



2013 PROGRAM REPORT
SOUTH ATHABASCA OIL SANDS AREA
REGIONAL GROUNDWATER MONITORING NETWORK

Report Prepared for:
ALBERTA ENVIRONMENT AND SUSTAINABLE RESOURCE DEVELOPMENT

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EXECUTIVE SUMMARY

Alberta Environment and Sustainable Resource Development (ESRD) retained Matrix Solutions Inc. to conduct the 2013 groundwater monitoring program for the South Athabasca Oil Sands (SAOS) regional groundwater monitoring network. The scope of work for 2013 included: conducting two monitoring events at SAOS monitoring wells installed in 2012; locating, monitoring and sampling existing Alberta Geologic Survey (AGS) wells recommended for inclusion in the SAOS regional groundwater monitoring network; evaluating government and industry wells for recommendation into the SAOS regional groundwater monitoring network; and developing a web-based data viewer for the 2013 SAOS Regional Groundwater Monitoring Program.

The monitoring network is being developed based on the guidance document by Matrix (2013) that provides a framework for the SAOS area and recommendations for key monitoring locations. The groundwater monitoring network is being implemented as a phased approach. Phase 1 began in 2012, and included drilling and installing monitoring wells at priority monitoring locations. Phase 1 involved installing 19 monitoring wells at 5 surface locations, which are completed in 7 different unconsolidated aquifers (plus 2 existing completions at one of the locations). These wells were monitored and sampled in September (21 wells) and October/November (28 wells).

Phase 2 began in 2013, and was focussed on the most heavily used (projected use) aquifers in the SAOS area and three investigation areas of the SAOS area. In the context of existing operator wells that may be suitable for the regional groundwater monitoring well network, this 2013 scope of work built off the recommendations of Matrix (2013). Synergies identified in Matrix (2013) were reviewed and specific monitoring locations were flagged as being most relevant to the network. Relevant locations included those that were not part of existing compliance monitoring, wells located nearest to areas of concern, locations that provided good spatial aquifer coverage, locations with sufficient data and nested locations. Data requests regarding these wells were then submitted to select operators. Matrix (2013) identified synergies with existing completions at five monitoring locations (three belonging to SAOS operators and two belonging to ESRD [formerly owned by AGS]). In addition, existing monitoring well locations that belong to SAOS operators that fall within two of the three Investigation Areas were identified by Matrix (2013). In one instance the operator in question provided an alternative monitoring well location for consideration. Phase 2 monitoring locations that belong to SAOS operators are recommended for inclusion into the SAOS regional monitoring network; ESRD will work collaboratively to officially add these locations to the network and develop a groundwater monitoring plan at these locations. It is recommended that ESRD continue communications with all SAOS operators to aid in the iterative development of the regional groundwater monitoring well network.

Water levels measured through 2013 at SAOS monitoring locations showed spatial variability, with recharge conditions at most locations. Unconsolidated aquifers showed stable groundwater levels, with seasonal fluctuations apparent in a few wells located adjacent to surface water bodies. Water levels in bedrock aquifers at locations with longer records show some changes and trends that may be related to

withdrawal from and disposal to bedrock aquifers. It is recommended that water level measurements continue to be recorded on a continuous basis at ESRD-owned wells.

Temperatures in existing SAOS monitoring wells were recorded at regular intervals with continuous data loggers; pressure transducers installed in all ESRD-owned monitoring wells record temperatures, as well as secondary temperature gauges that were installed at different depths within select monitoring wells. Accurate temperature measurement is important as it can provide insight into surface water groundwater interactions (vertically discretized measurements). Temperature measurements recorded above the well screens in monitoring wells may not accurately reflect the formation temperature. As such, it is recommended that temperature gauges be placed within monitoring well screens where possible and these gauges should be set to measure continuously.

The Groundwater Management Framework for the Lower Athabasca Region includes interim triggers for indicator parameters defined for the SAOS region (temperature increase, total dissolved solids, chloride, arsenic, silica, boron, benzene, toluene, ethylbenzene and xylenes, and phenols); results from the 2013 SAOS program were compared to the SAOS interim groundwater quality triggers (GoA 2012). Interim triggers for water quality parameters were exceeded in existing and recommended SAOS monitoring locations in every aquifer with active monitoring locations. The results indicate that interim trigger values do not reflect the spatial variability of water conditions in key SAOS aquifers. The suitability of a single trigger value for each water quality parameter in each aquifer may not be appropriate due to spatial variability, which should be considered in the development of final trigger values. As such, final trigger values are recommended to be established for each aquifer at each established monitoring location (reference point) as benchmarks for assessing the status of the groundwater system.

Currently, there is insufficient data from the SAOS groundwater monitoring network to conduct statistical analyses to determine if there are statistically significant trends at these reference points. It is recommended that groundwater quality sampling be done semi-annually (at intervals of no less than 4 months) at ESRD-owned wells until final triggers are established. Final triggers may be established once there is sufficient data to reflect the range in variability of the data so that statistical methods can be employed. Specific recommendations are provided for each monitoring location and investigation area, related to instrumentation, groundwater monitoring frequency/parameters, and working with operators in the SAOS region to identify synergies with proposed/existing monitoring locations.

A web-based data viewer, referred to as the Client Data Portal (CDP), was developed for ESRD to access and view all SAOS groundwater monitoring network data that are available to and stored on Matrix databases. Authorized individuals can provide feedback and recommendations to support data quality assurance/quality control beyond the current project completion date. It is recommended to develop a publically accessible web-based data viewer that builds on the current data set and CDP developed by Matrix.

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1 INTRODUCTION

Alberta Environment and Sustainable Resource Development (ESRD) contracted Matrix Solutions Inc. to provide consulting services for the installation, monitoring and sampling of the regional groundwater monitoring network of the South Athabasca Oil Sands (SAOS) Area in 2013.

As part of the strategies to improve land-use decision-making in Alberta, the government through the Land-Use Framework (GoA 2008) created seven land-use regions and called for the development of a regional plan for each. The seven land-use regions included the Lower Athabasca Region which includes a substantial portion of the Athabasca oil sands area (approximately 82% of the province's oil sands resource and much of the Cold Lake oil sands area). The Athabasca River is the main source of water for oil sands mining activities, while groundwater provides the main source of water used for in situ oil sands activities in the region (GoA 2012).

The SAOS area is located within the Lower Athabasca Regional Planning area (GoA 2008), and covers an area of approximately 35,000 km², south of Fort McMurray, Alberta (Figure 1). The Lower Athabasca Regional Plan (LARP) was released in September 2012 (GoA 2012). Aquifers in the region have the potential to become affected by resource extraction development and other activities occurring in the region (ASRD 2012). To support cumulative effects management at the regional level, the LARP included a Groundwater Management Framework (GMF) encompassing three areas, including the SAOS area. The SAOS regional groundwater monitoring system was designed to assess regional baseline conditions and to facilitate an understanding of potential cumulative effects of oil sands activities on regional groundwater quality and quantity. The monitoring network is being developed based on the guidance document by Matrix (2013) that provides a framework for the SAOS area and recommendations for key monitoring locations (Figure 1). The framework outlined seven objectives of the regulatory framework that are addressed by the proposed groundwater monitoring well network (Table 1).

The first phase of development was initiated in 2013, where five locations identified in Matrix (2013) were selected for the installation of nested monitoring wells, for a total of 19 monitoring wells (Figure 1, Table 2). The locations included:

- Plamondon
- House Crossing
- Mariana Lakes
- Waddell Creek
- Conklin

The House Crossing location already had two existing monitoring wells that belong to Alberta Geologic Survey (AGS; WR-99-1-8 in the shallow aquifer and WR-99-1-230 in the Empress Channel), bringing the total to 21 wells. The wells were monitored during two events during 2013 (September and

October/November). The two locations with existing completions that were monitored during the October/November 2013 event that have been incorporated to the SAOS monitoring network (seven additional wells) include:

- Wiau Lake (WEPA 00-1)
- Winefred Lake (WEPA 00-3)

The wells that are present at the Wiau Lake and Winefred Lake sites have historical water levels available in Lemay and Jean (2002). The 2013 field program is summarized in Table 3.

Finally, data has been provided by various operators for monitoring wells at other locations and investigation areas that are recommended to be incorporated to the SAOS regional groundwater monitoring network.

1.1 Objective

The objectives of this document include:

- discussing the SAOS groundwater monitoring network framework outlined in the *Framework for Development of a Regional Groundwater Monitoring Network - Interim Report, Southern Athabasca Oil Sands Area* (Matrix 2013)
- describing the existing SAOS regional groundwater monitoring network
- describing the work completed in 2013
- discussing key findings of the results from 2013
- providing recommendations for a path forward for development of the SAOS
- providing an introduction to use of the web-based data view (Client Data Portal; CDP) developed to access data for the SAOS groundwater monitoring network

1.2 Scope of Work

The scope of work for the 2013 SAOS groundwater monitoring program included:

- sampling (twice) the SAOS monitoring wells installed in 2012 (21 total wells; Matrix 2013)
- re-developing Conklin 76-7-41
- performing maintenance and/or repairs on Plamondon 68-16-7 as required
- locating, monitoring and sampling existing AGS wells recommended for inclusion in the SAOS regional groundwater monitoring network
- evaluating additional government and industry wells for incorporation into the SAOS regional groundwater monitoring network
- developing a web-based data viewer for the 2013 SAOS Regional Groundwater Monitoring Program (CDP)

- prepare recommendations for the 2014 SAOS regional groundwater monitoring program.

2 BACKGROUND

2.1 South Athabasca Oil Sands Network Objectives

The objectives of the SAOS monitoring network are to increase the understanding of the regional hydrogeological setting by establishing a monitoring network for strategic, investigative and surveillance purposes. Monitoring locations that comprise the SAOS groundwater monitoring network represent a subset of groundwater conditions within SAOS region, and do not necessarily exemplify the full range of variability of groundwater conditions. Rather, SAOS groundwater monitoring locations represent reference locations at which aquifer conditions can be monitored. The objectives of the monitoring network include:

- providing further understanding of natural variability of groundwater conditions
- providing adequate coverage in each key regional aquifer and baseline conditions where possible
- assessing long-term groundwater quality and water level trends, and assessing potential cumulative effects from current and future development activities
- providing data to support development of regional triggers and limits for indicator parameters in key aquifers
- gaining further understanding of regional aquifer interactions, and how/where the groundwater system is connected to surface environments
- collecting relevant information to support the analysis of groundwater-surface water interactions
- providing information to help better understand natural groundwater discharge and constituent flux to the Athabasca and Clearwater rivers
- identifying potential areas that may require additional monitoring
- generating data with which cumulative effects predictions can be improved
- reporting and communicating the results to the public

2.2 Framework for Regional Monitoring Network

A guidance document was prepared for ESRD for the development of the SAOS regional groundwater monitoring network (Matrix 2013). The document's intent was to provide direction as to how to develop a balanced, objective and practical network including:

- meeting the objectives of ESRD's Terms of Reference
- being consistent with Alberta's regulatory framework and goals
- incorporating previous regional groundwater monitoring initiatives in the SAOS area

- assessing and incorporating previous groundwater monitoring network proposals conducted for ESRD
- focusing on current and future in situ oil sands activities and potential effects on groundwater resources
- assessing available existing industry groundwater monitoring wells to which access has been granted
- considering the current understanding of the hydrostratigraphy and groundwater flow (the conceptual model) for the region in a balanced manner, specifically areas of potential concern
- providing ESRD with directional guidance on how to proceed with the implementation of the proposed groundwater monitoring well network
- providing recommendations to ESRD to facilitate the effective management of SAOS area groundwater resources

Table 1 was originally presented in the guidance document (Matrix 2013), and outlines seven specific objectives of the Lower Athabasca Region GMF (GoA 2012) that are addressed by the SAOS groundwater monitoring network. The guidance document also recommended locations that accounted for aspects of the conceptual model including:

- Lakes and Rivers
- Aquifer Extent
- Aquitard Extent (Colorado Group Aquitard)
- Bedrock Incisions
- Drift Thickness
- Recharge versus Discharge
- Aquifer Salinity
- In Situ Oil Sands Groundwater Users and Gas Production
- Shallow Groundwater Users

Budgetary constraints were another important consideration for the design of the SAOS regional monitoring network. Matrix (2013) outlined factors that may influence the budget including safety, access, synergies and sampling limitations.

2.2.1 Sub-networks

Monitoring locations that are part of the SAOS groundwater monitoring network are categorized as sub-networks that fulfill different objectives. The following four types of monitoring were considered in terms of both groundwater quality and quantity:

- Strategic monitoring (sometimes referred to as ambient monitoring) is typically beyond anthropogenic influence and aims to identify background levels and trends. These monitoring locations are considered to be part of Sub-network A.
- Surveillance monitoring provides earlier warning of threshold exceedances and an understanding of cumulative effects. These monitoring locations are considered to be part of Sub-network B.
- Operation monitoring or compliance monitoring is linked to a specific purpose and regulations. This type of monitoring is already being done by operators in the SAOS region and is not included as part of the SAOS regional groundwater monitoring network.
- Investigative monitoring is linked to monitoring areas of special interest (i.e., areas of potential aquifer interaction). These monitoring locations are considered to be part of Sub-network C.

2.3 Regional Monitoring Network Implementation

The guidance document recommended that the SAOS regional groundwater monitoring network should be implemented in a phased approach (Matrix 2013). The development of the network was envisioned as an iterative process in order to optimize logistics, budget and synergies. Six proposed phases of development are described in Matrix (2013). In 2013, Phase 1 was implemented and Phase 2 was initiated, as described in Section 4.1

3 GEOLOGY AND HYDROGEOLOGY

This section provides a brief overview of the conceptual model of geology and hydrogeology of the SAOS region that was originally presented in Matrix (2013). The conceptual model is expected to evolve as more data is collected through the regional groundwater monitoring well network, from other regional studies, other environmental impact assessments (EIAs) and from continued compliance monitoring and reporting.

The base of sedimentary deposits in the SAOS region is the Pre-Cambrian basement. Overlying the igneous and metamorphic rocks of the Pre-Cambrian basement deposits are the Devonian-aged carbonate deposits. Siliciclastic Cretaceous-aged deposits overlie the Devonian carbonate deposits. Overlying the siliciclastic deposits are unconsolidated Neogene/Quaternary-aged siliciclastic deposits. In certain locales, Neogene/Quaternary incision (buried bedrock channels) into the Cretaceous-aged deposits can be substantial.

A generalized hydrostratigraphic column is presented on Figure 2. Schematic cross-sections illustrating key hydrostratigraphic units and their general relationship to one another are presented on Figure 3. These cross-sections represent general concepts and are not intended to represent geologic reality.

In addition to local shallow aquifers or water table aquifers (Figure 4), the key Neogene/Quaternary aquifers in the SAOS region include:

- **Sand River Aquifer** (Figure 5): The Sand River Aquifer likely outcrops at surface near the unit's extent (Figure 3).
- **Ethel Lake Aquifer** (Figure 6): The Ethel Lake Aquifer is believed to intersect Christina Lake (Figure 3).
- **Bonnyville Aquifer** (Figure 7).
- **Muriel Lake Aquifer** (Figure 8).
- **Empress Terrace Aquifer** (Figure 9): The Empress Terrace Aquifer is generally believed to be discontinuous from the Empress Channel Aquifer (Figure 3).
- **Empress Channel Aquifers** (Figure 10): For this report, all deposits in all incisions, regardless of morphology, are referred to as Empress Channel Aquifer deposits. However, in reality the deposits in these channels are believed to contain both aquifer and aquitard properties. For pre-glacial fluvial channels, there are conceptually two aquifers separated by an aquitard (Andriashek 2003; Figure 2). For melt water or tunnel channels, the deposits are conceptualized to be a more unsorted, heterogeneous (undifferentiated) mixture of coarse- and fine-grained deposits (Figure 2). Incisions of the Christina Buried Bedrock Channel have been interpreted to erode into the Grand Rapids Formation (Figure 3). The Gregoire Channel has been interpreted to erode through Cretaceous-aged deposits (Figure 3). OPTI/Nexen (2006) has confirmed that the hydraulic conductivity of the Gregoire channel deposits is generally lower than that of other Empress Channel deposits (Matrix 2013). This suggests Gregoire Channel deposits are different from other Empress Channel deposits and grouping them together may not be completely appropriate. The geometry and connectivity of these channel aquifers to Cretaceous aquifers affects the groundwater flow regime in both the channel and Cretaceous aquifers. Locations of incisions into Cretaceous units are areas that may be more susceptible to vertical propagation of pressure effects and potential quality effects (i.e., aquifer interactions).

Key Cretaceous-aged aquifers identified in the SAOS region include:

- **Lower Grand Rapids Aquifer** (Figure 11): The Lower Grand Rapids Aquifer is present throughout much of the SAOS area, except along the Athabasca River (downstream of the Grand Rapids), along the Clearwater River, along lower portions of the Christina River and within the Gregoire Buried Bedrock Channel (Figures 3 and 11). In the southwest portion of the SAOS area (along the Athabasca River), some bitumen is present in the Grand Rapids Formation and is potentially in contact with non-saline groundwater resources. Gas has been identified in the Grand Rapids Formation, particularly in the southern portions of the SAOS area.

- **Upper Clearwater Aquifer** (Figure 12): The Upper Clearwater Aquifer is present in the northern portion of the SAOS area. The Upper Clearwater Aquifer may intersect the Athabasca River in the northwest and the lower reaches of the Christina River/Gregoire Buried Bedrock Channel (Figures 3 and 12). Current gas production is occurring in this unit.
- **Middle Clearwater Aquifer** (Figure 13): The Middle Clearwater Aquifer is present in the middle section of the SAOS area and is not interpreted to intersect surface. Current gas production is occurring in this unit.
- **Basal McMurray Aquifer** (Figure 14): The Basal McMurray Aquifer is mainly present along the eastern portion of the SAOS area. The Basal McMurray Aquifer is interpreted to outcrop along the Athabasca River near Fort McMurray, along the Alberta portion of the Clearwater River, and along the lower reaches of the Christina River and is also interpreted to subcrop in the Gregoire Buried Bedrock Channel (Figures 3 and 14). Gas is often present in the thick eastern portion of this aquifer and generally, within the SAOS area, the aquifer is saline. The McMurray Formation is the main bitumen reservoir in the SAOS area.

Other Cretaceous units of note in the SAOS area include the Viking, Wabiskaw and Clearwater C sand units (Figure 2). These sand units do not currently have any proposed groundwater demand for SAGD make-up water in the SAOS area. In addition, these units are either of marginal thickness, marginal sandiness or localized extent. For these reasons, these units are not considered to be key aquifers in the SAOS region (Matrix 2013).

Key Cretaceous-aged aquitards based on relationship to aquifers under planned stress include:

- **McMurray Bitumen Aquitard:** Present over most of the SAOS area except in the east SAOS area along the Saskatchewan border. Where it exists, it is believed to be an effective barrier to vertical and horizontal groundwater flow.
- **Clearwater Shale Aquitard:** Although relatively thin, it provides an effective barrier to groundwater flow between the Upper Clearwater Aquifer and Lower Grand Rapids Aquifer, as evidenced by the presence of gas in the Upper Clearwater Aquifer. In general, the Clearwater Formation has many fine-grained deposits that act as effective barriers to groundwater flow.
- **Colorado Group Aquitard:** A thick marine shale that is an effective barrier to groundwater flow. It is present in most of the SAOS area, except along portions of the Athabasca, Clearwater and Christina rivers (Figures 3). This unit has also been completely eroded in the Christina and Gregoire buried bedrock channels. Regions where this unit is not present are likely more susceptible to interactions between deep and shallower aquifers (aquifer interaction; Figures 3).

3.1 Groundwater Flow

Groundwater flow in the SAOS area is best described as an interconnected system. The SAOS area has its own unique groundwater flow characteristics and it is also part of a much larger basin-wide groundwater flow system. All key units identified in this report for the SAOS area are interconnected to varying degrees, none of which are totally confined nor isolated from one another.

The SAOS area is located at the distal edge of the Western Canadian Sedimentary Basin (WCSB). Regionally, groundwater flow in the WCSB originates in the topographic high of the Rocky Mountains and flows hundreds of kilometres across the province through deep sedimentary units (Cretaceous and Devonian-aged units for example) and discharges along major rivers adjacent to the Canadian Shield (surface outcrop of the Pre-Cambrian basement). The Athabasca River is such a discharge point, where deep, old and saline groundwater from the WCSB discharges to surface.

Overlying this deep regional groundwater flow in the SAOS area is a shallower flow regime. In general, groundwater is recharged in the topographic highlands (Stony Mountain Uplands, Mostoos Hills and May Hills) in the SAOS area (Barson et al. 2001). Shallowest groundwater discharges to numerous adjacent streams, rivers and lakes throughout the SAOS area. Deeper groundwater (deeper Quaternary and Cretaceous-aged sediments) discharges to major rivers in the SAOS area (Athabasca, Clearwater and Christina rivers). Interpreted groundwater flow for key aquifers in the SAOS region is described and illustrated in Matrix (2013).

Key groundwater flow observations include (Matrix 2013):

- Key SAOS specific discharge areas include the Athabasca River, Clearwater River and the lower reaches of the Christina River.
- There is a major discharge point from the western end of the Wiau Channel into the Athabasca River. There are springs at this location documented by Stewart (2003).
- Relatively low groundwater flow gradients in Christina and Wiau Channels near Saskatchewan border. There is some uncertainty as to the direction of groundwater flows in these channels near the provincial boundary due to lack of data points in this area.
- Groundwater mounding in the Lower Grand Rapids Aquifer beneath the Christina Channel (near the Sunday Creek Channel tributary); beneath the Stony Mountain Uplands; and near the Gregoire Channel (Matrix 2013). Apparent mounding near deep channel incisions suggests water levels in the Grand Rapids may be sensitive to water levels in upper units (or surface) near the Christina and Gregoire channel incisions (i.e., aquifer interactions). Mounding beneath the Stony Mountain Uplands is evidence of how topography can be a major influence on groundwater flow, even for deep aquifers.

- Similar to the Grand Rapids Aquifer, groundwater mounding in the Upper and Middle Clearwater aquifers is observed in the same locations, albeit more muted.
- Groundwater mounding is apparent below the Stony Mountain uplands in the McMurray Formation. The hydraulic gradient is relatively flat in the high permeability sediments of the Basal McMurray Aquifer (eastern part of SAOS area) suggesting horizontal flow in this unit northward to the Clearwater and Christina Rivers.

4 METHODS

Matrix personnel were required to comply with legislated and Matrix health and safety standards as well as the health and safety standards of applicable operators.

The following subsections outline Matrix's approach to achieving the 2013 program objectives for the SAOS area. The locations of existing and proposed SAOS regional groundwater monitoring wells, including potential operator wells to be considered are presented on Figure 1.

4.1 South Athabasca Oil Sands Groundwater Monitoring Network Development

The SAOS groundwater monitoring network is being implemented as a phased approach due to its size and logistics (Matrix 2013). Groundwater wells that were monitored during 2013 as part of the SAOS groundwater monitoring program were part of Phase 1 and 2 of the network development. The wells monitored in 2013 provide coverage throughout the SAOS area and include the majority of key aquifers identified in Matrix (2013). The monitoring locations include some historical monitoring locations that belong to government or industry, as well as new locations that were chosen to meet the specific objectives of the SAOS groundwater monitoring program and were installed in 2012 (Matrix 2013).

4.1.1 Phase 1 Locations

Phase 1 monitoring wells were installed in November 2012, and consists of 19 monitoring intervals within the drift at 5 surface locations. Of the 19 completion intervals, 14 are considered to be Sub-network A and 5 are considered as Sub-network B. The following five monitoring locations were installed as Phase 1:

- **Plamondon**
- **House Crossing** (existing AGS completions in the water table aquifer [WR99-1-230] and Empress Channel Aquifer [WR99-1-8])
- **Mariana Lakes**
- **Waddell Creek**
- **Conklin**

These locations were identified as highest priority due to the presence of numerous unconsolidated aquifers at each location (for which there is little hydrogeologic information was available in the SAOS area), as well as because of the all-season access and absence of adjacent gas and/or in situ oil sands developments.

4.1.2 Phase 2 Locations

Phase 2 focussed on the most heavily used (projected use) aquifers in the SAOS area and the identified investigation areas of the SAOS area (Matrix 2013). Investigation areas are locations believed to be more vulnerable to aquifer interaction and surface water-groundwater interaction due to adjacent groundwater demand (particularly in bedrock aquifers) and the possible absence of an effective aquitard unit to provide vertical hydraulic confinement. Potential synergies with in situ oil sands industry were desirable and identified because the most heavily used aquifers are deeper bedrock aquifers that are logistically challenging to install, test and sample.

4.1.2.1 Alberta Geologic Survey Monitoring Locations

Matrix (2013) identified synergies with existing AGS completions at the following proposed Phase 2 monitoring locations:

- **Wiau Lake** (formerly named WEPA 00-1)
- **Winefred Lake** (formerly named WEPA 00-3)

Monitoring wells at both locations are now owned by ESRD and have been established as official SAOS groundwater monitoring locations.

4.1.2.2 Operator Data Requests for Industry Monitoring Locations

Matrix (2013) reviewed and assessed hundreds of existing industry groundwater monitoring wells that were provided to ESRD. Of these, Matrix (2013) identified several existing industry monitoring wells that may have synergies with the SAOS regional groundwater monitoring network. Synergies identified in Matrix (2013) were reviewed and specific monitoring locations were flagged as being most relevant to the network. Rationale for relevant wells that were flagged included locations that were not part of existing compliance monitoring, wells located nearest to areas of concern, good spatial aquifer coverage, locations with sufficient data and nested locations. Data requests regarding these wells were then submitted to select operators.

Monitoring locations that were initially recommended for inclusion in sub-networks A and B (Table 7.4 of Matrix [2013]) identified synergies with existing completions owned by operators in the SAOS region. Additionally, a list of 35 monitoring wells that may be relevant to Investigation Areas (sub-network C) was provided in Table 2 of Matrix (2013), and preliminary data requests were sent to the operators.

As part of the scope of work for 2013, Matrix reviewed the information provided by operators that owned the wells on the lists (Matrix 2013), and selected the most relevant existing industry wells that

could be included in the regional groundwater monitoring network. Monitoring locations and identified wells for potential inclusion in sub-networks A and/or B included:

- **Caribou** (CenovusEnergy Inc - VWP CVE FCCL D14 FISHER 1AA/14-16-070-07W4M)
- **Graham** (ConocoPhillips Canada Resources Corp. - 1F1/05-19-080-01W4 and 1F2/05-19-080-01W4)
- **Kimowin** (ConocoPhillips Canada Resources Corp - 1F1/01-13-083-02W4 and 1F2/01-13-083-02W4)

Investigation areas and identified wells for potential inclusion in sub-network C included:

- **Gregoire Channel** (Nexen - 1WM/16-09-086-07W4/00, 1WM/16-09-086-07W4/02, 1WM/10-29-085-06W4/00, 1WM/10-29-085-06W4/03, 1WM/16-29-085-06W4/00, and 100022808505W400)
- **Lower Christina River** (ConocoPhillips - 1F1/05-14-083-03 W4M, 1F2/05-14-083-03 W4M, 1F1/15-34-083-04W/400, 1F1/11-28-081-04W4/00, 1F1/10-32-083-03W4/00; and Nexen - 1F1/10-32-083-03W4/00)
- **Christina Channel** (Cenovus - KE-GWO-3W1, CL MW25, 12MW26/15-12-076-06W4 [MW26], CL 10-03-CWB OBS, KE 12-18 MCM OBS, and 1F1151207606W400 [MW28]; and Devon - 1F2/10-33-075-07W4M and 1F1/03-27-075-06W4M)

The respective owners were contacted and data was requested for these locations. In one instance the operator provided an alternative monitoring well for consideration (1F1/05-36-084-04 W4M in the Lower Christina River Investigation Area).

4.1.2.3 Recommendations for Inclusion in SAOS Network

Selected industry-owned monitoring wells listed in Section 4.1.2.3 are recommended to be included in the SAOS regional groundwater monitoring network; the rationale for whether or not a monitoring completion was recommended is provided in Table 4a for the wells and VWPs requested for Investigation Areas, and in Table 4b for specific monitoring locations. The final recommendations are based on information about each completion that was provided by the operators in consideration of the objectives and priorities of the SAOS groundwater monitoring framework (Table 1). Reasons for not recommending wells include:

- wells are already part of existing compliance monitoring
- potential future use for water supply
- redundancy with higher priority completions in the same area

There are a total of ten monitoring completions that are recommended for incorporation to the SAOS groundwater monitoring network at this time, including seven completions owned by ConocoPhillips (three wells in the Lower Christina River Investigation [LCRIA], two wells for Graham, two wells for Kimowin) and three completions owned by Cenovus (two wells in the Christina Channel Investigation Area [CCIA], one vibrating wire piezometer [VWP] for Caribou). ESRD will work collaboratively with SAOS

operators to officially add recommended industry monitoring wells to the network and to identify additional relevant locations.

4.2 Groundwater Monitoring and Sampling Methods

Each well was monitored for the presence/absence of non-aqueous phase liquids, depth to the groundwater surface (from the top of the monitoring well casing), and depth to the bottom of the well, using an electronic oil/water interface probe and/or an electronic water level tape.

To arrive at the appropriate groundwater sampling methods for the 2013 SAOS program, Matrix considered the results of a recently completed study for the Cumulative Environmental Management Association. The study, completed by Matrix (Matrix 2012), was to develop “best practices” guidelines for groundwater monitoring and sampling in the Oil Sands region within the Regional Municipality of Wood Buffalo. The study reviewed four main sampling methodologies, including the advantages and limitations for each method.

According to the study report, choosing the most applicable sampling device and method for a specific type of well and site location should be based on the following factors:

- site-specific sampling objectives
- type of laboratory analyses required to meet the objectives
- geology and hydrogeology at the screened interval, including the length of screen
- site conditions and site access
- health and safety requirements
- regulatory requirements
- purge water disposal

After considering the above factors, the low-flow sampling methods was considered to be most suitable for the SAOS groundwater monitoring network. Details on the low-flow sampling methods and data quality assurance/quality control (QA/QC) protocols are included in Appendix A.

Sampling was completed using the Geotech GeoSub pump or the Solinst® bladder pump depending on the surface to groundwater depth. Where the GeoSub or the bladder pump could not be used either due to pump technical problems or extreme cold weather conditions, the low-flow Waterra Inertia Pump (foot valve) was used instead.

4.3 Groundwater Management Framework

The strategy for meeting the regional groundwater quality and quantity objectives, consistent with the outcomes and principles of the Land-use Framework includes completing and implementing the GMF for the Lower Athabasca Region. The GMF for the Lower Athabasca Region encompasses three areas

including the SAOS area (GoA 2012). In terms of groundwater quantity, the objectives of the GMF is to ensure that groundwater resources continue to support human and ecosystem needs, and maintain the integrity of the regional flow system. For groundwater quality objectives, the intention of the GMF is to establish limits for groundwater quality that reflect conditions within the range of natural variability. Regional groundwater quality triggers are meant to serve as early warnings of a negative change in condition from natural variability in aquifer conditions, and represent a condition beyond which the potential for impacts is considered unacceptable.

The GMF includes interim triggers for indicator groundwater quality parameters. The interim triggers were established based on regional knowledge and professional judgment, or (in the case of arsenic; As) based on descriptive statistics derived from available data in the region (GoA 2012). The GMF acknowledges that there is a wide range of groundwater quality conditions within the SAOS region and that it is difficult to define a suitable trigger to encompass all locations for a given aquifer. As such, the interim triggers will likely evolve as more data is collected for the aquifers in the SAOS region. Final trigger values could potentially include multiple triggers for a single aquifer to reflect the spatial variability of groundwater quality parameters.

Groundwater chemistry results from the 2013 SAOS program were compared to the interim groundwater quality triggers for the SAOS area. A list of the interim trigger values is provided in Table A.

Table A Interim Regional Groundwater Quality Triggers for the South Athabasca Oil Sands Area

Interval	Temperature Change ¹	TDS ^{1,2}	Cl ¹	NO ₃ ¹	As ²	Si ¹	B ¹	BTEX ¹	Phenols ¹
Surficial Deposits	5°C	600 ¹	50	0.05	0.003	10	0.2	< 10% DF	0.005
Buried Channels	2°C	1,000 ¹	100	0.01	0.003	10	0.4	< 10% DF	0.005
Grand Rapids Formation	2°C	2,000	1,000	0.01	0.003	10	1.0	< 10% DF	0.010
Clearwater Formation	2°C	3,500	1,000	0.01	0.003	10	1.5	< 10% DF	0.010
McMurray Formation	2°C	3,500	1,500	0.01	0.003	10	2.0	< 10% DF	0.010

Concentrations are shown in mg/L.

¹Values selected based on regional knowledge and professional judgment.

²Value represents the 75th percentile of data from the existing database for each identified interval.

TDS = total dissolved solids

Cl = chloride

NO₃ = nitrate

As = arsenic

Si = silica

B = boron

BTEX = benzene, toluene, ethylbenzene and xylenes

DF = detection frequency (parameter measured above detection limit)

4.4 Groundwater Monitoring and Sampling

A summary of the 2013 SAOS field program is provided in Table 3. Two groundwater monitoring and sampling events were completed as part of the program. During the monitoring events, each well was assessed for physical condition and static water levels. Water levels were measured using a standard electronic water level tape, and referenced to the top of casing. Pressure transducers were downloaded and the instrument checked to make sure there was adequate recording capacity until the next monitoring cycle next year.

The five SAOS sites that were established as part of Phase 1 of the network development were sampled during both monitoring events, with the two former AGS locations (Wiau Lake and Winefred Lake) sampled during the second event only.

The first event was completed between September 22 and 25, 2013 with groundwater samples collected from all 21 of the wells at the Phase 1 sites. One well at Conklin (Conklin 76-07-41) was re-developed during the first monitoring event; this was done to clean up dark coloured material at the bottom 0.3 m of the well that was observed in 2012 (Matrix 2013). One well at Plamondon (Plamondon 68-16-7) that had been found to have constricted PVC casing in 2012, likely due to frost heave, was examined during the first monitoring event. The constriction was found to be minimal and did not restrict access to the well, so water was drained from the protector casing to prevent further frost heave. The newly incorporated Phase 2 sites, Wiau Lake (formerly WEPA 00-1) and Winefred Lake (formerly WEPA 00-3), were visited during the first monitoring event for reconnaissance purposes to assess the condition of the wells and determine accessibility.

The second event was completed between October 28 and November 8, 2013 with groundwater samples collected from all 28 of the wells at the 7 sites. Pressure transducers were installed in monitoring wells at Wiau Lake (four wells) and Winefred Lake (three wells) during the second monitoring event (Table 3).

Prior to sampling, purged groundwater was monitored for field parameters (pH, electrical conductivity, temperature and chloride; Cl). Once the parameters stabilized, groundwater samples were collected into laboratory supplied containers, placed in a cooler with ice and submitted to ALS Environmental laboratory in Fort McMurray, Alberta. Laboratory analysis included the following parameters:

- major ions
- pH, conductivity and total alkalinity
- ammonia, nitrate (NO₃), nitrite
- dissolved organic carbon
- dissolved metals
- turbidity
- phenols

- benzene, toluene, ethylbenzene and xylenes (BTEX) and petroleum hydrocarbons fraction 1 (C₆-C₁₀, excluding BTEX) and fraction 2 (C_{>10}-C₁₆)
- polycyclic aromatic hydrocarbons
- naphthenic acids

4.5 Data Management Strategy

The program data management strategy ensures the integrity of field data collection, QA/QC protocol of laboratory and other field data, storage, analysis and data presentation.

Field data were recorded using standard groundwater sampling forms and field notes; groundwater samples submitted to the laboratory were recorded using triplicate chain-of-custody forms documenting sample identification numbers, analytical parameters, shipping and reporting details for each sample submitted. The lab analytical data were stored and accessed in EQuIS (a Matrix company-wide platform to manage environmental data), and the wells information, pressure and temperature data were stored and managed in Matrix's Physical Hydrogeology Database. Pressure and chemistry data from the 2012 program were also included in the databases. All data entered into the Matrix databases are reviewed and verified as part of Matrix quality assurance procedures.

Details on the data management and QA/QC processes are included in Appendix A.

4.5.1 Web-based Data Viewer

The CDP provides a web-based platform for accessing and viewing all SAOS groundwater monitoring network data that are available to and stored on Matrix databases. CDP enables rapid data access and supports a QA/QC process for the entire SAOS dataset. CDP works through a web browser and allows authorized individuals view and download their physical hydrogeological time series data which are already in Matrix databases including hydraulic heads and temperatures. Charts of key chemistry indicators over time, generated by a script from Matrix EQuIS database, are also available in CDP as PDF documents. Details on full CDP functionality are included in Appendix B.

Authorized individuals at ESRD and members of the SAOS technical committee are provided access to CDP (via a unique username and password issued by Matrix), through March 31, 2015. SAOS technical committee members can use the data viewer to identify any issues related to data quality, especially those who provided data for the recommended SAOS groundwater monitoring locations. Members can provide feedback and recommendations on data quality discrepancies and/or on the utility of the data viewer to support data QA/QC beyond the current project completion date. While efforts will be made to address all issues related to the web viewer, there is no commitment on the part of Matrix for when the issues will be addressed and how much effort will be involved beyond the March 31, 2014 project end date.

A copy of the entire SAOS dataset is provided to ESRD as part of the data deliverables for this project.

5 RESULTS

The results for the existing and recommended SAOS regional groundwater monitoring network are presented on the following summary pages. Each page presents:

- information about each site and how it addresses SAOS network objectives
- charts showing water levels and temperatures
- a table outlining which indicator parameters exceed the interim water quality triggers as presented in the Lower Athabasca Region GMF (GoA 2012)
- specific recommendations for the site

Water quality results are presented in Table 5 (Field-measured Parameters), Table 6 (General and Inorganic Parameters), Table 7 (Dissolved Metals), Table 8 (Dissolved Hydrocarbons & Naphthenic Acids), Table 9 (Polycyclic Aromatic Hydrocarbons) and Table 10 (Microbiological Parameters). Data quality evaluation procedures are presented in Appendix A, and QA/QC tables are presented in Tables 11a through 11e. Laboratory reports are included in Appendix C.

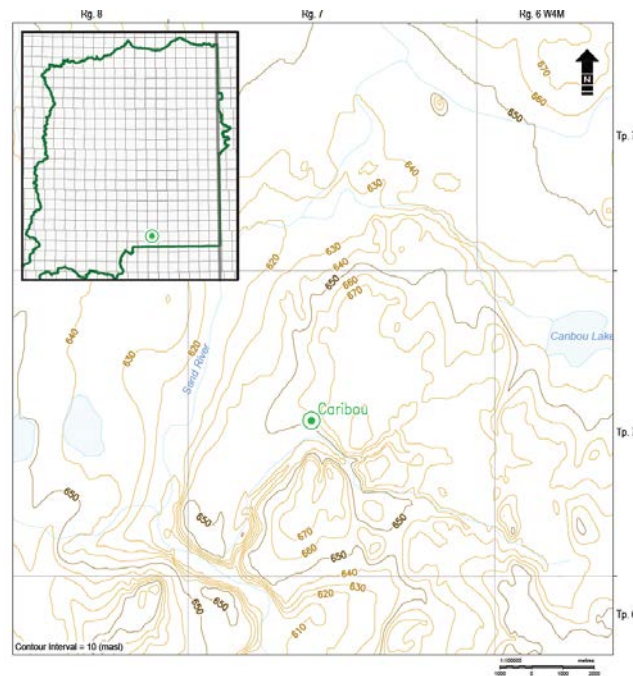
In 2012, each existing SAOS monitoring well was instrumented with a non-vented, Level Troll 300 or 500 level logger equipped with data recording capabilities and manufactured by In-Situ Inc. (In-Situ 2013). Each pressure transducer was set to record and store pressure measurements on an hourly interval beginning at the time of installation. The hydraulic head and temperature data derived from the measurements are presented on charts on the summary sheets. Pressure data was converted to hydraulic heads and corrected for atmospheric pressure variation using pressure data recorded by an In-Situ barometric pressure logger installed at the House Crossing monitoring site.

In addition to temperatures measured by the Level TROLL pressure transducers, secondary temperature gauges were installed and programmed to record temperatures in select monitoring wells. At Conklin 76-7-67 (Bonnyville), Mariana Lakes 80-13-134 (Empress Terrace) and Plamondon 68-16-70 (Empress Channel), Nautilus 85 data loggers manufactured by ACR Systems Inc. (2012) were emplaced within the well screens and were set to record temperature every 30 minutes. In House Crossing 77-15-161 (Muriel Lake), 3 HOBOTidbiT v2 temperature loggers manufactured by Onset Computer Corporation (2013) were placed at 68, 156 and 159 m depth and were set to record every 30 minutes. These temperature records are also presented on the summary sheets.

Summary pages for the seven existing SAOS monitoring locations are presented first, followed by summary pages for the three recommended SAOS monitoring locations and the three recommended investigation areas.

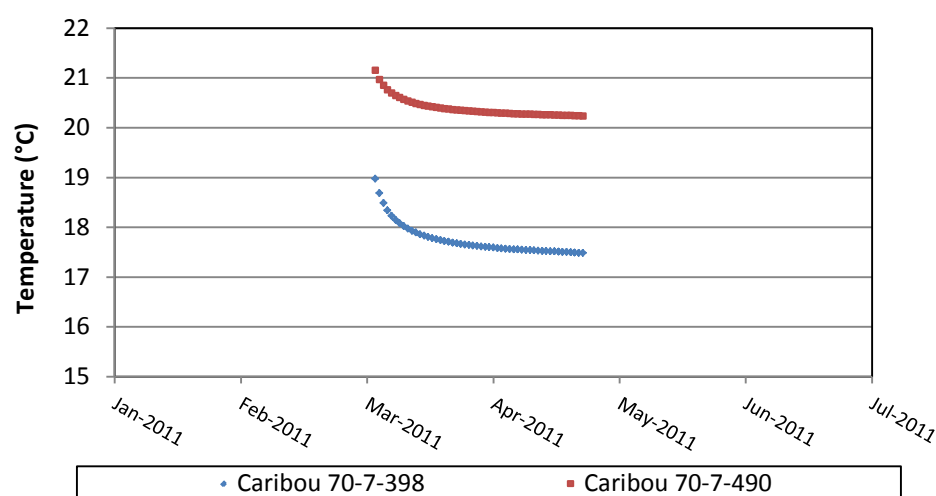
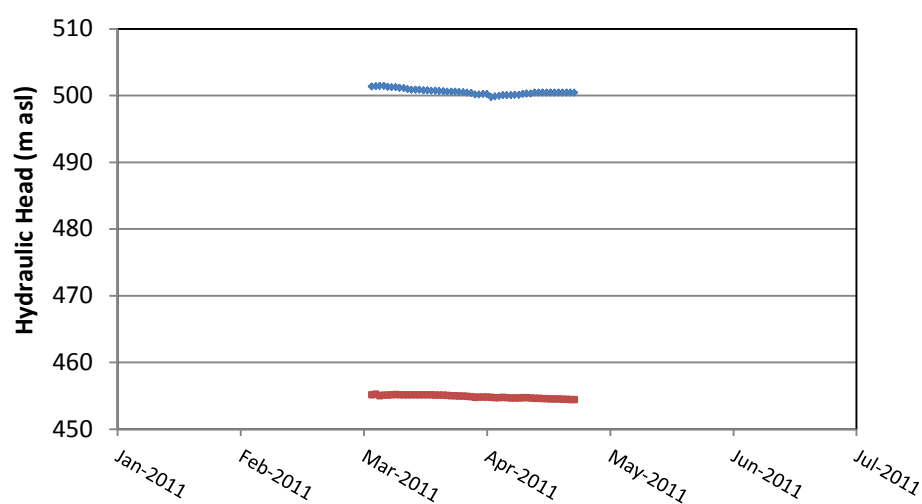
CARIBOU (14-16-070-07 W4M) 660.7 m asl

Location Objective	Support development of Sub-networks A and B as per Matrix (2013)
Development Phase	Phase 2 (recommended)
Key Rationale	Moderately close to in situ oil sands Lower Grand Rapids Aquifer demand Existing VWP that is more than 10 km away from any existing or proposed source/disposal wells
Safety, Access, Synergies and Priorities	Proximal to Grand Rapids, Clearwater and McMurray current gas production - but still several kilometres away Synergy with Cenovus CVE FCCL D14 FISHER 14-16-70-7 (1AA/14-16-070-07W4M) - very remote Higher priority location for Lower Grand Rapids and Basal McMurray aquifer completions



Aspects of Conceptual Model	
Major Lakes and Rivers - Distal Colorado Group Aquitard Extent - Present Bedrock Incisions - Distal Unconsolidated Deposit Thickness - Thick	Regional Recharge vs. Discharge - Recharge Gas Production - Proximal Oil Sands Groundwater Users - Distal Shallow Local Groundwater Users - Distal

Well Name	Screened Interval (mbgs)	Owner	Interpreted Aquifer	Network
---	---	---	near surface	A (Strategic)
Caribou 70-7-398 (CVE FCCL D14 FISHER 14-16-70-7)	397.6 VWP	Cenovus	Lower Grand Rapids	B (Surveillance)
Caribou 70-7-490 (CVE FCCL D14 FISHER 14-16-70-7)	489.6 VWP	Cenovus	Basal McMurray	B (Surveillance)



Parameters Exceeding LARP Interim Regional Groundwater Quality Triggers at Caribou		
	Exceeds Applicable Triggers (Yes/No) ¹	
Parameter	70-7-398	70-7-490
Temp.	No	No
TDS	---	---
Cl	---	---
NO ₃	---	---
As	---	---
Si	---	---
B	---	---
BTEX	---	---
Phenols	---	---

1 - Exceeds trigger in at least one historical sampling events

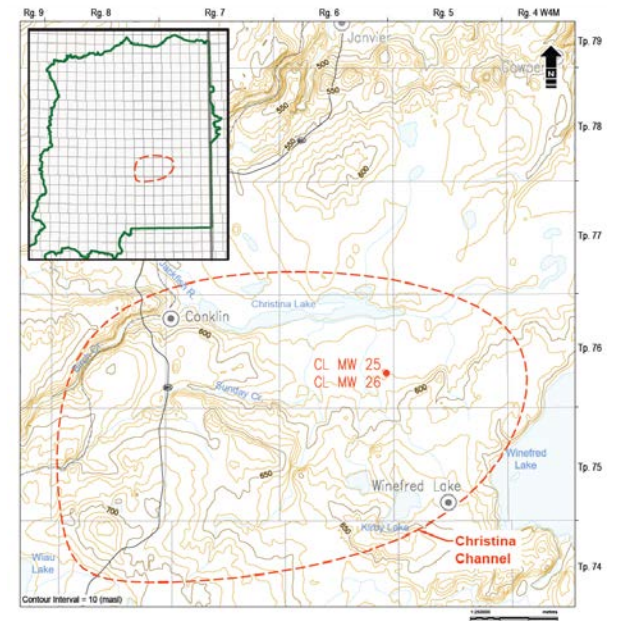
--- No data

Comments
Matrix (2013) identified a synergy between the Caribou location and nested Cenovus VWPs at 14-16-70-7W4M. The monitoring well is remote and instrumentation requires maintenance. Data is not currently being recorded; data is available only for a period in 2011. Water levels indicate a downward vertical hydraulic gradient. Temperatures were anomalously high; equipment may not have equilibrated with formation temperature.

Recommendations
<ul style="list-style-type: none"> ESRD will consult further with Cenovus before officially adding this location to the regional groundwater monitoring well network. Consultation will include feasibility of repairing or replacing instrumentation and responsibilities. If included in the regional groundwater monitoring well network, consider installing a near-surface monitoring well at this location.

CHRISTINA CHANNEL INVESTIGATION AREA (Townships 75 to 76, Ranges 5 to 7 W4M)

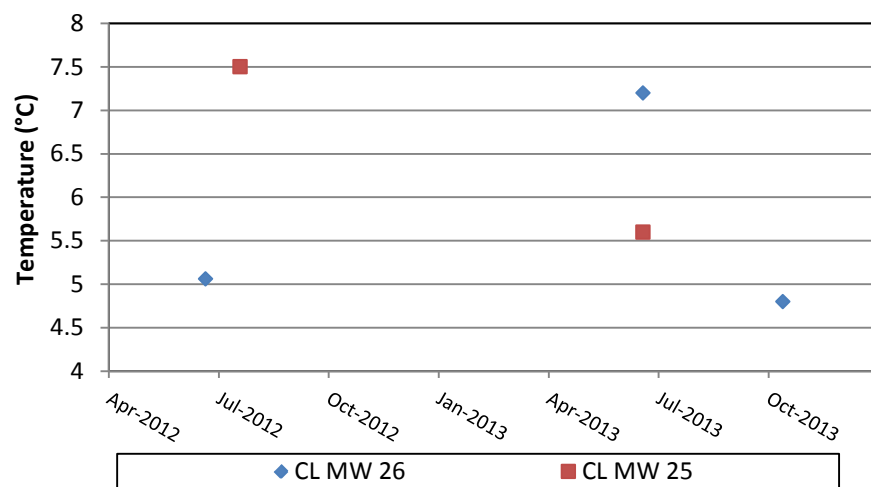
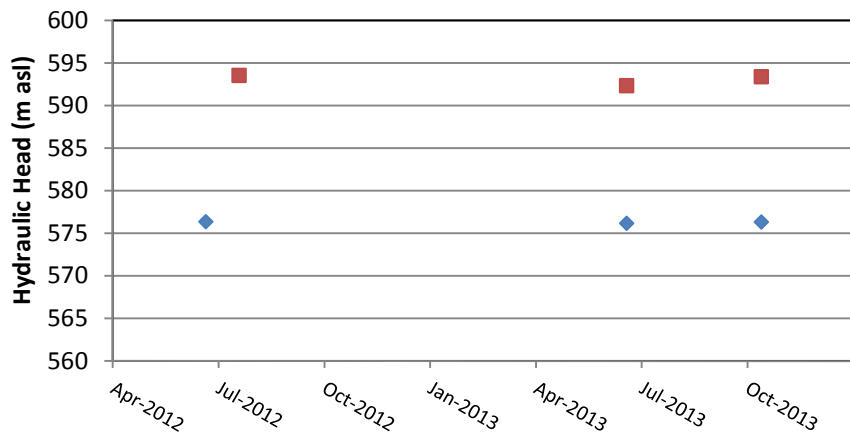
Location Objective	Support development of Sub-network C as per Matrix (2013)
Development Phase	Phase 2 (recommended locations)
Key Rationale	<p>Deep erosional incision through Colorado group Aquitard into Grand Rapids Formation</p> <p>High density of in situ oil sands existing and proposed source and disposal wells</p> <p>Identified as potentially vulnerable area (stressed aquifers; absent Colorado Group Aquitard)</p> <p>Maximum predicted drawdown for many key aquifers in this area</p> <p>RAMP, WSC, meteorological stations and lake monitoring sites nearby</p>
Safety, Access, Synergies and Priorities	<p>Synergies with Cenovus wells 12MW26/15-12-076-06W4 (CL MW 26) and 1F1/15-12-076-06W4 (CL MW 25). These two wells are in the same LSD.</p> <p>Discussions with Cenovus, Devon and MEG to negotiate which additional wells, if any, can be incorporated into Sub-network C.</p>



Aspects of Conceptual Model

Major Lakes and Rivers - Proximal Colorado Group Aquitard Extent - Absent Bedrock Incisions - Proximal Unconsolidated Deposit Thickness - Thick	Regional Recharge vs. Discharge - Recharge Gas Production - Proximal Oil Sands Groundwater Users - Proximal Shallow Local Groundwater Users - Proximal
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Well Name	Screened Interval (mbgs)	Owner	Interpreted Aquifer	Network
---	---	---	Sand River	C (Investigative)
CL MW 26	55.5 - 58.5	Cenovus	Ethel Lake	C (Investigative)
---	---	---	Bonnyville	C (Investigative)
---	---	---	Muriel Lake	C (Investigative)
---	---	---	Empress Terrace	C (Investigative)
CL MW 25	157.6 - 160.6	Cenovus	Empress Channel	C (Investigative)
---	---	---	Lower Grand Rapids	C (Investigative)
---	---	---	Upper Clearwater	C (Investigative)
---	---	---	Middle Clearwater	C (Investigative)
---	---	---	Basal McMurray	C (Investigative)



Parameters Exceeding LARP Interim Regional Groundwater Quality Triggers in Christina Channel Investigation Area		
Parameter	Exceeds Applicable Triggers (Yes/No) ¹	
	Ethel Lake	Empress Channel
Temp.	I.D.	I.D.
TDS	No	No
Cl	No	Yes
NO ₃	---	---
As	---	---
Si	---	---
B	---	---
BTEX	---	---
Phenols	---	---

1 - Exceeded trigger during historical sampling event(s)
 I.D. - Insufficient data to discern trend
 --- No data

Comments

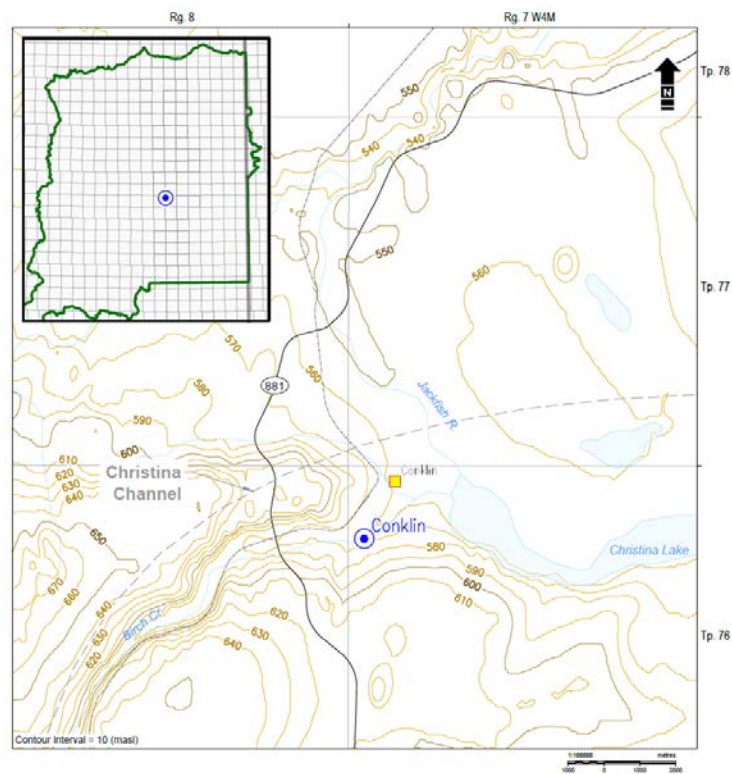
These two Cenovus monitoring wells located in the same LSD were identified as potential monitoring wells for the Christina Channel Investigation Area (Matrix 2013). Water levels indicate an upward vertical hydraulic gradient between the Empress Channel Aquifer and the overlying Ethel Lake Aquifer. Water level and temperature data records are insufficient to discern trends. Water quality parameters exceeded interim triggers in Empress Channel Aquifer (Cl). No data was provided for NO₃, As, Si, B, BTEX and phenols concentrations.

Recommendations

- ESRD will consult further with Cenovus before officially adding these monitoring wells to the regional groundwater monitoring well network. Consultation will include sampling responsibility, parameters and schedule.
- Consult with industry to identify possible nearby completions in the Sand River, Bonnyville, Muriel Lake, Empress Terrace, Lower Grand Rapids, Upper/Middle Clearwater and/or Basal McMurray aquifers that may be feasible/relevant for inclusion the Christina Channel Investigation Area.
- Pending consultation, Cenovus should continue groundwater data collection as per usual.

CONKLIN (11-30-076-07 W4M) 575 m asl

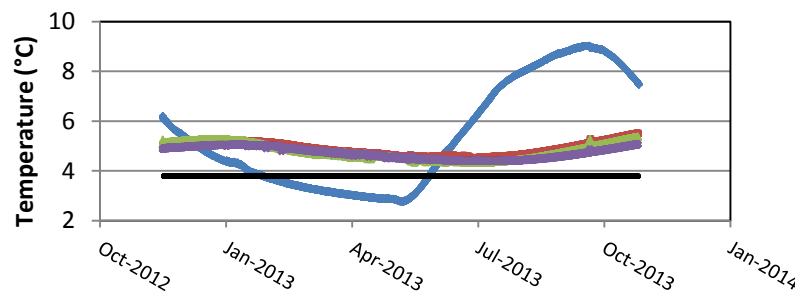
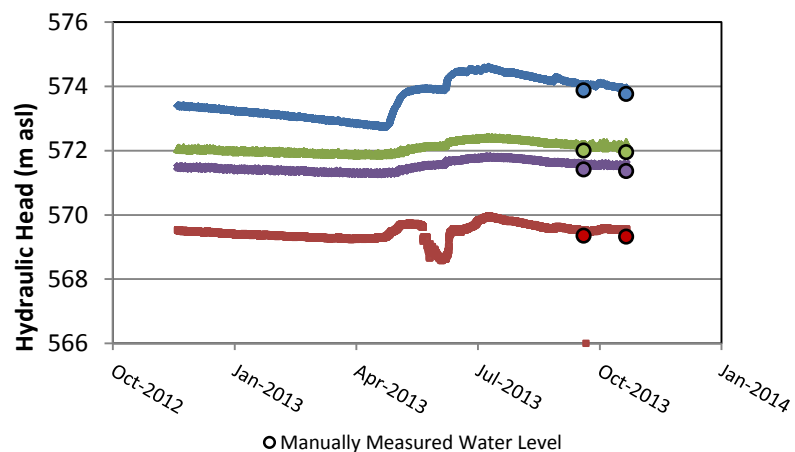
Location Objective	Support development of Sub-networks A and B as per Matrix (2013)
Development Phase	Phase 1 (existing)
Key Rationale	<p>Near shallow groundwater users (societal concerns) and major water body</p> <p>Near deep incision along Christina Channel</p> <p>Near in situ oil sands groundwater users</p> <p>Near Worley Parsons proposed groundwater monitoring well MW2</p> <p>Ethel Lake Aquifer present (aquifer intersects Christina Lake; surface water groundwater interactions)</p> <p>Numerous aquifers present (facilitates understanding of vertical hydraulic gradients)</p> <p>Over 50 m of predicted drawdown in the Lower Grand Rapids, Upper Clearwater and Middle Clearwater aquifers at this location</p> <p>Near lake monitoring and meteorological station</p>
Safety, Access, Synergies and Priorities	<p>Near historic Grand Rapids Formation gas production, within current Clearwater and McMurray formation gas production.</p> <p>All season access.</p> <p>Discussions with Christina Lake area operators (Harvest Operations Corp., Devon Canada Corporation, Cenovus Energy Inc. and MEG Energy) should be pursued to see if there is adjacent pressure data that can be utilized for the Lower Grand Rapids, Upper Clearwater and Middle Clearwater.</p> <p>This monitoring location can be linked to Christina Channel Investigation Area monitoring.</p> <p>Near surface, Sand River, Ethel Lake and Bonnyville completions installed in fall 2012.</p>



Aspects of Conceptual Model

Major Lakes and Rivers - Proximal	Regional Recharge vs. Discharge - Recharge
Colorado Group Aquitard Extent - Present	Gas Production - Proximal
Bedrock Incisions - Proximal	Oil Sands Groundwater Users - Proximal
Unconsolidated Deposit Thickness - Thick	Shallow Local Groundwater Users - Proximal

Well Name	Screened Interval (mbgs)	Owner	Interpreted Aquifer	Network
Conklin 76-07-6	3.0 - 6.1	ESRD	shallow	B (Surveillance)
Conklin 76-07-24	20.5 - 23.5	ESRD	Sand River	A (Strategic)
Conklin 76-07-41	35.0 - 41.0	ESRD	Ethel Lake	B (Surveillance)
Conklin 76-07-67	61.0 - 67	ESRD	Bonnyville	B (Surveillance)
---	---	---	Lower Grand Rapids	B (Surveillance)
---	---	---	Upper Clearwater	B (Surveillance)
---	---	---	Middle Clearwater	B (Surveillance)
---	---	---	Basal McMurray	B (Surveillance)



Conklin 76-7-6	Conklin 76-7-24
Conklin 76-7-41	Conklin 76-7-67
Conklin 76-7-68 Nautilus 85 at 66 m	

Parameters Exceeding LARP Interim Regional Groundwater Quality Triggers at Conklin

Parameter	Exceeds Applicable Triggers (Yes/No) ¹			
	76-07-6	76-07-24	76-07-41	76-07-67
Temp.	No	No	No	No
TDS	No	No	No	No
Cl	No	No	No	No
NO ₃	No	No	No	No
As	No	Yes	No	No
Si	No	Yes	Yes	Yes
B	No	No	Yes	Yes
BTEX	No	No	No	No
Phenols	No	No	No	No

1 - Exceeds trigger in at least one of two sampling events in 2013

Comments

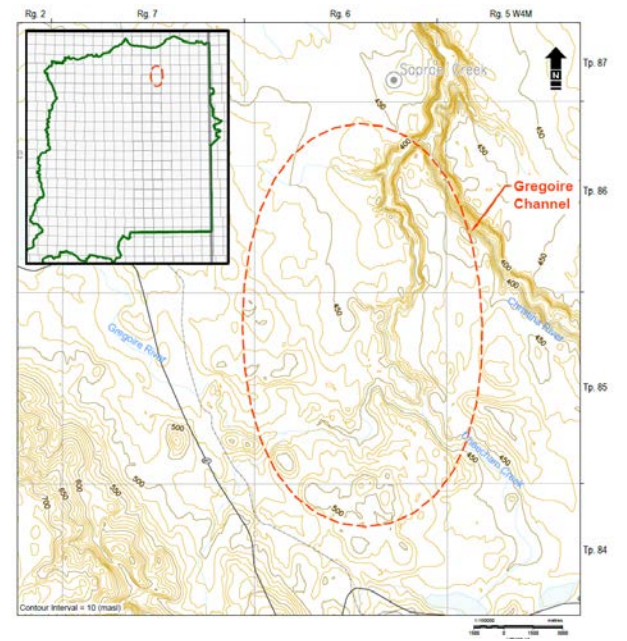
All key non-bedrock aquifers have been completed at this location - currently there are no bedrock completions installed or identified. Matrix (2013) has not identified bedrock aquifers as being high priority. Water levels confirm local recharge conditions, with the Sand River being underpressured with respect to overlying and underlying aquifers. Water levels in all units appear to vary seasonally. Temperature instrumentation depths do not appear to be optimal as temperature readings may not be representative of some aquifer units. This location was sampled twice in 2013 for routines, metals and hydrocarbons. Interim groundwater quality triggers were exceeded in the Sand River (As, Si), Ethel Lake (Si, B) and Bonnyville (Si, B). The Sand River Aquifer completion is expected to represent baseline condition in that aquifer.

Recommendations

- Consult with industry to identify possible nearby bedrock completions that may be feasible/relevant for inclusion the regional groundwater monitoring well network.
- Instrument all wells with temperature gauges adjacent to well screen to obtain representative unit temperatures if possible.
- Monitor and collect water quality parameters semi-annually at intervals of no less than 4 months (continue with routine, metals and petroleum hydrocarbons analyses).

GREGOIRE CHANNEL INVESTIGATION AREA (Townships 85 to 86, Ranges 6 to 7 W4M)

Location Objective	Support development of Sub-network C as per Matrix (2013)
Development Phase	Phase 2 (no existing or recommended locations)
Key Rationale	<p>Relatively deep erosional incision into Cretaceous succession</p> <p>High density of in situ oil sands existing and proposed source and disposal wells</p> <p>Identified as potentially vulnerable area (stressed aquifer; absent aquitard units)</p> <p>Relatively high predicted drawdown for key aquifers at this location</p> <p>RAMP and WSC sites nearby</p> <p>Identified as a high priority location by WorleyParsons</p>
Safety, Access, Synergies and Priorities	<p>Synergy with existing Nexen-owned monitoring wells</p> <p>Discussions with Nexen and other SAOS operators will need to be initiated to identify wells that can be incorporated into Sub-network C</p> <p>Near active McMurray disposal (~900 m)</p>



Aspects of Conceptual Model

Major Lakes and Rivers - Proximal Colorado Group Aquitard Extent - Absent Bedrock Incisions - Proximal Unconsolidated Deposit Thickness - Thick	Regional Recharge vs. Discharge - Recharge Gas Production - Proximal Oil Sands Groundwater Users - Proximal Shallow Local Groundwater Users - Distal
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Well Name	Screened Interval (mbgs)	Owner	Interpreted Aquifer	Network
---	---	---	Gregoire Channel	C (Investigative)
---	---	---	Lower Grand Rapids	C (Investigative)
---	---	---	Upper Clearwater	C (Investigative)
---	---	---	Basal McMurray	C (Investigative)

Comments

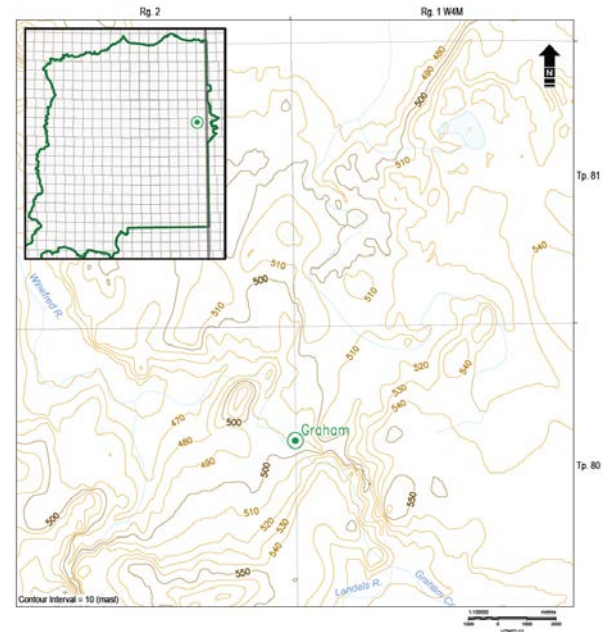
Monitoring wells owned by Nexen completed in the near surface, Gregoire Channel, Lower Grand Rapids and Basal McMurray aquifers were identified as potential monitoring wells for the Gregoire Channel Investigation Area (Matrix 2013). Once more information was provided by Nexen, however, it was determined that wells were too close to supply and disposal wells such that they would not fulfill the objectives of “investigative” type of groundwater monitoring. The wells are currently used for compliance monitoring purposes and reflect local impacts rather than regional cumulative effects.

Recommendations

- ESRD will consult further with Nexen and other SAOS operators to identify possible nearby completions in the Gregoire Channel, Lower Grand Rapids, Upper Clearwater and/or Basal McMurray aquifers that may be feasible/relevant for inclusion in the Gregoire Channel Investigation Area.

GRAHAM (05-19-080-01 W4M) 505.4 m asl

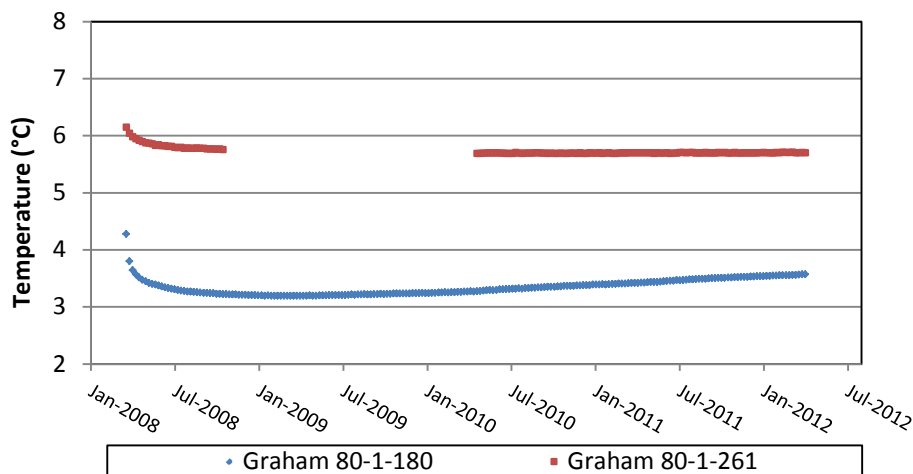
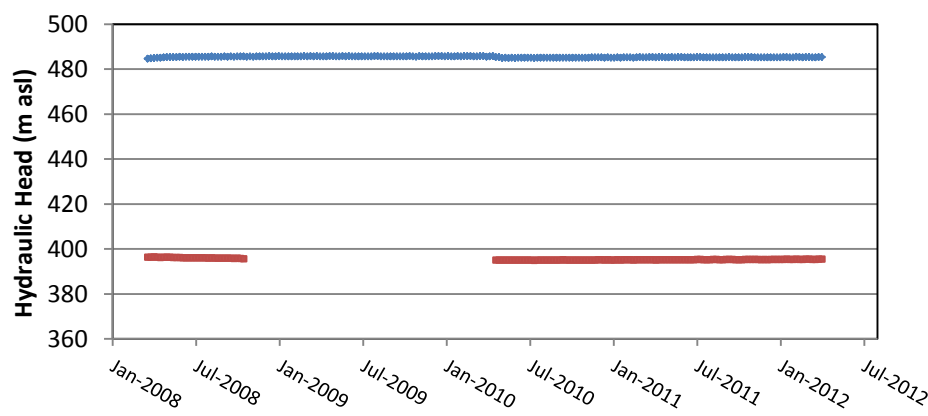
Location Objective	Support development of Sub-network A as per Matrix (2013)
Development Phase	Phase 2 (recommended)
Key Rationale	Existing monitoring wells in Upper Clearwater and Basal McMurray Located well away from existing or proposed source/disposal wells Near Saskatchewan border (societal concerns) Away from any identified gas production in Grand Rapids, Clearwater and McMurray formations
Safety, Access, Synergies and Priorities	Synergy with ConocoPhillips 1F1051908001W400 and 1F2051908001W400 Higher priority location for Upper Clearwater and Basal McMurray completions



Aspects of Conceptual Model

Major Lakes and Rivers - Proximal Colorado Group Aquitard Extent - Absent Bedrock Incisions - Distal Unconsolidated Deposit Thickness - Thin	Regional Recharge vs. Discharge - Discharge Gas Production - Distal Oil Sands Groundwater Users - Distal Shallow Local Groundwater Users - Distal
---	--

Well Name	Screened Interval (mbgs)	Owner	Interpreted Aquifer	Network
---	---	---	near surface	A (Strategic)
---	---	---	Bonnyville	A (Strategic)
---	---	---	Empress Terrace	A (Strategic)
---	---	---	Lower Grand Rapids	A (Strategic)
Graham 80-1-180	156.1 - 180.3	ConocoPhillips	Upper Clearwater	A (Strategic)
Graham 80-1-261	242.3 - 260.5	ConocoPhillips	Basal McMurray	A (Strategic)



Parameters Exceeding LARP Interim Regional Groundwater Quality Triggers at Graham

Parameter	Exceeds Applicable Triggers (Yes/No) ¹	
	80-1-180	80-1-261
Temp.	No	No
TDS	Yes	Yes
Cl	Yes	Yes
NO ₃	---	---
As	---	---
Si	---	---
B	---	---
BTEX	---	---
Phenols	---	---

1 - Exceeded trigger during historical sampling event(s)
--- No data

Comments

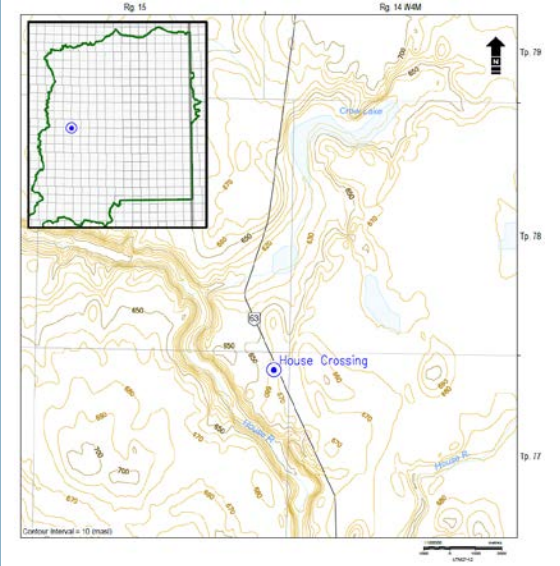
Matrix (2013) identified a synergy between the Graham location and nested ConocoPhillips monitoring wells at 05-19-80-1W4M. CPC and ESRD are in negotiations to transition ownership of these monitoring wells. Water levels indicate there is a downward vertical hydraulic gradient between the Upper Clearwater and Basal McMurray aquifers. Temperatures do not show seasonal variation; no trends are apparent in the McMurray but a slight increasing trend is apparent in the Clearwater from 2010 onward. Water quality results for groundwater samples that were collected at the time of well development were provided by ConocoPhillips; wells are not currently part of a regular sampling program. Water quality parameters exceed interim triggers for TDS and Cl in both aquifers. No data was provided for NO₃, As, Si, B, BTEX and phenols. Upper Clearwater and Basal McMurray aquifer completions at this location are expected to represent baseline conditions in their respective aquifers.

Recommendations

- Pending finalization of ownership transfer, ConocoPhillips should continue collected data as they planned.
- Once this location is officially added to the regional groundwater monitoring well network, an appropriate groundwater monitoring plan should be developed considering depth/nature of aquifer completions.
- Consult with industry to identify possible nearby completions that may be feasible/relevant for inclusion in the regional groundwater monitoring well network.
- If included in regional groundwater monitoring well network, consider installing a near-surface monitoring well at this location.

HOUSE CROSSING (07-36-077-15 W4M) 662.5 m asl

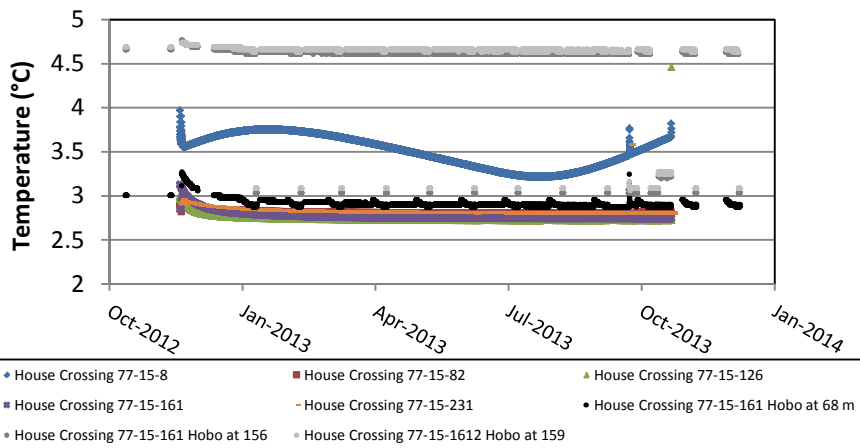
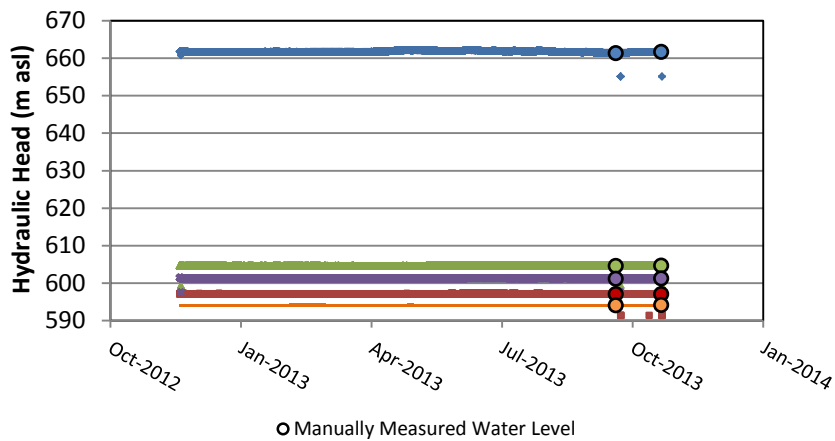
Location Objective	Support development of Sub-networks A and B as per Matrix (2013)
Development Phase	Phase 1 (existing)
Key Rationale	Existing AGS wells (WR99-1-8 and WR99-1-230) Empress Channel Aquifer (Wiau Channel) Near Worley Parsons (2010) proposed groundwater monitoring well MW13 Near GOWN well House River Baseline quality and quantity expected in unconsolidated units and Middle Clearwater Aquifer Predicted drawdown in this area is quite low (~ 1 m) in Empress Channel aquifer Near WSC site
Safety, Access, Synergies and Priorities	Near historic Grand Rapids Formation gas production. Near current McMurray Formation gas production. More or less all-season access (close to Highway 63). Synergy was achieved with existing AGS wells (WR99-1). A monitoring well already exists in the Empress Channel Aquifer at this location. Near surface, Ethel Lake, Bonnyville and Muriel Lake completions installed in Fall 2012. Higher priority location for Lower Grand Rapids and Middle Clearwater aquifer completions.



Aspects of Conceptual Model

Major Lakes and Rivers - Proximal Colorado Group Aquitard Extent - Present Bedrock Incisions - Proximal Unconsolidated Deposit Thickness - Thick	Regional Recharge vs. Discharge - Recharge Gas Production - Proximal Oil Sands Groundwater Users - Distal Shallow Local Groundwater Users - Distal
---	---

Well Name	Screened Interval (mbgs)	Owner	Interpreted Aquifer	Network
House Crossing 77-15-8 (WR99-1-8)	5.5 - 8.5	ESRD	shallow	A (Strategic)
House Crossing 77-15-82	78.0 - 81.5	ESRD	Ethel Lake	A (Strategic)
House Crossing 77-15-126	120.0 - 126.0	ESRD	Bonnyville	A (Strategic)
House Crossing 77-15-161	155.0 - 161.0	ESRD	Muriel Lake	A (Strategic)
House Crossing 77-15-231 (WR99-1-230)	223.0 - 231.0	ESRD	Empress Channel	A (Strategic)
---	---	---	Lower Grand Rapids	B (Surveillance)
---	---	---	Middle Clearwater	A (Strategic)
---	---	---	Basal McMurray	B (Surveillance)



Parameters Exceeding LARP Interim Regional Groundwater Quality Triggers at House Crossing

Parameter	Exceeds Applicable Triggers (Yes/No) ¹				
	77-15-8	77-15-82	77-15-126	77-15-161	77-15-231
Temp.	No	No	No	No	No
TDS	No	Yes	No	No	No
Cl	No	No	No	No	No
NO ₃	No	No	No	No	Yes
As	Yes	Yes	Yes	Yes	Yes
Si	No	No	Yes	Yes	Yes
B	No	Yes	Yes	No	No
BTEX	No	Yes	Yes	Yes	Yes
Phenols	No	Yes	No	No	No

1 - Exceeds trigger in at least one of two sampling events in 2013

Comments

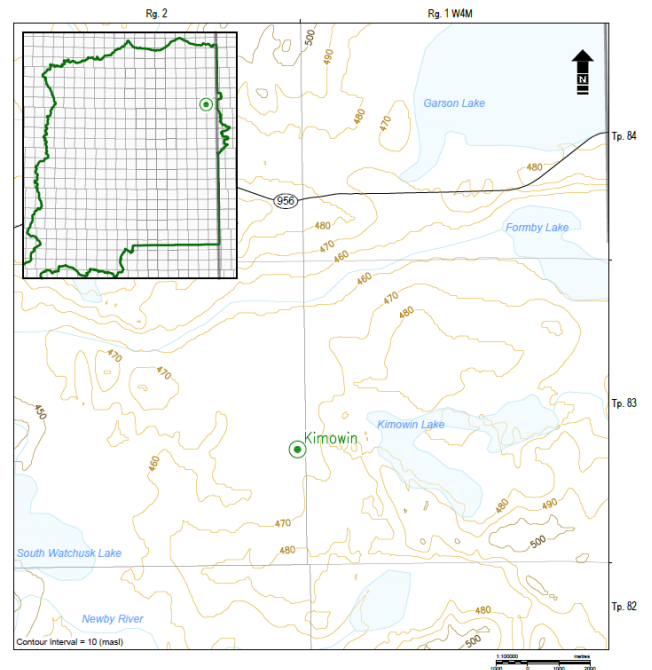
All key surficial aquifers have been completed at this location. There are two priority bedrock completions at this location that have yet to be installed in the Lower Grand Rapids and Middle Clearwater. Water levels indicate a generally downward vertical hydraulic gradient, with the exception of the Ethel Lake Aquifer where groundwater levels are lower than in the underlying Bonnyville. No increasing or decreasing trends in water levels were observed. Temperatures were measured by four instruments installed at different depths in the Muriel Lake Aquifer monitoring well; results indicate that gauges installed in the well screen provide the most accurate recording of formation temperature (Hobos at 156 and 159 m depth). This well was sampled twice in 2013 for routine parameters, metals, and hydrocarbons. Interim triggers were exceeded near surface (As), in Ethel Lake (TDS, As, B, BTEX and phenols), Bonnyville (As, Si, B, BTEX), Muriel Lake (As, Si, BTEX) and Empress Channel (NO₃, As, Si, BTEX). All unconsolidated aquifer completions at this location are expected to represent baseline conditions in their respective aquifers, including naturally high As concentrations.

Recommendations

- Consult with industry to identify possible nearby completions in the Lower Grand Rapids and/or Middle Clearwater aquifers that may be feasible/relevant for inclusion the regional groundwater monitoring well network.
- Instrument all wells with temperature gauges adjacent to well screen to obtain representative unit temperatures, if possible.
- Monitor and collect water quality parameters semi-annually at intervals of no less than 4 months (continue with routine, metals and petroleum hydrocarbons analyses).

KIMOWIN (01-13-083-02 W4M) 468.6 m asl

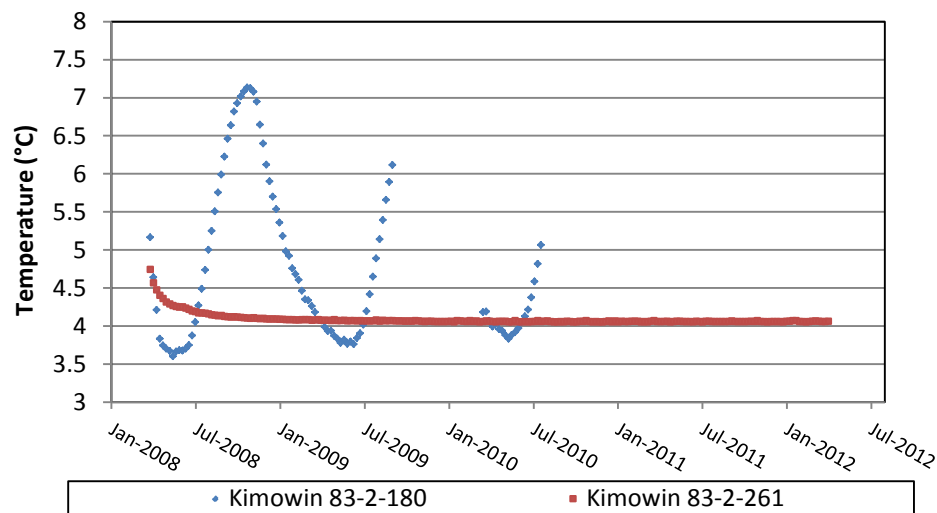
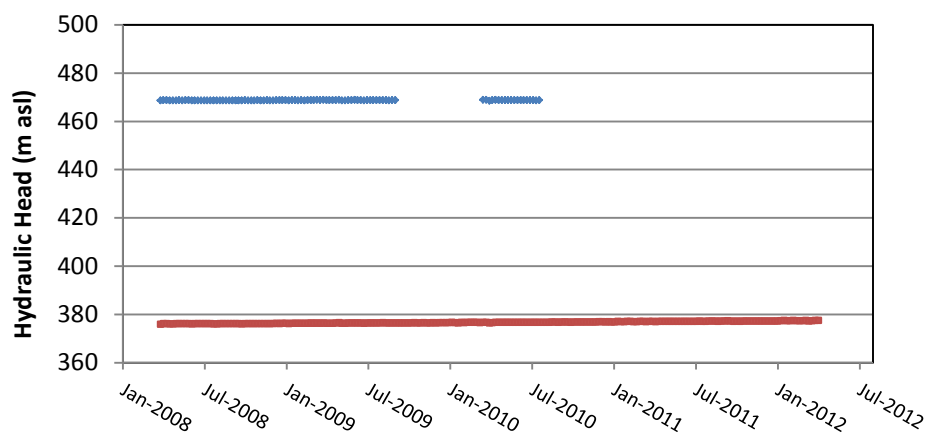
Location Objective	Support development of Sub-network A as per Matrix (2013)
Development Phase	Phase 2 (recommended)
Key Rationale	Existing monitoring wells in Upper Clearwater and Basal McMurray Located well away from existing or proposed source/disposal wells Near Saskatchewan border (societal concerns) Away from any identified gas production in Grand Rapids, Clearwater and McMurray formations
Safety, Access, Synergies and Priorities	Synergy with ConocoPhillips 1F1011308302W400 and 1F201130802W400 Higher priority location for Upper Clearwater and Basal McMurray completions



Aspects of Conceptual Model

Major Lakes and Rivers - Distal	Regional Recharge vs. Discharge - Discharge
Colorado Group Aquitard Extent - Absent	Gas Production - Distal
Bedrock Incisions - Distal	Oil Sands Groundwater Users - Distal
Unconsolidated Deposit Thickness - Thin	Shallow Local Groundwater Users - Distal

Well Name	Screened Interval (mbgs)	Owner	Interpreted Aquifer	Network
---	---	---	near surface	A (Strategic)
---	---	---	Lower Grand Rapids	A (Strategic)
Kimowin 83-2-180	156.1 - 180.3	ConocoPhillips	Upper Clearwater	A (Strategic)
Kimowin 83-2-261	242.3 - 260.5	ConocoPhillips	Basal McMurray	A (Strategic)



Parameters Exceeding LARP Interim Regional Groundwater Quality Triggers at Kimowin		
Parameter	Exceeds Applicable Triggers (Yes/No) ¹	
	83-2-180	83-2-261
Temp.	No	No
TDS	No	Yes
Cl	No	Yes
NO ₃	---	---
As	---	---
Si	---	---
B	---	---
BTEX	---	---
Phenols	---	---

1 - Exceeded trigger during historical sampling event(s)

--- No data

Comments

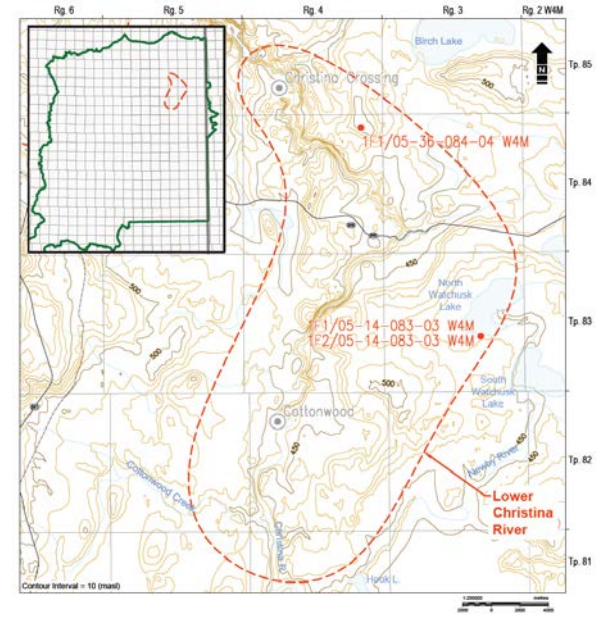
Matrix 2013 identified a synergy between the Kimowin location and nested ConocoPhillips monitoring wells at 01-13-83-2W4M. ConocoPhillips and ESRD are in negotiations to transition ownership of these monitoring wells. Water levels indicate there is a downward vertical hydraulic gradient between the Upper Clearwater and Basal McMurray aquifers. There has been a water level increase of about 2 m from 2008 to 2012 in the Basal McMurray Aquifer. No increasing or decreasing temperature trends are apparent in the McMurray. Water quality results for groundwater samples that were collected at the time of well development were provided by ConocoPhillips; wells are not currently part of a regular sampling program. Water quality parameters exceed interim triggers for TDS and Cl in McMurray. No data was provided for NO₃, As, Si, B, BTEX and phenols. Upper Clearwater and Basal McMurray aquifer completions at this location are expected to represent baseline conditions in their respective aquifers.

Recommendations

- Pending finalization of ownership transfer, CPC should continue collecting data as they planned.
- Once this location is officially added to the regional groundwater monitoring well network, an appropriate groundwater monitoring plan should be developed considering depth/nature of aquifer completions.
- Consult with industry to identify possible nearby completions that may be feasible/relevant for inclusion in the regional groundwater monitoring well network.
- If included in regional groundwater monitoring well network, consider installing a near-surface monitoring well at this location.

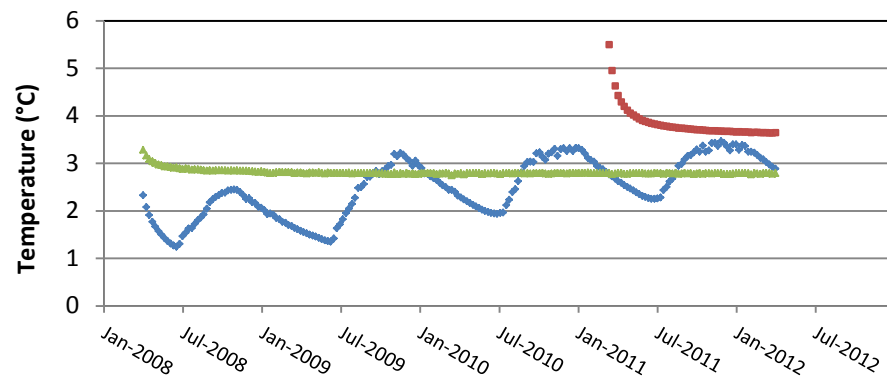
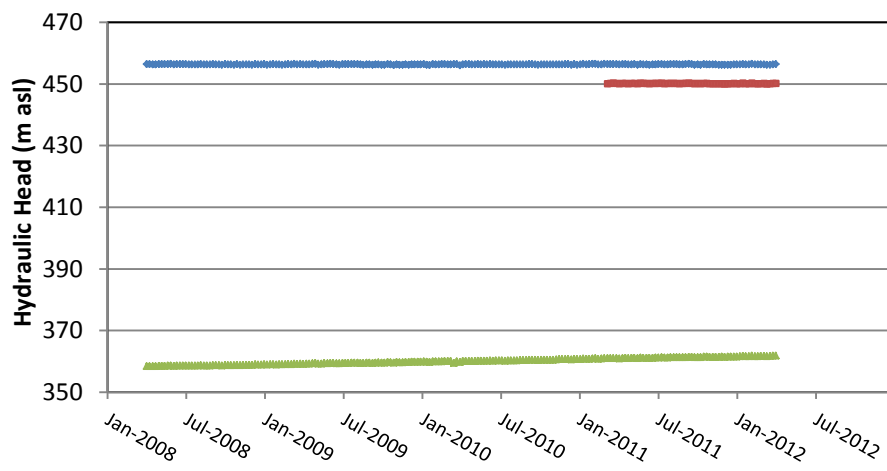
LOWER CHRISTINA RIVER INVESTIGATION AREA (Townships 81 to 84, Ranges 3 to 5 W4M)

Location Objective	Support development of Sub-network C as per Matrix (2013)
Development Phase	Phase 2 (recommended locations)
Key Rationale	Colorado Group regionally eroded away, regional discharge area to Christina River Moderate density of in situ oil sands existing and proposed source and disposal wells Identified as potentially vulnerable area (stressed aquifers; absence of Colorado Group Aquitard) Relatively high predicted drawdown in Lower Grand Rapids Aquifer and Upper Clearwater Aquifer in this area
Safety, Access, Synergies and Priorities	Synergies with ConocoPhillips wells 1F1/05-14-083-03W4/00, 1F2/05-14-083-03W4/00 and 1F1/05-36-084-04 Discussions with ConocoPhillips and Nexen (and possibly others) will need to be initiated to negotiate which additional wells, if any, can be incorporated into Sub-network C



Aspects of Conceptual Model	
Major Lakes and Rivers - Proximal Colorado Group Aquitard Extent - Absent Bedrock Incisions - Distal Unconsolidated Deposit Thickness - Thin	Regional Recharge vs. Discharge - Discharge Gas Production - Proximal Oil Sands Groundwater Users - Proximal Shallow Local Groundwater Users - Distal

Well Name	Screened Interval (mbgs)	Owner	Interpreted Aquifer	Network
1F2/05-14-083-03 W4M	69.7 - 81.8	ConocoPhillips	Lower Grand Rapids	C (Investigative)
1F1/05-36-084-04 W4M	149.1 - 170.4	ConocoPhillips	Upper Clearwater	C (Investigative)
1F1/05-14-083-03 W4M	240.2 - 252.3	ConocoPhillips	Basal McMurray	C (Investigative)



● 1F2/05-14-083-03 W4M (Lower Grand Rapids)
 ■ 1F1/05-36-084-04 W4M (Upper Clearwater)
▲ 1F1/05-14-083-03 W4M (McMurray)

Parameters Exceeding LARP Interim Regional Groundwater Quality Triggers in Lower Christina River Investigation Area			
Parameter	Exceeds Applicable Triggers (Yes/No) ¹		
	Lower Grand Rapids	Upper Clearwater	Basal McMurray
Temp.	No	No	No
TDS	Yes	No	Yes
Cl	Yes	No	Yes
NO ₃	---	---	---
As	---	---	---
Si	---	---	---
B	---	---	---
BTEX	---	---	---
Phenols	---	---	---

1 - Exceeded trigger during historical sampling event(s)

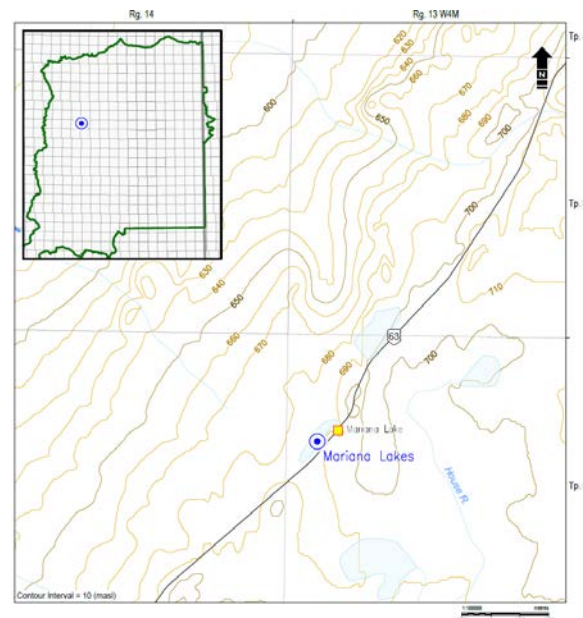
--- No data

Comments
Nested monitoring wells at 05-14-083-03 W4M were identified by Matrix (2013) as a potential monitoring well for the Lower Christina Channel Investigation Area. ConocoPhillips and ESRD are in negotiations to transition ownership of these monitoring wells. Monitoring well 05-36-084-04 W4M was recommended by ConocoPhillips as a potential monitoring well for the Lower Christina Channel Investigation Area. Water levels suggest a downward vertical hydraulic gradient between the Lower Grand Rapids, Upper Clearwater and Basal McMurray aquifers. Water levels were consistent in the Lower Grand Rapids Aquifer (2008-2012) and Upper Clearwater Aquifer (2011-2012), but water levels in the Basal McMurray Aquifer increased about 3 m between 2008 and 2012. Temperature measurements in the Lower Grand Rapids well show seasonal variation (likely related to the sensor depth) and indicate an increasing long-term trend; temperatures in the other aquifers have remained consistent. Water quality results for groundwater samples that were collected at the time of well development were provided by ConocoPhillips; wells are not currently part of a regular sampling program. Water quality parameters exceeded interim triggers in the Lower Grand Rapids and McMurray (TDS and Cl). No data was provided for NO ₃ , As, B, BTEX and phenols concentrations.

Recommendations
<ul style="list-style-type: none"> Pending finalization of ownership transfer, ConocoPhillips should continue collecting data as they planned at 05-14-083-03 W4M. ESRD will consult further with ConocoPhillips before officially adding monitoring well 05-36-084-04 W4M to the Lower Christina River Investigation Area. Consultation will include sampling responsibility, parameters and schedule. Once the 05-14-083-03 W4M location is officially added to the Lower Christina River Investigation Area, an appropriate groundwater monitoring plan should be developed considering depth/nature of aquifer completions. Consult with industry to identify possible nearby completions that may be feasible/relevant for inclusion in the Lower Christina River Investigation Area.

MARIANA LAKES (07-19-080-13 W4M) 692.9 m asl

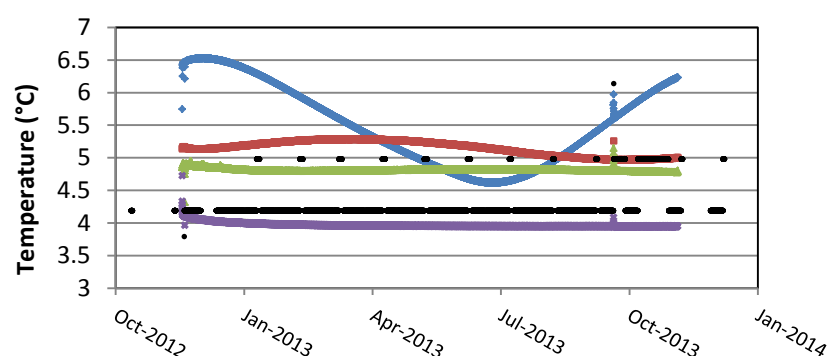
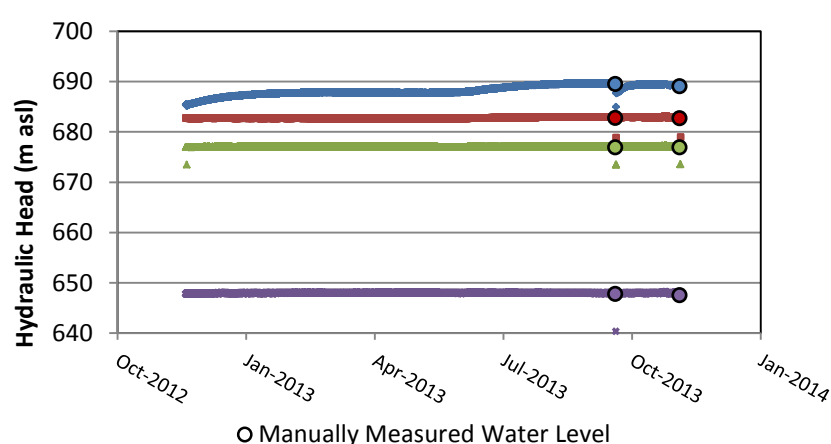
Location Objective	Support development of Sub-networks A and B as per Matrix (2013)
Development Phase	Phase 1 (existing)
Key Rationale	Near Mariana Lakes (water body and shallow groundwater users) Empress Terrace Aquifer present Near Worley Parsons proposed groundwater monitoring well MW12
Safety, Access, Synergies and Priorities	Near historic Grand Rapids Formation gas production All season access Synergy was achieved through existing publicly-owned lands Near Surface, Ethel Lake, Bonnyville and Empress Terrace completions installed in fall 2012



Aspects of Conceptual Model

Major Lakes and Rivers - Proximal Colorado Group Aquitard Extent - Present Bedrock Incisions - Distal Unconsolidated Deposit Thickness - Thick	Regional Recharge vs. Discharge - Recharge Gas Production - Proximal Oil Sands Groundwater Users - Proximal Shallow Local Groundwater Users - Proximal
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Well Name	Screened Interval (mbgs)	Owner	Interpreted Aquifer	Network
Mariana Lakes 80-13-7	4.6 - 7.6	ESRD	shallow	B (Surveillance)
Mariana Lakes 80-13-52	43.0 - 49.5	ESRD	Ethel Lake	A (Strategic)
Mariana Lakes 80-13-112	108.0 - 111.0	ESRD	Bonnyville	A (Strategic)
Mariana Lakes 80-13-134	131.0 - 134.0	ESRD	Empress Terrace	A (Strategic)
---	---	---	Lower Grand Rapids	B (Surveillance)



• Mariana Lakes 80-13-7	• Mariana Lakes 80-13-52
• Mariana Lakes 80-13-112	• Mariana Lakes 80-13-134
• Mariana Lakes 80-13-134 Nautilus 85 at 138 m	

Parameters Exceeding LARP Interim Regional Groundwater Quality Triggers at Mariana Lakes

Parameter	Exceeds Applicable Triggers (Yes/No) ¹			
	80-13-7	80-13-52	80-13-112	80-13-134
Temp.	No	No	No	No
TDS	No	No	No	No
Cl	No	No	No	No
NO ₃	No	No	No	No
As	No	Yes	Yes	Yes
Si	Yes	Yes	Yes	Yes
B	No	No	Yes	Yes
BTEX	Yes	Yes	No	No
Phenols	Yes	No	No	No

1 - Exceeds trigger in at least one of two sampling events in 2013

Comments

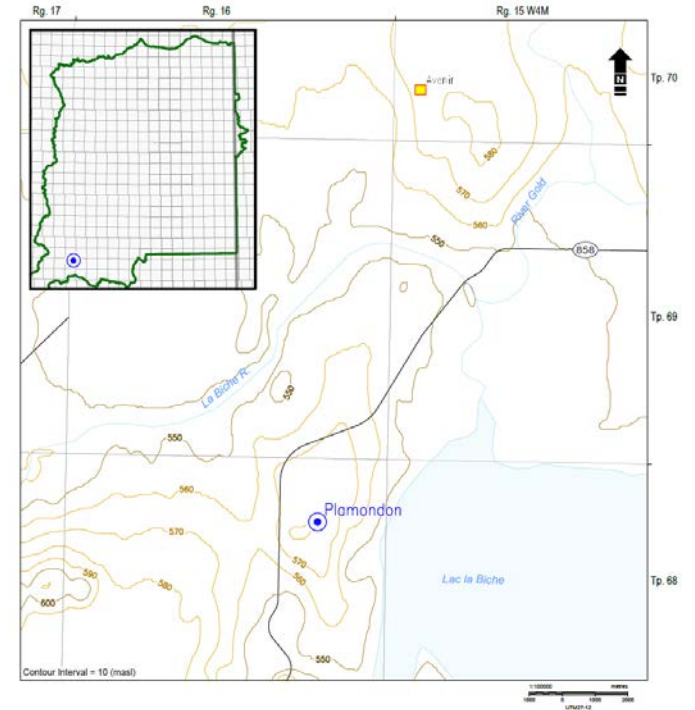
All key surficial aquifers have been completed at this location. There is one low priority bedrock completion identified at this location for the Lower Grand Rapids. Water levels indicate a downward vertical hydraulic gradient, with no increasing or decreasing trends observed (although seasonal fluctuations are evident in the near surface). Temperatures were measured by two instruments installed at different depths in the Empress Terrace monitoring well; results were similar, with slightly lower temperatures (0.2°C) observed throughout the year from the gauge installed within the well screen (more accurate than shallower gauge). This well was sampled twice in 2013 for routine parameters, metals and hydrocarbons. Interim triggers were exceeded near surface (Si, BTEX and phenols), in Ethel Lake (Si, B, BTEX), Bonnyville (Si, As, B) and Empress Terrace (Si, As, B). Aquifer completions in the Ethel Lake, Bonnyville and Empress Terrace aquifers at this location are believed to represent baseline conditions in their respective aquifers; As concentrations appear to be naturally high in the Bonnyville and Empress Terrace aquifers.

Recommendations

- Consult with industry to identify possible nearby Lower Grand Rapids completions that may be feasible/relevant for inclusion in the regional groundwater monitoring well network.
- Instrument all wells with temperature gauges adjacent to well screen, if possible.
- Monitor and collect water quality parameters semi-annually at intervals of no less than 4 months (continue with routine, metals and petroleum hydrocarbons analyses).

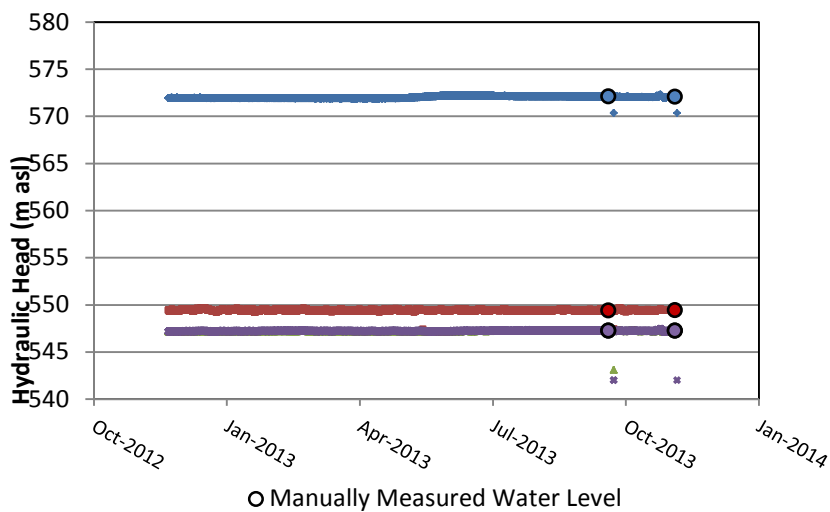
PLAMONDON (10-26-068-16 W4M) 577.9 m asl

Location Objective	Support development of Sub-networks A and B as per Matrix (2013)
Development Phase	Phase 1 (existing)
Key Rationale	Near the settlements of Plamondon and Lac La Biche (societal concerns) Near numerous shallow groundwater users and major water body Intersects buried bedrock channel Near WorleyParsons proposed groundwater monitoring well MW18 Far from any in situ oil sands project Near lake monitoring and WSC site
Safety, Access, Synergies and Priorities	Near historic and current Grand Rapids Formation gas production All season access Synergy was achieved with Canadian Natural Resources Limited at their 100/10-26-068-16 W4/00 well pad Near surface, Bonnyville (x2), and Empress Channel completions installed in fall 2012



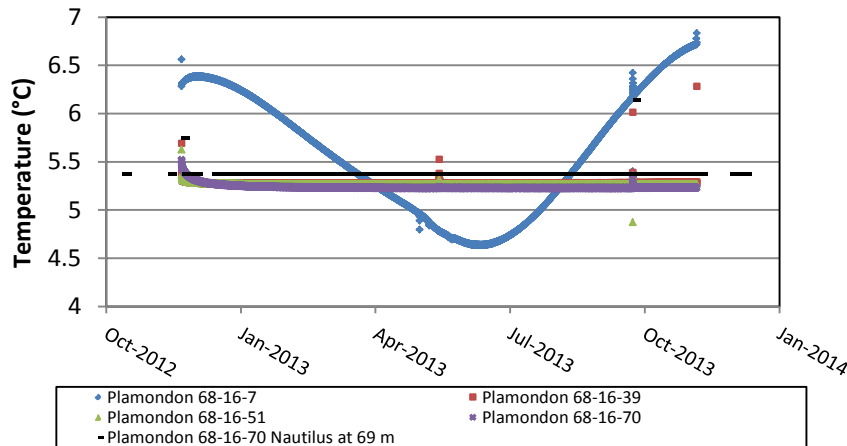
Aspects of Conceptual Model	
Major Lakes and Rivers - Proximal	Regional Recharge vs. Discharge - Recharge
Colorado Group Aquitard Extent - Present	Gas Production - Proximal
Bedrock Incisions - Proximal	Oil Sands Groundwater Users - Distal
Unconsolidated Deposit Thickness - Thick	Shallow Local Groundwater Users - Proximal

Well Name	Screened Interval (mbgs)	Owner	Interpreted Aquifer	Network
Plamondon 68-16-7	5.0 - 7.3	ESRD	shallow	B (Surveillance)
Plamondon 68-16-39	33.0 - 38.5	ESRD	Bonnyville	B (Surveillance)
Plamondon 68-16-51	45.0 - 51.2	ESRD	Bonnyville	B (Surveillance)
Plamondon 68-16-70	64.0 - 69.5	ESRD	Empress Channel	A (Strategic)
---	---	---	Lower Grand Rapids	B (Surveillance)



Parameters Exceeding LARP Interim Regional Groundwater Quality Triggers at Plamondon				
Parameter	Exceeds Applicable Triggers (Yes/No) ¹			
	68-16-7	68-16-39	68-16-51	68-16-70
Temp.	No	No	No	No
TDS	No	Yes	Yes	Yes
Cl	No	No	No	Yes
NO ₃	Yes	No	No	No
As	Yes	Yes	Yes	Yes
Si	No	No	No	No
B	No	Yes	Yes	Yes
BTEX	Yes	Yes	No	No
Phenols	No	No	No	No

1 - Exceeds trigger in at least one of two sampling events in 2013



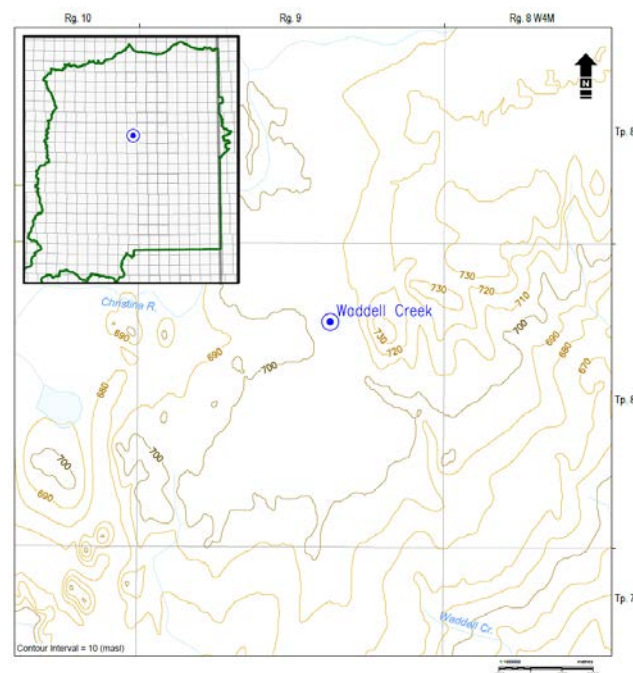
Comments

All key surficial aquifers have been completed at this location. Water levels indicate recharge conditions and a large downward vertical hydraulic gradient between the shallow aquifer and the underlying Bonnyville Aquifer, which suggests the presence of a confining/aquitard layer above the Bonnyville Aquifer. Seasonal variation in temperature is apparent in the near surface monitoring well. Water levels in the two lower wells (Bonnyville and Empress Channel) have been nearly identical since continuous monitoring began in November 2012, and are similar to the elevation of Lac La Biche. Temperature was measured by two different instruments (In-Situ and Nautilus gauges) installed at the same depth in the Empress Channel monitoring well, which recorded similar temperatures (about 0.15°C difference). All temperatures were measured within the well screen and appear to be representative of formation temperature. This location was sampled twice in 2013 for routine parameters, metals and hydrocarbons. Interim triggers were exceeded near surface (NO₃, As, BTEX), Bonnyville (TDS, As, B, BTEX) and Empress Channel (TDS, Cl, As, B). The Empress Channel Aquifer completion is expected to represent baseline conditions, and there are naturally high arsenic concentrations in aquifers at this location.

- Recommendations**
- Consult with industry to identify possible nearby Lower Grand Rapids completions that may be feasible/relevant for inclusion in the regional groundwater monitoring well network.
 - Instrument all wells with temperature gauges adjacent to well screen to obtain representative unit temperatures, if possible.
 - Monitor and collect water quality parameters semi-annually at intervals of no less than 4 months (continue with routine, metals and petroleum hydrocarbons analyses).

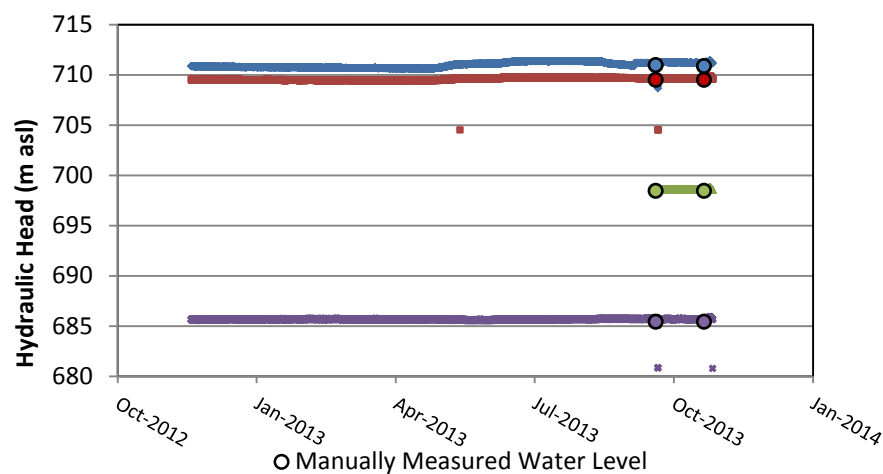
WADDELL CREEK (08-27-080-09 W4M) 717.9 m asl

Location Objective	Support development of Sub-networks A and B as per Matrix (2013)
Development Phase	Phase 1 (existing)
Key Rationale	On Stony Mountain Uplands Empress Channel Aquifer (Leismer Channel) Near Worley Parsons (2010) proposed groundwater monitoring well MW6 Baseline quality and quantity expected in shallow unconsolidated units Over 50 m of predicted drawdown in the Lower Grand Rapids Aquifer at this location
Safety, Access, Synergies and Priorities	Near historic Grand Rapids gas production All season access Synergy was achieved through existing DRS lands. Statoil Canada Ltd. provided access to location Near surface, Sand River, Ethel Lake and Bonnyville completions installed in 2012 Higher priority location for Empress Channel aquifer completion



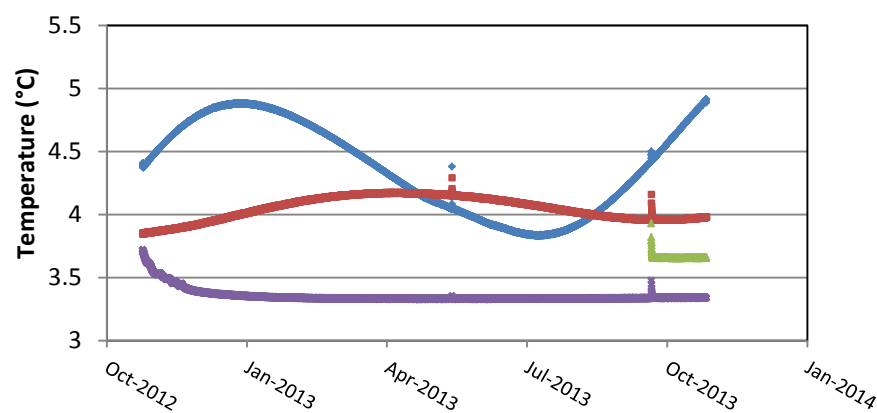
Aspects of Conceptual Model	
Major Lakes and Rivers - Distal	Regional Recharge vs. Discharge - Recharge
Colorado Group Aquitard Extent - Present	Gas Production - Proximal
Bedrock Incisions - Proximal	Oil Sands Groundwater Users - Proximal
Unconsolidated Deposit Thickness - Thick	Shallow Local Groundwater Users - Distal

Well Name	Screened Interval (mbgs)	Owner	Interpreted Aquifer	Network
Waddell Creek 80-9-9	6.1 - 9.2	ESRD	shallow	A (Strategic)
Waddell Creek 80-9-21	17.0 - 20.5	ESRD	Sand River	A (Strategic)
Waddell Creek 80-9-117	111.0 - 117.0	ESRD	Ethel Lake	A (Strategic)
Waddell Creek 80-9-149	146.0 - 149.0	ESRD	Bonnyville	A (Strategic)
---	---	---	Empress Channel	B (Surveillance)
---	---	---	Lower Grand Rapids	B (Surveillance)



Parameters Exceeding LARP Interim Regional Groundwater Quality Triggers at Waddell Creek				
Parameter	Exceeds Applicable Triggers (Yes/No) ¹			
	80-9-9	80-9-21	80-9-117	80-9-149
Temp.	No	No	No	No
TDS	No	No	No	No
Cl	No	No	No	No
NO ₃	Yes	No	No	No
As	No	Yes	No	No
Si	Yes	Yes	Yes	Yes
B	No	No	Yes	Yes
BTEX	No	No	No	No
Phenols	Yes	No	Yes	No

1 - Exceeds trigger in at least one of two sampling events in 2013



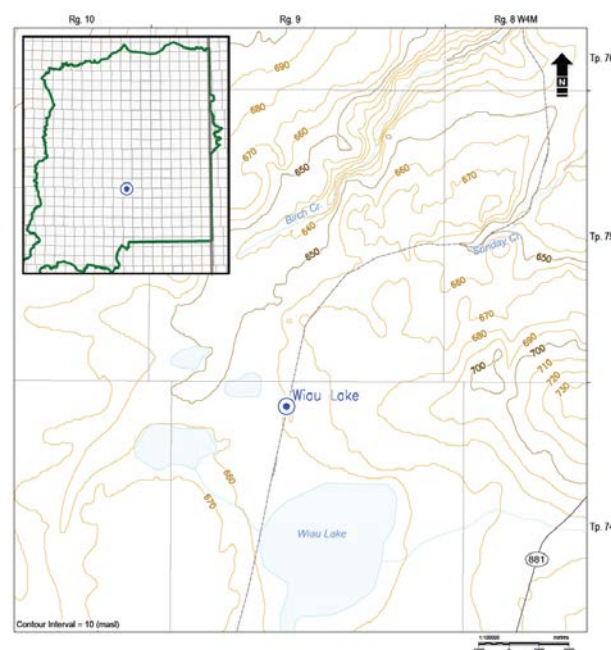
• Waddell Creek 80-9-9 • Waddell Creek 80-9-21 • Waddell Creek 80-9-117 • Waddell Creek 80-9-149

Comments
There is one high priority aquifer identified at this location to be completed in the Empress Channel. Water levels indicate a small downward vertical hydraulic gradient between the shallow aquifer and Sand River Aquifer, with no increasing or decreasing water level trends observed (although seasonal fluctuations are evident in the near surface). Temperatures measured by pressures transducers only (generally not within the well screen). This well was sampled twice in 2013 for routine parameters, metals, and hydrocarbons. Interim triggers were exceeded near surface (NO ₃ , Si, phenols), in Sand River (As, Si), Ethel Lake (Si, B, phenols) and Bonnyville (Si, B). All unconsolidated aquifer completions (except Empress Channel) at this location are expected to represent baseline conditions in their respective aquifers.

Recommendations
<ul style="list-style-type: none"> Consult with industry to identify possible nearby Empress Channel completion that may be feasible/relevant for inclusion in the regional groundwater monitoring well network. Instrument all wells with temperature gauges adjacent to well screen, if possible. Monitor and collect water quality parameters semi-annually at intervals of no less than 4 months (continue with routine, metals and petroleum hydrocarbons analyses).

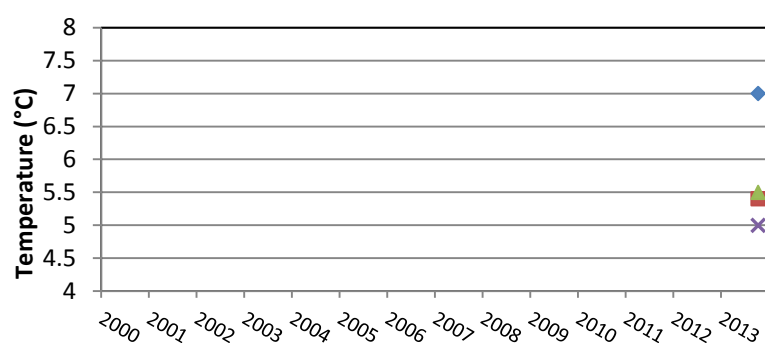
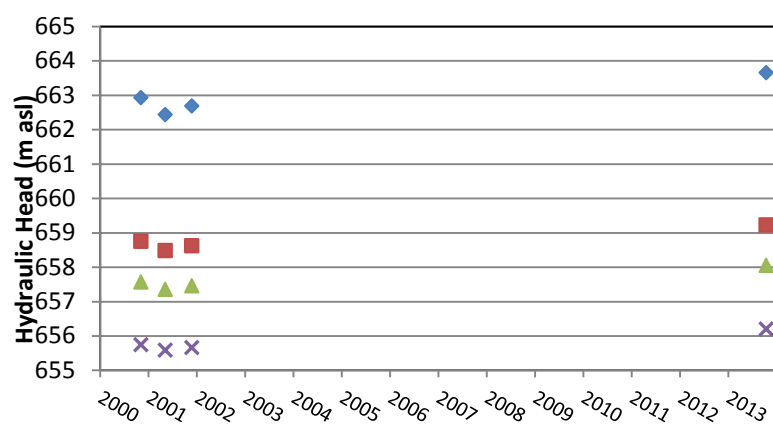
WIAU LAKE (06-33-073-09 W4M) 667.0 m asl

Location Objective	Support development of Sub-networks A and B as per Matrix (2013)
Development Phase	Phase 2 (existing)
Key Rationale	Empress Channel Aquifer (Wiau Channel) Near water body WEPA00-1 well pad present Near WorleyParsons proposed groundwater monitoring well MW14 Tens of metres of predicted drawdown in Empress Terrace Aquifer at this location About 50 m of drawdown is predicted in the Middle Clearwater Aquifer at this location
Safety, Access, Synergies and Priorities	Near historic Grand Rapids gas production. Near McMurray Formation current gas production, well away from any Clearwater Formation gas production. Likely winter access. Synergy with WEPA00-1 (Sand River and Bonnyville completions already exist). Discussions with Canadian Natural are recommended as there may be a synergy with access, existing wells or monitoring locations - especially regarding deeper Cretaceous units that don't necessarily need to be sampled regularly or at all.



Aspects of Conceptual Model	
Major Lakes and Rivers - Proximal	Regional Recharge vs. Discharge - Recharge
Colorado Group Aquitard Extent - Present	Gas Production - Proximal
Bedrock Incisions - Proximal	Oil Sands Groundwater Users - Proximal
Unconsolidated Deposit Thickness - Thick	Shallow Local Groundwater Users - Distal

Well Name	Screened Interval (mbgs)	Owner	Interpreted Aquifer	Network
---	---	---	near surface	A (Strategic)
Wiau Lake 73-9-15 (WEPA 00-1-WT)	9.3 - 15.4	ESRD	Sand River	A (Strategic)
---	---	---	Ethel Lake	A (Strategic)
Wiau Lake 73-9-41 (WEPA 00-1-41)	37.9 - 41.0	ESRD	Bonnyville	A (Strategic)
Wiau Lake 73-9-76 (WEPA 00-1-76)	72.4 - 75.3	ESRD	Bonnyville	A (Strategic)
Wiau Lake 73-9-120 (WEPA 00-1-120)	117.3 - 120.3	ESRD	Bonnyville	A (Strategic)
---	---	---	Muriel Lake	A (Strategic)
---	---	---	Empress Terrace	B (Surveillance)
---	---	---	Lower Grand Rapids	B (Surveillance)
---	---	---	Middle Clearwater	B (Surveillance)
---	---	---	Basal McMurray	B (Surveillance)



◆ Wiau Lake 73-9-15 ■ Wiau Lake 73-9-41 ▲ Wiau Lake 73-9-76 ✕ Wiau Lake 73-9-120

Parameters Exceeding LARP Interim Regional Groundwater Quality Triggers at Wiau Lake				
Parameter	Exceeds Applicable Triggers (Yes/No) ¹			
	73-9-15	73-9-41	73-9-76	73-9-120
Temp.	I.D.	I.D.	I.D.	I.D.
TDS	No	No	No	No
Cl	No	No	No	No
NO ₃	Yes	No	No	No
As	No	Yes	No	No
Si	Yes	Yes	No	Yes
B	No	No	No	No
BTEX	No	No	No	No
Phenols	No	No	No	No

1 - Exceeds trigger in at least one of two sampling events in 2013

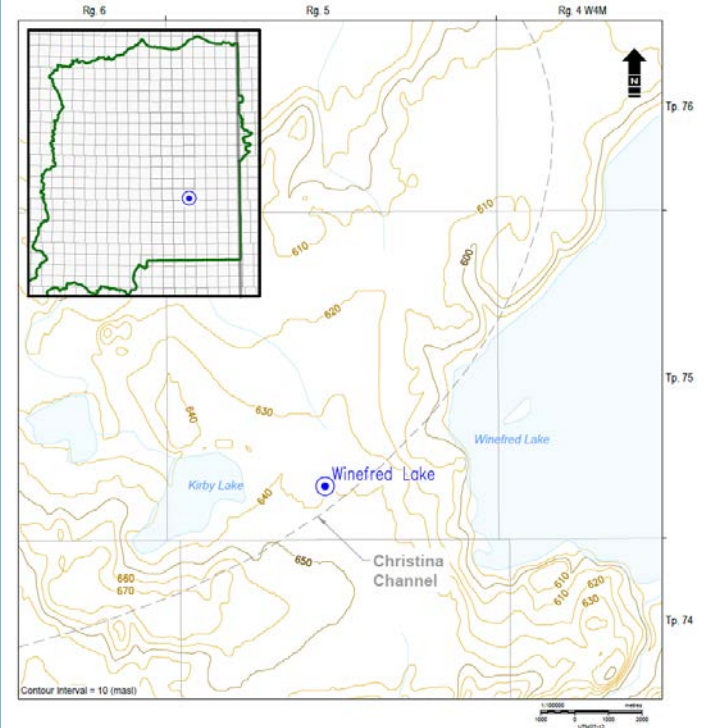
I.D. - Insufficient data to discern trends

Comments
This location had four existing monitoring wells completed in Sand River and Bonnyville aquifers; additional high priority aquifers for completion include the near surface, Ethel Lake, Muriel Lake, Empress Terrace and Middle Clearwater aquifers. Water levels indicate a downward vertical hydraulic gradient; water levels in all monitoring wells appear to have increased from 2001 to 2013. Pressures transducers were installed in October 2013 and were programmed to record pressure and temperature at hourly intervals. This location was sampled once in 2013 for routine parameters, metals and hydrocarbons. Interim triggers were exceeded in the Sand River (NO ₃ , Si) and the Bonnyville (As, Si). All unconsolidated aquifer completions at this location are expected to represent baseline conditions in their respective aquifers.

Recommendations
<ul style="list-style-type: none"> Consult with industry to identify possible nearby completions in the Ethel Lake, Muriel Lake, Empress Terrace and/or Middle Clearwater aquifers that may be feasible/relevant for inclusion in the regional groundwater monitoring well network. Instrument all wells with temperature gauges adjacent to well screen, if possible. Monitor and collect water quality parameters semi-annually at intervals of no less than 4 months (continue with routine, metals and petroleum hydrocarbons analyses). Consider installing a near-surface monitoring well at this location.

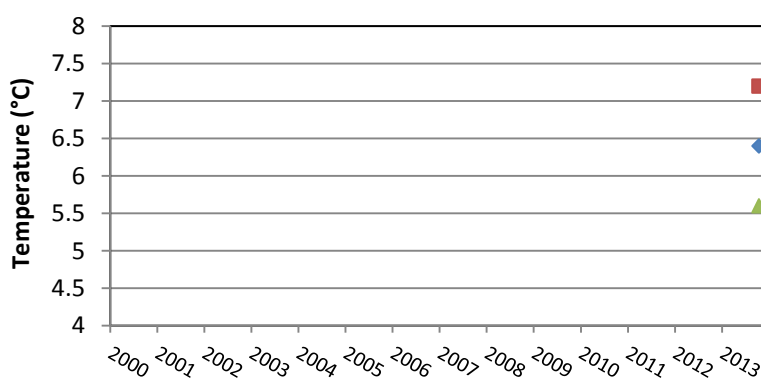
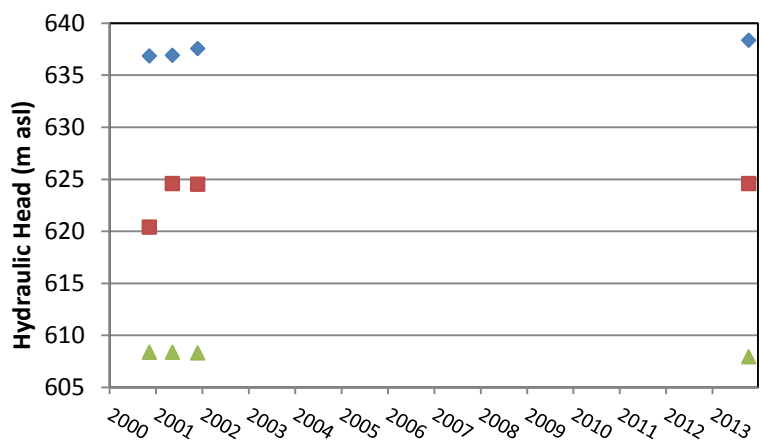
WINEFRED LAKE (16-04-075-05 W4M) 648.3 m asl

Location Objective	Support development of Sub-networks A and B as per Matrix (2013)
Development Phase	Phase 2 (existing)
Key Rationale	Near major lake (Winefred Lake; surface water-groundwater interactions) Near in situ oil sands groundwater users Empress Terrace Aquifer present WEPA00-3 well pad present Near WorleyParsons proposed groundwater monitoring well MW3 Over 50 m of predicted drawdown in the Lower Grand Rapids Aquifer and Upper Clearwater Aquifers at this location
Safety, Access, Synergies and Priorities	Near historic Grand Rapids and McMurray formation gas production, near current Clearwater gas production. Likely winter access. Synergy with WEPA00-3 (near surface, Bonnyville and Empress Terrace completions already exist). Optional synergy may be found with Devon's suspended gas well at 100/13-11-075-05 W4/00. Discussions with Cenovus are recommended as there may be a synergy with access, existing wells or monitoring locations, especially regarding deeper Cretaceous units that don't necessarily need to be sampled regularly or at all. This monitoring location can be linked to monitoring in the Christina Channel Investigation Area. Higher priority location for Ethel Lake and Muriel completions.



Aspects of Conceptual Model	
Major Lakes and Rivers - Proximal	Regional Recharge vs. Discharge - Recharge
Colorado Group Aquitard Extent - Present	Gas Production - Proximal
Bedrock Incisions - Distal	Oil Sands Groundwater Users - Proximal
Unconsolidated Deposit Thickness - Thick	Shallow Local Groundwater Users - Distal

Well Name	Screened Interval (mbgs)	Owner	Interpreted Aquifer	Network
Winefred Lake 75-5-17 (WEPA 00-3-17)	11.2 - 17.3	ESRD	shallow	A (Strategic)
---	---	---	Ethel Lake	B (Surveillance)
Winefred Lake 75-5-79 (WEPA 00-3-79)	76.6 - 79.6	ESRD	Bonnyville	B (Surveillance)
---	---	---	Muriel Lake	B (Surveillance)
Winefred Lake 75-5-158 (WEPA 00-3-158)	155.4 - 158.8	ESRD	Empress Terrace	B (Surveillance)
---	---	---	Lower Grand Rapids	B (Surveillance)
---	---	---	Upper Clearwater	B (Surveillance)
---	---	---	Middle Clearwater	B (Surveillance)



◆ Winefred Lake 75-5-17 ■ Winefred Lake 75-5-79 ▲ Winefred Lake 75-5-158

Parameters Exceeding LARP Interim Regional Groundwater Quality Triggers at Winefred Lake			
Parameter	Exceeds Applicable Triggers (Yes/No) ¹		
	73-9-15	73-9-41	73-9-76
Temp.	I.D.	I.D.	I.D.
TDS	Yes	Yes	No
Cl	Yes	No	No
NO ₃	Yes	No	No
As	Yes	Yes	No
Si	Yes	Yes	Yes
B	Yes	Yes	No
BTEX	No	No	No
Phenols	No	No	No

1 - Exceeds trigger in at least one of two sampling events in 2013

I.D. - Insufficient data to discern trends

Comments

This location had three existing monitoring wells completed in the near surface, Bonnyville and Empress Terrace aquifers; additional high priority aquifers for completion include the Ethel Lake and Muriel Lake aquifers. Water levels indicate a downward vertical hydraulic gradient. No significant changes in water level are apparent from 2001 to 2013. Pressures transducers were installed in October 2013 and were programmed to record pressure and temperature at hourly intervals. This location was sampled once in 2013 for routine parameters, metals, and hydrocarbons. Interim triggers were exceeded in the near surface (TDS, Cl, NO₃, Si), Bonnyville (TDS, As, Si, B) and Empress Terrace (As, Si, B).

Recommendations

- Consult with industry to identify possible nearby completions in the Ethel Lake, Muriel Lake, Lower Grand Rapids and Upper/Middle Clearwater aquifers that may be feasible/relevant for inclusion in the regional groundwater monitoring well network.
- Instrument all wells with temperature gauges adjacent to well screen, if possible.
- Monitor and collect water quality parameters semi-annually at intervals of no less than 4 months (continue with routine, metals and petroleum hydrocarbons analyses).

5.2 Key Aquifers

Key aquifers, particularly bedrock aquifers, have been extensively studied in the SAOS area. Large volumes of hydrogeologic information about key aquifers in areas within the SAOS region have been compiled by operators, regulators and academics in publically available documents (regional reports, studies, EIAs, *Water Act* diversion applications and compliance/regulatory groundwater monitoring reports). The data provided in these documents demonstrate the spatial variability of groundwater quality conditions in the SAOS region, and highlight the difficulty in defining a single groundwater quality trigger to encompass all locations for a given aquifer. Monitoring locations that comprise the SAOS groundwater monitoring network are recommended to be considered as reference locations that represent a subset of groundwater conditions within SAOS region, rather than a means by which to define regional conditions in SAOS key aquifers.

This section compares groundwater quality results to the interim triggers for SAOS defined in the GMF (GoA 2012).

5.2.1 Shallow Aquifers

Shallow aquifer monitoring wells were completed at six sites that are part of the existing SAOS regional groundwater monitoring network (Conklin, House Crossing, Mariana Lakes, Plamondon, Waddell Creek and Winefred Lake). The locations are indicated on Figure 4.

Completions within the shallow aquifers were generally calcium-carbonate (Ca-CO₃) type groundwaters (Table 6). Parameters exceeded the SAOS interim groundwater quality triggers for surficial deposits for total dissolved solids (TDS; Winefred Lake), chloride (Winefred Lake), nitrate (Conklin, Plamondon, Waddell Creek and Winefred Lake), arsenic (House Crossing and Plamondon), silica (Si; Mariana Lakes, Plamondon and Waddell Creek), BTEX (Mariana Lakes and Plamondon) and phenols (Mariana Lakes and Waddell Creek; Tables 6, 7 and 8).

5.2.2 Sand River Aquifer

There are three completions in the Sand River Aquifer that are part of the existing SAOS regional groundwater monitoring network (Conklin, Waddell Creek and Wiau Lake). The locations are indicated on Figure 5.

Completions within the Sand River Aquifer generally has calcium-carbonate type groundwater (Table 6). Parameters exceeded the SAOS interim groundwater quality triggers for surficial deposits for arsenic and silica (Conklin, Waddell Creek and Wiau Lake; Table 7).

5.2.3 Ethel Lake Aquifer

There are four completions in the Ethel Lake Aquifer that are part of the existing SAOS regional groundwater monitoring network (Conklin, House Crossing, Mariana Lakes and Waddell Creek) and one

completed that is recommended for the Christina Channel Investigation Area (CL MW 26). The locations are indicated on Figure 6.

Completions within the Ethel Lake Aquifer samples were calcium-carbonate and sodium-carbonate (Na-CO₃) type groundwaters (Table 6). Parameters exceeded the SAOS interim groundwater quality triggers for surficial deposits for TDS (House Crossing), arsenic (House Crossing and Mariana Lakes), silica (Conklin, Mariana Lakes and Waddell Creek), boron (B; Conklin, House Crossing and Waddell Creek), BTEX (House Crossing and Mariana Lakes) and phenols (House Crossing and Waddell Creek; Tables 6, 7 and 8).

5.2.4 Bonnyville Aquifer

There are ten completions at seven sites in the Bonnyville Aquifer that are part of the existing SAOS regional groundwater monitoring network (Conklin, House Crossing, Mariana Lakes, Plamondon [two wells], Waddell Creek, Wiau Lake [three wells] and Winefred Lake). The locations are indicated on Figure 7.

Completions within the Bonnyville Sand Aquifer samples were calcium-carbonate and sodium-carbonate type groundwaters (Table 6). Parameters exceeded the SAOS interim groundwater quality triggers for surficial deposits for TDS (Plamondon and Winefred Lake), nitrate (House Crossing and Wiau Lake), arsenic (House Crossing, Mariana Lakes, Plamondon and Winefred Lake), silica (Conklin, House Crossing, Mariana Lakes, Waddell Creek, Wiau Lake and Winefred Lake), boron (Conklin, House Crossing, Mariana Lakes, Plamondon, Waddell Creek and Winefred Lake), and BTEX (House Crossing and Plamondon; Tables 6, 7 and 8).

5.2.5 Muriel Lake Aquifer

There is one completion in the Muriel Lake Aquifer that is part of the existing SAOS regional groundwater monitoring network (House Crossing). The location is indicated on Figure 8.

The completion within the Muriel Lake Aquifer at House Crossing was a calcium-sodium-carbonate type groundwater (Table 6). Parameters exceeded the SAOS interim groundwater quality triggers for surficial deposits for arsenic, silica, and BTEX (Tables 7 and 8).

5.2.6 Empress Terrace Aquifer

There are two completions in the Empress Terrace Aquifer that are part of the existing SAOS regional groundwater monitoring network (Mariana Lakes and Winefred Lake). The locations are indicated on Figure 9.

Completions within the Empress Terrace Aquifer samples were sodium-carbonate type groundwaters (Table 6). Parameters exceeded the SAOS interim groundwater quality triggers for surficial deposits for

arsenic (Mariana Lakes and Winefred Lake), silica (Mariana Lakes and Winefred Lake) and boron (Mariana Lakes and Winefred Lake; Tables 7 and 8).

5.2.7 Empress Channel Aquifer

There are two completions in the Empress Channel Aquifer that are part of the existing SAOS regional groundwater monitoring network (House Crossing and Plamondon) and one location that is recommended for the Christina Channel Investigation Area (CL MW 25). The locations are indicated on Figure 10.

Completions within the Empress Channel Aquifer samples were Na-Cl type (CL MW 25 [CCIA] and Plamondon) and Na-Ca-CO₃ type (House Crossing) groundwaters (Table 6). Parameters exceeded the SAOS interim groundwater quality triggers for buried channels for TDS (Plamondon), chloride (CCIA and Plamondon), nitrate (House Crossing), arsenic (House Crossing and Plamondon), silica (House Crossing), boron (House Crossing and Plamondon), and BTEX (House Crossing; Tables 6, 7 and 8).

5.2.8 Lower Grand Rapids Aquifer

There are two completions in the Lower Grand Rapids Aquifer that are recommended to become part of the SAOS regional groundwater monitoring network (Caribou [VWP – no water quality data available] and 1F2/05-14-083-03 W4M [for the Lower Christina River Investigation Area]). The locations are indicated on Figure 11.

The completion within the Lower Grand Rapids Aquifer sample was Na-Cl type groundwater (Table 6). Parameters exceeded the SAOS interim groundwater quality triggers for the Lower Grand Rapids Formation for TDS (LCRIA) and chloride (LCRIA; Table 6).

5.2.9 Upper Clearwater Aquifer

There are three completions in the Upper Clearwater Aquifer that are recommended to become part of the SAOS regional groundwater monitoring network (Graham, Kimowin and 1F1/05-36-084-04 W4M [Lower Christina River Investigation Area]). The locations are indicated on Figure 12.

The completions within the Upper Clearwater Aquifer were Na-Cl type groundwater (Table 6). Parameters exceeded the SAOS interim groundwater quality triggers for the Clearwater Formation for TDS (extrapolated; Graham) and chloride (Graham; Table 6).

5.2.10 Middle Clearwater Aquifer

Currently there are no existing or recommended monitoring locations completed in the Middle Clearwater Aquifer that are part of the SAOS regional groundwater monitoring network. The extent of the Middle Clearwater Aquifer in the SAOS region is illustrated on Figure 13.

5.2.11 Basal McMurray Aquifer

There are four completions in the Basal McMurray Aquifer that are recommended to become part of the SAOS regional groundwater monitoring network (Caribou [VWP – no water quality data available], Graham, Kimowin and 1F1/05-14-083-03 W4M [Lower Christina River Investigation Area]). The locations are indicated on Figure 14.

The completions within the Basal McMurray Aquifer were sodium-chloride type groundwaters (Table 6). Parameters exceeded the SAOS interim groundwater quality triggers for the McMurray Formation for TDS (Graham, Kimowin and LCRIA) and chloride (Graham, Kimowin and LCRIA; Table 6).

5.3 Regional Groundwater Summary

A summary of the exceedances of interim water quality parameters for SAOS groundwater monitoring network locations is provided in Table 12. The table provides an overview of the percentage of existing and recommended SAOS groundwater monitoring wells that exceeded each indicator parameter, broken down by aquifer. The interim triggers were exceeded in every aquifer with active monitoring locations for two or more of the key indicators specified in Table A.

6 DISCUSSION

- There are a total of 28 existing monitoring wells and 10 recommended monitoring completions (9 wells and 1 VWP) in the SAOS regional groundwater monitoring network; there are existing completions in 9 of the 10 SAOS key aquifers. SAOS monitoring locations should be considered as reference points for groundwater conditions, and do not necessarily capture the full range of spatial variability within the SAOS region.
- Water levels in the SAOS region varied spatially.
 - ✦ Water levels generally indicate recharge conditions and downward vertical hydraulic gradients. Upward vertical hydraulic gradients were observed between aquifers at the following locations:
 - Christina Channel IA: Empress to Ethel Lake
 - Conklin: Sand River to Ethel Lake
 - House Crossing: Ethel Lake to Bonnyville
 - ✦ Water levels in unconsolidated aquifers were generally stable.
 - ✦ Water levels in bedrock aquifers at locations with longer records show some perturbations and trends that may be related to withdrawal from and disposal to bedrock aquifers.
- Temperature is an important parameter to measure accurately as it can provide information on surface water-groundwater interactions (vertically discretized measurements).

- ✦ Currently, temperature gauges at most locations are not placed within the screened interval of the well. SAOS locations where secondary gauges were placed recorded different temperatures than the pressure transducers. No seasonal variation was observed in the wells where temperatures were measured in the wells screens in deeper (< 20 m) wells. The temperatures measured within the well screens are believed to represent unit temperature more accurately than measurements recorded above the well screen.
- ✦ Seasonal fluctuation in temperatures in shallow aquifers is expected; variation attenuates with depth. Seasonal variation in temperature is not expected in deeper aquifers.
- Some water quality parameters measured in SAOS groundwater monitoring wells exceeded the interim water quality triggers for SAOS in the Lower Athabasca Region GMF in most aquifers.
 - ✦ The prevalence of interim trigger exceedances highlights the variability of groundwater quality conditions within each aquifer. A single limit for each parameter in each aquifer may not be appropriate; rather, site-specific triggers for aquifers present at each monitoring location may be more effective in the overall groundwater management of the SAOS area.
 - ✦ Large volumes of data on key aquifer exists in publically available documents, and could be used in conjunction with the SAOS monitoring locations (reference points) to develop appropriate triggers as necessary.
- At this point in time there is insufficient data from the SAOS groundwater monitoring network to conduct statistical analyses to determine if there are statistically significant trends at most monitoring locations (reference points).

7 CONCLUSIONS

- The regional groundwater monitoring well network is developing as per the framework outlined in the *Framework for Development of a Regional Groundwater Monitoring Network - Interim Report, Southern Athabasca Oil Sands Area* (Matrix 2013).
- In 2013, existing ESRD monitoring wells were sampled (28 wells at 7 locations), wells owned by AGS were added (7 wells at 2 locations) and recommendations for industry wells to be incorporated to SAOS were made (2 wells and a VWP owned by Cenovus and 7 wells owned by ConocoPhillips).
- The existing and proposed monitoring locations include completions in all SAOS key aquifers, with the exception of the Middle Clearwater Aquifer.
- Key findings of the 2013 program include the following:
 - ✦ Temperature is an important parameter to measure accurately.

- ✦ Some water quality parameters exceeded the interim triggers at many monitoring locations.
- ✦ There is insufficient data for statistical analyses of trends at these reference points at this time.
- Authorized individuals at ESRD and members of the SAOS technical committee have access to CDP through March 31, 2015 to support data QA/QC beyond the current project completion date.

8 RECOMMENDATIONS

Specific recommendations for monitoring sites and investigation areas are outlined on the summary sheets presented in Section 6. Recommended SAOS monitoring wells and VWPs that are owned by industry are provided in Tables 4a and 4b, which includes reasons for including or excluding the locations that were requested of the technical committee owners/operators in letters sent on January 21, 2014.

General recommendations for the development of the SAOS regional groundwater monitoring network in 2014 include the following:

- Continue collecting continuous water level and temperature data from existing SAOS regional groundwater monitoring wells.
- Install temperature gauges within the well screen of existing SAOS monitoring wells to obtain accurate formation temperature measurements; use temperatures recorded in the well screens for data interpretation rather than from pressure transducers that are generally installed above the well screens.
- Collect groundwater quality data semi-annually from existing SAOS regional groundwater monitoring wells, at intervals of no less than 4 months.
- Continue to work with technical committee members and operators to incorporate recommended monitoring locations to the SAOS regional groundwater monitoring well network:
 - ✦ Determine logistics and responsibilities for monitoring recommended SAOS locations that were provided by Cenovus and ConocoPhillips.
 - ✦ Discuss alternative locations within the Gregoire Channel Investigation Area with Nexen, as the initially identified locations were not found to meet the objectives of the SAOS groundwater monitoring framework.
- Continue discussions with SAOS operators to identify synergies with existing completions in aquifers that are not currently monitored, placing priority on Phases 1 and 2 of the development schedule of

the regional groundwater monitoring well network. Continue to develop a publically accessible web-based data viewer that builds on the current data set and CDP that was developed by Matrix.

Considering the interim water quality triggers outlined in the Lower Athabasca Region GMF (GoA 2012) are exceeded at several monitoring locations, it is clear the values do not reflect the spatial variability of water quality parameters in key SAOS aquifers. As such, it is recommended that relevant triggers should be established for each aquifer at each established SAOS monitoring location (reference point) as benchmarks for assessing the status of the groundwater system. Trigger values will be set once enough data has been collected to determine statistically significant trends and describe the variability of groundwater conditions. Six to eight data points are recommended to establish trigger values; therefore, trigger values may be established in two to four more years.

