# Phase II Environmental Site Assessment

## 5640 Bank Street, 7107 Marco Street, and 7041 Mitch Owens Road, City of Ottawa, Ontario

Ref: BAE-1241.2

Prepared For

*Alium Investments Ltd.*

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# LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ACM | Asbestos Containing Materials |
| AEC | Area of Environmental Concern |
| a.k.a. | Also Known As |
| APEC | Area of Potential Environmental Concern |
| AST | Aboveground Storage Tank |
| BH | Borehole |
| BTEX | Benzene, Toluene, Ethylbenzene and Xylenes |
| CCEA | Central Canada Exhibition Association |
| CFC | Chlorofluorocarbon |
| CNSC | Canadian Nuclear Safety Commission |
| COC | Contaminant of Concern |
| COPC | Contaminant of Potential Concern |
| CSA | Canadian Standards Association |
| CSFL | Contaminated Site on Federal Land |
| CWAC | Canadian Women's Army Corporation |
| CWS | Canada Wide Standards |
| DSS | Designated Substance Survey |
| DSHMS | Designated Substance and Hazardous Materials Survey |
| ESA | Environmental Site Assessment |
| FIP | Fire Insurance Plan |
| FOI | Freedom of Information |
| HCFC | Hydro chlorofluorocarbon |
| HLUI | Historical Land Use Inventory |
| HVAC | Heating Ventilation and Air Conditioning |
| LCP | Lead-Containing Paint |
| masl | Metres Above Sea Level |
| mbgs | Metres Below Ground Surface |
| MOE | Ministry of the Environment |
| MOL | Ministry of Labour |
| MSDS | Material Safety Data Sheet |
| MW | Monitoring Well |
| ODS | Ozone Depleting Substance |
| OHSA | Occupational Health and Safety Act |
| PAH | Polycyclic Aromatic Hydrocarbon |
| PCB | Polychlorinated Biphenyls |
| PHC | Petroleum Hydrocarbon |
| RSC | Record of Site Condition |
| SAR | Sodium Absorption Ratio |
| SCS | Site Condition Standard |
| TPH | Total Petroleum Hydrocarbons |
| TSSA | Technical Standards and Safety Authority |
| UST | Underground Storage Tank |
| UFFI | Urea Formaldehyde Foam Insulation |
| VOC | Volatile Organic Compounds |
| WL | Working Level |

## 1.0 EXECUTIVE SUMMARY

BAE and Associates Environmental Inc. (BAE) were retained by *Alium Investments Ltd.* to undertake a Phase II Environmental Site Assessment (ESA) at 5640 Bank Street, 7107 Marco Street, and 7041 Mitch Owens Road, City of Ottawa, Ontario. These investigations were conducted to reveal current environmental conditions for the subject property. A Phase I ESA completed by BAE had determined that a significant amount of fill had been brought onsite and thus a Phase II ESA was recommended.

The current investigation was conducted generally under the guidance of Part XV.1 of the Environmental Protection Act and Ontario Regulation 153/04 (O. Reg. 153/04) - as amended. All analysis was performed in accordance with O. Reg. 153/04 and compared to Part XV.1 of the *Environmental Protection Act* – Table 3: Full Depth Generic Site Condition Standards in a Non-Potable Groundwater Condition (July 2011) Criteria. The specific requirements for carrying out a Phase II ESA are set out in Part VIII of Ontario Regulation 153/04 - as amended by O. Reg. 511 (July, 2011).

The subject 0.275 hectare (0.7 acre) property is located on the southeast corner of Highway #7 West and Costa Road and includes a single storey commercial type building. The 470m$^2$ building is of brick, block and concrete construction with flat tar and gravel roof and supported by a slab-on-grade foundation. The building is serviced by municipal utilities (sewer and water), and by commercial natural gas and hydro. There are no environmental concerns for the current onsite operations.

Seven boreholes were advanced up to a depth of 15m below grade level (BGL) using a CME 75 mobile mounted drill rig with a 25cm diameter, hollow stem auger and split-spoon sampler. Three boreholes were developed as groundwater monitoring wells.

Representative soil and groundwater samples were submitted for independent chemical analyses of the Metal, Petroleum Hydrocarbon (PHC), Sodium Adsorption Ratio (SAR) and Volatile Organic Compound (VOC) Parameters. **All analysis results met applicable MOE/EPA Criteria**.

It is the opinion of BAE that the current environmental assessment performed is consistent with and meets MOE/EPA Criteria. The Environmental Site Assessment results do not suggest any chemical contamination associated with the imported fill or current or historical activities at the subject property and has determined that there is no evidence of any offsite impaction, or is likely to impact in the future, any adjacent public

Right of Ways at levels in excess of applicable criteria. **No further environmental investigations are recommended at this time.**

## 2.0 INTRODUCTION

BAE and Associates Environmental Inc. (BAE) were retained by Alium Investments Ltd. to undertake a Phase II Environmental Site Assessment (ESA) at 5640 Bank Street, 7107 Marco Street, and 7041 Mitch Owens Road, City of Ottawa, Ontario. These investigations were conducted to reveal current environmental conditions for the subject property. A Phase I ESA completed by BAE had determined that a significant amount of fill had been brought onsite and thus a Phase II ESA was recommended.

The current investigation was conducted generally under the guidance of Part XV.1 of the Environmental Protection Act and Ontario Regulation 153/04 (O. Reg. 153/04) - as amended. All analysis was performed in accordance with O. Reg. 153/04 and compared to Part XV.1 of the *Environmental Protection Act* – Table 2: Full Depth Generic Site Condition Standards in a Potable Groundwater Condition (July 2011) Criteria. The specific requirements for carrying out a Phase II ESA are set out in Part VIII of Ontario Regulation 153/04 - as amended by O. Reg. 511 (July, 2011).

## 3.0 SCOPE OF WORK

The scope of work was completed to determine if there appeared to be any indications of environmental impairment on the property, which could present liability. Phase II ESA investigations were undertaken and included:

- Performing background investigations and reviewing available previous environmental reports;
- Conducting a Borehole/ Monitoring Well Installation and Monitoring Well Access Program in the areas of potential concern to ascertain the subsurface conditions;
- Obtaining and submitting for independent chemical analysis, representative soil and groundwater samples for analyses of the Metal, Petroleum Hydrocarbon (PHC), Sodium Adsorption Ratio (SAR) and Volatile Organic Compound (VOC) Parameters; and,
- Completion of the engineering report with data and conclusions.

## 4.0 PREVIOUS INVESTIGATIONS

All and any pertinent reports or information were requested by BAE. There were no previous ESAs performed on the subject property with exception to the following.

### 4.1 Phase I ESA, BAE & Associates Environmental Inc., June 2012

At the request of Alium Investments Ltd., BAE completed a Phase I ESA in June of 2012. Following is a summary of the findings.

*BAE & Associates Environmental Inc. (BAE) was retained by Alium Investments Ltd. to prepare a Phase I Environmental Site Assessment (ESA) for 5640 Bank Street, 7107 Marco Street, and 7041 Mitch Owens Road, City of Ottawa, Ontario. These investigations were conducted to reveal any environmental concerns on or near the subject property.*

*As no Record of Site Condition was required, the terms of reference for the Phase I ESA were prepared and followed in accordance with CSA Standard Z768-01 for Phase I Environmental Site Assessments and generally in accordance with Part XV.1 of the Environmental Protection Act and Ontario Regulation 153/04 (O. Reg. 153/04) as amended.*

*There were no previous ESAs available for the subject property. The vacant subject 13 hectare (32 acre) Site is located on an irregular parcel of land situated at the northern periphery of the Community of Greely, at the southwest corner of the intersection of Bank Street and Mitch Owens Road. The Site encompasses three municipal addresses - 5640 Bank Street, 7107 Marco Street, and 7041 Mitch Owens Road.*

*The Site is currently vacant, and was previously utilized as a gravel pit. It is understood that much of the gravel pit has been backfilled with a fill derived from pond excavations at a site near Airport Parkway and Hunt Club Road to the north.*

*There are no other significant recorded items, soil or groundwater releases within a zone of concern. There are no ACMs, ASTs, landfills, lead, mercury, coal gasification plants, coal tar, UFFIs, USTs, PCBs, solid or liquid waste or improper storage of chemicals currently associated with the subject property. There was no evidence of*

*staining, stressed vegetation, or odours associated with the subject or neighbouring properties.*
*In summary, based on the current Phase I ESA findings, the possibility of potential environmental impairment from imported fill does exist. Further testing for Metals, SAR, PHCs and VOCs of the soil and groundwater are recommended to confirm the site is free from environmental liabilities.*

## 5.0 SITE DESCRIPTION

The legal description of the property is *Part of Lot 1, Concession 5, Geographic Township of Osgoode, City of Ottawa.* The Site encompasses three municipal addresses - 5640 Bank Street, 7107 Marco Street, and 7041 Mitch Owens Road.

The subject 13 hectare (32 acre) Site is located on an irregular parcel of land situated at the northern periphery of the Community of Greely, at the southwest corner of the intersection of Bank Street and Mitch Owens Road. The northern portion of the Site has an approximate frontage of 653m on the south side of Mitch Owens Road. The western portion of the Site has an approximate frontage of 200m on the east side of Old Prescott Road. The eastern portion of the Site has an approximate frontage of 150m on the west side of Bank Street. The southern portion of the Site has an approximate frontage of 35m on the north side of Marco Street and 720m backing onto the back of single family residential houses located along Marco Street.

The Site is currently vacant, and was previously utilized as a gravel pit (below water table in the central part of the site). It is understood that much of the gravel pit has been backfilled with a fill derived from pond excavations at a site near Airport Parkway and Hunt Club Road to the north. There are no significant environmental concerns from the current onsite operations. Figure 1 shows the Site location, Figure 2 shows the Site layout, and Figure 3 is the Site Plan of Survey.

Figure 1: Site Location

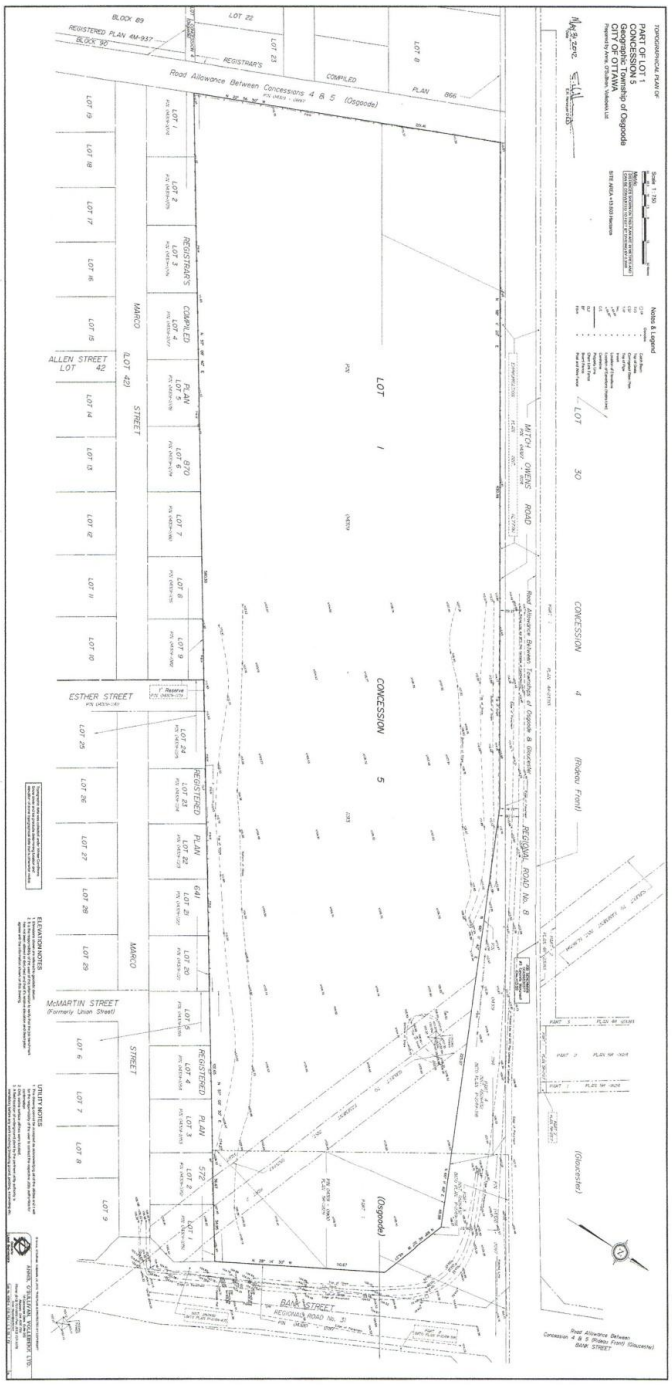
## 7.0 SURROUNDING LAND USE

Information concerning the surrounding land use in the vicinity of the subject property was obtained from documented information as well as several site visits. Properties in close proximity to the site are predominantly used as residential and aggregate extraction. Lands to the south and west of the site are in residential use, lands to the north remain in aggregate extractive use, and lands to the east are undeveloped except for a school to the immediate northeast and some scattered commercial properties.

Visual observation of the adjacent properties, to the extent possible, did not reveal the presence of any structures, equipment or materials of concern. There was no visual evidence any underground tanks adjacent to the subject site. There was no evidence of staining, stressed vegetation, odours or environmental concerns currently associated with any of the neighbouring properties.

Figure 2: Site Layout

Figure 3: Site Plan of Survey



## 8.0 PHYSICAL SETTING

The subject lands are located within the North Gower Drumlin Field physiographic region of southern Ontario, a drumlin field occupying much of the southern periphery of the City of Ottawa. According to Ontario Geological Survey Map 2556, the upper soils across the site mainly consist of glaciofluvial ice contact deposits of gravel and sand associated with the mapped abandoned raised beach, with glaciomarine deposits of sand and gravel mapped to the immediate west.

According to local water well records, mainly from wells located at the residential homes to the immediate south and west, the thickness of the undisturbed overburden in the close vicinity of the site is 15 to 27m. The thickest portion of the overburden appears to be along the north-south axis of the mapped abandoned raised beach trending through the centre of the site. The overburden is reported to consist primarily of granular deposits of sand and/or gravel.

### 8.2 Groundwater and Surface Water

The bedrock is the most commonly utilized source of potable groundwater in the area. Of the 92 reported wells within the same Township lot as the proposed development (i.e. Lot 1, Concession 5, Osgoode), 78 wells (85%) are reported to be completed in the bedrock. The remaining 14 wells are completed in gravel deposits in the lower overburden.

Groundwater is estimated to flow south toward North Castor River which is located approximately 1.5km to the south of the subject property. This information coincides with information taken from aerial photographs, which indicate that, the topography and hence the groundwater flows in the same direction toward this area.

### 8.3 Other Services

The Site was serviced at the road with hydro, telephone and gas services. Sanitary sewers and municipal water are not available in this area.

## 9.0 PHASE II ESA INVESTIGATIONS

BAE personnel conducted the Phase II ESA onsite investigations December 11th, 2012. Background information obtained from the BAE Phase I ESA in conjunction with onsite investigations was performed to determine parameters of potential concern for the subject and neighbouring properties. From these investigations it was determined that the potential parameters of concern were Metal, SAR, PHC and VOC Parameters, potentially emanating from previous onsite and offsite operations.

Onsite investigations consisted of a visual inspection of the property and conducting a borehole (BH) drilling and monitoring well (MW) installation program. The Phase II ESA was conducted to ascertain the surficial and subsurface conditions and to assess the need for further investigations. This section of the report describes the methodology and results of the Phase II ESA.

### 9.1 Borehole and Monitoring Well Installation and Access Program

Seven (7) boreholes were advanced up to a depth of 15m below grade level (BGL) using a CME 75 mobile mounted drill rig with a 25cm diameter, hollow stem auger and split-spoon sampler. Three boreholes were developed as groundwater monitoring wells. Downhole drilling equipment was decontaminated between boreholes and sampling equipment was decontaminated between sampling intervals.

Figure 4 shows the borehole (BH) and monitoring well (MW) locations. Borehole locations were selected to maximise property and proposed structure coverage, as well as determined by site accessibility. Borehole 1 was drilled to a depth of 3.5m at the southeast corner of the property, along the edge that was never exposed during pit operations. Borehole 2 was drilled to a depth of 7.6m to the west of BH #1 just north of the slope that runs along the southern property line. Borehole 3 was drilled to a depth of 7.6m towards the center of the property. Borehole 4 was drilled to a depth of 6.0m along the north edge of the property, to the southwest of the hydro tower. Borehole 5 was drilled to a depth of 9.0m along the north edge, in the west side of the subject property. Borehole 6 was drilled to a depth of 9.0m in the southwest corner of the subject property. Borehole 7 was drilled to a depth of 7.6m along the south side of the property, to the east of Borehole 6.

Water levels were measured in the open boreholes on completion of drilling. In addition, long term groundwater monitoring installations consisting of 19mm diameter PVC (polyvinyl chloride) pipes were installed in Borehole 2, 5 and 6 for subsequent

monitoring. The installation configuration is documented on the corresponding borehole logs.

## 9.2 Soil and Groundwater Sampling

Soil samples were collected from each borehole for the purpose of subsurface characterisation and field screening and testing. Soil samples were taken at 0.75m intervals and obtained from the split spoon. Each sample was logged with respect to nature, depth, thickness and evidence of impairment. The soil samples were placed in sterile polyethylene soil bags and labelled. The headspace vapours in each soil bag were tested for total petroleum hydrocarbon vapour concentrations using an RKI Eagle, One to Six Gas Portable Monitor and a MiniRae 3000 Portable Handheld VOC Monitor. The RKI Eagle measures total petroleum hydrocarbon vapours in the range of 0ppm to 50,000ppm. The MiniRae 3000 monitors Volatile Organic Compounds (VOCs) using a photo ionization detector (PID) measures VOC vapours in the range of 0ppm to 15,000ppm. All samples registered 0ppm on the Eagle. Samples registered between 1 and 1.8ppm. This field screening process indicated no volatilic gasoline/diesel/solvent impairment in the surface or subsurface soils in these areas.

As a tertiary onsite verification of the soil conditions, four representative samples were removed and tested using the Petroflag Turbidimetric Screening Method For Total Recoverable Petroleum Hydrocarbons in Soil - Official Method US EPA SW-846 Method 9074.

In addition, representative soil and groundwater samples were submitted to ALS for laboratory analysis during the Phase II ESA activities. Each sample was put into sterile, labelled laboratory supplied bottles. While under the care of BAE, the samples were maintained in ice-filled coolers following collection. Samples were submitted under chain-of-custody to ALS for independent chemical analysis.

## 9.3 Investigation Results

As a tertiary verification of the subsurface conditions, representative soil and groundwater samples were submitted to ALS for independent chemical analysis of the Metal, PHC, SAR and VOC Parameters. As outlined in Section 13 below, a**ll analysis results met applicable MOE/EPA Criteria**.

