

**Gravenhurst Patrol Yard
Site Selection and Class Environmental Assessment Study**

WP 5420-02-00

HYDROGEOLOGICAL INVESTIGATION REPORT

February 2005

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1.0 INTRODUCTION

McCormick Rankin Corporation (MRC) and Ecoplans Limited (Ecoplans) have been retained by the Ministry of Transportation - Northeastern Region (MTO) to carry out a Site Selection and Class Environmental Assessment Study to relocate the existing Gravenhurst Patrol Yard on the east side of Highway 11 just south of Muskoka Road 169 to a new location; either in the vicinity of the Highway 11/Doe Lake Road or Highway 11/Muskoka Road 169 interchange. The site selection process involved evaluating and screening potential sites based on screening criteria, selecting a preferred site, and carrying out a site specific subsurface investigation of the preferred site.

This report documents the results of the site specific subsurface investigation carried out at the preferred or selected site (“site”).

1.1 Purpose of Study

The purpose of the study is to assess the existing soil and groundwater conditions across the site.

1.2 Scope of Study

The scope of work for the study included:

- Background Information Review – reviewing topographic and geological maps, current and historical aerial photographs, and Ministry of the Environment (MOE) water well records;
- Site Inspection – identifying site features of hydrogeological significance such as the presence of surface water bodies, and groundwater springs and seeps; and surface topography and landforms;
- Water Well Survey – confirming the presence, location and construction details of all existing water wells within 500 metres of the site;
- Mini-Piezometer Installations – installing mini-piezometers in the substrate of significant water bodies;
- Subsurface Investigation – completing boreholes across the site; installing monitoring wells; carrying out soil and groundwater sampling and chemical and physical analysis; and groundwater monitoring; and
- Reporting – documenting the results of the study into a comprehensive written report.

2.0 SITE DESCRIPTION

The site is located approximately 300 metres southeast of the Highway 11 and Highway 169 Interchange. It is situated between the existing MTO Patrol Yard and Jevins Lake. Figure 1 shows the site location.

The site is irregular in shape extending approximately 400 metres in the northwest-southeast direction and 140 metres in the northeast-southwest direction. The estimated total area of the site is 5.1 hectares. Figure 2 shows the approximate site limits and significant site features. Site photographs have been included in Appendix A. These features are described below:

- the site is surrounded to the north, east and west by bedrock ridges with the most prominent flanking the north side which precipitates sharply to the north into Jevins Lake;
- between the ridges, the site slopes to the southeast;
- a small rectangular pond (referred to as the “small pond”) exists at the southeast corner of the site;
- southeast portion of the site is flanked by a wetland (referred to as the “large wetland”);
- south central portion of the site slopes to the southeast towards the wetland;
- the site is predominantly forested with the exception of small open pockets on bedrock outcrops; and
- a small number of access roads/trails meander through the site.

2.1 Current Land Use of Site and Surrounding Area

Ecoplans completed a ground survey to document the current land use of the site. At the time of the ground survey, the site was observed to be unoccupied with no obvious operations or activities occurring. However, it was noted that some miscellaneous garbage, debris, and supplies may suggest that the site is used for occasional camping, hunting or other outdoor activities. According to the Official Plan of the Muskoka District Area, the site is currently designated as “Rural”.

Ecoplans also completed a ground survey of the surrounding area to document current land use and any significant structures within 500 metres of the site. Figure 2 shows the approximate site limits and significant structures documented during the survey. The following relevant data from the ground survey is included below:

- Jevins Lake; a large wetland; and forested areas exist to the east and southeast of the site boundaries;
- Highway 11 and Highway 169 interchange exists to the west of the site;
- a utility easement exists to the west and north of the site;
- the current MTO Gravenhurst Patrol Yard exists to the west of the site, including associated office buildings and storage domes and shed;

- five (5) rural residential houses exist to the west of the site, including associated features (i.e. garage units, storage sheds, heating tanks) for low-density rural housing.

2.2 Current Municipal and Private Servicing of Site and Surrounding Area

Ecoplans completed a request for information from the District Municipality of Muskoka for existing water and sanitary sewer systems. The information was used to identify and confirm the presence of municipal servicing of areas within two (2) kilometers of the site. Based on the information obtained from the District, the southern limits of all water and sanitary sewer services are located at the north limits of the existing Highway 11 and Highway 169 interchange. According to the *Gravenhurst Water and Sanitary Service System* plan, supplied by the District of Muskoka, the closest municipal servicing is approximately 1 kilometre from the site.

In addition to completing a request for information from the District, Ecoplans also carried out a ground survey to confirm the presence of private servicing of the site and the immediate surrounding area. At the time of inspection, Ecoplans did not identify any private servicing to the site. Ecoplans did confirm that the five (5) rural residential houses located west of the site are serviced privately, with each dwelling serviced by a septic system and associated weeping tile bed; and water well. The current MTO Patrol Yard to the west of the site is also privately serviced with a septic system and associated tile bed; and water well (See Section 5.0).

3.0 BACKGROUND INFORMATION REVIEW

Ecoplans completed a background information review for the site. The purpose of the review was to gain a general understanding of the regional and local geology and hydrogeology of the area. This was achieved by reviewing geological maps, current and historical aerial photographs, and water well records.

3.1 Geology

According to the *Aggregate Resources Inventory of the Towns of Bracebridge and Gravenhurst* (Ontario Geological Survey Aggregate Resources Inventory Paper 147 – 1990) and *Open File Map 195 Quaternary Geology of the Gravenhurst Area* (Ontario Geological Survey - 1992), the Gravenhurst area is characterized by glacial and postglacial deposits of gravel, sand, silt and clay and swamp and organic deposits of peat and muck overlying Precambrian bedrock. The bedrock in the area exhibits the typical “rock knob” and “rock ridge” topography of the Canadian Shield.

The area is separated into two distinctive physiographic regions influenced by the bedrock geology. The area to the north and east of Gravenhurst is dominated by bedrock outcrops (“rock knob” topography) with pockets of glaciolacustrine deposits of fine to very fine sand with some gravel and

silt. The area to the south and west is dominated by northwest-southeast trending bedrock ridges (“rock ridge” topography) either exposed or covered by a thin veneer of soil. The valleys between the ridges are filled with glacial outwash deposits of well-stratified and uniformly bedded sand; and/or glaciolacustrine deposits of fine to very fine sand with some gravel and silt. The site under study is located on a glaciolacustrine deposits of fine sands and silts.

3.2 Hydrogeology

Preamble

Groundwater is found in water bearing zones below the ground. Less permeable or impermeable layers called aquitards may separate these water bearing zones or aquifers. The aquitards restrict groundwater movement typically between the shallow groundwater zone and the deeper groundwater zone. The shallow groundwater zone is usually perched, unconfined (i.e. not under hydrostatic pressure), limited in areal extent, and generally reflects the surface topography. On the other hand, the deeper groundwater zone is usually at depth, confined (i.e. under hydrostatic pressure/artesian conditions), regional in extent, and does not generally reflect the surface topography. The regional aquifer, or groundwater system, is usually the potable water supply source for human and agricultural consumption.

Site and Surrounding Area

The hydrogeology of the Gravenhurst area is characterized by shallow local and regional aquifers in the glacial sands and gravels; and a deep regional aquifer in the bedrock.

The shallow aquifers are generally unconfined (i.e. not under hydrostatic pressure) and are influenced by the bedrock topography with the most regionally extensive aquifers in the bedrock valleys or any other topographic lows where the glacial deposits are thickest. The top of the aquifer (i.e. water table) is usually very shallow (less than 5 metres below ground surface) and likely extends down to bedrock. The shallow aquifer system across the study area is hydraulically connected to the surface water courses; discharging as baseflow into the streams, lakes and wetlands. The aquifers may also be recharged from surface water courses during dry periods (late in the summer/fall).

The regionally extensive aquifer in the area is in the bedrock and is the principle source of drinking water to households and businesses not presently municipally serviced. The bedrock aquifer is confined (under hydrostatic pressure) and at depth. The groundwater is stored and transmitted through bedrock fractures.

3.2.1 Water Well Records

Preamble

The Ministry of the Environment's Water Well Database is a compilation of water wells drilled in the Province of Ontario for the purpose of human, agricultural and industrial consumption. Pursuant to the Ontario Water Resources Act, any well drilled for these purposes must be drilled by an MOE licensed well drilling contractor and documented on a Water Well Record. The record is then filed with the MOE. Examples of data recorded on a water well record include: location of well, date drilled, depth to water, static water level and subsurface stratigraphy. Since well records have been completed by many different drillers during the past 50 or so years, data accuracy and consistency is sometimes questionable. The most important data recorded on a record are the depth of the water supply aquifer and the subsurface stratigraphy. This information helps in determining whether the aquifer is hydraulically connected to the surface hydrology of an area through groundwater recharge and discharge. It is also important to realize that water wells are drilled into aquifers that can yield appreciable quantities of water for their intended purpose. The majority of these aquifers are normally found at depth in the deep groundwater zones. Therefore, shallow perched aquifers are rarely exploited as a resource due to high susceptibility to contamination, low yields, and potential impacts to surface water baseflow. Water well records seldom identify shallow perched aquifers.

However, given their limitations, water well records still provide a very useful source of both local and regional geology and hydrogeology.

Site and Surrounding Area

Ecoplans completed a water well record search of an area within 500 meters of the site. The results of the search identified two water well records for two wells located in close proximity to the study limits. These wells, which are shown on Figure 2, are located southwest of the site. One of the wells services the existing MTO patrol yard. The second well identified in the MOE well records search was not found by Ecoplans at the time of site inspection. The occupant of the residence, located south of the existing Patrol Yard and east of Highway 11, was unavailable at the time of inspection to verify if the well identified in the well records has been decommissioned or if the well was on the property. At the time of the site inspection, a well was found on the property; however the construction of the well (dug with wood casing) was different than that described on the well record (drilled with steel casing) (See Table 1 in Section 5.0). Both wells identified in the well records search are terminated in sand overburden at depths of 19 metres for the patrol yard well and 34 metres for the other well. No records were found for the site or the five (5) residences to the immediate west of the site.

3.3 Aerial Photographs

Current (2002) and historical aerial photographs (for the years 1956, 1960, 1969 and 1978) for the site and surrounding area were reviewed by Ecoplans to identify any surface features that are of potential

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hydrogeological significance (surface water bodies, vegetation cover and human development impacts). A description of the notable features for each aerial photo is summarized below:

1956 and 1960 Aerial Photographs

- The existing patrol yard site is developed but with no significant structures or buildings;
- A few of the existing residences immediately north of the existing patrol yard and west of the site are present. A road extends from these residences to the east through the site;
- The existing large wetland to the southeast of the site and the small pond at the southeast corner of the site are not present on the photos. The area is covered with dense forest.

1969 Aerial Photograph

Same as the 1956 and 1960 photos with the exception of:

- The existing patrol yard site is developed with a few buildings;
- A couple more residences appear in the cluster of existing residences immediately north of the existing patrol yard and west of the site;
- Highway 11 construction appears on the photo.

1978 Aerial Photograph

Same as the 1956 and 1960 photos with the exception of:

- The existing patrol yard site is more developed with the construction of the storage domes;
- A couple more residences appear in the cluster of existing residences immediately north of the existing patrol yard and west of the site;
- Highway 11 and Highway 169 Interchange and Highway 11 four-laning to the north in full operation.

2002 Aerial Photo

- The existing patrol yard is as it appears today;
- The existing large wetland to the southeast of the site and the small pond at the southeast corner of the site area is present on this photo;
- The cluster of residences immediately north of the existing patrol yard and west of the site is as it appears today;
- A road runs from the southeast corner of the existing patrol yard to the east and ends close to the wetland;

- The entire site is covered with forest but considerably less dense than that observed on the historical aerial photographs.

The most significant observation noted on the aerial photos was that sometime between 1978 and 2002, the forest was thinned by selective logging and the large wetland appeared. It is likely that selective logging in the past resulted in the formation of the wetland. This could have been caused by the increase in surface run-off and soil infiltration with the net effect being water storage in the topographically low wetland area. Figure 3 shows the 2002 aerial photograph and approximate site limits, noting significant site features.

4.0 SITE INSPECTION

The purpose of the site inspection is to observe and document any significant features of hydrogeologic concern such as surface water courses, seepage zones and springs (groundwater discharge), topography and surficial geology. During the course of the study, a number of site inspections were completed. Figures 2 and 3, and Appendix A (site photographs) show some of the features identified during the site inspections. The results of the site inspections are summarized below.

- the site contains many areas of shallow bedrock outcrops, including a few large bedrock ridges and knolls;
- the two existing water bodies, the small pond and large wetland, appear to be hydraulically connected to the shallow groundwater aquifer in the area. Both water bodies appear to fluctuate seasonally with the groundwater, however the small pond appears to be intermittent – this is due to the shallow water table which is generally at the same elevation as the bottom of the pond
- the small pond may have been used as a small borrow pit;
- a few small depressions are scattered across the site and at the time of the site inspections were noted to be full of water likely indicating shallow groundwater conditions;
- surficial geology is predominantly sand and gravel overburden with scattered boulders most notably at the southwest portion of the site;
- miscellaneous garbage and debris were scattered throughout the northeast portion of the site;
- a small network of access roads/trails meander through the site;
- no seepage zones or springs were noted;
- immediately to the west of the site (north of the Patrol Yard), the area appears to have been excavated as a possible large borrow pit, and some miscellaneous garbage and debris were noted.

5.0 WATER WELL SURVEY

Ecoplans completed a water well survey of all wells within 500 metres of the site. The purpose of the well survey was to confirm the presence, location and construction details of each well. Water level measurements of any of the wells were not undertaken as the wells were not easily accessible. The

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results of the survey identified seven (7) wells within 500 metres of the site. Five of the wells are associated with the rural residential housing along Holmes Road (north of the existing MTO patrol yard) and the other two (2) wells are associated with the existing patrol yard and the residence south of the patrol yard (see Section 3.2.1). It should be noted that all of the wells will be decommissioned to accommodate the proposed realignment of the Highway 11/169 interchange.

Table 1 summarizes the well survey results for the water wells within 500 metres of the site.

Table 1 Water Wells Within 500 Metres of the Site						
Location	Water Well Present	Date Installed	Well Diameter (m)	Well Type/ Material	Well Depth (m)	Notes
1029 Holmes	Yes (front/side of house)	~ 1950	1.17	Dug/Concrete Tiled	6.60	-
1033 Holmes	Yes (front/side of house)	Unknown	1.12-1.22*	Dug/Concrete Tiled	8-10*	Occupant refused access
1034 Holmes	Yes (front of house)	Unknown	1.12	Dug/Concrete Tiled	7-9*	Well cover sealed
1036 Holmes	Yes (front/side of house)	Unknown	0.91	Dug/Concrete Tiled	7.50	-
1039 Holmes	Yes (back of house)	~ 1950	1.07	Dug/Concrete Tiled	7.10	-
MTO Patrol Yard	Yes (west of main office)	1950	0.15	Drilled/Steel Casing	19	-
Residence¹ (south of MTO Yard)	Yes (back of house)	Unknown	0.91	Dug/Wood Planks	Unknown	No occupant available

Notes:

*Well information based on information obtained through occupant interview.

¹ Well information based on information identified during Ecoplans well survey, not on the MOE well records search.

6.0 SUBSURFACE INVESTIGATION

Ecoplans carried out a subsurface investigation at the selected site to provide a general physical and chemical assessment of the soil and groundwater conditions across the site. The investigation involved the drilling of boreholes and installation of groundwater monitoring wells on and adjacent to the site. Ecoplans also installed mini-piezometers in the beds of the small pond and large wetland to determine if groundwater is discharging into the water body. It should be noted that immediately following the subsurface investigation, the site limits were re-established to accommodate future Highway 11 and Highway 169 interchange improvements, and therefore some of the wells ended up lying outside of the site. The current site limits are as it appears in the attached figures referenced throughout this report. Figure 4 displays the approximate borehole, monitoring well and mini-piezometer locations. All drilling was carried out under the supervision of Ecoplans' Field Hydrogeologist. All soil and groundwater sampling was carried out by Ecoplans' Field Hydrogeologist.

6.1 Methodology/Protocols

All fieldwork was carried out with due regard to generally accepted environmental field protocols and in general accordance with applicable Ontario Ministry of the Environment (MOE) and Canadian Standards Association (CSA) guidelines. The specific methodology that Ecoplans followed is summarized in this section.

6.1.1 Drilling and Soil Sampling

All drilling work was completed using a professionally trained and reputable drilling company (Atcost Soil Drilling Inc.). Boreholes were advanced on May 17 through 19, 2004 using a track-mounted CME-75 on a Nodwell drilling rig equipped with hollow-stem augers. The augers were extended to the pre-determined sampling interval using conventional drilling methods, at which time a decontaminated split spoon sampler was driven ahead of the lead auger to collect a discrete soil sample.

Representative soil samples were collected from the boreholes using a 0.6 m (2-foot) split-spoon sampler, which was driven by use of a 63.5 kg (140 lb) hammer. The number of blows applied per each 0.15 m (6 inches) was recorded. Split-spoon soil samples were generally collected at 0.75 metre (2.5 foot) intervals and were either composited over the 0.6 metre spoon, or were composited to represent each different geological unit encountered (using the below naming conventions). The sampling interval was increased to 1.5 metre (5 foot) intervals in deeper boreholes. If split spoon samples were unobtainable (i.e. extended saturated soil conditions limited auger penetration depths), a drive cone was substituted to determine the depth at which bedrock was encountered and termination of borehole.

The soil sample naming convention used indicates the borehole number followed by the split-spoon number.

Soil Logging

Soil samples collected were described and recorded in the field in general accordance with the Unified Soil Classification System (USCS). Soil samples were evaluated by the following characteristics:

- Major soil type and/or USCS Description;
- Native soil or fill material;
- Secondary and minor soil components;
- Blow counts from split-spoon sampler (standard penetration test);
- Relative grain size/consistency;
- Colour; and
- Moisture content.

Additionally, all soil samples were inspected for the presence of gross impact (i.e. odours and/or staining) indicative of chemical presence before being placed in ziploc bags and sample jars for subsequent chemical analysis. All relevant soil logging information is presented on the borehole logs. These are included in Appendix B.

Soil Sample Screening

All soil samples were screened in the field for the presence of total organic vapors (TOV) using a MiniRae 2000 Portable VOC Monitor calibrated to benzene. Head space techniques were employed to screen the soil samples. Soil samples were placed in ziploc bags (partially filled) and allowed to equilibrate with indoor ambient air conditions (approximately two hours) to ensure that all samples were screened under the same conditions. Following equilibration, TOV measurements of the air within the ziploc bag were taken. The PID was zeroed and field calibrated to isobutylene prior to each day's use.

Decontamination

All equipment in contact with soil samples was decontaminated after each use to prevent the cross-contamination of individual samples and to ensure reliable, representative, and unbiased chemical test results. Decontamination of sampling equipment was typically achieved using tap water/lab detergent wash, followed by clean water rinse, methyl hydrate rinse, and deionized water rinse.

6.1.1 Monitoring Well Installation

A total of eight (8) monitoring wells were installed at the site (see Section 6.2). Scaled diagrams of the monitoring wells installed are included in the borehole logs (Appendix B).

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Well Construction

The monitoring wells were constructed from 50mm diameter, schedule 40 polyvinyl chloride (PVC) flush-joint threaded pipe. The well screens were comprised of factory slotted (slot width of 0.010 inch) PVC pipe to permit the entry of water into the well. The bottoms of the screens were plugged with screw-on or slip-on end caps. The appropriate numbers of risers were coupled with the screen sections via threaded joints to construct the well. No PVC cements or other solvents were used in the construction of the wells, as they provide a source of organic contamination in the wells.

Well Placement and Annulus Construction

Where possible, wells were positioned at the bottom of the borehole to ensure long-term stability. If a higher screened interval was required, an additional borehole was advanced to the prescribed depth for the well installation at least 1 metre, and no more than 2 metres, away from the original borehole.

Following well placement, medium-size silica sand was added to fill the annular space created between the outside of the well and the inside of the boring. Sand was added until the level of sand reached a minimum of 0.3 m and maximum of a 0.6 m above the top of the screened interval. The final level of the sand pack was plumbed with a weighted tape and recorded.

A water level measurement was then taken in the annulus of the borehole to confirm the presence/absence of water above the sand pack. Coarse ground bentonite and/or bentonite pellets 1 cm in diameter were then poured down the borehole to produce a seal above the sand pack extending to near ground surface. The bentonite was hydrated if required. The bentonite depth was verified using a weighted measuring tape and recorded.

The bentonite provides stability to the well installation and also acts as a seal to prevent surface runoff from entering the well.

Well Capping

The tops of the wells were capped using lockable J-plugs and high-density steel weather resistant locks. To prevent surface water infiltration and to provide security, a protective steel aboveground casing was placed over each well. The top 0.3 to 0.6 m of the well bores (above the upper bentonite seal) was filled with portland cement with the aboveground or flushmount casing set in place roughly 0.45 m into the cement.

Well Development

All wells were developed prior to any groundwater purging and sampling. The objective of well development is to repair damage done by drilling so that the natural hydraulic properties of the water-

bearing formation are restored. Well development was achieved either by continuous bailing/purging of the water present in the well to create agitation in the groundwater in order to remove particulate matter from the well.

In general, the wells installed at the site yielded significant quantities of groundwater within 24 hours of drilling. All wells were purged prior to groundwater sampling (see Section 6.1.1).

Well Tie-In

All monitoring wells at the site were surveyed for top of riser and ground elevation using a reputable surveying company (J D Barnes Limited). The elevation data was based on a local benchmark (DHO BM 271-67) located at the existing MTO Patrol Yard, which was used to establish the relative groundwater elevations.

6.1.1 Groundwater Monitoring and Sampling

All wells recovered quickly and were sampled on July 8, 2004. All wells were purged before sampling.

Water Level Measurements

Groundwater levels (i.e. depth of the water table below the top of the well riser) were measured using a TestWell electronic water level indicator and a weighted marked tape measure. The well depth was also measured using these methods. The measuring devices were decontaminated between monitoring locations using a methyl hydrate rinse followed by de-ionized water rinse.

Well Purging

Prior to groundwater sample collection, each well was purged of the standing volume of stagnant water, which is not representative of the formation groundwater. The objective of purging was to pump the well until water representative of the formation groundwater was obtained. This was achieved by pumping/bailing a total of three full bore volumes of water from the well using a disposable bailer dedicated to the well. Attempts were made to pump the water from the top of the standing water column so that the entire static volume was removed. The total volume of purge water pumped from the well was measured using a graduated bucket and recorded. If the well was pumped dry during purging, it was allowed to fully recover before subsequent sampling. Field measurements of temperature, conductivity and pH were taken of the purge water during well purging to ensure adequate groundwater stabilization.

Sample Collection and Transfer

All groundwater samples were collected using the dedicated inertial lift WaTerra pump. Clean plastic sheeting was placed on the ground surface adjacent to the well being sampled, which was used for storage of equipment and supplies. Clean latex gloves were employed throughout the sampling process to ensure reliable and representative sample collection. Low flow rates were maintained for collection of all benzene, toluene, ethylbenzene and xylene (BTEX) samples.

Following collection, all soil and groundwater samples were placed immediately into an insulated cooler complete with ice and/or freezer packs. Field chain-of-custody records completed at the time of sample collection, accompanied the samples inside the cooler for delivery to the laboratory. All coolers were hand delivered to the analytical laboratory.

Decontamination

All equipment in contact with groundwater samples was either discarded or otherwise decontaminated after each use to prevent the cross-contamination of the monitoring wells and to ensure reliable, representative, and unbiased chemical test results. Decontamination of groundwater sampling equipment was typically achieved using methyl hydrate rinse followed by de-ionized water rinse.

Single-Well Response Tests

Single-well response tests were completed for all monitoring wells to estimate the hydraulic conductivity of the water-bearing formation. The hydraulic conductivity of the formation is proportional to the rate of recovery of the well. A series of weighted 1 inch diameter steel slugs were used to displace the water column. The change in water level was recorded using a Solinst Model 3001 Levellogger LT. At the beginning of the slug test, the initial static water level measurement was taken and recorded. The slug was subsequently inserted or removed (depending on a rising or falling head test), with measurements recorded in one second intervals by the Levellogger. Once complete, the data was analyzed using the Bouwer and Rice Method, based on the known well geometry.

6.2 Drilling Program

A total of nine (9) boreholes (BH1 to BH7) were drilled at the locations shown on Figure 4 between May 17 and May 19, 2004. All of the boreholes are located in topographically flat areas and along cleared roads and trails to permit relatively easy drill rig access. The boreholes were drilled to between 1.8 and 16.4 metres below ground surface (bgs) and terminated in bedrock or until refusal (with the exception of BH3A and BH4A which were shallow boreholes as part of well nests – see the next paragraph) using a B-75 track-mounted drilling rig equipped with hollow-stem augers.

Each borehole (with the exception of BH6) was instrumented with a groundwater monitor (MW1 to MW8) to facilitate in the collection of groundwater samples, and to monitor groundwater levels. Since BH6 was not instrumented with a groundwater monitor, the borehole was appropriately abandoned as per Regulation 903, which included backfilling the borehole with bentonite seal. For the purposes of simplicity all of the boreholes are identified as MW1 to MW8. Two of the borehole locations (MW3/MW4 and MW5/MW6) consisted of well clusters or nests to monitor groundwater conditions in the shallow and deep aquifers.

6.3 Soil Sampling Program

A total of 46 soil samples were collected during the subsurface investigation. All soil samples were inspected for the presence of gross impact (i.e. odours and/or staining), and logged for colour, texture and consistency before being placed in Ziploc bags and sample jars (as described in Section 6.1.1). Borehole logs for the subsurface investigation are presented in Appendix B.

6.3.1 Soil Analytical Schedule

In an effort to establish the existing environmental (chemical) quality and physical conditions of the soil conditions across the site, a number of soil samples were collected and submitted to AGAT (a full service analytical laboratory certified by the Canadian Association of Environmental Analytical Laboratories) for chemical analyses and Thurber Engineering Ltd. (Thurber) for physical analyses. Each analytical package is described below:

Soil Inorganic Analyses

- **Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) Metals** - to assess the metals content of the soil.
- **Available Boron** – to assess the magnitude of available boron in the soil.
- **Cyanide** – to assess the magnitude of cyanide in the soil.

It should be noted that on the borehole logs, the metals soil analysis includes metals, available boron and cyanide.

- **Electrical Conductivity (EC)** – to assess the magnitude of electrical conductivity in the soil.
- **Sodium Adsorption Ratio (SAR)** - to assess the magnitude of S.A.R. in the soil.
- **pH** – to assess the pH level in the soil.

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Soil Organic Analyses

- **Total Petroleum Hydrocarbons (TPH) - Hot Extractables (TPH Heavy Oils)** - to characterize the nature and magnitude of suspected petroleum hydrocarbon (heavy oil) impacts in the soil.
- **TPH - Total Purgeables and Cold Extractables (TPH Gas/Diesel)/Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX) Analysis (TPH-g/d/BTEX)** - to characterize the nature and magnitude of suspected petroleum hydrocarbon (gasoline and diesel fuel) impact in the soil.

Soil Physical Analysis

- Moisture Content
- Grain-Size
- Atterberg Limits

Table 2 on the next page summarizes the soil analytical schedule.

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Table 2
Soil Analytical Schedule

Sample	Depth (metres below ground surface)	Chemical Analysis	Physical Analysis
BH1-2	1.07	Chemical Package	-
BH1-3	1.83	-	Grain-size/Moisture Content
BH2-2	1.07	Chemical Package	Moisture Content
BH2-3	1.68	-	Grain-size
BH3-3	1.83	Chemical Package	Moisture Content
BH3-4	2.59	-	Grain-size
BH3-8	6.16	-	Moisture Content
BH3-10	9.80	Chemical Package	-
BH3-11	10.67	-	Grain-size/Moisture Content/ Atterberg Limits
BH3-12	12.50	-	Grain-size/Moisture Content
BH4-3	1.83	Chemical Package	-
BH4-4	2.59	-	Grain-size/Moisture Content
BH4-5	3.58	-	Grain-size/Moisture Content
BH4-6	4.11	-	Grain-size/Moisture Content/ Atterberg Limits
BH4-7	4.90	Chemical Package	-
BH5-3	1.83	Chemical Package	-
BH5-4	2.59	-	Grain-size/Moisture Content
BH5-10	7.56	-	Grain-size/Moisture Content
BH6-2	1.07	-	Grain-size/Moisture Content
BH6-3	1.75	Chemical Package	-
BH7-3	1.83	Chemical Package	Moisture Content
BH7-4	2.59	-	Grain-size/Atterberg Limits

6.4 Groundwater Sampling Program

6.4.1 Groundwater Analytical Schedule

In an effort to establish the existing environmental (chemical) quality of the groundwater across the site, groundwater samples were collected on two occasions (July 8 and August 20, 2004) from each of the eight (8) monitoring wells and submitted to AGAT for the following analysis:

Groundwater Inorganic Analysis

- **General Groundwater Chemistry (Metals, Major Anions, Hardness, pH, Nitrate/Nitrite and Other General Parameters) (GGWC)** - to assess the groundwater for general environmental quality. All groundwater metals samples were field filtered prior to sampling with the exception of MW8 on the August 20 sampling event (insufficient water to pass through the filter).
- **Chloride** - to characterize the nature and magnitude of suspected chloride impacts in groundwater.

Groundwater Organic Analysis

- **TPH Heavy Oils** - to characterize the nature and magnitude of suspected petroleum hydrocarbon (heavy oil) impacts in the groundwater.
- **TPH-g/d/BTEX** - to characterize the nature and magnitude of suspected petroleum hydrocarbon (gasoline and diesel fuel) impact in the groundwater.

Groundwater sampling protocols are described in Section 6.1.1.

The procedures used by the laboratory for each of the above analytical packages (both soil and groundwater) were in accordance with industry-accepted laboratory protocols, and the MOE document entitled “Guidance for Sampling and Analytical Methods for use at Contaminated Sites in Ontario”.

The specific procedures used by AGAT for each analysis are documented in the laboratory certificates of analysis, included in Appendix D.

6.5 Sample QA/QC

AGAT completed a variety of quality assurance/quality control (QA/QC) measures on the soil and groundwater samples submitted as part of the sampling program. These included: **sample replicates**, which are identical analysis carried out on the same sample multiple times used to measure laboratory analytical precision; **matrix spiked laboratory blanks**, which are solvent or reagent blanks spiked with the analytes of interest used to measure and detect any analytical method errors; and **process**

blanks, which are matrices without the analytes of interest that are carried through all steps of the analytical procedure used to measure contamination when stirring, blending, digesting, or subsampling and to prepare sampling prior to analysis.

The results of the laboratory QA/QC program for this project are included in the laboratory certificates of analysis, presented in Appendix D.

In addition to the laboratory QA/QC, Ecoplans submitted one (1) **field duplicate** during the groundwater sampling event, which took place on July 8, 2004. The results of the duplicate analysis are shown in Appendix C. Most of the parameters analysed in the field duplicate were observed to be within acceptable limits of variance (<10%). Parameters with large variances between the duplicate and actual sample are considered to be estimates only and are to be interpreted with caution for the site.

6.6 Groundwater Monitoring Program

A groundwater monitoring program was carried out by Ecoplans across the site. The program consisted of measuring the water levels of the eight (8) wells on three occasions; July 8, July 21 and August 20, 2004; and carrying out single-well response tests on the wells on July 8, 2004. The purpose of the water levels measurements was to measure and monitor the potentiometric surface of the local aquifer(s) to determine hydraulic gradient and groundwater flow direction. The purpose of the single-well response tests (falling head tests) was to estimate the hydraulic conductivity and horizontal groundwater velocity of the aquifer.

7.0 MINI-PIEZOMETERS

On July 20, 2004 two (2) mini-piezometers were installed in the beds of significant surface water bodies. The purpose of the mini-piezometers was to determine if groundwater is discharging into the water bodies as baseflow. The mini-piezometers were constructed of ¾" diameter PVC pipe. The bottom 0.30 metres of each pipe was slotted and flush capped at the base to prevent clogging of sediments during installation. Each mini-piezometer was installed in the waterbody bed surface to a minimum depth of 0.45 metres. The tops of each mini-piezometer were fitted with a PVC screw-on cap in order to prevent precipitation entry into the pipe.

Mini-piezometer, P1 was installed in the small pond and P2 was installed in the large wetland. Their locations are shown on Figure 4. Water levels were measured on three occasions (July 8, July 21 and August 20, 2004) coinciding with the water levels taken of the monitoring wells.

8.0 RESULTS OF SUBSURFACE INVESTIGATION

8.1 Site Geology

Based on the observations and interpretation of the samples collected from the boreholes during the investigation, the site geology generally consists of native sand deposits (fine to medium-grained) overlying bedrock. These deposits are likely associated with glaciolacustrine deposits (predominantly consisting of sand) which are known to be in the Gravenhurst area. The sand overburden depth varied significantly across the site, and was found to be as shallow as 1.8 metres at BH6 (west central portion of site) to as deep as 16.5 metres at BH3 (south of site). Generally, shallow sand overburden was found in the southwest area of the site and in the vicinity of BH6 and MW8. Wet soil conditions were encountered between 0.6 to 1.75 metres bgs in all Ecoplans boreholes. Figures 5A through 5D display cross-sectional diagrams of the geological (hydrostratigraphic) conditions encountered at the site based on the borehole logs.

8.2 Site Hydrogeology

Monitoring Wells

Monitoring wells MW1, MW2, MW4, MW6, MW7 and MW8 were installed to capture the shallow unconfined aquifer. Monitoring wells MW3 and MW5 were installed to capture the observed deeper confined aquifer at the site. As indicated earlier, all of the wells at the site (MW1 to MW8) were surveyed for ground surface, top of riser elevations, and water level elevations on July 8, 2004. The wells were surveyed using a local referenced benchmark (tablet set in the west face of the MTO Patrol Yard office/garage building) and known elevation datum of 257.308 mAMSL. Ecoplans completed additional monitoring events on July 21 and August 20, 2004. Table 3 summarizes borehole and aquifer data for the site and Table 4 summarizes the relative groundwater elevations for each monitoring well at the site.

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Table 3
Borehole/Monitoring Well Data

Borehole/ Monitoring Well	Borehole Depth (m)	Screened Interval (m bgs)	Surface Elevation (mAMSL)	Depth to Aquifer (m bgs)	Elevation of Aquifer (mAMSL)	Aquifer Thickness ⁽¹⁾ (m)	Formation Type	Hydraulic Conductivity (ms ