-01]	Dissolved Calcium (Ca)	2016/09/20	0.55		%	20
			Dissolved Iron (Fe)	2016/09/20	NC		%	20
			Dissolved Magnesium (Mg)	2016/09/20	0.71		%	20
			Dissolved Manganese (Mn)	2016/09/20	NC		%	20
			Dissolved Potassium (K)	2016/09/20	0.52		%	20
			Dissolved Sodium (Na)	2016/09/20	1.4		%	20
8404610	HG3	Matrix Spike	Benzene	2016/09/20		96	%	70 - 130
			Toluene	2016/09/20		86	%	70 - 130
8404610	HG3	Spiked Blank	Benzene	2016/09/21		86	%	70 - 130
			Toluene	2016/09/21		85	%	70 - 130
8404610	HG3	Method Blank	Benzene	2016/09/20	<0.40		ug/L	
			Toluene	2016/09/20	<0.40		ug/L	
8404610	HG3	RPD	Benzene	2016/09/21	NC		%	40

Maxxam Job #: B681163
Report Date: 2016/09/21

GOLDER ASSOCIATES LTD
Client Project #: 1657760, AOMC
Site Location: EIA
Sampler Initials: RB

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC			Date					
Batch	Init	QC Type	Parameter	Analyzed	Value	Recovery	UNITS	QC Limits
			Toluene	2016/09/21	NC		%	40
N/A = Not Applicable								
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.								
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.								
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.								
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.								
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.								
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).								
NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).								

Maxxam Job #: B681163
Report Date: 2016/09/21

GOLDER ASSOCIATES LTD
Client Project #: 1657760, AOMC
Site Location: EIA
Sampler Initials: RB

VALIDATION SIGNATURE PAGE

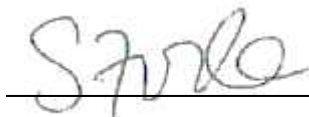
The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Daniel Reslan, cCT, QP, Organics Supervisor



Justin Geisel, B.Sc., Organics Supervisor



Suwan Fock, B.Sc., QP, Inorganics Senior Analyst

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

9/938

CHAIN OF CUSTODY RECORD

M 17812

Page 1 of 1

Invoice Information		Report Information (if differs from invoice)		Project Information		Turnaround Time (TAT) Required																																																																																																																																																																																																			
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Contact Name: <u>Steven Fiddler</u>		Contact Name: _____		P.O. #/ AFE#: _____		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS																																																																																																																																																																																																			
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Email: <u>sfiddler@golder.com</u>		Email: _____		Site #: _____		Date Required: <u>Sept 20/16</u>																																																																																																																																																																																																			
Copies: <u>csmdataguality@golder.com</u>		Copies: _____		Sampled By: <u>R. Boyce</u>		Rush Confirmation #: _____																																																																																																																																																																																																			
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APPENDIX E

Mann-Kendall Trend Analyses

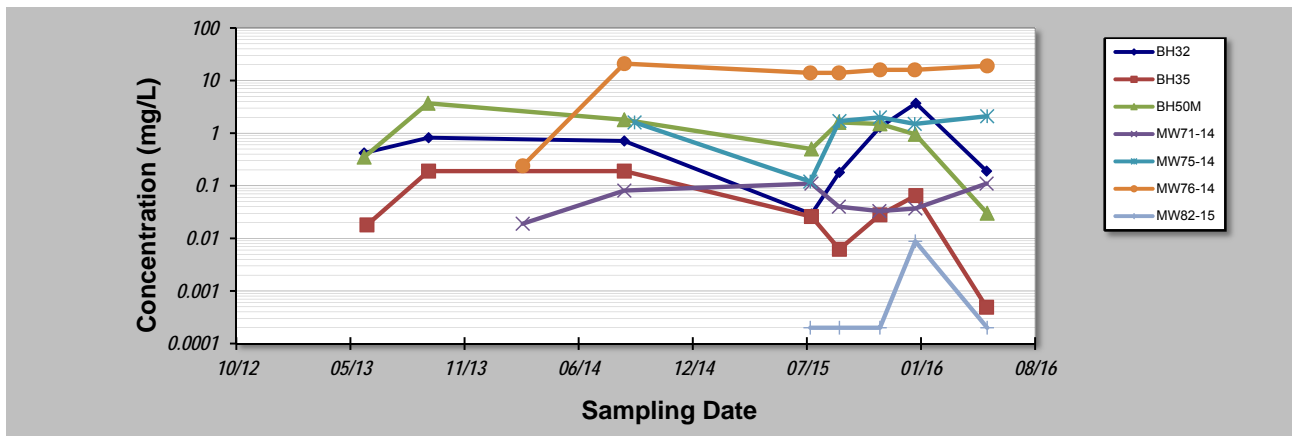
GSI MANN-KENDALL TOOLKIT

for Constituent Trend Analysis

Evaluation Date: **26-Oct-16**
 Facility Name: **PWGSC - AOMC**
 Conducted By: **Rebecca Boyce**

Job ID: **1657760**
 Constituent: **Benzene**
 Concentration Units: **mg/L**

Sampling Point ID:		BH32	BH35	BH50M	MW71-14	MW75-14	MW76-14	MW82-15
Sampling Event	Sampling Date	BENZENE CONCENTRATION (mg/L)						
1	30-May-13	0.42		0.35				
2	4-Jun-13		0.018					
3	19-Sep-13			3.7				
4	20-Sep-13	0.82	0.19					
5	4-Mar-14				0.019		0.24	
6	29-Aug-14	0.71	0.19	1.8	0.081		21	
7	16-Sep-14					1.6		
8	21-Jul-15					0.12	14	0.0002
9	23-Jul-15	0.029	0.026	0.5	0.11			
10	9-Sep-15			1.6	0.04		14	
11	10-Sep-15	0.18	0.0062			1.7		0.0002
12	19-Nov-15				0.033			
13	20-Nov-15	1.3	0.028	1.5		2	16	0.0002
14	20-Jan-16					1.5	16	
15	21-Jan-16			0.95	0.037			0.0088
16	22-Jan-16	3.7	0.065					
17	25-May-16	0.19	0.00049		0.11			
18	26-May-16			0.03		2.1	19	0.0002
19								
20								
Coefficient of Variation:		1.30	1.21	0.89	0.62	0.48	0.47	2.00
Mann-Kendall Statistic (S):		4	-7	-10	4	7	9	2
Confidence Factor:		64.0%	76.4%	86.2%	66.7%	86.4%	88.1%	59.2%
Concentration Trend:		No Trend	No Trend	Stable	No Trend	No Trend	No Trend	No Trend



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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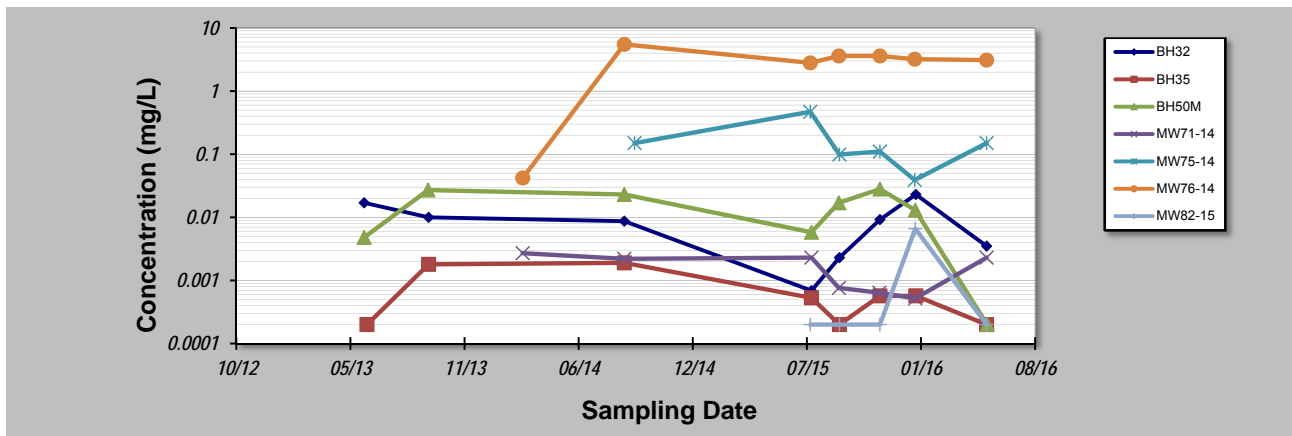
GSI MANN-KENDALL TOOLKIT