Figure 4: Borehole and Monitoring Well Locations

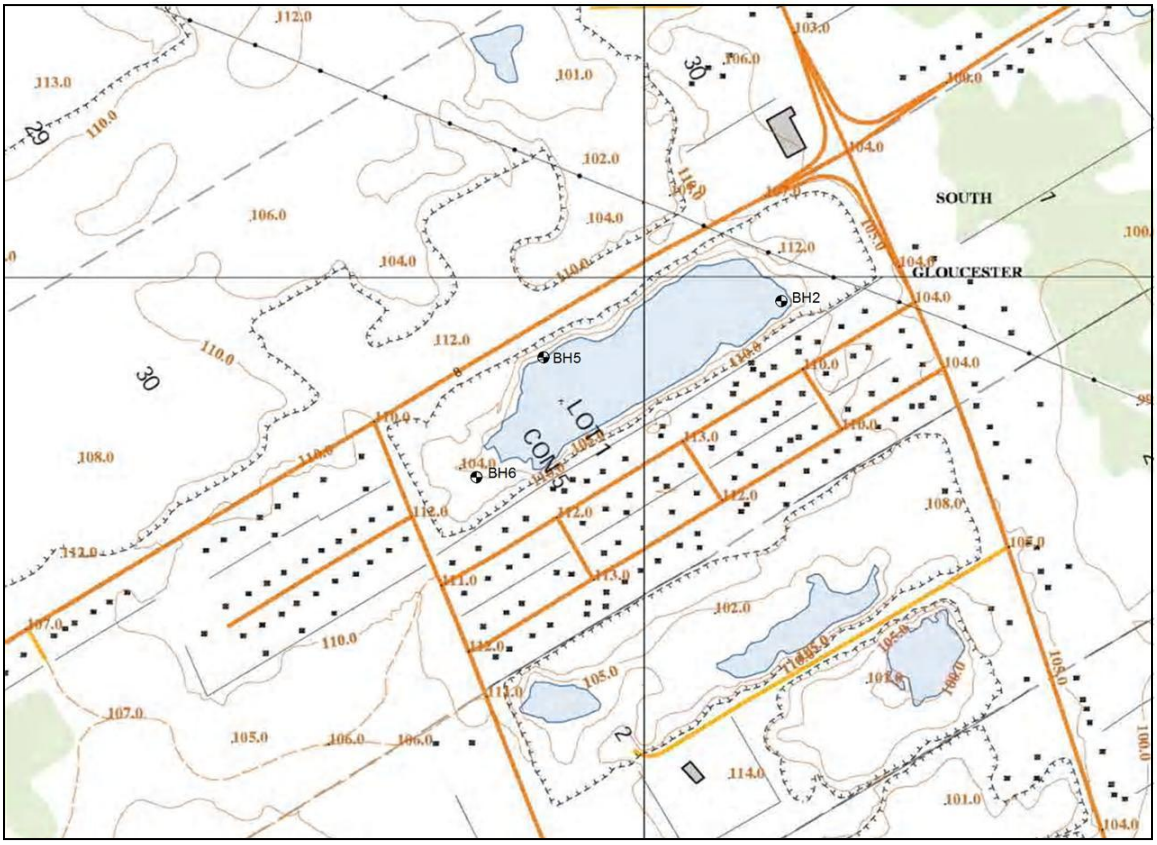
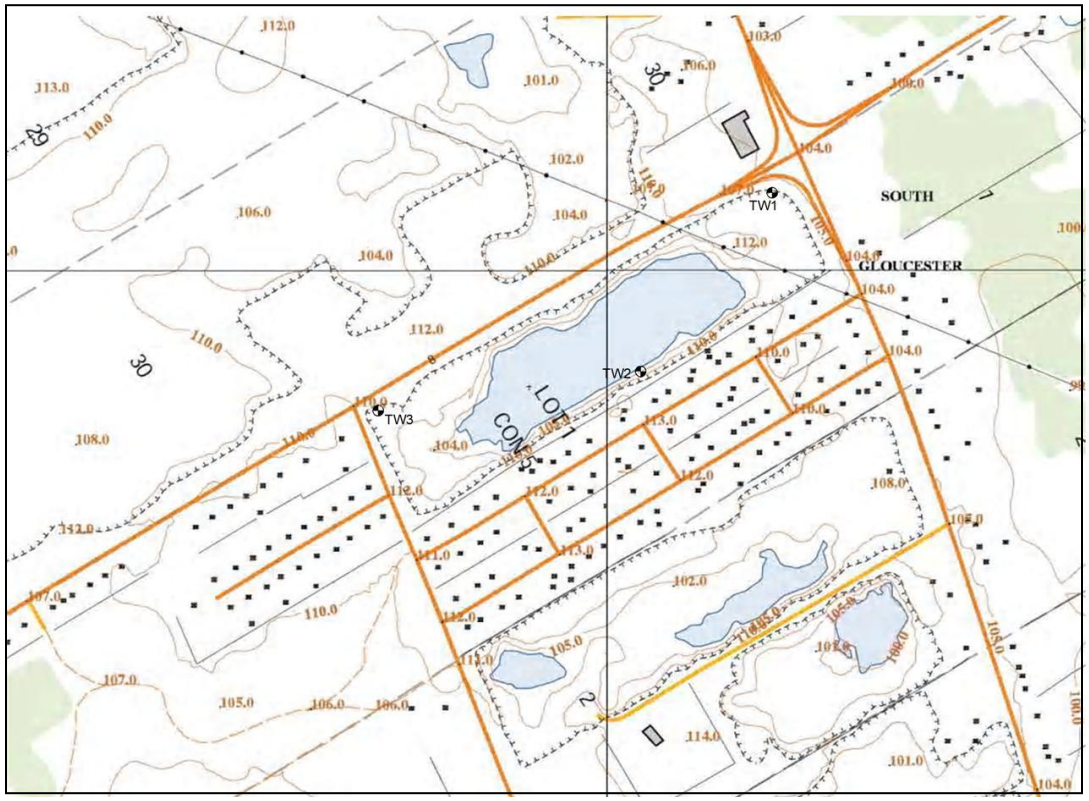


Figure 5: Monitoring Well Locations




## 10.0 APPLICABLE GOVERNMENT GUIDELINES

The current investigation was conducted generally in accordance with Part XV.1 of the Environmental Protection Act and Ontario Regulation 153/04 (O. Reg. 153/04) - as amended by O. Reg. 511 (July, 2011). All analysis was performed in accordance with O. Reg. 153/04 and compared to Part XV.1 of the *Environmental Protection Act* – Table 2: Full Depth Generic Site Condition Standards in a Potable Groundwater Condition (July 2011) Criteria.

The following rationale was used to determine the applicable site criteria:

**Site Sensitivity:** There were no sensitive environmental receivers identified within 30m of the site. Based on the information gathered during this investigation and previous investigations in the area, there is more than 2 m of overburden at the site.

**Land Use:** The site was originally developed as commercial. Surrounding land uses are predominantly residential properties, therefore the site will be considered to be commercial land use.

**Groundwater Use**: The area is not serviced by a municipal water supply. There are several known well users in the area. Based on this situation, the potable groundwater criteria would apply.

**Depth and Soil Texture Criteria Selection:** For this report, the full-depth criteria will be used for comparison of the analytical results.

The coarse textured soil classification will be used for comparison of analytical data. Based on the above information and assumptions, the criteria for this site corresponds to commercial land use criteria for medium to coarse textured soil using the full-depth approach and Part XV.1 of the *Environmental Protection Act* – Table 2: Full Depth Generic Site Condition Standards in a Potable Groundwater Condition (July 2011).

**TABLE 1: GROUNDWATER CHEMICAL ANALYSES - VOCs**

| PARAMETER | CRITERIA* | MDL | MW-1 | MW-2 | MW-3 |
|---|---|---|---|---|---|
| Acetone | 2700 | 30 | 88 | <30 | <30 |
| Benzene | 5 | 0.50 | <0.50 | <0.50 | <0.50 |
| Bromodichloromethane | 16 | 2.0 | <2.0 | <2.0 | <2.0 |
| Bromoform | 25 | 5.0 | <5.0 | <5.0 | <5.0 |
| Bromomethane | 0.89 | 0.50 | <0.50 | <0.50 | <0.50 |
| Carbon tetrachloride | 0.79 | 0.20 | <0.20 | <0.20 | <0.20 |
| Chlorobenzene | 30 | 0.50 | <0.50 | <0.50 | <0.50 |
| Dibromochloromethane | 25 | 2.0 | <2.0 | <2.0 | <2.0 |
| Chloroform | 2.4 | 1.0 | <1.0 | <1.0 | <1.0 |
| 1,2-Dibromoethane | 0.2 | 0.20 | <0.20 | <0.20 | <0.20 |
| 1,2-Dichlorobenzene | 3 | 0.50 | <0.50 | <0.50 | <0.50 |
| 1,3-Dichlorobenzene | 59 | 0.50 | <0.50 | <0.50 | <0.50 |
| 1,4-Dichlorobenzene | 1 | 0.50 | <0.50 | <0.50 | <0.50 |
| Dichlorodifluoromethane | 590 | 2.0 | <2.0 | <2.0 | <2.0 |

| PARAMETER | CRITERIA* | MDL | MW-1 | MW-2 | MW-3 |
|---|---|---|---|---|---|
| 1,1-Dichloroethane | 5 | 0.50 | <0.50 | <0.50 | <0.50 |
| 1,2-Dichloroethane | 1.6 | 0.50 | <0.50 | <0.50 | <0.50 |
| 1,1-Dichloroethylene | 1.6 | 0.50 | <0.50 | <0.50 | <0.50 |
| cis-1,2-Dichloroethylene | 1.6 | 0.50 | <0.50 | <0.50 | <0.50 |
| trans-1,2-Dichloroethylene | 1.6 | 0.50 | <0.50 | <0.50 | <0.50 |
| 1,3-Dichloropropene (cis & trans) | 0.5 | 0.50 | <0.50 | <0.50 | <0.50 |
| Methylene Chloride | 50 | 5.0 | <5.0 | <5.0 | <5.0 |
| 1,2-Dichloropropane | 5 | 0.50 | <0.50 | <0.50 | <0.50 |
| cis-1,3-Dichloropropene | | 0.30 | <0.30 | <0.30 | <0.30 |
| trans-1,3-Dichloropropene | | 0.30 | <0.30 | <0.30 | <0.30 |
| Ethyl Benzene | 2.4 | 0.50 | <0.50 | <0.50 | <0.50 |
| n-Hexane | 51 | 0.50 | <0.50 | <0.50 | <0.50 |
| Methyl Ethyl Ketone | 1800 | 20 | <20 | <20 | <20 |
| Methyl Isobutyl Ketone | 640 | 20 | <20 | <20 | <20 |
| MTBE | 15 | 2.0 | <2.0 | <2.0 | <2.0 |
| Styrene | 5.4 | 0.50 | <0.50 | <0.50 | <0.50 |
| 1,1,1,2-Tetrachloroethane | 1.1 | 0.50 | <0.50 | <0.50 | <0.50 |
| 1,1,2,2-Tetrachloroethane | 1 | 0.50 | <0.50 | <0.50 | <0.50 |
| Tetrachloroethylene | 1.6 | 0.50 | <0.50 | <0.50 | <0.50 |
| Toluene | 24 | 0.50 | <0.50 | <0.50 | <0.50 |
| 1,1,1-Trichloroethane | 200 | 0.50 | <0.50 | <0.50 | <0.50 |
| 1,1,2-Trichloroethane | 4.7 | 0.50 | <0.50 | <0.50 | <0.50 |
| Trichloroethylene | 1.6 | 0.50 | <0.50 | <0.50 | <0.50 |
| Trichlorofluoromethane | 150 | 5.0 | <5.0 | <5.0 | <5.0 |
| Vinyl chloride | 0.5 | 0.50 | <0.50 | <0.50 | <0.50 |
| o-Xylene | | 0.50 | <0.50 | <0.50 | <0.50 |
| m+p-Xylenes | | 0.50 | <0.50 | <0.50 | <0.50 |
| Xylenes (Total) | 300 | 0.71 | <0.71 | <0.71 | <0.71 |

All values in ug/l - ppb - parts per billion MDL- Method Detection Limit, N/V - No Value
*Part XV.1 of the *Environmental Protection Act* – Table 2: Full Depth Generic Site Condition Standards in a Potable Groundwater Condition (July 2011)

**TABLE 2: GROUNDWATER CHEMICAL ANALYSIS- METALS**

| PARAMETER | CRITERIA | MDL | MW-3 |
|---|---|---|---|
| Antimony (Sb) | 6 | 0.50 | <0.50 |
| Arsenic (As) | 25 | 1.0 | 1.4 |
| Barium (Ba) | 1000 | 2.0 | 189 |
| Beryllium (Be) | 4 | 0.50 | <0.50 |
| Boron (B) | 5000 | 10 | 57 |
| Cadmium (Cd) | 2.7 | 0.10 | <0.10 |
| Calcium (Ca) | | 0.50 | 105 |
| Chromium (Cr) | 50 | 0.50 | <0.50 |
| Cobalt (Co) | 3.8 | 0.50 | 1.50 |
| Copper (Cu) | 87 | 1.0 | <1.0 |
| Lead (Pb) | 10 | 1.0 | <1.0 |
| Magnesium (Mg) | | 0.50 | 25.9 |
| Molybdenum (Mo) | 70 | 0.50 | 1.76 |
| Nickel (Ni) | 100 | 1.0 | 2.6 |
| Selenium (Se) | 10 | 5.0 | <5.0 |
| Silver (Ag) | 1.5 | 0.10 | <0.10 |
| Sodium (Na) | 490000 | 5000 | 24800 |
| Thallium (Tl) | 2 | 0.30 | <0.30 |
| Uranium (U) | 20 | 2.0 | 2.5 |
| Vanadium (V) | 6.2 | 0.50 | 0.94 |
| Zinc (Zn) | 1100 | 3.0 | <3.0 |
| SAR | 12 | 0.03 | 0.56 |

All values in ug/l - ppb - parts per billion MDL- Method Detection Limit, N/V - No Value
*Part XV.1 of the *Environmental Protection Act* – Table 2: Full Depth Generic Site Condition Standards in a Potable Groundwater Condition (July 2011)

**TABLE 3: GROUNDWATER CHEMICAL ANALYSES –PETROLEUM HYDROCARBONS**

| PARAMETER | MOE/EPA CRITERIA | MDL | MW-1 | MW-2 |
|---|---|---|---|---|
| PHCs | | | | |
| F1 (C6-C10) | 25 | 25 | <25 | <25 |
| F1-BTEX | 25 | 25 | <25 | <25 |
| F2 (C10-C16) | 100 | 100 | <100 | <100 |
| F3 (C16-C34) | 250 | 250 | <250 | <250 |
| F4 (C34-C50) | 250 | 250 | <250 | <250 |
| Total PHCs | 250 | 250 | <250 | <250 |

All values in ug/l - ppb - parts per billion MDL- Method Detection Limit, N/V - No Value *Part XV.1 of the *Environmental Protection Act* – Table 2: Full Depth Generic Site Condition Standards in a Potable Groundwater Condition (July 2011).

**TABLE 4: SOIL CHEMICAL ANALYSIS- METALS**

| PARAMETER: | *CRITERIA | MDL | BH-3 1.5m | BH-4 1.5m |
|---|---|---|---|---|
| Antimony (Sb) | 50 | 1.0 | <1.0 | <1.0 |
| Arsenic (As) | 18 | 1.0 | 2.2 | 3.6 |
| Barium (Ba) | 670 | 1.0 | 62.2 | 96.7 |
| Beryllium (Be) | 10 | 0.50 | 0.52 | 0.67 |
| Cadmium (Cd) | 120 | 5.0 | 8.0 | 8.3 |
| Chromium (Cr) | 1.9 | 0.50 | <0.50 | <0.50 |
| Cobalt (Co) | 160 | 1.0 | 21.3 | 27.0 |
| Copper (Cu) | 100 | 1.0 | 8.1 | 8.6 |
| Lead (Pb) | 300 | 1.0 | 18.7 | 17.7 |
| Molybdenum (Mo) | 120 | 1.0 | 16.0 | 10.3 |
| Nickel (Ni) | 40 | 1.0 | <1.0 | <1.0 |
| Selenium (Se) | 340 | 1.0 | 19.0 | 20.7 |
| Silver (Ag) | 5.5 | 1.0 | <1.0 | <1.0 |
| Thallium (Tl) | 50 | 0.20 | <0.20 | <0.20 |
| Uranium (U) | 3.3 | 0.50 | <0.50 | <0.50 |
| Vanadium (V) | 33 | 1.0 | <1.0 | <1.0 |
| Zinc (Zn) | 86 | 1.0 | 31.0 | 41.5 |
| SAR | 5 | 0.10 | 0.87 | 0.41 |

All values in ug/g - ppm - parts per million, MDL- Method Detection Limit, *Part XV.1 of the *Environmental Protection Act* – Table 2: Full Depth Generic Site Condition Standards in a Potable Groundwater Condition, (July 2011).

**TABLE 5: SOIL CHEMICAL ANALYSES - VOCs**

| PARAMETER | *CRITERIA | MDL | BH5-1.5m |
|---|---|---|---|
| Acetone | 28 | 0.50 | <0.50 |
| Benzene | 0.4 | 0.020 | <0.020 |
| Bromodichloromethane | 1.9 | 0.050 | <0.050 |
| Bromoform | 1.7 | 0.050 | <0.050 |
| Bromomethane | 0.05 | 0.050 | <0.050 |
| Carbon tetrachloride | 0.71 | 0.050 | <0.050 |
| Chlorobenzene | 2.7 | 0.050 | <0.050 |
| Dibromochloromethane | 2.9 | 0.050 | <0.050 |

| PARAMETER | *CRITERIA | MDL | BH5-1.5m |
|---|---|---|---|
| Chloroform | 0.18 | 0.050 | <0.050 |
| 1,2-Dibromoethane | 0.05 | 0.050 | <0.050 |
| 1,2-Dichlorobenzene | 1.7 | 0.050 | <0.050 |
| 1,3-Dichlorobenzene | 12 | 0.050 | <0.050 |
| 1,4-Dichlorobenzene | 0.57 | 0.050 | <0.050 |
| Dichlorodifluoromethane | 25 | 0.050 | <0.050 |
| 1,1-Dichloroethane | 0.6 | 0.050 | <0.050 |
| 1,2-Dichloroethane | 0.05 | 0.050 | <0.050 |
| 1,1-Dichloroethylene | 0.48 | 0.050 | <0.050 |
| cis-1,2-Dichloroethylene | 2.5 | 0.050 | <0.050 |
| trans-1,2-Dichloroethylene | 2.5 | 0.050 | <0.050 |
| 1,3-Dichloropropene (cis & trans) | 0.081 | 0.042 | <0.042 |
| Methylene Chloride | 2 | 0.050 | <0.050 |
| 1,2-Dichloropropane | 0.68 | 0.050 | <0.050 |
| cis-1,3-Dichloropropene | | 0.030 | <0.030 |
| trans-1,3-Dichloropropene | | 0.030 | <0.030 |
| Ethyl Benzene | 1.6 | 0.050 | <0.050 |
| n-Hexane | 88 | 0.050 | <0.050 |
| Methyl Ethyl Ketone | 88 | 0.50 | <0.50 |
| Methyl Isobutyl Ketone | 210 | 0.50 | <0.50 |
| MTBE | 2.3 | 0.050 | <0.050 |
| Styrene | 43 | 0.050 | <0.050 |
| 1,1,1,2-Tetrachloroethane | 0.11 | 0.050 | <0.050 |
| 1,1,2,2-Tetrachloroethane | 0.094 | 0.050 | <0.050 |
| Tetrachloroethylene | 2.5 | 0.050 | <0.050 |
| Toluene | 9 | 0.20 | <0.20 |
| 1,1,1-Trichloroethane | 12 | 0.050 | <0.050 |
| 1,1,2-Trichloroethane | 0.11 | 0.050 | <0.050 |
| Trichloroethylene | 0.61 | 0.050 | <0.050 |
| Trichlorofluoromethane | 5.8 | 0.050 | <0.050 |
| Vinyl chloride | 0.25 | 0.020 | <0.020 |
| o-Xylene | | 0.020 | <0.020 |

| PARAMETER | *CRITERIA | MDL | BH5-1.5m |
|---|---|---|---|
| m+p-Xylenes | | 0.030 | <0.030 |
| Xylenes (Total) | 30 | 0.050 | <0.050 |

All values in ug/g - ppm - parts per million, MDL- Method Detection Limit, *Part XV.1 of the *Environmental Protection Act* – Table 2: Full Depth Generic Site Condition Standards in a Potable Groundwater Condition, (July 2011).

**TABLE 6: SOIL CHEMICAL ANALYSES –PETROLEUM HYDROCARBONS**

| PARAMETER | MOE/EPA CRITERIA | MDL | BH3-1.5m |
|---|---|---|---|
| PHCs | | | |
| F1 (C6-C10) | 65 | 5 | <5 |
| F1-BTEX | 65 | 5 | <5 |
| F2 (C10-C16) | 250 | 10 | <10 |
| F3 (C16-C34) | 2500 | 50 | <50 |
| F4 (C34-C50) | 6600 | 50 | 57 |
| Total PHCs | | 50 | 57 |

All values in ug/l - ppm - parts per million MDL- Method Detection Limit, N/V - No Value *Part XV.1 of the *Environmental Protection Act* – Table 2: Full Depth Generic Site Condition Standards in a Potable Groundwater Condition (July 2011).

## 11.0 LABORATORY CHEMICAL ANALYSES

All laboratory analyses were completed by an independent, accredited lab, ALS Laboratory Group of Richmond Hill/ Waterloo, Ontario (ALS). ALS is a CAEAL Registered and Accredited laboratory according to O. Reg. 153/04 section 47 (1) and ALS used the analytical methods as described in *Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (*MOE 2004, O. Reg. 153/04 section 47 (2). Appendix I of this report contains the detailed laboratory certificates of analyses. All analysis was performed in accordance with O. Reg. 153/04 and compared to Part XV.1 of the *Environmental Protection Act* – Table 2: Full Depth Generic Site Condition Standards in a Potable Groundwater Condition (July 2011). Representative soil and groundwater samples were submitted for the Metal, PHC, SAR and VOC Parameters. **As presented above and in the attached Certificates of Analysis, all analyses met applicable MOE/EPA criteria.**

## 12.0 FIELD and LABORATORY QA/QC

A strict Quality Assurance/Quality Control (QA/QC) program was implemented and maintained throughout the project to ensure the Site data are representative of the actual Site conditions. The QA/QC program provides a method of documented checks to assess the precision and accuracy of collected data. The QA/QC program includes a set of standard procedures or protocols to be followed throughout the investigations. To this end, BAE field and QA/QC protocols have been developed to meet or exceed those defined in the MOE documents entitled "*Guideline for Phase II Environmental Site Assessments in Ontario"* (Draft, March 2006) and "*Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario"* (1996) and Canadian Council of Ministers of the Environment (CCME) "*Guidance Manual Sampling, Analysis, and Data Management for Contaminated Sites"* (1993). The field QA/QC program included the following components:

1) The use of personnel protective equipment including hard hats, safety glasses, safety work boots, and chemically resistant latex/nitrile gloves for sample handling;

2) Thorough documentation of all field activities and sample handling practices including field notes, chain of custody forms, memos to file, etc;

3) Thorough decontamination of all non-dedicated sampling equipment employed in all investigation phases;

4) The use of laboratory analytical protocols and method detection limits that have been established in accordance with regulatory requirements of the Province of Ontario;

5) The RKI Eagle was re-calibrated to Hexane during the planning process;

6) The Petroflag Turbidimetric Screening Method For Total Recoverable Petroleum Hydrocarbons in Soil - Official Method US EPA SW-846 Method 9074 was re-calibrated with the appropriate blanks and standards (each 10 samples) prior to and during usage in the field;

7) The MiniRae 3000 Portable Handheld VOC Monitor was calibrated using isobutylene calibration gas prior to use; and,

8) The ALS Quality Control Report was provided by ALS at the request of BAE. ALS includes comprehensive QC checks with every analysis to ensure high standards of quality are met. Each QC result has a known or expected target value, which is

compared against predetermined data quality objectives to provide confidence in the accuracy of associated test results.

## 13.0 CONCLUSIONS

It is the opinion of BAE that the current environmental assessment performed is consistent with and meets MOE/EPA Criteria. The Environmental Site Assessment results do not suggest any chemical contamination associated with the imported fill or current or historical activities at the subject property and has determined that there is no evidence of any offsite impaction, or is likely to impact in the future, any adjacent public Right of Ways at levels in excess of applicable criteria. **No further environmental investigations are recommended at this time.**

## 14.0 REFERENCES

Chapman, L.J. and Putnam, D.F., 1984. "The Physiography of Southern Ontario", Ontario Geological Survey.

Part VIII of Ontario Regulation 153/04 and Part XV.1 of the *Environmental Protection Act* – Table 2: Full Depth Generic Site Condition Standards in a Potable Groundwater Condition (July 2011).

## 15.0 LIMITATIONS

The statement of limitations associated with the current Phase II ESA is as follows:

1. This project and verification assessment was conducted in accordance with generally accepted engineering standards. It is possible that materials other than those described in this report are present at the site. The client acknowledges that no assessment can necessarily identify the existence of all contaminants, potential contaminants or environmental conditions;

2. This report was prepared for the sole and exclusive use of Alium Investments Ltd. BAE accepts no responsibility or liability for any loss, damage, expense, fine or any other claim of any nature or type, including any liability or potential liability arising from its own negligence, for any use of this report or reliance on it, in whole or in part, by anyone other than Alium Investments Ltd.;

3. There is no representation, warranty or condition, express or implied, by BAE or its officers, directors, employees or agents that this assessment has identified all contaminants, potential contaminants or environmental conditions at the site or that the site is free from contamination, potential contaminants or environmental conditions other than those noted in this report;

4. This assessment has been completed from information and documentation described in this report. We have assumed that any such information and documentation is accurate and complete. We can accept no responsibility or liability for any errors, deficiencies or inaccuracies in this report arising from errors or omissions in the information and documentation provided by others;

5. This assessment was based on information and the results of investigations obtained on the dates specified. BAE accepts no responsibility or liability for any changes or potential changes in the condition of the site subsequent to the date of our investigations;

6. This assessment pertains only to the site specifically described in this report and not to any adjacent or other property;

7. This assessment does not include, nor is it intended to include, any opinion regarding the suitability of any structure on the site for any particular function, or the geotechnical conditions on the site, with the exception of how they may identify with environmental concerns. Inspections do not include compliance with building, gas, electrical or boiler codes, or any other federal, provincial or municipal codes not associated with environmental concerns. Should concerns regarding any parameters other than environmental concerns arise as a result of our investigations, they should be addressed by appropriately qualified professionals;

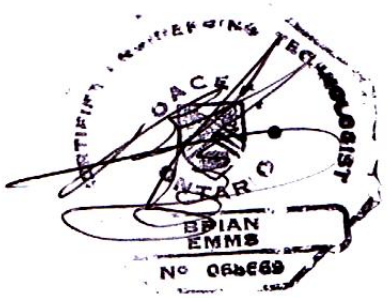
8. Should any conditions be encountered at the subject site that differs from our findings, we request that we be notified immediately in order to allow for a reassessment.

9. This report is not to be reproduced or released to any other party, other than Alium Investments Ltd. in whole or in part, without the express written consent of BAE.

## 16.0 QUALIFICATIONS OF ASSESSORS

This investigation was completed by Brian A. Emms, C.E.T. and reviewed by G. Jan Van Iterson, P. Eng. Mr. Van Iterson is registered with the Ministry of Environment as a Qualified Person as per Ontario Regulation 153/04. Jointly, the above have performed hundreds of ESAs and site remediation for various financial institutions, municipal governments, insurance companies, law firms and the private sector.

Respectfully submitted,
**BAE & Associates Environmental**



Brian A. Emms, C.E.T.
Senior Env. Technologist

G. Jan Van Iterson, P. Eng.
Associate

# APPENDIX I
# Certificates of Analysis

BRIAN A. EMMS
ATTN: BRIAN EMMS
RR 1 ORO STATION
ORO STATION ON L0L 2E0

Date Received: 11-DEC-12
Report Date: 15-JUL-13 07:47 (MT)
Version: FINAL REV. 2

Client Phone: 705-715-1881

# Certificate of Analysis

**Lab Work Order #: L1248030**
Project P.O. #: NOT SUBMITTED
Job Reference: CSTA-002
C of C Numbers: 131054
Legal Site Desc:

Mathumai Ganeshakumar
Account Manager

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

ADDRESS: 95 West Beaver Creek Road, Unit 1, Richmond Hill, ON L4B 1H2 Canada | Phone: +1 905 881 9887 | Fax: +1 905 881 8062
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# ANALYTICAL GUIDELINE REPORT

L1248030 CONTD....
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CSTA-002

| Sample Details Grouping / Analyte | Result | Qualifier | D.L. | Units | Analyzed | Guideline Limits #1 | #2 | #3 | #4 |
|---|---|---|---|---|---|---|---|---|---|
| L1248030-1 MW1 | | | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 12:00 | | | | | | | | | |
| Matrix: WATER | | | | | | | | | |
| **Volatile Organic Compounds** | | | | | | | | | |
| Acetone | 88 | | 30 | ug/L | 13-DEC-12 | | | | |
| Benzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Bromodichloromethane | <2.0 | | 2.0 | ug/L | 13-DEC-12 | | | | |
| Bromoform | <5.0 | | 5.0 | ug/L | 13-DEC-12 | | | | |
| Bromomethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Carbon tetrachloride | <0.20 | | 0.20 | ug/L | 13-DEC-12 | | | | |
| Chlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Dibromochloromethane | <2.0 | | 2.0 | ug/L | 13-DEC-12 | | | | |
| Chloroform | <1.0 | | 1.0 | ug/L | 13-DEC-12 | | | | |
| 1,2-Dibromoethane | <0.20 | | 0.20 | ug/L | 13-DEC-12 | | | | |
| 1,2-Dichlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,3-Dichlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,4-Dichlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Dichlorodifluoromethane | <2.0 | | 2.0 | ug/L | 13-DEC-12 | | | | |
| 1,1-Dichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,2-Dichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,1-Dichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| cis-1,2-Dichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| trans-1,2-Dichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,3-Dichloropropene (cis & trans) | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Methylene Chloride | <5.0 | | 5.0 | ug/L | 13-DEC-12 | | | | |
| 1,2-Dichloropropane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| cis-1,3-Dichloropropene | <0.30 | | 0.30 | ug/L | 13-DEC-12 | | | | |
| trans-1,3-Dichloropropene | <0.30 | | 0.30 | ug/L | 13-DEC-12 | | | | |
| Ethyl Benzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| n-Hexane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Methyl Ethyl Ketone | <20 | | 20 | ug/L | 13-DEC-12 | | | | |
| Methyl Isobutyl Ketone | <20 | | 20 | ug/L | 13-DEC-12 | | | | |
| MTBE | <2.0 | | 2.0 | ug/L | 13-DEC-12 | | | | |
| Styrene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,1,1,2-Tetrachloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,1,2,2-Tetrachloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Tetrachloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Toluene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,1,1-Trichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,1,2-Trichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Trichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Trichlorofluoromethane | <5.0 | | 5.0 | ug/L | 13-DEC-12 | | | | |
| Vinyl chloride | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| o-Xylene | <0.35 | | 0.35 | ug/L | 13-DEC-12 | | | | |
| m+p-Xylenes | <0.35 | | 0.35 | ug/L | 13-DEC-12 | | | | |
| Xylenes (Total) | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Surrogate: 4-Bromofluorobenzene | 83.1 | | 70-130 | % | 13-DEC-12 | | | | |
| Surrogate: 1,4-Difluorobenzene | 93.6 | | 70-130 | % | 13-DEC-12 | | | | |
| **Hydrocarbons** | | | | | | | | | |
| F1 (C6-C10) | <25 | | 25 | ug/L | 13-DEC-12 | | | | |
| F1-BTEX | <25 | | 25 | ug/L | 13-DEC-12 | | | | |
| F2 (C10-C16) | <100 | | 100 | ug/L | 13-DEC-12 | | | | |

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

**Ontario Regulation 153/04 - April 15, 2011 Standards = [Suite] - T2-All-Soil-Categories**

**#1: T2-Soil-Agricultural or Other Property Use (Coarse)**

**#2: T2-Soil-Agricultural or Other Property Use (Fine)**

**#3: T2-Soil-Ind/Com/Commu Property Use (Coarse)**

**#4: T2-Soil-Ind/Com/Commu Property Use (Fine)**

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# ANALYTICAL GUIDELINE REPORT

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| Sample Details Grouping / Analyte | Result | Qualifier | D.L. | Units | Analyzed | Guideline Limits #1 | #2 | #3 | #4 |
|---|---|---|---|---|---|---|---|---|---|
| L1248030-1 MW1 | | | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 12:00 | | | | | | | | | |
| Matrix: WATER | | | | | | | | | |
| **Hydrocarbons** | | | | | | | | | |
| F3 (C16-C34) | <250 | | 250 | ug/L | 13-DEC-12 | | | | |
| F4 (C34-C50) | <250 | | 250 | ug/L | 13-DEC-12 | | | | |
| Total Hydrocarbons (C6-C50) | <250 | | 250 | ug/L | 13-DEC-12 | | | | |
| Chrom. to baseline at nC50 | YES | | | No Unit | 13-DEC-12 | | | | |
| Surrogate: 2-Bromobenzotrifluoride | 61.3 | | 60-140 | % | 13-DEC-12 | | | | |
| Surrogate: 3,4-Dichlorotoluene | 72.6 | | 60-140 | % | 13-DEC-12 | | | | |
| Surrogate: Octacosane | 91.0 | | 60-140 | % | 13-DEC-12 | | | | |
| L1248030-2 MW2 | | | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 12:00 | | | | | | | | | |
| Matrix: WATER | | | | | | #1 | #2 | #3 | #4 |
| **Volatile Organic Compounds** | | | | | | | | | |
| Acetone | <30 | | 30 | ug/L | 13-DEC-12 | | | | |
| Benzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Bromodichloromethane | <2.0 | | 2.0 | ug/L | 13-DEC-12 | | | | |
| Bromoform | <5.0 | | 5.0 | ug/L | 13-DEC-12 | | | | |
| Bromomethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Carbon tetrachloride | <0.20 | | 0.20 | ug/L | 13-DEC-12 | | | | |
| Chlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Dibromochloromethane | <2.0 | | 2.0 | ug/L | 13-DEC-12 | | | | |
| Chloroform | <1.0 | | 1.0 | ug/L | 13-DEC-12 | | | | |
| 1,2-Dibromoethane | <0.20 | | 0.20 | ug/L | 13-DEC-12 | | | | |
| 1,2-Dichlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,3-Dichlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,4-Dichlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Dichlorodifluoromethane | <2.0 | | 2.0 | ug/L | 13-DEC-12 | | | | |
| 1,1-Dichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,2-Dichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,1-Dichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| cis-1,2-Dichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| trans-1,2-Dichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,3-Dichloropropene (cis & trans) | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Methylene Chloride | <5.0 | | 5.0 | ug/L | 13-DEC-12 | | | | |
| 1,2-Dichloropropane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| cis-1,3-Dichloropropene | <0.30 | | 0.30 | ug/L | 13-DEC-12 | | | | |
| trans-1,3-Dichloropropene | <0.30 | | 0.30 | ug/L | 13-DEC-12 | | | | |
| Ethyl Benzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| n-Hexane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Methyl Ethyl Ketone | <20 | | 20 | ug/L | 13-DEC-12 | | | | |
| Methyl Isobutyl Ketone | <20 | | 20 | ug/L | 13-DEC-12 | | | | |
| MTBE | <2.0 | | 2.0 | ug/L | 13-DEC-12 | | | | |
| Styrene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,1,1,2-Tetrachloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,1,2,2-Tetrachloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Tetrachloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Toluene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,1,1-Trichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

**Ontario Regulation 153/04 - April 15, 2011 Standards = [Suite] - T2-All-Soil-Categories**

**#1: T2-Soil-Agricultural or Other Property Use (Coarse)**

**#2: T2-Soil-Agricultural or Other Property Use (Fine)**

**#3: T2-Soil-Ind/Com/Commu Property Use (Coarse)**

**#4: T2-Soil-Ind/Com/Commu Property Use (Fine)**

ALS Environmental

# ANALYTICAL GUIDELINE REPORT

L1248030 CONTD....
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15-JUL-13 07:47 (MT)

CSTA-002

| Sample Details Grouping / Analyte | Result | Qualifier | D.L. | Units | Analyzed | Guideline Limits #1 | #2 | #3 | #4 |
|---|---|---|---|---|---|---|---|---|---|
| L1248030-2 MW2 | | | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 12:00 | | | | | | | | | |
| Matrix: WATER | | | | | | | | | |
| **Volatile Organic Compounds** | | | | | | | | | |
| 1,1,2-Trichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Trichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Trichlorofluoromethane | <5.0 | | 5.0 | ug/L | 13-DEC-12 | | | | |
| Vinyl chloride | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| o-Xylene | <0.35 | | 0.35 | ug/L | 13-DEC-12 | | | | |
| m+p-Xylenes | <0.35 | | 0.35 | ug/L | 13-DEC-12 | | | | |
| Xylenes (Total) | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Surrogate: 4-Bromofluorobenzene | 82.4 | | 70-130 | % | 13-DEC-12 | | | | |
| Surrogate: 1,4-Difluorobenzene | 93.1 | | 70-130 | % | 13-DEC-12 | | | | |
| **Hydrocarbons** | | | | | | | | | |
| F1 (C6-C10) | <25 | | 25 | ug/L | 13-DEC-12 | | | | |
| F1-BTEX | <25 | | 25 | ug/L | 13-DEC-12 | | | | |
| F2 (C10-C16) | <100 | | 100 | ug/L | 13-DEC-12 | | | | |
| F3 (C16-C34) | <250 | | 250 | ug/L | 13-DEC-12 | | | | |
| F4 (C34-C50) | <250 | | 250 | ug/L | 13-DEC-12 | | | | |
| Total Hydrocarbons (C6-C50) | <250 | | 250 | ug/L | 13-DEC-12 | | | | |
| Chrom. to baseline at nC50 | YES | | | No Unit | 13-DEC-12 | | | | |
| Surrogate: 2-Bromobenzotrifluoride | 63.0 | | 60-140 | % | 13-DEC-12 | | | | |
| Surrogate: 3,4-Dichlorotoluene | 70.3 | | 60-140 | % | 13-DEC-12 | | | | |
| Surrogate: Octacosane | 93.1 | | 60-140 | % | 13-DEC-12 | | | | |
| L1248030-3 MW3 | | | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 12:00 | | | | | | | | | |
| Matrix: WATER | | | | | | #1 | #2 | #3 | #4 |
| **Metals** | | | | | | | | | |
| Sodium Adsorption Ratio | 0.56 | | 0.030 | SAR | 14-DEC-12 | 5 | 5 | 12 | 12 |
| **Dissolved Metals** | | | | | | | | | |
| Antimony (Sb) | <0.50 | SFPL | 0.50 | ug/L | 12-DEC-12 | | | | |
| Arsenic (As) | 1.4 | SFPL | 1.0 | ug/L | 12-DEC-12 | | | | |
| Barium (Ba) | 189 | SFPL | 2.0 | ug/L | 12-DEC-12 | | | | |
| Beryllium (Be) | <0.50 | SFPL | 0.50 | ug/L | 12-DEC-12 | | | | |
| Boron (B) | 57 | SFPL | 10 | ug/L | 12-DEC-12 | | | | |
| Cadmium (Cd) | <0.10 | SFPL | 0.10 | ug/L | 12-DEC-12 | | | | |
| Calcium (Ca)-Dissolved | 105 | SFPL | 0.50 | mg/L | 12-DEC-12 | | | | |
| Chromium (Cr) | <0.50 | SFPL | 0.50 | ug/L | 12-DEC-12 | | | | |
| Cobalt (Co) | 1.50 | SFPL | 0.50 | ug/L | 12-DEC-12 | | | | |
| Copper (Cu) | <1.0 | SFPL | 1.0 | ug/L | 12-DEC-12 | | | | |
| Lead (Pb) | <1.0 | SFPL | 1.0 | ug/L | 12-DEC-12 | | | | |
| Magnesium (Mg)-Dissolved | 25.9 | SFPL | 0.50 | mg/L | 12-DEC-12 | | | | |
| Molybdenum (Mo) | 1.76 | SFPL | 0.50 | ug/L | 12-DEC-12 | | | | |
| Nickel (Ni) | 2.6 | SFPL | 1.0 | ug/L | 12-DEC-12 | | | | |
| Selenium (Se) | <5.0 | SFPL | 5.0 | ug/L | 12-DEC-12 | | | | |
| Silver (Ag) | <0.10 | SFPL | 0.10 | ug/L | 12-DEC-12 | | | | |
| Sodium (Na) | 24800 | SFPL | 500 | ug/L | 12-DEC-12 | | | | |
| Thallium (Tl) | <0.30 | SFPL | 0.30 | ug/L | 12-DEC-12 | | | | |
| Uranium (U) | 2.5 | SFPL | 2.0 | ug/L | 12-DEC-12 | | | | |
| Vanadium (V) | 0.94 | SFPL | 0.50 | ug/L | 12-DEC-12 | | | | |

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

**Ontario Regulation 153/04 - April 15, 2011 Standards = [Suite] - T2-All-Soil-Categories**

**#1: T2-Soil-Agricultural or Other Property Use (Coarse)**
**#2: T2-Soil-Agricultural or Other Property Use (Fine)**
**#3: T2-Soil-Ind/Com/Commu Property Use (Coarse)**
**#4: T2-Soil-Ind/Com/Commu Property Use (Fine)**

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## ANALYTICAL GUIDELINE REPORT

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| Sample Details Grouping / Analyte | Result | Qualifier | D.L. | Units | Analyzed | Guideline Limits #1 | #2 | #3 | #4 |
|---|---|---|---|---|---|---|---|---|---|
| L1248030-3 MW3 | | | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 12:00 | | | | | | | | | |
| Matrix: WATER | | | | | | | | | |
| **Dissolved Metals** | | | | | | | | | |
| Zinc (Zn) | <3.0 | SFPL | 3.0 | ug/L | 12-DEC-12 | | | | |
| **Volatile Organic Compounds** | | | | | | | | | |
| Acetone | <30 | | 30 | ug/L | 13-DEC-12 | | | | |
| Benzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Bromodichloromethane | <2.0 | | 2.0 | ug/L | 13-DEC-12 | | | | |
| Bromoform | <5.0 | | 5.0 | ug/L | 13-DEC-12 | | | | |
| Bromomethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Carbon tetrachloride | <0.20 | | 0.20 | ug/L | 13-DEC-12 | | | | |
| Chlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Dibromochloromethane | <2.0 | | 2.0 | ug/L | 13-DEC-12 | | | | |
| Chloroform | <1.0 | | 1.0 | ug/L | 13-DEC-12 | | | | |
| 1,2-Dibromoethane | <0.20 | | 0.20 | ug/L | 13-DEC-12 | | | | |
| 1,2-Dichlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,3-Dichlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,4-Dichlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Dichlorodifluoromethane | <2.0 | | 2.0 | ug/L | 13-DEC-12 | | | | |
| 1,1-Dichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,2-Dichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,1-Dichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| cis-1,2-Dichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| trans-1,2-Dichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,3-Dichloropropene (cis & trans) | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Methylene Chloride | <5.0 | | 5.0 | ug/L | 13-DEC-12 | | | | |
| 1,2-Dichloropropane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| cis-1,3-Dichloropropene | <0.30 | | 0.30 | ug/L | 13-DEC-12 | | | | |
| trans-1,3-Dichloropropene | <0.30 | | 0.30 | ug/L | 13-DEC-12 | | | | |
| Ethyl Benzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| n-Hexane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Methyl Ethyl Ketone | <20 | | 20 | ug/L | 13-DEC-12 | | | | |
| Methyl Isobutyl Ketone | <20 | | 20 | ug/L | 13-DEC-12 | | | | |
| MTBE | <2.0 | | 2.0 | ug/L | 13-DEC-12 | | | | |
| Styrene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,1,1,2-Tetrachloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,1,2,2-Tetrachloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Tetrachloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Toluene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,1,1-Trichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| 1,1,2-Trichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Trichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Trichlorofluoromethane | <5.0 | | 5.0 | ug/L | 13-DEC-12 | | | | |
| Vinyl chloride | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| o-Xylene | <0.35 | | 0.35 | ug/L | 13-DEC-12 | | | | |
| m+p-Xylenes | <0.35 | | 0.35 | ug/L | 13-DEC-12 | | | | |
| Xylenes (Total) | <0.50 | | 0.50 | ug/L | 13-DEC-12 | | | | |
| Surrogate: 4-Bromofluorobenzene | 83.0 | | 70-130 | % | 13-DEC-12 | | | | |
| Surrogate: 1,4-Difluorobenzene | 93.5 | | 70-130 | % | 13-DEC-12 | | | | |
| **Hydrocarbons** | | | | | | | | | |
| F1 (C6-C10) | <25 | | 25 | ug/L | 13-DEC-12 | | | | |

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

**Ontario Regulation 153/04 - April 15, 2011 Standards = [Suite] - T2-All-Soil-Categories**

**#1: T2-Soil-Agricultural or Other Property Use (Coarse)**

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**#3: T2-Soil-Ind/Com/Commu Property Use (Coarse)**

**#4: T2-Soil-Ind/Com/Commu Property Use (Fine)**

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| Sample Details Grouping / Analyte | Result | Qualifier | D.L. | Units | Analyzed | Guideline Limits #1 | #2 | #3 | #4 |
|---|---|---|---|---|---|---|---|---|---|
| L1248030-3 MW3 | | | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 12:00 | | | | | | | | | |
| Matrix: WATER | | | | | | | | | |
| **Hydrocarbons** | | | | | | | | | |
| F1-BTEX | <25 | | 25 | ug/L | 13-DEC-12 | | | | |
| Surrogate: 3,4-Dichlorotoluene | 77.6 | | 60-140 | % | 13-DEC-12 | | | | |
| L1248030-4 BH3 - 1.5 | | | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 12:00 | | | | | | | | | |
| Matrix: SOIL | | | | | | #1 | #2 | #3 | #4 |
| **Physical Tests** | | | | | | | | | |
| % Moisture | 17.9 | | 0.10 | % | 11-DEC-12 | | | | |
| **Saturated Paste Extractables** | | | | | | | | | |
| SAR | 0.87 | | 0.10 | SAR | 12-DEC-12 | 5 | 5 | 12 | 12 |
| Calcium (Ca) | 18.4 | | 0.10 | mg/L | 12-DEC-12 | | | | |
| Magnesium (Mg) | 1.62 | | 0.10 | mg/L | 12-DEC-12 | | | | |
| Sodium (Na) | 14.4 | | 0.10 | mg/L | 12-DEC-12 | | | | |
| **Metals** | | | | | | | | | |
| Antimony (Sb) | <1.0 | | 1.0 | ug/g | 12-DEC-12 | 7.5 | 7.5 | 40 | 50 |
| Arsenic (As) | 2.2 | | 1.0 | ug/g | 12-DEC-12 | 11 | 11 | 18 | 18 |
| Barium (Ba) | 62.2 | | 1.0 | ug/g | 12-DEC-12 | 390 | 390 | 670 | 670 |
| Beryllium (Be) | 0.52 | | 0.50 | ug/g | 12-DEC-12 | 4 | 5 | 8 | 10 |
| Boron (B) | 8.0 | | 5.0 | ug/g | 12-DEC-12 | 120 | 120 | 120 | 120 |
| Cadmium (Cd) | <0.50 | | 0.50 | ug/g | 12-DEC-12 | 1 | 1 | 1.9 | 1.9 |
| Chromium (Cr) | 21.3 | | 1.0 | ug/g | 12-DEC-12 | 160 | 160 | 160 | 160 |
| Cobalt (Co) | 8.1 | | 1.0 | ug/g | 12-DEC-12 | 22 | 22 | 80 | 100 |
| Copper (Cu) | 18.7 | | 1.0 | ug/g | 12-DEC-12 | 140 | 180 | 230 | 300 |
| Lead (Pb) | 16.0 | | 1.0 | ug/g | 12-DEC-12 | 45 | 45 | 120 | 120 |
| Molybdenum (Mo) | <1.0 | | 1.0 | ug/g | 12-DEC-12 | 6.9 | 6.9 | 40 | 40 |
| Nickel (Ni) | 19.0 | | 1.0 | ug/g | 12-DEC-12 | 100 | 130 | 270 | 340 |
| Selenium (Se) | <1.0 | | 1.0 | ug/g | 12-DEC-12 | 2.4 | 2.4 | 5.5 | 5.5 |
| Silver (Ag) | <0.20 | | 0.20 | ug/g | 12-DEC-12 | 20 | 25 | 40 | 50 |
| Thallium (Tl) | <0.50 | | 0.50 | ug/g | 12-DEC-12 | 1 | 1 | 3.3 | 3.3 |
| Uranium (U) | <1.0 | | 1.0 | ug/g | 12-DEC-12 | 23 | 23 | 33 | 33 |
| Vanadium (V) | 31.0 | | 1.0 | ug/g | 12-DEC-12 | 86 | 86 | 86 | 86 |
| Zinc (Zn) | 53.8 | | 5.0 | ug/g | 12-DEC-12 | 340 | 340 | 340 | 340 |
| **Hydrocarbons** | | | | | | | | | |
| F2 (C10-C16) | <10 | | 10 | ug/g | 14-DEC-12 | 98 | 150 | 230 | 250 |
| F3 (C16-C34) | <50 | | 50 | ug/g | 14-DEC-12 | 300 | 1300 | 1700 | 2500 |
| F4 (C34-C50) | 57 | | 50 | ug/g | 14-DEC-12 | 2800 | 5600 | 3300 | 6600 |
| Chrom. to baseline at nC50 | YES | | | No Unit | 14-DEC-12 | | | | |
| Surrogate: 2-Bromobenzotrifluoride | 73.4 | | 60-140 | % | 14-DEC-12 | | | | |
| Surrogate: Octacosane | 100.9 | | 60-140 | % | 14-DEC-12 | | | | |
| L1248030-5 BH4 - 1.5 | | | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 12:00 | | | | | | | | | |
| Matrix: SOIL | | | | | | #1 | #2 | #3 | #4 |
| **Saturated Paste Extractables** | | | | | | | | | |

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

**Ontario Regulation 153/04 - April 15, 2011 Standards = [Suite] - T2-All-Soil-Categories**

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# ANALYTICAL GUIDELINE REPORT

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| Sample Details Grouping / Analyte | Result | Qualifier | D.L. | Units | Analyzed | Guideline Limits #1 | #2 | #3 | #4 |
|---|---|---|---|---|---|---|---|---|---|
| L1248030-5 BH4 - 1.5 | | | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 12:00 | | | | | | | | | |
| Matrix: SOIL | | | | | | | | | |
| **Saturated Paste Extractables** | | | | | | | | | |
| SAR | 0.41 | | 0.10 | SAR | 12-DEC-12 | 5 | 5 | 12 | 12 |
| Calcium (Ca) | 9.91 | | 0.10 | mg/L | 12-DEC-12 | | | | |
| Magnesium (Mg) | 0.84 | | 0.10 | mg/L | 12-DEC-12 | | | | |
| Sodium (Na) | 5.02 | | 0.10 | mg/L | 12-DEC-12 | | | | |
| **Metals** | | | | | | | | | |
| Antimony (Sb) | <1.0 | | 1.0 | ug/g | 12-DEC-12 | 7.5 | 7.5 | 40 | 50 |
| Arsenic (As) | 3.6 | | 1.0 | ug/g | 12-DEC-12 | 11 | 11 | 18 | 18 |
| Barium (Ba) | 96.7 | | 1.0 | ug/g | 12-DEC-12 | 390 | 390 | 670 | 670 |
| Beryllium (Be) | 0.67 | | 0.50 | ug/g | 12-DEC-12 | 4 | 5 | 8 | 10 |
| Boron (B) | 8.3 | | 5.0 | ug/g | 12-DEC-12 | 120 | 120 | 120 | 120 |
| Cadmium (Cd) | <0.50 | | 0.50 | ug/g | 12-DEC-12 | 1 | 1 | 1.9 | 1.9 |
| Chromium (Cr) | 27.0 | | 1.0 | ug/g | 12-DEC-12 | 160 | 160 | 160 | 160 |
| Cobalt (Co) | 8.6 | | 1.0 | ug/g | 12-DEC-12 | 22 | 22 | 80 | 100 |
| Copper (Cu) | 17.7 | | 1.0 | ug/g | 12-DEC-12 | 140 | 180 | 230 | 300 |
| Lead (Pb) | 10.3 | | 1.0 | ug/g | 12-DEC-12 | 45 | 45 | 120 | 120 |
| Molybdenum (Mo) | <1.0 | | 1.0 | ug/g | 12-DEC-12 | 6.9 | 6.9 | 40 | 40 |
| Nickel (Ni) | 20.7 | | 1.0 | ug/g | 12-DEC-12 | 100 | 130 | 270 | 340 |
| Selenium (Se) | <1.0 | | 1.0 | ug/g | 12-DEC-12 | 2.4 | 2.4 | 5.5 | 5.5 |
| Silver (Ag) | <0.20 | | 0.20 | ug/g | 12-DEC-12 | 20 | 25 | 40 | 50 |
| Thallium (Tl) | <0.50 | | 0.50 | ug/g | 12-DEC-12 | 1 | 1 | 3.3 | 3.3 |
| Uranium (U) | <1.0 | | 1.0 | ug/g | 12-DEC-12 | 23 | 23 | 33 | 33 |
| Vanadium (V) | 41.5 | | 1.0 | ug/g | 12-DEC-12 | 86 | 86 | 86 | 86 |
| Zinc (Zn) | 45.7 | | 5.0 | ug/g | 12-DEC-12 | 340 | 340 | 340 | 340 |
| L1248030-6 BH5 - 1.5 | | | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 13:00 | | | | | | | | | |
| Matrix: SOIL | | | | | | #1 | #2 | #3 | #4 |
| **Physical Tests** | | | | | | | | | |
| % Moisture | 14.8 | | 0.10 | % | 11-DEC-12 | | | | |
| **Volatile Organic Compounds** | | | | | | | | | |
| Acetone | <0.50 | | 0.50 | ug/g | 13-DEC-12 | 16 | 28 | 16 | 28 |
| Benzene | <0.020 | | 0.020 | ug/g | 13-DEC-12 | 0.21 | 0.17 | 0.32 | 0.4 |
| Bromodichloromethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 1.5 | 1.9 | 1.5 | 1.9 |
| Bromoform | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 0.27 | 0.26 | 0.61 | 1.7 |
| Bromomethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 0.05 | 0.05 | 0.05 | 0.05 |
| Carbon tetrachloride | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 0.05 | 0.12 | 0.21 | 0.71 |
| Chlorobenzene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 2.4 | 2.7 | 2.4 | 2.7 |
| Dibromochloromethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 2.3 | 2.9 | 2.3 | 2.9 |
| Chloroform | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 0.05 | 0.17 | 0.47 | 0.18 |
| 1,2-Dibromoethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 0.05 | 0.05 | 0.05 | 0.05 |
| 1,2-Dichlorobenzene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 1.2 | 1.7 | 1.2 | 1.7 |
| 1,3-Dichlorobenzene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 4.8 | 6 | 9.6 | 12 |
| 1,4-Dichlorobenzene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 0.083 | 0.097 | 0.2 | 0.57 |
| Dichlorodifluoromethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 16 | 25 | 16 | 25 |

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
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# ANALYTICAL GUIDELINE REPORT

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| Sample Details Grouping / Analyte | Result | Qualifier | D.L. | Units | Analyzed | Guideline Limits #1 | #2 | #3 | #4 |
|---|---|---|---|---|---|---|---|---|---|
| L1248030-6 BH5 - 1.5 | | | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 13:00 | | | | | | | | | |
| Matrix: SOIL | | | | | | | | | |
| **Volatile Organic Compounds** | | | | | | | | | |
| 1,1-Dichloroethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 0.47 | 0.6 | 0.47 | 0.6 |
| 1,2-Dichloroethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 0.05 | 0.05 | 0.05 | 0.05 |
| 1,1-Dichloroethylene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 0.05 | 0.05 | 0.064 | 0.48 |
| cis-1,2-Dichloroethylene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 1.9 | 2.5 | 1.9 | 2.5 |
| trans-1,2-Dichloroethylene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 0.084 | 0.75 | 1.3 | 2.5 |
| 1,3-Dichloropropene (cis & trans) | <0.042 | | 0.042 | ug/g | 13-DEC-12 | 0.05 | 0.081 | 0.059 | 0.081 |
| Methylene Chloride | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 0.1 | 0.96 | 1.6 | 2 |
| 1,2-Dichloropropane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 0.05 | 0.085 | 0.16 | 0.68 |
| cis-1,3-Dichloropropene | <0.030 | | 0.030 | ug/g | 13-DEC-12 | | | | |
| trans-1,3-Dichloropropene | <0.030 | | 0.030 | ug/g | 13-DEC-12 | | | | |
| Ethyl Benzene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 1.1 | 1.6 | 1.1 | 1.6 |
| n-Hexane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 2.8 | 34 | 46 | 88 |
| Methyl Ethyl Ketone | <0.50 | | 0.50 | ug/g | 13-DEC-12 | 16 | 44 | 70 | 88 |
| Methyl Isobutyl Ketone | <0.50 | | 0.50 | ug/g | 13-DEC-12 | 1.7 | 4.3 | 31 | 210 |
| MTBE | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 0.75 | 1.4 | 1.6 | 2.3 |
| Styrene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 0.7 | 2.2 | 34 | 43 |
| 1,1,1,2-Tetrachloroethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 0.058 | 0.05 | 0.087 | 0.11 |
| 1,1,2,2-Tetrachloroethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 0.05 | 0.05 | 0.05 | 0.094 |
| Tetrachloroethylene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 0.28 | 2.3 | 1.9 | 2.5 |
| Toluene | <0.20 | | 0.20 | ug/g | 13-DEC-12 | 2.3 | 6 | 6.4 | 9 |
| 1,1,1-Trichloroethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 0.38 | 3.4 | 6.1 | 12 |
| 1,1,2-Trichloroethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 0.05 | 0.05 | 0.05 | 0.11 |
| Trichloroethylene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 0.061 | 0.52 | 0.55 | 0.61 |
| Trichlorofluoromethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 4 | 5.8 | 4 | 5.8 |
| Vinyl chloride | <0.020 | | 0.020 | ug/g | 13-DEC-12 | 0.02 | 0.022 | 0.032 | 0.25 |
| o-Xylene | <0.020 | | 0.020 | ug/g | 13-DEC-12 | | | | |
| m+p-Xylenes | <0.030 | | 0.030 | ug/g | 13-DEC-12 | | | | |
| Xylenes (Total) | <0.050 | | 0.050 | ug/g | 13-DEC-12 | 3.1 | 25 | 26 | 30 |
| Surrogate: 4-Bromofluorobenzene | 76.2 | | 70-130 | % | 13-DEC-12 | | | | |
| Surrogate: 1,4-Difluorobenzene | 87.9 | | 70-130 | % | 13-DEC-12 | | | | |
| **Hydrocarbons** | | | | | | | | | |
| F1 (C6-C10) | <5.0 | | 5.0 | ug/g | 13-DEC-12 | 55 | 65 | 55 | 65 |
| Surrogate: 3,4-Dichlorotoluene | 91.3 | | 60-140 | % | 13-DEC-12 | | | | |

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

**Ontario Regulation 153/04 - April 15, 2011 Standards = [Suite] - T2-All-Soil-Categories**

**#1: T2-Soil-Agricultural or Other Property Use (Coarse)**

**#2: T2-Soil-Agricultural or Other Property Use (Fine)**

**#3: T2-Soil-Ind/Com/Commu Property Use (Coarse)**

**#4: T2-Soil-Ind/Com/Commu Property Use (Fine)**

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# Reference Information

**Sample Parameter Qualifier key listed:**

| Qualifier | Description |
|---|---|
| SFPL | Sample was Filtered and Preserved at the laboratory |

**Methods Listed (if applicable):**

| ALS Test Code | Matrix | Test Description | Method Reference*** |
|---|---|---|---|
| CA-DIS-WT | Water | Calcium (Ca) - Dissolved | EPA 200.8 |
| ETL-SAR-CALC-WT | Water | Sodium Adsorption Ratio | Calculation |
| F1-F4-511-CALC-WT | Water | F1-F4 Hydrocarbon Calculated Parameters | CCME CWS-PHC DEC-2000 - PUB# 1310-L |

Analytical methods used for analysis of CCME Petroleum Hydrocarbons have been validated and comply with the Reference Method for the CWS PHC.

In cases where results for both F4 and F4G are reported, the greater of the two results must be used in any application of the CWS PHC guidelines and the gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
In samples where BTEX and F1 were analyzed , F1-BTEX represents a value where the sum of Benzene, Toluene, Ethylbenzene and total Xylenes has been subtracted from F1.

In samples where PAHs, F2 and F3 were analyzed, F2-Naphth represents the result where Naphthalene has been subtracted from F2. F3-PAH represents a result where the sum of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene has been subtracted from F3.

Unless otherwise qualified, the following quality control criteria have been met for the F1 hydrocarbon range:
1. All extraction and analysis holding times were met.
2. Instrument performance showing response factors for C6 and C10 within 30% of the response factor for toluene.
3. Linearity of gasoline response within 15% throughout the calibration range.

Unless otherwise qualified, the following quality control criteria have been met for the F2-F4 hydrocarbon ranges:
1. All extraction and analysis holding times were met.
2. Instrument performance showing C10, C16 and C34 response factors within 10% of their average.
3. Instrument performance showing the C50 response factor within 30% of the average of the C10, C16 and C34 response factors.
4. Linearity of diesel or motor oil response within 15% throughout the calibration range.

| | | | |
|---|---|---|---|
| F1-F4-511-CALC-WT | Soil | F1-F4 Hydrocarbon Calculated Parameters | CCME CWS-PHC DEC-2000 - PUB# 1310-S |

Analytical methods used for analysis of CCME Petroleum Hydrocarbons have been validated and comply with the Reference Method for the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

In cases where results for both F4 and F4G are reported, the greater of the two results must be used in any application of the CWS PHC guidelines and the gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
In samples where BTEX and F1 were analyzed , F1-BTEX represents a value where the sum of Benzene, Toluene, Ethylbenzene and total Xylenes has been subtracted from F1.

In samples where PAHs, F2 and F3 were analyzed, F2-Naphth represents the result where Naphthalene has been subtracted from F2. F3-PAH represents a result where the sum of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene has been subtracted from F3.

Unless otherwise qualified, the following quality control criteria have been met for the F1 hydrocarbon range:
1. All extraction and analysis holding times were met.
2. Instrument performance showing response factors for C6 and C10 within 30% of the response factor for toluene.
3. Linearity of gasoline response within 15% throughout the calibration range.

Unless otherwise qualified, the following quality control criteria have been met for the F2-F4 hydrocarbon ranges:
1. All extraction and analysis holding times were met.
2. Instrument performance showing C10, C16 and C34 response factors within 10% of their average.
3. Instrument performance showing the C50 response factor within 30% of the average of the C10, C16 and C34 response factors.
4. Linearity of diesel or motor oil response within 15% throughout the calibration range.

| | | | |
|---|---|---|---|
| F1-HS-511-WT | Water | F1-O.Reg 153/04 (July 2011) | E3398/CCME TIER 1-HS |

Fraction F1 is determined by analyzing by headspace-GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

| | | | |
|---|---|---|---|
| F1-HS-511-WT | Soil | F1-O.Reg 153/04 (July 2011) | E3398/CCME TIER 1-HS |

Fraction F1 is determined by extracting a soil or sediment sample as received with methanol, then analyzing by headspace-GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

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## Reference Information

| | | | |
|---|---|---|---|
| F2-F4-511-WT | Water | F2-F4-O.Reg 153/04 (July 2011) | MOE DECPH-E3398/CCME TIER 1 |

Fractions F2, F3 and F4 are determined by liquid/liquid extraction with a solvent. The solvent recovered from the extracted sample is dried and treated to remove polar material. The extract is then analyzed by GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

| | | | |
|---|---|---|---|
| F2-F4-511-WT | Soil | F2-F4-O.Reg 153/04 (July 2011) | MOE DECPH-E3398/CCME TIER 1 |

Fractions F2, F3 and F4 are determined by extracting a soil sample with a solvent mix. The solvent recovered from the extracted soil sample is dried and treated to remove polar material. The extract is analyzed by GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

| | | | |
|---|---|---|---|
| MET-R511-WT | Water | Metals (O. Reg 153/04, 511 Amendments) | EPA 200.8 |

Ground water samples are filtered and preserved and analyzed by ICP/MS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

| | | | |
|---|---|---|---|
| MET-UG/G-CCMS-WT | Soil | Metal Scan Collision Cell ICPMS | EPA 200.2/6020A |

Sample is vigorously digested with nitric and hydrochloric acid. Analysis is conducted by ICP/MS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

| | | | |
|---|---|---|---|
| MG-DIS-WT | Water | Magnesium (Mg) - Dissolved | EPA 200.8 |
| MOISTURE-WT | Soil | % Moisture | Gravimetric: Oven Dried |
| SAR-R511-WT | Soil | SAR-O.Reg 153/04 (July 2011) | SW846 6010C |

A dried, disaggregated solid sample is extracted with deionized water, the aqueous extract is separated from the solid, acidified and then analyzed using a ICP/OES.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

| | | | |
|---|---|---|---|
| VOC-1,3-DCP-CALC-WT | Water | Regulation 153 VOCs | SW8260B/SW8270C |
| VOC-1,3-DCP-CALC-WT | Soil | Regulation 153 VOCs | SW8260B/SW8270C |
| VOC-511-HS-WT | Water | VOC by GCMS HS O.Reg 153/04 (July 2011) | SW846 8260 |

Liquid samples are analyzed by headspace GC/MSD.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

| | | | |
|---|---|---|---|
| VOC-511-HS-WT | Water | VOC-O.Reg 153/04 (July 2011) | SW846 8260 |

Liquid samples are analyzed by headspace GC/MSD.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

| | | | |
|---|---|---|---|
| VOC-511-HS-WT | Soil | VOC-O.Reg 153/04 (July 2011) | SW846 8260 (511) |

Soil and sediment samples are extracted in methanol and analyzed by headspace-GC/MS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

*** ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody numbers:

131054

*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:*

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## Reference Information

| Laboratory Definition Code | Laboratory Location | Laboratory Definition Code | Laboratory Location |
|---|---|---|---|
| WT | ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA | | |

**GLOSSARY OF REPORT TERMS**

*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.*

*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.*

*Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information.*

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# ANALYTICAL GUIDELINE REPORT

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| Sample Details Grouping / Analyte | Result | Qualifier | D.L. | Units | Analyzed | Guideline Limits #1 | #2 |
|---|---|---|---|---|---|---|---|
| L1248030-1 MW1 | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 12:00 | | | | | | | |
| Matrix: WATER | | | | | | | |
| **Volatile Organic Compounds** | | | | | | | |
| Acetone | 88 | | 30 | ug/L | 13-DEC-12 | 2700 | 2700 |
| Benzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 5 | 5 |
| Bromodichloromethane | <2.0 | | 2.0 | ug/L | 13-DEC-12 | 16 | 16 |
| Bromoform | <5.0 | | 5.0 | ug/L | 13-DEC-12 | 25 | 25 |
| Bromomethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 0.89 | 0.89 |
| Carbon tetrachloride | <0.20 | | 0.20 | ug/L | 13-DEC-12 | 0.79 | 5 |
| Chlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 30 | 30 |
| Dibromochloromethane | <2.0 | | 2.0 | ug/L | 13-DEC-12 | 25 | 25 |
| Chloroform | <1.0 | | 1.0 | ug/L | 13-DEC-12 | 2.4 | 22 |
| 1,2-Dibromoethane | <0.20 | | 0.20 | ug/L | 13-DEC-12 | 0.2 | 0.2 |
| 1,2-Dichlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 3 | 3 |
| 1,3-Dichlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 59 | 59 |
| 1,4-Dichlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1 | 1 |
| Dichlorodifluoromethane | <2.0 | | 2.0 | ug/L | 13-DEC-12 | 590 | 590 |
| 1,1-Dichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 5 | 5 |
| 1,2-Dichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1.6 | 5 |
| 1,1-Dichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1.6 | 14 |
| cis-1,2-Dichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1.6 | 17 |
| trans-1,2-Dichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1.6 | 17 |
| 1,3-Dichloropropene (cis & trans) | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 0.5 | 0.5 |
| Methylene Chloride | <5.0 | | 5.0 | ug/L | 13-DEC-12 | 50 | 50 |
| 1,2-Dichloropropane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 5 | 5 |
| cis-1,3-Dichloropropene | <0.30 | | 0.30 | ug/L | 13-DEC-12 | | |
| trans-1,3-Dichloropropene | <0.30 | | 0.30 | ug/L | 13-DEC-12 | | |
| Ethyl Benzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 2.4 | 2.4 |
| n-Hexane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 51 | 520 |
| Methyl Ethyl Ketone | <20 | | 20 | ug/L | 13-DEC-12 | 1800 | 1800 |
| Methyl Isobutyl Ketone | <20 | | 20 | ug/L | 13-DEC-12 | 640 | 640 |
| MTBE | <2.0 | | 2.0 | ug/L | 13-DEC-12 | 15 | 15 |
| Styrene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 5.4 | 5.4 |
| 1,1,1,2-Tetrachloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1.1 | 1.1 |
| 1,1,2,2-Tetrachloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1 | 1 |
| Tetrachloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1.6 | 17 |
| Toluene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 24 | 24 |
| 1,1,1-Trichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 200 | 200 |
| 1,1,2-Trichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 4.7 | 5 |
| Trichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1.6 | 5 |
| Trichlorofluoromethane | <5.0 | | 5.0 | ug/L | 13-DEC-12 | 150 | 150 |
| Vinyl chloride | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 0.5 | 1.7 |
| o-Xylene | <0.35 | | 0.35 | ug/L | 13-DEC-12 | | |
| m+p-Xylenes | <0.35 | | 0.35 | ug/L | 13-DEC-12 | | |
| Xylenes (Total) | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 300 | 300 |
| Surrogate: 4-Bromofluorobenzene | 83.1 | | 70-130 | % | 13-DEC-12 | | |
| Surrogate: 1,4-Difluorobenzene | 93.6 | | 70-130 | % | 13-DEC-12 | | |

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

**Ontario Regulation 153/04 - April 15, 2011 Standards = [Suite] - T2-POTABLE-GROUNDWATER-ALL-TYPES-OF-PROPERTY-USE**

**#1: T2-Ground Water (Coarse Soil)-All Types of Property Use** **#2: T2-Ground Water (Fine Soil)-All Types of Property Use**

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## ANALYTICAL GUIDELINE REPORT

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| Sample Details Grouping / Analyte | Result | Qualifier | D.L. | Units | Analyzed | Guideline Limits #1 | #2 |
|---|---|---|---|---|---|---|---|
| L1248030-1 MW1 | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 12:00 | | | | | | | |
| Matrix: WATER | | | | | | | |
| **Hydrocarbons** | | | | | | | |
| F1 (C6-C10) | <25 | | 25 | ug/L | 13-DEC-12 | 750 | 750 |
| F1-BTEX | <25 | | 25 | ug/L | 13-DEC-12 | 750 | 750 |
| F2 (C10-C16) | <100 | | 100 | ug/L | 13-DEC-12 | 150 | 150 |
| F3 (C16-C34) | <250 | | 250 | ug/L | 13-DEC-12 | 500 | 500 |
| F4 (C34-C50) | <250 | | 250 | ug/L | 13-DEC-12 | 500 | 500 |
| Total Hydrocarbons (C6-C50) | <250 | | 250 | ug/L | 13-DEC-12 | | |
| Chrom. to baseline at nC50 | YES | | | No Unit | 13-DEC-12 | | |
| Surrogate: 2-Bromobenzotrifluoride | 61.3 | | 60-140 | % | 13-DEC-12 | | |
| Surrogate: 3,4-Dichlorotoluene | 72.6 | | 60-140 | % | 13-DEC-12 | | |
| Surrogate: Octacosane | 91.0 | | 60-140 | % | 13-DEC-12 | | |
| L1248030-2 MW2 | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 12:00 | | | | | | | |
| Matrix: WATER | | | | | | | |
| **Volatile Organic Compounds** | | | | | | | |
| Acetone | <30 | | 30 | ug/L | 13-DEC-12 | 2700 | 2700 |
| Benzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 5 | 5 |
| Bromodichloromethane | <2.0 | | 2.0 | ug/L | 13-DEC-12 | 16 | 16 |
| Bromoform | <5.0 | | 5.0 | ug/L | 13-DEC-12 | 25 | 25 |
| Bromomethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 0.89 | 0.89 |
| Carbon tetrachloride | <0.20 | | 0.20 | ug/L | 13-DEC-12 | 0.79 | 5 |
| Chlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 30 | 30 |
| Dibromochloromethane | <2.0 | | 2.0 | ug/L | 13-DEC-12 | 25 | 25 |
| Chloroform | <1.0 | | 1.0 | ug/L | 13-DEC-12 | 2.4 | 22 |
| 1,2-Dibromoethane | <0.20 | | 0.20 | ug/L | 13-DEC-12 | 0.2 | 0.2 |
| 1,2-Dichlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 3 | 3 |
| 1,3-Dichlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 59 | 59 |
| 1,4-Dichlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1 | 1 |
| Dichlorodifluoromethane | <2.0 | | 2.0 | ug/L | 13-DEC-12 | 590 | 590 |
| 1,1-Dichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 5 | 5 |
| 1,2-Dichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1.6 | 5 |
| 1,1-Dichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1.6 | 14 |
| cis-1,2-Dichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1.6 | 17 |
| trans-1,2-Dichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1.6 | 17 |
| 1,3-Dichloropropene (cis & trans) | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 0.5 | 0.5 |
| Methylene Chloride | <5.0 | | 5.0 | ug/L | 13-DEC-12 | 50 | 50 |
| 1,2-Dichloropropane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 5 | 5 |
| cis-1,3-Dichloropropene | <0.30 | | 0.30 | ug/L | 13-DEC-12 | | |
| trans-1,3-Dichloropropene | <0.30 | | 0.30 | ug/L | 13-DEC-12 | | |
| Ethyl Benzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 2.4 | 2.4 |
| n-Hexane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 51 | 520 |
| Methyl Ethyl Ketone | <20 | | 20 | ug/L | 13-DEC-12 | 1800 | 1800 |
| Methyl Isobutyl Ketone | <20 | | 20 | ug/L | 13-DEC-12 | 640 | 640 |
| MTBE | <2.0 | | 2.0 | ug/L | 13-DEC-12 | 15 | 15 |

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

**Ontario Regulation 153/04 - April 15, 2011 Standards = [Suite] - T2-POTABLE-GROUNDWATER-ALL-TYPES-OF-PROPERTY-USE**

**#1: T2-Ground Water (Coarse Soil)-All Types of Property Use** **#2: T2-Ground Water (Fine Soil)-All Types of Property Use**

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# ANALYTICAL GUIDELINE REPORT

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| Sample Details Grouping / Analyte | Result | Qualifier | D.L. | Units | Analyzed | Guideline Limits #1 | #2 |
|---|---|---|---|---|---|---|---|
| L1248030-2 MW2 | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 12:00 | | | | | | | |
| Matrix: WATER | | | | | | | |
| **Volatile Organic Compounds** | | | | | | | |
| Styrene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 5.4 | 5.4 |
| 1,1,1,2-Tetrachloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1.1 | 1.1 |
| 1,1,2,2-Tetrachloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1 | 1 |
| Tetrachloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1.6 | 17 |
| Toluene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 24 | 24 |
| 1,1,1-Trichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 200 | 200 |
| 1,1,2-Trichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 4.7 | 5 |
| Trichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1.6 | 5 |
| Trichlorofluoromethane | <5.0 | | 5.0 | ug/L | 13-DEC-12 | 150 | 150 |
| Vinyl chloride | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 0.5 | 1.7 |
| o-Xylene | <0.35 | | 0.35 | ug/L | 13-DEC-12 | | |
| m+p-Xylenes | <0.35 | | 0.35 | ug/L | 13-DEC-12 | | |
| Xylenes (Total) | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 300 | 300 |
| Surrogate: 4-Bromofluorobenzene | 82.4 | | 70-130 | % | 13-DEC-12 | | |
| Surrogate: 1,4-Difluorobenzene | 93.1 | | 70-130 | % | 13-DEC-12 | | |
| **Hydrocarbons** | | | | | | | |
| F1 (C6-C10) | <25 | | 25 | ug/L | 13-DEC-12 | 750 | 750 |
| F1-BTEX | <25 | | 25 | ug/L | 13-DEC-12 | 750 | 750 |
| F2 (C10-C16) | <100 | | 100 | ug/L | 13-DEC-12 | 150 | 150 |
| F3 (C16-C34) | <250 | | 250 | ug/L | 13-DEC-12 | 500 | 500 |
| F4 (C34-C50) | <250 | | 250 | ug/L | 13-DEC-12 | 500 | 500 |
| Total Hydrocarbons (C6-C50) | <250 | | 250 | ug/L | 13-DEC-12 | | |
| Chrom. to baseline at nC50 | YES | | | No Unit | 13-DEC-12 | | |
| Surrogate: 2-Bromobenzotrifluoride | 63.0 | | 60-140 | % | 13-DEC-12 | | |
| Surrogate: 3,4-Dichlorotoluene | 70.3 | | 60-140 | % | 13-DEC-12 | | |
| Surrogate: Octacosane | 93.1 | | 60-140 | % | 13-DEC-12 | | |
| L1248030-3 MW3 | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 12:00 | | | | | | | |
| Matrix: WATER | | | | | | | |
| **Metals** | | | | | | | |
| Sodium Adsorption Ratio | 0.56 | | 0.030 | SAR | 14-DEC-12 | | |
| **Dissolved Metals** | | | | | | | |
| Antimony (Sb) | <0.50 | SFPL | 0.50 | ug/L | 12-DEC-12 | 6 | 6 |
| Arsenic (As) | 1.4 | SFPL | 1.0 | ug/L | 12-DEC-12 | 25 | 25 |
| Barium (Ba) | 189 | SFPL | 2.0 | ug/L | 12-DEC-12 | 1000 | 1000 |
| Beryllium (Be) | <0.50 | SFPL | 0.50 | ug/L | 12-DEC-12 | 4 | 4 |
| Boron (B) | 57 | SFPL | 10 | ug/L | 12-DEC-12 | 5000 | 5000 |
| Cadmium (Cd) | <0.10 | SFPL | 0.10 | ug/L | 12-DEC-12 | 2.7 | 2.7 |
| Calcium (Ca)-Dissolved | 105 | SFPL | 0.50 | mg/L | 12-DEC-12 | | |
| Chromium (Cr) | <0.50 | SFPL | 0.50 | ug/L | 12-DEC-12 | 50 | 50 |
| Cobalt (Co) | 1.50 | SFPL | 0.50 | ug/L | 12-DEC-12 | 3.8 | 3.8 |
| Copper (Cu) | <1.0 | SFPL | 1.0 | ug/L | 12-DEC-12 | 87 | 87 |
| Lead (Pb) | <1.0 | SFPL | 1.0 | ug/L | 12-DEC-12 | 10 | 10 |
| Magnesium (Mg)-Dissolved | 25.9 | SFPL | 0.50 | mg/L | 12-DEC-12 | | |

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

**Ontario Regulation 153/04 - April 15, 2011 Standards = [Suite] - T2-POTABLE-GROUNDWATER-ALL-TYPES-OF-PROPERTY-USE**

**#1: T2-Ground Water (Coarse Soil)-All Types of Property Use** **#2: T2-Ground Water (Fine Soil)-All Types of Property Use**

ALS Environmental

# ANALYTICAL GUIDELINE REPORT

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| Sample Details Grouping / Analyte | Result | Qualifier | D.L. | Units | Analyzed | Guideline Limits #1 | Guideline Limits #2 |
|---|---|---|---|---|---|---|---|
| L1248030-3 MW3 | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 12:00 | | | | | | | |
| Matrix: WATER | | | | | | | |
| **Dissolved Metals** | | | | | | | |
| Molybdenum (Mo) | 1.76 | SFPL | 0.50 | ug/L | 12-DEC-12 | 70 | 70 |
| Nickel (Ni) | 2.6 | SFPL | 1.0 | ug/L | 12-DEC-12 | 100 | 100 |
| Selenium (Se) | <5.0 | SFPL | 5.0 | ug/L | 12-DEC-12 | 10 | 10 |
| Silver (Ag) | <0.10 | SFPL | 0.10 | ug/L | 12-DEC-12 | 1.5 | 1.5 |
| Sodium (Na) | 24800 | SFPL | 500 | ug/L | 12-DEC-12 | 490000 | 490000 |
| Thallium (Tl) | <0.30 | SFPL | 0.30 | ug/L | 12-DEC-12 | 2 | 2 |
| Uranium (U) | 2.5 | SFPL | 2.0 | ug/L | 12-DEC-12 | 20 | 20 |
| Vanadium (V) | 0.94 | SFPL | 0.50 | ug/L | 12-DEC-12 | 6.2 | 6.2 |
| Zinc (Zn) | <3.0 | SFPL | 3.0 | ug/L | 12-DEC-12 | 1100 | 1100 |
| **Volatile Organic Compounds** | | | | | | | |
| Acetone | <30 | | 30 | ug/L | 13-DEC-12 | 2700 | 2700 |
| Benzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 5 | 5 |
| Bromodichloromethane | <2.0 | | 2.0 | ug/L | 13-DEC-12 | 16 | 16 |
| Bromoform | <5.0 | | 5.0 | ug/L | 13-DEC-12 | 25 | 25 |
| Bromomethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 0.89 | 0.89 |
| Carbon tetrachloride | <0.20 | | 0.20 | ug/L | 13-DEC-12 | 0.79 | 5 |
| Chlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 30 | 30 |
| Dibromochloromethane | <2.0 | | 2.0 | ug/L | 13-DEC-12 | 25 | 25 |
| Chloroform | <1.0 | | 1.0 | ug/L | 13-DEC-12 | 2.4 | 22 |
| 1,2-Dibromoethane | <0.20 | | 0.20 | ug/L | 13-DEC-12 | 0.2 | 0.2 |
| 1,2-Dichlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 3 | 3 |
| 1,3-Dichlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 59 | 59 |
| 1,4-Dichlorobenzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1 | 1 |
| Dichlorodifluoromethane | <2.0 | | 2.0 | ug/L | 13-DEC-12 | 590 | 590 |
| 1,1-Dichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 5 | 5 |
| 1,2-Dichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1.6 | 5 |
| 1,1-Dichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1.6 | 14 |
| cis-1,2-Dichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1.6 | 17 |
| trans-1,2-Dichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1.6 | 17 |
| 1,3-Dichloropropene (cis & trans) | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 0.5 | 0.5 |
| Methylene Chloride | <5.0 | | 5.0 | ug/L | 13-DEC-12 | 50 | 50 |
| 1,2-Dichloropropane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 5 | 5 |
| cis-1,3-Dichloropropene | <0.30 | | 0.30 | ug/L | 13-DEC-12 | | |
| trans-1,3-Dichloropropene | <0.30 | | 0.30 | ug/L | 13-DEC-12 | | |
| Ethyl Benzene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 2.4 | 2.4 |
| n-Hexane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 51 | 520 |
| Methyl Ethyl Ketone | <20 | | 20 | ug/L | 13-DEC-12 | 1800 | 1800 |
| Methyl Isobutyl Ketone | <20 | | 20 | ug/L | 13-DEC-12 | 640 | 640 |
| MTBE | <2.0 | | 2.0 | ug/L | 13-DEC-12 | 15 | 15 |
| Styrene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 5.4 | 5.4 |
| 1,1,1,2-Tetrachloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1.1 | 1.1 |
| 1,1,2,2-Tetrachloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1 | 1 |
| Tetrachloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1.6 | 17 |
| Toluene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 24 | 24 |

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

**Ontario Regulation 153/04 - April 15, 2011 Standards = [Suite] - T2-POTABLE-GROUNDWATER-ALL-TYPES-OF-PROPERTY-USE**

**#1: T2-Ground Water (Coarse Soil)-All Types of Property Use** **#2: T2-Ground Water (Fine Soil)-All Types of Property Use**

Environmental

# ANALYTICAL GUIDELINE REPORT

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| Sample Details Grouping / Analyte | Result | Qualifier | D.L. | Units | Analyzed | Guideline Limits #1 | #2 |
|---|---|---|---|---|---|---|---|
| L1248030-3 MW3 | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 12:00 | | | | | | | |
| Matrix: WATER | | | | | | | |
| **Volatile Organic Compounds** | | | | | | | |
| 1,1,1-Trichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 200 | 200 |
| 1,1,2-Trichloroethane | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 4.7 | 5 |
| Trichloroethylene | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 1.6 | 5 |
| Trichlorofluoromethane | <5.0 | | 5.0 | ug/L | 13-DEC-12 | 150 | 150 |
| Vinyl chloride | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 0.5 | 1.7 |
| o-Xylene | <0.35 | | 0.35 | ug/L | 13-DEC-12 | | |
| m+p-Xylenes | <0.35 | | 0.35 | ug/L | 13-DEC-12 | | |
| Xylenes (Total) | <0.50 | | 0.50 | ug/L | 13-DEC-12 | 300 | 300 |
| Surrogate: 4-Bromofluorobenzene | 83.0 | | 70-130 | % | 13-DEC-12 | | |
| Surrogate: 1,4-Difluorobenzene | 93.5 | | 70-130 | % | 13-DEC-12 | | |
| **Hydrocarbons** | | | | | | | |
| F1 (C6-C10) | <25 | | 25 | ug/L | 13-DEC-12 | 750 | 750 |
| F1-BTEX | <25 | | 25 | ug/L | 13-DEC-12 | 750 | 750 |
| Surrogate: 3,4-Dichlorotoluene | 77.6 | | 60-140 | % | 13-DEC-12 | | |
| L1248030-4 BH3 - 1.5 | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 12:00 | | | | | | | |
| Matrix: SOIL | | | | | | | |
| **Physical Tests** | | | | | | | |
| % Moisture | 17.9 | | 0.10 | % | 11-DEC-12 | | |
| **Saturated Paste Extractables** | | | | | | | |
| SAR | 0.87 | | 0.10 | SAR | 12-DEC-12 | | |
| Calcium (Ca) | 18.4 | | 0.10 | mg/L | 12-DEC-12 | | |
| Magnesium (Mg) | 1.62 | | 0.10 | mg/L | 12-DEC-12 | | |
| Sodium (Na) | 14.4 | | 0.10 | mg/L | 12-DEC-12 | 490 | 490 |
| **Metals** | | | | | | | |
| Antimony (Sb) | <1.0 | | 1.0 | ug/g | 12-DEC-12 | | |
| Arsenic (As) | 2.2 | | 1.0 | ug/g | 12-DEC-12 | | |
| Barium (Ba) | 62.2 | | 1.0 | ug/g | 12-DEC-12 | | |
| Beryllium (Be) | 0.52 | | 0.50 | ug/g | 12-DEC-12 | | |
| Boron (B) | 8.0 | | 5.0 | ug/g | 12-DEC-12 | | |
| Cadmium (Cd) | <0.50 | | 0.50 | ug/g | 12-DEC-12 | | |
| Chromium (Cr) | 21.3 | | 1.0 | ug/g | 12-DEC-12 | | |
| Cobalt (Co) | 8.1 | | 1.0 | ug/g | 12-DEC-12 | | |
| Copper (Cu) | 18.7 | | 1.0 | ug/g | 12-DEC-12 | | |
| Lead (Pb) | 16.0 | | 1.0 | ug/g | 12-DEC-12 | | |
| Molybdenum (Mo) | <1.0 | | 1.0 | ug/g | 12-DEC-12 | | |
| Nickel (Ni) | 19.0 | | 1.0 | ug/g | 12-DEC-12 | | |
| Selenium (Se) | <1.0 | | 1.0 | ug/g | 12-DEC-12 | | |
| Silver (Ag) | <0.20 | | 0.20 | ug/g | 12-DEC-12 | | |
| Thallium (Tl) | <0.50 | | 0.50 | ug/g | 12-DEC-12 | | |
| Uranium (U) | <1.0 | | 1.0 | ug/g | 12-DEC-12 | | |
| Vanadium (V) | 31.0 | | 1.0 | ug/g | 12-DEC-12 | | |
| Zinc (Zn) | 53.8 | | 5.0 | ug/g | 12-DEC-12 | | |
| **Hydrocarbons** | | | | | | | |
| F2 (C10-C16) | <10 | | 10 | ug/g | 14-DEC-12 | | |