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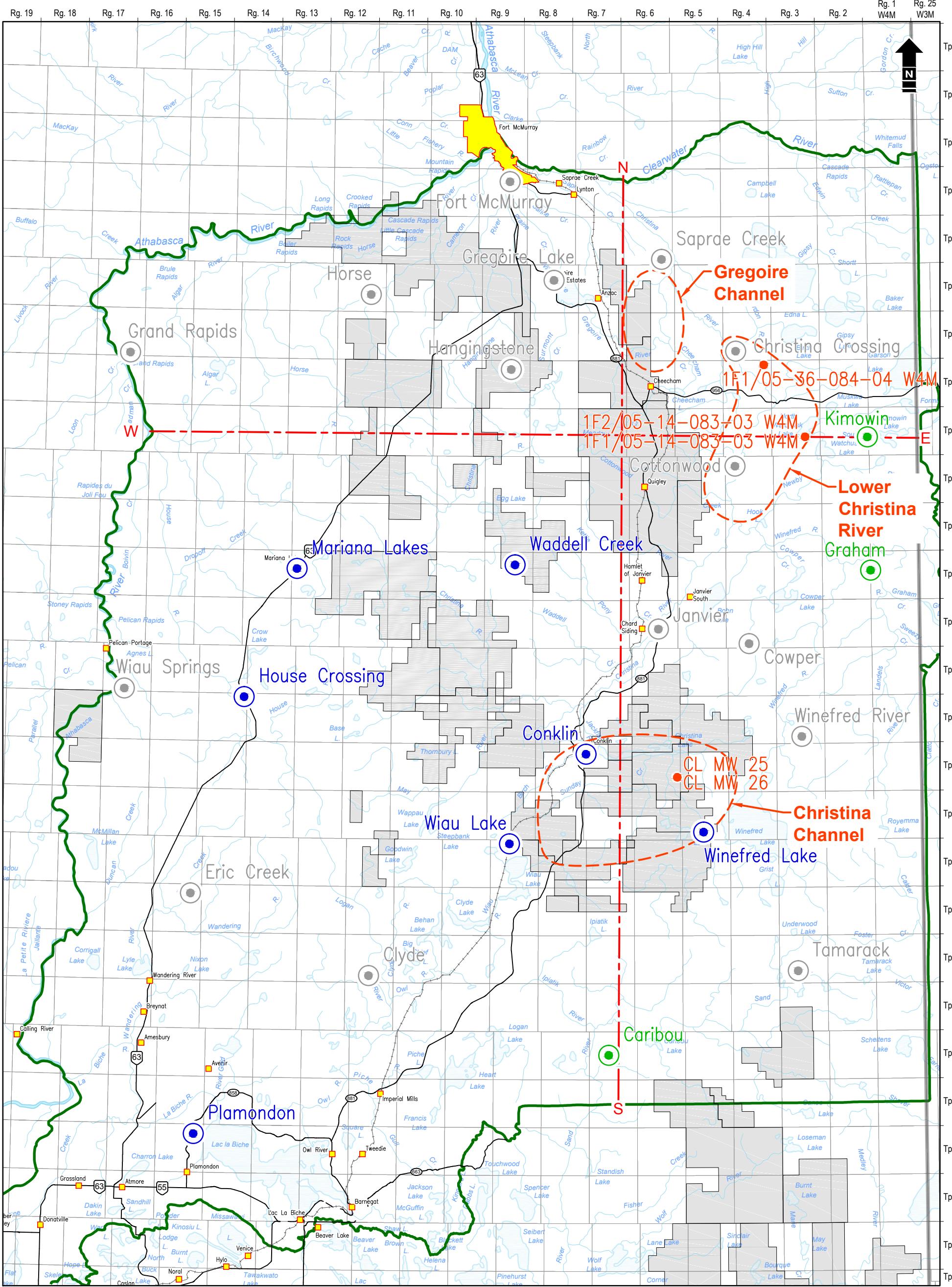
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South Athabasca Oil Sands (SAOS) Area	Existing Monitoring Location - Sub-network A and/or B
Geologic Cross Section	Recommended Monitoring Location - Sub-network A and/or B
Community	Recommended Monitoring Location - Sub-network C
In-Situ Oil Sand Lease	Proposed Future Monitoring Location
Water Body / Watercourse	Investigation Areas
Highway	

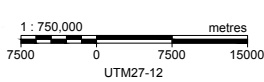
Reference:

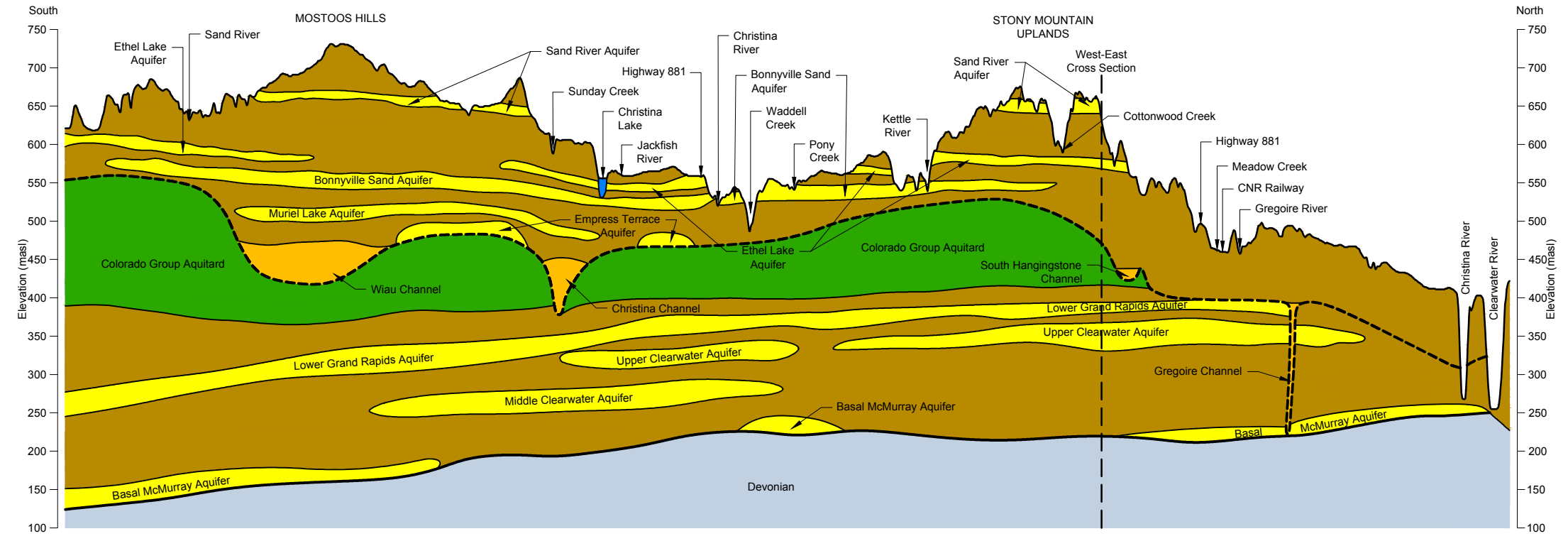
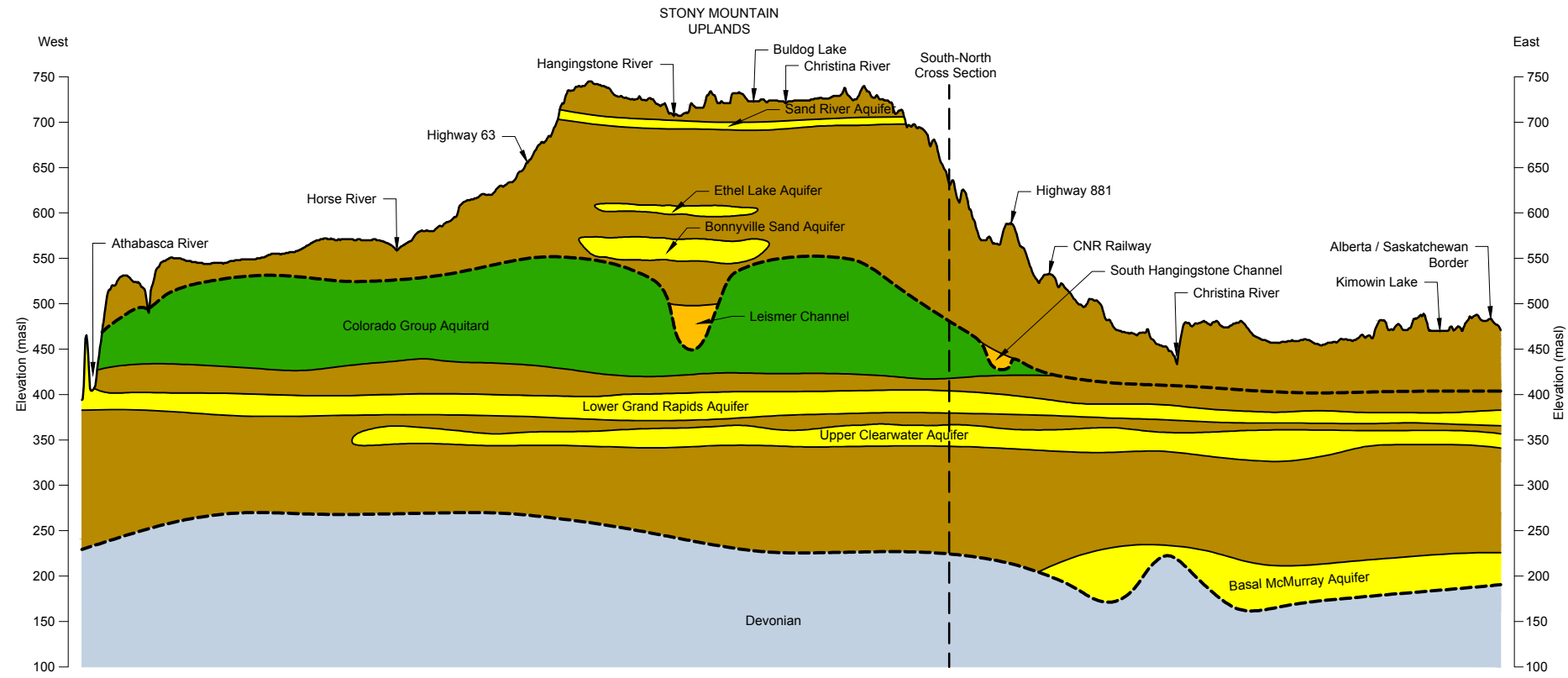
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Alberta Environment and Sustainable Resource Development
SAOS Area

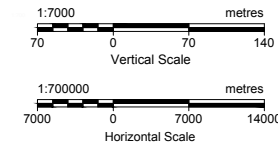
SAOS Regional Groundwater Monitoring Network

Date: February 2014	Project: 16054-SP-502-13	Technical: S. Murphy	Reviewer: A. Haluszka	Drawn: E. Rugayan
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- Undifferentiated
- Key Aquifer
- Undifferentiated Channel Deposits
- Key Aquitard
- Major Unconformities

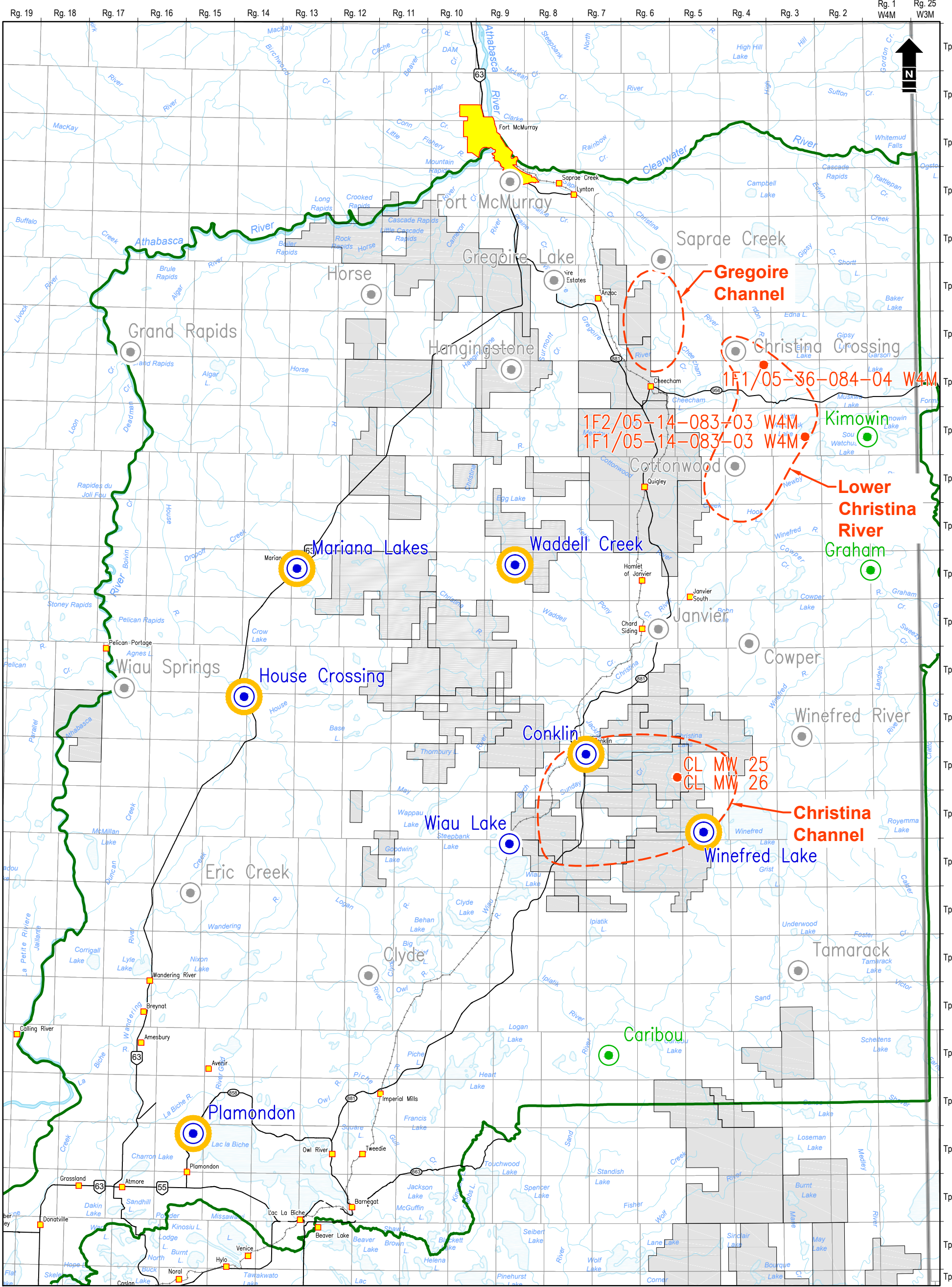


Alberta Environment and Sustainable Resource Development
SAOS Area

Regional Schematic Hydrostratigraphic Cross-sections

Date: February 2014 Project: 16054-SP-502-13 Technical: S. Murphy Reviewer: A. Haluszka Drawn: E. Rugayan

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South Athabasca Oil Sands (SAOS) Area	Existing Monitoring Location - Sub-network A and/ or B
Community	Recommended Monitoring Location - Sub-network A and/ or B
In-Situ Oil Sand Lease	Recommended Monitoring Location - Sub-network C
Water Body / Watercourse	Proposed Future Monitoring Location
Highway	Shallow Monitoring Well Present
Investigation Areas	

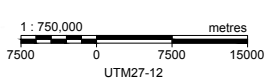
Reference:

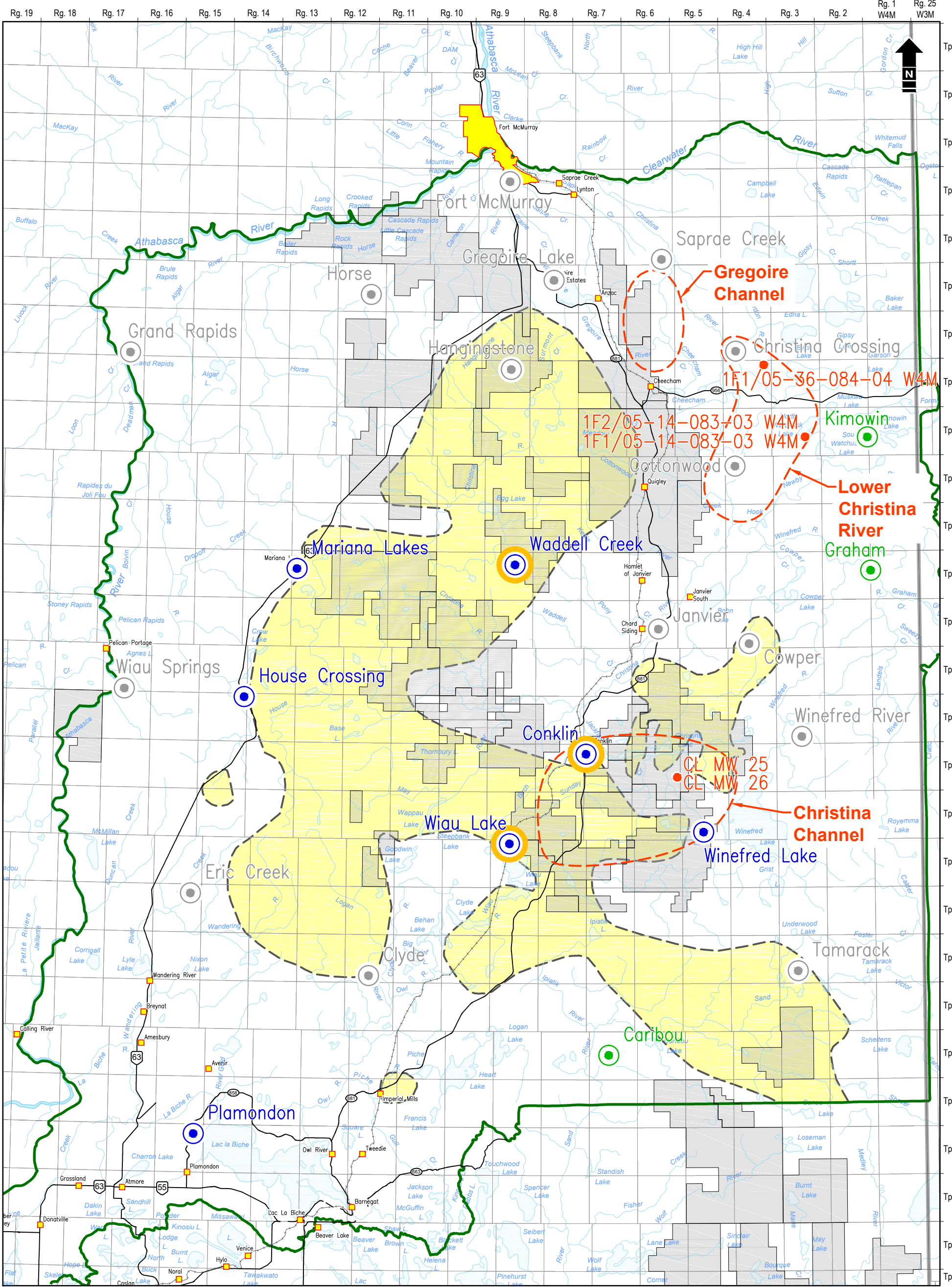
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Alberta Environment and Sustainable Resource Development
 SAOS Area

Uppermost Water-Bearing Units

Date: February 2014	Project: 16054-SP-502-13	Technical: S. Murphy	Reviewer: A. Haluszka	Drawn: E. Rugayan
<small>Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.</small>				Figure 4





South Athabasca Oil Sands (SAOS) Area	Existing Monitoring Location - Sub-network A and/ or B
Community	Recommended Monitoring Location - Sub-network A and/ or B
In-Situ Oil Sand Lease	Recommended Monitoring Location - Sub-network C
Water Body / Watercourse	Proposed Future Monitoring Location
Highway	Active Sand River Aquifer Completion (Existing or Recommended)
Sand River Aquifer Zero Edge	
Sand River Aquifer	
Investigation Areas	

Reference:

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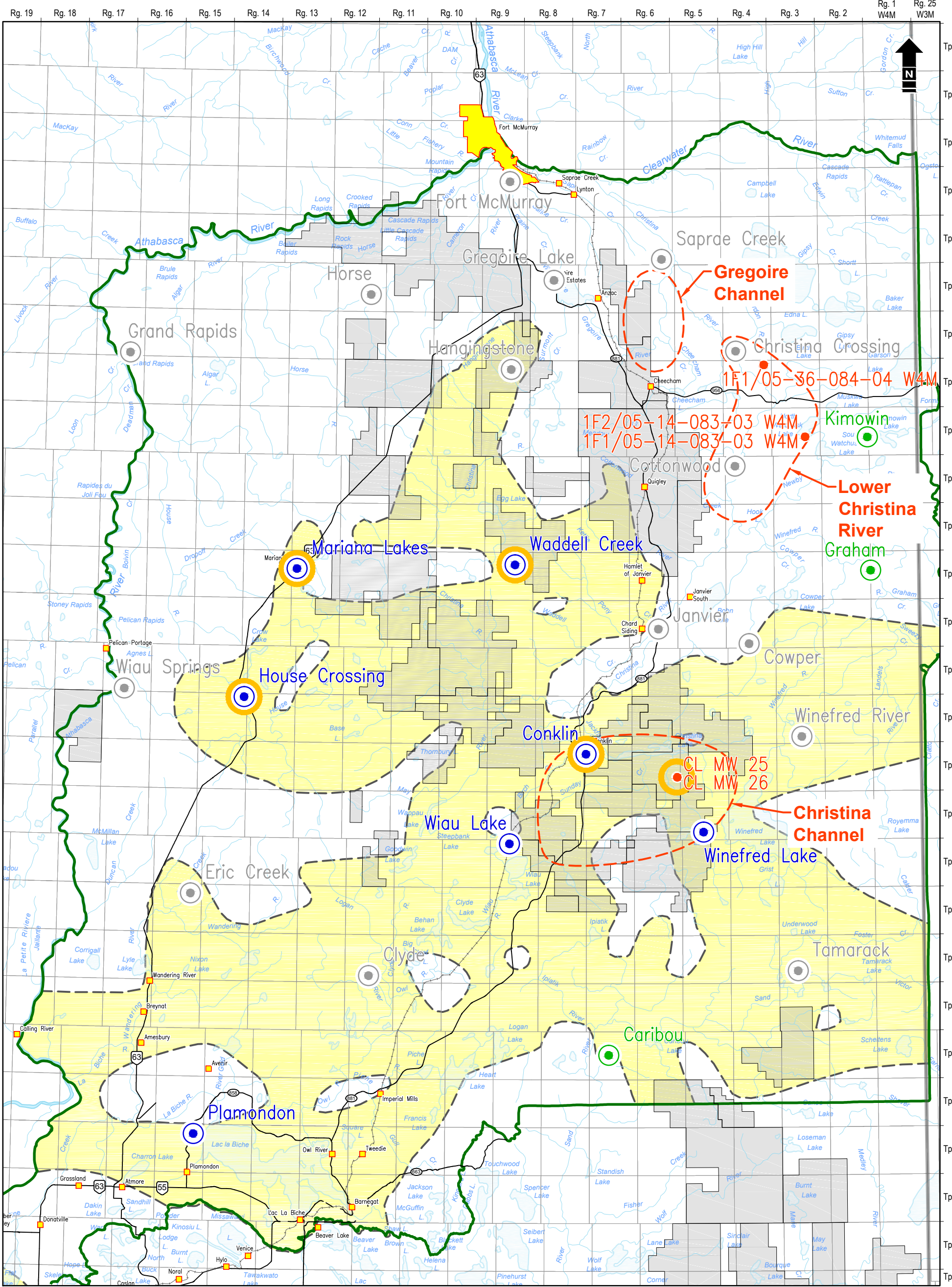
Alberta Environment and Sustainable Resource Development
SAOS Area

Sand River Aquifer

Date: February 2014	Project: 16054-SP-502-13	Technical: S. Murphy	Reviewer: A. Haluszka	Drawn: E. Rugayan
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1: 750,000 metres
7500 0 7500 15000
UTM27-12

Figure **5**



South Athabasca Oil Sands (SAOS) Area	Existing Monitoring Location - Sub-network A and/ or B
Community	Recommended Monitoring Location - Sub-network A and/ or B
In-Situ Oil Sand Lease	Recommended Monitoring Location - Sub-network C
Water Body / Watercourse	Proposed Future Monitoring Location
Highway	Active Ethel Lake Aquifer Completion (Existing or Recommended)
Ethel Lake Aquifer Zero Edge	
Ethel Lake Aquifer	
Investigation Areas	

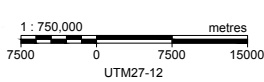
Reference:

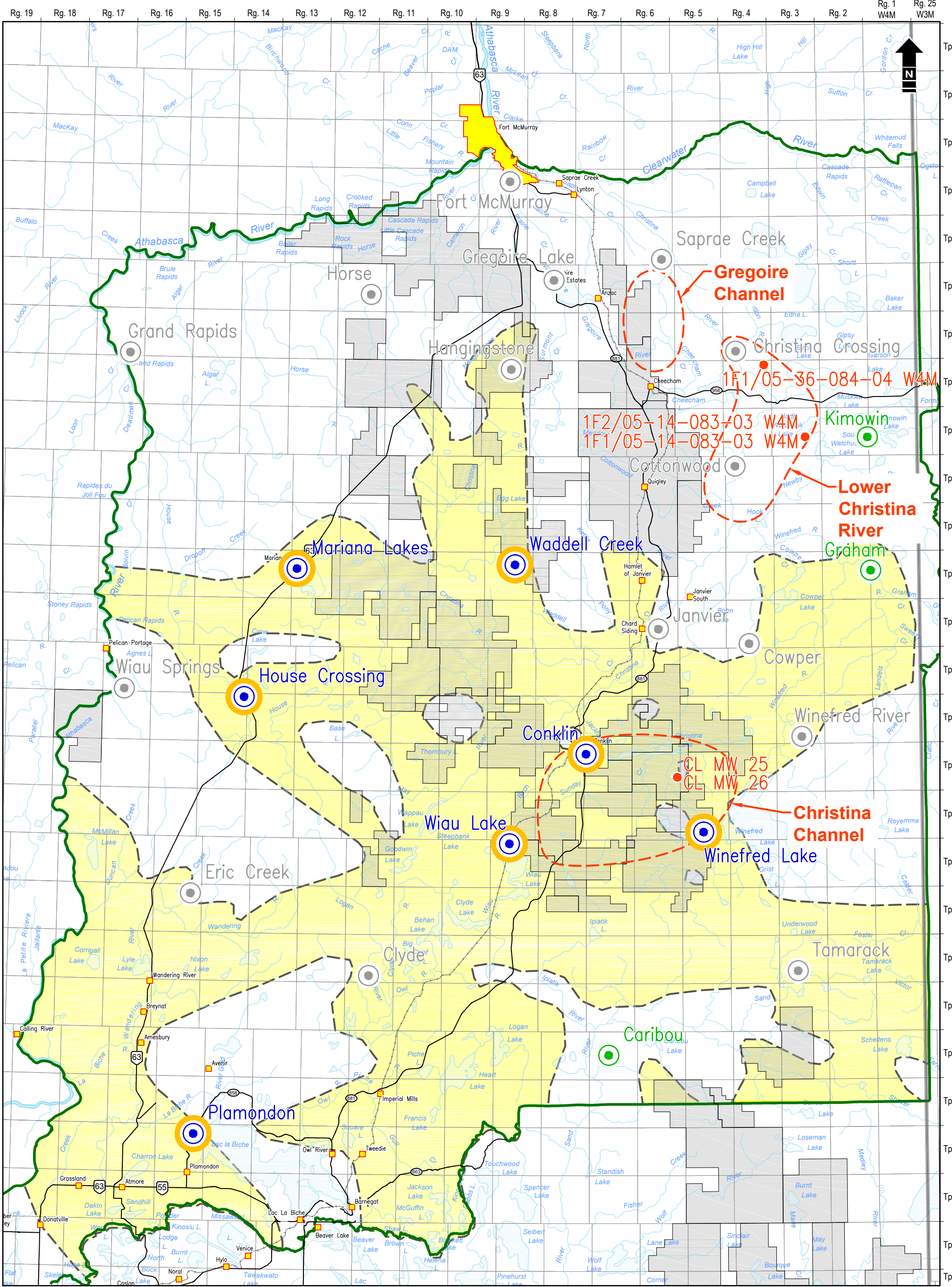
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Alberta Environment and Sustainable Resource Development
SAOS Area

Ethel Lake Aquifer

Date: February 2014	Project: 16054-SP-502-13	Technical: S. Murphy	Reviewer: A. Haluszka	Drawn: E. Rugayan
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South Athabasca Oil Sands (SAOS) Area	Existing Monitoring Location - Sub-network A and/ or B
Community	Recommended Monitoring Location - Sub-network A and/ or B
In-Situ Oil Sand Lease	Recommended Monitoring Location - Sub-network C
Water Body / Watercourse	Proposed Future Monitoring Location
Highway	Active Bonnyville Aquifer Completion (Existing or Recommended)
Bonnyville Aquifer Zero Edge	
Bonnyville Aquifer	
Investigation Areas	

Reference:

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

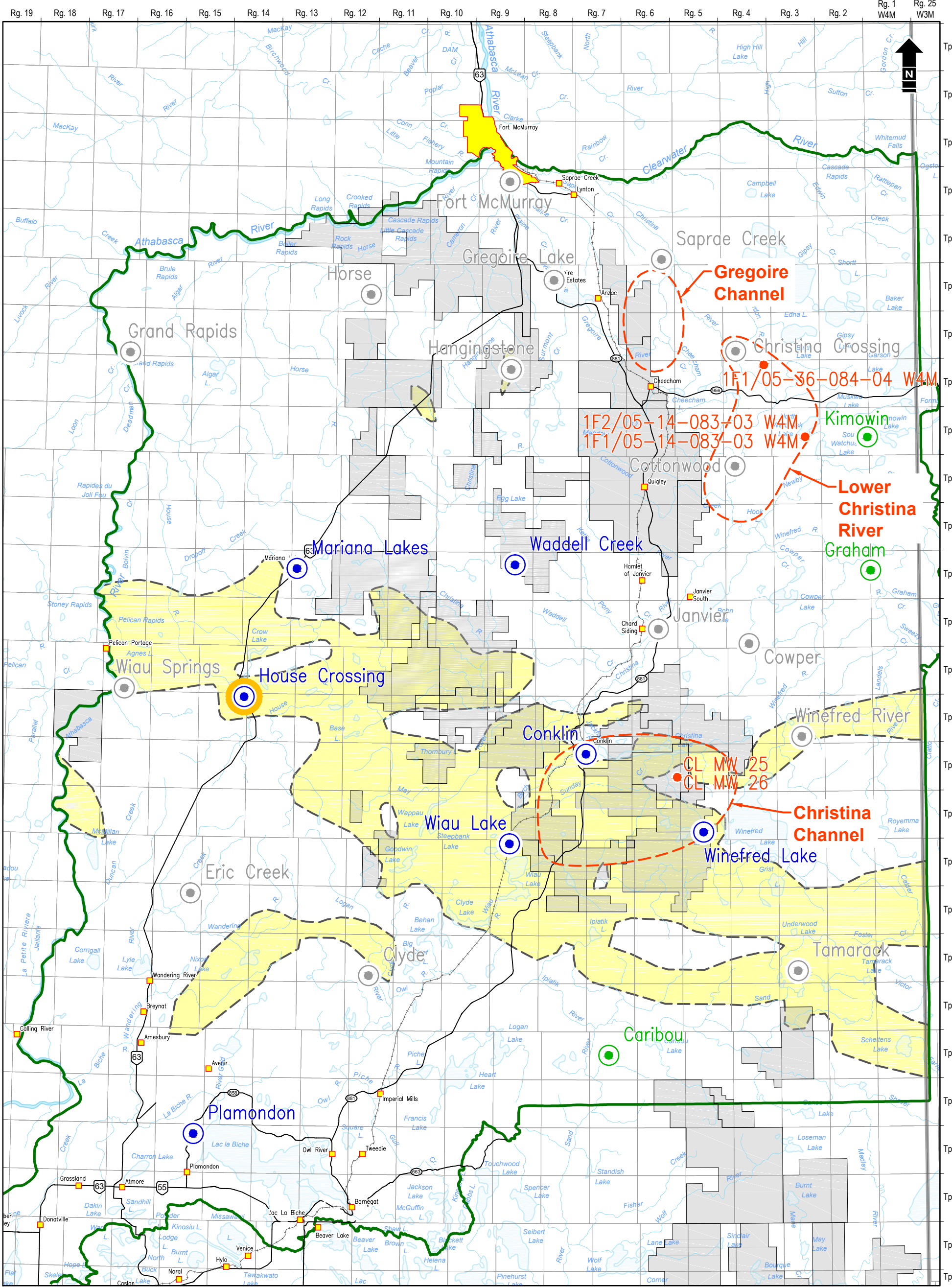
Alberta Environment and Sustainable Resource Development
SAOS Area

Bonnyville Aquifer

Date: February 2014	Project: 16054-SP-502-13	Technical: S. Murphy	Reviewer: A. Haluszka	Drawn: E. Rugayan
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1: 750,000 metres
7500 0 7500 15000
UTM27-12

Figure **7**



South Athabasca Oil Sands (SAOS) Area	Existing Monitoring Location - Sub-network A and/ or B
Community	Recommended Monitoring Location - Sub-network A and/ or B
In-Situ Oil Sand Lease	Recommended Monitoring Location - Sub-network C
Water Body / Watercourse	Proposed Future Monitoring Location
Highway	Active Muriel Lake Aquifer Completion (Existing or Recommended)
Muriel Lake Aquifer Zero Edge	
Muriel Lake Aquifer	
Investigation Areas	

Reference:

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

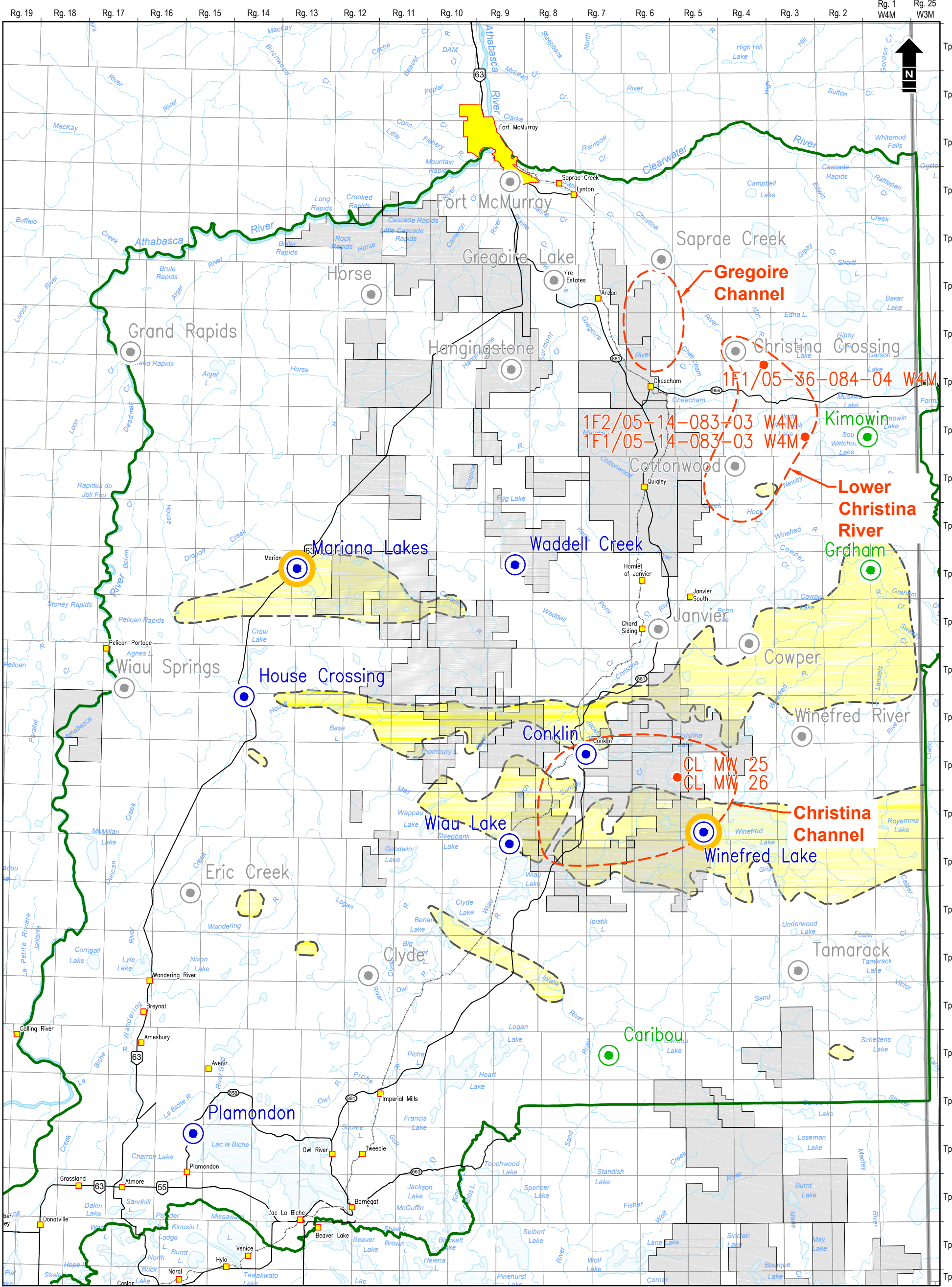
Alberta Environment and Sustainable Resource Development
SAOS Area

Muriel Lake Aquifer

Date: February 2014	Project: 16054-SP-502-13	Technical: S. Murphy	Reviewer: A. Haluszka	Drawn: E. Rugayan
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1: 750,000 metres
7500 0 7500 15000
UTM27-12

Figure **8**



South Athabasca Oil Sands (SAOS) Area	Existing Monitoring Location - Sub-network A and/ or B
Community	Recommended Monitoring Location - Sub-network A and/ or B
In-Situ Oil Sand Lease	Recommended Monitoring Location - Sub-network C
Water Body / Watercourse	Proposed Future Monitoring Location
Highway	Active Empress Terrace Aquifer Completion (Existing or Recommended)
Empress Terrace Aquifer Zero Edge	Investigation Areas
Empress Terrace Aquifer	

Reference: Steady-State Hydraulic Heads from Devon (2012).

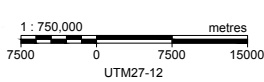
Matrix Solutions Inc.
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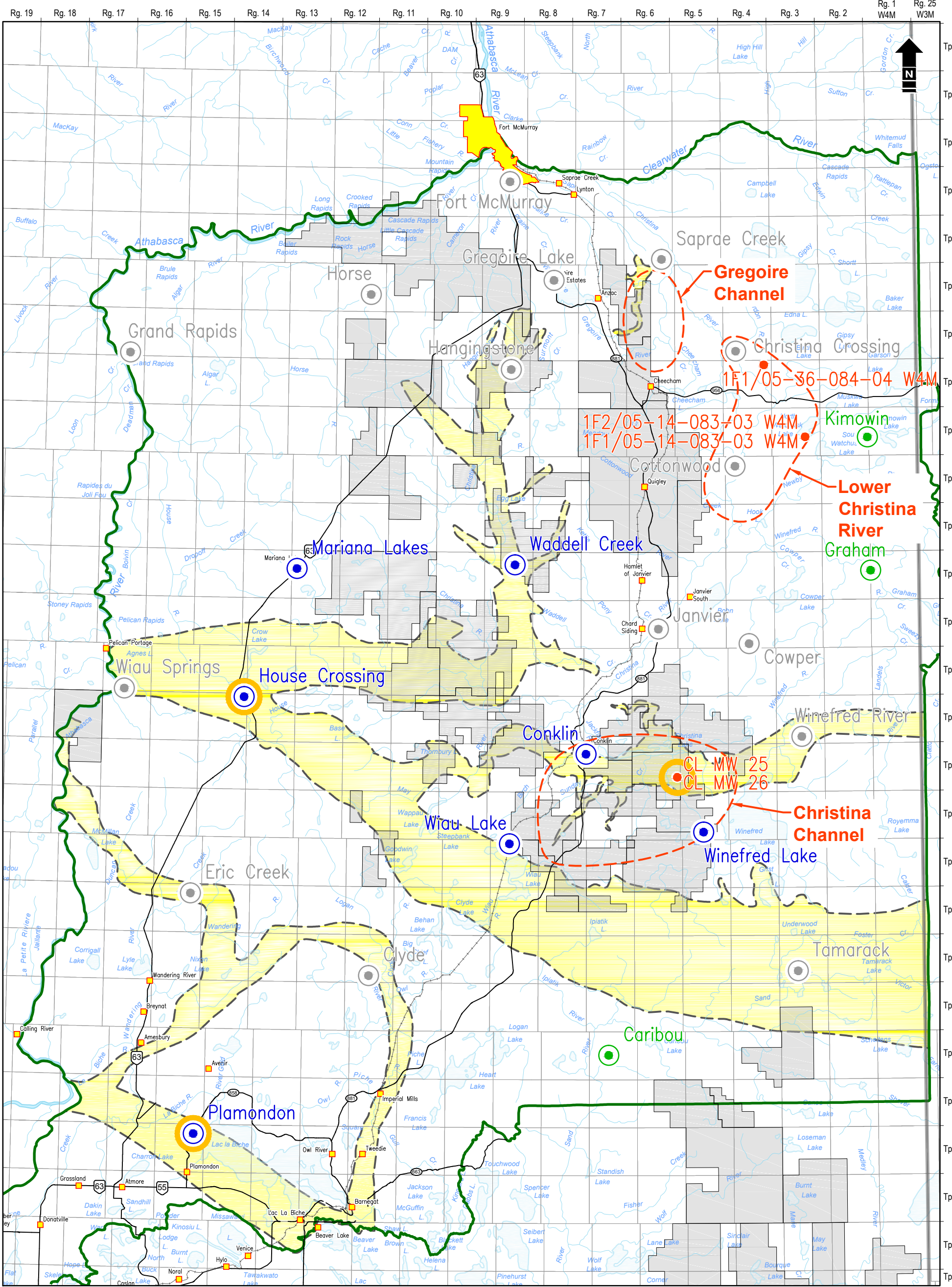
Alberta Environment and Sustainable Resource Development
SAOS Area

Empress Terrace Aquifer

Date: February 2014	Project: 16054-SP-502-13	Technical: S. Murphy	Reviewer: A. Haluszka	Drawn: E. Rugayan
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Figure 9





South Athabasca Oil Sands (SAOS) Area	Existing Monitoring Location - Sub-network A and/ or B
Community	Recommended Monitoring Location - Sub-network A and/ or B
In-Situ Oil Sand Lease	Recommended Monitoring Location - Sub-network C
Water Body / Watercourse	Proposed Future Monitoring Location
Highway	Active Empress Channel Aquifer Completion (Existing or Recommended)
Empress Channel Aquifer Zero Edge	Investigation Areas
Empress Channel Aquifer	

Reference: Steady-State Hydraulic Heads from Devon (2012).

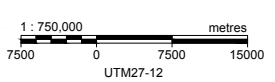
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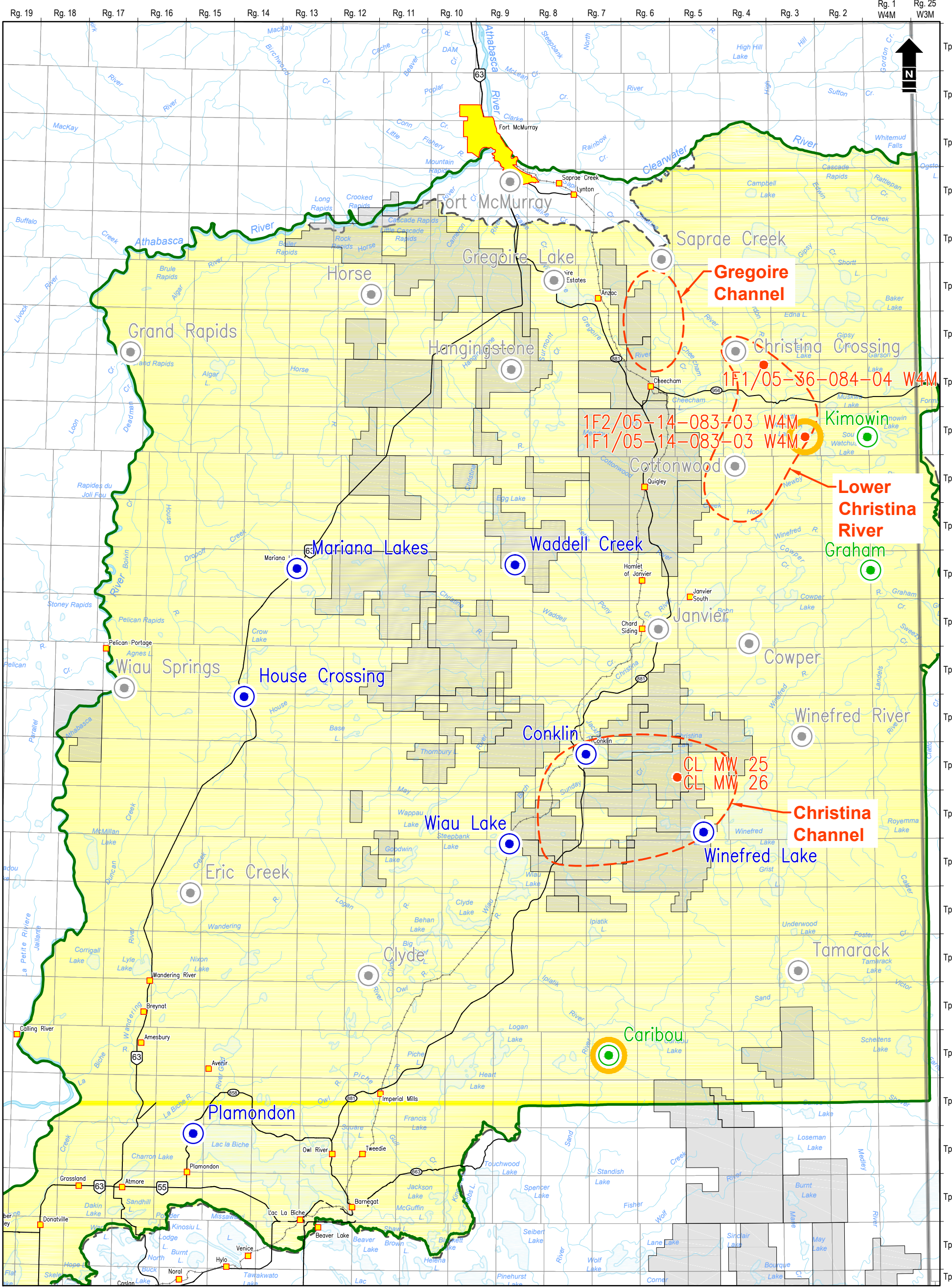
Alberta Environment and Sustainable Resource Development
SAOS Area

Empress Channel Aquifer


Date: February 2014	Project: 16054-SP-502-13	Technical: S. Murphy	Reviewer: A. Haluszka	Drawn: E. Rugayan
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Figure 10





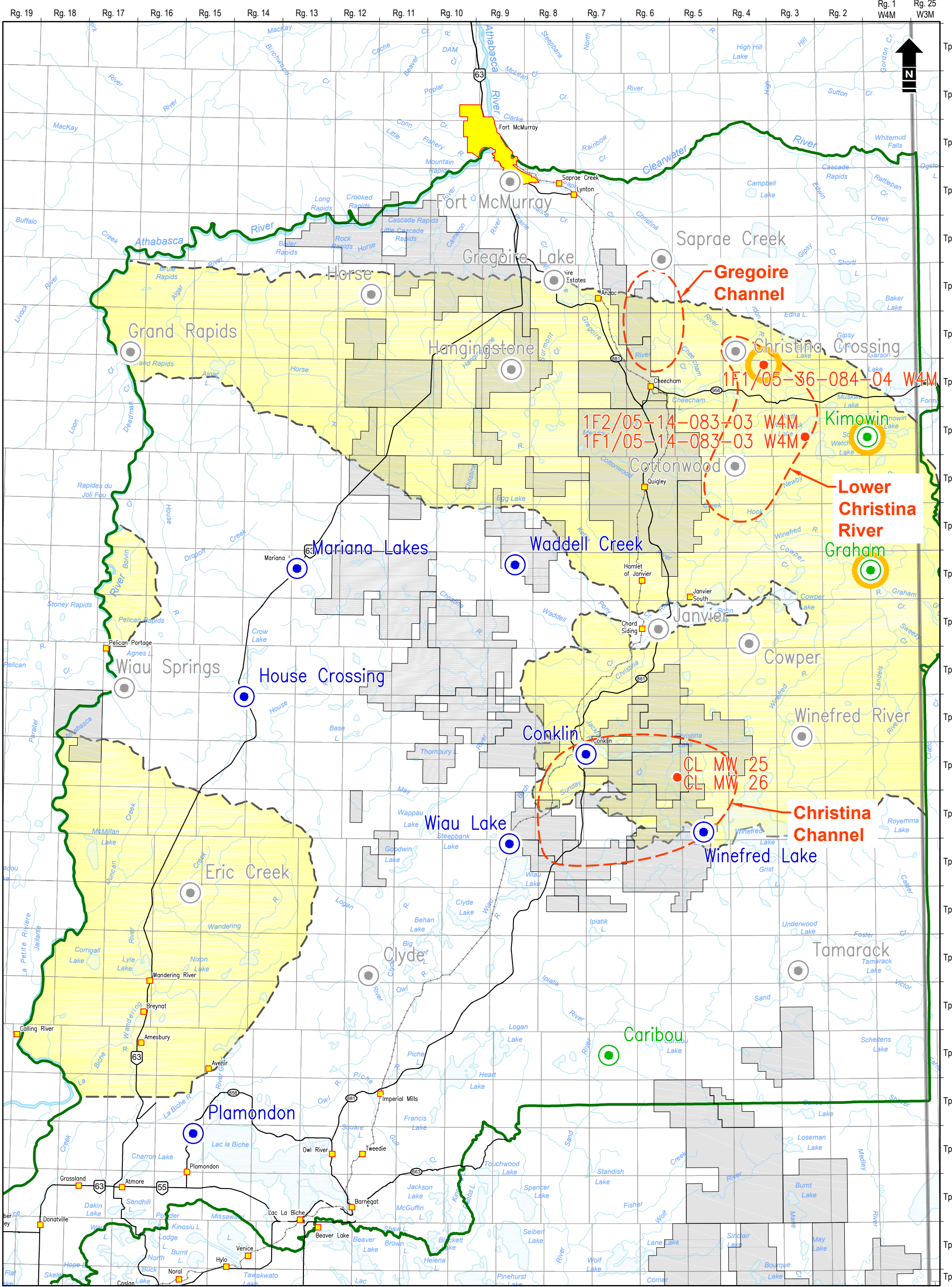
- South Athabasca Oil Sands (SAOS) Area
- Community
- In-Situ Oil Sand Lease
- ~ Water Body / Watercourse
- Highway
- Lower Grand Rapids Aquifer Zero Edge
- Lower Grand Rapids Aquifer
- Existing Monitoring Location
- Sub-network A and/ or B
- Recommended Monitoring Location
- Sub-network A and/ or B
- Recommended Monitoring Location
- Sub-network C
- Proposed Future Monitoring Location
- Active Lower Grand Rapids Aquifer Completion
(Existing or Recommended)
- Investigation Areas



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SAOS Area

Lower Grand Rapids Aquifer



South Athabasca Oil Sands (SAOS) Area	Existing Monitoring Location - Sub-network A and/ or B
Community	Recommended Monitoring Location - Sub-network A and/ or B
In-Situ Oil Sand Lease	Recommended Monitoring Location - Sub-network C
Water Body / Watercourse	Proposed Future Monitoring Location
Highway	Active Upper Clearwater Aquifer Completion (Existing or Recommended)
Upper Clearwater Aquifer Zero Edge	Investigation Areas
Upper Clearwater Aquifer	

Reference: Steady-State Hydraulic Heads from Devon (2012).

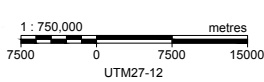
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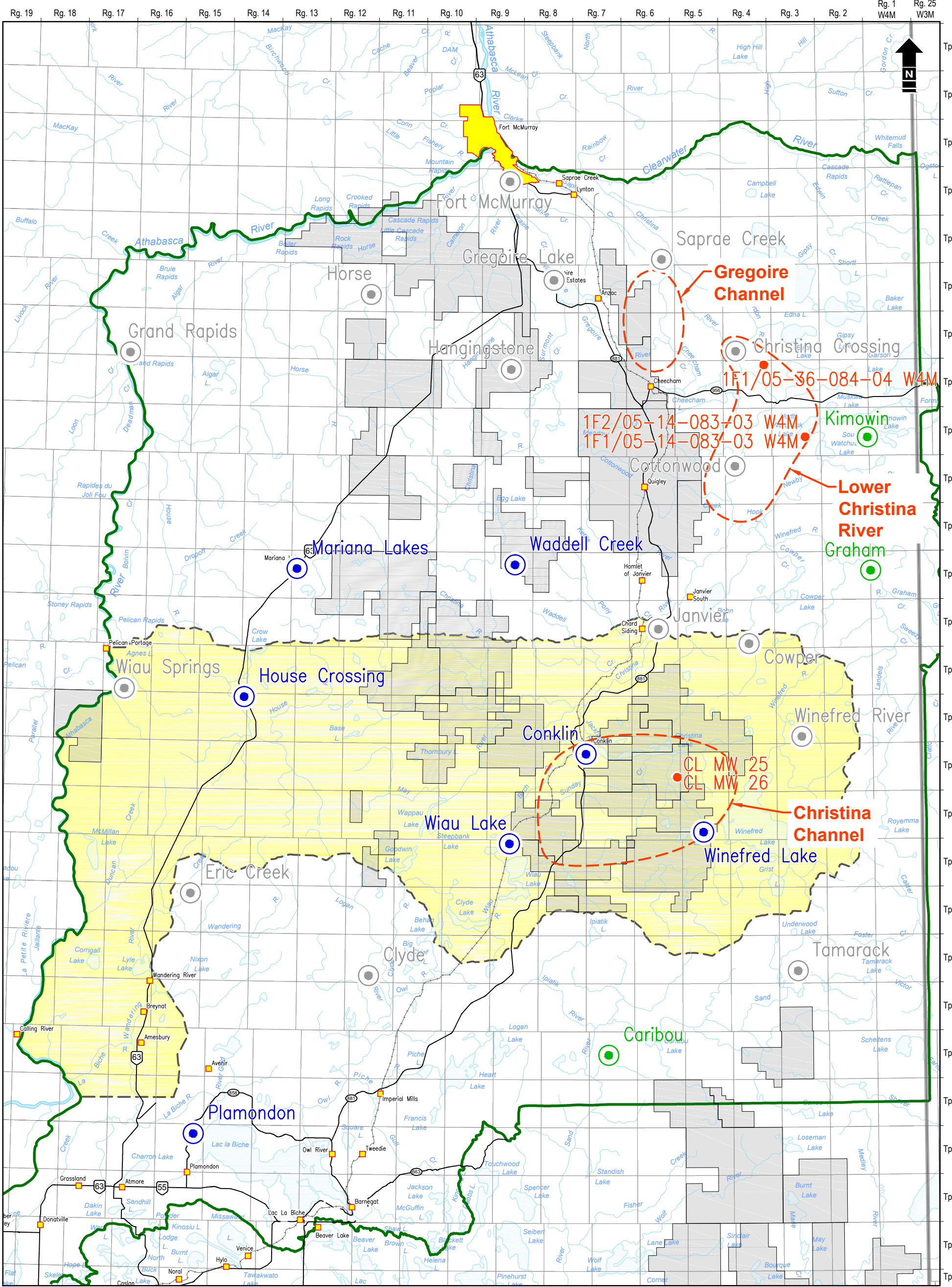
Alberta Environment and Sustainable Resource Development
SAOS Area

Upper Clearwater Aquifer

Date: February 2014	Project: 16054-SP-502-13	Technical: S. Murphy	Reviewer: A. Haluszka	Drawn: E. Rugayan
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Figure 12





South Athabasca Oil Sands (SAOS) Area	Existing Monitoring Location - Sub-network A and/ or B
Community	Recommended Monitoring Location - Sub-network A and/ or B
In-Situ Oil Sand Lease	Recommended Monitoring Location - Sub-network C
Water Body / Watercourse	Proposed Future Monitoring Location
Highway	Active Middle Clearwater Aquifer Completion (Existing or Recommended)
Middle Clearwater Aquifer Zero Edge	Investigation Areas
Middle Clearwater Aquifer	

Reference: Steady-State Hydraulic Heads from Devon (2012).

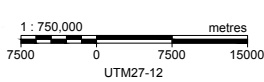
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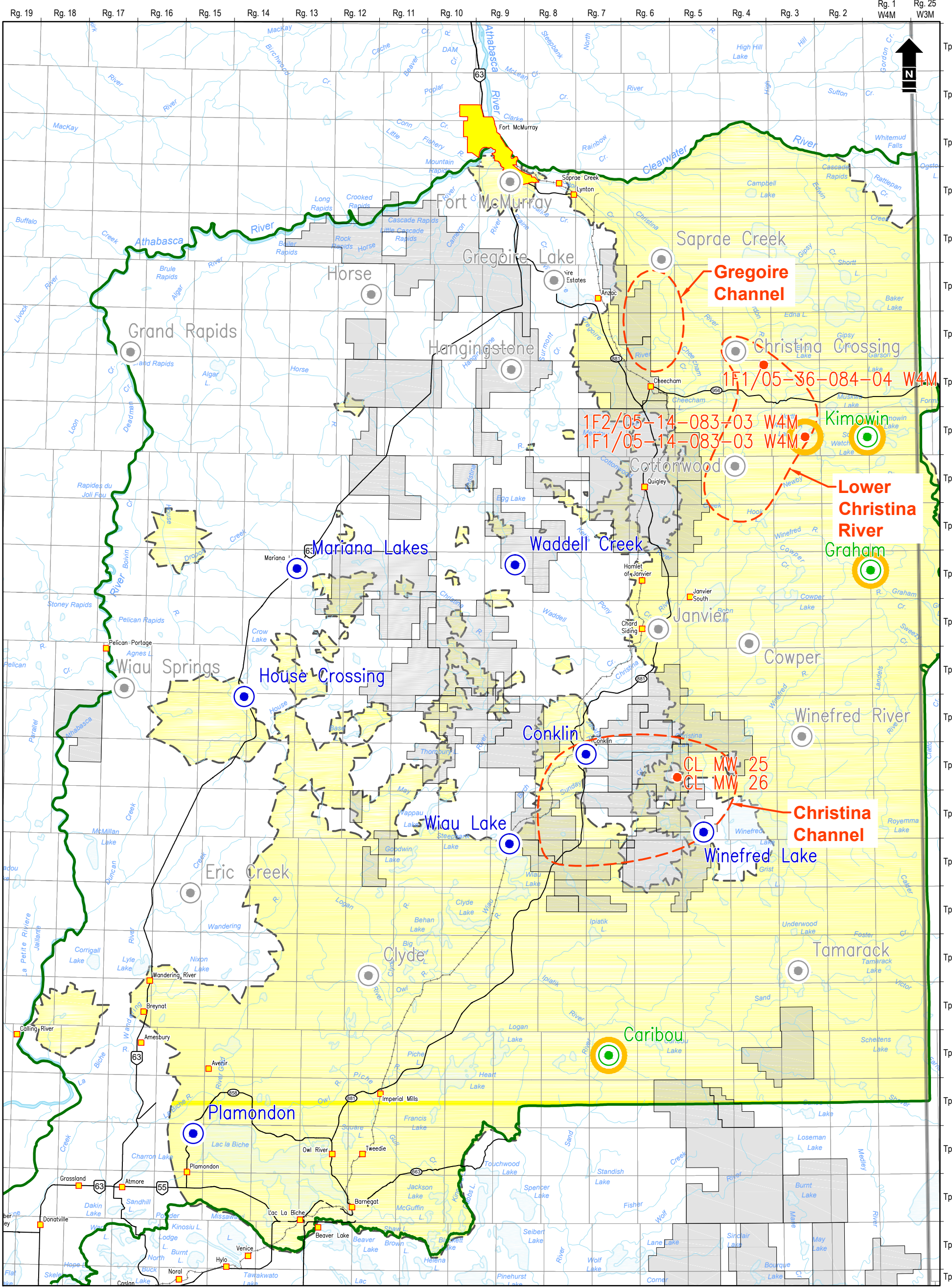
Alberta Environment and Sustainable Resource Development
SAOS Area

Middle Clearwater Aquifer

Date: February 2014	Project: 16054-SP-502-13	Technical: S. Murphy	Reviewer: A. Haluszka	Drawn: E. Rugayan
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Figure 13





South Athabasca Oil Sands (SAOS) Area	Existing Monitoring Location - Sub-network A and/ or B
Community	Recommended Monitoring Location - Sub-network A and/ or B
In-Situ Oil Sand Lease	Recommended Monitoring Location - Sub-network C
Water Body / Watercourse	Proposed Future Monitoring Location
Highway	Active McMurray Aquifer Completion (Existing or Recommended)
McMurray Aquifer Zero Edge	Investigation Areas
McMurray Aquifer	

Reference: Steady-State Hydraulic Heads from Devon (2012).

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Alberta Environment and Sustainable Resource Development
SAOS Area

McMurray Aquifer

Date: February 2014	Project: 16054-SP-502-13	Technical: S. Murphy	Reviewer: A. Haluszka	Drawn: E. Rugayan
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1 : 750,000 metres
7500 0 7500 15000
UTM27-12

Figure 14

TABLE 1.

SEVEN REGULATORY FRAMEWORK OBJECTIVES ADDRESSED BY PROPOSED GROUNDWATER MONITORING WELL NETWORK

Alberta Environment and Sustainable Resources Development (ESRD)

Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

#	Local Area Name	Township	Range	Depth Base of Screen (m)	Interpreted Aquifer	Sub-Network	1a. Natural Variability (Quality)	1b. Natural Variability (Quantity)	2a. Baseline Conditions (Quality)	2b. Baseline Conditions (Quantity)	3. Aquifer Interactions	4. SW/GW Interaction	5. Cumulative Effects	6a. Triggers and Limits (Quality)	6a. Triggers and Limits (Quantity)	7. River Impacts		
1	Plamondon	68	16	7	near surface	B					✓	✓		✓				
				39 and 51	Bonnyville	B	✓		✓		✓	✓		✓				
				70	Empress Channel	A	✓	✓	✓	✓	✓	✓		✓	✓			
				---	Lower Grand Rapids	B	✓		✓						✓			
2	House Crossing	77	15	---	near surface	A	✓	✓	✓	✓		✓		✓	✓			
				82	Ethel Lake	A	✓	✓	✓	✓	✓			✓	✓			
				126	Bonnyville	A	✓	✓	✓	✓	✓				✓	✓		
				161	Muriel Lake	A	✓	✓	✓	✓	✓				✓	✓		
				231	Empress Channel	A	✓	✓	✓	✓	✓	✓				✓	✓	
				---	Lower Grand Rapids	B	✓		✓	✓	✓					✓	✓	
				---	Middle Clearwater	A	✓	✓	✓	✓	✓				✓	✓	✓	
				---	Basal McMurray	B	✓		✓								✓	
3	Mariana Lakes	80	13	7	near surface	B	✓		✓			✓		✓				
				52	Ethel Lake	A	✓	✓	✓	✓		✓		✓	✓			
				112	Bonnyville	A	✓	✓	✓	✓	✓				✓	✓		
				134	Empress Terrace	A	✓	✓	✓	✓	✓	✓			✓	✓		
				---	Lower Grand Rapids	B	✓		✓					✓	✓			
4	Waddell Creek	80	9	9	near surface	A	✓	✓	✓	✓		✓		✓	✓			
				21	Sand River	A	✓	✓	✓	✓		✓		✓	✓			
				117	Ethel Lake	A	✓	✓	✓	✓	✓				✓	✓		
				149	Bonnyville	A	✓	✓	✓	✓	✓				✓	✓		
				---	Empress Channel	B	✓		✓		✓	✓		✓	✓			
				---	Lower Grand Rapids	B	✓		✓						✓	✓		
5	Conklin	76	6	6	near surface	B	✓		✓			✓		✓				
				24	Sand River	A	✓	✓	✓	✓		✓		✓	✓			
				41	Ethel Lake	B	✓		✓			✓		✓	✓			
				67	Bonnyville	B	✓		✓					✓	✓			
				---	Lower Grand Rapids	B	✓		✓						✓	✓		
				---	Upper Clearwater	B	✓		✓						✓	✓		
				---	Middle Clearwater	B	✓		✓						✓	✓		
---	Basal McMurray	B	✓		✓						✓	✓						

TABLE 1.**SEVEN REGULATORY FRAMEWORK OBJECTIVES ADDRESSED BY PROPOSED GROUNDWATER MONITORING WELL NETWORK**

Alberta Environment and Sustainable Resources Development (ESRD)

Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

#	Local Area Name	Township	Range	Depth Base of Screen (m)	Interpreted Aquifer	Sub-Network	1a. Natural Variability (Quality)	1b. Natural Variability (Quantity)	2a. Baseline Conditions (Quality)	2b. Baseline Conditions (Quantity)	3. Aquifer Interactions	4. SW/GW Interaction	5. Cumulative Effects	6a. Triggers and Limits (Quality)	6a. Triggers and Limits (Quantity)	7. River Impacts			
6	Wiau Springs	78	16	---	near surface	A	✓	✓	✓	✓	✓	✓		✓	✓	✓			
				---	Muriel Lake	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
				---	Empress Channel	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
				---	Lower Grand Rapids	B	✓		✓		✓		✓		✓		✓		✓
				---	Middle Clearwater	A	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓
7	Grand Rapids	85	17	---	near surface	A	✓	✓	✓	✓		✓		✓	✓	✓			
				---	Viking	A	✓	✓	✓	✓	✓		✓		✓	✓	✓		
				---	Lower Grand Rapids	A	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	
8	Fort McMurray	88	9	---	near surface	B					✓	✓				✓			
				---	Basal McMurray	A	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	
9	Gregoire Lake	86	8	---	near surface	A	✓	✓	✓	✓	✓	✓		✓	✓				
				---	Empress Channel	A	✓	✓	✓	✓	✓	✓		✓	✓				
				---	Lower Grand Rapids	B	✓		✓		✓	✓	✓	✓	✓				
10	Saprae Creek	87	6	---	near surface	A	✓	✓	✓	✓	✓	✓		✓	✓	✓			
				---	Lower Grand Rapids	B	✓		✓		✓		✓	✓		✓	✓		
				---	Basal McMurray	B	✓		✓		✓		✓	✓	✓		✓	✓	
11	Christina Crossing	85	4	---	near surface	A	✓	✓	✓	✓		✓		✓	✓	✓			
				---	Lower Grand Rapids	B	✓		✓		✓	✓	✓	✓		✓	✓		
				---	Upper Clearwater	B	✓		✓		✓		✓	✓	✓		✓	✓	
				---	Basal McMurray	B	✓		✓		✓		✓	✓	✓		✓		
12	Cottonwood	82	4	---	near surface	A	✓	✓	✓	✓		✓		✓	✓	✓			
				---	Lower Grand Rapids	B	✓		✓		✓		✓	✓		✓	✓		
				---	Upper Clearwater	B	✓		✓		✓		✓	✓		✓			
				---	Basal McMurray	B	✓		✓		✓		✓	✓		✓			
13	Janvier	79	6	---	near surface	A	✓	✓	✓	✓		✓		✓	✓	✓			
				---	Lower Grand Rapids	B	✓		✓		✓		✓	✓		✓	✓		
				---	Basal McMurray	B	✓		✓		✓		✓	✓		✓			
14	Horse	86	12	---	near surface	A	✓	✓	✓	✓	✓	✓		✓	✓				
				---	Lower Grand Rapids	B	✓		✓		✓		✓	✓		✓			
				---	Upper Clearwater	B	✓		✓		✓		✓	✓		✓			

TABLE 1.

SEVEN REGULATORY FRAMEWORK OBJECTIVES ADDRESSED BY PROPOSED GROUNDWATER MONITORING WELL NETWORK

Alberta Environment and Sustainable Resources Development (ESRD)

Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

#	Local Area Name	Township	Range	Depth Base of Screen (m)	Interpreted Aquifer	Sub-Network	1a. Natural Variability (Quality)	1b. Natural Variability (Quantity)	2a. Baseline Conditions (Quality)	2b. Baseline Conditions (Quantity)	3. Aquifer Interactions	4. SW/GW Interaction	5. Cumulative Effects	6a. Triggers and Limits (Quality)	6a. Triggers and Limits (Quantity)	7. River Impacts			
15	Hangingstone	84	9	---	near surface	A	✓	✓	✓	✓		✓		✓	✓				
				---	Sand River	A	✓	✓	✓	✓					✓	✓			
				---	Bonnyville	A	✓	✓	✓	✓						✓	✓		
				---	Muriel Lake	A	✓	✓	✓	✓						✓	✓		
				---	Empress Channel	B	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
				---	Lower Grand Rapids	B	✓		✓		✓					✓	✓		
16	Winefred River	77	3	---	near surface	A	✓	✓	✓	✓		✓		✓	✓				
				---	Ethel Lake	B	✓		✓	✓				✓	✓	✓			
				---	Bonnyville	A	✓	✓	✓	✓						✓	✓		
				---	Muriel Lake	A	✓	✓	✓	✓	✓					✓	✓	✓	
				---	Empress Channel	B	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
				---	Lower Grand Rapids	A	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	
				---	Upper Clearwater	B	✓		✓		✓					✓	✓		
				---	Middle Clearwater	B	✓		✓		✓					✓	✓		
17	Winefred Lake	75	5	---	near surface	A	✓	✓	✓	✓		✓		✓	✓				
				---	Ethel Lake	B	✓		✓	✓			✓		✓	✓			
				---	Bonnyville	B	✓		✓	✓					✓	✓			
				---	Muriel Lake	B	✓		✓	✓						✓	✓		
				---	Empress Terrace	B	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
				---	Lower Grand Rapids	B	✓		✓		✓					✓	✓		
				---	Upper Clearwater	B	✓		✓		✓					✓	✓		
				---	Middle Clearwater	B	✓		✓		✓					✓	✓		
18	Tamarack	72	3	---	near surface	A	✓	✓	✓	✓		✓		✓	✓				
				---	Sand River	A	✓	✓	✓	✓					✓	✓			
				---	Ethel Lake	A	✓	✓	✓	✓	✓				✓	✓	✓		
				---	Bonnyville	A	✓	✓	✓	✓	✓					✓	✓	✓	
				---	Muriel Lake	A	✓	✓	✓	✓	✓					✓	✓	✓	
				---	Empress Channel	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
				---	Lower Grand Rapids	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
---	Basal McMurray	A	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓					

TABLE 1.

SEVEN REGULATORY FRAMEWORK OBJECTIVES ADDRESSED BY PROPOSED GROUNDWATER MONITORING WELL NETWORK

Alberta Environment and Sustainable Resources Development (ESRD)

Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

#	Local Area Name	Township	Range	Depth Base of Screen (m)	Interpreted Aquifer	Sub-Network	1a. Natural Variability (Quality)	1b. Natural Variability (Quantity)	2a. Baseline Conditions (Quality)	2b. Baseline Conditions (Quantity)	3. Aquifer Interactions	4. SW/GW Interaction	5. Cumulative Effects	6a. Triggers and Limits (Quality)	6a. Triggers and Limits (Quantity)	7. River Impacts				
19	Wiau Lake	73	9	---	near surface	A	<	<	<	<	<	<	<	<	<	<				
				---	Sand River	A	<	<	<	<	<	<	<	<	<	<	<	<		
				---	Ethel Lake	A	<	<	<	<	<	<	<	<	<	<	<	<	<	
				---	Bonnyville	A	<	<	<	<	<	<	<	<	<	<	<	<	<	
				---	Muriel Lake	A	<	<	<	<	<	<	<	<	<	<	<	<	<	
				---	Empress Terrace	B	<	<	<	<	<	<	<	<	<	<	<	<	<	<
				---	Lower Grand Rapids	B	<	<	<	<	<	<	<	<	<	<	<	<	<	<
				---	Middle Clearwater	B	<	<	<	<	<	<	<	<	<	<	<	<	<	<
20	Cowper	79	4	---	near surface	A	<	<	<	<	<	<	<	<	<	<				
				---	Sand River	A	<	<	<	<	<	<	<	<	<	<	<	<		
				---	Ethel Lake	A	<	<	<	<	<	<	<	<	<	<	<	<	<	
				---	Bonnyville	A	<	<	<	<	<	<	<	<	<	<	<	<	<	
				---	Empress Terrace	A	<	<	<	<	<	<	<	<	<	<	<	<	<	
				---	Lower Grand Rapids	B	<	<	<	<	<	<	<	<	<	<	<	<	<	
				---	Basal McMurray	B	<	<	<	<	<	<	<	<	<	<	<	<	<	
21	Erik Creek	73	16	---	near surface	A	<	<	<	<	<	<	<	<	<	<				
				---	Ethel Lake	A	<	<	<	<	<	<	<	<	<	<	<	<		
				---	Empress Channel	A	<	<	<	<	<	<	<	<	<	<	<	<	<	
				---	Lower Grand Rapids	B	<	<	<	<	<	<	<	<	<	<	<	<	<	
				---	Upper Clearwater	B	<	<	<	<	<	<	<	<	<	<	<	<	<	
				---	Middle Clearwater	B	<	<	<	<	<	<	<	<	<	<	<	<	<	
				---	Basal McMurray	B	<	<	<	<	<	<	<	<	<	<	<	<	<	
22	Clyde	72	12	---	near surface	A	<	<	<	<	<	<	<	<	<	<				
				---	Muriel Lake	A	<	<	<	<	<	<	<	<	<	<	<			
				---	Empress Channel	A	<	<	<	<	<	<	<	<	<	<	<			
				---	Lower Grand Rapids	B	<	<	<	<	<	<	<	<	<	<	<			
				---	Basal McMurray	B	<	<	<	<	<	<	<	<	<	<	<			

TABLE 1.

SEVEN REGULATORY FRAMEWORK OBJECTIVES ADDRESSED BY PROPOSED GROUNDWATER MONITORING WELL NETWORK

Alberta Environment and Sustainable Resources Development (ESRD)

Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

#	Local Area Name	Township	Range	Depth Base of Screen (m)	Interpreted Aquifer	Sub-Network	1a. Natural Variability (Quality)	1b. Natural Variability (Quantity)	2a. Baseline Conditions (Quality)	2b. Baseline Conditions (Quantity)	3. Aquifer Interactions	4. SW/GW Interaction	5. Cumulative Effects	6a. Triggers and Limits (Quality)	6a. Triggers and Limits (Quantity)	7. River Impacts
23	Caribou	70	7	---	near surface	A	✓	✓	✓	✓	✓	✓		✓	✓	
				---	Lower Grand Rapids	B	✓		✓				✓	✓		
				---	Basal McMurray	B	✓		✓				✓	✓		
24	Kimowin	83	2	---	near surface	A	✓	✓	✓	✓	✓	✓		✓	✓	
				---	Lower Grand Rapids	A	✓	✓	✓	✓	✓	✓		✓	✓	
				---	Upper Clearwater	A	✓	✓	✓	✓	✓	✓		✓	✓	
				---	Basal McMurray	A	✓	✓	✓	✓	✓			✓	✓	
25	Graham	80	1	---	near surface	A	✓	✓	✓	✓	✓	✓		✓	✓	
				---	Bonnyville	A	✓	✓	✓	✓	✓	✓		✓	✓	
				---	Empress Terrace	A	✓	✓	✓	✓	✓	✓		✓	✓	
				---	Lower Grand Rapids	A	✓	✓	✓	✓	✓	✓		✓	✓	
				---	Upper Clearwater	A	✓	✓	✓	✓	✓			✓	✓	
				---	Basal McMurray	A	✓	✓	✓	✓	✓			✓	✓	
26	Christina Channel Investigation Area	75,76	5,6,7	---	Sand River	C					✓	✓	✓			
				---	Ethel Lake	C						✓	✓	✓		
				---	Bonnyville	C						✓		✓		
				---	Muriel Lake	C						✓		✓		
				---	Empress Channel	C						✓		✓		
				---	Lower Grand Rapids	C						✓		✓		
				---	Middle Clearwater	C						✓		✓		
				---	Basal McMurray	C						✓		✓		
27	Gregoire Channel Investigation Area	85,86	6,7	---	Quaternary	C					✓	✓	✓			
				---	Gregoire Channel	C						✓	✓	✓		
				---	Lower Grand Rapids	C						✓		✓		
				---	Basal McMurray	C						✓		✓		
28	Lower Christina River Investigation Area	81,82,83,84	3,4,5	---	Lower Grand Rapids	C					✓	✓	✓			
				---	Upper Clearwater	C						✓	✓	✓		
				---	Basal McMurray	C						✓		✓		

existing completion
 overburden priority completion
 bedrock priority completion

TABLE 2.

MONITORING WELL SUMMARY

Alberta Environment and Sustainable Resources Development (ESRD)
Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Elevation* (masl)						Depth (m)										Hydraulic Conductivity (m/s)	Method	Interpreted Aquifer
	Ground Surface	Top of Casing	Stick Up	Sept-13 [^]	Oct-13 ^{^^}	Nov-13 ^{^^^}	Grnd. to Total Drilled	Grnd. to Top of Screen	Grnd. to Base of Screen	Sept-13 [^]	Oct-13 ^{^^}	Nov-13 ^{^^^}	Top of Casing to Water	Grnd. to Water	Top of Casing to Water	Grnd. to Water			
				Water Level	Water Level	Water Level				Top of Casing to Water	Grnd. to Water	Top of Casing to Water							
Existing SAOS Monitoring Locations																			
Conklin 76-07-6	575.31	576.09	0.78	573.87	573.76	---	6.1	---	---	2.22	1.44	2.33	1.55	---	---	2E-05	KGS	near surface	
Conklin 76-07-24	575.21	576.01	0.80	569.35	569.32	---	24.4	---	---	6.66	5.86	6.69	5.89	---	---	6E-05	KGS	Sand River	
Conklin 76-07-41	575.10	575.84	0.74	572.00	571.95	---	42.7	---	---	3.84	3.10	3.89	3.15	---	---	1E-05	KGS	Ethel lake	
Conklin 76-07-67	575.04	575.78	0.74	571.41	571.36	---	68.0	---	---	4.37	3.63	4.42	3.68	---	---	6E-06	KGS	Bonnyville	
Waddell Creek 80-09-9	717.98	718.73	0.75	710.97	710.88	---	9.2	---	---	7.76	7.01	7.85	7.10	---	---	2E-05	KGS	near surface	
Waddell Creek 80-09-21	717.93	718.65	0.72	709.51	709.50	---	24.4	---	---	9.14	8.42	9.15	8.43	---	---	3E-04	H	Sand River	
Waddell Creek 80-09-117	717.91	718.55	0.64	698.44	698.44	---	119.5	---	---	20.11	19.47	20.11	19.47	---	---	5E-04	H	Ethel lake	
Waddell Creek 80-09-149	717.79	718.48	0.69	685.44	685.43	---	148.8	---	---	33.04	32.35	33.05	32.36	---	---	1E-06	D	Bonnyville	
Mariana Lakes 80-13-7	692.90	693.51	0.61	689.54	---	689.10	7.6	---	---	3.97	3.36	---	---	4.41	3.80	3E-05	BR	near surface	
Mariana Lakes 80-13-52	692.84	693.55	0.71	682.80	---	682.75	51.8	---	---	10.75	10.04	---	---	10.80	10.09	1E-05	BR	Ethel Lake	
Mariana Lakes 80-13-112	692.96	693.56	0.60	676.93	---	676.94	113.0	---	---	16.63	16.03	---	---	16.62	16.02	2E-04	KGS	Bonnyville	
Mariana Lakes 80-13-134	692.89	693.51	0.62	647.80	---	647.53	140.2	---	---	45.71	45.09	---	---	45.98	45.36	2E-04	KGS	Empress Terrace	
House Crossing 77-15-8	662.60	663.61	1.01	661.35	661.69	---	---	---	---	2.26	1.25	1.92	0.91	---	---	2E-06	BR	near surface	
House Crossing 77-15-82	662.51	663.18	0.67	597.11	597.11	---	85.3	---	---	66.07	65.40	66.07	65.40	---	---	8E-06	KGS	Ethel Lake	
House Crossing 77-15-126	662.48	663.16	0.68	604.61	604.64	---	128.0	---	---	58.55	57.87	58.52	57.84	---	---	1E-04	BR	Bonnyville	
House Crossing 77-15-161	662.52	663.24	0.72	601.21	601.25	---	164.6	---	---	62.03	61.31	61.99	61.27	---	---	3E-05	BR	Muriel Lake	
House Crossing 77-15-231	662.46	663.21	0.75	594.12	594.17	---	231.0	---	---	69.09	68.34	69.04	68.29	---	---	6E-05	BR	Empress Channel	
Plamondon 68-16-7	577.92	578.64	0.72	572.10	---	572.06	9.7	---	---	6.54	5.82	---	---	6.58	5.86	1E-05	BR	near surface	
Plamondon 68-16-39	577.88	578.61	0.73	549.39	---	549.42	46.3	---	---	29.22	28.49	---	---	29.19	28.46	4E-05	BR	Bonnyville	
Plamondon 68-16-51	577.86	578.57	0.71	547.25	---	547.24	52.4	---	---	31.32	30.61	---	---	31.33	30.62	2E-05	BR	Bonnyville	
Plamondon 68-16-70	577.76	578.46	0.70	547.24	---	547.24	73.1	---	---	31.22	30.52	---	---	31.22	30.52	9E-05	BR	Empress Channel	
Wiau Lake 73-9-41	667.01	667.77	0.76	---	659.22	---	---	37.9	41.0	---	---	8.55	7.79	---	---	---	---	Sand River	
Wiau Lake 73-9-76	666.99	667.76	0.77	---	658.05	---	---	72.4	75.3	---	---	9.71	8.94	---	---	---	---	Bonnyville	
Wiau Lake 73-9-120	666.92	667.68	0.76	---	656.20	---	---	117.3	120.3	---	---	11.48	10.72	---	---	---	---	Bonnyville	
Wiau Lake 73-9-15	666.83	667.64	0.81	---	663.65	---	---	9.3	15.4	---	---	3.99	3.18	---	---	---	---	Bonnyville	
Winefred Lake 75-5-17	648.17	648.78	0.61	---	638.36	---	---	11.2	17.3	---	---	10.42	9.81	---	---	---	---	near surface	
Winefred Lake 75-5-79	648.26	648.84	0.58	---	624.58	---	---	76.6	79.6	---	---	24.26	23.68	---	---	---	---	Bonnyville	
Winefred Lake 75-5-158	648.20	648.87	0.67	---	607.92	---	---	155.4	158.8	---	---	40.95	40.28	---	---	---	---	Empress Terrace	
Recommended SAOS Monitoring Locations																			
CL MW 25 (CCIA)	577.50	578.37	0.87	---	---	---	169.2	157.6	160.6	---	---	---	---	---	---	---	---	---	Empress Channel
CL MW 26 (CCIA)	576.72	577.45	0.73	---	---	---	61.0	55.5	58.5	---	---	---	---	---	---	---	---	---	Ethel Lake
Caribou 70-7-398 [†]	660.73	---	---	---	---	---	540.6	397.6	397.6	---	---	---	---	---	---	---	---	---	Lower Grand Rapids
Caribou 70-7-490 [†]	660.73	---	---	---	---	---	540.6	489.6	489.6	---	---	---	---	---	---	---	---	---	McMurray
Kimowin 83-2-180	469.49	470.69	1.20	---	---	---	184.0	156.1	180.3	---	---	---	---	---	---	---	---	---	Upper Clearwater
Kimowin 83-2-261	468.63	469.83	1.20	---	---	---	264.0	242.3	260.5	---	---	---	---	---	---	---	---	---	McMurray
Graham 80-1-180	505.40	506.10	0.70	---	---	---	180.0	149.8	176.9	---	---	---	---	---	---	---	---	---	Upper Clearwater
Graham 80-1-261	506.04	506.84	0.80	---	---	---	303.8	274.9	302.2	---	---	---	---	---	---	---	---	---	McMurray
1F1/05-14-083-03 W4M (LCRIA)	457.50	458.76	1.26	---	---	---	256.0	240.2	252.3	---	---	---	---	---	---	---	---	---	McMurray
1F1/05-36-084-04 W4M (LCRIA)	511.55	512.45	0.90	---	---	---	176.8	149.1	170.4	---	---	---	---	---	---	---	---	---	Upper Clearwater
1F2/05-14-083-03 W4M (LCRIA)	457.54	458.76	1.22	---	---	---	85.0	69.7	81.8	---	---	---	---	---	---	---	---	---	Lower Grand Rapids

Notes:

- * - elevations are geodetic
- masl - metres above sea level
-
- ^ - water levels measured on September 22, 2013, September 23, 2013 and September 25, 2013
- ^^ - water levels measured on October 24, 2013 and between October 29, 2013 to October 31, 2013
- ^^^ - water levels measured on November 7, 2013 and November 8, 2013
- † - monitoring location is a vibrating wire piezometer

- ND - not detected
- 0.xx - negative groundwater level denotes above ground surface
- H - Hvorslev analysis method (1951)
- BR - Bouwer and Rice method (1976)
- KGS - Hyder et al method (1994)
- D - Dagan method (1978)

TABLE 3.**2013 SAOS GROUNDWATER SAMPLING SUMMARY**

Alberta Environment and Sustainable Resources Development (ESRD)

Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

SAOS Well ID	Former Well Name	Formation	1st Monitoring Event (Sep 2013)	2nd Monitoring Event (Oct/Nov 2013)	Other Tasks Completed
Conklin					
Conklin 76-07-67	MW2A	Bonnyville Sand	Yes	Yes	
Conklin 76-07-41	MW2B	Ethel Lake	Yes	Yes	Well redeveloped
Conklin 76-07-24	MW2C	Sand River	Yes	Yes	
Conklin 76-07-6	MW2D	uppermost water-bearing units	Yes	Yes	
Waddell Creek					
Waddell Creek 80-09-149	MW6A	Bonnyville Sand	Yes	Yes	
Waddell Creek 80-09-117	MW6B	Ethel Lake	Yes	Yes	
Waddell Creek 80-09-21	MW6C	Sand River	Yes	Yes	
Waddell Creek 80-09-9	MW6D	uppermost water-bearing units	Yes	Yes	
Mariana Lake					
Mariana Lake 80-13-134	MW12A	Empress Terrace	Yes	Yes	
Mariana Lake 80-13-112	MW12B	Bonnyville Sand	Yes	Yes	
Mariana Lake 80-13-52	MW12C	Ethel Lake	Yes	Yes	
Mariana Lake 80-13-7	MW12D	uppermost water-bearing units	Yes	Yes	
House Crossing					
House Crossing 77-15-8	WR99-1-8(WT)	uppermost water-bearing units	Yes	Yes	
House Crossing 77-15-82	MW13C	Ethel Lake	Yes	Yes	
House Crossing 77-15-126	MW13B	Bonnyville	Yes	Yes	
House Crossing 77-15-161	MW13A	Muriel Lake	Yes	Yes	
House Crossing 77-15-231	WR99-1-230	Empress Channel	Yes	Yes	
Plamondon					
Plamondon 68-16-70	MW18A	Empress Channel	Yes	Yes	
Plamondon 68-16-51	MW18B	Bonnyville Sand Lower	Yes	Yes	
Plamondon 68-16-39	MW18C	Bonyville Sand Upper	Yes	Yes	
Plamondon 68-16-7	MW18D	uppermost water-bearing units	Yes	Yes	constriction inspected, water drained from protector casing

TABLE 3.**2013 SAOS GROUNDWATER SAMPLING SUMMARY**

Alberta Environment and Sustainable Resources Development (ESRD)

Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

SAOS Well ID	Former Well Name	Formation	1st Monitoring Event (Sep 2013)	2nd Monitoring Event (Oct/Nov 2013)	Other Tasks Completed
Wiau Lake					
Wiau Lake 73-9-120	WEPA 00-1-120	Muriel Lake	No	Yes	New pressure transducer installed
Wiau Lake 73-9-41	WEPA 00-1-41	Sand River	No	Yes	New pressure transducer installed
Wiau Lake 73-9-76	WEPA 00-1-76	Bonnyville	No	Yes	New pressure transducer installed
Wiau Lake 73-9-15	WEPA 00-1-WT	uppermost water-bearing units	No	Yes	New pressure transducer installed
Winefred Lake					
Winefred Lake 75-5-158	WEPA 00-3-158	Empress Channel	No	Yes	New pressure transducer installed
Winefred Lake 75-5-79	WEPA 00-3-79	Ethel Lake	No	Yes	New pressure transducer installed
Winefred Lake 75-5-17	WEPA 00-3-17	Sand River	No	Yes	New pressure transducer installed

2013 Program Summary

- 1st sampling event: September 2013 - 21 out of 21 wells sampled (all sites), reconnaissance of WEPA 00-1 and WEPA 00-3 redevelopment of Conklin 76-07-41, maintenance at Plamondon 68-16-7
- 2nd sampling event: October/November 2013 - 28 out of 28 wells sampled (all sites including Wiau Lake and Winefred Lake)
- Well redevelopment: 1 well (Conklin)
- Well instrumentation: new pressure transducer installed (7 wells in two sites - Wiau Lake and Winefred lake)

TABLE 4a.

INDUSTRY DATA REQUEST RATIONALE - INVESTIGATION AREAS

Alberta Environment and Sustainable Resources Development (ESRD)

Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Investigation Area	Key Hydrostratigraphic Units present	Wells Requested from Table 2 Matrix (2013)	Operator	Specific Rationale for Initial Selection	Recommended for Inclusion in SAOS?	Matrix Rationale for Final Recommendation
Christina Channel	Sand River	KE-GWO-3W1	Cenovus	only Sand River monitoring well identified in Table 2 (Matrix 2013), near Christina Channel thalweg, no source well in same unit, interpreted to be suitable for groundwater quality and quantity	No	Completion is in Marie Creek aquitard (incorrect initial interpretation). The Marie Creek was not identified as a Key Aquifer in the SAOS region.
	Ethel Lake	CL MW 26	Cenovus	near Christina Channel thalweg, no source wells identified in same unit within 5 km, interpreted to be suitable for groundwater quality and quantity	Yes	Key Aquifer completed in Christina Channel Investigation Area, nested location with CL MW 25.
	Bonnyville	1F2/10-33-075-07W4M	Devon	near Sunday Creek Channel, no Bonnyville source wells identified within 10 km	No	Associated with diversion licence 336306 00 00 (licence did not exist at time of Matrix 2013 report); very close to source well. Does not meet objectives of framework.
	Muriel Lake	CL MW28	Cenovus	only Muriel Lake monitoring well identified in Table 2 (Matrix 2013), near Christina Channel thalweg, no source well identified in same unit within 10 km, interpreted to be suitable for groundwater quality and quantity	No	Completion is in Bonnyville Aquifer (incorrect initial interpretation). Bonnyville completions already exist at Conklin and Winefred Lake which are within the Christina Channel Investigation Area - not a high priority location.
	Empress Channel	CL MW25	Cenovus	near Christina Channel thalweg, no source wells identified in same unit within 5 km, interpreted to be suitable for groundwater quality and quantity	Yes	Key Aquifer completed in Christina Channel Investigation Area, nested location with CL MW 26.
	Lower Grand Rapids	1F1/03-27-075-06W4M	Devon	only Lower Grand Rapids monitoring well identified in Table 2 (Matrix 2013), non-saline portion of aquifer, near Christina Channel thalweg, but 3 km away from Lower Grand Rapids source well (suitability of baseline needs to be assessed)	No	Limited historical data available; proximal to source wells. Does not meet objectives of framework.
	Middle Clearwater	CL 10-03-CWB OBS	Cenovus	only Middle Clearwater monitoring well identified in Table 2 (Matrix 2013), near Christina Channel thalweg, close to pumping so suitability of baseline to be determined, all weather access, likely only feasible from a groundwater quantity perspective	No	Limited historical data available; proximal to source wells. Does not meet objectives of framework.
	Basal McMurray	KE 12-18 MCM OBS	Cenovus	only McMurray monitoring well identified in Table 2 (Matrix 2013), near Christina Channel thalweg, close to pumping/disposal so suitability of baseline to be determined, likely only feasible from a groundwater quantity perspective	No	Limited historical data available; proximal to source wells. Does not meet objectives of framework.
Gregoire Channel	Surficial	1WM/16-09-086-07W4/02	Nexen	outside Gregoire Channel, away from any Quaternary sand pumping, nested location with Lower Grand Rapids monitoring well, located between Gregoire Lake and Gregoire Channel, near Anzac	No	Operator identified wells as already being part of existing compliance monitoring
	Gregoire Channel	1WM/10-29-085-06W4/00	Nexen	in Gregoire Channel, nested location (deep Gregoire), all weather access	No	Operator identified wells as already being part of existing compliance monitoring
	Gregoire Channel	1WM/10-29-085-06W4/03	Nexen	in Gregoire Channel, nested location (shallow Gregoire), all weather access	No	Operator identified wells as already being part of existing compliance monitoring
	Lower Grand Rapids	1WM/16-09-086-07W4/00	Nexen	outside Gregoire Channel, 5 km from any identified Lower Grand Rapids source well, nested location with Quaternary sand monitoring well	Yes	Operator identified wells as already being part of existing compliance monitoring
	Lower Grand Rapids	1WM/16-29-085-06W4/00	Nexen	within Gregoire Channel, but close to source wells so suitability for baseline needs to be assessed, location has potential determine channel Lower Grand Rapids interaction	No	Operator identified wells as already being part of existing compliance monitoring
	Basal McMurray	100/02-28-085-06W4M	Nexen	only McMurray monitoring well identified in Table 2 (Matrix 2013), only McMurray observation well near Gregoire Channel, but near disposal wells so suitability as baseline needs to be assessed, location has potential to determine McMurray/Gregoire channel interactions	Yes	Operator identified wells as already being part of existing compliance monitoring
Lower Christina River	Lower Grand Rapids	1F2/05-14-083-03 W4M	ConocoPhillips	ownership offered to ESRD by ConocoPhillips	Yes	Key aquifer completed in Lower Christina River Investigation Area; in process of transferring ownership to ESRD
	Lower Grand Rapids	1F1/15-34-083-04W400	ConocoPhillips	located at least 3 km from any identified existing/proposed source well, central portion of Investigation Area, west of Christina River	No	Potential source well location; existing completion in Lower Grand Rapids at 5-14-83-3 fulfills framework objectives.
	Upper Clearwater	1F1/11-28-081-04W400	ConocoPhillips	located at least 3 km from any identified existing/proposed source well, east side of Christina River, southern portion of Investigation Area	No	Potential source well location; alternative location recommended by ConocoPhillips at 5-36-84-4 W4M.
	Upper Clearwater	1F1/05-36-084-04 W4M	ConocoPhillips	Not initially identified as a potential location	Yes	Alternative Upper Clearwater monitoring location recommended by ConocoPhillips
	Basal McMurray	1F1/05-14-083-03 W4M	ConocoPhillips	ownership offered to ESRD by ConocoPhillips	Yes	Key Aquifer completed in Lower Christina River Investigation Area; in process of transferring ownership to ESRD
	Basal McMurray	1F1/10-32-083-03W4/00	Nexen	near Christina River, but close to identified existing/proposed source/disposal wells so suitability to baseline needs to be assessed	No	Limited historical data available; proximal to source wells. Does not meet objectives of framework.

TABLE 4b.

INDUSTRY DATA REQUEST RATIONALE - MONITORING LOCATIONS

Alberta Environment and Sustainable Resources Development (ESRD)

Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Proposed Monitoring Location	Hydrostratigraphic Unit	Wells Requested from Table 7.4 Matrix (2013)	Operator	Specific Rationale	Recommended for Inclusion in SAOS?	Matrix Rationale for Recommendation
Caribou	Lower Grand Rapids	VWP CVE FCCL D14 FISHER 1AA/14-16-070-07W4M	Cenovus	specifically identified in Matrix (2013) for this location, nested location, moderately close to existing Lower Grand Rapids demand but located more than 10 km away from any existing or proposed Lower Grand Rapids/McMurray source/disposal well, proximal to gas Mannville gas production but still many kms away	Yes	Key Aquifer completed at Caribou monitoring location
	McMurray	VWP CVE FCCL D14 FISHER 1AA/14-16-070-07W4M	Cenovus	specifically identified in Matrix (2013) for this location, nested location, moderately close to existing Lower Grand Rapids demand but located more than 10 km away from any existing or proposed Lower Grand Rapids/McMurray source/disposal well, proximal to gas Mannville gas production but still many kms away	Yes	Key Aquifer completed at Caribou monitoring location
Kimowin	Upper Clearwater	1F2/01-13-083-02W4	ConocoPhillips	specifically identified in Matrix (2013) for this location, nested location, located well away from existing/proposed source wells, away from gas production, near Saskatchewan border, Strategic (background) monitoring location [Figure 6.3.1 Matrix (2013)], ownership offered to ESRD	Yes	Key Aquifer completed at Kimowin monitoring location; in process of transferring ownership to ESRD
	Basal McMurray	1F1/01-13-083-02W4	ConocoPhillips	specifically identified in Matrix (2013) for this location, nested location, located well away from existing/proposed source wells, away from gas production, near Saskatchewan border, Strategic (background) monitoring location [Figure 6.3.1 Matrix (2013)], ownership offered to ESRD	Yes	Key Aquifer completed at Kimowin monitoring location; in process of transferring ownership to ESRD
Graham	Upper Clearwater	1F1/05-19-080-01W4	ConocoPhillips	specifically identified in Matrix (2013) for this location, nested location, located well away from existing/proposed source wells, away from gas production, near Saskatchewan border, Strategic (background) monitoring location [Figure 6.3.1 Matrix (2013)], ownership offered to ESRD	Yes	Key Aquifer completed at Graham monitoring location; in process of transferring ownership to ESRD
	Basal McMurray	1F2/05-19-080-01W4	ConocoPhillips	specifically identified in Matrix (2013) for this location, nested location, located well away from existing/proposed source wells, away from gas production, near Saskatchewan border, Strategic (background) monitoring location [Figure 6.3.1 Matrix (2013)], ownership offered to ESRD	Yes	Key Aquifer completed at Graham monitoring location; in process of transferring ownership to ESRD

TABLE 5.

GROUNDWATER QUALITY RESULTS - FIELD MEASURED PARAMETERS

Alberta Environment and Sustainable Resources Development (ESRD)

Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Sample Date	MSI Sample Number	Field Temp °C	Field pH	Field EC ^A µS/cm	Field DO mg/L	Field Cl mg/L
CL MW 25	11-Mar-12	16054120311001	4.8	8.52	1597	1.68	---
CL MW 25	20-Jul-12	16054120720001	7.5	9.82	1490	1.08	---
CL MW 25	22-Jun-13	16054130622002	5.6	8.14	1433	3.0	---
CL MW 25	17-Oct-13	16054131017002	3.2	7.74	1226	2.8	---
CL MW 26	21-Jun-12	16054120621001	5.06	7.62	900	2.5	---
CL MW 26	22-Jun-13	16054130622001	7.2	9.19	592.2	2.4	---
CL MW 26	17-Oct-13	16054131017001	4.8	7.67	493.7	1.2	---
Conklin 76-07-6	15-Nov-12	16054121115104	5.4	6.3	100	7.6	---
Conklin 76-07-6	23-Sep-13	16054130923054	11	6.5	70	---	---
Conklin 76-07-6	29-Oct-13	16054131029010	9.3	6.3	70	---	---
Conklin 76-07-24	15-Nov-12	16054121115103	4	7.6	370	0.8	---
Conklin 76-07-24	23-Sep-13	16054130923053	6.5	7.5	425	---	---
Conklin 76-07-24	29-Oct-13	16054131029009	5.4	7.5	410	---	---
Conklin 76-07-41	15-Nov-12	16054121115102	4.2	7.4	750	1.0	---
Conklin 76-07-41	23-Sep-13	16054130923052	6.4	7.4	778	---	---
Conklin 76-07-41	29-Oct-13	16054131029008	5.5	7.5	810	---	---
Conklin 76-07-67	15-Nov-12	16054121115101	4	7.5	760	3.0	---
Conklin 76-07-67	23-Sep-13	16054130923051	4.9	7.4	781	---	---
Conklin 76-07-67	29-Oct-13	16054131029007	3.9	7.4	810	---	---
Waddell Creek 80-09-9	22-Oct-12	16054121022101	5.8	7.6	890	6.8	---
Waddell Creek 80-09-9	23-Sep-13	16054130923048	6.8	7.1	560	---	<34
Waddell Creek 80-09-9	29-Oct-13	16054131029011	4	7	970	---	---
Waddell Creek 80-09-21	22-Oct-12	16054121022102	3.6	7.3	510	2.3	---
Waddell Creek 80-09-21	23-Sep-13	16054130923050	6.6	7.3	497	---	<34
Waddell Creek 80-09-21	29-Oct-13	16054131029015	4.2	7.4	500	---	---
Waddell Creek 80-09-117	23-Oct-12	16054121023104	2.7	7.4	540	2.6	---
Waddell Creek 80-09-117	23-Sep-13	16054130923049	4.3	7.5	716	---	<34
Waddell Creek 80-09-117	29-Oct-13	16054131029014	4	7.5	720	---	---
Waddell Creek 80-09-149	22-Oct-12	16054121022103	4.2	7.4	930	2.0	---
Waddell Creek 80-09-149	23-Sep-13	16054130923047	5.7	7.4	929	---	<34
Waddell Creek 80-09-149	29-Oct-13	16054131029013	5.2	7.5	930	---	---
Alberta Tier 1 - Natural Areas*			NS	6.5-8.5^{P(AO)}	NS	NS	230^A

TABLE 5.**GROUNDWATER QUALITY RESULTS - FIELD MEASURED PARAMETERS**

Alberta Environment and Sustainable Resources Development (ESRD)

Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Sample Date	MSI Sample Number	Field Temp °C	Field pH	Field EC [^] µS/cm	Field DO mg/L	Field Cl mg/L
WM McM 02-28-85-6	06-Mar-07	16054070306001	--	--	--	4.5	--
WM McM 02-28-85-6	06-Mar-07	16054070306002	--	--	--	9.5	--
WM McM 02-28-85-6	17-Dec-08	16054081217001	2.34	6.82	3014	7.0	--
WS GR 6-18-85-5	22-Sep-09	16054090922002	5.81	9	1064	20.2	--
Mariana Lakes 80-13-7	17-Nov-12	16054121117102	3.1	7	440	7.0	--
Mariana Lakes 80-13-7	19-Nov-12	16054121119301	3.1	7	440	7.0	--
Mariana Lakes 80-13-7	22-Sep-13	16054130922046	9.9	6.5	460	--	<32
Mariana Lakes 80-13-7	07-Nov-13	16054131107030	7.2	7.5	840	--	--
Mariana Lakes 80-13-52	17-Nov-12	16054121117103	4.3	7.3	560	4.4	--
Mariana Lakes 80-13-52	22-Sep-13	16054130922045	5.2	7.3	610	--	<32
Mariana Lakes 80-13-52	07-Nov-13	16054131107029	4.5	7.3	640	--	--
Mariana Lakes 80-13-112	17-Nov-12	16054121117104	4.2	7.5	850	1.6	--
Mariana Lakes 80-13-112	22-Sep-13	16054130922044	5.7	7.5	898	--	<32
Mariana Lakes 80-13-112	07-Nov-13	16054131107028	4.6	7.5	930	--	--
Mariana Lakes 80-13-134	17-Nov-12	16054121117101	5.3	7.3	840	2.5	--
Mariana Lakes 80-13-134	22-Sep-13	16054130922043	7.9	7.2	900	--	<32
Mariana Lakes 80-13-134	07-Nov-13	16054131107027	4.2	7.3	930	--	--
House Crossing 77-15-8	19-Nov-12	16054121119104	3.4	7.3	610	2.2	--
House Crossing 77-15-8	25-Sep-13	16054130925060	5.8	7.2	600	--	--
House Crossing 77-15-8	24-Oct-13	16054131024005	5	7.4	660	--	--
House Crossing 77-15-82	19-Nov-12	16054121119101	3	7.8	990	--	--
House Crossing 77-15-82	25-Sep-13	16054130925059	5.7	7.5	1104	--	--
House Crossing 77-15-82	24-Oct-13	16054131024001	4.4	7.6	1070	--	--
House Crossing 77-15-126	19-Nov-12	16054121119103	4.05	7.4	560	7.5	--
House Crossing 77-15-126	25-Sep-13	16054130925058	4.3	7.4	570	--	--
House Crossing 77-15-126	24-Oct-13	16054131024004	3.3	7.5	570	--	--
Alberta Tier 1 - Natural Areas*			NS	6.5-8.5^{P(AO)}	NS	NS	230^A

TABLE 5.

GROUNDWATER QUALITY RESULTS - FIELD MEASURED PARAMETERS

Alberta Environment and Sustainable Resources Development (ESRD)
 Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Sample Date	MSI Sample Number	Field Temp °C	Field pH	Field EC [^] µS/cm	Field DO mg/L	Field Cl mg/L
House Crossing 77-15-161	19-Nov-12	16054121119102	4	7.4	620	5.1	---
House Crossing 77-15-161	25-Sep-13	16054130925057	5.7	7.5	625	---	---
House Crossing 77-15-161	24-Oct-13	16054131024003	3.5	7.6	630	---	---
House Crossing 77-15-231	19-Nov-12	16054121119105	3.6	7.6	730	2.6	---
House Crossing 77-15-231	25-Sep-13	16054130925056	4.6	7.6	757	---	---
House Crossing 77-15-231	24-Oct-13	16054131024002	4.2	7.7	760	---	---
Plamondon 68-16-7	21-Nov-12	16054121121101	3.3	8.2	460	10.5	---
Plamondon 68-16-7	25-Sep-13	16054130925065	6.5	8.4	280	---	<35
Plamondon 68-16-7	08-Nov-13	16054131108035	5.6	8	300	---	---
Plamondon 68-16-39	21-Nov-12	16054121121104	5.1	8	1550	3.9	---
Plamondon 68-16-39	25-Sep-13	16054130925064	6	7.8	1706	---	<35
Plamondon 68-16-39	08-Nov-13	16054131108034	5.7	7.9	1760	---	---
Plamondon 68-16-51	21-Nov-12	16054121121103	5.8	8	9130	3.5	---
Plamondon 68-16-51	25-Sep-13	16054130925063	6.1	7.9	1229	---	<35
Plamondon 68-16-51	08-Nov-13	16054131108033	6.1	8	1280	---	---
Plamondon 68-16-70	21-Nov-12	16054121121102	5.9	8.4	15180	1	---
Plamondon 68-16-70	25-Sep-13	16054130925062	6.4	8.2	28200	---	477
Plamondon 68-16-70	08-Nov-13	16054131108032	6.3	8.3	2930	---	---
Wiau Lake 73-9-15	30-Oct-13	16054131030019	7	6.8	980	---	---
Wiau Lake 73-9-41	30-Oct-13	16054131030017	5.4	7.4	570	---	---
Wiau Lake 73-9-76	30-Oct-13	16054131030018	5.5	7.5	570	---	---
Wiau Lake 73-9-120	30-Oct-13	16054131030016	5	7.5	620	---	---
Winefred Lake 75-5-17	31-Oct-13	16054131031023	6.4	7.2	1340	---	---
Winefred Lake 75-5-79	31-Oct-13	16054131031021	7.2	7.3	1350	---	---
Winefred Lake 75-5-158	31-Oct-13	16054131031020	5.6	7.7	910	---	---
Alberta Tier 1 - Natural Areas*			NS	6.5-8.5^{P(AO)}	NS	NS	230^A

Notes:

- - not analyzed
- NS - guideline not specified
- ^{AO} - aesthetic objective from Guidelines for Canadian Drinking Water Quality (Health Canada, 2012)
- ^P - indicates guideline for Potable Groundwater exposure pathway
- ^A - field EC corrected to 25°C
- * - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AENV, 2010)
- Italics** - indicates values do not meet applicable guidelines

TABLE 6.

GROUNDWATER QUALITY RESULTS - GENERAL AND INORGANIC PARAMETERS

Alberta Environment and Sustainable Resources Development (ESRD)
 Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Sample Date	MSI Sample Number	Lab pH	Lab EC µS/cm	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO ₄ mg/L	NO ₂ -N mg/L	NO ₃ -N+ mg/L	NO ₂ /NO ₃ -N mg/L	Total Alkalinity ^A mg/L	HCO ₃ mg/L	Hardness ^A mg/L	TDS mg/L	NH ₃ -N mg/L	TKN mg/L	PO ₄ -P Total mg/L	DOC mg/L	Phenol mg/L	Turbidity NTU	CO ₃ mg/L		
Surficial Deposits																										
Conklin 76-07-6	15-Nov-12	16054121115104	6.97	109	12	3.82	1.7	0.74	0.95	2.96	<0.05	0.242	0.242	49.9	60.9	45.7	53.2	<0.05	---	---	3	0.0011	---	<5.0		
Conklin 76-07-6	23-Sep-13	16054130923054	7.38	71	7.86	2.22	1.5	0.6	1.68	3.14	<0.05	0.129	0.129	30.6	37.3	28.8	35.9	<0.05	<0.2	---	2.4	<0.001	28.5	<5.0		
Conklin 76-07-6	29-Oct-13	16054131029010	6.79	69.5	7.86	2.21	1.5	0.58	1.34	2.57	<0.05	0.157	0.157	30.8	37.6	28.7	35.2	<0.05	<0.2	0.036	2.4	<0.001	---	<5.0		
House Crossing 77-15-8	19-Nov-12	16054121119104	7.59	645	99.7	19.1	4	2.38	25.7	5.5	<0.05	<0.05	<0.071	311	379	328	343	0.288	---	---	7.5	<0.001	---	<5.0		
House Crossing 77-15-8	25-Sep-13	16054130925060	7.89	637	97.5	18.7	3.68	2.15	26	5.15	<0.05	<0.05	<0.071	314	383	320	342	0.255	0.65	0.342	10.1	<0.001	226	<5.0		
House Crossing 77-15-8	24-Oct-13	16054131024005	8.35	646	104	19.9	4.1	2.28	27.8	5.68	<0.05	<0.05	<0.071	318	379	342	355	0.448	0.65	0.218	7.9	0.0013	---	<5.0		
Mariana Lakes 80-13-7	17-Nov-12	16054121117102	7.54	332	39.8	8.71	9.5	4.72	11.9	15.2	<0.05	<0.05	<0.071	134	164	135	170	0.106	---	---	---	---	---	<5.0		
Mariana Lakes 80-13-7	19-Nov-12	16054121119301	---	---	48.5	10.5	9.25	3.74	---	---	---	---	---	---	---	160	---	---	---	---	6.9	0.005	---	---		
Mariana Lakes 80-13-7	22-Sep-13	16054130922046	7.89	442	55.8	12.8	18.9	4.1	2.01	74.2	<0.05	<0.05	<0.071	153	187	192	260	<0.05	<0.2	0.161	5.4	<0.001	80.6	<5.0		
Mariana Lakes 80-13-7	07-Nov-13	16054131107030	7.17	541	55.3	12.5	18.7	4.6	1.91	85.3	<0.05	<0.05	<0.071	202	247	190	300	0.119	1.76	1.56	5	0.0027	---	<5.0		
Plamondon 68-16-7	21-Nov-12	16054121121101	8.09	324	21.4	6.61	48.1	1.42	2.79	31.1	<0.05	0.47	0.47	159	194	80.7	209	0.088	---	---	5.7	0.0036	---	<5.0		
Plamondon 68-16-7	25-Sep-13	16054130925065	8.2	287	27.9	9.04	18.7	1.43	0.91	9.2	<0.05	0.239	0.239	145	177	107	155	<0.05	0.44	0.49	4.4	<0.001	569	<5.0		
Plamondon 68-16-7	08-Nov-13	16054131108035	7.93	292	29.8	9.36	18.4	1.73	1.32	10.4	<0.05	0.252	0.252	146	178	113	160	<0.05	0.46	0.505	3.1	<0.001	---	<5.0		
Waddell Creek 80-09-9	22-Oct-12	16054121022101	8.05	829	120	44.4	8.5	3.67	0.79	23.4	<0.05	0.951	0.951	479	584	482	492	0.07	---	---	11.3	0.0611	---	<5.0		
Waddell Creek 80-09-9	23-Sep-13	16054130923048	7.86	970	150	45.6	9.88	3.37	7.89	40.5	<0.05	0.859	0.859	532	649	562	580	<0.05	0.53	---	10.4	<0.001	394	<5.0		
Waddell Creek 80-09-9	29-Oct-13	16054131029011	7.52	998	145	43.4	9.4	3.33	8.48	39.6	<0.05	0.853	0.853	528	644	541	570	<0.05	1.86	1.11	8.4	0.0158	---	<5.0		
Winefred Lake 75-5-17	31-Oct-13	16054131031023	7.68	1380	157	60.8	44.2	3.56	117	47.1	<0.05	0.093	0.093	557	680	642	764	<0.05	0.2	0.029	8.2	<0.001	---	<5.0		
Alberta Tier 1 - Natural Areas*			6.5-8.5^{P(AO)}	NS	NS	NS	200^{P(AO)}	NS	230^A	500^{P(AO)}	0.06^A	2.9^A	NS	NS	NS	NS	500^{P(AO)}	0.282^{A,pH/T***}	NS	NS	NS	0.004^A	NS	NS		
Sand River																										
Conklin 76-07-24	15-Nov-12	16054121115103	7.9	391	47.8	14.5	12	3.6	<0.50	3.95	<0.05	<0.05	<0.071	228	279	179	219	0.448	---	---	3.3	<0.001	---	<5.0		
Conklin 76-07-24	23-Sep-13	16054130923053	8.43	417	52.4	14.6	12.2	3.3	<0.50	4.38	<0.05	<0.05	<0.071	234	278	191	227	0.416	0.65	---	3.6	<0.001	14.4	<5.0		
Conklin 76-07-24	29-Oct-13	16054131029009	7.81	404	52.7	13.6	11.4	3.17	<0.50	3.99	<0.05	<0.05	<0.071	222	270	188	218	0.519	0.48	0.352	3.2	<0.001	---	<5.0		
Waddell Creek 80-09-21	22-Oct-12	16054121022102	7.87	488	68.4	18.9	9.2	2.7	1.2	17.5	<0.05	<0.05	<0.071	264	322	249	276	0.163	---	---	5.3	<0.001	---	<5.0		
Waddell Creek 80-09-21	23-Sep-13	16054130923050	8.32	491	71.8	19	5.45	2.22	<0.50	14.9	<0.05	<0.05	<0.071	271	327	258	276	0.092	<0.2	---	4.4	<0.001	11.5	<5.0		
Waddell Creek 80-09-21	29-Oct-13	16054131029015	7.8	503	75.4	17.5	5	2.24	<0.50	14.5	<0.05	<0.05	<0.071	263	321	260	272	0.112	<0.2	0.151	4	<0.001	---	<5.0		
Wiau Lake 73-9-41	30-Oct-13	16054131030017	7.8	553	79.1	20.9	7.2	2.63	0.96	1.13	<0.05	<0.05	<0.071	309	377	284	297	0.956	1.11	0.378	<1.0	0.0011	---	<5.0		
Alberta Tier 1 - Natural Areas*			6.5-8.5^{P(AO)}	NS	NS	NS	200^{P(AO)}	NS	230^A	500^{P(AO)}	0.06^A	2.9^A	NS	NS	NS	NS	500^{P(AO)}	0.282^{A,pH/T***}	NS	NS	NS	0.004^A	NS	NS		

TABLE 6.

GROUNDWATER QUALITY RESULTS - GENERAL AND INORGANIC PARAMETERS

Alberta Environment and Sustainable Resources Development (ESRD)
 Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Sample Date	MSI Sample Number	Lab pH	Lab EC µS/cm	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO ₄ mg/L	NO ₂ -N mg/L	NO ₃ -N+ mg/L	NO ₂ /NO ₃ -N mg/L	Total Alkalinity ^A mg/L	HCO ₃ mg/L	Hardness ^A mg/L	TDS mg/L	NH ₃ -N mg/L	TKN mg/L	PO ₄ -P Total mg/L	DOC mg/L	Phenol mg/L	Turbidity NTU	CO ₃ mg/L		
Ethel Lake																										
CL MW 26	21-Jun-12	16054120621001	8.04	870	71	22	95	5.9	5.2	<1.0	<0.003	<0.003	<0.003	500	610	270	520	---	---	---	---	---	11	<0.5		
CL MW 26	22-Jun-13	16054130622001	7.98	610	27	10	100	4.8	8.4	<1.0	<0.003	<0.003	<0.003	310	380	110	360	---	---	---	---	---	4.9	<0.5		
CL MW 26	17-Oct-13	16054131017001	7.78	630	26	11	98	5.4	8.9	<1.0	0.0035	0.0034	0.007	300	370	110	390	---	---	---	---	---	4.7	<0.5		
Conklin 76-07-41	15-Nov-12	16054121115102	7.92	775	73.6	24.2	51.8	5.46	<0.50	10.6	<0.05	<0.05	<0.071	433	528	283	425	2.19	---	---	6.6	<0.001	---	<5.0		
Conklin 76-07-41	23-Sep-13	16054130923052	8.47	769	78.6	25.1	58.4	4.95	<0.50	11.3	<0.05	<0.05	<0.071	456	533	300	452	2.02	2.42	---	7.3	<0.001	17.2	11.3		
Conklin 76-07-41	29-Oct-13	16054131029008	7.79	792	81.1	23.9	55.1	5.27	<0.50	10.9	<0.05	<0.05	<0.071	480	586	301	464	2.29	2.27	0.843	6.3	<0.001	---	<5.0		
House Crossing 77-15-82	19-Nov-12	16054121119101	8.12	965	41.1	10.4	150	4.51	23.8	78.5	<0.05	<0.05	<0.071	413	504	145	556	1.39	---	---	10.4	0.0071	---	<5.0		
House Crossing 77-15-82	25-Sep-13	16054130925059	8.16	1070	50.5	11.7	183	4.89	49.7	86.1	<0.05	<0.05	<0.071	433	529	174	646	1.27	1.44	1.03	9.6	<0.001	31.8	<5.0		
House Crossing 77-15-82	24-Oct-13	16054131024001	8.54	1090	48.7	12.8	171	4.71	44.1	91	<0.05	<0.05	<0.071	438	501	174	635	1.42	1.64	1.2	8.4	0.001	---	16.6		
Mariana Lakes 80-13-52	17-Nov-12	16054121117103	7.76	574	73.5	18.4	16.8	4.59	0.52	23.4	<0.05	<0.05	<0.071	297	362	259	315	0.897	---	---	6.7	0.0022	---	<5.0		
Mariana Lakes 80-13-52	22-Sep-13	16054130922045	8.43	601	81	20.7	19.7	4.26	3.38	31.3	<0.05	<0.05	<0.071	312	368	287	348	0.833	0.94	1.22	8.6	0.0012	149	6.4		
Mariana Lakes 80-13-52	07-Nov-13	16054131107029	7.77	593	72.2	20	19	4.1	<0.50	29.1	<0.05	<0.05	<0.071	306	373	263	328	0.905	1.01	1.53	6.7	0.0027	---	<5.0		
Waddell Creek 80-09-117	23-Oct-12	16054121023104	7.96	697	61.4	16.6	73	4.22	0.25	26.4	<0.05	<0.05	<0.071	374	456	222	406	1.5	---	---	6.2	<0.001	---	<5.0		
Waddell Creek 80-09-117	23-Sep-13	16054130923049	8.4	699	65.7	16.5	71.5	4.03	<0.50	25.2	<0.05	<0.05	<0.071	386	457	232	415	1.19	1.68	---	8.2	<0.001	40.4	6.7		
Waddell Creek 80-09-117	29-Oct-13	16054131029014	7.86	720	65.8	15.7	69	4.26	<0.50	25	<0.05	<0.05	<0.071	381	465	229	408	1.49	1.77	0.49	6.6	0.0055	---	<5.0		
Alberta Tier 1 - Natural Areas*			6.5-8.5 ^{P(AO)}	NS	NS	NS	200 ^{P(AO)}	NS	230 ^A	500 ^{P(AO)}	0.06 ^A	2.9 ^A	NS	NS	NS	NS	500 ^{P(AO)}	0.282 ^{A,pH/T***}	NS	NS	NS	0.004 ^A	NS	NS		
Bonnyville																										
Conklin 76-07-67	15-Nov-12	16054121115101	7.91	785	66.8	22.8	64.5	5.78	0.62	9.39	<0.05	<0.05	<0.071	439	535	261	433	2.72	---	---	7.7	<0.001	---	<5.0		
Conklin 76-07-67	23-Sep-13	16054130923051	8.45	777	81.2	24.9	62.7	5.13	<0.50	10.5	<0.05	<0.05	<0.071	459	540	305	460	2.28	3.12	---	7.4	<0.001	15.8	9.5		
Conklin 76-07-67	29-Oct-13	16054131029007	7.79	799	80.2	23.7	58.5	5.27	<0.50	10.3	<0.05	<0.05	<0.071	447	545	298	446	2.69	2.71	0.996	6.3	<0.001	---	<5.0		
House Crossing 77-15-126	19-Nov-12	16054121119103	7.9	577	60.1	15.8	37.9	4.14	3.84	16.7	<0.05	<0.05	<0.071	302	368	215	320	1.31	---	---	5.9	<0.001	---	<5.0		
House Crossing 77-15-126	25-Sep-13	16054130925058	8.07	563	61.2	16.6	33.4	4.04	<0.50	15.6	<0.05	<0.05	<0.071	310	378	221	317	1.08	1.46	0.921	6	<0.001	41	<5.0		
House Crossing 77-15-126	24-Oct-13	16054131024004	8.43	565	64.8	17.9	31.3	3.91	<0.50	16.2	0.152	<0.05	0.152	310	361	236	321	1.43	1.24	0.805	5.2	0.0017	---	8.2		
Mariana Lakes 80-13-112	17-Nov-12	16054121117104	7.96	885	67	16.9	84.1	7.01	0.87	113	<0.05	<0.05	<0.071	377	460	237	515	1.87	---	---	7.3	<0.001	---	<5.0		
Mariana Lakes 80-13-112	22-Sep-13	16054130922044	8.54	890	79.6	21.1	101	7.45	0.69	114	<0.05	<0.05	<0.071	394	453	286	560	1.73	2.23	0.452	6.1	<0.001	19.1	14		
Mariana Lakes 80-13-112	07-Nov-13	16054131107028	7.94	910	71.6	19.5	97.9	7.11	0.61	123	<0.05	<0.05	<0.071	385	469	259	551	1.89	1.85	0.407	6.2	<0.001	---	<5.0		
Plamondon 68-16-39	21-Nov-12	16054121121104	8.19	1560	58.1	21.8	304	3.36	3.88	455	<0.05	<0.05	<0.071	518	631	235	1160	3.83	---	---	11.3	<0.001	---	<5.0		
Plamondon 68-16-39	25-Sep-13	16054130925064	8.42	1730	65.5	22.6	312	3.64	3.6	416	<0.05	<0.05	<0.071	521	613	257	1140	3.24	3.75	0.916	15	0.0011	14.6	11.5		
Plamondon 68-16-39	08-Nov-13	16054131108034	8.06	1760	64.4	23.2	302	3.65	4.21	439	<0.05	<0.05	<0.071	509	621	256	1140	3.32	3.84	0.876	10.8	<0.001	---	<5.0		
Plamondon 68-16-51	21-Nov-12	16054121121103	8.27	1160	25.8	9.32	268	2.43	18.2	130	<0.05	<0.05	<0.071	560	683	103	790	3.5	---	---	12.7	<0.001	---	<5.0		
Plamondon 68-16-51	25-Sep-13	16054130925063	8.49	1260	26.7	9.9	268	2.38	16.5	113	<0.05	<0.05	<0.071	560	653	107	772	3.41	3.86	2.23	17.4	<0.001	1.99	14.5		
Plamondon 68-16-51	08-Nov-13	16054131108033	8.18	1270	25.9	9.49	249	2.17	18.9	123	<0.05	<0.05	<0.071	580	707	104	776	3.47	3.97	2.27	12.1	<0.001	---	<5.0		
Waddell Creek 80-09-149	22-Oct-12	16054121022103	7.97	878	84.5	24.2	87	7.89	0.61	50.5	<0.05	<0.05	<0.071	471	575	311	537	1.87	---	---	7.9	0.0036	---	<5.0		
Waddell Creek 80-09-149	23-Sep-13	16054130923047	8.4	901	101	25.9	76	7.45	<0.50	49.8	<0.05	<0.05	<0.071	531	630	359	579	1.45	2.13	---	10.7	<0.001	45.2	8.8		
Waddell Creek 80-09-149	29-Oct-13	16054131029013	7.86	936	97.4	24.9	72.2	7.88	<0.50	50.5	<0.05	<0.05	<0.071	490	597	346	547	1.77	2.03	1.24	7.9	<0.001	---	<5.0		
Wiau Lake 73-9-15	30-Oct-13	16054131030019	7.36	1010	151	46.4	3.8	1.28	0.92	3.25	<0.05	0.087	0.087	595	726	568	564	<0.05	<0.2	<0.020	50.7	<0.001	---	<5.0		
Wiau Lake 73-9-76	30-Oct-13	16054131030018	7.69	550	72.7	18.8	11.7	4.63	<0.50	0.62	<0.05	<0.05	<0.071	310	378	259	294	1.96	2.1	0.407	24.3	<0.001	---	<5.0		
Wiau Lake 73-9-120	30-Oct-13	16054131030016	7.83	609	81.4	20.1	17.4	3.9	<0.50	<0.50	<0.05	<0.05	<0.071	348	424	286	332	1.06	1.14	0.471	11	<0.001	---	<5.0		
Winefred Lake 75-5-79	31-Oct-13	16054131031021	7.69	1350	144	37.1	129	4.33	14.3	41.5	<0.05	<0.05	<0.071	768	937	512	831	1.21	1.44	0.062	10.6	<0.001	---	<5.0		
Alberta Tier 1 - Natural Areas*			6.5-8.5 ^{P(AO)}	NS	NS	NS	200 ^{P(AO)}	NS	230 ^A	500 ^{P(AO)}	0.06 ^A	2.9 ^A	NS	NS	NS	NS	500 ^{P(AO)}	0.282 ^{A,pH/T***}	NS	NS	NS	0.004 ^A	NS	NS		

TABLE 6.

GROUNDWATER QUALITY RESULTS - GENERAL AND INORGANIC PARAMETERS

Alberta Environment and Sustainable Resources Development (ESRD)
Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Sample Date	MSI Sample Number	Lab pH	Lab EC µS/cm	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO ₄ mg/L	NO ₂ -N mg/L	NO ₃ -N+ mg/L	NO ₂ /NO ₃ -N mg/L	Total Alkalinity ^A mg/L	HCO ₃ mg/L	Hardness ^A mg/L	TDS mg/L	NH ₃ -N mg/L	TKN mg/L	PO ₄ -P Total mg/L	DOC mg/L	Phenol mg/L	Turbidity NTU	CO ₃ mg/L		
Muriel Lake																										
House Crossing 77-15-161	19-Nov-12	16054121119102	7.96	646	65.2	17.3	46.8	4.09	24.6	22.3	<0.05	<0.05	<0.071	296	361	234	358	1.56	---	---	5.2	0.0033	---	<5.0		
House Crossing 77-15-161	25-Sep-13	16054130925057	8.09	600	62.9	17.1	40.8	3.9	9.17	17.3	<0.05	<0.05	<0.071	312	381	227	338	1.23	1.49	1.18	6.4	<0.001	63.5	<5.0		
House Crossing 77-15-161	24-Oct-13	16054131024003	8.44	622	66.4	17.8	38.1	3.78	13.3	20.3	<0.05	<0.05	<0.071	313	363	239	347	1.61	1.56	1.02	5.3	<0.001	---	9.3		
Alberta Tier 1 - Natural Areas*			6.5-8.5 ^{P(AO)}	NS	NS	NS	200 ^{P(AO)}	NS	230 ^A	500 ^{P(AO)}	0.06 ^A	2.9 ^A	NS	NS	NS	NS	500 ^{P(AO)}	0.282 ^{A,pH/T***}	NS	NS	NS	0.004 ^A	NS	NS		
Empress Terrace																										
Mariana Lakes 80-13-134	17-Nov-12	16054121117101	7.86	877	65.4	16.3	90.3	5.47	2.34	117	<0.05	<0.05	<0.071	359	438	230	512	1.58	---	---	6.8	0.0012	---	<5.0		
Mariana Lakes 80-13-134	22-Sep-13	16054130922043	8.48	877	78.0	19.9	103	5.35	0.89	111	<0.05	<0.05	<0.071	394	459	277	555	1.45	2.06	0.561	7.0	<0.001	233	10.8		
Mariana Lakes 80-13-134	07-Nov-13	16054131107027	7.94	906	73.0	18.9	97.6	5.17	0.65	123	<0.05	<0.05	<0.071	424	518	260	573	1.64	1.74	0.234	5.9	0.0035	---	<5.0		
Winefred Lake 75-5-158	31-Oct-13	16054131031020	8	923	32.3	9.82	170	4.68	6.69	44.1	<0.05	<0.05	<0.071	460	562	121	544	1.37	1.58	0.51	8.5	<0.001	---	<5.0		
Alberta Tier 1 - Natural Areas*			6.5-8.5 ^{P(AO)}	NS	NS	NS	200 ^{P(AO)}	NS	230 ^A	500 ^{P(AO)}	0.06 ^A	2.9 ^A	NS	NS	NS	NS	500 ^{P(AO)}	0.282 ^{A,pH/T***}	NS	NS	NS	0.004 ^A	NS	NS		
Empress Channel																										
CL MW 25	11-Mar-12	16054120311001	8.56	1600	15	5.5	290	9.8	200	1.9	<0.003	<0.003	<0.003	480	550	60	860	---	---	---	---	---	1.9	18		
CL MW 25	20-Jul-12	16054120720001	8.65	1600	7.1	4.9	300	17	190	<1.0	<0.003	<0.003	<0.003	500	560	38	870	---	---	---	---	---	91	25		
CL MW 25	22-Jun-13	16054130622002	8.62	1500	15	4.4	300	13	190	<1.0	0.0033	0.0041	0.007	480	550	57	780	---	---	---	---	---	13	17		
CL MW 25	17-Oct-13	16054131017002	8.78	1500	15	4.6	280	9.7	180	<1.0	0.0033	0.0031	0.006	460	500	57	850	---	---	---	---	---	75	27		
House Crossing 77-15-231	19-Nov-12	16054121119105	7.97	780	57.4	16.4	89.8	6.31	6.75	36.6	<0.05	0.318	0.318	389	475	211	448	1.79	---	---	7.9	<0.001	---	<5.0		
House Crossing 77-15-231	25-Sep-13	16054130925056	8.18	759	55.0	16.6	90.4	5.39	2.61	32.7	<0.05	<0.05	<0.071	406	495	206	446	1.70	1.92	1.37	8.4	<0.001	41.3	<5.0		
House Crossing 77-15-231	24-Oct-13	16054131024002	8.59	763	61.3	17.2	81.3	5.06	1.92	32.3	<0.05	<0.05	<0.071	435	423	224	460	1.88	1.94	1.31	8	<0.001	---	52.9		
Plamondon 68-16-70	21-Nov-12	16054121121102	8.34	2550	27	10.4	633	3.88	550	107	<0.05	<0.05	<0.071	581	693	110	1680	2.77	---	---	20.7	<0.001	---	7.8		
Plamondon 68-16-70	25-Sep-13	16054130925062	8.56	2860	28	9.97	581	3.87	527	97.2	<0.05	<0.05	<0.071	585	669	111	1600	2.31	3.25	1.37	26	<0.001	1.49	22.1		
Plamondon 68-16-70	08-Nov-13	16054131108032	8.29	2900	26.5	9.65	546	3.79	555	102	<0.05	<0.05	<0.071	575	702	106	1590	2.56	3.11	1.25	18.5	<0.001	---	<5.0		
Alberta Tier 1 - Natural Areas*			6.5-8.5 ^{P(AO)}	NS	NS	NS	200 ^{P(AO)}	NS	230 ^A	500 ^{P(AO)}	0.06 ^A	2.9 ^A	NS	NS	NS	NS	500 ^{P(AO)}	0.282 ^{A,pH/T***}	NS	NS	NS	0.004 ^A	NS	NS		
Lower Grand Rapids																										
1F2/05-14-083-03 W4M	26-Mar-08	16054080326001	8.4	6800	17.2	9.7	1390	5.3	2060	<0.5	<0.05	<0.1	<0.1	356	424	82	3700	---	---	---	---	---	---	<5		
GMF Interim Quality Triggers for SAOSA^{AA}			NS	NS	NS	NS	NS	NS	1000	NS	NS	0.002+	NS	NS	NS	NS	2000	NS	NS	NS	NS	0.01	NS	NS		
Alberta Tier 1 - Natural Areas*			6.5-8.5 ^{P(AO)}	NS	NS	NS	200 ^{P(AO)}	NS	230 ^A	500 ^{P(AO)}	0.06 ^A	2.9 ^A	NS	NS	NS	NS	500 ^{P(AO)}	0.282 ^{A,pH/T***}	NS	NS	NS	0.004 ^A	NS	NS		

TABLE 6.

GROUNDWATER QUALITY RESULTS - GENERAL AND INORGANIC PARAMETERS

Alberta Environment and Sustainable Resources Development (ESRD)
 Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Sample Date	MSI Sample Number	Lab pH	Lab EC µS/cm	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO ₄ mg/L	NO ₂ -N mg/L	NO ₃ -N+ mg/L	NO ₂ /NO ₃ -N mg/L	Total Alkalinity ^A mg/L	HCO ₃ mg/L	Hardness ^A mg/L	TDS mg/L	NH ₃ -N mg/L	TKN mg/L	PO ₄ -P Total mg/L	DOC mg/L	Phenol mg/L	Turbidity NTU	CO ₃ mg/L		
Upper Clearwater																										
Graham 80-1-180	11-Mar-08	16054080311001	8.3	9950	36.8	38.8	2230	7.3	3450	<0.5	<0.05	<0.1	<0.1	579	691	252	6110	---	---	---	---	---	---	---	<5	
1F1/05-36-084-04 W4M	04-Mar-11	16054110304001	9.15	1040	6.04	0.31	240	2.49	28.9	4.87	<0.05	<0.05	<0.071	519	502	16.4	595	---	---	---	---	---	---	---	64.8	
Kimowin 83-2-180	18-Mar-08	16054080318002	8.8	2250	1.6	0.8	483	2.6	465	2.1	<0.05	<u>0.2</u>	0.2	518	551	7	1270	---	---	---	---	---	---	---	40	
GMF Interim Quality Triggers for SAOSA^{^^}			NS	NS	NS	NS	NS	NS	1000	NS	NS	0.002+	NS	NS	NS	NS	3500	NS	NS	NS	NS	0.01	NS	NS		
Alberta Tier 1 - Natural Areas*			6.5-8.5^{P(AO)}	NS	NS	NS	200^{P(AO)}	NS	230^A	500^{P(AO)}	0.06^A	2.9^A	NS	NS	NS	NS	500^{P(AO)}	0.282^{A,pH/T,***}	NS	NS	NS	0.004^A	NS	NS		
McMurray																										
Kimowin 83-2-261	18-Mar-08	16054080318001	8.1	20300	266	137	4270	15.9	7000	815	<0.05	<u>0.3</u>	0.3	358	436	1230	12700	---	---	---	---	---	---	---	<5	
1F1/05-14-083-03 W4M	27-Mar-08	16054080327001	7.9	26500	317	167	5750	19.4	9680	889	<0.05	<0.1	<0.1	502	613	1480	17100	---	---	---	---	---	---	---	<5	
Graham 80-1-261	13-Mar-08	16054080313001	7.9	29000	269	171	5460	25.8	11300	737	<0.05	<0.1	<0.1	543	662	1380	18300	---	---	---	---	---	---	---	<5	
GMF Interim Quality Triggers for SAOSA^{^^}			NS	NS	NS	NS	NS	NS	1500	NS	NS	0.002+	NS	NS	NS	NS	3500	NS	NS	NS	NS	0.01	NS	NS		
Alberta Tier 1 - Natural Areas*			6.5-8.5^{P(AO)}	NS	NS	NS	200^{P(AO)}	NS	230^A	500^{P(AO)}	0.06^A	2.9^A	NS	NS	NS	NS	500^{P(AO)}	0.282^{A,pH/T,***}	NS	NS	NS	0.004^A	NS	NS		

Notes:

- - not analyzed
- NS - not specified
- ^A - indicates guideline for Aquatic Life exposure pathway
- ^{Ir} - indicates guideline for Irrigation exposure pathway
- ^L - indicates guideline for Livestock exposure pathway
- ^P - indicates guideline for Potable Groundwater exposure pathway
- ^{AO} - aesthetic objective from Guidelines for Canadian Drinking Water Quality (Health Canada, 2012)
- ^{MAC} - maximum acceptable concentration based on health effects from Guidelines for Canadian Drinking Water Quality (Health Canada, 2012)
- + - Interim guidelines 0.01 is for NO₃. Guideline converted to NO₃-N by Matrix Solutions (0.01*0.226), 0.002 mg/L
- [^] - expressed as CaCO₃
- ^{^^} - Groundwater Management Framework Interim Quality Triggers for the South Athabasca Oil Sands Area
- * - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AENV, 2010)
- ** - Guidelines for Canadian Drinking Water Quality (Health Canada, 2012)
- ^{pH/T} - most stringent value, guideline pH and temperature dependant, see CCME factsheet for guideline information
- *** - Alberta Environment Surface Water Quality Guidelines for Use in Alberta (AENV, 1999)
- Italics** - indicates values do not meet applicable guidelines
- Underline - indicates values do not meet Alberta Tier 1 Natural Areas guideline

TABLE 7.

GROUNDWATER QUALITY RESULTS - DISSOLVED METALS

Alberta Environment and Sustainable Resources Development (ESRD)
Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Sample Date	MSI Sample Number	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Mn mg/L	Hg mg/L	Mo mg/L	Ni mg/L	Se mg/L	Si mg/L	Ag mg/L	Sr mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L				
Surficial Deposits																																	
Conklin 76-07-6	15-Nov-12	16054121115104	<0.01	<0.0004	<0.0004	0.0316	<0.0005	---	0.0117	<0.0001	<0.0004	0.00011	<0.0006	<0.01	<0.0001	0.0065	<0.0001	0.00024	0.00176	<0.0004	---	<0.0002	0.05	<0.00005	<0.0002	<0.0003	<0.0001	0.00012	0.0012				
Conklin 76-07-6	23-Sep-13	16054130923054	0.0042	<0.0004	<0.0004	0.0182	<0.0005	<0.00005	0.0121	<0.0001	<0.0004	<0.0001	0.00102	<0.01	<0.0001	0.0037	<0.0001	0.00017	0.0015	<0.0004	5.25	<0.00001	0.0309	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	0.0087				
Conklin 76-07-6	29-Oct-13	16054131029010	0.0034	<0.0004	<0.0004	0.0184	<0.0005	<0.00005	<0.050	<0.0001	<0.0004	<0.0001	<0.0006	<0.01	<0.0001	<0.002	<0.00002	0.0002	0.0014	<0.0004	4.97	<0.00001	0.0326	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	0.0015				
House Crossing 77-15-8	19-Nov-12	16054121119104	<0.01	<0.0004	0.00346	0.22	<0.0005	---	0.0538	<0.0001	<0.0004	0.001	0.00078	0.33	0.0023	1.2	<0.0001	0.00458	0.0025	<0.0004	---	<0.0002	0.411	<0.00005	<0.0002	<0.0003	0.00049	<0.0001	0.0152				
House Crossing 77-15-8	25-Sep-13	16054130925060	<0.001	<0.0004	0.0193	0.285	<0.0005	<0.00005	0.0551	<0.0001	<0.0004	0.0004	<0.0006	13	<0.0001	1.3	<0.0001	0.00511	0.00066	<0.0004	9.31	<0.00001	0.408	<0.00005	<0.0002	<0.0003	0.0005	0.00014	0.0058				
House Crossing 77-15-8	24-Oct-13	16054131024005	0.0041	<0.0004	0.0151	0.279	<0.0005	<0.00005	0.0587	<0.0001	<0.0004	0.00038	0.00114	11.1	<0.0001	1.27	<0.00002	0.00511	0.00121	<0.0004	8.6	<0.00001	0.411	<0.00005	<0.0002	<0.0003	0.000439	0.00017	0.0235				
Mariana Lakes 80-13-7	17-Nov-12	16054121117102	---	---	---	---	---	---	---	---	---	---	---	0.465	---	1.73	---	---	---	---	---	---	---	---	---	---	---	---	---				
Mariana Lakes 80-13-7	19-Nov-12	16054121119301	0.03	<0.0004	0.00137	0.179	<0.0005	---	0.0847	<0.0001	<0.0004	0.00968	<0.0006	0.064	0.00011	2.13	<0.0001	0.00303	0.0187	0.00711	---	<0.0002	0.254	<0.00005	<0.0002	0.00035	0.00148	0.00027	0.009				
Mariana Lakes 80-13-7	22-Sep-13	16054130922046	0.0428	<0.0004	0.00181	0.113	<0.0005	<0.00005	0.107	0.00015	0.00062	0.0066	0.00215	0.633	<0.0001	0.936	<0.0001	0.0024	0.0341	0.00122	14.1	<0.00001	0.26	<0.00005	<0.0002	<0.0003	0.00029	0.00011	0.204				
Mariana Lakes 80-13-7	07-Nov-13	16054131107030	0.03	<0.0004	0.00085	0.129	<0.0005	<0.00005	0.099	<0.0001	<0.0004	0.00583	<0.0006	1.03	<0.0001	1.38	<0.00002	0.00122	0.0229	0.00138	13.6	<0.00001	0.27	<0.00005	<0.0002	<0.0003	0.00059	0.00011	0.016				
Plamondon 68-16-7	21-Nov-12	16054121121101	0.0088	0.00714	0.00445	0.063	<0.0005	---	0.033	<0.00005	<0.0005	0.00035	0.00203	<0.03	<0.0001	0.0297	<0.00005	0.0125	0.00155	0.0043	---	<0.00001	0.159	<0.0001	<0.0001	<0.001	0.00736	<0.001	<0.005				
Plamondon 68-16-7	25-Sep-13	16054130925065	0.0074	0.00097	0.00206	0.0678	<0.0005	<0.00005	0.0337	<0.0001	<0.0004	0.00015	0.00124	<0.01	<0.0001	0.0642	<0.0001	0.00266	0.00108	0.00059	5.77	<0.00001	0.106	<0.00005	<0.0002	<0.0003	0.00331	0.00038	0.0053				
Plamondon 68-16-7	08-Nov-13	16054131108035	0.0061	0.00057	0.00219	0.077	<0.0005	<0.00005	0.0321	<0.0001	<0.0004	0.0001	0.00602	<0.01	0.00026	0.0327	<0.00002	0.00207	0.00106	0.00052	5.5	<0.00001	0.0979	<0.00005	0.00038	<0.0003	0.00234	0.00035	0.0019				
Waddell Creek 80-09-9	22-Oct-12	16054121022101	<0.005	<0.0001	0.0004	0.133	<0.0005	---	0.071	<0.00005	<0.0005	0.00082	0.00176	<0.03	<0.0001	0.103	<0.00005	0.00305	0.00233	0.0031	---	<0.00001	0.294	<0.0001	<0.0001	<0.001	0.0146	<0.001	<0.005				
Waddell Creek 80-09-9	23-Sep-13	16054130923048	0.0112	<0.0004	<0.0004	0.14	<0.0005	<0.00005	0.0859	<0.0001	<0.0004	0.00045	0.00211	0.013	<0.0001	0.0693	<0.00010	0.00091	0.00242	0.0041	11.5	<0.00001	0.304	<0.00005	<0.0002	<0.0003	0.015	0.00023	0.0134				
Waddell Creek 80-09-9	29-Oct-13	16054131029011	<0.001	<0.0004	<0.0004	0.147	<0.0005	<0.00005	0.0848	<0.00010	<0.0004	0.00025	0.00184	<0.010	<0.00010	0.0551	<0.00002	0.00069	0.00201	0.00387	13.5	<0.00001	0.314	<0.00005	<0.00020	<0.00030	0.0142	0.00014	0.004				
Winefred Lake 75-5-17	31-Oct-13	16054131031023	<0.001	<0.0004	0.00063	0.222	<0.0005	<0.00005	0.058	<0.0001	<0.0004	<0.0001	0.00137	0.083	<0.0001	0.0201	<0.00002	0.00162	0.00167	<0.0004	11.8	<0.00001	0.473	<0.00005	<0.0002	<0.0003	0.00554	<0.0001	0.0026				
Alberta Tier 1 - Natural Areas*			0.005^a-0.1^{b,A**}	0.006^{P(MAC)}	0.005^A	1^{P(MAC)}	NS	NS	1.5^A	H^A	0.001^{AdA}	NS	0.007^{Ac}	0.3^{P(AO),A}	H^A	0.05^{P(AO)}	0.000005^{Ac}	NS	H^A	0.001^A	NS	0.0001^A	NS	NS	NS	NS	NS	NS	NS	0.02^{P(MAC)}	NS	0.03^A	
Sand River																																	
Conklin 76-07-24	15-Nov-12	16054121115103	<0.01	<0.0004	0.00487	0.129	<0.0005	---	0.0787	<0.0001	<0.0004	0.0005	<0.0006	0.747	<0.0001	0.199	<0.0001	0.00382	0.00071	<0.0004	---	<0.0002	0.391	<0.00005	<0.0002	<0.0003	0.00011	0.00024	0.0025				
Conklin 76-07-24	23-Sep-13	16054130923053	0.0013	<0.0004	0.00511	0.139	<0.0005	<0.00005	0.0807	<0.0001	<0.0004	<0.0001	<0.0006	1.5	<0.0001	0.173	<0.0001	0.00386	0.00018	<0.0004	10.7	<0.00001	0.391	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	0.0125				
Conklin 76-07-24	29-Oct-13	16054131029009	0.0013	<0.0004	0.00493	0.131	<0.0005	<0.00005	0.085	<0.0001	<0.0004	<0.0001	<0.0006	1.38	<0.0001	0.163	<0.00002	0.00386	0.00029	<0.0004	12.1	<0.00001	0.427	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	0.0012				
Waddell Creek 80-09-21	22-Oct-12	16054121022102	<0.005	<0.0001	0.00331	0.117	---	---	0.085	<0.0001	<0.0005	---	0.0018	<0.01	<0.0001	0.0551	<0.00002	---	0.002	0.00387	13.5	<0.0001	---	---	---	---	0.0142	---	0.004				
Waddell Creek 80-09-21	23-Sep-13	16054130923050	0.0046	<0.0004	0.00447	0.128	<0.0005	<0.00005	0.047	<0.00005	<0.0005	0.00198	<0.0001	0.363	<0.0001	0.374	<0.00010	0.00396	0.00187	<0.001	9.46	<0.00001	0.236	<0.0001	<0.0001	<0.001	0.00232	<0.001	<0.005				
Waddell Creek 80-09-21	29-Oct-13	16054131029015	0.0017	<0.0004	0.00429	0.123	<0.0005	<0.00005	0.055	<0.00010	<0.0004	0.00049	<0.00060	1.41	0.00013	0.217	<0.00002	0.00243	0.00073	<0.0004	11	<0.00001	0.238	<0.00005	<0.00020	<0.00030	0.00144	<0.00010	0.0026				
Wiau Lake 73-9-41	30-Oct-13	16054131030017	<0.001	<0.0004	0.0129	0.218	<0.0005	<0.00005	0.057	<0.0001	<0.0004	<0.0001	<0.0006	3.18	<0.0001	0.425	<0.00002	0.00114	0.0003	<0.0004	10	<0.00001	0.435	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	0.002				
Alberta Tier 1 - Natural Areas*			0.005^a-0.1^{b,A**}	0.006^{P(MAC)}	0.005^A	1^{P(MAC)}	NS	NS	1.5^A	H^A	0.001^{AdA}	NS	0.007^{Ac}	0.3^{P(AO),A}	H^A	0.05^{P(AO)}	0.000005^{Ac}	NS	H^A	0.001^A	NS	0.0001^A	NS	NS	NS	NS	NS	NS	NS	NS	0.02^{P(MAC)}	NS	0.03^A
Ethel Lake																																	
Conklin 76-07-41	15-Nov-12	16054121115102	<0.01	<0.0004	<0.0004	0.0905	<0.0005	---	0.236	<0.0001	<0.0004	0.0002	<0.0006	1.42	<0.0001	0.0612	<0.0001	0.0011	0.00016	<0.0004	---	<0.0002	0.639	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	0.0012				
Conklin 76-07-41	23-Sep-13	16054130923052	0.0011	<0.0004	<0.0004	0.0995	<0.0005	<0.00005	0.237	<0.0001	<0.0004	<0.0001	<0.0006	1.63	<0.0001	0.0571	<0.0001	0.00119	0.00023	<0.0004	10.9	<0.00001	0.616	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	0.0178				
Conklin 76-07-41	29-Oct-13	16054131029008	<0.001	<0.0004	<0.0004	0.102	<0.0005	<0.00005	0.24	<0.0001	<0.0004	<0.0001	<0.0006	1.61	<0.0001	0.0548	<0.00002	0.00111	<0.0001	<0.0004	12.5	<0.00001	0.666</										

TABLE 7.

GROUNDWATER QUALITY RESULTS - DISSOLVED METALS

Alberta Environment and Sustainable Resources Development (ESRD)
Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Sample Date	MSI Sample Number	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Mn mg/L	Hg mg/L	Mo mg/L	Ni mg/L	Se mg/L	Si mg/L	Ag mg/L	Sr mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L		
Bonnyville																															
Conklin 76-07-67	15-Nov-12	16054121115101	<0.01	<0.0004	<0.0004	0.0799	<0.0005	---	0.262	<0.0001	<0.0004	0.00023	<0.0006	0.011	<0.0001	0.0422	<0.0001	0.0006	0.00036	<0.0004	---	<0.0002	0.636	<0.00005	<0.0002	<0.0003	0.0002	0.00011	0.0034		
Conklin 76-07-67	23-Sep-13	16054130923051	<0.001	<0.0004	<0.0004	0.119	<0.0005	<0.00005	0.245	<0.0001	<0.0004	0.00012	<0.0006	1.51	<0.0001	0.0432	<0.0001	0.00055	0.00016	<0.0004	10.7	<0.00001	0.638	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	0.0091		
Conklin 76-07-67	29-Oct-13	16054131029007	<0.001	<0.0004	<0.0004	0.115	<0.0005	<0.00005	0.247	<0.0001	<0.0004	0.00012	<0.0006	1.43	<0.0001	0.0401	<0.00002	0.0005	0.00025	<0.0004	12.1	<0.00001	0.676	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	<0.001		
House Crossing 77-15-126	19-Nov-12	16054121119103	<0.01	<0.0004	0.00717	0.0433	<0.0005	---	0.209	<0.0001	<0.0004	0.00014	<0.0006	<0.03	<0.0001	0.41	<0.0001	0.0106	0.00103	<0.0004	---	<0.0002	0.403	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	0.0039		
House Crossing 77-15-126	25-Sep-13	16054130925058	0.0016	<0.0004	0.0143	0.0834	<0.0005	<0.00005	0.222	<0.0001	<0.0004	<0.0001	0.00066	3.67	<0.0001	0.525	<0.0001	0.0128	0.00024	<0.0004	10.6	<0.00001	0.412	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	0.0247		
House Crossing 77-15-126	24-Oct-13	16054131024004	<0.001	<0.0004	0.00939	0.0484	<0.0005	<0.00005	0.195	<0.0001	<0.0004	<0.0001	0.00086	0.837	<0.0001	0.467	<0.00002	0.0133	0.00047	<0.0004	9.95	<0.00001	0.403	<0.00005	<0.0002	<0.0003	0.000017	<0.0001	0.0077		
Mariana Lakes 80-13-112	17-Nov-12	16054121117104	<0.01	<0.0004	0.00329	0.0391	<0.0005	---	0.44	<0.0001	<0.0004	0.00023	<0.0006	<0.03	<0.0001	0.125	<0.0001	0.0149	0.0005	<0.0004	---	<0.0002	0.737	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	0.0034		
Mariana Lakes 80-13-112	22-Sep-13	16054130922044	0.0060	<0.0004	0.00384	0.0424	<0.0005	<0.00005	0.475	<0.0001	<0.0004	<0.00013	<0.0006	1.69	<0.0001	0.148	<0.0001	0.0135	0.00036	<0.0004	12.5	<0.00001	0.732	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	0.0086		
Mariana Lakes 80-13-112	07-Nov-13	16054131107028	<0.001	<0.0004	0.00416	0.0344	<0.0005	<0.00005	0.431	<0.0001	<0.0004	0.00014	<0.0006	1.68	<0.0001	0.133	<0.00002	0.0146	0.00054	<0.0004	12.3	<0.00001	0.709	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	0.003		
Plamondon 68-16-39	21-Nov-12	16054121121104	<0.005	0.00053	0.0273	0.0847	<0.0005	---	0.594	<0.00005	<0.0005	0.00062	0.00047	<0.03	<0.0001	0.0456	<0.00005	0.0111	0.0017	<0.001	---	<0.00001	0.636	<0.0001	0.00014	<0.001	0.000638	<0.001	<0.005		
Plamondon 68-16-39	25-Sep-13	16054130925064	0.0035	<0.0004	0.0229	0.105	<0.001	<0.0001	0.732	<0.0001	<0.0004	0.0004	<0.0006	1.35	<0.0001	0.215	<0.0001	0.00926	0.00125	<0.0004	6.46	<0.00002	0.648	<0.0001	0.00036	<0.0006	0.00044	0.00024	0.0124		
Plamondon 68-16-39	08-Nov-13	16054131108034	0.004	<0.0004	0.0236	0.107	<0.001	<0.0001	0.64	<0.0001	0.00077	0.00043	<0.0006	1.28	<0.0001	0.189	<0.00002	0.00917	0.00152	<0.0004	5.87	<0.00002	0.627	<0.0001	0.00022	<0.0006	0.00042	0.00022	0.0089		
Plamondon 68-16-51	21-Nov-12	16054121121103	<0.005	0.00019	0.0766	0.178	<0.0005	---	0.353	<0.00005	<0.0005	0.0006	0.00059	0.041	<0.0001	0.0237	<0.00005	0.00207	0.00145	<0.001	---	<0.00001	0.285	<0.0001	0.00021	<0.001	0.000465	0.0011	0.005		
Plamondon 68-16-51	25-Sep-13	16054130925063	0.0078	<0.0004	0.0682	0.201	<0.0005	<0.00005	0.375	<0.0001	<0.0004	0.00078	<0.0006	0.616	<0.0001	0.11	<0.0001	0.00278	0.00201	<0.0004	6.34	<0.00001	0.285	<0.00005	0.00034	0.00056	0.00038	0.00072	0.0115		
Plamondon 68-16-51	08-Nov-13	16054131108033	0.0022	<0.0004	0.0747	0.201	<0.0005	<0.00005	0.348	<0.0001	<0.0004	0.0006	<0.0006	0.592	<0.0001	0.0737	<0.00002	0.00159	0.00117	<0.0004	5.87	<0.00001	0.266	<0.00005	<0.0002	0.00036	0.0002	0.00066	0.0014		
Waddell Creek 80-09-149	22-Oct-12	16054121022103	<0.005	<0.0001	0.00038	0.0463	<0.0005	<0.00005	0.31	<0.0001	<0.0004	0.00035	<0.0006	3.77	<0.0001	0.25	<0.0001	0.00588	0.00053	<0.0004	---	<0.0002	0.466	<0.00005	<0.0002	<0.0003	0.00021	<0.0001	0.0094		
Waddell Creek 80-09-149	23-Sep-13	16054130923047	0.0012	<0.0004	<0.0004	0.0775	<0.0005	<0.00005	0.245	<0.00005	<0.0005	0.00046	0.00031	1.32	<0.0001	0.116	<0.00010	0.00958	0.00331	<0.001	11.2	<0.00001	0.814	<0.0001	<0.0001	<0.001	0.000064	<0.001	<0.005		
Waddell Creek 80-09-149	29-Oct-13	16054131029013	<0.001	<0.0004	<0.0004	0.0682	<0.0005	<0.00005	0.252	<0.00010	<0.0004	0.00016	<0.00060	3.84	<0.00010	0.0856	<0.00002	0.0121	0.00053	<0.0004	12.8	<0.00001	1.07	<0.00005	<0.00020	<0.00030	0.00011	<0.00010	<0.001		
Wiau Lake 73-9-15	30-Oct-13	16054131030019	<0.001	<0.0004	<0.0004	0.218	<0.0005	<0.00005	<0.050	<0.0001	<0.0004	0.0002	0.00093	<0.01	<0.0001	0.0431	<0.00002	0.0004	0.00216	<0.0004	12.6	<0.00001	0.147	<0.00005	<0.0002	<0.0003	0.00076	<0.0001	0.0011		
Wiau Lake 73-9-76	30-Oct-13	16054131030018	<0.001	<0.0004	0.00154	0.248	<0.0005	<0.00005	0.087	<0.0001	<0.0004	0.00066	<0.0006	4.12	<0.0001	0.592	<0.00002	0.00286	0.00144	<0.0004	7.99	<0.00001	0.505	<0.00005	<0.0002	<0.0003	0.0003	<0.0001	0.0068		
Wiau Lake 73-9-120	30-Oct-13	16054131030016	<0.001	<0.0004	<0.0004	0.326	<0.0005	<0.00005	0.133	<0.0001	<0.0004	0.00015	<0.0006	3.16	<0.0001	0.152	<0.00002	0.0009	<0.0001	<0.0004	11.1	<0.00001	0.622	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	<0.001		
Winefred Lake 75-5-79	31-Oct-13	16054131031021	<0.001	<0.0004	0.0115	0.0608	<0.0005	<0.00005	0.308	<0.0001	<0.0004	0.00447	<0.0006	1.68	<0.0001	0.756	<0.00002	0.00444	0.00195	<0.0004	11.2	<0.00001	0.624	<0.00005	<0.0002	<0.0003	0.00474	<0.0001	0.0017		
Alberta Tier 1 - Natural Areas*			0.005 ^a -0.1 ^{b,A**}	0.006 ^{P(MAC)}	0.005 ^A	1 ^{P(MAC)}	NS	NS	1.5 ^A	H ^A	0.001 ^{A,d}	NS	0.007 ^{Ac}	0.3 ^{P(AO),A}	H ^A	0.05 ^{P(AO)}	0.000005 ^{Ac}	NS	H ^A	0.001 ^A	NS	0.0001 ^A	NS	NS	NS	NS	NS	NS	0.02 ^{P(MAC)}	NS	0.03 ^A
Muriel Lake																															
House Crossing 77-15-161	19-Nov-12	16054121119102	<0.01	<0.0004	0.00374	0.0562	<0.0005	---	0.189	<0.0001	<0.0004	0.00018	<0.0006	<0.03	<0.0001	0.166	<0.0001	0.00733	0.00073	<0.0004	---	<0.0002	0.418	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	0.007		
House Crossing 77-15-161	25-Sep-13	16054130925057	0.0018	<0.0004	0.00442	0.163	<0.0005	<0.00005	0.2	<0.0001	<0.0004	<0.0001	0.00073	5.53	<0.0001	0.261	<0.0001	0.00588	0.00061	<0.0004	11.5	<0.00001	0.425	<0.00005	0.00023	<0.0003	<0.0001	<0.0001	0.0107		
House Crossing 77-15-161	24-Oct-13	16054131024003	0.0242	<0.0004	0.00455	0.144	<0.0005	<0.00005	0.17	<0.0001	<0.0004	0.00017	0.00061	5.78	<0.0001	0.24	<0.00002	0.00622	0.00176	<0.0004	10.7	<0.00001	0.415	<0.00005	0.00065	0.00129	0.000064	0.00019	0.0108		
Alberta Tier 1 - Natural Areas*			0.005 ^a -0.1 ^{b,A**}	0.006 ^{P(MAC)}	0.005 ^A	1 ^{P(MAC)}	NS	NS	1.5 ^A	H ^A	0.001 ^{A,d}	NS	0.007 ^{Ac}	0.3 ^{P(AO),A}	H ^A	0.05 ^{P(AO)}	0.000005 ^{Ac}	NS	H ^A	0.001 ^A	NS	0.0001 ^A	NS	NS	NS	NS	NS	NS	0.02 ^{P(MAC)}	NS	0.03 ^A
Empress Terrace																															
Mariana Lakes 80-13-134	17-Nov-12	16054121117101	<0.01	<0.0004	0.0062	0.0552	<0.0005	---	0.574	<0.0001	<0.0004	0.0009	<0.0006	<0.03	<0.0001	0.447	<0.0001	0.0291	0.00404	<0.0004	---	<0.0002	0.605	<0.00005	<0.0002	<0.0003	0.00207	0.00089	0.0045		
Mariana Lakes 80-13-134	22-Sep-13	16054130922043	0.0029	<0.0004	0.00176	0.0356	<0.0005	<0.00005	0.598	<0.0001	<0.0004	0.00038																			

TABLE 7.

GROUNDWATER QUALITY RESULTS - DISSOLVED METALS

Alberta Environment and Sustainable Resources Development (ESRD)
Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Sample Date	MSI Sample Number	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Mn mg/L	Hg mg/L	Mo mg/L	Ni mg/L	Se mg/L	Si mg/L	Ag mg/L	Sr mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L		
Lower Grand Rapids																															
1F2/05-14-083-03 W4M	26-Mar-08	16054080326001	---	---	---	---	---	---	---	---	---	---	---	<0.005	---	0.017	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
GMF Interim Quality Triggers for SAOSA^^			NS	NS	0.003	NS	NS	NS	1.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
Alberta Tier 1 - Natural Areas*			0.005 ^a -0.1 ^{b,A**}	0.006 ^{P(MAC)}	0.005 ^A	1 ^{P(MAC)}	NS	NS	1.5 ^A	H ^{A^A}	0.001 ^{A^dA}	NS	0.007 ^{Ac}	0.3 ^{P(AO),A}	H ^{A^A}	0.05 ^{P(AO)}	0.000005 ^{Ac}	NS	H ^{A^A}	0.001 ^A	NS	0.0001 ^{A^A}	NS	NS	NS	NS	NS	0.02 ^{P(MAC)}	NS	0.03 ^A	
Upper Clearwater																															
Graham 80-1-180	11-Mar-08	16054080311001	---	---	---	---	---	---	---	---	---	---	---	0.304	---	0.018	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
1F1/05-36-084-04 W4M	04-Mar-11	16054110304001	---	---	---	---	---	---	---	---	---	---	---	0.019	---	<0.002	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Kimowin 83-2-180	18-Mar-08	16054080318002	---	---	---	---	---	---	---	---	---	---	---	5.13	---	0.078	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
GMF Interim Quality Triggers for SAOSA^^			NS	NS	0.003	NS	NS	NS	1.5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
Alberta Tier 1 - Natural Areas*			0.005 ^a -0.1 ^{b,A**}	0.006 ^{P(MAC)}	0.005 ^A	1 ^{P(MAC)}	NS	NS	1.5 ^A	H ^{A^A}	0.001 ^{A^dA}	NS	0.007 ^{Ac}	0.3 ^{P(AO),A}	H ^{A^A}	0.05 ^{P(AO)}	0.000005 ^{Ac}	NS	H ^{A^A}	0.001 ^A	NS	0.0001 ^{A^A}	NS	NS	NS	NS	NS	NS	0.02 ^{P(MAC)}	NS	0.03 ^A
McMurray																															
Kimowin 83-2-261	18-Mar-08	16054080318001	---	---	---	---	---	---	---	---	---	---	---	<0.005	---	0.512	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
1F1/05-14-083-03 W4M	27-Mar-08	16054080327001	---	---	---	---	---	---	---	---	---	---	---	1.28	---	0.455	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Graham 80-1-261	13-Mar-08	16054080313001	---	---	---	---	---	---	---	---	---	---	---	2.41	---	0.361	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
GMF Interim Quality Triggers for SAOSA^^			NS	NS	0.003	NS	NS	NS	2.0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
Alberta Tier 1 - Natural Areas*			0.005 ^a -0.1 ^{b,A**}	0.006 ^{P(MAC)}	0.005 ^A	1 ^{P(MAC)}	NS	NS	1.5 ^A	H ^{A^A}	0.001 ^{A^dA}	NS	0.007 ^{Ac}	0.3 ^{P(AO),A}	H ^{A^A}	0.05 ^{P(AO)}	0.000005 ^{Ac}	NS	H ^{A^A}	0.001 ^A	NS	0.0001 ^{A^A}	NS	NS	NS	NS	NS	NS	0.02 ^{P(MAC)}	NS	0.03 ^A

Notes:

- - not analyzed
- NS - guideline not specified
- ^a - value if pH <6.5
- ^b - value if pH ≥6.5
- ^c - Chronic aquatic life guideline from Alberta Environment Surface Water Quality Guidelines for Use in Alberta (AENV, 1999)
- ^d - indicates guideline level for Cr(VI); guideline level for Cr(III) = 0.0089 mg/L
- ^A - indicates guideline for Aquatic Life exposure pathway
- ^P - indicates guideline for Potable Groundwater exposure pathway
- H - dependent on hardness value
- ^{AO} - aesthetic objective from Guidelines for Canadian Drinking Water Quality (Health Canada, 2012)
- ^{MAC} - maximum acceptable concentration based on health effects from Guidelines for Canadian Drinking Water Quality (Health Canada, 2012)
- * - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AENV, 2010)
- ** - Alberta Environment Surface Water Quality Guidelines for Use in Alberta (AENV, 1999)
- ^A - Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME, accessed on line July 2012)
- ^{AA} - Groundwater Management Framework Interim Quality Triggers for the South Athabasca Oil Sands Area
- Italics* - indicates values do not meet applicable guidelines
- Underline - indicates values do not meet Alberta Tier 1 Natural Areas guideline

TABLE 8.

GROUNDWATER QUALITY RESULTS - DISSOLVED HYDROCARBONS & NAPHTHENIC ACIDS

Alberta Environment and Sustainable Resources Development (ESRD)

Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Sample Date	MSI Sample Number	Benzene mg/L	Toluene mg/L	Ethylbenzene mg/L	Xylenes mg/L	Total BTEX mg/L	F1 ^{††} C ₆ -C ₁₀ mg/L	F2 C ₉₋₁₀ -C ₁₆ mg/L	Naphthenic Acids mg/L
Surficial Deposits										
Conklin 76-07-6	15-Nov-12	16054121115104	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Conklin 76-07-6	23-Sep-13	16054130923054	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Conklin 76-07-6	29-Oct-13	16054131029010	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
House Crossing 77-15-8	19-Nov-12	16054121119104	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
House Crossing 77-15-8	25-Sep-13	16054130925060	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
House Crossing 77-15-8	24-Oct-13	16054131024005	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Mariana Lakes 80-13-7	17-Nov-12	16054121117102	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Mariana Lakes 80-13-7	22-Sep-13	16054130922046	<0.0005	0.00057	<0.0005	<0.00071	0.00057	<0.1	<0.25	<1.0
Mariana Lakes 80-13-7	07-Nov-13	16054131107030	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Plamondon 68-16-7	21-Nov-12	16054121121101	<0.0005	0.00055	<0.0005	0.00056	0.00111	<0.1	<0.25	<1.0
Plamondon 68-16-7	25-Sep-13	16054130925065	<0.0005	0.00103	<0.0005	<0.00071	0.00103	<0.1	<0.25	2.1
Plamondon 68-16-7	08-Nov-13	16054131108035	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Waddell Creek 80-09-9	22-Oct-12	16054121022101	<0.0005	<0.0005	<0.0005	<0.0005	ND	<0.1	<0.25	<1.0
Waddell Creek 80-09-9	23-Sep-13	16054130923048	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Waddell Creek 80-09-9	29-Oct-13	16054131029011	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Winefred Lake 75-5-17	31-Oct-13	16054131031023	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
GMF Interim Quality Triggers for SAOSA^{^^}			NS	NS	NS	NS	<10% DF	NS	NS	NS
Alberta Tier 1 - Fine Grained Soils - Natural Areas*			0.005^{P(MAC)}	0.024^{P(AO)}	0.0024^{P(AO)}	0.3^{P(AO)}	NS	2.2^P	1.1^P	NS
Sand River										
Conklin 76-07-24	15-Nov-12	16054121115103	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Conklin 76-07-24	23-Sep-13	16054130923053	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Conklin 76-07-24	29-Oct-13	16054131029009	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Waddell Creek 80-09-21	22-Oct-12	16054121022102	<0.0005	<0.0005	<0.0005	<0.0005	ND	<0.1	<0.25	<1.0
Waddell Creek 80-09-21	23-Sep-13	16054130923050	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Waddell Creek 80-09-21	29-Oct-13	16054131029015	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Wiau Lake 73-9-41	30-Oct-13	16054131030017	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Alberta Tier 1 - Fine Grained Soils - Natural Areas*			0.005^{P(MAC)}	0.024^{P(AO)}	0.0024^{P(AO)}	0.3^{P(AO)}	NS	2.2^P	1.1^P	NS

TABLE 8.**GROUNDWATER QUALITY RESULTS - DISSOLVED HYDROCARBONS & NAPHTHENIC ACIDS**

Alberta Environment and Sustainable Resources Development (ESRD)

Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Sample Date	MSI Sample Number	Benzene mg/L	Toluene mg/L	Ethylbenzene mg/L	Xylenes mg/L	Total BTEX mg/L	F1 ^{††} C ₆ -C ₁₀ mg/L	F2 C ₉ -C ₁₆ mg/L	Naphthenic Acids mg/L
Ethel Lake										
Conklin 76-07-41	15-Nov-12	16054121115102	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Conklin 76-07-41	23-Sep-13	16054130923052	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Conklin 76-07-41	29-Oct-13	16054131029008	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
House Crossing 77-15-82	19-Nov-12	16054121119101	<0.0005	0.00738	<0.0005	<0.00071	0.00738	<0.1	<0.25	<1.0
House Crossing 77-15-82	25-Sep-13	16054130925059	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
House Crossing 77-15-82	24-Oct-13	16054131024001	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Mariana Lakes 80-13-52	17-Nov-12	16054121117103	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Mariana Lakes 80-13-52	22-Sep-13	16054130922045	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Mariana Lakes 80-13-52	07-Nov-13	16054131107029	<0.0005	<0.0005	0.00059	0.00311	0.0037	<0.1	<0.25	<1.0
Waddell Creek 80-09-117	23-Oct-12	16054121023104	<0.0005	<0.0005	<0.0005	<0.0005	ND	<0.1	<0.25	<1.0
Waddell Creek 80-09-117	23-Sep-13	16054130923049	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Waddell Creek 80-09-117	29-Oct-13	16054131029014	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Bonnyville										
Conklin 76-07-67	15-Nov-12	16054121115101	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Conklin 76-07-67	23-Sep-13	16054130923051	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	1.0
Conklin 76-07-67	29-Oct-13	16054131029007	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
House Crossing 77-15-126	19-Nov-12	16054121119103	<0.0005	0.00092	<0.0005	<0.00071	0.00092	<0.1	<0.25	<1.0
House Crossing 77-15-126	25-Sep-13	16054130925058	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
House Crossing 77-15-126	24-Oct-13	16054131024004	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Mariana Lakes 80-13-112	17-Nov-12	16054121117104	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Mariana Lakes 80-13-112	22-Sep-13	16054130922044	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Mariana Lakes 80-13-112	07-Nov-13	16054131107028	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Plamondon 68-16-39	21-Nov-12	16054121121104	<0.0005	0.00062	<0.0005	<0.0005	0.00062	<0.1	<0.25	<1.0
Plamondon 68-16-39	25-Sep-13	16054130925064	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Plamondon 68-16-39	08-Nov-13	16054131108034	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Plamondon 68-16-51	21-Nov-12	16054121121103	<0.0005	<0.0005	<0.0005	<0.0005	ND	<0.1	<0.25	<1.0
Plamondon 68-16-51	25-Sep-13	16054130925063	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Plamondon 68-16-51	08-Nov-13	16054131108033	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Alberta Tier 1 - Fine Grained Soils - Natural Areas*			0.005^{P(MAC)}	0.024^{P(AO)}	0.0024^{P(AO)}	0.3^{P(AO)}	NS	2.2^P	1.1^P	NS

TABLE 8.

GROUNDWATER QUALITY RESULTS - DISSOLVED HYDROCARBONS & NAPHTHENIC ACIDS

Alberta Environment and Sustainable Resources Development (ESRD)

Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Sample Date	MSI Sample Number	Benzene mg/L	Toluene mg/L	Ethylbenzene mg/L	Xylenes mg/L	Total BTEX mg/L	F1 ^{††} C ₆ -C ₁₀ mg/L	F2 C ₉ -C ₁₆ mg/L	Naphthenic Acids mg/L
Bonnyville										
Waddell Creek 80-09-149	22-Oct-12	16054121022103	<0.0005	<0.0005	<0.0005	<0.0005	ND	<0.1	<0.25	1.0
Waddell Creek 80-09-149	23-Sep-13	16054130923047	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Waddell Creek 80-09-149	29-Oct-13	16054131029013	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Wiau Lake 73-9-15	30-Oct-13	16054131030019	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Wiau Lake 73-9-76	30-Oct-13	16054131030018	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Wiau Lake 73-9-120	30-Oct-13	16054131030016	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Winefred Lake 75-5-79	31-Oct-13	16054131031021	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	1.4
Muriel Lake										
House Crossing 77-15-161	19-Nov-12	16054121119102	<0.0005	0.00124	<0.0005	<0.00071	0.00124	<0.1	<0.25	<1.0
House Crossing 77-15-161	25-Sep-13	16054130925057	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
House Crossing 77-15-161	24-Oct-13	16054131024003	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Empress Terrace										
Mariana Lakes 80-13-134	17-Nov-12	16054121117101	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Mariana Lakes 80-13-134	22-Sep-13	16054130922043	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Mariana Lakes 80-13-134	07-Nov-13	16054131107027	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Winefred Lake 75-5-158	31-Oct-13	16054131031020	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Empress Channel										
House Crossing 77-15-231	19-Nov-12	16054121119105	<0.0005	0.00051	<0.0005	<0.00071	0.00051	<0.1	<0.25	<1.0
House Crossing 77-15-231	25-Sep-13	16054130925056	<0.0005	0.00076	<0.0005	<0.00071	0.00076	<0.1	<0.25	<1.0
House Crossing 77-15-231	24-Oct-13	16054131024002	<0.0005	0.00102	<0.0005	<0.00071	0.00102	<0.1	<0.25	<1.0
Plamondon 68-16-70	21-Nov-12	16054121121102	<0.0005	<0.0005	<0.0005	<0.0005	ND	<0.1	<0.25	1.4
Plamondon 68-16-70	25-Sep-13	16054130925062	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	1.3
Plamondon 68-16-70	08-Nov-13	16054131108032	<0.0005	<0.0005	<0.0005	<0.00071	ND	<0.1	<0.25	<1.0
Alberta Tier 1 - Fine Grained Soils - Natural Areas*			0.005^{P(MAC)}	0.024^{P(AO)}	0.0024^{P(AO)}	0.3^{P(AO)}	NS	2.2^P	1.1^P	NS

Notes:

- ^{††} - F1 excludes BTEX
- ^P - indicates guideline for Potable Groundwater exposure pathway
- ^{AO} - aesthetic objective from Guidelines for Canadian Drinking Water Quality (Health Canada, 2012)
- ^{MAC} - maximum acceptable concentration based on health effects from Guidelines for Canadian Drinking Water Quality (Health Canada, 2012)
- NS - guideline not specified
- * - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AENV, 2010)
- ^{^^} - Groundwater Management Framework Interim Quality Triggers for the South Athabasca Oil Sands Area
- Italics* - indicates values do not meet applicable guidelines

TABLE 9.

GROUNDWATER QUALITY RESULTS - POLYCYCLIC AROMATIC HYDROCARBONS

Alberta Environment and Sustainable Resources Development (ESRD)
Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Sample Point	Sample Date	MSI Sample Number	Acenaphthene mg/L	Acenaphthylene mg/L	Anthracene mg/L	Benz[a]anthracene** mg/L	Benzo[b]fluoranthene** mg/L	Benzo[k]fluoranthene** mg/L	Benzo[ghi,perylene]** mg/L	Benzo[a]pyrene** mg/L	Chrysene** mg/L	Dibenzo[a,h]anthracene** mg/L	Fluoranthene mg/L	Fluorene mg/L	Indeno[1,2,3-c,d]pyrene** mg/L	Naphthalene mg/L	Phenanthrene mg/L	Pyrene mg/L	Benzo[a]pyreneTPE** mg/L
Surficial Deposits																			
Conklin 76-07-6	15-Nov-12	16054121115104	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Conklin 76-07-6	23-Sep-13	16054130923054	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	0.00005	<0.00005	<0.00002	ND
Conklin 76-07-6	29-Oct-13	16054131029010	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
House Crossing 77-15-8	19-Nov-12	16054121119104	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
House Crossing 77-15-8	25-Sep-13	16054130925060	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
House Crossing 77-15-8	24-Oct-13	16054131024005	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Mariana Lakes 80-13-7	17-Nov-12	16054121117102	0.000032	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	0.000056	<0.00001	0.00237	<0.00005	<0.00002	ND
Mariana Lakes 80-13-7	22-Sep-13	16054130922046	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Mariana Lakes 80-13-7	07-Nov-13	16054131107030	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Plamondon 68-16-7	21-Nov-12	16054121121101	<0.00005	<0.00005	<0.00001	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00002	<0.00005	<0.00005	0.00089	<0.00005	<0.00002	ND
Plamondon 68-16-7	25-Sep-13	16054130925065	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Plamondon 68-16-7	08-Nov-13	16054131108035	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Waddell Creek 80-09-9	22-Oct-12	16054121022101	<0.00005	<0.00005	<0.00001	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00002	<0.00005	<0.00005	0.00869	<0.00005	<0.00002	ND
Waddell Creek 80-09-9	23-Sep-13	16054130923048	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Waddell Creek 80-09-9	29-Oct-13	16054131029011	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Winefred Lake 75-5-17	31-Oct-13	16054131031023	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Sand River																			
Conklin 76-07-24	15-Nov-12	16054121115103	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Conklin 76-07-24	23-Sep-13	16054130923053	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Conklin 76-07-24	29-Oct-13	16054131029009	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Waddell Creek 80-09-21	22-Oct-12	16054121022102	<0.00005	<0.00005	<0.00001	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00002	<0.00005	<0.00005	<0.00005	<0.00005	<0.00002	ND
Waddell Creek 80-09-21	23-Sep-13	16054130923050	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Waddell Creek 80-09-21	29-Oct-13	16054131029015	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Wiau Lake 73-9-41	30-Oct-13	16054131030017	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Ethel Lake																			
Conklin 76-07-41	15-Nov-12	16054121115102	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Conklin 76-07-41	23-Sep-13	16054130923052	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Conklin 76-07-41	29-Oct-13	16054131029008	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
House Crossing 77-15-82	19-Nov-12	16054121119101	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	0.00032	<0.00005	<0.00002	ND
House Crossing 77-15-82	25-Sep-13	16054130925059	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
House Crossing 77-15-82	24-Oct-13	16054131024001	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Mariana Lakes 80-13-52	17-Nov-12	16054121117103	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Mariana Lakes 80-13-52	22-Sep-13	16054130922045	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Mariana Lakes 80-13-52	07-Nov-13	16054131107029	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Waddell Creek 80-09-117	23-Oct-12	16054121023104	<0.00005	<0.00005	<0.00001	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00002	<0.00005	<0.00005	0.00038	<0.00005	<0.00002	ND
Waddell Creek 80-09-117	23-Sep-13	16054130923049	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Waddell Creek 80-09-117	29-Oct-13	16054131029014	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
AB Tier 1 - Fine Grained Soils - Natural Areas*			0.0058^A	0.046^A	0.000012^A	0.000018^A	0.00048^A	0.00048^A	0.00021^A	0.000017^A	0.0014^A	0.00028^A	0.00004^A	0.003^A	0.00023^A	0.0011^A	0.0004^A	0.000025^A	0.00001^P

TABLE 9.

GROUNDWATER QUALITY RESULTS - POLYCYCLIC AROMATIC HYDROCARBONS

Alberta Environment and Sustainable Resources Development (ESRD)
Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Sample Point	Sample Date	MSI Sample Number	Acenaphthene mg/L	Acenaphthylene mg/L	Anthracene mg/L	Benzo[a]anthracene** mg/L	Benzo[b]fluoranthene** mg/L	Benzo[k]fluoranthene** mg/L	Benzo[ghi,perylene]** mg/L	Benzo[a]pyrene** mg/L	Chrysene** mg/L	Dibenzo[a,h]anthracene** mg/L	Fluoranthene mg/L	Fluorene mg/L	Indeno[1,2,3-c,d]pyrene** mg/L	Naphthalene mg/L	Phenanthrene mg/L	Pyrene mg/L	Benzo[a]pyreneTPE** mg/L
Bonnyville																			
Conklin 76-07-67	15-Nov-12	16054121115101	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	0.00005	<0.00005	<0.00002	ND
Conklin 76-07-67	23-Sep-13	16054130923051	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Conklin 76-07-67	29-Oct-13	16054131029007	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
House Crossing 77-15-126	19-Nov-12	16054121119103	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	0.00012	<0.00005	<0.00002	ND
House Crossing 77-15-126	25-Sep-13	16054130925058	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
House Crossing 77-15-126	24-Oct-13	16054131024004	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Mariana Lakes 80-13-112	17-Nov-12	16054121117104	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	0.00013	<0.00005	<0.00002	ND
Mariana Lakes 80-13-112	22-Sep-13	16054130922044	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	0.00007	<0.00005	<0.00002	ND
Mariana Lakes 80-13-112	07-Nov-13	16054131107028	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Plamondon 68-16-39	21-Nov-12	16054121121104	<0.00005	<0.00005	<0.00001	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00002	<0.00005	<0.00005	0.00016	<0.00005	<0.00002	ND
Plamondon 68-16-39	25-Sep-13	16054130925064	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Plamondon 68-16-39	08-Nov-13	16054131108034	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Plamondon 68-16-51	21-Nov-12	16054121121103	<0.00005	<0.00005	<0.00001	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00002	<0.00005	<0.00005	0.00016	<0.00005	<0.00002	ND
Plamondon 68-16-51	25-Sep-13	16054130925063	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Plamondon 68-16-51	08-Nov-13	16054131108033	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Waddell Creek 80-09-149	22-Oct-12	16054121022103	<0.00005	<0.00005	<0.00001	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00002	<0.00005	<0.00005	0.00124	<0.00005	<0.00002	ND
Waddell Creek 80-09-149	23-Sep-13	16054130923047	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	0.00012	<0.00005	<0.00002	ND
Waddell Creek 80-09-149	29-Oct-13	16054131029013	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Wiau Lake 73-9-15	30-Oct-13	16054131030019	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Wiau Lake 73-9-76	30-Oct-13	16054131030018	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Wiau Lake 73-9-120	30-Oct-13	16054131030016	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	0.00000020
Winefred Lake 75-5-79	31-Oct-13	16054131031021	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Muriel Lake																			
House Crossing 77-15-161	19-Nov-12	16054121119102	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	0.00036	<0.00005	<0.00002	ND
House Crossing 77-15-161	25-Sep-13	16054130925057	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	0.00006	<0.00005	<0.00002	ND
House Crossing 77-15-161	24-Oct-13	16054131024003	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	0.00007	<0.00005	<0.00002	ND
Empress Terrace																			
Mariana Lakes 80-13-134	17-Nov-12	16054121117101	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	0.00026	<0.00005	<0.00002	ND
Mariana Lakes 80-13-134	22-Sep-13	16054130922043	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	0.00018	<0.00005	<0.00002	ND
Mariana Lakes 80-13-134	07-Nov-13	16054131107027	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Winefred Lake 75-5-158	31-Oct-13	16054131031020	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Empress Channel																			
House Crossing 77-15-231	19-Nov-12	16054121119105	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
House Crossing 77-15-231	25-Sep-13	16054130925056	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	0.00012	<0.00005	<0.00002	ND
House Crossing 77-15-231	24-Oct-13	16054131024002	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	0.00012	<0.00005	<0.00002	ND
Plamondon 68-16-70	21-Nov-12	16054121121102	<0.00005	<0.00005	<0.00001	<0.00001	<0.00005	<0.00005	<0.00005	<0.00001	<0.00005	<0.00005	<0.00002	<0.00005	<0.00005	<0.00005	<0.00005	<0.00002	ND
Plamondon 68-16-70	25-Sep-13	16054130925062	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Plamondon 68-16-70	08-Nov-13	16054131108032	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002	ND
Minimal Detection Limit			0.00005	0.00005	0.00001	0.00001	0.00005	0.00005	0.00005	0.00001	0.00005	0.00005	0.00002	0.00005	0.00050	0.00005	0.00005	0.00002	-
AB Tier 1 - Fine Grained Soils - Natural Areas*			0.0058^A	0.046^A	0.000012^A	0.000018^A	0.00048^A	0.00048^A	0.00021^A	0.000017^A	0.0014^A	0.00028^A	0.00004^A	0.003^A	0.00023^A	0.0011^A	0.0004^A	0.000025^A	0.00001^P

Notes:

- ND - not detected
- ^A - indicates guideline for Aquatic Life exposure pathway
- ^P - indicates guideline for Potable Groundwater exposure pathway
- ^{AA} - Groundwater Management Framework Interim Quality Triggers for the South Athabasca Oil Sands Area
- * - Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AENV, 2010)
- ** - Equivalent Benzo[a]pyrene concentrations based on relative carcinogenic potency
- ** - Carcinogenic PAHs
- Italics* - indicates values do not meet applicable guidelines

TABLE 10.**GROUNDWATER QUALITY RESULTS - MICROBIOLOGICAL PARAMETERS**

Alberta Environment and Sustainable Resources Development (ESRD)

Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Sample Point	Sample Date	MSI Sample Number	Total Coliforms CFU / 100 mL	Faecal Coliforms CFU / 100 mL	E.Coli CFU / 100 mL	Sulphate Reducing Bacteria (SRB) CFU / mL	Iron Related Bacteria (IRB) CFU / mL
Surficial Deposits							
Conklin 76-07-6	15-Nov-12	16054121115104	---	<1	---	---	---
Mariana Lakes 80-13-7	19-Nov-12	16054121119301	---	<1	---	---	---
Mariana Lakes 80-13-7	22-Sep-13	16054130922046	---	---	---	5000	9000
House Crossing 77-15-8	19-Nov-12	16054121119104	---	<1	---	---	---
Plamondon 68-16-7	21-Nov-12	16054121121101	---	<1	---	---	---
Ethel Lake							
Mariana Lakes 80-13-52	22-Sep-13	16054130922045	---	---	---	18000	9000
House Crossing 77-15-82	19-Nov-12	16054121119101	---	<1	---	---	---
Bonnyville							
Mariana Lakes 80-13-112	22-Sep-13	16054130922044	---	---	---	18000	2300
Empress Terrace							
Mariana Lakes 80-13-134	22-Sep-13	16054130922043	---	---	---	18000	9000
Minimal Detection Limit			-	1	-	1	1
Canadian Drinking Water Guidelines**			0^{MAC}	0^{MAC}	0^{MAC}	NS	NS

Notes:

--- - not analyzed

CFU - colony forming unit

^{MAC} - maximum acceptable concentration based on health effects from Guidelines for Canadian Drinking Water Quality (Health Canada, 2012)

** - Guidelines for Canadian Drinking Water Quality (Health Canada, 2012)

*** - Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME, accessed on line July 2012)

Italics - indicates values do not meet drinking water guidelines, resampling is recommended to confirm the presence of Coliforms

TABLE 11a.

WATER QUALITY CONTROL SAMPLE RESULTS - FIELD MEASURED PARAMETERS

Alberta Environment and Sustainable Resources Development (ESRD)
Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Sample Date	MSI Sample Number	Temp °C	Field pH	Field EC µS/cm
Conklin 76-07-6	29-Oct-13	16054131029010	9.3	6.3	70
Conklin 76-07-6 dup	29-Oct-13	16054131029012	9.3	6.3	70
Detection Limit (DL)			0.1	---	10
Duplicate Sample Results Evaluation			Good	Good	Good
Mariana Lakes 80-13-52	07-Nov-13	16054131107029	4.5	7.3	640
Mariana Lakes 80-13-52 dup	07-Nov-13	16054131107031	4.5	7.3	640
Detection Limit (DL)			0.1	---	10
Duplicate Sample Results Evaluation			Good	Good	Good
Winefred Lake 75-5-158	31-Oct-13	16054131031020	5.6	7.7	910
Winefred Lake 75-5-158 dup	31-Oct-13	16054131031022	5.8	7.7	910
Detection Limit (DL)			0.1	---	10
Duplicate Sample Results Evaluation			Good	Good	Good

TABLE 11b.

WATER QUALITY CONTROL SAMPLE RESULTS - GENERAL AND INORGANIC PARAMETERS

Alberta Environment and Sustainable Resources Development (ESRD)
Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Sample Date	MSI Sample Number	Lab pH	Lab EC µS/cm	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO ₄ mg/L	NO ₂ -N mg/L	NO ₃ -N mg/L	NO ₂ /NO ₃ -N mg/L	Total Alkalinity mg/L	HCO ₃ mg/L	Hardness mg/L	TDS mg/L	NH ₃ -N mg/L	TKN mg/L	PO ₄ -P mg/L	DOC mg/L	Phenol mg/L	Turbidity	
Conklin 76-07-24 dup	23-Sep-13	16054130923053	8.43	417	52.4	14.6	12.2	3.3	<0.50	4.38	<0.05	<0.05	<0.071	234	278	191	227	0.416	0.65	---	3.6	<0.001	14.4	
Conklin 76-07-24 dup	23-Sep-13	16054130923055	8.44	410	53.2	14.6	12	3.26	<0.50	4.43	<0.05	<0.05	<0.071	235	278	193	228	0.449	0.66	---	3.3	<0.001	13.7	
Detection Limit (DL)			1.0	0.2	0.5	0.1	0.5	0.1	0.5	0.5	0.05	0.05	0.071	2	5	1	1	0.05	0.2	0.02	1	0.001	0.1	
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	---	Good	Good	Good
House Crossing 77-15-82	25-Sep-13	16054130925059	8.16	1070	50.5	11.7	183	4.89	49.7	86.1	<0.05	<0.05	<0.071	433	529	174	646	1.27	1.44	1.03	9.6	<0.001	31.8	
House Crossing 77-15-82 dup	25-Sep-13	16054130925061	8.19	1080	44.2	12	182	4.93	49.2	85.5	<0.05	<0.05	<0.071	475	579	160	663	1.2	1.74	1.07	9.9	<0.001	31.6	
Detection Limit (DL)			1.0	0.2	0.5	0.1	0.5	0.1	0.5	0.5	0.05	0.05	0.071	2	5	1	1	0.05	0.2	0.02	1	0.001	0.1	
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Conklin 76-07-6	29-Oct-13	16054131029010	6.79	69.5	7.86	2.21	1.5	0.58	1.34	2.57	<0.050	0.157	0.157	30.8	37.6	28.7	35.2	<0.050	<0.20	0.036	2.4	<0.0010	---	
Conklin 76-07-6 dup	29-Oct-13	16054131029012	6.8	68.4	8.03	2.21	1.6	0.58	1.35	2.64	<0.050	0.158	0.158	30.3	37	29.2	35.3	<0.050	<0.20	0.033	2.4	<0.0010	---	
Detection Limit (DL)			0.1	0.2	0.5	0.1	1	0.1	0.5	0.5	0.05	0.05	0.071	2	5	1	1	0.05	0.2	0.02	1	0.001	-	
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	---
Mariana Lakes 80-13-52	07-Nov-13	16054131107029	7.77	593	72.2	20	19	4.1	<0.50	29.1	<0.050	<0.050	<0.071	306	373	263	328	0.905	1.01	1.53	6.7	0.0027	---	
Mariana Lakes 80-13-52 dup	07-Nov-13	16054131107031	7.78	592	71.2	19	18.6	3.93	<0.50	28.8	<0.050	<0.050	<0.071	305	372	256	325	0.876	1	1.57	6.6	0.0035	---	
Detection Limit (DL)			0.1	0.2	0.5	0.1	0.5	0.1	0.5	0.5	0.05	0.05	0.071	2	5	1	1	0.05	0.2	0	1	0.001	-	
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	---
Winefred Lake 75-5-158	31-Oct-13	16054131031020	8	923	32.3	9.82	170	4.68	6.69	44.1	<0.050	<0.050	<0.071	460	562	121	544	1.37	1.58	0.51	8.5	<0.0010	---	
Winefred Lake 75-5-158 dup	31-Oct-13	16054131031022	7.96	925	31.2	9.9	174	4.63	6.66	44.9	<0.050	<0.050	<0.071	444	542	119	538	1.37	1.54	0.52	8.5	<0.0010	---	
Detection Limit (DL)			0.1	0.2	0.5	0.1	1	0.1	0.5	0.5	0.05	0.05	0.071	2	5	1	1	0.05	0.2	0.02	1	0.001	-	
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	---

Notes:

- Good - evaluation indicates acceptable reproducibility
- Poor - evaluation indicates poor reproducibility

TABLE 11c.

WATER QUALITY CONTROL SAMPLE RESULTS - DISSOLVED METALS

Alberta Environment and Sustainable Resources Development (ESRD)
Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Sample Date	MSI Sample Number	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L
Conklin 76-07-24	23-Sep-13	16054130923053	0.0013	<0.0004	0.00511	0.139	<0.0005	<0.00005	0.0807	<0.0001	<0.0004	<0.0001	<0.0006	1.5	<0.0001
Conklin 76-07-24 dup	23-Sep-13	16054130923055	<0.0010	<0.0004	0.00502	0.144	<0.0005	<0.00005	0.0758	<0.0001	<0.0004	<0.0001	<0.0006	1.47	<0.0001
Detection Limit (DL)			0.001	0.0004	0.0004	0.0001	0.0005	0.00005	0.002	0.0001	0.0004	0.0001	0.0006	0.01	0.0001
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
House Crossing 77-15-82	25-Sep-13	16054130925059	0.0014	<0.0004	0.023	0.0739	<0.0005	<0.00005	0.9	<0.0001	<0.0004	0.00038	<0.0006	2.48	<0.0001
House Crossing 77-15-82 dup	25-Sep-13	16054130925061	0.0024	<0.0004	0.0229	0.0746	<0.0005	<0.00005	0.785	<0.0001	<0.0004	0.00039	0.0006	2.54	<0.0001
Detection Limit (DL)			0.001	0.0004	0.0004	0.0001	0.0005	0.00005	0.002	0.0001	0.0004	0.0001	0.0006	0.01	0.0001
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Conklin 76-07-6	29-Oct-13	16054131029010	0.0034	<0.00040	<0.00040	0.0184	<0.00050	<0.00005	<0.050	<0.0001	<0.0004	<0.0001	<0.0006	<0.01	<0.0001
Conklin 76-07-6 dup	29-Oct-13	16054131029012	0.0027	<0.00040	<0.00040	0.0177	<0.00050	<0.00005	<0.050	<0.0001	<0.0004	<0.0001	<0.0010	<0.01	<0.0001
Detection Limit (DL)			0.001	0.0004	0.0004	0.005	0.0005	0.00005	0.05	0.0001	0.0004	0.0001	0.001	0.01	0.0001
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Mariana Lakes 80-13-52	07-Nov-13	16054131107029	0.0014	<0.0004	0.0212	0.0659	<0.0005	<0.00005	0.157	<0.0001	<0.0004	0.00013	<0.0006	9.2	<0.0001
Mariana Lakes 80-13-52 dup	07-Nov-13	16054131107031	0.0012	<0.0004	0.0213	0.0627	<0.0005	<0.00005	0.142	<0.0001	<0.0004	0.00011	<0.0006	8.95	<0.0001
Detection Limit (DL)			0.001	0.0004	0.0004	0.0001	0.0005	0.00005	0.002	0.0001	0.0004	0.0001	0.0006	0.01	0.0001
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Winefred Lake 75-5-158	31-Oct-13	16054131031020	<0.005	<0.0004	0.0276	0.0786	<0.00050	<0.00005	0.418	<0.0001	<0.005	0.00028	<0.0010	0.586	0.00017
Winefred Lake 75-5-158 dup	31-Oct-13	16054131031022	<0.005	<0.0004	0.0275	0.0795	<0.00050	<0.00005	0.429	<0.0001	<0.005	0.00029	<0.0010	0.594	0.00017
Detection Limit (DL)			0.005	0.0004	0.0004	0.005	0.0005	0.00005	0.05	0.0001	0.0004	0.0001	0.001	0.01	0.0001
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good

Monitoring Well	Sample Date	MSI Sample Number	Mn mg/L	Hg mg/L	Mo mg/L	Ni mg/L	Se mg/L	Si mg/L	Ag mg/L	Sr mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L
Conklin 76-07-24	23-Sep-13	16054130923053	0.173	<0.0001	0.00386	0.00018	<0.0004	10.7	<0.00001	0.391	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	0.0125
Conklin 76-07-24 dup	23-Sep-13	16054130923055	0.175	<0.0001	0.00391	0.0002	<0.0004	10.7	<0.00001	0.387	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	0.0127
Detection Limit (DL)			0.002	0.0001	0.0001	0.0001	0.0004	0.05	0.00001	0.0001	0.00005	0.0002	0.0003	0.0001	0.0001	0.001
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
House Crossing 77-15-82	25-Sep-13	16054130925059	0.323	<0.0001	0.0328	0.00136	<0.0004	8.7	<0.00001	0.409	<0.00005	<0.0002	<0.0003	0.00053	0.00012	0.0042
House Crossing 77-15-82 dup	25-Sep-13	16054130925061	0.335	<0.0001	0.0296	0.00147	<0.0004	8.7	<0.00001	0.361	<0.00005	<0.0002	<0.0003	0.00047	0.00012	0.0138
Detection Limit (DL)			0.002	0.0001	0.0001	0.0001	0.0004	0.05	0.00001	0.0001	0.00005	0.0002	0.0003	0.0001	0.0001	0.001
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Conklin 76-07-6	29-Oct-13	16054131029010	<0.0020	<0.00002	0.0002	0.0014	<0.00040	4.97	<0.00001	0.0326	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	0.002
Conklin 76-07-6 dup	29-Oct-13	16054131029012	<0.0020	<0.00002	0.00016	0.0014	<0.00040	4.93	<0.00001	0.0338	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	<0.0010
Detection Limit (DL)			0.002	0.00002	0.0001	0.002	0.0004	0.05	0.00001	0.0001	0.00005	0.0002	0.0003	0.0001	0.0001	0.001
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Mariana Lakes 80-13-52	07-Nov-13	16054131107029	0.43	<0.0001	0.00836	0.0009	<0.0004	10.1	<0.000010	0.438	<0.00005	<0.0002	<0.0003	<0.0001	0.0001	0.004
Mariana Lakes 80-13-52 dup	07-Nov-13	16054131107031	0.417	<0.0001	0.00812	0.00076	<0.0004	9.63	<0.000010	0.451	<0.00005	<0.0002	<0.0003	<0.0001	<0.0001	0.002
Detection Limit (DL)			0.002	0.0001	0.0001	0.0001	0.0004	0.05	0.00001	0.0001	0.00005	0.0002	0.0003	0.0001	0.0001	0.001
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Winefred Lake 75-5-158	31-Oct-13	16054131031020	0.111	<0.00002	0.0269	<0.002	<0.0004	14.1	<0.00001	0.354	<0.00005	<0.0002	<0.0003	0.00026	0.00013	<0.0030
Winefred Lake 75-5-158 dup	31-Oct-13	16054131031022	0.111	<0.00002	0.0263	<0.002	<0.0004	14.5	<0.00001	0.349	<0.00005	<0.0002	<0.0003	0.00028	0.00011	<0.0030
Detection Limit (DL)			0.1	0.00002	0.0001	0.002	0.0004	0.05	0.00001	0.0001	0.00005	0.0002	0.0003	0.0001	0.0001	0.003
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good

Notes:

Good - evaluation indicates acceptable reproducibility

Poor - evaluation indicates poor reproducibility

TABLE 11d.**WATER QUALITY CONTROL SAMPLE RESULTS - DISSOLVED HYDROCARBONS**

Alberta Environment and Sustainable Resources Development (ESRD)

Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Monitoring Well	Sample Date	MSI Sample Number	Benzene mg/L	Toluene mg/L	Ethylbenzene mg/L	Xylenes mg/L	F1 ^{††} C ₆ -C ₁₀ mg/L	F2 C ₁₀ -C ₁₆ mg/L	Naphthenic Acids mg/L
Conklin 76-07-24	23-Sep-13	16054130923053	<0.0005	<0.0005	<0.0005	<0.00071	<0.1	<0.25	<1.0
Conklin 76-07-24 dup	23-Sep-13	16054130923055	<0.0005	<0.0005	<0.0005	<0.00071	<0.1	<0.25	<1.0
Detection Limit (DL)			0.0005	0.0005	0.0005	0.00071	0.1	0.25	1.0
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good
House Crossing 77-15-82	25-Sep-13	16054130925059	<0.0005	<0.0005	<0.0005	<0.00071	<0.1	<0.25	<1.0
House Crossing 77-15-82 dup	25-Sep-13	16054130925061	<0.0005	<0.0005	<0.0005	<0.00071	<0.1	<0.25	<1.0
Detection Limit (DL)			0.0005	0.0005	0.0005	0.00071	0.1	0.25	1.0
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good
Conklin 76-07-6	29-Oct-13	16054131029010	<0.00050	<0.00050	<0.00050	<0.00071	<0.10	<0.25	<1.0
Conklin 76-07-6 dup	29-Oct-13	16054131029012	<0.00050	<0.00050	<0.00050	<0.00071	<0.10	<0.25	<1.0
Detection Limit (DL)			0.0005	0.0005	0.0005	0.00071	0.1	0.25	1.0
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good
Mariana Lakes 80-13-52	07-Nov-13	16054131107029	<0.00050	<0.00050	0.00059	0.00311	<0.10	<0.25	<1.0
Mariana Lakes 80-13-52 dup	07-Nov-13	16054131107031	<0.00050	<0.00050	<0.00050	<0.00071	<0.10	<0.25	<1.0
Detection Limit (DL)			0.0005	0.0005	0.0005	0.00071	0.1	0.25	1.0
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good
Winefred Lake 75-5-158	31-Oct-13	16054131031020	<0.00050	<0.00050	<0.00050	<0.00071	<0.10	<0.25	<1.0
Winefred Lake 75-5-158 dup	31-Oct-13	16054131031022	<0.00050	<0.00050	<0.00050	<0.00071	<0.10	<0.25	<1.0
Detection Limit (DL)			0.0005	0.0005	0.0005	0.00071	0.1	0.25	1.0
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good

Notes:

Good - evaluation indicates acceptable reproducibility

Poor - evaluation indicates poor reproducibility

TABLE 11e.

WATER QUALITY CONTROL SAMPLE RESULTS - POLYCYCLIC AROMATIC HYDROCARBONS

Alberta Environment and Sustainable Resources Development (ESRD)
 Southern Athabasca Oil Sands (SAOS) Groundwater Monitoring Network

Sample Well	Sample Date	MSI Sample Number	Acenaphthene mg/L	Acenaphthylene mg/L	Anthracene mg/L	Benz[a]anthracene** mg/L	Benzo[b+]fluoranthene** mg/L	Benzo[k]fluoranthene** mg/L	Benzo[g,h,i]perylene** mg/L	Benzo[a]pyrene** mg/L	Chrysene** mg/L	Dibenz[a,h]anthracene** mg/L	Fluoranthene mg/L	Fluorene mg/L	Indeno[1,2,3-c,d]pyrene** mg/L	Naphthalene mg/L	Phenanthrene mg/L	Pyrene mg/L
Conklin 76-07-24	23-Sep-13	16054130923053	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002
Conklin 76-07-24 dup	23-Sep-13	16054130923055	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002
Detection Limit (DL)			0.00002	0.00002	0.00001	0.00001	0.00001	0.00001	0.00002	0.000005	0.00002	0.000005	0.00002	0.00002	0.00001	0.00005	0.00005	0.00002
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
House Crossing 77-15-82	25-Sep-13	16054130925059	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002
House Crossing 77-15-82 dup	25-Sep-13	16054130925061	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002
Detection Limit (DL)			0.00002	0.00002	0.00001	0.00001	0.00001	0.00001	0.00002	0.000005	0.00002	0.000005	0.00002	0.00002	0.00001	0.00005	0.00005	0.00002
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Conklin 76-07-6	29-Oct-13	16054131029010	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002
Conklin 76-07-6 dup	29-Oct-13	16054131029012	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002
Detection Limit (DL)			0.00002	0.00002	0.00001	0.00001	0.00001	0.00001	0.00002	0.000005	0.00002	0.000005	0.00002	0.00002	0.00001	0.00005	0.00005	0.00002
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Mariana Lakes 80-13-52	07-Nov-13	16054131107029	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002
Mariana Lakes 80-13-52 dup	07-Nov-13	16054131107031	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002
Detection Limit (DL)			0.00002	0.00002	0.00001	0.00001	0.00001	0.00001	0.00002	0.000005	0.00002	0.000005	0.00002	0.00002	0.00001	0.00005	0.00005	0.00002
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Winefred Lake 75-5-158	31-Oct-13	16054131031020	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002
Winefred Lake 75-5-158 dup	31-Oct-13	16054131031022	<0.00002	<0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00002	<0.000005	<0.00002	<0.000005	<0.00002	<0.00002	<0.00001	<0.00005	<0.00005	<0.00002
Detection Limit (DL)			0.00002	0.00002	0.00001	0.00001	0.00001	0.00001	0.00002	0.000005	0.00002	0.000005	0.00002	0.00002	0.00001	0.00005	0.00005	0.00002
Duplicate Sample Results Evaluation			Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good

Notes:

- Good - evaluation indicates acceptable reproducibility
- Poor - evaluation indicates poor reproducibility

TABLE 12.**SAOS NETWORK GROUNDWATER QUALITY SUMMARY (EXISTING AND RECOMMENDED LOCATIONS)**

Alberta Environment and Sustainable Resource Development

South Athabasca Oil Sands Area Regional Groundwater Monitoring Network

SAOS Interval	Aquifer	Number of Existing SAOS Completions	Number of Recommended SAOS Completions	Percentage of Existing and Recommended Wells Exceeding SAOS Interim Water Quality Trigger Value								
				Temp Change	TDS	Cl	NO ₃	As	Si	B	BTEX	Phenols
Surficial Deposits	Shallow	6	0	0%	17%	17%	67%	33%	50%	0%	33%	33%
	Sand River	3	0	0%	0%	0%	0%	100%	100%	0%	0%	0%
	Ethel Lake	4	1*	0%	20%	0%	0%	50%	75%	75%	50%	50%
	Bonnyville	7	0	0%	29%	0%	29%	57%	86%	86%	29%	0%
	Muriel Lake	1	0	0%	0%	0%	0%	100%	100%	0%	100%	0%
	Empress Terrace	2	0	0%	0%	0%	0%	100%	100%	100%	0%	0%
Buried Channels	Empress Channel	2	1*	0%	33%	67%	50%	100%	50%	100%	50%	0%
Grand Rapids Formation	Lower Grand Rapids	0	1 (+1**)	0%	100%	100%	--	--	--	--	--	--
Clearwater Formation	Upper Clearwater	0	3	0%	33%	33%	--	--	--	--	--	--
	Middle Clearwater	0	0	--	--	--	--	--	--	--	--	--
McMurray Formation	Basal McMurray	0	3 (+1**)	0%	100%	100%	--	--	--	--	--	--

Notes:

* no data for NO₃, As, Si, B, BTEX and Phenols

** location completed as a VWP, no available water quality data

-- no available data

APPENDIX A

GROUNDWATER SAMPLING AND QUALITY ASSURANCE/
QUALITY CONTROL PROTOCOLS

APPENDIX A

GROUNDWATER SAMPLING AND QUALITY ASSURANCE/QUALITY CONTROL PROTOCOLS

The following sections describe the groundwater monitoring and sampling, and the data quality assurance/quality control (QA/QC) protocol used during the 2013 South Athabasca Oil Sands Area regional groundwater monitoring program.

1 GROUNDWATER MONITORING AND SAMPLING

1.1 Low-flow Sampling

Low-flow sampling is an acceptable method for both shallow wells and regional wells (production wells not already equipped with submersible pumps). This sampling method requires the use of a pump capable of operating at low speeds (less than or equal to the natural flow rates through the screen). The pumping rate during purging must be equal to or less than the natural recovery rate of the well.

Low-flow sampling involves removing water directly from the screened interval without physically or hydraulically disturbing the stagnant water column above the screen (Nielsen and Nielsen 2007). It can be achieved by either installing a dedicated pump in a well or by lowering a portable pump so that its intake is within the screened interval (typically near the middle of the screen). In low-flow sampling, the well is pumped at a low flow rate to maintain a stable water level in the well. Typical flow rates are in the order of 0.1 to 0.5 mL per minute but may be as fast as 1 L per minute in high-yield (coarse) formations.

To avoid excessive drawdown in the well, water levels have to be monitored continuously until stabilization has been achieved. Keeping drawdown at a minimum will isolate the stagnant water column from the sampling point. Puls and Barcelona (1996) proposed that drawdown in a well should not exceed 0.1 m. However, the most important factor is to obtain stable water levels to eliminate the potential for stagnant water to enter the pump intake. Drawdown should not exceed the distance between the top of the well screen and the pump intake (Nielsen and Nielsen 2007).

With this method, the well is purged until indicator parameters, measured in an attached flow-through cell, have stabilized according to the criteria listed in Table 1. Parameters typically monitored include pH, temperature, electrical conductivity, oxidation-reduction potential (ORP) and dissolved oxygen (DO). The amount of water purged will vary based on the well diameter but typically ranges between less than one half of a well volume to one well volume (Barcelona et al. 1994).

Table 1 Stabilization Criteria for Groundwater Quality Indicator Parameters

Parameter	Stabilization Criteria
pH	+/- 0.1 Standard Unit
Specific Electrical Conductance (SC)	± 5% for SC ≤ 100 µS/cm ± 3% for SC > 100 µS/cm
Temperature	+/- 0.2°C for thermistor thermometers +/- 0.5°C for liquid in glass thermometers
DO	+/- 0.3 mg/L
ORP	+/- 10 mV

Source: Wilde et al. 1998

1.2 Method Advantages

The advantages of low-flow purging and sampling include:

- Minimizes turbulent flow through the well screen which eliminates the entrainment of artifactual turbidity in the samples collected. This negates the need for field filtration.
- Produces small volumes of purge water.
- Improves sample accuracy and precision (reproducibility).
- Reduces sampling time.
- No limits on sampling volumes other than the formation.
- Can be used in wells where the water table is above or within the screen and in bedrock wells.
- Low-flow sampling produces a weighted average concentration over the screened length (Martin-Hayden and Robbins 1997; Puls and Paul 1997). The effects of heterogeneity at the screened interval may change the contribution of various zones but do not change the effect of concentration averaging. Site-specific sampling objectives must be reviewed to determine if this sampling method is suitable.

1.3 Method Disadvantages

The disadvantages of low-flow purging and sampling include:

- Pumps need to be decontaminated between wells (if using portable pump).
- Produces large volumes of disposable tubing (if using portable pump).
- Requires source of power (generator or battery).
- May have mechanical problems in the field (less user friendly than other methods).
- Requires more training on use of different types of pumps.

- Initial cost can be expensive but should be considered for long-term monitoring programs.
- Certain pumps have limitations (lift capability, physical dimensions, analytical limitations, heating samples, etc.).

2 CHEMICAL ANALYSIS

All field equipment involved in monitoring and sampling was decontaminated following each event. Groundwater samples were collected using appropriate handling protocols and were placed in sample containers provided by the laboratory. Sample filtration and preservation were conducted in the field as required. All samples were labelled with a distinctive sample identifier. Chain-of-custody forms were completed and the samples were stored in chilled coolers following collection and during shipment to the analytical laboratory. Care was taken to ensure that sample holding times were not exceeded.

Groundwater samples were submitted to ALS Environmental laboratory in Fort McMurray, Alberta. ALS is accredited with the Canadian Association for Laboratory Accreditation. All samples were kept cool by refrigeration or the use of ice packs. The requested analytical parameters were outlined in the main text of this report and the analytical reports are included in the appendices.

2.1 Data Management

For this program, two standard field forms were completed. One form, the groundwater sampling form, captures all water level, purging, sampling and field parameter information; the second form, a triplicate chain-of-custody form, assigns sample control numbers, analyte requirements, shipping and reporting details for each sample submitted to the laboratory.

3 QUALITY ASSURANCE/QUALITY CONTROL PROTOCOL

Matrix standard QA/QC protocol provided a formal system for evaluating the technical adequacy of sample collection and handling, equipment decontamination procedures, and analysis. The QA/QC protocol describes procedures, auditing techniques and documentation for controlled data collection. The ultimate purpose of this protocol is to obtain representative data and to reduce uncertainty. The QA/QC program is designed to confirm that potential sources of bias (such as inconsistent sampling procedures, potential cross-contamination from sampling equipment, shipping conditions and laboratory practices) were not contributing an unacceptable variation in data quality. The QA/QC protocol for the groundwater sampling program consisted of two programs: the field and data management QA/QC programs.

3.1 Field Quality Assurance/Quality Control Program

Duplicate samples were collected at each site and used to assess precision of field sampling procedures. A duplicate sample is one where the QA/QC sample is collected successively to the original sample (i.e., two groundwater samples taken immediately after one another under comparable conditions). Both samples are submitted for laboratory analysis. Relative percent difference (RPD) is then calculated to compare the values from this pair of samples. Theoretically, these samples should have similar chemical concentrations. Due to factors such as sample matrix heterogeneity, natural variability, or variations in sample collection, handling or analysis, a minor variation in chemical concentration may

occur. The maximum acceptable RPD selected to meet the data quality objectives of this project is set at 20% for inorganic parameters and 30% for organic parameters. The quantity target for QA/QC duplicate samples for water is set at 10% of total water samples submitted for analysis. The RPD was calculated as follows:

$$RPD = \frac{\text{Absolute difference between the two duplicate results}}{\text{Mean of the two duplicate results}} \times 100$$

Where: RPD = relative percent difference

Theoretically, the samples should have identical chemical concentrations (i.e., RPD = 0). The reproducibility of duplicate analyses at concentrations near the reported detection limit can be difficult, and can often result in RPD values of greater than 20% and 30%. Therefore, RPD values of greater than the project objective are acceptable if the differences in concentrations of the duplicate analyses are less than approximately ten times the method detection limit. The QA/QC duplicate samples are used to assess the reliability of field sampling procedures, with analysis of these samples used to evaluate the reproducibility or precision of the sampling methodology. Reproducibility was evaluated based on the RPD calculated for each parameter. Rinsate samples are used to assess the adequacy of the decontamination process and detect any contamination associated with sampling equipment. The rinsate samples were collected by using laboratory-supplied de-ionized water to rinse off the water level tape to confirm de-contamination of the probe.

Field blanks are used to assess contamination from field conditions during sampling. Field blank samples were collected using laboratory-supplied de-ionized water that was transferred to a sample container at a sampling location, which exposes it to the sampling environment. Trip blanks are used to assess contamination introduced during the transport of sample bottles to the site and back to the Laboratory. The laboratory supplied the trip blank samples, which were kept with the sample bottles and samples and were returned, unopened, to the laboratory.

3.2 Data Management Quality Assurance/Quality Control Program

A project chemistry data was managed using EQuIS software, a database application developed specifically for management of environmental data. Electronic data (e.g., laboratory results) were uploaded to the database directly, and other data (e.g., data from field notes) were manually entered. The following data quality controls were established for the project database:

- A check was completed on the manually entered data to confirm that it has been transcribed correctly from the field forms into the database.
- Electronic data was checked by the data manager to confirm that data for the requested analyses have been provided by ALS.
- Database functions were used to check the data had been supplied in the correct units and were within the expected ranges.
- The project coordinator confirmed the data meets the program technical objectives.

- Database maintenance was performed on an ongoing basis and included an initial QA/QC check of data prior to entry into the database.

4 REFERENCES

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APPENDIX B

MATRIX CLIENT DATA PORTAL - GETTING STARTED

Matrix Client Data Portal - Getting Started

What is the Client Data Portal?

The client data portal (CDP) is primarily a tool that enables rapid read-only accessibility to your physical hydrogeological data that is already stored in a database system at Matrix.

CDP functionality is delivered via a secure web application that should not interfere with corporate IT requirements. Specifically, because the CDP works through a web browser, it does not require any software to be installed and it is not blocked by corporate firewalls.

Authorized individuals can view and download their physical hydrogeological time series data which is already stored in Matrix's Physical Hydrogeological Database (PHD), including heads, water flow rates, and temperatures.

Well locations are shown on an interactive map and are color coded depending on well type.

Wells contain screened or perforated intervals of hydraulic communication between the well and the formation, or the well may contain one or more temperature measurement points. These downhole intervals or measurement points are called "well segments" in the CDP. Details regarding well segments can be grouped, sorted and selected for data plotting in an interactive data grid view. Well segment data can be copied and pasted to other apps such as Excel.

Data plots can show data from multiple well segments and can be interactively re-scaled with the mouse for zooming in on data over small time scales. Plotted data can be exported to Excel.

The CDP is intended to provide time-efficient access to groundwater data and to support a data QA/QC process. Ultimately, it should be expected that the CDP will lower the costs of data management for several aspects of groundwater resource stewardship such as data review, modeling, reporting, operations decision making, and permit applications.

The Client Data Portal is New

Matrix has recognized a requirement by clients for better access to their groundwater data and in response has invested in development of the CDP. This tool is new, and therefore will undoubtedly have some "rough edges". That's where you, as an engaged user, can help out. We want your thoughts. What works well, what needs improvement, what functionality is it missing, does it do the job at hand? We'd like to know.

We won't promise to implement every change or suggestion we receive, but if you and others find this tool useful and worthy of its objectives, then evolutionary improvements based on your feedback will likely proceed.

Getting Started

The CDP is intended to be a fairly simple application to use, much like an iPhone or iPad application, and is probably best learned by experimenting with it. The sections below provide details on what functionality is available.

Login

- Open a web browser (e.g. Internet Explorer) and enter '**cdp.matrix-solutions.com**'.
- A login page should appear.
- Enter your CDP user ID and password.
- Current Limitation: A second login box may appear (sorry, it's a Microsoft technical issue yet to be resolved). For the second login, **prefix** your CDP user ID with '**matrix-solutions.com**' and use the same CDP password as before.
- NOTE: **If you enter an incorrect password more than 3 times, you will be locked out** and will not be able to login. In that case, contact Matrix to reinstate the password. This is a security measure.
- Once you're logged in, you should see the CDP Home Tab page in the web browser.

Main Page

- The Home tab is displayed at the top left of the Main Page and is described in the next section.
- Help, in the form of this document, is available using the Help link at the top right of the Main Page.
- Use the Send Feedback link to email question, comments, bug reports or feature requests.
- The Logout button will end your session and present the login page.

Home Tab

- Top half is the Map View, bottom half is the Data View.
- The Map View and Data View sizes can be changed by dragging the view separator bar.
- Logout button is at top right.

Map View

- The Map View is used to view the spatial locations of wells and to select wells for review.
- Well locations are shown on map and are color coded based on well type.
- Well labels are shown if they don't overlap another well point.
- Additional well information shows as a tool tip when the mouse is pointed at a well point.
- Map Zooming
 - Use the mouse scroll wheel or the zoom control at top left of map.
 - Current scale is indicated on lower right of map.
- Map Panning
 - Click and drag mouse, or use pan control at top left of map.
- Base Map Selection
 - Selectable using drop down at top left of map view.

- Well Selection
 - Clicking on a well point will display the well's segments in the Data View.
 - The Load All Well Segments button will load well segments from all wells into the Data View.
 - If a well has no segments, or if the well segment data is already shown in the Data View, a message box will appear to indicate either of these situations.
 - Selected wells (i.e. wells with well segments shown in the Data View) are highlighted in the Map View.
- Current Limitations
 - The only way to select multiple wells is to click on each one at a time or by using the Load All Well Segments button.
 - It is not possible to see how many well segments a well has before clicking it with the mouse.

Data View

- The primary purpose of the Data View is to select individual well segments.
- Each row in the Data View corresponds to one well segment.
- Well segments from wells selected in the Map View will be shown in the Data View.
- The Clear Well Segments button removes all well segments from the Data View.
- The Load All Well Segment button loads all available well segments into the Data View.

Working with Well Segment Data

- Well segment data can be interactively grouped, sorted, filtered, selected and copied easily in the Data View. This facilitates finding well segments of particular interest.
- Grouping Data
 - Drag and drop a column label in the grey area directly above the column labels.
 - Subgrouping is possible by dragging and dropping multiple column labels individually.
- Reordering Data Columns
 - Drag a column label horizontally to a new position and drop it in place.
 - Reordering data columns is very useful to when data has been grouped or sorted.
- Sorting Data
 - Click a column label once to sort in ascending order. Further clicks will toggle to sort by descending or ascending order.
 - Multiple sorting levels are also possible by first sorting one column as just described, and then Ctrl-clicking additional columns. For example, sort by Well Type, and then sort by Geologic Unit.
- Filtering Data
 - Hold the mouse pointer near the right side of a column label to display a drop down arrow. Clicking the drop down arrow will display a filter settings box.
 - Filter settings for the column can then be set.
- Selecting Well Segments
 - Select a single well segment by clicking on the row for a well segment.
 - Select multiple well segments by first selecting a single well segment, then press the Ctrl or Shift key and click on another well segment. Ctrl-click selection will only select the well segments clicked, whereas Shift-click selection will select all well segments between the first and last well segments selected.
 - Select all well segments by first clicking on a well segment row or a group row, then press Ctrl-A.

- Copying Well Segment Data
 - First select one or more well segments, then press Ctrl-C to copy data from the selected well segment rows to the clipboard.
 - The data from the clipboard can then be pasted to another application such as Excel by pressing Ctrl-P.
- Current Limitations
 - Wells for selected well segments are not highlighted in the Map View.

Plotting Well Segment Time-Series Data

- Different types of measurements, such as head, water flow rate, and temperature, may be associated with each well segment.
- Plotting Time-Series Data
 - Select one or more well segments in the Data View.
 - Click on one of the Plot buttons at the top right of the Data View.
 - All data for the selected well segment and specified measurement type is retrieved from the database for plotting.
 - A new tab for each plot, or Graph View, is created beside the Home Tab at the top right of the display.
 - To close a Graph View tab, click the 'X' located to the right of each tab.
- Current Limitations
 - Measurement types and number of measurements are not shown in the Data View.

Graph View

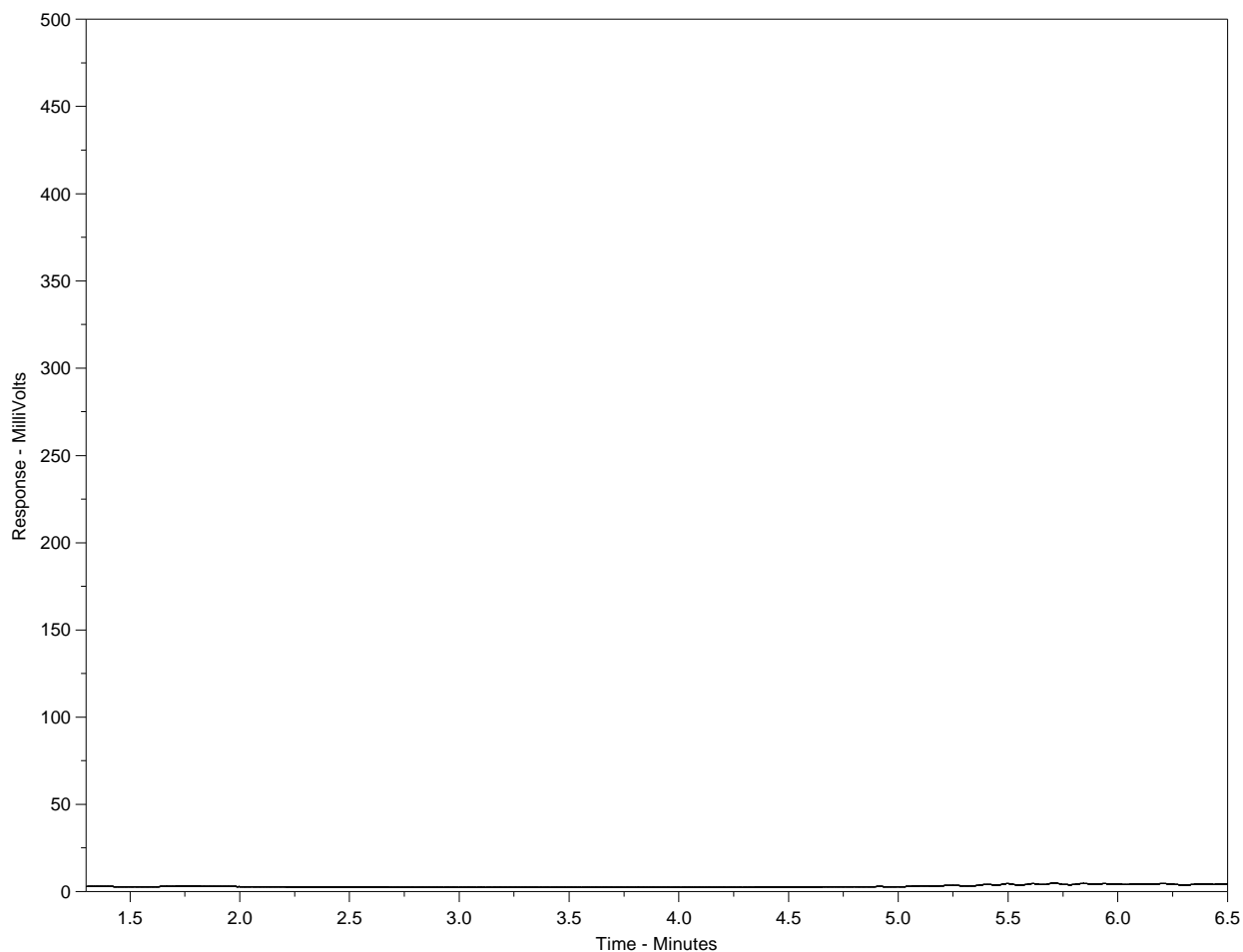
- The purpose of the Graph View is to graphically browse and export time-series data.
- Data Zoom
 - By default, the Axis XY radio button at the bottom right of the Graph View should be selected. If not, select it.
 - Mouse-click and drag a rectangle over the plot area of interest.
 - The plot will be re-drawn to show only the area selected.
 - Click the Zoom Out button to redraw the plot at the original scale.
 - The Axis X and Axis Y radio buttons can be used to select zoom ranges along the x- and y-axes, respectively.
- Symbol Toggle
 - There may be tens of thousands of data points in each time-series.
 - Symbols can slow display time and therefore can be toggled using the Show Symbols checkbox at the bottom of the Graph View.
 - The number of symbols shown depends on the amount of zoom and the amount of data points shown on the plot. At some point when zooming in, there will be a 1:1 symbols to data point ratio.
- Export Data
 - Click the Export button, and select a folder location and file name to save an Excel file.
 - If a large data set is exported, the user interface may become unresponsive during the latter portion of the data export process.

APPENDIX C
LABORATORY REPORTS

Hydrocarbon Distribution Report



ALS Sample ID: L1366644-1
Client ID: 16054130922043



F2		F3		F4		F4	
nC10	nC16			nC34	nC50		
174°C	287°C			481°C	575°C		
346°F	549°F			898°F	1067°F		
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

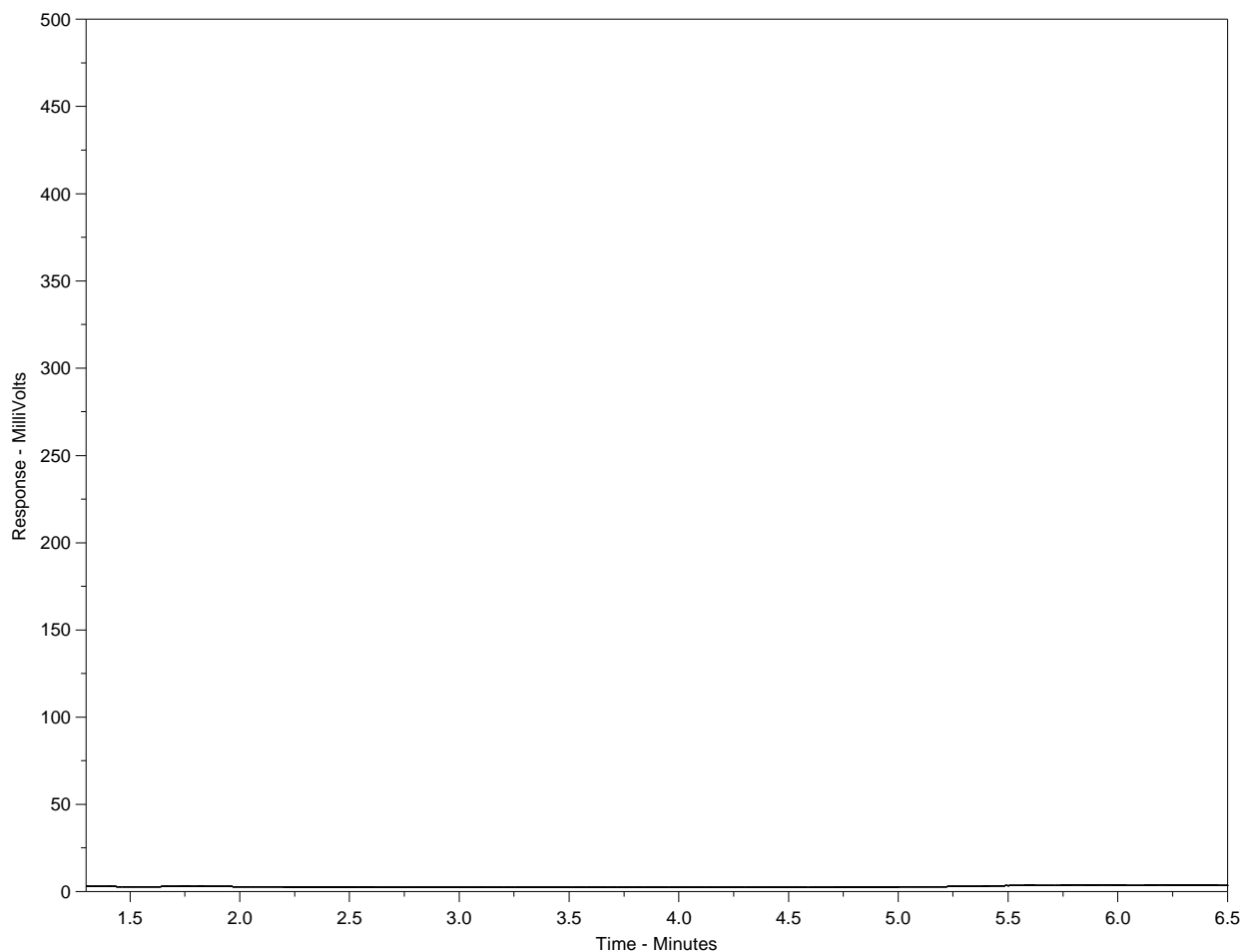
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1366644-2
Client ID: 16054130922044



← F2 →		← F3 →		← F4 →		← F4 →	
nC10	nC16	nC34	nC50				
174°C	287°C	481°C	575°C				
346°F	549°F	898°F	1067°F				
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →				
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

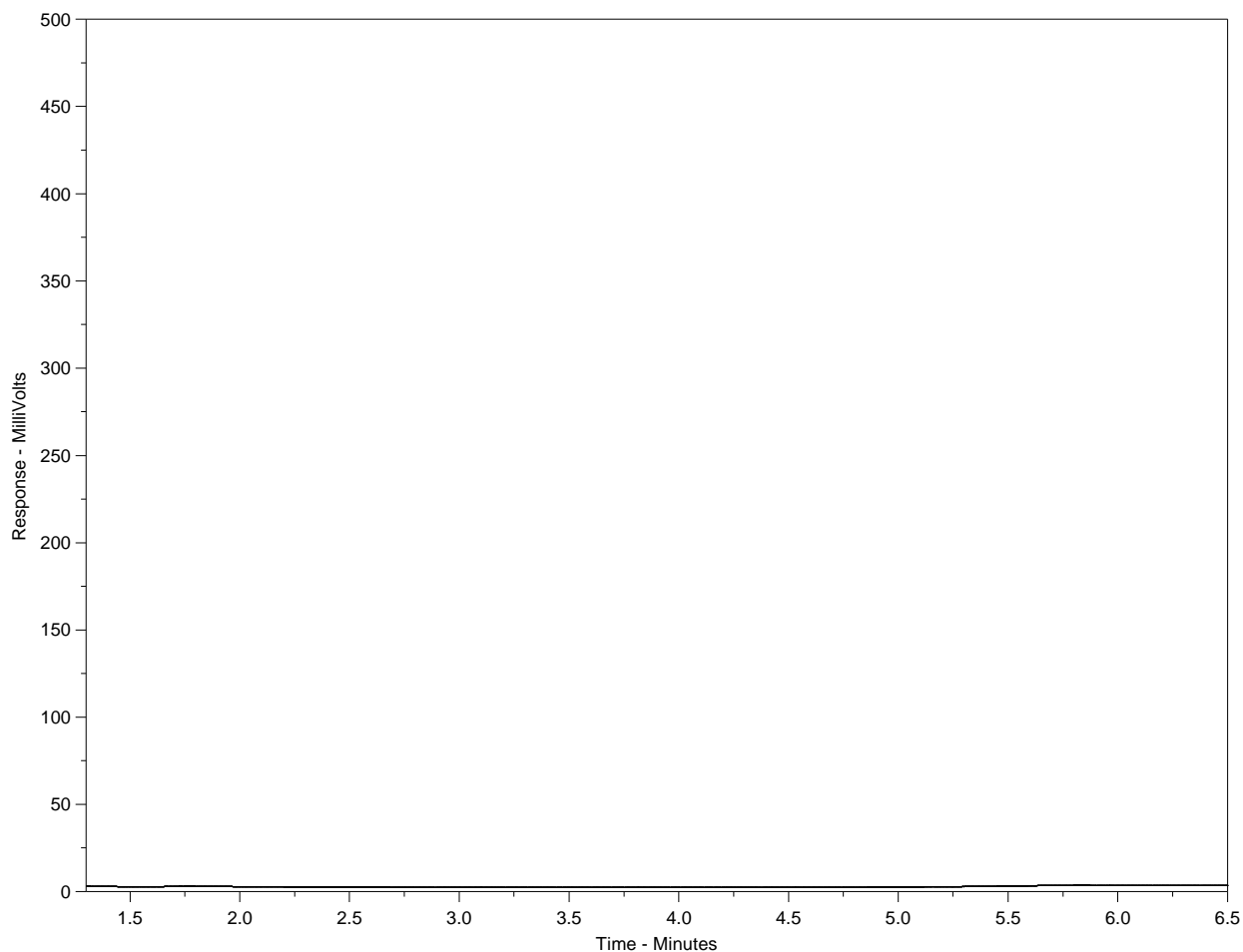
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1366644-3
Client ID: 16054130922045



← F2 →		← F3 →		← F4 →		← F4 →	
nC10	nC16			nC34		nC50	
174°C	287°C			481°C		575°C	
346°F	549°F			898°F		1067°F	
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

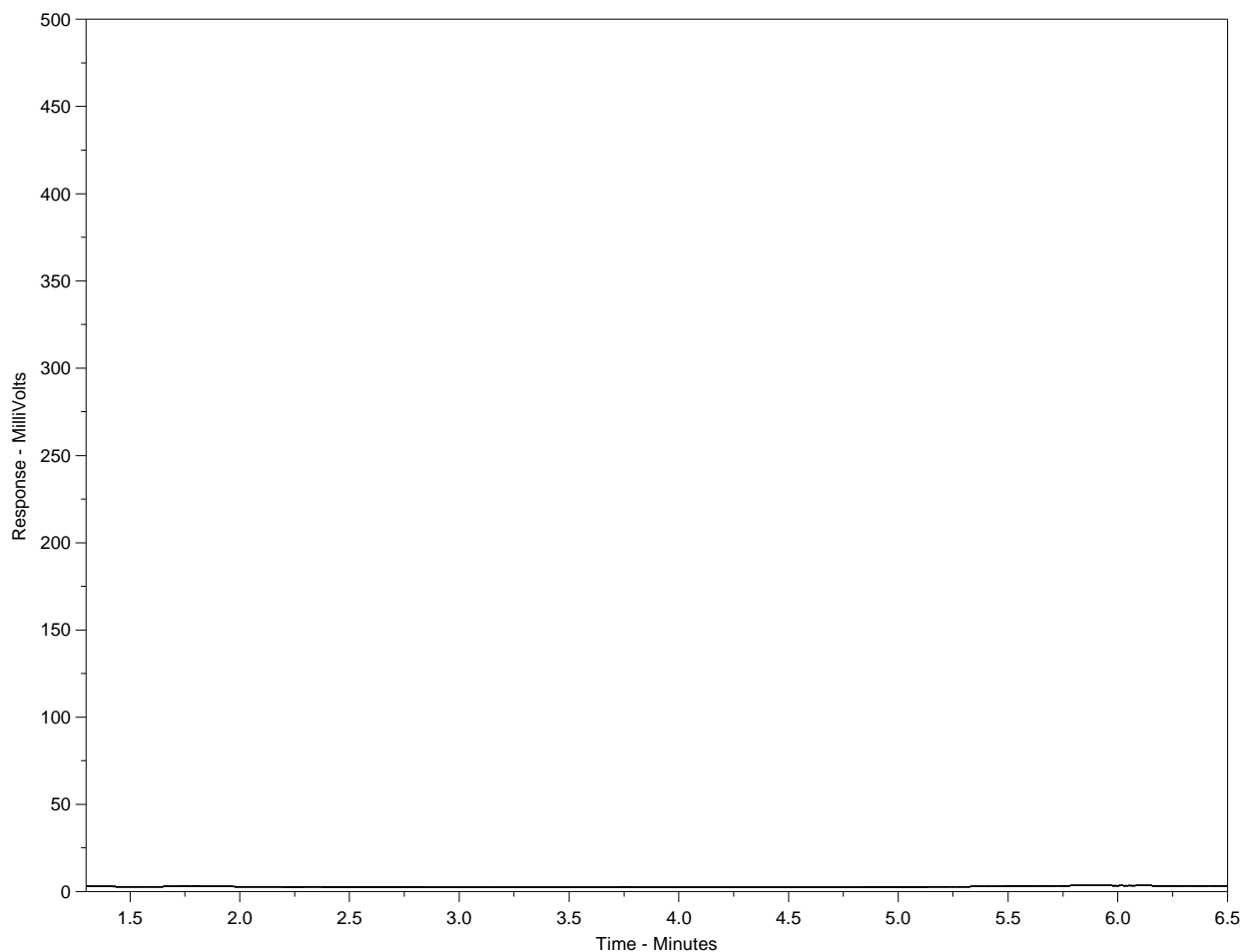
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1366644-4
Client ID: 16054130922046



← F2 →		← F3 →		← F4 →		← F4 →	
nC10	nC16	nC34	nC50				
174°C	287°C	481°C	575°C				
346°F	549°F	898°F	1067°F				
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →					
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.



MATRIX SOLUTIONS INC.
ATTN: SUE RAYNARD
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Date Received: 23-SEP-13
Report Date: 17-DEC-13 13:46 (MT)
Version: FINAL REV. 4

Client Phone: 403-237-0606

Certificate of Analysis

Lab Work Order #: L1366644
Project P.O. #: NOT SUBMITTED
Job Reference: MARIANA LAKE (SAOS) 16054-502 7-19-80-13
C of C Numbers: M060594
Legal Site Desc: 7-19-80-13

Comments: ADDITIONAL 18-OCT-13 11:18
17-DEC-2013 LORs for Ag and Al have been fixed


Catherine Evaristo-Cordero
Senior Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 9936-67 Avenue, Edmonton, AB T6E 0P5 Canada | Phone: +1 780 413 5227 | Fax: +1 780 437 2311
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1366644-1 16054130922043									
Sampled By: JF/GK on 22-SEP-13									
Matrix: Water									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702007
Toluene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702007
EthylBenzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702007
o-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702007
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702007
Styrene	<0.0010	-		0.0010	mg/L	-		30-SEP-13	R2702007
F1(C6-C10)	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702007
F1-BTEX	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702007
Xylenes	<0.00071	-		0.00071	mg/L	-		30-SEP-13	R2702007
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	02-OCT-13	02-OCT-13	R2707487
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	02-OCT-13	02-OCT-13	R2707487
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	02-OCT-13	02-OCT-13	R2707487
Surr: 2-Bromobenzotrifluoride	91.5	-		N/A	%	-	02-OCT-13	02-OCT-13	R2707487
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.598	+/-0.072		0.0020	mg/L	0		06-OCT-13	R2709757
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-SEP-13	R2701610
Miscellaneous Parameters									
Ammonia, Total (as N)	1.45	-		0.050	mg/L	-		03-OCT-13	R2707594
Dissolved Organic Carbon	7.0	+/-0.9		1.0	mg/L	0		06-OCT-13	R2710003
Iron Bacteria	See Attached	-				-		24-SEP-13	R2704840
Naphthenic Acids	<1.0	-		1.0	mg/L	-	30-SEP-13	30-SEP-13	R2704473
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		07-OCT-13	R2710827
Sulphate Reducing Bacteria	See Attached	-				-		24-SEP-13	R2704840
Total Kjeldahl Nitrogen	2.06	+/-0.42		0.20	mg/L	0	07-OCT-13	07-OCT-13	R2710906
Phosphorus (P)-Total	0.561	+/-0.048		0.020	mg/L	0	25-SEP-13	26-SEP-13	R2701623
Turbidity	233	+/-20		0.10	NTU	0		24-SEP-13	R2700132
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Anthracene	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Fluoranthene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Fluorene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Naphthalene	0.000176	+/-0.000061		0.000050	mg/L	0	01-OCT-13	04-OCT-13	R2708717
Phenanthrene	<0.000050	-		0.000050	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Pyrene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Benzo(a)pyrene	<0.0000050	-		0.0000050	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Chrysene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Dibenzo(a,h)anthracene	<0.0000050	-		0.0000050	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Surr: Nitrobenzene d5	69.5	-		N/A	%	-	01-OCT-13	04-OCT-13	R2708717

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1366644-1 16054130922043									
Sampled By: JF/GK on 22-SEP-13									
Matrix: Water									
PAH & Carcinogenic PAH List									
Surr: 2-Fluorobiphenyl	71.8	-		N/A	%	-	01-OCT-13	04-OCT-13	R2708717
Surr: p-Terphenyl d14	104.0	-		N/A	%	-	01-OCT-13	04-OCT-13	R2708717
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	0.89	+/-0.07		0.50	mg/L	0		24-SEP-13	R2701343
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0029	+/-0.0006		0.0010	mg/L	0		06-OCT-13	R2709757
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	0		06-OCT-13	R2709757
Arsenic (As)-Dissolved	0.00176	+/-0.00018		0.00040	mg/L	0		06-OCT-13	R2709757
Barium (Ba)-Dissolved	0.0356	+/-0.0031		0.00010	mg/L	0		06-OCT-13	R2709757
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		06-OCT-13	R2709757
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		06-OCT-13	R2709757
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		06-OCT-13	R2709757
Calcium (Ca)-Dissolved	78.0	+/-11		0.50	mg/L	0		06-OCT-13	R2709757
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		06-OCT-13	R2709757
Cobalt (Co)-Dissolved	0.00038	+/-0.00004		0.00010	mg/L	0		06-OCT-13	R2709757
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		06-OCT-13	R2709757
Iron (Fe)-Dissolved	0.352	+/-0.032		0.010	mg/L	0		06-OCT-13	R2709757
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		06-OCT-13	R2709757
Magnesium (Mg)-Dissolved	19.9	+/-1.6		0.10	mg/L	0		06-OCT-13	R2709757
Manganese (Mn)-Dissolved	0.628	+/-0.043		0.0020	mg/L	0		06-OCT-13	R2709757
Molybdenum (Mo)-Dissolved	0.0184	+/-0.0019		0.00010	mg/L	0		06-OCT-13	R2709757
Nickel (Ni)-Dissolved	0.00221	+/-0.00018		0.00010	mg/L	0		06-OCT-13	R2709757
Potassium (K)-Dissolved	5.35	+/-0.41		0.50	mg/L	0		06-OCT-13	R2709757
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	0		06-OCT-13	R2709757
Silicon (Si)-Dissolved	10.3	+/-0.87		0.050	mg/L	0		06-OCT-13	R2709757
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		06-OCT-13	R2709757
Sodium (Na)-Dissolved	103	+/-7.2		1.0	mg/L	0		06-OCT-13	R2709757
Strontium (Sr)-Dissolved	0.578	+/-0.043		0.00010	mg/L	0		06-OCT-13	R2709757
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		06-OCT-13	R2709757
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		06-OCT-13	R2709757
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		06-OCT-13	R2709757
Uranium (U)-Dissolved	0.00154	+/-0.00016		0.00010	mg/L	0		06-OCT-13	R2709757
Vanadium (V)-Dissolved	0.00022	+/-0.00002		0.00010	mg/L	0		06-OCT-13	R2709757
Zinc (Zn)-Dissolved	<0.0010	-		0.0010	mg/L	-		06-OCT-13	R2709757
Ion Balance Calculation									
Ion Balance	100	-			%	-		07-OCT-13	
TDS (Calculated)	555	-			mg/L	-		07-OCT-13	
Hardness (as CaCO3)	277	-			mg/L	-		07-OCT-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		24-SEP-13	R2701343
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		27-SEP-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		24-SEP-13	R2701343
Sulfate by IC									
Sulfate (SO4)	111	+/-4.6		0.50	mg/L	0		24-SEP-13	R2701343
pH, Conductivity and Total Alkalinity									
pH	8.48	+/-0.04		0.10	pH	0		26-SEP-13	R2700213
Conductivity (EC)	877	+/-29		0.20	uS/cm	0		26-SEP-13	R2700213
Bicarbonate (HCO3)	459	-		5.0	mg/L	-		26-SEP-13	R2700213
Carbonate (CO3)	10.8	-		5.0	mg/L	-		26-SEP-13	R2700213

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1366644-1 16054130922043 Sampled By: JF/GK on 22-SEP-13 Matrix: Water									
pH, Conductivity and Total Alkalinity									
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		26-SEP-13	R2700213
Alkalinity, Total (as CaCO3)	394	+/-14		2.0	mg/L	0		26-SEP-13	R2700213
L1366644-2 16054130922044 Sampled By: JF/GK on 22-SEP-13 Matrix: Water									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702007
Toluene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702007
EthylBenzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702007
o-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702007
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702007
Styrene	<0.0010	-		0.0010	mg/L	-		30-SEP-13	R2702007
F1(C6-C10)	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702007
F1-BTEX	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702007
Xylenes	<0.00071	-		0.00071	mg/L	-		30-SEP-13	R2702007
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	02-OCT-13	02-OCT-13	R2707487
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	02-OCT-13	02-OCT-13	R2707487
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	02-OCT-13	02-OCT-13	R2707487
Surr: 2-Bromobenzotrifluoride	91.6	-		N/A	%	-	02-OCT-13	02-OCT-13	R2707487
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.475	+/-0.057		0.0020	mg/L	0		06-OCT-13	R2709757
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-SEP-13	R2701610
Miscellaneous Parameters									
Ammonia, Total (as N)	1.73	-		0.050	mg/L	-		03-OCT-13	R2707594
Dissolved Organic Carbon	6.1	+/-0.9		1.0	mg/L	0		07-OCT-13	R2710003
Iron Bacteria	See Attached	-				-		24-SEP-13	R2704840
Naphthenic Acids	<1.0	-		1.0	mg/L	-	30-SEP-13	30-SEP-13	R2704473
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		07-OCT-13	R2710827
Sulphate Reducing Bacteria	See Attached	-				-		24-SEP-13	R2704840
Total Kjeldahl Nitrogen	2.23	+/-0.45		0.20	mg/L	0	07-OCT-13	07-OCT-13	R2710906
Phosphorus (P)-Total	0.452	+/-0.040		0.020	mg/L	0	25-SEP-13	26-SEP-13	R2701623
Turbidity	19.1	+/-1.7		0.10	NTU	0		24-SEP-13	R2700132
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Anthracene	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Fluoranthene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Fluorene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Naphthalene	0.000074	+/-0.000039		0.000050	mg/L	0	01-OCT-13	04-OCT-13	R2708717
Phenanthrene	<0.000050	-		0.000050	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Pyrene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Benzo(a)pyrene	<0.000050	-		0.000050	mg/L	-	01-OCT-13	04-OCT-13	R2708717

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1366644-2 16054130922044 Sampled By: JF/GK on 22-SEP-13 Matrix: Water									
Sulfate by IC									
Sulfate (SO4)	114	+/-4.8		0.50	mg/L	0		24-SEP-13	R2701343
pH, Conductivity and Total Alkalinity									
pH	8.54	+/-0.04		0.10	pH	0		26-SEP-13	R2700213
Conductivity (EC)	890	+/-30		0.20	uS/cm	0		26-SEP-13	R2700213
Bicarbonate (HCO3)	453	-		5.0	mg/L	-		26-SEP-13	R2700213
Carbonate (CO3)	14.0	-		5.0	mg/L	-		26-SEP-13	R2700213
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		26-SEP-13	R2700213
Alkalinity, Total (as CaCO3)	394	+/-14		2.0	mg/L	0		26-SEP-13	R2700213
L1366644-3 16054130922045 Sampled By: JF/GK on 22-SEP-13 Matrix: Water									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702007
Toluene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702007
EthylBenzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702007
o-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702007
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702007
Styrene	<0.0010	-		0.0010	mg/L	-		30-SEP-13	R2702007
F1(C6-C10)	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702007
F1-BTEX	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702007
Xylenes	<0.00071	-		0.00071	mg/L	-		30-SEP-13	R2702007
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	02-OCT-13	02-OCT-13	R2707487
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	02-OCT-13	02-OCT-13	R2707487
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	02-OCT-13	02-OCT-13	R2707487
Surr: 2-Bromobenzotrifluoride	92.8	-		N/A	%	-	02-OCT-13	02-OCT-13	R2707487
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.180	+/-0.022		0.0020	mg/L	0		06-OCT-13	R2709757
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-SEP-13	R2701610
Miscellaneous Parameters									
Ammonia, Total (as N)	0.833	-		0.050	mg/L	-		03-OCT-13	R2707594
Dissolved Organic Carbon	8.6	+/-1.1		1.0	mg/L	0		07-OCT-13	R2710003
Iron Bacteria	See Attached	-				-		24-SEP-13	R2704840
Naphthenic Acids	<1.0	-		1.0	mg/L	-	30-SEP-13	30-SEP-13	R2704473
Phenols (4AAP)	0.0012	+/-0.0007		0.0010	mg/L	-6.9%		07-OCT-13	R2710827
Sulphate Reducing Bacteria	See Attached	-				-		24-SEP-13	R2704840
Total Kjeldahl Nitrogen	0.94	+/-0.20		0.20	mg/L	0	07-OCT-13	07-OCT-13	R2710906
Phosphorus (P)-Total	1.22	+/-0.098		0.020	mg/L	0	25-SEP-13	26-SEP-13	R2701623
Turbidity	149	+/-13		0.10	NTU	0		24-SEP-13	R2700132
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Anthracene	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Fluoranthene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Fluorene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Naphthalene	<0.000050	-		0.000050	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Phenanthrene	<0.000050	-		0.000050	mg/L	-	01-OCT-13	04-OCT-13	R2708717

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1366644-3 16054130922045									
Sampled By: JF/GK on 22-SEP-13									
Matrix: Water									
PAH & Carcinogenic PAH List									
Pyrene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Benzo(a)pyrene	<0.0000050	-		0.000005	mg/L	-	01-OCT-13	04-OCT-13	R2708717
				0					
Chrysene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Dibenzo(a,h)anthracene	<0.0000050	-		0.000005	mg/L	-	01-OCT-13	04-OCT-13	R2708717
				0					
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Surr: Nitrobenzene d5	81.4	-		N/A	%	-	01-OCT-13	04-OCT-13	R2708717
Surr: 2-Fluorobiphenyl	81.0	-		N/A	%	-	01-OCT-13	04-OCT-13	R2708717
Surr: p-Terphenyl d14	108.5	-		N/A	%	-	01-OCT-13	04-OCT-13	R2708717
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	3.38	+/-0.13		0.50	mg/L	0		24-SEP-13	R2701343
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0024	+/-0.0005		0.0010	mg/L	0		06-OCT-13	R2709757
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		06-OCT-13	R2709757
Arsenic (As)-Dissolved	0.0212	+/-0.0022		0.00040	mg/L	0		06-OCT-13	R2709757
Barium (Ba)-Dissolved	0.0644	+/-0.0056		0.00010	mg/L	0		06-OCT-13	R2709757
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		06-OCT-13	R2709757
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		06-OCT-13	R2709757
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		06-OCT-13	R2709757
Calcium (Ca)-Dissolved	81.0	+/-11		0.50	mg/L	0		06-OCT-13	R2709757
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		06-OCT-13	R2709757
Cobalt (Co)-Dissolved	0.00011	+/-0.00001		0.00010	mg/L	0		06-OCT-13	R2709757
Copper (Cu)-Dissolved	0.00085	+/-0.00007		0.00060	mg/L	0		06-OCT-13	R2709757
Iron (Fe)-Dissolved	9.28	+/-0.84		0.010	mg/L	0		06-OCT-13	R2709757
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		06-OCT-13	R2709757
Magnesium (Mg)-Dissolved	20.7	+/-1.6		0.10	mg/L	0		06-OCT-13	R2709757
Manganese (Mn)-Dissolved	0.481	+/-0.033		0.0020	mg/L	0		06-OCT-13	R2709757
Molybdenum (Mo)-Dissolved	0.00905	+/-0.00095		0.00010	mg/L	0		06-OCT-13	R2709757
Nickel (Ni)-Dissolved	0.00036	+/-0.00005		0.00010	mg/L	0		06-OCT-13	R2709757
Potassium (K)-Dissolved	4.26	+/-0.33		0.50	mg/L	0		06-OCT-13	R2709757
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		06-OCT-13	R2709757
Silicon (Si)-Dissolved	9.97	+/-0.85		0.050	mg/L	0		06-OCT-13	R2709757
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		06-OCT-13	R2709757
Sodium (Na)-Dissolved	19.7	+/-1.4		1.0	mg/L	0		06-OCT-13	R2709757
Strontium (Sr)-Dissolved	0.466	+/-0.035		0.00010	mg/L	0		06-OCT-13	R2709757
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		06-OCT-13	R2709757
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		06-OCT-13	R2709757
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		06-OCT-13	R2709757
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		06-OCT-13	R2709757
Vanadium (V)-Dissolved	0.00011	+/-0.00001		0.00010	mg/L	0		06-OCT-13	R2709757
Zinc (Zn)-Dissolved	0.0155	+/-0.0018		0.0010	mg/L	0		06-OCT-13	R2709757
Ion Balance Calculation									
Ion Balance	96.8	-			%	-		07-OCT-13	
TDS (Calculated)	348	-			mg/L	-		07-OCT-13	
Hardness (as CaCO3)	287	-			mg/L	-		07-OCT-13	

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1366644-3 16054130922045 Sampled By: JF/GK on 22-SEP-13 Matrix: Water									
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		24-SEP-13	R2701343
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		27-SEP-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		24-SEP-13	R2701343
Sulfate by IC									
Sulfate (SO4)	31.3	+/-1.3		0.50	mg/L	0		24-SEP-13	R2701343
pH, Conductivity and Total Alkalinity									
pH	8.43	+/-0.04		0.10	pH	0		26-SEP-13	R2700213
Conductivity (EC)	601	+/-20		0.20	uS/cm	0		26-SEP-13	R2700213
Bicarbonate (HCO3)	368	-		5.0	mg/L	-		26-SEP-13	R2700213
Carbonate (CO3)	6.4	-		5.0	mg/L	-		26-SEP-13	R2700213
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		26-SEP-13	R2700213
Alkalinity, Total (as CaCO3)	312	+/-12		2.0	mg/L	0		26-SEP-13	R2700213
L1366644-4 16054130922046 Sampled By: JF/GK on 22-SEP-13 Matrix: Water									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	29-SEP-13	30-SEP-13	R2702007
Toluene	0.00057	-		0.00050	mg/L	-	29-SEP-13	30-SEP-13	R2702007
EthylBenzene	<0.00050	-		0.00050	mg/L	-	29-SEP-13	30-SEP-13	R2702007
o-Xylene	<0.00050	-		0.00050	mg/L	-	29-SEP-13	30-SEP-13	R2702007
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	29-SEP-13	30-SEP-13	R2702007
Styrene	<0.0010	-		0.0010	mg/L	-	29-SEP-13	30-SEP-13	R2702007
F1(C6-C10)	<0.10	-		0.10	mg/L	-	29-SEP-13	30-SEP-13	R2702007
F1-BTEX	<0.10	-		0.10	mg/L	-	29-SEP-13	30-SEP-13	R2702007
Xylenes	<0.00071	-		0.00071	mg/L	-	29-SEP-13	30-SEP-13	R2702007
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	02-OCT-13	02-OCT-13	R2707487
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	02-OCT-13	02-OCT-13	R2707487
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	02-OCT-13	02-OCT-13	R2707487
Surr: 2-Bromobenzotrifluoride	91.7	-		N/A	%	-	02-OCT-13	02-OCT-13	R2707487
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.107	+/-0.013		0.0020	mg/L	0		06-OCT-13	R2709757
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		27-SEP-13	R2701610
Miscellaneous Parameters									
Ammonia, Total (as N)	<0.050	-		0.050	mg/L	-		03-OCT-13	R2707594
Dissolved Organic Carbon	5.4	+/-0.8		1.0	mg/L	0		07-OCT-13	R2710003
Iron Bacteria	See Attached	-				-		24-SEP-13	R2704840
Naphthenic Acids	<1.0	-		1.0	mg/L	-	30-SEP-13	30-SEP-13	R2704473
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		07-OCT-13	R2710827
Sulphate Reducing Bacteria	See Attached	-				-		24-SEP-13	R2704840
Total Kjeldahl Nitrogen	<0.20	-		0.20	mg/L	-	07-OCT-13	07-OCT-13	R2710906
Phosphorus (P)-Total	0.161	+/-0.021		0.020	mg/L	0	25-SEP-13	26-SEP-13	R2701623
Turbidity	80.6	+/-7.1		0.10	NTU	0		24-SEP-13	R2700132
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1366644-4 16054130922046									
Sampled By: JF/GK on 22-SEP-13									
Matrix: Water									
PAH & Carcinogenic PAH List									
Anthracene	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Fluoranthene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Fluorene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Naphthalene	<0.000050	-		0.000050	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Phenanthrene	<0.000050	-		0.000050	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Pyrene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Benzo(a)pyrene	<0.000050	-		0.000005	mg/L	-	01-OCT-13	04-OCT-13	R2708717
				0					
Chrysene	<0.000020	-		0.000020	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Dibenzo(a,h)anthracene	<0.000050	-		0.000005	mg/L	-	01-OCT-13	04-OCT-13	R2708717
				0					
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	01-OCT-13	04-OCT-13	R2708717
Surr: Nitrobenzene d5	76.4	-		N/A	%	-	01-OCT-13	04-OCT-13	R2708717
Surr: 2-Fluorobiphenyl	77.9	-		N/A	%	-	01-OCT-13	04-OCT-13	R2708717
Surr: p-Terphenyl d14	100.1	-		N/A	%	-	01-OCT-13	04-OCT-13	R2708717
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	2.01	+/-0.10		0.50	mg/L	0		24-SEP-13	R2701343
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0428	+/-0.006		0.0010	mg/L	0		06-OCT-13	R2709757
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		06-OCT-13	R2709757
Arsenic (As)-Dissolved	0.00181	+/-0.00019		0.00040	mg/L	0		06-OCT-13	R2709757
Barium (Ba)-Dissolved	0.113	+/-0.0098		0.00010	mg/L	0		06-OCT-13	R2709757
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		06-OCT-13	R2709757
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		06-OCT-13	R2709757
Cadmium (Cd)-Dissolved	0.00015	+/-0.00002		0.00010	mg/L	0		06-OCT-13	R2709757
Calcium (Ca)-Dissolved	55.8	+/-7.6		0.50	mg/L	0		06-OCT-13	R2709757
Chromium (Cr)-Dissolved	0.00062	+/-0.00005		0.00040	mg/L	0		06-OCT-13	R2709757
Cobalt (Co)-Dissolved	0.00660	+/-0.00062		0.00010	mg/L	0		06-OCT-13	R2709757
Copper (Cu)-Dissolved	0.00215	+/-0.00016		0.00060	mg/L	0		06-OCT-13	R2709757
Iron (Fe)-Dissolved	0.633	+/-0.057		0.010	mg/L	0		06-OCT-13	R2709757
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		06-OCT-13	R2709757
Magnesium (Mg)-Dissolved	12.8	+/-0.99		0.10	mg/L	0		06-OCT-13	R2709757
Manganese (Mn)-Dissolved	0.936	+/-0.064		0.0020	mg/L	0		06-OCT-13	R2709757
Molybdenum (Mo)-Dissolved	0.00240	+/-0.00025		0.00010	mg/L	0		06-OCT-13	R2709757
Nickel (Ni)-Dissolved	0.0341	+/-0.0028		0.00010	mg/L	0		06-OCT-13	R2709757
Potassium (K)-Dissolved	4.10	+/-0.32		0.50	mg/L	0		06-OCT-13	R2709757
Selenium (Se)-Dissolved	0.00122	+/-0.00020		0.00040	mg/L	0		06-OCT-13	R2709757
Silicon (Si)-Dissolved	14.1	+/-1.2		0.050	mg/L	0		06-OCT-13	R2709757
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		06-OCT-13	R2709757
Sodium (Na)-Dissolved	18.9	+/-1.3		1.0	mg/L	0		06-OCT-13	R2709757
Strontium (Sr)-Dissolved	0.260	+/-0.019		0.00010	mg/L	0		06-OCT-13	R2709757
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		06-OCT-13	R2709757
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		06-OCT-13	R2709757
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		06-OCT-13	R2709757
Uranium (U)-Dissolved	0.00029	+/-0.00003		0.00010	mg/L	0		06-OCT-13	R2709757
Vanadium (V)-Dissolved	0.00011	+/-0.00001		0.00010	mg/L	0		06-OCT-13	R2709757

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1366644-4 16054130922046									
Sampled By: JF/GK on 22-SEP-13									
Matrix: Water									
Dissolved Metals in Water by CRC ICPMS									
Zinc (Zn)-Dissolved	0.204	+/-0.024		0.0010	mg/L	0		06-OCT-13	R2709757
Ion Balance Calculation									
Ion Balance	102	-			%	-		07-OCT-13	
TDS (Calculated)	260	-			mg/L	-		07-OCT-13	
Hardness (as CaCO3)	192	-			mg/L	-		07-OCT-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		24-SEP-13	R2701343
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		27-SEP-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		24-SEP-13	R2701343
Sulfate by IC									
Sulfate (SO4)	74.2	+/-3.1		0.50	mg/L	0		24-SEP-13	R2701343
pH, Conductivity and Total Alkalinity									
pH	7.89	+/-0.04		0.10	pH	0		26-SEP-13	R2700213
Conductivity (EC)	442	+/-15		0.20	uS/cm	0		26-SEP-13	R2700213
Bicarbonate (HCO3)	187	-		5.0	mg/L	-		26-SEP-13	R2700213
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		26-SEP-13	R2700213
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		26-SEP-13	R2700213
Alkalinity, Total (as CaCO3)	153	+/-6.4		2.0	mg/L	0		26-SEP-13	R2700213
* Refer to Referenced Information for Qualifiers (if any) and Methodology.									

Reference Information

Report Comments: ADDITIONAL 18-OCT-13 11:18
17-DEC-2013 LORs for Ag and Al have been fixed

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Phosphorus (P)-Total	MS-B	
Matrix Spike	Phosphorus (P)-Total	MS-B	
Matrix Spike	Chloride (Cl)	MS-B	

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
B-D-L-CCMS-ED	Water	Dissolved Boron in Water by CRC ICPMS		APHA 3030 B / EPA SW-846 6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).				
BTXS,F1-ED	Water	BTEX, Styrene and F1 (C6-C10)		EPA 5021/8015&8260 GC-MS & FID
C-DIS-ORG-ED	Water	Dissolved Organic Carbon		APHA 5310 B-Instrumental
CL-IC-ED	Water	Chloride by IC		APHA 4110 B-ION CHROMATOGRAPHY
F2,F3,F4-ED	Water	F2, F3, F4		EPA 3510/CCME PHC CWS-GC-FID
HG-D-CVAA-ED	Water	Mercury (Hg) - Dissolved		EPA 245.7 / EPA 245.1
IB-BART-PB	Water	Iron Bacteria		BART Test Kit
BART Test Kit Analysis performed at PBR Laboratories Inc., Edmonton.				
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET-D-CCMS-ED	Water	Dissolved Metals in Water by CRC ICPMS		APHA 3030 B&E / EPA SW-846 6020A
NAPHTHENIC-ACID-FM	Water	Naphthenic Acids by FTIR		Naphthenic Acids by FTIR, Syncrude, 1994
Dissolved naphthenic acids are solvent extracted from acidified aqueous samples using Dichloromethane prior to quantitation by Fourier Transform Infra-Red spectroscopy. Note that FTIR is not uniquely selective to naphthenic acids. If present, other carboxylic acids (e.g. humic acids, fulvic acids) may also be detected by this method.				
NH3-CFA-ED	Water	Ammonia in Water by Colour		APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.				
NO2+NO3-CALC-ED	Water	Nitrate+Nitrite		CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
P-T-COL-ED	Water	Total P in Water by Colour		APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.				
PAH-ABT1-ED	Water	PAH & Carcinogenic PAH List		EPA 3510/8270-GC/MS
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)				
PHENOLS-4AAP-ED	Water	Phenols (4AAP)		AB ENV.06537-COLORIMETRIC
This analysis is carried out using procedures adapted from ENVIRODAT VMV 06537 689, Method Code 154, in "Methods Manual for Chemical Analysis of Water and Wastes" published by the Alberta Environmental Centre. This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide and 4-aminoantipyrine to form a red complex which is measured at 505 nm.				
SO4-IC-ED	Water	Sulfate by IC		APHA 4110 B-ION CHROMATOGRAPHY
SRB-BART-PB	Water	Sulphate Reducing Bacteria / BART method		BART TEST KIT
BART Test Kit				

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
TKN-CFA-ED	Water	TKN in Water by Colour		APHA 4500-NORG (TKN)
This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 celcius with analysis using an automated colourimetric finish.				
TURBIDITY-ED	Water	Turbidity		APHA 2130 B-Nephelometer

** The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS methods may incorporate modifications from the specified reference to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
PB	PBR LABORATORIES
FM	ALS ENVIRONMENTAL - FORT MCMURRAY, ALBERTA, CANADA

Chain of Custody Numbers:

M060594

GLOSSARY OF REPORT TERMS

Surr - Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

MU: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.

Bias: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent.

Zero values indicate no detectable method bias.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Environmental

Quality Control Report

Workorder: L1366644

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-D-L-CCMS-ED		Water						
Batch	R2709757							
WG1762144-2	CRM	ED-HIGH-WATRM						
Boron (B)-Dissolved			98.9		%		80-120	06-OCT-13
WG1762144-3	DUP	L1363737-3						
Boron (B)-Dissolved		0.191	0.197		mg/L	3.2	20	06-OCT-13
WG1762144-4	DUP	L1366644-4						
Boron (B)-Dissolved		0.107	0.106		mg/L	0.4	20	06-OCT-13
WG1762144-8	DUP	L1370510-1						
Boron (B)-Dissolved		0.0861	0.0871		mg/L	1.1	20	06-OCT-13
WG1762144-1	MB							
Boron (B)-Dissolved			<0.0020		mg/L		0.002	06-OCT-13
BTXS,F1-ED		Water						
Batch	R2702007							
WG1757354-2	LCS							
Benzene			86.8		%		70-130	30-SEP-13
Toluene			72.3		%		70-130	30-SEP-13
EthylBenzene			85.2		%		70-130	30-SEP-13
o-Xylene			84.6		%		70-130	30-SEP-13
m+p-Xylene			85.2		%		70-130	30-SEP-13
Styrene			76.6		%		70-130	30-SEP-13
WG1757354-3	LCS							
F1(C6-C10)			99.5		%		70-130	30-SEP-13
WG1757354-1	MB							
Benzene			<0.00050		mg/L		0.0005	30-SEP-13
Toluene			<0.00050		mg/L		0.0005	30-SEP-13
EthylBenzene			<0.00050		mg/L		0.0005	30-SEP-13
o-Xylene			<0.00050		mg/L		0.0005	30-SEP-13
m+p-Xylene			<0.00050		mg/L		0.0005	30-SEP-13
Styrene			<0.0010		mg/L		0.001	30-SEP-13
F1(C6-C10)			<0.10		mg/L		0.1	30-SEP-13
C-DIS-ORG-ED		Water						
Batch	R2710003							
WG1762224-3	CVS							
Dissolved Organic Carbon			101.5		%		70-130	07-OCT-13
WG1762224-2	LCS							
Dissolved Organic Carbon			95.9		%		80-120	06-OCT-13
WG1762224-1	MB							



Quality Control Report

Workorder: L1366644

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C-DIS-ORG-ED		Water						
Batch	R2710003							
WG1762224-1	MB							
Dissolved Organic Carbon			<1.0		mg/L		1	06-OCT-13
CL-IC-ED		Water						
Batch	R2701343							
WG1754113-3	DUP	L1366644-3						
Chloride (Cl)		3.38	3.36		mg/L	0.5	20	24-SEP-13
WG1754113-5	DUP	L1365876-4						
Chloride (Cl)		0.77	0.70		mg/L	9.4	20	24-SEP-13
WG1754113-7	DUP	L1367334-4						
Chloride (Cl)		287	288		mg/L	0.6	20	24-SEP-13
WG1754113-2	LCS							
Chloride (Cl)			100.8		%		90-110	24-SEP-13
WG1754113-1	MB							
Chloride (Cl)			<0.50		mg/L		0.5	24-SEP-13
WG1754113-4	MS	L1366644-3						
Chloride (Cl)			102.6		%		75-125	24-SEP-13
WG1754113-6	MS	L1365876-4						
Chloride (Cl)			103.0		%		75-125	24-SEP-13
WG1754113-8	MS	L1367334-4						
Chloride (Cl)			N/A	MS-B	%		-	24-SEP-13
F2,F3,F4-ED		Water						
Batch	R2707487							
WG1759361-2	LCS							
F2 (>C10-C16)			101.1		%		65-135	02-OCT-13
F3 (C16-C34)			102.9		%		65-135	02-OCT-13
F4 (C34-C50)			102.0		%		65-135	02-OCT-13
WG1759361-5	LCS							
F2 (>C10-C16)			100.8		%		65-135	02-OCT-13
F3 (C16-C34)			105.2		%		65-135	02-OCT-13
F4 (C34-C50)			102.3		%		65-135	02-OCT-13
WG1759361-1	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	02-OCT-13
F3 (C16-C34)			<0.25		mg/L		0.25	02-OCT-13
F4 (C34-C50)			<0.25		mg/L		0.25	02-OCT-13
Surrogate: 2-Bromobenzotrifluoride			105.1		%		50-150	02-OCT-13
WG1759361-4	MB							



Quality Control Report

Workorder: L1366644

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2,F3,F4-ED		Water						
Batch	R2707487							
WG1759361-4	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	02-OCT-13
F3 (C16-C34)			<0.25		mg/L		0.25	02-OCT-13
F4 (C34-C50)			<0.25		mg/L		0.25	02-OCT-13
Surrogate: 2-Bromobenzotrifluoride			104.8		%		50-150	02-OCT-13
HG-D-CVAA-ED		Water						
Batch	R2701610							
WG1755329-11	DUP	L1367764-2						
Mercury (Hg)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	29-SEP-13
WG1755329-13	DUP	L1366644-1						
Mercury (Hg)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	29-SEP-13
WG1755329-2	LCS							
Mercury (Hg)-Dissolved			86.5		%		80-120	26-SEP-13
WG1755329-3	LCS	WG1755329-2						
Mercury (Hg)-Dissolved		86.5	87.4		%	1.1	20	26-SEP-13
WG1755329-1	MB							
Mercury (Hg)-Dissolved			<0.00010		mg/L		0.0001	26-SEP-13
WG1755329-10	MS	L1367764-2						
Mercury (Hg)-Dissolved			93.2		%		70-130	29-SEP-13
WG1755329-12	MS	L1366644-1						
Mercury (Hg)-Dissolved			105.7		%		70-130	29-SEP-13
MET-D-CCMS-ED		Water						
Batch	R2709757							
WG1762144-2	CRM	ED-HIGH-WATRM						
Aluminum (Al)-Dissolved			99.4		%		80-120	06-OCT-13
Antimony (Sb)-Dissolved			99.1		%		80-120	06-OCT-13
Arsenic (As)-Dissolved			99.6		%		80-120	06-OCT-13
Barium (Ba)-Dissolved			99.8		%		80-120	06-OCT-13
Beryllium (Be)-Dissolved			99.6		%		80-120	06-OCT-13
Bismuth (Bi)-Dissolved			97.3		%		80-120	06-OCT-13
Cadmium (Cd)-Dissolved			102.6		%		80-120	06-OCT-13
Calcium (Ca)-Dissolved			101.7		%		80-120	06-OCT-13
Chromium (Cr)-Dissolved			101.2		%		80-120	06-OCT-13
Cobalt (Co)-Dissolved			98.4		%		80-120	06-OCT-13
Copper (Cu)-Dissolved			96.0		%		80-120	06-OCT-13
Lead (Pb)-Dissolved			97.4		%		80-120	06-OCT-13



Quality Control Report

Workorder: L1366644

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED		Water						
Batch	R2709757							
WG1762144-2 CRM	ED-HIGH-WATRM							
Magnesium (Mg)-Dissolved			99.4		%		80-120	06-OCT-13
Manganese (Mn)-Dissolved			99.8		%		80-120	06-OCT-13
Molybdenum (Mo)-Dissolved			100.6		%		80-120	06-OCT-13
Nickel (Ni)-Dissolved			99.0		%		80-120	06-OCT-13
Potassium (K)-Dissolved			93.3		%		80-120	06-OCT-13
Selenium (Se)-Dissolved			102.8		%		80-120	06-OCT-13
Silicon (Si)-Dissolved			97.7		%		80-120	06-OCT-13
Silver (Ag)-Dissolved			95.0		%		80-120	06-OCT-13
Sodium (Na)-Dissolved			108.2		%		80-120	06-OCT-13
Strontium (Sr)-Dissolved			101.1		%		80-120	06-OCT-13
Thallium (Tl)-Dissolved			101.0		%		80-120	06-OCT-13
Titanium (Ti)-Dissolved			100.3		%		80-120	06-OCT-13
Tin (Sn)-Dissolved			96.7		%		80-120	06-OCT-13
Uranium (U)-Dissolved			94.8		%		80-120	06-OCT-13
Vanadium (V)-Dissolved			97.4		%		80-120	06-OCT-13
Zinc (Zn)-Dissolved			99.8		%		80-120	06-OCT-13
WG1762144-10 DUP		L1370659-1						
Aluminum (Al)-Dissolved		0.0020	0.0028	J	mg/L	0.0008	0.002	06-OCT-13
Antimony (Sb)-Dissolved		0.00165	0.00162		mg/L	2.1	20	06-OCT-13
Arsenic (As)-Dissolved		0.00124	0.00128		mg/L	3.1	20	06-OCT-13
Barium (Ba)-Dissolved		0.0589	0.0588		mg/L	0.2	20	06-OCT-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	06-OCT-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	06-OCT-13
Cadmium (Cd)-Dissolved		0.000011	<0.000010	RPD-NA	mg/L	N/A	20	06-OCT-13
Calcium (Ca)-Dissolved		97.3	95.2		mg/L	2.1	20	06-OCT-13
Chromium (Cr)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Cobalt (Co)-Dissolved		0.00061	0.00060		mg/L	0.3	20	06-OCT-13
Copper (Cu)-Dissolved		0.00108	0.00108		mg/L	0.5	20	06-OCT-13
Iron (Fe)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	06-OCT-13
Lead (Pb)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	06-OCT-13
Magnesium (Mg)-Dissolved		27.3	27.4		mg/L	0.2	20	06-OCT-13
Manganese (Mn)-Dissolved		0.142	0.140		mg/L	1.3	20	06-OCT-13
Molybdenum (Mo)-Dissolved		0.0307	0.0302		mg/L	1.9	20	06-OCT-13



Quality Control Report

Workorder: L1366644

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2709757							
WG1762144-10	DUP	L1370659-1						
Nickel (Ni)-Dissolved		0.00417	0.00401		mg/L	3.7	20	06-OCT-13
Potassium (K)-Dissolved		7.39	7.39		mg/L	0.0	20	06-OCT-13
Selenium (Se)-Dissolved		0.00321	0.00315		mg/L	1.9	20	06-OCT-13
Silicon (Si)-Dissolved		2.88	2.90		mg/L	0.7	20	06-OCT-13
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	06-OCT-13
Sodium (Na)-Dissolved		127	126		mg/L	0.4	20	06-OCT-13
Strontium (Sr)-Dissolved		0.729	0.717		mg/L	1.7	20	06-OCT-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	06-OCT-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	06-OCT-13
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Uranium (U)-Dissolved		0.0175	0.0176		mg/L	0.9	20	06-OCT-13
Vanadium (V)-Dissolved		0.00014	0.00015		mg/L	8.3	20	06-OCT-13
WG1762144-3	DUP	L1363737-3						
Aluminum (Al)-Dissolved		<0.0010	0.0012	RPD-NA	mg/L	N/A	20	06-OCT-13
Antimony (Sb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Arsenic (As)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Barium (Ba)-Dissolved		0.119	0.120		mg/L	0.3	20	06-OCT-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	06-OCT-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	06-OCT-13
Cadmium (Cd)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	06-OCT-13
Calcium (Ca)-Dissolved		80.0	78.0		mg/L	2.6	20	06-OCT-13
Chromium (Cr)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Copper (Cu)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Iron (Fe)-Dissolved		3.37	3.33		mg/L	1.3	20	06-OCT-13
Lead (Pb)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	06-OCT-13
Magnesium (Mg)-Dissolved		22.9	23.4		mg/L	2.1	20	06-OCT-13
Manganese (Mn)-Dissolved		0.152	0.155		mg/L	1.8	20	06-OCT-13
Molybdenum (Mo)-Dissolved		0.000384	0.000374		mg/L	2.6	20	06-OCT-13
Nickel (Ni)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Potassium (K)-Dissolved		2.52	2.57		mg/L	1.7	20	06-OCT-13
Selenium (Se)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Silicon (Si)-Dissolved		9.35	9.33		mg/L	0.2	20	06-OCT-13



Quality Control Report

Workorder: L1366644

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2709757							
WG1762144-3	DUP	L1363737-3						
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	06-OCT-13
Sodium (Na)-Dissolved		92.4	94.6		mg/L	2.4	20	06-OCT-13
Strontium (Sr)-Dissolved		0.351	0.355		mg/L	1.2	20	06-OCT-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	06-OCT-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	06-OCT-13
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Uranium (U)-Dissolved		0.000017	0.000013	J	mg/L	0.000004	0.00002	06-OCT-13
Vanadium (V)-Dissolved		0.00019	0.00021		mg/L	8.3	20	06-OCT-13
Zinc (Zn)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	06-OCT-13
WG1762144-4	DUP	L1366644-4						
Aluminum (Al)-Dissolved		0.0428	0.044		mg/L	3.0	20	06-OCT-13
Antimony (Sb)-Dissolved		<0.00040	0.00040	RPD-NA	mg/L	N/A	20	06-OCT-13
Arsenic (As)-Dissolved		0.00181	0.00174		mg/L	3.6	20	06-OCT-13
Barium (Ba)-Dissolved		0.113	0.111		mg/L	1.9	20	06-OCT-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	06-OCT-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	06-OCT-13
Cadmium (Cd)-Dissolved		0.00015	0.00015		mg/L	2.5	20	06-OCT-13
Calcium (Ca)-Dissolved		55.8	56.7		mg/L	1.7	20	06-OCT-13
Chromium (Cr)-Dissolved		0.00062	0.00067		mg/L	8.6	20	06-OCT-13
Cobalt (Co)-Dissolved		0.00660	0.00672		mg/L	1.7	20	06-OCT-13
Copper (Cu)-Dissolved		0.00215	0.00214		mg/L	0.7	20	06-OCT-13
Iron (Fe)-Dissolved		0.633	0.626		mg/L	1.1	20	06-OCT-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Magnesium (Mg)-Dissolved		12.8	13.2		mg/L	3.4	20	06-OCT-13
Manganese (Mn)-Dissolved		0.936	0.935		mg/L	0.1	20	06-OCT-13
Molybdenum (Mo)-Dissolved		0.00240	0.00238		mg/L	0.7	20	06-OCT-13
Nickel (Ni)-Dissolved		0.0341	0.0342		mg/L	0.3	20	06-OCT-13
Potassium (K)-Dissolved		4.10	4.08		mg/L	0.5	20	06-OCT-13
Selenium (Se)-Dissolved		0.00122	0.00126		mg/L	3.1	20	06-OCT-13
Silicon (Si)-Dissolved		14.1	13.7		mg/L	3.2	20	06-OCT-13
Silver (Ag)-Dissolved		<0.000010	<0.000020	RPD-NA	mg/L	N/A	20	06-OCT-13
Sodium (Na)-Dissolved		18.9	19.0		mg/L	0.1	20	06-OCT-13
Strontium (Sr)-Dissolved		0.260	0.264		mg/L	1.7	20	06-OCT-13



Quality Control Report

Workorder: L1366644

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2709757							
WG1762144-4	DUP	L1366644-4						
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	06-OCT-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	06-OCT-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	06-OCT-13
Uranium (U)-Dissolved		0.00029	0.00030		mg/L	1.9	20	06-OCT-13
Vanadium (V)-Dissolved		0.00011	0.00011		mg/L	2.4	20	06-OCT-13
Zinc (Zn)-Dissolved		0.204	0.205		mg/L	0.6	20	06-OCT-13
WG1762144-5	DUP	L1369943-1						
Aluminum (Al)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	06-OCT-13
Antimony (Sb)-Dissolved		0.00047	0.00046		mg/L	0.9	20	06-OCT-13
Arsenic (As)-Dissolved		0.00213	0.00213		mg/L	0.1	20	06-OCT-13
Barium (Ba)-Dissolved		0.177	0.184		mg/L	4.2	20	06-OCT-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	06-OCT-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	06-OCT-13
Cadmium (Cd)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	06-OCT-13
Calcium (Ca)-Dissolved		72.1	72.0		mg/L	0.2	20	06-OCT-13
Chromium (Cr)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Copper (Cu)-Dissolved		0.00088	0.00088		mg/L	0.7	20	06-OCT-13
Iron (Fe)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	06-OCT-13
Lead (Pb)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	06-OCT-13
Magnesium (Mg)-Dissolved		18.2	18.0		mg/L	1.1	20	06-OCT-13
Manganese (Mn)-Dissolved		0.000214	0.000200		mg/L	6.5	20	06-OCT-13
Molybdenum (Mo)-Dissolved		0.00619	0.00619		mg/L	0.1	20	06-OCT-13
Nickel (Ni)-Dissolved		0.00150	0.00156		mg/L	3.9	20	06-OCT-13
Potassium (K)-Dissolved		11.2	11.5		mg/L	1.9	20	06-OCT-13
Selenium (Se)-Dissolved		0.00047	0.00048		mg/L	2.2	20	06-OCT-13
Silicon (Si)-Dissolved		3.79	3.85		mg/L	1.5	20	06-OCT-13
Silver (Ag)-Dissolved		0.000067	0.000065		mg/L	3.6	20	06-OCT-13
Sodium (Na)-Dissolved		44.4	45.7		mg/L	2.7	20	06-OCT-13
Strontium (Sr)-Dissolved		0.262	0.267		mg/L	1.8	20	06-OCT-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	06-OCT-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	06-OCT-13
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13



Quality Control Report

Workorder: L1366644

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2709757							
WG1762144-5	DUP	L1369943-1						
Uranium (U)-Dissolved		0.00391	0.00388		mg/L	0.8	20	06-OCT-13
Vanadium (V)-Dissolved		0.00049	0.00049		mg/L	0.1	20	06-OCT-13
Zinc (Zn)-Dissolved		0.0010	<0.0010	RPD-NA	mg/L	N/A	20	06-OCT-13
WG1762144-6	DUP	L1370084-4						
Aluminum (Al)-Dissolved		0.0027	0.0029		mg/L	8.0	20	06-OCT-13
Antimony (Sb)-Dissolved		0.00011	0.00011		mg/L	1.8	20	06-OCT-13
Arsenic (As)-Dissolved		0.00155	0.00158		mg/L	2.5	20	06-OCT-13
Barium (Ba)-Dissolved		0.0522	0.0515		mg/L	1.3	20	06-OCT-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	06-OCT-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	06-OCT-13
Cadmium (Cd)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	06-OCT-13
Calcium (Ca)-Dissolved		51.2	51.4		mg/L	0.4	20	06-OCT-13
Chromium (Cr)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Cobalt (Co)-Dissolved		0.00019	0.00018		mg/L	9.5	20	06-OCT-13
Copper (Cu)-Dissolved		0.00018	0.00017		mg/L	8.9	20	06-OCT-13
Iron (Fe)-Dissolved		0.056	0.056		mg/L	0.2	20	06-OCT-13
Lead (Pb)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	06-OCT-13
Magnesium (Mg)-Dissolved		25.4	25.2		mg/L	0.6	20	06-OCT-13
Manganese (Mn)-Dissolved		0.0409	0.0401		mg/L	2.0	20	06-OCT-13
Molybdenum (Mo)-Dissolved		0.000419	0.000389		mg/L	7.3	20	06-OCT-13
Nickel (Ni)-Dissolved		0.00092	0.00086		mg/L	5.9	20	06-OCT-13
Potassium (K)-Dissolved		10.9	11.2		mg/L	2.7	20	06-OCT-13
Selenium (Se)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Silicon (Si)-Dissolved		0.840	0.845		mg/L	0.5	20	06-OCT-13
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	06-OCT-13
Sodium (Na)-Dissolved		56.3	55.5		mg/L	1.6	20	06-OCT-13
Strontium (Sr)-Dissolved		0.492	0.485		mg/L	1.5	20	06-OCT-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	06-OCT-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	06-OCT-13
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Uranium (U)-Dissolved		0.000569	0.000563		mg/L	1.0	20	06-OCT-13
Vanadium (V)-Dissolved		0.00046	0.00043		mg/L	5.4	20	06-OCT-13
Zinc (Zn)-Dissolved		0.0010	0.0012		mg/L	18	20	06-OCT-13



Quality Control Report

Workorder: L1366644

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2709757							
WG1762144-7	DUP	L1370146-1						
Aluminum (Al)-Dissolved		0.169	0.172		mg/L	2.0	20	06-OCT-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	06-OCT-13
Arsenic (As)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	06-OCT-13
Barium (Ba)-Dissolved		0.261	0.258		mg/L	1.1	20	06-OCT-13
Beryllium (Be)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	06-OCT-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	06-OCT-13
Cadmium (Cd)-Dissolved		0.000095	0.000108		mg/L	13	20	06-OCT-13
Calcium (Ca)-Dissolved		108	105		mg/L	2.9	20	06-OCT-13
Chromium (Cr)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	06-OCT-13
Cobalt (Co)-Dissolved		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	06-OCT-13
Copper (Cu)-Dissolved		0.0012	0.0012		mg/L	1.3	20	06-OCT-13
Iron (Fe)-Dissolved		0.154	0.155		mg/L	1.0	20	06-OCT-13
Lead (Pb)-Dissolved		0.00035	0.00035		mg/L	0.6	20	06-OCT-13
Magnesium (Mg)-Dissolved		40.7	40.2		mg/L	1.2	20	06-OCT-13
Manganese (Mn)-Dissolved		0.0278	0.0278		mg/L	0.2	20	06-OCT-13
Molybdenum (Mo)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	06-OCT-13
Nickel (Ni)-Dissolved		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	06-OCT-13
Potassium (K)-Dissolved		5.27	5.17		mg/L	1.9	20	06-OCT-13
Selenium (Se)-Dissolved		0.00504	0.00502		mg/L	0.5	20	06-OCT-13
Silicon (Si)-Dissolved		12.3	12.0		mg/L	2.5	20	06-OCT-13
Silver (Ag)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	06-OCT-13
Sodium (Na)-Dissolved		13.1	13.2		mg/L	1.1	20	06-OCT-13
Strontium (Sr)-Dissolved		0.967	0.940		mg/L	2.9	20	06-OCT-13
Thallium (Tl)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Titanium (Ti)-Dissolved		0.0037	0.0035		mg/L	6.5	20	06-OCT-13
Tin (Sn)-Dissolved		<0.050	<0.050	RPD-NA	mg/L	N/A	20	06-OCT-13
Uranium (U)-Dissolved		0.0142	0.0139		mg/L	2.6	20	06-OCT-13
Vanadium (V)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	06-OCT-13
Zinc (Zn)-Dissolved		<0.0040	<0.0040	RPD-NA	mg/L	N/A	20	06-OCT-13
WG1762144-8	DUP	L1370510-1						
Aluminum (Al)-Dissolved		0.0021	0.0032	J	mg/L	0.0010	0.002	06-OCT-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	06-OCT-13
Arsenic (As)-Dissolved		0.00795	0.00778		mg/L	2.2	20	06-OCT-13



Quality Control Report

Workorder: L1366644

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2709757							
WG1762144-8	DUP	L1370510-1						
Barium (Ba)-Dissolved		0.0742	0.0738		mg/L	0.5	20	06-OCT-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	06-OCT-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	06-OCT-13
Cadmium (Cd)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Calcium (Ca)-Dissolved		108	106		mg/L	1.9	20	06-OCT-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	06-OCT-13
Cobalt (Co)-Dissolved		0.00327	0.00324		mg/L	1.1	20	06-OCT-13
Copper (Cu)-Dissolved		<0.00060	<0.00060	RPD-NA	mg/L	N/A	20	06-OCT-13
Iron (Fe)-Dissolved		0.064	0.064		mg/L	0.3	20	06-OCT-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Magnesium (Mg)-Dissolved		65.0	64.7		mg/L	0.5	20	06-OCT-13
Manganese (Mn)-Dissolved		0.706	0.727		mg/L	3.0	20	06-OCT-13
Molybdenum (Mo)-Dissolved		0.00581	0.00596		mg/L	2.4	20	06-OCT-13
Nickel (Ni)-Dissolved		0.00390	0.00396		mg/L	1.4	20	06-OCT-13
Potassium (K)-Dissolved		5.63	5.47		mg/L	2.9	20	06-OCT-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	06-OCT-13
Silicon (Si)-Dissolved		9.45	9.65		mg/L	2.0	20	06-OCT-13
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	06-OCT-13
Sodium (Na)-Dissolved		66.6	65.3		mg/L	2.0	20	06-OCT-13
Strontium (Sr)-Dissolved		0.531	0.531		mg/L	0.1	20	06-OCT-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	06-OCT-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	06-OCT-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	06-OCT-13
Uranium (U)-Dissolved		0.0219	0.0223		mg/L	1.6	20	06-OCT-13
Vanadium (V)-Dissolved		0.00042	0.00047		mg/L	9.9	20	06-OCT-13
Zinc (Zn)-Dissolved		0.0038	0.0034		mg/L	11	20	06-OCT-13
WG1762144-9	DUP	L1370531-2						
Aluminum (Al)-Dissolved		0.0328	0.0335		mg/L	2.2	20	06-OCT-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	06-OCT-13
Arsenic (As)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	06-OCT-13
Barium (Ba)-Dissolved		0.0132	0.0135		mg/L	1.7	20	06-OCT-13
Beryllium (Be)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	06-OCT-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	06-OCT-13



Quality Control Report

Workorder: L1366644

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2709757							
WG1762144-9	DUP	L1370531-2						
Cadmium (Cd)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	06-OCT-13
Calcium (Ca)-Dissolved		8.74	8.85		mg/L	1.2	20	06-OCT-13
Chromium (Cr)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	06-OCT-13
Cobalt (Co)-Dissolved		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	06-OCT-13
Copper (Cu)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	06-OCT-13
Iron (Fe)-Dissolved		0.063	0.060		mg/L	4.0	20	06-OCT-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Magnesium (Mg)-Dissolved		2.70	2.70		mg/L	0.2	20	06-OCT-13
Manganese (Mn)-Dissolved		0.0069	0.0071		mg/L	2.0	20	06-OCT-13
Molybdenum (Mo)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	06-OCT-13
Nickel (Ni)-Dissolved		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	06-OCT-13
Potassium (K)-Dissolved		<0.50	<0.50	RPD-NA	mg/L	N/A	20	06-OCT-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	06-OCT-13
Silicon (Si)-Dissolved		0.126	0.122		mg/L	3.4	20	06-OCT-13
Silver (Ag)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	06-OCT-13
Sodium (Na)-Dissolved		<1.0	<1.0	RPD-NA	mg/L	N/A	20	06-OCT-13
Strontium (Sr)-Dissolved		0.0159	0.0162		mg/L	2.0	20	06-OCT-13
Thallium (Tl)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Titanium (Ti)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	06-OCT-13
Tin (Sn)-Dissolved		<0.050	<0.050	RPD-NA	mg/L	N/A	20	06-OCT-13
Uranium (U)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	06-OCT-13
Vanadium (V)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	06-OCT-13
Zinc (Zn)-Dissolved		<0.0040	<0.0040	RPD-NA	mg/L	N/A	20	06-OCT-13
WG1762144-1	MB							
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	06-OCT-13
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	06-OCT-13
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	06-OCT-13
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	06-OCT-13
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	06-OCT-13
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	06-OCT-13
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	06-OCT-13
Calcium (Ca)-Dissolved			<0.020		mg/L		0.02	06-OCT-13
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	06-OCT-13



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED		Water						
Batch R2709757								
WG1762144-1 MB								
	Cobalt (Co)-Dissolved		<0.00010		mg/L		0.0001	06-OCT-13
	Copper (Cu)-Dissolved		<0.00010		mg/L		0.0001	06-OCT-13
	Iron (Fe)-Dissolved		<0.010		mg/L		0.01	06-OCT-13
	Lead (Pb)-Dissolved		<0.000050		mg/L		0.00005	06-OCT-13
	Magnesium (Mg)-Dissolved		<0.0050		mg/L		0.005	06-OCT-13
	Manganese (Mn)-Dissolved		<0.000050		mg/L		0.00005	06-OCT-13
	Molybdenum (Mo)-Dissolved		<0.000050		mg/L		0.00005	06-OCT-13
	Nickel (Ni)-Dissolved		<0.00010		mg/L		0.0001	06-OCT-13
	Potassium (K)-Dissolved		<0.050		mg/L		0.05	06-OCT-13
	Selenium (Se)-Dissolved		<0.00010		mg/L		0.0001	06-OCT-13
	Silicon (Si)-Dissolved		<0.050		mg/L		0.05	06-OCT-13
	Silver (Ag)-Dissolved		<0.000010		mg/L		0.00001	06-OCT-13
	Sodium (Na)-Dissolved		<0.050		mg/L		0.05	06-OCT-13
	Strontium (Sr)-Dissolved		<0.00010		mg/L		0.0001	06-OCT-13
	Thallium (Tl)-Dissolved		<0.000050		mg/L		0.00005	06-OCT-13
	Titanium (Ti)-Dissolved		<0.00030		mg/L		0.0003	06-OCT-13
	Tin (Sn)-Dissolved		<0.00010		mg/L		0.0001	06-OCT-13
	Uranium (U)-Dissolved		<0.000010		mg/L		0.00001	06-OCT-13
	Vanadium (V)-Dissolved		<0.00010		mg/L		0.0001	06-OCT-13
	Zinc (Zn)-Dissolved		<0.0010		mg/L		0.001	06-OCT-13
NAPHTHENIC-ACID-FM		Water						
Batch R2704473								
WG1757610-3 DUP		L1365422-2						
	Naphthenic Acids	<1.0	<1.0	RPD-NA	mg/L	N/A	30	30-SEP-13
WG1757610-7 DUP		L1368936-2						
	Naphthenic Acids	5.9	6.0		mg/L	1.6	30	30-SEP-13
WG1757610-4 LCS								
	Naphthenic Acids		102.9		%		70-130	30-SEP-13
WG1757610-1 MB								
	Naphthenic Acids		<1.0		mg/L		1	30-SEP-13
WG1757610-5 MB								
	Naphthenic Acids		<1.0		mg/L		1	30-SEP-13
WG1757610-2 MS		L1365422-1						
	Naphthenic Acids		111.4		%		50-150	30-SEP-13
WG1757610-6 MS		L1368936-1						



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
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Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NAPHTHENIC-ACID-FM Water								
Batch	R2704473							
WG1757610-6	MS	L1368936-1	133.8		%		50-150	30-SEP-13
Naphthenic Acids								
NH3-CFA-ED Water								
Batch	R2707594							
WG1760080-3	DUP	L1371372-2	<0.050	RPD-NA	mg/L	N/A	20	03-OCT-13
Ammonia, Total (as N)								
WG1760080-5	DUP	L1372225-1	0.657		mg/L	5.4	20	03-OCT-13
Ammonia, Total (as N)								
WG1760080-7	DUP	L1369999-2	<0.050	RPD-NA	mg/L	N/A	20	03-OCT-13
Ammonia, Total (as N)								
WG1760080-2	LCS		92.3		%		85-115	03-OCT-13
Ammonia, Total (as N)								
WG1760080-1	MB		<0.050		mg/L		0.05	03-OCT-13
Ammonia, Total (as N)								
WG1760080-4	MS	L1369337-3	96.9		%		75-125	03-OCT-13
Ammonia, Total (as N)								
WG1760080-6	MS	L1366013-4	93.8		%		75-125	03-OCT-13
Ammonia, Total (as N)								
NO2-IC-ED Water								
Batch	R2701343							
WG1754113-3	DUP	L1366644-3	<0.050	RPD-NA	mg/L	N/A	20	24-SEP-13
Nitrite (as N)								
WG1754113-5	DUP	L1365876-4	<0.050	RPD-NA	mg/L	N/A	20	24-SEP-13
Nitrite (as N)								
WG1754113-2	LCS		100.1		%		90-110	24-SEP-13
Nitrite (as N)								
WG1754113-1	MB		<0.050		mg/L		0.05	24-SEP-13
Nitrite (as N)								
WG1754113-4	MS	L1366644-3	92.0		%		75-125	24-SEP-13
Nitrite (as N)								
WG1754113-6	MS	L1365876-4	101.0		%		75-125	24-SEP-13
Nitrite (as N)								
NO3-IC-ED Water								
Batch	R2701343							
WG1754113-3	DUP	L1366644-3	<0.050	RPD-NA	mg/L	N/A	20	24-SEP-13
Nitrate (as N)								
WG1754113-5	DUP	L1365876-4						



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
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Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-IC-ED		Water						
Batch	R2701343							
WG1754113-5	DUP	L1365876-4						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	24-SEP-13
WG1754113-2	LCS							
Nitrate (as N)			96.4		%		90-110	24-SEP-13
WG1754113-1	MB							
Nitrate (as N)			<0.050		mg/L		0.05	24-SEP-13
WG1754113-4	MS	L1366644-3						
Nitrate (as N)			96.4		%		75-125	24-SEP-13
WG1754113-6	MS	L1365876-4						
Nitrate (as N)			96.0		%		75-125	24-SEP-13
P-T-COL-ED		Water						
Batch	R2701623							
WG1754593-3	DUP	L1354653-4						
Phosphorus (P)-Total		2.13	2.09		mg/L	1.9	20	26-SEP-13
WG1754593-5	DUP	L1367066-3						
Phosphorus (P)-Total		0.112	0.118		mg/L	5.5	20	26-SEP-13
WG1754593-7	DUP	L1367300-2						
Phosphorus (P)-Total		2.95	2.94		mg/L	0.2	20	26-SEP-13
WG1754593-2	LCS							
Phosphorus (P)-Total			97.8		%		80-120	26-SEP-13
WG1754593-1	MB							
Phosphorus (P)-Total			<0.020		mg/L		0.02	26-SEP-13
WG1754593-4	MS	L1354653-4						
Phosphorus (P)-Total			N/A	MS-B	%		-	26-SEP-13
WG1754593-6	MS	L1367066-3						
Phosphorus (P)-Total			97.9		%		70-130	26-SEP-13
WG1754593-8	MS	L1367300-2						
Phosphorus (P)-Total			N/A	MS-B	%		-	26-SEP-13
PAH-ABT1-ED		Water						
Batch	R2708717							
WG1758668-3	LCS							
Acenaphthene			81.3		%		60-130	04-OCT-13
Acenaphthylene			81.3		%		60-130	04-OCT-13
Anthracene			82.5		%		60-130	04-OCT-13
Fluoranthene			83.3		%		60-130	04-OCT-13
Fluorene			82.2		%		60-130	04-OCT-13
Naphthalene			81.7		%		50-130	04-OCT-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
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Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ABT1-ED		Water						
Batch	R2708717							
WG1758668-3	LCS							
Phenanthrene			83.9		%		60-130	04-OCT-13
Pyrene			82.2		%		60-130	04-OCT-13
Benzo(a)anthracene			86.4		%		60-130	04-OCT-13
Benzo(k)fluoranthene			94.4		%		60-130	04-OCT-13
Benzo(b&j)fluoranthene			94.6		%		60-130	04-OCT-13
Benzo(g,h,i)perylene			89.5		%		60-130	04-OCT-13
Benzo(a)pyrene			85.6		%		60-130	04-OCT-13
Chrysene			86.2		%		60-130	04-OCT-13
Dibenzo(a,h)anthracene			90.3		%		60-130	04-OCT-13
Indeno(1,2,3-cd)pyrene			85.9		%		60-130	04-OCT-13
WG1758668-2	MB							
Acenaphthene			<0.000020		mg/L		0.00002	04-OCT-13
Acenaphthylene			<0.000020		mg/L		0.00002	04-OCT-13
Anthracene			<0.000010		mg/L		0.00001	04-OCT-13
Fluoranthene			<0.000020		mg/L		0.00002	04-OCT-13
Fluorene			<0.000020		mg/L		0.00002	04-OCT-13
Naphthalene			<0.000050		mg/L		0.00005	04-OCT-13
Phenanthrene			<0.000050		mg/L		0.00005	04-OCT-13
Pyrene			<0.000020		mg/L		0.00002	04-OCT-13
Benzo(a)anthracene			<0.000010		mg/L		0.00001	04-OCT-13
Benzo(k)fluoranthene			<0.000010		mg/L		0.00001	04-OCT-13
Benzo(b&j)fluoranthene			<0.000010		mg/L		0.00001	04-OCT-13
Benzo(g,h,i)perylene			<0.000020		mg/L		0.00002	04-OCT-13
Benzo(a)pyrene			<0.0000050		mg/L		0.000005	04-OCT-13
Chrysene			<0.000020		mg/L		0.00002	04-OCT-13
Dibenzo(a,h)anthracene			<0.0000050		mg/L		0.000005	04-OCT-13
Indeno(1,2,3-cd)pyrene			<0.000010		mg/L		0.00001	04-OCT-13
Surrogate: Nitrobenzene d5			85.8		%		40-130	04-OCT-13
Surrogate: 2-Fluorobiphenyl			71.8		%		40-130	04-OCT-13
Surrogate: p-Terphenyl d14			106.3		%		40-130	04-OCT-13
PH/EC/ALK-ED		Water						



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch	R2700213							
WG1754255-10 DUP		L1367259-4						
pH		7.80	7.78	J	pH	0.02	0.3	26-SEP-13
Conductivity (EC)		3370	3360		uS/cm	0.3	10	26-SEP-13
Bicarbonate (HCO3)		849	821		mg/L	3.4	25	26-SEP-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	26-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	26-SEP-13
Alkalinity, Total (as CaCO3)		696	673		mg/L	3.4	20	26-SEP-13
WG1754255-6 DUP		L1365876-20						
pH		8.13	8.12	J	pH	0.02	0.3	25-SEP-13
Conductivity (EC)		994	991		uS/cm	0.3	10	25-SEP-13
Bicarbonate (HCO3)		726	730		mg/L	0.7	25	25-SEP-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	25-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	25-SEP-13
Alkalinity, Total (as CaCO3)		595	599		mg/L	0.7	20	25-SEP-13
WG1754255-7 DUP		L1366719-18						
pH		8.52	8.51	J	pH	0.01	0.3	25-SEP-13
Conductivity (EC)		1070	1050		uS/cm	1.9	10	25-SEP-13
Bicarbonate (HCO3)		482	476		mg/L	1.4	25	25-SEP-13
Carbonate (CO3)		15.5	14.7		mg/L	5.3	25	25-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	25-SEP-13
Alkalinity, Total (as CaCO3)		421	415		mg/L	1.6	20	25-SEP-13
WG1754255-8 DUP		L1367031-7						
pH		8.19	8.18	J	pH	0.01	0.3	25-SEP-13
Conductivity (EC)		222	221		uS/cm	0.5	10	25-SEP-13
Bicarbonate (HCO3)		125	123		mg/L	1.0	25	25-SEP-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	25-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	25-SEP-13
Alkalinity, Total (as CaCO3)		102	101		mg/L	1.0	20	25-SEP-13
WG1754255-9 DUP		L1367087-8						
pH		8.23	8.22	J	pH	0.01	0.3	26-SEP-13
Conductivity (EC)		261	261		uS/cm	0.0	10	26-SEP-13
Bicarbonate (HCO3)		105	105		mg/L	0.0	25	26-SEP-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	26-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	26-SEP-13
Alkalinity, Total (as CaCO3)		86.4	86.4					



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
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Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch	R2700213							
WG1754255-9	DUP	L1367087-8						
Alkalinity, Total (as CaCO3)		86.4	86.4		mg/L	0.0	20	26-SEP-13
WG1754255-2	LCS							
Conductivity (EC)			101.4		%		90-110	25-SEP-13
WG1754255-3	LCS							
pH			7.05		pH		6.7-7.3	25-SEP-13
WG1754255-4	LCS							
Alkalinity, Total (as CaCO3)			99.0		%		85-115	25-SEP-13
WG1754255-5	LCS							
Conductivity (EC)			98.4		%		90-110	25-SEP-13
WG1754255-1	MB							
Bicarbonate (HCO3)			<5.0		mg/L		5	25-SEP-13
Carbonate (CO3)			<5.0		mg/L		5	25-SEP-13
Hydroxide (OH)			<5.0		mg/L		5	25-SEP-13
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	25-SEP-13
PHENOLS-4AAP-ED		Water						
Batch	R2710827							
WG1762905-4	DUP	L1371205-11						
Phenols (4AAP)		0.0015	0.0014		mg/L	6.9	15	07-OCT-13
WG1762905-6	DUP	L1370496-10						
Phenols (4AAP)		0.0019	0.0018		mg/L	5.4	15	07-OCT-13
WG1762905-7	DUP	L1369709-6						
Phenols (4AAP)		0.0013	0.0018	J	mg/L	0.0005	0.002	07-OCT-13
WG1762905-8	DUP	L1367031-19						
Phenols (4AAP)		0.0032	0.0026	J	mg/L	0.0006	0.002	07-OCT-13
WG1762905-9	DUP	L1368087-5						
Phenols (4AAP)		0.0066	0.0063		mg/L	4.7	15	07-OCT-13
WG1762905-3	LCS							
Phenols (4AAP)			92.0		%		85-115	07-OCT-13
WG1762905-2	MB							
Phenols (4AAP)			<0.0010		mg/L		0.001	07-OCT-13
WG1762905-5	MS	L1371205-11						
Phenols (4AAP)			96.5		%		75-125	07-OCT-13
SO4-IC-ED		Water						



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
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Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-IC-ED		Water						
Batch	R2701343							
WG1754113-3	DUP	L1366644-3						
Sulfate (SO4)		31.3	31.0		mg/L	1.2	20	24-SEP-13
WG1754113-5	DUP	L1365876-4						
Sulfate (SO4)		20.8	20.7		mg/L	0.3	20	24-SEP-13
WG1754113-2	LCS							
Sulfate (SO4)			99.2		%		90-110	24-SEP-13
WG1754113-1	MB							
Sulfate (SO4)			<0.50		mg/L		0.5	24-SEP-13
WG1754113-4	MS	L1366644-3						
Sulfate (SO4)			96.7		%		75-125	24-SEP-13
WG1754113-6	MS	L1365876-4						
Sulfate (SO4)			97.9		%		75-125	24-SEP-13
TKN-CFA-ED		Water						
Batch	R2710906							
WG1762317-5	DUP	L1366644-4						
Total Kjeldahl Nitrogen		<0.20	<0.20	RPD-NA	mg/L	N/A	20	07-OCT-13
WG1762317-2	LCS							
Total Kjeldahl Nitrogen			97.1		mg/L		75-125	07-OCT-13
WG1762317-3	LCS							
Total Kjeldahl Nitrogen			83.8		mg/L		75-125	07-OCT-13
WG1762317-4	LCS							
Total Kjeldahl Nitrogen			96.3		mg/L		75-125	07-OCT-13
WG1762317-1	MB							
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	07-OCT-13
WG1762317-6	MS	L1366644-4						
Total Kjeldahl Nitrogen			108		mg/L		70-130	07-OCT-13
TURBIDITY-ED		Water						
Batch	R2700132							
WG1753636-3	DUP	L1367055-4						
Turbidity		3.95	4.15		NTU	4.9	15	24-SEP-13
WG1753636-4	DUP	L1367033-1						
Turbidity		50.4	50.1		NTU	0.6	15	24-SEP-13
WG1753636-2	LCS							
Turbidity			97.8		%		85-115	24-SEP-13
WG1753636-1	MB							
Turbidity			<0.10		NTU		0.1	24-SEP-13

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Contact: SUE RAYNARD

Legend:

Limit ALS Control Limit (Data Quality Objectives)
DUP Duplicate
RPD Relative Percent Difference
N/A Not Available
LCS Laboratory Control Sample
SRM Standard Reference Material
MS Matrix Spike
MSD Matrix Spike Duplicate
ADE Average Desorption Efficiency
MB Method Blank
IRM Internal Reference Material
CRM Certified Reference Material
CCV Continuing Calibration Verification
CVS Calibration Verification Standard
LCSD Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



ALS 131001-02 (13-DLC)

CONFIDENTIAL ANALYSIS REPORT

REPORT #: 131001-02

WO #: 13-DLC

PO #: L1366644

CLIENT: ALS Laboratory Group - Edmonton
9936-67 Avenue
Edmonton, AB
T6E 0P5

ATTENTION: ALS-ED Reporting
Tel: (780) 413-5227
Fax: (780) 437-2311

SAMPLE DESCRIPTION: Water Samples

DATE AND TIME OF SAMPLE COLLECTION: September 22, 2013

DATE AND TIME OF SAMPLE RECEIPT: September 24, 2013/14:00

SAMPLE TEMPERATURE WHEN RECEIVED: 11.1° Celsius

TEST PERFORMED: Iron Related Bacteria
Sulfate Reducing Bacteria

TEST START DATE: September 24, 2013/15:00

DATE COMPLETED: September 29, 2013

CERTIFICATE OF ANALYSIS: See Page 2

QUALITY CONTROL DATA: See Attached Appendix 1

The report shall not be reproduced, except in full, without the written authority of PBR Laboratories Inc.

Certificate of Analysis

PBR ID	Sample #	Client ID	Lot #	Test	Protocol	Quantity Analyzed	*DF	Result	Units	Note
13-DLC-01	L1366644-1	16054130922043		Iron Related Bacteria	BART	15 ml		9.0×10^3	CFU/ml	1
				Sulfate Reducing Bacteria	BART	15 ml		1.8×10^4	CFU/ml	1
13-DLC-02	L1366644-2	16054130922044		Iron Related Bacteria	BART	15 ml		2.3×10^3	CFU/ml	1
				Sulfate Reducing Bacteria	BART	15 ml		1.8×10^4	CFU/ml	1
13-DLC-03	L1366644-3	16054130922045		Iron Related Bacteria	BART	15 ml		9.0×10^3	CFU/ml	1
				Sulfate Reducing Bacteria	BART	15 ml		1.8×10^4	CFU/ml	1
13-DLC-04	L1366644-4	16054130922046		Iron Related Bacteria	BART	15 ml		9.0×10^3	CFU/ml	1
				Sulfate Reducing Bacteria	BART	15 ml		5.0×10^3	CFU/ml	1

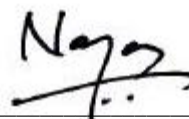
*DF - Dilution Factor used for analysis

Notes

1 CFU = Colony Forming Unit.

BART results represent the Approximate Population only.

The reported results apply only to the items tested.


Sarita Sharma Ph. D. (Analyst)
Date: Oct 01 2013


Approved By:

Narayan Pokharel, Ph.D.
Date: Oct 01 2013



PIBR
Laboratories Inc.

ALS 131001-02 (13-DLC)

APPENDIX 1

Quality Control Data for Iron Related Bacteria (BART)

Controls	Organism/Medium	Result
Sterility (media blank)	BART medium	Pass
Positive	Acidithiobacillus ferrooxidans	Pass
Negative	D/W Sterile	Pass

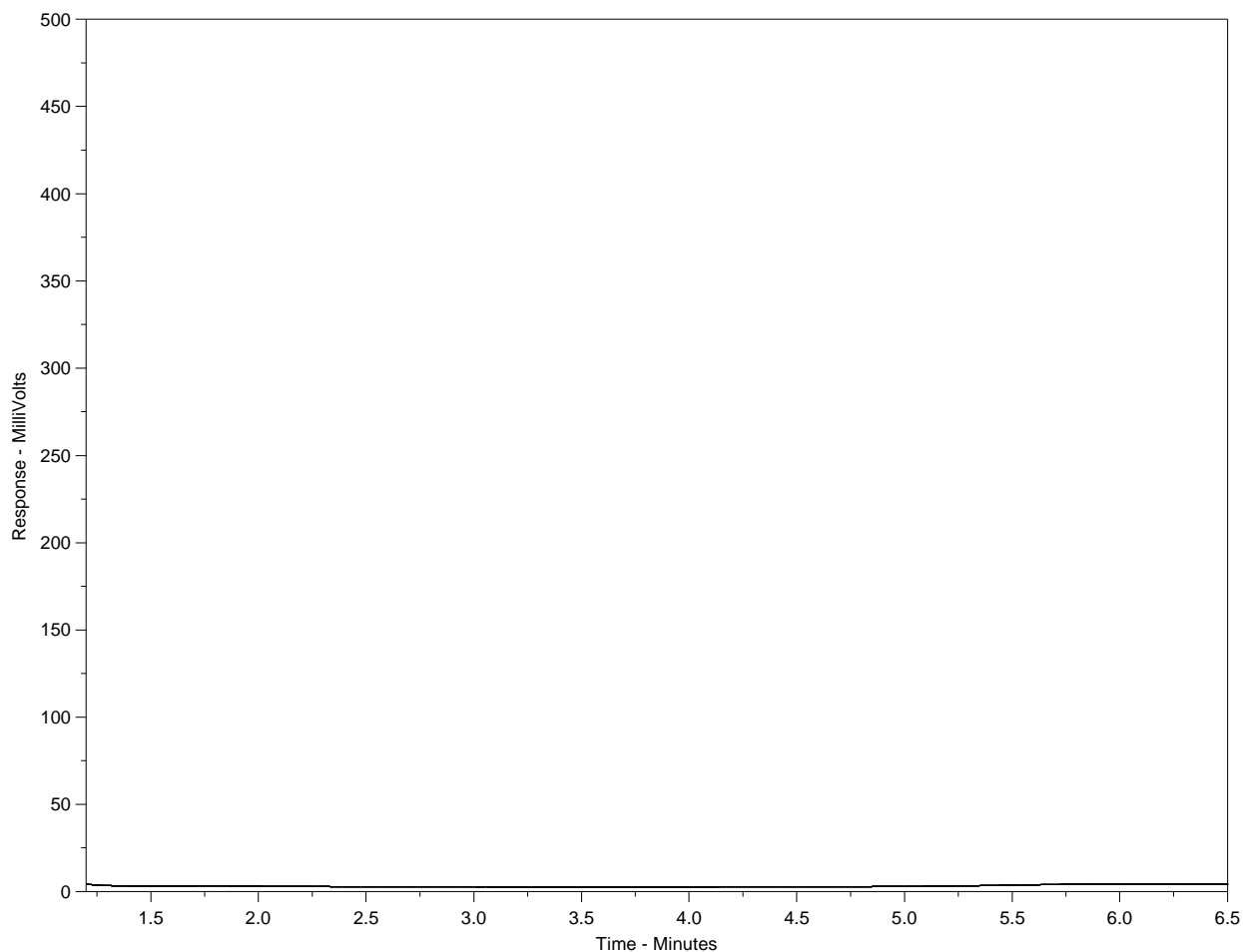
Quality Control Data for Sulfate Reducing Bacteria (BART)

Controls	Organism/Medium	Result
Sterility	BART medium	Pass
Positive	SRB	Pass
Negative	D/W Sterile	Pass

Hydrocarbon Distribution Report



ALS Sample ID: L1367764-1
 Client ID: 16054130923047



F2		F3		F4		F4	
nC10	nC16			nC34	nC50		
174°C	287°C			481°C	575°C		
346°F	549°F			898°F	1067°F		
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

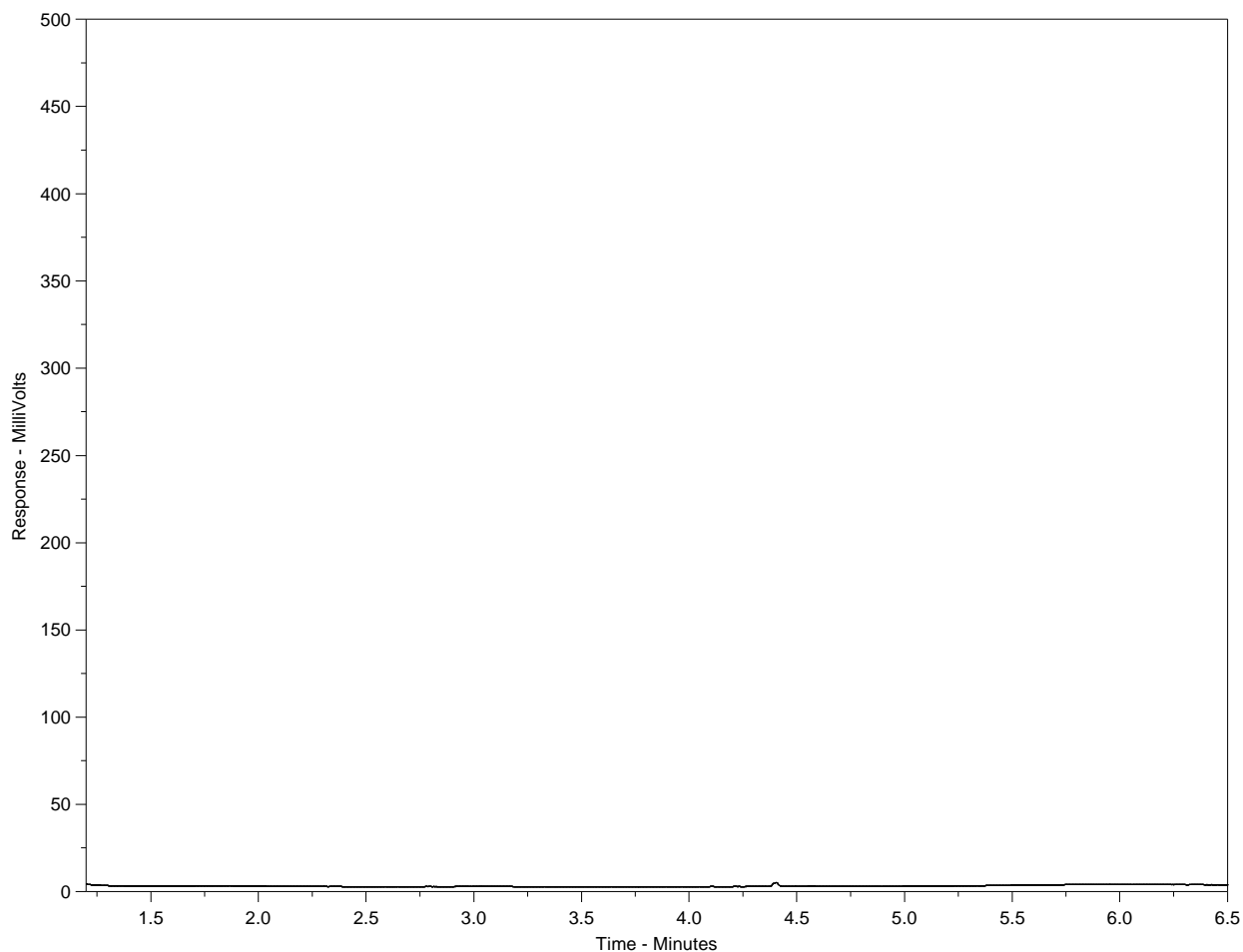
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1367764-2
Client ID: 16054130923048



F2		F3		F4		F4	
nC10	nC16			nC34		nC50	
174°C	287°C			481°C		575°C	
346°F	549°F			898°F		1067°F	
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

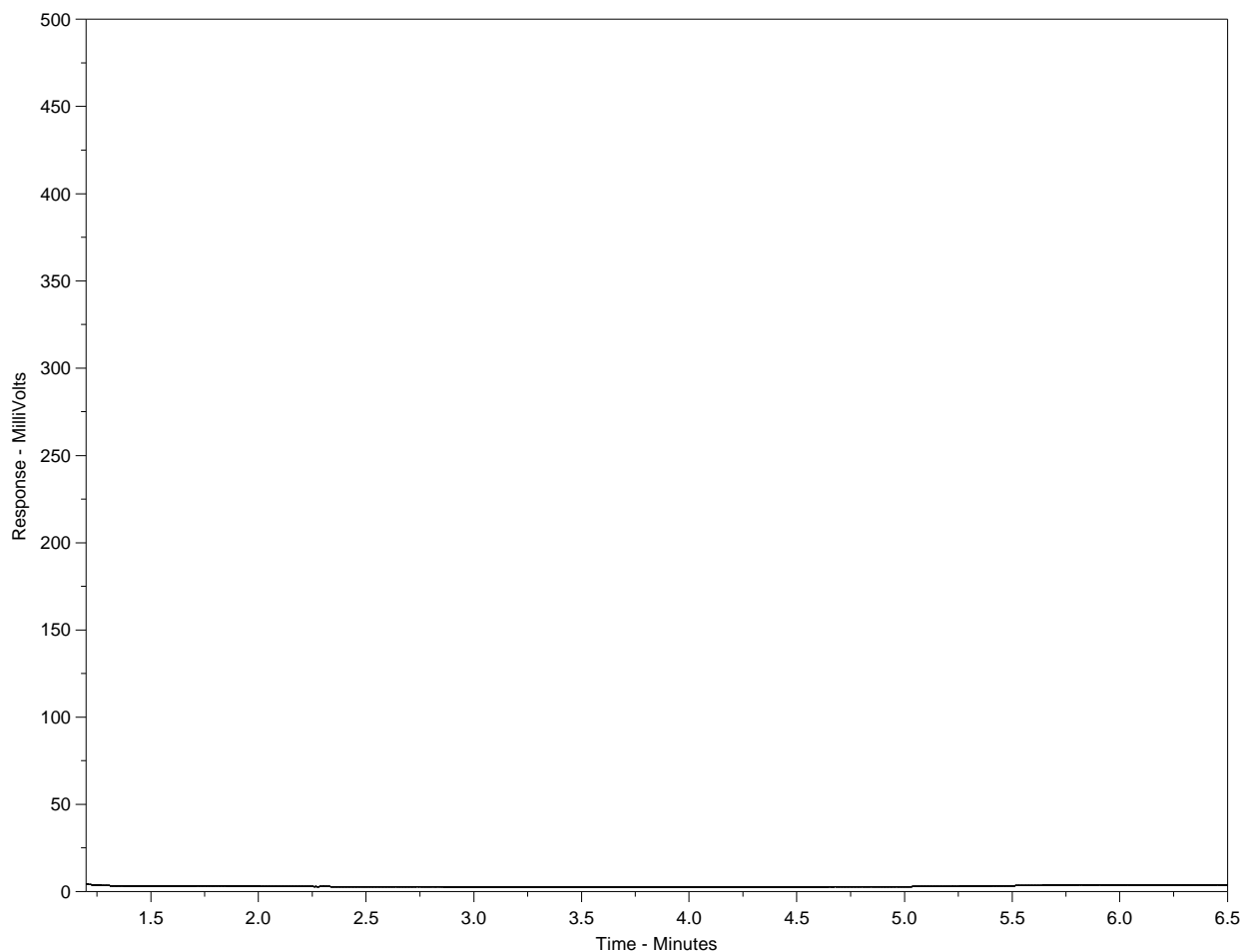
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1367764-3
Client ID: 16054130923049



F2		F3		F4		F4	
nC10	nC16			nC34	nC50		
174°C	287°C			481°C	575°C		
346°F	549°F			898°F	1067°F		
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

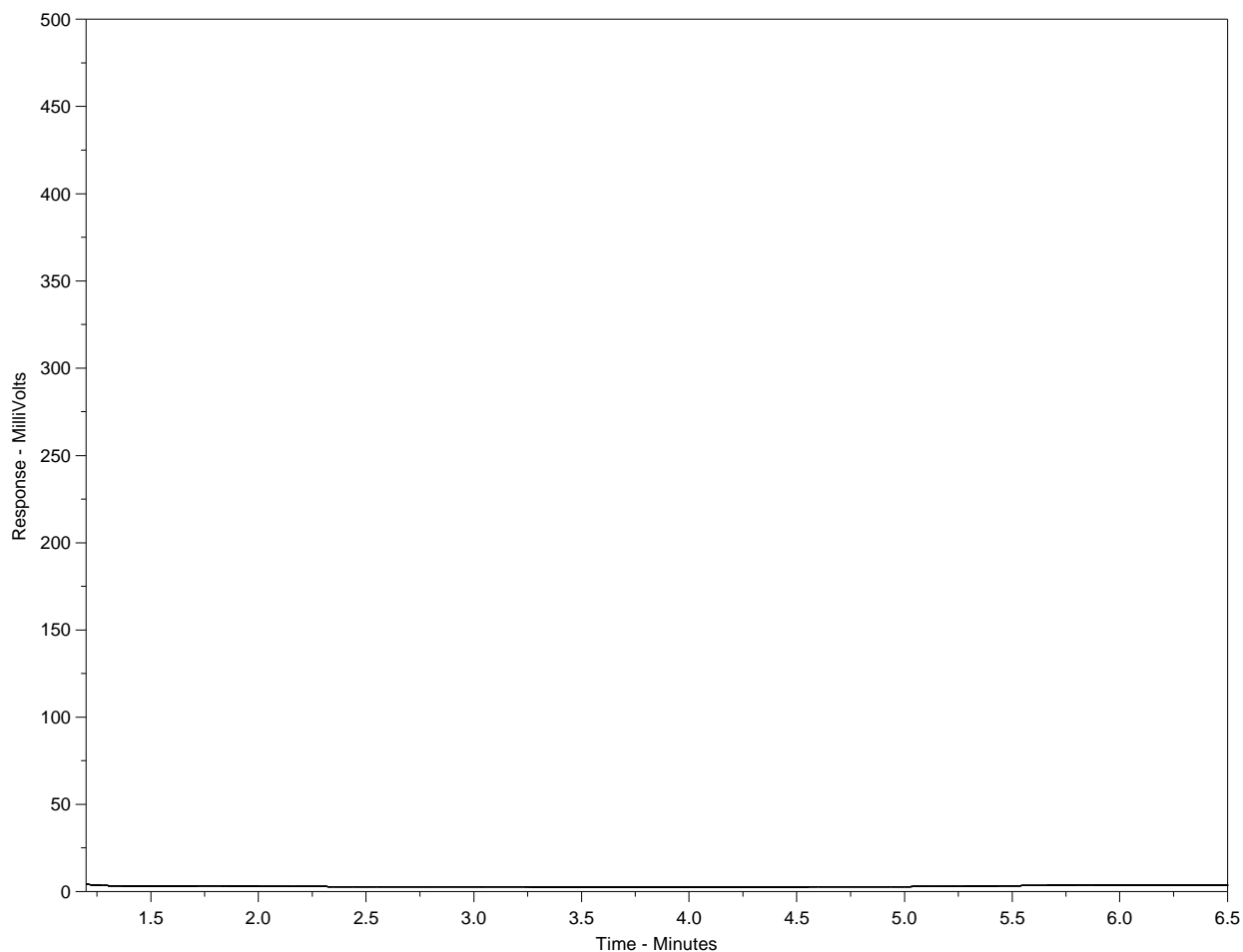
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1367764-4
Client ID: 16054130923050



← F2 →		← F3 →		← F4 →		← F4 →	
nC10	nC16	nC34	nC50				
174°C	287°C	481°C	575°C				
346°F	549°F	898°F	1067°F				
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →				
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.