for Constituent Trend Analysis

Evaluation Date: **26-Oct-16**
 Facility Name: **PWGSC - AOMC**
 Conducted By: **Rebecca Boyce**

Job ID: **1657760**
 Constituent: **Toluene**
 Concentration Units: **mg/L**

Sampling Point ID:		BH32	BH35	BH50M	MW71-14	MW75-14	MW76-14	MW82-15
Sampling Event	Sampling Date	TOLUENE CONCENTRATION (mg/L)						
1	30-May-13	0.017		0.0048				
2	4-Jun-13		0.0002					
3	19-Sep-13			0.027				
4	20-Sep-13	0.01	0.0018					
5	4-Mar-14				0.0027		0.042	
6	29-Aug-14	0.0087	0.0019	0.023	0.0022		5.5	
7	16-Sep-14					0.15		
8	21-Jul-15					0.47	2.8	0.0002
9	23-Jul-15	0.00069	0.00053	0.0058	0.0023			
10	9-Sep-15			0.017	0.00076		3.6	
11	10-Sep-15	0.0023	0.0002			0.099		0.0002
12	19-Nov-15				0.00064			
13	20-Nov-15	0.0092	0.00057	0.028		0.11	3.6	0.0002
14	20-Jan-16					0.039	3.2	
15	21-Jan-16			0.013	0.00052			0.0066
16	22-Jan-16	0.023	0.00057					
17	25-May-16	0.0035	0.0002		0.0023	0.15	3.1	0.0002
18	26-May-16			0.0002				
19								
20								
Coefficient of Variation:		0.82	0.94	0.72	0.58	0.90	0.52	1.93
Mann-Kendall Statistic (S):		-4	-4	-4	-10	-4	0	2
Confidence Factor:		64.0%	64.0%	64.0%	90.7%	70.3%	37.9%	59.2%
Concentration Trend:		Stable	Stable	Stable	Prob. Decreasing	Stable	Stable	No Trend



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing (S>0) or decreasing (S<0): >95% = Increasing or Decreasing; ≥ 90% = Probably Increasing or Probably Decreasing; < 90% and S>0 = No Trend; < 90%, S≤0, and COV ≥ 1 = No Trend; < 90% and COV < 1 = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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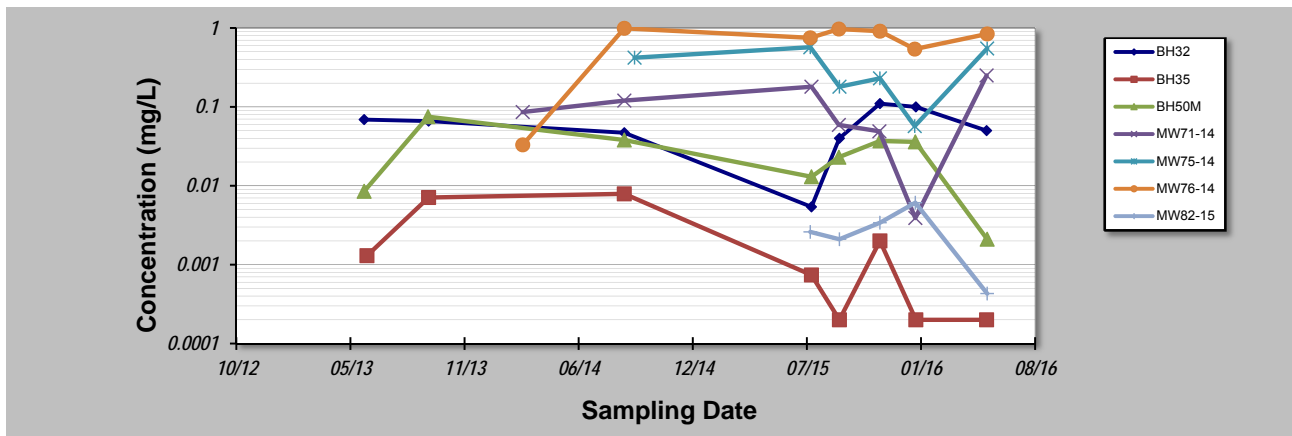
GSI MANN-KENDALL TOOLKIT