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

**Ontario Regulation 153/04 - April 15, 2011 Standards = [Suite] - T2-POTABLE-GROUNDWATER-ALL-TYPES-OF-PROPERTY-USE**

**#1: T2-Ground Water (Coarse Soil)-All Types of Property Use** **#2: T2-Ground Water (Fine Soil)-All Types of Property Use**

Environmental

## ANALYTICAL GUIDELINE REPORT

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| Sample Details Grouping / Analyte | Result | Qualifier | D.L. | Units | Analyzed | Guideline Limits | | | |
|---|---|---|---|---|---|---|---|---|---|
| L1248030-4 BH3 - 1.5 | | | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 12:00 | | | | | | | | | |
| Matrix: SOIL | | | | | | #1 | #2 | | |
| **Hydrocarbons** | | | | | | | | | |
| F3 (C16-C34) | <50 | | 50 | ug/g | 14-DEC-12 | | | | |
| F4 (C34-C50) | 57 | | 50 | ug/g | 14-DEC-12 | | | | |
| Chrom. to baseline at nC50 | YES | | | No Unit | 14-DEC-12 | | | | |
| Surrogate: 2-Bromobenzotrifluoride | 73.4 | | 60-140 | % | 14-DEC-12 | | | | |
| Surrogate: Octacosane | 100.9 | | 60-140 | % | 14-DEC-12 | | | | |
| L1248030-5 BH4 - 1.5 | | | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 12:00 | | | | | | | | | |
| Matrix: SOIL | | | | | | #1 | #2 | | |
| **Saturated Paste Extractables** | | | | | | | | | |
| SAR | 0.41 | | 0.10 | SAR | 12-DEC-12 | | | | |
| Calcium (Ca) | 9.91 | | 0.10 | mg/L | 12-DEC-12 | | | | |
| Magnesium (Mg) | 0.84 | | 0.10 | mg/L | 12-DEC-12 | | | | |
| Sodium (Na) | 5.02 | | 0.10 | mg/L | 12-DEC-12 | 490 | 490 | | |
| **Metals** | | | | | | | | | |
| Antimony (Sb) | <1.0 | | 1.0 | ug/g | 12-DEC-12 | | | | |
| Arsenic (As) | 3.6 | | 1.0 | ug/g | 12-DEC-12 | | | | |
| Barium (Ba) | 96.7 | | 1.0 | ug/g | 12-DEC-12 | | | | |
| Beryllium (Be) | 0.67 | | 0.50 | ug/g | 12-DEC-12 | | | | |
| Boron (B) | 8.3 | | 5.0 | ug/g | 12-DEC-12 | | | | |
| Cadmium (Cd) | <0.50 | | 0.50 | ug/g | 12-DEC-12 | | | | |
| Chromium (Cr) | 27.0 | | 1.0 | ug/g | 12-DEC-12 | | | | |
| Cobalt (Co) | 8.6 | | 1.0 | ug/g | 12-DEC-12 | | | | |
| Copper (Cu) | 17.7 | | 1.0 | ug/g | 12-DEC-12 | | | | |
| Lead (Pb) | 10.3 | | 1.0 | ug/g | 12-DEC-12 | | | | |
| Molybdenum (Mo) | <1.0 | | 1.0 | ug/g | 12-DEC-12 | | | | |
| Nickel (Ni) | 20.7 | | 1.0 | ug/g | 12-DEC-12 | | | | |
| Selenium (Se) | <1.0 | | 1.0 | ug/g | 12-DEC-12 | | | | |
| Silver (Ag) | <0.20 | | 0.20 | ug/g | 12-DEC-12 | | | | |
| Thallium (Tl) | <0.50 | | 0.50 | ug/g | 12-DEC-12 | | | | |
| Uranium (U) | <1.0 | | 1.0 | ug/g | 12-DEC-12 | | | | |
| Vanadium (V) | 41.5 | | 1.0 | ug/g | 12-DEC-12 | | | | |
| Zinc (Zn) | 45.7 | | 5.0 | ug/g | 12-DEC-12 | | | | |
| L1248030-6 BH5 - 1.5 | | | | | | | | | |
| Sampled By: CLIENT on 11-DEC-12 @ 13:00 | | | | | | | | | |
| Matrix: SOIL | | | | | | #1 | #2 | | |
| **Physical Tests** | | | | | | | | | |
| % Moisture | 14.8 | | 0.10 | % | 11-DEC-12 | | | | |
| **Volatile Organic Compounds** | | | | | | | | | |
| Acetone | <0.50 | | 0.50 | ug/g | 13-DEC-12 | | | | |
| Benzene | <0.020 | | 0.020 | ug/g | 13-DEC-12 | | | | |
| Bromodichloromethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| Bromoform | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| Bromomethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| Carbon tetrachloride | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| Chlorobenzene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

**Ontario Regulation 153/04 - April 15, 2011 Standards = [Suite] - T2-POTABLE-GROUNDWATER-ALL-TYPES-OF-PROPERTY-USE**

**#1: T2-Ground Water (Coarse Soil)-All Types of Property Use** **#2: T2-Ground Water (Fine Soil)-All Types of Property Use**

Environmental

## ANALYTICAL GUIDELINE REPORT

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| Sample Details Grouping / Analyte | Result | Qualifier | D.L. | Units | Analyzed | Guideline Limits #1 | #2 | | |
|---|---|---|---|---|---|---|---|---|---|
| L1248030-6 BH5 - 1.5<br>Sampled By: CLIENT on 11-DEC-12 @ 13:00<br>Matrix: SOIL | | | | | | | | | |
| **Volatile Organic Compounds** | | | | | | | | | |
| Dibromochloromethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| Chloroform | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| 1,2-Dibromoethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| 1,2-Dichlorobenzene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| 1,3-Dichlorobenzene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| 1,4-Dichlorobenzene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| Dichlorodifluoromethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| 1,1-Dichloroethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| 1,2-Dichloroethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| 1,1-Dichloroethylene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| cis-1,2-Dichloroethylene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| trans-1,2-Dichloroethylene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| 1,3-Dichloropropene (cis & trans) | <0.042 | | 0.042 | ug/g | 13-DEC-12 | | | | |
| Methylene Chloride | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| 1,2-Dichloropropane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| cis-1,3-Dichloropropene | <0.030 | | 0.030 | ug/g | 13-DEC-12 | | | | |
| trans-1,3-Dichloropropene | <0.030 | | 0.030 | ug/g | 13-DEC-12 | | | | |
| Ethyl Benzene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| n-Hexane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| Methyl Ethyl Ketone | <0.50 | | 0.50 | ug/g | 13-DEC-12 | | | | |
| Methyl Isobutyl Ketone | <0.50 | | 0.50 | ug/g | 13-DEC-12 | | | | |
| MTBE | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| Styrene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| 1,1,1,2-Tetrachloroethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| 1,1,2,2-Tetrachloroethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| Tetrachloroethylene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| Toluene | <0.20 | | 0.20 | ug/g | 13-DEC-12 | | | | |
| 1,1,1-Trichloroethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| 1,1,2-Trichloroethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| Trichloroethylene | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| Trichlorofluoromethane | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| Vinyl chloride | <0.020 | | 0.020 | ug/g | 13-DEC-12 | | | | |
| o-Xylene | <0.020 | | 0.020 | ug/g | 13-DEC-12 | | | | |
| m+p-Xylenes | <0.030 | | 0.030 | ug/g | 13-DEC-12 | | | | |
| Xylenes (Total) | <0.050 | | 0.050 | ug/g | 13-DEC-12 | | | | |
| Surrogate: 4-Bromofluorobenzene | 76.2 | | 70-130 | % | 13-DEC-12 | | | | |
| Surrogate: 1,4-Difluorobenzene | 87.9 | | 70-130 | % | 13-DEC-12 | | | | |
| **Hydrocarbons** | | | | | | | | | |
| F1 (C6-C10) | <5.0 | | 5.0 | ug/g | 13-DEC-12 | | | | |
| Surrogate: 3,4-Dichlorotoluene | 91.3 | | 60-140 | % | 13-DEC-12 | | | | |

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

**Ontario Regulation 153/04 - April 15, 2011 Standards = [Suite] - T2-POTABLE-GROUNDWATER-ALL-TYPES-OF-PROPERTY-USE**

**#1: T2-Ground Water (Coarse Soil)-All Types of Property Use** **#2: T2-Ground Water (Fine Soil)-All Types of Property Use**

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## Reference Information

**Sample Parameter Qualifier key listed:**

| Qualifier | Description |
|---|---|
| SFPL | Sample was Filtered and Preserved at the laboratory |

**Methods Listed (if applicable):**

| ALS Test Code | Matrix | Test Description | Method Reference*** |
|---|---|---|---|
| CA-DIS-WT | Water | Calcium (Ca) - Dissolved | EPA 200.8 |
| ETL-SAR-CALC-WT | Water | Sodium Adsorption Ratio | Calculation |
| F1-F4-511-CALC-WT | Water | F1-F4 Hydrocarbon Calculated Parameters | CCME CWS-PHC DEC-2000 - PUB# 1310-L |

Analytical methods used for analysis of CCME Petroleum Hydrocarbons have been validated and comply with the Reference Method for the CWS PHC.

In cases where results for both F4 and F4G are reported, the greater of the two results must be used in any application of the CWS PHC guidelines and the gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
In samples where BTEX and F1 were analyzed , F1-BTEX represents a value where the sum of Benzene, Toluene, Ethylbenzene and total Xylenes has been subtracted from F1.

In samples where PAHs, F2 and F3 were analyzed, F2-Naphth represents the result where Naphthalene has been subtracted from F2. F3-PAH represents a result where the sum of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene has been subtracted from F3.

Unless otherwise qualified, the following quality control criteria have been met for the F1 hydrocarbon range:
1. All extraction and analysis holding times were met.
2. Instrument performance showing response factors for C6 and C10 within 30% of the response factor for toluene.
3. Linearity of gasoline response within 15% throughout the calibration range.

Unless otherwise qualified, the following quality control criteria have been met for the F2-F4 hydrocarbon ranges:
1. All extraction and analysis holding times were met.
2. Instrument performance showing C10, C16 and C34 response factors within 10% of their average.
3. Instrument performance showing the C50 response factor within 30% of the average of the C10, C16 and C34 response factors.
4. Linearity of diesel or motor oil response within 15% throughout the calibration range.

| | | | |
|---|---|---|---|
| F1-F4-511-CALC-WT | Soil | F1-F4 Hydrocarbon Calculated Parameters | CCME CWS-PHC DEC-2000 - PUB# 1310-S |

Analytical methods used for analysis of CCME Petroleum Hydrocarbons have been validated and comply with the Reference Method for the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

In cases where results for both F4 and F4G are reported, the greater of the two results must be used in any application of the CWS PHC guidelines and the gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
In samples where BTEX and F1 were analyzed , F1-BTEX represents a value where the sum of Benzene, Toluene, Ethylbenzene and total Xylenes has been subtracted from F1.

In samples where PAHs, F2 and F3 were analyzed, F2-Naphth represents the result where Naphthalene has been subtracted from F2. F3-PAH represents a result where the sum of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene has been subtracted from F3.

Unless otherwise qualified, the following quality control criteria have been met for the F1 hydrocarbon range:
1. All extraction and analysis holding times were met.
2. Instrument performance showing response factors for C6 and C10 within 30% of the response factor for toluene.
3. Linearity of gasoline response within 15% throughout the calibration range.

Unless otherwise qualified, the following quality control criteria have been met for the F2-F4 hydrocarbon ranges:
1. All extraction and analysis holding times were met.
2. Instrument performance showing C10, C16 and C34 response factors within 10% of their average.
3. Instrument performance showing the C50 response factor within 30% of the average of the C10, C16 and C34 response factors.
4. Linearity of diesel or motor oil response within 15% throughout the calibration range.

| | | | |
|---|---|---|---|
| F1-HS-511-WT | Water | F1-O.Reg 153/04 (July 2011) | E3398/CCME TIER 1-HS |

Fraction F1 is determined by analyzing by headspace-GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

| | | | |
|---|---|---|---|
| F1-HS-511-WT | Soil | F1-O.Reg 153/04 (July 2011) | E3398/CCME TIER 1-HS |

Fraction F1 is determined by extracting a soil or sediment sample as received with methanol, then analyzing by headspace-GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

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## Reference Information

| | | | |
|---|---|---|---|
| F2-F4-511-WT | Water | F2-F4-O.Reg 153/04 (July 2011) | MOE DECPH-E3398/CCME TIER 1 |

Fractions F2, F3 and F4 are determined by liquid/liquid extraction with a solvent. The solvent recovered from the extracted sample is dried and treated to remove polar material. The extract is then analyzed by GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

| | | | |
|---|---|---|---|
| F2-F4-511-WT | Soil | F2-F4-O.Reg 153/04 (July 2011) | MOE DECPH-E3398/CCME TIER 1 |

Fractions F2, F3 and F4 are determined by extracting a soil sample with a solvent mix. The solvent recovered from the extracted soil sample is dried and treated to remove polar material. The extract is analyzed by GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

| | | | |
|---|---|---|---|
| MET-R511-WT | Water | Metals (O. Reg 153/04, 511 Amendments) | EPA 200.8 |

Ground water samples are filtered and preserved and analyzed by ICP/MS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

| | | | |
|---|---|---|---|
| MET-UG/G-CCMS-WT | Soil | Metal Scan Collision Cell ICPMS | EPA 200.2/6020A |

Sample is vigorously digested with nitric and hydrochloric acid. Analysis is conducted by ICP/MS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

| | | | |
|---|---|---|---|
| MG-DIS-WT | Water | Magnesium (Mg) - Dissolved | EPA 200.8 |
| MOISTURE-WT | Soil | % Moisture | Gravimetric: Oven Dried |
| SAR-R511-WT | Soil | SAR-O.Reg 153/04 (July 2011) | SW846 6010C |

A dried, disaggregated solid sample is extracted with deionized water, the aqueous extract is separated from the solid, acidified and then analyzed using a ICP/OES.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

| | | | |
|---|---|---|---|
| VOC-1,3-DCP-CALC-WT | Water | Regulation 153 VOCs | SW8260B/SW8270C |
| VOC-1,3-DCP-CALC-WT | Soil | Regulation 153 VOCs | SW8260B/SW8270C |
| VOC-511-HS-WT | Water | VOC by GCMS HS O.Reg 153/04 (July 2011) | SW846 8260 |

Liquid samples are analyzed by headspace GC/MSD.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

| | | | |
|---|---|---|---|
| VOC-511-HS-WT | Water | VOC-O.Reg 153/04 (July 2011) | SW846 8260 |

Liquid samples are analyzed by headspace GC/MSD.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

| | | | |
|---|---|---|---|
| VOC-511-HS-WT | Soil | VOC-O.Reg 153/04 (July 2011) | SW846 8260 (511) |

Soil and sediment samples are extracted in methanol and analyzed by headspace-GC/MS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

*** ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody numbers:

131054

*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:*

CSTA-002

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## Reference Information

| Laboratory Definition Code | Laboratory Location | Laboratory Definition Code | Laboratory Location |
|---|---|---|---|
| WT | ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA | | |

**GLOSSARY OF REPORT TERMS**

*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.*

*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.*

*Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information.*

131054
C of C # 00000

# CHAIN OF CUSTODY / ANALYTICAL SERVICES REQUEST FORM

Page 1 of 1

60 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B8
Phone: (519) 886-6910
Fax: (519) 886-9047
Toll Free: 1-800-668-9878

ALS Environmental

*Note: all TAT Quoted material is in business days which exclude statutory holidays and weekends. TAT samples received past 3:00 pm or Saturday/Sunday begin the next day.*

Specify date required: 14 12 12

Service requested: 5 day (regular) ☐ 3-4 day (25%) ✓ 2 day TAT (50%) ☐ Next day TAT (100%) ☐ Same day TAT (200%) ☐

COMPANY NAME: BAE-Emms
OFFICE: Oro Station
PROJECT MANAGER: Brian Emms
PROJECT #: CSTA-002
PHONE: 7057151881 FAX:
ACCOUNT #: 19051
QUOTATION #: PO #:

CRITERIA — Criteria on report YES ✓ NO ___
Reg 153/04 ☐ Reg 511/09 ✓
Table 1 2 (3) 4 5 6 7 8 9
TCLP ___ MISA ___ PWQO ___
ODWS ___ OTHER ___

REPORT FORMAT/DISTRIBUTION
EMAIL ✓ FAX ___ BOTH ___
SELECT: PDF ✓ DIGITAL ___ BOTH ___
EMAIL 1: envsol@rogers.com
EMAIL 2:

ANALYSIS REQUEST

PLEASE INDICATE FILTERED, PRESERVED OR BOTH <---- (F, P, F/P)

SUBMISSION #: L1248030
ENTERED BY: MGA
DATE/TIME ENTERED: DEC-11-12
BIN #:

SAMPLING INFORMATION

| Sample Date/Time: Date (dd-mm-yy) | Time (24hr) (hh:mm) | TYPE: COMP | GRAB | MATRIX: WATER | SOIL | OTHER | SAMPLE DESCRIPTION TO APPEAR ON REPORT | NUMBER OF CONTAINERS | VOCs, Fl | F2,3,4 | Metals + SAR | COMMENTS | LAB ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11-12-12 | 12:00 | | | ✓ | | | MW1 | 4 | ✓ | ✓ | | | -1 |
| ↓ | ↓ | | | ✓ | | | MW2 | 4 | ✓ | ✓ | | | -2 |
| ↓ | ↓ | | | ✓ | | | MW3 | 4 | ✓ | | ✓ | | -3 |
| ↓ | ↓ | | ✓ | | ✓ | | BH3-1.5 | 2 | | ✓ | ✓ | | -4 |
| ↓ | ↓ | | ✓ | | ✓ | | BH4-1.5 | 1 | | | ✓ | | -5 |
| ↓ | 1800 | | | | | | BH5-1.5 | 4 | ✓ | | | | -6 |

SPECIAL INSTRUCTIONS/COMMENTS
Some silt in GW-sample
Need results by Friday PM

THE QUESTIONS BELOW MUST BE ANSWERED FOR WATER SAMPLES (CHECK Yes OR No)
Are any samples taken from a regulated DW System? Yes ☐ No ☒
If yes, an authorized drinking water COC MUST be used for this submission.
Is the water sampled intended to be potable for human consumption? Yes ☐ No ☒

SAMPLE CONDITION
FROZEN ☐ COLD ☒ COOLING INITIATED ☐ AMBIENT ☐
MEAN TEMP: 3.2°C
OBSERVATIONS Yes ☐ No ☒ If yes add SIF
INIT: MG

SAMPLED BY: [signature]
RELINQUISHED BY: [signature]
DATE & TIME
RECEIVED BY:
DATE & TIME
RECEIVED AT LAB BY: MG1
DATE & TIME: DEC-12-12 14:15

Notes
1. Quote number must be provided to ensure proper pricing
2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.
3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.