MATRIX SOLUTIONS INC.
ATTN: SUE RAYNARD
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Date Received: 24-SEP-13
Report Date: 17-DEC-13 13:46 (MT)
Version: FINAL REV. 4

Client Phone: 403-237-0606

Certificate of Analysis

Lab Work Order #: L1367764
Project P.O. #: NOT SUBMITTED
Job Reference: SAOS WADDELL CREEK 16054-502 8-27-80-9
W4M
C of C Numbers: M060605
Legal Site Desc: 8-27-80-9 W4M

Comments: ADDITIONAL 18-OCT-13 11:18
17-DEC-2013 LORs for Ag and Al have been fixed


Catherine Evaristo-Cordero
Senior Account Manager

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ADDRESS: 9936-67 Avenue, Edmonton, AB T6E 0P5 Canada | Phone: +1 780 413 5227 | Fax: +1 780 437 2311
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1367764-1 16054130923047									
Sampled By: JF/GK on 23-SEP-13									
Matrix: Water									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		25-SEP-13	R2701555
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0012	+/-0.0004		0.0010	mg/L	0		02-OCT-13	R2707427
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Arsenic (As)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Barium (Ba)-Dissolved	0.0775	+/-0.0067		0.00010	mg/L	0		02-OCT-13	R2707427
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		02-OCT-13	R2707427
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		02-OCT-13	R2707427
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Calcium (Ca)-Dissolved	101	+/-14		0.50	mg/L	0		02-OCT-13	R2707427
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Cobalt (Co)-Dissolved	0.00016	+/-0.00001		0.00010	mg/L	0		02-OCT-13	R2707427
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		02-OCT-13	R2707427
Iron (Fe)-Dissolved	3.99	+/-0.36		0.010	mg/L	0		02-OCT-13	R2707427
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Magnesium (Mg)-Dissolved	25.9	+/-2.0		0.10	mg/L	0		02-OCT-13	R2707427
Manganese (Mn)-Dissolved	0.0927	+/-0.0063		0.0020	mg/L	0		02-OCT-13	R2707427
Molybdenum (Mo)-Dissolved	0.0129	+/-0.0014		0.00010	mg/L	0		02-OCT-13	R2707427
Nickel (Ni)-Dissolved	0.00040	+/-0.00005		0.00010	mg/L	0		02-OCT-13	R2707427
Potassium (K)-Dissolved	7.45	+/-0.58		0.50	mg/L	0		02-OCT-13	R2707427
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Silicon (Si)-Dissolved	11.2	+/-0.96		0.050	mg/L	0		02-OCT-13	R2707427
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		02-OCT-13	R2707427
Sodium (Na)-Dissolved	76.0	+/-5.4		1.0	mg/L	0		02-OCT-13	R2707427
Strontium (Sr)-Dissolved	0.968	+/-0.072		0.00010	mg/L	0		02-OCT-13	R2707427
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		02-OCT-13	R2707427
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		02-OCT-13	R2707427
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		02-OCT-13	R2707427
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Zinc (Zn)-Dissolved	0.0012	+/-0.0003		0.0010	mg/L	0		02-OCT-13	R2707427
Ion Balance Calculation									
Ion Balance	92.4	-			%	-		03-OCT-13	
TDS (Calculated)	579	-			mg/L	-		03-OCT-13	
Hardness (as CaCO3)	359	-			mg/L	-		03-OCT-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		25-SEP-13	R2701555
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		30-SEP-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		25-SEP-13	R2701555
Sulfate by IC									
Sulfate (SO4)	49.8	+/-2.1		0.50	mg/L	0		25-SEP-13	R2701555
pH, Conductivity and Total Alkalinity									
pH	8.40	+/-0.04		0.10	pH	0		26-SEP-13	R2701489
Conductivity (EC)	901	+/-30		0.20	uS/cm	0		26-SEP-13	R2701489
Bicarbonate (HCO3)	630	-		5.0	mg/L	-		26-SEP-13	R2701489
Carbonate (CO3)	8.8	-		5.0	mg/L	-		26-SEP-13	R2701489
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		26-SEP-13	R2701489
Alkalinity, Total (as CaCO3)	531	+/-19		2.0	mg/L	0		26-SEP-13	R2701489

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1367764-2 16054130923048									
Sampled By: JF/GK on 23-SEP-13									
Matrix: Water									
Chloride by IC									
Chloride (Cl)	7.89	+/-0.27		0.50	mg/L	0		25-SEP-13	R2701555
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0112	+/-0.002		0.0010	mg/L	0		02-OCT-13	R2707427
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Arsenic (As)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Barium (Ba)-Dissolved	0.140	+/-0.012		0.00010	mg/L	0		02-OCT-13	R2707427
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		02-OCT-13	R2707427
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		02-OCT-13	R2707427
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Calcium (Ca)-Dissolved	150	+/-20		0.50	mg/L	0		02-OCT-13	R2707427
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Cobalt (Co)-Dissolved	0.00045	+/-0.00004		0.00010	mg/L	0		02-OCT-13	R2707427
Copper (Cu)-Dissolved	0.00211	+/-0.00016		0.00060	mg/L	0		02-OCT-13	R2707427
Iron (Fe)-Dissolved	0.013	+/-0.001		0.010	mg/L	0		02-OCT-13	R2707427
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Magnesium (Mg)-Dissolved	45.6	+/-3.5		0.10	mg/L	0		02-OCT-13	R2707427
Manganese (Mn)-Dissolved	0.0693	+/-0.0047		0.0020	mg/L	0		02-OCT-13	R2707427
Molybdenum (Mo)-Dissolved	0.00091	+/-0.00010		0.00010	mg/L	0		02-OCT-13	R2707427
Nickel (Ni)-Dissolved	0.00242	+/-0.00020		0.00010	mg/L	0		02-OCT-13	R2707427
Potassium (K)-Dissolved	3.37	+/-0.26		0.50	mg/L	0		02-OCT-13	R2707427
Selenium (Se)-Dissolved	0.00410	+/-0.00068		0.00040	mg/L	0		02-OCT-13	R2707427
Silicon (Si)-Dissolved	11.5	+/-0.98		0.050	mg/L	0		02-OCT-13	R2707427
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		02-OCT-13	R2707427
Sodium (Na)-Dissolved	9.9	+/-0.69		1.0	mg/L	0		02-OCT-13	R2707427
Strontium (Sr)-Dissolved	0.304	+/-0.023		0.00010	mg/L	0		02-OCT-13	R2707427
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		02-OCT-13	R2707427
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		02-OCT-13	R2707427
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		02-OCT-13	R2707427
Uranium (U)-Dissolved	0.0150	+/-0.0016		0.00010	mg/L	0		02-OCT-13	R2707427
Vanadium (V)-Dissolved	0.00023	+/-0.00002		0.00010	mg/L	0		02-OCT-13	R2707427
Zinc (Zn)-Dissolved	0.0134	+/-0.0016		0.0010	mg/L	0		02-OCT-13	R2707427
Ion Balance Calculation									
Ion Balance	99.9	-			%	-		03-OCT-13	
TDS (Calculated)	580	-			mg/L	-		03-OCT-13	
Hardness (as CaCO3)	562	-			mg/L	-		03-OCT-13	
Nitrate as N by IC									
Nitrate (as N)	0.859	+/-0.058		0.050	mg/L	0		25-SEP-13	R2701555
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	0.859	-		0.071	mg/L	-		30-SEP-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		25-SEP-13	R2701555
Sulfate by IC									
Sulfate (SO4)	40.5	+/-1.7		0.50	mg/L	0		25-SEP-13	R2701555
pH, Conductivity and Total Alkalinity									
pH	7.86	+/-0.04		0.10	pH	0		26-SEP-13	R2701489
Conductivity (EC)	970	+/-32		0.20	uS/cm	0		26-SEP-13	R2701489
Bicarbonate (HCO3)	649	-		5.0	mg/L	-		26-SEP-13	R2701489
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		26-SEP-13	R2701489
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		26-SEP-13	R2701489
Alkalinity, Total (as CaCO3)	532	+/-19		2.0	mg/L	0		26-SEP-13	R2701489

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1367764-3 16054130923049									
Sampled By: JF/GK on 23-SEP-13									
Matrix: Water									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		25-SEP-13	R2701555
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.0010	-		0.0010	mg/L	-		02-OCT-13	R2707427
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Arsenic (As)-Dissolved	0.00064	+/-0.00007		0.00040	mg/L	0		02-OCT-13	R2707427
Barium (Ba)-Dissolved	0.0914	+/-0.0079		0.00010	mg/L	0		02-OCT-13	R2707427
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		02-OCT-13	R2707427
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		02-OCT-13	R2707427
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Calcium (Ca)-Dissolved	65.7	+/-8.9		0.50	mg/L	0		02-OCT-13	R2707427
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Cobalt (Co)-Dissolved	0.00035	+/-0.00003		0.00010	mg/L	0		02-OCT-13	R2707427
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		02-OCT-13	R2707427
Iron (Fe)-Dissolved	3.77	+/-0.34		0.010	mg/L	0		02-OCT-13	R2707427
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Magnesium (Mg)-Dissolved	16.5	+/-1.3		0.10	mg/L	0		02-OCT-13	R2707427
Manganese (Mn)-Dissolved	0.250	+/-0.017		0.0020	mg/L	0		02-OCT-13	R2707427
Molybdenum (Mo)-Dissolved	0.00588	+/-0.00062		0.00010	mg/L	0		02-OCT-13	R2707427
Nickel (Ni)-Dissolved	0.00053	+/-0.00006		0.00010	mg/L	0		02-OCT-13	R2707427
Potassium (K)-Dissolved	4.03	+/-0.31		0.50	mg/L	0		02-OCT-13	R2707427
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Silicon (Si)-Dissolved	9.86	+/-0.84		0.050	mg/L	0		02-OCT-13	R2707427
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		02-OCT-13	R2707427
Sodium (Na)-Dissolved	71.5	+/-5.0		1.0	mg/L	0		02-OCT-13	R2707427
Strontium (Sr)-Dissolved	0.466	+/-0.035		0.00010	mg/L	0		02-OCT-13	R2707427
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		02-OCT-13	R2707427
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		02-OCT-13	R2707427
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		02-OCT-13	R2707427
Uranium (U)-Dissolved	0.00021	+/-0.00002		0.00010	mg/L	0		02-OCT-13	R2707427
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Zinc (Zn)-Dissolved	0.0094	+/-0.0011		0.0010	mg/L	0		02-OCT-13	R2707427
Ion Balance Calculation									
Ion Balance	96.3	-			%	-		03-OCT-13	
TDS (Calculated)	415	-			mg/L	-		03-OCT-13	
Hardness (as CaCO3)	232	-			mg/L	-		03-OCT-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		25-SEP-13	R2701555
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		30-SEP-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		25-SEP-13	R2701555
Sulfate by IC									
Sulfate (SO4)	25.2	+/-1.1		0.50	mg/L	0		25-SEP-13	R2701555
pH, Conductivity and Total Alkalinity									
pH	8.40	+/-0.04		0.10	pH	0		26-SEP-13	R2701489
Conductivity (EC)	699	+/-23		0.20	uS/cm	0		26-SEP-13	R2701489
Bicarbonate (HCO3)	457	-		5.0	mg/L	-		26-SEP-13	R2701489
Carbonate (CO3)	6.7	-		5.0	mg/L	-		26-SEP-13	R2701489
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		26-SEP-13	R2701489
Alkalinity, Total (as CaCO3)	386	+/-14		2.0	mg/L	0		26-SEP-13	R2701489

Reference Information

Report Comments: ADDITIONAL 18-OCT-13 11:18
17-DEC-2013 LORs for Ag and Al have been fixed

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Sulfate (SO4)	MS-B	
Matrix Spike	Dissolved Organic Carbon	MS-B	

Qualifiers for Individual Samples Listed:

Sample Number	Client ID	Qualifier	Description
L1367764-1	16054130923047	SFP	DOC - Sample was Filtered and Preserved at the laboratory

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
B-D-L-CCMS-ED	Water	Dissolved Boron in Water by CRC ICPMS		APHA 3030 B / EPA SW-846 6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).				
BTXS,F1-ED	Water	BTEX, Styrene and F1 (C6-C10)		EPA 5021/8015&8260 GC-MS & FID
C-DIS-ORG-ED	Water	Dissolved Organic Carbon		APHA 5310 B-Instrumental
CL-IC-ED	Water	Chloride by IC		APHA 4110 B-ION CHROMATOGRAPHY
F2,F3,F4-ED	Water	F2, F3, F4		EPA 3510/CCME PHC CWS-GC-FID
HG-D-CVAA-ED	Water	Mercury (Hg) - Dissolved		EPA 245.7 / EPA 245.1
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET-D-CCMS-ED	Water	Dissolved Metals in Water by CRC ICPMS		APHA 3030 B&E / EPA SW-846 6020A
NAPHTHENIC-ACID-FM	Water	Naphthenic Acids by FTIR		Naphthenic Acids by FTIR, Syncrude, 1994
Dissolved naphthenic acids are solvent extracted from acidified aqueous samples using Dichloromethane prior to quantitation by Fourier Transform Infra-Red spectroscopy. Note that FTIR is not uniquely selective to naphthenic acids. If present, other carboxylic acids (e.g. humic acids, fulvic acids) may also be detected by this method.				
NH3-CFA-ED	Water	Ammonia in Water by Colour		APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.				
NO2+NO3-CALC-ED	Water	Nitrate+Nitrite		CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
PAH-ABT1-ED	Water	PAH & Carcinogenic PAH List		EPA 3510/8270-GC/MS
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)				
PHENOLS-4AAP-ED	Water	Phenols (4AAP)		AB ENV.06537-COLORIMETRIC
This analysis is carried out using procedures adapted from ENVIRODAT VMV 06537 689, Method Code 154, in "Methods Manual for Chemical Analysis of Water and Wastes" published by the Alberta Environmental Centre. This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide and 4-aminoantipyrine to form a red complex which is measured at 505 nm.				
SO4-IC-ED	Water	Sulfate by IC		APHA 4110 B-ION CHROMATOGRAPHY
TKN-CFA-ED	Water	TKN in Water by Colour		APHA 4500-NORG (TKN)
This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 celcius with analysis using an automated colourimetric finish.				
TURBIDITY-ED	Water	Turbidity		APHA 2130 B-Nephelometer

** The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS methods may incorporate modifications from the specified reference to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
		Laboratory Definition Code	Laboratory Location	
ED		ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA		
FM		ALS ENVIRONMENTAL - FORT MCMURRAY, ALBERTA, CANADA		

Chain of Custody Numbers:

M060605

GLOSSARY OF REPORT TERMS

Surr - Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

MU: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.

Bias: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent.

Zero values indicate no detectable method bias.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Environmental

Quality Control Report

Workorder: L1367764

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-D-L-CCMS-ED		Water						
Batch	R2707427							
WG1759470-2	CRM	ED-HIGH-WATRM						
Boron (B)-Dissolved			108.6		%		80-120	02-OCT-13
WG1759470-3	DUP	L1367775-1						
Boron (B)-Dissolved		0.245	0.258		mg/L	5.4	20	02-OCT-13
WG1759470-1	MB							
Boron (B)-Dissolved			<0.0020		mg/L		0.002	02-OCT-13
BTXS,F1-ED		Water						
Batch	R2702007							
WG1757354-2	LCS							
Benzene			86.8		%		70-130	30-SEP-13
Toluene			72.3		%		70-130	30-SEP-13
EthylBenzene			85.2		%		70-130	30-SEP-13
o-Xylene			84.6		%		70-130	30-SEP-13
m+p-Xylene			85.2		%		70-130	30-SEP-13
Styrene			76.6		%		70-130	30-SEP-13
WG1757354-3	LCS							
F1(C6-C10)			99.5		%		70-130	30-SEP-13
WG1757354-1	MB							
Benzene			<0.00050		mg/L		0.0005	30-SEP-13
Toluene			<0.00050		mg/L		0.0005	30-SEP-13
EthylBenzene			<0.00050		mg/L		0.0005	30-SEP-13
o-Xylene			<0.00050		mg/L		0.0005	30-SEP-13
m+p-Xylene			<0.00050		mg/L		0.0005	30-SEP-13
Styrene			<0.0010		mg/L		0.001	30-SEP-13
F1(C6-C10)			<0.10		mg/L		0.1	30-SEP-13
C-DIS-ORG-ED		Water						
Batch	R2709550							
WG1761992-3	CVS							
Dissolved Organic Carbon			138.8		%		80-160	05-OCT-13
WG1761992-4	DUP	L1365837-5						
Dissolved Organic Carbon		25.4	24.6		mg/L	3.3	20	05-OCT-13
WG1761992-8	DUP	L1369101-25						
Dissolved Organic Carbon		7.2	7.1		mg/L	0.7	20	06-OCT-13
WG1761992-2	LCS							
Dissolved Organic Carbon			113.8		%		80-120	05-OCT-13
WG1761992-1	MB							



Quality Control Report

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Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C-DIS-ORG-ED		Water						
Batch	R2709550							
WG1761992-1	MB							
Dissolved Organic Carbon			<1.0		mg/L		1	05-OCT-13
WG1761992-5	MS	L1365837-5						
Dissolved Organic Carbon			N/A	MS-B	%		-	05-OCT-13
WG1761992-9	MS	L1369101-25						
Dissolved Organic Carbon			110.3		%		70-130	06-OCT-13
CL-IC-ED		Water						
Batch	R2701555							
WG1754970-3	DUP	L1367775-5						
Chloride (Cl)			<0.50	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-5	DUP	L1367764-4						
Chloride (Cl)			<0.50	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-7	DUP	L1367259-26						
Chloride (Cl)			53.7		mg/L	0.9	20	25-SEP-13
WG1754970-9	DUP	L1366522-5						
Chloride (Cl)			<0.50	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-2	LCS							
Chloride (Cl)			101.1		%		90-110	25-SEP-13
WG1754970-1	MB							
Chloride (Cl)			<0.50		mg/L		0.5	26-SEP-13
WG1754970-10	MS	L1366522-5						
Chloride (Cl)			102.2		%		75-125	25-SEP-13
WG1754970-4	MS	L1367775-5						
Chloride (Cl)			102.3		%		75-125	25-SEP-13
WG1754970-6	MS	L1367764-4						
Chloride (Cl)			103.8		%		75-125	25-SEP-13
WG1754970-8	MS	L1367259-26						
Chloride (Cl)			97.2		%		75-125	25-SEP-13
F2,F3,F4-ED		Water						
Batch	R2705779							
WG1757665-2	LCS							
F2 (>C10-C16)			99.2		%		65-135	30-SEP-13
F3 (C16-C34)			101.1		%		65-135	30-SEP-13
F4 (C34-C50)			99.9		%		65-135	30-SEP-13
WG1757665-5	LCS							
F2 (>C10-C16)			97.9		%		65-135	30-SEP-13
F3 (C16-C34)			101.0		%		65-135	30-SEP-13



Quality Control Report

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2,F3,F4-ED								
	Water							
Batch	R2705779							
WG1757665-5	LCS							
F4 (C34-C50)			99.5		%		65-135	30-SEP-13
WG1757665-8	LCS							
F2 (>C10-C16)			100.3		%		65-135	30-SEP-13
F3 (C16-C34)			100.9		%		65-135	30-SEP-13
F4 (C34-C50)			91.5		%		65-135	30-SEP-13
WG1757665-1	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	30-SEP-13
F3 (C16-C34)			<0.25		mg/L		0.25	30-SEP-13
F4 (C34-C50)			<0.25		mg/L		0.25	30-SEP-13
Surrogate: 2-Bromobenzotrifluoride			101.1		%		50-150	30-SEP-13
WG1757665-4	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	30-SEP-13
F3 (C16-C34)			<0.25		mg/L		0.25	30-SEP-13
F4 (C34-C50)			<0.25		mg/L		0.25	30-SEP-13
Surrogate: 2-Bromobenzotrifluoride			100.2		%		50-150	30-SEP-13
WG1757665-7	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	30-SEP-13
F3 (C16-C34)			<0.25		mg/L		0.25	30-SEP-13
F4 (C34-C50)			<0.25		mg/L		0.25	30-SEP-13
Surrogate: 2-Bromobenzotrifluoride			97.8		%		50-150	30-SEP-13
WG1757665-9	MS	L1369104-9						
F2 (>C10-C16)			104.0		%		50-150	30-SEP-13
F3 (C16-C34)			102.6		%		50-150	30-SEP-13
F4 (C34-C50)			91.4		%		50-150	30-SEP-13
HG-D-CVAA-ED								
	Water							
Batch	R2701610							
WG1755329-11	DUP	L1367764-2						
Mercury (Hg)-Dissolved			<0.00010	<0.00010	RPD-NA	mg/L	N/A	20
WG1755329-13	DUP	L1366644-1						
Mercury (Hg)-Dissolved			<0.00010	<0.00010	RPD-NA	mg/L	N/A	20
WG1755329-2	LCS							
Mercury (Hg)-Dissolved			86.5		%		80-120	26-SEP-13
WG1755329-3	LCSD	WG1755329-2						
Mercury (Hg)-Dissolved			86.5	87.4	%	1.1	20	26-SEP-13
WG1755329-1	MB						0.0001	



Quality Control Report

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-D-CVAA-ED								
	Water							
Batch	R2701610							
WG1755329-1 MB								
Mercury (Hg)-Dissolved			<0.00010		mg/L		0.0001	26-SEP-13
WG1755329-10 MS		L1367764-2						
Mercury (Hg)-Dissolved			93.2		%		70-130	29-SEP-13
WG1755329-12 MS		L1366644-1						
Mercury (Hg)-Dissolved			105.7		%		70-130	29-SEP-13
MET-D-CCMS-ED								
	Water							
Batch	R2707427							
WG1759470-2 CRM		ED-HIGH-WATRM						
Aluminum (Al)-Dissolved			114.6		%		80-120	02-OCT-13
Antimony (Sb)-Dissolved			119.7		%		80-120	02-OCT-13
Beryllium (Be)-Dissolved			115.5		%		80-120	02-OCT-13
Calcium (Ca)-Dissolved			118.4		%		80-120	02-OCT-13
Chromium (Cr)-Dissolved			113.8		%		80-120	02-OCT-13
Cobalt (Co)-Dissolved			112.4		%		80-120	02-OCT-13
Copper (Cu)-Dissolved			113.6		%		80-120	02-OCT-13
Magnesium (Mg)-Dissolved			115.4		%		80-120	02-OCT-13
Manganese (Mn)-Dissolved			114.6		%		80-120	02-OCT-13
Molybdenum (Mo)-Dissolved			116.9		%		80-120	02-OCT-13
Nickel (Ni)-Dissolved			115.5		%		80-120	02-OCT-13
Potassium (K)-Dissolved			111.6		%		80-120	02-OCT-13
Selenium (Se)-Dissolved			115.5		%		80-120	02-OCT-13
Silicon (Si)-Dissolved			112.3		%		80-120	02-OCT-13
Silver (Ag)-Dissolved			114.2		%		80-120	02-OCT-13
Strontium (Sr)-Dissolved			117.0		%		80-120	02-OCT-13
Thallium (Tl)-Dissolved			120.0		%		80-120	02-OCT-13
Titanium (Ti)-Dissolved			111.8		%		80-120	02-OCT-13
Tin (Sn)-Dissolved			113.3		%		80-120	02-OCT-13
Uranium (U)-Dissolved			118.2		%		80-120	02-OCT-13
Vanadium (V)-Dissolved			119.3		%		80-120	02-OCT-13
Zinc (Zn)-Dissolved			116.1		%		80-120	02-OCT-13
WG1759470-3 DUP		L1367775-1						
Aluminum (Al)-Dissolved		<0.0010	<0.010	RPD-NA	mg/L	N/A	20	02-OCT-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	02-OCT-13
Arsenic (As)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	02-OCT-13



Quality Control Report

Workorder: L1367764

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2707427							
WG1759470-3	DUP	L1367775-1						
Barium (Ba)-Dissolved		0.119	0.119		mg/L	0.2	20	02-OCT-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-OCT-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-OCT-13
Cadmium (Cd)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Calcium (Ca)-Dissolved		81.2	82.9		mg/L	2.0	20	02-OCT-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	02-OCT-13
Cobalt (Co)-Dissolved		0.00012	0.00012		mg/L	5.6	20	02-OCT-13
Copper (Cu)-Dissolved		<0.00060	<0.00060	RPD-NA	mg/L	N/A	20	02-OCT-13
Iron (Fe)-Dissolved		1.51	1.48		mg/L	1.9	20	02-OCT-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Magnesium (Mg)-Dissolved		24.9	25.5		mg/L	2.5	20	02-OCT-13
Manganese (Mn)-Dissolved		0.0432	0.0436		mg/L	0.8	20	02-OCT-13
Molybdenum (Mo)-Dissolved		0.00055	0.00056		mg/L	1.3	20	02-OCT-13
Nickel (Ni)-Dissolved		0.00016	0.00015		mg/L	7.3	20	02-OCT-13
Potassium (K)-Dissolved		5.13	4.91		mg/L	4.4	20	02-OCT-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	02-OCT-13
Silicon (Si)-Dissolved		10.7	10.8		mg/L	0.5	20	02-OCT-13
Silver (Ag)-Dissolved		<0.000010	<0.00020	RPD-NA	mg/L	N/A	20	02-OCT-13
Sodium (Na)-Dissolved		62.7	62.7		mg/L	0.1	20	02-OCT-13
Strontium (Sr)-Dissolved		0.638	0.670		mg/L	4.8	20	02-OCT-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-OCT-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	02-OCT-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	02-OCT-13
Uranium (U)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Vanadium (V)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Zinc (Zn)-Dissolved		0.0091	0.0084		mg/L	8.4	20	02-OCT-13
WG1759470-4	DUP	L1369101-8						
Aluminum (Al)-Dissolved		0.0020	0.0015	J	mg/L	0.0005	0.002	02-OCT-13
Antimony (Sb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Arsenic (As)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Barium (Ba)-Dissolved		0.0105	0.0106		mg/L	0.2	20	02-OCT-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-OCT-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-OCT-13



Quality Control Report

Workorder: L1367764

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2707427							
WG1759470-4	DUP	L1369101-8						
Cadmium (Cd)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	02-OCT-13
Calcium (Ca)-Dissolved		15.4	14.4		mg/L	7.1	20	02-OCT-13
Chromium (Cr)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Copper (Cu)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Iron (Fe)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	02-OCT-13
Lead (Pb)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-OCT-13
Magnesium (Mg)-Dissolved		4.66	4.73		mg/L	1.4	20	02-OCT-13
Manganese (Mn)-Dissolved		0.0128	0.0128		mg/L	0.5	20	02-OCT-13
Molybdenum (Mo)-Dissolved		0.00243	0.00228		mg/L	6.2	20	02-OCT-13
Nickel (Ni)-Dissolved		0.00014	0.00013		mg/L	1.3	20	02-OCT-13
Potassium (K)-Dissolved		1.61	1.59		mg/L	0.9	20	02-OCT-13
Selenium (Se)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Silicon (Si)-Dissolved		4.35	4.27		mg/L	1.8	20	02-OCT-13
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	02-OCT-13
Sodium (Na)-Dissolved		289	285		mg/L	1.4	20	02-OCT-13
Strontium (Sr)-Dissolved		0.439	0.419		mg/L	4.6	20	02-OCT-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-OCT-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	02-OCT-13
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Uranium (U)-Dissolved		0.000087	0.000082		mg/L	5.7	20	02-OCT-13
Vanadium (V)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Zinc (Zn)-Dissolved		0.0012	0.0012		mg/L	3.2	20	02-OCT-13
WG1759470-5	DUP	L1369104-1						
Aluminum (Al)-Dissolved		0.0047	0.0042		mg/L	13	20	02-OCT-13
Antimony (Sb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Arsenic (As)-Dissolved		0.00050	0.00051		mg/L	2.0	20	02-OCT-13
Barium (Ba)-Dissolved		0.198	0.202		mg/L	2.0	20	02-OCT-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-OCT-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-OCT-13
Cadmium (Cd)-Dissolved		0.000119	0.000119		mg/L	0.1	20	02-OCT-13
Calcium (Ca)-Dissolved		82.6	82.1		mg/L	0.5	20	02-OCT-13
Chromium (Cr)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2707427							
WG1759470-5	DUP	L1369104-1						
Cobalt (Co)-Dissolved		0.00020	0.00020		mg/L	1.2	20	02-OCT-13
Copper (Cu)-Dissolved		0.00051	0.00051		mg/L	0.4	20	02-OCT-13
Iron (Fe)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	02-OCT-13
Lead (Pb)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-OCT-13
Magnesium (Mg)-Dissolved		9.21	9.31		mg/L	1.1	20	02-OCT-13
Manganese (Mn)-Dissolved		0.359	0.361		mg/L	0.5	20	02-OCT-13
Molybdenum (Mo)-Dissolved		0.000815	0.000841		mg/L	3.1	20	02-OCT-13
Nickel (Ni)-Dissolved		0.00059	0.00059		mg/L	1.0	20	02-OCT-13
Potassium (K)-Dissolved		<0.50	<0.50	RPD-NA	mg/L	N/A	20	02-OCT-13
Selenium (Se)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Silicon (Si)-Dissolved		5.02	4.77		mg/L	5.0	20	02-OCT-13
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	02-OCT-13
Sodium (Na)-Dissolved		4.4	4.3		mg/L	2.5	20	02-OCT-13
Strontium (Sr)-Dissolved		0.108	0.108		mg/L	0.1	20	02-OCT-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-OCT-13
Titanium (Ti)-Dissolved		0.00063	0.00053		mg/L	18	20	02-OCT-13
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Uranium (U)-Dissolved		0.000357	0.000354		mg/L	0.9	20	02-OCT-13
Vanadium (V)-Dissolved		0.00018	0.00017		mg/L	1.6	20	02-OCT-13
Zinc (Zn)-Dissolved		0.0037	0.0031		mg/L	19	20	02-OCT-13
WG1759470-1	MB							
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	02-OCT-13
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	02-OCT-13
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	02-OCT-13
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	02-OCT-13
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	02-OCT-13
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	02-OCT-13
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	02-OCT-13
Calcium (Ca)-Dissolved			<0.020		mg/L		0.02	02-OCT-13
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	02-OCT-13
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	02-OCT-13
Copper (Cu)-Dissolved			<0.00010		mg/L		0.0001	02-OCT-13
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	02-OCT-13



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200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED		Water						
Batch R2707427								
WG1759470-1 MB								
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	02-OCT-13
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	02-OCT-13
Manganese (Mn)-Dissolved			<0.000050		mg/L		0.00005	02-OCT-13
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	02-OCT-13
Nickel (Ni)-Dissolved			<0.00010		mg/L		0.0001	02-OCT-13
Potassium (K)-Dissolved			<0.050		mg/L		0.05	02-OCT-13
Selenium (Se)-Dissolved			<0.00010		mg/L		0.0001	02-OCT-13
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	02-OCT-13
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	02-OCT-13
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	02-OCT-13
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	02-OCT-13
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	02-OCT-13
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	02-OCT-13
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	02-OCT-13
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	02-OCT-13
Vanadium (V)-Dissolved			<0.00010		mg/L		0.0001	02-OCT-13
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	02-OCT-13
NAPHTHENIC-ACID-FM		Water						
Batch R2700794								
WG1754347-3 DUP		L1364191-8						
Naphthenic Acids		1.2	<1.0	RPD-NA	mg/L	N/A	30	25-SEP-13
WG1754347-7 DUP		L1367748-2						
Naphthenic Acids		37.3	37.2		mg/L	0.3	30	25-SEP-13
WG1754347-4 LCS								
Naphthenic Acids			104.2		%		70-130	25-SEP-13
WG1754347-1 MB								
Naphthenic Acids			<1.0		mg/L		1	25-SEP-13
WG1754347-5 MB								
Naphthenic Acids			<1.0		mg/L		1	25-SEP-13
WG1754347-2 MS		L1364191-7						
Naphthenic Acids			121.9		%		50-150	25-SEP-13
WG1754347-6 MS		L1366226-5						
Naphthenic Acids			105.0		%		50-150	25-SEP-13
NH3-CFA-ED		Water						



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200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-CFA-ED		Water						
Batch	R2706589							
WG1759121-11	DUP	L1369030-6						
Ammonia, Total (as N)		1.20	1.21		mg/L	0.4	20	02-OCT-13
WG1759121-12	DUP	L1369105-1						
Ammonia, Total (as N)		12.4	12.5		mg/L	0.9	20	02-OCT-13
WG1759121-6	DUP	L1371511-1						
Ammonia, Total (as N)		0.749	0.714		mg/L	4.8	20	02-OCT-13
WG1759121-9	DUP	L1369101-25						
Ammonia, Total (as N)		1.53	1.49		mg/L	2.7	20	02-OCT-13
WG1759121-2	LCS							
Ammonia, Total (as N)			98.5		%		85-115	02-OCT-13
WG1759121-1	MB							
Ammonia, Total (as N)			<0.050		mg/L		0.05	02-OCT-13
WG1759121-10	MS	L1368925-2						
Ammonia, Total (as N)			102.0		%		75-125	02-OCT-13
WG1759121-5	MS	L1367764-4						
Ammonia, Total (as N)			91.6		%		75-125	02-OCT-13
WG1759121-8	MS	L1369101-1						
Ammonia, Total (as N)			97.2		%		75-125	02-OCT-13
NO2-IC-ED		Water						
Batch	R2701555							
WG1754970-3	DUP	L1367775-5						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-5	DUP	L1367764-4						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-7	DUP	L1367259-26						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-9	DUP	L1366522-5						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-2	LCS							
Nitrite (as N)			93.7		%		90-110	25-SEP-13
WG1754970-1	MB							
Nitrite (as N)			<0.050		mg/L		0.05	26-SEP-13
WG1754970-10	MS	L1366522-5						
Nitrite (as N)			94.0		%		75-125	25-SEP-13
WG1754970-4	MS	L1367775-5						
Nitrite (as N)			89.9		%		75-125	25-SEP-13
WG1754970-6	MS	L1367764-4						
Nitrite (as N)			89.6		%		75-125	25-SEP-13



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO2-IC-ED								
	Water							
Batch	R2701555							
WG1754970-8	MS	L1367259-26						
Nitrite (as N)			88.8		%		75-125	25-SEP-13
NO3-IC-ED								
	Water							
Batch	R2701555							
WG1754970-3	DUP	L1367775-5						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-5	DUP	L1367764-4						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-7	DUP	L1367259-26						
Nitrate (as N)		0.312	0.307		mg/L	1.7	20	25-SEP-13
WG1754970-9	DUP	L1366522-5						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-2	LCS							
Nitrate (as N)			99.4		%		90-110	25-SEP-13
WG1754970-1	MB							
Nitrate (as N)			<0.050		mg/L		0.05	26-SEP-13
WG1754970-10	MS	L1366522-5						
Nitrate (as N)			97.4		%		75-125	25-SEP-13
WG1754970-4	MS	L1367775-5						
Nitrate (as N)			98.5		%		75-125	25-SEP-13
WG1754970-6	MS	L1367764-4						
Nitrate (as N)			100.4		%		75-125	25-SEP-13
WG1754970-8	MS	L1367259-26						
Nitrate (as N)			101.2		%		75-125	25-SEP-13
PAH-ABT1-ED								
	Water							
Batch	R2704447							
WG1755256-3	LCS							
Acenaphthene			80.8		%		60-130	30-SEP-13
Acenaphthylene			81.9		%		60-130	30-SEP-13
Anthracene			79.6		%		60-130	30-SEP-13
Fluoranthene			82.8		%		60-130	30-SEP-13
Fluorene			81.1		%		60-130	30-SEP-13
Naphthalene			82.1		%		50-130	30-SEP-13
Phenanthrene			82.4		%		60-130	30-SEP-13
Pyrene			82.0		%		60-130	30-SEP-13
Benzo(a)anthracene			96.5		%		60-130	30-SEP-13



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 200 - 150 13 Ave SW
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Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ABT1-ED								
	Water							
Batch	R2704447							
WG1755256-3	LCS							
Benzo(k)fluoranthene			80.8		%		60-130	30-SEP-13
Benzo(b&j)fluoranthene			90.8		%		60-130	30-SEP-13
Benzo(g,h,i)perylene			85.5		%		60-130	30-SEP-13
Benzo(a)pyrene			82.7		%		60-130	30-SEP-13
Chrysene			76.2		%		60-130	30-SEP-13
Dibenzo(a,h)anthracene			95.7		%		60-130	30-SEP-13
Indeno(1,2,3-cd)pyrene			96.2		%		60-130	30-SEP-13
WG1755256-2	MB							
Acenaphthene			<0.000020		mg/L		0.00002	30-SEP-13
Acenaphthylene			<0.000020		mg/L		0.00002	30-SEP-13
Anthracene			<0.000010		mg/L		0.00001	30-SEP-13
Fluoranthene			<0.000020		mg/L		0.00002	30-SEP-13
Fluorene			<0.000020		mg/L		0.00002	30-SEP-13
Naphthalene			<0.000050		mg/L		0.00005	30-SEP-13
Phenanthrene			<0.000050		mg/L		0.00005	30-SEP-13
Pyrene			<0.000020		mg/L		0.00002	30-SEP-13
Benzo(a)anthracene			<0.000010		mg/L		0.00001	30-SEP-13
Benzo(k)fluoranthene			<0.000010		mg/L		0.00001	30-SEP-13
Benzo(b&j)fluoranthene			<0.000010		mg/L		0.00001	30-SEP-13
Benzo(g,h,i)perylene			<0.000020		mg/L		0.00002	30-SEP-13
Benzo(a)pyrene			<0.0000050		mg/L		0.000005	30-SEP-13
Chrysene			<0.000020		mg/L		0.00002	30-SEP-13
Dibenzo(a,h)anthracene			<0.0000050		mg/L		0.000005	30-SEP-13
Indeno(1,2,3-cd)pyrene			<0.000010		mg/L		0.00001	30-SEP-13
Surrogate: Nitrobenzene d5			84.5		%		40-130	30-SEP-13
Surrogate: 2-Fluorobiphenyl			72.8		%		40-130	30-SEP-13
Surrogate: p-Terphenyl d14			85.6		%		40-130	30-SEP-13
PH/EC/ALK-ED								
	Water							
Batch	R2701489							
WG1755183-10	DUP	L1367259-26						
pH		8.37	8.47	J	pH	0.09	0.3	27-SEP-13
Conductivity (EC)		939	928		uS/cm	1.2	10	27-SEP-13
Bicarbonate (HCO3)		390	380		mg/L	2.5	25	27-SEP-13
Carbonate (CO3)		<5.0	7.8	RPD-NA	mg/L	N/A	25	27-SEP-13



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 200 - 150 13 Ave SW
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Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch	R2701489							
WG1755183-10	DUP	L1367259-26						
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	27-SEP-13
Alkalinity, Total (as CaCO3)		325	324		mg/L	0.2	20	27-SEP-13
WG1755183-6	DUP	L1368108-4						
pH		8.16	8.14	J	pH	0.02	0.3	26-SEP-13
Conductivity (EC)		655	653		uS/cm	0.3	10	26-SEP-13
Bicarbonate (HCO3)		358	357		mg/L	0.2	25	26-SEP-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	26-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	26-SEP-13
Alkalinity, Total (as CaCO3)		293	293		mg/L	0.2	20	26-SEP-13
WG1755183-7	DUP	L1367995-1						
pH		10.68	10.64	J	pH	0.04	0.3	26-SEP-13
Conductivity (EC)		3870	3840		uS/cm	0.8	10	26-SEP-13
Bicarbonate (HCO3)		236	241		mg/L	2.2	25	26-SEP-13
Carbonate (CO3)		109	104		mg/L	4.4	25	26-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	26-SEP-13
Alkalinity, Total (as CaCO3)		374	371		mg/L	1.0	20	26-SEP-13
WG1755183-8	DUP	L1367764-4						
pH		8.32	8.30	J	pH	0.02	0.3	26-SEP-13
Conductivity (EC)		491	490		uS/cm	0.2	10	26-SEP-13
Bicarbonate (HCO3)		327	327		mg/L	0.1	25	26-SEP-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	26-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	26-SEP-13
Alkalinity, Total (as CaCO3)		271	270		mg/L	0.4	20	26-SEP-13
WG1755183-9	DUP	L1367203-7						
pH		8.35	8.34	J	pH	0.01	0.3	26-SEP-13
Conductivity (EC)		9490	9500		uS/cm	0.1	10	26-SEP-13
Bicarbonate (HCO3)		793	747		mg/L	6.0	25	26-SEP-13
Carbonate (CO3)		7.2	6.5		mg/L	10	25	26-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	26-SEP-13
Alkalinity, Total (as CaCO3)		662	623		mg/L	6.1	20	26-SEP-13
WG1755183-2	LCS	L1367764-4						
Conductivity (EC)			102.1		%		90-110	26-SEP-13
WG1755183-3	LCS	L1367764-4						
pH			7.06		pH		6.7-7.3	26-SEP-13



Quality Control Report

Workorder: L1367764

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch	R2701489							
WG1755183-4	LCS							
Alkalinity, Total (as CaCO3)			101.0		%		85-115	26-SEP-13
WG1755183-5	LCS							
Conductivity (EC)			97.8		%		90-110	26-SEP-13
WG1755183-1	MB							
Bicarbonate (HCO3)			<5.0		mg/L		5	26-SEP-13
Carbonate (CO3)			<5.0		mg/L		5	26-SEP-13
Hydroxide (OH)			<5.0		mg/L		5	26-SEP-13
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	26-SEP-13
PHENOLS-4AAP-ED		Water						
Batch	R2706556							
WG1759489-10	DUP	L1368882-6						
Phenols (4AAP)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	15	02-OCT-13
WG1759489-5	DUP	L1369050-27						
Phenols (4AAP)		0.0016	0.0020	J	mg/L	0.0004	0.002	02-OCT-13
WG1759489-6	DUP	L1370429-1						
Phenols (4AAP)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	15	02-OCT-13
WG1759489-7	DUP	L1366493-2						
Phenols (4AAP)		0.0111	0.0111		mg/L	0.0	15	02-OCT-13
WG1759489-8	DUP	L1368214-3						
Phenols (4AAP)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	15	02-OCT-13
WG1759489-9	DUP	L1368865-5						
Phenols (4AAP)		0.0016	0.0022	J	mg/L	0.0006	0.002	02-OCT-13
WG1759489-3	LCS							
Phenols (4AAP)			92.0		%		85-115	02-OCT-13
WG1759489-2	MB							
Phenols (4AAP)			<0.0010		mg/L		0.001	02-OCT-13
WG1759489-4	MS	L1368066-6						
Phenols (4AAP)			100.0		%		75-125	02-OCT-13
SO4-IC-ED		Water						
Batch	R2701555							
WG1754970-3	DUP	L1367775-5						
Sulfate (SO4)		4.43	4.41		mg/L	0.4	20	25-SEP-13
WG1754970-5	DUP	L1367764-4						
Sulfate (SO4)		14.9	14.9		mg/L	0.4	20	25-SEP-13
WG1754970-7	DUP	L1367259-26						
Sulfate (SO4)		118	117		mg/L	0.9	20	25-SEP-13



Quality Control Report

Workorder: L1367764

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-IC-ED		Water						
Batch	R2701555							
WG1754970-9	DUP	L1366522-5						
Sulfate (SO4)		<0.50	<0.50	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-2	LCS							
Sulfate (SO4)			100.9		%		90-110	25-SEP-13
WG1754970-1	MB							
Sulfate (SO4)			<0.50		mg/L		0.5	26-SEP-13
WG1754970-10	MS	L1366522-5						
Sulfate (SO4)			101.5		%		75-125	25-SEP-13
WG1754970-4	MS	L1367775-5						
Sulfate (SO4)			100.4		%		75-125	25-SEP-13
WG1754970-6	MS	L1367764-4						
Sulfate (SO4)			100.9		%		75-125	25-SEP-13
WG1754970-8	MS	L1367259-26						
Sulfate (SO4)			N/A	MS-B	%		-	25-SEP-13
TKN-CFA-ED		Water						
Batch	R2707883							
WG1760073-5	DUP	L1361457-1						
Total Kjeldahl Nitrogen		<0.20	<0.20	RPD-NA	mg/L	N/A	20	03-OCT-13
WG1760073-2	LCS							
Total Kjeldahl Nitrogen			107		mg/L		75-125	03-OCT-13
WG1760073-3	LCS							
Total Kjeldahl Nitrogen			91.9		mg/L		75-125	03-OCT-13
WG1760073-4	LCS							
Total Kjeldahl Nitrogen			103		mg/L		75-125	03-OCT-13
WG1760073-1	MB							
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	03-OCT-13
WG1760073-6	MS	L1361457-1						
Total Kjeldahl Nitrogen			112		mg/L		70-130	03-OCT-13
TURBIDITY-ED		Water						
Batch	R2701091							
WG1754359-3	DUP	L1366777-10						
Turbidity		0.56	0.57		NTU	2.1	15	25-SEP-13
WG1754359-4	DUP	L1367764-2						
Turbidity		394	399		NTU	1.3	15	25-SEP-13
WG1754359-2	LCS							
Turbidity			97.0		%		85-115	25-SEP-13
WG1754359-1	MB							
Turbidity			<0.10		NTU		0.1	25-SEP-13

Quality Control Report

Workorder: L1367764

Report Date: 17-DEC-13

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

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Contact: SUE RAYNARD

Legend:

Limit ALS Control Limit (Data Quality Objectives)
DUP Duplicate
RPD Relative Percent Difference
N/A Not Available
LCS Laboratory Control Sample
SRM Standard Reference Material
MS Matrix Spike
MSD Matrix Spike Duplicate
ADE Average Desorption Efficiency
MB Method Blank
IRM Internal Reference Material
CRM Certified Reference Material
CCV Continuing Calibration Verification
CVS Calibration Verification Standard
LCSD Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

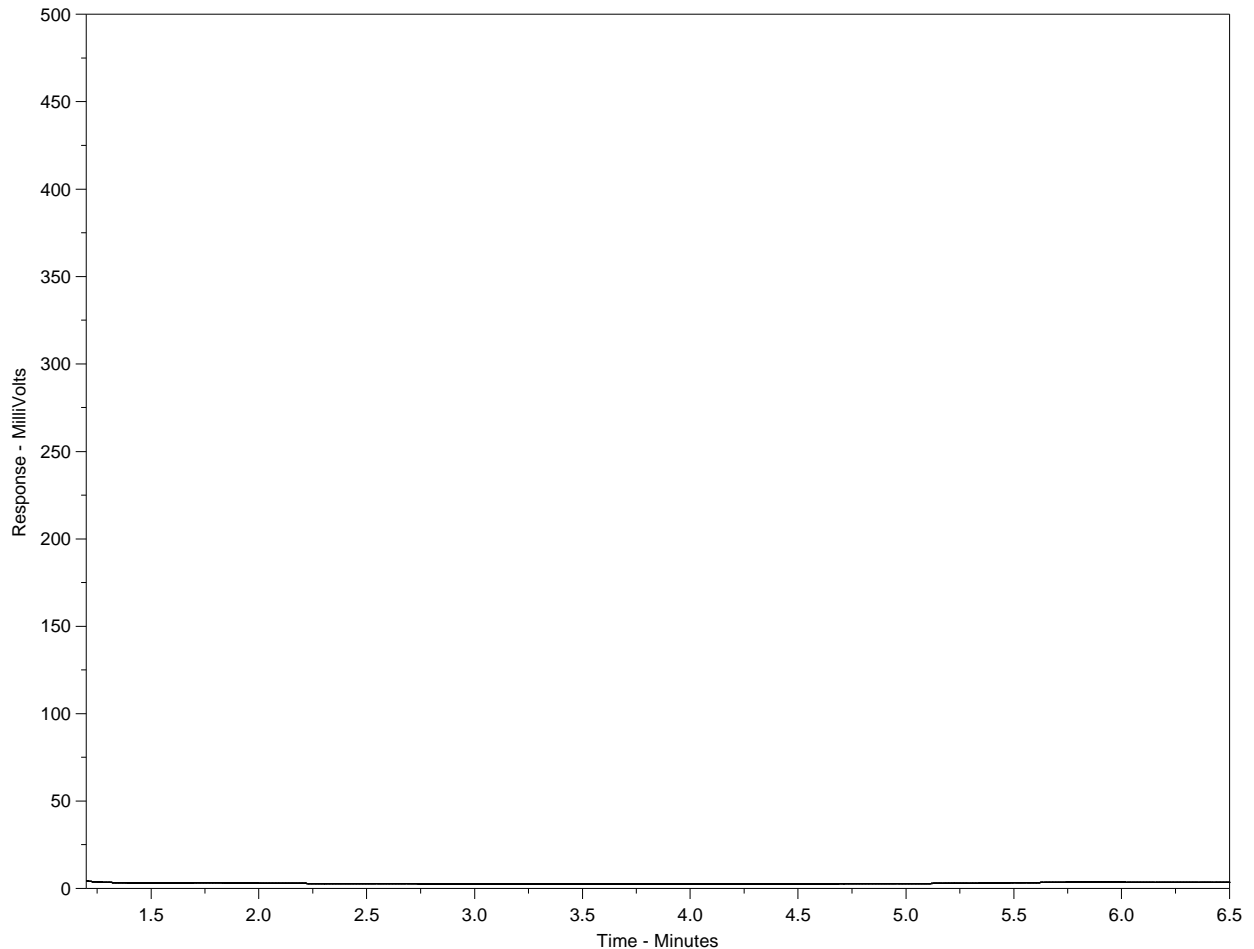
The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Hydrocarbon Distribution Report



ALS Sample ID: L1367775-1
 Client ID: 16054130923051



← F2 →		← F3 →		← F4 →		← F4 →	
nC10	nC16			nC34	nC50		
174°C	287°C			481°C	575°C		
346°F	549°F			898°F	1067°F		
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

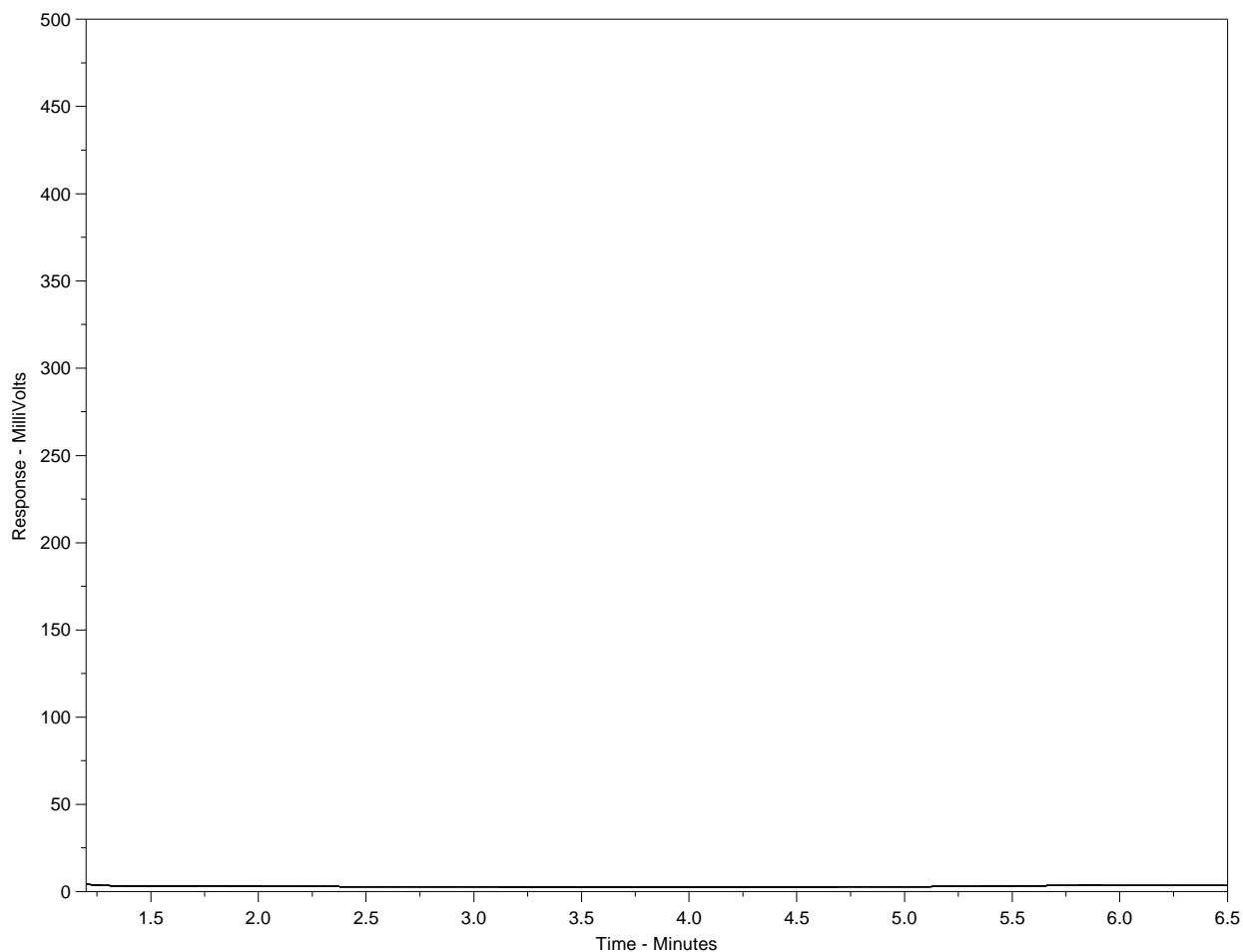
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1367775-2
Client ID: 16054130923052



F2		F3		F4		F4	
nC10	nC16			nC34	nC50		
174°C	287°C			481°C	575°C		
346°F	549°F			898°F	1067°F		
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

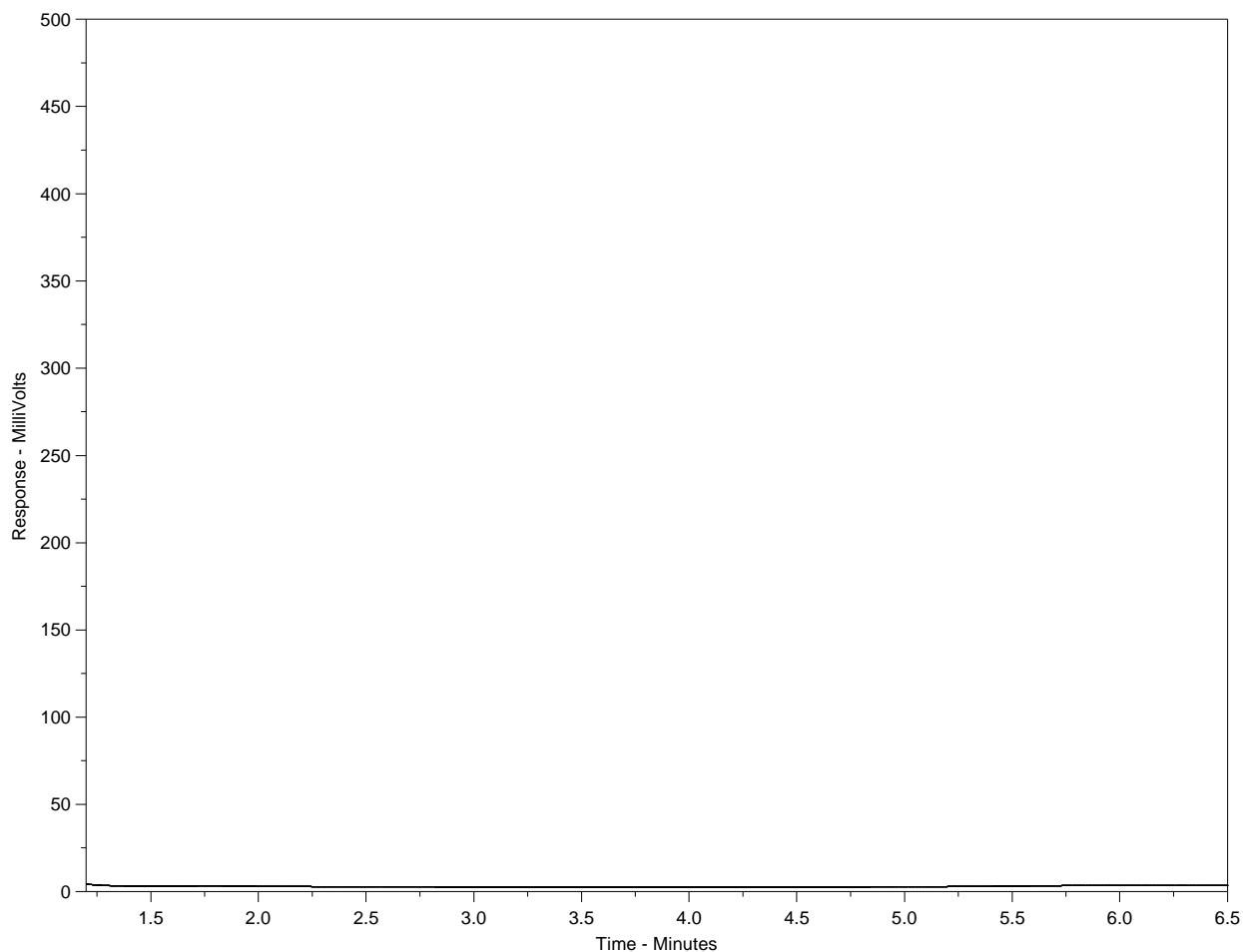
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1367775-3
 Client ID: 16054130923053



F2		F3		F4		F4	
nC10	nC16			nC34	nC50		
174°C	287°C			481°C	575°C		
346°F	549°F			898°F	1067°F		
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

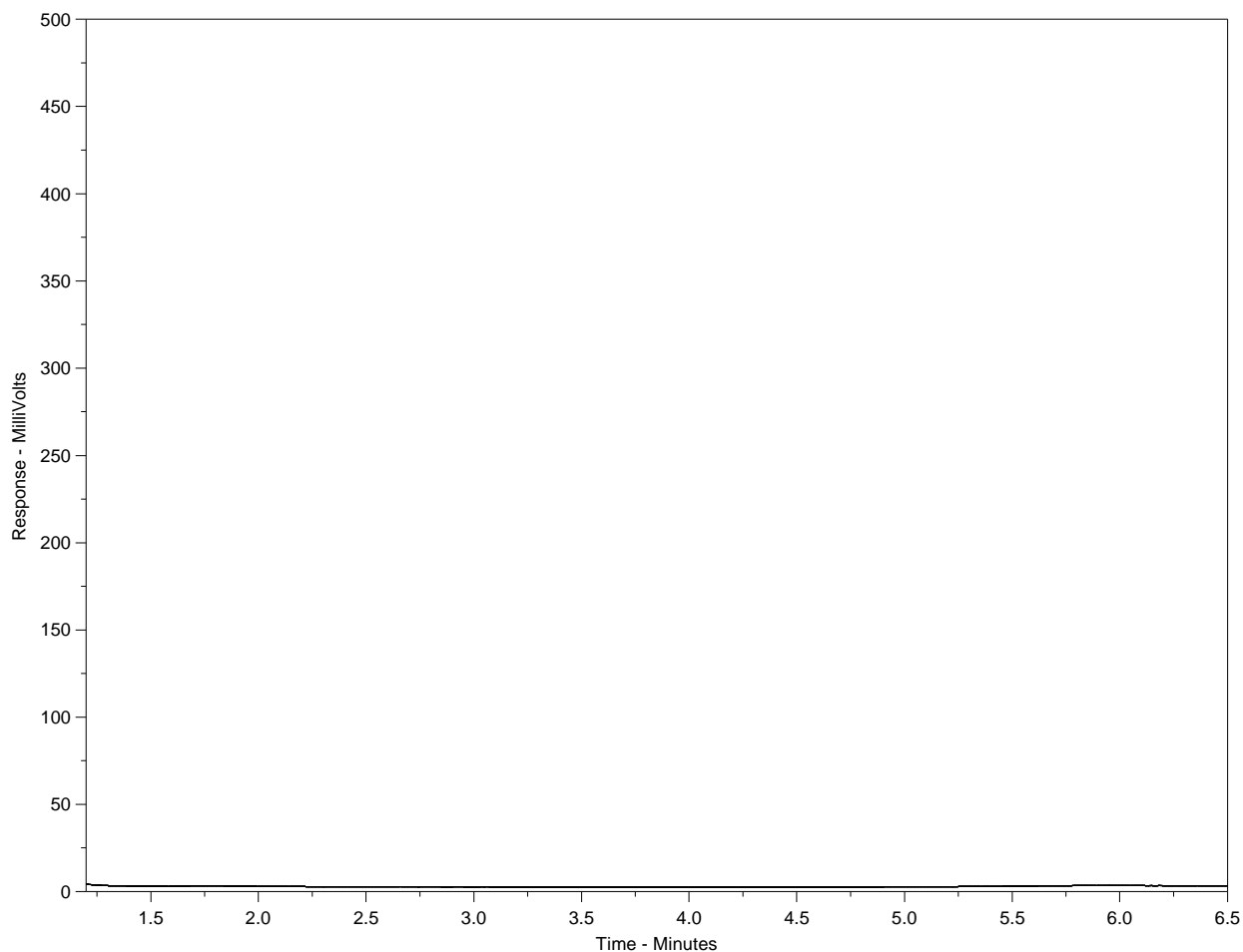
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1367775-4
Client ID: 16054130923054



← F2 →		← F3 →		← F4 →		← F4 →	
nC10	nC16	nC34	nC50				
174°C	287°C	481°C	575°C				
346°F	549°F	898°F	1067°F				
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →				
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

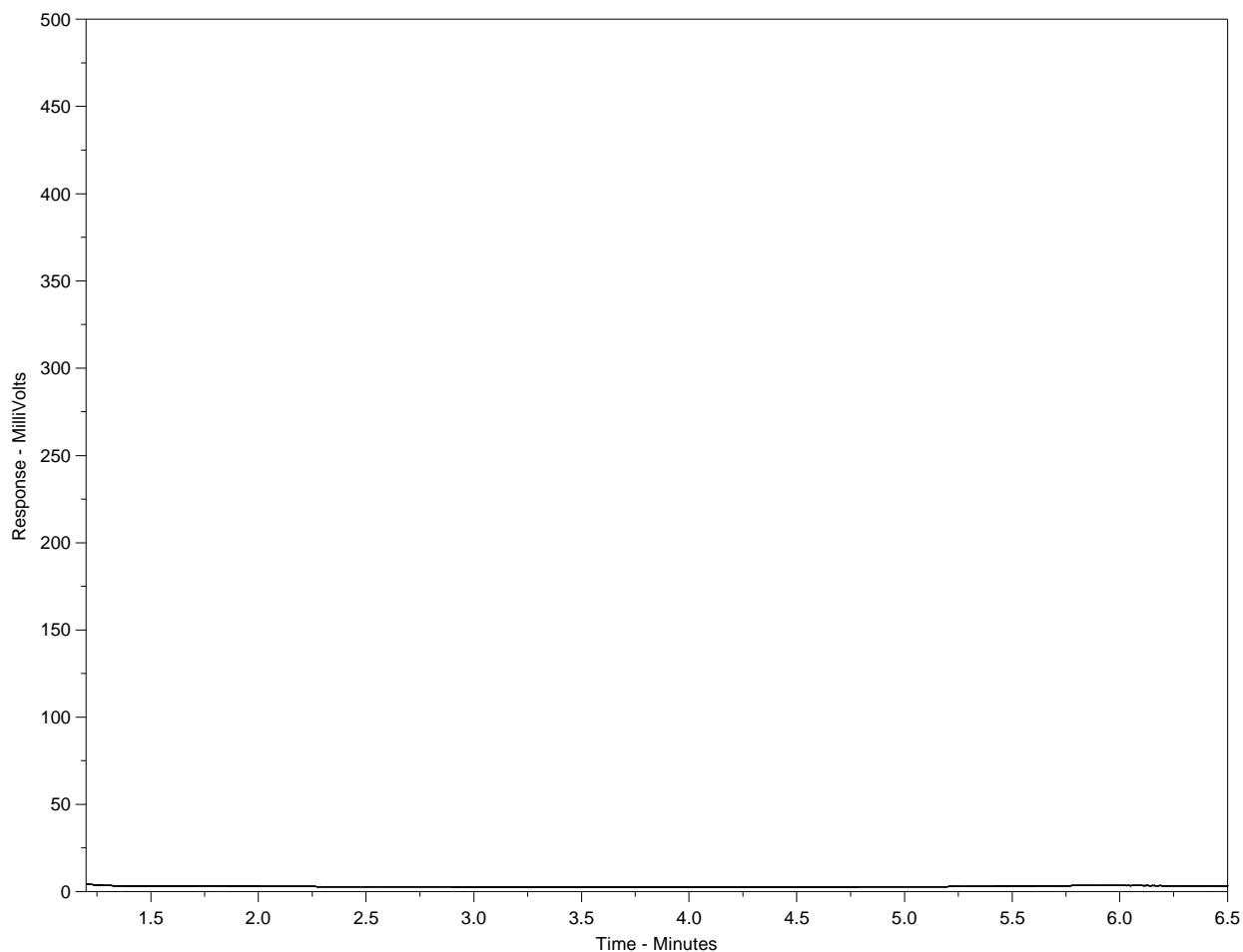
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1367775-5
 Client ID: 16054130923055



F2		F3		F4		F4	
nC10	nC16			nC34	nC50		
174°C	287°C			481°C	575°C		
346°F	549°F			898°F	1067°F		
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.



MATRIX SOLUTIONS INC.
ATTN: SUE RAYNARD
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Date Received: 24-SEP-13
Report Date: 17-DEC-13 13:48 (MT)
Version: FINAL REV. 4

Client Phone: 403-237-0606

Certificate of Analysis

Lab Work Order #: L1367775
Project P.O. #: NOT SUBMITTED
Job Reference: SAOS CONKLIN 16054-502 11-30-76-7 W4M
C of C Numbers: M060604
Legal Site Desc: 11-30-76-7 W4M

Comments: ADDITIONAL 18-OCT-13 11:17
17-DEC-2013 LORs for Ag and Al have been fixed


Catherine Evaristo-Cordero
Senior Account Manager

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ADDRESS: 9936-67 Avenue, Edmonton, AB T6E 0P5 Canada | Phone: +1 780 413 5227 | Fax: +1 780 437 2311
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1367775-1 16054130923051									
Sampled By: JF/GK on 23-SEP-13									
Matrix: Water									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		25-SEP-13	R2701555
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.0010	-		0.0010	mg/L	-		02-OCT-13	R2707427
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Arsenic (As)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Barium (Ba)-Dissolved	0.119	+/-0.010		0.00010	mg/L	0		02-OCT-13	R2707427
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		02-OCT-13	R2707427
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		02-OCT-13	R2707427
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Calcium (Ca)-Dissolved	81.2	+/-11		0.50	mg/L	0		02-OCT-13	R2707427
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Cobalt (Co)-Dissolved	0.00012	+/-0.00001		0.00010	mg/L	0		02-OCT-13	R2707427
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		02-OCT-13	R2707427
Iron (Fe)-Dissolved	1.51	+/-0.14		0.010	mg/L	0		02-OCT-13	R2707427
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Magnesium (Mg)-Dissolved	24.9	+/-1.9		0.10	mg/L	0		02-OCT-13	R2707427
Manganese (Mn)-Dissolved	0.0432	+/-0.0030		0.0020	mg/L	0		02-OCT-13	R2707427
Molybdenum (Mo)-Dissolved	0.00055	+/-0.00006		0.00010	mg/L	0		02-OCT-13	R2707427
Nickel (Ni)-Dissolved	0.00016	+/-0.00004		0.00010	mg/L	0		02-OCT-13	R2707427
Potassium (K)-Dissolved	5.13	+/-0.40		0.50	mg/L	0		02-OCT-13	R2707427
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Silicon (Si)-Dissolved	10.7	+/-0.91		0.050	mg/L	0		02-OCT-13	R2707427
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		02-OCT-13	R2707427
Sodium (Na)-Dissolved	62.7	+/-4.4		1.0	mg/L	0		02-OCT-13	R2707427
Strontium (Sr)-Dissolved	0.638	+/-0.047		0.00010	mg/L	0		02-OCT-13	R2707427
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		02-OCT-13	R2707427
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		02-OCT-13	R2707427
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		02-OCT-13	R2707427
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Zinc (Zn)-Dissolved	0.0091	+/-0.0011		0.0010	mg/L	0		02-OCT-13	R2707427
Ion Balance Calculation									
Ion Balance	97.2	-			%	-		03-OCT-13	
TDS (Calculated)	460	-			mg/L	-		03-OCT-13	
Hardness (as CaCO3)	305	-			mg/L	-		03-OCT-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		25-SEP-13	R2701555
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		30-SEP-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		25-SEP-13	R2701555
Sulfate by IC									
Sulfate (SO4)	10.5	+/-0.48		0.50	mg/L	0		25-SEP-13	R2701555
pH, Conductivity and Total Alkalinity									
pH	8.45	+/-0.04		0.10	pH	0		27-SEP-13	R2701489
Conductivity (EC)	777	+/-26		0.20	uS/cm	0		27-SEP-13	R2701489
Bicarbonate (HCO3)	540	-		5.0	mg/L	-		27-SEP-13	R2701489
Carbonate (CO3)	9.5	-		5.0	mg/L	-		27-SEP-13	R2701489
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2701489
Alkalinity, Total (as CaCO3)	459	+/-17		2.0	mg/L	0		27-SEP-13	R2701489

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1367775-2 16054130923052									
Sampled By: JF/GK on 23-SEP-13									
Matrix: Water									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		25-SEP-13	R2701555
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0011	+/-0.0004		0.0010	mg/L	0		02-OCT-13	R2707427
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Arsenic (As)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Barium (Ba)-Dissolved	0.0995	+/-0.0086		0.00010	mg/L	0		02-OCT-13	R2707427
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		02-OCT-13	R2707427
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		02-OCT-13	R2707427
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Calcium (Ca)-Dissolved	78.6	+/-11		0.50	mg/L	0		02-OCT-13	R2707427
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Cobalt (Co)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		02-OCT-13	R2707427
Iron (Fe)-Dissolved	1.63	+/-0.15		0.010	mg/L	0		02-OCT-13	R2707427
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Magnesium (Mg)-Dissolved	25.1	+/-2.0		0.10	mg/L	0		02-OCT-13	R2707427
Manganese (Mn)-Dissolved	0.0571	+/-0.0039		0.0020	mg/L	0		02-OCT-13	R2707427
Molybdenum (Mo)-Dissolved	0.00119	+/-0.00013		0.00010	mg/L	0		02-OCT-13	R2707427
Nickel (Ni)-Dissolved	0.00023	+/-0.00004		0.00010	mg/L	0		02-OCT-13	R2707427
Potassium (K)-Dissolved	4.95	+/-0.38		0.50	mg/L	0		02-OCT-13	R2707427
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Silicon (Si)-Dissolved	10.9	+/-0.93		0.050	mg/L	0		02-OCT-13	R2707427
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		02-OCT-13	R2707427
Sodium (Na)-Dissolved	58.4	+/-4.1		1.0	mg/L	0		02-OCT-13	R2707427
Strontium (Sr)-Dissolved	0.616	+/-0.046		0.00010	mg/L	0		02-OCT-13	R2707427
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		02-OCT-13	R2707427
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		02-OCT-13	R2707427
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		02-OCT-13	R2707427
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Zinc (Zn)-Dissolved	0.0178	+/-0.0021		0.0010	mg/L	0		02-OCT-13	R2707427
Ion Balance Calculation									
Ion Balance	94.1	-			%	-		03-OCT-13	
TDS (Calculated)	452	-			mg/L	-		03-OCT-13	
Hardness (as CaCO3)	300	-			mg/L	-		03-OCT-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		25-SEP-13	R2701555
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		30-SEP-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		25-SEP-13	R2701555
Sulfate by IC									
Sulfate (SO4)	11.3	+/-0.51		0.50	mg/L	0		25-SEP-13	R2701555
pH, Conductivity and Total Alkalinity									
pH	8.47	+/-0.04		0.10	pH	0		27-SEP-13	R2701489
Conductivity (EC)	769	+/-26		0.20	uS/cm	0		27-SEP-13	R2701489
Bicarbonate (HCO3)	533	-		5.0	mg/L	-		27-SEP-13	R2701489
Carbonate (CO3)	11.3	-		5.0	mg/L	-		27-SEP-13	R2701489
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2701489
Alkalinity, Total (as CaCO3)	456	+/-17		2.0	mg/L	0		27-SEP-13	R2701489

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1367775-3 16054130923053									
Sampled By: JF/GK on 23-SEP-13									
Matrix: Water									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		25-SEP-13	R2701555
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0013	+/-0.0004		0.0010	mg/L	0		02-OCT-13	R2707427
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Arsenic (As)-Dissolved	0.00511	+/-0.00054		0.00040	mg/L	0		02-OCT-13	R2707427
Barium (Ba)-Dissolved	0.139	+/-0.012		0.00010	mg/L	0		02-OCT-13	R2707427
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		02-OCT-13	R2707427
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		02-OCT-13	R2707427
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Calcium (Ca)-Dissolved	52.4	+/-7.1		0.50	mg/L	0		02-OCT-13	R2707427
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Cobalt (Co)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		02-OCT-13	R2707427
Iron (Fe)-Dissolved	1.50	+/-0.13		0.010	mg/L	0		02-OCT-13	R2707427
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Magnesium (Mg)-Dissolved	14.6	+/-1.1		0.10	mg/L	0		02-OCT-13	R2707427
Manganese (Mn)-Dissolved	0.173	+/-0.012		0.0020	mg/L	0		02-OCT-13	R2707427
Molybdenum (Mo)-Dissolved	0.00386	+/-0.00040		0.00010	mg/L	0		02-OCT-13	R2707427
Nickel (Ni)-Dissolved	0.00018	+/-0.00004		0.00010	mg/L	0		02-OCT-13	R2707427
Potassium (K)-Dissolved	3.30	+/-0.25		0.50	mg/L	0		02-OCT-13	R2707427
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Silicon (Si)-Dissolved	10.7	+/-0.91		0.050	mg/L	0		02-OCT-13	R2707427
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		02-OCT-13	R2707427
Sodium (Na)-Dissolved	12.2	+/-0.86		1.0	mg/L	0		02-OCT-13	R2707427
Strontium (Sr)-Dissolved	0.391	+/-0.029		0.00010	mg/L	0		02-OCT-13	R2707427
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		02-OCT-13	R2707427
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		02-OCT-13	R2707427
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		02-OCT-13	R2707427
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Zinc (Zn)-Dissolved	0.0125	+/-0.0015		0.0010	mg/L	0		02-OCT-13	R2707427
Ion Balance Calculation									
Ion Balance	96.0	-			%	-		03-OCT-13	
TDS (Calculated)	227	-			mg/L	-		03-OCT-13	
Hardness (as CaCO3)	191	-			mg/L	-		03-OCT-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		25-SEP-13	R2701555
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		30-SEP-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		25-SEP-13	R2701555
Sulfate by IC									
Sulfate (SO4)	4.38	+/-0.23		0.50	mg/L	0		25-SEP-13	R2701555
pH, Conductivity and Total Alkalinity									
pH	8.43	+/-0.04		0.10	pH	0		27-SEP-13	R2701489
Conductivity (EC)	417	+/-14		0.20	uS/cm	0		27-SEP-13	R2701489
Bicarbonate (HCO3)	278	-		5.0	mg/L	-		27-SEP-13	R2701489
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2701489
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2701489
Alkalinity, Total (as CaCO3)	234	+/-9.1		2.0	mg/L	0		27-SEP-13	R2701489

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1367775-4 16054130923054									
Sampled By: JF/GK on 23-SEP-13									
Matrix: Water									
Chloride by IC									
Chloride (Cl)	1.68	+/-0.09		0.50	mg/L	0		25-SEP-13	R2701555
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0042	+/-0.0008		0.0010	mg/L	0		02-OCT-13	R2707427
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Arsenic (As)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Barium (Ba)-Dissolved	0.0182	+/-0.0016		0.00010	mg/L	0		02-OCT-13	R2707427
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		02-OCT-13	R2707427
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		02-OCT-13	R2707427
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Calcium (Ca)-Dissolved	7.86	+/-1.1		0.50	mg/L	0		02-OCT-13	R2707427
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Cobalt (Co)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Copper (Cu)-Dissolved	0.00102	+/-0.00008		0.00060	mg/L	0		02-OCT-13	R2707427
Iron (Fe)-Dissolved	<0.010	-		0.010	mg/L	-		02-OCT-13	R2707427
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Magnesium (Mg)-Dissolved	2.22	+/-0.17		0.10	mg/L	0		02-OCT-13	R2707427
Manganese (Mn)-Dissolved	0.0037	+/-0.0003		0.0020	mg/L	0		02-OCT-13	R2707427
Molybdenum (Mo)-Dissolved	0.00017	+/-0.00002		0.00010	mg/L	0		02-OCT-13	R2707427
Nickel (Ni)-Dissolved	0.00150	+/-0.00013		0.00010	mg/L	0		02-OCT-13	R2707427
Potassium (K)-Dissolved	0.60	+/-0.04		0.50	mg/L	0		02-OCT-13	R2707427
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Silicon (Si)-Dissolved	5.25	+/-0.45		0.050	mg/L	0		02-OCT-13	R2707427
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		02-OCT-13	R2707427
Sodium (Na)-Dissolved	1.5	+/-0.10		1.0	mg/L	0		02-OCT-13	R2707427
Strontium (Sr)-Dissolved	0.0309	+/-0.0023		0.00010	mg/L	0		02-OCT-13	R2707427
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		02-OCT-13	R2707427
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		02-OCT-13	R2707427
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		02-OCT-13	R2707427
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Zinc (Zn)-Dissolved	0.0087	+/-0.0011		0.0010	mg/L	0		02-OCT-13	R2707427
Ion Balance Calculation									
Ion Balance	Low EC	-			%	-		03-OCT-13	
TDS (Calculated)	35.9	-			mg/L	-		03-OCT-13	
Hardness (as CaCO3)	28.8	-			mg/L	-		03-OCT-13	
Nitrate as N by IC									
Nitrate (as N)	0.129	+/-0.013		0.050	mg/L	0		25-SEP-13	R2701555
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	0.129	-		0.071	mg/L	-		30-SEP-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		25-SEP-13	R2701555
Sulfate by IC									
Sulfate (SO4)	3.14	+/-0.18		0.50	mg/L	0		25-SEP-13	R2701555
pH, Conductivity and Total Alkalinity									
pH	7.38	+/-0.04		0.10	pH	0		27-SEP-13	R2701489
Conductivity (EC)	71.0	+/-2.4		0.20	uS/cm	0		27-SEP-13	R2701489
Bicarbonate (HCO3)	37.3	-		5.0	mg/L	-		27-SEP-13	R2701489
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2701489
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2701489
Alkalinity, Total (as CaCO3)	30.6	+/-2.6		2.0	mg/L	0		27-SEP-13	R2701489

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1367775-5 16054130923055									
Sampled By: JF/GK on 23-SEP-13									
Matrix: Water									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		25-SEP-13	R2701555
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.0010	-		0.0010	mg/L	-		02-OCT-13	R2707427
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Arsenic (As)-Dissolved	0.00502	+/-0.00053		0.00040	mg/L	0		02-OCT-13	R2707427
Barium (Ba)-Dissolved	0.144	+/-0.012		0.00010	mg/L	0		02-OCT-13	R2707427
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		02-OCT-13	R2707427
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		02-OCT-13	R2707427
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Calcium (Ca)-Dissolved	53.2	+/-7.2		0.50	mg/L	0		02-OCT-13	R2707427
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Cobalt (Co)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		02-OCT-13	R2707427
Iron (Fe)-Dissolved	1.47	+/-0.13		0.010	mg/L	0		02-OCT-13	R2707427
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Magnesium (Mg)-Dissolved	14.6	+/-1.1		0.10	mg/L	0		02-OCT-13	R2707427
Manganese (Mn)-Dissolved	0.175	+/-0.012		0.0020	mg/L	0		02-OCT-13	R2707427
Molybdenum (Mo)-Dissolved	0.00391	+/-0.00041		0.00010	mg/L	0		02-OCT-13	R2707427
Nickel (Ni)-Dissolved	0.00020	+/-0.00004		0.00010	mg/L	0		02-OCT-13	R2707427
Potassium (K)-Dissolved	3.26	+/-0.25		0.50	mg/L	0		02-OCT-13	R2707427
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		02-OCT-13	R2707427
Silicon (Si)-Dissolved	10.7	+/-0.91		0.050	mg/L	0		02-OCT-13	R2707427
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		02-OCT-13	R2707427
Sodium (Na)-Dissolved	12.0	+/-0.85		1.0	mg/L	0		02-OCT-13	R2707427
Strontium (Sr)-Dissolved	0.387	+/-0.029		0.00010	mg/L	0		02-OCT-13	R2707427
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		02-OCT-13	R2707427
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		02-OCT-13	R2707427
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		02-OCT-13	R2707427
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		02-OCT-13	R2707427
Zinc (Zn)-Dissolved	0.0127	+/-0.0015		0.0010	mg/L	0		02-OCT-13	R2707427
Ion Balance Calculation									
Ion Balance	96.7	-			%	-		03-OCT-13	
TDS (Calculated)	228	-			mg/L	-		03-OCT-13	
Hardness (as CaCO3)	193	-			mg/L	-		03-OCT-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		25-SEP-13	R2701555
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		30-SEP-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		25-SEP-13	R2701555
Sulfate by IC									
Sulfate (SO4)	4.43	+/-0.23		0.50	mg/L	0		25-SEP-13	R2701555
pH, Conductivity and Total Alkalinity									
pH	8.44	+/-0.04		0.10	pH	0		27-SEP-13	R2701489
Conductivity (EC)	410	+/-14		0.20	uS/cm	0		27-SEP-13	R2701489
Bicarbonate (HCO3)	278	-		5.0	mg/L	-		27-SEP-13	R2701489
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2701489
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2701489
Alkalinity, Total (as CaCO3)	235	+/-9.1		2.0	mg/L	0		27-SEP-13	R2701489
* Refer to Referenced Information for Qualifiers (if any) and Methodology.									

Reference Information

Report Comments: ADDITIONAL 18-OCT-13 11:17
17-DEC-2013 LORs for Ag and Al have been fixed

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Sulfate (SO4)	MS-B	
Matrix Spike	Dissolved Organic Carbon	MS-B	

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
B-D-L-CCMS-ED	Water	Dissolved Boron in Water by CRC ICPMS		APHA 3030 B / EPA SW-846 6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).				
BTXS,F1-ED	Water	BTEX, Styrene and F1 (C6-C10)		EPA 5021/8015&8260 GC-MS & FID
C-DIS-ORG-ED	Water	Dissolved Organic Carbon		APHA 5310 B-Instrumental
CL-IC-ED	Water	Chloride by IC		APHA 4110 B-ION CHROMATOGRAPHY
F2,F3,F4-ED	Water	F2, F3, F4		EPA 3510/CCME PHC CWS-GC-FID
HG-D-CVAA-ED	Water	Mercury (Hg) - Dissolved		EPA 245.7 / EPA 245.1
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET-D-CCMS-ED	Water	Dissolved Metals in Water by CRC ICPMS		APHA 3030 B&E / EPA SW-846 6020A
NAPHTHENIC-ACID-FM	Water	Naphthenic Acids by FTIR		Naphthenic Acids by FTIR, Syncrude, 1994
Dissolved naphthenic acids are solvent extracted from acidified aqueous samples using Dichloromethane prior to quantitation by Fourier Transform Infra-Red spectroscopy. Note that FTIR is not uniquely selective to naphthenic acids. If present, other carboxylic acids (e.g. humic acids, fulvic acids) may also be detected by this method.				
NH3-CFA-ED	Water	Ammonia in Water by Colour		APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.				
NO2+NO3-CALC-ED	Water	Nitrate+Nitrite		CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
PAH-ABT1-ED	Water	PAH & Carcinogenic PAH List		EPA 3510/8270-GC/MS
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)				
PHENOLS-4AAP-ED	Water	Phenols (4AAP)		AB ENV.06537-COLORIMETRIC
This analysis is carried out using procedures adapted from ENVIRODAT VMV 06537 689, Method Code 154, in "Methods Manual for Chemical Analysis of Water and Wastes" published by the Alberta Environmental Centre. This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide and 4-aminoantipyrine to form a red complex which is measured at 505 nm.				
SO4-IC-ED	Water	Sulfate by IC		APHA 4110 B-ION CHROMATOGRAPHY
TKN-CFA-ED	Water	TKN in Water by Colour		APHA 4500-NORG (TKN)
This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 celcius with analysis using an automated colourimetric finish.				
TURBIDITY-ED	Water	Turbidity		APHA 2130 B-Nephelometer

** The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS methods may incorporate modifications from the specified reference to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
FM	ALS ENVIRONMENTAL - FORT MCMURRAY, ALBERTA, CANADA

Reference Information

Chain of Custody Numbers:

M060604

GLOSSARY OF REPORT TERMS

Surr - Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

MU: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.

Bias: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent.

Zero values indicate no detectable method bias.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Environmental

Quality Control Report

Workorder: L1367775

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-D-L-CCMS-ED		Water						
Batch	R2707427							
WG1759470-2	CRM	ED-HIGH-WATRM						
Boron (B)-Dissolved			108.6		%		80-120	02-OCT-13
WG1759470-3	DUP	L1367775-1						
Boron (B)-Dissolved		0.245	0.258		mg/L	5.4	20	02-OCT-13
WG1759470-1	MB							
Boron (B)-Dissolved			<0.0020		mg/L		0.002	02-OCT-13
BTXS,F1-ED		Water						
Batch	R2702007							
WG1757354-2	LCS							
Benzene			86.8		%		70-130	30-SEP-13
Toluene			72.3		%		70-130	30-SEP-13
EthylBenzene			85.2		%		70-130	30-SEP-13
o-Xylene			84.6		%		70-130	30-SEP-13
m+p-Xylene			85.2		%		70-130	30-SEP-13
Styrene			76.6		%		70-130	30-SEP-13
WG1757354-3	LCS							
F1(C6-C10)			99.5		%		70-130	30-SEP-13
WG1757354-1	MB							
Benzene			<0.00050		mg/L		0.0005	30-SEP-13
Toluene			<0.00050		mg/L		0.0005	30-SEP-13
EthylBenzene			<0.00050		mg/L		0.0005	30-SEP-13
o-Xylene			<0.00050		mg/L		0.0005	30-SEP-13
m+p-Xylene			<0.00050		mg/L		0.0005	30-SEP-13
Styrene			<0.0010		mg/L		0.001	30-SEP-13
F1(C6-C10)			<0.10		mg/L		0.1	30-SEP-13
C-DIS-ORG-ED		Water						
Batch	R2709550							
WG1761992-3	CVS							
Dissolved Organic Carbon			138.8		%		80-160	05-OCT-13
WG1761992-4	DUP	L1365837-5						
Dissolved Organic Carbon		25.4	24.6		mg/L	3.3	20	05-OCT-13
WG1761992-8	DUP	L1369101-25						
Dissolved Organic Carbon		7.2	7.1		mg/L	0.7	20	06-OCT-13
WG1761992-2	LCS							
Dissolved Organic Carbon			113.8		%		80-120	05-OCT-13
WG1761992-1	MB							



Quality Control Report

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
C-DIS-ORG-ED		Water						
Batch	R2709550							
WG1761992-1	MB							
Dissolved Organic Carbon			<1.0		mg/L		1	05-OCT-13
WG1761992-5	MS	L1365837-5						
Dissolved Organic Carbon			N/A	MS-B	%		-	05-OCT-13
WG1761992-9	MS	L1369101-25						
Dissolved Organic Carbon			110.3		%		70-130	06-OCT-13
CL-IC-ED		Water						
Batch	R2701555							
WG1754970-3	DUP	L1367775-5						
Chloride (Cl)			<0.50	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-5	DUP	L1367764-4						
Chloride (Cl)			<0.50	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-7	DUP	L1367259-26						
Chloride (Cl)			53.7		mg/L	0.9	20	25-SEP-13
WG1754970-9	DUP	L1366522-5						
Chloride (Cl)			<0.50	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-2	LCS							
Chloride (Cl)			101.1		%		90-110	25-SEP-13
WG1754970-1	MB							
Chloride (Cl)			<0.50		mg/L		0.5	26-SEP-13
WG1754970-10	MS	L1366522-5						
Chloride (Cl)			102.2		%		75-125	25-SEP-13
WG1754970-4	MS	L1367775-5						
Chloride (Cl)			102.3		%		75-125	25-SEP-13
WG1754970-6	MS	L1367764-4						
Chloride (Cl)			103.8		%		75-125	25-SEP-13
WG1754970-8	MS	L1367259-26						
Chloride (Cl)			97.2		%		75-125	25-SEP-13
F2,F3,F4-ED		Water						
Batch	R2705779							
WG1757665-2	LCS							
F2 (>C10-C16)			99.2		%		65-135	30-SEP-13
F3 (C16-C34)			101.1		%		65-135	30-SEP-13
F4 (C34-C50)			99.9		%		65-135	30-SEP-13
WG1757665-5	LCS							
F2 (>C10-C16)			97.9		%		65-135	30-SEP-13
F3 (C16-C34)			101.0		%		65-135	30-SEP-13



Quality Control Report

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed	
F2,F3,F4-ED		Water							
Batch	R2705779								
WG1757665-5	LCS								
F4 (C34-C50)			99.5		%		65-135	30-SEP-13	
WG1757665-8	LCS								
F2 (>C10-C16)			100.3		%		65-135	30-SEP-13	
F3 (C16-C34)			100.9		%		65-135	30-SEP-13	
F4 (C34-C50)			91.5		%		65-135	30-SEP-13	
WG1757665-1	MB								
F2 (>C10-C16)			<0.25		mg/L		0.25	30-SEP-13	
F3 (C16-C34)			<0.25		mg/L		0.25	30-SEP-13	
F4 (C34-C50)			<0.25		mg/L		0.25	30-SEP-13	
Surrogate: 2-Bromobenzotrifluoride			101.1		%		50-150	30-SEP-13	
WG1757665-4	MB								
F2 (>C10-C16)			<0.25		mg/L		0.25	30-SEP-13	
F3 (C16-C34)			<0.25		mg/L		0.25	30-SEP-13	
F4 (C34-C50)			<0.25		mg/L		0.25	30-SEP-13	
Surrogate: 2-Bromobenzotrifluoride			100.2		%		50-150	30-SEP-13	
WG1757665-7	MB								
F2 (>C10-C16)			<0.25		mg/L		0.25	30-SEP-13	
F3 (C16-C34)			<0.25		mg/L		0.25	30-SEP-13	
F4 (C34-C50)			<0.25		mg/L		0.25	30-SEP-13	
Surrogate: 2-Bromobenzotrifluoride			97.8		%		50-150	30-SEP-13	
WG1757665-9	MS	L1369104-9							
F2 (>C10-C16)			104.0		%		50-150	30-SEP-13	
F3 (C16-C34)			102.6		%		50-150	30-SEP-13	
F4 (C34-C50)			91.4		%		50-150	30-SEP-13	
HG-D-CVAA-ED		Water							
Batch	R2701610								
WG1755329-11	DUP	L1367764-2							
Mercury (Hg)-Dissolved			<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	29-SEP-13
WG1755329-13	DUP	L1366644-1							
Mercury (Hg)-Dissolved			<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	29-SEP-13
WG1755329-2	LCS								
Mercury (Hg)-Dissolved			86.5		%		80-120	26-SEP-13	
WG1755329-3	LCSD	WG1755329-2							
Mercury (Hg)-Dissolved			86.5	87.4	%	1.1	20	26-SEP-13	
WG1755329-1	MB						0.0001		



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-D-CVAA-ED								
	Water							
Batch	R2701610							
WG1755329-1 MB								
Mercury (Hg)-Dissolved			<0.00010		mg/L		0.0001	26-SEP-13
WG1755329-10 MS		L1367764-2						
Mercury (Hg)-Dissolved			93.2		%		70-130	29-SEP-13
WG1755329-12 MS		L1366644-1						
Mercury (Hg)-Dissolved			105.7		%		70-130	29-SEP-13
MET-D-CCMS-ED								
	Water							
Batch	R2707427							
WG1759470-2 CRM		ED-HIGH-WATRM						
Aluminum (Al)-Dissolved			114.6		%		80-120	02-OCT-13
Antimony (Sb)-Dissolved			119.7		%		80-120	02-OCT-13
Beryllium (Be)-Dissolved			115.5		%		80-120	02-OCT-13
Calcium (Ca)-Dissolved			118.4		%		80-120	02-OCT-13
Chromium (Cr)-Dissolved			113.8		%		80-120	02-OCT-13
Cobalt (Co)-Dissolved			112.4		%		80-120	02-OCT-13
Copper (Cu)-Dissolved			113.6		%		80-120	02-OCT-13
Magnesium (Mg)-Dissolved			115.4		%		80-120	02-OCT-13
Manganese (Mn)-Dissolved			114.6		%		80-120	02-OCT-13
Molybdenum (Mo)-Dissolved			116.9		%		80-120	02-OCT-13
Nickel (Ni)-Dissolved			115.5		%		80-120	02-OCT-13
Potassium (K)-Dissolved			111.6		%		80-120	02-OCT-13
Selenium (Se)-Dissolved			115.5		%		80-120	02-OCT-13
Silicon (Si)-Dissolved			112.3		%		80-120	02-OCT-13
Silver (Ag)-Dissolved			114.2		%		80-120	02-OCT-13
Strontium (Sr)-Dissolved			117.0		%		80-120	02-OCT-13
Thallium (Tl)-Dissolved			120.0		%		80-120	02-OCT-13
Titanium (Ti)-Dissolved			111.8		%		80-120	02-OCT-13
Tin (Sn)-Dissolved			113.3		%		80-120	02-OCT-13
Uranium (U)-Dissolved			118.2		%		80-120	02-OCT-13
Vanadium (V)-Dissolved			119.3		%		80-120	02-OCT-13
Zinc (Zn)-Dissolved			116.1		%		80-120	02-OCT-13
WG1759470-3 DUP		L1367775-1						
Aluminum (Al)-Dissolved		<0.0010	<0.010	RPD-NA	mg/L	N/A	20	02-OCT-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	02-OCT-13
Arsenic (As)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	02-OCT-13



Quality Control Report

Workorder: L1367775

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2707427							
WG1759470-3	DUP	L1367775-1						
Barium (Ba)-Dissolved		0.119	0.119		mg/L	0.2	20	02-OCT-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-OCT-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-OCT-13
Cadmium (Cd)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Calcium (Ca)-Dissolved		81.2	82.9		mg/L	2.0	20	02-OCT-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	02-OCT-13
Cobalt (Co)-Dissolved		0.00012	0.00012		mg/L	5.6	20	02-OCT-13
Copper (Cu)-Dissolved		<0.00060	<0.00060	RPD-NA	mg/L	N/A	20	02-OCT-13
Iron (Fe)-Dissolved		1.51	1.48		mg/L	1.9	20	02-OCT-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Magnesium (Mg)-Dissolved		24.9	25.5		mg/L	2.5	20	02-OCT-13
Manganese (Mn)-Dissolved		0.0432	0.0436		mg/L	0.8	20	02-OCT-13
Molybdenum (Mo)-Dissolved		0.00055	0.00056		mg/L	1.3	20	02-OCT-13
Nickel (Ni)-Dissolved		0.00016	0.00015		mg/L	7.3	20	02-OCT-13
Potassium (K)-Dissolved		5.13	4.91		mg/L	4.4	20	02-OCT-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	02-OCT-13
Silicon (Si)-Dissolved		10.7	10.8		mg/L	0.5	20	02-OCT-13
Silver (Ag)-Dissolved		<0.000010	<0.00020	RPD-NA	mg/L	N/A	20	02-OCT-13
Sodium (Na)-Dissolved		62.7	62.7		mg/L	0.1	20	02-OCT-13
Strontium (Sr)-Dissolved		0.638	0.670		mg/L	4.8	20	02-OCT-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-OCT-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	02-OCT-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	02-OCT-13
Uranium (U)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Vanadium (V)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Zinc (Zn)-Dissolved		0.0091	0.0084		mg/L	8.4	20	02-OCT-13
WG1759470-4	DUP	L1369101-8						
Aluminum (Al)-Dissolved		0.0020	0.0015	J	mg/L	0.0005	0.002	02-OCT-13
Antimony (Sb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Arsenic (As)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Barium (Ba)-Dissolved		0.0105	0.0106		mg/L	0.2	20	02-OCT-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-OCT-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-OCT-13



Quality Control Report

Workorder: L1367775

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2707427							
WG1759470-4	DUP	L1369101-8						
Cadmium (Cd)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	02-OCT-13
Calcium (Ca)-Dissolved		15.4	14.4		mg/L	7.1	20	02-OCT-13
Chromium (Cr)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Copper (Cu)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Iron (Fe)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	02-OCT-13
Lead (Pb)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-OCT-13
Magnesium (Mg)-Dissolved		4.66	4.73		mg/L	1.4	20	02-OCT-13
Manganese (Mn)-Dissolved		0.0128	0.0128		mg/L	0.5	20	02-OCT-13
Molybdenum (Mo)-Dissolved		0.00243	0.00228		mg/L	6.2	20	02-OCT-13
Nickel (Ni)-Dissolved		0.00014	0.00013		mg/L	1.3	20	02-OCT-13
Potassium (K)-Dissolved		1.61	1.59		mg/L	0.9	20	02-OCT-13
Selenium (Se)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Silicon (Si)-Dissolved		4.35	4.27		mg/L	1.8	20	02-OCT-13
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	02-OCT-13
Sodium (Na)-Dissolved		289	285		mg/L	1.4	20	02-OCT-13
Strontium (Sr)-Dissolved		0.439	0.419		mg/L	4.6	20	02-OCT-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-OCT-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	02-OCT-13
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Uranium (U)-Dissolved		0.000087	0.000082		mg/L	5.7	20	02-OCT-13
Vanadium (V)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Zinc (Zn)-Dissolved		0.0012	0.0012		mg/L	3.2	20	02-OCT-13
WG1759470-5	DUP	L1369104-1						
Aluminum (Al)-Dissolved		0.0047	0.0042		mg/L	13	20	02-OCT-13
Antimony (Sb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Arsenic (As)-Dissolved		0.00050	0.00051		mg/L	2.0	20	02-OCT-13
Barium (Ba)-Dissolved		0.198	0.202		mg/L	2.0	20	02-OCT-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	02-OCT-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-OCT-13
Cadmium (Cd)-Dissolved		0.000119	0.000119		mg/L	0.1	20	02-OCT-13
Calcium (Ca)-Dissolved		82.6	82.1		mg/L	0.5	20	02-OCT-13
Chromium (Cr)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13



Quality Control Report

Workorder: L1367775

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2707427							
WG1759470-5 DUP		L1369104-1						
Cobalt (Co)-Dissolved		0.00020	0.00020		mg/L	1.2	20	02-OCT-13
Copper (Cu)-Dissolved		0.00051	0.00051		mg/L	0.4	20	02-OCT-13
Iron (Fe)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	02-OCT-13
Lead (Pb)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-OCT-13
Magnesium (Mg)-Dissolved		9.21	9.31		mg/L	1.1	20	02-OCT-13
Manganese (Mn)-Dissolved		0.359	0.361		mg/L	0.5	20	02-OCT-13
Molybdenum (Mo)-Dissolved		0.000815	0.000841		mg/L	3.1	20	02-OCT-13
Nickel (Ni)-Dissolved		0.00059	0.00059		mg/L	1.0	20	02-OCT-13
Potassium (K)-Dissolved		<0.50	<0.50	RPD-NA	mg/L	N/A	20	02-OCT-13
Selenium (Se)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Silicon (Si)-Dissolved		5.02	4.77		mg/L	5.0	20	02-OCT-13
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	02-OCT-13
Sodium (Na)-Dissolved		4.4	4.3		mg/L	2.5	20	02-OCT-13
Strontium (Sr)-Dissolved		0.108	0.108		mg/L	0.1	20	02-OCT-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	02-OCT-13
Titanium (Ti)-Dissolved		0.00063	0.00053		mg/L	18	20	02-OCT-13
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	02-OCT-13
Uranium (U)-Dissolved		0.000357	0.000354		mg/L	0.9	20	02-OCT-13
Vanadium (V)-Dissolved		0.00018	0.00017		mg/L	1.6	20	02-OCT-13
Zinc (Zn)-Dissolved		0.0037	0.0031		mg/L	19	20	02-OCT-13
WG1759470-1 MB								
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	02-OCT-13
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	02-OCT-13
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	02-OCT-13
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	02-OCT-13
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	02-OCT-13
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	02-OCT-13
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	02-OCT-13
Calcium (Ca)-Dissolved			<0.020		mg/L		0.02	02-OCT-13
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	02-OCT-13
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	02-OCT-13
Copper (Cu)-Dissolved			<0.00010		mg/L		0.0001	02-OCT-13
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	02-OCT-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED		Water						
Batch	R2707427							
WG1759470-1	MB							
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	02-OCT-13
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	02-OCT-13
Manganese (Mn)-Dissolved			<0.000050		mg/L		0.00005	02-OCT-13
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	02-OCT-13
Nickel (Ni)-Dissolved			<0.00010		mg/L		0.0001	02-OCT-13
Potassium (K)-Dissolved			<0.050		mg/L		0.05	02-OCT-13
Selenium (Se)-Dissolved			<0.00010		mg/L		0.0001	02-OCT-13
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	02-OCT-13
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	02-OCT-13
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	02-OCT-13
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	02-OCT-13
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	02-OCT-13
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	02-OCT-13
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	02-OCT-13
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	02-OCT-13
Vanadium (V)-Dissolved			<0.00010		mg/L		0.0001	02-OCT-13
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	02-OCT-13
NAPHTHENIC-ACID-FM		Water						
Batch	R2700794							
WG1754347-3	DUP	L1364191-8						
Naphthenic Acids		1.2	<1.0	RPD-NA	mg/L	N/A	30	25-SEP-13
WG1754347-7	DUP	L1367748-2						
Naphthenic Acids		37.3	37.2		mg/L	0.3	30	25-SEP-13
WG1754347-4	LCS							
Naphthenic Acids			104.2		%		70-130	25-SEP-13
WG1754347-1	MB							
Naphthenic Acids			<1.0		mg/L		1	25-SEP-13
WG1754347-5	MB							
Naphthenic Acids			<1.0		mg/L		1	25-SEP-13
WG1754347-2	MS	L1364191-7						
Naphthenic Acids			121.9		%		50-150	25-SEP-13
WG1754347-6	MS	L1366226-5						
Naphthenic Acids			105.0		%		50-150	25-SEP-13
NH3-CFA-ED		Water						



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-CFA-ED		Water						
Batch	R2706589							
WG1759121-11	DUP	L1369030-6						
Ammonia, Total (as N)		1.20	1.21		mg/L	0.4	20	02-OCT-13
WG1759121-12	DUP	L1369105-1						
Ammonia, Total (as N)		12.4	12.5		mg/L	0.9	20	02-OCT-13
WG1759121-6	DUP	L1371511-1						
Ammonia, Total (as N)		0.749	0.714		mg/L	4.8	20	02-OCT-13
WG1759121-9	DUP	L1369101-25						
Ammonia, Total (as N)		1.53	1.49		mg/L	2.7	20	02-OCT-13
WG1759121-2	LCS							
Ammonia, Total (as N)			98.5		%		85-115	02-OCT-13
WG1759121-1	MB							
Ammonia, Total (as N)			<0.050		mg/L		0.05	02-OCT-13
WG1759121-10	MS	L1368925-2						
Ammonia, Total (as N)			102.0		%		75-125	02-OCT-13
WG1759121-5	MS	L1367764-4						
Ammonia, Total (as N)			91.6		%		75-125	02-OCT-13
WG1759121-8	MS	L1369101-1						
Ammonia, Total (as N)			97.2		%		75-125	02-OCT-13
NO2-IC-ED		Water						
Batch	R2701555							
WG1754970-3	DUP	L1367775-5						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-5	DUP	L1367764-4						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-7	DUP	L1367259-26						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-9	DUP	L1366522-5						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-2	LCS							
Nitrite (as N)			93.7		%		90-110	25-SEP-13
WG1754970-1	MB							
Nitrite (as N)			<0.050		mg/L		0.05	26-SEP-13
WG1754970-10	MS	L1366522-5						
Nitrite (as N)			94.0		%		75-125	25-SEP-13
WG1754970-4	MS	L1367775-5						
Nitrite (as N)			89.9		%		75-125	25-SEP-13
WG1754970-6	MS	L1367764-4						
Nitrite (as N)			89.6		%		75-125	25-SEP-13



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO2-IC-ED		Water						
Batch	R2701555							
WG1754970-8	MS	L1367259-26						
Nitrite (as N)			88.8		%		75-125	25-SEP-13
NO3-IC-ED		Water						
Batch	R2701555							
WG1754970-3	DUP	L1367775-5						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-5	DUP	L1367764-4						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-7	DUP	L1367259-26						
Nitrate (as N)		0.312	0.307		mg/L	1.7	20	25-SEP-13
WG1754970-9	DUP	L1366522-5						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-2	LCS							
Nitrate (as N)			99.4		%		90-110	25-SEP-13
WG1754970-1	MB							
Nitrate (as N)			<0.050		mg/L		0.05	26-SEP-13
WG1754970-10	MS	L1366522-5						
Nitrate (as N)			97.4		%		75-125	25-SEP-13
WG1754970-4	MS	L1367775-5						
Nitrate (as N)			98.5		%		75-125	25-SEP-13
WG1754970-6	MS	L1367764-4						
Nitrate (as N)			100.4		%		75-125	25-SEP-13
WG1754970-8	MS	L1367259-26						
Nitrate (as N)			101.2		%		75-125	25-SEP-13
PAH-ABT1-ED		Water						
Batch	R2704447							
WG1757541-3	LCS							
Acenaphthene			88.7		%		60-130	02-OCT-13
Acenaphthylene			89.2		%		-	02-OCT-13
Anthracene			84.0		%		60-130	02-OCT-13
Fluoranthene			88.4		%		60-130	02-OCT-13
Fluorene			85.4		%		60-130	02-OCT-13
Naphthalene			86.5		%		50-130	02-OCT-13
Phenanthrene			89.3		%		60-130	02-OCT-13
Pyrene			87.9		%		60-130	02-OCT-13
Benzo(a)anthracene			92.3		%		60-130	02-OCT-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ABT1-ED								
	Water							
Batch	R2704447							
WG1757541-3	LCS							
Benzo(k)fluoranthene			91.7		%		60-130	02-OCT-13
Benzo(b&j)fluoranthene			99.2		%		60-130	02-OCT-13
Benzo(g,h,i)perylene			92.8		%		60-130	02-OCT-13
Benzo(a)pyrene			84.6		%		60-130	02-OCT-13
Chrysene			90.6		%		60-130	02-OCT-13
Dibenzo(a,h)anthracene			91.3		%		60-130	02-OCT-13
Indeno(1,2,3-cd)pyrene			94.6		%		60-130	02-OCT-13
WG1757541-2	MB							
Acenaphthene			<0.000020		mg/L		0.00002	01-OCT-13
Acenaphthylene			<0.000020		mg/L		0.00002	01-OCT-13
Anthracene			<0.000010		mg/L		0.00001	01-OCT-13
Fluoranthene			<0.000020		mg/L		0.00002	01-OCT-13
Fluorene			<0.000020		mg/L		0.00002	01-OCT-13
Naphthalene			<0.000050		mg/L		0.00005	01-OCT-13
Phenanthrene			<0.000050		mg/L		0.00005	01-OCT-13
Pyrene			<0.000020		mg/L		0.00002	01-OCT-13
Benzo(a)anthracene			<0.000010		mg/L		0.00001	01-OCT-13
Benzo(k)fluoranthene			<0.000010		mg/L		0.00001	01-OCT-13
Benzo(b&j)fluoranthene			<0.000010		mg/L		0.00001	01-OCT-13
Benzo(g,h,i)perylene			<0.000020		mg/L		0.00002	01-OCT-13
Benzo(a)pyrene			<0.0000050		mg/L		0.000005	01-OCT-13
Chrysene			<0.000020		mg/L		0.00002	01-OCT-13
Dibenzo(a,h)anthracene			<0.0000050		mg/L		0.000005	01-OCT-13
Indeno(1,2,3-cd)pyrene			<0.000010		mg/L		0.00001	01-OCT-13
Surrogate: Nitrobenzene d5			94.4		%		40-130	01-OCT-13
Surrogate: 2-Fluorobiphenyl			86.0		%		40-130	01-OCT-13
Surrogate: p-Terphenyl d14			113.5		%		40-130	01-OCT-13
PH/EC/ALK-ED								
	Water							
Batch	R2701489							
WG1755183-10	DUP	L1367259-26						
pH		8.37	8.47	J	pH	0.09	0.3	27-SEP-13
Conductivity (EC)		939	928		uS/cm	1.2	10	27-SEP-13
Bicarbonate (HCO3)		390	380		mg/L	2.5	25	27-SEP-13
Carbonate (CO3)		<5.0	7.8	RPD-NA	mg/L	N/A	25	27-SEP-13



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch	R2701489							
WG1755183-10	DUP	L1367259-26						
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	27-SEP-13
Alkalinity, Total (as CaCO3)		325	324		mg/L	0.2	20	27-SEP-13
WG1755183-6	DUP	L1368108-4						
pH		8.16	8.14	J	pH	0.02	0.3	26-SEP-13
Conductivity (EC)		655	653		uS/cm	0.3	10	26-SEP-13
Bicarbonate (HCO3)		358	357		mg/L	0.2	25	26-SEP-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	26-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	26-SEP-13
Alkalinity, Total (as CaCO3)		293	293		mg/L	0.2	20	26-SEP-13
WG1755183-7	DUP	L1367995-1						
pH		10.68	10.64	J	pH	0.04	0.3	26-SEP-13
Conductivity (EC)		3870	3840		uS/cm	0.8	10	26-SEP-13
Bicarbonate (HCO3)		236	241		mg/L	2.2	25	26-SEP-13
Carbonate (CO3)		109	104		mg/L	4.4	25	26-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	26-SEP-13
Alkalinity, Total (as CaCO3)		374	371		mg/L	1.0	20	26-SEP-13
WG1755183-8	DUP	L1367764-4						
pH		8.32	8.30	J	pH	0.02	0.3	26-SEP-13
Conductivity (EC)		491	490		uS/cm	0.2	10	26-SEP-13
Bicarbonate (HCO3)		327	327		mg/L	0.1	25	26-SEP-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	26-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	26-SEP-13
Alkalinity, Total (as CaCO3)		271	270		mg/L	0.4	20	26-SEP-13
WG1755183-9	DUP	L1367203-7						
pH		8.35	8.34	J	pH	0.01	0.3	26-SEP-13
Conductivity (EC)		9490	9500		uS/cm	0.1	10	26-SEP-13
Bicarbonate (HCO3)		793	747		mg/L	6.0	25	26-SEP-13
Carbonate (CO3)		7.2	6.5		mg/L	10	25	26-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	26-SEP-13
Alkalinity, Total (as CaCO3)		662	623		mg/L	6.1	20	26-SEP-13
WG1755183-2	LCS							
Conductivity (EC)			102.1		%		90-110	26-SEP-13
WG1755183-3	LCS							
pH			7.06		pH		6.7-7.3	26-SEP-13



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Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch	R2701489							
WG1755183-4	LCS							
Alkalinity, Total (as CaCO3)			101.0		%		85-115	26-SEP-13
WG1755183-5	LCS							
Conductivity (EC)			97.8		%		90-110	26-SEP-13
WG1755183-1	MB							
Bicarbonate (HCO3)			<5.0		mg/L		5	26-SEP-13
Carbonate (CO3)			<5.0		mg/L		5	26-SEP-13
Hydroxide (OH)			<5.0		mg/L		5	26-SEP-13
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	26-SEP-13
PHENOLS-4AAP-ED		Water						
Batch	R2707859							
WG1760653-4	DUP	L1371011-1						
Phenols (4AAP)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	15	03-OCT-13
WG1760653-6	DUP	L1368534-5						
Phenols (4AAP)		<0.0010	0.0011	RPD-NA	mg/L	N/A	15	03-OCT-13
WG1760653-7	DUP	L1369585-8						
Phenols (4AAP)		0.0018	0.0031	J	mg/L	0.0013	0.002	03-OCT-13
WG1760653-8	DUP	L1369585-20						
Phenols (4AAP)		0.0034	0.0038		mg/L	11	15	03-OCT-13
WG1760653-3	LCS							
Phenols (4AAP)			97.6		%		85-115	03-OCT-13
WG1760653-2	MB							
Phenols (4AAP)			<0.0010		mg/L		0.001	03-OCT-13
WG1760653-5	MS	L1371011-16						
Phenols (4AAP)			101.5		%		75-125	03-OCT-13
SO4-IC-ED		Water						
Batch	R2701555							
WG1754970-3	DUP	L1367775-5						
Sulfate (SO4)		4.43	4.41		mg/L	0.4	20	25-SEP-13
WG1754970-5	DUP	L1367764-4						
Sulfate (SO4)		14.9	14.9		mg/L	0.4	20	25-SEP-13
WG1754970-7	DUP	L1367259-26						
Sulfate (SO4)		118	117		mg/L	0.9	20	25-SEP-13
WG1754970-9	DUP	L1366522-5						
Sulfate (SO4)		<0.50	<0.50	RPD-NA	mg/L	N/A	20	25-SEP-13
WG1754970-2	LCS							
Sulfate (SO4)			100.9		%		90-110	25-SEP-13



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-IC-ED		Water						
Batch	R2701555							
WG1754970-1	MB							
Sulfate (SO4)			<0.50		mg/L		0.5	26-SEP-13
WG1754970-10	MS	L1366522-5						
Sulfate (SO4)			101.5		%		75-125	25-SEP-13
WG1754970-4	MS	L1367775-5						
Sulfate (SO4)			100.4		%		75-125	25-SEP-13
WG1754970-6	MS	L1367764-4						
Sulfate (SO4)			100.9		%		75-125	25-SEP-13
WG1754970-8	MS	L1367259-26						
Sulfate (SO4)			N/A	MS-B	%		-	25-SEP-13
TKN-CFA-ED		Water						
Batch	R2707883							
WG1760073-5	DUP	L1361457-1						
Total Kjeldahl Nitrogen			<0.20	RPD-NA	mg/L	N/A	20	03-OCT-13
WG1760073-2	LCS							
Total Kjeldahl Nitrogen			107		mg/L		75-125	03-OCT-13
WG1760073-3	LCS							
Total Kjeldahl Nitrogen			91.9		mg/L		75-125	03-OCT-13
WG1760073-4	LCS							
Total Kjeldahl Nitrogen			103		mg/L		75-125	03-OCT-13
WG1760073-1	MB							
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	03-OCT-13
WG1760073-6	MS	L1361457-1						
Total Kjeldahl Nitrogen			112		mg/L		70-130	03-OCT-13
TURBIDITY-ED		Water						
Batch	R2701091							
WG1754359-3	DUP	L1366777-10						
Turbidity			0.56		NTU	2.1	15	25-SEP-13
WG1754359-4	DUP	L1367764-2						
Turbidity			394		NTU	1.3	15	25-SEP-13
WG1754359-2	LCS							
Turbidity			97.0		%		85-115	25-SEP-13
WG1754359-1	MB							
Turbidity			<0.10		NTU		0.1	25-SEP-13

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Contact: SUE RAYNARD

Legend:

Limit ALS Control Limit (Data Quality Objectives)
DUP Duplicate
RPD Relative Percent Difference
N/A Not Available
LCS Laboratory Control Sample
SRM Standard Reference Material
MS Matrix Spike
MSD Matrix Spike Duplicate
ADE Average Desorption Efficiency
MB Method Blank
IRM Internal Reference Material
CRM Certified Reference Material
CCV Continuing Calibration Verification
CVS Calibration Verification Standard
LCSD Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

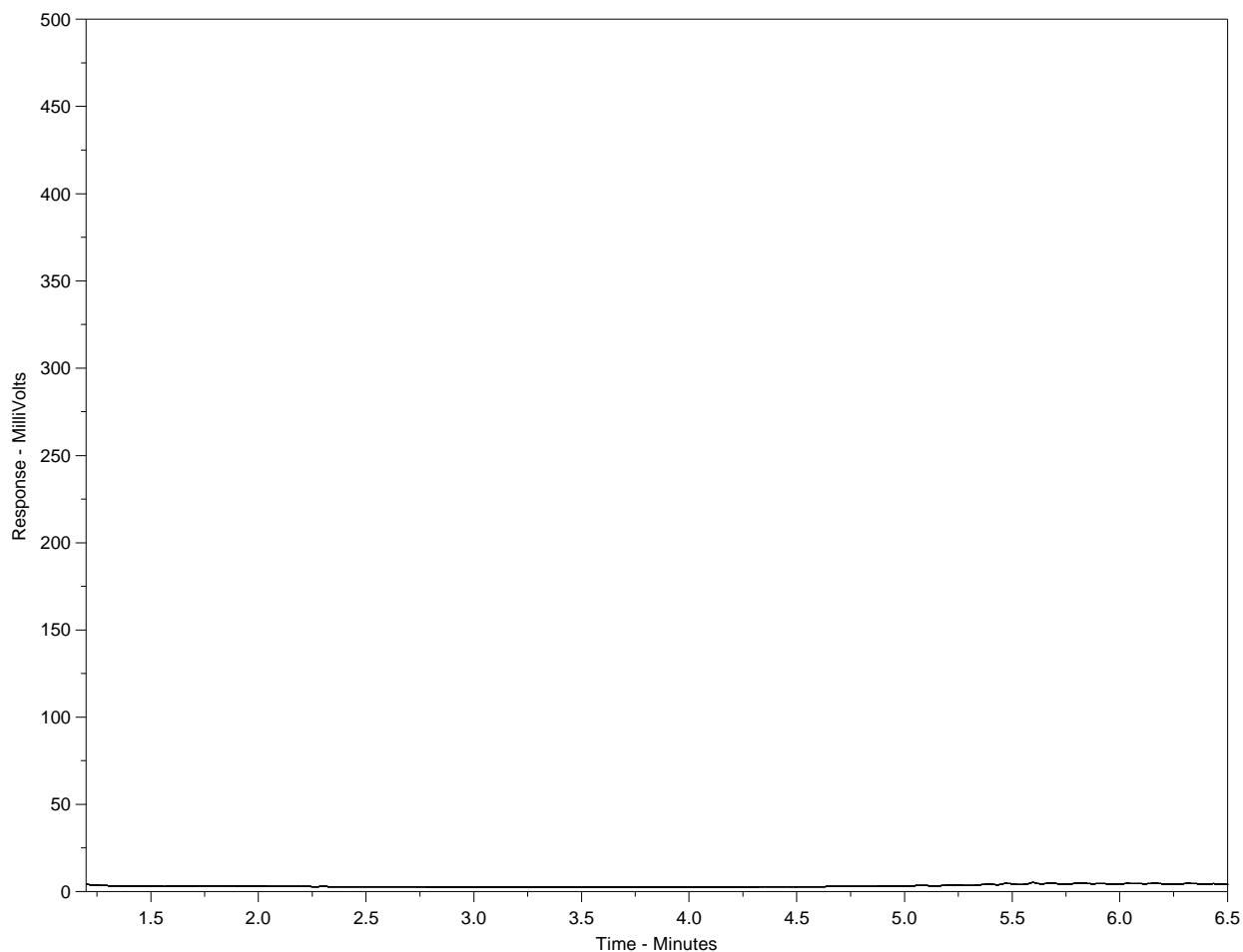
The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Hydrocarbon Distribution Report



ALS Sample ID: L1369029-1
 Client ID: 16054130925062



F2		F3		F4		F4	
nC10	nC16			nC34	nC50		
174°C	287°C			481°C	575°C		
346°F	549°F			898°F	1067°F		
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

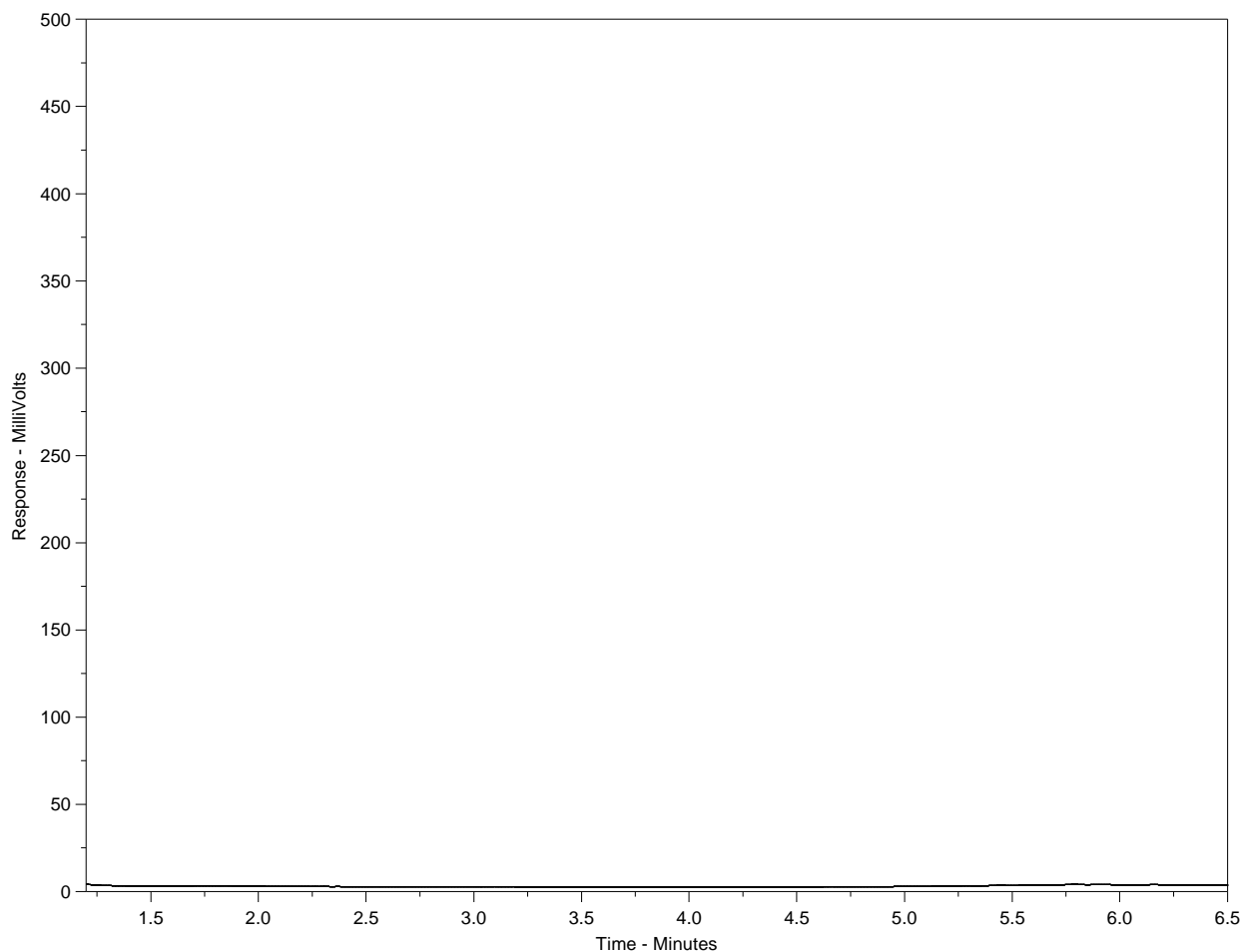
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1369029-2
 Client ID: 16054130925063



F2		F3		F4		F4	
nC10	nC16			nC34	nC50		
174°C	287°C			481°C	575°C		
346°F	549°F			898°F	1067°F		
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

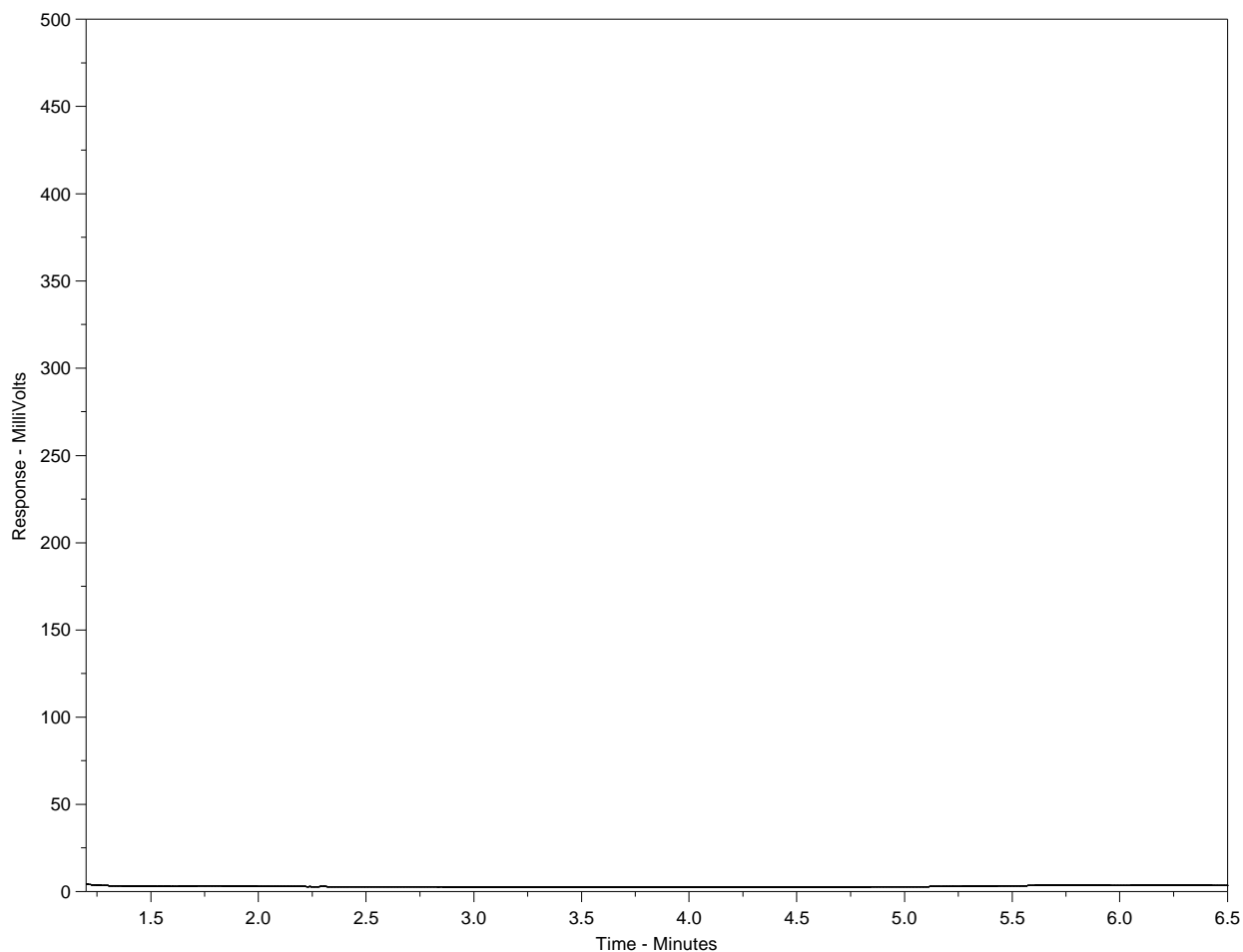
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1369029-3
Client ID: 16054130925064



F2		F3		F4		F4	
nC10	nC16			nC34	nC50		
174°C	287°C			481°C	575°C		
346°F	549°F			898°F	1067°F		
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

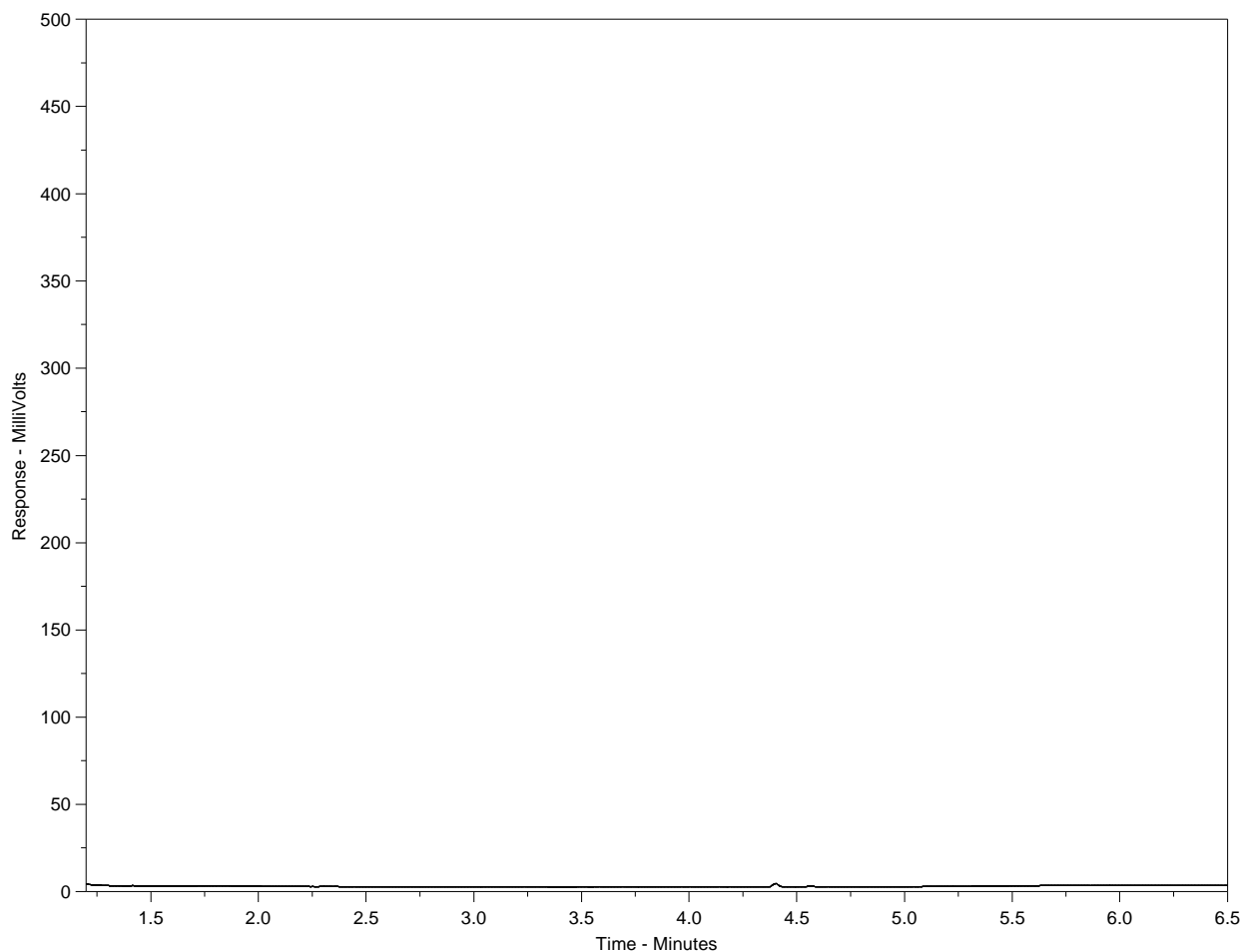
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1369029-4
Client ID: 16054130925065



F2		F3		F4		F4	
nC10	nC16			nC34	nC50		
174°C	287°C			481°C	575°C		
346°F	549°F			898°F	1067°F		
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.



MATRIX SOLUTIONS INC.
ATTN: SUE RAYNARD
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Date Received: 26-SEP-13
Report Date: 17-DEC-13 13:47 (MT)
Version: FINAL REV. 3

Client Phone: 403-237-0606

Certificate of Analysis

Lab Work Order #: L1369029
Project P.O. #: NOT SUBMITTED
Job Reference: 16054-502 SAOS PLAMONDON
C of C Numbers: M060607
Legal Site Desc:

Comments: ADDITIONAL 18-OCT-13 11:16
17-DEC-2013 LORs for Ag and Al have been fixed


Catherine Evaristo-Cordero
Senior Account Manager

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ADDRESS: 9936-67 Avenue, Edmonton, AB T6E 0P5 Canada | Phone: +1 780 413 5227 | Fax: +1 780 437 2311
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1369029-1 16054130925062									
Sampled By: J.FALLIS & G KOSHIN on 25-SEP-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
Toluene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
EthylBenzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
o-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
Styrene	<0.0010	-		0.0010	mg/L	-		30-SEP-13	R2702509
F1(C6-C10)	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702509
F1-BTEX	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702509
Xylenes	<0.00071	-		0.00071	mg/L	-		30-SEP-13	R2702509
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
Surr: 2-Bromobenzotrifluoride	98.6	-		N/A	%	-	30-SEP-13	30-SEP-13	R2705779
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.794	+/-0.096	DLM	0.010	mg/L	0		03-OCT-13	R2708784
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0067	+/-0.0011	DLM	0.0050	mg/L	0		03-OCT-13	R2708784
Antimony (Sb)-Dissolved	<0.00050	-	DLM	0.00050	mg/L	-		03-OCT-13	R2708784
Arsenic (As)-Dissolved	0.0539	+/-0.0057	DLM	0.00050	mg/L	0		03-OCT-13	R2708784
Barium (Ba)-Dissolved	0.330	+/-0.029	DLM	0.00025	mg/L	0		03-OCT-13	R2708784
Beryllium (Be)-Dissolved	<0.0025	-	DLM	0.0025	mg/L	-		03-OCT-13	R2708784
Bismuth (Bi)-Dissolved	<0.00025	-	DLM	0.00025	mg/L	-		03-OCT-13	R2708784
Cadmium (Cd)-Dissolved	<0.00010	-	DLM	0.00010	mg/L	-		03-OCT-13	R2708784
Calcium (Ca)-Dissolved	28.0	+/-3.8	DLM	0.50	mg/L	0		03-OCT-13	R2708784
Chromium (Cr)-Dissolved	<0.00050	-	DLM	0.00050	mg/L	-		03-OCT-13	R2708784
Cobalt (Co)-Dissolved	0.00071	+/-0.00007	DLM	0.00050	mg/L	0		03-OCT-13	R2708784
Copper (Cu)-Dissolved	<0.00060	-	DLM	0.00060	mg/L	-		03-OCT-13	R2708784
Iron (Fe)-Dissolved	0.475	+/-0.043	DLM	0.050	mg/L	0		03-OCT-13	R2708784
Lead (Pb)-Dissolved	<0.00025	-	DLM	0.00025	mg/L	-		03-OCT-13	R2708784
Magnesium (Mg)-Dissolved	9.97	+/-0.78	DLM	0.10	mg/L	0		03-OCT-13	R2708784
Manganese (Mn)-Dissolved	0.0939	+/-0.0064	DLM	0.0020	mg/L	0		03-OCT-13	R2708784
Molybdenum (Mo)-Dissolved	0.0127	+/-0.0013	DLM	0.00025	mg/L	0		03-OCT-13	R2708784
Nickel (Ni)-Dissolved	0.00112	+/-0.00010	DLM	0.00050	mg/L	0		03-OCT-13	R2708784
Potassium (K)-Dissolved	3.87	+/-0.30	DLM	0.50	mg/L	0		03-OCT-13	R2708784
Selenium (Se)-Dissolved	<0.00050	-	DLM	0.00050	mg/L	-		03-OCT-13	R2708784
Silicon (Si)-Dissolved	3.37	+/-0.29	DLM	0.25	mg/L	0		03-OCT-13	R2708784
Silver (Ag)-Dissolved	<0.000050	-	DLM	0.000050	mg/L	-		03-OCT-13	R2708784
Sodium (Na)-Dissolved	581	+/-41	DLM	1.0	mg/L	0		03-OCT-13	R2708784
Strontium (Sr)-Dissolved	0.453	+/-0.034	DLM	0.00050	mg/L	0		03-OCT-13	R2708784
Thallium (Tl)-Dissolved	<0.00025	-	DLM	0.00025	mg/L	-		03-OCT-13	R2708784
Titanium (Ti)-Dissolved	<0.0015	-	DLM	0.0015	mg/L	-		03-OCT-13	R2708784
Tin (Sn)-Dissolved	<0.00050	-	DLM	0.00050	mg/L	-		03-OCT-13	R2708784
Uranium (U)-Dissolved	0.00037	+/-0.00004	DLM	0.00010	mg/L	0		03-OCT-13	R2708784
Vanadium (V)-Dissolved	<0.00050	-	DLM	0.00050	mg/L	-		03-OCT-13	R2708784
Zinc (Zn)-Dissolved	0.0149	+/-0.0018	DLM	0.0050	mg/L	0		03-OCT-13	R2708784
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		01-OCT-13	R2705538
Miscellaneous Parameters									
Ammonia, Total (as N)	2.31	-		0.050	mg/L	-		02-OCT-13	R2706589

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1369029-1 16054130925062									
Sampled By: J.FALLIS & G KOSHIN on 25-SEP-13									
Matrix: WATER									
Dissolved Organic Carbon	26.0	+/-2.8		1.0	mg/L	0		06-OCT-13	R2709550
Naphthenic Acids	1.3	+/-0.4		1.0	mg/L	0	01-OCT-13	01-OCT-13	R2705822
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		03-OCT-13	R2707859
Total Kjeldahl Nitrogen	3.25	+/-0.65		0.20	mg/L	0	04-OCT-13	04-OCT-13	R2709131
Phosphorus (P)-Total	1.37	+/-0.11		0.020	mg/L	0	30-SEP-13	30-SEP-13	R2704752
Turbidity	1.49	+/-0.19		0.10	NTU	0		27-SEP-13	R2702491
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Anthracene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Fluoranthene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Fluorene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Naphthalene	<0.000050	-		0.000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Phenanthrene	<0.000050	-		0.000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Pyrene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(a)pyrene	<0.0000050	-		0.000005	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Chrysene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Dibenzo(a,h)anthracene	<0.0000050	-		0.000005	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Surr: Nitrobenzene d5	85.9	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Surr: 2-Fluorobiphenyl	91.5	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Surr: p-Terphenyl d14	99.2	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	527	+/-16		0.50	mg/L	0		27-SEP-13	R2702879
Ion Balance Calculation									
Ion Balance	97.1	-			%	-		04-OCT-13	
TDS (Calculated)	1600	-			mg/L	-		04-OCT-13	
Hardness (as CaCO3)	111	-			mg/L	-		04-OCT-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		27-SEP-13	R2702879
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		02-OCT-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		27-SEP-13	R2702879
Sulfate by IC									
Sulfate (SO4)	97.2	+/-4.1		0.50	mg/L	0		27-SEP-13	R2702879
pH, Conductivity and Total Alkalinity									
pH	8.56	+/-0.04		0.10	pH	0		27-SEP-13	R2702318
Conductivity (EC)	2860	+/-95		0.20	uS/cm	0		27-SEP-13	R2702318
Bicarbonate (HCO3)	669	-		5.0	mg/L	-		27-SEP-13	R2702318
Carbonate (CO3)	22.1	-		5.0	mg/L	-		27-SEP-13	R2702318
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2702318
Alkalinity, Total (as CaCO3)	585	+/-21		2.0	mg/L	0		27-SEP-13	R2702318

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1369029-2 16054130925063									
Sampled By: J.FALLIS & G KOSHIN on 25-SEP-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
Toluene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
EthylBenzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
o-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
Styrene	<0.0010	-		0.0010	mg/L	-		30-SEP-13	R2702509
F1(C6-C10)	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702509
F1-BTEX	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702509
Xylenes	<0.00071	-		0.00071	mg/L	-		30-SEP-13	R2702509
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
Surr: 2-Bromobenzotrifluoride	98.6	-		N/A	%	-	30-SEP-13	30-SEP-13	R2705779
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.375	+/-0.045		0.0020	mg/L	0		03-OCT-13	R2708784
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0078	+/-0.0013		0.0010	mg/L	0		03-OCT-13	R2708784
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Arsenic (As)-Dissolved	0.0682	+/-0.0072		0.00040	mg/L	0		03-OCT-13	R2708784
Barium (Ba)-Dissolved	0.201	+/-0.017		0.00010	mg/L	0		03-OCT-13	R2708784
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		03-OCT-13	R2708784
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		03-OCT-13	R2708784
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Calcium (Ca)-Dissolved	26.7	+/-3.6		0.50	mg/L	0		03-OCT-13	R2708784
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Cobalt (Co)-Dissolved	0.00078	+/-0.00007		0.00010	mg/L	0		03-OCT-13	R2708784
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		03-OCT-13	R2708784
Iron (Fe)-Dissolved	0.616	+/-0.055		0.010	mg/L	0		03-OCT-13	R2708784
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Magnesium (Mg)-Dissolved	9.90	+/-0.77		0.10	mg/L	0		03-OCT-13	R2708784
Manganese (Mn)-Dissolved	0.110	+/-0.0075		0.0020	mg/L	0		03-OCT-13	R2708784
Molybdenum (Mo)-Dissolved	0.00278	+/-0.00029		0.00010	mg/L	0		03-OCT-13	R2708784
Nickel (Ni)-Dissolved	0.00201	+/-0.00017		0.00010	mg/L	0		03-OCT-13	R2708784
Potassium (K)-Dissolved	2.38	+/-0.18		0.50	mg/L	0		03-OCT-13	R2708784
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Silicon (Si)-Dissolved	6.34	+/-0.54		0.050	mg/L	0		03-OCT-13	R2708784
Silver (Ag)-Dissolved	<0.000010	-		0.00012	mg/L	-		03-OCT-13	R2708784
Sodium (Na)-Dissolved	268	+/-19		1.0	mg/L	0		03-OCT-13	R2708784
Strontium (Sr)-Dissolved	0.285	+/-0.021		0.00010	mg/L	0		03-OCT-13	R2708784
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		03-OCT-13	R2708784
Titanium (Ti)-Dissolved	0.00056	+/-0.00027		0.00030	mg/L	0		03-OCT-13	R2708784
Tin (Sn)-Dissolved	0.00034	+/-0.00003		0.00020	mg/L	0		03-OCT-13	R2708784
Uranium (U)-Dissolved	0.00038	+/-0.00004		0.00010	mg/L	0		03-OCT-13	R2708784
Vanadium (V)-Dissolved	0.00072	+/-0.00006		0.00010	mg/L	0		03-OCT-13	R2708784
Zinc (Zn)-Dissolved	0.0115	+/-0.0014		0.0010	mg/L	0		03-OCT-13	R2708784
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		01-OCT-13	R2705538
Miscellaneous Parameters									
Ammonia, Total (as N)	3.41	-		0.050	mg/L	-		02-OCT-13	R2706589

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1369029-2 16054130925063									
Sampled By: J.FALLIS & G KOSHIN on 25-SEP-13									
Matrix: WATER									
Dissolved Organic Carbon	17.4	+/-2.0		1.0	mg/L	0		06-OCT-13	R2709550
Naphthenic Acids	<1.0	-		1.0	mg/L	-	01-OCT-13	01-OCT-13	R2705822
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		03-OCT-13	R2707859
Total Kjeldahl Nitrogen	3.86	+/-0.77		0.20	mg/L	0	04-OCT-13	04-OCT-13	R2709131
Phosphorus (P)-Total	2.23	+/-0.17		0.020	mg/L	0	30-SEP-13	30-SEP-13	R2704752
Turbidity	1.99	+/-0.23		0.10	NTU	0		27-SEP-13	R2702491
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Anthracene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Fluoranthene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Fluorene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Naphthalene	<0.000050	-		0.000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Phenanthrene	<0.000050	-		0.000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Pyrene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(a)pyrene	<0.0000050	-		0.000005	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Chrysene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Dibenzo(a,h)anthracene	<0.0000050	-		0.000005	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Surr: Nitrobenzene d5	79.8	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Surr: 2-Fluorobiphenyl	87.9	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Surr: p-Terphenyl d14	109.4	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	16.5	+/-0.53		0.50	mg/L	0		27-SEP-13	R2702879
Ion Balance Calculation									
Ion Balance	101	-			%	-		04-OCT-13	
TDS (Calculated)	772	-			mg/L	-		04-OCT-13	
Hardness (as CaCO3)	107	-			mg/L	-		04-OCT-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		27-SEP-13	R2702879
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		02-OCT-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		27-SEP-13	R2702879
Sulfate by IC									
Sulfate (SO4)	113	+/-4.7		0.50	mg/L	0		27-SEP-13	R2702879
pH, Conductivity and Total Alkalinity									
pH	8.49	+/-0.04		0.10	pH	0		27-SEP-13	R2702318
Conductivity (EC)	1260	+/-42		0.20	uS/cm	0		27-SEP-13	R2702318
Bicarbonate (HCO3)	653	-		5.0	mg/L	-		27-SEP-13	R2702318
Carbonate (CO3)	14.5	-		5.0	mg/L	-		27-SEP-13	R2702318
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2702318
Alkalinity, Total (as CaCO3)	560	+/-20		2.0	mg/L	0		27-SEP-13	R2702318

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1369029-3 16054130925064									
Sampled By: J.FALLIS & G KOSHIN on 25-SEP-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
Toluene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
EthylBenzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
o-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
Styrene	<0.0010	-		0.0010	mg/L	-		30-SEP-13	R2702509
F1(C6-C10)	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702509
F1-BTEX	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702509
Xylenes	<0.00071	-		0.00071	mg/L	-		30-SEP-13	R2702509
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
Surr: 2-Bromobenzotrifluoride	102.1	-		N/A	%	-	30-SEP-13	30-SEP-13	R2705779
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.732	+/-0.089	DLM	0.0040	mg/L	0		03-OCT-13	R2708784
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0035	+/-0.0007	DLM	0.0020	mg/L	0		03-OCT-13	R2708784
Antimony (Sb)-Dissolved	<0.00040	-	DLM	0.00040	mg/L	-		03-OCT-13	R2708784
Arsenic (As)-Dissolved	0.0229	+/-0.0024	DLM	0.00040	mg/L	0		03-OCT-13	R2708784
Barium (Ba)-Dissolved	0.105	+/-0.0091	DLM	0.00010	mg/L	0		03-OCT-13	R2708784
Beryllium (Be)-Dissolved	<0.0010	-	DLM	0.0010	mg/L	-		03-OCT-13	R2708784
Bismuth (Bi)-Dissolved	<0.00010	-	DLM	0.00010	mg/L	-		03-OCT-13	R2708784
Cadmium (Cd)-Dissolved	<0.00010	-	DLM	0.00010	mg/L	-		03-OCT-13	R2708784
Calcium (Ca)-Dissolved	65.5	+/-8.9	DLM	0.50	mg/L	0		03-OCT-13	R2708784
Chromium (Cr)-Dissolved	<0.00040	-	DLM	0.00040	mg/L	-		03-OCT-13	R2708784
Cobalt (Co)-Dissolved	0.00040	+/-0.00004	DLM	0.00020	mg/L	0		03-OCT-13	R2708784
Copper (Cu)-Dissolved	<0.00060	-	DLM	0.00060	mg/L	-		03-OCT-13	R2708784
Iron (Fe)-Dissolved	1.35	+/-0.12	DLM	0.020	mg/L	0		03-OCT-13	R2708784
Lead (Pb)-Dissolved	<0.00010	-	DLM	0.00010	mg/L	-		03-OCT-13	R2708784
Magnesium (Mg)-Dissolved	22.6	+/-1.8	DLM	0.10	mg/L	0		03-OCT-13	R2708784
Manganese (Mn)-Dissolved	0.215	+/-0.015	DLM	0.0020	mg/L	0		03-OCT-13	R2708784
Molybdenum (Mo)-Dissolved	0.00926	+/-0.00097	DLM	0.00010	mg/L	0		03-OCT-13	R2708784
Nickel (Ni)-Dissolved	0.00125	+/-0.00011	DLM	0.00020	mg/L	0		03-OCT-13	R2708784
Potassium (K)-Dissolved	3.64	+/-0.28	DLM	0.50	mg/L	0		03-OCT-13	R2708784
Selenium (Se)-Dissolved	<0.00040	-	DLM	0.00040	mg/L	-		03-OCT-13	R2708784
Silicon (Si)-Dissolved	6.46	+/-0.55		0.10	mg/L	0		03-OCT-13	R2708784
Silver (Ag)-Dissolved	<0.000020	-	DLM	0.000020	mg/L	-		03-OCT-13	R2708784
Sodium (Na)-Dissolved	312	+/-22	DLM	1.0	mg/L	0		03-OCT-13	R2708784
Strontium (Sr)-Dissolved	0.648	+/-0.048	DLM	0.00020	mg/L	0		03-OCT-13	R2708784
Thallium (Tl)-Dissolved	<0.00010	-	DLM	0.00010	mg/L	-		03-OCT-13	R2708784
Titanium (Ti)-Dissolved	<0.00060	-	DLM	0.00060	mg/L	-		03-OCT-13	R2708784
Tin (Sn)-Dissolved	0.00036	+/-0.00003	DLM	0.00020	mg/L	0		03-OCT-13	R2708784
Uranium (U)-Dissolved	0.00044	+/-0.00005	DLM	0.00010	mg/L	0		03-OCT-13	R2708784
Vanadium (V)-Dissolved	0.00024	+/-0.00002	DLM	0.00020	mg/L	0		03-OCT-13	R2708784
Zinc (Zn)-Dissolved	0.0124	+/-0.0015	DLM	0.0020	mg/L	0		03-OCT-13	R2708784
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		01-OCT-13	R2705538
Miscellaneous Parameters									
Ammonia, Total (as N)	3.24	-		0.050	mg/L	-		02-OCT-13	R2706589

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1369029-3 16054130925064									
Sampled By: J.FALLIS & G KOSHIN on 25-SEP-13									
Matrix: WATER									
Dissolved Organic Carbon	15.0	+/-1.7		1.0	mg/L	0		06-OCT-13	R2709550
Naphthenic Acids	<1.0	-		1.0	mg/L	-	01-OCT-13	01-OCT-13	R2705822
Phenols (4AAP)	0.0011	+/-0.0007		0.0010	mg/L	-6.9%		03-OCT-13	R2707859
Total Kjeldahl Nitrogen	3.75	+/-0.75		0.20	mg/L	0	04-OCT-13	04-OCT-13	R2709131
Phosphorus (P)-Total	0.916	+/-0.075		0.020	mg/L	0	30-SEP-13	30-SEP-13	R2704752
Turbidity	14.6	+/-1.3		0.10	NTU	0		27-SEP-13	R2702491
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Anthracene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Fluoranthene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Fluorene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Naphthalene	<0.000050	-		0.000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Phenanthrene	<0.000050	-		0.000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Pyrene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(a)pyrene	<0.000050	-		0.000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Chrysene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Dibenzo(a,h)anthracene	<0.000050	-		0.000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Surr: Nitrobenzene d5	84.9	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Surr: 2-Fluorobiphenyl	91.4	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Surr: p-Terphenyl d14	99.9	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	3.60	+/-0.14		0.50	mg/L	0		27-SEP-13	R2702879
Ion Balance Calculation									
Ion Balance	99.1	-			%	-		04-OCT-13	
TDS (Calculated)	1140	-			mg/L	-		04-OCT-13	
Hardness (as CaCO3)	257	-			mg/L	-		04-OCT-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		27-SEP-13	R2702879
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		02-OCT-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		27-SEP-13	R2702879
Sulfate by IC									
Sulfate (SO4)	416	+/-17		0.50	mg/L	0		27-SEP-13	R2702879
pH, Conductivity and Total Alkalinity									
pH	8.42	+/-0.04		0.10	pH	0		27-SEP-13	R2702318
Conductivity (EC)	1730	+/-58		0.20	uS/cm	0		27-SEP-13	R2702318
Bicarbonate (HCO3)	613	-		5.0	mg/L	-		27-SEP-13	R2702318
Carbonate (CO3)	11.5	-		5.0	mg/L	-		27-SEP-13	R2702318
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2702318
Alkalinity, Total (as CaCO3)	521	+/-19		2.0	mg/L	0		27-SEP-13	R2702318

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1369029-4 16054130925065									
Sampled By: J.FALLIS & G KOSHIN on 25-SEP-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
Toluene	0.00103	-		0.00050	mg/L	-		30-SEP-13	R2702509
EthylBenzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
o-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
Styrene	<0.0010	-		0.0010	mg/L	-		30-SEP-13	R2702509
F1(C6-C10)	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702509
F1-BTEX	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702509
Xylenes	<0.00071	-		0.00071	mg/L	-		30-SEP-13	R2702509
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
Surr: 2-Bromobenzotrifluoride	99.7	-		N/A	%	-	30-SEP-13	30-SEP-13	R2705779
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.0337	+/-0.0040		0.0020	mg/L	0		03-OCT-13	R2708784
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0074	+/-0.0012		0.0010	mg/L	0		03-OCT-13	R2708784
Antimony (Sb)-Dissolved	0.00097	+/-0.00009		0.00040	mg/L	0		03-OCT-13	R2708784
Arsenic (As)-Dissolved	0.00206	+/-0.00022		0.00040	mg/L	0		03-OCT-13	R2708784
Barium (Ba)-Dissolved	0.0678	+/-0.0059		0.00010	mg/L	0		03-OCT-13	R2708784
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		03-OCT-13	R2708784
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		03-OCT-13	R2708784
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Calcium (Ca)-Dissolved	27.9	+/-3.8		0.50	mg/L	0		03-OCT-13	R2708784
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Cobalt (Co)-Dissolved	0.00015	+/-0.00001		0.00010	mg/L	0		03-OCT-13	R2708784
Copper (Cu)-Dissolved	0.00124	+/-0.00010		0.00060	mg/L	0		03-OCT-13	R2708784
Iron (Fe)-Dissolved	<0.010	-		0.010	mg/L	-		03-OCT-13	R2708784
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Magnesium (Mg)-Dissolved	9.04	+/-0.70		0.10	mg/L	0		03-OCT-13	R2708784
Manganese (Mn)-Dissolved	0.0642	+/-0.0044		0.0020	mg/L	0		03-OCT-13	R2708784
Molybdenum (Mo)-Dissolved	0.00266	+/-0.00028		0.00010	mg/L	0		03-OCT-13	R2708784
Nickel (Ni)-Dissolved	0.00108	+/-0.00010		0.00010	mg/L	0		03-OCT-13	R2708784
Potassium (K)-Dissolved	1.43	+/-0.11		0.50	mg/L	0		03-OCT-13	R2708784
Selenium (Se)-Dissolved	0.00059	+/-0.00010		0.00040	mg/L	0		03-OCT-13	R2708784
Silicon (Si)-Dissolved	5.77	+/-0.49		0.050	mg/L	0		03-OCT-13	R2708784
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		03-OCT-13	R2708784
Sodium (Na)-Dissolved	18.7	+/-1.3		1.0	mg/L	0		03-OCT-13	R2708784
Strontium (Sr)-Dissolved	0.106	+/-0.0079		0.00010	mg/L	0		03-OCT-13	R2708784
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		03-OCT-13	R2708784
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		03-OCT-13	R2708784
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		03-OCT-13	R2708784
Uranium (U)-Dissolved	0.00331	+/-0.00035		0.00010	mg/L	0		03-OCT-13	R2708784
Vanadium (V)-Dissolved	0.00038	+/-0.00003		0.00010	mg/L	0		03-OCT-13	R2708784
Zinc (Zn)-Dissolved	0.0053	+/-0.0007		0.0010	mg/L	0		03-OCT-13	R2708784
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		01-OCT-13	R2705538
Miscellaneous Parameters									
Ammonia, Total (as N)	<0.050	-		0.050	mg/L	-		02-OCT-13	R2706589

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1369029-4 16054130925065									
Sampled By: J.FALLIS & G KOSHIN on 25-SEP-13									
Matrix: WATER									
Dissolved Organic Carbon	4.4	+/-0.7		1.0	mg/L	0		06-OCT-13	R2709550
Naphthenic Acids	2.1	+/-0.5		1.0	mg/L	0	01-OCT-13	01-OCT-13	R2705822
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		03-OCT-13	R2707859
Total Kjeldahl Nitrogen	0.44	+/-0.11		0.20	mg/L	0	04-OCT-13	04-OCT-13	R2709131
Phosphorus (P)-Total	0.490	+/-0.043		0.020	mg/L	0	30-SEP-13	30-SEP-13	R2704752
Turbidity	569	+/-50		0.10	NTU	0		27-SEP-13	R2702491
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Anthracene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Fluoranthene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Fluorene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Naphthalene	<0.000050	-		0.000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Phenanthrene	<0.000050	-		0.000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Pyrene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(a)pyrene	<0.0000050	-		0.000005	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Chrysene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Dibenzo(a,h)anthracene	<0.0000050	-		0.000005	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Surr: Nitrobenzene d5	74.5	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Surr: 2-Fluorobiphenyl	80.4	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Surr: p-Terphenyl d14	89.1	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	0.91	+/-0.07		0.50	mg/L	0		27-SEP-13	R2702879
Ion Balance Calculation									
Ion Balance	95.3	-			%	-		04-OCT-13	
TDS (Calculated)	155	-			mg/L	-		04-OCT-13	
Hardness (as CaCO3)	107	-			mg/L	-		04-OCT-13	
Nitrate as N by IC									
Nitrate (as N)	0.239	+/-0.019		0.050	mg/L	0		27-SEP-13	R2702879
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	0.239	-		0.071	mg/L	-		02-OCT-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		27-SEP-13	R2702879
Sulfate by IC									
Sulfate (SO4)	9.20	+/-0.42		0.50	mg/L	0		27-SEP-13	R2702879
pH, Conductivity and Total Alkalinity									
pH	8.20	+/-0.04		0.10	pH	0		27-SEP-13	R2702318
Conductivity (EC)	287	+/-9.6		0.20	uS/cm	0		27-SEP-13	R2702318
Bicarbonate (HCO3)	177	-		5.0	mg/L	-		27-SEP-13	R2702318
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2702318
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2702318
Alkalinity, Total (as CaCO3)	145	+/-6.1		2.0	mg/L	0		27-SEP-13	R2702318
* Refer to Referenced Information for Qualifiers (if any) and Methodology.									

Reference Information

Report Comments: ADDITIONAL 18-OCT-13 11:16
17-DEC-2013 LORs for Ag and Al have been fixed

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Phosphorus (P)-Total	MS-B	
Matrix Spike	Dissolved Organic Carbon	MS-B	

Sample Parameter Qualifier Key:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
B-D-L-CCMS-ED	Water	Dissolved Boron in Water by CRC ICPMS		APHA 3030 B / EPA SW-846 6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).				
BTXS,F1-ED	Water	BTEX, Styrene and F1 (C6-C10)		EPA 5021/8015&8260 GC-MS & FID
C-DIS-ORG-ED	Water	Dissolved Organic Carbon		APHA 5310 B-Instrumental
CL-IC-ED	Water	Chloride by IC		APHA 4110 B-ION CHROMATOGRAPHY
F2,F3,F4-ED	Water	F2, F3, F4		EPA 3510/CCME PHC CWS-GC-FID
HG-D-CVAA-ED	Water	Mercury (Hg) - Dissolved		EPA 245.7 / EPA 245.1
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET-D-CCMS-ED	Water	Dissolved Metals in Water by CRC ICPMS		APHA 3030 B&E / EPA SW-846 6020A
NAPHTHENIC-ACID-FM	Water	Naphthenic Acids by FTIR		Naphthenic Acids by FTIR, Syncrude, 1994
Dissolved naphthenic acids are solvent extracted from acidified aqueous samples using Dichloromethane prior to quantitation by Fourier Transform Infra-Red spectroscopy. Note that FTIR is not uniquely selective to naphthenic acids. If present, other carboxylic acids (e.g. humic acids, fulvic acids) may also be detected by this method.				
NH3-CFA-ED	Water	Ammonia in Water by Colour		APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.				
NO2+NO3-CALC-ED	Water	Nitrate+Nitrite		CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
P-T-COL-ED	Water	Total P in Water by Colour		APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.				
PAH-ABT1-ED	Water	PAH & Carcinogenic PAH List		EPA 3510/8270-GC/MS
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)				
PHENOLS-4AAP-ED	Water	Phenols (4AAP)		AB ENV.06537-COLORIMETRIC
This analysis is carried out using procedures adapted from ENVIRODAT VMV 06537 689, Method Code 154, in "Methods Manual for Chemical Analysis of Water and Wastes" published by the Alberta Environmental Centre. This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide and 4-aminoantipyrine to form a red complex which is measured at 505 nm.				
SO4-IC-ED	Water	Sulfate by IC		APHA 4110 B-ION CHROMATOGRAPHY
TKN-CFA-ED	Water	TKN in Water by Colour		APHA 4500-NORG (TKN)

This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 celcius with analysis using an automated colourimetric finish.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
TURBIDITY-ED	Water	Turbidity		APHA 2130 B-Nephelometer

** The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS methods may incorporate modifications from the specified reference to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
FM	ALS ENVIRONMENTAL - FORT MCMURRAY, ALBERTA, CANADA

Chain of Custody Numbers:

M060607

GLOSSARY OF REPORT TERMS

Surr - Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

MU: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.

Bias: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent.

Zero values indicate no detectable method bias.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Environmental

Quality Control Report

Workorder: L1369029

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-D-L-CCMS-ED		Water						
Batch	R2708784							
WG1760732-2	CRM	ED-HIGH-WATRM						
Boron (B)-Dissolved			95.7		%		80-120	03-OCT-13
WG1760732-3	DUP	L1369029-2						
Boron (B)-Dissolved		0.375	0.399		mg/L	6.2	20	03-OCT-13
WG1760732-1	MB							
Boron (B)-Dissolved			<0.0020		mg/L		0.002	03-OCT-13
BTXS,F1-ED		Water						
Batch	R2702509							
WG1757393-4	DUP	L1369029-1						
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	30-SEP-13
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	30-SEP-13
EthylBenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	30-SEP-13
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	30-SEP-13
m+p-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	30-SEP-13
Styrene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	50	30-SEP-13
F1(C6-C10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	30-SEP-13
WG1757393-5	DUP	L1369092-2						
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	30-SEP-13
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	30-SEP-13
EthylBenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	30-SEP-13
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	30-SEP-13
m+p-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	30-SEP-13
Styrene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	50	30-SEP-13
F1(C6-C10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	30-SEP-13
WG1757393-2	LCS							
Benzene			91.2		%		70-130	30-SEP-13
Toluene			91.0		%		70-130	30-SEP-13
EthylBenzene			90.6		%		70-130	30-SEP-13
o-Xylene			89.9		%		70-130	30-SEP-13
m+p-Xylene			87.6		%		70-130	30-SEP-13
Styrene			89.2		%		70-130	30-SEP-13
WG1757393-3	LCS							
F1(C6-C10)			120.4		%		70-130	30-SEP-13
WG1757393-1	MB							
Benzene			<0.00050		mg/L		0.0005	30-SEP-13
							0.0005	



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTXS,F1-ED Water								
Batch R2702509								
WG1757393-1 MB								
Toluene			<0.00050		mg/L		0.0005	30-SEP-13
EthylBenzene			<0.00050		mg/L		0.0005	30-SEP-13
o-Xylene			<0.00050		mg/L		0.0005	30-SEP-13
m+p-Xylene			<0.00050		mg/L		0.0005	30-SEP-13
Styrene			<0.0010		mg/L		0.001	30-SEP-13
F1(C6-C10)			<0.10		mg/L		0.1	30-SEP-13
WG1757393-6 MS		L1369092-2						
Benzene			79.3		%		50-150	30-SEP-13
Toluene			78.2		%		50-150	30-SEP-13
EthylBenzene			82.2		%		50-150	30-SEP-13
o-Xylene			85.8		%		50-150	30-SEP-13
m+p-Xylene			80.0		%		50-150	30-SEP-13
Styrene			85.1		%		50-150	30-SEP-13
WG1757393-7 MS		L1369092-2						
F1(C6-C10)			77.9		%		50-150	30-SEP-13
C-DIS-ORG-ED Water								
Batch R2709550								
WG1761992-3 CVS								
Dissolved Organic Carbon			138.8		%		80-160	05-OCT-13
WG1761992-4 DUP		L1365837-5						
Dissolved Organic Carbon		25.4	24.6		mg/L	3.3	20	05-OCT-13
WG1761992-8 DUP		L1369101-25						
Dissolved Organic Carbon		7.2	7.1		mg/L	0.7	20	06-OCT-13
WG1761992-2 LCS								
Dissolved Organic Carbon			113.8		%		80-120	05-OCT-13
WG1761992-1 MB								
Dissolved Organic Carbon			<1.0		mg/L		1	05-OCT-13
WG1761992-5 MS		L1365837-5						
Dissolved Organic Carbon			N/A	MS-B	%		-	05-OCT-13
WG1761992-9 MS		L1369101-25						
Dissolved Organic Carbon			110.3		%		70-130	06-OCT-13
CL-IC-ED Water								
Batch R2702879								
WG1756678-3 DUP		L1368562-2						
Chloride (Cl)		4.70	4.73		mg/L	0.5	20	27-SEP-13
WG1756678-5 DUP		L1369104-1						



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-IC-ED		Water						
Batch	R2702879							
WG1756678-5	DUP	L1369104-1						
Chloride (Cl)		3.38	3.39		mg/L	0.4	20	27-SEP-13
WG1756678-7	DUP	L1369030-3						
Chloride (Cl)		<0.50	<0.50	RPD-NA	mg/L	N/A	20	27-SEP-13
WG1756678-2	LCS		99.4		%		90-110	27-SEP-13
Chloride (Cl)								
WG1756678-1	MB		<0.50		mg/L		0.5	27-SEP-13
Chloride (Cl)								
WG1756678-4	MS	L1368562-2	102.3		%		75-125	27-SEP-13
Chloride (Cl)								
WG1756678-6	MS	L1369104-1	102.1		%		75-125	27-SEP-13
Chloride (Cl)								
WG1756678-8	MS	L1369030-3	106.8		%		75-125	27-SEP-13
Chloride (Cl)								
F2,F3,F4-ED		Water						
Batch	R2705779							
WG1757665-2	LCS		99.2		%		65-135	30-SEP-13
F2 (>C10-C16)								
F3 (C16-C34)			101.1		%		65-135	30-SEP-13
F4 (C34-C50)			99.9		%		65-135	30-SEP-13
WG1757665-5	LCS		97.9		%		65-135	30-SEP-13
F2 (>C10-C16)								
F3 (C16-C34)			101.0		%		65-135	30-SEP-13
F4 (C34-C50)			99.5		%		65-135	30-SEP-13
WG1757665-8	LCS		100.3		%		65-135	30-SEP-13
F2 (>C10-C16)								
F3 (C16-C34)			100.9		%		65-135	30-SEP-13
F4 (C34-C50)			91.5		%		65-135	30-SEP-13
WG1757665-1	MB		<0.25		mg/L		0.25	30-SEP-13
F2 (>C10-C16)								
F3 (C16-C34)			<0.25		mg/L		0.25	30-SEP-13
F4 (C34-C50)			<0.25		mg/L		0.25	30-SEP-13
Surrogate: 2-Bromobenzotrifluoride			101.1		%		50-150	30-SEP-13
WG1757665-4	MB		<0.25		mg/L		0.25	30-SEP-13
F2 (>C10-C16)								
F3 (C16-C34)			<0.25		mg/L		0.25	30-SEP-13
F4 (C34-C50)			<0.25		mg/L		0.25	30-SEP-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2,F3,F4-ED		Water						
Batch	R2705779							
WG1757665-4 MB								
Surrogate: 2-Bromobenzotrifluoride			100.2		%		50-150	30-SEP-13
WG1757665-7 MB								
F2 (>C10-C16)			<0.25		mg/L		0.25	30-SEP-13
F3 (C16-C34)			<0.25		mg/L		0.25	30-SEP-13
F4 (C34-C50)			<0.25		mg/L		0.25	30-SEP-13
Surrogate: 2-Bromobenzotrifluoride			97.8		%		50-150	30-SEP-13
WG1757665-9 MS		L1369104-9						
F2 (>C10-C16)			104.0		%		50-150	30-SEP-13
F3 (C16-C34)			102.6		%		50-150	30-SEP-13
F4 (C34-C50)			91.4		%		50-150	30-SEP-13
HG-D-CVAA-ED		Water						
Batch	R2705538							
WG1758529-13 DUP		L1368865-1						
Mercury (Hg)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	01-OCT-13
WG1758529-15 DUP		L1368882-1						
Mercury (Hg)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	01-OCT-13
WG1758529-16 DUP		L1368882-4						
Mercury (Hg)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	01-OCT-13
WG1758529-4 DUP		L1364770-1						
Mercury (Hg)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	01-OCT-13
WG1758529-2 LCS								
Mercury (Hg)-Dissolved			93.6		%		80-120	01-OCT-13
WG1758529-3 LCSD		WG1758529-2						
Mercury (Hg)-Dissolved		93.6	97.8		%	4.4	20	01-OCT-13
WG1758529-1 MB								
Mercury (Hg)-Dissolved			<0.00010		mg/L		0.0001	01-OCT-13
WG1758529-12 MS		L1368865-1						
Mercury (Hg)-Dissolved			90.5		%		70-130	01-OCT-13
WG1758529-14 MS		L1368882-1						
Mercury (Hg)-Dissolved			103.3		%		70-130	01-OCT-13
WG1758529-17 MS		L1368882-4						
Mercury (Hg)-Dissolved			83.6		%		70-130	01-OCT-13
WG1758529-5 MS		L1364770-1						
Mercury (Hg)-Dissolved			75.2		%		70-130	01-OCT-13
MET-D-CCMS-ED		Water						



Quality Control Report

Workorder: L1369029

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED		Water						
Batch	R2708784							
WG1760732-2 CRM	ED-HIGH-WATRM							
Aluminum (Al)-Dissolved			105.1		%		80-120	03-OCT-13
Antimony (Sb)-Dissolved			106.2		%		80-120	03-OCT-13
Arsenic (As)-Dissolved			103.4		%		80-120	03-OCT-13
Barium (Ba)-Dissolved			108.3		%		80-120	03-OCT-13
Beryllium (Be)-Dissolved			99.1		%		80-120	03-OCT-13
Bismuth (Bi)-Dissolved			100.4		%		80-120	03-OCT-13
Cadmium (Cd)-Dissolved			101.9		%		80-120	03-OCT-13
Calcium (Ca)-Dissolved			102.3		%		80-120	03-OCT-13
Chromium (Cr)-Dissolved			104.0		%		80-120	03-OCT-13
Cobalt (Co)-Dissolved			99.5		%		80-120	03-OCT-13
Copper (Cu)-Dissolved			97.6		%		80-120	03-OCT-13
Lead (Pb)-Dissolved			102.0		%		80-120	03-OCT-13
Magnesium (Mg)-Dissolved			100.8		%		80-120	03-OCT-13
Manganese (Mn)-Dissolved			102.7		%		80-120	03-OCT-13
Molybdenum (Mo)-Dissolved			99.7		%		80-120	03-OCT-13
Nickel (Ni)-Dissolved			101.6		%		80-120	03-OCT-13
Potassium (K)-Dissolved			97.0		%		80-120	03-OCT-13
Selenium (Se)-Dissolved			103.3		%		80-120	03-OCT-13
Silver (Ag)-Dissolved			102.2		%		80-120	03-OCT-13
Sodium (Na)-Dissolved			111.2		%		80-120	03-OCT-13
Strontium (Sr)-Dissolved			109.5		%		80-120	03-OCT-13
Thallium (Tl)-Dissolved			104.7		%		80-120	03-OCT-13
Titanium (Ti)-Dissolved			112.1		%		80-120	03-OCT-13
Tin (Sn)-Dissolved			96.8		%		80-120	03-OCT-13
Uranium (U)-Dissolved			102.5		%		80-120	03-OCT-13
Vanadium (V)-Dissolved			100.9		%		80-120	03-OCT-13
Zinc (Zn)-Dissolved			100.2		%		80-120	03-OCT-13
WG1760732-3 DUP		L1369029-2						
Aluminum (Al)-Dissolved		0.0078	<0.010	RPD-NA	mg/L	N/A	20	03-OCT-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	03-OCT-13
Arsenic (As)-Dissolved		0.0682	0.0683		mg/L	0.2	20	03-OCT-13
Barium (Ba)-Dissolved		0.201	0.199		mg/L	0.8	20	03-OCT-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	03-OCT-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2708784							
WG1760732-3	DUP	L1369029-2						
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	03-OCT-13
Cadmium (Cd)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	03-OCT-13
Calcium (Ca)-Dissolved		26.7	26.6		mg/L	0.1	20	03-OCT-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	03-OCT-13
Cobalt (Co)-Dissolved		0.00078	0.00078		mg/L	0.4	20	03-OCT-13
Copper (Cu)-Dissolved		<0.00060	<0.00060	RPD-NA	mg/L	N/A	20	03-OCT-13
Iron (Fe)-Dissolved		0.616	0.618		mg/L	0.3	20	03-OCT-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	03-OCT-13
Magnesium (Mg)-Dissolved		9.90	9.98		mg/L	0.9	20	03-OCT-13
Manganese (Mn)-Dissolved		0.110	0.111		mg/L	0.7	20	03-OCT-13
Molybdenum (Mo)-Dissolved		0.00278	0.00277		mg/L	0.4	20	03-OCT-13
Nickel (Ni)-Dissolved		0.00201	0.00199		mg/L	0.8	20	03-OCT-13
Potassium (K)-Dissolved		2.38	2.42		mg/L	1.7	20	03-OCT-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	03-OCT-13
Silicon (Si)-Dissolved		6.34	6.61		mg/L	4.1	20	03-OCT-13
Silver (Ag)-Dissolved		<0.000010	<0.00020	RPD-NA	mg/L	N/A	20	03-OCT-13
Sodium (Na)-Dissolved		268	270		mg/L	1.1	20	03-OCT-13
Strontium (Sr)-Dissolved		0.285	0.280		mg/L	1.6	20	03-OCT-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	03-OCT-13
Titanium (Ti)-Dissolved		0.00056	0.00041	J	mg/L	0.00015	0.0006	03-OCT-13
Tin (Sn)-Dissolved		0.00034	0.00035		mg/L	3.1	20	03-OCT-13
Uranium (U)-Dissolved		0.00038	0.00038		mg/L	0.1	20	03-OCT-13
Vanadium (V)-Dissolved		0.00072	0.00073		mg/L	1.6	20	03-OCT-13
Zinc (Zn)-Dissolved		0.0115	0.0108		mg/L	5.5	20	03-OCT-13
WG1760732-4	DUP	L1369657-7						
Aluminum (Al)-Dissolved		0.0016	0.0013		mg/L	18	20	03-OCT-13
Antimony (Sb)-Dissolved		0.00030	0.00028		mg/L	4.9	20	03-OCT-13
Arsenic (As)-Dissolved		0.00031	0.00030		mg/L	6.0	20	03-OCT-13
Barium (Ba)-Dissolved		0.740	0.768		mg/L	3.7	20	03-OCT-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	03-OCT-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	03-OCT-13
Cadmium (Cd)-Dissolved		0.000042	0.000039		mg/L	5.9	20	03-OCT-13
Calcium (Ca)-Dissolved		178	175		mg/L	1.8	20	03-OCT-13



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2708784							
WG1760732-4	DUP	L1369657-7						
Chromium (Cr)-Dissolved		0.00044	0.00044		mg/L	0.2	20	03-OCT-13
Cobalt (Co)-Dissolved		0.00021	0.00020		mg/L	2.2	20	03-OCT-13
Copper (Cu)-Dissolved		0.00138	0.00138		mg/L	0.1	20	03-OCT-13
Iron (Fe)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	03-OCT-13
Lead (Pb)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	03-OCT-13
Magnesium (Mg)-Dissolved		51.2	50.4		mg/L	1.5	20	03-OCT-13
Manganese (Mn)-Dissolved		0.00264	0.00256		mg/L	3.3	20	03-OCT-13
Molybdenum (Mo)-Dissolved		0.000612	0.000587		mg/L	4.2	20	03-OCT-13
Nickel (Ni)-Dissolved		0.00283	0.00287		mg/L	1.6	20	03-OCT-13
Potassium (K)-Dissolved		1.81	1.80		mg/L	0.6	20	03-OCT-13
Selenium (Se)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	03-OCT-13
Silicon (Si)-Dissolved		6.45	6.40		mg/L	0.8	20	03-OCT-13
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	03-OCT-13
Sodium (Na)-Dissolved		11.3	11.1		mg/L	2.0	20	03-OCT-13
Strontium (Sr)-Dissolved		0.332	0.332		mg/L	0.2	20	03-OCT-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	03-OCT-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	03-OCT-13
Tin (Sn)-Dissolved		0.00210	0.00209		mg/L	0.2	20	03-OCT-13
Uranium (U)-Dissolved		0.00399	0.00400		mg/L	0.4	20	03-OCT-13
Vanadium (V)-Dissolved		0.00041	0.00041		mg/L	2.2	20	03-OCT-13
WG1760732-1	MB							
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	03-OCT-13
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	03-OCT-13
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	03-OCT-13
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	03-OCT-13
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	03-OCT-13
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	03-OCT-13
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	03-OCT-13
Calcium (Ca)-Dissolved			<0.020		mg/L		0.02	03-OCT-13
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	03-OCT-13
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	03-OCT-13
Copper (Cu)-Dissolved			<0.00010		mg/L		0.0001	03-OCT-13
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	03-OCT-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2708784							
WG1760732-1	MB							
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	03-OCT-13
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	03-OCT-13
Manganese (Mn)-Dissolved			<0.000050		mg/L		0.00005	03-OCT-13
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	03-OCT-13
Nickel (Ni)-Dissolved			<0.00010		mg/L		0.0001	03-OCT-13
Potassium (K)-Dissolved			<0.050		mg/L		0.05	03-OCT-13
Selenium (Se)-Dissolved			<0.00010		mg/L		0.0001	03-OCT-13
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	03-OCT-13
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	03-OCT-13
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	03-OCT-13
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	03-OCT-13
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	03-OCT-13
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	03-OCT-13
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	03-OCT-13
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	03-OCT-13
Vanadium (V)-Dissolved			<0.00010		mg/L		0.0001	03-OCT-13
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	03-OCT-13
NAPHTHENIC-ACID-FM								
	Water							
Batch	R2705822							
WG1758369-3	DUP	L1369029-2						
Naphthenic Acids		<1.0	<1.0	RPD-NA	mg/L	N/A	30	01-OCT-13
WG1758369-4	LCS							
Naphthenic Acids			107.9		%		70-130	01-OCT-13
WG1758369-1	MB							
Naphthenic Acids			<1.0		mg/L		1	01-OCT-13
WG1758369-2	MS	L1369029-1						
Naphthenic Acids			117.2		%		50-150	01-OCT-13
NH3-CFA-ED								
	Water							
Batch	R2706589							
WG1759121-11	DUP	L1369030-6						
Ammonia, Total (as N)		1.20	1.21		mg/L	0.4	20	02-OCT-13
WG1759121-12	DUP	L1369105-1						
Ammonia, Total (as N)		12.4	12.5		mg/L	0.9	20	02-OCT-13
WG1759121-6	DUP	L1371511-1						
Ammonia, Total (as N)		0.749	0.714		mg/L	4.8	20	02-OCT-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
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Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-CFA-ED		Water						
Batch	R2706589							
WG1759121-9	DUP	L1369101-25						
Ammonia, Total (as N)		1.53	1.49		mg/L	2.7	20	02-OCT-13
WG1759121-2	LCS							
Ammonia, Total (as N)			98.5		%		85-115	02-OCT-13
WG1759121-1	MB							
Ammonia, Total (as N)			<0.050		mg/L		0.05	02-OCT-13
WG1759121-10	MS	L1368925-2						
Ammonia, Total (as N)			102.0		%		75-125	02-OCT-13
WG1759121-5	MS	L1367764-4						
Ammonia, Total (as N)			91.6		%		75-125	02-OCT-13
WG1759121-8	MS	L1369101-1						
Ammonia, Total (as N)			97.2		%		75-125	02-OCT-13
NO2-IC-ED		Water						
Batch	R2702879							
WG1756678-3	DUP	L1368562-2						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	27-SEP-13
WG1756678-5	DUP	L1369104-1						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	27-SEP-13
WG1756678-7	DUP	L1369030-3						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	27-SEP-13
WG1756678-2	LCS							
Nitrite (as N)			95.0		%		90-110	27-SEP-13
WG1756678-1	MB							
Nitrite (as N)			<0.050		mg/L		0.05	27-SEP-13
WG1756678-4	MS	L1368562-2						
Nitrite (as N)			96.3		%		75-125	27-SEP-13
WG1756678-6	MS	L1369104-1						
Nitrite (as N)			95.1		%		75-125	27-SEP-13
WG1756678-8	MS	L1369030-3						
Nitrite (as N)			98.9		%		75-125	27-SEP-13
NO3-IC-ED		Water						
Batch	R2702879							
WG1756678-3	DUP	L1368562-2						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	27-SEP-13
WG1756678-5	DUP	L1369104-1						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	27-SEP-13
WG1756678-7	DUP	L1369030-3						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	27-SEP-13



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-IC-ED		Water						
Batch	R2702879							
WG1756678-2	LCS							
Nitrate (as N)			99.7		%		90-110	27-SEP-13
WG1756678-1	MB							
Nitrate (as N)			<0.050		mg/L		0.05	27-SEP-13
WG1756678-4	MS	L1368562-2						
Nitrate (as N)			83.4		%		75-125	27-SEP-13
WG1756678-6	MS	L1369104-1						
Nitrate (as N)			92.1		%		75-125	27-SEP-13
WG1756678-8	MS	L1369030-3						
Nitrate (as N)			93.5		%		75-125	27-SEP-13
P-T-COL-ED		Water						
Batch	R2704752							
WG1757656-3	DUP	L1369030-6						
Phosphorus (P)-Total		1.07	1.12		mg/L	4.4	20	30-SEP-13
WG1757656-5	DUP	L1369337-3						
Phosphorus (P)-Total		0.132	0.138		mg/L	17	20	30-SEP-13
WG1757656-2	LCS							
Phosphorus (P)-Total			104.3		%		80-120	30-SEP-13
WG1757656-1	MB							
Phosphorus (P)-Total			<0.020		mg/L		0.02	30-SEP-13
WG1757656-4	MS	L1369030-6						
Phosphorus (P)-Total			N/A	MS-B	%		-	30-SEP-13
PAH-ABT1-ED		Water						
Batch	R2704447							
WG1757541-3	LCS							
Acenaphthene			88.7		%		60-130	02-OCT-13
Acenaphthylene			89.2		%		-	02-OCT-13
Anthracene			84.0		%		60-130	02-OCT-13
Fluoranthene			88.4		%		60-130	02-OCT-13
Fluorene			85.4		%		60-130	02-OCT-13
Naphthalene			86.5		%		50-130	02-OCT-13
Phenanthrene			89.3		%		60-130	02-OCT-13
Pyrene			87.9		%		60-130	02-OCT-13
Benzo(a)anthracene			92.3		%		60-130	02-OCT-13
Benzo(k)fluoranthene			91.7		%		60-130	02-OCT-13
Benzo(b&j)fluoranthene			99.2		%		60-130	02-OCT-13



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200 - 150 13 Ave SW
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Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ABT1-ED								
	Water							
Batch	R2704447							
WG1757541-3	LCS							
Benzo(g,h,i)perylene			92.8		%		60-130	02-OCT-13
Benzo(a)pyrene			84.6		%		60-130	02-OCT-13
Chrysene			90.6		%		60-130	02-OCT-13
Dibenzo(a,h)anthracene			91.3		%		60-130	02-OCT-13
Indeno(1,2,3-cd)pyrene			94.6		%		60-130	02-OCT-13
WG1757541-2	MB							
Acenaphthene			<0.000020		mg/L		0.00002	01-OCT-13
Acenaphthylene			<0.000020		mg/L		0.00002	01-OCT-13
Anthracene			<0.000010		mg/L		0.00001	01-OCT-13
Fluoranthene			<0.000020		mg/L		0.00002	01-OCT-13
Fluorene			<0.000020		mg/L		0.00002	01-OCT-13
Naphthalene			<0.000050		mg/L		0.00005	01-OCT-13
Phenanthrene			<0.000050		mg/L		0.00005	01-OCT-13
Pyrene			<0.000020		mg/L		0.00002	01-OCT-13
Benzo(a)anthracene			<0.000010		mg/L		0.00001	01-OCT-13
Benzo(k)fluoranthene			<0.000010		mg/L		0.00001	01-OCT-13
Benzo(b&j)fluoranthene			<0.000010		mg/L		0.00001	01-OCT-13
Benzo(g,h,i)perylene			<0.000020		mg/L		0.00002	01-OCT-13
Benzo(a)pyrene			<0.0000050		mg/L		0.000005	01-OCT-13
Chrysene			<0.000020		mg/L		0.00002	01-OCT-13
Dibenzo(a,h)anthracene			<0.0000050		mg/L		0.000005	01-OCT-13
Indeno(1,2,3-cd)pyrene			<0.000010		mg/L		0.00001	01-OCT-13
Surrogate: Nitrobenzene d5			94.4		%		40-130	01-OCT-13
Surrogate: 2-Fluorobiphenyl			86.0		%		40-130	01-OCT-13
Surrogate: p-Terphenyl d14			113.5		%		40-130	01-OCT-13
PH/EC/ALK-ED								
	Water							
Batch	R2702318							
WG1756128-10	DUP	L1369104-1						
pH		8.10	8.12	J	pH	0.03	0.3	28-SEP-13
Conductivity (EC)		443	442		uS/cm	0.2	10	28-SEP-13
Bicarbonate (HCO3)		286	288		mg/L	0.6	25	28-SEP-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	28-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	28-SEP-13
Alkalinity, Total (as CaCO3)		235	236		mg/L	0.6	20	28-SEP-13



Quality Control Report

Workorder: L1369029

Report Date: 17-DEC-13

Page 12 of 15

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch	R2702318							
WG1756128-11	DUP	L1369657-20						
pH		7.77	7.77	J	pH	0.00	0.3	28-SEP-13
Conductivity (EC)		939	928		uS/cm	1.2	10	28-SEP-13
Bicarbonate (HCO3)		644	695		mg/L	7.6	25	28-SEP-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	28-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	28-SEP-13
Alkalinity, Total (as CaCO3)		528	570		mg/L	7.6	20	28-SEP-13
WG1756128-6	DUP	L1368044-2						
pH		8.09	8.10	J	pH	0.01	0.3	27-SEP-13
Conductivity (EC)		1390	1390		uS/cm	0.1	10	27-SEP-13
Bicarbonate (HCO3)		571	528		mg/L	7.8	25	27-SEP-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	27-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	27-SEP-13
Alkalinity, Total (as CaCO3)		468	433		mg/L	7.8	20	27-SEP-13
WG1756128-7	DUP	L1369030-3						
pH		8.07	8.05	J	pH	0.02	0.3	27-SEP-13
Conductivity (EC)		563	565		uS/cm	0.4	10	27-SEP-13
Bicarbonate (HCO3)		378	378		mg/L	0.2	25	27-SEP-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	27-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	27-SEP-13
Alkalinity, Total (as CaCO3)		310	310		mg/L	0.2	20	27-SEP-13
WG1756128-8	DUP	L1369101-20						
pH		7.75	7.77	J	pH	0.02	0.3	27-SEP-13
Conductivity (EC)		2340	2340		uS/cm	0.0	10	27-SEP-13
Bicarbonate (HCO3)		580	530		mg/L	8.9	25	27-SEP-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	27-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	27-SEP-13
Alkalinity, Total (as CaCO3)		475	435		mg/L	8.9	20	27-SEP-13
WG1756128-9	DUP	L1368562-2						
pH		8.15	7.99	J	pH	0.16	0.3	27-SEP-13
Conductivity (EC)		327	322		uS/cm	1.5	10	27-SEP-13
Bicarbonate (HCO3)		184	184		mg/L	0.1	25	27-SEP-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	27-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	27-SEP-13
Alkalinity, Total (as CaCO3)		151	151					



Quality Control Report

Workorder: L1369029

Report Date: 17-DEC-13

Page 13 of 15

Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch	R2702318							
WG1756128-9	DUP	L1368562-2						
Alkalinity, Total (as CaCO3)		151	151		mg/L	0.1	20	27-SEP-13
WG1756128-2	LCS							
Conductivity (EC)			102.4		%		90-110	27-SEP-13
WG1756128-3	LCS							
pH			7.06		pH		6.7-7.3	27-SEP-13
WG1756128-4	LCS							
Alkalinity, Total (as CaCO3)			101.7		%		85-115	27-SEP-13
WG1756128-5	LCS							
Conductivity (EC)			96.6		%		90-110	27-SEP-13
WG1756128-1	MB							
Bicarbonate (HCO3)			<5.0		mg/L		5	27-SEP-13
Carbonate (CO3)			<5.0		mg/L		5	27-SEP-13
Hydroxide (OH)			<5.0		mg/L		5	27-SEP-13
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	27-SEP-13
PHENOLS-4AAP-ED		Water						
Batch	R2707859							
WG1760653-4	DUP	L1371011-1						
Phenols (4AAP)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	15	03-OCT-13
WG1760653-6	DUP	L1368534-5						
Phenols (4AAP)		<0.0010	0.0011	RPD-NA	mg/L	N/A	15	03-OCT-13
WG1760653-7	DUP	L1369585-8						
Phenols (4AAP)		0.0018	0.0031	J	mg/L	0.0013	0.002	03-OCT-13
WG1760653-8	DUP	L1369585-20						
Phenols (4AAP)		0.0034	0.0038		mg/L	11	15	03-OCT-13
WG1760653-3	LCS							
Phenols (4AAP)			97.6		%		85-115	03-OCT-13
WG1760653-2	MB							
Phenols (4AAP)			<0.0010		mg/L		0.001	03-OCT-13
WG1760653-5	MS	L1371011-16						
Phenols (4AAP)			101.5		%		75-125	03-OCT-13
SO4-IC-ED		Water						
Batch	R2702879							
WG1756678-3	DUP	L1368562-2						
Sulfate (SO4)		16.0	16.1		mg/L	0.7	20	27-SEP-13
WG1756678-5	DUP	L1369104-1						
Sulfate (SO4)		8.33	8.35		mg/L	0.2	20	27-SEP-13

Quality Control Report

Workorder: L1369029

Report Date: 17-DEC-13

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Page 15 of 15

Contact: SUE RAYNARD

Legend:

Limit ALS Control Limit (Data Quality Objectives)
DUP Duplicate
RPD Relative Percent Difference
N/A Not Available
LCS Laboratory Control Sample
SRM Standard Reference Material
MS Matrix Spike
MSD Matrix Spike Duplicate
ADE Average Desorption Efficiency
MB Method Blank
IRM Internal Reference Material
CRM Certified Reference Material
CCV Continuing Calibration Verification
CVS Calibration Verification Standard
LCSD Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

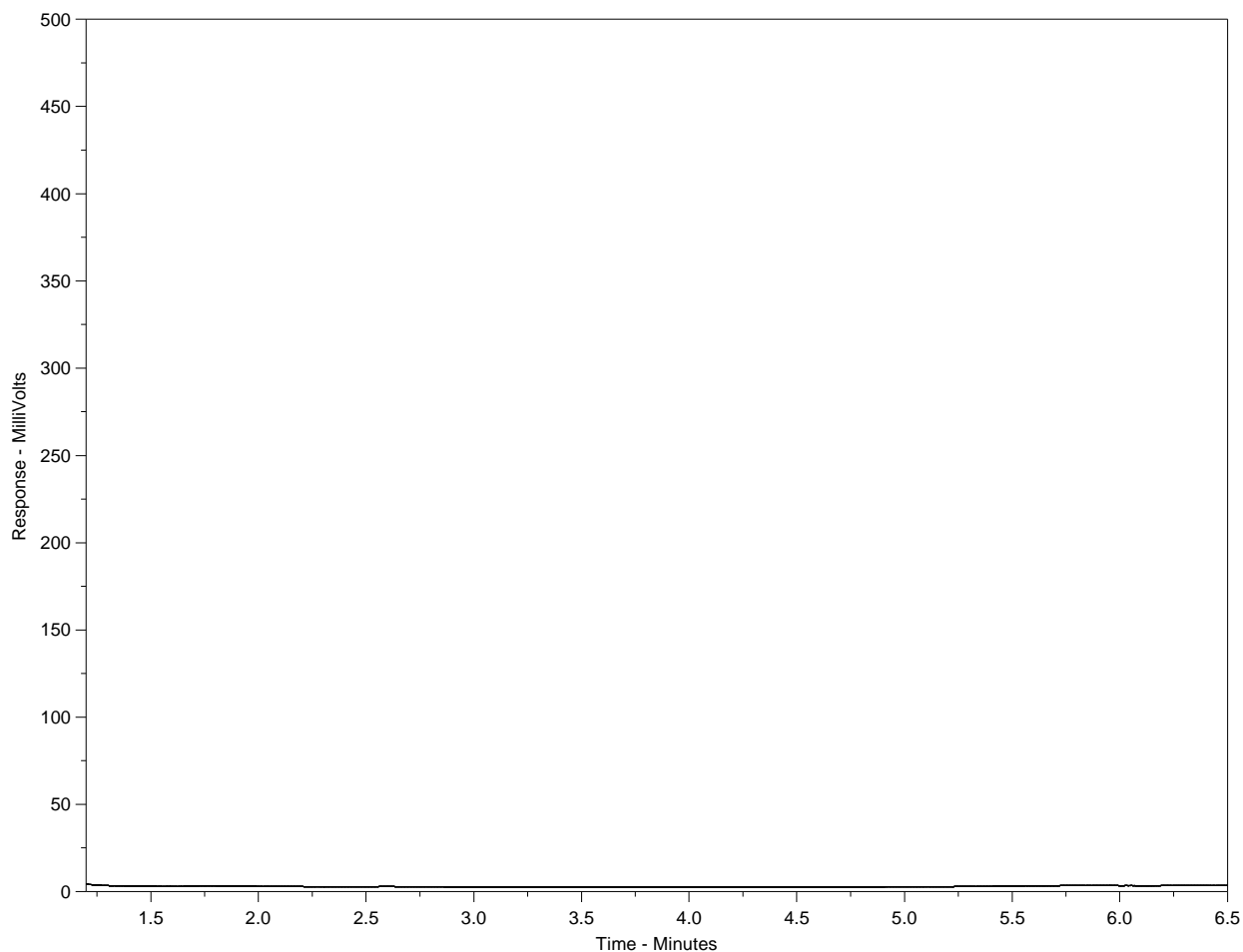
The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Hydrocarbon Distribution Report



ALS Sample ID: L1369030-1
 Client ID: 16054130925056



F2		F3		F4		F4	
nC10	nC16			nC34	nC50		
174°C	287°C			481°C	575°C		
346°F	549°F			898°F	1067°F		
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

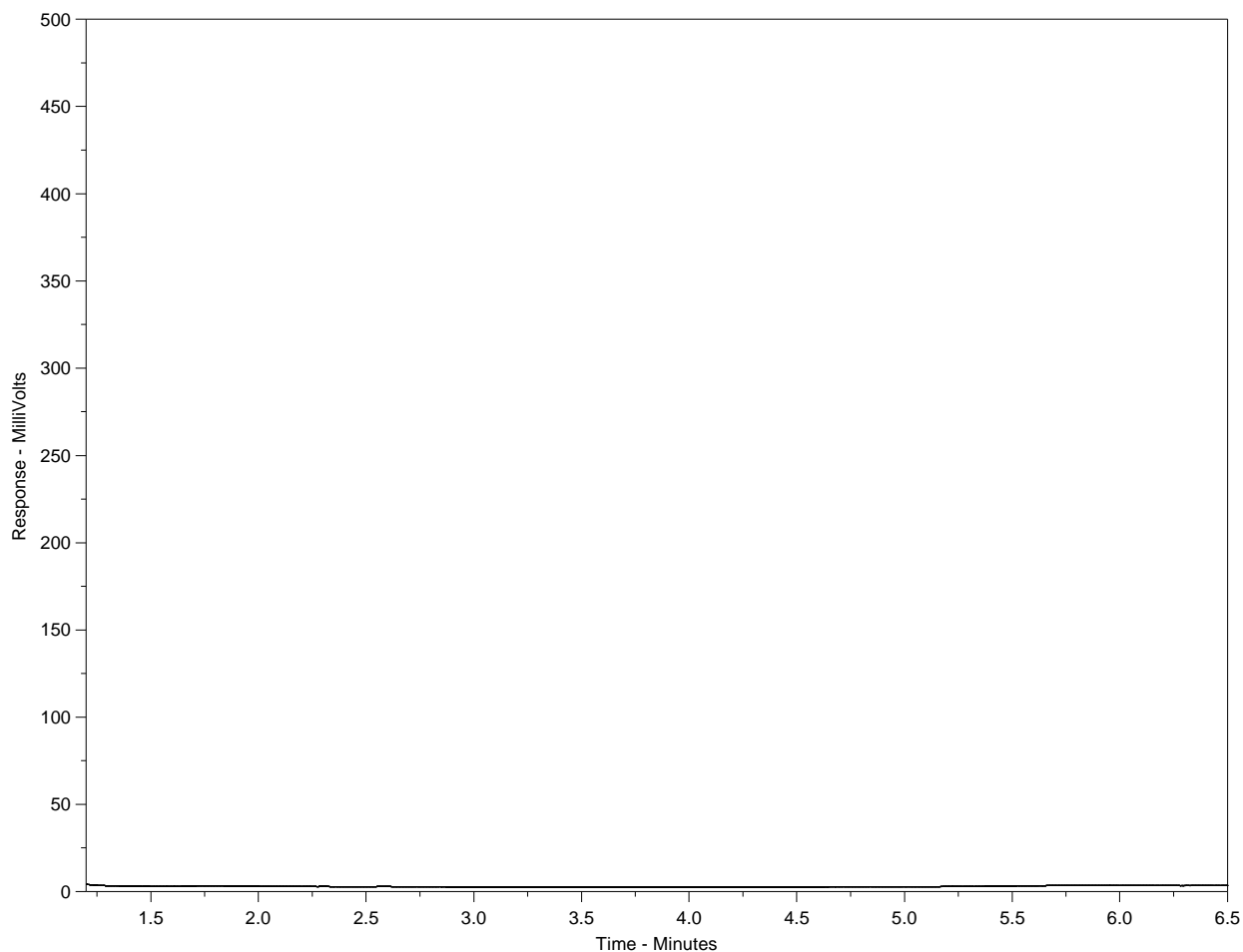
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1369030-2
 Client ID: 16054130925057



← F2 →		← F3 →		← F4 →		← F4 →	
nC10	nC16			nC34	nC50		
174°C	287°C			481°C	575°C		
346°F	549°F			898°F	1067°F		
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

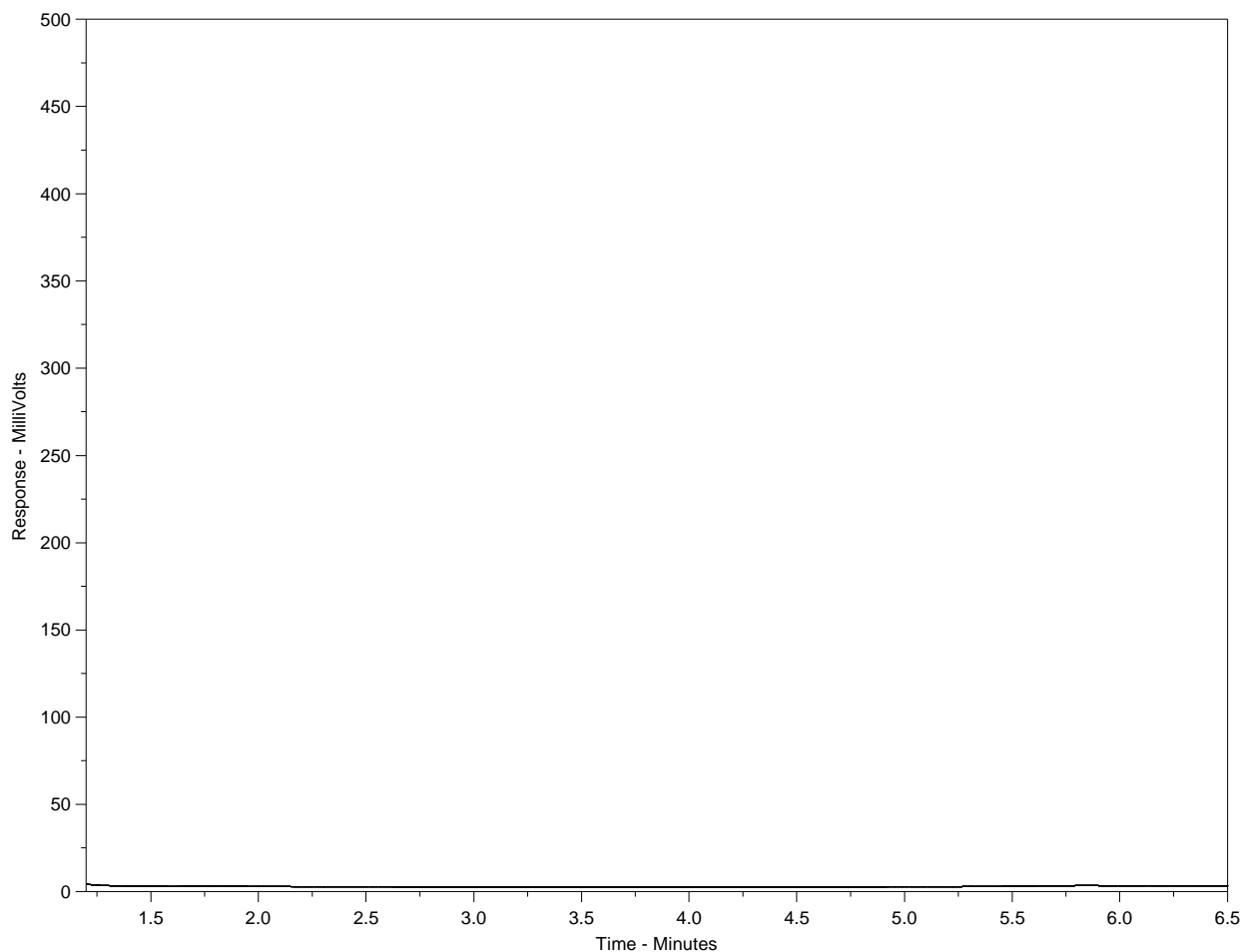
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1369030-3
Client ID: 16054130925058



F2		F3		F4		F4	
nC10	nC16			nC34	nC50		
174°C	287°C			481°C	575°C		
346°F	549°F			898°F	1067°F		
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

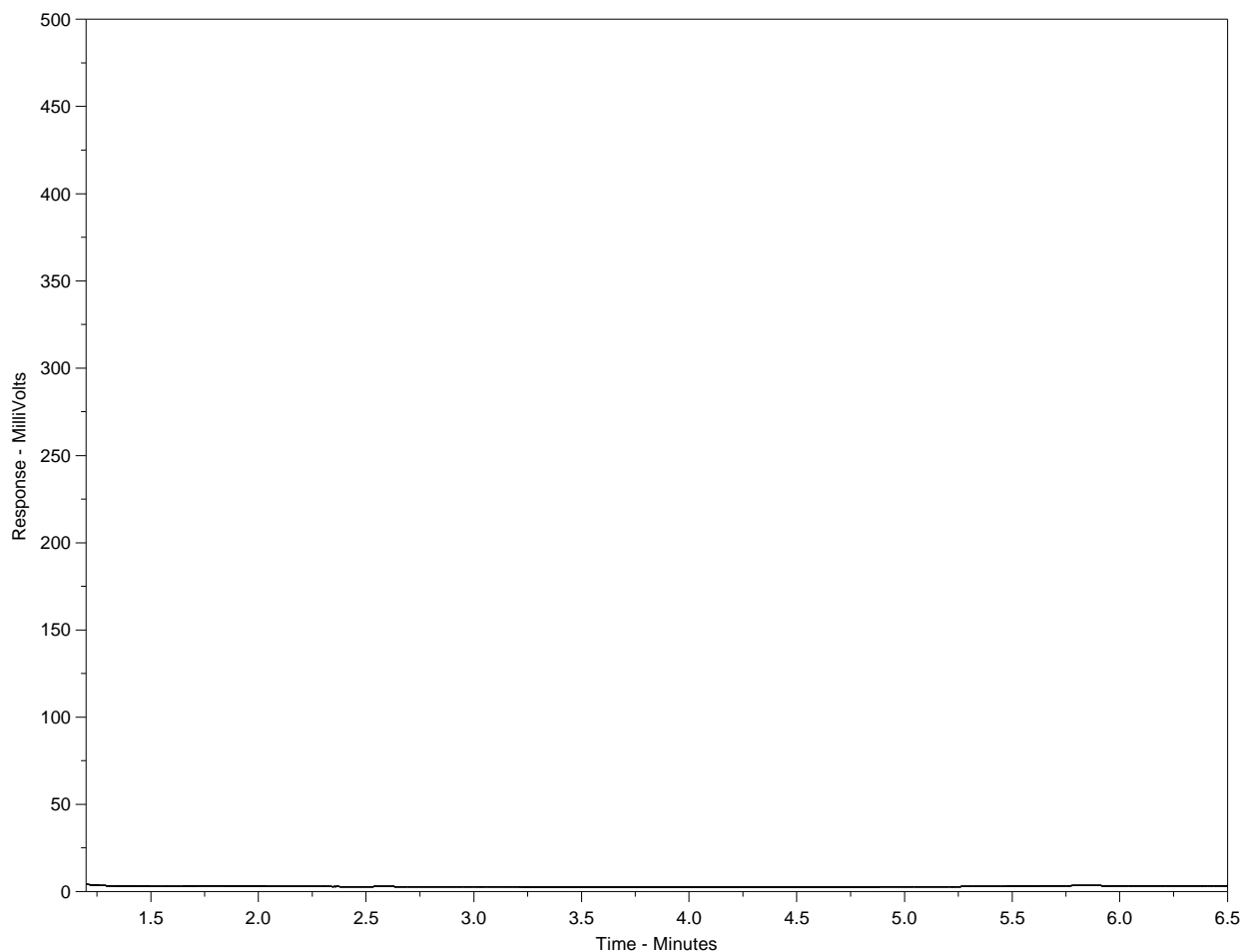
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1369030-4
Client ID: 16054130925059



F2		F3		F4		F4	
nC10	nC16			nC34	nC50		
174°C	287°C			481°C	575°C		
346°F	549°F			898°F	1067°F		
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

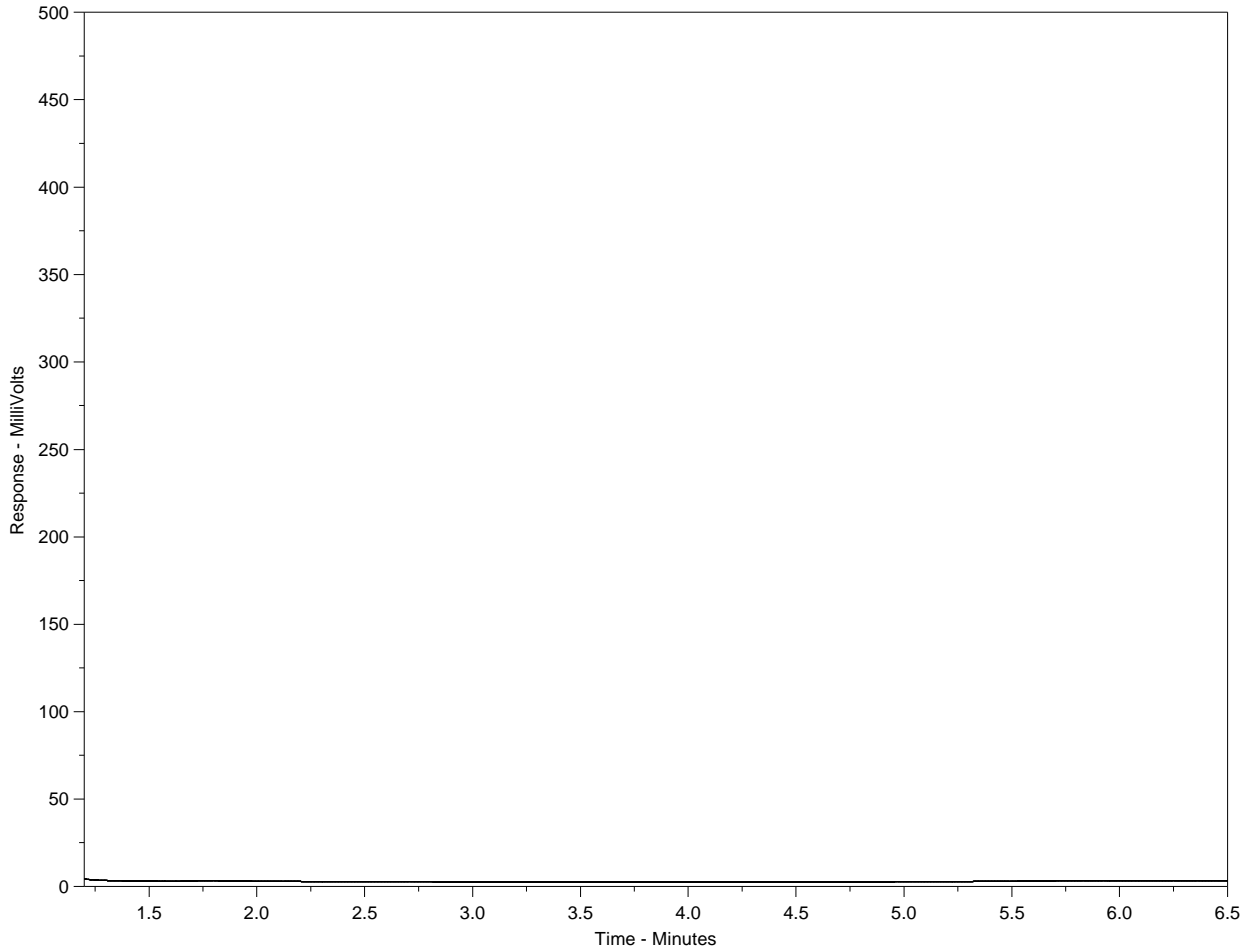
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1369030-5
Client ID: 16054130925060



← F2 →		← F3 →		← F4 →		← F4 →	
nC10	nC16	nC34	nC50				
174°C	287°C	481°C	575°C				
346°F	549°F	898°F	1067°F				
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →				
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

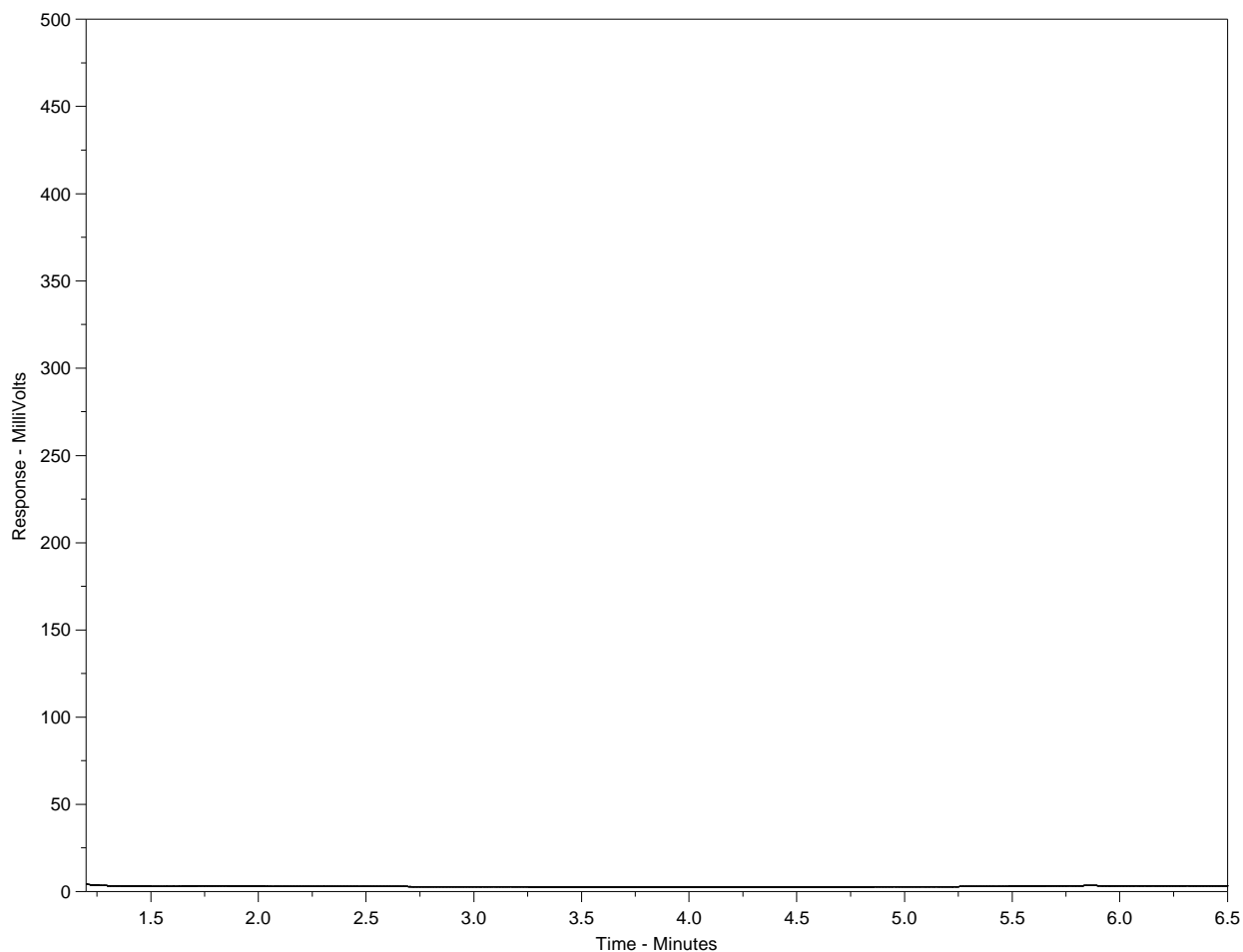
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1369030-6
Client ID: 16054130925061



F2		F3		F4		F4	
nC10	nC16			nC34	nC50		
174°C	287°C			481°C	575°C		
346°F	549°F			898°F	1067°F		
← Gasoline →				← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →							

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.



MATRIX SOLUTIONS INC.
ATTN: SUE RAYNARD
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Date Received: 26-SEP-13
Report Date: 17-DEC-13 13:49 (MT)
Version: FINAL REV. 3

Client Phone: 403-237-0606

Certificate of Analysis

Lab Work Order #: L1369030
Project P.O. #: NOT SUBMITTED
Job Reference: 16054-502 SAOS HOUSE CROSSING 7-36-77-13
W4M
C of C Numbers: M060608
Legal Site Desc: 7-36-77-13 W4M

Comments: ADDITIONAL 18-OCT-13 11:15
17-DEC-2013 LORs for Ag and Al have been fixed



Catherine Evaristo-Cordero
Senior Account Manager

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ADDRESS: 9936-67 Avenue, Edmonton, AB T6E 0P5 Canada | Phone: +1 780 413 5227 | Fax: +1 780 437 2311
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1369030-1 16054130925056									
Sampled By: J.FALLIS + G. KOSHIN on 25-SEP-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
Toluene	0.00076	-		0.00050	mg/L	-		30-SEP-13	R2702509
EthylBenzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
o-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
Styrene	<0.0010	-		0.0010	mg/L	-		30-SEP-13	R2702509
F1(C6-C10)	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702509
F1-BTEX	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702509
Xylenes	<0.00071	-		0.00071	mg/L	-		30-SEP-13	R2702509
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
Surr: 2-Bromobenzotrifluoride	105.9	-		N/A	%	-	30-SEP-13	30-SEP-13	R2705779
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.298	+/-0.036		0.0020	mg/L	0		03-OCT-13	R2708784
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0014	+/-0.0004		0.0010	mg/L	0		03-OCT-13	R2708784
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Arsenic (As)-Dissolved	0.00385	+/-0.00041		0.00040	mg/L	0		03-OCT-13	R2708784
Barium (Ba)-Dissolved	0.0836	+/-0.0073		0.00010	mg/L	0		03-OCT-13	R2708784
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		03-OCT-13	R2708784
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		03-OCT-13	R2708784
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Calcium (Ca)-Dissolved	55.0	+/-7.5		0.50	mg/L	0		03-OCT-13	R2708784
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Cobalt (Co)-Dissolved	0.00011	+/-0.00001		0.00010	mg/L	0		03-OCT-13	R2708784
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		03-OCT-13	R2708784
Iron (Fe)-Dissolved	0.080	+/-0.007		0.010	mg/L	0		03-OCT-13	R2708784
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Magnesium (Mg)-Dissolved	16.6	+/-1.3		0.10	mg/L	0		03-OCT-13	R2708784
Manganese (Mn)-Dissolved	0.0933	+/-0.0064		0.0020	mg/L	0		03-OCT-13	R2708784
Molybdenum (Mo)-Dissolved	0.00787	+/-0.00082		0.00010	mg/L	0		03-OCT-13	R2708784
Nickel (Ni)-Dissolved	0.00045	+/-0.00005		0.00010	mg/L	0		03-OCT-13	R2708784
Potassium (K)-Dissolved	5.39	+/-0.42		0.50	mg/L	0		03-OCT-13	R2708784
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Silicon (Si)-Dissolved	10.1	+/-0.86		0.050	mg/L	0		03-OCT-13	R2708784
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		03-OCT-13	R2708784
Sodium (Na)-Dissolved	90.4	+/-6.4		1.0	mg/L	0		03-OCT-13	R2708784
Strontium (Sr)-Dissolved	0.504	+/-0.038		0.00010	mg/L	0		03-OCT-13	R2708784
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		03-OCT-13	R2708784
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		03-OCT-13	R2708784
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		03-OCT-13	R2708784
Uranium (U)-Dissolved	0.00011	+/-0.00001		0.00010	mg/L	0		03-OCT-13	R2708784
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Zinc (Zn)-Dissolved	0.0817	+/-0.0095		0.0010	mg/L	0		03-OCT-13	R2708784
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		01-OCT-13	R2705538
Miscellaneous Parameters									
Ammonia, Total (as N)	1.70	-		0.050	mg/L	-		02-OCT-13	R2706589

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1369030-1 16054130925056									
Sampled By: J.FALLIS + G. KOSHIN on 25-SEP-13									
Matrix: WATER									
Dissolved Organic Carbon	8.4	+/-1.1		1.0	mg/L	0		06-OCT-13	R2709550
Naphthenic Acids	<1.0	-		1.0	mg/L	-	01-OCT-13	01-OCT-13	R2705822
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		03-OCT-13	R2707859
Total Kjeldahl Nitrogen	1.92	+/-0.39		0.20	mg/L	0	04-OCT-13	04-OCT-13	R2709131
Phosphorus (P)-Total	1.37	+/-0.11		0.020	mg/L	0	30-SEP-13	30-SEP-13	R2704752
Turbidity	41.3	+/-3.7		0.10	NTU	0		27-SEP-13	R2702491
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Anthracene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Fluoranthene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Fluorene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Naphthalene	0.000122	+/-0.000049		0.000050	mg/L	0	30-SEP-13	04-OCT-13	R2704447
Phenanthrene	<0.000050	-		0.000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Pyrene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(a)pyrene	<0.0000050	-		0.0000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Chrysene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Dibenzo(a,h)anthracene	<0.0000050	-		0.0000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Surr: Nitrobenzene d5	78.0	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Surr: 2-Fluorobiphenyl	83.5	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Surr: p-Terphenyl d14	97.1	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	2.61	+/-0.11		0.50	mg/L	0		27-SEP-13	R2702879
Ion Balance Calculation									
Ion Balance	93.6	-			%	-		04-OCT-13	
TDS (Calculated)	446	-			mg/L	-		04-OCT-13	
Hardness (as CaCO3)	206	-			mg/L	-		04-OCT-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		27-SEP-13	R2702879
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		02-OCT-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		27-SEP-13	R2702879
Sulfate by IC									
Sulfate (SO4)	32.7	+/-1.4		0.50	mg/L	0		27-SEP-13	R2702879
pH, Conductivity and Total Alkalinity									
pH	8.18	+/-0.04		0.10	pH	0		27-SEP-13	R2702318
Conductivity (EC)	759	+/-25		0.20	uS/cm	0		27-SEP-13	R2702318
Bicarbonate (HCO3)	495	-		5.0	mg/L	-		27-SEP-13	R2702318
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2702318
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2702318
Alkalinity, Total (as CaCO3)	406	+/-15		2.0	mg/L	0		27-SEP-13	R2702318

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1369030-2 16054130925057									
Sampled By: J.FALLIS + G. KOSHIN on 25-SEP-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
Toluene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
EthylBenzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
o-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
Styrene	<0.0010	-		0.0010	mg/L	-		30-SEP-13	R2702509
F1(C6-C10)	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702509
F1-BTEX	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702509
Xylenes	<0.00071	-		0.00071	mg/L	-		30-SEP-13	R2702509
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
Surr: 2-Bromobenzotrifluoride	100.8	-		N/A	%	-	30-SEP-13	30-SEP-13	R2705779
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.200	+/-0.024		0.0020	mg/L	0		03-OCT-13	R2708784
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0018	+/-0.0004		0.0010	mg/L	0		03-OCT-13	R2708784
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Arsenic (As)-Dissolved	0.00442	+/-0.00046		0.00040	mg/L	0		03-OCT-13	R2708784
Barium (Ba)-Dissolved	0.163	+/-0.014		0.00010	mg/L	0		03-OCT-13	R2708784
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		03-OCT-13	R2708784
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		03-OCT-13	R2708784
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Calcium (Ca)-Dissolved	62.9	+/-8.5		0.50	mg/L	0		03-OCT-13	R2708784
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Cobalt (Co)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Copper (Cu)-Dissolved	0.00073	+/-0.00007		0.00060	mg/L	0		03-OCT-13	R2708784
Iron (Fe)-Dissolved	5.53	+/-0.50		0.010	mg/L	0		03-OCT-13	R2708784
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Magnesium (Mg)-Dissolved	17.1	+/-1.3		0.10	mg/L	0		03-OCT-13	R2708784
Manganese (Mn)-Dissolved	0.261	+/-0.018		0.0020	mg/L	0		03-OCT-13	R2708784
Molybdenum (Mo)-Dissolved	0.00588	+/-0.00062		0.00010	mg/L	0		03-OCT-13	R2708784
Nickel (Ni)-Dissolved	0.00061	+/-0.00006		0.00010	mg/L	0		03-OCT-13	R2708784
Potassium (K)-Dissolved	3.90	+/-0.30		0.50	mg/L	0		03-OCT-13	R2708784
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Silicon (Si)-Dissolved	11.5	+/-0.98		0.050	mg/L	0		03-OCT-13	R2708784
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		03-OCT-13	R2708784
Sodium (Na)-Dissolved	40.8	+/-2.9		1.0	mg/L	0		03-OCT-13	R2708784
Strontium (Sr)-Dissolved	0.425	+/-0.032		0.00010	mg/L	0		03-OCT-13	R2708784
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		03-OCT-13	R2708784
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		03-OCT-13	R2708784
Tin (Sn)-Dissolved	0.00023	+/-0.00002		0.00020	mg/L	0		03-OCT-13	R2708784
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Zinc (Zn)-Dissolved	0.0107	+/-0.0013		0.0010	mg/L	0		03-OCT-13	R2708784
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		01-OCT-13	R2705538
Miscellaneous Parameters									
Ammonia, Total (as N)	1.23	-		0.050	mg/L	-		02-OCT-13	R2706589

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1369030-2 16054130925057									
Sampled By: J.FALLIS + G. KOSHIN on 25-SEP-13									
Matrix: WATER									
Dissolved Organic Carbon	6.4	+/-0.9		1.0	mg/L	0		06-OCT-13	R2709550
Naphthenic Acids	<1.0	-		1.0	mg/L	-	01-OCT-13	01-OCT-13	R2705822
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		03-OCT-13	R2707859
Total Kjeldahl Nitrogen	1.49	+/-0.30		0.20	mg/L	0	04-OCT-13	04-OCT-13	R2709131
Phosphorus (P)-Total	1.18	+/-0.094		0.020	mg/L	0	30-SEP-13	30-SEP-13	R2704752
Turbidity	63.5	+/-5.6		0.10	NTU	0		27-SEP-13	R2702491
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Anthracene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Fluoranthene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Fluorene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Naphthalene	0.000063	+/-0.000037		0.000050	mg/L	0	30-SEP-13	04-OCT-13	R2704447
Phenanthrene	<0.000050	-		0.000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Pyrene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(a)pyrene	<0.0000050	-		0.000005	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Chrysene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Dibenzo(a,h)anthracene	<0.0000050	-		0.000005	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Surr: Nitrobenzene d5	76.2	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Surr: 2-Fluorobiphenyl	81.3	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Surr: p-Terphenyl d14	93.0	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	9.17	+/-0.31		0.50	mg/L	0		27-SEP-13	R2702879
Ion Balance Calculation									
Ion Balance	94.8	-			%	-		04-OCT-13	
TDS (Calculated)	338	-			mg/L	-		04-OCT-13	
Hardness (as CaCO3)	227	-			mg/L	-		04-OCT-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		27-SEP-13	R2702879
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		02-OCT-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		27-SEP-13	R2702879
Sulfate by IC									
Sulfate (SO4)	17.3	+/-0.76		0.50	mg/L	0		27-SEP-13	R2702879
pH, Conductivity and Total Alkalinity									
pH	8.09	+/-0.04		0.10	pH	0		27-SEP-13	R2702318
Conductivity (EC)	600	+/-20		0.20	uS/cm	0		27-SEP-13	R2702318
Bicarbonate (HCO3)	381	-		5.0	mg/L	-		27-SEP-13	R2702318
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2702318
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2702318
Alkalinity, Total (as CaCO3)	312	+/-12		2.0	mg/L	0		27-SEP-13	R2702318

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1369030-3 16054130925058									
Sampled By: J.FALLIS + G. KOSHIN on 25-SEP-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
Toluene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
EthylBenzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
o-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
Styrene	<0.0010	-		0.0010	mg/L	-		30-SEP-13	R2702509
F1(C6-C10)	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702509
F1-BTEX	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702509
Xylenes	<0.00071	-		0.00071	mg/L	-		30-SEP-13	R2702509
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
Surr: 2-Bromobenzotrifluoride	99.7	-		N/A	%	-	30-SEP-13	30-SEP-13	R2705779
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.222	+/-0.027		0.0020	mg/L	0		03-OCT-13	R2708784
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0016	+/-0.0004		0.0010	mg/L	0		03-OCT-13	R2708784
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Arsenic (As)-Dissolved	0.0143	+/-0.0015		0.00040	mg/L	0		03-OCT-13	R2708784
Barium (Ba)-Dissolved	0.0834	+/-0.0072		0.00010	mg/L	0		03-OCT-13	R2708784
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		03-OCT-13	R2708784
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		03-OCT-13	R2708784
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Calcium (Ca)-Dissolved	61.2	+/-8.3		0.50	mg/L	0		03-OCT-13	R2708784
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Cobalt (Co)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Copper (Cu)-Dissolved	0.00066	+/-0.00006		0.00060	mg/L	0		03-OCT-13	R2708784
Iron (Fe)-Dissolved	3.67	+/-0.33		0.010	mg/L	0		03-OCT-13	R2708784
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Magnesium (Mg)-Dissolved	16.6	+/-1.3		0.10	mg/L	0		03-OCT-13	R2708784
Manganese (Mn)-Dissolved	0.525	+/-0.036		0.0020	mg/L	0		03-OCT-13	R2708784
Molybdenum (Mo)-Dissolved	0.0128	+/-0.0013		0.00010	mg/L	0		03-OCT-13	R2708784
Nickel (Ni)-Dissolved	0.00024	+/-0.00004		0.00010	mg/L	0		03-OCT-13	R2708784
Potassium (K)-Dissolved	4.04	+/-0.31		0.50	mg/L	0		03-OCT-13	R2708784
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Silicon (Si)-Dissolved	10.6	+/-0.90		0.050	mg/L	0		03-OCT-13	R2708784
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		03-OCT-13	R2708784
Sodium (Na)-Dissolved	33.4	+/-2.4		1.0	mg/L	0		03-OCT-13	R2708784
Strontium (Sr)-Dissolved	0.412	+/-0.031		0.00010	mg/L	0		03-OCT-13	R2708784
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		03-OCT-13	R2708784
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		03-OCT-13	R2708784
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		03-OCT-13	R2708784
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Zinc (Zn)-Dissolved	0.0247	+/-0.0029		0.0010	mg/L	0		03-OCT-13	R2708784
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		01-OCT-13	R2705538
Miscellaneous Parameters									
Ammonia, Total (as N)	1.08	-		0.050	mg/L	-		02-OCT-13	R2706589

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1369030-3 16054130925058									
Sampled By: J.FALLIS + G. KOSHIN on 25-SEP-13									
Matrix: WATER									
Dissolved Organic Carbon	6.0	+/-0.9		1.0	mg/L	0		06-OCT-13	R2709550
Naphthenic Acids	<1.0	-		1.0	mg/L	-	01-OCT-13	01-OCT-13	R2705822
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		03-OCT-13	R2707859
Total Kjeldahl Nitrogen	1.46	+/-0.30		0.20	mg/L	0	04-OCT-13	04-OCT-13	R2709131
Phosphorus (P)-Total	0.921	+/-0.075		0.020	mg/L	0	30-SEP-13	30-SEP-13	R2704752
Turbidity	41.0	+/-3.6		0.10	NTU	0		27-SEP-13	R2702491
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Anthracene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Fluoranthene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Fluorene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Naphthalene	<0.000050	-		0.000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Phenanthrene	<0.000050	-		0.000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Pyrene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(a)pyrene	<0.0000050	-		0.000005	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Chrysene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Dibenzo(a,h)anthracene	<0.0000050	-		0.000005	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Surr: Nitrobenzene d5	79.8	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Surr: 2-Fluorobiphenyl	85.3	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Surr: p-Terphenyl d14	88.5	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		27-SEP-13	R2702879
Ion Balance Calculation									
Ion Balance	92.9	-			%	-		04-OCT-13	
TDS (Calculated)	317	-			mg/L	-		04-OCT-13	
Hardness (as CaCO3)	221	-			mg/L	-		04-OCT-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		27-SEP-13	R2702879
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		02-OCT-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		27-SEP-13	R2702879
Sulfate by IC									
Sulfate (SO4)	15.6	+/-0.69		0.50	mg/L	0		27-SEP-13	R2702879
pH, Conductivity and Total Alkalinity									
pH	8.07	+/-0.04		0.10	pH	0		27-SEP-13	R2702318
Conductivity (EC)	563	+/-19		0.20	uS/cm	0		27-SEP-13	R2702318
Bicarbonate (HCO3)	378	-		5.0	mg/L	-		27-SEP-13	R2702318
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2702318
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2702318
Alkalinity, Total (as CaCO3)	310	+/-12		2.0	mg/L	0		27-SEP-13	R2702318

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1369030-4 16054130925059									
Sampled By: J.FALLIS + G. KOSHIN on 25-SEP-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
Toluene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
EthylBenzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
o-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
Styrene	<0.0010	-		0.0010	mg/L	-		30-SEP-13	R2702509
F1(C6-C10)	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702509
F1-BTEX	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702509
Xylenes	<0.00071	-		0.00071	mg/L	-		30-SEP-13	R2702509
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
Surr: 2-Bromobenzotrifluoride	102.8	-		N/A	%	-	30-SEP-13	30-SEP-13	R2705779
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.900	+/-0.11		0.0020	mg/L	0		03-OCT-13	R2708784
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0014	+/-0.0004		0.0010	mg/L	0		03-OCT-13	R2708784
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Arsenic (As)-Dissolved	0.0230	+/-0.0024		0.00040	mg/L	0		03-OCT-13	R2708784
Barium (Ba)-Dissolved	0.0739	+/-0.0064		0.00010	mg/L	0		03-OCT-13	R2708784
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		03-OCT-13	R2708784
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		03-OCT-13	R2708784
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Calcium (Ca)-Dissolved	50.5	+/-6.9		0.50	mg/L	0		03-OCT-13	R2708784
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Cobalt (Co)-Dissolved	0.00038	+/-0.00004		0.00010	mg/L	0		03-OCT-13	R2708784
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		03-OCT-13	R2708784
Iron (Fe)-Dissolved	2.48	+/-0.22		0.010	mg/L	0		03-OCT-13	R2708784
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Magnesium (Mg)-Dissolved	11.7	+/-0.91		0.10	mg/L	0		03-OCT-13	R2708784
Manganese (Mn)-Dissolved	0.323	+/-0.022		0.0020	mg/L	0		03-OCT-13	R2708784
Molybdenum (Mo)-Dissolved	0.0328	+/-0.0034		0.00010	mg/L	0		03-OCT-13	R2708784
Nickel (Ni)-Dissolved	0.00136	+/-0.00012		0.00010	mg/L	0		03-OCT-13	R2708784
Potassium (K)-Dissolved	4.89	+/-0.38		0.50	mg/L	0		03-OCT-13	R2708784
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Silicon (Si)-Dissolved	8.70	+/-0.74		0.050	mg/L	0		03-OCT-13	R2708784
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		03-OCT-13	R2708784
Sodium (Na)-Dissolved	183	+/-13		1.0	mg/L	0		03-OCT-13	R2708784
Strontium (Sr)-Dissolved	0.409	+/-0.030		0.00010	mg/L	0		03-OCT-13	R2708784
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		03-OCT-13	R2708784
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		03-OCT-13	R2708784
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		03-OCT-13	R2708784
Uranium (U)-Dissolved	0.00053	+/-0.00005		0.00010	mg/L	0		03-OCT-13	R2708784
Vanadium (V)-Dissolved	0.00012	+/-0.00001		0.00010	mg/L	0		03-OCT-13	R2708784
Zinc (Zn)-Dissolved	0.0042	+/-0.0006		0.0010	mg/L	0		03-OCT-13	R2708784
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		01-OCT-13	R2705538
Miscellaneous Parameters									
Ammonia, Total (as N)	1.27	-		0.050	mg/L	-		02-OCT-13	R2706589

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1369030-4 16054130925059									
Sampled By: J.FALLIS + G. KOSHIN on 25-SEP-13									
Matrix: WATER									
Dissolved Organic Carbon	9.6	+/-1.2		1.0	mg/L	0		06-OCT-13	R2709550
Naphthenic Acids	<1.0	-		1.0	mg/L	-	01-OCT-13	01-OCT-13	R2705822
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		03-OCT-13	R2707859
Total Kjeldahl Nitrogen	1.44	+/-0.30		0.20	mg/L	0	04-OCT-13	04-OCT-13	R2709131
Phosphorus (P)-Total	1.03	+/-0.083		0.020	mg/L	0	30-SEP-13	30-SEP-13	R2704752
Turbidity	31.8	+/-2.8		0.10	NTU	0		27-SEP-13	R2702491
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Anthracene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Fluoranthene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Fluorene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Naphthalene	<0.000050	-		0.000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Phenanthrene	<0.000050	-		0.000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Pyrene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(a)pyrene	<0.0000050	-		0.000005	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Chrysene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Dibenzo(a,h)anthracene	<0.0000050	-		0.000005	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Surr: Nitrobenzene d5	81.4	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Surr: 2-Fluorobiphenyl	86.2	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Surr: p-Terphenyl d14	98.7	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	49.7	+/-1.6		0.50	mg/L	0		27-SEP-13	R2702879
Ion Balance Calculation									
Ion Balance	98.3	-			%	-		04-OCT-13	
TDS (Calculated)	646	-			mg/L	-		04-OCT-13	
Hardness (as CaCO3)	174	-			mg/L	-		04-OCT-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		27-SEP-13	R2702879
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		02-OCT-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		27-SEP-13	R2702879
Sulfate by IC									
Sulfate (SO4)	86.1	+/-3.6		0.50	mg/L	0		27-SEP-13	R2702879
pH, Conductivity and Total Alkalinity									
pH	8.16	+/-0.04		0.10	pH	0		27-SEP-13	R2702318
Conductivity (EC)	1070	+/-36		0.20	uS/cm	0		27-SEP-13	R2702318
Bicarbonate (HCO3)	529	-		5.0	mg/L	-		27-SEP-13	R2702318
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2702318
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2702318
Alkalinity, Total (as CaCO3)	433	+/-16		2.0	mg/L	0		27-SEP-13	R2702318

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1369030-5 16054130925060									
Sampled By: J.FALLIS + G. KOSHIN on 25-SEP-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
Toluene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
EthylBenzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
o-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
Styrene	<0.0010	-		0.0010	mg/L	-		30-SEP-13	R2702509
F1(C6-C10)	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702509
F1-BTEX	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702509
Xylenes	<0.00071	-		0.00071	mg/L	-		30-SEP-13	R2702509
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
Surr: 2-Bromobenzotrifluoride	99.4	-		N/A	%	-	30-SEP-13	30-SEP-13	R2705779
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.0551	+/-0.0066		0.0020	mg/L	0		03-OCT-13	R2708784
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.0010	-		0.0010	mg/L	-		03-OCT-13	R2708784
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Arsenic (As)-Dissolved	0.0193	+/-0.0020		0.00040	mg/L	0		03-OCT-13	R2708784
Barium (Ba)-Dissolved	0.285	+/-0.025		0.00010	mg/L	0		03-OCT-13	R2708784
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		03-OCT-13	R2708784
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		03-OCT-13	R2708784
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Calcium (Ca)-Dissolved	97.5	+/-13		0.50	mg/L	0		03-OCT-13	R2708784
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Cobalt (Co)-Dissolved	0.00040	+/-0.00004		0.00010	mg/L	0		03-OCT-13	R2708784
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		03-OCT-13	R2708784
Iron (Fe)-Dissolved	13.0	+/-1.2		0.010	mg/L	0		03-OCT-13	R2708784
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Magnesium (Mg)-Dissolved	18.7	+/-1.5		0.10	mg/L	0		03-OCT-13	R2708784
Manganese (Mn)-Dissolved	1.30	+/-0.089		0.0020	mg/L	0		03-OCT-13	R2708784
Molybdenum (Mo)-Dissolved	0.00511	+/-0.00054		0.00010	mg/L	0		03-OCT-13	R2708784
Nickel (Ni)-Dissolved	0.00066	+/-0.00007		0.00010	mg/L	0		03-OCT-13	R2708784
Potassium (K)-Dissolved	2.15	+/-0.16		0.50	mg/L	0		03-OCT-13	R2708784
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Silicon (Si)-Dissolved	9.31	+/-0.79		0.050	mg/L	0		03-OCT-13	R2708784
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		03-OCT-13	R2708784
Sodium (Na)-Dissolved	3.7	+/-0.26		1.0	mg/L	0		03-OCT-13	R2708784
Strontium (Sr)-Dissolved	0.408	+/-0.030		0.00010	mg/L	0		03-OCT-13	R2708784
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		03-OCT-13	R2708784
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		03-OCT-13	R2708784
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		03-OCT-13	R2708784
Uranium (U)-Dissolved	0.00050	+/-0.00005		0.00010	mg/L	0		03-OCT-13	R2708784
Vanadium (V)-Dissolved	0.00014	+/-0.00001		0.00010	mg/L	0		03-OCT-13	R2708784
Zinc (Zn)-Dissolved	0.0058	+/-0.0007		0.0010	mg/L	0		03-OCT-13	R2708784
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		01-OCT-13	R2705538
Miscellaneous Parameters									
Ammonia, Total (as N)	0.255	-		0.050	mg/L	-		02-OCT-13	R2706589

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1369030-5 16054130925060									
Sampled By: J.FALLIS + G. KOSHIN on 25-SEP-13									
Matrix: WATER									
Dissolved Organic Carbon	10.1	+/-1.2		1.0	mg/L	0		06-OCT-13	R2709550
Naphthenic Acids	<1.0	-		1.0	mg/L	-	01-OCT-13	01-OCT-13	R2705822
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		03-OCT-13	R2707859
Total Kjeldahl Nitrogen	0.65	+/-0.15		0.20	mg/L	0	04-OCT-13	04-OCT-13	R2709131
Phosphorus (P)-Total	0.342	+/-0.033		0.020	mg/L	0	30-SEP-13	30-SEP-13	R2704752
Turbidity	226	+/-20		0.10	NTU	0		27-SEP-13	R2702491
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Anthracene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Fluoranthene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Fluorene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Naphthalene	<0.000050	-		0.000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Phenanthrene	<0.000050	-		0.000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Pyrene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(a)pyrene	<0.0000050	-		0.000005	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Chrysene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Dibenzo(a,h)anthracene	<0.0000050	-		0.000005	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Surr: Nitrobenzene d5	83.3	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Surr: 2-Fluorobiphenyl	88.9	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Surr: p-Terphenyl d14	96.3	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	26.0	+/-0.83		0.50	mg/L	0		27-SEP-13	R2702879
Ion Balance Calculation									
Ion Balance	93.3	-			%	-		04-OCT-13	
TDS (Calculated)	342	-			mg/L	-		04-OCT-13	
Hardness (as CaCO3)	320	-			mg/L	-		04-OCT-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		27-SEP-13	R2702879
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		02-OCT-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		27-SEP-13	R2702879
Sulfate by IC									
Sulfate (SO4)	5.15	+/-0.26		0.50	mg/L	0		27-SEP-13	R2702879
pH, Conductivity and Total Alkalinity									
pH	7.89	+/-0.04		0.10	pH	0		27-SEP-13	R2702318
Conductivity (EC)	637	+/-21		0.20	uS/cm	0		27-SEP-13	R2702318
Bicarbonate (HCO3)	383	-		5.0	mg/L	-		27-SEP-13	R2702318
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2702318
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2702318
Alkalinity, Total (as CaCO3)	314	+/-12		2.0	mg/L	0		27-SEP-13	R2702318

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1369030-6 16054130925061									
Sampled By: J.FALLIS + G. KOSHIN on 25-SEP-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
Toluene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
EthylBenzene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
o-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		30-SEP-13	R2702509
Styrene	<0.0010	-		0.0010	mg/L	-		30-SEP-13	R2702509
F1(C6-C10)	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702509
F1-BTEX	<0.10	-		0.10	mg/L	-		30-SEP-13	R2702509
Xylenes	<0.00071	-		0.00071	mg/L	-		30-SEP-13	R2702509
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	30-SEP-13	30-SEP-13	R2705779
Surr: 2-Bromobenzotrifluoride	98.6	-		N/A	%	-	30-SEP-13	30-SEP-13	R2705779
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.785	+/-0.095		0.0020	mg/L	0		03-OCT-13	R2708784
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0024	+/-0.0005		0.0010	mg/L	0		03-OCT-13	R2708784
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Arsenic (As)-Dissolved	0.0229	+/-0.0024		0.00040	mg/L	0		03-OCT-13	R2708784
Barium (Ba)-Dissolved	0.0746	+/-0.0065		0.00010	mg/L	0		03-OCT-13	R2708784
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		03-OCT-13	R2708784
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		03-OCT-13	R2708784
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Calcium (Ca)-Dissolved	44.2	+/-6.0		0.50	mg/L	0		03-OCT-13	R2708784
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Cobalt (Co)-Dissolved	0.00039	+/-0.00004		0.00010	mg/L	0		03-OCT-13	R2708784
Copper (Cu)-Dissolved	0.00060	+/-0.00006		0.00060	mg/L	0		03-OCT-13	R2708784
Iron (Fe)-Dissolved	2.54	+/-0.23		0.010	mg/L	0		03-OCT-13	R2708784
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		03-OCT-13	R2708784
Magnesium (Mg)-Dissolved	12.0	+/-0.93		0.10	mg/L	0		03-OCT-13	R2708784
Manganese (Mn)-Dissolved	0.335	+/-0.023		0.0020	mg/L	0		03-OCT-13	R2708784
Molybdenum (Mo)-Dissolved	0.0296	+/-0.0031		0.00010	mg/L	0		03-OCT-13	R2708784
Nickel (Ni)-Dissolved	0.00147	+/-0.00013		0.00010	mg/L	0		03-OCT-13	R2708784
Potassium (K)-Dissolved	4.93	+/-0.38		0.50	mg/L	0		03-OCT-13	R2708784
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		03-OCT-13	R2708784
Silicon (Si)-Dissolved	8.70	+/-0.74		0.050	mg/L	0		03-OCT-13	R2708784
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		03-OCT-13	R2708784
Sodium (Na)-Dissolved	182	+/-13		1.0	mg/L	0		03-OCT-13	R2708784
Strontium (Sr)-Dissolved	0.361	+/-0.027		0.00010	mg/L	0		03-OCT-13	R2708784
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		03-OCT-13	R2708784
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		03-OCT-13	R2708784
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		03-OCT-13	R2708784
Uranium (U)-Dissolved	0.00047	+/-0.00005		0.00010	mg/L	0		03-OCT-13	R2708784
Vanadium (V)-Dissolved	0.00012	+/-0.00001		0.00010	mg/L	0		03-OCT-13	R2708784
Zinc (Zn)-Dissolved	0.0138	+/-0.0016		0.0010	mg/L	0		03-OCT-13	R2708784
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.00010	-		0.00010	mg/L	-		01-OCT-13	R2705538
Miscellaneous Parameters									
Ammonia, Total (as N)	1.20	-		0.050	mg/L	-		02-OCT-13	R2706589

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1369030-6 16054130925061									
Sampled By: J.FALLIS + G. KOSHIN on 25-SEP-13									
Matrix: WATER									
Dissolved Organic Carbon	9.9	+/-1.2		1.0	mg/L	0		06-OCT-13	R2709550
Naphthenic Acids	<1.0	-		1.0	mg/L	-	01-OCT-13	01-OCT-13	R2705822
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		03-OCT-13	R2707859
Total Kjeldahl Nitrogen	1.74	+/-0.35		0.20	mg/L	0	04-OCT-13	04-OCT-13	R2709131
Phosphorus (P)-Total	1.07	+/-0.086		0.020	mg/L	0	30-SEP-13	30-SEP-13	R2704752
Turbidity	31.6	+/-2.8		0.10	NTU	0		27-SEP-13	R2702491
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Anthracene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Fluoranthene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Fluorene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Naphthalene	<0.000050	-		0.000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Phenanthrene	<0.000050	-		0.000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Pyrene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Benzo(a)pyrene	<0.0000050	-		0.0000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Chrysene	<0.000020	-		0.000020	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Dibenzo(a,h)anthracene	<0.0000050	-		0.0000050	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	30-SEP-13	04-OCT-13	R2704447
Surr: Nitrobenzene d5	81.7	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Surr: 2-Fluorobiphenyl	88.3	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Surr: p-Terphenyl d14	100.5	-		N/A	%	-	30-SEP-13	04-OCT-13	R2704447
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	49.2	+/-1.6		0.50	mg/L	0		27-SEP-13	R2702879
Ion Balance Calculation									
Ion Balance	89.5	-	BL:INT		%	-		04-OCT-13	
TDS (Calculated)	663	-			mg/L	-		04-OCT-13	
Hardness (as CaCO3)	160	-			mg/L	-		04-OCT-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		27-SEP-13	R2702879
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		02-OCT-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		27-SEP-13	R2702879
Sulfate by IC									
Sulfate (SO4)	85.5	+/-3.6		0.50	mg/L	0		27-SEP-13	R2702879
pH, Conductivity and Total Alkalinity									
pH	8.19	+/-0.04		0.10	pH	0		27-SEP-13	R2702318
Conductivity (EC)	1080	+/-36		0.20	uS/cm	0		27-SEP-13	R2702318
Bicarbonate (HCO3)	579	-		5.0	mg/L	-		27-SEP-13	R2702318
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2702318
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		27-SEP-13	R2702318
Alkalinity, Total (as CaCO3)	475	+/-17		2.0	mg/L	0		27-SEP-13	R2702318
* Refer to Referenced Information for Qualifiers (if any) and Methodology.									

Reference Information

Report Comments: ADDITIONAL 18-OCT-13 11:15
17-DEC-2013 LORs for Ag and Al have been fixed

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Phosphorus (P)-Total	MS-B	
Matrix Spike	Dissolved Organic Carbon	MS-B	

Qualifiers for Individual Samples Listed:

Sample Number	Client ID	Qualifier	Description
L1369030-4	16054130925059	SP	NH3, P-T, Phenols, TKN - Sample was Preserved at the laboratory

Sample Parameter Qualifier Key:

Qualifier	Description
BL:INT	Balance Reviewed: Interference Or Non-Measured Component
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
B-D-L-CCMS-ED	Water	Dissolved Boron in Water by CRC ICPMS		APHA 3030 B / EPA SW-846 6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).				
BTXS,F1-ED	Water	BTEX, Styrene and F1 (C6-C10)		EPA 5021/8015&8260 GC-MS & FID
C-DIS-ORG-ED	Water	Dissolved Organic Carbon		APHA 5310 B-Instrumental
CL-IC-ED	Water	Chloride by IC		APHA 4110 B-ION CHROMATOGRAPHY
F2,F3,F4-ED	Water	F2, F3, F4		EPA 3510/CCME PHC CWS-GC-FID
HG-D-CVAA-ED	Water	Mercury (Hg) - Dissolved		EPA 245.7 / EPA 245.1
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET-D-CCMS-ED	Water	Dissolved Metals in Water by CRC ICPMS		APHA 3030 B&E / EPA SW-846 6020A
NAPHTHENIC-ACID-FM	Water	Naphthenic Acids by FTIR		Naphthenic Acids by FTIR,Syn crude,1994
Dissolved naphthenic acids are solvent extracted from acidified aqueous samples using Dichloromethane prior to quantitation by Fourier Transform Infra-Red spectroscopy. Note that FTIR is not uniquely selective to naphthenic acids. If present, other carboxylic acids (e.g. humic acids, fulvic acids) may also be detected by this method.				
NH3-CFA-ED	Water	Ammonia in Water by Colour		APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.				
NO2+NO3-CALC-ED	Water	Nitrate+Nitrite		CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
P-T-COL-ED	Water	Total P in Water by Colour		APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.				
PAH-ABT1-ED	Water	PAH & Carcinogenic PAH List		EPA 3510/8270-GC/MS
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)				
PHENOLS-4AAP-ED	Water	Phenols (4AAP)		AB ENV.06537-COLORIMETRIC

This analysis is carried out using procedures adapted from ENVIRODAT VMV 06537 689, Method Code 154, in "Methods Manual for Chemical Analysis of Water and Wastes" published by the Alberta Environmental Centre. This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide and 4-aminoantipyrine to form a red complex which is measured at 505 nm.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
SO4-IC-ED	Water	Sulfate by IC		APHA 4110 B-ION CHROMATOGRAPHY
TKN-CFA-ED	Water	TKN in Water by Colour		APHA 4500-NORG (TKN)
TURBIDITY-ED	Water	Turbidity		APHA 2130 B-Nephelometer

This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 celcius with analysis using an automated colourimetric finish.

** The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS methods may incorporate modifications from the specified reference to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
FM	ALS ENVIRONMENTAL - FORT MCMURRAY, ALBERTA, CANADA

Chain of Custody Numbers:

M060608

GLOSSARY OF REPORT TERMS

Surr - Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

MU: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.

Bias: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent.

Zero values indicate no detectable method bias.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Environmental

Quality Control Report

Workorder: L1369030

Report Date: 17-DEC-13

Page 1 of 15

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-D-L-CCMS-ED		Water						
Batch	R2708784							
WG1760732-2	CRM	ED-HIGH-WATRM						
Boron (B)-Dissolved			95.7		%		80-120	03-OCT-13
WG1760732-3	DUP	L1369029-2						
Boron (B)-Dissolved		0.375	0.399		mg/L	6.2	20	03-OCT-13
WG1760732-1	MB							
Boron (B)-Dissolved			<0.0020		mg/L		0.002	03-OCT-13
BTXS,F1-ED		Water						
Batch	R2702509							
WG1757393-4	DUP	L1369029-1						
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	30-SEP-13
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	30-SEP-13
EthylBenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	30-SEP-13
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	30-SEP-13
m+p-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	30-SEP-13
Styrene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	50	30-SEP-13
F1(C6-C10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	30-SEP-13
WG1757393-5	DUP	L1369092-2						
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	30-SEP-13
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	30-SEP-13
EthylBenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	30-SEP-13
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	30-SEP-13
m+p-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	30-SEP-13
Styrene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	50	30-SEP-13
F1(C6-C10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	30-SEP-13
WG1757393-2	LCS							
Benzene			91.2		%		70-130	30-SEP-13
Toluene			91.0		%		70-130	30-SEP-13
EthylBenzene			90.6		%		70-130	30-SEP-13
o-Xylene			89.9		%		70-130	30-SEP-13
m+p-Xylene			87.6		%		70-130	30-SEP-13
Styrene			89.2		%		70-130	30-SEP-13
WG1757393-3	LCS							
F1(C6-C10)			120.4		%		70-130	30-SEP-13
WG1757393-1	MB							
Benzene			<0.00050		mg/L		0.0005	30-SEP-13
							0.0005	



Quality Control Report

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTXS,F1-ED								
	Water							
Batch	R2702509							
WG1757393-1	MB							
Toluene			<0.00050		mg/L		0.0005	30-SEP-13
EthylBenzene			<0.00050		mg/L		0.0005	30-SEP-13
o-Xylene			<0.00050		mg/L		0.0005	30-SEP-13
m+p-Xylene			<0.00050		mg/L		0.0005	30-SEP-13
Styrene			<0.0010		mg/L		0.001	30-SEP-13
F1(C6-C10)			<0.10		mg/L		0.1	30-SEP-13
WG1757393-6	MS	L1369092-2						
Benzene			79.3		%		50-150	30-SEP-13
Toluene			78.2		%		50-150	30-SEP-13
EthylBenzene			82.2		%		50-150	30-SEP-13
o-Xylene			85.8		%		50-150	30-SEP-13
m+p-Xylene			80.0		%		50-150	30-SEP-13
Styrene			85.1		%		50-150	30-SEP-13
WG1757393-7	MS	L1369092-2						
F1(C6-C10)			77.9		%		50-150	30-SEP-13
C-DIS-ORG-ED								
	Water							
Batch	R2709550							
WG1761992-3	CVS							
Dissolved Organic Carbon			138.8		%		80-160	05-OCT-13
WG1761992-4	DUP	L1365837-5						
Dissolved Organic Carbon		25.4	24.6		mg/L	3.3	20	05-OCT-13
WG1761992-8	DUP	L1369101-25						
Dissolved Organic Carbon		7.2	7.1		mg/L	0.7	20	06-OCT-13
WG1761992-2	LCS							
Dissolved Organic Carbon			113.8		%		80-120	05-OCT-13
WG1761992-1	MB							
Dissolved Organic Carbon			<1.0		mg/L		1	05-OCT-13
WG1761992-5	MS	L1365837-5						
Dissolved Organic Carbon			N/A	MS-B	%		-	05-OCT-13
WG1761992-9	MS	L1369101-25						
Dissolved Organic Carbon			110.3		%		70-130	06-OCT-13
CL-IC-ED								
	Water							
Batch	R2702879							
WG1756678-3	DUP	L1368562-2						
Chloride (Cl)		4.70	4.73		mg/L	0.5	20	27-SEP-13
WG1756678-5	DUP	L1369104-1						



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-IC-ED		Water						
Batch	R2702879							
WG1756678-5	DUP	L1369104-1						
Chloride (Cl)		3.38	3.39		mg/L	0.4	20	27-SEP-13
WG1756678-7	DUP	L1369030-3						
Chloride (Cl)		<0.50	<0.50	RPD-NA	mg/L	N/A	20	27-SEP-13
WG1756678-2	LCS		99.4		%		90-110	27-SEP-13
Chloride (Cl)								
WG1756678-1	MB		<0.50		mg/L		0.5	27-SEP-13
Chloride (Cl)								
WG1756678-4	MS	L1368562-2	102.3		%		75-125	27-SEP-13
Chloride (Cl)								
WG1756678-6	MS	L1369104-1	102.1		%		75-125	27-SEP-13
Chloride (Cl)								
WG1756678-8	MS	L1369030-3	106.8		%		75-125	27-SEP-13
Chloride (Cl)								
F2,F3,F4-ED		Water						
Batch	R2705779							
WG1757665-2	LCS		99.2		%		65-135	30-SEP-13
F2 (>C10-C16)								
F3 (C16-C34)			101.1		%		65-135	30-SEP-13
F4 (C34-C50)			99.9		%		65-135	30-SEP-13
WG1757665-5	LCS		97.9		%		65-135	30-SEP-13
F2 (>C10-C16)								
F3 (C16-C34)			101.0		%		65-135	30-SEP-13
F4 (C34-C50)			99.5		%		65-135	30-SEP-13
WG1757665-8	LCS		100.3		%		65-135	30-SEP-13
F2 (>C10-C16)								
F3 (C16-C34)			100.9		%		65-135	30-SEP-13
F4 (C34-C50)			91.5		%		65-135	30-SEP-13
WG1757665-1	MB		<0.25		mg/L		0.25	30-SEP-13
F2 (>C10-C16)								
F3 (C16-C34)			<0.25		mg/L		0.25	30-SEP-13
F4 (C34-C50)			<0.25		mg/L		0.25	30-SEP-13
Surrogate: 2-Bromobenzotrifluoride			101.1		%		50-150	30-SEP-13
WG1757665-4	MB		<0.25		mg/L		0.25	30-SEP-13
F2 (>C10-C16)								
F3 (C16-C34)			<0.25		mg/L		0.25	30-SEP-13
F4 (C34-C50)			<0.25		mg/L		0.25	30-SEP-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2,F3,F4-ED		Water						
Batch	R2705779							
WG1757665-4 MB								
Surrogate: 2-Bromobenzotrifluoride			100.2		%		50-150	30-SEP-13
WG1757665-7 MB								
F2 (>C10-C16)			<0.25		mg/L		0.25	30-SEP-13
F3 (C16-C34)			<0.25		mg/L		0.25	30-SEP-13
F4 (C34-C50)			<0.25		mg/L		0.25	30-SEP-13
Surrogate: 2-Bromobenzotrifluoride			97.8		%		50-150	30-SEP-13
WG1757665-9 MS		L1369104-9						
F2 (>C10-C16)			104.0		%		50-150	30-SEP-13
F3 (C16-C34)			102.6		%		50-150	30-SEP-13
F4 (C34-C50)			91.4		%		50-150	30-SEP-13
HG-D-CVAA-ED		Water						
Batch	R2705538							
WG1758529-13 DUP		L1368865-1						
Mercury (Hg)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	01-OCT-13
WG1758529-15 DUP		L1368882-1						
Mercury (Hg)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	01-OCT-13
WG1758529-16 DUP		L1368882-4						
Mercury (Hg)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	01-OCT-13
WG1758529-4 DUP		L1364770-1						
Mercury (Hg)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	01-OCT-13
WG1758529-2 LCS								
Mercury (Hg)-Dissolved			93.6		%		80-120	01-OCT-13
WG1758529-3 LCSD		WG1758529-2						
Mercury (Hg)-Dissolved		93.6	97.8		%	4.4	20	01-OCT-13
WG1758529-1 MB								
Mercury (Hg)-Dissolved			<0.00010		mg/L		0.0001	01-OCT-13
WG1758529-12 MS		L1368865-1						
Mercury (Hg)-Dissolved			90.5		%		70-130	01-OCT-13
WG1758529-14 MS		L1368882-1						
Mercury (Hg)-Dissolved			103.3		%		70-130	01-OCT-13
WG1758529-17 MS		L1368882-4						
Mercury (Hg)-Dissolved			83.6		%		70-130	01-OCT-13
WG1758529-5 MS		L1364770-1						
Mercury (Hg)-Dissolved			75.2		%		70-130	01-OCT-13
MET-D-CCMS-ED		Water						



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED		Water						
Batch	R2708784							
WG1760732-2 CRM	ED-HIGH-WATRM							
Aluminum (Al)-Dissolved			105.1		%		80-120	03-OCT-13
Antimony (Sb)-Dissolved			106.2		%		80-120	03-OCT-13
Arsenic (As)-Dissolved			103.4		%		80-120	03-OCT-13
Barium (Ba)-Dissolved			108.3		%		80-120	03-OCT-13
Beryllium (Be)-Dissolved			99.1		%		80-120	03-OCT-13
Bismuth (Bi)-Dissolved			100.4		%		80-120	03-OCT-13
Cadmium (Cd)-Dissolved			101.9		%		80-120	03-OCT-13
Calcium (Ca)-Dissolved			102.3		%		80-120	03-OCT-13
Chromium (Cr)-Dissolved			104.0		%		80-120	03-OCT-13
Cobalt (Co)-Dissolved			99.5		%		80-120	03-OCT-13
Copper (Cu)-Dissolved			97.6		%		80-120	03-OCT-13
Lead (Pb)-Dissolved			102.0		%		80-120	03-OCT-13
Magnesium (Mg)-Dissolved			100.8		%		80-120	03-OCT-13
Manganese (Mn)-Dissolved			102.7		%		80-120	03-OCT-13
Molybdenum (Mo)-Dissolved			99.7		%		80-120	03-OCT-13
Nickel (Ni)-Dissolved			101.6		%		80-120	03-OCT-13
Potassium (K)-Dissolved			97.0		%		80-120	03-OCT-13
Selenium (Se)-Dissolved			103.3		%		80-120	03-OCT-13
Silver (Ag)-Dissolved			102.2		%		80-120	03-OCT-13
Sodium (Na)-Dissolved			111.2		%		80-120	03-OCT-13
Strontium (Sr)-Dissolved			109.5		%		80-120	03-OCT-13
Thallium (Tl)-Dissolved			104.7		%		80-120	03-OCT-13
Titanium (Ti)-Dissolved			112.1		%		80-120	03-OCT-13
Tin (Sn)-Dissolved			96.8		%		80-120	03-OCT-13
Uranium (U)-Dissolved			102.5		%		80-120	03-OCT-13
Vanadium (V)-Dissolved			100.9		%		80-120	03-OCT-13
Zinc (Zn)-Dissolved			100.2		%		80-120	03-OCT-13
WG1760732-3 DUP		L1369029-2						
Aluminum (Al)-Dissolved		0.0078	<0.010	RPD-NA	mg/L	N/A	20	03-OCT-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	03-OCT-13
Arsenic (As)-Dissolved		0.0682	0.0683		mg/L	0.2	20	03-OCT-13
Barium (Ba)-Dissolved		0.201	0.199		mg/L	0.8	20	03-OCT-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	03-OCT-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2708784							
WG1760732-3	DUP	L1369029-2						
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	03-OCT-13
Cadmium (Cd)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	03-OCT-13
Calcium (Ca)-Dissolved		26.7	26.6		mg/L	0.1	20	03-OCT-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	03-OCT-13
Cobalt (Co)-Dissolved		0.00078	0.00078		mg/L	0.4	20	03-OCT-13
Copper (Cu)-Dissolved		<0.00060	<0.00060	RPD-NA	mg/L	N/A	20	03-OCT-13
Iron (Fe)-Dissolved		0.616	0.618		mg/L	0.3	20	03-OCT-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	03-OCT-13
Magnesium (Mg)-Dissolved		9.90	9.98		mg/L	0.9	20	03-OCT-13
Manganese (Mn)-Dissolved		0.110	0.111		mg/L	0.7	20	03-OCT-13
Molybdenum (Mo)-Dissolved		0.00278	0.00277		mg/L	0.4	20	03-OCT-13
Nickel (Ni)-Dissolved		0.00201	0.00199		mg/L	0.8	20	03-OCT-13
Potassium (K)-Dissolved		2.38	2.42		mg/L	1.7	20	03-OCT-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	03-OCT-13
Silicon (Si)-Dissolved		6.34	6.61		mg/L	4.1	20	03-OCT-13
Silver (Ag)-Dissolved		<0.000010	<0.000020	RPD-NA	mg/L	N/A	20	03-OCT-13
Sodium (Na)-Dissolved		268	270		mg/L	1.1	20	03-OCT-13
Strontium (Sr)-Dissolved		0.285	0.280		mg/L	1.6	20	03-OCT-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	03-OCT-13
Titanium (Ti)-Dissolved		0.00056	0.00041	J	mg/L	0.00015	0.0006	03-OCT-13
Tin (Sn)-Dissolved		0.00034	0.00035		mg/L	3.1	20	03-OCT-13
Uranium (U)-Dissolved		0.00038	0.00038		mg/L	0.1	20	03-OCT-13
Vanadium (V)-Dissolved		0.00072	0.00073		mg/L	1.6	20	03-OCT-13
Zinc (Zn)-Dissolved		0.0115	0.0108		mg/L	5.5	20	03-OCT-13
WG1760732-4	DUP	L1369657-7						
Aluminum (Al)-Dissolved		0.0016	0.0013		mg/L	18	20	03-OCT-13
Antimony (Sb)-Dissolved		0.00030	0.00028		mg/L	4.9	20	03-OCT-13
Arsenic (As)-Dissolved		0.00031	0.00030		mg/L	6.0	20	03-OCT-13
Barium (Ba)-Dissolved		0.740	0.768		mg/L	3.7	20	03-OCT-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	03-OCT-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	03-OCT-13
Cadmium (Cd)-Dissolved		0.000042	0.000039		mg/L	5.9	20	03-OCT-13
Calcium (Ca)-Dissolved		178	175		mg/L	1.8	20	03-OCT-13



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2708784							
WG1760732-4	DUP	L1369657-7						
Chromium (Cr)-Dissolved		0.00044	0.00044		mg/L	0.2	20	03-OCT-13
Cobalt (Co)-Dissolved		0.00021	0.00020		mg/L	2.2	20	03-OCT-13
Copper (Cu)-Dissolved		0.00138	0.00138		mg/L	0.1	20	03-OCT-13
Iron (Fe)-Dissolved		<0.010	<0.010	RPD-NA	mg/L	N/A	20	03-OCT-13
Lead (Pb)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	03-OCT-13
Magnesium (Mg)-Dissolved		51.2	50.4		mg/L	1.5	20	03-OCT-13
Manganese (Mn)-Dissolved		0.00264	0.00256		mg/L	3.3	20	03-OCT-13
Molybdenum (Mo)-Dissolved		0.000612	0.000587		mg/L	4.2	20	03-OCT-13
Nickel (Ni)-Dissolved		0.00283	0.00287		mg/L	1.6	20	03-OCT-13
Potassium (K)-Dissolved		1.81	1.80		mg/L	0.6	20	03-OCT-13
Selenium (Se)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	03-OCT-13
Silicon (Si)-Dissolved		6.45	6.40		mg/L	0.8	20	03-OCT-13
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	03-OCT-13
Sodium (Na)-Dissolved		11.3	11.1		mg/L	2.0	20	03-OCT-13
Strontium (Sr)-Dissolved		0.332	0.332		mg/L	0.2	20	03-OCT-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	03-OCT-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	03-OCT-13
Tin (Sn)-Dissolved		0.00210	0.00209		mg/L	0.2	20	03-OCT-13
Uranium (U)-Dissolved		0.00399	0.00400		mg/L	0.4	20	03-OCT-13
Vanadium (V)-Dissolved		0.00041	0.00041		mg/L	2.2	20	03-OCT-13
WG1760732-1	MB							
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	03-OCT-13
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	03-OCT-13
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	03-OCT-13
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	03-OCT-13
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	03-OCT-13
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	03-OCT-13
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	03-OCT-13
Calcium (Ca)-Dissolved			<0.020		mg/L		0.02	03-OCT-13
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	03-OCT-13
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	03-OCT-13
Copper (Cu)-Dissolved			<0.00010		mg/L		0.0001	03-OCT-13
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	03-OCT-13



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2708784							
WG1760732-1	MB							
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	03-OCT-13
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	03-OCT-13
Manganese (Mn)-Dissolved			<0.000050		mg/L		0.00005	03-OCT-13
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	03-OCT-13
Nickel (Ni)-Dissolved			<0.00010		mg/L		0.0001	03-OCT-13
Potassium (K)-Dissolved			<0.050		mg/L		0.05	03-OCT-13
Selenium (Se)-Dissolved			<0.00010		mg/L		0.0001	03-OCT-13
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	03-OCT-13
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	03-OCT-13
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	03-OCT-13
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	03-OCT-13
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	03-OCT-13
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	03-OCT-13
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	03-OCT-13
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	03-OCT-13
Vanadium (V)-Dissolved			<0.00010		mg/L		0.0001	03-OCT-13
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	03-OCT-13
NAPHTHENIC-ACID-FM								
	Water							
Batch	R2705822							
WG1758369-3	DUP	L1369029-2						
Naphthenic Acids		<1.0	<1.0	RPD-NA	mg/L	N/A	30	01-OCT-13
WG1758369-4	LCS							
Naphthenic Acids			107.9		%		70-130	01-OCT-13
WG1758369-1	MB							
Naphthenic Acids			<1.0		mg/L		1	01-OCT-13
WG1758369-2	MS	L1369029-1						
Naphthenic Acids			117.2		%		50-150	01-OCT-13
NH3-CFA-ED								
	Water							
Batch	R2706589							
WG1759121-11	DUP	L1369030-6						
Ammonia, Total (as N)		1.20	1.21		mg/L	0.4	20	02-OCT-13
WG1759121-12	DUP	L1369105-1						
Ammonia, Total (as N)		12.4	12.5		mg/L	0.9	20	02-OCT-13
WG1759121-6	DUP	L1371511-1						
Ammonia, Total (as N)		0.749	0.714		mg/L	4.8	20	02-OCT-13



Quality Control Report

Workorder: L1369030

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-CFA-ED		Water						
Batch	R2706589							
WG1759121-9	DUP	L1369101-25						
Ammonia, Total (as N)		1.53	1.49		mg/L	2.7	20	02-OCT-13
WG1759121-2	LCS							
Ammonia, Total (as N)			98.5		%		85-115	02-OCT-13
WG1759121-1	MB							
Ammonia, Total (as N)			<0.050		mg/L		0.05	02-OCT-13
WG1759121-10	MS	L1368925-2						
Ammonia, Total (as N)			102.0		%		75-125	02-OCT-13
WG1759121-5	MS	L1367764-4						
Ammonia, Total (as N)			91.6		%		75-125	02-OCT-13
WG1759121-8	MS	L1369101-1						
Ammonia, Total (as N)			97.2		%		75-125	02-OCT-13
NO2-IC-ED		Water						
Batch	R2702879							
WG1756678-3	DUP	L1368562-2						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	27-SEP-13
WG1756678-5	DUP	L1369104-1						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	27-SEP-13
WG1756678-7	DUP	L1369030-3						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	27-SEP-13
WG1756678-2	LCS							
Nitrite (as N)			95.0		%		90-110	27-SEP-13
WG1756678-1	MB							
Nitrite (as N)			<0.050		mg/L		0.05	27-SEP-13
WG1756678-4	MS	L1368562-2						
Nitrite (as N)			96.3		%		75-125	27-SEP-13
WG1756678-6	MS	L1369104-1						
Nitrite (as N)			95.1		%		75-125	27-SEP-13
WG1756678-8	MS	L1369030-3						
Nitrite (as N)			98.9		%		75-125	27-SEP-13
NO3-IC-ED		Water						
Batch	R2702879							
WG1756678-3	DUP	L1368562-2						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	27-SEP-13
WG1756678-5	DUP	L1369104-1						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	27-SEP-13
WG1756678-7	DUP	L1369030-3						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	27-SEP-13



Quality Control Report

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-IC-ED		Water						
Batch	R2702879							
WG1756678-2	LCS							
Nitrate (as N)			99.7		%		90-110	27-SEP-13
WG1756678-1	MB							
Nitrate (as N)			<0.050		mg/L		0.05	27-SEP-13
WG1756678-4	MS	L1368562-2						
Nitrate (as N)			83.4		%		75-125	27-SEP-13
WG1756678-6	MS	L1369104-1						
Nitrate (as N)			92.1		%		75-125	27-SEP-13
WG1756678-8	MS	L1369030-3						
Nitrate (as N)			93.5		%		75-125	27-SEP-13
P-T-COL-ED		Water						
Batch	R2704752							
WG1757656-3	DUP	L1369030-6						
Phosphorus (P)-Total		1.07	1.12		mg/L	4.4	20	30-SEP-13
WG1757656-5	DUP	L1369337-3						
Phosphorus (P)-Total		0.132	0.138		mg/L	17	20	30-SEP-13
WG1757656-2	LCS							
Phosphorus (P)-Total			104.3		%		80-120	30-SEP-13
WG1757656-1	MB							
Phosphorus (P)-Total			<0.020		mg/L		0.02	30-SEP-13
WG1757656-4	MS	L1369030-6						
Phosphorus (P)-Total			N/A	MS-B	%		-	30-SEP-13
PAH-ABT1-ED		Water						
Batch	R2704447							
WG1757541-3	LCS							
Acenaphthene			88.7		%		60-130	02-OCT-13
Acenaphthylene			89.2		%		-	02-OCT-13
Anthracene			84.0		%		60-130	02-OCT-13
Fluoranthene			88.4		%		60-130	02-OCT-13
Fluorene			85.4		%		60-130	02-OCT-13
Naphthalene			86.5		%		50-130	02-OCT-13
Phenanthrene			89.3		%		60-130	02-OCT-13
Pyrene			87.9		%		60-130	02-OCT-13
Benzo(a)anthracene			92.3		%		60-130	02-OCT-13
Benzo(k)fluoranthene			91.7		%		60-130	02-OCT-13
Benzo(b&j)fluoranthene			99.2		%		60-130	02-OCT-13



Quality Control Report

Workorder: L1369030

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ABT1-ED								
	Water							
Batch	R2704447							
WG1757541-3	LCS							
Benzo(g,h,i)perylene			92.8		%		60-130	02-OCT-13
Benzo(a)pyrene			84.6		%		60-130	02-OCT-13
Chrysene			90.6		%		60-130	02-OCT-13
Dibenzo(a,h)anthracene			91.3		%		60-130	02-OCT-13
Indeno(1,2,3-cd)pyrene			94.6		%		60-130	02-OCT-13
WG1757541-2	MB							
Acenaphthene			<0.000020		mg/L		0.00002	01-OCT-13
Acenaphthylene			<0.000020		mg/L		0.00002	01-OCT-13
Anthracene			<0.000010		mg/L		0.00001	01-OCT-13
Fluoranthene			<0.000020		mg/L		0.00002	01-OCT-13
Fluorene			<0.000020		mg/L		0.00002	01-OCT-13
Naphthalene			<0.000050		mg/L		0.00005	01-OCT-13
Phenanthrene			<0.000050		mg/L		0.00005	01-OCT-13
Pyrene			<0.000020		mg/L		0.00002	01-OCT-13
Benzo(a)anthracene			<0.000010		mg/L		0.00001	01-OCT-13
Benzo(k)fluoranthene			<0.000010		mg/L		0.00001	01-OCT-13
Benzo(b&j)fluoranthene			<0.000010		mg/L		0.00001	01-OCT-13
Benzo(g,h,i)perylene			<0.000020		mg/L		0.00002	01-OCT-13
Benzo(a)pyrene			<0.0000050		mg/L		0.000005	01-OCT-13
Chrysene			<0.000020		mg/L		0.00002	01-OCT-13
Dibenzo(a,h)anthracene			<0.0000050		mg/L		0.000005	01-OCT-13
Indeno(1,2,3-cd)pyrene			<0.000010		mg/L		0.00001	01-OCT-13
Surrogate: Nitrobenzene d5			94.4		%		40-130	01-OCT-13
Surrogate: 2-Fluorobiphenyl			86.0		%		40-130	01-OCT-13
Surrogate: p-Terphenyl d14			113.5		%		40-130	01-OCT-13
PH/EC/ALK-ED								
	Water							
Batch	R2702318							
WG1756128-10	DUP	L1369104-1						
pH		8.10	8.12	J	pH	0.03	0.3	28-SEP-13
Conductivity (EC)		443	442		uS/cm	0.2	10	28-SEP-13
Bicarbonate (HCO3)		286	288		mg/L	0.6	25	28-SEP-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	28-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	28-SEP-13
Alkalinity, Total (as CaCO3)		235	236		mg/L	0.6	20	28-SEP-13



Quality Control Report

Workorder: L1369030

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch	R2702318							
WG1756128-11	DUP	L1369657-20						
pH		7.77	7.77	J	pH	0.00	0.3	28-SEP-13
Conductivity (EC)		939	928		uS/cm	1.2	10	28-SEP-13
Bicarbonate (HCO3)		644	695		mg/L	7.6	25	28-SEP-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	28-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	28-SEP-13
Alkalinity, Total (as CaCO3)		528	570		mg/L	7.6	20	28-SEP-13
WG1756128-6	DUP	L1368044-2						
pH		8.09	8.10	J	pH	0.01	0.3	27-SEP-13
Conductivity (EC)		1390	1390		uS/cm	0.1	10	27-SEP-13
Bicarbonate (HCO3)		571	528		mg/L	7.8	25	27-SEP-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	27-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	27-SEP-13
Alkalinity, Total (as CaCO3)		468	433		mg/L	7.8	20	27-SEP-13
WG1756128-7	DUP	L1369030-3						
pH		8.07	8.05	J	pH	0.02	0.3	27-SEP-13
Conductivity (EC)		563	565		uS/cm	0.4	10	27-SEP-13
Bicarbonate (HCO3)		378	378		mg/L	0.2	25	27-SEP-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	27-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	27-SEP-13
Alkalinity, Total (as CaCO3)		310	310		mg/L	0.2	20	27-SEP-13
WG1756128-8	DUP	L1369101-20						
pH		7.75	7.77	J	pH	0.02	0.3	27-SEP-13
Conductivity (EC)		2340	2340		uS/cm	0.0	10	27-SEP-13
Bicarbonate (HCO3)		580	530		mg/L	8.9	25	27-SEP-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	27-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	27-SEP-13
Alkalinity, Total (as CaCO3)		475	435		mg/L	8.9	20	27-SEP-13
WG1756128-9	DUP	L1368562-2						
pH		8.15	7.99	J	pH	0.16	0.3	27-SEP-13
Conductivity (EC)		327	322		uS/cm	1.5	10	27-SEP-13
Bicarbonate (HCO3)		184	184		mg/L	0.1	25	27-SEP-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	27-SEP-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	27-SEP-13
Alkalinity, Total (as CaCO3)		151	151					



Quality Control Report

Workorder: L1369030

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch	R2702318							
WG1756128-9	DUP	L1368562-2						
Alkalinity, Total (as CaCO3)		151	151		mg/L	0.1	20	27-SEP-13
WG1756128-2	LCS							
Conductivity (EC)			102.4		%		90-110	27-SEP-13
WG1756128-3	LCS							
pH			7.06		pH		6.7-7.3	27-SEP-13
WG1756128-4	LCS							
Alkalinity, Total (as CaCO3)			101.7		%		85-115	27-SEP-13
WG1756128-5	LCS							
Conductivity (EC)			96.6		%		90-110	27-SEP-13
WG1756128-1	MB							
Bicarbonate (HCO3)			<5.0		mg/L		5	27-SEP-13
Carbonate (CO3)			<5.0		mg/L		5	27-SEP-13
Hydroxide (OH)			<5.0		mg/L		5	27-SEP-13
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	27-SEP-13
PHENOLS-4AAP-ED		Water						
Batch	R2707859							
WG1760653-4	DUP	L1371011-1						
Phenols (4AAP)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	15	03-OCT-13
WG1760653-6	DUP	L1368534-5						
Phenols (4AAP)		<0.0010	0.0011	RPD-NA	mg/L	N/A	15	03-OCT-13
WG1760653-7	DUP	L1369585-8						
Phenols (4AAP)		0.0018	0.0031	J	mg/L	0.0013	0.002	03-OCT-13
WG1760653-8	DUP	L1369585-20						
Phenols (4AAP)		0.0034	0.0038		mg/L	11	15	03-OCT-13
WG1760653-3	LCS							
Phenols (4AAP)			97.6		%		85-115	03-OCT-13
WG1760653-2	MB							
Phenols (4AAP)			<0.0010		mg/L		0.001	03-OCT-13
WG1760653-5	MS	L1371011-16						
Phenols (4AAP)			101.5		%		75-125	03-OCT-13
SO4-IC-ED		Water						
Batch	R2702879							
WG1756678-3	DUP	L1368562-2						
Sulfate (SO4)		16.0	16.1		mg/L	0.7	20	27-SEP-13
WG1756678-5	DUP	L1369104-1						
Sulfate (SO4)		8.33	8.35		mg/L	0.2	20	27-SEP-13



Quality Control Report

Workorder: L1369030

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-IC-ED		Water						
Batch	R2702879							
WG1756678-7	DUP	L1369030-3						
Sulfate (SO4)		15.6	15.5		mg/L	0.7	20	27-SEP-13
WG1756678-2	LCS							
Sulfate (SO4)			98.2		%		90-110	27-SEP-13
WG1756678-1	MB							
Sulfate (SO4)			<0.50		mg/L		0.5	27-SEP-13
WG1756678-4	MS	L1368562-2						
Sulfate (SO4)			98.8		%		75-125	27-SEP-13
WG1756678-6	MS	L1369104-1						
Sulfate (SO4)			98.5		%		75-125	27-SEP-13
WG1756678-8	MS	L1369030-3						
Sulfate (SO4)			102.3		%		75-125	27-SEP-13
TKN-CFA-ED		Water						
Batch	R2709131							
WG1761018-5	DUP	L1365261-3						
Total Kjeldahl Nitrogen		<0.20	<0.20	RPD-NA	mg/L	N/A	20	04-OCT-13
WG1761018-2	LCS							
Total Kjeldahl Nitrogen			116		mg/L		75-125	04-OCT-13
WG1761018-3	LCS							
Total Kjeldahl Nitrogen			111		mg/L		75-125	04-OCT-13
WG1761018-4	LCS							
Total Kjeldahl Nitrogen			102		mg/L		75-125	04-OCT-13
WG1761018-1	MB							
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	04-OCT-13
WG1761018-6	MS	L1365261-4						
Total Kjeldahl Nitrogen			110		mg/L		70-130	04-OCT-13
TURBIDITY-ED		Water						
Batch	R2702491							
WG1756207-3	DUP	L1369029-4						
Turbidity		569	579		NTU	1.7	15	27-SEP-13
WG1756207-2	LCS							
Turbidity			97.0		%		85-115	27-SEP-13
WG1756207-1	MB							
Turbidity			<0.10		NTU		0.1	27-SEP-13

Quality Control Report

Workorder: L1369030

Report Date: 17-DEC-13

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

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Contact: SUE RAYNARD

Legend:

Limit ALS Control Limit (Data Quality Objectives)
DUP Duplicate
RPD Relative Percent Difference
N/A Not Available
LCS Laboratory Control Sample
SRM Standard Reference Material
MS Matrix Spike
MSD Matrix Spike Duplicate
ADE Average Desorption Efficiency
MB Method Blank
IRM Internal Reference Material
CRM Certified Reference Material
CCV Continuing Calibration Verification
CVS Calibration Verification Standard
LCSD Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



MATRIX SOLUTIONS INC.
ATTN: SUE RAYNARD
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Date Received: 28-OCT-13
Report Date: 12-DEC-13 16:42 (MT)
Version: FINAL REV. 2

Client Phone: 403-237-0606

Certificate of Analysis

Lab Work Order #: L1383988
Project P.O. #: NOT SUBMITTED
Job Reference: HOUSE CROSSING 77-15 16054-502 7-36-77-15 W4M
C of C Numbers: M061023
Legal Site Desc: 7-36-77-15 W4M

Comments: ADDITIONAL 06-DEC-13 14:29
12-DEC-2013 Added Si-Dis to samples


Catherine Evaristo-Cordero
Senior Account Manager

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ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1383988-1 16054131024001									
Sampled By: GK/BP on 24-OCT-13									
Matrix: WATER									
Chloride by IC									
Chloride (Cl)	44.1	+/-1.4		0.50	mg/L	0		31-OCT-13	R2731159
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0014	+/-0.0004		0.0010	mg/L	0		05-NOV-13	R2733151
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		05-NOV-13	R2733151
Arsenic (As)-Dissolved	0.0209	+/-0.0022		0.00040	mg/L	0		05-NOV-13	R2733151
Barium (Ba)-Dissolved	0.0749	+/-0.0065		0.00010	mg/L	0		05-NOV-13	R2733151
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		05-NOV-13	R2733151
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		05-NOV-13	R2733151
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		05-NOV-13	R2733151
Calcium (Ca)-Dissolved	48.7	+/-6.6		0.50	mg/L	0		05-NOV-13	R2733151
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		05-NOV-13	R2733151
Cobalt (Co)-Dissolved	0.00040	+/-0.00004		0.00010	mg/L	0		05-NOV-13	R2733151
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		05-NOV-13	R2733151
Iron (Fe)-Dissolved	2.53	+/-0.23		0.010	mg/L	0		05-NOV-13	R2733151
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		05-NOV-13	R2733151
Magnesium (Mg)-Dissolved	12.8	+/-0.99		0.10	mg/L	0		05-NOV-13	R2733151
Manganese (Mn)-Dissolved	0.274	+/-0.019		0.0020	mg/L	0		05-NOV-13	R2733151
Molybdenum (Mo)-Dissolved	0.0343	+/-0.0036		0.00010	mg/L	0		05-NOV-13	R2733151
Nickel (Ni)-Dissolved	0.00254	+/-0.00021		0.00010	mg/L	0		05-NOV-13	R2733151
Potassium (K)-Dissolved	4.71	+/-0.36		0.50	mg/L	0		05-NOV-13	R2733151
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		05-NOV-13	R2733151
Silicon (Si)-Dissolved	8.64	+/-0.73		0.050	mg/L	0		05-NOV-13	R2733151
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		05-NOV-13	R2733151
Sodium (Na)-Dissolved	171	+/-12		1.0	mg/L	0		05-NOV-13	R2733151
Strontium (Sr)-Dissolved	0.368	+/-0.027		0.00010	mg/L	0		05-NOV-13	R2733151
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		05-NOV-13	R2733151
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		05-NOV-13	R2733151
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		05-NOV-13	R2733151
Uranium (U)-Dissolved	0.000425	+/-0.000044		0.000010	mg/L	0		05-NOV-13	R2733151
Vanadium (V)-Dissolved	0.00013	+/-0.00001		0.00010	mg/L	0		05-NOV-13	R2733151
Zinc (Zn)-Dissolved	0.0048	+/-0.0006		0.0010	mg/L	0		05-NOV-13	R2733151
Ion Balance Calculation									
Ion Balance	93.6	-			%	-		07-NOV-13	
TDS (Calculated)	635	-			mg/L	-		07-NOV-13	
Hardness (as CaCO3)	174	-			mg/L	-		07-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		31-OCT-13	R2731159
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		08-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		31-OCT-13	R2731159
Sulfate by IC									
Sulfate (SO4)	91.0	+/-3.8		0.50	mg/L	0		31-OCT-13	R2731159
pH, Conductivity and Total Alkalinity									
pH	8.54	+/-0.04		0.10	pH	0		31-OCT-13	R2731550
Conductivity (EC)	1090	+/-36		0.20	uS/cm	0		31-OCT-13	R2731550
Bicarbonate (HCO3)	501	-		5.0	mg/L	-		31-OCT-13	R2731550
Carbonate (CO3)	16.6	-		5.0	mg/L	-		31-OCT-13	R2731550
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		31-OCT-13	R2731550
Alkalinity, Total (as CaCO3)	438	+/-16		2.0	mg/L	0		31-OCT-13	R2731550

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1383988-2 16054131024002									
Sampled By: GK/BP on 24-OCT-13									
Matrix: WATER									
Chloride by IC									
Chloride (Cl)	1.92	+/-0.09		0.50	mg/L	0		31-OCT-13	R2731159
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0147	+/-0.0023		0.0010	mg/L	0		05-NOV-13	R2733151
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		05-NOV-13	R2733151
Arsenic (As)-Dissolved	0.0225	+/-0.0024		0.00040	mg/L	0		05-NOV-13	R2733151
Barium (Ba)-Dissolved	0.178	+/-0.015		0.00010	mg/L	0		05-NOV-13	R2733151
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		05-NOV-13	R2733151
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		05-NOV-13	R2733151
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		05-NOV-13	R2733151
Calcium (Ca)-Dissolved	61.3	+/-8.3		0.50	mg/L	0		05-NOV-13	R2733151
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		05-NOV-13	R2733151
Cobalt (Co)-Dissolved	0.00013	+/-0.00001		0.00010	mg/L	0		05-NOV-13	R2733151
Copper (Cu)-Dissolved	0.00075	+/-0.00007		0.00060	mg/L	0		05-NOV-13	R2733151
Iron (Fe)-Dissolved	4.47	+/-0.40		0.010	mg/L	0		05-NOV-13	R2733151
Lead (Pb)-Dissolved	0.00091	+/-0.00008		0.00010	mg/L	0		05-NOV-13	R2733151
Magnesium (Mg)-Dissolved	17.2	+/-1.3		0.10	mg/L	0		05-NOV-13	R2733151
Manganese (Mn)-Dissolved	0.115	+/-0.0078		0.0020	mg/L	0		05-NOV-13	R2733151
Molybdenum (Mo)-Dissolved	0.00800	+/-0.00084		0.00010	mg/L	0		05-NOV-13	R2733151
Nickel (Ni)-Dissolved	0.00039	+/-0.00005		0.00010	mg/L	0		05-NOV-13	R2733151
Potassium (K)-Dissolved	5.06	+/-0.39		0.50	mg/L	0		05-NOV-13	R2733151
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		05-NOV-13	R2733151
Silicon (Si)-Dissolved	9.68	+/-0.82		0.050	mg/L	0		05-NOV-13	R2733151
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		05-NOV-13	R2733151
Sodium (Na)-Dissolved	81.3	+/-5.7		1.0	mg/L	0		05-NOV-13	R2733151
Strontium (Sr)-Dissolved	0.524	+/-0.039		0.00010	mg/L	0		05-NOV-13	R2733151
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		05-NOV-13	R2733151
Titanium (Ti)-Dissolved	0.00036	+/-0.00018		0.00030	mg/L	0		05-NOV-13	R2733151
Tin (Sn)-Dissolved	0.00024	+/-0.00002		0.00020	mg/L	0		05-NOV-13	R2733151
Uranium (U)-Dissolved	0.000116	+/-0.000012		0.000010	mg/L	0		05-NOV-13	R2733151
Vanadium (V)-Dissolved	0.00020	+/-0.00002		0.00010	mg/L	0		05-NOV-13	R2733151
Zinc (Zn)-Dissolved	0.230	+/-0.027		0.0010	mg/L	0		05-NOV-13	R2733151
Ion Balance Calculation									
Ion Balance	87.8	-			%	-		09-NOV-13	
TDS (Calculated)	460	-			mg/L	-		09-NOV-13	
Hardness (as CaCO3)	224	-			mg/L	-		09-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		31-OCT-13	R2731159
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		08-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		31-OCT-13	R2731159
Sulfate by IC									
Sulfate (SO4)	32.3	+/-1.4		0.50	mg/L	0		31-OCT-13	R2731159
pH, Conductivity and Total Alkalinity									
pH	8.59	+/-0.04		0.10	pH	0		31-OCT-13	R2731550
Conductivity (EC)	763	+/-25		0.20	uS/cm	0		31-OCT-13	R2731550
Bicarbonate (HCO3)	423	-		5.0	mg/L	-		31-OCT-13	R2731550
Carbonate (CO3)	52.9	-		5.0	mg/L	-		31-OCT-13	R2731550
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		31-OCT-13	R2731550
Alkalinity, Total (as CaCO3)	435	+/-16		2.0	mg/L	0		31-OCT-13	R2731550

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1383988-3 16054131024003									
Sampled By: GK/BP on 24-OCT-13									
Matrix: WATER									
Chloride by IC									
Chloride (Cl)	13.3	+/-0.43		0.50	mg/L	0		31-OCT-13	R2731159
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0242	+/-0.0037		0.0010	mg/L	0		05-NOV-13	R2733151
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		05-NOV-13	R2733151
Arsenic (As)-Dissolved	0.00455	+/-0.00048		0.00040	mg/L	0		05-NOV-13	R2733151
Barium (Ba)-Dissolved	0.144	+/-0.012		0.00010	mg/L	0		05-NOV-13	R2733151
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		05-NOV-13	R2733151
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		05-NOV-13	R2733151
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		05-NOV-13	R2733151
Calcium (Ca)-Dissolved	66.4	+/-9.0		0.50	mg/L	0		05-NOV-13	R2733151
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		05-NOV-13	R2733151
Cobalt (Co)-Dissolved	0.00017	+/-0.00002		0.00010	mg/L	0		05-NOV-13	R2733151
Copper (Cu)-Dissolved	0.00061	+/-0.00006		0.00060	mg/L	0		05-NOV-13	R2733151
Iron (Fe)-Dissolved	5.78	+/-0.52		0.010	mg/L	0		05-NOV-13	R2733151
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		05-NOV-13	R2733151
Magnesium (Mg)-Dissolved	17.8	+/-1.4		0.10	mg/L	0		05-NOV-13	R2733151
Manganese (Mn)-Dissolved	0.240	+/-0.016		0.0020	mg/L	0		05-NOV-13	R2733151
Molybdenum (Mo)-Dissolved	0.00622	+/-0.00065		0.00010	mg/L	0		05-NOV-13	R2733151
Nickel (Ni)-Dissolved	0.00176	+/-0.00015		0.00010	mg/L	0		05-NOV-13	R2733151
Potassium (K)-Dissolved	3.78	+/-0.29		0.50	mg/L	0		05-NOV-13	R2733151
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		05-NOV-13	R2733151
Silicon (Si)-Dissolved	10.7	+/-0.91		0.050	mg/L	0		05-NOV-13	R2733151
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		05-NOV-13	R2733151
Sodium (Na)-Dissolved	38.1	+/-2.7		1.0	mg/L	0		05-NOV-13	R2733151
Strontium (Sr)-Dissolved	0.415	+/-0.031		0.00010	mg/L	0		05-NOV-13	R2733151
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		05-NOV-13	R2733151
Titanium (Ti)-Dissolved	0.00129	+/-0.00062		0.00030	mg/L	0		05-NOV-13	R2733151
Tin (Sn)-Dissolved	0.00065	+/-0.00005		0.00020	mg/L	0		05-NOV-13	R2733151
Uranium (U)-Dissolved	0.000064	+/-0.000006		0.000010	mg/L	0		05-NOV-13	R2733151
Vanadium (V)-Dissolved	0.00019	+/-0.00002		0.00010	mg/L	0		05-NOV-13	R2733151
Zinc (Zn)-Dissolved	0.0108	+/-0.0013		0.0010	mg/L	0		05-NOV-13	R2733151
Ion Balance Calculation									
Ion Balance	94.2	-			%	-		07-NOV-13	
TDS (Calculated)	347	-			mg/L	-		07-NOV-13	
Hardness (as CaCO3)	239	-			mg/L	-		07-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		31-OCT-13	R2731159
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		08-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		31-OCT-13	R2731159
Sulfate by IC									
Sulfate (SO4)	20.3	+/-0.88		0.50	mg/L	0		31-OCT-13	R2731159
pH, Conductivity and Total Alkalinity									
pH	8.44	+/-0.04		0.10	pH	0		31-OCT-13	R2731550
Conductivity (EC)	622	+/-21		0.20	uS/cm	0		31-OCT-13	R2731550
Bicarbonate (HCO3)	363	-		5.0	mg/L	-		31-OCT-13	R2731550
Carbonate (CO3)	9.3	-		5.0	mg/L	-		31-OCT-13	R2731550
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		31-OCT-13	R2731550
Alkalinity, Total (as CaCO3)	313	+/-12		2.0	mg/L	0		31-OCT-13	R2731550

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1383988-4 16054131024004									
Sampled By: GK/BP on 24-OCT-13									
Matrix: WATER									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		31-OCT-13	R2731159
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.0010	-		0.0010	mg/L	-		05-NOV-13	R2733151
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		05-NOV-13	R2733151
Arsenic (As)-Dissolved	0.00939	+/-0.00099		0.00040	mg/L	0		05-NOV-13	R2733151
Barium (Ba)-Dissolved	0.0484	+/-0.0042		0.00010	mg/L	0		05-NOV-13	R2733151
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		05-NOV-13	R2733151
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		05-NOV-13	R2733151
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		05-NOV-13	R2733151
Calcium (Ca)-Dissolved	64.8	+/-8.8		0.50	mg/L	0		05-NOV-13	R2733151
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		05-NOV-13	R2733151
Cobalt (Co)-Dissolved	<0.00010	-		0.00010	mg/L	-		05-NOV-13	R2733151
Copper (Cu)-Dissolved	0.00086	+/-0.00007		0.00060	mg/L	0		05-NOV-13	R2733151
Iron (Fe)-Dissolved	0.837	+/-0.075		0.010	mg/L	0		05-NOV-13	R2733151
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		05-NOV-13	R2733151
Magnesium (Mg)-Dissolved	17.9	+/-1.4		0.10	mg/L	0		05-NOV-13	R2733151
Manganese (Mn)-Dissolved	0.467	+/-0.032		0.0020	mg/L	0		05-NOV-13	R2733151
Molybdenum (Mo)-Dissolved	0.0133	+/-0.0014		0.00010	mg/L	0		05-NOV-13	R2733151
Nickel (Ni)-Dissolved	0.00047	+/-0.00006		0.00010	mg/L	0		05-NOV-13	R2733151
Potassium (K)-Dissolved	3.91	+/-0.30		0.50	mg/L	0		05-NOV-13	R2733151
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		05-NOV-13	R2733151
Silicon (Si)-Dissolved	9.95	+/-0.85		0.050	mg/L	0		05-NOV-13	R2733151
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		05-NOV-13	R2733151
Sodium (Na)-Dissolved	31.3	+/-2.2		1.0	mg/L	0		05-NOV-13	R2733151
Strontium (Sr)-Dissolved	0.403	+/-0.030		0.00010	mg/L	0		05-NOV-13	R2733151
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		05-NOV-13	R2733151
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		05-NOV-13	R2733151
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		05-NOV-13	R2733151
Uranium (U)-Dissolved	0.000017	+/-0.000002		0.000010	mg/L	0		05-NOV-13	R2733151
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		05-NOV-13	R2733151
Zinc (Zn)-Dissolved	0.0077	+/-0.0010		0.0010	mg/L	0		05-NOV-13	R2733151
Ion Balance Calculation									
Ion Balance	95.9	-			%	-		07-NOV-13	
TDS (Calculated)	321	-			mg/L	-		07-NOV-13	
Hardness (as CaCO3)	236	-			mg/L	-		07-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		31-OCT-13	R2731159
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	0.152	-		0.071	mg/L	-		08-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	0.152	+/-0.020		0.050	mg/L	0		31-OCT-13	R2731159
Sulfate by IC									
Sulfate (SO4)	16.2	+/-0.71		0.50	mg/L	0		31-OCT-13	R2731159
pH, Conductivity and Total Alkalinity									
pH	8.43	+/-0.04		0.10	pH	0		31-OCT-13	R2731550
Conductivity (EC)	565	+/-19		0.20	uS/cm	0		31-OCT-13	R2731550
Bicarbonate (HCO3)	361	-		5.0	mg/L	-		31-OCT-13	R2731550
Carbonate (CO3)	8.2	-		5.0	mg/L	-		31-OCT-13	R2731550
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		31-OCT-13	R2731550
Alkalinity, Total (as CaCO3)	310	+/-12		2.0	mg/L	0		31-OCT-13	R2731550

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1383988-5 16054131024005									
Sampled By: GK/BP on 24-OCT-13									
Matrix: WATER									
Chloride by IC									
Chloride (Cl)	27.8	+/-0.89		0.50	mg/L	0		31-OCT-13	R2731159
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0041	+/-0.0007		0.0010	mg/L	0		05-NOV-13	R2733151
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		05-NOV-13	R2733151
Arsenic (As)-Dissolved	0.0151	+/-0.0016		0.00040	mg/L	0		05-NOV-13	R2733151
Barium (Ba)-Dissolved	0.279	+/-0.024		0.00010	mg/L	0		05-NOV-13	R2733151
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		05-NOV-13	R2733151
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		05-NOV-13	R2733151
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		05-NOV-13	R2733151
Calcium (Ca)-Dissolved	104	+/-14		0.50	mg/L	0		05-NOV-13	R2733151
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		05-NOV-13	R2733151
Cobalt (Co)-Dissolved	0.00038	+/-0.00004		0.00010	mg/L	0		05-NOV-13	R2733151
Copper (Cu)-Dissolved	0.00114	+/-0.00009		0.00060	mg/L	0		05-NOV-13	R2733151
Iron (Fe)-Dissolved	11.1	+/-1.0		0.010	mg/L	0		05-NOV-13	R2733151
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		05-NOV-13	R2733151
Magnesium (Mg)-Dissolved	19.9	+/-1.5		0.10	mg/L	0		05-NOV-13	R2733151
Manganese (Mn)-Dissolved	1.27	+/-0.087		0.0020	mg/L	0		05-NOV-13	R2733151
Molybdenum (Mo)-Dissolved	0.00511	+/-0.00054		0.00010	mg/L	0		05-NOV-13	R2733151
Nickel (Ni)-Dissolved	0.00121	+/-0.00011		0.00010	mg/L	0		05-NOV-13	R2733151
Potassium (K)-Dissolved	2.28	+/-0.18		0.50	mg/L	0		05-NOV-13	R2733151
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		05-NOV-13	R2733151
Silicon (Si)-Dissolved	8.60	+/-0.73		0.050	mg/L	0		05-NOV-13	R2733151
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		05-NOV-13	R2733151
Sodium (Na)-Dissolved	4.1	+/-0.3		1.0	mg/L	0		05-NOV-13	R2733151
Strontium (Sr)-Dissolved	0.411	+/-0.031		0.00010	mg/L	0		05-NOV-13	R2733151
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		05-NOV-13	R2733151
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		05-NOV-13	R2733151
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		05-NOV-13	R2733151
Uranium (U)-Dissolved	0.000439	+/-0.000046		0.000010	mg/L	0		05-NOV-13	R2733151
Vanadium (V)-Dissolved	0.00017	+/-0.00001		0.00010	mg/L	0		05-NOV-13	R2733151
Zinc (Zn)-Dissolved	0.0235	+/-0.0028		0.0010	mg/L	0		05-NOV-13	R2733151
Ion Balance Calculation									
Ion Balance	99.8	-			%	-		07-NOV-13	
TDS (Calculated)	355	-			mg/L	-		07-NOV-13	
Hardness (as CaCO3)	342	-			mg/L	-		07-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		31-OCT-13	R2731159
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		08-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		31-OCT-13	R2731159
Sulfate by IC									
Sulfate (SO4)	5.68	+/-0.28		0.50	mg/L	0		31-OCT-13	R2731159
pH, Conductivity and Total Alkalinity									
pH	8.35	+/-0.04		0.10	pH	0		31-OCT-13	R2731550
Conductivity (EC)	646	+/-22		0.20	uS/cm	0		31-OCT-13	R2731550
Bicarbonate (HCO3)	379	-		5.0	mg/L	-		31-OCT-13	R2731550
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		31-OCT-13	R2731550
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		31-OCT-13	R2731550
Alkalinity, Total (as CaCO3)	318	+/-12		2.0	mg/L	0		31-OCT-13	R2731550

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1383988-6 16054131024006 Sampled By: GK/BP on 24-OCT-13 Matrix: WATER									
BTEX and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730670
Toluene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730670
Ethylbenzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730670
o-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730670
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730670
F1(C6-C10)	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730670
F1-BTEX	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730670
Xylenes	<0.00071	-		0.00071	mg/L	-		04-NOV-13	R2730670
* Refer to Referenced Information for Qualifiers (if any) and Methodology.									

Reference Information

Report Comments: ADDITIONAL 06-DEC-13 14:29
12-DEC-2013 Added Si-Dis to samples

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Phosphorus (P)-Total	MS-B	
Matrix Spike	Phosphorus (P)-Total	MS-B	
Matrix Spike	Phosphorus (P)-Total	MS-B	

Sample Parameter Qualifier Key:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
B-D-L-CCMS-ED	Water	Dissolved Boron in Water by CRC ICPMS		APHA 3030 B / EPA SW-846 6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).				
BTX,F1-ED	Water	BTEX and F1 (C6-C10)		EPA 5021/8015&8260 GC-MS & FID
C-DIS-ORG-ED	Water	Dissolved Organic Carbon		APHA 5310 B-Instrumental
CL-IC-ED	Water	Chloride by IC		APHA 4110 B-ION CHROMATOGRAPHY
F2,F3,F4-ED	Water	F2, F3, F4		EPA 3510/CCME PHC CWS-GC-FID
HG-D-L-CVAA-ED	Water	Mercury (Hg) - Dissolved		EPA 245.7 / EPA 245.1
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET-D-CCMS-ED	Water	Dissolved Metals in Water by CRC ICPMS		APHA 3030 B&E / EPA SW-846 6020A
NAPHTHENIC-ACID-FM	Water	Naphthenic Acids by FTIR		Naphthenic Acids by FTIR, Syncrude, 1994
Dissolved naphthenic acids are solvent extracted from acidified aqueous samples using Dichloromethane prior to quantitation by Fourier Transform Infra-Red spectroscopy. Note that FTIR is not uniquely selective to naphthenic acids. If present, other carboxylic acids (e.g. humic acids, fulvic acids) may also be detected by this method.				
NH3-CFA-ED	Water	Ammonia in Water by Colour		APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.				
NO2+NO3-CALC-ED	Water	Nitrate+Nitrite		CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
P-T-COL-ED	Water	Total P in Water by Colour		APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.				
PAH-ABT1-ED	Water	PAH & Carcinogenic PAH List		EPA 3510/8270-GC/MS
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)				
PHENOLS-4AAP-ED	Water	Phenols (4AAP)		AB ENV.06537-COLORIMETRIC
This analysis is carried out using procedures adapted from ENVIRODAT VMV 06537 689, Method Code 154, in "Methods Manual for Chemical Analysis of Water and Wastes" published by the Alberta Environmental Centre. This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide and 4-aminoantipyrine to form a red complex which is measured at 505 nm.				
SIO2-D-CALC-ED	Water	Dissolved Silicon (reported as Silica)		CALCULATION
SO4-IC-ED	Water	Sulfate by IC		APHA 4110 B-ION CHROMATOGRAPHY

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
TKN-CFA-ED	Water	TKN in Water by Colour		APHA 4500-NORG (TKN)

This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 celcius with analysis using an automated colourimetric finish.

** The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS methods may incorporate modifications from the specified reference to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
FM	ALS ENVIRONMENTAL - FORT MCMURRAY, ALBERTA, CANADA

Chain of Custody Numbers:

M061023

GLOSSARY OF REPORT TERMS

Surr - Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

MU: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.

Bias: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent.

Zero values indicate no detectable method bias.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Quality Control Report

Workorder: L1383988

Report Date: 12-DEC-13

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-D-L-CCMS-ED		Water						
Batch	R2733151							
WG1781635-2	CRM	ED-HIGH-WATRM						
Boron (B)-Dissolved			89.1		%		80-120	04-NOV-13
WG1781635-4	DUP	L1383988-1						
Boron (B)-Dissolved		0.736	0.724		mg/L	1.7	20	05-NOV-13
WG1781635-1	MB							
Boron (B)-Dissolved			<0.0020		mg/L		0.002	04-NOV-13
BTX,F1-ED		Water						
Batch	R2730670							
WG1779523-4	DUP	L1383988-6						
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-NOV-13
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-NOV-13
Ethylbenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-NOV-13
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	04-NOV-13
m+p-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	04-NOV-13
F1(C6-C10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	04-NOV-13
WG1779523-5	DUP	L1384466-11						
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-NOV-13
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-NOV-13
Ethylbenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-NOV-13
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	04-NOV-13
m+p-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	04-NOV-13
F1(C6-C10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	04-NOV-13
WG1779523-2	LCS							
Benzene			105.1		%		70-130	01-NOV-13
Toluene			96.9		%		70-130	01-NOV-13
Ethylbenzene			101.8		%		70-130	01-NOV-13
o-Xylene			104.8		%		70-130	01-NOV-13
m+p-Xylene			97.5		%		70-130	01-NOV-13
WG1779523-3	LCS							
F1(C6-C10)			109.5		%		70-130	01-NOV-13
WG1779523-1	MB							
Benzene			<0.00050		mg/L		0.0005	01-NOV-13
Toluene			<0.00050		mg/L		0.0005	01-NOV-13
Ethylbenzene			<0.00050		mg/L		0.0005	01-NOV-13
o-Xylene			<0.00050		mg/L		0.0005	01-NOV-13
m+p-Xylene			<0.00050		mg/L		0.0005	01-NOV-13



Quality Control Report

Workorder: L1383988

Report Date: 12-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTX,F1-ED								
	Water							
Batch	R2730670							
WG1779523-1	MB							
m+p-Xylene			<0.00050		mg/L		0.0005	01-NOV-13
F1(C6-C10)			<0.10		mg/L		0.1	01-NOV-13
WG1779523-6	MS	L1384466-11						
Benzene			112.8		%		50-150	04-NOV-13
Toluene			104.6		%		50-150	04-NOV-13
Ethylbenzene			120.6		%		50-150	04-NOV-13
o-Xylene			119.6		%		50-150	04-NOV-13
m+p-Xylene			123.9		%		50-150	04-NOV-13
WG1779523-7	MS	L1384466-11						
F1(C6-C10)			72.3		%		50-150	05-NOV-13
C-DIS-ORG-ED								
	Water							
Batch	R2733170							
WG1781379-3	CVS							
Dissolved Organic Carbon			121.8		%		80-160	04-NOV-13
WG1781379-6	DUP	L1383988-1						
Dissolved Organic Carbon		8.4	8.7		mg/L	3.5	20	04-NOV-13
WG1781379-2	LCS							
Dissolved Organic Carbon			102.8		%		80-120	04-NOV-13
WG1781379-1	MB							
Dissolved Organic Carbon			<1.0		mg/L		1	04-NOV-13
WG1781379-7	MS	L1383988-1						
Dissolved Organic Carbon			113.5		%		70-130	04-NOV-13
CL-IC-ED								
	Water							
Batch	R2731159							
WG1780026-6	DUP	L1384550-2						
Chloride (Cl)		2.22	2.23		mg/L	0.3	20	31-OCT-13
WG1780026-8	DUP	L1384618-4						
Chloride (Cl)		9.50	9.49		mg/L	0.1	20	31-OCT-13
WG1780026-5	LCS							
Chloride (Cl)			102.2		%		90-110	31-OCT-13
WG1780026-4	MB							
Chloride (Cl)			<0.50		mg/L		0.5	31-OCT-13
WG1780026-7	MS	L1384550-2						
Chloride (Cl)			100.3		%		75-125	31-OCT-13
WG1780026-9	MS	L1384618-4						
Chloride (Cl)			100.2		%		75-125	31-OCT-13



Quality Control Report

Workorder: L1383988

Report Date: 12-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2,F3,F4-ED		Water						
Batch	R2729903							
WG1778067-2	LCS							
F2 (>C10-C16)			84.8		%		65-135	30-OCT-13
F3 (C16-C34)			83.7		%		65-135	30-OCT-13
F4 (C34-C50)			82.3		%		65-135	30-OCT-13
WG1778067-5	LCS							
F2 (>C10-C16)			85.9		%		65-135	30-OCT-13
F3 (C16-C34)			86.1		%		65-135	30-OCT-13
F4 (C34-C50)			81.6		%		65-135	30-OCT-13
WG1778067-1	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	30-OCT-13
F3 (C16-C34)			<0.25		mg/L		0.25	30-OCT-13
F4 (C34-C50)			<0.25		mg/L		0.25	30-OCT-13
Surrogate: 2-Bromobenzotrifluoride			96.8		%		50-150	30-OCT-13
WG1778067-4	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	30-OCT-13
F3 (C16-C34)			<0.25		mg/L		0.25	30-OCT-13
F4 (C34-C50)			<0.25		mg/L		0.25	30-OCT-13
Surrogate: 2-Bromobenzotrifluoride			97.0		%		50-150	30-OCT-13
HG-D-L-CVAA-ED		Water						
Batch	R2731870							
WG1781283-13	DUP	L1384618-4						
Mercury (Hg)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	03-NOV-13
WG1781283-15	DUP	L1384628-1						
Mercury (Hg)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	03-NOV-13
WG1781283-17	DUP	L1384628-12						
Mercury (Hg)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	03-NOV-13
WG1781283-7	LCS							
Mercury (Hg)-Dissolved			98.4		%		80-120	03-NOV-13
WG1781283-8	LCSD	WG1781283-7						
Mercury (Hg)-Dissolved		98.4	101.1		%	2.7	20	03-NOV-13
WG1781283-6	MB							
Mercury (Hg)-Dissolved			<0.000020		mg/L		0.00002	03-NOV-13
WG1781283-14	MS	L1384618-4						
Mercury (Hg)-Dissolved			74.6		%		70-130	03-NOV-13
WG1781283-16	MS	L1384628-1						
Mercury (Hg)-Dissolved			93.5		%		70-130	03-NOV-13
WG1781283-18	MS	L1384628-12						



Quality Control Report

Workorder: L1383988

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-D-L-CVAA-ED								
	Water							
Batch	R2731870							
WG1781283-18 MS		L1384628-12						
Mercury (Hg)-Dissolved			93.9		%		70-130	03-NOV-13
MET-D-CCMS-ED								
	Water							
Batch	R2733151							
WG1781635-2 CRM		ED-HIGH-WATRM						
Aluminum (Al)-Dissolved			100.3		%		80-120	04-NOV-13
Antimony (Sb)-Dissolved			102.4		%		80-120	04-NOV-13
Arsenic (As)-Dissolved			98.1		%		80-120	04-NOV-13
Barium (Ba)-Dissolved			101.4		%		80-120	04-NOV-13
Beryllium (Be)-Dissolved			97.6		%		80-120	04-NOV-13
Bismuth (Bi)-Dissolved			99.6		%		80-120	04-NOV-13
Cadmium (Cd)-Dissolved			104.7		%		80-120	04-NOV-13
Calcium (Ca)-Dissolved			105.5		%		80-120	04-NOV-13
Chromium (Cr)-Dissolved			100.2		%		80-120	04-NOV-13
Cobalt (Co)-Dissolved			97.1		%		80-120	04-NOV-13
Copper (Cu)-Dissolved			97.8		%		80-120	04-NOV-13
Lead (Pb)-Dissolved			100.3		%		80-120	04-NOV-13
Magnesium (Mg)-Dissolved			92.8		%		80-120	04-NOV-13
Manganese (Mn)-Dissolved			100.3		%		80-120	04-NOV-13
Molybdenum (Mo)-Dissolved			103.6		%		80-120	04-NOV-13
Nickel (Ni)-Dissolved			98.9		%		80-120	04-NOV-13
Potassium (K)-Dissolved			98.3		%		80-120	04-NOV-13
Selenium (Se)-Dissolved			97.6		%		80-120	04-NOV-13
Silicon (Si)-Dissolved			116.5		%		80-120	04-NOV-13
Silver (Ag)-Dissolved			93.5		%		80-120	04-NOV-13
Sodium (Na)-Dissolved			105.2		%		80-120	04-NOV-13
Strontium (Sr)-Dissolved			112.3		%		80-120	04-NOV-13
Thallium (Tl)-Dissolved			112.4		%		80-120	04-NOV-13
Titanium (Ti)-Dissolved			83.3		%		80-120	04-NOV-13
Tin (Sn)-Dissolved			92.1		%		80-120	04-NOV-13
Uranium (U)-Dissolved			101.1		%		80-120	04-NOV-13
Vanadium (V)-Dissolved			99.3		%		80-120	04-NOV-13
Zinc (Zn)-Dissolved			109.2		%		80-120	04-NOV-13
WG1781635-3 DUP		L1383621-17						



Quality Control Report

Workorder: L1383988

Report Date: 12-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2733151							
WG1781635-3	DUP	L1383621-17						
Aluminum (Al)-Dissolved		<0.0050	0.0054	RPD-NA	mg/L	N/A	20	05-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	05-NOV-13
Arsenic (As)-Dissolved		0.0284	0.0279		mg/L	1.8	20	05-NOV-13
Barium (Ba)-Dissolved		0.102	0.0978		mg/L	4.6	20	05-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	05-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	05-NOV-13
Cadmium (Cd)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	05-NOV-13
Calcium (Ca)-Dissolved		60.3	56.9		mg/L	5.8	20	05-NOV-13
Chromium (Cr)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	05-NOV-13
Cobalt (Co)-Dissolved		0.00126	0.00120		mg/L	4.5	20	05-NOV-13
Copper (Cu)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	05-NOV-13
Iron (Fe)-Dissolved		12.7	12.4		mg/L	3.1	20	05-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	05-NOV-13
Magnesium (Mg)-Dissolved		36.3	35.4		mg/L	2.4	20	05-NOV-13
Manganese (Mn)-Dissolved		2.13	2.09		mg/L	2.1	20	05-NOV-13
Molybdenum (Mo)-Dissolved		0.00297	0.00296		mg/L	0.2	20	05-NOV-13
Potassium (K)-Dissolved		17.6	17.3		mg/L	1.6	20	05-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	05-NOV-13
Silicon (Si)-Dissolved		10.5	10.9		mg/L	3.6	20	05-NOV-13
Silver (Ag)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	05-NOV-13
Sodium (Na)-Dissolved		95.4	93.7		mg/L	1.8	20	05-NOV-13
Strontium (Sr)-Dissolved		0.593	0.577		mg/L	2.7	20	05-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	05-NOV-13
Titanium (Ti)-Dissolved		0.00098	0.00086		mg/L	13	20	05-NOV-13
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	05-NOV-13
Uranium (U)-Dissolved		0.00327	0.00320		mg/L	2.1	20	05-NOV-13
Vanadium (V)-Dissolved		0.00146	0.00144		mg/L	0.9	20	05-NOV-13
Zinc (Zn)-Dissolved		0.0052	0.0045		mg/L	16	20	05-NOV-13
WG1781635-4	DUP	L1383988-1						
Aluminum (Al)-Dissolved		0.0014	0.0018	J	mg/L	0.0004	0.002	05-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	05-NOV-13
Arsenic (As)-Dissolved		0.0209	0.0205		mg/L	1.8	20	05-NOV-13
Barium (Ba)-Dissolved		0.0749	0.0730		mg/L	2.5	20	05-NOV-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2733151							
WG1781635-4	DUP	L1383988-1						
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	05-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	05-NOV-13
Cadmium (Cd)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	05-NOV-13
Calcium (Ca)-Dissolved		48.7	45.6		mg/L	6.7	20	05-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	05-NOV-13
Cobalt (Co)-Dissolved		0.00040	0.00042		mg/L	6.4	20	05-NOV-13
Copper (Cu)-Dissolved		<0.00060	<0.00060	RPD-NA	mg/L	N/A	20	05-NOV-13
Iron (Fe)-Dissolved		2.53	2.48		mg/L	1.7	20	05-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	05-NOV-13
Magnesium (Mg)-Dissolved		12.8	12.2		mg/L	5.0	20	05-NOV-13
Manganese (Mn)-Dissolved		0.274	0.269		mg/L	1.6	20	05-NOV-13
Molybdenum (Mo)-Dissolved		0.0343	0.0320		mg/L	6.7	20	05-NOV-13
Nickel (Ni)-Dissolved		0.00254	0.00260		mg/L	2.4	20	05-NOV-13
Potassium (K)-Dissolved		4.71	4.63		mg/L	1.8	20	05-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	05-NOV-13
Silicon (Si)-Dissolved		8.64	8.38		mg/L	3.0	20	05-NOV-13
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	05-NOV-13
Sodium (Na)-Dissolved		171	168		mg/L	1.6	20	05-NOV-13
Strontium (Sr)-Dissolved		0.368	0.335		mg/L	9.1	20	05-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	05-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	05-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	05-NOV-13
Uranium (U)-Dissolved		0.000425	0.000384		mg/L	10	20	05-NOV-13
Vanadium (V)-Dissolved		0.00013	0.00012		mg/L	9.2	20	05-NOV-13
Zinc (Zn)-Dissolved		0.0048	0.0038	J	mg/L	0.0010	0.002	05-NOV-13
WG1781635-1	MB							
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	04-NOV-13
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	04-NOV-13
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	04-NOV-13
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	04-NOV-13
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	04-NOV-13
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	04-NOV-13
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	04-NOV-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED		Water						
Batch	R2733151							
WG1781635-1	MB							
Calcium (Ca)-Dissolved			<0.020		mg/L		0.02	04-NOV-13
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	04-NOV-13
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	04-NOV-13
Copper (Cu)-Dissolved			<0.00010		mg/L		0.0001	04-NOV-13
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	04-NOV-13
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	04-NOV-13
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	04-NOV-13
Manganese (Mn)-Dissolved			<0.000050		mg/L		0.00005	04-NOV-13
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	04-NOV-13
Nickel (Ni)-Dissolved			<0.00010		mg/L		0.0001	04-NOV-13
Potassium (K)-Dissolved			<0.050		mg/L		0.05	04-NOV-13
Selenium (Se)-Dissolved			<0.00010		mg/L		0.0001	04-NOV-13
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	04-NOV-13
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	04-NOV-13
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	04-NOV-13
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	04-NOV-13
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	04-NOV-13
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	04-NOV-13
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	04-NOV-13
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	04-NOV-13
Vanadium (V)-Dissolved			<0.00010		mg/L		0.0001	04-NOV-13
NAPHTHENIC-ACID-FM		Water						
Batch	R2733154							
WG1781084-3	DUP	L1381091-5						
Naphthenic Acids		<1.0	<1.0	RPD-NA	mg/L	N/A	30	04-NOV-13
WG1781084-7	DUP	L1384436-2						
Naphthenic Acids		7.8	7.8		mg/L	0.0	30	04-NOV-13
WG1781084-4	LCS							
Naphthenic Acids			103.6		%		70-130	04-NOV-13
WG1781084-1	MB							
Naphthenic Acids			<1.0		mg/L		1	04-NOV-13
WG1781084-5	MB							
Naphthenic Acids			<1.0		mg/L		1	04-NOV-13
WG1781084-2	MS	L1381091-1						
Naphthenic Acids			126.0		%		50-150	04-NOV-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NAPHTHENIC-ACID-FM								
	Water							
Batch	R2733154							
WG1781084-6 MS		L1384436-1						
Naphthenic Acids			137.8		%		50-150	04-NOV-13
NH3-CFA-ED								
	Water							
Batch	R2735161							
WG1783159-3 DUP		L1388005-4						
Ammonia, Total (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	06-NOV-13
WG1783159-6 DUP		L1388104-1						
Ammonia, Total (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	06-NOV-13
WG1783159-7 DUP		L1384218-3						
Ammonia, Total (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	06-NOV-13
WG1783159-8 DUP		L1384463-3						
Ammonia, Total (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	06-NOV-13
WG1783159-9 DUP		L1385032-2						
Ammonia, Total (as N)		0.088	0.086		mg/L	1.8	20	06-NOV-13
WG1783159-2 LCS								
Ammonia, Total (as N)			104.0		%		85-115	06-NOV-13
WG1783159-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	06-NOV-13
WG1783159-10 MS		L1384482-4						
Ammonia, Total (as N)			101.8		%		75-125	06-NOV-13
WG1783159-4 MS		L1388050-5						
Ammonia, Total (as N)			97.9		%		75-125	06-NOV-13
WG1783159-5 MS		L1381091-10						
Ammonia, Total (as N)			93.5		%		75-125	06-NOV-13
Batch	R2737708							
WG1785570-6 DUP		L1386344-1						
Ammonia, Total (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	09-NOV-13
WG1785570-2 LCS								
Ammonia, Total (as N)			99.2		%		85-115	09-NOV-13
WG1785570-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	09-NOV-13
WG1785570-5 MS		L1386217-3						
Ammonia, Total (as N)			85.9		%		75-125	09-NOV-13
WG1785570-7 MS		L1386702-2						
Ammonia, Total (as N)			90.5		%		75-125	09-NOV-13
NO2-IC-ED	Water							



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO2-IC-ED		Water						
Batch	R2731159							
WG1780026-6	DUP	L1384550-2						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	31-OCT-13
WG1780026-8	DUP	L1384618-4						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	31-OCT-13
WG1780026-5	LCS							
Nitrite (as N)			100.6		%		90-110	31-OCT-13
WG1780026-4	MB							
Nitrite (as N)			<0.050		mg/L		0.05	31-OCT-13
WG1780026-7	MS	L1384550-2						
Nitrite (as N)			101.6		%		75-125	31-OCT-13
WG1780026-9	MS	L1384618-4						
Nitrite (as N)			90.2		%		75-125	31-OCT-13
NO3-IC-ED		Water						
Batch	R2731159							
WG1780026-6	DUP	L1384550-2						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	31-OCT-13
WG1780026-8	DUP	L1384618-4						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	31-OCT-13
WG1780026-5	LCS							
Nitrate (as N)			99.8		%		90-110	31-OCT-13
WG1780026-4	MB							
Nitrate (as N)			<0.050		mg/L		0.05	31-OCT-13
WG1780026-7	MS	L1384550-2						
Nitrate (as N)			92.1		%		75-125	31-OCT-13
WG1780026-9	MS	L1384618-4						
Nitrate (as N)			96.4		%		75-125	31-OCT-13
P-T-COL-ED		Water						
Batch	R2731338							
WG1779679-11	DUP	L1381513-17						
Phosphorus (P)-Total		0.134	0.119		mg/L	13	20	01-NOV-13
WG1779679-3	DUP	L1378652-15						
Phosphorus (P)-Total		<0.020	<0.020	RPD-NA	mg/L	N/A	20	01-NOV-13
WG1779679-5	DUP	L1384218-3						
Phosphorus (P)-Total		0.704	0.698		mg/L	0.9	20	01-NOV-13
WG1779679-7	DUP	L1384383-1						
Phosphorus (P)-Total		2.16	2.11		mg/L	2.6	20	01-NOV-13
WG1779679-9	DUP	L1384601-3						
Phosphorus (P)-Total		3.80	3.83		mg/L			01-NOV-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
P-T-COL-ED		Water						
Batch	R2731338							
WG1779679-9	DUP	L1384601-3						
Phosphorus (P)-Total		3.80	3.83		mg/L	0.8	20	01-NOV-13
WG1779679-2	LCS							
Phosphorus (P)-Total			95.5		%		80-120	01-NOV-13
WG1779679-1	MB							
Phosphorus (P)-Total			<0.020		mg/L		0.02	01-NOV-13
WG1779679-10	MS	L1384601-3						
Phosphorus (P)-Total			N/A	MS-B	%		-	01-NOV-13
WG1779679-4	MS	L1378652-15						
Phosphorus (P)-Total			108.2		%		70-130	01-NOV-13
WG1779679-6	MS	L1384218-3						
Phosphorus (P)-Total			N/A	MS-B	%		-	01-NOV-13
WG1779679-8	MS	L1384383-1						
Phosphorus (P)-Total			N/A	MS-B	%		-	01-NOV-13
PH/EC/ALK-ED		Water						
Batch	R2731550							
WG1779316-10	DUP	L1384550-4						
pH		8.06	8.07	J	pH	0.00	0.3	01-NOV-13
Conductivity (EC)		273	273		uS/cm	0.0	10	01-NOV-13
Bicarbonate (HCO3)		181	182		mg/L	0.6	25	01-NOV-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	01-NOV-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	01-NOV-13
Alkalinity, Total (as CaCO3)		148	149		mg/L	0.6	20	01-NOV-13
WG1779316-11	DUP	L1384466-1						
pH		7.89	7.81	J	pH	0.08	0.3	01-NOV-13
Conductivity (EC)		1380	1390		uS/cm	0.8	10	01-NOV-13
Bicarbonate (HCO3)		871	920		mg/L	5.4	25	01-NOV-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	01-NOV-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	01-NOV-13
Alkalinity, Total (as CaCO3)		714	754		mg/L	5.4	20	01-NOV-13
WG1779316-7	DUP	L1383814-10						
pH		8.11	8.14	J	pH	0.03	0.3	31-OCT-13
Conductivity (EC)		1730	1740		uS/cm	0.2	10	31-OCT-13
Bicarbonate (HCO3)		267	267		mg/L	0.1	25	31-OCT-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	31-OCT-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	31-OCT-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch	R2731550							
WG1779316-7	DUP	L1383814-10						
Alkalinity, Total (as CaCO3)		219	219		mg/L	0.1	20	31-OCT-13
WG1779316-8	DUP	L1384113-4						
pH		7.29	7.26	J	pH	0.03	0.3	31-OCT-13
Conductivity (EC)		65.0	63.6		uS/cm	2.1	10	31-OCT-13
Bicarbonate (HCO3)		26.4	25.9		mg/L	2.2	25	31-OCT-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	31-OCT-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	31-OCT-13
Alkalinity, Total (as CaCO3)		21.7	21.2		mg/L	2.2	20	31-OCT-13
WG1779316-9	DUP	L1383789-4						
pH		8.00	8.02	J	pH	0.02	0.3	31-OCT-13
Conductivity (EC)		955	948		uS/cm	0.8	10	31-OCT-13
Bicarbonate (HCO3)		424	423		mg/L	0.1	25	31-OCT-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	31-OCT-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	31-OCT-13
Alkalinity, Total (as CaCO3)		347	347		mg/L	0.1	20	31-OCT-13
WG1779316-2	LCS							
Conductivity (EC)			101.5		%		90-110	31-OCT-13
WG1779316-3	LCS							
pH			7.02		pH		6.7-7.3	31-OCT-13
WG1779316-4	LCS							
Alkalinity, Total (as CaCO3)			99.1		%		85-115	31-OCT-13
WG1779316-5	LCS							
Conductivity (EC)			99.8		%		90-110	31-OCT-13
WG1779316-1	MB							
Bicarbonate (HCO3)			<5.0		mg/L		5	31-OCT-13
Carbonate (CO3)			<5.0		mg/L		5	31-OCT-13
Hydroxide (OH)			<5.0		mg/L		5	31-OCT-13
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	31-OCT-13
PHENOLS-4AAP-ED		Water						
Batch	R2734177							
WG1782786-3	DUP	L1387367-4						
Phenols (4AAP)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	15	05-NOV-13
WG1782786-4	DUP	L1387455-2						
Phenols (4AAP)		<0.0010	0.0010	RPD-NA	mg/L	N/A	15	05-NOV-13
WG1782786-5	DUP	L1384920-11						



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PHENOLS-4AAP-ED								
	Water							
Batch	R2734177							
WG1782786-5	DUP	L1384920-11						
Phenols (4AAP)		0.0014	0.0022	J	mg/L	0.0008	0.002	05-NOV-13
WG1782786-6	LCS							
Phenols (4AAP)			88.0		%		85-115	05-NOV-13
WG1782786-2	MB							
Phenols (4AAP)			<0.0010		mg/L		0.001	05-NOV-13
SO4-IC-ED								
	Water							
Batch	R2731159							
WG1780026-6	DUP	L1384550-2						
Sulfate (SO4)		0.76	0.78		mg/L	3.6	20	31-OCT-13
WG1780026-8	DUP	L1384618-4						
Sulfate (SO4)		39.4	40.0		mg/L	1.4	20	31-OCT-13
WG1780026-5	LCS							
Sulfate (SO4)			101.3		%		90-110	31-OCT-13
WG1780026-4	MB							
Sulfate (SO4)			<0.50		mg/L		0.5	31-OCT-13
WG1780026-7	MS	L1384550-2						
Sulfate (SO4)			97.9		%		75-125	31-OCT-13
WG1780026-9	MS	L1384618-4						
Sulfate (SO4)			97.0		%		75-125	31-OCT-13
TKN-CFA-ED								
	Water							
Batch	R2735498							
WG1783428-2	LCS							
Total Kjeldahl Nitrogen			92.0		mg/L		75-125	06-NOV-13
WG1783428-3	LCS							
Total Kjeldahl Nitrogen			92.9		mg/L		75-125	06-NOV-13
WG1783428-4	LCS							
Total Kjeldahl Nitrogen			97.2		mg/L		75-125	06-NOV-13
WG1783428-1	MB							
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	06-NOV-13
Batch	R2736391							
WG1784233-6	DUP	L1388777-9						
Total Kjeldahl Nitrogen		<0.20	<0.20	RPD-NA	mg/L	N/A	20	07-NOV-13
WG1784233-2	LCS							
Total Kjeldahl Nitrogen			96.3		mg/L		75-125	07-NOV-13
WG1784233-3	LCS							
Total Kjeldahl Nitrogen			89.2		mg/L		75-125	07-NOV-13
WG1784233-4	LCS							



Quality Control Report

Workorder: L1383988

Report Date: 12-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-CFA-ED	Water							
Batch	R2736391							
WG1784233-4	LCS							
Total Kjeldahl Nitrogen			93.0		mg/L		75-125	07-NOV-13
WG1784233-1	MB							
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	07-NOV-13

Quality Control Report

Workorder: L1383988

Report Date: 12-DEC-13

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

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Contact: SUE RAYNARD

Legend:

Limit ALS Control Limit (Data Quality Objectives)
DUP Duplicate
RPD Relative Percent Difference
N/A Not Available
LCS Laboratory Control Sample
SRM Standard Reference Material
MS Matrix Spike
MSD Matrix Spike Duplicate
ADE Average Desorption Efficiency
MB Method Blank
IRM Internal Reference Material
CRM Certified Reference Material
CCV Continuing Calibration Verification
CVS Calibration Verification Standard
LCSD Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1383988

Report Date: 12-DEC-13

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2
Contact: SUE RAYNARD

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Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Anions and Nutrients							
Nitrate as N by IC							
	1	24-OCT-13	31-OCT-13 08:00	48	164	hours	EHTR
	2	24-OCT-13	31-OCT-13 08:00	48	164	hours	EHTR
	3	24-OCT-13	31-OCT-13 08:00	48	164	hours	EHTR
	4	24-OCT-13	31-OCT-13 08:00	48	164	hours	EHTR
	5	24-OCT-13	31-OCT-13 08:00	48	164	hours	EHTR
Nitrite as N by IC							
	1	24-OCT-13	31-OCT-13 08:00	48	164	hours	EHTR
	2	24-OCT-13	31-OCT-13 08:00	48	164	hours	EHTR
	3	24-OCT-13	31-OCT-13 08:00	48	164	hours	EHTR
	4	24-OCT-13	31-OCT-13 08:00	48	164	hours	EHTR
	5	24-OCT-13	31-OCT-13 08:00	48	164	hours	EHTR

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1383988 were received on 28-OCT-13 09:59.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

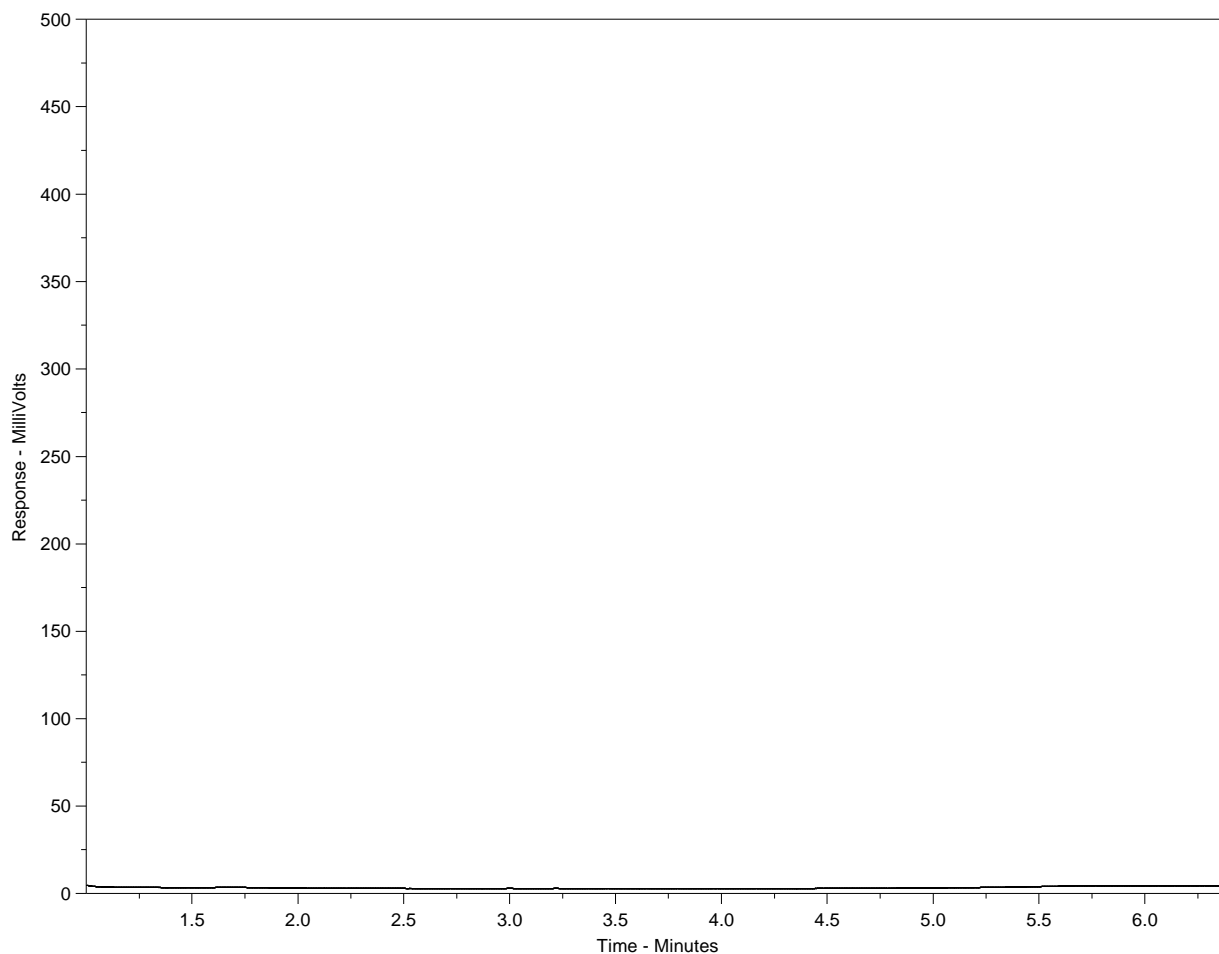
The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Hydrocarbon Distribution Report



ALS Sample ID: L1386767-1
Client ID: 16054131031020



F2		F3		F4		F4
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →				
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

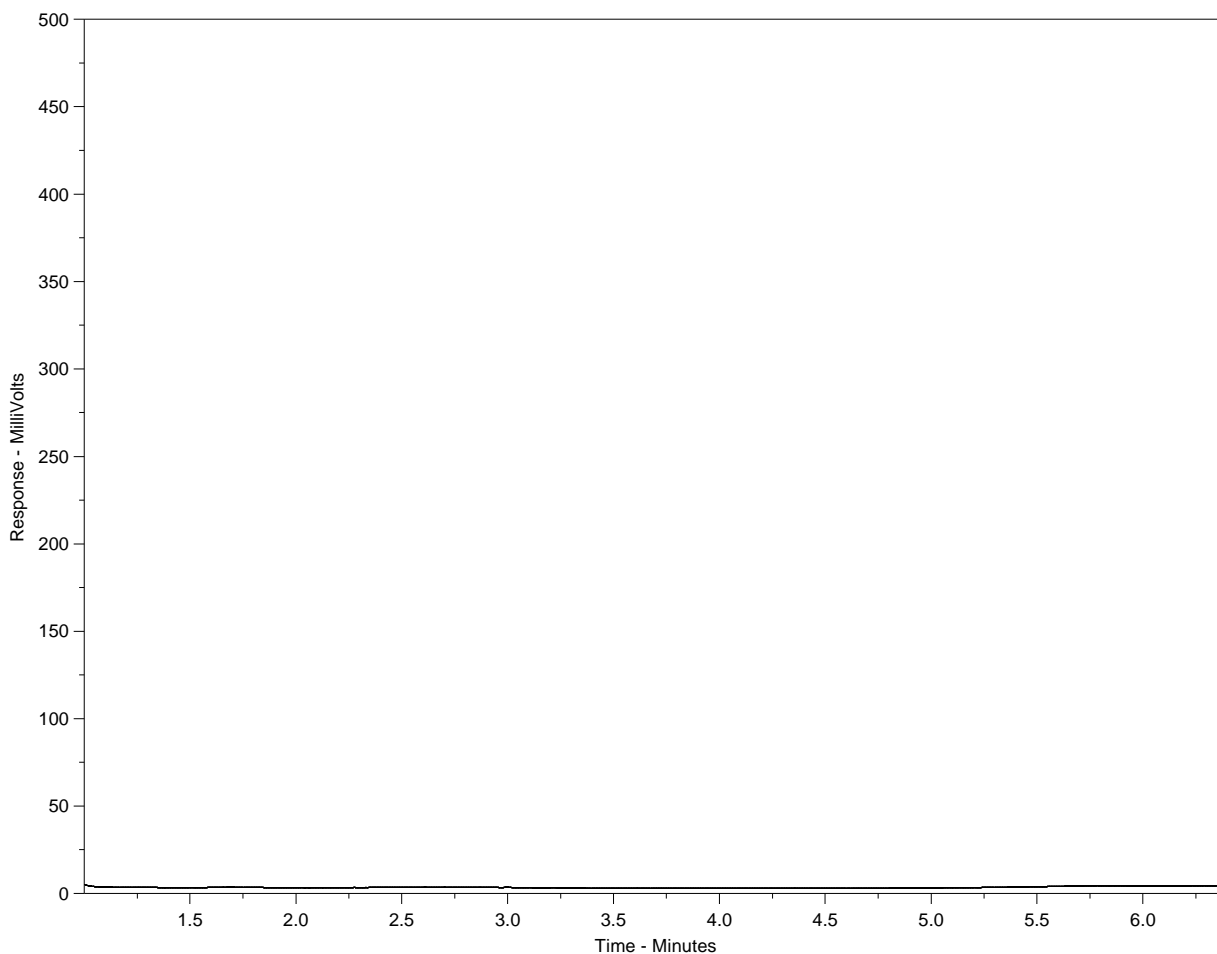
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1386767-2
Client ID: 16054131031021



← F2 →		← F3 →		← F4 →		← F4 →
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

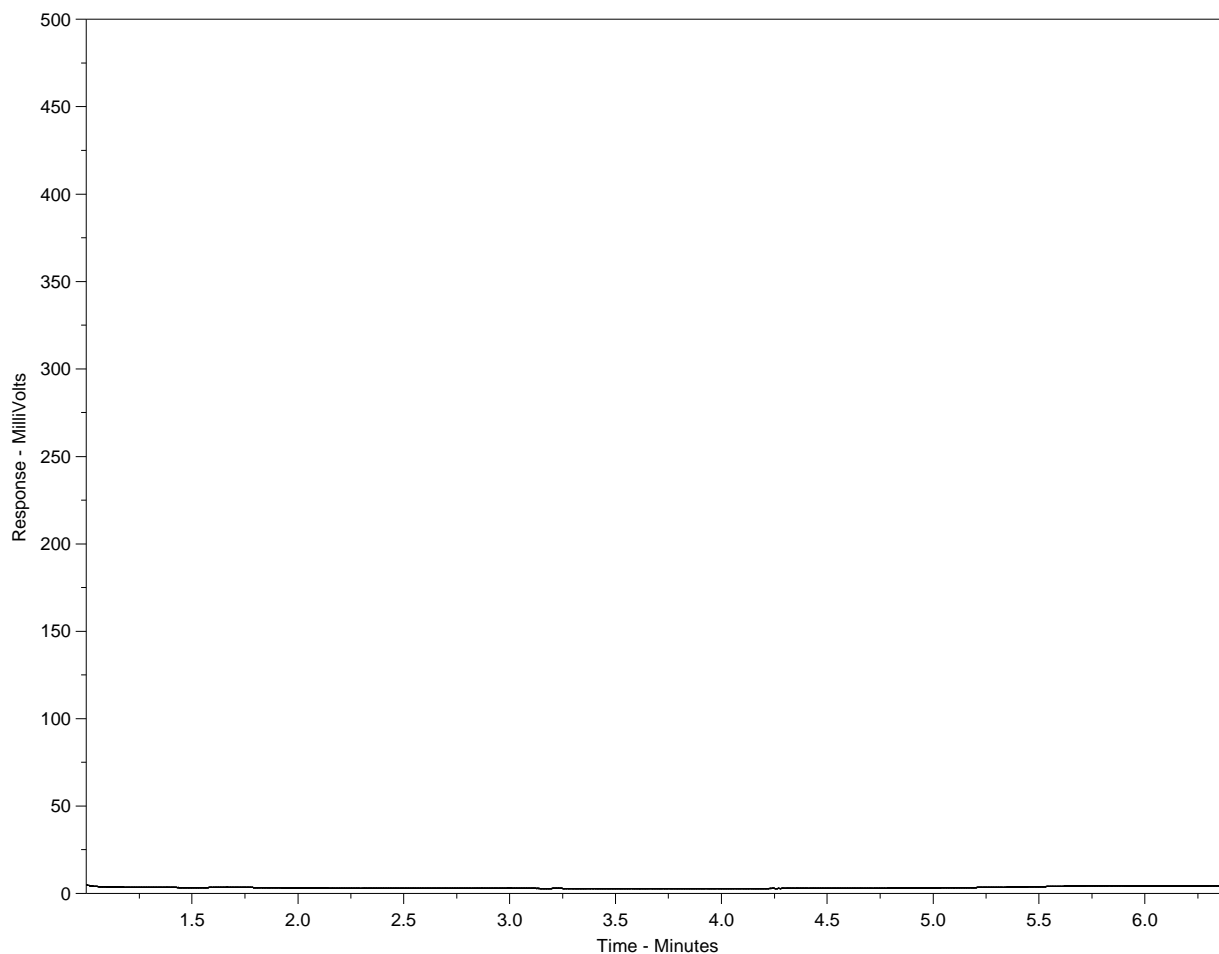
Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note:
 This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1386767-3
 Client ID: 16054131031022



← F2 →		← F3 →		← F4 →		← F4 →
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

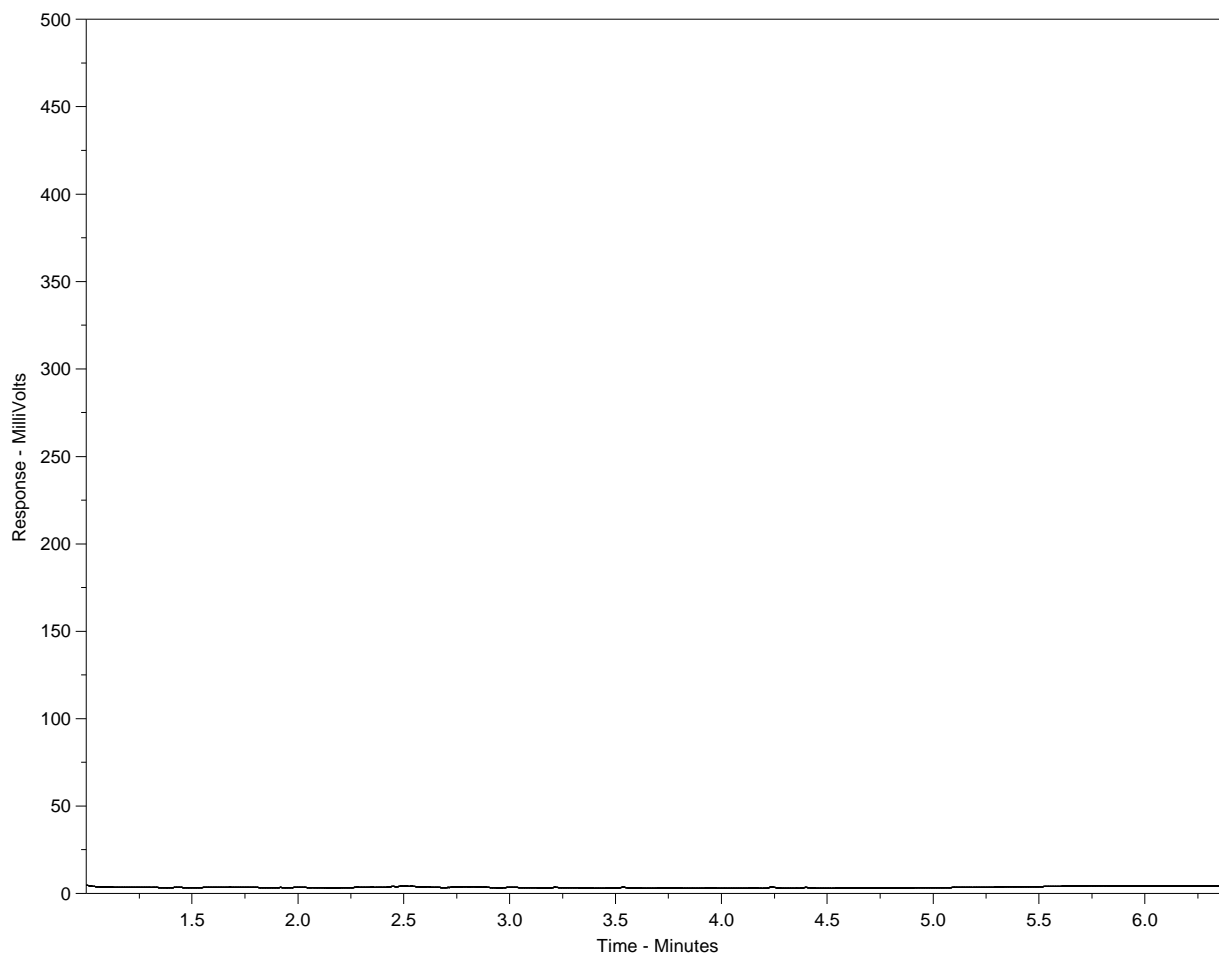
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1386767-4
Client ID: 16054131031023



← F2 →		← F3 →		← F4 →		← F4 →
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.



MATRIX SOLUTIONS INC.
ATTN: SUE RAYNARD
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Date Received: 01-NOV-13
Report Date: 17-DEC-13 13:39 (MT)
Version: FINAL REV. 3

Client Phone: 403-237-0606

Certificate of Analysis

Lab Work Order #: L1386767
Project P.O. #: NOT SUBMITTED
Job Reference: WEPA00-3 16054-502 16-04-75-05 W4M
C of C Numbers: M061029
Legal Site Desc: 16-04-75-05 W4M

Comments: 13-DEC-2013 Metals list has been revised as well as the DL for Cr
17-DEC-2013 LOR for Ag has been fixed


Catherine Evaristo-Cordero
Senior Account Manager

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ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386767-1 16054131031020									
Sampled By: GK/BP on 31-OCT-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Toluene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
EthylBenzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
o-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Styrene	<0.0010	-		0.0010	mg/L	-		04-NOV-13	R2730783
F1(C6-C10)	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
F1-BTEX	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
Xylenes	<0.00071	-		0.00071	mg/L	-		04-NOV-13	R2730783
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
Surr: 2-Bromobenzotrifluoride	101.4	-		N/A	%	-	04-NOV-13	04-NOV-13	R2734016
ICP Metals & Hg -Dissolved									
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0012	+/-0.00039		0.0010	mg/L	0		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	0.0276	+/-0.0029		0.00040	mg/L	0		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.0786	+/-0.0068		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	32.3	+/-4.4		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	0.00028	+/-0.00003		0.00010	mg/L	0		12-NOV-13	R2739197
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		12-NOV-13	R2739197
Iron (Fe)-Dissolved	0.586	+/-0.053		0.010	mg/L	0		12-NOV-13	R2739197
Lead (Pb)-Dissolved	0.00017	+/-0.00002		0.00010	mg/L	0		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	9.82	+/-0.76		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	0.111	+/-0.0076		0.0020	mg/L	0		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.0269	+/-0.0028		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	0.00158	+/-0.00014		0.00010	mg/L	0		12-NOV-13	R2739197
Potassium (K)-Dissolved	4.68	+/-0.36		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Silicon (Si)-Dissolved	14.1	+/-1.2		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	170	+/-12		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	0.354	+/-0.026		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	0.00026	+/-0.00003		0.00010	mg/L	0		12-NOV-13	R2739197
Vanadium (V)-Dissolved	0.00013	+/-0.00001		0.00010	mg/L	0		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	0.0021	+/-0.0004		0.0010	mg/L	0		12-NOV-13	R2739197
Hardness (from Dissolved Ca and Mg)									
Hardness (as CaCO3)	121	-		1.3	mg/L	-		13-NOV-13	
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		09-NOV-13	R2737347
Miscellaneous Parameters									
Ammonia, Total (as N)	1.37	-		0.050	mg/L	-		10-NOV-13	R2737984

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386767-1 16054131031020									
Sampled By: GK/BP on 31-OCT-13									
Matrix: WATER									
Boron (B)-Dissolved	0.418	+/-0.051		0.0020	mg/L	0		12-NOV-13	R2739197
Dissolved Organic Carbon	8.5	+/-1.1		1.0	mg/L	0		09-NOV-13	R2737505
Naphthenic Acids	<1.0	-		1.0	mg/L	-	08-NOV-13	08-NOV-13	R2737525
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		10-NOV-13	R2738116
Total Kjeldahl Nitrogen	1.58	+/-0.32		0.20	mg/L	0	11-NOV-13	11-NOV-13	R2738380
Phosphorus (P)-Total	0.510	+/-0.045		0.020	mg/L	0	05-NOV-13	05-NOV-13	R2734215
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Fluoranthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Fluorene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Naphthalene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Phenanthrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Pyrene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(a)pyrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Chrysene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Dibenzo(a,h)anthracene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Surr: Nitrobenzene d5	77.3	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Surr: 2-Fluorobiphenyl	75.5	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Surr: p-Terphenyl d14	91.9	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	6.69	+/-0.23		0.50	mg/L	0		04-NOV-13	R2732968
Ion Balance Calculation									
Ion Balance	97.2	-			%	-		13-NOV-13	
TDS (Calculated)	544	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	121	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	44.1	+/-1.9		0.50	mg/L	0		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	8.00	+/-0.04		0.10	pH	0		04-NOV-13	R2732970
Conductivity (EC)	923	+/-31		0.20	uS/cm	0		04-NOV-13	R2732970
Bicarbonate (HCO3)	562	-		5.0	mg/L	-		04-NOV-13	R2732970
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Alkalinity, Total (as CaCO3)	460	+/-17		2.0	mg/L	0		04-NOV-13	R2732970

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386767-2 16054131031021									
Sampled By: GK/BP on 31-OCT-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Toluene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
EthylBenzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
o-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Styrene	<0.0010	-		0.0010	mg/L	-		04-NOV-13	R2730783
F1(C6-C10)	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
F1-BTEX	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
Xylenes	<0.00071	-		0.00071	mg/L	-		04-NOV-13	R2730783
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
Surr: 2-Bromobenzotrifluoride	103.2	-		N/A	%	-	04-NOV-13	04-NOV-13	R2734016
ICP Metals & Hg -Dissolved									
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	0.0115	+/-0.0012		0.00040	mg/L	0		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.0608	+/-0.0053		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	144	+/-20		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	0.00447	+/-0.00042		0.00010	mg/L	0		12-NOV-13	R2739197
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		12-NOV-13	R2739197
Iron (Fe)-Dissolved	1.68	+/-0.15		0.010	mg/L	0		12-NOV-13	R2739197
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	37.1	+/-2.9		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	0.756	+/-0.052		0.0020	mg/L	0		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.00444	+/-0.00047		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	0.00195	+/-0.00016		0.00010	mg/L	0		12-NOV-13	R2739197
Potassium (K)-Dissolved	4.33	+/-0.33		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Silicon (Si)-Dissolved	11.2	+/-0.96		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	129	+/-9.1		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	0.624	+/-0.046		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	0.00474	+/-0.00050		0.00010	mg/L	0		12-NOV-13	R2739197
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	0.0017	+/-0.0004		0.0010	mg/L	0		12-NOV-13	R2739197
Hardness (from Dissolved Ca and Mg)									
Hardness (as CaCO3)	513	-		1.3	mg/L	-		13-NOV-13	
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		09-NOV-13	R2737347
Miscellaneous Parameters									
Ammonia, Total (as N)	1.21	-		0.050	mg/L	-		10-NOV-13	R2737984

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386767-2 16054131031021									
Sampled By: GK/BP on 31-OCT-13									
Matrix: WATER									
Boron (B)-Dissolved	0.308	+/-0.037		0.0020	mg/L	0		12-NOV-13	R2739197
Dissolved Organic Carbon	10.6	+/-1.3		1.0	mg/L	0		09-NOV-13	R2737505
Naphthenic Acids	1.4	+/-0.4		1.0	mg/L	0	08-NOV-13	08-NOV-13	R2737525
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		10-NOV-13	R2738116
Total Kjeldahl Nitrogen	1.44	+/-0.29		0.20	mg/L	0	11-NOV-13	11-NOV-13	R2738380
Phosphorus (P)-Total	0.062	+/-0.017		0.020	mg/L	0	05-NOV-13	05-NOV-13	R2734215
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Fluoranthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Fluorene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Naphthalene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Phenanthrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Pyrene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(a)pyrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Chrysene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Dibenzo(a,h)anthracene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Surr: Nitrobenzene d5	73.1	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Surr: 2-Fluorobiphenyl	77.2	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Surr: p-Terphenyl d14	80.8	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	14.3	+/-0.47		0.50	mg/L	0		04-NOV-13	R2732968
Ion Balance Calculation									
Ion Balance	96.5	-			%	-		13-NOV-13	
TDS (Calculated)	831	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	512	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	41.5	+/-1.8		0.50	mg/L	0		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	7.69	+/-0.04		0.10	pH	0		04-NOV-13	R2732970
Conductivity (EC)	1350	+/-45		0.20	uS/cm	0		04-NOV-13	R2732970
Bicarbonate (HCO3)	937	-		5.0	mg/L	-		04-NOV-13	R2732970
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Alkalinity, Total (as CaCO3)	768	+/-27		2.0	mg/L	0		04-NOV-13	R2732970

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386767-3 16054131031022									
Sampled By: GK/BP on 31-OCT-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Toluene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
EthylBenzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
o-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Styrene	<0.0010	-		0.0010	mg/L	-		04-NOV-13	R2730783
F1(C6-C10)	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
F1-BTEX	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
Xylenes	<0.00071	-		0.00071	mg/L	-		04-NOV-13	R2730783
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
Surr: 2-Bromobenzotrifluoride	97.7	-		N/A	%	-	04-NOV-13	04-NOV-13	R2734016
ICP Metals & Hg -Dissolved									
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	0.0275	+/-0.0029		0.00040	mg/L	0		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.0795	+/-0.0069		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	31.2	+/-4.2		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	0.00029	+/-0.00003		0.00010	mg/L	0		12-NOV-13	R2739197
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		12-NOV-13	R2739197
Iron (Fe)-Dissolved	0.594	+/-0.053		0.010	mg/L	0		12-NOV-13	R2739197
Lead (Pb)-Dissolved	0.00017	+/-0.00002		0.00010	mg/L	0		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	9.90	+/-0.77		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	0.111	+/-0.0076		0.0020	mg/L	0		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.0263	+/-0.0028		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	0.00155	+/-0.00013		0.00010	mg/L	0		12-NOV-13	R2739197
Potassium (K)-Dissolved	4.63	+/-0.36		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Silicon (Si)-Dissolved	14.5	+/-1.2		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	174	+/-12		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	0.349	+/-0.026		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	0.00028	+/-0.00003		0.00010	mg/L	0		12-NOV-13	R2739197
Vanadium (V)-Dissolved	0.00011	+/-0.00001		0.00010	mg/L	0		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	0.0012	+/-0.0003		0.0010	mg/L	0		12-NOV-13	R2739197
Hardness (from Dissolved Ca and Mg)									
Hardness (as CaCO3)	119	-		1.3	mg/L	-		13-NOV-13	
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		09-NOV-13	R2737347
Miscellaneous Parameters									
Ammonia, Total (as N)	1.37	-		0.050	mg/L	-		10-NOV-13	R2737984

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386767-3 16054131031022									
Sampled By: GK/BP on 31-OCT-13									
Matrix: WATER									
Boron (B)-Dissolved	0.429	+/-0.052		0.0020	mg/L	0		12-NOV-13	R2739197
Dissolved Organic Carbon	8.5	+/-1.1		1.0	mg/L	0		09-NOV-13	R2737505
Naphthenic Acids	<1.0	-		1.0	mg/L	-	08-NOV-13	08-NOV-13	R2737525
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		10-NOV-13	R2738116
Total Kjeldahl Nitrogen	1.54	+/-0.31		0.20	mg/L	0	11-NOV-13	11-NOV-13	R2738380
Phosphorus (P)-Total	0.520	+/-0.045		0.020	mg/L	0	05-NOV-13	05-NOV-13	R2734215
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Fluoranthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Fluorene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Naphthalene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Phenanthrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Pyrene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(a)pyrene	<0.0000050	-		0.000005	mg/L	-	05-NOV-13	07-NOV-13	R2736969
				0					
Chrysene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Dibenzo(a,h)anthracene	<0.0000050	-		0.000005	mg/L	-	05-NOV-13	07-NOV-13	R2736969
				0					
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Surr: Nitrobenzene d5	66.6	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Surr: 2-Fluorobiphenyl	67.1	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Surr: p-Terphenyl d14	90.3	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	6.66	+/-0.23		0.50	mg/L	0		04-NOV-13	R2732968
Ion Balance Calculation									
Ion Balance	102	-			%	-		13-NOV-13	
TDS (Calculated)	538	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	119	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	44.9	+/-1.9		0.50	mg/L	0		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	7.96	+/-0.04		0.10	pH	0		04-NOV-13	R2732970
Conductivity (EC)	925	+/-31		0.20	uS/cm	0		04-NOV-13	R2732970
Bicarbonate (HCO3)	542	-		5.0	mg/L	-		04-NOV-13	R2732970
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Alkalinity, Total (as CaCO3)	444	+/-16		2.0	mg/L	0		04-NOV-13	R2732970

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386767-4 16054131031023									
Sampled By: GK/BP on 31-OCT-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Toluene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
EthylBenzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
o-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Styrene	<0.0010	-		0.0010	mg/L	-		04-NOV-13	R2730783
F1(C6-C10)	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
F1-BTEX	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
Xylenes	<0.00071	-		0.00071	mg/L	-		04-NOV-13	R2730783
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
Surr: 2-Bromobenzotrifluoride	97.9	-		N/A	%	-	04-NOV-13	04-NOV-13	R2734016
ICP Metals & Hg -Dissolved									
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	0.00063	+/-0.00007		0.00040	mg/L	0		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.222	+/-0.019		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	157	+/-21		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Copper (Cu)-Dissolved	0.00137	+/-0.00011		0.00060	mg/L	0		12-NOV-13	R2739197
Iron (Fe)-Dissolved	0.083	+/-0.007		0.010	mg/L	0		12-NOV-13	R2739197
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	60.8	+/-4.7		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	0.0201	+/-0.0014		0.0020	mg/L	0		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.00162	+/-0.00017		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	0.00167	+/-0.00014		0.00010	mg/L	0		12-NOV-13	R2739197
Potassium (K)-Dissolved	3.56	+/-0.27		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Silicon (Si)-Dissolved	11.8	+/-1.0		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	44.2	+/-3.1		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	0.473	+/-0.035		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	0.00554	+/-0.00058		0.00010	mg/L	0		12-NOV-13	R2739197
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	0.0026	+/-0.0004		0.0010	mg/L	0		12-NOV-13	R2739197
Hardness (from Dissolved Ca and Mg)									
Hardness (as CaCO3)	642	-		1.3	mg/L	-		13-NOV-13	
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		09-NOV-13	R2737347
Miscellaneous Parameters									
Ammonia, Total (as N)	<0.050	-		0.050	mg/L	-		10-NOV-13	R2737984

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386767-4 16054131031023									
Sampled By: GK/BP on 31-OCT-13									
Matrix: WATER									
Boron (B)-Dissolved	0.0578	+/-0.0069		0.0020	mg/L	0		12-NOV-13	R2739197
Dissolved Organic Carbon	8.2	+/-1.1		1.0	mg/L	0		09-NOV-13	R2737505
Naphthenic Acids	<1.0	-		1.0	mg/L	-	08-NOV-13	08-NOV-13	R2737525
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		10-NOV-13	R2738116
Total Kjeldahl Nitrogen	0.20	+/-0.08		0.20	mg/L	0	11-NOV-13	11-NOV-13	R2738380
Phosphorus (P)-Total	0.029	+/-0.016		0.020	mg/L	0	05-NOV-13	05-NOV-13	R2734215
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Fluoranthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Fluorene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Naphthalene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Phenanthrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Pyrene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(a)pyrene	<0.0000050	-		0.000005	mg/L	-	05-NOV-13	07-NOV-13	R2736969
				0					
Chrysene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Dibenzo(a,h)anthracene	<0.0000050	-		0.000005	mg/L	-	05-NOV-13	07-NOV-13	R2736969
				0					
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Surr: Nitrobenzene d5	78.8	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Surr: 2-Fluorobiphenyl	75.8	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Surr: p-Terphenyl d14	88.5	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	117	+/-3.7		0.50	mg/L	0		04-NOV-13	R2732968
Ion Balance Calculation									
Ion Balance	96.2	-			%	-		13-NOV-13	
TDS (Calculated)	764	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	642	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	0.093	+/-0.011		0.050	mg/L	0		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	0.093	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	47.1	+/-2.0		0.50	mg/L	0		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	7.68	+/-0.04		0.10	pH	0		04-NOV-13	R2732970
Conductivity (EC)	1380	+/-46		0.20	uS/cm	0		04-NOV-13	R2732970
Bicarbonate (HCO3)	680	-		5.0	mg/L	-		04-NOV-13	R2732970
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Alkalinity, Total (as CaCO3)	557	+/-20		2.0	mg/L	0		04-NOV-13	R2732970

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386767-5 16054131031024 Sampled By: GK/BP on 31-OCT-13 Matrix: WATER									
BTEX, Styrene and F1 (C6-C10)									
Benzene	0.0901	-		0.00050	mg/L	-		04-NOV-13	R2730783
Toluene	0.0794	-		0.00050	mg/L	-		04-NOV-13	R2730783
EthylBenzene	0.0836	-		0.00050	mg/L	-		04-NOV-13	R2730783
o-Xylene	0.0888	-		0.00050	mg/L	-		04-NOV-13	R2730783
m+p-Xylene	0.172	-		0.00050	mg/L	-		04-NOV-13	R2730783
Styrene	0.0842	-		0.0010	mg/L	-		04-NOV-13	R2730783
F1(C6-C10)	0.64	-		0.10	mg/L	-		04-NOV-13	R2730783
F1-BTEX	0.13	-		0.10	mg/L	-		04-NOV-13	R2730783
Xylenes	0.261	-		0.00071	mg/L	-		04-NOV-13	R2730783
L1386767-6 16054131031025 Sampled By: GK/BP on 31-OCT-13 Matrix: WATER									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Toluene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
EthylBenzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
o-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Styrene	<0.0010	-		0.0010	mg/L	-		04-NOV-13	R2730783
F1(C6-C10)	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
F1-BTEX	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
Xylenes	<0.00071	-		0.00071	mg/L	-		04-NOV-13	R2730783
L1386767-7 16054131031026 Sampled By: GK/BP on 31-OCT-13 Matrix: WATER									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Toluene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
EthylBenzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
o-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Styrene	<0.0010	-		0.0010	mg/L	-		04-NOV-13	R2730783
F1(C6-C10)	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
F1-BTEX	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
Xylenes	<0.00071	-		0.00071	mg/L	-		04-NOV-13	R2730783
* Refer to Referenced Information for Qualifiers (if any) and Methodology.									

Reference Information

Report Comments: 13-DEC-2013 Metals list has been revised as well as the DL for Cr
17-DEC-2013 LOR for Ag has been fixed

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Phosphorus (P)-Total	MS-B	
Matrix Spike	Phosphorus (P)-Total	MS-B	
Matrix Spike	Chloride (Cl)	MS-B	
Matrix Spike	Sulfate (SO4)	MS-B	

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
B-D-L-CCMS-ED	Water	Dissolved Boron in Water by CRC ICPMS		APHA 3030 B / EPA SW-846 6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).				
BTXS,F1-ED	Water	BTEX, Styrene and F1 (C6-C10)		EPA 5021/8015&8260 GC-MS & FID
C-DIS-ORG-ED	Water	Dissolved Organic Carbon		APHA 5310 B-Instrumental
CL-IC-ED	Water	Chloride by IC		APHA 4110 B-ION CHROMATOGRAPHY
ETL-HARDNESS-DIS-ED	Water	Hardness (from Dissolved Ca and Mg)		APHA 2340 B-Calculation
F2,F3,F4-ED	Water	F2, F3, F4		EPA 3510/CCME PHC CWS-GC-FID
HG-D-L-CVAA-ED	Water	Mercury (Hg) - Dissolved		EPA 245.7 / EPA 245.1
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET-D-CCMS-ED	Water	Dissolved Metals in Water by CRC ICPMS		APHA 3030 B&E / EPA SW-846 6020A
NAPHTHENIC-ACID-FM	Water	Naphthenic Acids by FTIR		Naphthenic Acids by FTIR,Syncrude,1994
Dissolved naphthenic acids are solvent extracted from acidified aqueous samples using Dichloromethane prior to quantitation by Fourier Transform Infra-Red spectroscopy. Note that FTIR is not uniquely selective to naphthenic acids. If present, other carboxylic acids (e.g. humic acids, fulvic acids) may also be detected by this method.				
NH3-CFA-ED	Water	Ammonia in Water by Colour		APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.				
NO2+NO3-CALC-ED	Water	Nitrate+Nitrite		CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
P-T-COL-ED	Water	Total P in Water by Colour		APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.				
PAH-ABT1-ED	Water	PAH & Carcinogenic PAH List		EPA 3510/8270-GC/MS
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)				
PHENOLS-4AAP-ED	Water	Phenols (4AAP)		AB ENV.06537-COLORIMETRIC
This analysis is carried out using procedures adapted from ENVIRODAT VMV 06537 689, Method Code 154, in "Methods Manual for Chemical Analysis of Water and Wastes" published by the Alberta Environmental Centre. This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide and 4-aminoantipyrine to form a red complex which is measured at 505 nm.				
SO4-IC-ED	Water	Sulfate by IC		APHA 4110 B-ION CHROMATOGRAPHY
TKN-CFA-ED	Water	TKN in Water by Colour		APHA 4500-NORG (TKN)

This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 celcius with analysis using an automated colourimetric finish.

** The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
methods may incorporate modifications from the specified reference to improve performance.				

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
FM	ALS ENVIRONMENTAL - FORT MCMURRAY, ALBERTA, CANADA

Chain of Custody Numbers:

M061029

GLOSSARY OF REPORT TERMS

Surr - Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

MU: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.

Bias: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent.

Zero values indicate no detectable method bias.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Environmental

Quality Control Report

Workorder: L1386767

Report Date: 17-DEC-13

Page 1 of 17

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-D-L-CCMS-ED		Water						
Batch	R2739197							
WG1786584-2	CRM	ED-HIGH-WATRM						
Boron (B)-Dissolved			95.2		%		80-120	12-NOV-13
WG1786584-3	DUP	L1386451-6						
Boron (B)-Dissolved		0.0114	0.0109		mg/L	4.4	20	12-NOV-13
WG1786584-4	DUP	L1386771-2						
Boron (B)-Dissolved		0.240	0.250		mg/L	4.0	20	12-NOV-13
WG1786584-5	DUP	L1387739-7						
Boron (B)-Dissolved		0.0143	0.0141		mg/L	0.9	20	12-NOV-13
WG1786584-6	DUP	L1387752-5						
Boron (B)-Dissolved		0.0879	0.0878		mg/L	0.1	20	12-NOV-13
WG1786584-1	MB							
Boron (B)-Dissolved			<0.0020		mg/L		0.002	12-NOV-13
BTXS,F1-ED		Water						
Batch	R2730783							
WG1781329-4	DUP	L1386772-4						
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-NOV-13
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-NOV-13
EthylBenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-NOV-13
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	04-NOV-13
m+p-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	04-NOV-13
Styrene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	50	04-NOV-13
F1(C6-C10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	04-NOV-13
WG1781329-2	LCS							
Benzene			100.6		%		70-130	03-NOV-13
Toluene			91.5		%		70-130	03-NOV-13
EthylBenzene			99.1		%		70-130	03-NOV-13
o-Xylene			106.3		%		70-130	03-NOV-13
m+p-Xylene			97.9		%		70-130	03-NOV-13
Styrene			100.4		%		70-130	03-NOV-13
WG1781329-3	LCS							
F1(C6-C10)			85.6		%		70-130	03-NOV-13
WG1781329-1	MB							
Benzene			<0.00050		mg/L		0.0005	03-NOV-13
Toluene			<0.00050		mg/L		0.0005	03-NOV-13
EthylBenzene			<0.00050		mg/L		0.0005	03-NOV-13
o-Xylene			<0.00050		mg/L		0.0005	03-NOV-13



Quality Control Report

Workorder: L1386767

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTXS,F1-ED								
	Water							
Batch	R2730783							
WG1781329-1	MB							
m+p-Xylene			<0.00050		mg/L		0.0005	03-NOV-13
Styrene			<0.0010		mg/L		0.001	03-NOV-13
F1(C6-C10)			<0.10		mg/L		0.1	03-NOV-13
WG1781329-5	MS	L1386772-4						
Benzene			97.4		%		50-150	04-NOV-13
Toluene			90.5		%		50-150	04-NOV-13
EthylBenzene			98.2		%		50-150	04-NOV-13
o-Xylene			106.3		%		50-150	04-NOV-13
m+p-Xylene			96.6		%		50-150	04-NOV-13
Styrene			97.9		%		50-150	04-NOV-13
WG1781329-6	MS	L1386772-4						
F1(C6-C10)			79.6		%		50-150	04-NOV-13
C-DIS-ORG-ED								
	Water							
Batch	R2737505							
WG1785307-3	CVS							
Dissolved Organic Carbon			109.8		%		80-160	08-NOV-13
WG1785307-6	DUP	L1386731-3						
Dissolved Organic Carbon		4.2	3.9		mg/L	6.7	20	09-NOV-13
WG1785307-8	DUP	L1386767-4						
Dissolved Organic Carbon		8.2	8.1		mg/L	1.2	20	09-NOV-13
WG1785307-2	LCS							
Dissolved Organic Carbon			95.2		%		80-120	08-NOV-13
WG1785307-1	MB							
Dissolved Organic Carbon			<1.0		mg/L		1	08-NOV-13
WG1785307-7	MS	L1386731-3						
Dissolved Organic Carbon			84.7		%		70-130	09-NOV-13
WG1785307-9	MS	L1386767-4						
Dissolved Organic Carbon			85.3		%		70-130	09-NOV-13
CL-IC-ED								
	Water							
Batch	R2732968							
WG1781728-3	DUP	L1386772-4						
Chloride (Cl)		0.96	0.94		mg/L	2.5	20	04-NOV-13
WG1781728-5	DUP	L1386805-1						
Chloride (Cl)		35.8	35.9		mg/L	0.3	20	04-NOV-13
WG1781728-7	DUP	L1387059-2						
Chloride (Cl)		450	447		mg/L	0.6	20	04-NOV-13



Quality Control Report

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-IC-ED		Water						
Batch	R2732968							
WG1781728-2	LCS							
Chloride (Cl)			105.1		%		90-110	04-NOV-13
WG1781728-1	MB							
Chloride (Cl)			<0.50		mg/L		0.5	04-NOV-13
WG1781728-4	MS	L1386772-4						
Chloride (Cl)			99.6		%		75-125	04-NOV-13
WG1781728-6	MS	L1386805-1						
Chloride (Cl)			98.1		%		75-125	04-NOV-13
WG1781728-8	MS	L1387059-2						
Chloride (Cl)			N/A	MS-B	%		-	04-NOV-13
F2,F3,F4-ED		Water						
Batch	R2734016							
WG1781653-5	LCS							
F2 (>C10-C16)			93.1		%		65-135	04-NOV-13
F3 (C16-C34)			98.8		%		65-135	04-NOV-13
F4 (C34-C50)			92.8		%		65-135	04-NOV-13
WG1781653-8	LCS							
F2 (>C10-C16)			95.8		%		65-135	04-NOV-13
F3 (C16-C34)			95.8		%		65-135	04-NOV-13
F4 (C34-C50)			92.0		%		65-135	04-NOV-13
WG1781653-4	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	04-NOV-13
F3 (C16-C34)			<0.25		mg/L		0.25	04-NOV-13
F4 (C34-C50)			<0.25		mg/L		0.25	04-NOV-13
Surrogate: 2-Bromobenzotrifluoride			93.4		%		50-150	04-NOV-13
WG1781653-7	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	04-NOV-13
F3 (C16-C34)			<0.25		mg/L		0.25	04-NOV-13
F4 (C34-C50)			<0.25		mg/L		0.25	04-NOV-13
Surrogate: 2-Bromobenzotrifluoride			92.8		%		50-150	04-NOV-13
WG1781653-9	MS	L1386772-1						
F2 (>C10-C16)			93.6		%		50-150	04-NOV-13
F3 (C16-C34)			96.1		%		50-150	04-NOV-13
F4 (C34-C50)			93.5		%		50-150	04-NOV-13
HG-D-L-CVAA-ED		Water						



Quality Control Report

Workorder: L1386767

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-D-L-CVAA-ED		Water						
Batch	R2737347							
WG1784962-4	DUP	L1386731-1						
Mercury (Hg)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	08-NOV-13
WG1784962-8	DUP	L1386451-12						
Mercury (Hg)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	09-NOV-13
WG1784962-2	LCS							
Mercury (Hg)-Dissolved			97.7		%		80-120	08-NOV-13
WG1784962-3	LCSD	WG1784962-2						
Mercury (Hg)-Dissolved		97.7	97.0		%	0.7	20	08-NOV-13
WG1784962-1	MB							
Mercury (Hg)-Dissolved			<0.000020		mg/L		0.00002	08-NOV-13
WG1784962-5	MS	L1386731-1						
Mercury (Hg)-Dissolved			98.3		%		70-130	08-NOV-13
WG1784962-9	MS	L1386451-12						
Mercury (Hg)-Dissolved			70.4		%		70-130	09-NOV-13
MET-D-CCMS-ED		Water						
Batch	R2739197							
WG1786584-2	CRM	ED-HIGH-WATRM						
Aluminum (Al)-Dissolved			101.1		%		80-120	12-NOV-13
Antimony (Sb)-Dissolved			101.4		%		80-120	12-NOV-13
Arsenic (As)-Dissolved			103.6		%		80-120	12-NOV-13
Barium (Ba)-Dissolved			105.6		%		80-120	12-NOV-13
Beryllium (Be)-Dissolved			96.3		%		80-120	12-NOV-13
Bismuth (Bi)-Dissolved			98.4		%		80-120	12-NOV-13
Cadmium (Cd)-Dissolved			102.7		%		80-120	12-NOV-13
Calcium (Ca)-Dissolved			99.6		%		80-120	12-NOV-13
Chromium (Cr)-Dissolved			96.0		%		80-120	12-NOV-13
Cobalt (Co)-Dissolved			96.8		%		80-120	12-NOV-13
Copper (Cu)-Dissolved			96.4		%		80-120	12-NOV-13
Lead (Pb)-Dissolved			98.4		%		80-120	12-NOV-13
Magnesium (Mg)-Dissolved			96.9		%		80-120	12-NOV-13
Manganese (Mn)-Dissolved			97.8		%		80-120	12-NOV-13
Molybdenum (Mo)-Dissolved			95.3		%		80-120	12-NOV-13
Nickel (Ni)-Dissolved			97.9		%		80-120	12-NOV-13
Potassium (K)-Dissolved			97.7		%		80-120	12-NOV-13
Selenium (Se)-Dissolved			104.7		%		80-120	12-NOV-13
Silicon (Si)-Dissolved			109.0		%		80-120	12-NOV-13



Quality Control Report

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED		Water						
Batch	R2739197							
WG1786584-2 CRM	ED-HIGH-WATRM							
Silver (Ag)-Dissolved			98.8		%		80-120	12-NOV-13
Sodium (Na)-Dissolved			100.3		%		80-120	12-NOV-13
Strontium (Sr)-Dissolved			101.4		%		80-120	12-NOV-13
Thallium (Tl)-Dissolved			97.9		%		80-120	12-NOV-13
Titanium (Ti)-Dissolved			98.5		%		80-120	12-NOV-13
Tin (Sn)-Dissolved			97.3		%		80-120	12-NOV-13
Uranium (U)-Dissolved			98.4		%		80-120	12-NOV-13
Vanadium (V)-Dissolved			98.3		%		80-120	12-NOV-13
Zinc (Zn)-Dissolved			99.4		%		80-120	12-NOV-13
WG1786584-3 DUP	L1386451-6							
Aluminum (Al)-Dissolved		0.0065	0.0050	J	mg/L	0.0014	0.002	12-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Arsenic (As)-Dissolved		0.00047	0.00047		mg/L	0.0	20	12-NOV-13
Barium (Ba)-Dissolved		0.0147	0.0148		mg/L	0.1	20	12-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cadmium (Cd)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Calcium (Ca)-Dissolved		25.0	23.8		mg/L	5.2	20	12-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Copper (Cu)-Dissolved		<0.00060	<0.00060	RPD-NA	mg/L	N/A	20	12-NOV-13
Iron (Fe)-Dissolved		0.523	0.529		mg/L	1.1	20	12-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Magnesium (Mg)-Dissolved		7.92	7.70		mg/L	2.8	20	12-NOV-13
Manganese (Mn)-Dissolved		0.0541	0.0528		mg/L	2.4	20	12-NOV-13
Molybdenum (Mo)-Dissolved		0.00012	0.00011		mg/L	3.1	20	12-NOV-13
Nickel (Ni)-Dissolved		0.00030	0.00035		mg/L	15	20	12-NOV-13
Potassium (K)-Dissolved		<0.50	<0.50	RPD-NA	mg/L	N/A	20	12-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Silicon (Si)-Dissolved		4.65	4.65		mg/L	0.1	20	12-NOV-13
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	12-NOV-13
Sodium (Na)-Dissolved		3.9	3.8		mg/L	2.1	20	12-NOV-13
Strontium (Sr)-Dissolved		0.0528	0.0517		mg/L	2.2	20	12-NOV-13



Quality Control Report

Workorder: L1386767

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2739197							
WG1786584-3	DUP	L1386451-6						
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	12-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	12-NOV-13
Uranium (U)-Dissolved		0.000029	0.000029		mg/L	0.9	20	12-NOV-13
Vanadium (V)-Dissolved		0.00010	0.00012		mg/L	18	20	12-NOV-13
WG1786584-4	DUP	L1386771-2						
Aluminum (Al)-Dissolved		<0.0010	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Arsenic (As)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Barium (Ba)-Dissolved		0.102	0.0982		mg/L	3.9	20	12-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cadmium (Cd)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Calcium (Ca)-Dissolved		81.1	81.1		mg/L	0.0	20	12-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Copper (Cu)-Dissolved		<0.00060	<0.0010	RPD-NA	mg/L	N/A	20	12-NOV-13
Iron (Fe)-Dissolved		1.61	1.64		mg/L	1.5	20	12-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Magnesium (Mg)-Dissolved		23.9	24.4		mg/L	1.9	20	12-NOV-13
Manganese (Mn)-Dissolved		0.0548	0.0549		mg/L	0.3	20	12-NOV-13
Molybdenum (Mo)-Dissolved		0.00111	0.00109		mg/L	1.6	20	12-NOV-13
Nickel (Ni)-Dissolved		<0.00010	<0.0020	RPD-NA	mg/L	N/A	20	12-NOV-13
Potassium (K)-Dissolved		5.27	5.30		mg/L	0.4	20	12-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Silicon (Si)-Dissolved		12.5	12.4		mg/L	0.8	20	12-NOV-13
Silver (Ag)-Dissolved		<0.000010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Sodium (Na)-Dissolved		55.1	55.7		mg/L	1.1	20	12-NOV-13
Strontium (Sr)-Dissolved		0.666	0.666		mg/L	0.1	20	12-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	12-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Uranium (U)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13



Quality Control Report

Workorder: L1386767

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2739197							
WG1786584-4	DUP	L1386771-2						
Vanadium (V)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Zinc (Zn)-Dissolved		<0.0010	<0.0030	RPD-NA	mg/L	N/A	20	12-NOV-13
WG1786584-5	DUP	L1387739-7						
Aluminum (Al)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Arsenic (As)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Barium (Ba)-Dissolved		0.137	0.139		mg/L	1.7	20	12-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cadmium (Cd)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Calcium (Ca)-Dissolved		125	124		mg/L	0.1	20	12-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Copper (Cu)-Dissolved		<0.00060	<0.00060	RPD-NA	mg/L	N/A	20	12-NOV-13
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	12-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Magnesium (Mg)-Dissolved		27.7	27.7		mg/L	0.1	20	12-NOV-13
Manganese (Mn)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Molybdenum (Mo)-Dissolved		0.00093	0.00095		mg/L	1.7	20	12-NOV-13
Nickel (Ni)-Dissolved		0.00116	0.00114		mg/L	1.9	20	12-NOV-13
Potassium (K)-Dissolved		1.73	1.73		mg/L	0.1	20	12-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Silicon (Si)-Dissolved		4.41	4.41		mg/L	0.1	20	12-NOV-13
Silver (Ag)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Sodium (Na)-Dissolved		11.1	11.1		mg/L	0.2	20	12-NOV-13
Strontium (Sr)-Dissolved		0.412	0.425		mg/L	3.1	20	12-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	12-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	12-NOV-13
Uranium (U)-Dissolved		0.00257	0.00255		mg/L	1.0	20	12-NOV-13
Vanadium (V)-Dissolved		0.00015	0.00016		mg/L	2.8	20	12-NOV-13
Zinc (Zn)-Dissolved		0.0034	0.0017	J	mg/L	0.0017	0.002	12-NOV-13
WG1786584-6	DUP	L1387752-5						



Quality Control Report

Workorder: L1386767

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2739197							
WG1786584-6	DUP	L1387752-5						
Aluminum (Al)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Arsenic (As)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Barium (Ba)-Dissolved		0.185	0.180		mg/L	2.3	20	12-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cadmium (Cd)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Calcium (Ca)-Dissolved		133	133		mg/L	0.1	20	12-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Cobalt (Co)-Dissolved		0.00047	0.00043		mg/L	8.0	20	12-NOV-13
Copper (Cu)-Dissolved		0.00123	0.00122		mg/L	0.5	20	12-NOV-13
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	12-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Magnesium (Mg)-Dissolved		38.8	38.3		mg/L	1.3	20	12-NOV-13
Manganese (Mn)-Dissolved		0.155	0.155		mg/L	0.2	20	12-NOV-13
Molybdenum (Mo)-Dissolved		0.00035	0.00036		mg/L	3.9	20	12-NOV-13
Nickel (Ni)-Dissolved		0.00270	0.00264		mg/L	2.3	20	12-NOV-13
Potassium (K)-Dissolved		1.95	1.94		mg/L	0.8	20	12-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Silicon (Si)-Dissolved		9.81	10.0		mg/L	1.9	20	12-NOV-13
Silver (Ag)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Sodium (Na)-Dissolved		41.5	40.1		mg/L	3.4	20	12-NOV-13
Strontium (Sr)-Dissolved		0.773	0.787		mg/L	1.8	20	12-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	12-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	12-NOV-13
Uranium (U)-Dissolved		0.0133	0.0133		mg/L	0.3	20	12-NOV-13
Vanadium (V)-Dissolved		0.00012	0.00012		mg/L	4.5	20	12-NOV-13
Zinc (Zn)-Dissolved		0.0063	0.0060		mg/L	5.4	20	12-NOV-13
WG1786584-1	MB							
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	12-NOV-13
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2739197							
WG1786584-1	MB							
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	12-NOV-13
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	12-NOV-13
Calcium (Ca)-Dissolved			<0.020		mg/L		0.02	12-NOV-13
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Copper (Cu)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	12-NOV-13
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	12-NOV-13
Manganese (Mn)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Nickel (Ni)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Potassium (K)-Dissolved			<0.050		mg/L		0.05	12-NOV-13
Selenium (Se)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	12-NOV-13
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	12-NOV-13
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	12-NOV-13
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	12-NOV-13
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	12-NOV-13
Vanadium (V)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	12-NOV-13
NAPHTHENIC-ACID-FM								
	Water							
Batch	R2737525							
WG1784551-3	DUP	L1385544-2						
Naphthenic Acids		31.7	31.9		mg/L	0.6	30	08-NOV-13
WG1784551-4	LCS							
Naphthenic Acids			99.8		%		70-130	08-NOV-13
WG1784551-1	MB							
Naphthenic Acids			<1.0		mg/L		1	08-NOV-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
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Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NAPHTHENIC-ACID-FM								
Water								
Batch	R2737525							
WG1784551-2	MS	L1385544-1						
Naphthenic Acids			133.4		%		50-150	08-NOV-13
NH3-CFA-ED								
Water								
Batch	R2737984							
WG1785936-4	DUP	L1386548-2						
Ammonia, Total (as N)		0.053	0.051		mg/L	4.6	20	10-NOV-13
WG1785936-5	DUP	L1386573-2						
Ammonia, Total (as N)		0.074	0.060	J	mg/L	0.014	0.1	10-NOV-13
WG1785936-2	LCS							
Ammonia, Total (as N)			104.8		%		85-115	10-NOV-13
WG1785936-1	MB							
Ammonia, Total (as N)			<0.050		mg/L		0.05	10-NOV-13
WG1785936-3	MS	L1386451-12						
Ammonia, Total (as N)			112.3		%		75-125	10-NOV-13
NO2-IC-ED								
Water								
Batch	R2732968							
WG1781728-3	DUP	L1386772-4						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-5	DUP	L1386805-1						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-7	DUP	L1387059-2						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-2	LCS							
Nitrite (as N)			90.9		%		90-110	04-NOV-13
WG1781728-1	MB							
Nitrite (as N)			<0.050		mg/L		0.05	04-NOV-13
WG1781728-4	MS	L1386772-4						
Nitrite (as N)			84.6		%		75-125	04-NOV-13
WG1781728-6	MS	L1386805-1						
Nitrite (as N)			85.5		%		75-125	04-NOV-13
WG1781728-8	MS	L1387059-2						
Nitrite (as N)			78.4		%		75-125	04-NOV-13
NO3-IC-ED								
Water								
Batch	R2732968							
WG1781728-3	DUP	L1386772-4						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-5	DUP	L1386805-1						



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-IC-ED		Water						
Batch	R2732968							
WG1781728-5	DUP	L1386805-1						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-7	DUP	L1387059-2						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-2	LCS							
Nitrate (as N)			102.7		%		90-110	04-NOV-13
WG1781728-1	MB							
Nitrate (as N)			<0.050		mg/L		0.05	04-NOV-13
WG1781728-4	MS	L1386772-4						
Nitrate (as N)			93.6		%		75-125	04-NOV-13
WG1781728-6	MS	L1386805-1						
Nitrate (as N)			98.9		%		75-125	04-NOV-13
WG1781728-8	MS	L1387059-2						
Nitrate (as N)			97.2		%		75-125	04-NOV-13
P-T-COL-ED		Water						
Batch	R2734215							
WG1782357-11	DUP	L1387367-4						
Phosphorus (P)-Total		<0.020	<0.020	RPD-NA	mg/L	N/A	20	05-NOV-13
WG1782357-12	DUP	L1387455-1						
Phosphorus (P)-Total		0.103	0.093		mg/L	9.4	20	05-NOV-13
WG1782357-3	DUP	L1386217-3						
Phosphorus (P)-Total		0.469	0.502		mg/L	6.8	20	05-NOV-13
WG1782357-5	DUP	L1386451-1						
Phosphorus (P)-Total		0.023	0.031	J	mg/L	0.008	0.04	05-NOV-13
WG1782357-7	DUP	L1386767-1						
Phosphorus (P)-Total		0.510	0.543		mg/L	6.2	20	05-NOV-13
WG1782357-9	DUP	L1386771-5						
Phosphorus (P)-Total		0.033	0.036		mg/L	9.1	20	05-NOV-13
WG1782357-2	LCS							
Phosphorus (P)-Total			100.9		%		80-120	05-NOV-13
WG1782357-1	MB							
Phosphorus (P)-Total			<0.020		mg/L		0.02	05-NOV-13
WG1782357-10	MS	L1386771-5						
Phosphorus (P)-Total			103.3		%		70-130	05-NOV-13
WG1782357-4	MS	L1386217-3						
Phosphorus (P)-Total			N/A	MS-B	%		-	05-NOV-13
WG1782357-6	MS	L1386451-1						
Phosphorus (P)-Total			105.6		%		70-130	05-NOV-13



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
P-T-COL-ED								
	Water							
Batch	R2734215							
WG1782357-8 MS		L1386767-1						
Phosphorus (P)-Total			N/A	MS-B	%		-	05-NOV-13
PAH-ABT1-ED								
	Water							
Batch	R2736969							
WG1782649-3 LCS								
Acenaphthene			83.2		%		60-130	07-NOV-13
Acenaphthylene			87.9		%		60-130	07-NOV-13
Anthracene			88.1		%		60-130	07-NOV-13
Fluoranthene			89.2		%		60-130	07-NOV-13
Fluorene			85.9		%		60-130	07-NOV-13
Naphthalene			78.7		%		50-130	07-NOV-13
Phenanthrene			87.1		%		60-130	07-NOV-13
Pyrene			89.7		%		60-130	07-NOV-13
Benzo(a)anthracene			92.4		%		60-130	07-NOV-13
Benzo(k)fluoranthene			88.2		%		60-130	07-NOV-13
Benzo(b&j)fluoranthene			95.9		%		60-130	07-NOV-13
Benzo(g,h,i)perylene			97.5		%		60-130	07-NOV-13
Benzo(a)pyrene			95.5		%		60-130	07-NOV-13
Chrysene			88.7		%		60-130	07-NOV-13
Dibenzo(a,h)anthracene			100.8		%		60-130	07-NOV-13
Indeno(1,2,3-cd)pyrene			96.8		%		60-130	07-NOV-13
WG1782649-2 MB								
Acenaphthene			<0.000020		mg/L		0.00002	07-NOV-13
Acenaphthylene			<0.000020		mg/L		0.00002	07-NOV-13
Anthracene			<0.000010		mg/L		0.00001	07-NOV-13
Fluoranthene			<0.000020		mg/L		0.00002	07-NOV-13
Fluorene			<0.000020		mg/L		0.00002	07-NOV-13
Naphthalene			<0.000050		mg/L		0.00005	07-NOV-13
Phenanthrene			<0.000050		mg/L		0.00005	07-NOV-13
Pyrene			<0.000020		mg/L		0.00002	07-NOV-13
Benzo(a)anthracene			<0.000010		mg/L		0.00001	07-NOV-13
Benzo(k)fluoranthene			<0.000010		mg/L		0.00001	07-NOV-13
Benzo(b&j)fluoranthene			<0.000010		mg/L		0.00001	07-NOV-13
Benzo(g,h,i)perylene			<0.000020		mg/L		0.00002	07-NOV-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ABT1-ED		Water						
Batch R2736969								
WG1782649-2 MB								
Benzo(a)pyrene			<0.0000050		mg/L		0.000005	07-NOV-13
Chrysene			<0.000020		mg/L		0.00002	07-NOV-13
Dibenzo(a,h)anthracene			<0.0000050		mg/L		0.000005	07-NOV-13
Indeno(1,2,3-cd)pyrene			<0.000010		mg/L		0.00001	07-NOV-13
Surrogate: Nitrobenzene d5			78.0		%		40-130	07-NOV-13
Surrogate: 2-Fluorobiphenyl			73.9		%		40-130	07-NOV-13
Surrogate: p-Terphenyl d14			91.2		%		40-130	07-NOV-13
PH/EC/ALK-ED		Water						
Batch R2732970								
WG1781579-7 DUP		L1386772-2						
pH		7.36	7.37	J	pH	0.00	0.3	04-NOV-13
Conductivity (EC)		1010	1010		uS/cm	0.2	10	04-NOV-13
Bicarbonate (HCO3)		726	723		mg/L	0.4	25	04-NOV-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	04-NOV-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	04-NOV-13
Alkalinity, Total (as CaCO3)		595	593		mg/L	0.4	20	04-NOV-13
WG1781579-9 DUP		L1387059-2						
pH		7.99	7.98	J	pH	0.01	0.3	04-NOV-13
Conductivity (EC)		2270	2280		uS/cm	0.5	10	04-NOV-13
Bicarbonate (HCO3)		356	354		mg/L	0.4	25	04-NOV-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	04-NOV-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	04-NOV-13
Alkalinity, Total (as CaCO3)		291	290		mg/L	0.4	20	04-NOV-13
WG1781579-2 LCS								
Conductivity (EC)			103.5		%		90-110	04-NOV-13
WG1781579-3 LCS								
pH			7.01		pH		6.7-7.3	04-NOV-13
WG1781579-4 LCS								
Alkalinity, Total (as CaCO3)			100.2		%		85-115	04-NOV-13
WG1781579-5 LCS								
Conductivity (EC)			101.2		%		90-110	04-NOV-13
WG1781579-1 MB								
Bicarbonate (HCO3)			<5.0		mg/L		5	04-NOV-13
Carbonate (CO3)			<5.0		mg/L		5	04-NOV-13
Hydroxide (OH)			<5.0		mg/L		5	04-NOV-13



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch	R2732970							
WG1781579-1	MB							
Hydroxide (OH)			<5.0		mg/L		5	04-NOV-13
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	04-NOV-13
PHENOLS-4AAP-ED		Water						
Batch	R2738116							
WG1786079-4	DUP	L1383649-9						
Phenols (4AAP)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	15	10-NOV-13
WG1786079-3	LCS							
Phenols (4AAP)			92.0		%		85-115	10-NOV-13
WG1786079-2	MB							
Phenols (4AAP)			<0.0010		mg/L		0.001	10-NOV-13
WG1786079-5	MS	L1386451-10						
Phenols (4AAP)			94.0		%		75-125	10-NOV-13
SO4-IC-ED		Water						
Batch	R2732968							
WG1781728-3	DUP	L1386772-4						
Sulfate (SO4)		1.13	1.05		mg/L	7.0	20	04-NOV-13
WG1781728-5	DUP	L1386805-1						
Sulfate (SO4)		22.9	22.8		mg/L	0.0	20	04-NOV-13
WG1781728-7	DUP	L1387059-2						
Sulfate (SO4)		166	165		mg/L	0.8	20	04-NOV-13
WG1781728-2	LCS							
Sulfate (SO4)			104.8		%		90-110	04-NOV-13
WG1781728-1	MB							
Sulfate (SO4)			<0.50		mg/L		0.5	04-NOV-13
WG1781728-4	MS	L1386772-4						
Sulfate (SO4)			99.0		%		75-125	04-NOV-13
WG1781728-6	MS	L1386805-1						
Sulfate (SO4)			97.7		%		75-125	04-NOV-13
WG1781728-8	MS	L1387059-2						
Sulfate (SO4)			N/A	MS-B	%		-	04-NOV-13
TKN-CFA-ED		Water						
Batch	R2738380							
WG1786148-6	DUP	L1390171-8						
Total Kjeldahl Nitrogen		<0.20	<0.20	RPD-NA	mg/L	N/A	20	11-NOV-13
WG1786148-2	LCS							
Total Kjeldahl Nitrogen			101		mg/L		75-125	11-NOV-13



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-CFA-ED	Water							
Batch	R2738380							
WG1786148-3	LCS							
Total Kjeldahl Nitrogen			110		mg/L		75-125	11-NOV-13
WG1786148-4	LCS							
Total Kjeldahl Nitrogen			106		mg/L		75-125	11-NOV-13
WG1786148-1	MB							
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	11-NOV-13

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Contact: SUE RAYNARD

Legend:

Limit ALS Control Limit (Data Quality Objectives)
DUP Duplicate
RPD Relative Percent Difference
N/A Not Available
LCS Laboratory Control Sample
SRM Standard Reference Material
MS Matrix Spike
MSD Matrix Spike Duplicate
ADE Average Desorption Efficiency
MB Method Blank
IRM Internal Reference Material
CRM Certified Reference Material
CCV Continuing Calibration Verification
CVS Calibration Verification Standard
LCSD Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2
Contact: SUE RAYNARD

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Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Anions and Nutrients							
Nitrate as N by IC							
	1	31-OCT-13	04-NOV-13 08:00	48	92	hours	EHTL
	2	31-OCT-13	04-NOV-13 08:00	48	92	hours	EHTL
	3	31-OCT-13	04-NOV-13 08:00	48	92	hours	EHTL
	4	31-OCT-13	04-NOV-13 08:00	48	92	hours	EHTL
Nitrite as N by IC							
	1	31-OCT-13	04-NOV-13 08:00	48	92	hours	EHTL
	2	31-OCT-13	04-NOV-13 08:00	48	92	hours	EHTL
	3	31-OCT-13	04-NOV-13 08:00	48	92	hours	EHTL
	4	31-OCT-13	04-NOV-13 08:00	48	92	hours	EHTL

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1386767 were received on 01-NOV-13 16:37.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

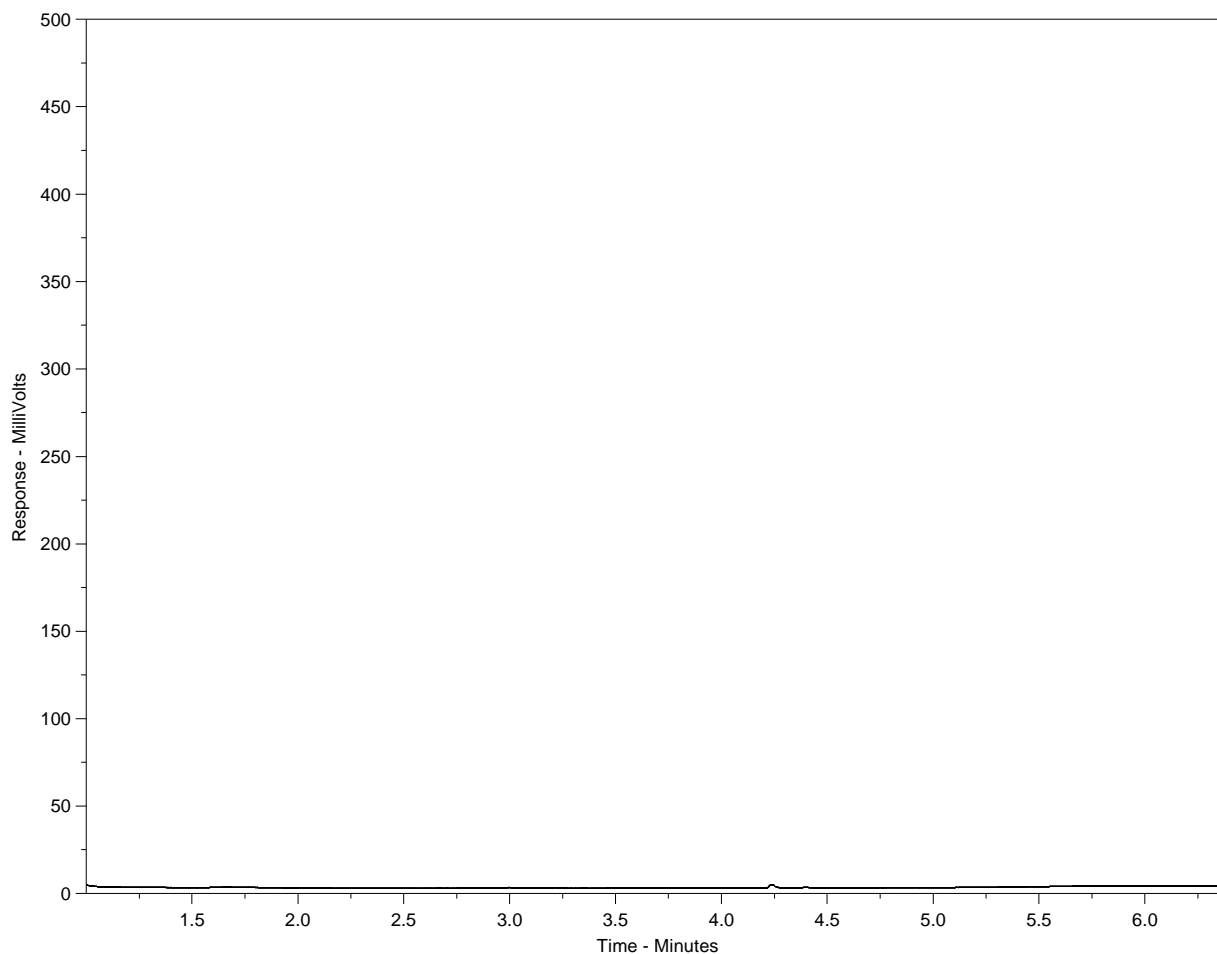
The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Hydrocarbon Distribution Report



ALS Sample ID: L1386769-1
Client ID: 16054131029011



← F2 →		← F3 →		← F4 →		← F4 →
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

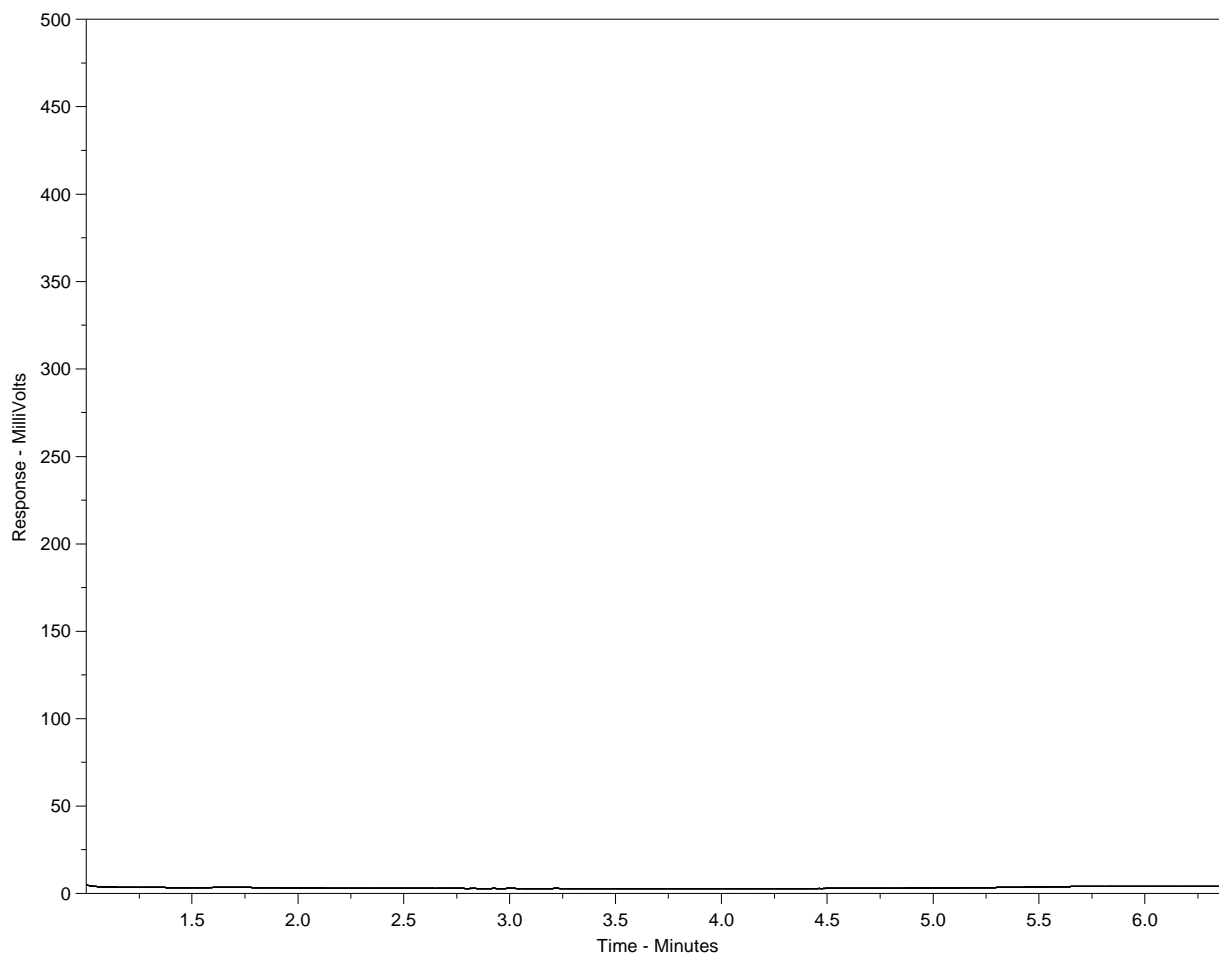
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1386769-2
Client ID: 16054131029013



← F2 →		← F3 →		← F4 →		← F4 →
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →				
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

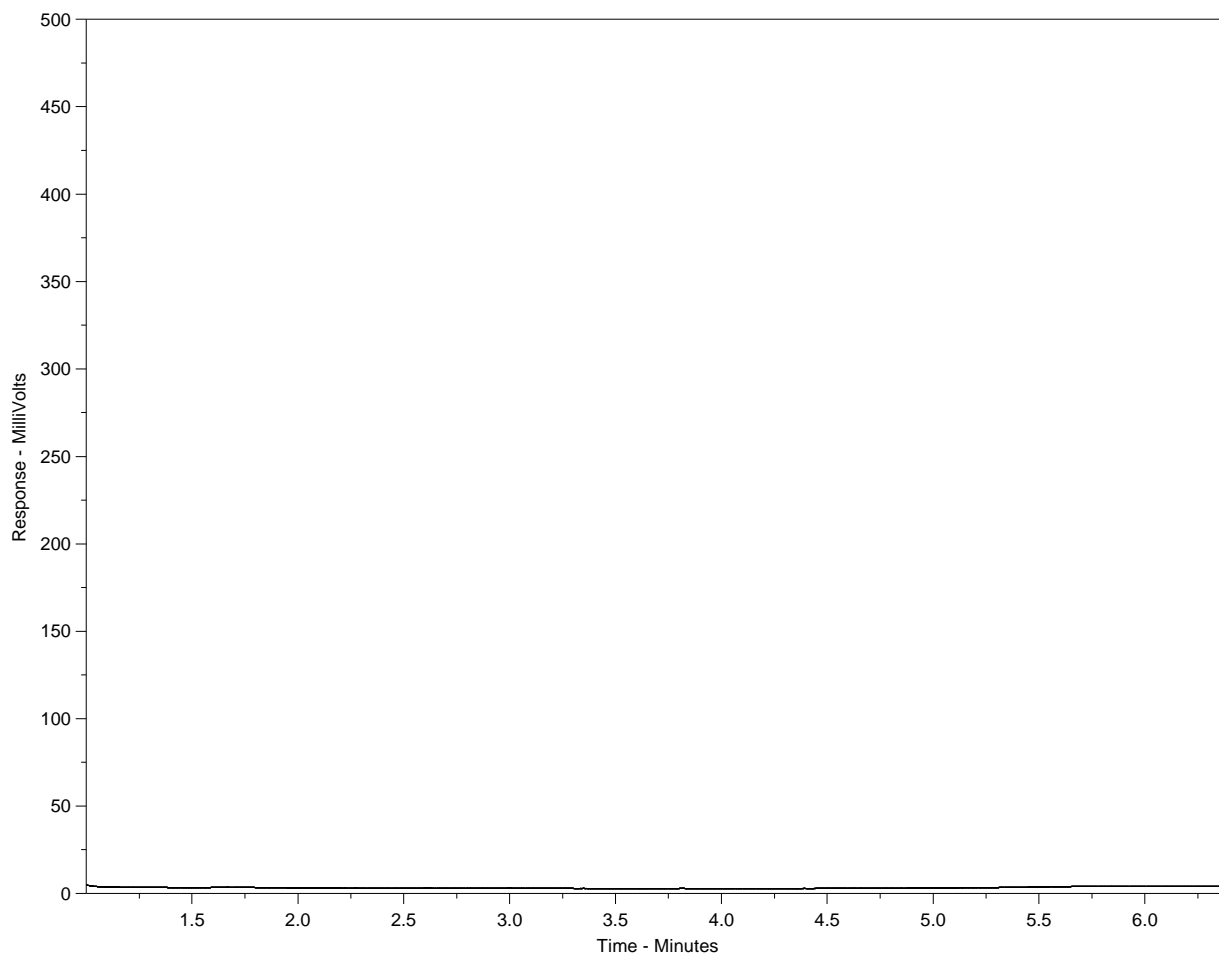
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1386769-3
 Client ID: 16054131029014



← F2 →		← F3 →		← F4 →		← F4 →
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

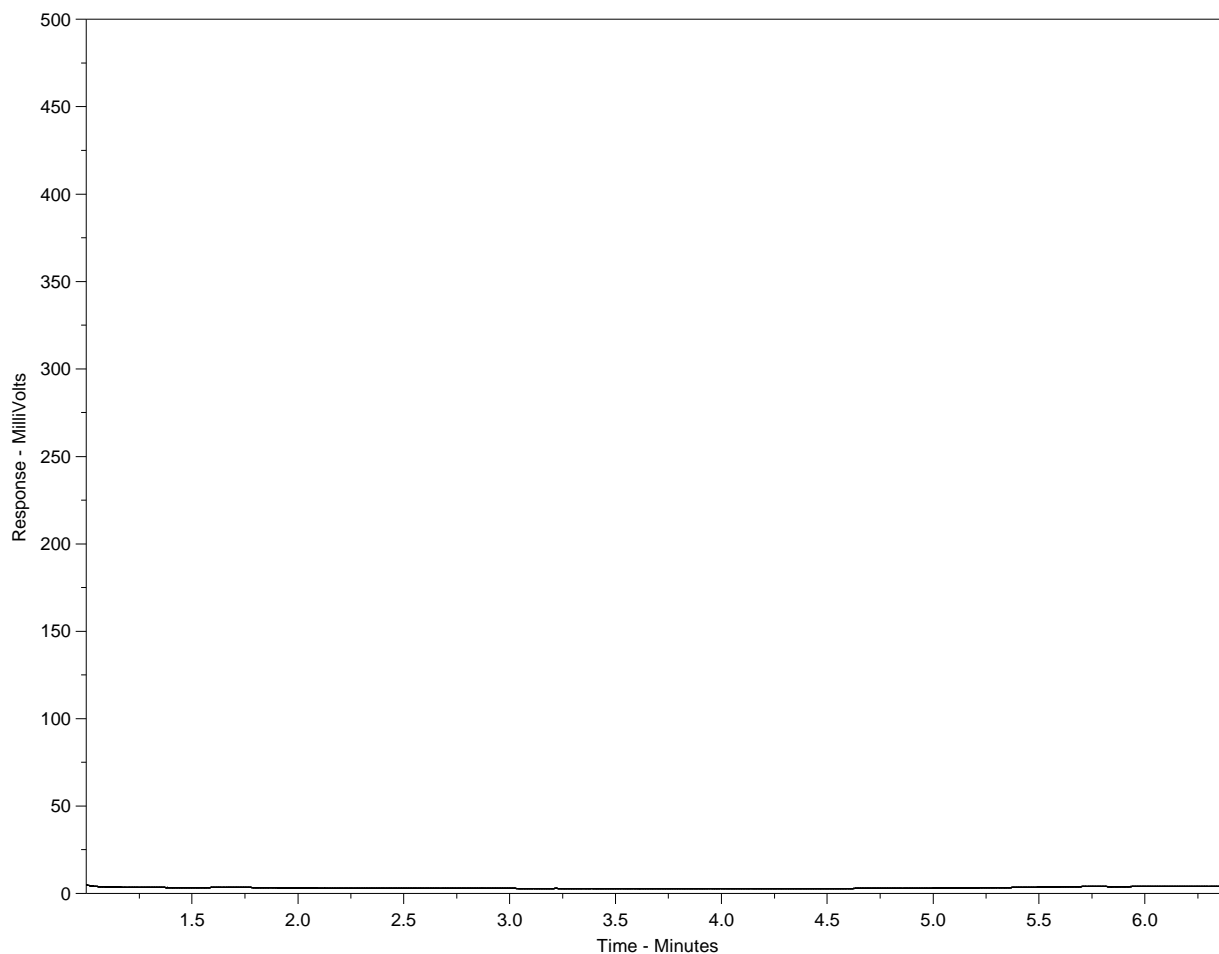
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1386769-4
Client ID: 16054131029015



← F2 →		← F3 →		← F4 →		← F4 →
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.



MATRIX SOLUTIONS INC.
ATTN: SUE RAYNARD
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Date Received: 01-NOV-13
Report Date: 17-DEC-13 13:40 (MT)
Version: FINAL REV. 3

Client Phone: 403-237-0606

Certificate of Analysis

Lab Work Order #: L1386769
Project P.O. #: NOT SUBMITTED
Job Reference: WADDELL CREEK 16054-502 08-27-80-09 W4M
C of C Numbers: M061030
Legal Site Desc: 08-27-80-09 W4M

Comments: 13-DEC-2013 Metal List as been revised and DL for Cr as well
17-DEC-2013 LOR for Ag has been fixed


Catherine Evaristo-Cordero
Senior Account Manager

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ADDRESS: 9936-67 Avenue, Edmonton, AB T6E 0P5 Canada | Phone: +1 780 413 5227 | Fax: +1 780 437 2311
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386769-1 16054131029011									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
Chloride by IC									
Chloride (Cl)	8.48	+/-0.29		0.50	mg/L	0		04-NOV-13	R2732968
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0017	+/-0.00044		0.0010	mg/L	0		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.147	+/-0.013		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	145	+/-20		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	0.00025	+/-0.00002		0.00010	mg/L	0		12-NOV-13	R2739197
Copper (Cu)-Dissolved	0.00184	+/-0.00014		0.00060	mg/L	0		12-NOV-13	R2739197
Iron (Fe)-Dissolved	<0.010	-		0.010	mg/L	-		12-NOV-13	R2739197
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	43.4	+/-3.4		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	0.0551	+/-0.0038		0.0020	mg/L	0		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.00069	+/-0.00007		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	0.00201	+/-0.00017		0.00010	mg/L	0		12-NOV-13	R2739197
Potassium (K)-Dissolved	3.33	+/-0.26		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	0.00387	+/-0.00064		0.00040	mg/L	0		12-NOV-13	R2739197
Silicon (Si)-Dissolved	13.5	+/-1.2		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	9.35	+/-0.66		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	0.314	+/-0.023		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	0.0142	+/-0.0015		0.00010	mg/L	0		12-NOV-13	R2739197
Vanadium (V)-Dissolved	0.00014	+/-0.00001		0.00010	mg/L	0		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	0.0040	+/-0.0005		0.0010	mg/L	0		12-NOV-13	R2739197
Ion Balance Calculation									
Ion Balance	96.8	-			%	-		13-NOV-13	
TDS (Calculated)	570	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	541	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	0.853	+/-0.058		0.050	mg/L	0		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	0.853	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	39.6	+/-1.7		0.50	mg/L	0		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	7.52	+/-0.04		0.10	pH	0		04-NOV-13	R2732970
Conductivity (EC)	998	+/-33		0.20	uS/cm	0		04-NOV-13	R2732970
Bicarbonate (HCO3)	644	-		5.0	mg/L	-		04-NOV-13	R2732970
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Alkalinity, Total (as CaCO3)	528	+/-19		2.0	mg/L	0		04-NOV-13	R2732970

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386769-2 16054131029013									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		04-NOV-13	R2732968
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.0682	+/-0.0059		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	97.4	+/-13		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	0.00016	+/-0.00001		0.00010	mg/L	0		12-NOV-13	R2739197
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		12-NOV-13	R2739197
Iron (Fe)-Dissolved	3.84	+/-0.35		0.010	mg/L	0		12-NOV-13	R2739197
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	24.9	+/-1.9		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	0.0856	+/-0.0058		0.0020	mg/L	0		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.0121	+/-0.0013		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	0.00053	+/-0.00006		0.00010	mg/L	0		12-NOV-13	R2739197
Potassium (K)-Dissolved	7.88	+/-0.61		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Silicon (Si)-Dissolved	12.8	+/-1.1		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	72.2	+/-5.1		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	1.07	+/-0.080		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	0.00011	+/-0.00001		0.00010	mg/L	0		12-NOV-13	R2739197
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Ion Balance Calculation									
Ion Balance	95.8	-			%	-		13-NOV-13	
TDS (Calculated)	547	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	346	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	50.5	+/-2.1		0.50	mg/L	0		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	7.86	+/-0.04		0.10	pH	0		04-NOV-13	R2732970
Conductivity (EC)	936	+/-31		0.20	uS/cm	0		04-NOV-13	R2732970
Bicarbonate (HCO3)	597	-		5.0	mg/L	-		04-NOV-13	R2732970
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Alkalinity, Total (as CaCO3)	490	+/-18		2.0	mg/L	0		04-NOV-13	R2732970

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386769-3 16054131029014									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		04-NOV-13	R2732968
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	0.00065	+/-0.00007		0.00040	mg/L	0		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.0863	+/-0.0075		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	65.8	+/-8.9		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	0.00035	+/-0.00003		0.00010	mg/L	0		12-NOV-13	R2739197
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		12-NOV-13	R2739197
Iron (Fe)-Dissolved	3.71	+/-0.33		0.010	mg/L	0		12-NOV-13	R2739197
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	15.7	+/-1.2		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	0.234	+/-0.016		0.0020	mg/L	0		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.00560	+/-0.00059		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	0.00051	+/-0.00006		0.00010	mg/L	0		12-NOV-13	R2739197
Potassium (K)-Dissolved	4.26	+/-0.33		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Silicon (Si)-Dissolved	11.4	+/-0.97		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	69.0	+/-4.9		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	0.488	+/-0.036		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	0.00018	+/-0.00002		0.00010	mg/L	0		12-NOV-13	R2739197
Vanadium (V)-Dissolved	0.00010	+/-0.00001		0.00010	mg/L	0		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	0.0011	+/-0.0003		0.0010	mg/L	0		12-NOV-13	R2739197
Ion Balance Calculation									
Ion Balance	95.7	-			%	-		13-NOV-13	
TDS (Calculated)	408	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	229	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	25.0	+/-1.1		0.50	mg/L	0		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	7.86	+/-0.04		0.10	pH	0		04-NOV-13	R2732970
Conductivity (EC)	720	+/-24		0.20	uS/cm	0		04-NOV-13	R2732970
Bicarbonate (HCO3)	465	-		5.0	mg/L	-		04-NOV-13	R2732970
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Alkalinity, Total (as CaCO3)	381	+/-14		2.0	mg/L	0		04-NOV-13	R2732970

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386769-4 16054131029015									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		04-NOV-13	R2732968
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	0.00429	+/-0.00045		0.00040	mg/L	0		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.123	+/-0.011		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	75.4	+/-10		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	0.00049	+/-0.00005		0.00010	mg/L	0		12-NOV-13	R2739197
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		12-NOV-13	R2739197
Iron (Fe)-Dissolved	1.41	+/-0.13		0.010	mg/L	0		12-NOV-13	R2739197
Lead (Pb)-Dissolved	0.00013	+/-0.00001		0.00010	mg/L	0		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	17.5	+/-1.4		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	0.217	+/-0.015		0.0020	mg/L	0		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.00243	+/-0.00026		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	0.00073	+/-0.00007		0.00010	mg/L	0		12-NOV-13	R2739197
Potassium (K)-Dissolved	2.24	+/-0.17		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Silicon (Si)-Dissolved	11.0	+/-0.94		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	5.04	+/-0.35		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	0.238	+/-0.018		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	0.00144	+/-0.00015		0.00010	mg/L	0		12-NOV-13	R2739197
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	0.0026	+/-0.0004		0.0010	mg/L	0		12-NOV-13	R2739197
Ion Balance Calculation									
Ion Balance	98.6	-			%	-		13-NOV-13	
TDS (Calculated)	272	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	260	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	14.5	+/-0.64		0.50	mg/L	0		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	7.80	+/-0.04		0.10	pH	0		04-NOV-13	R2732970
Conductivity (EC)	503	+/-17		0.20	uS/cm	0		04-NOV-13	R2732970
Bicarbonate (HCO3)	321	-		5.0	mg/L	-		04-NOV-13	R2732970
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Alkalinity, Total (as CaCO3)	263	+/-10		2.0	mg/L	0		04-NOV-13	R2732970
* Refer to Referenced Information for Qualifiers (if any) and Methodology.									

Reference Information

Report Comments: 13-DEC-2013 Metal List as been revised and DL for Cr as well
17-DEC-2013 LOR for Ag has been fixed

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Phosphorus (P)-Total	MS-B	
Matrix Spike	Phosphorus (P)-Total	MS-B	
Matrix Spike	Chloride (Cl)	MS-B	
Matrix Spike	Sulfate (SO4)	MS-B	

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
B-D-L-CCMS-ED	Water	Dissolved Boron in Water by CRC ICPMS		APHA 3030 B / EPA SW-846 6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).				
BTXS,F1-ED	Water	BTEX, Styrene and F1 (C6-C10)		EPA 5021/8015&8260 GC-MS & FID
C-DIS-ORG-ED	Water	Dissolved Organic Carbon		APHA 5310 B-Instrumental
CL-IC-ED	Water	Chloride by IC		APHA 4110 B-ION CHROMATOGRAPHY
ETL-HARDNESS-DIS-ED	Water	Hardness (from Dissolved Ca and Mg)		APHA 2340 B-Calculation
F2,F3,F4-ED	Water	F2, F3, F4		EPA 3510/CCME PHC CWS-GC-FID
HG-D-L-CVAA-ED	Water	Mercury (Hg) - Dissolved		EPA 245.7 / EPA 245.1
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET-D-CCMS-ED	Water	Dissolved Metals in Water by CRC ICPMS		APHA 3030 B&E / EPA SW-846 6020A
NAPHTHENIC-ACID-FM	Water	Naphthenic Acids by FTIR		Naphthenic Acids by FTIR,Syncrude,1994
Dissolved naphthenic acids are solvent extracted from acidified aqueous samples using Dichloromethane prior to quantitation by Fourier Transform Infra-Red spectroscopy. Note that FTIR is not uniquely selective to naphthenic acids. If present, other carboxylic acids (e.g. humic acids, fulvic acids) may also be detected by this method.				
NH3-CFA-ED	Water	Ammonia in Water by Colour		APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.				
NO2+NO3-CALC-ED	Water	Nitrate+Nitrite		CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
P-T-COL-ED	Water	Total P in Water by Colour		APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.				
PAH-ABT1-ED	Water	PAH & Carcinogenic PAH List		EPA 3510/8270-GC/MS
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)				
PHENOLS-4AAP-ED	Water	Phenols (4AAP)		AB ENV.06537-COLORIMETRIC
This analysis is carried out using procedures adapted from ENVIRODAT VMV 06537 689, Method Code 154, in "Methods Manual for Chemical Analysis of Water and Wastes" published by the Alberta Environmental Centre. This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide and 4-aminoantipyrine to form a red complex which is measured at 505 nm.				
SO4-IC-ED	Water	Sulfate by IC		APHA 4110 B-ION CHROMATOGRAPHY
TKN-CFA-ED	Water	TKN in Water by Colour		APHA 4500-NORG (TKN)

This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 celcius with analysis using an automated colourimetric finish.

** The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
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methods may incorporate modifications from the specified reference to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
FM	ALS ENVIRONMENTAL - FORT MCMURRAY, ALBERTA, CANADA

Chain of Custody Numbers:

M061030

GLOSSARY OF REPORT TERMS

Surr - Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

MU: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.

Bias: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent.

Zero values indicate no detectable method bias.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Quality Control Report

Workorder: L1386769

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-D-L-CCMS-ED		Water						
Batch	R2739197							
WG1786584-2	CRM	ED-HIGH-WATRM						
Boron (B)-Dissolved			95.2		%		80-120	12-NOV-13
WG1786584-3	DUP	L1386451-6						
Boron (B)-Dissolved		0.0114	0.0109		mg/L	4.4	20	12-NOV-13
WG1786584-4	DUP	L1386771-2						
Boron (B)-Dissolved		0.240	0.250		mg/L	4.0	20	12-NOV-13
WG1786584-5	DUP	L1387739-7						
Boron (B)-Dissolved		0.0143	0.0141		mg/L	0.9	20	12-NOV-13
WG1786584-6	DUP	L1387752-5						
Boron (B)-Dissolved		0.0879	0.0878		mg/L	0.1	20	12-NOV-13
WG1786584-1	MB							
Boron (B)-Dissolved			<0.0020		mg/L		0.002	12-NOV-13
BTXS,F1-ED		Water						
Batch	R2730783							
WG1781329-4	DUP	L1386772-4						
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-NOV-13
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-NOV-13
EthylBenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-NOV-13
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	04-NOV-13
m+p-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	04-NOV-13
Styrene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	50	04-NOV-13
F1(C6-C10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	04-NOV-13
WG1781329-2	LCS							
Benzene			100.6		%		70-130	03-NOV-13
Toluene			91.5		%		70-130	03-NOV-13
EthylBenzene			99.1		%		70-130	03-NOV-13
o-Xylene			106.3		%		70-130	03-NOV-13
m+p-Xylene			97.9		%		70-130	03-NOV-13
Styrene			100.4		%		70-130	03-NOV-13
WG1781329-3	LCS							
F1(C6-C10)			85.6		%		70-130	03-NOV-13
WG1781329-1	MB							
Benzene			<0.00050		mg/L		0.0005	03-NOV-13
Toluene			<0.00050		mg/L		0.0005	03-NOV-13
EthylBenzene			<0.00050		mg/L		0.0005	03-NOV-13
o-Xylene			<0.00050		mg/L		0.0005	03-NOV-13



Quality Control Report

Workorder: L1386769

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTXS,F1-ED								
	Water							
Batch	R2730783							
WG1781329-1	MB							
m+p-Xylene			<0.00050		mg/L		0.0005	03-NOV-13
Styrene			<0.0010		mg/L		0.001	03-NOV-13
F1(C6-C10)			<0.10		mg/L		0.1	03-NOV-13
WG1781329-5	MS	L1386772-4						
Benzene			97.4		%		50-150	04-NOV-13
Toluene			90.5		%		50-150	04-NOV-13
EthylBenzene			98.2		%		50-150	04-NOV-13
o-Xylene			106.3		%		50-150	04-NOV-13
m+p-Xylene			96.6		%		50-150	04-NOV-13
Styrene			97.9		%		50-150	04-NOV-13
WG1781329-6	MS	L1386772-4						
F1(C6-C10)			79.6		%		50-150	04-NOV-13
C-DIS-ORG-ED								
	Water							
Batch	R2737505							
WG1785307-3	CVS							
Dissolved Organic Carbon			109.8		%		80-160	08-NOV-13
WG1785307-6	DUP	L1386731-3						
Dissolved Organic Carbon		4.2	3.9		mg/L	6.7	20	09-NOV-13
WG1785307-8	DUP	L1386767-4						
Dissolved Organic Carbon		8.2	8.1		mg/L	1.2	20	09-NOV-13
WG1785307-2	LCS							
Dissolved Organic Carbon			95.2		%		80-120	08-NOV-13
WG1785307-1	MB							
Dissolved Organic Carbon			<1.0		mg/L		1	08-NOV-13
WG1785307-7	MS	L1386731-3						
Dissolved Organic Carbon			84.7		%		70-130	09-NOV-13
WG1785307-9	MS	L1386767-4						
Dissolved Organic Carbon			85.3		%		70-130	09-NOV-13
CL-IC-ED								
	Water							
Batch	R2732968							
WG1781728-3	DUP	L1386772-4						
Chloride (Cl)		0.96	0.94		mg/L	2.5	20	04-NOV-13
WG1781728-5	DUP	L1386805-1						
Chloride (Cl)		35.8	35.9		mg/L	0.3	20	04-NOV-13
WG1781728-7	DUP	L1387059-2						
Chloride (Cl)		450	447		mg/L	0.6	20	04-NOV-13



Quality Control Report

Workorder: L1386769

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-IC-ED		Water						
Batch	R2732968							
WG1781728-2	LCS							
Chloride (Cl)			105.1		%		90-110	04-NOV-13
WG1781728-1	MB							
Chloride (Cl)			<0.50		mg/L		0.5	04-NOV-13
WG1781728-4	MS	L1386772-4						
Chloride (Cl)			99.6		%		75-125	04-NOV-13
WG1781728-6	MS	L1386805-1						
Chloride (Cl)			98.1		%		75-125	04-NOV-13
WG1781728-8	MS	L1387059-2						
Chloride (Cl)			N/A	MS-B	%		-	04-NOV-13
F2,F3,F4-ED		Water						
Batch	R2734016							
WG1781653-5	LCS							
F2 (>C10-C16)			93.1		%		65-135	04-NOV-13
F3 (C16-C34)			98.8		%		65-135	04-NOV-13
F4 (C34-C50)			92.8		%		65-135	04-NOV-13
WG1781653-8	LCS							
F2 (>C10-C16)			95.8		%		65-135	04-NOV-13
F3 (C16-C34)			95.8		%		65-135	04-NOV-13
F4 (C34-C50)			92.0		%		65-135	04-NOV-13
WG1781653-4	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	04-NOV-13
F3 (C16-C34)			<0.25		mg/L		0.25	04-NOV-13
F4 (C34-C50)			<0.25		mg/L		0.25	04-NOV-13
Surrogate: 2-Bromobenzotrifluoride			93.4		%		50-150	04-NOV-13
WG1781653-7	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	04-NOV-13
F3 (C16-C34)			<0.25		mg/L		0.25	04-NOV-13
F4 (C34-C50)			<0.25		mg/L		0.25	04-NOV-13
Surrogate: 2-Bromobenzotrifluoride			92.8		%		50-150	04-NOV-13
WG1781653-9	MS	L1386772-1						
F2 (>C10-C16)			93.6		%		50-150	04-NOV-13
F3 (C16-C34)			96.1		%		50-150	04-NOV-13
F4 (C34-C50)			93.5		%		50-150	04-NOV-13
HG-D-L-CVAA-ED		Water						



Quality Control Report

Workorder: L1386769

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-D-L-CVAA-ED		Water						
Batch	R2737347							
WG1784962-4	DUP	L1386731-1						
Mercury (Hg)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	08-NOV-13
WG1784962-8	DUP	L1386451-12						
Mercury (Hg)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	09-NOV-13
WG1784962-2	LCS							
Mercury (Hg)-Dissolved			97.7		%		80-120	08-NOV-13
WG1784962-3	LCSD	WG1784962-2						
Mercury (Hg)-Dissolved		97.7	97.0		%	0.7	20	08-NOV-13
WG1784962-1	MB							
Mercury (Hg)-Dissolved			<0.000020		mg/L		0.00002	08-NOV-13
WG1784962-5	MS	L1386731-1						
Mercury (Hg)-Dissolved			98.3		%		70-130	08-NOV-13
WG1784962-9	MS	L1386451-12						
Mercury (Hg)-Dissolved			70.4		%		70-130	09-NOV-13
MET-D-CCMS-ED		Water						
Batch	R2739197							
WG1786584-2	CRM	ED-HIGH-WATRM						
Aluminum (Al)-Dissolved			101.1		%		80-120	12-NOV-13
Antimony (Sb)-Dissolved			101.4		%		80-120	12-NOV-13
Arsenic (As)-Dissolved			103.6		%		80-120	12-NOV-13
Barium (Ba)-Dissolved			105.6		%		80-120	12-NOV-13
Beryllium (Be)-Dissolved			96.3		%		80-120	12-NOV-13
Bismuth (Bi)-Dissolved			98.4		%		80-120	12-NOV-13
Cadmium (Cd)-Dissolved			102.7		%		80-120	12-NOV-13
Calcium (Ca)-Dissolved			99.6		%		80-120	12-NOV-13
Chromium (Cr)-Dissolved			96.0		%		80-120	12-NOV-13
Cobalt (Co)-Dissolved			96.8		%		80-120	12-NOV-13
Copper (Cu)-Dissolved			96.4		%		80-120	12-NOV-13
Lead (Pb)-Dissolved			98.4		%		80-120	12-NOV-13
Magnesium (Mg)-Dissolved			96.9		%		80-120	12-NOV-13
Manganese (Mn)-Dissolved			97.8		%		80-120	12-NOV-13
Molybdenum (Mo)-Dissolved			95.3		%		80-120	12-NOV-13
Nickel (Ni)-Dissolved			97.9		%		80-120	12-NOV-13
Potassium (K)-Dissolved			97.7		%		80-120	12-NOV-13
Selenium (Se)-Dissolved			104.7		%		80-120	12-NOV-13
Silicon (Si)-Dissolved			109.0		%		80-120	12-NOV-13



Quality Control Report

Workorder: L1386769

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED		Water						
Batch	R2739197							
WG1786584-2 CRM		ED-HIGH-WATRM						
Silver (Ag)-Dissolved			98.8		%		80-120	12-NOV-13
Sodium (Na)-Dissolved			100.3		%		80-120	12-NOV-13
Strontium (Sr)-Dissolved			101.4		%		80-120	12-NOV-13
Thallium (Tl)-Dissolved			97.9		%		80-120	12-NOV-13
Titanium (Ti)-Dissolved			98.5		%		80-120	12-NOV-13
Tin (Sn)-Dissolved			97.3		%		80-120	12-NOV-13
Uranium (U)-Dissolved			98.4		%		80-120	12-NOV-13
Vanadium (V)-Dissolved			98.3		%		80-120	12-NOV-13
Zinc (Zn)-Dissolved			99.4		%		80-120	12-NOV-13
WG1786584-3 DUP		L1386451-6						
Aluminum (Al)-Dissolved		0.0065	0.0050	J	mg/L	0.0014	0.002	12-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Arsenic (As)-Dissolved		0.00047	0.00047		mg/L	0.0	20	12-NOV-13
Barium (Ba)-Dissolved		0.0147	0.0148		mg/L	0.1	20	12-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cadmium (Cd)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Calcium (Ca)-Dissolved		25.0	23.8		mg/L	5.2	20	12-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Copper (Cu)-Dissolved		<0.00060	<0.00060	RPD-NA	mg/L	N/A	20	12-NOV-13
Iron (Fe)-Dissolved		0.523	0.529		mg/L	1.1	20	12-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Magnesium (Mg)-Dissolved		7.92	7.70		mg/L	2.8	20	12-NOV-13
Manganese (Mn)-Dissolved		0.0541	0.0528		mg/L	2.4	20	12-NOV-13
Molybdenum (Mo)-Dissolved		0.00012	0.00011		mg/L	3.1	20	12-NOV-13
Nickel (Ni)-Dissolved		0.00030	0.00035		mg/L	15	20	12-NOV-13
Potassium (K)-Dissolved		<0.50	<0.50	RPD-NA	mg/L	N/A	20	12-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Silicon (Si)-Dissolved		4.65	4.65		mg/L	0.1	20	12-NOV-13
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	12-NOV-13
Sodium (Na)-Dissolved		3.9	3.8		mg/L	2.1	20	12-NOV-13
Strontium (Sr)-Dissolved		0.0528	0.0517		mg/L	2.2	20	12-NOV-13



Quality Control Report

Workorder: L1386769

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2739197							
WG1786584-3	DUP	L1386451-6						
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	12-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	12-NOV-13
Uranium (U)-Dissolved		0.000029	0.000029		mg/L	0.9	20	12-NOV-13
Vanadium (V)-Dissolved		0.00010	0.00012		mg/L	18	20	12-NOV-13
WG1786584-4	DUP	L1386771-2						
Aluminum (Al)-Dissolved		<0.0010	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Arsenic (As)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Barium (Ba)-Dissolved		0.102	0.0982		mg/L	3.9	20	12-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cadmium (Cd)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Calcium (Ca)-Dissolved		81.1	81.1		mg/L	0.0	20	12-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Copper (Cu)-Dissolved		<0.00060	<0.0010	RPD-NA	mg/L	N/A	20	12-NOV-13
Iron (Fe)-Dissolved		1.61	1.64		mg/L	1.5	20	12-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Magnesium (Mg)-Dissolved		23.9	24.4		mg/L	1.9	20	12-NOV-13
Manganese (Mn)-Dissolved		0.0548	0.0549		mg/L	0.3	20	12-NOV-13
Molybdenum (Mo)-Dissolved		0.00111	0.00109		mg/L	1.6	20	12-NOV-13
Nickel (Ni)-Dissolved		<0.00010	<0.0020	RPD-NA	mg/L	N/A	20	12-NOV-13
Potassium (K)-Dissolved		5.27	5.30		mg/L	0.4	20	12-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Silicon (Si)-Dissolved		12.5	12.4		mg/L	0.8	20	12-NOV-13
Silver (Ag)-Dissolved		<0.000010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Sodium (Na)-Dissolved		55.1	55.7		mg/L	1.1	20	12-NOV-13
Strontium (Sr)-Dissolved		0.666	0.666		mg/L	0.1	20	12-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	12-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Uranium (U)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13



Quality Control Report

Workorder: L1386769

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2739197							
WG1786584-4	DUP	L1386771-2						
Vanadium (V)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Zinc (Zn)-Dissolved		<0.0010	<0.0030	RPD-NA	mg/L	N/A	20	12-NOV-13
WG1786584-5	DUP	L1387739-7						
Aluminum (Al)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Arsenic (As)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Barium (Ba)-Dissolved		0.137	0.139		mg/L	1.7	20	12-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cadmium (Cd)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Calcium (Ca)-Dissolved		125	124		mg/L	0.1	20	12-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Copper (Cu)-Dissolved		<0.00060	<0.00060	RPD-NA	mg/L	N/A	20	12-NOV-13
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	12-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Magnesium (Mg)-Dissolved		27.7	27.7		mg/L	0.1	20	12-NOV-13
Manganese (Mn)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Molybdenum (Mo)-Dissolved		0.00093	0.00095		mg/L	1.7	20	12-NOV-13
Nickel (Ni)-Dissolved		0.00116	0.00114		mg/L	1.9	20	12-NOV-13
Potassium (K)-Dissolved		1.73	1.73		mg/L	0.1	20	12-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Silicon (Si)-Dissolved		4.41	4.41		mg/L	0.1	20	12-NOV-13
Silver (Ag)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Sodium (Na)-Dissolved		11.1	11.1		mg/L	0.2	20	12-NOV-13
Strontium (Sr)-Dissolved		0.412	0.425		mg/L	3.1	20	12-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	12-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	12-NOV-13
Uranium (U)-Dissolved		0.00257	0.00255		mg/L	1.0	20	12-NOV-13
Vanadium (V)-Dissolved		0.00015	0.00016		mg/L	2.8	20	12-NOV-13
Zinc (Zn)-Dissolved		0.0034	0.0017	J	mg/L	0.0017	0.002	12-NOV-13
WG1786584-6	DUP	L1387752-5						



Quality Control Report

Workorder: L1386769

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2739197							
WG1786584-6	DUP	L1387752-5						
Aluminum (Al)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Arsenic (As)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Barium (Ba)-Dissolved		0.185	0.180		mg/L	2.3	20	12-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cadmium (Cd)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Calcium (Ca)-Dissolved		133	133		mg/L	0.1	20	12-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Cobalt (Co)-Dissolved		0.00047	0.00043		mg/L	8.0	20	12-NOV-13
Copper (Cu)-Dissolved		0.00123	0.00122		mg/L	0.5	20	12-NOV-13
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	12-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Magnesium (Mg)-Dissolved		38.8	38.3		mg/L	1.3	20	12-NOV-13
Manganese (Mn)-Dissolved		0.155	0.155		mg/L	0.2	20	12-NOV-13
Molybdenum (Mo)-Dissolved		0.00035	0.00036		mg/L	3.9	20	12-NOV-13
Nickel (Ni)-Dissolved		0.00270	0.00264		mg/L	2.3	20	12-NOV-13
Potassium (K)-Dissolved		1.95	1.94		mg/L	0.8	20	12-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Silicon (Si)-Dissolved		9.81	10.0		mg/L	1.9	20	12-NOV-13
Silver (Ag)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Sodium (Na)-Dissolved		41.5	40.1		mg/L	3.4	20	12-NOV-13
Strontium (Sr)-Dissolved		0.773	0.787		mg/L	1.8	20	12-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	12-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	12-NOV-13
Uranium (U)-Dissolved		0.0133	0.0133		mg/L	0.3	20	12-NOV-13
Vanadium (V)-Dissolved		0.00012	0.00012		mg/L	4.5	20	12-NOV-13
Zinc (Zn)-Dissolved		0.0063	0.0060		mg/L	5.4	20	12-NOV-13
WG1786584-1	MB							
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	12-NOV-13
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13



Quality Control Report

Workorder: L1386769

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2739197							
WG1786584-1	MB							
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	12-NOV-13
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	12-NOV-13
Calcium (Ca)-Dissolved			<0.020		mg/L		0.02	12-NOV-13
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Copper (Cu)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	12-NOV-13
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	12-NOV-13
Manganese (Mn)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Nickel (Ni)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Potassium (K)-Dissolved			<0.050		mg/L		0.05	12-NOV-13
Selenium (Se)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	12-NOV-13
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	12-NOV-13
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	12-NOV-13
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	12-NOV-13
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	12-NOV-13
Vanadium (V)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	12-NOV-13
NAPHTHENIC-ACID-FM								
	Water							
Batch	R2737525							
WG1784551-3	DUP	L1385544-2						
Naphthenic Acids		31.7	31.9		mg/L	0.6	30	08-NOV-13
WG1784551-4	LCS							
Naphthenic Acids			99.8		%		70-130	08-NOV-13
WG1784551-1	MB							
Naphthenic Acids			<1.0		mg/L		1	08-NOV-13



Quality Control Report

Workorder: L1386769

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NAPHTHENIC-ACID-FM								
Water								
Batch	R2737525							
WG1784551-2	MS	L1385544-1						
Naphthenic Acids			133.4		%		50-150	08-NOV-13
NH3-CFA-ED								
Water								
Batch	R2737984							
WG1785936-4	DUP	L1386548-2						
Ammonia, Total (as N)		0.053	0.051		mg/L	4.6	20	10-NOV-13
WG1785936-5	DUP	L1386573-2						
Ammonia, Total (as N)		0.074	0.060	J	mg/L	0.014	0.1	10-NOV-13
WG1785936-2	LCS							
Ammonia, Total (as N)			104.8		%		85-115	10-NOV-13
WG1785936-1	MB							
Ammonia, Total (as N)			<0.050		mg/L		0.05	10-NOV-13
WG1785936-3	MS	L1386451-12						
Ammonia, Total (as N)			112.3		%		75-125	10-NOV-13
NO2-IC-ED								
Water								
Batch	R2732968							
WG1781728-3	DUP	L1386772-4						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-5	DUP	L1386805-1						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-7	DUP	L1387059-2						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-2	LCS							
Nitrite (as N)			90.9		%		90-110	04-NOV-13
WG1781728-1	MB							
Nitrite (as N)			<0.050		mg/L		0.05	04-NOV-13
WG1781728-4	MS	L1386772-4						
Nitrite (as N)			84.6		%		75-125	04-NOV-13
WG1781728-6	MS	L1386805-1						
Nitrite (as N)			85.5		%		75-125	04-NOV-13
WG1781728-8	MS	L1387059-2						
Nitrite (as N)			78.4		%		75-125	04-NOV-13
NO3-IC-ED								
Water								
Batch	R2732968							
WG1781728-3	DUP	L1386772-4						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-5	DUP	L1386805-1						



Quality Control Report

Workorder: L1386769

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-IC-ED		Water						
Batch	R2732968							
WG1781728-5	DUP	L1386805-1						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-7	DUP	L1387059-2						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-2	LCS							
Nitrate (as N)			102.7		%		90-110	04-NOV-13
WG1781728-1	MB							
Nitrate (as N)			<0.050		mg/L		0.05	04-NOV-13
WG1781728-4	MS	L1386772-4						
Nitrate (as N)			93.6		%		75-125	04-NOV-13
WG1781728-6	MS	L1386805-1						
Nitrate (as N)			98.9		%		75-125	04-NOV-13
WG1781728-8	MS	L1387059-2						
Nitrate (as N)			97.2		%		75-125	04-NOV-13
P-T-COL-ED		Water						
Batch	R2734215							
WG1782357-11	DUP	L1387367-4						
Phosphorus (P)-Total		<0.020	<0.020	RPD-NA	mg/L	N/A	20	05-NOV-13
WG1782357-12	DUP	L1387455-1						
Phosphorus (P)-Total		0.103	0.093		mg/L	9.4	20	05-NOV-13
WG1782357-3	DUP	L1386217-3						
Phosphorus (P)-Total		0.469	0.502		mg/L	6.8	20	05-NOV-13
WG1782357-5	DUP	L1386451-1						
Phosphorus (P)-Total		0.023	0.031	J	mg/L	0.008	0.04	05-NOV-13
WG1782357-7	DUP	L1386767-1						
Phosphorus (P)-Total		0.510	0.543		mg/L	6.2	20	05-NOV-13
WG1782357-9	DUP	L1386771-5						
Phosphorus (P)-Total		0.033	0.036		mg/L	9.1	20	05-NOV-13
WG1782357-2	LCS							
Phosphorus (P)-Total			100.9		%		80-120	05-NOV-13
WG1782357-1	MB							
Phosphorus (P)-Total			<0.020		mg/L		0.02	05-NOV-13
WG1782357-10	MS	L1386771-5						
Phosphorus (P)-Total			103.3		%		70-130	05-NOV-13
WG1782357-4	MS	L1386217-3						
Phosphorus (P)-Total			N/A	MS-B	%		-	05-NOV-13
WG1782357-6	MS	L1386451-1						
Phosphorus (P)-Total			105.6		%		70-130	05-NOV-13



Quality Control Report

Workorder: L1386769

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
P-T-COL-ED								
	Water							
Batch	R2734215							
WG1782357-8 MS		L1386767-1						
Phosphorus (P)-Total			N/A	MS-B	%		-	05-NOV-13
PAH-ABT1-ED								
	Water							
Batch	R2736969							
WG1782649-3 LCS								
Acenaphthene			83.2		%		60-130	07-NOV-13
Acenaphthylene			87.9		%		60-130	07-NOV-13
Anthracene			88.1		%		60-130	07-NOV-13
Fluoranthene			89.2		%		60-130	07-NOV-13
Fluorene			85.9		%		60-130	07-NOV-13
Naphthalene			78.7		%		50-130	07-NOV-13
Phenanthrene			87.1		%		60-130	07-NOV-13
Pyrene			89.7		%		60-130	07-NOV-13
Benzo(a)anthracene			92.4		%		60-130	07-NOV-13
Benzo(k)fluoranthene			88.2		%		60-130	07-NOV-13
Benzo(b&j)fluoranthene			95.9		%		60-130	07-NOV-13
Benzo(g,h,i)perylene			97.5		%		60-130	07-NOV-13
Benzo(a)pyrene			95.5		%		60-130	07-NOV-13
Chrysene			88.7		%		60-130	07-NOV-13
Dibenzo(a,h)anthracene			100.8		%		60-130	07-NOV-13
Indeno(1,2,3-cd)pyrene			96.8		%		60-130	07-NOV-13
WG1782649-2 MB								
Acenaphthene			<0.000020		mg/L		0.00002	07-NOV-13
Acenaphthylene			<0.000020		mg/L		0.00002	07-NOV-13
Anthracene			<0.000010		mg/L		0.00001	07-NOV-13
Fluoranthene			<0.000020		mg/L		0.00002	07-NOV-13
Fluorene			<0.000020		mg/L		0.00002	07-NOV-13
Naphthalene			<0.000050		mg/L		0.00005	07-NOV-13
Phenanthrene			<0.000050		mg/L		0.00005	07-NOV-13
Pyrene			<0.000020		mg/L		0.00002	07-NOV-13
Benzo(a)anthracene			<0.000010		mg/L		0.00001	07-NOV-13
Benzo(k)fluoranthene			<0.000010		mg/L		0.00001	07-NOV-13
Benzo(b&j)fluoranthene			<0.000010		mg/L		0.00001	07-NOV-13
Benzo(g,h,i)perylene			<0.000020		mg/L		0.00002	07-NOV-13



Quality Control Report

Workorder: L1386769

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ABT1-ED		Water						
Batch R2736969								
WG1782649-2 MB								
Benzo(a)pyrene			<0.0000050		mg/L		0.000005	07-NOV-13
Chrysene			<0.000020		mg/L		0.00002	07-NOV-13
Dibenzo(a,h)anthracene			<0.0000050		mg/L		0.000005	07-NOV-13
Indeno(1,2,3-cd)pyrene			<0.000010		mg/L		0.00001	07-NOV-13
Surrogate: Nitrobenzene d5			78.0		%		40-130	07-NOV-13
Surrogate: 2-Fluorobiphenyl			73.9		%		40-130	07-NOV-13
Surrogate: p-Terphenyl d14			91.2		%		40-130	07-NOV-13
PH/EC/ALK-ED		Water						
Batch R2732970								
WG1781579-7 DUP		L1386772-2						
pH		7.36	7.37	J	pH	0.00	0.3	04-NOV-13
Conductivity (EC)		1010	1010		uS/cm	0.2	10	04-NOV-13
Bicarbonate (HCO3)		726	723		mg/L	0.4	25	04-NOV-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	04-NOV-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	04-NOV-13
Alkalinity, Total (as CaCO3)		595	593		mg/L	0.4	20	04-NOV-13
WG1781579-9 DUP		L1387059-2						
pH		7.99	7.98	J	pH	0.01	0.3	04-NOV-13
Conductivity (EC)		2270	2280		uS/cm	0.5	10	04-NOV-13
Bicarbonate (HCO3)		356	354		mg/L	0.4	25	04-NOV-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	04-NOV-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	04-NOV-13
Alkalinity, Total (as CaCO3)		291	290		mg/L	0.4	20	04-NOV-13
WG1781579-2 LCS								
Conductivity (EC)			103.5		%		90-110	04-NOV-13
WG1781579-3 LCS								
pH			7.01		pH		6.7-7.3	04-NOV-13
WG1781579-4 LCS								
Alkalinity, Total (as CaCO3)			100.2		%		85-115	04-NOV-13
WG1781579-5 LCS								
Conductivity (EC)			101.2		%		90-110	04-NOV-13
WG1781579-1 MB								
Bicarbonate (HCO3)			<5.0		mg/L		5	04-NOV-13
Carbonate (CO3)			<5.0		mg/L		5	04-NOV-13
Hydroxide (OH)			<5.0		mg/L		5	04-NOV-13



Quality Control Report

Workorder: L1386769

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch	R2732970							
WG1781579-1	MB							
Hydroxide (OH)			<5.0		mg/L		5	04-NOV-13
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	04-NOV-13
PHENOLS-4AAP-ED		Water						
Batch	R2738116							
WG1786079-4	DUP	L1383649-9						
Phenols (4AAP)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	15	10-NOV-13
WG1786079-3	LCS							
Phenols (4AAP)			92.0		%		85-115	10-NOV-13
WG1786079-2	MB							
Phenols (4AAP)			<0.0010		mg/L		0.001	10-NOV-13
WG1786079-5	MS	L1386451-10						
Phenols (4AAP)			94.0		%		75-125	10-NOV-13
SO4-IC-ED		Water						
Batch	R2732968							
WG1781728-3	DUP	L1386772-4						
Sulfate (SO4)		1.13	1.05		mg/L	7.0	20	04-NOV-13
WG1781728-5	DUP	L1386805-1						
Sulfate (SO4)		22.9	22.8		mg/L	0.0	20	04-NOV-13
WG1781728-7	DUP	L1387059-2						
Sulfate (SO4)		166	165		mg/L	0.8	20	04-NOV-13
WG1781728-2	LCS							
Sulfate (SO4)			104.8		%		90-110	04-NOV-13
WG1781728-1	MB							
Sulfate (SO4)			<0.50		mg/L		0.5	04-NOV-13
WG1781728-4	MS	L1386772-4						
Sulfate (SO4)			99.0		%		75-125	04-NOV-13
WG1781728-6	MS	L1386805-1						
Sulfate (SO4)			97.7		%		75-125	04-NOV-13
WG1781728-8	MS	L1387059-2						
Sulfate (SO4)			N/A	MS-B	%		-	04-NOV-13
TKN-CFA-ED		Water						
Batch	R2739042							
WG1786421-6	DUP	L1390232-6						
Total Kjeldahl Nitrogen		<0.20	<0.20	RPD-NA	mg/L	N/A	20	12-NOV-13
WG1786421-2	LCS							
Total Kjeldahl Nitrogen			103		mg/L		75-125	12-NOV-13



Quality Control Report

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-CFA-ED	Water							
Batch	R2739042							
WG1786421-3	LCS							
Total Kjeldahl Nitrogen			105		mg/L		75-125	12-NOV-13
WG1786421-4	LCS							
Total Kjeldahl Nitrogen			88.3		mg/L		75-125	12-NOV-13
WG1786421-1	MB							
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	12-NOV-13
WG1786421-5	MS	L1386771-5						
Total Kjeldahl Nitrogen			100		mg/L		70-130	12-NOV-13

Quality Control Report

Workorder: L1386769

Report Date: 17-DEC-13

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

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Contact: SUE RAYNARD

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1386769

Report Date: 17-DEC-13

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2
Contact: SUE RAYNARD

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Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Anions and Nutrients							
Nitrate as N by IC							
	1	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	2	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	3	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	4	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
Nitrite as N by IC							
	1	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	2	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	3	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	4	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1386769 were received on 01-NOV-13 16:42.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



MATRIX SOLUTIONS INC.
ATTN: SUE RAYNARD
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Date Received: 01-NOV-13
Report Date: 17-DEC-13 13:41 (MT)
Version: FINAL REV. 3

Client Phone: 403-237-0606

Certificate of Analysis

Lab Work Order #: L1386771
Project P.O. #: NOT SUBMITTED
Job Reference: CONKLIN 76-07 16054-502 11-30-76-7 W4M
C of C Numbers: M061025
Legal Site Desc: 11-30-76-7 W4M

Comments: 13-DEC-2013 Metals List was revised as well as DL for Cr
17-DEC-2013 LOR for Ag has been fixed



Catherine Evaristo-Cordero
Senior Account Manager

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ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386771-1 16054131029007									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Toluene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
EthylBenzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
o-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Styrene	<0.0010	-		0.0010	mg/L	-		04-NOV-13	R2730783
F1(C6-C10)	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
F1-BTEX	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
Xylenes	<0.00071	-		0.00071	mg/L	-		04-NOV-13	R2730783
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
Surr: 2-Bromobenzotrifluoride	98.0	-		N/A	%	-	04-NOV-13	04-NOV-13	R2734016
ICP Metals & Hg -Dissolved									
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.115	+/-0.010		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	80.2	+/-11		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	0.00012	+/-0.00001		0.00010	mg/L	0		12-NOV-13	R2739197
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		12-NOV-13	R2739197
Iron (Fe)-Dissolved	1.43	+/-0.13		0.010	mg/L	0		12-NOV-13	R2739197
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	23.7	+/-1.8		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	0.0401	+/-0.0027		0.0020	mg/L	0		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.00050	+/-0.00006		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	0.00025	+/-0.00004		0.00010	mg/L	0		12-NOV-13	R2739197
Potassium (K)-Dissolved	5.27	+/-0.41		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Silicon (Si)-Dissolved	12.1	+/-1.0		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	58.5	+/-4.1		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	0.676	+/-0.050		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Hardness (from Dissolved Ca and Mg)									
Hardness (as CaCO3)	298	-		1.3	mg/L	-		13-NOV-13	
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		09-NOV-13	R2737347
Miscellaneous Parameters									
Ammonia, Total (as N)	2.69	-		0.050	mg/L	-		10-NOV-13	R2737984

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386771-1 16054131029007									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
Boron (B)-Dissolved	0.247	+/-0.030		0.0020	mg/L	0		12-NOV-13	R2739197
Dissolved Organic Carbon	6.3	+/-0.9		1.0	mg/L	0		09-NOV-13	R2737505
Naphthenic Acids	<1.0	-		1.0	mg/L	-	08-NOV-13	08-NOV-13	R2737525
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		10-NOV-13	R2738116
Total Kjeldahl Nitrogen	2.71	+/-0.55		0.20	mg/L	0	12-NOV-13	12-NOV-13	R2739042
Phosphorus (P)-Total	0.996	+/-0.081		0.020	mg/L	0	05-NOV-13	05-NOV-13	R2734215
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Fluoranthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Fluorene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Naphthalene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Phenanthrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Pyrene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(a)pyrene	<0.0000050	-		0.0000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Chrysene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Dibenzo(a,h)anthracene	<0.0000050	-		0.0000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Surr: Nitrobenzene d5	84.7	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Surr: 2-Fluorobiphenyl	80.3	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Surr: p-Terphenyl d14	83.9	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		04-NOV-13	R2732968
Ion Balance Calculation									
Ion Balance	96.5	-			%	-		13-NOV-13	
TDS (Calculated)	446	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	298	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	10.3	+/-0.47		0.50	mg/L	0		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	7.79	+/-0.04		0.10	pH	0		04-NOV-13	R2732970
Conductivity (EC)	799	+/-27		0.20	uS/cm	0		04-NOV-13	R2732970
Bicarbonate (HCO3)	545	-		5.0	mg/L	-		04-NOV-13	R2732970
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Alkalinity, Total (as CaCO3)	447	+/-16		2.0	mg/L	0		04-NOV-13	R2732970

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386771-2 16054131029008									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Toluene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
EthylBenzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
o-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Styrene	<0.0010	-		0.0010	mg/L	-		04-NOV-13	R2730783
F1(C6-C10)	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
F1-BTEX	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
Xylenes	<0.00071	-		0.00071	mg/L	-		04-NOV-13	R2730783
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
Surr: 2-Bromobenzotrifluoride	96.1	-		N/A	%	-	04-NOV-13	04-NOV-13	R2734016
ICP Metals & Hg -Dissolved									
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.102	+/-0.0089		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	81.1	+/-11		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		12-NOV-13	R2739197
Iron (Fe)-Dissolved	1.61	+/-0.15		0.010	mg/L	0		12-NOV-13	R2739197
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	23.9	+/-1.9		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	0.0548	+/-0.0037		0.0020	mg/L	0		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.00111	+/-0.00012		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Potassium (K)-Dissolved	5.27	+/-0.41		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Silicon (Si)-Dissolved	12.5	+/-1.1		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	55.1	+/-3.9		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	0.666	+/-0.050		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Hardness (from Dissolved Ca and Mg)									
Hardness (as CaCO3)	301	-		1.3	mg/L	-		13-NOV-13	
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		09-NOV-13	R2737347
Miscellaneous Parameters									
Ammonia, Total (as N)	2.29	-		0.050	mg/L	-		10-NOV-13	R2737984

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386771-2 16054131029008									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
Boron (B)-Dissolved	0.240	+/-0.029		0.0020	mg/L	0		12-NOV-13	R2739197
Dissolved Organic Carbon	6.3	+/-0.9		1.0	mg/L	0		09-NOV-13	R2737505
Naphthenic Acids	<1.0	-		1.0	mg/L	-	08-NOV-13	08-NOV-13	R2737525
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		10-NOV-13	R2738116
Total Kjeldahl Nitrogen	2.27	+/-0.46		0.20	mg/L	0	12-NOV-13	12-NOV-13	R2739042
Phosphorus (P)-Total	0.843	+/-0.069		0.020	mg/L	0	05-NOV-13	05-NOV-13	R2734215
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Fluoranthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Fluorene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Naphthalene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Phenanthrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Pyrene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(a)pyrene	<0.0000050	-		0.0000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Chrysene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Dibenzo(a,h)anthracene	<0.0000050	-		0.0000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Surr: Nitrobenzene d5	87.1	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Surr: 2-Fluorobiphenyl	80.0	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Surr: p-Terphenyl d14	92.3	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		04-NOV-13	R2732968
Ion Balance Calculation									
Ion Balance	88.6	-	BL:INT		%	-		13-NOV-13	
TDS (Calculated)	464	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	301	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	10.9	+/-0.49		0.50	mg/L	0		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	7.79	+/-0.04		0.10	pH	0		04-NOV-13	R2732970
Conductivity (EC)	792	+/-26		0.20	uS/cm	0		04-NOV-13	R2732970
Bicarbonate (HCO3)	586	-		5.0	mg/L	-		04-NOV-13	R2732970
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Alkalinity, Total (as CaCO3)	480	+/-17		2.0	mg/L	0		04-NOV-13	R2732970

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386771-3 16054131029009									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Toluene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
EthylBenzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
o-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Styrene	<0.0010	-		0.0010	mg/L	-		04-NOV-13	R2730783
F1(C6-C10)	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
F1-BTEX	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
Xylenes	<0.00071	-		0.00071	mg/L	-		04-NOV-13	R2730783
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
Surr: 2-Bromobenzotrifluoride	94.7	-		N/A	%	-	04-NOV-13	04-NOV-13	R2734016
ICP Metals & Hg -Dissolved									
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0013	+/-0.00039		0.0010	mg/L	0		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	0.00493	+/-0.00052		0.00040	mg/L	0		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.131	+/-0.011		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	52.7	+/-7.2		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		12-NOV-13	R2739197
Iron (Fe)-Dissolved	1.38	+/-0.12		0.010	mg/L	0		12-NOV-13	R2739197
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	13.6	+/-1.1		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	0.163	+/-0.011		0.0020	mg/L	0		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.00366	+/-0.00038		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	0.00029	+/-0.00005		0.00010	mg/L	0		12-NOV-13	R2739197
Potassium (K)-Dissolved	3.17	+/-0.24		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Silicon (Si)-Dissolved	12.1	+/-1.0		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	11.4	+/-0.80		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	0.427	+/-0.032		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	0.0012	+/-0.0003		0.0010	mg/L	0		12-NOV-13	R2739197
Hardness (from Dissolved Ca and Mg)									
Hardness (as CaCO3)	188	-		1.3	mg/L	-		13-NOV-13	
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		09-NOV-13	R2737347
Miscellaneous Parameters									
Ammonia, Total (as N)	0.519	-		0.050	mg/L	-		10-NOV-13	R2737984

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386771-3 16054131029009									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
Boron (B)-Dissolved	0.0848	+/-0.010		0.0020	mg/L	0		12-NOV-13	R2739197
Dissolved Organic Carbon	3.2	+/-0.6		1.0	mg/L	0		09-NOV-13	R2737505
Naphthenic Acids	<1.0	-		1.0	mg/L	-	08-NOV-13	08-NOV-13	R2737525
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		10-NOV-13	R2738116
Total Kjeldahl Nitrogen	0.48	+/-0.12		0.20	mg/L	0	12-NOV-13	12-NOV-13	R2739042
Phosphorus (P)-Total	0.352	+/-0.033		0.020	mg/L	0	05-NOV-13	05-NOV-13	R2734215
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Fluoranthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Fluorene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Naphthalene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Phenanthrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Pyrene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(a)pyrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Chrysene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Dibenzo(a,h)anthracene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Surr: Nitrobenzene d5	90.2	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Surr: 2-Fluorobiphenyl	83.3	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Surr: p-Terphenyl d14	94.3	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		04-NOV-13	R2732968
Ion Balance Calculation									
Ion Balance	96.8	-			%	-		13-NOV-13	
TDS (Calculated)	218	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	188	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	3.99	+/-0.21		0.50	mg/L	0		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	7.81	+/-0.04		0.10	pH	0		04-NOV-13	R2732970
Conductivity (EC)	404	+/-13		0.20	uS/cm	0		04-NOV-13	R2732970
Bicarbonate (HCO3)	270	-		5.0	mg/L	-		04-NOV-13	R2732970
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Alkalinity, Total (as CaCO3)	222	+/-8.6		2.0	mg/L	0		04-NOV-13	R2732970

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386771-4 16054131029010									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Toluene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
EthylBenzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
o-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Styrene	<0.0010	-		0.0010	mg/L	-		04-NOV-13	R2730783
F1(C6-C10)	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
F1-BTEX	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
Xylenes	<0.00071	-		0.00071	mg/L	-		04-NOV-13	R2730783
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
Surr: 2-Bromobenzotrifluoride	102.9	-		N/A	%	-	04-NOV-13	04-NOV-13	R2734016
ICP Metals & Hg -Dissolved									
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0034	+/-0.00065		0.0010	mg/L	0		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.0184	+/-0.0016		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	7.86	+/-1.1		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		12-NOV-13	R2739197
Iron (Fe)-Dissolved	<0.010	-		0.010	mg/L	-		12-NOV-13	R2739197
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	2.21	+/-0.17		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	<0.0020	-		0.0020	mg/L	-		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.00020	+/-0.00003		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	0.00140	+/-0.00012		0.00010	mg/L	0		12-NOV-13	R2739197
Potassium (K)-Dissolved	0.58	+/-0.04		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Silicon (Si)-Dissolved	4.97	+/-0.42		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	1.49	+/-0.10		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	0.0326	+/-0.0024		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	0.0015	+/-0.0003		0.0010	mg/L	0		12-NOV-13	R2739197
Hardness (from Dissolved Ca and Mg)									
Hardness (as CaCO3)	28.7	-		1.3	mg/L	-		13-NOV-13	
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		09-NOV-13	R2737347
Miscellaneous Parameters									
Ammonia, Total (as N)	<0.050	-		0.050	mg/L	-		10-NOV-13	R2737984

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386771-4 16054131029010									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
Boron (B)-Dissolved	0.0145	+/-0.0018		0.0020	mg/L	0		12-NOV-13	R2739197
Dissolved Organic Carbon	2.4	+/-0.6		1.0	mg/L	0		09-NOV-13	R2737505
Naphthenic Acids	<1.0	-		1.0	mg/L	-	08-NOV-13	08-NOV-13	R2737525
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		10-NOV-13	R2738116
Total Kjeldahl Nitrogen	<0.20	-		0.20	mg/L	-	12-NOV-13	12-NOV-13	R2739042
Phosphorus (P)-Total	0.036	+/-0.016		0.020	mg/L	0	05-NOV-13	05-NOV-13	R2734215
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Fluoranthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Fluorene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Naphthalene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Phenanthrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Pyrene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(a)pyrene	<0.0000050	-		0.0000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Chrysene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Dibenzo(a,h)anthracene	<0.0000050	-		0.0000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Surr: Nitrobenzene d5	91.5	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Surr: 2-Fluorobiphenyl	86.2	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Surr: p-Terphenyl d14	93.5	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	1.34	+/-0.08		0.50	mg/L	0		04-NOV-13	R2732968
Ion Balance Calculation									
Ion Balance	Low EC	-			%	-		13-NOV-13	
TDS (Calculated)	35.2	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	28.7	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	0.157	+/-0.014		0.050	mg/L	0		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	0.157	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	2.57	+/-0.16		0.50	mg/L	0		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	6.79	+/-0.04		0.10	pH	0		04-NOV-13	R2732970
Conductivity (EC)	69.5	+/-2.3		0.20	uS/cm	0		04-NOV-13	R2732970
Bicarbonate (HCO3)	37.6	-		5.0	mg/L	-		04-NOV-13	R2732970
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Alkalinity, Total (as CaCO3)	30.8	+/-2.6		2.0	mg/L	0		04-NOV-13	R2732970

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386771-5 16054131029012									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Toluene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
EthylBenzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
o-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Styrene	<0.0010	-		0.0010	mg/L	-		04-NOV-13	R2730783
F1(C6-C10)	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
F1-BTEX	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
Xylenes	<0.00071	-		0.00071	mg/L	-		04-NOV-13	R2730783
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
Surr: 2-Bromobenzotrifluoride	99.3	-		N/A	%	-	04-NOV-13	04-NOV-13	R2734016
ICP Metals & Hg -Dissolved									
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0027	+/-0.00055		0.0010	mg/L	0		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.0177	+/-0.0015		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	8.03	+/-1.1		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		12-NOV-13	R2739197
Iron (Fe)-Dissolved	<0.010	-		0.010	mg/L	-		12-NOV-13	R2739197
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	2.21	+/-0.17		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	<0.0020	-		0.0020	mg/L	-		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.00016	+/-0.00002		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	0.00140	+/-0.00012		0.00010	mg/L	0		12-NOV-13	R2739197
Potassium (K)-Dissolved	0.58	+/-0.04		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Silicon (Si)-Dissolved	4.93	+/-0.42		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	1.55	+/-0.11		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	0.0338	+/-0.0025		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Hardness (from Dissolved Ca and Mg)									
Hardness (as CaCO3)	29.2	-		1.3	mg/L	-		13-NOV-13	
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		09-NOV-13	R2737347
Miscellaneous Parameters									
Ammonia, Total (as N)	<0.050	-		0.050	mg/L	-		10-NOV-13	R2737984

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386771-5 16054131029012									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
Boron (B)-Dissolved	0.0129	+/-0.0016		0.0020	mg/L	0		12-NOV-13	R2739197
Dissolved Organic Carbon	2.4	+/-0.6		1.0	mg/L	0		09-NOV-13	R2737505
Naphthenic Acids	<1.0	-		1.0	mg/L	-	08-NOV-13	08-NOV-13	R2737525
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		10-NOV-13	R2738116
Total Kjeldahl Nitrogen	<0.20	-		0.20	mg/L	-	12-NOV-13	12-NOV-13	R2739042
Phosphorus (P)-Total	0.033	+/-0.016		0.020	mg/L	0	05-NOV-13	05-NOV-13	R2734215
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Fluoranthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Fluorene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Naphthalene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Phenanthrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Pyrene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(a)pyrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Chrysene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Dibenzo(a,h)anthracene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Surr: Nitrobenzene d5	89.0	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Surr: 2-Fluorobiphenyl	82.2	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Surr: p-Terphenyl d14	90.4	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	1.35	+/-0.08		0.50	mg/L	0		04-NOV-13	R2732968
Ion Balance Calculation									
Ion Balance	Low EC	-			%	-		13-NOV-13	
TDS (Calculated)	35.3	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	29.2	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	0.158	+/-0.014		0.050	mg/L	0		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	0.158	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	2.64	+/-0.16		0.50	mg/L	0		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	6.80	+/-0.04		0.10	pH	0		04-NOV-13	R2732970
Conductivity (EC)	68.4	+/-2.3		0.20	uS/cm	0		04-NOV-13	R2732970
Bicarbonate (HCO3)	37.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Alkalinity, Total (as CaCO3)	30.3	+/-2.6		2.0	mg/L	0		04-NOV-13	R2732970
* Refer to Referenced Information for Qualifiers (if any) and Methodology.									

Reference Information

Report Comments: 13-DEC-2013 Metals List was revised as well as DL for Cr
17-DEC-2013 LOR for Ag has been fixed

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Phosphorus (P)-Total	MS-B	
Matrix Spike	Phosphorus (P)-Total	MS-B	
Matrix Spike	Chloride (Cl)	MS-B	
Matrix Spike	Sulfate (SO4)	MS-B	

Sample Parameter Qualifier Key:

Qualifier	Description
BL:INT	Balance Reviewed: Interference Or Non-Measured Component
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
B-D-L-CCMS-ED	Water	Dissolved Boron in Water by CRC ICPMS		APHA 3030 B / EPA SW-846 6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).				
BTXS,F1-ED	Water	BTEX, Styrene and F1 (C6-C10)		EPA 5021/8015&8260 GC-MS & FID
C-DIS-ORG-ED	Water	Dissolved Organic Carbon		APHA 5310 B-Instrumental
CL-IC-ED	Water	Chloride by IC		APHA 4110 B-ION CHROMATOGRAPHY
ETL-HARDNESS-DIS-ED	Water	Hardness (from Dissolved Ca and Mg)		APHA 2340 B-Calculation
F2,F3,F4-ED	Water	F2, F3, F4		EPA 3510/CCME PHC CWS-GC-FID
HG-D-L-CVAA-ED	Water	Mercury (Hg) - Dissolved		EPA 245.7 / EPA 245.1
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET-D-CCMS-ED	Water	Dissolved Metals in Water by CRC ICPMS		APHA 3030 B&E / EPA SW-846 6020A
NAPHTHENIC-ACID-FM	Water	Naphthenic Acids by FTIR		Naphthenic Acids by FTIR, Syncrude, 1994
Dissolved naphthenic acids are solvent extracted from acidified aqueous samples using Dichloromethane prior to quantitation by Fourier Transform Infra-Red spectroscopy. Note that FTIR is not uniquely selective to naphthenic acids. If present, other carboxylic acids (e.g. humic acids, fulvic acids) may also be detected by this method.				
NH3-CFA-ED	Water	Ammonia in Water by Colour		APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.				
NO2+NO3-CALC-ED	Water	Nitrate+Nitrite		CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
P-T-COL-ED	Water	Total P in Water by Colour		APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.				
PAH-ABT1-ED	Water	PAH & Carcinogenic PAH List		EPA 3510/8270-GC/MS
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)				
PHENOLS-4AAP-ED	Water	Phenols (4AAP)		AB ENV.06537-COLORIMETRIC

This analysis is carried out using procedures adapted from ENVIRODAT VMV 06537 689, Method Code 154, in "Methods Manual for Chemical Analysis of Water and Wastes" published by the Alberta Environmental Centre. This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide and 4-aminoantipyrine to form a red complex which is measured at 505 nm.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
SO4-IC-ED	Water	Sulfate by IC		APHA 4110 B-ION CHROMATOGRAPHY
TKN-CFA-ED	Water	TKN in Water by Colour		APHA 4500-NORG (TKN)

This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 celcius with analysis using an automated colourimetric finish.

** The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS methods may incorporate modifications from the specified reference to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
FM	ALS ENVIRONMENTAL - FORT MCMURRAY, ALBERTA, CANADA

Chain of Custody Numbers:

M061025

GLOSSARY OF REPORT TERMS

Surr - Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

MU: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.

Bias: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent.

Zero values indicate no detectable method bias.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Quality Control Report

Workorder: L1386771

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-D-L-CCMS-ED		Water						
Batch	R2739197							
WG1786584-2	CRM	ED-HIGH-WATRM						
Boron (B)-Dissolved			95.2		%		80-120	12-NOV-13
WG1786584-3	DUP	L1386451-6						
Boron (B)-Dissolved		0.0114	0.0109		mg/L	4.4	20	12-NOV-13
WG1786584-4	DUP	L1386771-2						
Boron (B)-Dissolved		0.240	0.250		mg/L	4.0	20	12-NOV-13
WG1786584-5	DUP	L1387739-7						
Boron (B)-Dissolved		0.0143	0.0141		mg/L	0.9	20	12-NOV-13
WG1786584-6	DUP	L1387752-5						
Boron (B)-Dissolved		0.0879	0.0878		mg/L	0.1	20	12-NOV-13
WG1786584-1	MB							
Boron (B)-Dissolved			<0.0020		mg/L		0.002	12-NOV-13
BTXS,F1-ED		Water						
Batch	R2730783							
WG1781329-4	DUP	L1386772-4						
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-NOV-13
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-NOV-13
EthylBenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-NOV-13
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	04-NOV-13
m+p-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	04-NOV-13
Styrene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	50	04-NOV-13
F1(C6-C10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	04-NOV-13
WG1781329-2	LCS							
Benzene			100.6		%		70-130	03-NOV-13
Toluene			91.5		%		70-130	03-NOV-13
EthylBenzene			99.1		%		70-130	03-NOV-13
o-Xylene			106.3		%		70-130	03-NOV-13
m+p-Xylene			97.9		%		70-130	03-NOV-13
Styrene			100.4		%		70-130	03-NOV-13
WG1781329-3	LCS							
F1(C6-C10)			85.6		%		70-130	03-NOV-13
WG1781329-1	MB							
Benzene			<0.00050		mg/L		0.0005	03-NOV-13
Toluene			<0.00050		mg/L		0.0005	03-NOV-13
EthylBenzene			<0.00050		mg/L		0.0005	03-NOV-13
o-Xylene			<0.00050		mg/L		0.0005	03-NOV-13



Quality Control Report

Workorder: L1386771

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTXS,F1-ED								
	Water							
Batch	R2730783							
WG1781329-1	MB							
m+p-Xylene			<0.00050		mg/L		0.0005	03-NOV-13
Styrene			<0.0010		mg/L		0.001	03-NOV-13
F1(C6-C10)			<0.10		mg/L		0.1	03-NOV-13
WG1781329-5	MS	L1386772-4						
Benzene			97.4		%		50-150	04-NOV-13
Toluene			90.5		%		50-150	04-NOV-13
EthylBenzene			98.2		%		50-150	04-NOV-13
o-Xylene			106.3		%		50-150	04-NOV-13
m+p-Xylene			96.6		%		50-150	04-NOV-13
Styrene			97.9		%		50-150	04-NOV-13
WG1781329-6	MS	L1386772-4						
F1(C6-C10)			79.6		%		50-150	04-NOV-13
C-DIS-ORG-ED								
	Water							
Batch	R2737505							
WG1785307-3	CVS							
Dissolved Organic Carbon			109.8		%		80-160	08-NOV-13
WG1785307-6	DUP	L1386731-3						
Dissolved Organic Carbon		4.2	3.9		mg/L	6.7	20	09-NOV-13
WG1785307-8	DUP	L1386767-4						
Dissolved Organic Carbon		8.2	8.1		mg/L	1.2	20	09-NOV-13
WG1785307-2	LCS							
Dissolved Organic Carbon			95.2		%		80-120	08-NOV-13
WG1785307-1	MB							
Dissolved Organic Carbon			<1.0		mg/L		1	08-NOV-13
WG1785307-7	MS	L1386731-3						
Dissolved Organic Carbon			84.7		%		70-130	09-NOV-13
WG1785307-9	MS	L1386767-4						
Dissolved Organic Carbon			85.3		%		70-130	09-NOV-13
CL-IC-ED								
	Water							
Batch	R2732968							
WG1781728-3	DUP	L1386772-4						
Chloride (Cl)		0.96	0.94		mg/L	2.5	20	04-NOV-13
WG1781728-5	DUP	L1386805-1						
Chloride (Cl)		35.8	35.9		mg/L	0.3	20	04-NOV-13
WG1781728-7	DUP	L1387059-2						
Chloride (Cl)		450	447		mg/L	0.6	20	04-NOV-13



Quality Control Report

Workorder: L1386771

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-IC-ED		Water						
Batch	R2732968							
WG1781728-2	LCS							
Chloride (Cl)			105.1		%		90-110	04-NOV-13
WG1781728-1	MB							
Chloride (Cl)			<0.50		mg/L		0.5	04-NOV-13
WG1781728-4	MS	L1386772-4						
Chloride (Cl)			99.6		%		75-125	04-NOV-13
WG1781728-6	MS	L1386805-1						
Chloride (Cl)			98.1		%		75-125	04-NOV-13
WG1781728-8	MS	L1387059-2						
Chloride (Cl)			N/A	MS-B	%		-	04-NOV-13
F2,F3,F4-ED		Water						
Batch	R2734016							
WG1781653-5	LCS							
F2 (>C10-C16)			93.1		%		65-135	04-NOV-13
F3 (C16-C34)			98.8		%		65-135	04-NOV-13
F4 (C34-C50)			92.8		%		65-135	04-NOV-13
WG1781653-8	LCS							
F2 (>C10-C16)			95.8		%		65-135	04-NOV-13
F3 (C16-C34)			95.8		%		65-135	04-NOV-13
F4 (C34-C50)			92.0		%		65-135	04-NOV-13
WG1781653-4	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	04-NOV-13
F3 (C16-C34)			<0.25		mg/L		0.25	04-NOV-13
F4 (C34-C50)			<0.25		mg/L		0.25	04-NOV-13
Surrogate: 2-Bromobenzotrifluoride			93.4		%		50-150	04-NOV-13
WG1781653-7	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	04-NOV-13
F3 (C16-C34)			<0.25		mg/L		0.25	04-NOV-13
F4 (C34-C50)			<0.25		mg/L		0.25	04-NOV-13
Surrogate: 2-Bromobenzotrifluoride			92.8		%		50-150	04-NOV-13
WG1781653-9	MS	L1386772-1						
F2 (>C10-C16)			93.6		%		50-150	04-NOV-13
F3 (C16-C34)			96.1		%		50-150	04-NOV-13
F4 (C34-C50)			93.5		%		50-150	04-NOV-13
HG-D-L-CVAA-ED		Water						



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-D-L-CVAA-ED		Water						
Batch	R2737347							
WG1784962-4	DUP	L1386731-1						
Mercury (Hg)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	08-NOV-13
WG1784962-8	DUP	L1386451-12						
Mercury (Hg)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	09-NOV-13
WG1784962-2	LCS							
Mercury (Hg)-Dissolved			97.7		%		80-120	08-NOV-13
WG1784962-3	LCSD	WG1784962-2						
Mercury (Hg)-Dissolved		97.7	97.0		%	0.7	20	08-NOV-13
WG1784962-1	MB							
Mercury (Hg)-Dissolved			<0.000020		mg/L		0.00002	08-NOV-13
WG1784962-5	MS	L1386731-1						
Mercury (Hg)-Dissolved			98.3		%		70-130	08-NOV-13
WG1784962-9	MS	L1386451-12						
Mercury (Hg)-Dissolved			70.4		%		70-130	09-NOV-13
MET-D-CCMS-ED		Water						
Batch	R2739197							
WG1786584-2	CRM	ED-HIGH-WATRM						
Aluminum (Al)-Dissolved			101.1		%		80-120	12-NOV-13
Antimony (Sb)-Dissolved			101.4		%		80-120	12-NOV-13
Arsenic (As)-Dissolved			103.6		%		80-120	12-NOV-13
Barium (Ba)-Dissolved			105.6		%		80-120	12-NOV-13
Beryllium (Be)-Dissolved			96.3		%		80-120	12-NOV-13
Bismuth (Bi)-Dissolved			98.4		%		80-120	12-NOV-13
Cadmium (Cd)-Dissolved			102.7		%		80-120	12-NOV-13
Calcium (Ca)-Dissolved			99.6		%		80-120	12-NOV-13
Chromium (Cr)-Dissolved			96.0		%		80-120	12-NOV-13
Cobalt (Co)-Dissolved			96.8		%		80-120	12-NOV-13
Copper (Cu)-Dissolved			96.4		%		80-120	12-NOV-13
Lead (Pb)-Dissolved			98.4		%		80-120	12-NOV-13
Magnesium (Mg)-Dissolved			96.9		%		80-120	12-NOV-13
Manganese (Mn)-Dissolved			97.8		%		80-120	12-NOV-13
Molybdenum (Mo)-Dissolved			95.3		%		80-120	12-NOV-13
Nickel (Ni)-Dissolved			97.9		%		80-120	12-NOV-13
Potassium (K)-Dissolved			97.7		%		80-120	12-NOV-13
Selenium (Se)-Dissolved			104.7		%		80-120	12-NOV-13
Silicon (Si)-Dissolved			109.0		%		80-120	12-NOV-13



Quality Control Report

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Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED		Water						
Batch	R2739197							
WG1786584-2 CRM		ED-HIGH-WATRM						
Silver (Ag)-Dissolved			98.8		%		80-120	12-NOV-13
Sodium (Na)-Dissolved			100.3		%		80-120	12-NOV-13
Strontium (Sr)-Dissolved			101.4		%		80-120	12-NOV-13
Thallium (Tl)-Dissolved			97.9		%		80-120	12-NOV-13
Titanium (Ti)-Dissolved			98.5		%		80-120	12-NOV-13
Tin (Sn)-Dissolved			97.3		%		80-120	12-NOV-13
Uranium (U)-Dissolved			98.4		%		80-120	12-NOV-13
Vanadium (V)-Dissolved			98.3		%		80-120	12-NOV-13
Zinc (Zn)-Dissolved			99.4		%		80-120	12-NOV-13
WG1786584-3 DUP		L1386451-6						
Aluminum (Al)-Dissolved		0.0065	0.0050	J	mg/L	0.0014	0.002	12-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Arsenic (As)-Dissolved		0.00047	0.00047		mg/L	0.0	20	12-NOV-13
Barium (Ba)-Dissolved		0.0147	0.0148		mg/L	0.1	20	12-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cadmium (Cd)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Calcium (Ca)-Dissolved		25.0	23.8		mg/L	5.2	20	12-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Copper (Cu)-Dissolved		<0.00060	<0.00060	RPD-NA	mg/L	N/A	20	12-NOV-13
Iron (Fe)-Dissolved		0.523	0.529		mg/L	1.1	20	12-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Magnesium (Mg)-Dissolved		7.92	7.70		mg/L	2.8	20	12-NOV-13
Manganese (Mn)-Dissolved		0.0541	0.0528		mg/L	2.4	20	12-NOV-13
Molybdenum (Mo)-Dissolved		0.00012	0.00011		mg/L	3.1	20	12-NOV-13
Nickel (Ni)-Dissolved		0.00030	0.00035		mg/L	15	20	12-NOV-13
Potassium (K)-Dissolved		<0.50	<0.50	RPD-NA	mg/L	N/A	20	12-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Silicon (Si)-Dissolved		4.65	4.65		mg/L	0.1	20	12-NOV-13
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	12-NOV-13
Sodium (Na)-Dissolved		3.9	3.8		mg/L	2.1	20	12-NOV-13
Strontium (Sr)-Dissolved		0.0528	0.0517		mg/L	2.2	20	12-NOV-13



Quality Control Report

Workorder: L1386771

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2739197							
WG1786584-3	DUP	L1386451-6						
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	12-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	12-NOV-13
Uranium (U)-Dissolved		0.000029	0.000029		mg/L	0.9	20	12-NOV-13
Vanadium (V)-Dissolved		0.00010	0.00012		mg/L	18	20	12-NOV-13
WG1786584-4	DUP	L1386771-2						
Aluminum (Al)-Dissolved		<0.0010	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Arsenic (As)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Barium (Ba)-Dissolved		0.102	0.0982		mg/L	3.9	20	12-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cadmium (Cd)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Calcium (Ca)-Dissolved		81.1	81.1		mg/L	0.0	20	12-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Copper (Cu)-Dissolved		<0.00060	<0.0010	RPD-NA	mg/L	N/A	20	12-NOV-13
Iron (Fe)-Dissolved		1.61	1.64		mg/L	1.5	20	12-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Magnesium (Mg)-Dissolved		23.9	24.4		mg/L	1.9	20	12-NOV-13
Manganese (Mn)-Dissolved		0.0548	0.0549		mg/L	0.3	20	12-NOV-13
Molybdenum (Mo)-Dissolved		0.00111	0.00109		mg/L	1.6	20	12-NOV-13
Nickel (Ni)-Dissolved		<0.00010	<0.0020	RPD-NA	mg/L	N/A	20	12-NOV-13
Potassium (K)-Dissolved		5.27	5.30		mg/L	0.4	20	12-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Silicon (Si)-Dissolved		12.5	12.4		mg/L	0.8	20	12-NOV-13
Silver (Ag)-Dissolved		<0.000010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Sodium (Na)-Dissolved		55.1	55.7		mg/L	1.1	20	12-NOV-13
Strontium (Sr)-Dissolved		0.666	0.666		mg/L	0.1	20	12-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	12-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Uranium (U)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13



Quality Control Report

Workorder: L1386771

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2739197							
WG1786584-4	DUP	L1386771-2						
Vanadium (V)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Zinc (Zn)-Dissolved		<0.0010	<0.0030	RPD-NA	mg/L	N/A	20	12-NOV-13
WG1786584-5	DUP	L1387739-7						
Aluminum (Al)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Arsenic (As)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Barium (Ba)-Dissolved		0.137	0.139		mg/L	1.7	20	12-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cadmium (Cd)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Calcium (Ca)-Dissolved		125	124		mg/L	0.1	20	12-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Copper (Cu)-Dissolved		<0.00060	<0.00060	RPD-NA	mg/L	N/A	20	12-NOV-13
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	12-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Magnesium (Mg)-Dissolved		27.7	27.7		mg/L	0.1	20	12-NOV-13
Manganese (Mn)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Molybdenum (Mo)-Dissolved		0.00093	0.00095		mg/L	1.7	20	12-NOV-13
Nickel (Ni)-Dissolved		0.00116	0.00114		mg/L	1.9	20	12-NOV-13
Potassium (K)-Dissolved		1.73	1.73		mg/L	0.1	20	12-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Silicon (Si)-Dissolved		4.41	4.41		mg/L	0.1	20	12-NOV-13
Silver (Ag)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Sodium (Na)-Dissolved		11.1	11.1		mg/L	0.2	20	12-NOV-13
Strontium (Sr)-Dissolved		0.412	0.425		mg/L	3.1	20	12-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	12-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	12-NOV-13
Uranium (U)-Dissolved		0.00257	0.00255		mg/L	1.0	20	12-NOV-13
Vanadium (V)-Dissolved		0.00015	0.00016		mg/L	2.8	20	12-NOV-13
Zinc (Zn)-Dissolved		0.0034	0.0017	J	mg/L	0.0017	0.002	12-NOV-13
WG1786584-6	DUP	L1387752-5						



Quality Control Report

Workorder: L1386771

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2739197							
WG1786584-6	DUP	L1387752-5						
Aluminum (Al)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Arsenic (As)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Barium (Ba)-Dissolved		0.185	0.180		mg/L	2.3	20	12-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cadmium (Cd)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Calcium (Ca)-Dissolved		133	133		mg/L	0.1	20	12-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Cobalt (Co)-Dissolved		0.00047	0.00043		mg/L	8.0	20	12-NOV-13
Copper (Cu)-Dissolved		0.00123	0.00122		mg/L	0.5	20	12-NOV-13
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	12-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Magnesium (Mg)-Dissolved		38.8	38.3		mg/L	1.3	20	12-NOV-13
Manganese (Mn)-Dissolved		0.155	0.155		mg/L	0.2	20	12-NOV-13
Molybdenum (Mo)-Dissolved		0.00035	0.00036		mg/L	3.9	20	12-NOV-13
Nickel (Ni)-Dissolved		0.00270	0.00264		mg/L	2.3	20	12-NOV-13
Potassium (K)-Dissolved		1.95	1.94		mg/L	0.8	20	12-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Silicon (Si)-Dissolved		9.81	10.0		mg/L	1.9	20	12-NOV-13
Silver (Ag)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Sodium (Na)-Dissolved		41.5	40.1		mg/L	3.4	20	12-NOV-13
Strontium (Sr)-Dissolved		0.773	0.787		mg/L	1.8	20	12-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	12-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	12-NOV-13
Uranium (U)-Dissolved		0.0133	0.0133		mg/L	0.3	20	12-NOV-13
Vanadium (V)-Dissolved		0.00012	0.00012		mg/L	4.5	20	12-NOV-13
Zinc (Zn)-Dissolved		0.0063	0.0060		mg/L	5.4	20	12-NOV-13
WG1786584-1	MB							
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	12-NOV-13
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13



Quality Control Report

Workorder: L1386771

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2739197							
WG1786584-1	MB							
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	12-NOV-13
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	12-NOV-13
Calcium (Ca)-Dissolved			<0.020		mg/L		0.02	12-NOV-13
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Copper (Cu)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	12-NOV-13
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	12-NOV-13
Manganese (Mn)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Nickel (Ni)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Potassium (K)-Dissolved			<0.050		mg/L		0.05	12-NOV-13
Selenium (Se)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	12-NOV-13
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	12-NOV-13
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	12-NOV-13
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	12-NOV-13
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	12-NOV-13
Vanadium (V)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	12-NOV-13
NAPHTHENIC-ACID-FM								
	Water							
Batch	R2737525							
WG1784551-3	DUP	L1385544-2						
Naphthenic Acids		31.7	31.9		mg/L	0.6	30	08-NOV-13
WG1784551-4	LCS							
Naphthenic Acids			99.8		%		70-130	08-NOV-13
WG1784551-1	MB							
Naphthenic Acids			<1.0		mg/L		1	08-NOV-13



Quality Control Report

Workorder: L1386771

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NAPHTHENIC-ACID-FM								
Water								
Batch	R2737525							
WG1784551-2	MS	L1385544-1						
Naphthenic Acids			133.4		%		50-150	08-NOV-13
NH3-CFA-ED								
Water								
Batch	R2737984							
WG1785936-4	DUP	L1386548-2						
Ammonia, Total (as N)		0.053	0.051		mg/L	4.6	20	10-NOV-13
WG1785936-5	DUP	L1386573-2						
Ammonia, Total (as N)		0.074	0.060	J	mg/L	0.014	0.1	10-NOV-13
WG1785936-2	LCS							
Ammonia, Total (as N)			104.8		%		85-115	10-NOV-13
WG1785936-1	MB							
Ammonia, Total (as N)			<0.050		mg/L		0.05	10-NOV-13
WG1785936-3	MS	L1386451-12						
Ammonia, Total (as N)			112.3		%		75-125	10-NOV-13
NO2-IC-ED								
Water								
Batch	R2732968							
WG1781728-3	DUP	L1386772-4						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-5	DUP	L1386805-1						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-7	DUP	L1387059-2						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-2	LCS							
Nitrite (as N)			90.9		%		90-110	04-NOV-13
WG1781728-1	MB							
Nitrite (as N)			<0.050		mg/L		0.05	04-NOV-13
WG1781728-4	MS	L1386772-4						
Nitrite (as N)			84.6		%		75-125	04-NOV-13
WG1781728-6	MS	L1386805-1						
Nitrite (as N)			85.5		%		75-125	04-NOV-13
WG1781728-8	MS	L1387059-2						
Nitrite (as N)			78.4		%		75-125	04-NOV-13
NO3-IC-ED								
Water								
Batch	R2732968							
WG1781728-3	DUP	L1386772-4						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-5	DUP	L1386805-1						



Environmental

Quality Control Report

Workorder: L1386771

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-IC-ED		Water						
Batch	R2732968							
WG1781728-5	DUP	L1386805-1						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-7	DUP	L1387059-2						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-2	LCS							
Nitrate (as N)			102.7		%		90-110	04-NOV-13
WG1781728-1	MB							
Nitrate (as N)			<0.050		mg/L		0.05	04-NOV-13
WG1781728-4	MS	L1386772-4						
Nitrate (as N)			93.6		%		75-125	04-NOV-13
WG1781728-6	MS	L1386805-1						
Nitrate (as N)			98.9		%		75-125	04-NOV-13
WG1781728-8	MS	L1387059-2						
Nitrate (as N)			97.2		%		75-125	04-NOV-13
P-T-COL-ED		Water						
Batch	R2734215							
WG1782357-11	DUP	L1387367-4						
Phosphorus (P)-Total		<0.020	<0.020	RPD-NA	mg/L	N/A	20	05-NOV-13
WG1782357-12	DUP	L1387455-1						
Phosphorus (P)-Total		0.103	0.093		mg/L	9.4	20	05-NOV-13
WG1782357-3	DUP	L1386217-3						
Phosphorus (P)-Total		0.469	0.502		mg/L	6.8	20	05-NOV-13
WG1782357-5	DUP	L1386451-1						
Phosphorus (P)-Total		0.023	0.031	J	mg/L	0.008	0.04	05-NOV-13
WG1782357-7	DUP	L1386767-1						
Phosphorus (P)-Total		0.510	0.543		mg/L	6.2	20	05-NOV-13
WG1782357-9	DUP	L1386771-5						
Phosphorus (P)-Total		0.033	0.036		mg/L	9.1	20	05-NOV-13
WG1782357-2	LCS							
Phosphorus (P)-Total			100.9		%		80-120	05-NOV-13
WG1782357-1	MB							
Phosphorus (P)-Total			<0.020		mg/L		0.02	05-NOV-13
WG1782357-10	MS	L1386771-5						
Phosphorus (P)-Total			103.3		%		70-130	05-NOV-13
WG1782357-4	MS	L1386217-3						
Phosphorus (P)-Total			N/A	MS-B	%		-	05-NOV-13
WG1782357-6	MS	L1386451-1						
Phosphorus (P)-Total			105.6		%		70-130	05-NOV-13



Quality Control Report

Workorder: L1386771

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
P-T-COL-ED								
	Water							
Batch	R2734215							
WG1782357-8 MS		L1386767-1						
Phosphorus (P)-Total			N/A	MS-B	%		-	05-NOV-13
PAH-ABT1-ED								
	Water							
Batch	R2734551							
WG1782243-5 LCS								
Acenaphthene			84.9		%		60-130	06-NOV-13
Acenaphthylene			84.4		%		60-130	06-NOV-13
Anthracene			88.4		%		60-130	06-NOV-13
Fluoranthene			89.1		%		60-130	06-NOV-13
Fluorene			86.2		%		60-130	06-NOV-13
Naphthalene			81.5		%		50-130	06-NOV-13
Phenanthrene			89.3		%		60-130	06-NOV-13
Pyrene			88.9		%		60-130	06-NOV-13
Benzo(a)anthracene			90.0		%		60-130	06-NOV-13
Benzo(k)fluoranthene			91.9		%		60-130	06-NOV-13
Benzo(b&j)fluoranthene			91.6		%		60-130	06-NOV-13
Benzo(g,h,i)perylene			88.7		%		60-130	06-NOV-13
Benzo(a)pyrene			91.8		%		60-130	06-NOV-13
Chrysene			89.4		%		60-130	06-NOV-13
Dibenzo(a,h)anthracene			90.4		%		60-130	06-NOV-13
Indeno(1,2,3-cd)pyrene			86.9		%		60-130	06-NOV-13
WG1782243-4 MB								
Acenaphthene			<0.000020		mg/L		0.00002	06-NOV-13
Acenaphthylene			<0.000020		mg/L		0.00002	06-NOV-13
Anthracene			<0.000010		mg/L		0.00001	06-NOV-13
Fluoranthene			<0.000020		mg/L		0.00002	06-NOV-13
Fluorene			<0.000020		mg/L		0.00002	06-NOV-13
Naphthalene			<0.000050		mg/L		0.00005	06-NOV-13
Phenanthrene			<0.000050		mg/L		0.00005	06-NOV-13
Pyrene			<0.000020		mg/L		0.00002	06-NOV-13
Benzo(a)anthracene			<0.000010		mg/L		0.00001	06-NOV-13
Benzo(k)fluoranthene			<0.000010		mg/L		0.00001	06-NOV-13
Benzo(b&j)fluoranthene			<0.000010		mg/L		0.00001	06-NOV-13
Benzo(g,h,i)perylene			<0.000020		mg/L		0.00002	06-NOV-13



Quality Control Report

Workorder: L1386771

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ABT1-ED		Water						
Batch R2734551								
WG1782243-4 MB								
Benzo(a)pyrene			<0.0000050		mg/L		0.000005	06-NOV-13
Chrysene			<0.000020		mg/L		0.00002	06-NOV-13
Dibenzo(a,h)anthracene			<0.0000050		mg/L		0.000005	06-NOV-13
Indeno(1,2,3-cd)pyrene			<0.000010		mg/L		0.00001	06-NOV-13
Surrogate: Nitrobenzene d5			83.3		%		40-130	06-NOV-13
Surrogate: 2-Fluorobiphenyl			76.0		%		40-130	06-NOV-13
Surrogate: p-Terphenyl d14			90.2		%		40-130	06-NOV-13
PH/EC/ALK-ED		Water						
Batch R2732970								
WG1781579-7 DUP		L1386772-2						
pH		7.36	7.37	J	pH	0.00	0.3	04-NOV-13
Conductivity (EC)		1010	1010		uS/cm	0.2	10	04-NOV-13
Bicarbonate (HCO3)		726	723		mg/L	0.4	25	04-NOV-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	04-NOV-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	04-NOV-13
Alkalinity, Total (as CaCO3)		595	593		mg/L	0.4	20	04-NOV-13
WG1781579-9 DUP		L1387059-2						
pH		7.99	7.98	J	pH	0.01	0.3	04-NOV-13
Conductivity (EC)		2270	2280		uS/cm	0.5	10	04-NOV-13
Bicarbonate (HCO3)		356	354		mg/L	0.4	25	04-NOV-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	04-NOV-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	04-NOV-13
Alkalinity, Total (as CaCO3)		291	290		mg/L	0.4	20	04-NOV-13
WG1781579-2 LCS								
Conductivity (EC)			103.5		%		90-110	04-NOV-13
WG1781579-3 LCS								
pH			7.01		pH		6.7-7.3	04-NOV-13
WG1781579-4 LCS								
Alkalinity, Total (as CaCO3)			100.2		%		85-115	04-NOV-13
WG1781579-5 LCS								
Conductivity (EC)			101.2		%		90-110	04-NOV-13
WG1781579-1 MB								
Bicarbonate (HCO3)			<5.0		mg/L		5	04-NOV-13
Carbonate (CO3)			<5.0		mg/L		5	04-NOV-13
Hydroxide (OH)			<5.0		mg/L		5	04-NOV-13



Quality Control Report

Workorder: L1386771

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch	R2732970							
WG1781579-1	MB							
Hydroxide (OH)			<5.0		mg/L		5	04-NOV-13
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	04-NOV-13
PHENOLS-4AAP-ED		Water						
Batch	R2738116							
WG1786079-4	DUP	L1383649-9						
Phenols (4AAP)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	15	10-NOV-13
WG1786079-3	LCS							
Phenols (4AAP)			92.0		%		85-115	10-NOV-13
WG1786079-2	MB							
Phenols (4AAP)			<0.0010		mg/L		0.001	10-NOV-13
WG1786079-5	MS	L1386451-10						
Phenols (4AAP)			94.0		%		75-125	10-NOV-13
SO4-IC-ED		Water						
Batch	R2732968							
WG1781728-3	DUP	L1386772-4						
Sulfate (SO4)		1.13	1.05		mg/L	7.0	20	04-NOV-13
WG1781728-5	DUP	L1386805-1						
Sulfate (SO4)		22.9	22.8		mg/L	0.0	20	04-NOV-13
WG1781728-7	DUP	L1387059-2						
Sulfate (SO4)		166	165		mg/L	0.8	20	04-NOV-13
WG1781728-2	LCS							
Sulfate (SO4)			104.8		%		90-110	04-NOV-13
WG1781728-1	MB							
Sulfate (SO4)			<0.50		mg/L		0.5	04-NOV-13
WG1781728-4	MS	L1386772-4						
Sulfate (SO4)			99.0		%		75-125	04-NOV-13
WG1781728-6	MS	L1386805-1						
Sulfate (SO4)			97.7		%		75-125	04-NOV-13
WG1781728-8	MS	L1387059-2						
Sulfate (SO4)			N/A	MS-B	%		-	04-NOV-13
TKN-CFA-ED		Water						
Batch	R2739042							
WG1786421-6	DUP	L1390232-6						
Total Kjeldahl Nitrogen		<0.20	<0.20	RPD-NA	mg/L	N/A	20	12-NOV-13
WG1786421-2	LCS							
Total Kjeldahl Nitrogen			103		mg/L		75-125	12-NOV-13



Quality Control Report

Workorder: L1386771

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-CFA-ED	Water							
Batch	R2739042							
WG1786421-3	LCS							
Total Kjeldahl Nitrogen			105		mg/L		75-125	12-NOV-13
WG1786421-4	LCS							
Total Kjeldahl Nitrogen			88.3		mg/L		75-125	12-NOV-13
WG1786421-1	MB							
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	12-NOV-13
WG1786421-5	MS	L1386771-5						
Total Kjeldahl Nitrogen			100		mg/L		70-130	12-NOV-13

Quality Control Report

Workorder: L1386771

Report Date: 17-DEC-13

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

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Contact: SUE RAYNARD

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1386771

Report Date: 17-DEC-13

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2
Contact: SUE RAYNARD

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Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Anions and Nutrients							
Nitrate as N by IC							
	1	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	2	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	3	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	4	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	5	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
Nitrite as N by IC							
	1	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	2	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	3	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	4	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	5	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1386771 were received on 01-NOV-13 16:47.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



MATRIX SOLUTIONS INC.
ATTN: SUE RAYNARD
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Date Received: 01-NOV-13
Report Date: 13-DEC-13 14:26 (MT)
Version: FINAL REV. 2

Client Phone: 403-237-0606

Certificate of Analysis

Lab Work Order #: L1386771
Project P.O. #: NOT SUBMITTED
Job Reference: CONKLIN 76-07 16054-502 11-30-76-7 W4M
C of C Numbers: M061025
Legal Site Desc: 11-30-76-7 W4M

Comments:

13-DEC-2013 Metals List was revised as well as DL for Cr


Catherine Evaristo-Cordero
Senior Account Manager

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ADDRESS: 9936-67 Avenue, Edmonton, AB T6E 0P5 Canada | Phone: +1 780 413 5227 | Fax: +1 780 437 2311
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386771-1 16054131029007									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Toluene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
EthylBenzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
o-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Styrene	<0.0010	-		0.0010	mg/L	-		04-NOV-13	R2730783
F1(C6-C10)	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
F1-BTEX	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
Xylenes	<0.00071	-		0.00071	mg/L	-		04-NOV-13	R2730783
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
Surr: 2-Bromobenzotrifluoride	98.0	-		N/A	%	-	04-NOV-13	04-NOV-13	R2734016
ICP Metals & Hg -Dissolved									
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.115	+/-0.010		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	80.2	+/-11		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	0.00012	+/-0.00001		0.00010	mg/L	0		12-NOV-13	R2739197
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		12-NOV-13	R2739197
Iron (Fe)-Dissolved	1.43	+/-0.13		0.010	mg/L	0		12-NOV-13	R2739197
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	23.7	+/-1.8		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	0.0401	+/-0.0027		0.0020	mg/L	0		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.00050	+/-0.00006		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	0.00025	+/-0.00004		0.00010	mg/L	0		12-NOV-13	R2739197
Potassium (K)-Dissolved	5.27	+/-0.41		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Silicon (Si)-Dissolved	12.1	+/-1.0		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	58.5	+/-4.1		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	0.676	+/-0.050		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Hardness (from Dissolved Ca and Mg)									
Hardness (as CaCO3)	298	-		1.3	mg/L	-		13-NOV-13	
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		09-NOV-13	R2737347
Miscellaneous Parameters									
Ammonia, Total (as N)	2.69	-		0.050	mg/L	-		10-NOV-13	R2737984

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386771-1 16054131029007									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
Boron (B)-Dissolved	0.247	+/-0.030		0.0020	mg/L	0		12-NOV-13	R2739197
Dissolved Organic Carbon	6.3	+/-0.9		1.0	mg/L	0		09-NOV-13	R2737505
Naphthenic Acids	<1.0	-		1.0	mg/L	-	08-NOV-13	08-NOV-13	R2737525
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		10-NOV-13	R2738116
Total Kjeldahl Nitrogen	2.71	+/-0.55		0.20	mg/L	0	12-NOV-13	12-NOV-13	R2739042
Phosphorus (P)-Total	0.996	+/-0.081		0.020	mg/L	0	05-NOV-13	05-NOV-13	R2734215
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Fluoranthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Fluorene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Naphthalene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Phenanthrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Pyrene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(a)pyrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Chrysene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Dibenzo(a,h)anthracene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Surr: Nitrobenzene d5	84.7	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Surr: 2-Fluorobiphenyl	80.3	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Surr: p-Terphenyl d14	83.9	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		04-NOV-13	R2732968
Ion Balance Calculation									
Ion Balance	96.5	-			%	-		13-NOV-13	
TDS (Calculated)	446	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	298	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	10.3	+/-0.47		0.50	mg/L	0		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	7.79	+/-0.04		0.10	pH	0		04-NOV-13	R2732970
Conductivity (EC)	799	+/-27		0.20	uS/cm	0		04-NOV-13	R2732970
Bicarbonate (HCO3)	545	-		5.0	mg/L	-		04-NOV-13	R2732970
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Alkalinity, Total (as CaCO3)	447	+/-16		2.0	mg/L	0		04-NOV-13	R2732970

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386771-2 16054131029008									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Toluene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
EthylBenzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
o-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Styrene	<0.0010	-		0.0010	mg/L	-		04-NOV-13	R2730783
F1(C6-C10)	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
F1-BTEX	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
Xylenes	<0.00071	-		0.00071	mg/L	-		04-NOV-13	R2730783
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
Surr: 2-Bromobenzotrifluoride	96.1	-		N/A	%	-	04-NOV-13	04-NOV-13	R2734016
ICP Metals & Hg -Dissolved									
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.102	+/-0.0089		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	81.1	+/-11		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		12-NOV-13	R2739197
Iron (Fe)-Dissolved	1.61	+/-0.15		0.010	mg/L	0		12-NOV-13	R2739197
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	23.9	+/-1.9		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	0.0548	+/-0.0037		0.0020	mg/L	0		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.00111	+/-0.00012		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Potassium (K)-Dissolved	5.27	+/-0.41		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Silicon (Si)-Dissolved	12.5	+/-1.1		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	55.1	+/-3.9		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	0.666	+/-0.050		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Hardness (from Dissolved Ca and Mg)									
Hardness (as CaCO3)	301	-		1.3	mg/L	-		13-NOV-13	
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		09-NOV-13	R2737347
Miscellaneous Parameters									
Ammonia, Total (as N)	2.29	-		0.050	mg/L	-		10-NOV-13	R2737984

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386771-2 16054131029008									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
Boron (B)-Dissolved	0.240	+/-0.029		0.0020	mg/L	0		12-NOV-13	R2739197
Dissolved Organic Carbon	6.3	+/-0.9		1.0	mg/L	0		09-NOV-13	R2737505
Naphthenic Acids	<1.0	-		1.0	mg/L	-	08-NOV-13	08-NOV-13	R2737525
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		10-NOV-13	R2738116
Total Kjeldahl Nitrogen	2.27	+/-0.46		0.20	mg/L	0	12-NOV-13	12-NOV-13	R2739042
Phosphorus (P)-Total	0.843	+/-0.069		0.020	mg/L	0	05-NOV-13	05-NOV-13	R2734215
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Fluoranthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Fluorene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Naphthalene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Phenanthrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Pyrene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(a)pyrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Chrysene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Dibenzo(a,h)anthracene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Surr: Nitrobenzene d5	87.1	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Surr: 2-Fluorobiphenyl	80.0	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Surr: p-Terphenyl d14	92.3	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		04-NOV-13	R2732968
Ion Balance Calculation									
Ion Balance	88.6	-	BL:INT		%	-		13-NOV-13	
TDS (Calculated)	464	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	301	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	10.9	+/-0.49		0.50	mg/L	0		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	7.79	+/-0.04		0.10	pH	0		04-NOV-13	R2732970
Conductivity (EC)	792	+/-26		0.20	uS/cm	0		04-NOV-13	R2732970
Bicarbonate (HCO3)	586	-		5.0	mg/L	-		04-NOV-13	R2732970
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Alkalinity, Total (as CaCO3)	480	+/-17		2.0	mg/L	0		04-NOV-13	R2732970

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386771-3 16054131029009									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Toluene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
EthylBenzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
o-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Styrene	<0.0010	-		0.0010	mg/L	-		04-NOV-13	R2730783
F1(C6-C10)	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
F1-BTEX	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
Xylenes	<0.00071	-		0.00071	mg/L	-		04-NOV-13	R2730783
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
Surr: 2-Bromobenzotrifluoride	94.7	-		N/A	%	-	04-NOV-13	04-NOV-13	R2734016
ICP Metals & Hg -Dissolved									
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0013	+/-0.00039		0.0010	mg/L	0		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	0.00493	+/-0.00052		0.00040	mg/L	0		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.131	+/-0.011		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	52.7	+/-7.2		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		12-NOV-13	R2739197
Iron (Fe)-Dissolved	1.38	+/-0.12		0.010	mg/L	0		12-NOV-13	R2739197
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	13.6	+/-1.1		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	0.163	+/-0.011		0.0020	mg/L	0		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.00366	+/-0.00038		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	0.00029	+/-0.00005		0.00010	mg/L	0		12-NOV-13	R2739197
Potassium (K)-Dissolved	3.17	+/-0.24		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Silicon (Si)-Dissolved	12.1	+/-1.0		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	11.4	+/-0.80		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	0.427	+/-0.032		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	0.0012	+/-0.0003		0.0010	mg/L	0		12-NOV-13	R2739197
Hardness (from Dissolved Ca and Mg)									
Hardness (as CaCO3)	188	-		1.3	mg/L	-		13-NOV-13	
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		09-NOV-13	R2737347
Miscellaneous Parameters									
Ammonia, Total (as N)	0.519	-		0.050	mg/L	-		10-NOV-13	R2737984

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386771-3 16054131029009									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
Boron (B)-Dissolved	0.0848	+/-0.010		0.0020	mg/L	0		12-NOV-13	R2739197
Dissolved Organic Carbon	3.2	+/-0.6		1.0	mg/L	0		09-NOV-13	R2737505
Naphthenic Acids	<1.0	-		1.0	mg/L	-	08-NOV-13	08-NOV-13	R2737525
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		10-NOV-13	R2738116
Total Kjeldahl Nitrogen	0.48	+/-0.12		0.20	mg/L	0	12-NOV-13	12-NOV-13	R2739042
Phosphorus (P)-Total	0.352	+/-0.033		0.020	mg/L	0	05-NOV-13	05-NOV-13	R2734215
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Fluoranthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Fluorene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Naphthalene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Phenanthrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Pyrene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(a)pyrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Chrysene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Dibenzo(a,h)anthracene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Surr: Nitrobenzene d5	90.2	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Surr: 2-Fluorobiphenyl	83.3	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Surr: p-Terphenyl d14	94.3	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		04-NOV-13	R2732968
Ion Balance Calculation									
Ion Balance	96.8	-			%	-		13-NOV-13	
TDS (Calculated)	218	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	188	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	3.99	+/-0.21		0.50	mg/L	0		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	7.81	+/-0.04		0.10	pH	0		04-NOV-13	R2732970
Conductivity (EC)	404	+/-13		0.20	uS/cm	0		04-NOV-13	R2732970
Bicarbonate (HCO3)	270	-		5.0	mg/L	-		04-NOV-13	R2732970
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Alkalinity, Total (as CaCO3)	222	+/-8.6		2.0	mg/L	0		04-NOV-13	R2732970

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386771-4 16054131029010									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Toluene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
EthylBenzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
o-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Styrene	<0.0010	-		0.0010	mg/L	-		04-NOV-13	R2730783
F1(C6-C10)	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
F1-BTEX	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
Xylenes	<0.00071	-		0.00071	mg/L	-		04-NOV-13	R2730783
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
Surr: 2-Bromobenzotrifluoride	102.9	-		N/A	%	-	04-NOV-13	04-NOV-13	R2734016
ICP Metals & Hg -Dissolved									
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0034	+/-0.00065		0.0010	mg/L	0		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.0184	+/-0.0016		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	7.86	+/-1.1		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		12-NOV-13	R2739197
Iron (Fe)-Dissolved	<0.010	-		0.010	mg/L	-		12-NOV-13	R2739197
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	2.21	+/-0.17		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	<0.0020	-		0.0020	mg/L	-		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.00020	+/-0.00003		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	0.00140	+/-0.00012		0.00010	mg/L	0		12-NOV-13	R2739197
Potassium (K)-Dissolved	0.58	+/-0.04		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Silicon (Si)-Dissolved	4.97	+/-0.42		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	1.49	+/-0.10		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	0.0326	+/-0.0024		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	0.0015	+/-0.0003		0.0010	mg/L	0		12-NOV-13	R2739197
Hardness (from Dissolved Ca and Mg)									
Hardness (as CaCO3)	28.7	-		1.3	mg/L	-		13-NOV-13	
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		09-NOV-13	R2737347
Miscellaneous Parameters									
Ammonia, Total (as N)	<0.050	-		0.050	mg/L	-		10-NOV-13	R2737984

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386771-4 16054131029010									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
Boron (B)-Dissolved	0.0145	+/-0.0018		0.0020	mg/L	0		12-NOV-13	R2739197
Dissolved Organic Carbon	2.4	+/-0.6		1.0	mg/L	0		09-NOV-13	R2737505
Naphthenic Acids	<1.0	-		1.0	mg/L	-	08-NOV-13	08-NOV-13	R2737525
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		10-NOV-13	R2738116
Total Kjeldahl Nitrogen	<0.20	-		0.20	mg/L	-	12-NOV-13	12-NOV-13	R2739042
Phosphorus (P)-Total	0.036	+/-0.016		0.020	mg/L	0	05-NOV-13	05-NOV-13	R2734215
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Fluoranthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Fluorene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Naphthalene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Phenanthrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Pyrene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(a)pyrene	<0.0000050	-		0.0000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Chrysene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Dibenzo(a,h)anthracene	<0.0000050	-		0.0000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Surr: Nitrobenzene d5	91.5	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Surr: 2-Fluorobiphenyl	86.2	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Surr: p-Terphenyl d14	93.5	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	1.34	+/-0.08		0.50	mg/L	0		04-NOV-13	R2732968
Ion Balance Calculation									
Ion Balance	Low EC	-			%	-		13-NOV-13	
TDS (Calculated)	35.2	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	28.7	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	0.157	+/-0.014		0.050	mg/L	0		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	0.157	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	2.57	+/-0.16		0.50	mg/L	0		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	6.79	+/-0.04		0.10	pH	0		04-NOV-13	R2732970
Conductivity (EC)	69.5	+/-2.3		0.20	uS/cm	0		04-NOV-13	R2732970
Bicarbonate (HCO3)	37.6	-		5.0	mg/L	-		04-NOV-13	R2732970
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Alkalinity, Total (as CaCO3)	30.8	+/-2.6		2.0	mg/L	0		04-NOV-13	R2732970

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386771-5 16054131029012									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Toluene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
EthylBenzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
o-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Styrene	<0.0010	-		0.0010	mg/L	-		04-NOV-13	R2730783
F1(C6-C10)	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
F1-BTEX	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
Xylenes	<0.00071	-		0.00071	mg/L	-		04-NOV-13	R2730783
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
Surr: 2-Bromobenzotrifluoride	99.3	-		N/A	%	-	04-NOV-13	04-NOV-13	R2734016
ICP Metals & Hg -Dissolved									
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0027	+/-0.00055		0.0010	mg/L	0		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.0177	+/-0.0015		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	8.03	+/-1.1		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		12-NOV-13	R2739197
Iron (Fe)-Dissolved	<0.010	-		0.010	mg/L	-		12-NOV-13	R2739197
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	2.21	+/-0.17		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	<0.0020	-		0.0020	mg/L	-		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.00016	+/-0.00002		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	0.00140	+/-0.00012		0.00010	mg/L	0		12-NOV-13	R2739197
Potassium (K)-Dissolved	0.58	+/-0.04		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Silicon (Si)-Dissolved	4.93	+/-0.42		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	1.55	+/-0.11		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	0.0338	+/-0.0025		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Hardness (from Dissolved Ca and Mg)									
Hardness (as CaCO3)	29.2	-		1.3	mg/L	-		13-NOV-13	
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		09-NOV-13	R2737347
Miscellaneous Parameters									
Ammonia, Total (as N)	<0.050	-		0.050	mg/L	-		10-NOV-13	R2737984

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386771-5 16054131029012									
Sampled By: GK/BP on 29-OCT-13									
Matrix: WATER									
Boron (B)-Dissolved	0.0129	+/-0.0016		0.0020	mg/L	0		12-NOV-13	R2739197
Dissolved Organic Carbon	2.4	+/-0.6		1.0	mg/L	0		09-NOV-13	R2737505
Naphthenic Acids	<1.0	-		1.0	mg/L	-	08-NOV-13	08-NOV-13	R2737525
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		10-NOV-13	R2738116
Total Kjeldahl Nitrogen	<0.20	-		0.20	mg/L	-	12-NOV-13	12-NOV-13	R2739042
Phosphorus (P)-Total	0.033	+/-0.016		0.020	mg/L	0	05-NOV-13	05-NOV-13	R2734215
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Fluoranthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Fluorene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Naphthalene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Phenanthrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Pyrene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Benzo(a)pyrene	<0.0000050	-		0.0000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Chrysene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Dibenzo(a,h)anthracene	<0.0000050	-		0.0000050	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	05-NOV-13	06-NOV-13	R2734551
Surr: Nitrobenzene d5	89.0	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Surr: 2-Fluorobiphenyl	82.2	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Surr: p-Terphenyl d14	90.4	-		N/A	%	-	05-NOV-13	06-NOV-13	R2734551
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	1.35	+/-0.08		0.50	mg/L	0		04-NOV-13	R2732968
Ion Balance Calculation									
Ion Balance	Low EC	-			%	-		13-NOV-13	
TDS (Calculated)	35.3	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	29.2	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	0.158	+/-0.014		0.050	mg/L	0		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	0.158	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	2.64	+/-0.16		0.50	mg/L	0		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	6.80	+/-0.04		0.10	pH	0		04-NOV-13	R2732970
Conductivity (EC)	68.4	+/-2.3		0.20	uS/cm	0		04-NOV-13	R2732970
Bicarbonate (HCO3)	37.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Alkalinity, Total (as CaCO3)	30.3	+/-2.6		2.0	mg/L	0		04-NOV-13	R2732970
* Refer to Referenced Information for Qualifiers (if any) and Methodology.									

Reference Information

Report Comments:

13-DEC-2013 Metals List was revised as well as DL for Cr

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Phosphorus (P)-Total	MS-B	
Matrix Spike	Phosphorus (P)-Total	MS-B	
Matrix Spike	Chloride (Cl)	MS-B	
Matrix Spike	Sulfate (SO4)	MS-B	

Sample Parameter Qualifier Key:

Qualifier	Description
BL:INT	Balance Reviewed: Interference Or Non-Measured Component
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
B-D-L-CCMS-ED	Water	Dissolved Boron in Water by CRC ICPMS		APHA 3030 B / EPA SW-846 6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).				
BTXS,F1-ED	Water	BTEX, Styrene and F1 (C6-C10)		EPA 5021/8015&8260 GC-MS & FID
C-DIS-ORG-ED	Water	Dissolved Organic Carbon		APHA 5310 B-Instrumental
CL-IC-ED	Water	Chloride by IC		APHA 4110 B-ION CHROMATOGRAPHY
ETL-HARDNESS-DIS-ED	Water	Hardness (from Dissolved Ca and Mg)		APHA 2340 B-Calculation
F2,F3,F4-ED	Water	F2, F3, F4		EPA 3510/CCME PHC CWS-GC-FID
HG-D-L-CVAA-ED	Water	Mercury (Hg) - Dissolved		EPA 245.7 / EPA 245.1
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET-D-CCMS-ED	Water	Dissolved Metals in Water by CRC ICPMS		APHA 3030 B&E / EPA SW-846 6020A
NAPHTHENIC-ACID-FM	Water	Naphthenic Acids by FTIR		Naphthenic Acids by FTIR, Syncrude, 1994
Dissolved naphthenic acids are solvent extracted from acidified aqueous samples using Dichloromethane prior to quantitation by Fourier Transform Infra-Red spectroscopy. Note that FTIR is not uniquely selective to naphthenic acids. If present, other carboxylic acids (e.g. humic acids, fulvic acids) may also be detected by this method.				
NH3-CFA-ED	Water	Ammonia in Water by Colour		APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.				
NO2+NO3-CALC-ED	Water	Nitrate+Nitrite		CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
P-T-COL-ED	Water	Total P in Water by Colour		APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.				
PAH-ABT1-ED	Water	PAH & Carcinogenic PAH List		EPA 3510/8270-GC/MS
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)				
PHENOLS-4AAP-ED	Water	Phenols (4AAP)		AB ENV.06537-COLORIMETRIC

This analysis is carried out using procedures adapted from ENVIRODAT VMV 06537 689, Method Code 154, in "Methods Manual for Chemical Analysis of Water and Wastes" published by the Alberta Environmental Centre. This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide and 4-aminoantipyrine to form a red complex which is measured at 505 nm.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
SO4-IC-ED	Water	Sulfate by IC		APHA 4110 B-ION CHROMATOGRAPHY
TKN-CFA-ED	Water	TKN in Water by Colour		APHA 4500-NORG (TKN)

This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 celcius with analysis using an automated colourimetric finish.

** The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS methods may incorporate modifications from the specified reference to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
FM	ALS ENVIRONMENTAL - FORT MCMURRAY, ALBERTA, CANADA

Chain of Custody Numbers:

M061025

GLOSSARY OF REPORT TERMS

Surr - Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

MU: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.

Bias: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent.

Zero values indicate no detectable method bias.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Quality Control Report

Workorder: L1386771

Report Date: 13-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-D-L-CCMS-ED		Water						
Batch	R2739197							
WG1786584-2	CRM	ED-HIGH-WATRM						
Boron (B)-Dissolved			95.2		%		80-120	12-NOV-13
WG1786584-3	DUP	L1386451-6						
Boron (B)-Dissolved		0.0114	0.0109		mg/L	4.4	20	12-NOV-13
WG1786584-4	DUP	L1386771-2						
Boron (B)-Dissolved		0.240	0.250		mg/L	4.0	20	12-NOV-13
WG1786584-5	DUP	L1387739-7						
Boron (B)-Dissolved		0.0143	0.0141		mg/L	0.9	20	12-NOV-13
WG1786584-6	DUP	L1387752-5						
Boron (B)-Dissolved		0.0879	0.0878		mg/L	0.1	20	12-NOV-13
WG1786584-1	MB		<0.0020		mg/L		0.002	12-NOV-13
BTXS,F1-ED		Water						
Batch	R2730783							
WG1781329-4	DUP	L1386772-4						
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-NOV-13
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-NOV-13
EthylBenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-NOV-13
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	04-NOV-13
m+p-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	04-NOV-13
Styrene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	50	04-NOV-13
F1(C6-C10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	04-NOV-13
WG1781329-2	LCS							
Benzene			100.6		%		70-130	03-NOV-13
Toluene			91.5		%		70-130	03-NOV-13
EthylBenzene			99.1		%		70-130	03-NOV-13
o-Xylene			106.3		%		70-130	03-NOV-13
m+p-Xylene			97.9		%		70-130	03-NOV-13
Styrene			100.4		%		70-130	03-NOV-13
WG1781329-3	LCS							
F1(C6-C10)			85.6		%		70-130	03-NOV-13
WG1781329-1	MB							
Benzene			<0.00050		mg/L		0.0005	03-NOV-13
Toluene			<0.00050		mg/L		0.0005	03-NOV-13
EthylBenzene			<0.00050		mg/L		0.0005	03-NOV-13
o-Xylene			<0.00050		mg/L		0.0005	03-NOV-13



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Workorder: L1386771

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTXS,F1-ED								
	Water							
Batch	R2730783							
WG1781329-1	MB							
m+p-Xylene			<0.00050		mg/L		0.0005	03-NOV-13
Styrene			<0.0010		mg/L		0.001	03-NOV-13
F1(C6-C10)			<0.10		mg/L		0.1	03-NOV-13
WG1781329-5	MS	L1386772-4						
Benzene			97.4		%		50-150	04-NOV-13
Toluene			90.5		%		50-150	04-NOV-13
EthylBenzene			98.2		%		50-150	04-NOV-13
o-Xylene			106.3		%		50-150	04-NOV-13
m+p-Xylene			96.6		%		50-150	04-NOV-13
Styrene			97.9		%		50-150	04-NOV-13
WG1781329-6	MS	L1386772-4						
F1(C6-C10)			79.6		%		50-150	04-NOV-13
C-DIS-ORG-ED								
	Water							
Batch	R2737505							
WG1785307-3	CVS							
Dissolved Organic Carbon			109.8		%		80-160	08-NOV-13
WG1785307-6	DUP	L1386731-3						
Dissolved Organic Carbon		4.2	3.9		mg/L	6.7	20	09-NOV-13
WG1785307-8	DUP	L1386767-4						
Dissolved Organic Carbon		8.2	8.1		mg/L	1.2	20	09-NOV-13
WG1785307-2	LCS							
Dissolved Organic Carbon			95.2		%		80-120	08-NOV-13
WG1785307-1	MB							
Dissolved Organic Carbon			<1.0		mg/L		1	08-NOV-13
WG1785307-7	MS	L1386731-3						
Dissolved Organic Carbon			84.7		%		70-130	09-NOV-13
WG1785307-9	MS	L1386767-4						
Dissolved Organic Carbon			85.3		%		70-130	09-NOV-13
CL-IC-ED								
	Water							
Batch	R2732968							
WG1781728-3	DUP	L1386772-4						
Chloride (Cl)		0.96	0.94		mg/L	2.5	20	04-NOV-13
WG1781728-5	DUP	L1386805-1						
Chloride (Cl)		35.8	35.9		mg/L	0.3	20	04-NOV-13
WG1781728-7	DUP	L1387059-2						
Chloride (Cl)		450	447		mg/L	0.6	20	04-NOV-13



Quality Control Report

Workorder: L1386771

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-IC-ED		Water						
Batch	R2732968							
WG1781728-2	LCS							
Chloride (Cl)			105.1		%		90-110	04-NOV-13
WG1781728-1	MB							
Chloride (Cl)			<0.50		mg/L		0.5	04-NOV-13
WG1781728-4	MS	L1386772-4						
Chloride (Cl)			99.6		%		75-125	04-NOV-13
WG1781728-6	MS	L1386805-1						
Chloride (Cl)			98.1		%		75-125	04-NOV-13
WG1781728-8	MS	L1387059-2						
Chloride (Cl)			N/A	MS-B	%		-	04-NOV-13
F2,F3,F4-ED		Water						
Batch	R2734016							
WG1781653-5	LCS							
F2 (>C10-C16)			93.1		%		65-135	04-NOV-13
F3 (C16-C34)			98.8		%		65-135	04-NOV-13
F4 (C34-C50)			92.8		%		65-135	04-NOV-13
WG1781653-8	LCS							
F2 (>C10-C16)			95.8		%		65-135	04-NOV-13
F3 (C16-C34)			95.8		%		65-135	04-NOV-13
F4 (C34-C50)			92.0		%		65-135	04-NOV-13
WG1781653-4	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	04-NOV-13
F3 (C16-C34)			<0.25		mg/L		0.25	04-NOV-13
F4 (C34-C50)			<0.25		mg/L		0.25	04-NOV-13
Surrogate: 2-Bromobenzotrifluoride			93.4		%		50-150	04-NOV-13
WG1781653-7	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	04-NOV-13
F3 (C16-C34)			<0.25		mg/L		0.25	04-NOV-13
F4 (C34-C50)			<0.25		mg/L		0.25	04-NOV-13
Surrogate: 2-Bromobenzotrifluoride			92.8		%		50-150	04-NOV-13
WG1781653-9	MS	L1386772-1						
F2 (>C10-C16)			93.6		%		50-150	04-NOV-13
F3 (C16-C34)			96.1		%		50-150	04-NOV-13
F4 (C34-C50)			93.5		%		50-150	04-NOV-13
HG-D-L-CVAA-ED		Water						



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-D-L-CVAA-ED		Water						
Batch	R2737347							
WG1784962-4	DUP	L1386731-1						
Mercury (Hg)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	08-NOV-13
WG1784962-8	DUP	L1386451-12						
Mercury (Hg)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	09-NOV-13
WG1784962-2	LCS							
Mercury (Hg)-Dissolved			97.7		%		80-120	08-NOV-13
WG1784962-3	LCSD	WG1784962-2						
Mercury (Hg)-Dissolved		97.7	97.0		%	0.7	20	08-NOV-13
WG1784962-1	MB							
Mercury (Hg)-Dissolved			<0.000020		mg/L		0.00002	08-NOV-13
WG1784962-5	MS	L1386731-1						
Mercury (Hg)-Dissolved			98.3		%		70-130	08-NOV-13
WG1784962-9	MS	L1386451-12						
Mercury (Hg)-Dissolved			70.4		%		70-130	09-NOV-13
MET-D-CCMS-ED		Water						
Batch	R2739197							
WG1786584-2	CRM	ED-HIGH-WATRM						
Aluminum (Al)-Dissolved			101.1		%		80-120	12-NOV-13
Antimony (Sb)-Dissolved			101.4		%		80-120	12-NOV-13
Arsenic (As)-Dissolved			103.6		%		80-120	12-NOV-13
Barium (Ba)-Dissolved			105.6		%		80-120	12-NOV-13
Beryllium (Be)-Dissolved			96.3		%		80-120	12-NOV-13
Bismuth (Bi)-Dissolved			98.4		%		80-120	12-NOV-13
Cadmium (Cd)-Dissolved			102.7		%		80-120	12-NOV-13
Calcium (Ca)-Dissolved			99.6		%		80-120	12-NOV-13
Chromium (Cr)-Dissolved			96.0		%		80-120	12-NOV-13
Cobalt (Co)-Dissolved			96.8		%		80-120	12-NOV-13
Copper (Cu)-Dissolved			96.4		%		80-120	12-NOV-13
Lead (Pb)-Dissolved			98.4		%		80-120	12-NOV-13
Magnesium (Mg)-Dissolved			96.9		%		80-120	12-NOV-13
Manganese (Mn)-Dissolved			97.8		%		80-120	12-NOV-13
Molybdenum (Mo)-Dissolved			95.3		%		80-120	12-NOV-13
Nickel (Ni)-Dissolved			97.9		%		80-120	12-NOV-13
Potassium (K)-Dissolved			97.7		%		80-120	12-NOV-13
Selenium (Se)-Dissolved			104.7		%		80-120	12-NOV-13
Silicon (Si)-Dissolved			109.0		%		80-120	12-NOV-13



Quality Control Report

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED		Water						
Batch	R2739197							
WG1786584-2 CRM	ED-HIGH-WATRM							
Silver (Ag)-Dissolved			98.8		%		80-120	12-NOV-13
Sodium (Na)-Dissolved			100.3		%		80-120	12-NOV-13
Strontium (Sr)-Dissolved			101.4		%		80-120	12-NOV-13
Thallium (Tl)-Dissolved			97.9		%		80-120	12-NOV-13
Titanium (Ti)-Dissolved			98.5		%		80-120	12-NOV-13
Tin (Sn)-Dissolved			97.3		%		80-120	12-NOV-13
Uranium (U)-Dissolved			98.4		%		80-120	12-NOV-13
Vanadium (V)-Dissolved			98.3		%		80-120	12-NOV-13
Zinc (Zn)-Dissolved			99.4		%		80-120	12-NOV-13
WG1786584-3 DUP		L1386451-6						
Aluminum (Al)-Dissolved		0.0065	0.0050	J	mg/L	0.0014	0.002	12-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Arsenic (As)-Dissolved		0.00047	0.00047		mg/L	0.0	20	12-NOV-13
Barium (Ba)-Dissolved		0.0147	0.0148		mg/L	0.1	20	12-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cadmium (Cd)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Calcium (Ca)-Dissolved		25.0	23.8		mg/L	5.2	20	12-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Copper (Cu)-Dissolved		<0.00060	<0.00060	RPD-NA	mg/L	N/A	20	12-NOV-13
Iron (Fe)-Dissolved		0.523	0.529		mg/L	1.1	20	12-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Magnesium (Mg)-Dissolved		7.92	7.70		mg/L	2.8	20	12-NOV-13
Manganese (Mn)-Dissolved		0.0541	0.0528		mg/L	2.4	20	12-NOV-13
Molybdenum (Mo)-Dissolved		0.00012	0.00011		mg/L	3.1	20	12-NOV-13
Nickel (Ni)-Dissolved		0.00030	0.00035		mg/L	15	20	12-NOV-13
Potassium (K)-Dissolved		<0.50	<0.50	RPD-NA	mg/L	N/A	20	12-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Silicon (Si)-Dissolved		4.65	4.65		mg/L	0.1	20	12-NOV-13
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	12-NOV-13
Sodium (Na)-Dissolved		3.9	3.8		mg/L	2.1	20	12-NOV-13
Strontium (Sr)-Dissolved		0.0528	0.0517		mg/L	2.2	20	12-NOV-13



Quality Control Report

Workorder: L1386771

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2739197							
WG1786584-3	DUP	L1386451-6						
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	12-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	12-NOV-13
Uranium (U)-Dissolved		0.000029	0.000029		mg/L	0.9	20	12-NOV-13
Vanadium (V)-Dissolved		0.00010	0.00012		mg/L	18	20	12-NOV-13
WG1786584-4	DUP	L1386771-2						
Aluminum (Al)-Dissolved		<0.0010	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Arsenic (As)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Barium (Ba)-Dissolved		0.102	0.0982		mg/L	3.9	20	12-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cadmium (Cd)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Calcium (Ca)-Dissolved		81.1	81.1		mg/L	0.0	20	12-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Copper (Cu)-Dissolved		<0.00060	<0.0010	RPD-NA	mg/L	N/A	20	12-NOV-13
Iron (Fe)-Dissolved		1.61	1.64		mg/L	1.5	20	12-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Magnesium (Mg)-Dissolved		23.9	24.4		mg/L	1.9	20	12-NOV-13
Manganese (Mn)-Dissolved		0.0548	0.0549		mg/L	0.3	20	12-NOV-13
Molybdenum (Mo)-Dissolved		0.00111	0.00109		mg/L	1.6	20	12-NOV-13
Nickel (Ni)-Dissolved		<0.00010	<0.0020	RPD-NA	mg/L	N/A	20	12-NOV-13
Potassium (K)-Dissolved		5.27	5.30		mg/L	0.4	20	12-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Silicon (Si)-Dissolved		12.5	12.4		mg/L	0.8	20	12-NOV-13
Silver (Ag)-Dissolved		<0.00020	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Sodium (Na)-Dissolved		55.1	55.7		mg/L	1.1	20	12-NOV-13
Strontium (Sr)-Dissolved		0.666	0.666		mg/L	0.1	20	12-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	12-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Uranium (U)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13



Quality Control Report

Workorder: L1386771

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2739197							
WG1786584-4	DUP	L1386771-2						
Vanadium (V)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Zinc (Zn)-Dissolved		<0.0010	<0.0030	RPD-NA	mg/L	N/A	20	12-NOV-13
WG1786584-5	DUP	L1387739-7						
Aluminum (Al)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Arsenic (As)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Barium (Ba)-Dissolved		0.137	0.139		mg/L	1.7	20	12-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cadmium (Cd)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Calcium (Ca)-Dissolved		125	124		mg/L	0.1	20	12-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Copper (Cu)-Dissolved		<0.00060	<0.00060	RPD-NA	mg/L	N/A	20	12-NOV-13
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	12-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Magnesium (Mg)-Dissolved		27.7	27.7		mg/L	0.1	20	12-NOV-13
Manganese (Mn)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Molybdenum (Mo)-Dissolved		0.00093	0.00095		mg/L	1.7	20	12-NOV-13
Nickel (Ni)-Dissolved		0.00116	0.00114		mg/L	1.9	20	12-NOV-13
Potassium (K)-Dissolved		1.73	1.73		mg/L	0.1	20	12-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Silicon (Si)-Dissolved		4.41	4.41		mg/L	0.1	20	12-NOV-13
Silver (Ag)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Sodium (Na)-Dissolved		11.1	11.1		mg/L	0.2	20	12-NOV-13
Strontium (Sr)-Dissolved		0.412	0.425		mg/L	3.1	20	12-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	12-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	12-NOV-13
Uranium (U)-Dissolved		0.00257	0.00255		mg/L	1.0	20	12-NOV-13
Vanadium (V)-Dissolved		0.00015	0.00016		mg/L	2.8	20	12-NOV-13
Zinc (Zn)-Dissolved		0.0034	0.0017	J	mg/L	0.0017	0.002	12-NOV-13
WG1786584-6	DUP	L1387752-5						



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2739197							
WG1786584-6	DUP	L1387752-5						
Aluminum (Al)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Arsenic (As)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Barium (Ba)-Dissolved		0.185	0.180		mg/L	2.3	20	12-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cadmium (Cd)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Calcium (Ca)-Dissolved		133	133		mg/L	0.1	20	12-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Cobalt (Co)-Dissolved		0.00047	0.00043		mg/L	8.0	20	12-NOV-13
Copper (Cu)-Dissolved		0.00123	0.00122		mg/L	0.5	20	12-NOV-13
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	12-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Magnesium (Mg)-Dissolved		38.8	38.3		mg/L	1.3	20	12-NOV-13
Manganese (Mn)-Dissolved		0.155	0.155		mg/L	0.2	20	12-NOV-13
Molybdenum (Mo)-Dissolved		0.00035	0.00036		mg/L	3.9	20	12-NOV-13
Nickel (Ni)-Dissolved		0.00270	0.00264		mg/L	2.3	20	12-NOV-13
Potassium (K)-Dissolved		1.95	1.94		mg/L	0.8	20	12-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Silicon (Si)-Dissolved		9.81	10.0		mg/L	1.9	20	12-NOV-13
Silver (Ag)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Sodium (Na)-Dissolved		41.5	40.1		mg/L	3.4	20	12-NOV-13
Strontium (Sr)-Dissolved		0.773	0.787		mg/L	1.8	20	12-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	12-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	12-NOV-13
Uranium (U)-Dissolved		0.0133	0.0133		mg/L	0.3	20	12-NOV-13
Vanadium (V)-Dissolved		0.00012	0.00012		mg/L	4.5	20	12-NOV-13
Zinc (Zn)-Dissolved		0.0063	0.0060		mg/L	5.4	20	12-NOV-13
WG1786584-1	MB							
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	12-NOV-13
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13



Quality Control Report

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2739197							
WG1786584-1	MB							
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Beryllium (Be)-Dissolved			<0.000050		mg/L		0.0005	12-NOV-13
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	12-NOV-13
Calcium (Ca)-Dissolved			<0.020		mg/L		0.02	12-NOV-13
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Copper (Cu)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	12-NOV-13
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	12-NOV-13
Manganese (Mn)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Nickel (Ni)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Potassium (K)-Dissolved			<0.050		mg/L		0.05	12-NOV-13
Selenium (Se)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	12-NOV-13
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	12-NOV-13
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	12-NOV-13
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	12-NOV-13
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	12-NOV-13
Vanadium (V)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	12-NOV-13
NAPHTHENIC-ACID-FM								
	Water							
Batch	R2737525							
WG1784551-3	DUP	L1385544-2						
Naphthenic Acids		31.7	31.9		mg/L	0.6	30	08-NOV-13
WG1784551-4	LCS							
Naphthenic Acids			99.8		%		70-130	08-NOV-13
WG1784551-1	MB							
Naphthenic Acids			<1.0		mg/L		1	08-NOV-13



Quality Control Report

Workorder: L1386771

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NAPHTHENIC-ACID-FM Water								
Batch	R2737525							
WG1784551-2	MS	L1385544-1						
Naphthenic Acids			133.4		%		50-150	08-NOV-13
NH3-CFA-ED Water								
Batch	R2737984							
WG1785936-4	DUP	L1386548-2						
Ammonia, Total (as N)			0.053		mg/L	4.6	20	10-NOV-13
WG1785936-5	DUP	L1386573-2						
Ammonia, Total (as N)			0.074	J	mg/L	0.014	0.1	10-NOV-13
WG1785936-2	LCS							
Ammonia, Total (as N)			104.8		%		85-115	10-NOV-13
WG1785936-1	MB							
Ammonia, Total (as N)			<0.050		mg/L		0.05	10-NOV-13
WG1785936-3	MS	L1386451-12						
Ammonia, Total (as N)			112.3		%		75-125	10-NOV-13
NO2-IC-ED Water								
Batch	R2732968							
WG1781728-3	DUP	L1386772-4						
Nitrite (as N)			<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-5	DUP	L1386805-1						
Nitrite (as N)			<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-7	DUP	L1387059-2						
Nitrite (as N)			<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-2	LCS							
Nitrite (as N)			90.9		%		90-110	04-NOV-13
WG1781728-1	MB							
Nitrite (as N)			<0.050		mg/L		0.05	04-NOV-13
WG1781728-4	MS	L1386772-4						
Nitrite (as N)			84.6		%		75-125	04-NOV-13
WG1781728-6	MS	L1386805-1						
Nitrite (as N)			85.5		%		75-125	04-NOV-13
WG1781728-8	MS	L1387059-2						
Nitrite (as N)			78.4		%		75-125	04-NOV-13
NO3-IC-ED Water								
Batch	R2732968							
WG1781728-3	DUP	L1386772-4						
Nitrate (as N)			<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-5	DUP	L1386805-1						



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Workorder: L1386771

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-IC-ED		Water						
Batch	R2732968							
WG1781728-5	DUP	L1386805-1						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-7	DUP	L1387059-2						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-2	LCS							
Nitrate (as N)			102.7		%		90-110	04-NOV-13
WG1781728-1	MB							
Nitrate (as N)			<0.050		mg/L		0.05	04-NOV-13
WG1781728-4	MS	L1386772-4						
Nitrate (as N)			93.6		%		75-125	04-NOV-13
WG1781728-6	MS	L1386805-1						
Nitrate (as N)			98.9		%		75-125	04-NOV-13
WG1781728-8	MS	L1387059-2						
Nitrate (as N)			97.2		%		75-125	04-NOV-13
P-T-COL-ED		Water						
Batch	R2734215							
WG1782357-11	DUP	L1387367-4						
Phosphorus (P)-Total		<0.020	<0.020	RPD-NA	mg/L	N/A	20	05-NOV-13
WG1782357-12	DUP	L1387455-1						
Phosphorus (P)-Total		0.103	0.093		mg/L	9.4	20	05-NOV-13
WG1782357-3	DUP	L1386217-3						
Phosphorus (P)-Total		0.469	0.502		mg/L	6.8	20	05-NOV-13
WG1782357-5	DUP	L1386451-1						
Phosphorus (P)-Total		0.023	0.031	J	mg/L	0.008	0.04	05-NOV-13
WG1782357-7	DUP	L1386767-1						
Phosphorus (P)-Total		0.510	0.543		mg/L	6.2	20	05-NOV-13
WG1782357-9	DUP	L1386771-5						
Phosphorus (P)-Total		0.033	0.036		mg/L	9.1	20	05-NOV-13
WG1782357-2	LCS							
Phosphorus (P)-Total			100.9		%		80-120	05-NOV-13
WG1782357-1	MB							
Phosphorus (P)-Total			<0.020		mg/L		0.02	05-NOV-13
WG1782357-10	MS	L1386771-5						
Phosphorus (P)-Total			103.3		%		70-130	05-NOV-13
WG1782357-4	MS	L1386217-3						
Phosphorus (P)-Total			N/A	MS-B	%		-	05-NOV-13
WG1782357-6	MS	L1386451-1						
Phosphorus (P)-Total			105.6		%		70-130	05-NOV-13



Quality Control Report

Workorder: L1386771

Report Date: 13-DEC-13

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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
P-T-COL-ED								
	Water							
Batch	R2734215							
WG1782357-8 MS		L1386767-1						
Phosphorus (P)-Total			N/A	MS-B	%		-	05-NOV-13
PAH-ABT1-ED								
	Water							
Batch	R2734551							
WG1782243-5 LCS								
Acenaphthene			84.9		%		60-130	06-NOV-13
Acenaphthylene			84.4		%		60-130	06-NOV-13
Anthracene			88.4		%		60-130	06-NOV-13
Fluoranthene			89.1		%		60-130	06-NOV-13
Fluorene			86.2		%		60-130	06-NOV-13
Naphthalene			81.5		%		50-130	06-NOV-13
Phenanthrene			89.3		%		60-130	06-NOV-13
Pyrene			88.9		%		60-130	06-NOV-13
Benzo(a)anthracene			90.0		%		60-130	06-NOV-13
Benzo(k)fluoranthene			91.9		%		60-130	06-NOV-13
Benzo(b&j)fluoranthene			91.6		%		60-130	06-NOV-13
Benzo(g,h,i)perylene			88.7		%		60-130	06-NOV-13
Benzo(a)pyrene			91.8		%		60-130	06-NOV-13
Chrysene			89.4		%		60-130	06-NOV-13
Dibenzo(a,h)anthracene			90.4		%		60-130	06-NOV-13
Indeno(1,2,3-cd)pyrene			86.9		%		60-130	06-NOV-13
WG1782243-4 MB								
Acenaphthene			<0.000020		mg/L		0.00002	06-NOV-13
Acenaphthylene			<0.000020		mg/L		0.00002	06-NOV-13
Anthracene			<0.000010		mg/L		0.00001	06-NOV-13
Fluoranthene			<0.000020		mg/L		0.00002	06-NOV-13
Fluorene			<0.000020		mg/L		0.00002	06-NOV-13
Naphthalene			<0.000050		mg/L		0.00005	06-NOV-13
Phenanthrene			<0.000050		mg/L		0.00005	06-NOV-13
Pyrene			<0.000020		mg/L		0.00002	06-NOV-13
Benzo(a)anthracene			<0.000010		mg/L		0.00001	06-NOV-13
Benzo(k)fluoranthene			<0.000010		mg/L		0.00001	06-NOV-13
Benzo(b&j)fluoranthene			<0.000010		mg/L		0.00001	06-NOV-13
Benzo(g,h,i)perylene			<0.000020		mg/L		0.00002	06-NOV-13



Quality Control Report

Workorder: L1386771

Report Date: 13-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ABT1-ED		Water						
Batch R2734551								
WG1782243-4 MB								
Benzo(a)pyrene			<0.0000050		mg/L		0.000005	06-NOV-13
Chrysene			<0.000020		mg/L		0.00002	06-NOV-13
Dibenzo(a,h)anthracene			<0.0000050		mg/L		0.000005	06-NOV-13
Indeno(1,2,3-cd)pyrene			<0.000010		mg/L		0.00001	06-NOV-13
Surrogate: Nitrobenzene d5			83.3		%		40-130	06-NOV-13
Surrogate: 2-Fluorobiphenyl			76.0		%		40-130	06-NOV-13
Surrogate: p-Terphenyl d14			90.2		%		40-130	06-NOV-13
PH/EC/ALK-ED		Water						
Batch R2732970								
WG1781579-7 DUP		L1386772-2						
pH		7.36	7.37	J	pH	0.00	0.3	04-NOV-13
Conductivity (EC)		1010	1010		uS/cm	0.2	10	04-NOV-13
Bicarbonate (HCO3)		726	723		mg/L	0.4	25	04-NOV-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	04-NOV-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	04-NOV-13
Alkalinity, Total (as CaCO3)		595	593		mg/L	0.4	20	04-NOV-13
WG1781579-9 DUP		L1387059-2						
pH		7.99	7.98	J	pH	0.01	0.3	04-NOV-13
Conductivity (EC)		2270	2280		uS/cm	0.5	10	04-NOV-13
Bicarbonate (HCO3)		356	354		mg/L	0.4	25	04-NOV-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	04-NOV-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	04-NOV-13
Alkalinity, Total (as CaCO3)		291	290		mg/L	0.4	20	04-NOV-13
WG1781579-2 LCS								
Conductivity (EC)			103.5		%		90-110	04-NOV-13
WG1781579-3 LCS								
pH			7.01		pH		6.7-7.3	04-NOV-13
WG1781579-4 LCS								
Alkalinity, Total (as CaCO3)			100.2		%		85-115	04-NOV-13
WG1781579-5 LCS								
Conductivity (EC)			101.2		%		90-110	04-NOV-13
WG1781579-1 MB								
Bicarbonate (HCO3)			<5.0		mg/L		5	04-NOV-13
Carbonate (CO3)			<5.0		mg/L		5	04-NOV-13
Hydroxide (OH)			<5.0		mg/L		5	04-NOV-13



Quality Control Report

Workorder: L1386771

Report Date: 13-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch	R2732970							
WG1781579-1	MB							
Hydroxide (OH)			<5.0		mg/L		5	04-NOV-13
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	04-NOV-13
PHENOLS-4AAP-ED		Water						
Batch	R2738116							
WG1786079-4	DUP	L1383649-9						
Phenols (4AAP)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	15	10-NOV-13
WG1786079-3	LCS							
Phenols (4AAP)			92.0		%		85-115	10-NOV-13
WG1786079-2	MB							
Phenols (4AAP)			<0.0010		mg/L		0.001	10-NOV-13
WG1786079-5	MS	L1386451-10						
Phenols (4AAP)			94.0		%		75-125	10-NOV-13
SO4-IC-ED		Water						
Batch	R2732968							
WG1781728-3	DUP	L1386772-4						
Sulfate (SO4)		1.13	1.05		mg/L	7.0	20	04-NOV-13
WG1781728-5	DUP	L1386805-1						
Sulfate (SO4)		22.9	22.8		mg/L	0.0	20	04-NOV-13
WG1781728-7	DUP	L1387059-2						
Sulfate (SO4)		166	165		mg/L	0.8	20	04-NOV-13
WG1781728-2	LCS							
Sulfate (SO4)			104.8		%		90-110	04-NOV-13
WG1781728-1	MB							
Sulfate (SO4)			<0.50		mg/L		0.5	04-NOV-13
WG1781728-4	MS	L1386772-4						
Sulfate (SO4)			99.0		%		75-125	04-NOV-13
WG1781728-6	MS	L1386805-1						
Sulfate (SO4)			97.7		%		75-125	04-NOV-13
WG1781728-8	MS	L1387059-2						
Sulfate (SO4)			N/A	MS-B	%		-	04-NOV-13
TKN-CFA-ED		Water						
Batch	R2739042							
WG1786421-6	DUP	L1390232-6						
Total Kjeldahl Nitrogen		<0.20	<0.20	RPD-NA	mg/L	N/A	20	12-NOV-13
WG1786421-2	LCS							
Total Kjeldahl Nitrogen			103		mg/L		75-125	12-NOV-13



Quality Control Report

Workorder: L1386771

Report Date: 13-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-CFA-ED	Water							
Batch	R2739042							
WG1786421-3	LCS							
Total Kjeldahl Nitrogen			105		mg/L		75-125	12-NOV-13
WG1786421-4	LCS							
Total Kjeldahl Nitrogen			88.3		mg/L		75-125	12-NOV-13
WG1786421-1	MB							
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	12-NOV-13
WG1786421-5	MS	L1386771-5						
Total Kjeldahl Nitrogen			100		mg/L		70-130	12-NOV-13

Quality Control Report

Workorder: L1386771

Report Date: 13-DEC-13

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

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Contact: SUE RAYNARD

Legend:

Limit ALS Control Limit (Data Quality Objectives)
DUP Duplicate
RPD Relative Percent Difference
N/A Not Available
LCS Laboratory Control Sample
SRM Standard Reference Material
MS Matrix Spike
MSD Matrix Spike Duplicate
ADE Average Desorption Efficiency
MB Method Blank
IRM Internal Reference Material
CRM Certified Reference Material
CCV Continuing Calibration Verification
CVS Calibration Verification Standard
LCSD Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1386771

Report Date: 13-DEC-13

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2
Contact: SUE RAYNARD

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Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Anions and Nutrients							
Nitrate as N by IC							
	1	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	2	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	3	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	4	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	5	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
Nitrite as N by IC							
	1	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	2	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	3	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	4	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR
	5	29-OCT-13	04-NOV-13 08:00	48	140	hours	EHTR

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1386771 were received on 01-NOV-13 16:47.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

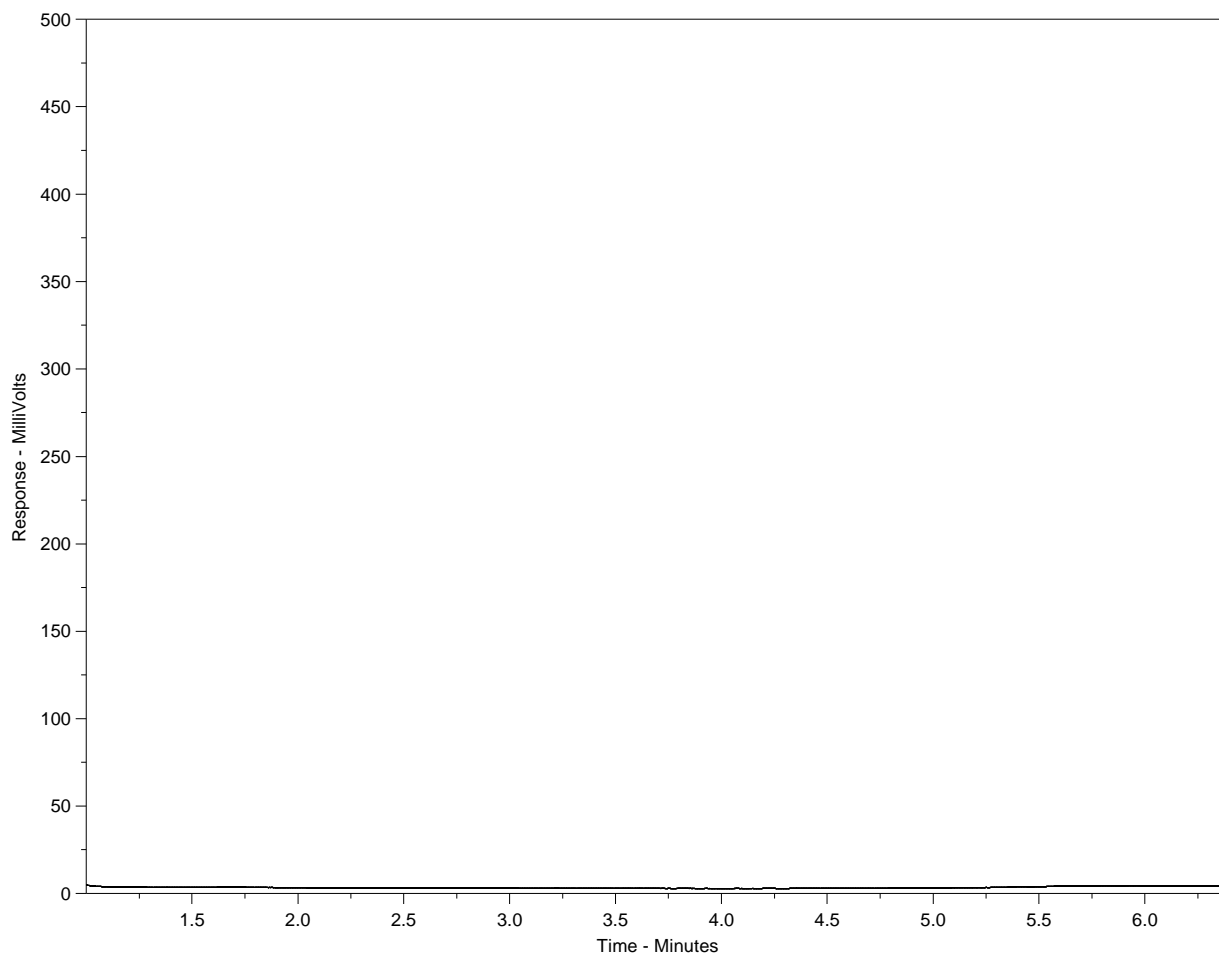
The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Hydrocarbon Distribution Report



ALS Sample ID: L1386772-1
Client ID: 1605413103018



F2		F3		F4		F4
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

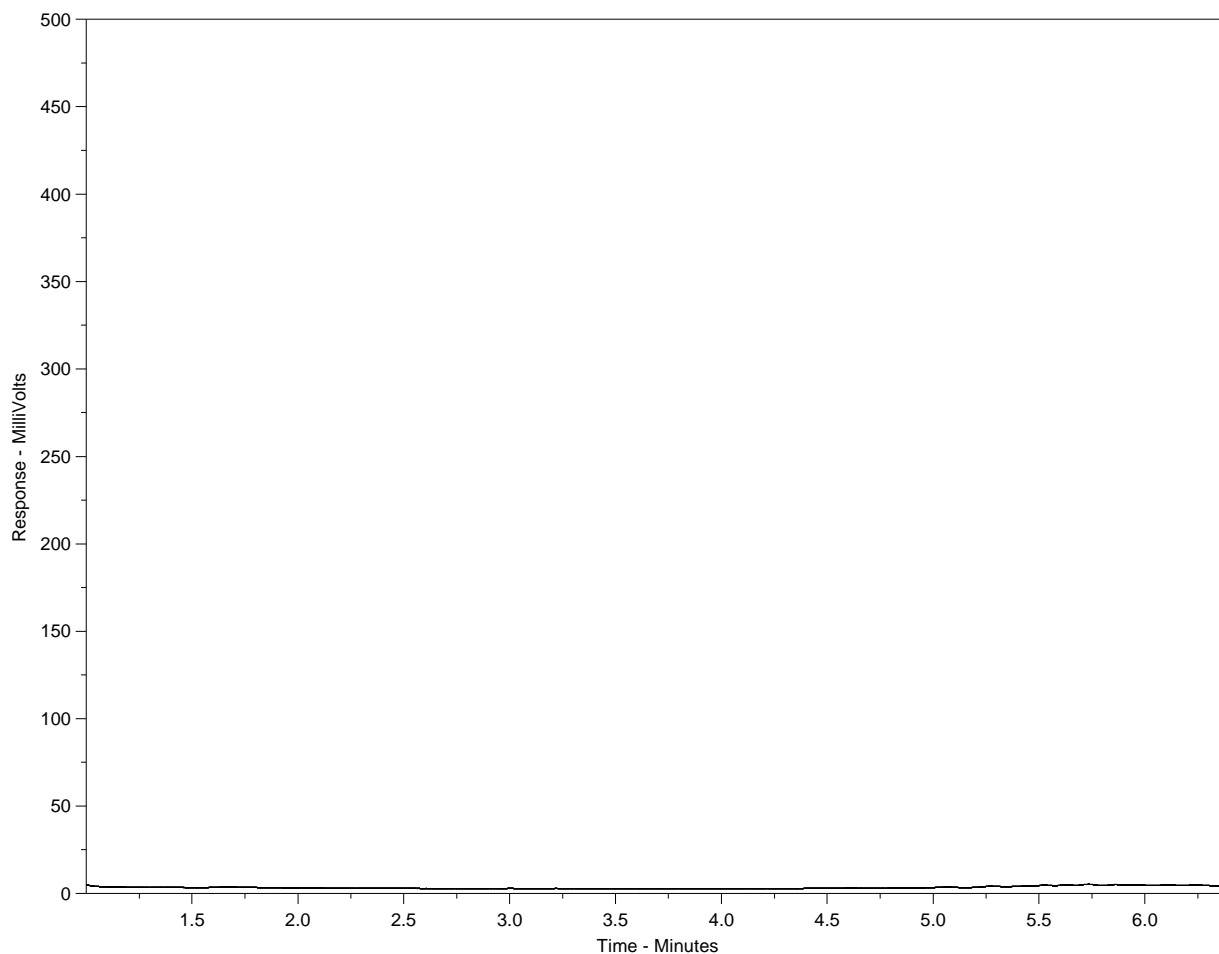
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1386772-2
Client ID: 1605413103019



F2		F3		F4		F4
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →				
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

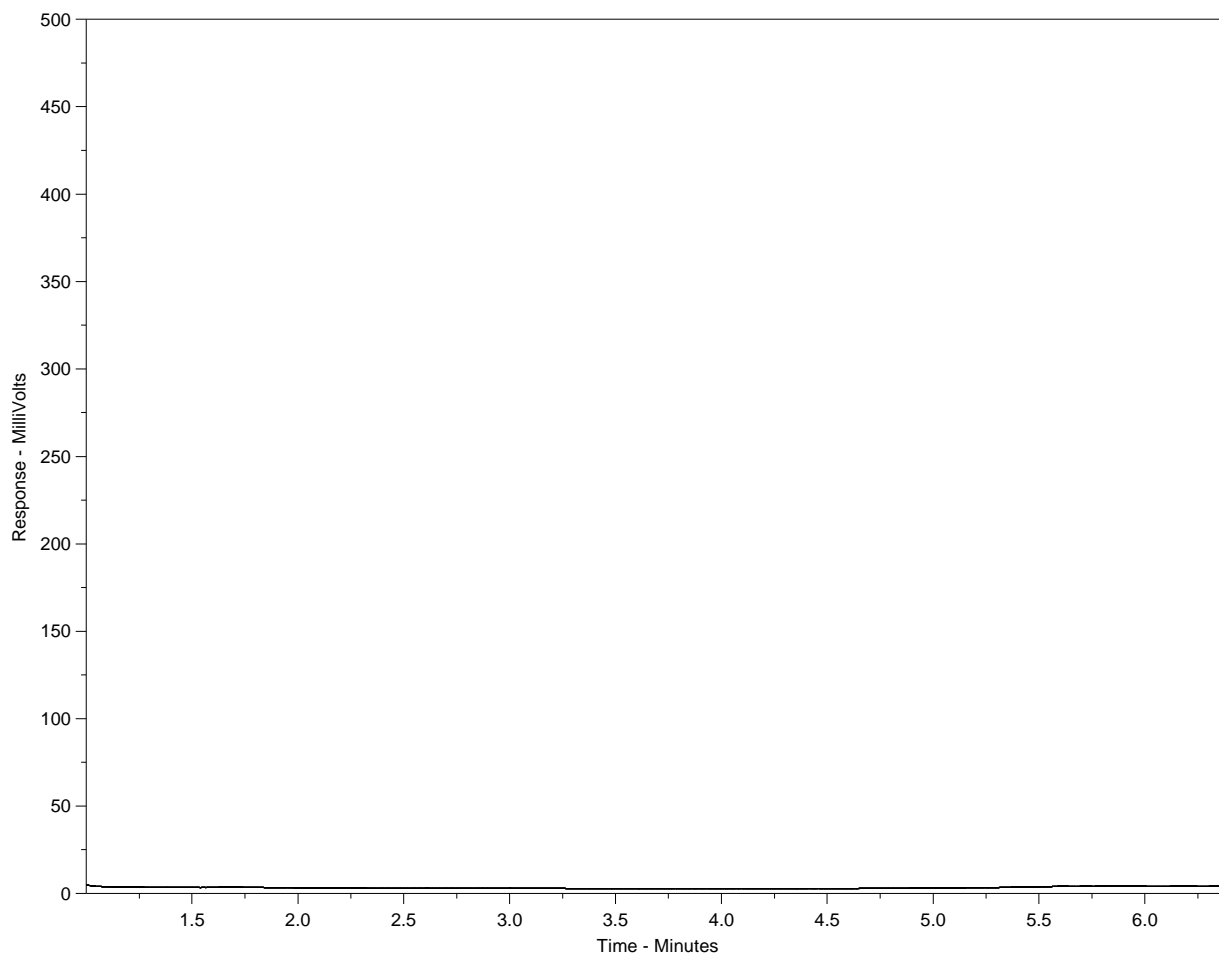
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1386772-3
Client ID: 1605413103016



← F2 →		← F3 →		← F4 →		← F4 →
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →		← Motor Oils/ Lube Oils/ Grease →				
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

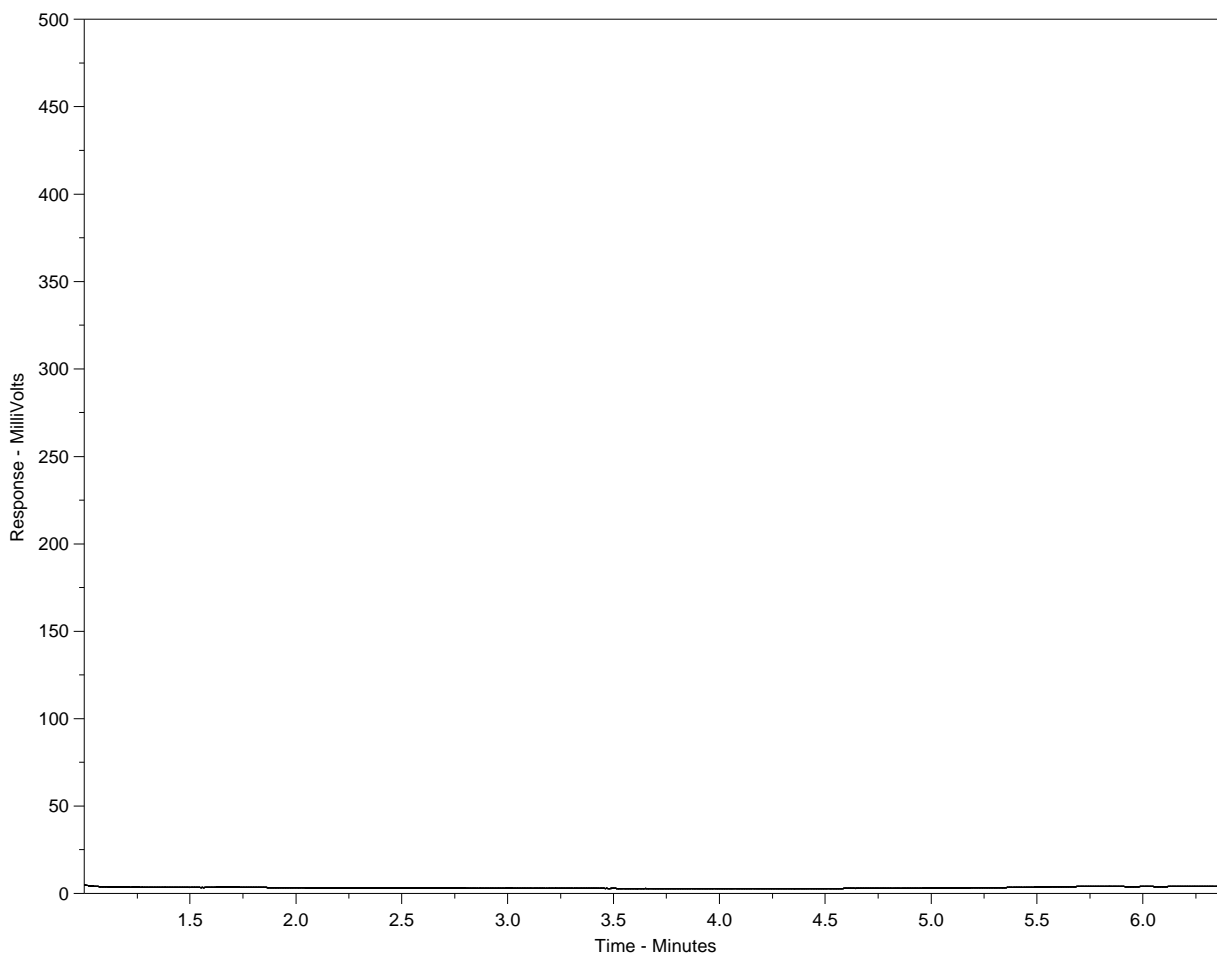
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1386772-4
Client ID: 1605413103017



← F2 →		← F3 →		← F4 →		← F4 →
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note:
 This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.



MATRIX SOLUTIONS INC.
ATTN: SUE RAYNARD
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Date Received: 01-NOV-13
Report Date: 17-DEC-13 13:42 (MT)
Version: FINAL REV. 3

Client Phone: 403-237-0606

Certificate of Analysis

Lab Work Order #: L1386772
Project P.O. #: NOT SUBMITTED
Job Reference: WEPA00-1 16054-502 06-33-074-09-W4M
C of C Numbers: M061028
Legal Site Desc: 06-33-074-09-W4M

Comments: 13-DEC-2013 Metals List has been revised as well as DL for Cr
17-DEC-2013 LOR for Ag has been fixed


Catherine Evaristo-Cordero
Senior Account Manager

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ADDRESS: 9936-67 Avenue, Edmonton, AB T6E 0P5 Canada | Phone: +1 780 413 5227 | Fax: +1 780 437 2311
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386772-1 16054131030018									
Sampled By: GK/BP on 30-OCT-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Toluene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
EthylBenzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
o-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Styrene	<0.0010	-		0.0010	mg/L	-		04-NOV-13	R2730783
F1(C6-C10)	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
F1-BTEX	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
Xylenes	<0.00071	-		0.00071	mg/L	-		04-NOV-13	R2730783
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
Surr: 2-Bromobenzotrifluoride	96.2	-		N/A	%	-	04-NOV-13	04-NOV-13	R2734016
ICP Metals & Hg -Dissolved									
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	0.00154	+/-0.00016		0.00040	mg/L	0		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.248	+/-0.022		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	72.7	+/-9.9		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	0.00066	+/-0.00006		0.00010	mg/L	0		12-NOV-13	R2739197
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		12-NOV-13	R2739197
Iron (Fe)-Dissolved	4.12	+/-0.37		0.010	mg/L	0		12-NOV-13	R2739197
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	18.8	+/-1.5		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	0.592	+/-0.040		0.0020	mg/L	0		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.00286	+/-0.00030		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	0.00144	+/-0.00012		0.00010	mg/L	0		12-NOV-13	R2739197
Potassium (K)-Dissolved	4.63	+/-0.36		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Silicon (Si)-Dissolved	7.99	+/-0.68		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	11.7	+/-0.82		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	0.505	+/-0.038		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	0.00030	+/-0.00003		0.00010	mg/L	0		12-NOV-13	R2739197
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	0.0068	+/-0.0008		0.0010	mg/L	0		12-NOV-13	R2739197
Hardness (from Dissolved Ca and Mg)									
Hardness (as CaCO3)	259	-		1.3	mg/L	-		13-NOV-13	
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		09-NOV-13	R2737347
Miscellaneous Parameters									
Ammonia, Total (as N)	1.96	-		0.050	mg/L	-		10-NOV-13	R2737984

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386772-1 16054131030018									
Sampled By: GK/BP on 30-OCT-13									
Matrix: WATER									
Boron (B)-Dissolved	0.0873	+/-0.010		0.0020	mg/L	0		12-NOV-13	R2739197
Dissolved Organic Carbon	24.3	+/-2.6		1.0	mg/L	0		09-NOV-13	R2737505
Naphthenic Acids	<1.0	-		1.0	mg/L	-	08-NOV-13	08-NOV-13	R2737525
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		11-NOV-13	R2738668
Total Kjeldahl Nitrogen	2.10	+/-0.42		0.20	mg/L	0	13-NOV-13	13-NOV-13	R2740029
Phosphorus (P)-Total	0.407	+/-0.037		0.020	mg/L	0	05-NOV-13	05-NOV-13	R2734215
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Fluoranthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Fluorene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Naphthalene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Phenanthrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Pyrene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(a)pyrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Chrysene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Dibenzo(a,h)anthracene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Surr: Nitrobenzene d5	75.6	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Surr: 2-Fluorobiphenyl	74.7	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Surr: p-Terphenyl d14	87.0	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		04-NOV-13	R2732968
Ion Balance Calculation									
Ion Balance	95.7	-			%	-		13-NOV-13	
TDS (Calculated)	294	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	259	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	0.62	+/-0.10		0.50	mg/L	0		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	7.69	+/-0.04		0.10	pH	0		13-NOV-13	R2740349
Conductivity (EC)	550	+/-18		0.20	uS/cm	0		13-NOV-13	R2740349
Bicarbonate (HCO3)	378	-		5.0	mg/L	-		13-NOV-13	R2740349
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		13-NOV-13	R2740349
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		13-NOV-13	R2740349
Alkalinity, Total (as CaCO3)	310	+/-12		2.0	mg/L	0		13-NOV-13	R2740349

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386772-2 16054131030019									
Sampled By: GK/BP on 30-OCT-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Toluene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
EthylBenzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
o-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Styrene	<0.0010	-		0.0010	mg/L	-		04-NOV-13	R2730783
F1(C6-C10)	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
F1-BTEX	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
Xylenes	<0.00071	-		0.00071	mg/L	-		04-NOV-13	R2730783
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
Surr: 2-Bromobenzotrifluoride	94.5	-		N/A	%	-	04-NOV-13	04-NOV-13	R2734016
ICP Metals & Hg -Dissolved									
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.218	+/-0.019		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	151	+/-21		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	0.00020	+/-0.00002		0.00010	mg/L	0		12-NOV-13	R2739197
Copper (Cu)-Dissolved	0.00093	+/-0.00008		0.00060	mg/L	0		12-NOV-13	R2739197
Iron (Fe)-Dissolved	<0.010	-		0.010	mg/L	-		12-NOV-13	R2739197
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	46.4	+/-3.6		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	0.0431	+/-0.0029		0.0020	mg/L	0		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.00040	+/-0.00005		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	0.00216	+/-0.00018		0.00010	mg/L	0		12-NOV-13	R2739197
Potassium (K)-Dissolved	1.28	+/-0.10		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Silicon (Si)-Dissolved	12.6	+/-1.1		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	3.80	+/-0.27		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	0.147	+/-0.011		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	0.00076	+/-0.00008		0.00010	mg/L	0		12-NOV-13	R2739197
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	0.0011	+/-0.0003		0.0010	mg/L	0		12-NOV-13	R2739197
Hardness (from Dissolved Ca and Mg)									
Hardness (as CaCO3)	567	-		1.3	mg/L	-		13-NOV-13	
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		09-NOV-13	R2737347
Miscellaneous Parameters									
Ammonia, Total (as N)	<0.050	-		0.050	mg/L	-		10-NOV-13	R2737984

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386772-2 16054131030019									
Sampled By: GK/BP on 30-OCT-13									
Matrix: WATER									
Boron (B)-Dissolved	0.0217	+/-0.0026		0.0020	mg/L	0		12-NOV-13	R2739197
Dissolved Organic Carbon	50.7	+/-5.3		1.0	mg/L	0		09-NOV-13	R2737505
Naphthenic Acids	<1.0	-		1.0	mg/L	-	08-NOV-13	08-NOV-13	R2737525
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		11-NOV-13	R2738668
Total Kjeldahl Nitrogen	<0.20	-		0.20	mg/L	-	13-NOV-13	13-NOV-13	R2740029
Phosphorus (P)-Total	<0.020	-		0.020	mg/L	-	05-NOV-13	05-NOV-13	R2734215
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Fluoranthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Fluorene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Naphthalene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Phenanthrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Pyrene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(a)pyrene	<0.0000050	-		0.000005	mg/L	-	05-NOV-13	07-NOV-13	R2736969
				0					
Chrysene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Dibenzo(a,h)anthracene	<0.0000050	-		0.000005	mg/L	-	05-NOV-13	07-NOV-13	R2736969
				0					
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Surr: Nitrobenzene d5	73.5	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Surr: 2-Fluorobiphenyl	73.3	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Surr: p-Terphenyl d14	90.3	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	0.92	+/-0.07		0.50	mg/L	0		04-NOV-13	R2732968
Ion Balance Calculation									
Ion Balance	96.3	-			%	-		13-NOV-13	
TDS (Calculated)	564	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	568	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	0.087	+/-0.011		0.050	mg/L	0		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	0.087	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	3.25	+/-0.18		0.50	mg/L	0		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	7.36	+/-0.04		0.10	pH	0		04-NOV-13	R2732970
Conductivity (EC)	1010	+/-34		0.20	uS/cm	0		04-NOV-13	R2732970
Bicarbonate (HCO3)	726	-		5.0	mg/L	-		04-NOV-13	R2732970
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Alkalinity, Total (as CaCO3)	595	+/-21		2.0	mg/L	0		04-NOV-13	R2732970

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386772-3 16054131030016									
Sampled By: GK/BP on 30-OCT-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Toluene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
EthylBenzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
o-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Styrene	<0.0010	-		0.0010	mg/L	-		04-NOV-13	R2730783
F1(C6-C10)	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
F1-BTEX	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
Xylenes	<0.00071	-		0.00071	mg/L	-		04-NOV-13	R2730783
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
Surr: 2-Bromobenzotrifluoride	97.1	-		N/A	%	-	04-NOV-13	04-NOV-13	R2734016
ICP Metals & Hg -Dissolved									
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.326	+/-0.028		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	81.4	+/-11		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	0.00015	+/-0.00001		0.00010	mg/L	0		12-NOV-13	R2739197
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		12-NOV-13	R2739197
Iron (Fe)-Dissolved	3.16	+/-0.29		0.010	mg/L	0		12-NOV-13	R2739197
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	20.1	+/-1.6		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	0.152	+/-0.010		0.0020	mg/L	0		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.00090	+/-0.00010		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Potassium (K)-Dissolved	3.90	+/-0.30		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Silicon (Si)-Dissolved	11.1	+/-0.94		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	17.4	+/-1.2		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	0.622	+/-0.046		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Hardness (from Dissolved Ca and Mg)									
Hardness (as CaCO3)	286	-		1.3	mg/L	-		13-NOV-13	
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		09-NOV-13	R2737347
Miscellaneous Parameters									
Ammonia, Total (as N)	1.06	-		0.050	mg/L	-		10-NOV-13	R2737984

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386772-3 16054131030016									
Sampled By: GK/BP on 30-OCT-13									
Matrix: WATER									
Boron (B)-Dissolved	0.133	+/-0.016		0.0020	mg/L	0		12-NOV-13	R2739197
Dissolved Organic Carbon	11.0	+/-1.3		1.0	mg/L	0		09-NOV-13	R2737505
Naphthenic Acids	<1.0	-		1.0	mg/L	-	08-NOV-13	08-NOV-13	R2737525
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		11-NOV-13	R2738668
Total Kjeldahl Nitrogen	1.14	+/-0.24		0.20	mg/L	0	13-NOV-13	13-NOV-13	R2740029
Phosphorus (P)-Total	0.471	+/-0.042		0.020	mg/L	0	05-NOV-13	05-NOV-13	R2734215
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Fluoranthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Fluorene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Naphthalene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Phenanthrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Pyrene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(g,h,i)perylene	0.000020	+/-0.000009		0.000020	mg/L	0	05-NOV-13	07-NOV-13	R2736969
Benzo(a)pyrene	<0.0000050	-		0.000005 0	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Chrysene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Dibenzo(a,h)anthracene	<0.0000050	-		0.000005 0	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Surr: Nitrobenzene d5	77.1	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Surr: 2-Fluorobiphenyl	75.3	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Surr: p-Terphenyl d14	86.4	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		04-NOV-13	R2732968
Ion Balance Calculation									
Ion Balance	95.7	-			%	-		13-NOV-13	
TDS (Calculated)	332	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	286	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	<0.50	-		0.50	mg/L	-		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	7.83	+/-0.04		0.10	pH	0		04-NOV-13	R2732970
Conductivity (EC)	609	+/-20		0.20	uS/cm	0		04-NOV-13	R2732970
Bicarbonate (HCO3)	424	-		5.0	mg/L	-		04-NOV-13	R2732970
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Alkalinity, Total (as CaCO3)	348	+/-13		2.0	mg/L	0		04-NOV-13	R2732970

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386772-4 16054131030017									
Sampled By: GK/BP on 30-OCT-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Toluene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
EthylBenzene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
o-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
m+p-Xylene	<0.00050	-		0.00050	mg/L	-		04-NOV-13	R2730783
Styrene	<0.0010	-		0.0010	mg/L	-		04-NOV-13	R2730783
F1(C6-C10)	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
F1-BTEX	<0.10	-		0.10	mg/L	-		04-NOV-13	R2730783
Xylenes	<0.00071	-		0.00071	mg/L	-		04-NOV-13	R2730783
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	04-NOV-13	04-NOV-13	R2734016
Surr: 2-Bromobenzotrifluoride	95.2	-		N/A	%	-	04-NOV-13	04-NOV-13	R2734016
ICP Metals & Hg -Dissolved									
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	<0.0010	-		0.0010	mg/L	-		12-NOV-13	R2739197
Antimony (Sb)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Arsenic (As)-Dissolved	0.0129	+/-0.0014		0.00040	mg/L	0		12-NOV-13	R2739197
Barium (Ba)-Dissolved	0.218	+/-0.019		0.00010	mg/L	0		12-NOV-13	R2739197
Beryllium (Be)-Dissolved	<0.00050	-		0.00050	mg/L	-		12-NOV-13	R2739197
Bismuth (Bi)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Calcium (Ca)-Dissolved	79.1	+/-11		0.50	mg/L	0		12-NOV-13	R2739197
Chromium (Cr)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Cobalt (Co)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		12-NOV-13	R2739197
Iron (Fe)-Dissolved	3.18	+/-0.29		0.010	mg/L	0		12-NOV-13	R2739197
Lead (Pb)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Magnesium (Mg)-Dissolved	20.9	+/-1.6		0.10	mg/L	0		12-NOV-13	R2739197
Manganese (Mn)-Dissolved	0.425	+/-0.029		0.0020	mg/L	0		12-NOV-13	R2739197
Molybdenum (Mo)-Dissolved	0.00114	+/-0.00012		0.00010	mg/L	0		12-NOV-13	R2739197
Nickel (Ni)-Dissolved	0.00030	+/-0.00005		0.00010	mg/L	0		12-NOV-13	R2739197
Potassium (K)-Dissolved	2.63	+/-0.20		0.10	mg/L	0		12-NOV-13	R2739197
Selenium (Se)-Dissolved	<0.00040	-		0.00040	mg/L	-		12-NOV-13	R2739197
Silicon (Si)-Dissolved	10.0	+/-0.85		0.050	mg/L	0		12-NOV-13	R2739197
Silver (Ag)-Dissolved	<0.000010	-		0.000010	mg/L	-		12-NOV-13	R2739197
Sodium (Na)-Dissolved	7.17	+/-0.50		0.50	mg/L	0		12-NOV-13	R2739197
Strontium (Sr)-Dissolved	0.435	+/-0.032		0.00010	mg/L	0		12-NOV-13	R2739197
Thallium (Tl)-Dissolved	<0.000050	-		0.000050	mg/L	-		12-NOV-13	R2739197
Titanium (Ti)-Dissolved	<0.00030	-		0.00030	mg/L	-		12-NOV-13	R2739197
Tin (Sn)-Dissolved	<0.00020	-		0.00020	mg/L	-		12-NOV-13	R2739197
Uranium (U)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Vanadium (V)-Dissolved	<0.00010	-		0.00010	mg/L	-		12-NOV-13	R2739197
Zinc (Zn)-Dissolved	0.0020	+/-0.0004		0.0010	mg/L	0		12-NOV-13	R2739197
Hardness (from Dissolved Ca and Mg)									
Hardness (as CaCO3)	283	-		1.3	mg/L	-		13-NOV-13	
Mercury (Hg) - Dissolved									
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		09-NOV-13	R2737347
Miscellaneous Parameters									
Ammonia, Total (as N)	0.956	-		0.050	mg/L	-		10-NOV-13	R2737984

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1386772-4 16054131030017									
Sampled By: GK/BP on 30-OCT-13									
Matrix: WATER									
Boron (B)-Dissolved	0.0569	+/-0.0068		0.0020	mg/L	0		12-NOV-13	R2739197
Dissolved Organic Carbon	<1.0	-		1.0	mg/L	-		09-NOV-13	R2737505
Naphthenic Acids	<1.0	-		1.0	mg/L	-	08-NOV-13	08-NOV-13	R2737525
Phenols (4AAP)	0.0011	+/-0.0007		0.0010	mg/L	-6.9%		11-NOV-13	R2738668
Total Kjeldahl Nitrogen	1.11	+/-0.23		0.20	mg/L	0	13-NOV-13	13-NOV-13	R2740029
Phosphorus (P)-Total	0.378	+/-0.035		0.020	mg/L	0	05-NOV-13	05-NOV-13	R2734215
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Fluoranthene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Fluorene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Naphthalene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Phenanthrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Pyrene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Benzo(a)pyrene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Chrysene	<0.000020	-		0.000020	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Dibenzo(a,h)anthracene	<0.000050	-		0.000050	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	05-NOV-13	07-NOV-13	R2736969
Surr: Nitrobenzene d5	68.4	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Surr: 2-Fluorobiphenyl	67.1	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Surr: p-Terphenyl d14	68.5	-		N/A	%	-	05-NOV-13	07-NOV-13	R2736969
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	0.96	+/-0.07		0.50	mg/L	0		04-NOV-13	R2732968
Ion Balance Calculation									
Ion Balance	98.2	-			%	-		13-NOV-13	
TDS (Calculated)	297	-			mg/L	-		13-NOV-13	
Hardness (as CaCO3)	284	-			mg/L	-		13-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		13-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		04-NOV-13	R2732968
Sulfate by IC									
Sulfate (SO4)	1.13	+/-0.11		0.50	mg/L	0		04-NOV-13	R2732968
pH, Conductivity and Total Alkalinity									
pH	7.80	+/-0.04		0.10	pH	0		04-NOV-13	R2732970
Conductivity (EC)	553	+/-18		0.20	uS/cm	0		04-NOV-13	R2732970
Bicarbonate (HCO3)	377	-		5.0	mg/L	-		04-NOV-13	R2732970
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		04-NOV-13	R2732970
Alkalinity, Total (as CaCO3)	309	+/-12		2.0	mg/L	0		04-NOV-13	R2732970
* Refer to Referenced Information for Qualifiers (if any) and Methodology.									

Reference Information

Report Comments: 13-DEC-2013 Metals List has been revised as well as DL for Cr
17-DEC-2013 LOR for Ag has been fixed

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Phosphorus (P)-Total	MS-B	
Matrix Spike	Phosphorus (P)-Total	MS-B	
Matrix Spike	Chloride (Cl)	MS-B	
Matrix Spike	Sulfate (SO4)	MS-B	

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
B-D-L-CCMS-ED	Water	Dissolved Boron in Water by CRC ICPMS		APHA 3030 B / EPA SW-846 6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).				
BTXS,F1-ED	Water	BTEX, Styrene and F1 (C6-C10)		EPA 5021/8015&8260 GC-MS & FID
C-DIS-ORG-ED	Water	Dissolved Organic Carbon		APHA 5310 B-Instrumental
CL-IC-ED	Water	Chloride by IC		APHA 4110 B-ION CHROMATOGRAPHY
ETL-HARDNESS-DIS-ED	Water	Hardness (from Dissolved Ca and Mg)		APHA 2340 B-Calculation
F2,F3,F4-ED	Water	F2, F3, F4		EPA 3510/CCME PHC CWS-GC-FID
HG-D-L-CVAA-ED	Water	Mercury (Hg) - Dissolved		EPA 245.7 / EPA 245.1
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET-D-CCMS-ED	Water	Dissolved Metals in Water by CRC ICPMS		APHA 3030 B&E / EPA SW-846 6020A
NAPHTHENIC-ACID-FM	Water	Naphthenic Acids by FTIR		Naphthenic Acids by FTIR,Syncrude,1994
Dissolved naphthenic acids are solvent extracted from acidified aqueous samples using Dichloromethane prior to quantitation by Fourier Transform Infra-Red spectroscopy. Note that FTIR is not uniquely selective to naphthenic acids. If present, other carboxylic acids (e.g. humic acids, fulvic acids) may also be detected by this method.				
NH3-CFA-ED	Water	Ammonia in Water by Colour		APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.				
NO2+NO3-CALC-ED	Water	Nitrate+Nitrite		CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
NO3-IC-ED	Water	Nitrate as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
P-T-COL-ED	Water	Total P in Water by Colour		APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.				
PAH-ABT1-ED	Water	PAH & Carcinogenic PAH List		EPA 3510/8270-GC/MS
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)				
PHENOLS-4AAP-ED	Water	Phenols (4AAP)		AB ENV.06537-COLORIMETRIC
This analysis is carried out using procedures adapted from ENVIRODAT VMV 06537 689, Method Code 154, in "Methods Manual for Chemical Analysis of Water and Wastes" published by the Alberta Environmental Centre. This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide and 4-aminoantipyrine to form a red complex which is measured at 505 nm.				
SO4-IC-ED	Water	Sulfate by IC		APHA 4110 B-ION CHROMATOGRAPHY
TKN-CFA-ED	Water	TKN in Water by Colour		APHA 4500-NORG (TKN)

This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 celcius with analysis using an automated colourimetric finish.

** The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
methods may incorporate modifications from the specified reference to improve performance.				

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
FM	ALS ENVIRONMENTAL - FORT MCMURRAY, ALBERTA, CANADA

Chain of Custody Numbers:

M061028

GLOSSARY OF REPORT TERMS

Surr - Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

MU: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.

Bias: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent.