for Constituent Trend Analysis

Evaluation Date: **4-Mar-16**
 Facility Name: **PWGSC - AOMC**
 Conducted By: **Jeff Rogers**

Job ID: **1529387**
 Constituent: **Ethylbenzene**
 Concentration Units: **mg/L**

Sampling Point ID:		BH32	BH35	BH50M	MW71-14	MW75-14	MW76-14	MW82-15
Sampling Event	Sampling Date	ETHYLBENZENE CONCENTRATION (mg/L)						
1	30-May-13	0.069		0.0085				
2	4-Jun-13		0.0013					
3	19-Sep-13			0.075				
4	20-Sep-13	0.066	0.0071					
5	4-Mar-14				0.086		0.033	
6	29-Aug-14	0.047	0.0079	0.038	0.12		0.99	
7	16-Sep-14					0.42		
8	21-Jul-15					0.57	0.75	0.0026
9	23-Jul-15	0.0054	0.00074	0.013	0.18			
10	9-Sep-15			0.023	0.059		0.97	
11	10-Sep-15	0.04	0.0002			0.18		0.0021
12	19-Nov-15				0.049			
13	20-Nov-15	0.11	0.002	0.037		0.23	0.91	0.0034
14	20-Jan-16					0.057	0.54	
15	21-Jan-16			0.036	0.0039			0.0061
16	22-Jan-16	0.1	0.0002					
17	25-May-16	0.05	0.0002		0.25			
18	26-May-16			0.0021		0.55	0.84	0.00043
19								
20								
Coefficient of Variation:		0.55	1.30	0.80	0.79	0.63	0.47	0.71
Mann-Kendall Statistic (S):		0	-13	-6	-3	-3	-1	0
Confidence Factor:		45.2%	92.9%	72.6%	61.4%	64.0%	50.0%	40.8%
Concentration Trend:		Stable	Prob. Decreasing	Stable	Stable	Stable	Stable	Stable



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing ($S > 0$) or decreasing ($S < 0$): $> 95\%$ = Increasing or Decreasing; $\geq 90\%$ = Probably Increasing or Probably Decreasing; $< 90\%$ and $S > 0$ = No Trend; $< 90\%$, $S \leq 0$, and $COV \geq 1$ = No Trend; $< 90\%$ and $COV < 1$ = Stable.
- Methodology based on "MAROS: A Decision Support System for Optimizing Monitoring Plans", J.J. Aziz, M. Ling, H.S. Rifai, C.J. Newell, and J.R. Gonzales, *Ground Water*, 41(3):355-367, 2003.

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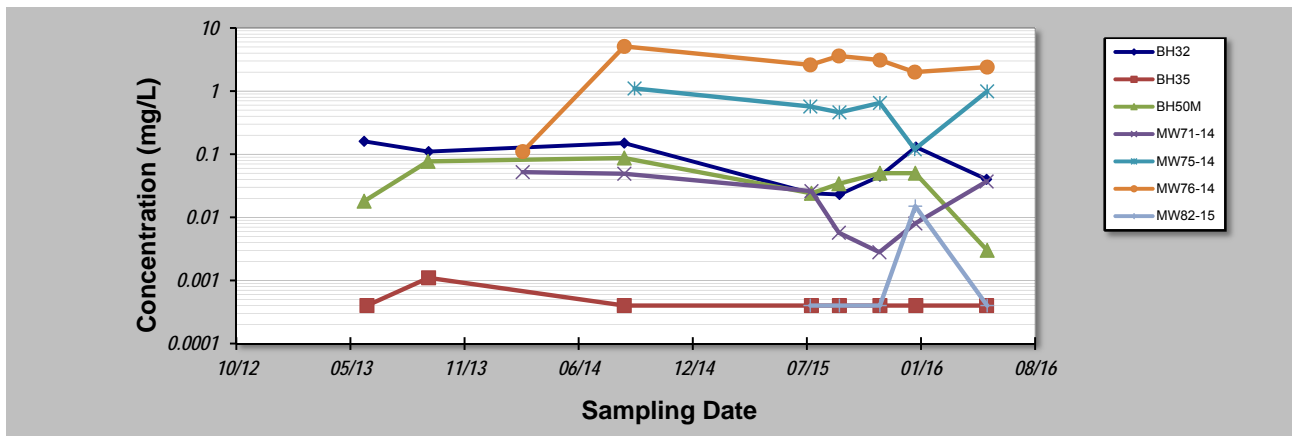
GSI MANN-KENDALL TOOLKIT

for Constituent Trend Analysis

Evaluation Date: **26-Oct-16**
 Facility Name: **PWGSC - AOMC**
 Conducted By: **Rebecca Boyce**

Job ID: **1657760**
 Constituent: **Xylene**
 Concentration Units: **mg/L**

Sampling Point ID:		BH32	BH35	BH50M	MW71-14	MW75-14	MW76-14	MW82-15
Sampling Event	Sampling Date	XYLENE CONCENTRATION (mg/L)						
1	30-May-13	0.16		0.018				
2	4-Jun-13		0.0004					
3	19-Sep-13			0.077				
4	20-Sep-13	0.11	0.0011					
5	4-Mar-14				0.052		0.11	
6	29-Aug-14	0.15	0.0004	0.087	0.049		5.1	
7	16-Sep-14					1.1		
8	21-Jul-15					0.57	2.6	0.0004
9	23-Jul-15	0.024	0.0004	0.024	0.026			
10	9-Sep-15			0.034	0.0057		3.6	
11	10-Sep-15	0.023	0.0004			0.46		0.0004
12	19-Nov-15				0.0028			
13	20-Nov-15	0.045	0.0004	0.05		0.65	3.1	0.0004
14	20-Jan-16					0.12	2	
15	21-Jan-16			0.05	0.008			0.015
16	22-Jan-16	0.13	0.0004					
17	25-May-16	0.04	0.0004		0.037			
18	26-May-16			0.003		0.99	2.4	0.0004
19								
20								
Coefficient of Variation:		0.68	0.51	0.67	0.81	0.55	0.57	1.97
Mann-Kendall Statistic (S):		-10	-5	-3	-9	-3	-3	2
Confidence Factor:		86.2%	68.3%	59.4%	88.1%	64.0%	61.4%	59.2%
Concentration Trend:		Stable	Stable	Stable	Stable	Stable	Stable	No Trend



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing ($S > 0$) or decreasing ($S < 0$): $> 95\%$ = Increasing or Decreasing; $\geq 90\%$ = Probably Increasing or Probably Decreasing; $< 90\%$ and $S > 0$ = No Trend; $< 90\%$, $S \leq 0$, and $COV \geq 1$ = No Trend; $< 90\%$ and $COV < 1$ = Stable.
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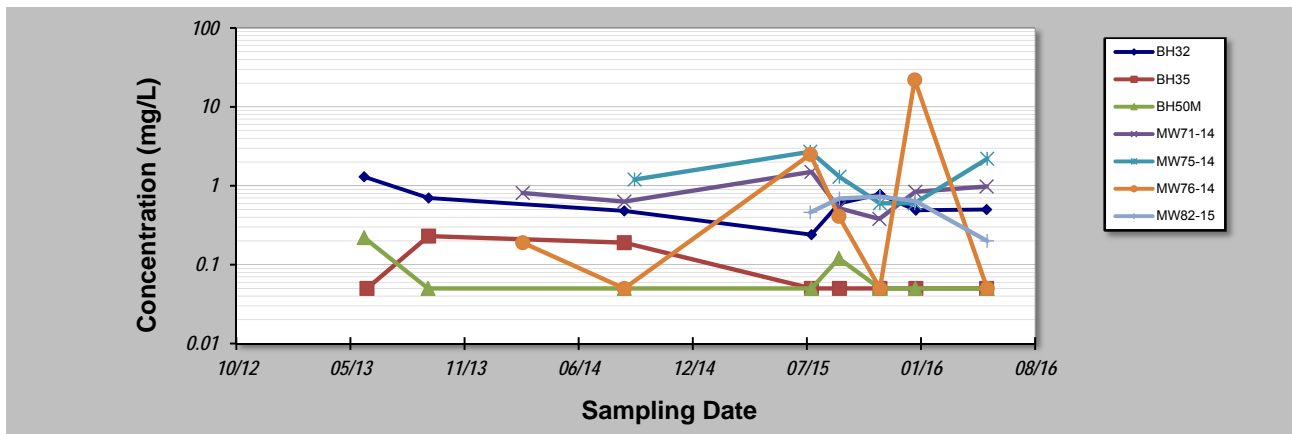
GSI MANN-KENDALL TOOLKIT

for Constituent Trend Analysis

Evaluation Date: **26-Oct-16**
 Facility Name: **PWGS - AOMC**
 Conducted By: **Rebecca Boyce**

Job ID: **1657760**
 Constituent: **PHC F1**
 Concentration Units: **mg/L**

Sampling Point ID:		BH32	BH35	BH50M	MW71-14	MW75-14	MW76-14	MW82-15
Sampling Event	Sampling Date	PHC F1 CONCENTRATION (mg/L)						
1	30-May-13	1.3		0.22				
2	4-Jun-13		0.05					
3	19-Sep-13			0.05				
4	20-Sep-13	0.7	0.23					
5	4-Mar-14				0.81		0.19	
6	29-Aug-14	0.48	0.19	0.05	0.63		0.05	
7	16-Sep-14					1.2		
8	21-Jul-15					2.7	2.5	0.46
9	23-Jul-15	0.24	0.05	0.05	1.5			
10	9-Sep-15			0.12	0.52		0.41	
11	10-Sep-15	0.6	0.05			1.3		0.69
12	19-Nov-15				0.38			
13	20-Nov-15	0.78	0.05	0.05		0.6	0.05	0.73
14	20-Jan-16					0.6	22	
15	21-Jan-16			0.05	0.84			0.64
16	22-Jan-16	0.49	0.05					
17	25-May-16	0.5	0.05		0.98			
18	26-May-16			0.05		2.2	0.05	0.2
19								
20								
Coefficient of Variation:		0.49	0.83	0.77	0.45	0.60	2.26	0.40
Mann-Kendall Statistic (S):		-6	-9	-7	1	-2	0	-2
Confidence Factor:		72.6%	83.2%	76.4%	50.0%	57.0%	37.9%	59.2%
Concentration Trend:		Stable	Stable	Stable	No Trend	Stable	No Trend	Stable



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
- Confidence in Trend = Confidence (in percent) that constituent concentration is increasing ($S > 0$) or decreasing ($S < 0$): $> 95\%$ = Increasing or Decreasing; $\geq 90\%$ = Probably Increasing or Probably Decreasing; $< 90\%$ and $S > 0$ = No Trend; $< 90\%$, $S \leq 0$, and $COV \geq 1$ = No Trend; $< 90\%$ and $COV < 1$ = Stable.
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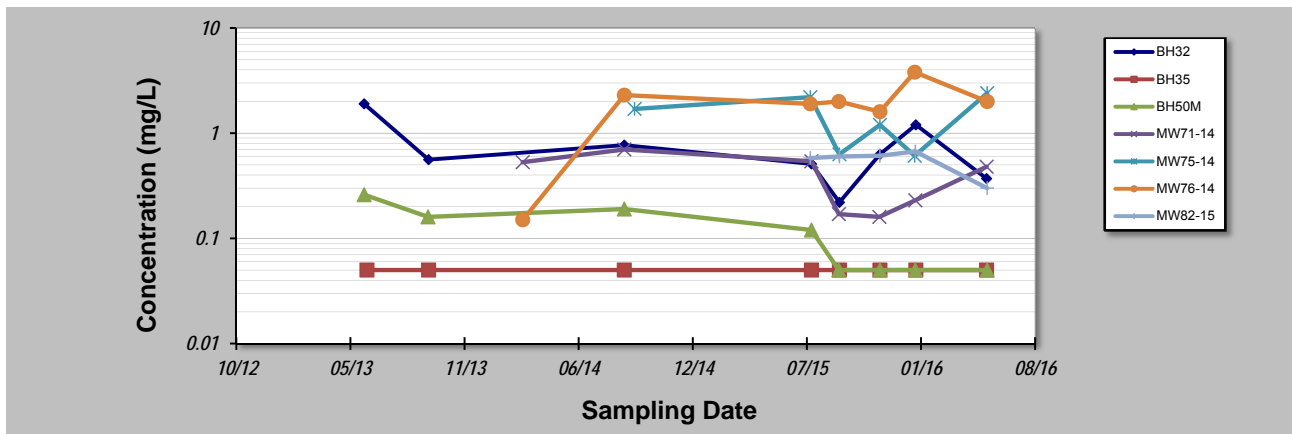
GSI MANN-KENDALL TOOLKIT

for Constituent Trend Analysis

Evaluation Date: **26-Oct-16**
 Facility Name: **PWGSC - AOMC**
 Conducted By: **Rebecca Boyce**

Job ID: **1657760**
 Constituent: **PHC F2**
 Concentration Units: **mg/L**

Sampling Point ID:		BH32	BH35	BH50M	MW71-14	MW75-14	MW76-14	MW82-15
Sampling Event	Sampling Date	PHC F2 CONCENTRATION (mg/L)						
1	30-May-13	1.9		0.26				
2	4-Jun-13		0.05					
3	19-Sep-13			0.16				
4	20-Sep-13	0.56	0.05					
5	4-Mar-14				0.53		0.15	
6	29-Aug-14	0.77	0.05	0.19	0.7		2.3	
7	16-Sep-14					1.7		
8	21-Jul-15					2.2	1.9	0.58
9	23-Jul-15	0.51	0.05	0.12	0.54			
10	9-Sep-15			0.05	0.17		2	
11	10-Sep-15	0.22	0.05			0.63		0.6
12	19-Nov-15				0.16			
13	20-Nov-15	0.63	0.05	0.05		1.2	1.6	0.61
14	20-Jan-16					0.61	3.8	
15	21-Jan-16			0.05	0.23			0.67
16	22-Jan-16	1.2	0.05					
17	25-May-16	0.37	0.05		0.48			
18	26-May-16			0.05		2.4	2	0.3
19								
20								
Coefficient of Variation:		0.70	0.00	0.69	0.53	0.53	0.55	0.26
Mann-Kendall Statistic (S):		-8	0	-20	-7	-1	6	2
Confidence Factor:		80.1%	45.2%	99.3%	80.9%	50.0%	76.4%	59.2%
Concentration Trend:		Stable	Stable	Decreasing	Stable	Stable	No Trend	No Trend



Notes:

- At least four independent sampling events per well are required for calculating the trend. *Methodology is valid for 4 to 40 samples.*
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