# APPENDIX II
# Field Screening Apparatus

Environmental Protection Development September 2001
Agency Washington, DC 20460

# Innovative Technology Verification Report

Field Measurement Technologies for Total Petroleum Hydrocarbons in Soil

Dexsil® Corporation PetroFLAG™ System

EPA/600/R-01/092
September 2001

# Innovative Technology Verification Report

Dexsil® Corporation PetroFLAG™ System

Prepared by
Tetra Tech EM Inc.
200 East Randolph Drive, Suite 4700
Chicago, Illinois 60601
Contract No. 68-C5-0037
Dr. Stephen Billets
Characterization and Monitoring Branch
Environmental Sciences Division
Las Vegas, Nevada 89193-3478
National Exposure Research Laboratory
Office of Research and Development
U.S. Environmental Protection Agency

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
Office of Research and Development
Washington, DC 20460

**ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM**

# VERIFICATION STATEMENT

TECHNOLOGY TYPE: **FIELD MEASUREMENT DEVICE**
APPLICATION: **MEASUREMENT OF TOTAL PETROLEUM HYDROCARBONS**
TECHNOLOGY NAME: **PetroFLAG™ SYSTEM**
COMPANY: **DEXSIL® CORPORATION**
ADDRESS: **ONE HAMDEN PARK DRIVE**
**HAMDEN, CT 06517**
WEB SITE: **http://www.dexsil.com**
TELEPHONE: **(203) 288-3509**

## VERIFICATION PROGRAM DESCRIPTION

The U.S. Environmental Protection Agency (EPA) created the Superfund Innovative Technology Evaluation (SITE) and Environmental Technology Verification (ETV) Programs to facilitate deployment of innovative technologies through performance verification and information dissemination. The goal of these programs is to further environmental protection by substantially accelerating the acceptance and use of improved and cost-effective technologies. These programs assist and inform those involved in design, distribution, permitting, and purchase of environmental technologies. This document summarizes results of a demonstration of the PetroFLAG™ System developed by Dexsil® Corporation (Dexsil).

## PROGRAM OPERATION

Under the SITE and ETV Programs, with the full participation of the technology developers, the EPA evaluates and documents the performance of innovative technologies by developing demonstration plans, conducting field tests, collecting and analyzing demonstration data, and preparing reports. The technologies are evaluated under rigorous quality assurance (QA) protocols to produce well-documented data of known quality. The EPA National Exposure Research Laboratory, which demonstrates field sampling, monitoring, and measurement technologies, selected Tetra Tech EM Inc. as the verification organization to assist in field testing seven field measurement devices for total petroleum hydrocarbons (TPH) in soil. This demonstration was funded by the SITE Program.

## DEMONSTRATION DESCRIPTION

In June 2000, the EPA conducted a field demonstration of the PetroFLAG™ System and six other field measurement devices for TPH in soil. This verification statement focuses on the PetroFLAG™ System; a similar statement has been prepared for each of the other six devices. The performance and cost of the PetroFLAG™ System were compared to those of an off-site laboratory reference method, "Test Methods for Evaluating Solid Waste" (SW-846) Method 8015B (modified). To verify a wide range of performance attributes, the demonstration had both primary and secondary objectives. The primary objectives included (1) determining the method detection limit, (2) evaluating the accuracy and precision of TPH measurement, (3) evaluating the effect of interferents, and (4) evaluating the effect of moisture content on TPH measurement for each device. Additional primary objectives were to measure sample throughput and estimate TPH measurement costs. Secondary objectives included (1) documenting the skills and training

required to properly operate the device, (2) documenting the portability of the device, (3) evaluating the device's durability, and (4) documenting the availability of the device and associated spare parts.

The PetroFLAG™ System was demonstrated by using it to analyze 66 soil environmental samples, 79 soil performance evaluation (PE) samples, and 36 liquid PE samples. In addition to these 181 samples, 10 extract duplicates prepared using the environmental samples were analyzed. The environmental samples were collected in four areas contaminated with gasoline, diesel, or other petroleum products, and the PE samples were obtained from a commercial provider. Dexsil chose not to analyze soil samples collected in a fifth area because Dexsil believed that the natural organic material in the area would adversely impact the PetroFLAG™ System's ability to accurately measure TPH. In addition, Dexsil chose not to analyze low- and medium-concentration-range weathered gasoline soil PE samples because according to Dexsil, the PetroFLAG™ System was not sensitive to weathered gasoline concentrations of less than 1,000 milligrams per kilogram. Collectively, the environmental and PE samples provided the different matrix types and the different levels and types of petroleum hydrocarbon contamination needed to perform a comprehensive evaluation of the PetroFLAG™ System. A complete description of the demonstration and a summary of its results are available in the "Innovative Technology Verification Report: Field Measurement Devices for Total Petroleum Hydrocarbons in Soil—Dexsil® Corporation.

## TECHNOLOGY DESCRIPTION

The PetroFLAG™ System manufactured by Dexsil is based on emulsion turbidimetry, which involves measurement of the light scattered by an emulsion. With the PetroFLAG™ System, a proprietary, nonpolar, organic solvent mixture composed of alcohols, primarily methanol, is used to extract petroleum hydrocarbons from soil samples. A proprietary developer solution that is polar in nature and that acts as an emulsifier is added to a sample extract in order to precipitate the aromatic and aliphatic hydrocarbons and form uniformly sized micelles. Light at a wavelength of 585 nanometers is passed through the emulsion, and the amount of light scattered by the emulsion at a 90-degree angle is measured using a turbidimeter. The TPH concentration in the emulsion is then determined by comparing the turbidity reading for the emulsion to that for a reference standard or to a standard calibration curve. According to Dexsil, the TPH concentration thus measured is a function of the mean molecular weight of the hydrocarbons present in the sample. During the demonstration, extraction of petroleum hydrocarbons in a given soil sample was typically completed by adding 10 milliliters (mL) of proprietary methanol mixture extraction solvent to 10 grams of the sample. To form an emulsion, 2 mL of sample extract was then decanted into a vial containing 4 mL of developer solution. The emulsion was analyzed using the PetroFLAG™ Analyzer (turbidimeter) to obtain a direct measurement of the TPH concentration in the soil sample.

## VERIFICATION OF PERFORMANCE

To ensure data usability, data quality indicators for accuracy, precision, representativeness, completeness, and comparability were assessed for the reference method based on project-specific QA objectives. Although the reference method results generally exhibited a negative bias, based on the results for the data quality indicators, the reference method results were considered to be of adequate quality. The bias was considered to be significant primarily for low- and medium concentration- range soil samples containing diesel, which made up only 13 percent of the total number of samples analyzed during the demonstration. The reference method recoveries observed during the demonstration were typical of the

recoveries obtained by most organic analytical methods for environmental samples. In general, the user should exercise caution when evaluating the accuracy of a field measurement device by comparing it to reference methods because the reference methods themselves may have limitations. Key demonstration findings are summarized below for the primary objectives.

***Method Detection Limit***: Based on the TPH results for seven low-concentration-range diesel soil PE samples, the method detection limits were determined to be 20 and 6.32 milligrams per kilogram for the PetroFLAG™ System and reference method, respectively.

***Accuracy and Precision***: Seventy-one of 97 PetroFLAG™ System results (73 percent) used to draw conclusions regarding whether the TPH concentration in a given sampling area or sample type exceeded a specified action level agreed with those of the reference method; 26 PetroFLAG™ System conclusions were false positives. There were no false negatives. Of 91 PetroFLAG™ System results used to assess measurement bias, 11 were within 30 percent, 9 were within 30 to 50 percent, and 71 were not within 50 percent of the reference method results; 82 PetroFLAG™ System results were biased high, and 9 were biased low. For soil environmental samples, the PetroFLAG™ System results were statistically (1) the same as the reference method results for one of the four sampling areas and (2) different from the reference method results for three of the sampling areas. For soil PE samples, the PetroFLAG™ System results were statistically (1) the same as the reference method results for high concentration- range diesel samples and (2) different from the reference method results for blank samples, high-concentration range weathered gasoline samples, and low- and medium-concentration-range diesel samples. For liquid PE samples, the PetroFLAG™ System results were statistically different from the reference method results for both weathered gasoline and diesel samples. The PetroFLAG™ System results correlated highly with the reference method results for one of the four sampling areas and diesel soil PE samples (the square of the correlation coefficient [R2] values were greater than 0.90, and F-test probability values were less than 5 percent). The PetroFLAG™ System results correlated moderately with the reference method results for two of the four sampling areas (R2 values were 0.84 and 0.86, and F-test probability values were less than 5 percent). The PetroFLAG™ System results correlated weakly with the reference method results for one of the four sampling areas and weathered gasoline soil PE samples (R2 values were 0.42 and 0.10, respectively, and F-test probability values were greater than 5 percent). Comparison of the PetroFLAG™ System and reference method median relative standard deviations (RSD) showed that the PetroFLAG™ System and the reference method exhibited similar overall precision. Specifically, the median RSD ranges were 6 to 19 percent and 5.5 to 16 percent for the PetroFLAG™ System and reference method, respectively. The analytical precision was about the same for the PetroFLAG™ System (a median relative percent difference of 5) and reference method (a median relative percent difference of 4).

***Effect of Interferents***: The PetroFLAG™ System showed a mean response of less than 5 percent for neat methyl-tert-butyl ether (MTBE) and tetrachloroethene (PCE) and for soil spiked with humic acid. The device's mean responses for neat Stoddard solvent; turpentine; and 1,2,4-trichlorobenzene were 42.5, 103, and 16 percent, respectively. The reference method showed varying mean responses for MTBE (39 percent); PCE (17.5 percent); Stoddard solvent (85 percent); turpentine (52 percent); 1,2,4-trichlorobenzene (50 percent); and humic acid (0 percent). For the demonstration, MTBE and Stoddard solvent were included in the definition of TPH.

***Effect of Moisture Content***: The PetroFLAG™ System showed a statistically significant decrease (17 percent) in TPH results when the soil moisture content was increased from 9 to 16 percent for weathered gasoline soil PE samples; the reference method TPH results were unaffected. Both PetroFLAG™ System and reference method TPH results were unaffected when the soil moisture content was increased from less than 1 to 9 percent for diesel soil PE samples.

***Measurement Time***: From the time of sample receipt, Dexsil required 50 hours, 40 minutes, to prepare a draft data package containing TPH results for 181 samples and 10 extract duplicates compared to 30 days for the reference method, which was used to analyze 199 samples and 13 extract duplicates.

Key demonstration findings are summarized below for the secondary objectives.

***Skill and Training Requirements***: The PetroFLAG™ System can be operated by one person with basic wet chemistry skills. The sample analysis procedure for the device can be learned in the field with a few practice attempts.

***Portability***: The PetroFLAG™ System is battery-operated and requires no alternating current power source. The device can be easily moved between sampling areas in the field, if necessary.

***Durability and Availability of the Device***: All items in the PetroFLAG™ System are available from Dexsil. During a 6-month warranty period, Dexsil will supply replacement parts for the device by overnight courier service at no cost. During the demonstration, none of the device's reusable items malfunctioned or was damaged.

In summary, during the demonstration, the PetroFLAG™ System exhibited the following desirable characteristics of a field TPH measurement device: (1) good precision, (2) lack of sensitivity to interferents that are not petroleum hydrocarbons (PCE and humic acid), (3) low measurement costs, and (4) ease of use. In addition, the PetroFLAG™ System exhibited moderate sample throughput. Based on action level conclusions and statistical correlations, the PetroFLAG™ System TPH results compared well with those of the reference method; however, the device exhibited a high bias, and its TPH results were determined to be statistically different from those of the reference method. In addition, turpentine and 1,2,4-trichlorobenzene biased the device's TPH results high. Moreover, an increase in soil moisture content biased the device's TPH results low for weathered gasoline soil PE samples. Collectively, the demonstration findings indicated that the user should exercise caution when considering the device for a specific field TPH measurement application.

Original signed by

Gary J. Foley, Ph.D.
Director
National Exposure Research Laboratory
Office of Research and Development

P001-0102

# ONE TO SIX GAS PORTABLE MONITOR

Gas Detection For Life

## EAGLE™ Model

### Features

- Simultaneous detection of up to 6 different gases
- Over 250 gas monitoring configurations
- Widest range of gas sensors available
- PPM / LEL hydrocarbon detection
- Powerful long-life pump with 125' range
- Low flow pump shut off and alarm
- Methane elimination switch for environmental use
- Security "Adjustment Lockout Switch"
- Up to 30 hours of continuous operation
- IR Sensors available for $CO_2$, % LEL $CH_4$, and 0-100% volume $CH_4$
- Transformer testing version available
- Alkaline or Ni-Cad capability
- Ergonomic RFI/EMI/Chemical resistant case
- Datalogging option
- Autocalibration
- Intrinsically safe design, CSA/NRTL & UL Classified (most versions)

RKI is proud to produce the most versatile portable gas detector on the market. The EAGLE is a powerful instrument that does more than offer standard confined space protection. The EAGLE also provides detection combinations never before offered in a portable gas monitor featuring the industry's widest selection of high quality, long life and field proven sensors.

The EAGLE's ergonomic design offers easy access to controls such as autocalibration, alarm silence, demand zero, peak hold and a wide variety of other features. Each channel has 2 alarm levels plus TWA and STEL alarms for toxic channels. Alarm levels are adjustable and can be latching or self resetting.

Standard features on the EAGLE are not available on other competitive units. These features include PPM/LEL hydrocarbon detection and a methane elimination switch for environmental applications. For quick response and recovery, the EAGLE has a strong internal pump which can draw samples from over 125 feet. The EAGLE will continuously operate for over 30 hours on alkaline batteries or 18 hours on Ni-Cads. Many accessories such as long hoses, special probes, datalogging, continuous operation adapters, remote alarms and strobes, dilution fittings, internal hydrophobic filter, etc, are available to help satisfy almost any application. Rugged, weatherproof, easy to operate and maintain, the EAGLE is the industry's answer to portable gas detection.

RKI Instruments, Inc. • 1855 Whipple Rd. Hayward, CA 94544 • Phone (800) 754-5165 • (510) 441-5656 • Fax (510) 441-5650

World Leader In Gas Detection & Sensor Technology
www.rkiinstruments.com

# EAGLE™ Model

| | |
|---|---|
| **Enclosure** | Weatherproof, chemical resistant, RFI/EMI coated high impact polycarbonate-polyester blend. Can be set in rain or into 2.5" of water without damage. Ergonomically balanced with rugged top mounted handle. |
| **Dimensions** | 10.5" L x 5.9" W 7" H |
| **Weight** | 5 lbs |
| **Detection Principle** | Catalytic combustion, electrochemical cell, galvanic cell, and infrared. |
| **Sensor Life** | 2 years under normal conditions. |
| **Sampling Method** | Powerful, long-life pump (over 6,000 hours) can draw samples over 125 feet. Flow rate approximately 2.0 SCFH. |
| **Display** | 4 x 20 LCD readout with backlighting. Viewed through window in case top. Displays readings & status of all channels simultaneously. |
| **Alarms** | 2 alarms per channel plus TWA and STEL alarms. Fully adjustable for levels, latching or self reset and silenceable. |
| **Alarm Method** | Buzzer 85dB at 30 cm, dual high intensity LED's, and flashing display. |
| **Controls** | 6 external push buttons for operation, demand zero, and autocalibration. Buttons also access LEL/ppm, alarm silence, peak hold, TWA / STEL values, battery status and many other features. |
| **Continuous Operating Hours** | 30 hours minimum using alkaline batteries, or 18 hours using Ni-Cads. |
| **Power Source** | Size D batteries, 4 alkaline or Ni-Cad. Charger has alkaline recognition to prevent battery damage if charging is attempted with alkalines. |
| **Operating Temp. & Humidity** | -10°C to 40°C (14°F to 104°F), 0 to 95% RH, non-condensing. |
| **Indication Accuracy** | Maximum variance +/- 5% of full scale. |
| **Response Time** | 30 seconds to 90% (for most gases). |
| **Safety Design** | Intrinsically Safe, Class I, Division 1, Groups A, B, C and D. CSA / NRTL & UL Classified (most versions). |
| **Standard Accessories** | Shoulder strap, alkaline batteries, hydrophobic probe and 5 foot hose (for special toxic gas versions, shorter teflon hose used without probe). |
| **Optional Accessories** | • Datalogging of up to 4 gases (No datalogging possible on 5 or 6 gas versions or versions with more than 2 toxic sensors).<br>• Remote alarm<br>• Dilution fitting (50/50)<br>• Ni-Cad batteries<br>• Battery charger, 115 VAC, 220 VAC, or 12 VDC<br>• Continous Operation Adapter, 115 VAC or 12 VDC<br>• Extra loud buzzer<br>• Extension Probes<br>• Internal Hydrophobic Filter (strongly recommended) |
| **Warranty** | One year material and workmanship. |

## Gases & Detectable Ranges

| Standard Confined Space Gases | |
|---|---|
| Hydrocarbons ($CH_4$, std) | 0 - 100% LEL<br>0 - 50,000 ppm |
| Oxygen ($O_2$) | 0 - 40% Vol. |
| Carbon Monoxide (CO) | 0 - 500 ppm |
| Hydrogen Sulfide ($H_2S$) | 0 - 100 ppm |
| **Super Toxics and Other Gases** | |
| Ammonia ($NH_3$) | 0 - 75 ppm |
| Arsine ($AsH_3$) | 0 - 1 ppm<br>0 - 200 ppb |
| Carbon Dioxide ($CO_2$) (I R Sensor) | 0 - 5,000 ppm<br>0 - 10,000 ppm<br>0 - 5% Vol.<br>0 - 20% Vol.<br>0 - 50% Vol. |
| Chlorine ($Cl_2$) | 0 - 3 ppm |
| Fluorine ($F_2$) | 0 - 5 ppm |
| Hydrogen Fluoride (HF) | 0 - 9 ppm |
| Hydrogen Chloride (HCl) | 0 - 5 ppm |
| Hydrogen Cyanide (HCN) | 0 - 30 ppm |
| Methane ($CH_4$) (IR Sensor) | 0 - 100% LEL<br>0 - 100% Vol. |
| Nitrogen Dioxide ($NO_2$) | 0 - 15 ppm |
| Nitric Oxide (NO) | 0 - 100 ppm |
| Ozone ($O_3$) | 0 - 1 ppm |
| Phosphine ($PH_3$) | 0 - 1 ppm |
| Silane ($SiH_4$) | 0 - 15 ppm |
| Sulfur Dioxide ($SO_2$) | 0 - 30 ppm |

The EAGLE can be provided with up to 6 gas sensors (2 Toxics maximum from "super toxics" list). Please specify gas combination when ordering.

### Special Features

- Low Flow alarm shuts pump off to avoid damage to instrument.
- Hydrophobic filter disc in probe.
- Internal dust filter (or optional internal hydrophobic filter).
- Quick autocalibration using 4 in 1 calibration gas standard.
- Single gas calibration capability.
- Methane elimination switch for environmental applications.
- "Adjustment Lockout Switch" for added security.
- Confirmation beep (silenceable).
- Backlight, automatic for alarms and by demand with adjustable time.
- Meets EPA Method 21 protocol for fugitive emissions testing.

**RKI Instruments, Inc.**

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**Authorized Distributor:**

# MiniRAE 3000

## Portable Handheld VOC Monitor

The MiniRAE 3000 is the most advanced handheld volatile organic compound (VOC) monitor on the market. Its photoionization detector's (PID) extended range of **0 to 15,000 ppm** makes it an ideal instrument for applications from industrial hygiene to leak detection and HazMat.

The **RF modem allows real-time data transmissions** with a base controller located up to 500 feet away from the MiniRAE 3000 (or two miles with optional RAELink3 portable modem). A personal computer can be used as the base station for a MiniRAE 3000 system. The standard ProRAE Remote software is capable of monitoring the input of up to 64 remotely located monitors, including MiniRAE 3000, AreaRAE, etc.

### Key Features

- **Proven PID technology**
  The patented sensor provides the following unique features:
  - 3-second response time
  - Extended range up to 15,000 ppm with improved linearity
  - Humidity compensation with integral humidity and temperature sensors
- **Real-time wireless** data transmission with built-in RF modem or Bluetooth
- **Designed for simple service** Easy access to lamp and sensor in seconds without tools
- **Big graphic display** for easy overview of gas type, Correction Factor and concentration
- **Field-interchangeable battery pack** replaced in seconds without tools
- **Integrated flashlight** for better view in dark conditions
- **User-friendly screens, including dataplot chart view**
- **Integrated RAE Systems Correction Factors list for more than 200 compounds** to measure more chemicals than any other PID
- **Multi-language support** with 12 languages encoded
- **Rugged housing** withstands use in harsh environments
  - IP67 waterproof design for easy cleaning and decontamination in water
  - Strong protective removable rubber boot

### Additional Advantages

- View real-time sensor data and alarm status at headquarters or command center
- Automatic lamp type recognition
- Duty-cycling™ lamp and sensor auto-cleaning technology
- Tough, flexible inlet Flexi-Probe™
- 3 large keys operable with 3 layers of gloves
- Strong, built-in sample pump draws up to 100 feet (30m) horizontally or vertically
- Loud, 95dB audible alarm
- Bright red flashing visual alarm
- Interchangeable drop-in Lithium-Ion and alkaline battery packs
- Charging cradle doubles as an external battery charger
- Compatible with AutoRAE™ calibration station
- ProRAE Remote software simultaneously controls and displays readings for up to 64 remote detectors
- License-free, ISM band RF transmission with communication range up to 500 feet (2 miles with optional RAELink3 modem)
- Optional RAELink3 modem provides GPS capability to track and display readings from remote detectors and provide up to 2 miles' long-distance transmission
- Datalogging with up to 6 months of data at one-minute intervals
- 3-year 10.6 eV lamp warranty

Wireless

AutoRAE Compatible

www.raesystems.com

ISO 9001 CERT FIED ATEX

RAE SYSTEMS

# MiniRAE 3000

## Specifications*

### Detector Specifications

| | |
|---|---|
| **Size** | 10" L x 3.0" W x 2.5" H (25.5 cm x 7.6 cm x 6.4 cm) |
| **Weight** | 26 oz (738 g) |
| **Sensors** | Photoionization sensor with standard 10.6 eV or optional 9.8 eV or 11.7 eV lamps |
| **Battery** | • Rechargeable, external field-replaceable Lithium-Ion battery pack<br>• Alkaline battery adapter |
| **Operating Hours** | 16 hours of operation (12 hours with alkaline battery) |
| **Display Graphic** | 4 lines, 28 x 43 mm, with LED backlight for enhanced display readability |
| **Keypad** | 1 operation and 2 programming keys, 1 flashlight on/off |
| **Direct Readout** | Instantaneous reading<br>• VOCs as ppm by volume<br>• High values<br>• STEL and TWA<br>• Battery and shutdown voltage<br>• Date, time, temperature |
| **Alarms** | 95dB at 12" (30 cm) buzzer and flashing red LED to indicate exceeded preset limits<br>• High: 3 beeps and flashes per second<br>• Low: 2 beeps and flashes per second<br>• STEL and TWA: 1 beep and flash per second<br>• Alarms latching with manual override or automatic reset<br>• Additional diagnostic alarm and display message for low battery and pump stall |
| **EMI/RFI** | Highly resistant to EMI/RFI. Compliant with EMC directive (2004/108/EC); R & TTE directive (1999/5/EC) |
| **IP Rating** | • IP67 unit off and without flexible probe<br>• IP65 unit running |
| **Datalogging** | Standard 6 months at one-minute intervals |
| **Calibration** | Two-point or three-point calibration for zero and span. Calibration memory for 8 calibration gases, alarm limits, span values and calibration dates |
| **Sampling Pump** | • Internal, integrated flow rate at 500 cc/mn<br>• Sample from 100' (30m) horizontally and vertically |
| **Low Flow Alarm** | • Auto pump shutoff at low-flow condition |
| **Communication** | • Download data and upload instrument set-up from PC through charging cradle or optional Bluetooth™<br>• Wireless data transmission through built-in RF modem |
| **Frequency** | 902 to 928 MHz (license-free), 2.400 to 2.4835 GHz (license-free), 433 MHz, 869 MHz |
| **RF Range** | Up to 500' (152m; 900 MHz, 433 Mhz, 869 Mhz), extendable with RAELink3 Repeater to 2 miles (3.2km) |
| **Hazard Area Approval** | • **US and Canada:** c(SP)us, Classified as Intrinsically Safe for use in Class I, Division 1 Groups A, B, C, D<br>• **Europe:** ATEX II 2G EEx ia IIC T4 |
| **Temperature** | -4° to 122° F (-20° to 50° C) |
| **Humidity** | 0% to 95% relative humidity (non-condensing) |
| **Attachments** | Durable bright yellow rubber boot |
| **Warranty** | 3 years for 10.6 eV lamp, 1 year for pump, battery, sensor and instrument |

*Specifications are subject to change

### Sensor Specifications

| Gas Monitor | Range | Resolution | Response Time T90 |
|---|---|---|---|
| **VOCs** | 0 to 999.9 ppm<br>1000 to 15,000 ppm | 0.1 ppm<br>1 ppm | < 3 s<br>< 3 s |

### Monitor only includes:

- MiniRAE 3000 Monitor, Model PGM-7320
- Wireless communication module built in, as specified
- Datalogging with ProRAE Studio Package for Windows™ 98, 2000, NT, ME & XP
- Charging/download adapter
- RAE UV lamp, as specified
- Flex-I-Probe™
- External filter
- Rubber boot
- Alkaline battery adapter
- Lamp-cleaning kit
- Tool kit
- Operation CD-ROM
- Operation & Maintenance manual
- Soft leather case

### Monitor with accessories kit adds:

- Hard transport case with pre-cut foam padding
- Charging/download cradle
- 5 Porous metal filters and O-rings
- Organic vapor zeroing kit
- Gas outlet port adapter and tubing

### Optional calibration kit adds:

- 100 ppm isobutylene calibration gas, 34L
- Calibration regulator and flow controller

### Optional Guaranteed Cost of Ownership Program:

- 4-year repair and replacement guarantee
- Annual maintenance service

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DS-1018-02

Solinst®

# Interface Meter

**Model 122 Data Sheet**

Get Quote | More Info

## Interface Meter
Model 122

Solinst Oil/Water Interface Meters give clear and accurate measurements of product level and thickness in wells and tanks.

Determination of both light (floating) non-aqueous phase liquids (LNAPL) and dense (sinking) non-aqueous phase liquids (DNAPL) is quick and easy. The factory-sealed probes are pressure proof and tapes are available in a range of lengths from 65 - 1000 ft (20 - 300 m).

The 5/8" (16 mm) diameter P1 Probe allows easy access through tight spaces and into narrow wells. The Probe is designed for use in various monitoring applications.

## Hazardous Locations Use

The Model 122 Interface Meter has been approved by the Canadian Standards Association (CSA) for use in explosive environments. It is suitable for use in hazardous locations Class I, Groups C&D.

The grounding strap is a safety essential when the meter is used in potentially explosive environments. It also ensures that the electronics are properly protected.

## Operating Principles

**Product** (Non-conductive liquid) = Steady light and tone

**Water** (Conductive liquid) = Intermittent light and tone

To detect liquids, Solinst Interface Meters use an infra-red beam and detector. When the probe enters a liquid the beam is refracted away from the detector which activates an audible tone and light. If the liquid is a non-conductive oil/product the signals are steady. If the liquid is water (conductive liquid greater than 50 µS/cm), the conductivity of the water completes a conductivity circuit. This overrides the infra-red circuit, and the tone and light are intermittent.

Both sensors use exactly the same zero point, giving accuracy as good as 1/200 ft or 1.0 mm. The high accuracy enables the sensors to detect the slightest sheen of oil on the surface of the water; this is indicated by a rapid intermittent tone.

## Accurate, Reliable, Robust

- Designed for rugged field use
- Stable electronics with automatic circuitry testing
- Tape uses stranded stainless steel conductors:
  - non-stretch; does not corrode
  - resists kinking and breaks
  - easy to repair and splice
- Sturdy free-standing reel with carrying handle

## High Quality Design

The state-of-the-art electronics include automatic circuitry testing when the 'On' button is used; 120 hours of on-time battery life; clear signals; and high accuracy.

Infra-red refraction is used to detect liquids and conductivity to distinguish water. Both optical and electronic sensors are precisely aligned at the same zero point. A steady light and tone indicate product. Water is indicated by intermittent signals.

The factory sealed probe does not need to be accessed by the user. An integral stainless steel shield protects the sensors. It is set permanently into place, yet allows for easy cleaning.

The circuits are powered by 2 standard 9V batteries which are housed in easy-access drawers in the faceplate of the reel.

## Features

- Sensor accuracy to 1/200 ft or 1.0 mm
- Certified intrinsically safe
- 5/8" (16 mm) diameter probe
- Easy access batteries: minimum 120 hours of life
- Automatic shut off after 10 minutes
- Inexpensive, simple repairs
- 3 year warranty

® Solinst is a registered trademark of Solinst Canada Ltd.

*Model 122 & 122M are CSA approved for use in hazardous locations Class I, Groups C&D*

*High Quality Groundwater and Surface Water Monitoring Instrumentation*

Solinst®

Solinst® **Interface Meter**

## Mini Interface Meter
Model 122M

The 122 Mini is a convenient small version of the Solinst Interface Meter, small enough to fit in a backpack. A custom carrying bag is also an option. The Mini is available in 65 ft or 20 m lengths.

The 5/8" (16 mm) diameter probe is attached to narrow 1/4" (6 mm) tape, which is accurately marked each 1/100 ft or millimeter. Enhanced electronics allow operation for up to 300 hours of on-time, using one 9V battery.

## Obtaining Product Measurements

To measure the thickness of a product layer, lower the probe into the well until the signals activate. If there is an oil/product layer on the top of the water (LNAPL), the light and tone will be steady, indicating an air/product interface.

Read the depth off the permanently marked tape. Lower the probe further into the water, where the signals become intermittent, then pull back up and take a reading at the product/water interface. The thickness of the product layer is then determined by subtracting the first reading from the second.

If there is only water in the well and no product, there will only be intermittent (water) signals.

The presence or absence of dense (sinking) non-aqueous layers (DNAPL) is determined by continuing to lower the probe to the bottom of the well.

If the steady tone and light return, this indicates a non-conductive liquid. Measure the depth and continue lowering the probe until it touches bottom and the tape goes slack.

To determine the thickness of the DNAPL layer, subtract the first reading from the bottom depth.

*Model 122 P1 and 122M Probes*

## Probes

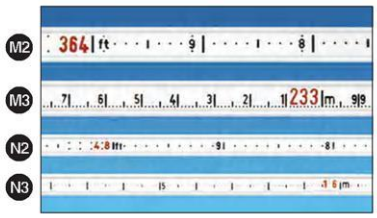
**122 P1:** 5/8" diameter (16 mm) stainless steel. The beam is emitted from within a cone-shaped tip made from rigid polyurethane. The tip is protected by an integral stainless steel shield. This probe is excellent for the vast majority of product monitoring situations.

**122M Probe:** 5/8" diameter (16 mm) stainless steel. Similar to the P1 but shorter.

## Tape

The easy-to-read markings on the tape are permanently heat-stamped into the tape. The dog bone shaped tape avoids adherence to wet surfaces in wells. It is resistant to most chemicals, and the smooth surface of the tape is easy to decontaminate, and easy to handle.

**M2** Feet and tenths: with markings every 1/100 ft.
**M3** Meters and centimeters: with markings every mm.
**N2** and **N3** As above, but on the narrow 1/4" (6 mm) tape for the 122 Mini Interface Meter.




## Standard Equipment

Each standard meter is provided with a grounding clip, cleaning brush, a convenient carrying bag with shoulder strap, and a tape guide/datum.

The tape guide may be used to provide support for the reel on the well casing. It acts as a datum allowing repeatably accurate measurements; ensures that the probe hangs in the centre of the well; and protects the tape from damage.

It is essential to use the grounding clip to ensure safety and proper function of the electronics in all applications.

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Solinst®

# APPENDIX III
# Project Photographs

Borehole #1

Test Pit #1

Borehole #4

Borehole #3

Borehole #6

Monitoring Well #1

Borehole #7

# APPENDIX IV
# Borehole Records

**BOREHOLE RECORD** BH 1

BAE & Associates

CLIENT: Otis
Penetration Test Hammer: 63.5kg
Groundwater Level Estimated - 6.0m

LOCATION: Greely
Drop: 760mm
Continual Split Spoon Sampling @ 0.45m intervals

DATE: April 4, 2012

| DEPTH (m) | ELEV....(m) | STRATA DESCRIPTION | STRATA PLOT | H2O LEVEL | DEPTH (m) | WATER CONTENT PERCENT / HYDRAULIC CONDUCTIVITY k,cm/s (10 20 30 40; 10-6 10-5 10-4 10-3) | SAMPLES TYPE | SAMPLES N-VALUE | WELL DATA/ Comments |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | Native Overburden/Topsoil 50mm- | | | | Δ | S/S | | |
| | | Grey Clay – moist, firm, mixed with gravel | | | | Δ | | 8 | No Well Install |
| 1 | | Sand trace silt, mixed with rocks/gravel/boulders Moist to Wet | | | 5 | Δ | | 13 | |
| 2 | | Sand with boulders, trace Silt | | | | Δ | | 24 | Groundwater not observed, borehole terminated due to clay shale layer |
| | | Brown Sand and gravel | | | | Δ | | 71 | |
| 3 | | Clay Shale Borehole Terminated 3.5m | | | 10 | | | | |
| 4 | | | | | | | | | |
| | | | | | 15 | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |

## BOREHOLE RECORD BH 2

BAE & Associates

CLIENT: Otis LOCATION: Greely DATE: April 4, 2012
Penetration Test Hammer: 63.5kg Drop: 760mm
Groundwater Level Estimated - 6.0m Continual Split Spoon Sampling @ 0.45m intervals

| DEPTH (m) | ELEV....(m) | STRATA DESCRIPTION | STRATA PLOT | H2O LEVEL | DEPTH (ft) | WATER CONTENT PERCENT / HYDRAULIC CONDUCTIVITY k,cm/s | SAMPLES TYPE | SAMPLES N-VALUE | WELL DATA/ Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Δ 10 20 30 40 10-6 10-5 10-4 10-3 | S/S | | |
| 0 | | Native Overburden/Topsoil 50mm | | | | Δ | | | **MW #3** Well installed at 20ft |
| | | Clay with Silt and Sand | | | | | | 5 | |
| 1 | | Grey Clay trace sand, trace silt Moist | | | | Δ | | 5 | |
| | | Becoming Wet | | | 5 | | | 7 | |
| 2 | | | | | | | | | Groundwater at about 5.8m |
| | | | | | | Δ | | 6 | |
| 3 | | | | | 10 | | | 2 | |
| | | Grey Clay Some Sand and Gravel | | | | | | | |
| 4 | | Grey Clay and Silt with Sand | | | | Δ | | 4 | |
| | | | | | 15 | | | 2 | |
| 5 | | | | | | | | | |
| 6 | | Brown Sand and Gravel End of Borehole 7.6m | | | | | | 156 | |

**BOREHOLE RECORD** BH 3

BAE & Associates

CLIENT: Otis LOCATION: Greely DATE: April 4, 2012
Penetration Test Hammer: 63.5kg Drop: 760mm
Groundwater Level Estimated - 6.0m Continual Split Spoon Sampling @ 0.45m intervals

| DEPTH (m) | ELEV (m) | STRATA DESCRIPTION | STRATA PLOT | WATER LEVEL | DEPTH (ft) | WATER CONTENT PERCENT / HYDRAULIC CONDUCTIVITY k,cm/s | SAMPLES TYPE | SAMPLES N-VALUE | WELL DATA/ Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Δ 10 20 30 40 10-6 10-5 10-4 10-3 | S/S | | |
| 0 | | Native Overburden/Topsoil 50mm | | | | | | | No well install |
| | | Grey Clay trace Silt, trace Sand Soft, Moist | | | | | | 6 | |
| 1 | | Grey Clay trace Silt, trace Sand Some black mottling, possible peat | | | 5 | | | | |
| 2 | | | | | | | | 6 | Groundwater at about 5m |
| | | Grey Clay trace Silt, trace Sand trace Gravel Soft, wet | | | | | | | |
| 3 | | | | | 10 | | | 6 | |
| 4 | | | | | | | | 5 | |
| | | | | | 15 | | | 8 | |
| 5 | | | | | | | | 17 | |
| | | Brown Sand, trace Silt wet, coarse at 6M | | | | | | | |
| 6 | | End of Borehole – 7.6M | | | | | | 89 | |

**BOREHOLE RECORD** BH 4

BAE & Associates

CLIENT: Otis
Penetration Test Hammer: 63.5kg
Groundwater Level Estimated - 6.0m

LOCATION: Greely
Drop: 760mm
Continual Split Spoon Sampling @ 0.45m intervals

DATE: April 4, 2012

| DEPTH (m) | ELEV (m) | STRATA DESCRIPTION | STRATA PLOT | H2O LEVEL | DEPTH (ft) | WATER CONTENT PERCENT / HYDRAULIC CONDUCTIVITY k,cm/s | SAMPLES TYPE | SAMPLES N-VALUE | WELL DATA/ Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Δ 10 20 30 40 10-6 10-5 10-4 10-3 | S / S | | |
| 0 | | Native Overburden/Topsoil 50mm | | | | | | | No Well Install |
| | | Grey Clay, trace Silt, trace Sand Soft, Moist | | | | | | 3 | |
| 1 | | | | | | | | | |
| | | Grey Clay, with Sand, trace Silt Some fill debris Moist to Wet Loose | | | 5 | | | 7 | |
| 2 | | | | | | | | | Groundwater at about 3.6m |
| | | | | | | | | 13 | |
| 3 | | | | | 10 | | | | |
| | | Grey Clay, trace sand, trace gravel Wet, Loose | | | | | | 10 | |
| 4 | | | | | | | | 9 | |
| | | Brown Sand and Gravel | | | 15 | | | | |
| 5 | | End of Borehole 15m | | | | | | | |
| 6 | | | | | | | | | |

## BOREHOLE RECORD

BH 5

BAE & Associates

CLIENT: Otis
Penetration Test Hammer: 63.5kg
Groundwater Level Estimated - 6.0m

LOCATION: Greely
Drop: 760mm
Continual Split Spoon Sampling @ 0.45m intervals

DATE: April 4, 2012

| DEPTH (m) | ELEV (m) | STRATA DESCRIPTION | STRATA PLOT | H2O LEVEL | DEPTH (ft) | WATER CONTENT PERCENT / HYDRAULIC CONDUCTIVITY k,cm/s (10 20 30 40 10-6 10-5 10-4 10-3) | SAMPLES TYPE | SAMPLES N-VALUE | WELL DATA/ Comments |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | Native Overburden/Topsoil 50mm | | | | Δ | S/S | | |
| | | Grey Clay, trace Sand, trace Gravel Moist, soft | | | | Δ | | 5 | **MW #2** Well installed at 8.2m |
| 1 | | | | | 5 | | | | |
| | | Grey Clay, with Sand, trace Silt, trace Gravel | | | | Δ | | 2 | |
| 2 | | | | | | | | | Groundwater at about 4.3m |
| | | | | | | | | 8 | |
| 3 | | | | | 10 | | | | |
| | | Grey Clay with Sand, trace Silt Soft, Moist | | | | Δ | | 3 | |
| 4 | | | | | | | | 4 | |
| | | | | | 15 | | | | |
| 5 | | | | | | Δ | | 3 | |
| | | Brown/Grey Sand Coarse, Wet from 7.2m | | | | | | | |
| 6 | | End of Borehole 9.0m | | | | | | 32 | |

**BOREHOLE RECORD** BH 6

BAE & Associates

CLIENT: Otis
Penetration Test Hammer: 63.5kg
Groundwater Level Estimated - 6.0m

LOCATION: Greely
Drop: 760mm
Continual Split Spoon Sampling @ 0.45m intervals

DATE: April 4, 2012

| DEPTH (m) | ELEV (m) | STRATA DESCRIPTION | STRATA PLOT | PIEZO LEVEL | DEPTH (ft) | WATER CONTENT PERCENT / HYDRAULIC CONDUCTIVITY k,cm/s | SAMPLES TYPE | SAMPLES N-VALUE | WELL DATA/ Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Δ 10 20 30 40 10-6 10-5 10-4 10-3 | S/c | | |
| 0 | | Native Overburden/Topsoil 50mm | | | | | | | **MW #1** Well installed at 9.0m |
| | | Grey Clay, trace Sand, trace Silt Moist, soft | | | 5 | | | 2 | |
| 1 | | | | | | | | | |
| 2 | | Grey Clay, trace Silt, trace Sand Wet, soft | | | | | | | Groundwater at about 7.9m |
| 3 | -3.00 | | | | 10 | | | 2 | |
| 4 | | | | | | | | | |
| | | | | | 15 | | | 4 | |
| 5 | | Grey Sand, with Silt, trace Gravel from 6.4m Grey Clay and Silt with gravel from 7.7m | | | | | | | |
| | | Brown Sand, Coarse from 8.8m | | | | | | 36 | |
| 6 | | End of Borehole 9.0 | | | | | | | |

## BOREHOLE RECORD

BH 7

BAE & Associates

CLIENT: Otis
Penetration Test Hammer: 63.5kg
Groundwater Level Estimated - 6.0m

LOCATION: Greely
Drop: 760mm
Continual Split Spoon Sampling @ 0.45m intervals

DATE: April 4, 2012

| DEPTH (m) | ELEV (m) | STRATA DESCRIPTION | STRATA PLOT | H2O LEVEL | DEPTH (ft) | WATER CONTENT PERCENT / HYDRAULIC CONDUCTIVITY k,cm/s (10 20 30 40; 10-6 10-5 10-4 10-3) | SAMPLES TYPE (S/S) | SAMPLES N-VALUE | WELL DATA |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | Native Overburden/Topsoil 50mm | | | | | 1 | | No Well Install |
| | | Grey Clay with Sand and Silt Moist, soft | | | | | 2 | 4 | |
| 1 | | | | | | | 3 | | |
| | | | | | 5 | | | 5 | |
| 2 | | | | | | | 4 | | Groundwater at about 4.6m |
| | | | | | | | 5 | | |
| 3 | -3.00 | Grey Clay trace Sand, trace Silt, trace Gravel Wet, soft | | | 10 | | 6 | 3 | |
| 4 | | | | | | | 7 | 4 | |
| | | | | | 15 | | 8 | | |
| 5 | | | | | | | | 39 | |
| | | Brown Sand, wet, coarse from 7.0m | | | | | | | |
| 6 | | End of Borehole 7.6m | | | | | | | |