Zero values indicate no detectable method bias.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Quality Control Report

Workorder: L1386772

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-D-L-CCMS-ED		Water						
Batch	R2739197							
WG1786584-2	CRM	ED-HIGH-WATRM						
Boron (B)-Dissolved			95.2		%		80-120	12-NOV-13
WG1786584-3	DUP	L1386451-6						
Boron (B)-Dissolved		0.0114	0.0109		mg/L	4.4	20	12-NOV-13
WG1786584-4	DUP	L1386771-2						
Boron (B)-Dissolved		0.240	0.250		mg/L	4.0	20	12-NOV-13
WG1786584-5	DUP	L1387739-7						
Boron (B)-Dissolved		0.0143	0.0141		mg/L	0.9	20	12-NOV-13
WG1786584-6	DUP	L1387752-5						
Boron (B)-Dissolved		0.0879	0.0878		mg/L	0.1	20	12-NOV-13
WG1786584-1	MB							
Boron (B)-Dissolved			<0.0020		mg/L		0.002	12-NOV-13
BTXS,F1-ED		Water						
Batch	R2730783							
WG1781329-4	DUP	L1386772-4						
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-NOV-13
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-NOV-13
EthylBenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	04-NOV-13
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	04-NOV-13
m+p-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	04-NOV-13
Styrene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	50	04-NOV-13
F1(C6-C10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	04-NOV-13
WG1781329-2	LCS							
Benzene			100.6		%		70-130	03-NOV-13
Toluene			91.5		%		70-130	03-NOV-13
EthylBenzene			99.1		%		70-130	03-NOV-13
o-Xylene			106.3		%		70-130	03-NOV-13
m+p-Xylene			97.9		%		70-130	03-NOV-13
Styrene			100.4		%		70-130	03-NOV-13
WG1781329-3	LCS							
F1(C6-C10)			85.6		%		70-130	03-NOV-13
WG1781329-1	MB							
Benzene			<0.00050		mg/L		0.0005	03-NOV-13
Toluene			<0.00050		mg/L		0.0005	03-NOV-13
EthylBenzene			<0.00050		mg/L		0.0005	03-NOV-13
o-Xylene			<0.00050		mg/L		0.0005	03-NOV-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTXS,F1-ED								
	Water							
Batch	R2730783							
WG1781329-1	MB							
m+p-Xylene			<0.00050		mg/L		0.0005	03-NOV-13
Styrene			<0.0010		mg/L		0.001	03-NOV-13
F1(C6-C10)			<0.10		mg/L		0.1	03-NOV-13
WG1781329-5	MS	L1386772-4						
Benzene			97.4		%		50-150	04-NOV-13
Toluene			90.5		%		50-150	04-NOV-13
EthylBenzene			98.2		%		50-150	04-NOV-13
o-Xylene			106.3		%		50-150	04-NOV-13
m+p-Xylene			96.6		%		50-150	04-NOV-13
Styrene			97.9		%		50-150	04-NOV-13
WG1781329-6	MS	L1386772-4						
F1(C6-C10)			79.6		%		50-150	04-NOV-13
C-DIS-ORG-ED								
	Water							
Batch	R2737505							
WG1785307-3	CVS							
Dissolved Organic Carbon			109.8		%		80-160	08-NOV-13
WG1785307-6	DUP	L1386731-3						
Dissolved Organic Carbon		4.2	3.9		mg/L	6.7	20	09-NOV-13
WG1785307-8	DUP	L1386767-4						
Dissolved Organic Carbon		8.2	8.1		mg/L	1.2	20	09-NOV-13
WG1785307-2	LCS							
Dissolved Organic Carbon			95.2		%		80-120	08-NOV-13
WG1785307-1	MB							
Dissolved Organic Carbon			<1.0		mg/L		1	08-NOV-13
WG1785307-7	MS	L1386731-3						
Dissolved Organic Carbon			84.7		%		70-130	09-NOV-13
WG1785307-9	MS	L1386767-4						
Dissolved Organic Carbon			85.3		%		70-130	09-NOV-13
CL-IC-ED								
	Water							
Batch	R2732968							
WG1781728-3	DUP	L1386772-4						
Chloride (Cl)		0.96	0.94		mg/L	2.5	20	04-NOV-13
WG1781728-5	DUP	L1386805-1						
Chloride (Cl)		35.8	35.9		mg/L	0.3	20	04-NOV-13
WG1781728-7	DUP	L1387059-2						
Chloride (Cl)		450	447		mg/L	0.6	20	04-NOV-13



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-IC-ED		Water						
Batch	R2732968							
WG1781728-2	LCS							
Chloride (Cl)			105.1		%		90-110	04-NOV-13
WG1781728-1	MB							
Chloride (Cl)			<0.50		mg/L		0.5	04-NOV-13
WG1781728-4	MS	L1386772-4						
Chloride (Cl)			99.6		%		75-125	04-NOV-13
WG1781728-6	MS	L1386805-1						
Chloride (Cl)			98.1		%		75-125	04-NOV-13
WG1781728-8	MS	L1387059-2						
Chloride (Cl)			N/A	MS-B	%		-	04-NOV-13
F2,F3,F4-ED		Water						
Batch	R2734016							
WG1781653-5	LCS							
F2 (>C10-C16)			93.1		%		65-135	04-NOV-13
F3 (C16-C34)			98.8		%		65-135	04-NOV-13
F4 (C34-C50)			92.8		%		65-135	04-NOV-13
WG1781653-8	LCS							
F2 (>C10-C16)			95.8		%		65-135	04-NOV-13
F3 (C16-C34)			95.8		%		65-135	04-NOV-13
F4 (C34-C50)			92.0		%		65-135	04-NOV-13
WG1781653-4	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	04-NOV-13
F3 (C16-C34)			<0.25		mg/L		0.25	04-NOV-13
F4 (C34-C50)			<0.25		mg/L		0.25	04-NOV-13
Surrogate: 2-Bromobenzotrifluoride			93.4		%		50-150	04-NOV-13
WG1781653-7	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	04-NOV-13
F3 (C16-C34)			<0.25		mg/L		0.25	04-NOV-13
F4 (C34-C50)			<0.25		mg/L		0.25	04-NOV-13
Surrogate: 2-Bromobenzotrifluoride			92.8		%		50-150	04-NOV-13
WG1781653-9	MS	L1386772-1						
F2 (>C10-C16)			93.6		%		50-150	04-NOV-13
F3 (C16-C34)			96.1		%		50-150	04-NOV-13
F4 (C34-C50)			93.5		%		50-150	04-NOV-13
HG-D-L-CVAA-ED		Water						



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Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-D-L-CVAA-ED		Water						
Batch	R2737347							
WG1784962-4	DUP	L1386731-1						
Mercury (Hg)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	08-NOV-13
WG1784962-8	DUP	L1386451-12						
Mercury (Hg)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	09-NOV-13
WG1784962-2	LCS							
Mercury (Hg)-Dissolved			97.7		%		80-120	08-NOV-13
WG1784962-3	LCSD	WG1784962-2						
Mercury (Hg)-Dissolved		97.7	97.0		%	0.7	20	08-NOV-13
WG1784962-1	MB							
Mercury (Hg)-Dissolved			<0.000020		mg/L		0.00002	08-NOV-13
WG1784962-5	MS	L1386731-1						
Mercury (Hg)-Dissolved			98.3		%		70-130	08-NOV-13
WG1784962-9	MS	L1386451-12						
Mercury (Hg)-Dissolved			70.4		%		70-130	09-NOV-13
MET-D-CCMS-ED		Water						
Batch	R2739197							
WG1786584-2	CRM	ED-HIGH-WATRM						
Aluminum (Al)-Dissolved			101.1		%		80-120	12-NOV-13
Antimony (Sb)-Dissolved			101.4		%		80-120	12-NOV-13
Arsenic (As)-Dissolved			103.6		%		80-120	12-NOV-13
Barium (Ba)-Dissolved			105.6		%		80-120	12-NOV-13
Beryllium (Be)-Dissolved			96.3		%		80-120	12-NOV-13
Bismuth (Bi)-Dissolved			98.4		%		80-120	12-NOV-13
Cadmium (Cd)-Dissolved			102.7		%		80-120	12-NOV-13
Calcium (Ca)-Dissolved			99.6		%		80-120	12-NOV-13
Chromium (Cr)-Dissolved			96.0		%		80-120	12-NOV-13
Cobalt (Co)-Dissolved			96.8		%		80-120	12-NOV-13
Copper (Cu)-Dissolved			96.4		%		80-120	12-NOV-13
Lead (Pb)-Dissolved			98.4		%		80-120	12-NOV-13
Magnesium (Mg)-Dissolved			96.9		%		80-120	12-NOV-13
Manganese (Mn)-Dissolved			97.8		%		80-120	12-NOV-13
Molybdenum (Mo)-Dissolved			95.3		%		80-120	12-NOV-13
Nickel (Ni)-Dissolved			97.9		%		80-120	12-NOV-13
Potassium (K)-Dissolved			97.7		%		80-120	12-NOV-13
Selenium (Se)-Dissolved			104.7		%		80-120	12-NOV-13
Silicon (Si)-Dissolved			109.0		%		80-120	12-NOV-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED		Water						
Batch	R2739197							
WG1786584-2 CRM		ED-HIGH-WATRM						
Silver (Ag)-Dissolved			98.8		%		80-120	12-NOV-13
Sodium (Na)-Dissolved			100.3		%		80-120	12-NOV-13
Strontium (Sr)-Dissolved			101.4		%		80-120	12-NOV-13
Thallium (Tl)-Dissolved			97.9		%		80-120	12-NOV-13
Titanium (Ti)-Dissolved			98.5		%		80-120	12-NOV-13
Tin (Sn)-Dissolved			97.3		%		80-120	12-NOV-13
Uranium (U)-Dissolved			98.4		%		80-120	12-NOV-13
Vanadium (V)-Dissolved			98.3		%		80-120	12-NOV-13
Zinc (Zn)-Dissolved			99.4		%		80-120	12-NOV-13
WG1786584-3 DUP		L1386451-6						
Aluminum (Al)-Dissolved		0.0065	0.0050	J	mg/L	0.0014	0.002	12-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Arsenic (As)-Dissolved		0.00047	0.00047		mg/L	0.0	20	12-NOV-13
Barium (Ba)-Dissolved		0.0147	0.0148		mg/L	0.1	20	12-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cadmium (Cd)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Calcium (Ca)-Dissolved		25.0	23.8		mg/L	5.2	20	12-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Copper (Cu)-Dissolved		<0.00060	<0.00060	RPD-NA	mg/L	N/A	20	12-NOV-13
Iron (Fe)-Dissolved		0.523	0.529		mg/L	1.1	20	12-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Magnesium (Mg)-Dissolved		7.92	7.70		mg/L	2.8	20	12-NOV-13
Manganese (Mn)-Dissolved		0.0541	0.0528		mg/L	2.4	20	12-NOV-13
Molybdenum (Mo)-Dissolved		0.00012	0.00011		mg/L	3.1	20	12-NOV-13
Nickel (Ni)-Dissolved		0.00030	0.00035		mg/L	15	20	12-NOV-13
Potassium (K)-Dissolved		<0.50	<0.50	RPD-NA	mg/L	N/A	20	12-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Silicon (Si)-Dissolved		4.65	4.65		mg/L	0.1	20	12-NOV-13
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	12-NOV-13
Sodium (Na)-Dissolved		3.9	3.8		mg/L	2.1	20	12-NOV-13
Strontium (Sr)-Dissolved		0.0528	0.0517		mg/L	2.2	20	12-NOV-13



Quality Control Report

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2739197							
WG1786584-3	DUP	L1386451-6						
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	12-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	12-NOV-13
Uranium (U)-Dissolved		0.000029	0.000029		mg/L	0.9	20	12-NOV-13
Vanadium (V)-Dissolved		0.00010	0.00012		mg/L	18	20	12-NOV-13
WG1786584-4	DUP	L1386771-2						
Aluminum (Al)-Dissolved		<0.0010	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Arsenic (As)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Barium (Ba)-Dissolved		0.102	0.0982		mg/L	3.9	20	12-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cadmium (Cd)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Calcium (Ca)-Dissolved		81.1	81.1		mg/L	0.0	20	12-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Copper (Cu)-Dissolved		<0.00060	<0.0010	RPD-NA	mg/L	N/A	20	12-NOV-13
Iron (Fe)-Dissolved		1.61	1.64		mg/L	1.5	20	12-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Magnesium (Mg)-Dissolved		23.9	24.4		mg/L	1.9	20	12-NOV-13
Manganese (Mn)-Dissolved		0.0548	0.0549		mg/L	0.3	20	12-NOV-13
Molybdenum (Mo)-Dissolved		0.00111	0.00109		mg/L	1.6	20	12-NOV-13
Nickel (Ni)-Dissolved		<0.00010	<0.0020	RPD-NA	mg/L	N/A	20	12-NOV-13
Potassium (K)-Dissolved		5.27	5.30		mg/L	0.4	20	12-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Silicon (Si)-Dissolved		12.5	12.4		mg/L	0.8	20	12-NOV-13
Silver (Ag)-Dissolved		<0.000010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Sodium (Na)-Dissolved		55.1	55.7		mg/L	1.1	20	12-NOV-13
Strontium (Sr)-Dissolved		0.666	0.666		mg/L	0.1	20	12-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	12-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Uranium (U)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2739197							
WG1786584-4	DUP	L1386771-2						
Vanadium (V)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Zinc (Zn)-Dissolved		<0.0010	<0.0030	RPD-NA	mg/L	N/A	20	12-NOV-13
WG1786584-5	DUP	L1387739-7						
Aluminum (Al)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Arsenic (As)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Barium (Ba)-Dissolved		0.137	0.139		mg/L	1.7	20	12-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cadmium (Cd)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Calcium (Ca)-Dissolved		125	124		mg/L	0.1	20	12-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Cobalt (Co)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Copper (Cu)-Dissolved		<0.00060	<0.00060	RPD-NA	mg/L	N/A	20	12-NOV-13
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	12-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Magnesium (Mg)-Dissolved		27.7	27.7		mg/L	0.1	20	12-NOV-13
Manganese (Mn)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Molybdenum (Mo)-Dissolved		0.00093	0.00095		mg/L	1.7	20	12-NOV-13
Nickel (Ni)-Dissolved		0.00116	0.00114		mg/L	1.9	20	12-NOV-13
Potassium (K)-Dissolved		1.73	1.73		mg/L	0.1	20	12-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Silicon (Si)-Dissolved		4.41	4.41		mg/L	0.1	20	12-NOV-13
Silver (Ag)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Sodium (Na)-Dissolved		11.1	11.1		mg/L	0.2	20	12-NOV-13
Strontium (Sr)-Dissolved		0.412	0.425		mg/L	3.1	20	12-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	12-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	12-NOV-13
Uranium (U)-Dissolved		0.00257	0.00255		mg/L	1.0	20	12-NOV-13
Vanadium (V)-Dissolved		0.00015	0.00016		mg/L	2.8	20	12-NOV-13
Zinc (Zn)-Dissolved		0.0034	0.0017	J	mg/L	0.0017	0.002	12-NOV-13
WG1786584-6	DUP	L1387752-5						



Quality Control Report

Workorder: L1386772

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2739197							
WG1786584-6	DUP	L1387752-5						
Aluminum (Al)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	12-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Arsenic (As)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Barium (Ba)-Dissolved		0.185	0.180		mg/L	2.3	20	12-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	12-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Cadmium (Cd)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Calcium (Ca)-Dissolved		133	133		mg/L	0.1	20	12-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Cobalt (Co)-Dissolved		0.00047	0.00043		mg/L	8.0	20	12-NOV-13
Copper (Cu)-Dissolved		0.00123	0.00122		mg/L	0.5	20	12-NOV-13
Iron (Fe)-Dissolved		<0.030	<0.030	RPD-NA	mg/L	N/A	20	12-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Magnesium (Mg)-Dissolved		38.8	38.3		mg/L	1.3	20	12-NOV-13
Manganese (Mn)-Dissolved		0.155	0.155		mg/L	0.2	20	12-NOV-13
Molybdenum (Mo)-Dissolved		0.00035	0.00036		mg/L	3.9	20	12-NOV-13
Nickel (Ni)-Dissolved		0.00270	0.00264		mg/L	2.3	20	12-NOV-13
Potassium (K)-Dissolved		1.95	1.94		mg/L	0.8	20	12-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	12-NOV-13
Silicon (Si)-Dissolved		9.81	10.0		mg/L	1.9	20	12-NOV-13
Silver (Ag)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	12-NOV-13
Sodium (Na)-Dissolved		41.5	40.1		mg/L	3.4	20	12-NOV-13
Strontium (Sr)-Dissolved		0.773	0.787		mg/L	1.8	20	12-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	12-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	12-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	12-NOV-13
Uranium (U)-Dissolved		0.0133	0.0133		mg/L	0.3	20	12-NOV-13
Vanadium (V)-Dissolved		0.00012	0.00012		mg/L	4.5	20	12-NOV-13
Zinc (Zn)-Dissolved		0.0063	0.0060		mg/L	5.4	20	12-NOV-13
WG1786584-1	MB							
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	12-NOV-13
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2739197							
WG1786584-1	MB							
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Beryllium (Be)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	12-NOV-13
Calcium (Ca)-Dissolved			<0.020		mg/L		0.02	12-NOV-13
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Copper (Cu)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	12-NOV-13
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	12-NOV-13
Manganese (Mn)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Nickel (Ni)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Potassium (K)-Dissolved			<0.050		mg/L		0.05	12-NOV-13
Selenium (Se)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	12-NOV-13
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	12-NOV-13
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	12-NOV-13
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	12-NOV-13
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	12-NOV-13
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	12-NOV-13
Vanadium (V)-Dissolved			<0.00010		mg/L		0.0001	12-NOV-13
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	12-NOV-13
NAPHTHENIC-ACID-FM								
	Water							
Batch	R2737525							
WG1784551-3	DUP	L1385544-2						
Naphthenic Acids		31.7	31.9		mg/L	0.6	30	08-NOV-13
WG1784551-4	LCS							
Naphthenic Acids			99.8		%		70-130	08-NOV-13
WG1784551-1	MB							
Naphthenic Acids			<1.0		mg/L		1	08-NOV-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NAPHTHENIC-ACID-FM								
Water								
Batch	R2737525							
WG1784551-2 MS		L1385544-1						
Naphthenic Acids			133.4		%		50-150	08-NOV-13
NH3-CFA-ED								
Water								
Batch	R2737984							
WG1785936-4 DUP		L1386548-2						
Ammonia, Total (as N)		0.053	0.051		mg/L	4.6	20	10-NOV-13
WG1785936-5 DUP		L1386573-2						
Ammonia, Total (as N)		0.074	0.060	J	mg/L	0.014	0.1	10-NOV-13
WG1785936-2 LCS								
Ammonia, Total (as N)			104.8		%		85-115	10-NOV-13
WG1785936-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	10-NOV-13
WG1785936-3 MS		L1386451-12						
Ammonia, Total (as N)			112.3		%		75-125	10-NOV-13
NO2-IC-ED								
Water								
Batch	R2732968							
WG1781728-3 DUP		L1386772-4						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-5 DUP		L1386805-1						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-7 DUP		L1387059-2						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-2 LCS								
Nitrite (as N)			90.9		%		90-110	04-NOV-13
WG1781728-1 MB								
Nitrite (as N)			<0.050		mg/L		0.05	04-NOV-13
WG1781728-4 MS		L1386772-4						
Nitrite (as N)			84.6		%		75-125	04-NOV-13
WG1781728-6 MS		L1386805-1						
Nitrite (as N)			85.5		%		75-125	04-NOV-13
WG1781728-8 MS		L1387059-2						
Nitrite (as N)			78.4		%		75-125	04-NOV-13
NO3-IC-ED								
Water								
Batch	R2732968							
WG1781728-3 DUP		L1386772-4						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-5 DUP		L1386805-1						



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-IC-ED		Water						
Batch	R2732968							
WG1781728-5	DUP	L1386805-1						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-7	DUP	L1387059-2						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-NOV-13
WG1781728-2	LCS							
Nitrate (as N)			102.7		%		90-110	04-NOV-13
WG1781728-1	MB							
Nitrate (as N)			<0.050		mg/L		0.05	04-NOV-13
WG1781728-4	MS	L1386772-4						
Nitrate (as N)			93.6		%		75-125	04-NOV-13
WG1781728-6	MS	L1386805-1						
Nitrate (as N)			98.9		%		75-125	04-NOV-13
WG1781728-8	MS	L1387059-2						
Nitrate (as N)			97.2		%		75-125	04-NOV-13
P-T-COL-ED		Water						
Batch	R2734215							
WG1782357-11	DUP	L1387367-4						
Phosphorus (P)-Total		<0.020	<0.020	RPD-NA	mg/L	N/A	20	05-NOV-13
WG1782357-12	DUP	L1387455-1						
Phosphorus (P)-Total		0.103	0.093		mg/L	9.4	20	05-NOV-13
WG1782357-3	DUP	L1386217-3						
Phosphorus (P)-Total		0.469	0.502		mg/L	6.8	20	05-NOV-13
WG1782357-5	DUP	L1386451-1						
Phosphorus (P)-Total		0.023	0.031	J	mg/L	0.008	0.04	05-NOV-13
WG1782357-7	DUP	L1386767-1						
Phosphorus (P)-Total		0.510	0.543		mg/L	6.2	20	05-NOV-13
WG1782357-9	DUP	L1386771-5						
Phosphorus (P)-Total		0.033	0.036		mg/L	9.1	20	05-NOV-13
WG1782357-2	LCS							
Phosphorus (P)-Total			100.9		%		80-120	05-NOV-13
WG1782357-1	MB							
Phosphorus (P)-Total			<0.020		mg/L		0.02	05-NOV-13
WG1782357-10	MS	L1386771-5						
Phosphorus (P)-Total			103.3		%		70-130	05-NOV-13
WG1782357-4	MS	L1386217-3						
Phosphorus (P)-Total			N/A	MS-B	%		-	05-NOV-13
WG1782357-6	MS	L1386451-1						
Phosphorus (P)-Total			105.6		%		70-130	05-NOV-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
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Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
P-T-COL-ED								
	Water							
Batch	R2734215							
WG1782357-8 MS		L1386767-1						
Phosphorus (P)-Total			N/A	MS-B	%		-	05-NOV-13
PAH-ABT1-ED								
	Water							
Batch	R2736969							
WG1782649-3 LCS								
Acenaphthene			83.2		%		60-130	07-NOV-13
Acenaphthylene			87.9		%		60-130	07-NOV-13
Anthracene			88.1		%		60-130	07-NOV-13
Fluoranthene			89.2		%		60-130	07-NOV-13
Fluorene			85.9		%		60-130	07-NOV-13
Naphthalene			78.7		%		50-130	07-NOV-13
Phenanthrene			87.1		%		60-130	07-NOV-13
Pyrene			89.7		%		60-130	07-NOV-13
Benzo(a)anthracene			92.4		%		60-130	07-NOV-13
Benzo(k)fluoranthene			88.2		%		60-130	07-NOV-13
Benzo(b&j)fluoranthene			95.9		%		60-130	07-NOV-13
Benzo(g,h,i)perylene			97.5		%		60-130	07-NOV-13
Benzo(a)pyrene			95.5		%		60-130	07-NOV-13
Chrysene			88.7		%		60-130	07-NOV-13
Dibenzo(a,h)anthracene			100.8		%		60-130	07-NOV-13
Indeno(1,2,3-cd)pyrene			96.8		%		60-130	07-NOV-13
WG1782649-2 MB								
Acenaphthene			<0.000020		mg/L		0.00002	07-NOV-13
Acenaphthylene			<0.000020		mg/L		0.00002	07-NOV-13
Anthracene			<0.000010		mg/L		0.00001	07-NOV-13
Fluoranthene			<0.000020		mg/L		0.00002	07-NOV-13
Fluorene			<0.000020		mg/L		0.00002	07-NOV-13
Naphthalene			<0.000050		mg/L		0.00005	07-NOV-13
Phenanthrene			<0.000050		mg/L		0.00005	07-NOV-13
Pyrene			<0.000020		mg/L		0.00002	07-NOV-13
Benzo(a)anthracene			<0.000010		mg/L		0.00001	07-NOV-13
Benzo(k)fluoranthene			<0.000010		mg/L		0.00001	07-NOV-13
Benzo(b&j)fluoranthene			<0.000010		mg/L		0.00001	07-NOV-13
Benzo(g,h,i)perylene			<0.000020		mg/L		0.00002	07-NOV-13



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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ABT1-ED		Water						
Batch R2736969								
WG1782649-2 MB								
Benzo(a)pyrene			<0.0000050		mg/L		0.000005	07-NOV-13
Chrysene			<0.000020		mg/L		0.00002	07-NOV-13
Dibenzo(a,h)anthracene			<0.0000050		mg/L		0.000005	07-NOV-13
Indeno(1,2,3-cd)pyrene			<0.000010		mg/L		0.00001	07-NOV-13
Surrogate: Nitrobenzene d5			78.0		%		40-130	07-NOV-13
Surrogate: 2-Fluorobiphenyl			73.9		%		40-130	07-NOV-13
Surrogate: p-Terphenyl d14			91.2		%		40-130	07-NOV-13
PH/EC/ALK-ED		Water						
Batch R2732970								
WG1781579-7 DUP		L1386772-2						
pH		7.36	7.37	J	pH	0.00	0.3	04-NOV-13
Conductivity (EC)		1010	1010		uS/cm	0.2	10	04-NOV-13
Bicarbonate (HCO3)		726	723		mg/L	0.4	25	04-NOV-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	04-NOV-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	04-NOV-13
Alkalinity, Total (as CaCO3)		595	593		mg/L	0.4	20	04-NOV-13
WG1781579-9 DUP		L1387059-2						
pH		7.99	7.98	J	pH	0.01	0.3	04-NOV-13
Conductivity (EC)		2270	2280		uS/cm	0.5	10	04-NOV-13
Bicarbonate (HCO3)		356	354		mg/L	0.4	25	04-NOV-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	04-NOV-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	04-NOV-13
Alkalinity, Total (as CaCO3)		291	290		mg/L	0.4	20	04-NOV-13
WG1781579-2 LCS								
Conductivity (EC)			103.5		%		90-110	04-NOV-13
WG1781579-3 LCS								
pH			7.01		pH		6.7-7.3	04-NOV-13
WG1781579-4 LCS								
Alkalinity, Total (as CaCO3)			100.2		%		85-115	04-NOV-13
WG1781579-5 LCS								
Conductivity (EC)			101.2		%		90-110	04-NOV-13
WG1781579-1 MB								
Bicarbonate (HCO3)			<5.0		mg/L		5	04-NOV-13
Carbonate (CO3)			<5.0		mg/L		5	04-NOV-13
Hydroxide (OH)			<5.0		mg/L		5	04-NOV-13



Quality Control Report

Workorder: L1386772

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch R2732970								
WG1781579-1 MB								
	Hydroxide (OH)		<5.0		mg/L		5	04-NOV-13
	Alkalinity, Total (as CaCO3)		<2.0		mg/L		2	04-NOV-13
Batch R2740349								
WG1787163-10 DUP		L1390827-1						
	pH	9.25	9.21	J	pH	0.04	0.3	13-NOV-13
	Conductivity (EC)	28.0	27.3		uS/cm	2.2	10	13-NOV-13
	Bicarbonate (HCO3)	<5.0	<5.0	RPD-NA	mg/L	N/A	25	13-NOV-13
	Carbonate (CO3)	16.5	15.8		mg/L	4.4	25	13-NOV-13
	Hydroxide (OH)	<5.0	<5.0	RPD-NA	mg/L	N/A	25	13-NOV-13
	Alkalinity, Total (as CaCO3)	28.1	28.1		mg/L	0.1	20	13-NOV-13
WG1787163-6 DUP		L1390707-2						
	pH	7.98	7.98	J	pH	0.00	0.3	13-NOV-13
	Conductivity (EC)	324	324		uS/cm	0.0	10	13-NOV-13
	Bicarbonate (HCO3)	139	139		mg/L	0.4	25	13-NOV-13
	Carbonate (CO3)	<5.0	<5.0	RPD-NA	mg/L	N/A	25	13-NOV-13
	Hydroxide (OH)	<5.0	<5.0	RPD-NA	mg/L	N/A	25	13-NOV-13
	Alkalinity, Total (as CaCO3)	114	114		mg/L	0.4	20	13-NOV-13
WG1787163-8 DUP		L1390663-28						
	pH	7.81	7.78	J	pH	0.03	0.3	13-NOV-13
	Conductivity (EC)	645	644		uS/cm	0.2	10	13-NOV-13
	Bicarbonate (HCO3)	410	424		mg/L	3.4	25	13-NOV-13
	Carbonate (CO3)	<5.0	<5.0	RPD-NA	mg/L	N/A	25	13-NOV-13
	Hydroxide (OH)	<5.0	<5.0	RPD-NA	mg/L	N/A	25	13-NOV-13
	Alkalinity, Total (as CaCO3)	336	348		mg/L	3.4	20	13-NOV-13
WG1787163-9 DUP		L1390695-2						
	pH	5.27	5.15	J	pH	0.12	0.3	13-NOV-13
	Conductivity (EC)	0.65	0.64		uS/cm	2.9	10	13-NOV-13
	Bicarbonate (HCO3)	<5.0	<5.0	RPD-NA	mg/L	N/A	25	13-NOV-13
	Carbonate (CO3)	<5.0	<5.0	RPD-NA	mg/L	N/A	25	13-NOV-13
	Hydroxide (OH)	<5.0	<5.0	RPD-NA	mg/L	N/A	25	13-NOV-13
	Alkalinity, Total (as CaCO3)	<2.0	<2.0	RPD-NA	mg/L	N/A	20	13-NOV-13
WG1787163-2 LCS								
	Conductivity (EC)		100.8		%		90-110	13-NOV-13
WG1787163-3 LCS								



Quality Control Report

Workorder: L1386772

Report Date: 17-DEC-13

Page 15 of 18

Client: MATRIX SOLUTIONS INC.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch	R2740349							
WG1787163-3	LCS							
pH			7.00		pH		6.7-7.3	13-NOV-13
WG1787163-4	LCS							
Alkalinity, Total (as CaCO3)			100.1		%		85-115	13-NOV-13
WG1787163-5	LCS							
Conductivity (EC)			101.4		%		90-110	13-NOV-13
WG1787163-1	MB							
Bicarbonate (HCO3)			<5.0		mg/L		5	13-NOV-13
Carbonate (CO3)			<5.0		mg/L		5	13-NOV-13
Hydroxide (OH)			<5.0		mg/L		5	13-NOV-13
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	13-NOV-13
PHENOLS-4AAP-ED		Water						
Batch	R2738668							
WG1786313-3	LCS							
Phenols (4AAP)			89.0		%		85-115	11-NOV-13
WG1786313-2	MB							
Phenols (4AAP)			<0.0010		mg/L		0.001	11-NOV-13
SO4-IC-ED		Water						
Batch	R2732968							
WG1781728-3	DUP	L1386772-4						
Sulfate (SO4)		1.13	1.05		mg/L	7.0	20	04-NOV-13
WG1781728-5	DUP	L1386805-1						
Sulfate (SO4)		22.9	22.8		mg/L	0.0	20	04-NOV-13
WG1781728-7	DUP	L1387059-2						
Sulfate (SO4)		166	165		mg/L	0.8	20	04-NOV-13
WG1781728-2	LCS							
Sulfate (SO4)			104.8		%		90-110	04-NOV-13
WG1781728-1	MB							
Sulfate (SO4)			<0.50		mg/L		0.5	04-NOV-13
WG1781728-4	MS	L1386772-4						
Sulfate (SO4)			99.0		%		75-125	04-NOV-13
WG1781728-6	MS	L1386805-1						
Sulfate (SO4)			97.7		%		75-125	04-NOV-13
WG1781728-8	MS	L1387059-2						
Sulfate (SO4)			N/A	MS-B	%		-	04-NOV-13
TKN-CFA-ED		Water						



Quality Control Report

Workorder: L1386772

Report Date: 17-DEC-13

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Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-CFA-ED	Water							
Batch	R2740029							
WG1787192-2	LCS							
Total Kjeldahl Nitrogen			106		mg/L		75-125	13-NOV-13
WG1787192-3	LCS							
Total Kjeldahl Nitrogen			97.3		mg/L		75-125	13-NOV-13
WG1787192-4	LCS							
Total Kjeldahl Nitrogen			96.9		mg/L		75-125	13-NOV-13
WG1787192-1	MB							
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	13-NOV-13

Quality Control Report

Workorder: L1386772

Report Date: 17-DEC-13

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

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Contact: SUE RAYNARD

Legend:

Limit ALS Control Limit (Data Quality Objectives)
DUP Duplicate
RPD Relative Percent Difference
N/A Not Available
LCS Laboratory Control Sample
SRM Standard Reference Material
MS Matrix Spike
MSD Matrix Spike Duplicate
ADE Average Desorption Efficiency
MB Method Blank
IRM Internal Reference Material
CRM Certified Reference Material
CCV Continuing Calibration Verification
CVS Calibration Verification Standard
LCSD Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1386772

Report Date: 17-DEC-13

Client: MATRIX SOLUTIONS INC.
200 - 150 13 Ave SW
Calgary AB T2R 0V2
Contact: SUE RAYNARD

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Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Anions and Nutrients							
Nitrate as N by IC							
	1	30-OCT-13	04-NOV-13 08:00	48	116	hours	EHTR
	2	30-OCT-13	04-NOV-13 08:00	48	116	hours	EHTR
	3	30-OCT-13	04-NOV-13 08:00	48	116	hours	EHTR
	4	30-OCT-13	04-NOV-13 08:00	48	116	hours	EHTR
Nitrite as N by IC							
	1	30-OCT-13	04-NOV-13 08:00	48	116	hours	EHTR
	2	30-OCT-13	04-NOV-13 08:00	48	116	hours	EHTR
	3	30-OCT-13	04-NOV-13 08:00	48	116	hours	EHTR
	4	30-OCT-13	04-NOV-13 08:00	48	116	hours	EHTR

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1386772 were received on 01-NOV-13 16:51.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

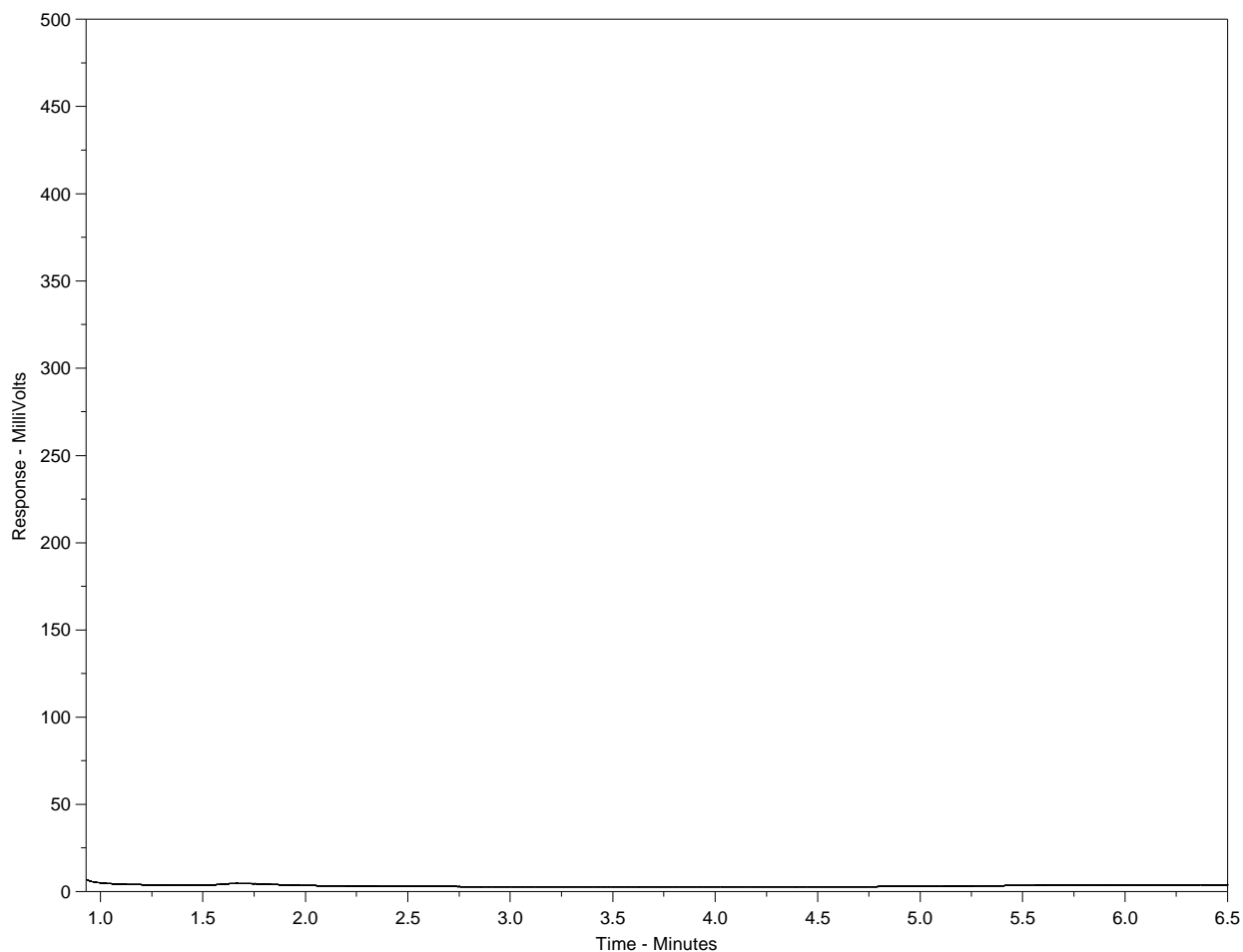
The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Hydrocarbon Distribution Report



ALS Sample ID: L1390043-1
 Client ID: 16054131107027



F2		F3		F4		F4
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

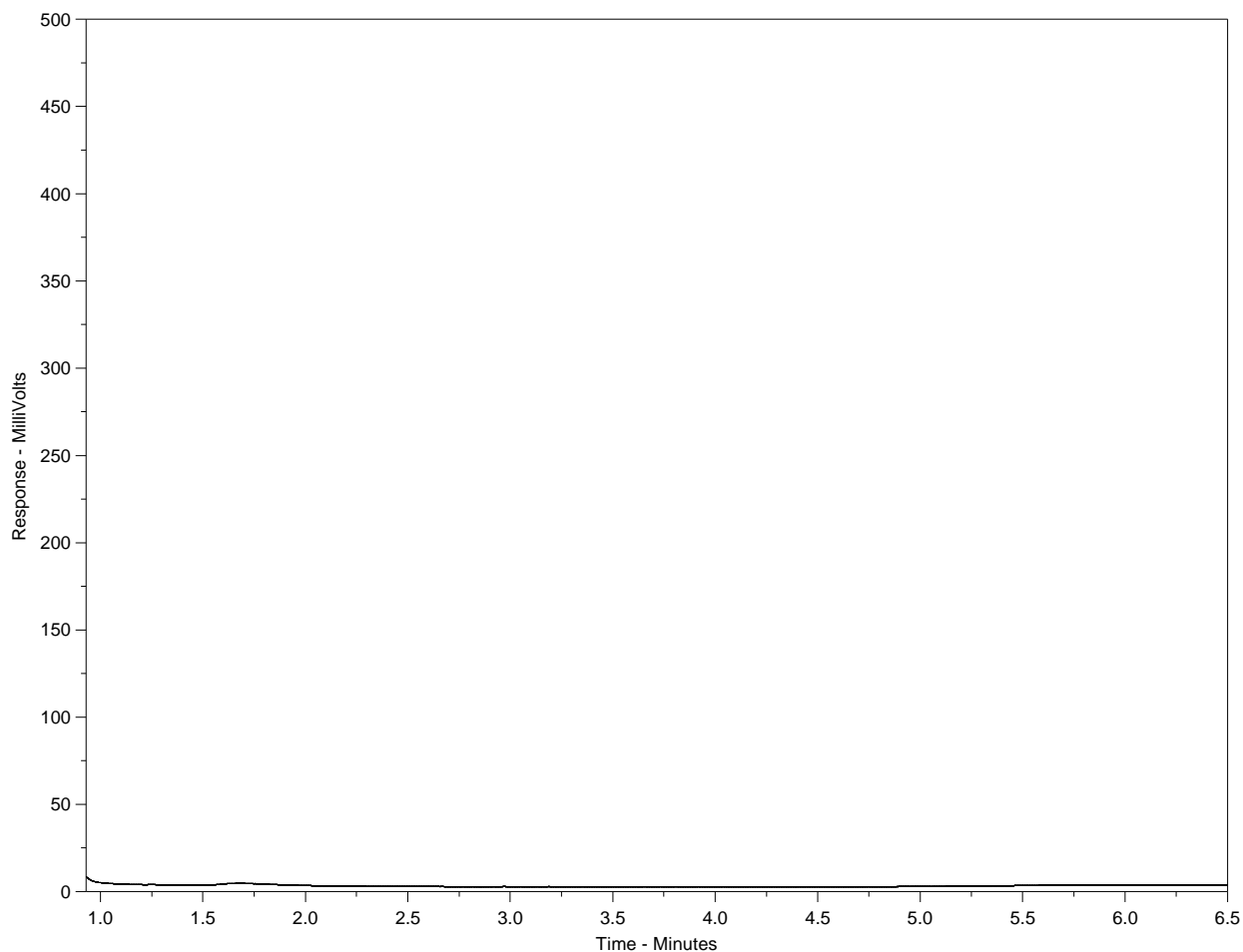
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1390043-2
Client ID: 16054131107028



F2		F3		F4		F4
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

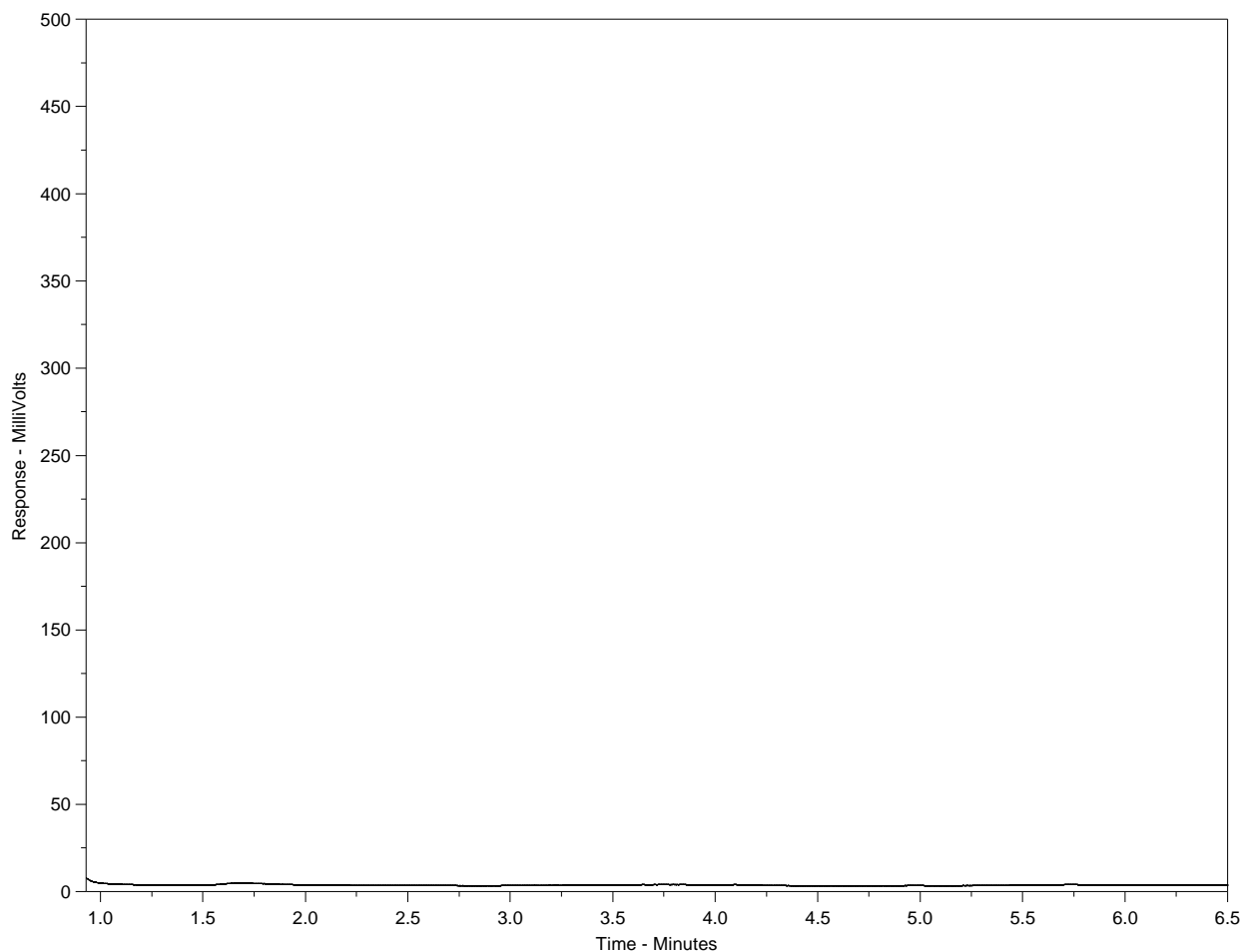
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1390043-3
Client ID: 16054131107029



F2		F3		F4		F4
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

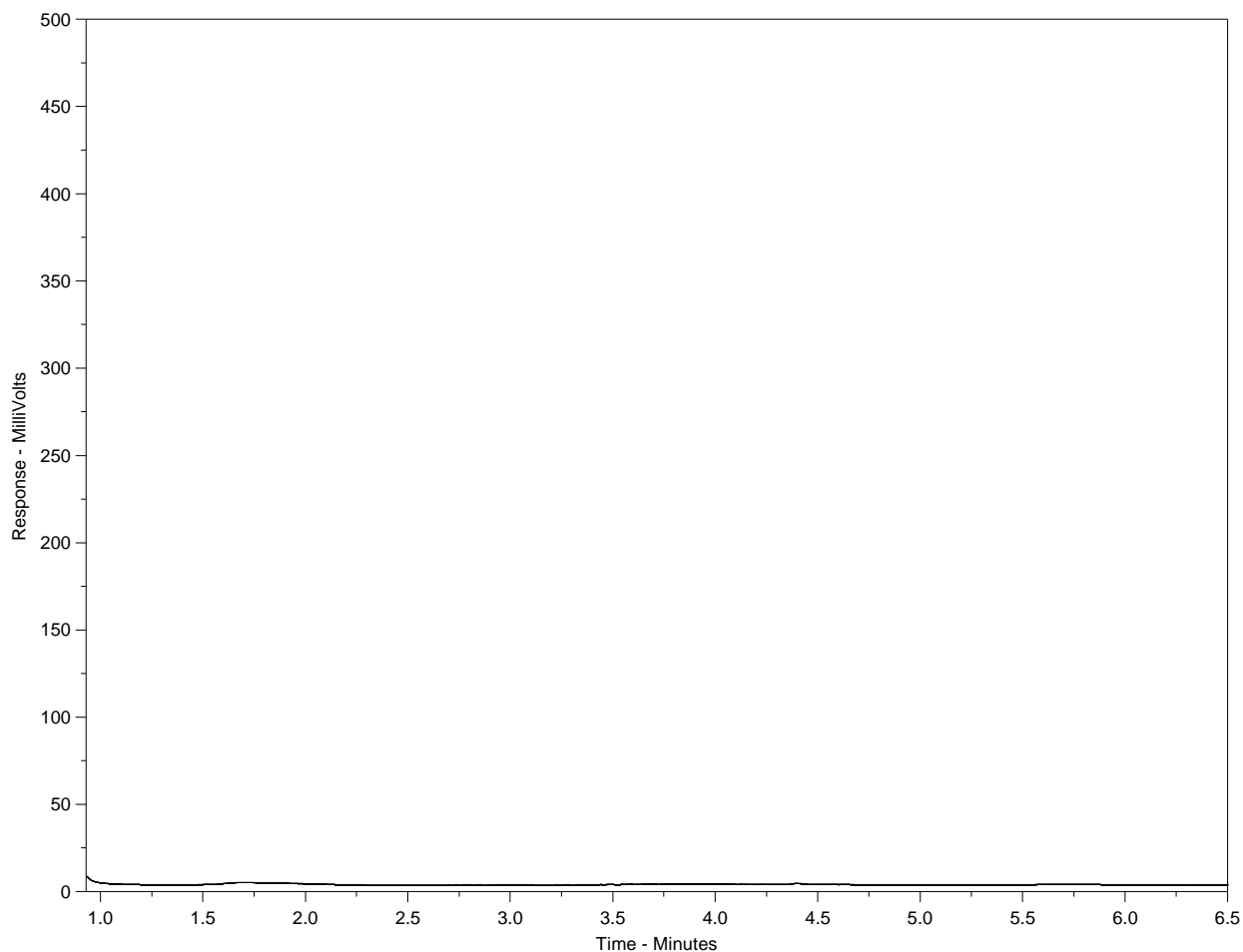
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1390043-4
 Client ID: 16054131107030



F2		F3		F4		F4
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

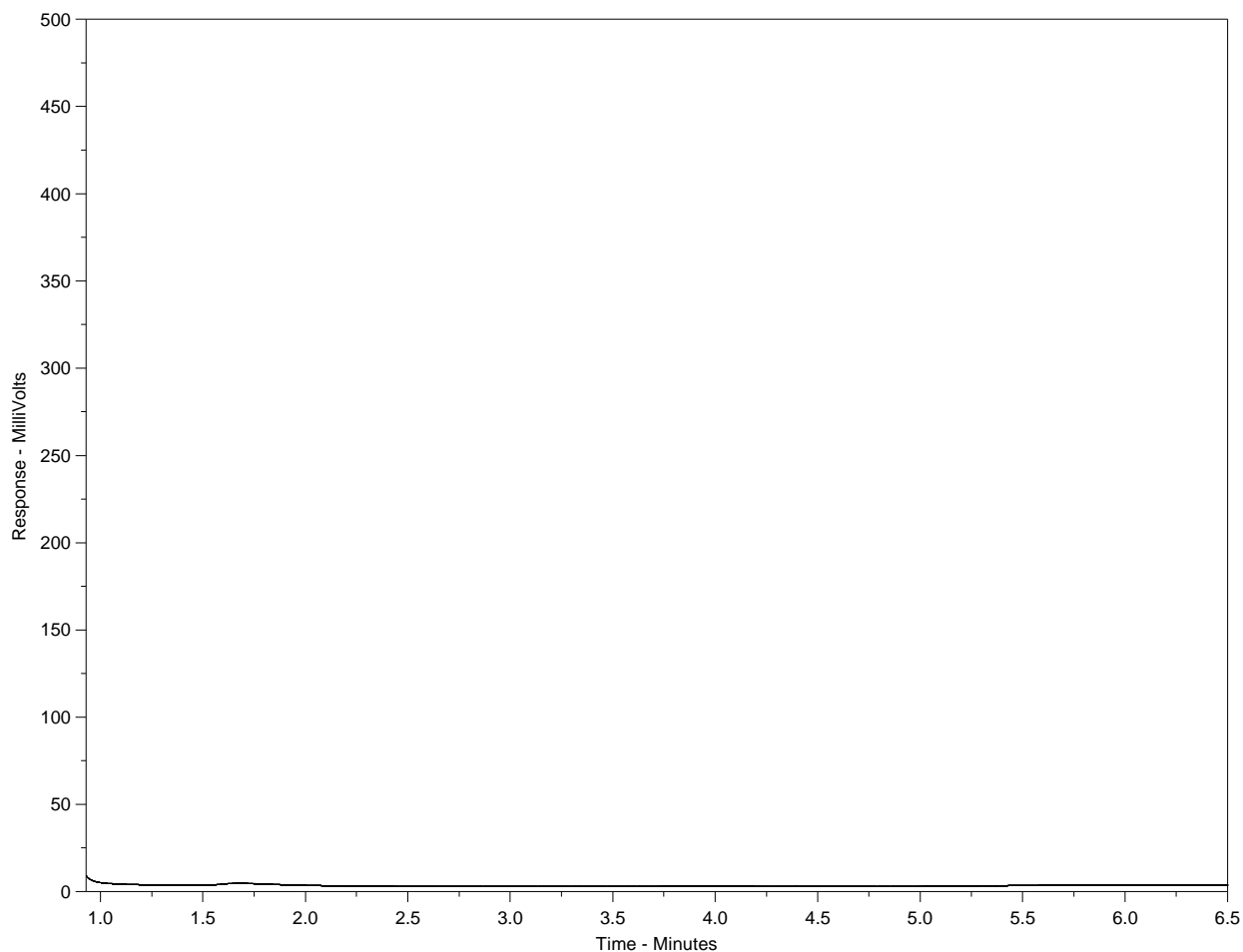
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1390043-5
 Client ID: 16054131107031



F2		F3		F4		F4
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.



Matrix Solutions Inc.
ATTN: SUE RAYNARD
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Date Received: 08-NOV-13
Report Date: 29-JAN-14 09:41 (MT)
Version: FINAL REV. 4

Client Phone: 403-237-0606

Certificate of Analysis

Lab Work Order #: L1390043
Project P.O. #: NOT SUBMITTED
Job Reference: 16054-502 PRIARIANA LAKES 80-13 07-19-80-13-W4M
C of C Numbers: M050294
Legal Site Desc: 07-19-80-13-W4M

Comments: ADDITIONAL 27-JAN-14 14:11
ADDITIONAL 13-DEC-13 13:32
16-DEC-2013 L1390043-1; Result for Se-Dis has been revised after recheck analysis.
Also DL for Al and Hg have been revised on all samples
17-DEC-2013 LOr for Ag has been fixed
29-JAN-2014 Added Si-D to all samples with metal analysis


Catherine Evaristo-Cordero
Senior Account Manager

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ADDRESS: 9936-67 Avenue, Edmonton, AB T6E 0P5 Canada | Phone: +1 780 413 5227 | Fax: +1 780 437 2311
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1390043-1 16054131107027									
Sampled By: GULLED KOSHIN on 07-NOV-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Toluene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
EthylBenzene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
o-Xylene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Styrene	<0.0010	-		0.0010	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1(C6-C10)	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1-BTEX	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Xylenes	<0.00071	-		0.00071	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
Surr: 2-Bromobenzotrifluoride	98.8	-		N/A	%	-	13-NOV-13	13-NOV-13	R2741639
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.524	+/-0.063		0.0020	mg/L	0		19-NOV-13	R2745411
Miscellaneous Parameters									
Ammonia, Total (as N)	1.64	-		0.050	mg/L	-		15-NOV-13	R2742341
Dissolved Organic Carbon	5.9	+/-0.9		1.0	mg/L	0		18-NOV-13	R2744336
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		13-DEC-13	R2743248
Naphthenic Acids	<1.0	-		1.0	mg/L	-	14-NOV-13	15-NOV-13	R2742301
Phenols (4AAP)	0.0035	+/-0.0008		0.0010	mg/L	-6.9%		20-NOV-13	R2745998
Total Kjeldahl Nitrogen	1.74	+/-0.35		0.20	mg/L	0	19-NOV-13	19-NOV-13	R2745008
Phosphorus (P)-Total	0.234	+/-0.026		0.020	mg/L	0	13-NOV-13	14-NOV-13	R2741476
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Anthracene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Fluoranthene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Fluorene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Naphthalene	<0.000050	-		0.000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Phenanthrene	<0.000050	-		0.000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Pyrene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(a)pyrene	<0.0000050	-		0.0000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Chrysene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Dibenzo(a,h)anthracene	<0.0000050	-		0.0000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Surr: Nitrobenzene d5	77.1	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Surr: 2-Fluorobiphenyl	77.9	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Surr: p-Terphenyl d14	92.1	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	0.65	+/-0.07		0.50	mg/L	0		10-NOV-13	R2738432

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1390043-2 16054131107028									
Sampled By: GULLED KOSHIN on 07-NOV-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Toluene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
EthylBenzene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
o-Xylene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Styrene	<0.0010	-		0.0010	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1(C6-C10)	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1-BTEX	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Xylenes	<0.00071	-		0.00071	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
Surr: 2-Bromobenzotrifluoride	95.0	-		N/A	%	-	13-NOV-13	13-NOV-13	R2741639
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.431	+/-0.052		0.0020	mg/L	0		19-NOV-13	R2745411
Miscellaneous Parameters									
Ammonia, Total (as N)	1.89	-		0.050	mg/L	-		15-NOV-13	R2742341
Dissolved Organic Carbon	6.2	+/-0.9		1.0	mg/L	0		18-NOV-13	R2744336
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		13-DEC-13	R2743248
Naphthenic Acids	<1.0	-		1.0	mg/L	-	14-NOV-13	15-NOV-13	R2742301
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		20-NOV-13	R2745998
Total Kjeldahl Nitrogen	1.85	+/-0.38		0.20	mg/L	0	19-NOV-13	19-NOV-13	R2745008
Phosphorus (P)-Total	0.407	+/-0.037		0.020	mg/L	0	13-NOV-13	14-NOV-13	R2741476
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Anthracene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Fluoranthene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Fluorene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Naphthalene	<0.000050	-		0.000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Phenanthrene	<0.000050	-		0.000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Pyrene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(a)pyrene	<0.0000050	-		0.0000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Chrysene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Dibenzo(a,h)anthracene	<0.0000050	-		0.0000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Surr: Nitrobenzene d5	84.5	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Surr: 2-Fluorobiphenyl	85.2	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Surr: p-Terphenyl d14	95.1	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	0.61	+/-0.07		0.50	mg/L	0		10-NOV-13	R2738432

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1390043-3 16054131107029									
Sampled By: GULLED KOSHIN on 07-NOV-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Toluene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
EthylBenzene	0.00059	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
o-Xylene	0.00123	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
m+p-Xylene	0.00188	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Styrene	<0.0010	-		0.0010	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1(C6-C10)	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1-BTEX	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Xylenes	0.00311	-		0.00071	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
Surr: 2-Bromobenzotrifluoride	104.0	-		N/A	%	-	13-NOV-13	13-NOV-13	R2741639
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.157	+/-0.019		0.0020	mg/L	0		19-NOV-13	R2745411
Miscellaneous Parameters									
Ammonia, Total (as N)	0.905	-		0.050	mg/L	-		15-NOV-13	R2742341
Dissolved Organic Carbon	6.7	+/-0.9		1.0	mg/L	0		18-NOV-13	R2744336
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		13-DEC-13	R2743248
Naphthenic Acids	<1.0	-		1.0	mg/L	-	14-NOV-13	15-NOV-13	R2742301
Phenols (4AAP)	0.0027	+/-0.0007		0.0010	mg/L	-6.9%		20-NOV-13	R2745998
Total Kjeldahl Nitrogen	1.01	+/-0.21		0.20	mg/L	0	19-NOV-13	19-NOV-13	R2745008
Phosphorus (P)-Total	1.53	+/-0.12		0.020	mg/L	0	13-NOV-13	14-NOV-13	R2741476
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Anthracene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Fluoranthene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Fluorene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Naphthalene	<0.000050	-		0.000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Phenanthrene	<0.000050	-		0.000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Pyrene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(a)pyrene	<0.0000050	-		0.0000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Chrysene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Dibenzo(a,h)anthracene	<0.0000050	-		0.0000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Surr: Nitrobenzene d5	79.4	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Surr: 2-Fluorobiphenyl	80.3	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Surr: p-Terphenyl d14	87.8	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		10-NOV-13	R2738432

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1390043-4 16054131107030									
Sampled By: GULLED KOSHIN on 07-NOV-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Toluene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
EthylBenzene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
o-Xylene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Styrene	<0.0010	-		0.0010	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1(C6-C10)	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1-BTEX	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Xylenes	<0.00071	-		0.00071	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
Surr: 2-Bromobenzotrifluoride	114.8	-		N/A	%	-	13-NOV-13	13-NOV-13	R2741639
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.0990	+/-0.012		0.0020	mg/L	0		19-NOV-13	R2745411
Miscellaneous Parameters									
Ammonia, Total (as N)	0.119	-		0.050	mg/L	-		15-NOV-13	R2742341
Dissolved Organic Carbon	5.0	+/-0.8		1.0	mg/L	0		18-NOV-13	R2744336
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		13-DEC-13	R2743248
Naphthenic Acids	<1.0	-		1.0	mg/L	-	14-NOV-13	15-NOV-13	R2742301
Phenols (4AAP)	0.0027	+/-0.0007		0.0010	mg/L	-6.9%		20-NOV-13	R2745998
Total Kjeldahl Nitrogen	1.76	+/-0.36		0.20	mg/L	0	19-NOV-13	19-NOV-13	R2745008
Phosphorus (P)-Total	1.56	+/-0.12		0.020	mg/L	0	13-NOV-13	14-NOV-13	R2741476
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Anthracene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Fluoranthene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Fluorene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Naphthalene	<0.000050	-		0.000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Phenanthrene	<0.000050	-		0.000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Pyrene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(a)pyrene	<0.0000050	-		0.0000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Chrysene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Dibenzo(a,h)anthracene	<0.0000050	-		0.0000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Surr: Nitrobenzene d5	76.3	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Surr: 2-Fluorobiphenyl	78.8	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Surr: p-Terphenyl d14	88.2	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	1.91	+/-0.09	RRV	0.50	mg/L	0		10-NOV-13	R2738432

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1390043-5 16054131107031									
Sampled By: GULLED KOSHIN on 07-NOV-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Toluene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
EthylBenzene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
o-Xylene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Styrene	<0.0010	-		0.0010	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1(C6-C10)	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1-BTEX	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Xylenes	<0.00071	-		0.00071	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
Surr: 2-Bromobenzotrifluoride	98.8	-		N/A	%	-	13-NOV-13	13-NOV-13	R2741639
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.142	+/-0.017		0.0020	mg/L	0		19-NOV-13	R2745411
Miscellaneous Parameters									
Ammonia, Total (as N)	0.876	-		0.050	mg/L	-		15-NOV-13	R2742341
Dissolved Organic Carbon	6.6	+/-0.9		1.0	mg/L	0		18-NOV-13	R2744336
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		13-DEC-13	R2743248
Naphthenic Acids	<1.0	-		1.0	mg/L	-	14-NOV-13	15-NOV-13	R2742301
Phenols (4AAP)	0.0035	+/-0.0008		0.0010	mg/L	-6.9%		20-NOV-13	R2745998
Total Kjeldahl Nitrogen	1.00	+/-0.21		0.20	mg/L	0	19-NOV-13	19-NOV-13	R2745008
Phosphorus (P)-Total	1.57	+/-0.12		0.020	mg/L	0	13-NOV-13	14-NOV-13	R2741476
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Anthracene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Fluoranthene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Fluorene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Naphthalene	<0.000050	-		0.000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Phenanthrene	<0.000050	-		0.000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Pyrene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(a)pyrene	<0.0000050	-		0.0000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Chrysene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Dibenzo(a,h)anthracene	<0.0000050	-		0.0000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Surr: Nitrobenzene d5	74.8	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Surr: 2-Fluorobiphenyl	77.4	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Surr: p-Terphenyl d14	85.2	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		10-NOV-13	R2738432

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1390043-6 16054131108038 Sampled By: GULLED KOSHIN on 08-NOV-13 Matrix: WATER									
BTEX, Styrene and F1 (C6-C10)									
Benzene	0.0584	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Toluene	0.0536	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
EthylBenzene	0.0512	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
o-Xylene	0.0489	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
m+p-Xylene	0.0511	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Styrene	0.0478	-		0.0010	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1(C6-C10)	0.43	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1-BTEX	0.16	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Xylenes	0.100	-		0.00071	mg/L	-	12-NOV-13	14-NOV-13	R2740023
* Refer to Referenced Information for Qualifiers (if any) and Methodology.									

Reference Information

Report Comments: ADDITIONAL 27-JAN-14 14:11
 ADDITIONAL 13-DEC-13 13:32
 16-DEC-2013 L1390043-1; Result for Se-Dis has been revised after recheck analysis.
 Also DL for Al and Hg have been revised on all samples
 17-DEC-2013 LOr for Ag has been fixed
 29-JAN-2014 Added Si-D to all samples with metal analysis

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Phosphorus (P)-Total	MS-B	
Matrix Spike	Chloride (Cl)	MS-B	
Matrix Spike	Sulfate (SO4)	MS-B	
Matrix Spike	Dissolved Organic Carbon	MS-B	

Sample Parameter Qualifier Key:

Qualifier	Description
BL:INT	Balance Reviewed: Interference Or Non-Measured Component
DLM	Detection Limit Adjusted due to sample matrix effects.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
B-D-L-CCMS-ED	Water	Dissolved Boron in Water by CRC ICPMS		APHA 3030 B / EPA SW-846 6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).				
BTXS,F1-ED	Water	BTEX, Styrene and F1 (C6-C10)		EPA 5021/8015&8260 GC-MS & FID
C-DIS-ORG-ED	Water	Dissolved Organic Carbon		APHA 5310 B-Instrumental
CL-IC-ED	Water	Chloride by IC		APHA 4110 B-ION CHROMATOGRAPHY
F2,F3,F4-ED	Water	F2, F3, F4		EPA 3510/CCME PHC CWS-GC-FID
HG-D-CVAA-ED	Water	Mercury (Hg) - Dissolved		EPA 245.7 / EPA 245.1
HG-D-L-CVAA-ED	Water	Mercury (Hg) - Dissolved		EPA 245.7 / EPA 245.1
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET-D-CCMS-ED	Water	Dissolved Metals in Water by CRC ICPMS		APHA 3030 B&E / EPA SW-846 6020A
NAPHTHENIC-ACID-FM	Water	Naphthenic Acids by FTIR		Naphthenic Acids by FTIR,Syncrude,1994
Dissolved naphthenic acids are solvent extracted from acidified aqueous samples using Dichloromethane prior to quantitation by Fourier Transform Infra-Red spectroscopy. Note that FTIR is not uniquely selective to naphthenic acids. If present, other carboxylic acids (e.g. humic acids, fulvic acids) may also be detected by this method.				
NH3-CFA-ED	Water	Ammonia in Water by Colour		APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.				
NO2+NO3-CALC-ED	Water	Nitrate+Nitrite		CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".				
NO3-IC-ED	Water	Nitrate as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".				
P-T-COL-ED	Water	Total P in Water by Colour		APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.				
PAH-ABT1-ED	Water	PAH & Carcinogenic PAH List		EPA 3510/8270-GC/MS

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)				
PHENOLS-4AAP-ED	Water	Phenols (4AAP)		AB ENV.06537-COLORIMETRIC
This analysis is carried out using procedures adapted from ENVIRODAT VMV 06537 689, Method Code 154, in "Methods Manual for Chemical Analysis of Water and Wastes" published by the Alberta Environmental Centre. This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide and 4-aminoantipyrine to form a red complex which is measured at 505 nm.				
SO4-IC-ED	Water	Sulfate by IC		APHA 4110 B-ION CHROMATOGRAPHY
TKN-CFA-ED	Water	TKN in Water by Colour		APHA 4500-NORG (TKN)

This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 celcius with analysis using an automated colourimetric finish.

** The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS methods may incorporate modifications from the specified reference to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
FM	ALS ENVIRONMENTAL - FORT MCMURRAY, ALBERTA, CANADA

Chain of Custody Numbers:

M050294

GLOSSARY OF REPORT TERMS

Surr - Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

MU: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.

Bias: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent.

Zero values indicate no detectable method bias.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Environmental

Quality Control Report

Workorder: L1390043

Report Date: 29-JAN-14

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Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-D-L-CCMS-ED		Water						
Batch	R2745411							
WG1790854-2	CRM	ED-HIGH-WATRM						
Boron (B)-Dissolved			90.4		%		80-120	19-NOV-13
WG1790854-3	DUP	L1390043-3						
Boron (B)-Dissolved		0.157	0.150		mg/L	4.4	20	19-NOV-13
WG1790854-1	MB							
Boron (B)-Dissolved			<0.0020		mg/L		0.002	19-NOV-13
BTXS,F1-ED		Water						
Batch	R2740023							
WG1786850-4	DUP	L1389584-17						
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	14-NOV-13
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	14-NOV-13
EthylBenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	14-NOV-13
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	14-NOV-13
m+p-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	14-NOV-13
Styrene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	50	14-NOV-13
F1(C6-C10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	14-NOV-13
WG1786850-7	DUP	L1390044-5						
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	14-NOV-13
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	14-NOV-13
EthylBenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	14-NOV-13
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	14-NOV-13
m+p-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	14-NOV-13
Styrene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	50	14-NOV-13
F1(C6-C10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	14-NOV-13
WG1786850-2	LCS							
Benzene			91.0		%		70-130	17-NOV-13
Toluene			84.8		%		70-130	17-NOV-13
EthylBenzene			89.1		%		70-130	17-NOV-13
o-Xylene			91.0		%		70-130	17-NOV-13
m+p-Xylene			91.3		%		70-130	17-NOV-13
Styrene			88.3		%		70-130	17-NOV-13
WG1786850-3	LCS							
F1(C6-C10)			94.8		%		70-130	14-NOV-13
WG1786850-1	MB							
Benzene			<0.00050		mg/L		0.0005	14-NOV-13
							0.0005	



Quality Control Report

Workorder: L1390043

Report Date: 29-JAN-14

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Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTXS,F1-ED								
	Water							
Batch	R2740023							
WG1786850-1	MB							
Toluene			<0.00050		mg/L		0.0005	14-NOV-13
EthylBenzene			<0.00050		mg/L		0.0005	14-NOV-13
o-Xylene			<0.00050		mg/L		0.0005	14-NOV-13
m+p-Xylene			<0.00050		mg/L		0.0005	14-NOV-13
Styrene			<0.0010		mg/L		0.001	14-NOV-13
F1(C6-C10)			<0.10		mg/L		0.1	14-NOV-13
WG1786850-5	MS	L1389584-17						
Benzene			85.0		%		50-150	14-NOV-13
Toluene			84.8		%		50-150	14-NOV-13
EthylBenzene			80.9		%		50-150	14-NOV-13
o-Xylene			86.1		%		50-150	14-NOV-13
m+p-Xylene			84.7		%		50-150	14-NOV-13
Styrene			90.6		%		50-150	14-NOV-13
WG1786850-6	MS	L1389584-17						
F1(C6-C10)			71.2		%		50-150	14-NOV-13
C-DIS-ORG-ED								
	Water							
Batch	R2744336							
WG1790206-8	CVS							
Dissolved Organic Carbon			99.5		%		80-160	18-NOV-13
WG1790206-11	DUP	L1390043-5						
Dissolved Organic Carbon		6.6	6.6		mg/L	0.1	20	18-NOV-13
WG1790206-13	DUP	L1391157-3						
Dissolved Organic Carbon		12.7	12.8		mg/L	0.6	20	19-NOV-13
WG1790206-7	LCS							
Dissolved Organic Carbon			91.4		%		80-120	18-NOV-13
WG1790206-6	MB							
Dissolved Organic Carbon			<1.0		mg/L		1	18-NOV-13
WG1790206-12	MS	L1390043-5						
Dissolved Organic Carbon			89.0		%		70-130	18-NOV-13
WG1790206-14	MS	L1391157-3						
Dissolved Organic Carbon			N/A	MS-B	%		-	19-NOV-13
CL-IC-ED								
	Water							
Batch	R2738432							
WG1786062-3	DUP	L1389950-2						
Chloride (Cl)		112	115		mg/L	2.5	20	10-NOV-13
WG1786062-5	DUP	L1389791-2						



Quality Control Report

Workorder: L1390043

Report Date: 29-JAN-14

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Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-IC-ED		Water						
Batch	R2738432							
WG1786062-5	DUP	L1389791-2						
Chloride (Cl)		45.6	45.7		mg/L	0.2	20	10-NOV-13
WG1786062-2	LCS							
Chloride (Cl)			107.8		%		90-110	10-NOV-13
WG1786062-1	MB							
Chloride (Cl)			<0.50		mg/L		0.5	10-NOV-13
WG1786062-4	MS	L1389950-2						
Chloride (Cl)			N/A	MS-B	%		-	10-NOV-13
WG1786062-6	MS	L1389791-2						
Chloride (Cl)			90.9		%		75-125	10-NOV-13
F2,F3,F4-ED		Water						
Batch	R2741639							
WG1787290-20	LCS							
F2 (>C10-C16)			99.0		%		65-135	13-NOV-13
F3 (C16-C34)			98.8		%		65-135	13-NOV-13
F4 (C34-C50)			98.6		%		65-135	13-NOV-13
WG1787290-23	LCS							
F2 (>C10-C16)			90.1		%		65-135	13-NOV-13
F3 (C16-C34)			89.4		%		65-135	13-NOV-13
F4 (C34-C50)			89.4		%		65-135	13-NOV-13
WG1787290-19	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	13-NOV-13
F3 (C16-C34)			<0.25		mg/L		0.25	13-NOV-13
F4 (C34-C50)			<0.25		mg/L		0.25	13-NOV-13
Surrogate: 2-Bromobenzotrifluoride			96.1		%		50-150	13-NOV-13
WG1787290-22	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	13-NOV-13
F3 (C16-C34)			<0.25		mg/L		0.25	13-NOV-13
F4 (C34-C50)			<0.25		mg/L		0.25	13-NOV-13
Surrogate: 2-Bromobenzotrifluoride			99.0		%		50-150	13-NOV-13
HG-D-L-CVAA-ED		Water						
Batch	R2743248							
WG1789804-8	DUP	L1391414-1						
Mercury (Hg)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	17-NOV-13
WG1789804-2	LCS							
Mercury (Hg)-Dissolved			88.2		%		80-120	17-NOV-13
WG1789804-3	LCSD	WG1789804-2						



Quality Control Report

Workorder: L1390043

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Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-D-L-CVAA-ED								
	Water							
Batch	R2743248							
WG1789804-3	LCSD	WG1789804-2						
Mercury (Hg)-Dissolved		88.2	88.6		%	0.4	20	17-NOV-13
WG1789804-1	MB							
Mercury (Hg)-Dissolved			<0.000020		mg/L		0.00002	17-NOV-13
WG1789804-9	MS	L1391414-1						
Mercury (Hg)-Dissolved			74.9		%		70-130	17-NOV-13
MET-D-CCMS-ED								
	Water							
Batch	R2745411							
WG1790854-2	CRM	ED-HIGH-WATRM						
Aluminum (Al)-Dissolved			101.8		%		80-120	19-NOV-13
Antimony (Sb)-Dissolved			105.1		%		80-120	19-NOV-13
Arsenic (As)-Dissolved			101.7		%		80-120	19-NOV-13
Barium (Ba)-Dissolved			100.0		%		80-120	19-NOV-13
Beryllium (Be)-Dissolved			93.4		%		80-120	19-NOV-13
Bismuth (Bi)-Dissolved			98.7		%		80-120	19-NOV-13
Cadmium (Cd)-Dissolved			100.4		%		80-120	19-NOV-13
Calcium (Ca)-Dissolved			96.1		%		80-120	19-NOV-13
Chromium (Cr)-Dissolved			99.1		%		80-120	19-NOV-13
Cobalt (Co)-Dissolved			97.1		%		80-120	19-NOV-13
Copper (Cu)-Dissolved			94.5		%		80-120	19-NOV-13
Lead (Pb)-Dissolved			97.3		%		80-120	19-NOV-13
Magnesium (Mg)-Dissolved			97.7		%		80-120	19-NOV-13
Manganese (Mn)-Dissolved			95.9		%		80-120	19-NOV-13
Molybdenum (Mo)-Dissolved			92.6		%		80-120	19-NOV-13
Nickel (Ni)-Dissolved			97.6		%		80-120	19-NOV-13
Potassium (K)-Dissolved			100.5		%		80-120	19-NOV-13
Selenium (Se)-Dissolved			102.3		%		80-120	19-NOV-13
Silicon (Si)-Dissolved			98.5		%		80-120	19-NOV-13
Silver (Ag)-Dissolved			97.8		%		80-120	19-NOV-13
Sodium (Na)-Dissolved			104.3		%		80-120	19-NOV-13
Strontium (Sr)-Dissolved			98.6		%		80-120	19-NOV-13
Thallium (Tl)-Dissolved			98.8		%		80-120	19-NOV-13
Titanium (Ti)-Dissolved			100.4		%		80-120	19-NOV-13
Tin (Sn)-Dissolved			96.7		%		80-120	19-NOV-13
Uranium (U)-Dissolved			94.4		%		80-120	19-NOV-13



Quality Control Report

Workorder: L1390043

Report Date: 29-JAN-14

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Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED		Water						
Batch	R2745411							
WG1790854-2 CRM		ED-HIGH-WATRM						
Vanadium (V)-Dissolved			98.0		%		80-120	19-NOV-13
WG1790854-3 DUP		L1390043-3						
Aluminum (Al)-Dissolved		0.0014	<0.010	RPD-NA	mg/L	N/A	20	19-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	19-NOV-13
Arsenic (As)-Dissolved		0.0212	0.0213		mg/L	0.1	20	19-NOV-13
Barium (Ba)-Dissolved		0.0659	0.0658		mg/L	0.1	20	19-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	19-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-NOV-13
Cadmium (Cd)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-NOV-13
Calcium (Ca)-Dissolved		72.2	74.3		mg/L	2.9	20	19-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	19-NOV-13
Cobalt (Co)-Dissolved		0.00013	0.00011		mg/L	11	20	19-NOV-13
Copper (Cu)-Dissolved		<0.00060	<0.00060	RPD-NA	mg/L	N/A	20	19-NOV-13
Iron (Fe)-Dissolved		9.20	9.12		mg/L	0.8	20	19-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-NOV-13
Magnesium (Mg)-Dissolved		20.0	19.1		mg/L	4.5	20	19-NOV-13
Manganese (Mn)-Dissolved		0.430	0.421		mg/L	2.3	20	19-NOV-13
Molybdenum (Mo)-Dissolved		0.00836	0.00837		mg/L	0.1	20	19-NOV-13
Nickel (Ni)-Dissolved		0.00090	0.00087		mg/L	3.3	20	19-NOV-13
Potassium (K)-Dissolved		4.10	4.04		mg/L	1.4	20	19-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	19-NOV-13
Silicon (Si)-Dissolved		10.1	10.0		mg/L	1.0	20	19-NOV-13
Silver (Ag)-Dissolved		<0.000010	<0.00020	RPD-NA	mg/L	N/A	20	19-NOV-13
Sodium (Na)-Dissolved		19.0	18.8		mg/L	1.2	20	19-NOV-13
Strontium (Sr)-Dissolved		0.438	0.455		mg/L	3.7	20	19-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	19-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	19-NOV-13
Uranium (U)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-NOV-13
Vanadium (V)-Dissolved		0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-NOV-13
WG1790854-4 DUP		L1390180-2						
Aluminum (Al)-Dissolved		0.0067	0.0063		mg/L	7.2	20	19-NOV-13
Antimony (Sb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-NOV-13



Quality Control Report

Workorder: L1390043

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Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2745411							
WG1790854-4	DUP	L1390180-2						
Arsenic (As)-Dissolved		0.00401	0.00334		mg/L	18	20	19-NOV-13
Barium (Ba)-Dissolved		0.306	0.268		mg/L	13	20	19-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	19-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-NOV-13
Cadmium (Cd)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	19-NOV-13
Calcium (Ca)-Dissolved		167	170		mg/L	1.5	20	19-NOV-13
Chromium (Cr)-Dissolved		0.00016	0.00010	J	mg/L	0.00005	0.0002	19-NOV-13
Cobalt (Co)-Dissolved		0.0148	0.0123		mg/L	18	20	19-NOV-13
Copper (Cu)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-NOV-13
Iron (Fe)-Dissolved		11.2	11.0		mg/L	1.2	20	19-NOV-13
Lead (Pb)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-NOV-13
Magnesium (Mg)-Dissolved		46.1	38.1		mg/L	19	20	19-NOV-13
Manganese (Mn)-Dissolved		3.41	2.94		mg/L	15	20	19-NOV-13
Molybdenum (Mo)-Dissolved		0.000269	0.000266		mg/L	1.1	20	19-NOV-13
Nickel (Ni)-Dissolved		0.0141	0.0119		mg/L	17	20	19-NOV-13
Potassium (K)-Dissolved		2.06	1.72		mg/L	18	20	19-NOV-13
Selenium (Se)-Dissolved		0.00021	0.00020		mg/L	4.7	20	19-NOV-13
Silicon (Si)-Dissolved		9.45	9.21		mg/L	2.5	20	19-NOV-13
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	19-NOV-13
Sodium (Na)-Dissolved		111	92.2		mg/L	19	20	19-NOV-13
Strontium (Sr)-Dissolved		0.495	0.505		mg/L	2.0	20	19-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-NOV-13
Titanium (Ti)-Dissolved		0.00034	<0.00030	RPD-NA	mg/L	N/A	20	19-NOV-13
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-NOV-13
Uranium (U)-Dissolved		0.00199	0.00197		mg/L	1.4	20	19-NOV-13
Vanadium (V)-Dissolved		0.00085	0.00067	J	mg/L	0.00018	0.0002	19-NOV-13
Zinc (Zn)-Dissolved		0.0016	0.0017		mg/L	3.6	20	19-NOV-13
WG1790854-5	DUP	L1391133-4						
Aluminum (Al)-Dissolved		0.0107	0.0106		mg/L	1.0	20	19-NOV-13
Antimony (Sb)-Dissolved		0.00015	0.00015		mg/L	1.3	20	19-NOV-13
Arsenic (As)-Dissolved		0.00032	0.00030		mg/L	6.0	20	19-NOV-13
Barium (Ba)-Dissolved		0.110	0.108		mg/L	2.0	20	19-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	19-NOV-13



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Client: Matrix Solutions Inc.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2
 Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2745411							
WG1790854-5	DUP	L1391133-4						
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-NOV-13
Cadmium (Cd)-Dissolved		0.000070	0.000069		mg/L	1.1	20	19-NOV-13
Calcium (Ca)-Dissolved		73.7	73.5		mg/L	0.3	20	19-NOV-13
Chromium (Cr)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-NOV-13
Cobalt (Co)-Dissolved		<0.00010	0.00011	RPD-NA	mg/L	N/A	20	19-NOV-13
Copper (Cu)-Dissolved		0.00238	0.00261		mg/L	9.2	20	19-NOV-13
Iron (Fe)-Dissolved		0.011	0.011		mg/L	7.9	20	19-NOV-13
Lead (Pb)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-NOV-13
Magnesium (Mg)-Dissolved		32.7	31.9		mg/L	2.7	20	19-NOV-13
Manganese (Mn)-Dissolved		0.00859	0.00824		mg/L	4.2	20	19-NOV-13
Molybdenum (Mo)-Dissolved		0.00139	0.00142		mg/L	2.0	20	19-NOV-13
Nickel (Ni)-Dissolved		0.00239	0.00221		mg/L	7.5	20	19-NOV-13
Potassium (K)-Dissolved		1.07	1.03		mg/L	3.5	20	19-NOV-13
Selenium (Se)-Dissolved		0.00042	0.00042		mg/L	1.2	20	19-NOV-13
Silicon (Si)-Dissolved		6.92	6.87		mg/L	0.7	20	19-NOV-13
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	19-NOV-13
Sodium (Na)-Dissolved		8.0	7.7		mg/L	3.9	20	19-NOV-13
Strontium (Sr)-Dissolved		0.185	0.187		mg/L	0.6	20	19-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-NOV-13
Titanium (Ti)-Dissolved		0.00040	0.00077	J	mg/L	0.00037	0.0006	19-NOV-13
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-NOV-13
Uranium (U)-Dissolved		0.00249	0.00245		mg/L	1.8	20	19-NOV-13
Vanadium (V)-Dissolved		0.00085	0.00088		mg/L	3.2	20	19-NOV-13
Zinc (Zn)-Dissolved		0.0028	0.0025		mg/L	9.5	20	19-NOV-13
WG1790854-1	MB							
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	19-NOV-13
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-13
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-13
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-13
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	19-NOV-13
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-13
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	19-NOV-13
Calcium (Ca)-Dissolved			<0.020		mg/L		0.02	19-NOV-13



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Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED		Water						
Batch R2745411								
WG1790854-1 MB								
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-13
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-13
Copper (Cu)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-13
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	19-NOV-13
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-13
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	19-NOV-13
Manganese (Mn)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-13
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-13
Nickel (Ni)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-13
Potassium (K)-Dissolved			<0.050		mg/L		0.05	19-NOV-13
Selenium (Se)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-13
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	19-NOV-13
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	19-NOV-13
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	19-NOV-13
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-13
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-13
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	19-NOV-13
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-13
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	19-NOV-13
Vanadium (V)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-13
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	19-NOV-13
Batch R2745956								
WG1790854-2 CRM		ED-HIGH-WATRM						
Zinc (Zn)-Dissolved			97.0		%		80-120	21-NOV-13
WG1791601-2 CRM		ED-HIGH-WATRM						
Zinc (Zn)-Dissolved			101.8		%		80-120	20-NOV-13
WG1790854-3 DUP		L1390043-3						
Zinc (Zn)-Dissolved		0.0040	0.0041		mg/L	3.2	20	21-NOV-13
WG1791601-3 DUP		L1390663-5						
Zinc (Zn)-Dissolved		0.0011	<0.0010	RPD-NA	mg/L	N/A	20	21-NOV-13
WG1791601-4 DUP		L1390663-19						
Zinc (Zn)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	21-NOV-13
WG1791601-5 DUP		L1390663-28						
Zinc (Zn)-Dissolved		<0.0010	0.0010	RPD-NA	mg/L	N/A	20	21-NOV-13
WG1791601-6 DUP		L1390663-39						



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200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED		Water						
Batch	R2745956							
WG1791601-6	DUP	L1390663-39						
Zinc (Zn)-Dissolved		0.0015	0.0015		mg/L	3.1	20	21-NOV-13
WG1791601-7	DUP	L1390663-41						
Zinc (Zn)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	21-NOV-13
WG1791601-1	MB							
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	20-NOV-13
Batch	R2756110							
WG1801103-2	CRM	ED-HIGH-WATRM						
Selenium (Se)-Dissolved			100.6		%		80-120	06-DEC-13
WG1801103-1	MB							
Selenium (Se)-Dissolved			<0.00010		mg/L		0.0001	06-DEC-13
NAPHTHENIC-ACID-FM		Water						
Batch	R2742301							
WG1787794-3	DUP	L1389950-2						
Naphthenic Acids		11.2	11.6		mg/L	3.1	30	15-NOV-13
WG1787794-4	LCS							
Naphthenic Acids			102.4		%		70-130	15-NOV-13
WG1787794-1	MB							
Naphthenic Acids			<1.0		mg/L		1	15-NOV-13
WG1787794-2	MS	L1389950-1						
Naphthenic Acids			131.7		%		50-150	15-NOV-13
NH3-CFA-ED		Water						
Batch	R2742341							
WG1788748-11	DUP	L1390243-3						
Ammonia, Total (as N)		<0.050	0.051	RPD-NA	mg/L	N/A	20	15-NOV-13
WG1788748-3	DUP	L1391718-5						
Ammonia, Total (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	15-NOV-13
WG1788748-7	DUP	L1390199-1						
Ammonia, Total (as N)		0.242	0.245		mg/L	1.1	20	15-NOV-13
WG1788748-8	DUP	L1392067-1						
Ammonia, Total (as N)		0.476	0.478		mg/L	0.3	20	15-NOV-13
WG1788748-2	LCS							
Ammonia, Total (as N)			97.7		%		85-115	15-NOV-13
WG1788748-1	MB							
Ammonia, Total (as N)			<0.050		mg/L		0.05	15-NOV-13
WG1788748-10	MS	L1390044-5						
Ammonia, Total (as N)			111.7		%		75-125	15-NOV-13
WG1788748-4	MS	L1391873-3						



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Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-CFA-ED		Water						
Batch	R2742341							
WG1788748-4 MS		L1391873-3						
Ammonia, Total (as N)			109.9		%		75-125	15-NOV-13
WG1788748-6 MS		L1389933-3						
Ammonia, Total (as N)			108.6		%		75-125	15-NOV-13
NO2-IC-ED		Water						
Batch	R2738432							
WG1786062-3 DUP		L1389950-2						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	10-NOV-13
WG1786062-2 LCS								
Nitrite (as N)			108.2		%		90-110	10-NOV-13
WG1786062-1 MB								
Nitrite (as N)			<0.050		mg/L		0.05	10-NOV-13
WG1786062-4 MS		L1389950-2						
Nitrite (as N)			97.2		%		75-125	10-NOV-13
NO3-IC-ED		Water						
Batch	R2738432							
WG1786062-3 DUP		L1389950-2						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	10-NOV-13
WG1786062-2 LCS								
Nitrate (as N)			101.9		%		90-110	10-NOV-13
WG1786062-1 MB								
Nitrate (as N)			<0.050		mg/L		0.05	10-NOV-13
WG1786062-4 MS		L1389950-2						
Nitrate (as N)			97.6		%		75-125	10-NOV-13
P-T-COL-ED		Water						
Batch	R2741476							
WG1787610-3 DUP		L1389284-3						
Phosphorus (P)-Total		0.340	0.356		mg/L	4.4	20	14-NOV-13
WG1787610-5 DUP		L1390291-1						
Phosphorus (P)-Total		2.19	2.19		mg/L	0.2	20	14-NOV-13
WG1787610-2 LCS								
Phosphorus (P)-Total			102.9		%		80-120	14-NOV-13
WG1787610-1 MB								
Phosphorus (P)-Total			<0.020		mg/L		0.02	14-NOV-13
WG1787610-4 MS		L1389284-3						
Phosphorus (P)-Total			122.6		%		70-130	14-NOV-13
WG1787610-6 MS		L1390291-1						



Environmental

Quality Control Report

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Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
P-T-COL-ED								
	Water							
Batch	R2741476							
WG1787610-6 MS		L1390291-1						
Phosphorus (P)-Total			N/A	MS-B	%		-	14-NOV-13
PAH-ABT1-ED								
	Water							
Batch	R2742080							
WG1786514-3 LCS								
Acenaphthene			80.9		%		60-130	14-NOV-13
Acenaphthylene			84.5		%		60-130	14-NOV-13
Anthracene			82.0		%		60-130	14-NOV-13
Fluoranthene			89.1		%		60-130	14-NOV-13
Fluorene			84.4		%		60-130	14-NOV-13
Naphthalene			80.3		%		50-130	14-NOV-13
Phenanthrene			84.2		%		60-130	14-NOV-13
Pyrene			89.3		%		60-130	14-NOV-13
Benzo(a)anthracene			90.4		%		60-130	14-NOV-13
Benzo(k)fluoranthene			102.3		%		60-130	14-NOV-13
Benzo(b&j)fluoranthene			107.1		%		60-130	14-NOV-13
Benzo(g,h,i)perylene			106.3		%		60-130	14-NOV-13
Benzo(a)pyrene			108.5		%		60-130	14-NOV-13
Chrysene			84.2		%		60-130	14-NOV-13
Dibenzo(a,h)anthracene			108.0		%		60-130	14-NOV-13
Indeno(1,2,3-cd)pyrene			110.7		%		60-130	14-NOV-13
WG1786514-2 MB								
Acenaphthene			<0.000020		mg/L		0.00002	15-NOV-13
Acenaphthylene			<0.000020		mg/L		0.00002	15-NOV-13
Anthracene			<0.000010		mg/L		0.00001	15-NOV-13
Fluoranthene			<0.000020		mg/L		0.00002	15-NOV-13
Fluorene			<0.000020		mg/L		0.00002	15-NOV-13
Naphthalene			<0.000050		mg/L		0.00005	15-NOV-13
Phenanthrene			<0.000050		mg/L		0.00005	15-NOV-13
Pyrene			<0.000020		mg/L		0.00002	15-NOV-13
Benzo(a)anthracene			<0.000010		mg/L		0.00001	15-NOV-13
Benzo(k)fluoranthene			<0.000010		mg/L		0.00001	15-NOV-13
Benzo(b&j)fluoranthene			<0.000010		mg/L		0.00001	15-NOV-13
Benzo(g,h,i)perylene			<0.000020		mg/L		0.00002	15-NOV-13



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Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ABT1-ED								
	Water							
Batch	R2742080							
WG1786514-2	MB							
Benzo(a)pyrene			<0.0000050		mg/L		0.000005	15-NOV-13
Chrysene			<0.000020		mg/L		0.00002	15-NOV-13
Dibenzo(a,h)anthracene			<0.0000050		mg/L		0.000005	15-NOV-13
Indeno(1,2,3-cd)pyrene			<0.000010		mg/L		0.00001	15-NOV-13
Surrogate: Nitrobenzene d5			83.6		%		40-130	15-NOV-13
Surrogate: 2-Fluorobiphenyl			79.1		%		40-130	15-NOV-13
Surrogate: p-Terphenyl d14			89.8		%		40-130	15-NOV-13
PH/EC/ALK-ED								
	Water							
Batch	R2737927							
WG1785629-11	DUP	L1390096-2						
pH		7.88	7.87	J	pH	0.01	0.3	10-NOV-13
Conductivity (EC)		1780	1780		uS/cm	0.3	10	10-NOV-13
Bicarbonate (HCO3)		583	634		mg/L	8.3	25	10-NOV-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	10-NOV-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	10-NOV-13
Alkalinity, Total (as CaCO3)		478	520		mg/L	8.3	20	10-NOV-13
WG1785629-6	DUP	L1389584-5						
pH		7.73	7.75	J	pH	0.01	0.3	09-NOV-13
Conductivity (EC)		988	986		uS/cm	0.2	10	09-NOV-13
Bicarbonate (HCO3)		376	378		mg/L	0.5	25	09-NOV-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	09-NOV-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	09-NOV-13
Alkalinity, Total (as CaCO3)		308	310		mg/L	0.5	20	09-NOV-13
WG1785629-7	DUP	L1389950-1						
pH		7.57	7.59	J	pH	0.01	0.3	09-NOV-13
Conductivity (EC)		17500	17600		uS/cm	0.5	10	09-NOV-13
Bicarbonate (HCO3)		2580	2540		mg/L	1.5	25	09-NOV-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	09-NOV-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	09-NOV-13
Alkalinity, Total (as CaCO3)		2110	2080		mg/L	1.5	20	09-NOV-13
WG1785629-8	DUP	L1389621-10						
pH		9.44	9.49	J	pH	0.05	0.3	09-NOV-13
Conductivity (EC)		552	559		uS/cm	1.3	10	09-NOV-13
Bicarbonate (HCO3)		234	229		mg/L	2.0	25	09-NOV-13

Quality Control Report

Workorder: L1390043

Report Date: 29-JAN-14

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Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch	R2737927							
WG1785629-8	DUP	L1389621-10						
Carbonate (CO3)		66.2	71.1		mg/L	7.1	25	09-NOV-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	09-NOV-13
Alkalinity, Total (as CaCO3)		302	306		mg/L	1.4	20	09-NOV-13
WG1785629-9	DUP	L1389621-31						
pH		8.05	8.06	J	pH	0.01	0.3	10-NOV-13
Conductivity (EC)		1050	1050		uS/cm	0.2	10	10-NOV-13
Bicarbonate (HCO3)		656	661		mg/L	0.8	25	10-NOV-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	10-NOV-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	10-NOV-13
Alkalinity, Total (as CaCO3)		538	542		mg/L	0.8	20	10-NOV-13
WG1785629-2	LCS							
Conductivity (EC)			103.7		%		90-110	09-NOV-13
WG1785629-3	LCS							
pH			7.02		pH		6.7-7.3	09-NOV-13
WG1785629-4	LCS							
Alkalinity, Total (as CaCO3)			99.1		%		85-115	09-NOV-13
WG1785629-5	LCS							
Conductivity (EC)			99.3		%		90-110	09-NOV-13
WG1785629-1	MB							
Bicarbonate (HCO3)			<5.0		mg/L		5	09-NOV-13
Carbonate (CO3)			<5.0		mg/L		5	09-NOV-13
Hydroxide (OH)			<5.0		mg/L		5	09-NOV-13
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	09-NOV-13
PHENOLS-4AAP-ED		Water						
Batch	R2745998							
WG1791945-4	DUP	L1390044-5						
Phenols (4AAP)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	15	20-NOV-13
WG1791945-5	DUP	L1390096-8						
Phenols (4AAP)		<0.0010	0.0011	RPD-NA	mg/L	N/A	15	20-NOV-13
WG1791945-6	DUP	L1390730-13						
Phenols (4AAP)		0.0178	0.0185		mg/L	3.9	15	20-NOV-13
WG1791945-3	LCS							
Phenols (4AAP)			100.0		%		85-115	20-NOV-13
WG1791945-2	MB							
Phenols (4AAP)			<0.0010		mg/L		0.001	20-NOV-13



Quality Control Report

Workorder: L1390043

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Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-IC-ED		Water						
Batch	R2738432							
WG1786062-3	DUP	L1389950-2						
Sulfate (SO4)		339	349		mg/L	2.7	20	10-NOV-13
WG1786062-5	DUP	L1389791-2						
Sulfate (SO4)		63.8	63.9		mg/L	0.2	20	10-NOV-13
WG1786062-2	LCS							
Sulfate (SO4)			106.9		%		90-110	10-NOV-13
WG1786062-1	MB							
Sulfate (SO4)			<0.50		mg/L		0.5	10-NOV-13
WG1786062-4	MS	L1389950-2						
Sulfate (SO4)			N/A	MS-B	%		-	10-NOV-13
WG1786062-6	MS	L1389791-2						
Sulfate (SO4)			89.7		%		75-125	10-NOV-13
TKN-CFA-ED		Water						
Batch	R2745008							
WG1790609-6	DUP	L1392671-15						
Total Kjeldahl Nitrogen		<0.20	<0.20	RPD-NA	mg/L	N/A	20	19-NOV-13
WG1790609-2	LCS							
Total Kjeldahl Nitrogen			99.3		mg/L		75-125	19-NOV-13
WG1790609-3	LCS							
Total Kjeldahl Nitrogen			98.0		mg/L		75-125	19-NOV-13
WG1790609-4	LCS							
Total Kjeldahl Nitrogen			98.1		mg/L		75-125	19-NOV-13
WG1790609-1	MB							
Total Kjeldahl Nitrogen			<0.20		mg/L		0.2	19-NOV-13
WG1790609-5	MS	L1390043-5						
Total Kjeldahl Nitrogen			97.0		mg/L		70-130	19-NOV-13

Quality Control Report

Workorder: L1390043

Report Date: 29-JAN-14

Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2
Contact: SUE RAYNARD

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Legend:

Limit ALS Control Limit (Data Quality Objectives)
DUP Duplicate
RPD Relative Percent Difference
N/A Not Available
LCS Laboratory Control Sample
SRM Standard Reference Material
MS Matrix Spike
MSD Matrix Spike Duplicate
ADE Average Desorption Efficiency
MB Method Blank
IRM Internal Reference Material
CRM Certified Reference Material
CCV Continuing Calibration Verification
CVS Calibration Verification Standard
LCSD Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1390043

Report Date: 29-JAN-14

Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2
Contact: SUE RAYNARD

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Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Anions and Nutrients							
Nitrate as N by IC							
	1	07-NOV-13	10-NOV-13 08:00	48	68	hours	EHTL
	2	07-NOV-13	10-NOV-13 08:00	48	68	hours	EHTL
	3	07-NOV-13	10-NOV-13 08:00	48	68	hours	EHTL
	4	07-NOV-13	10-NOV-13 08:00	48	68	hours	EHTL
	5	07-NOV-13	10-NOV-13 08:00	48	68	hours	EHTL
Nitrite as N by IC							
	1	07-NOV-13	10-NOV-13 08:00	48	68	hours	EHTL
	2	07-NOV-13	10-NOV-13 08:00	48	68	hours	EHTL
	3	07-NOV-13	10-NOV-13 08:00	48	68	hours	EHTL
	4	07-NOV-13	10-NOV-13 08:00	48	68	hours	EHTL
	5	07-NOV-13	10-NOV-13 08:00	48	68	hours	EHTL
Dissolved Metals							
Mercury (Hg) - Dissolved							
	1	07-NOV-13	13-DEC-13 15:41	28	36	days	EHT
	2	07-NOV-13	13-DEC-13 15:41	28	36	days	EHT
	3	07-NOV-13	13-DEC-13 15:41	28	36	days	EHT
	4	07-NOV-13	13-DEC-13 15:41	28	36	days	EHT
	5	07-NOV-13	13-DEC-13 15:41	28	36	days	EHT

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1390043 were received on 08-NOV-13 19:16.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

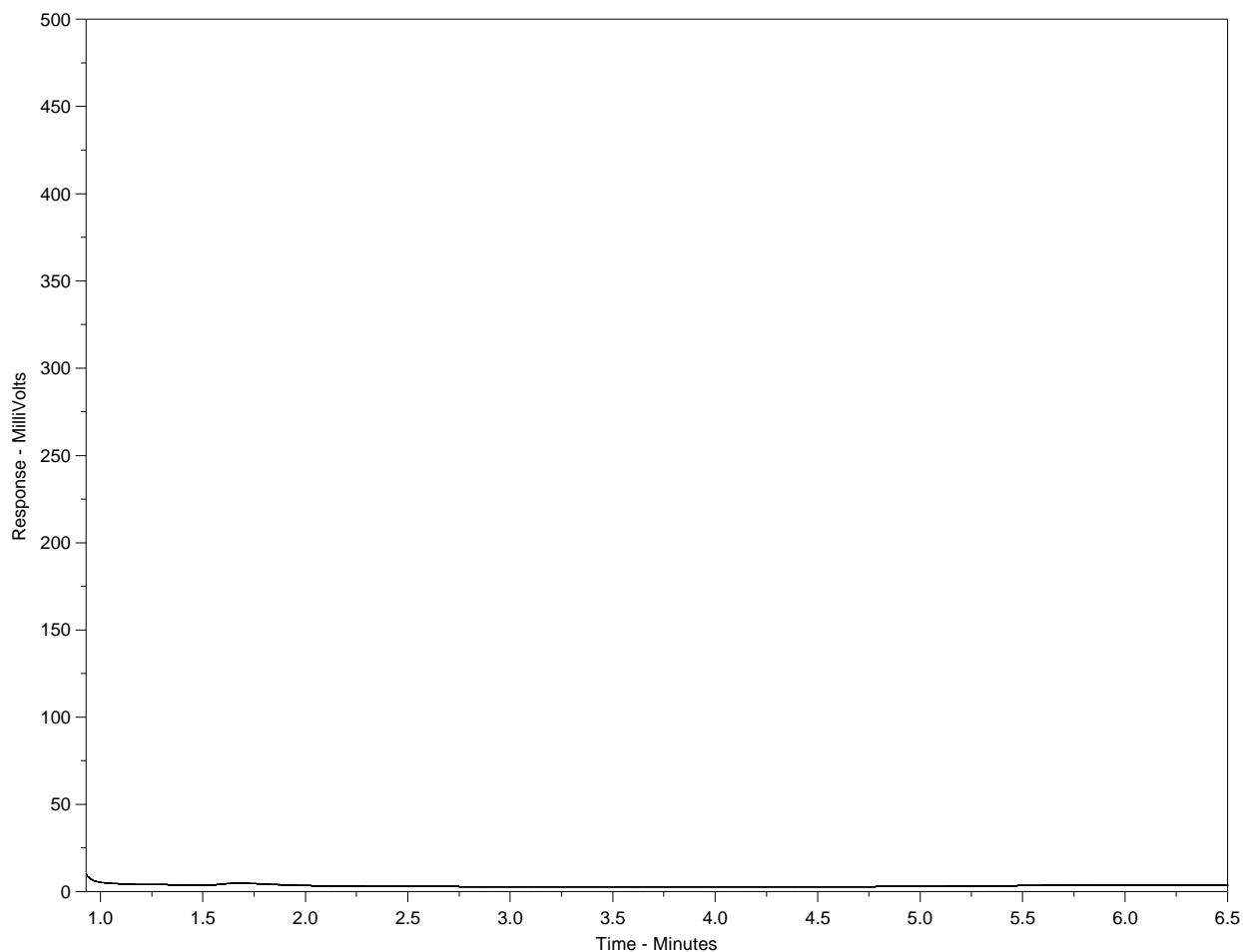
The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Hydrocarbon Distribution Report



ALS Sample ID: L1390044-1
Client ID: 16054131108032



F2		F3		F4		F4
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

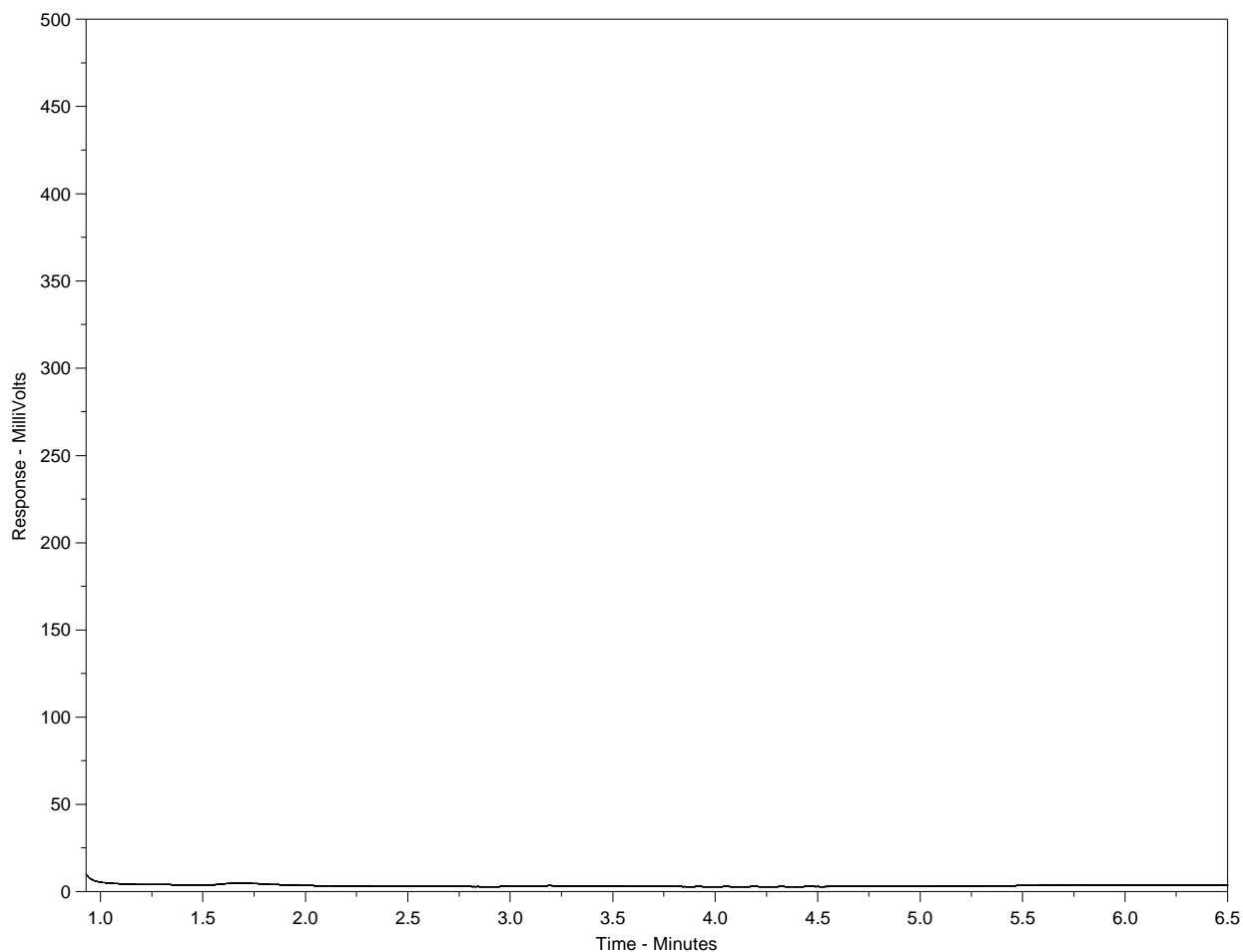
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1390044-2
 Client ID: 16054131108033



F2		F3		F4		F4
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

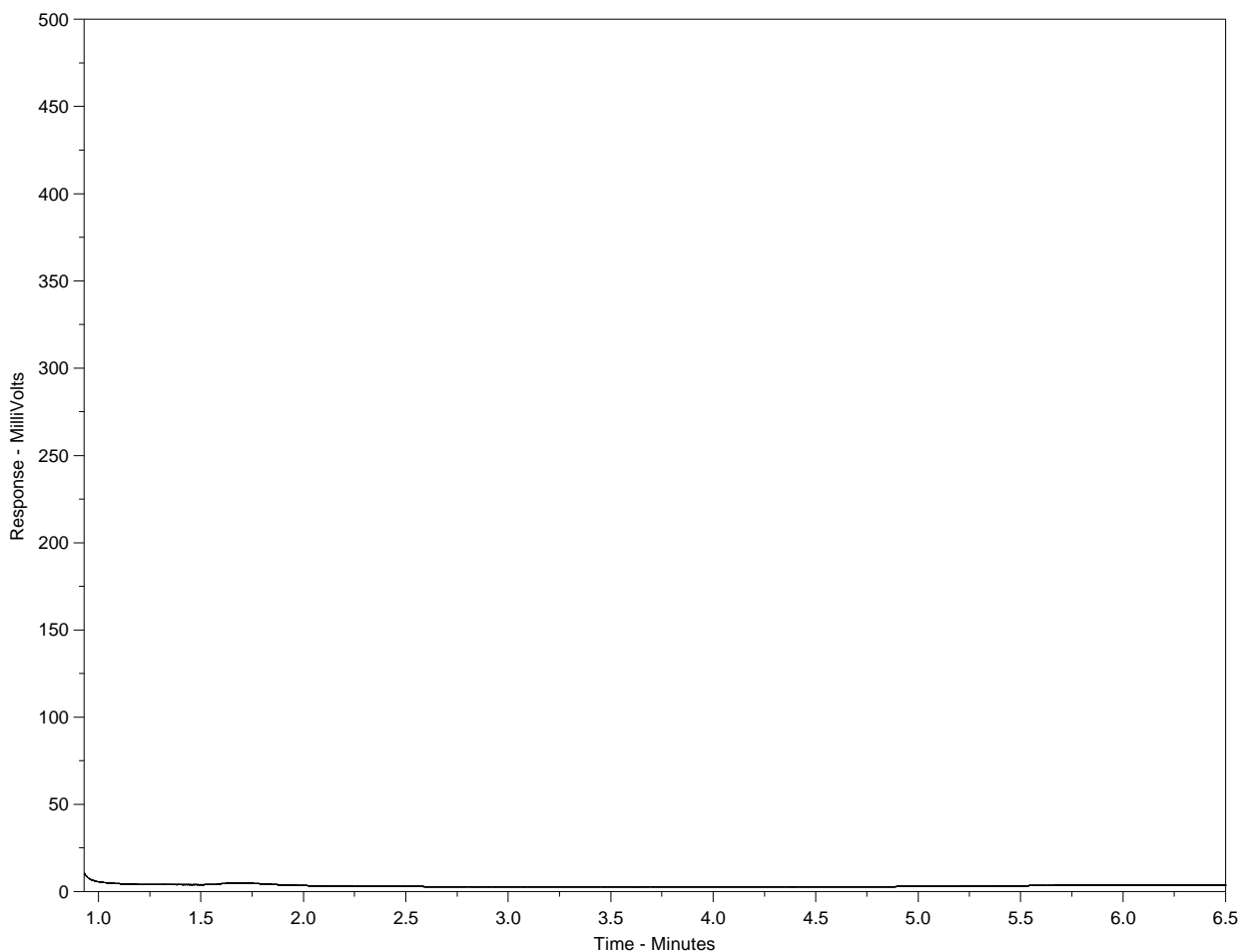
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1390044-3
Client ID: 16054131108034



← F2 →		← F3 →		← F4 →		← F4 →
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

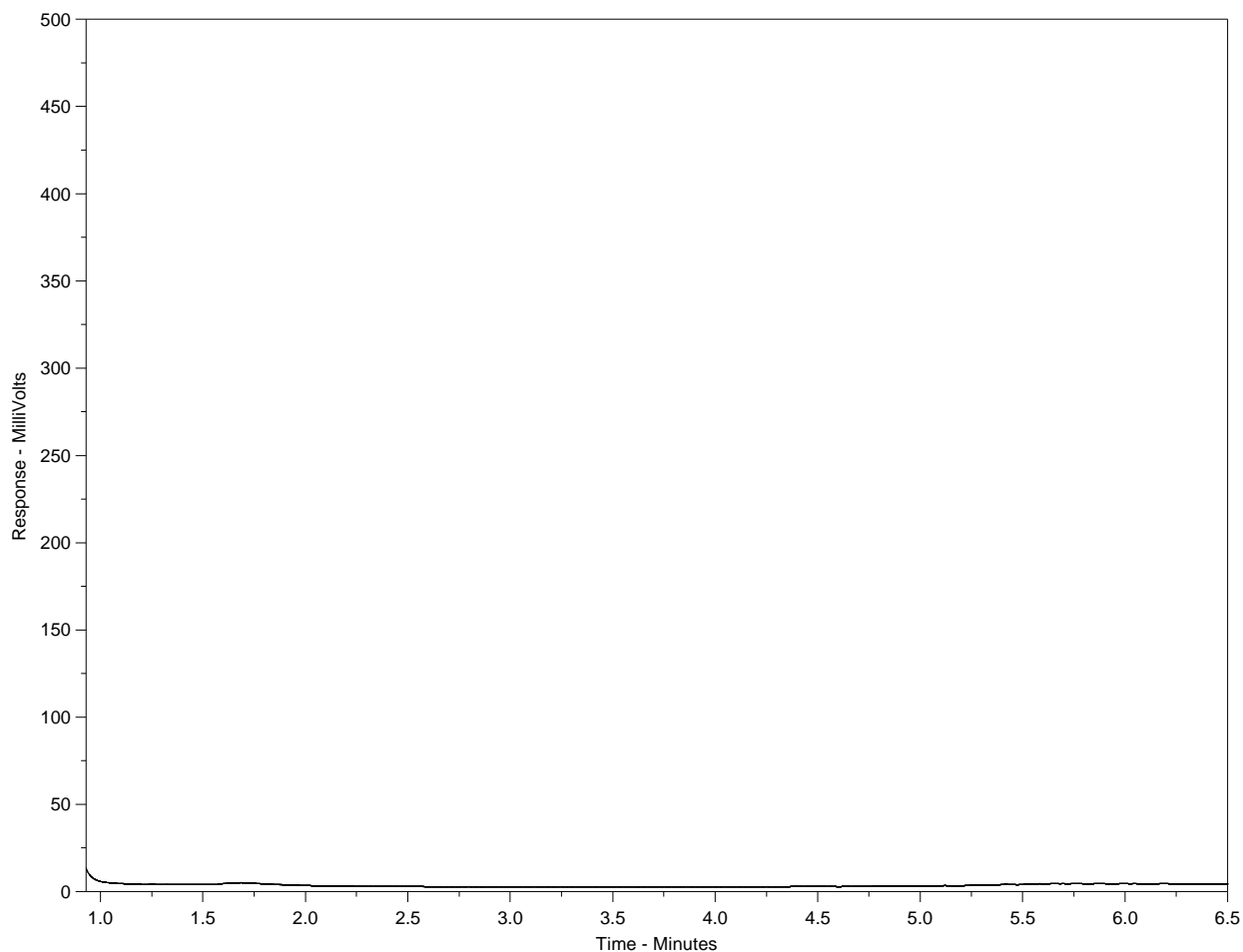
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1390044-4
 Client ID: 16054131108035



F2		F3		F4		F4
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

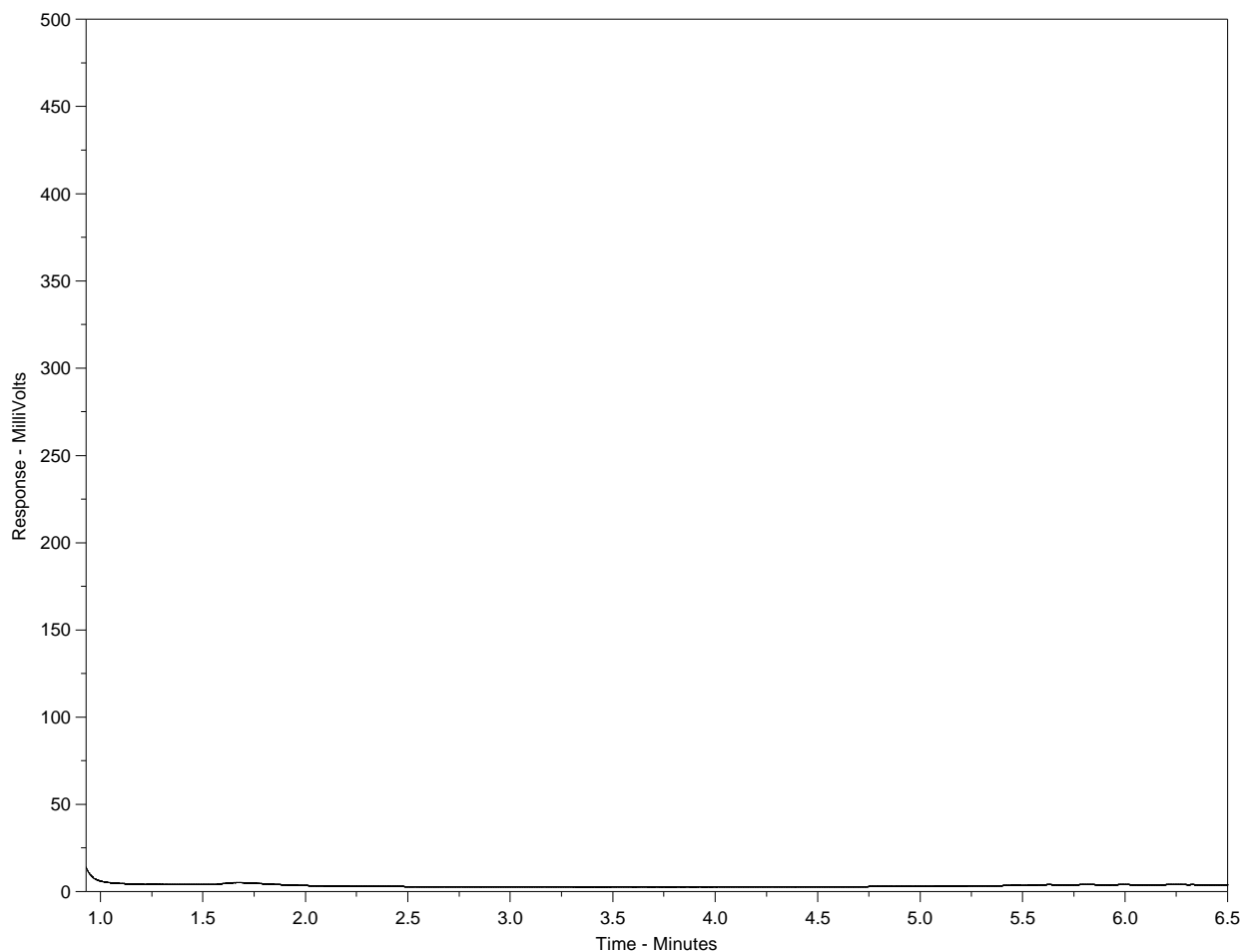
Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.

Hydrocarbon Distribution Report



ALS Sample ID: L1390044-5
 Client ID: 16054131108036



F2		F3		F4		F4
nC10	nC16	nC34	nC50			
174°C	287°C	481°C	575°C			
346°F	549°F	898°F	1067°F			
← Gasoline →			← Motor Oils/ Lube Oils/ Grease →			
← Diesel/ Jet Fuels →						

The Canada Wide Standard Hydrocarbon Distribution Report is intended to assist you in characterizing hydrocarbon products that may be present in your sample. The scale at the bottom of the chromatogram indicates the approximate retention times of common petroleum products as well as a number of specified n-alkane hydrocarbon marker compounds. Comparison of this report with those of reference standards may also assist in characterizing hydrocarbons present in the sample.

Peak heights in this report are a function of the sample concentration, the sample amount extracted, the sample dilution factor, and the scale at left.

Note:

This chromatogram was produced with a high temperature GC method that is specific to the Canada-Wide Standard method. Note that retention times and distribution profiles from reports produced using different GC programs will differ.



Matrix Solutions Inc.
ATTN: SUE RAYNARD
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Date Received: 08-NOV-13
Report Date: 29-JAN-14 09:13 (MT)
Version: FINAL REV. 4

Client Phone: 403-237-0606

Certificate of Analysis

Lab Work Order #: L1390044
Project P.O. #: NOT SUBMITTED
Job Reference: 16054-502 PLAMONDON-68-16 10-26-68-16 W4M
C of C Numbers: M050293
Legal Site Desc: 10-26-68-16 W4M

Comments: ADDITIONAL 27-JAN-14 14:12
ADDITIONAL 13-DEC-13 13:34
16-DEC-2013 DL for Al and Hg has been revised for all samples
17-DEC-2013 LOR for Ag has been fixed
29-JAN-2014 Added Si-D to all samples with metal analysis


Catherine Evaristo-Cordero
Senior Account Manager

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ADDRESS: 9936-67 Avenue, Edmonton, AB T6E 0P5 Canada | Phone: +1 780 413 5227 | Fax: +1 780 437 2311
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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1390044-1 16054131108032									
Sampled By: GULLED KOSHIN on 08-NOV-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Toluene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
EthylBenzene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
o-Xylene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Styrene	<0.0010	-		0.0010	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1(C6-C10)	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1-BTEX	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Xylenes	<0.00071	-		0.00071	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
Surr: 2-Bromobenzotrifluoride	96.8	-		N/A	%	-	13-NOV-13	13-NOV-13	R2741639
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.684	+/-0.083		0.010	mg/L	0		19-NOV-13	R2745411
Miscellaneous Parameters									
Ammonia, Total (as N)	2.56	-		0.050	mg/L	-		15-NOV-13	R2742341
Dissolved Organic Carbon	18.5	+/-2.1		1.0	mg/L	0		18-NOV-13	R2744336
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		13-DEC-13	R2743248
Naphthenic Acids	<1.0	-		1.0	mg/L	-	14-NOV-13	15-NOV-13	R2742301
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		20-NOV-13	R2745998
Total Kjeldahl Nitrogen	3.11	+/-0.62		0.20	mg/L	0	20-NOV-13	20-NOV-13	R2745730
Phosphorus (P)-Total	1.25	+/-0.10		0.020	mg/L	0	18-NOV-13	19-NOV-13	R2745218
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Anthracene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Fluoranthene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Fluorene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Naphthalene	<0.000050	-		0.000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Phenanthrene	<0.000050	-		0.000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Pyrene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(a)pyrene	<0.0000050	-		0.0000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Chrysene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Dibenzo(a,h)anthracene	<0.0000050	-		0.0000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Surr: Nitrobenzene d5	74.2	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Surr: 2-Fluorobiphenyl	73.7	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Surr: p-Terphenyl d14	80.8	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	555	+/-17		0.50	mg/L	0		14-NOV-13	R2741290

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1390044-1 16054131108032 Sampled By: GULLED KOSHIN on 08-NOV-13 Matrix: WATER									
Dissolved Metals in Water by CRC ICPMS									
Aluminum (Al)-Dissolved	0.0259	+/-0.0039		0.0050	mg/L	0		19-NOV-13	R2745411
Antimony (Sb)-Dissolved	<0.00050	-	DLM	0.00050	mg/L	-		19-NOV-13	R2745411
Arsenic (As)-Dissolved	0.0504	+/-0.0053		0.00050	mg/L	0		19-NOV-13	R2745411
Barium (Ba)-Dissolved	0.313	+/-0.027		0.00025	mg/L	0		19-NOV-13	R2745411
Beryllium (Be)-Dissolved	<0.0025	-	DLM	0.0025	mg/L	-		19-NOV-13	R2745411
Bismuth (Bi)-Dissolved	<0.00025	-	DLM	0.00025	mg/L	-		19-NOV-13	R2745411
Cadmium (Cd)-Dissolved	<0.00010	-		0.00010	mg/L	-		19-NOV-13	R2745411
Calcium (Ca)-Dissolved	26.5	+/-3.6		0.50	mg/L	0		19-NOV-13	R2745411
Chromium (Cr)-Dissolved	<0.00050	-	DLM	0.00050	mg/L	-		19-NOV-13	R2745411
Cobalt (Co)-Dissolved	0.00072	+/-0.00007		0.00050	mg/L	0		19-NOV-13	R2745411
Copper (Cu)-Dissolved	<0.00060	-		0.00060	mg/L	-		19-NOV-13	R2745411
Iron (Fe)-Dissolved	0.480	+/-0.043		0.050	mg/L	0		19-NOV-13	R2745411
Lead (Pb)-Dissolved	<0.00025	-	DLM	0.00025	mg/L	-		19-NOV-13	R2745411
Magnesium (Mg)-Dissolved	9.65	+/-0.75		0.10	mg/L	0		19-NOV-13	R2745411
Manganese (Mn)-Dissolved	0.0905	+/-0.0062		0.0020	mg/L	0		19-NOV-13	R2745411
Molybdenum (Mo)-Dissolved	0.0115	+/-0.0012		0.00025	mg/L	0		19-NOV-13	R2745411
Nickel (Ni)-Dissolved	0.00144	+/-0.00012		0.00050	mg/L	0		19-NOV-13	R2745411
Potassium (K)-Dissolved	3.79	+/-0.29		0.50	mg/L	0		19-NOV-13	R2745411
Selenium (Se)-Dissolved	<0.00050	-	DLM	0.00050	mg/L	-		19-NOV-13	R2745411
Silicon (Si)-Dissolved	3.52	+/-0.30		0.25	mg/L	0		19-NOV-13	R2745411
Silver (Ag)-Dissolved	<0.000050	-		0.000050	mg/L	-		19-NOV-13	R2745411
Sodium (Na)-Dissolved	546	+/-38		0.50	mg/L	0		19-NOV-13	R2745411
Strontium (Sr)-Dissolved	0.428	+/-0.032		0.00050	mg/L	0		19-NOV-13	R2745411
Thallium (Tl)-Dissolved	<0.00025	-	DLM	0.00025	mg/L	-		19-NOV-13	R2745411
Titanium (Ti)-Dissolved	<0.0015	-	DLM	0.0015	mg/L	-		19-NOV-13	R2745411
Tin (Sn)-Dissolved	0.00055	+/-0.00004		0.00050	mg/L	0		19-NOV-13	R2745411
Uranium (U)-Dissolved	0.00040	+/-0.00004		0.00010	mg/L	0		19-NOV-13	R2745411
Vanadium (V)-Dissolved	<0.00050	-	DLM	0.00050	mg/L	-		19-NOV-13	R2745411
Zinc (Zn)-Dissolved	0.0343	+/-0.0040		0.0050	mg/L	0		19-NOV-13	R2745411
Ion Balance Calculation									
Ion Balance	89.3	-	BL:INT		%	-		21-NOV-13	
TDS (Calculated)	1590	-			mg/L	-		21-NOV-13	
Hardness (as CaCO3)	106	-			mg/L	-		21-NOV-13	
Nitrate as N by IC									
Nitrate (as N)	<0.050	-		0.050	mg/L	-		14-NOV-13	R2741290
Nitrate+Nitrite									
Nitrate and Nitrite (as N)	<0.071	-		0.071	mg/L	-		22-NOV-13	
Nitrite as N by IC									
Nitrite (as N)	<0.050	-		0.050	mg/L	-		14-NOV-13	R2741290
Sulfate by IC									
Sulfate (SO4)	102	+/-4.3		0.50	mg/L	0		14-NOV-13	R2741290
pH, Conductivity and Total Alkalinity									
pH	8.29	+/-0.04		0.10	pH	0		12-NOV-13	R2739225
Conductivity (EC)	2900	+/-97		0.20	uS/cm	0		12-NOV-13	R2739225
Bicarbonate (HCO3)	702	-		5.0	mg/L	-		12-NOV-13	R2739225
Carbonate (CO3)	<5.0	-		5.0	mg/L	-		12-NOV-13	R2739225
Hydroxide (OH)	<5.0	-		5.0	mg/L	-		12-NOV-13	R2739225
Alkalinity, Total (as CaCO3)	575	+/-21		2.0	mg/L	0		12-NOV-13	R2739225
L1390044-2 16054131108033 Sampled By: GULLED KOSHIN on 08-NOV-13 Matrix: WATER									

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1390044-2 16054131108033									
Sampled By: GULLED KOSHIN on 08-NOV-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Toluene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
EthylBenzene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
o-Xylene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Styrene	<0.0010	-		0.0010	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1(C6-C10)	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1-BTEX	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Xylenes	<0.00071	-		0.00071	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
Surr: 2-Bromobenzotrifluoride	99.4	-		N/A	%	-	13-NOV-13	13-NOV-13	R2741639
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.348	+/-0.042		0.0020	mg/L	0		19-NOV-13	R2745411
Miscellaneous Parameters									
Ammonia, Total (as N)	3.47	-		0.050	mg/L	-		15-NOV-13	R2742341
Dissolved Organic Carbon	12.1	+/-1.4		1.0	mg/L	0		18-NOV-13	R2744336
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		13-DEC-13	R2743248
Naphthenic Acids	<1.0	-		1.0	mg/L	-	14-NOV-13	15-NOV-13	R2742301
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		20-NOV-13	R2745998
Total Kjeldahl Nitrogen	3.97	+/-0.80		0.20	mg/L	0	20-NOV-13	20-NOV-13	R2745730
Phosphorus (P)-Total	2.27	+/-0.18		0.020	mg/L	0	18-NOV-13	19-NOV-13	R2745218
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Anthracene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Fluoranthene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Fluorene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Naphthalene	<0.000050	-		0.000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Phenanthrene	<0.000050	-		0.000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Pyrene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(a)pyrene	<0.0000050	-		0.0000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Chrysene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Dibenzo(a,h)anthracene	<0.0000050	-		0.0000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Surr: Nitrobenzene d5	81.7	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Surr: 2-Fluorobiphenyl	82.4	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Surr: p-Terphenyl d14	94.8	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	18.9	+/-0.61		0.50	mg/L	0		14-NOV-13	R2741290

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1390044-3 16054131108034									
Sampled By: GULLED KOSHIN on 08-NOV-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Toluene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
EthylBenzene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
o-Xylene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Styrene	<0.0010	-		0.0010	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1(C6-C10)	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1-BTEX	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Xylenes	<0.00071	-		0.00071	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
Surr: 2-Bromobenzotrifluoride	98.1	-		N/A	%	-	13-NOV-13	13-NOV-13	R2741639
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.640	+/-0.078		0.0040	mg/L	0		19-NOV-13	R2745411
Miscellaneous Parameters									
Ammonia, Total (as N)	3.32	-		0.050	mg/L	-		15-NOV-13	R2742341
Dissolved Organic Carbon	10.8	+/-1.3		1.0	mg/L	0		18-NOV-13	R2744336
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		13-DEC-13	R2743248
Naphthenic Acids	<1.0	-		1.0	mg/L	-	14-NOV-13	15-NOV-13	R2742301
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		20-NOV-13	R2745998
Total Kjeldahl Nitrogen	3.84	+/-0.77		0.20	mg/L	0	20-NOV-13	20-NOV-13	R2745730
Phosphorus (P)-Total	0.876	+/-0.072		0.020	mg/L	0	18-NOV-13	19-NOV-13	R2745218
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Anthracene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Fluoranthene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Fluorene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Naphthalene	<0.000050	-		0.000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Phenanthrene	<0.000050	-		0.000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Pyrene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(a)pyrene	<0.0000050	-		0.0000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Chrysene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Dibenzo(a,h)anthracene	<0.0000050	-		0.0000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Surr: Nitrobenzene d5	84.6	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Surr: 2-Fluorobiphenyl	85.9	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Surr: p-Terphenyl d14	96.3	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	4.21	+/-0.16		0.50	mg/L	0		14-NOV-13	R2741290

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1390044-4 16054131108035									
Sampled By: GULLED KOSHIN on 08-NOV-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Toluene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
EthylBenzene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
o-Xylene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Styrene	<0.0010	-		0.0010	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1(C6-C10)	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1-BTEX	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Xylenes	<0.00071	-		0.00071	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
Surr: 2-Bromobenzotrifluoride	98.4	-		N/A	%	-	13-NOV-13	13-NOV-13	R2741639
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	0.0321	+/-0.0038		0.0020	mg/L	0		19-NOV-13	R2745411
Miscellaneous Parameters									
Ammonia, Total (as N)	<0.050	-		0.050	mg/L	-		15-NOV-13	R2742341
Dissolved Organic Carbon	3.1	+/-0.6		1.0	mg/L	0		18-NOV-13	R2744336
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		13-DEC-13	R2743248
Naphthenic Acids	<1.0	-		1.0	mg/L	-	14-NOV-13	15-NOV-13	R2742301
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		20-NOV-13	R2745998
Total Kjeldahl Nitrogen	0.46	+/-0.11		0.20	mg/L	0	20-NOV-13	20-NOV-13	R2745730
Phosphorus (P)-Total	0.505	+/-0.044		0.020	mg/L	0	18-NOV-13	19-NOV-13	R2745218
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Anthracene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Fluoranthene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Fluorene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Naphthalene	<0.000050	-		0.000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Phenanthrene	<0.000050	-		0.000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Pyrene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(a)pyrene	<0.0000050	-		0.0000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Chrysene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Dibenzo(a,h)anthracene	<0.0000050	-		0.0000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Surr: Nitrobenzene d5	75.8	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Surr: 2-Fluorobiphenyl	74.1	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Surr: p-Terphenyl d14	85.3	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	1.32	+/-0.08		0.50	mg/L	0		14-NOV-13	R2741290

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1390044-5 16054131108036									
Sampled By: GULLED KOSHIN on 08-NOV-13									
Matrix: WATER									
BTXS, Styrene & F1-F4									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Toluene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
EthylBenzene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
o-Xylene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Styrene	<0.0010	-		0.0010	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1(C6-C10)	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1-BTEX	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Xylenes	<0.00071	-		0.00071	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F2, F3, F4									
F2 (>C10-C16)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
F3 (C16-C34)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
F4 (C34-C50)	<0.25	-		0.25	mg/L	-	13-NOV-13	13-NOV-13	R2741639
Surr: 2-Bromobenzotrifluoride	98.3	-		N/A	%	-	13-NOV-13	13-NOV-13	R2741639
Diss. Metals in Water by ICPOES/MS & Hg									
Dissolved Boron in Water by CRC ICPMS									
Boron (B)-Dissolved	<0.0020	-		0.0020	mg/L	-		19-NOV-13	R2745411
Miscellaneous Parameters									
Ammonia, Total (as N)	<0.050	-		0.050	mg/L	-		15-NOV-13	R2742341
Dissolved Organic Carbon	<1.0	-		1.0	mg/L	-		18-NOV-13	R2744336
Mercury (Hg)-Dissolved	<0.000020	-		0.000020	mg/L	-		13-DEC-13	R2743248
Naphthenic Acids	<1.0	-		1.0	mg/L	-	14-NOV-13	15-NOV-13	R2742301
Phenols (4AAP)	<0.0010	-		0.0010	mg/L	-		20-NOV-13	R2745998
Total Kjeldahl Nitrogen	<0.20	-		0.20	mg/L	-	20-NOV-13	20-NOV-13	R2745730
Phosphorus (P)-Total	<0.020	-		0.020	mg/L	-	18-NOV-13	19-NOV-13	R2745218
PAH & Carcinogenic PAH List									
Acenaphthene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Acenaphthylene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Anthracene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Fluoranthene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Fluorene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Naphthalene	<0.000050	-		0.000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Phenanthrene	<0.000050	-		0.000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Pyrene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(a)anthracene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(k)fluoranthene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(b&j)fluoranthene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(g,h,i)perylene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Benzo(a)pyrene	<0.0000050	-		0.0000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Chrysene	<0.000020	-		0.000020	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Dibenzo(a,h)anthracene	<0.0000050	-		0.0000050	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Indeno(1,2,3-cd)pyrene	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
B(A)P Total Potency Equivalent	<0.000010	-		0.000010	mg/L	-	12-NOV-13	15-NOV-13	R2742080
Surr: Nitrobenzene d5	78.0	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Surr: 2-Fluorobiphenyl	68.2	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Surr: p-Terphenyl d14	60.0	-		N/A	%	-	12-NOV-13	15-NOV-13	R2742080
Routine Water Analysis									
Chloride by IC									
Chloride (Cl)	<0.50	-		0.50	mg/L	-		14-NOV-13	R2741290

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	MU	Qualifier*	D.L.	Units	Bias	Extracted	Analyzed	Batch
L1390044-6 16054131108037 Sampled By: GULLED KOSHIN on 08-NOV-13 Matrix: WATER									
BTEX, Styrene and F1 (C6-C10)									
Benzene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Toluene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
EthylBenzene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
o-Xylene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
m+p-Xylene	<0.00050	-		0.00050	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Styrene	<0.0010	-		0.0010	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1(C6-C10)	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
F1-BTEX	<0.10	-		0.10	mg/L	-	12-NOV-13	14-NOV-13	R2740023
Xylenes	<0.00071	-		0.00071	mg/L	-	12-NOV-13	14-NOV-13	R2740023
* Refer to Referenced Information for Qualifiers (if any) and Methodology.									

Reference Information

Report Comments: ADDITIONAL 27-JAN-14 14:12
 ADDITIONAL 13-DEC-13 13:34
 16-DEC-2013 DL for Al and Hg has been revised for all samples
 17-DEC-2013 LOR for Ag has been fixed
 29-JAN-2014 Added Si-D to all samples with metal analysis

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Dissolved Organic Carbon	MS-B	
Matrix Spike	Phosphorus (P)-Total	MS-B	
Matrix Spike	Sulfate (SO4)	MS-B	

Sample Parameter Qualifier Key:

Qualifier	Description
BL:INT	Balance Reviewed: Interference Or Non-Measured Component
DLM	Detection Limit Adjusted due to sample matrix effects.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RRV	Reported Result Verified By Repeat Analysis

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
B-D-L-CCMS-ED	Water	Dissolved Boron in Water by CRC ICPMS		APHA 3030 B / EPA SW-846 6020A
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using hotblock, or filtration (APHA 3030B&E). Instrumental analysis is by collision cell inductively coupled plasma - mass spectrometry (modified from EPA Method 6020A).				
BTXS,F1-ED	Water	BTEX, Styrene and F1 (C6-C10)		EPA 5021/8015&8260 GC-MS & FID
C-DIS-ORG-ED	Water	Dissolved Organic Carbon		APHA 5310 B-Instrumental
CL-IC-ED	Water	Chloride by IC		APHA 4110 B-ION CHROMATOGRAPHY
F2,F3,F4-ED	Water	F2, F3, F4		EPA 3510/CCME PHC CWS-GC-FID
HG-D-CVAA-ED	Water	Mercury (Hg) - Dissolved		EPA 245.7 / EPA 245.1
HG-D-L-CVAA-ED	Water	Mercury (Hg) - Dissolved		EPA 245.7 / EPA 245.1
IONBALANCE-ED	Water	Ion Balance Calculation		APHA 1030E
MET-D-CCMS-ED	Water	Dissolved Metals in Water by CRC ICPMS		APHA 3030 B&E / EPA SW-846 6020A
NAPHTHENIC-ACID-FM	Water	Naphthenic Acids by FTIR		Naphthenic Acids by FTIR, Syncrude, 1994
Dissolved naphthenic acids are solvent extracted from acidified aqueous samples using Dichloromethane prior to quantitation by Fourier Transform Infra-Red spectroscopy. Note that FTIR is not uniquely selective to naphthenic acids. If present, other carboxylic acids (e.g. humic acids, fulvic acids) may also be detected by this method.				
NH3-CFA-ED	Water	Ammonia in Water by Colour		APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the automated phenate colourimetric method.				
NO2+NO3-CALC-ED	Water	Nitrate+Nitrite		CALCULATION
NO2-IC-ED	Water	Nitrite as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".				
NO3-IC-ED	Water	Nitrate as N by IC		APHA 4110 B-ION CHROMATOGRAPHY
This analysis is carried out using procedures adapted from EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".				
P-T-COL-ED	Water	Total P in Water by Colour		APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.				
PAH-ABT1-ED	Water	PAH & Carcinogenic PAH List		EPA 3510/8270-GC/MS
PH/EC/ALK-ED	Water	pH, Conductivity and Total Alkalinity		APHA 4500-H, 2510, 2320

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Preparation Method Reference	Method Reference**
All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)				
PHENOLS-4AAP-ED	Water	Phenols (4AAP)		AB ENV.06537-COLORIMETRIC
This analysis is carried out using procedures adapted from ENVIRODAT VMV 06537 689, Method Code 154, in "Methods Manual for Chemical Analysis of Water and Wastes" published by the Alberta Environmental Centre. This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide and 4-aminoantipyrine to form a red complex which is measured at 505 nm.				
SO4-IC-ED	Water	Sulfate by IC		APHA 4110 B-ION CHROMATOGRAPHY
TKN-CFA-ED	Water	TKN in Water by Colour		APHA 4500-NORG (TKN)

This analysis is carried out using procedures adapted from APHA Method 4500-Norg "Nitrogen (Organic)". Total Kjeldahl Nitrogen is determined by sample digestion at 380 celcius with analysis using an automated colourimetric finish.

** The indicated Method Reference is the closest nationally or internationally recognized reference for the applicable ALS test method. ALS methods may incorporate modifications from the specified reference to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA
FM	ALS ENVIRONMENTAL - FORT MCMURRAY, ALBERTA, CANADA

Chain of Custody Numbers:

M050293

GLOSSARY OF REPORT TERMS

Surr - Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg wwt - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

MU: Measurement Uncertainty. The reported uncertainty is an expanded uncertainty calculated using a coverage factor of 2 which gives a level of confidence of approximately 95%.

Bias: The reported method bias is the average long term deviation from the target value for a long term reference or control sample, measured in percent.

Zero values indicate no detectable method bias.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.



Environmental

Quality Control Report

Workorder: L1390044

Report Date: 29-JAN-14

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Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-D-L-CCMS-ED		Water						
Batch	R2745411							
WG1790854-2	CRM	ED-HIGH-WATRM						
Boron (B)-Dissolved			90.4		%		80-120	19-NOV-13
WG1790854-3	DUP	L1390043-3						
Boron (B)-Dissolved		0.157	0.150		mg/L	4.4	20	19-NOV-13
WG1790854-1	MB							
Boron (B)-Dissolved			<0.0020		mg/L		0.002	19-NOV-13
BTXS,F1-ED		Water						
Batch	R2740023							
WG1786850-4	DUP	L1389584-17						
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	14-NOV-13
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	14-NOV-13
EthylBenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	14-NOV-13
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	14-NOV-13
m+p-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	14-NOV-13
Styrene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	50	14-NOV-13
F1(C6-C10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	14-NOV-13
WG1786850-7	DUP	L1390044-5						
Benzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	14-NOV-13
Toluene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	14-NOV-13
EthylBenzene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	30	14-NOV-13
o-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	14-NOV-13
m+p-Xylene		<0.00050	<0.00050	RPD-NA	mg/L	N/A	24	14-NOV-13
Styrene		<0.0010	<0.0010	RPD-NA	mg/L	N/A	50	14-NOV-13
F1(C6-C10)		<0.10	<0.10	RPD-NA	mg/L	N/A	30	14-NOV-13
WG1786850-2	LCS							
Benzene			91.0		%		70-130	17-NOV-13
Toluene			84.8		%		70-130	17-NOV-13
EthylBenzene			89.1		%		70-130	17-NOV-13
o-Xylene			91.0		%		70-130	17-NOV-13
m+p-Xylene			91.3		%		70-130	17-NOV-13
Styrene			88.3		%		70-130	17-NOV-13
WG1786850-3	LCS							
F1(C6-C10)			94.8		%		70-130	14-NOV-13
WG1786850-1	MB							
Benzene			<0.00050		mg/L		0.0005	14-NOV-13
							0.0005	



Quality Control Report

Workorder: L1390044

Report Date: 29-JAN-14

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Client: Matrix Solutions Inc.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTXS,F1-ED								
	Water							
Batch	R2740023							
WG1786850-1	MB							
Toluene			<0.00050		mg/L		0.0005	14-NOV-13
EthylBenzene			<0.00050		mg/L		0.0005	14-NOV-13
o-Xylene			<0.00050		mg/L		0.0005	14-NOV-13
m+p-Xylene			<0.00050		mg/L		0.0005	14-NOV-13
Styrene			<0.0010		mg/L		0.001	14-NOV-13
F1(C6-C10)			<0.10		mg/L		0.1	14-NOV-13
WG1786850-5	MS	L1389584-17						
Benzene			85.0		%		50-150	14-NOV-13
Toluene			84.8		%		50-150	14-NOV-13
EthylBenzene			80.9		%		50-150	14-NOV-13
o-Xylene			86.1		%		50-150	14-NOV-13
m+p-Xylene			84.7		%		50-150	14-NOV-13
Styrene			90.6		%		50-150	14-NOV-13
WG1786850-6	MS	L1389584-17						
F1(C6-C10)			71.2		%		50-150	14-NOV-13
C-DIS-ORG-ED								
	Water							
Batch	R2744336							
WG1790206-8	CVS							
Dissolved Organic Carbon			99.5		%		80-160	18-NOV-13
WG1790206-11	DUP	L1390043-5						
Dissolved Organic Carbon		6.6	6.6		mg/L	0.1	20	18-NOV-13
WG1790206-13	DUP	L1391157-3						
Dissolved Organic Carbon		12.7	12.8		mg/L	0.6	20	19-NOV-13
WG1790206-7	LCS							
Dissolved Organic Carbon			91.4		%		80-120	18-NOV-13
WG1790206-6	MB							
Dissolved Organic Carbon			<1.0		mg/L		1	18-NOV-13
WG1790206-12	MS	L1390043-5						
Dissolved Organic Carbon			89.0		%		70-130	18-NOV-13
WG1790206-14	MS	L1391157-3						
Dissolved Organic Carbon			N/A	MS-B	%		-	19-NOV-13
CL-IC-ED								
	Water							
Batch	R2741290							
WG1788274-11	DUP	L1390695-2						
Chloride (Cl)		<0.50	<0.50	RPD-NA	mg/L	N/A	20	14-NOV-13
WG1788274-3	DUP	L1390180-2						



Environmental

Quality Control Report

Workorder: L1390044

Report Date: 29-JAN-14

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Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-IC-ED		Water						
Batch	R2741290							
WG1788274-3	DUP	L1390180-2						
Chloride (Cl)		23.9	24.5		mg/L	2.4	20	14-NOV-13
WG1788274-5	DUP	L1390707-2						
Chloride (Cl)		3.94	3.95		mg/L	0.2	20	14-NOV-13
WG1788274-7	DUP	L1391212-4						
Chloride (Cl)		1.73	1.72		mg/L	0.6	20	14-NOV-13
WG1788274-9	DUP	L1390663-28						
Chloride (Cl)		4.25	4.42		mg/L	4.0	20	14-NOV-13
WG1788274-2	LCS		107.2		%		90-110	14-NOV-13
Chloride (Cl)								
WG1788274-1	MB		<0.50		mg/L		0.5	14-NOV-13
Chloride (Cl)								
WG1788274-10	MS	L1390663-28						
Chloride (Cl)			109.3		%		75-125	14-NOV-13
WG1788274-12	MS	L1390695-2						
Chloride (Cl)			109.9		%		75-125	14-NOV-13
WG1788274-4	MS	L1390180-2						
Chloride (Cl)			106.7		%		75-125	14-NOV-13
WG1788274-6	MS	L1390707-2						
Chloride (Cl)			107.6		%		75-125	14-NOV-13
WG1788274-8	MS	L1391212-4						
Chloride (Cl)			110.1		%		75-125	14-NOV-13
F2,F3,F4-ED		Water						
Batch	R2741639							
WG1787290-20	LCS							
F2 (>C10-C16)			99.0		%		65-135	13-NOV-13
F3 (C16-C34)			98.8		%		65-135	13-NOV-13
F4 (C34-C50)			98.6		%		65-135	13-NOV-13
WG1787290-23	LCS							
F2 (>C10-C16)			90.1		%		65-135	13-NOV-13
F3 (C16-C34)			89.4		%		65-135	13-NOV-13
F4 (C34-C50)			89.4		%		65-135	13-NOV-13
WG1787290-19	MB							
F2 (>C10-C16)			<0.25		mg/L		0.25	13-NOV-13
F3 (C16-C34)			<0.25		mg/L		0.25	13-NOV-13
F4 (C34-C50)			<0.25		mg/L		0.25	13-NOV-13
Surrogate: 2-Bromobenzotrifluoride			96.1		%		50-150	13-NOV-13



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Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F2,F3,F4-ED		Water						
Batch	R2741639							
WG1787290-22 MB								
F2 (>C10-C16)			<0.25		mg/L		0.25	13-NOV-13
F3 (C16-C34)			<0.25		mg/L		0.25	13-NOV-13
F4 (C34-C50)			<0.25		mg/L		0.25	13-NOV-13
Surrogate: 2-Bromobenzotrifluoride			99.0		%		50-150	13-NOV-13
HG-D-L-CVAA-ED		Water						
Batch	R2743248							
WG1789804-8 DUP		L1391414-1						
Mercury (Hg)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	17-NOV-13
WG1789804-2 LCS								
Mercury (Hg)-Dissolved			88.2		%		80-120	17-NOV-13
WG1789804-3 LCSD		WG1789804-2						
Mercury (Hg)-Dissolved		88.2	88.6		%	0.4	20	17-NOV-13
WG1789804-1 MB								
Mercury (Hg)-Dissolved			<0.000020		mg/L		0.00002	17-NOV-13
WG1789804-9 MS		L1391414-1						
Mercury (Hg)-Dissolved			74.9		%		70-130	17-NOV-13
MET-D-CCMS-ED		Water						
Batch	R2745411							
WG1790854-2 CRM		ED-HIGH-WATRM						
Aluminum (Al)-Dissolved			101.8		%		80-120	19-NOV-13
Antimony (Sb)-Dissolved			105.1		%		80-120	19-NOV-13
Arsenic (As)-Dissolved			101.7		%		80-120	19-NOV-13
Barium (Ba)-Dissolved			100.0		%		80-120	19-NOV-13
Beryllium (Be)-Dissolved			93.4		%		80-120	19-NOV-13
Bismuth (Bi)-Dissolved			98.7		%		80-120	19-NOV-13
Cadmium (Cd)-Dissolved			100.4		%		80-120	19-NOV-13
Calcium (Ca)-Dissolved			96.1		%		80-120	19-NOV-13
Chromium (Cr)-Dissolved			99.1		%		80-120	19-NOV-13
Cobalt (Co)-Dissolved			97.1		%		80-120	19-NOV-13
Copper (Cu)-Dissolved			94.5		%		80-120	19-NOV-13
Lead (Pb)-Dissolved			97.3		%		80-120	19-NOV-13
Magnesium (Mg)-Dissolved			97.7		%		80-120	19-NOV-13
Manganese (Mn)-Dissolved			95.9		%		80-120	19-NOV-13
Molybdenum (Mo)-Dissolved			92.6		%		80-120	19-NOV-13
Nickel (Ni)-Dissolved			97.6		%		80-120	19-NOV-13



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Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED		Water						
Batch	R2745411							
WG1790854-2 CRM	ED-HIGH-WATRM							
Nickel (Ni)-Dissolved			97.6		%		80-120	19-NOV-13
Potassium (K)-Dissolved			100.5		%		80-120	19-NOV-13
Selenium (Se)-Dissolved			102.3		%		80-120	19-NOV-13
Silicon (Si)-Dissolved			98.5		%		80-120	19-NOV-13
Silver (Ag)-Dissolved			97.8		%		80-120	19-NOV-13
Sodium (Na)-Dissolved			104.3		%		80-120	19-NOV-13
Strontium (Sr)-Dissolved			98.6		%		80-120	19-NOV-13
Thallium (Tl)-Dissolved			98.8		%		80-120	19-NOV-13
Titanium (Ti)-Dissolved			100.4		%		80-120	19-NOV-13
Tin (Sn)-Dissolved			96.7		%		80-120	19-NOV-13
Uranium (U)-Dissolved			94.4		%		80-120	19-NOV-13
Vanadium (V)-Dissolved			98.0		%		80-120	19-NOV-13
WG1790854-3 DUP		L1390043-3						
Aluminum (Al)-Dissolved		0.0014	<0.010	RPD-NA	mg/L	N/A	20	19-NOV-13
Antimony (Sb)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	19-NOV-13
Arsenic (As)-Dissolved		0.0212	0.0213		mg/L	0.1	20	19-NOV-13
Barium (Ba)-Dissolved		0.0659	0.0658		mg/L	0.1	20	19-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	19-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-NOV-13
Cadmium (Cd)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-NOV-13
Calcium (Ca)-Dissolved		72.2	74.3		mg/L	2.9	20	19-NOV-13
Chromium (Cr)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	19-NOV-13
Cobalt (Co)-Dissolved		0.00013	0.00011		mg/L	11	20	19-NOV-13
Copper (Cu)-Dissolved		<0.00060	<0.00060	RPD-NA	mg/L	N/A	20	19-NOV-13
Iron (Fe)-Dissolved		9.20	9.12		mg/L	0.8	20	19-NOV-13
Lead (Pb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-NOV-13
Magnesium (Mg)-Dissolved		20.0	19.1		mg/L	4.5	20	19-NOV-13
Manganese (Mn)-Dissolved		0.430	0.421		mg/L	2.3	20	19-NOV-13
Molybdenum (Mo)-Dissolved		0.00836	0.00837		mg/L	0.1	20	19-NOV-13
Nickel (Ni)-Dissolved		0.00090	0.00087		mg/L	3.3	20	19-NOV-13
Potassium (K)-Dissolved		4.10	4.04		mg/L	1.4	20	19-NOV-13
Selenium (Se)-Dissolved		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	19-NOV-13
Silicon (Si)-Dissolved		10.1	10.0		mg/L	1.0	20	19-NOV-13



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Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2745411							
WG1790854-3 DUP		L1390043-3						
Silver (Ag)-Dissolved		<0.000010	<0.00020	RPD-NA	mg/L	N/A	20	19-NOV-13
Sodium (Na)-Dissolved		19.0	18.8		mg/L	1.2	20	19-NOV-13
Strontium (Sr)-Dissolved		0.438	0.455		mg/L	3.7	20	19-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-NOV-13
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	19-NOV-13
Tin (Sn)-Dissolved		<0.00020	<0.00020	RPD-NA	mg/L	N/A	20	19-NOV-13
Uranium (U)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-NOV-13
Vanadium (V)-Dissolved		0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-NOV-13
WG1790854-4 DUP		L1390180-2						
Aluminum (Al)-Dissolved		0.0067	0.0063		mg/L	7.2	20	19-NOV-13
Antimony (Sb)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-NOV-13
Arsenic (As)-Dissolved		0.00401	0.00334		mg/L	18	20	19-NOV-13
Barium (Ba)-Dissolved		0.306	0.268		mg/L	13	20	19-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	19-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-NOV-13
Cadmium (Cd)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	19-NOV-13
Calcium (Ca)-Dissolved		167	170		mg/L	1.5	20	19-NOV-13
Chromium (Cr)-Dissolved		0.00016	0.00010	J	mg/L	0.00005	0.0002	19-NOV-13
Cobalt (Co)-Dissolved		0.0148	0.0123		mg/L	18	20	19-NOV-13
Copper (Cu)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-NOV-13
Iron (Fe)-Dissolved		11.2	11.0		mg/L	1.2	20	19-NOV-13
Lead (Pb)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-NOV-13
Magnesium (Mg)-Dissolved		46.1	38.1		mg/L	19	20	19-NOV-13
Manganese (Mn)-Dissolved		3.41	2.94		mg/L	15	20	19-NOV-13
Molybdenum (Mo)-Dissolved		0.000269	0.000266		mg/L	1.1	20	19-NOV-13
Nickel (Ni)-Dissolved		0.0141	0.0119		mg/L	17	20	19-NOV-13
Potassium (K)-Dissolved		2.06	1.72		mg/L	18	20	19-NOV-13
Selenium (Se)-Dissolved		0.00021	0.00020		mg/L	4.7	20	19-NOV-13
Silicon (Si)-Dissolved		9.45	9.21		mg/L	2.5	20	19-NOV-13
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	19-NOV-13
Sodium (Na)-Dissolved		111	92.2		mg/L	19	20	19-NOV-13
Strontium (Sr)-Dissolved		0.495	0.505		mg/L	2.0	20	19-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-NOV-13



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Client: Matrix Solutions Inc.
 200 - 150 13 Ave SW
 Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2745411							
WG1790854-4	DUP	L1390180-2						
Titanium (Ti)-Dissolved		0.00034	<0.00030	RPD-NA	mg/L	N/A	20	19-NOV-13
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-NOV-13
Uranium (U)-Dissolved		0.00199	0.00197		mg/L	1.4	20	19-NOV-13
Vanadium (V)-Dissolved		0.00085	0.00067	J	mg/L	0.00018	0.0002	19-NOV-13
Zinc (Zn)-Dissolved		0.0016	0.0017		mg/L	3.6	20	19-NOV-13
WG1790854-5	DUP	L1391133-4						
Aluminum (Al)-Dissolved		0.0107	0.0106		mg/L	1.0	20	19-NOV-13
Antimony (Sb)-Dissolved		0.00015	0.00015		mg/L	1.3	20	19-NOV-13
Arsenic (As)-Dissolved		0.00032	0.00030		mg/L	6.0	20	19-NOV-13
Barium (Ba)-Dissolved		0.110	0.108		mg/L	2.0	20	19-NOV-13
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	19-NOV-13
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-NOV-13
Cadmium (Cd)-Dissolved		0.000070	0.000069		mg/L	1.1	20	19-NOV-13
Calcium (Ca)-Dissolved		73.7	73.5		mg/L	0.3	20	19-NOV-13
Chromium (Cr)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-NOV-13
Cobalt (Co)-Dissolved		<0.00010	0.00011	RPD-NA	mg/L	N/A	20	19-NOV-13
Copper (Cu)-Dissolved		0.00238	0.00261		mg/L	9.2	20	19-NOV-13
Iron (Fe)-Dissolved		0.011	0.011		mg/L	7.9	20	19-NOV-13
Lead (Pb)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-NOV-13
Magnesium (Mg)-Dissolved		32.7	31.9		mg/L	2.7	20	19-NOV-13
Manganese (Mn)-Dissolved		0.00859	0.00824		mg/L	4.2	20	19-NOV-13
Molybdenum (Mo)-Dissolved		0.00139	0.00142		mg/L	2.0	20	19-NOV-13
Nickel (Ni)-Dissolved		0.00239	0.00221		mg/L	7.5	20	19-NOV-13
Potassium (K)-Dissolved		1.07	1.03		mg/L	3.5	20	19-NOV-13
Selenium (Se)-Dissolved		0.00042	0.00042		mg/L	1.2	20	19-NOV-13
Silicon (Si)-Dissolved		6.92	6.87		mg/L	0.7	20	19-NOV-13
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	19-NOV-13
Sodium (Na)-Dissolved		8.0	7.7		mg/L	3.9	20	19-NOV-13
Strontium (Sr)-Dissolved		0.185	0.187		mg/L	0.6	20	19-NOV-13
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-NOV-13
Titanium (Ti)-Dissolved		0.00040	0.00077	J	mg/L	0.00037	0.0006	19-NOV-13
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	19-NOV-13
Uranium (U)-Dissolved		0.00249	0.00245		mg/L	1.8	20	19-NOV-13



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200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED								
	Water							
Batch	R2745411							
WG1790854-5 DUP		L1391133-4						
Vanadium (V)-Dissolved		0.00085	0.00088		mg/L	3.2	20	19-NOV-13
Zinc (Zn)-Dissolved		0.0028	0.0025		mg/L	9.5	20	19-NOV-13
WG1790854-1 MB								
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	19-NOV-13
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-13
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-13
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-13
Beryllium (Be)-Dissolved			<0.00050		mg/L		0.0005	19-NOV-13
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-13
Cadmium (Cd)-Dissolved			<0.000010		mg/L		0.00001	19-NOV-13
Calcium (Ca)-Dissolved			<0.020		mg/L		0.02	19-NOV-13
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-13
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-13
Copper (Cu)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-13
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	19-NOV-13
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-13
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	19-NOV-13
Manganese (Mn)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-13
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-13
Nickel (Ni)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-13
Potassium (K)-Dissolved			<0.050		mg/L		0.05	19-NOV-13
Selenium (Se)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-13
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	19-NOV-13
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	19-NOV-13
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	19-NOV-13
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-13
Thallium (Tl)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-13
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	19-NOV-13
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-13
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	19-NOV-13
Vanadium (V)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-13
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	19-NOV-13



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Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-ED		Water						
Batch	R2745956							
WG1790854-2	CRM	ED-HIGH-WATRM						
Zinc (Zn)-Dissolved			97.0		%		80-120	21-NOV-13
WG1791601-2	CRM	ED-HIGH-WATRM						
Strontium (Sr)-Dissolved			98.8		%		80-120	20-NOV-13
Zinc (Zn)-Dissolved			101.8		%		80-120	20-NOV-13
WG1790854-3	DUP	L1390043-3						
Zinc (Zn)-Dissolved		N/A	0.0041		mg/L	3.2	20	21-NOV-13
WG1791601-3	DUP	L1390663-5						
Strontium (Sr)-Dissolved		0.142	0.141		mg/L	0.6	20	21-NOV-13
Zinc (Zn)-Dissolved		0.0011	<0.0010	RPD-NA	mg/L	N/A	20	21-NOV-13
WG1791601-4	DUP	L1390663-19						
Strontium (Sr)-Dissolved		0.828	0.820		mg/L	0.9	20	21-NOV-13
Zinc (Zn)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	21-NOV-13
WG1791601-5	DUP	L1390663-28						
Strontium (Sr)-Dissolved		0.116	0.119		mg/L	2.4	20	21-NOV-13
Zinc (Zn)-Dissolved		<0.0010	0.0010	RPD-NA	mg/L	N/A	20	21-NOV-13
WG1791601-6	DUP	L1390663-39						
Strontium (Sr)-Dissolved		0.411	0.410		mg/L	0.3	20	21-NOV-13
Zinc (Zn)-Dissolved		0.0015	0.0015		mg/L	3.1	20	21-NOV-13
WG1791601-7	DUP	L1390663-41						
Strontium (Sr)-Dissolved		0.115	0.118		mg/L	2.5	20	21-NOV-13
Zinc (Zn)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	21-NOV-13
WG1791601-1	MB							
Strontium (Sr)-Dissolved			<0.00010		mg/L		0.0001	20-NOV-13
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	20-NOV-13
NAPHTHENIC-ACID-FM		Water						
Batch	R2742301							
WG1787794-3	DUP	L1389950-2						
Naphthenic Acids		11.2	11.6		mg/L	3.1	30	15-NOV-13
WG1787794-4	LCS							
Naphthenic Acids			102.4		%		70-130	15-NOV-13
WG1787794-1	MB							
Naphthenic Acids			<1.0		mg/L		1	15-NOV-13
WG1787794-2	MS	L1389950-1						
Naphthenic Acids			131.7		%		50-150	15-NOV-13
NH3-CFA-ED		Water						



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Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-CFA-ED		Water						
Batch	R2742341							
WG1788748-11	DUP	L1390243-3						
Ammonia, Total (as N)		<0.050	0.051	RPD-NA	mg/L	N/A	20	15-NOV-13
WG1788748-3	DUP	L1391718-5						
Ammonia, Total (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	15-NOV-13
WG1788748-7	DUP	L1390199-1						
Ammonia, Total (as N)		0.242	0.245		mg/L	1.1	20	15-NOV-13
WG1788748-8	DUP	L1392067-1						
Ammonia, Total (as N)		0.476	0.478		mg/L	0.3	20	15-NOV-13
WG1788748-2	LCS							
Ammonia, Total (as N)			97.7		%		85-115	15-NOV-13
WG1788748-1	MB							
Ammonia, Total (as N)			<0.050		mg/L		0.05	15-NOV-13
WG1788748-10	MS	L1390044-5						
Ammonia, Total (as N)			111.7		%		75-125	15-NOV-13
WG1788748-4	MS	L1391873-3						
Ammonia, Total (as N)			109.9		%		75-125	15-NOV-13
WG1788748-6	MS	L1389933-3						
Ammonia, Total (as N)			108.6		%		75-125	15-NOV-13
NO2-IC-ED		Water						
Batch	R2741290							
WG1788274-11	DUP	L1390695-2						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	14-NOV-13
WG1788274-3	DUP	L1390180-2						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	14-NOV-13
WG1788274-5	DUP	L1390707-2						
Nitrite (as N)		0.139	0.141		mg/L	1.5	20	14-NOV-13
WG1788274-7	DUP	L1391212-4						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	14-NOV-13
WG1788274-9	DUP	L1390663-28						
Nitrite (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	14-NOV-13
WG1788274-2	LCS							
Nitrite (as N)			98.7		%		90-110	14-NOV-13
WG1788274-1	MB							
Nitrite (as N)			<0.050		mg/L		0.05	14-NOV-13
WG1788274-10	MS	L1390663-28						
Nitrite (as N)			89.5		%		75-125	14-NOV-13
WG1788274-12	MS	L1390695-2						
Nitrite (as N)			109.2		%		75-125	14-NOV-13



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Workorder: L1390044

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Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO2-IC-ED		Water						
Batch	R2741290							
WG1788274-6	MS	L1390707-2						
Nitrite (as N)			101.2		%		75-125	14-NOV-13
WG1788274-8	MS	L1391212-4						
Nitrite (as N)			91.3		%		75-125	14-NOV-13
NO3-IC-ED		Water						
Batch	R2741290							
WG1788274-11	DUP	L1390695-2						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	14-NOV-13
WG1788274-3	DUP	L1390180-2						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	14-NOV-13
WG1788274-5	DUP	L1390707-2						
Nitrate (as N)		0.195	0.189		mg/L	3.2	20	14-NOV-13
WG1788274-7	DUP	L1391212-4						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	14-NOV-13
WG1788274-9	DUP	L1390663-28						
Nitrate (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	14-NOV-13
WG1788274-2	LCS							
Nitrate (as N)			102.9		%		90-110	14-NOV-13
WG1788274-1	MB							
Nitrate (as N)			<0.050		mg/L		0.05	14-NOV-13
WG1788274-10	MS	L1390663-28						
Nitrate (as N)			104.2		%		75-125	14-NOV-13
WG1788274-12	MS	L1390695-2						
Nitrate (as N)			122.6		%		75-125	14-NOV-13
WG1788274-4	MS	L1390180-2						
Nitrate (as N)			102.8		%		75-125	14-NOV-13
WG1788274-6	MS	L1390707-2						
Nitrate (as N)			103.7		%		75-125	14-NOV-13
WG1788274-8	MS	L1391212-4						
Nitrate (as N)			106.0		%		75-125	14-NOV-13
P-T-COL-ED		Water						
Batch	R2745218							
WG1790473-3	DUP	L1390044-5						
Phosphorus (P)-Total		<0.020	<0.020	RPD-NA	mg/L	N/A	20	19-NOV-13
WG1790473-5	DUP	L1390897-2						
Phosphorus (P)-Total		2.77	2.79		mg/L	0.7	20	19-NOV-13
WG1790473-7	DUP	L1392649-28						
Phosphorus (P)-Total		<0.020	<0.020	RPD-NA	mg/L	N/A	20	19-NOV-13



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Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
P-T-COL-ED								
	Water							
Batch	R2745218							
WG1790473-2	LCS							
Phosphorus (P)-Total			102.7		%		80-120	19-NOV-13
WG1790473-1	MB							
Phosphorus (P)-Total			<0.020		mg/L		0.02	19-NOV-13
WG1790473-4	MS	L1390044-5						
Phosphorus (P)-Total			107.1		%		70-130	19-NOV-13
WG1790473-6	MS	L1390897-2						
Phosphorus (P)-Total			N/A	MS-B	%		-	19-NOV-13
WG1790473-8	MS	L1392649-28						
Phosphorus (P)-Total			113.2		%		70-130	19-NOV-13
PAH-ABT1-ED								
	Water							
Batch	R2742080							
WG1786514-3	LCS							
Acenaphthene			80.9		%		60-130	14-NOV-13
Acenaphthylene			84.5		%		60-130	14-NOV-13
Anthracene			82.0		%		60-130	14-NOV-13
Fluoranthene			89.1		%		60-130	14-NOV-13
Fluorene			84.4		%		60-130	14-NOV-13
Naphthalene			80.3		%		50-130	14-NOV-13
Phenanthrene			84.2		%		60-130	14-NOV-13
Pyrene			89.3		%		60-130	14-NOV-13
Benzo(a)anthracene			90.4		%		60-130	14-NOV-13
Benzo(k)fluoranthene			102.3		%		60-130	14-NOV-13
Benzo(b&j)fluoranthene			107.1		%		60-130	14-NOV-13
Benzo(g,h,i)perylene			106.3		%		60-130	14-NOV-13
Benzo(a)pyrene			108.5		%		60-130	14-NOV-13
Chrysene			84.2		%		60-130	14-NOV-13
Dibenzo(a,h)anthracene			108.0		%		60-130	14-NOV-13
Indeno(1,2,3-cd)pyrene			110.7		%		60-130	14-NOV-13
WG1786514-2	MB							
Acenaphthene			<0.000020		mg/L		0.00002	15-NOV-13
Acenaphthylene			<0.000020		mg/L		0.00002	15-NOV-13
Anthracene			<0.000010		mg/L		0.00001	15-NOV-13
Fluoranthene			<0.000020		mg/L		0.00002	15-NOV-13
Fluorene			<0.000020		mg/L		0.00002	15-NOV-13
Naphthalene			<0.000050		mg/L		0.00005	15-NOV-13



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Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PAH-ABT1-ED		Water						
Batch R2742080								
WG1786514-2 MB								
Phenanthrene			<0.000050		mg/L		0.00005	15-NOV-13
Pyrene			<0.000020		mg/L		0.00002	15-NOV-13
Benzo(a)anthracene			<0.000010		mg/L		0.00001	15-NOV-13
Benzo(k)fluoranthene			<0.000010		mg/L		0.00001	15-NOV-13
Benzo(b&j)fluoranthene			<0.000010		mg/L		0.00001	15-NOV-13
Benzo(g,h,i)perylene			<0.000020		mg/L		0.00002	15-NOV-13
Benzo(a)pyrene			<0.0000050		mg/L		0.000005	15-NOV-13
Chrysene			<0.000020		mg/L		0.00002	15-NOV-13
Dibenzo(a,h)anthracene			<0.0000050		mg/L		0.000005	15-NOV-13
Indeno(1,2,3-cd)pyrene			<0.000010		mg/L		0.00001	15-NOV-13
Surrogate: Nitrobenzene d5			83.6		%		40-130	15-NOV-13
Surrogate: 2-Fluorobiphenyl			79.1		%		40-130	15-NOV-13
Surrogate: p-Terphenyl d14			89.8		%		40-130	15-NOV-13
PH/EC/ALK-ED		Water						
Batch R2739225								
WG1786503-10 DUP		L1390486-2						
pH		8.01	8.01	J	pH	0.00	0.3	12-NOV-13
Conductivity (EC)		422	422		uS/cm	0.0	10	12-NOV-13
Bicarbonate (HCO3)		177	176		mg/L	0.3	25	12-NOV-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	12-NOV-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	12-NOV-13
Alkalinity, Total (as CaCO3)		145	145		mg/L	0.3	20	12-NOV-13
WG1786503-7 DUP		L1390104-1						
pH		7.89	7.89	J	pH	0.00	0.3	12-NOV-13
Conductivity (EC)		8180	8170		uS/cm	0.1	10	12-NOV-13
Bicarbonate (HCO3)		909	856		mg/L	6.0	25	12-NOV-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	12-NOV-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	12-NOV-13
Alkalinity, Total (as CaCO3)		745	701		mg/L	6.0	20	12-NOV-13
WG1786503-8 DUP		L1385255-2						
pH		8.71	8.73	J	pH	0.02	0.3	12-NOV-13
Conductivity (EC)		925	919		uS/cm	0.7	10	12-NOV-13
Bicarbonate (HCO3)		324	320		mg/L	1.3	25	12-NOV-13
Carbonate (CO3)		16.1	17.6		mg/L	9.3	25	12-NOV-13



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Client: Matrix Solutions Inc.
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Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PH/EC/ALK-ED		Water						
Batch	R2739225							
WG1786503-8	DUP	L1385255-2						
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	12-NOV-13
Alkalinity, Total (as CaCO3)		293	292		mg/L	0.3	20	12-NOV-13
WG1786503-9	DUP	L1390180-2						
pH		7.43	7.44	J	pH	0.01	0.3	12-NOV-13
Conductivity (EC)		1440	1440		uS/cm	0.1	10	12-NOV-13
Bicarbonate (HCO3)		977	978		mg/L	0.1	25	12-NOV-13
Carbonate (CO3)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	12-NOV-13
Hydroxide (OH)		<5.0	<5.0	RPD-NA	mg/L	N/A	25	12-NOV-13
Alkalinity, Total (as CaCO3)		800	802		mg/L	0.1	20	12-NOV-13
WG1786503-2	LCS							
Conductivity (EC)			102.6		%		90-110	12-NOV-13
WG1786503-3	LCS							
pH			7.01		pH		6.7-7.3	12-NOV-13
WG1786503-4	LCS							
Alkalinity, Total (as CaCO3)			99.2		%		85-115	12-NOV-13
WG1786503-5	LCS							
Conductivity (EC)			101.3		%		90-110	12-NOV-13
WG1786503-1	MB							
Bicarbonate (HCO3)			<5.0		mg/L		5	12-NOV-13
Carbonate (CO3)			<5.0		mg/L		5	12-NOV-13
Hydroxide (OH)			<5.0		mg/L		5	12-NOV-13
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	12-NOV-13
PHENOLS-4AAP-ED		Water						
Batch	R2745998							
WG1791945-4	DUP	L1390044-5						
Phenols (4AAP)		<0.0010	<0.0010	RPD-NA	mg/L	N/A	15	20-NOV-13
WG1791945-5	DUP	L1390096-8						
Phenols (4AAP)		<0.0010	0.0011	RPD-NA	mg/L	N/A	15	20-NOV-13
WG1791945-6	DUP	L1390730-13						
Phenols (4AAP)		0.0178	0.0185		mg/L	3.9	15	20-NOV-13
WG1791945-3	LCS							
Phenols (4AAP)			100.0		%		85-115	20-NOV-13
WG1791945-2	MB							
Phenols (4AAP)			<0.0010		mg/L		0.001	20-NOV-13
SO4-IC-ED		Water						



Environmental

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Client: Matrix Solutions Inc.
200 - 150 13 Ave SW
Calgary AB T2R 0V2

Contact: SUE RAYNARD

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-IC-ED		Water						
Batch	R2741290							
WG1788274-11	DUP	L1390695-2						
Sulfate (SO4)		<0.50	<0.50	RPD-NA	mg/L	N/A	20	14-NOV-13
WG1788274-3	DUP	L1390180-2						
Sulfate (SO4)		19.8	20.9		mg/L	5.6	20	14-NOV-13
WG1788274-5	DUP	L1390707-2						
Sulfate (SO4)		43.0	42.9		mg/L	0.1	20	14-NOV-13
WG1788274-7	DUP	L1391212-4						
Sulfate (SO4)		142	142		mg/L	0.2	20	14-NOV-13
WG1788274-9	DUP	L1390663-28						
Sulfate (SO4)		10.5	10.6		mg/L	0.7	20	14-NOV-13
WG1788274-2	LCS		107.1		%		90-110	14-NOV-13
Sulfate (SO4)								
WG1788274-1	MB		<0.50		mg/L		0.5	14-NOV-13
Sulfate (SO4)								
WG1788274-10	MS	L1390663-28						
Sulfate (SO4)			107.1		%		75-125	14-NOV-13
WG1788274-12	MS	L1390695-2						
Sulfate (SO4)			108.8		%		75-125	14-NOV-13
WG1788274-4	MS	L1390180-2						
Sulfate (SO4)			103.5		%		75-125	14-NOV-13
WG1788274-6	MS	L1390707-2						
Sulfate (SO4)			102.1		%		75-125	14-NOV-13
WG1788274-8	MS	L1391212-4						
Sulfate (SO4)			N/A	MS-B	%		-	14-NOV-13
TKN-CFA-ED		Water						
Batch	R2745730							
WG1791415-6	DUP	L1392838-15						
Total Kjeldahl Nitrogen		<0.20	<0.20	RPD-NA	mg/L	N/A	20	20-NOV-13
WG1791415-2	LCS		98.9		mg/L		75-125	20-NOV-13
Total Kjeldahl Nitrogen								
WG1791415-3	LCS		87.0		mg/L		75-125	20-NOV-13
Total Kjeldahl Nitrogen								
WG1791415-4	LCS		93.1		mg/L		75-125	20-NOV-13
Total Kjeldahl Nitrogen								
WG1791415-1	MB		<0.20		mg/L		0.2	20-NOV-13
Total Kjeldahl Nitrogen								
WG1791415-5	MS	L1390044-5						
Total Kjeldahl Nitrogen			93.0		mg/L		70-130	20-NOV-13

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Legend:

Limit ALS Control Limit (Data Quality Objectives)
DUP Duplicate
RPD Relative Percent Difference
N/A Not Available
LCS Laboratory Control Sample
SRM Standard Reference Material
MS Matrix Spike
MSD Matrix Spike Duplicate
ADE Average Desorption Efficiency
MB Method Blank
IRM Internal Reference Material
CRM Certified Reference Material
CCV Continuing Calibration Verification
CVS Calibration Verification Standard
LCSD Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

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Client: Matrix Solutions Inc.
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Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Anions and Nutrients							
Nitrate as N by IC							
	1	08-NOV-13	14-NOV-13 08:00	48	140	hours	EHT
	2	08-NOV-13	14-NOV-13 08:00	48	140	hours	EHT
	3	08-NOV-13	14-NOV-13 08:00	48	140	hours	EHT
	4	08-NOV-13	14-NOV-13 08:00	48	140	hours	EHT
	5	08-NOV-13	14-NOV-13 08:00	48	140	hours	EHT
Nitrite as N by IC							
	1	08-NOV-13	14-NOV-13 08:00	48	140	hours	EHT
	2	08-NOV-13	14-NOV-13 08:00	48	140	hours	EHT
	3	08-NOV-13	14-NOV-13 08:00	48	140	hours	EHT
	4	08-NOV-13	14-NOV-13 08:00	48	140	hours	EHT
	5	08-NOV-13	14-NOV-13 08:00	48	140	hours	EHT
Dissolved Metals							
Mercury (Hg) - Dissolved							
	1	08-NOV-13	13-DEC-13 15:41	28	35	days	EHT
	2	08-NOV-13	13-DEC-13 15:41	28	35	days	EHT
	3	08-NOV-13	13-DEC-13 15:41	28	35	days	EHT
	4	08-NOV-13	13-DEC-13 15:41	28	35	days	EHT
	5	08-NOV-13	13-DEC-13 15:41	28	35	days	EHT

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1390044 were received on 08-NOV-13 19:17.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.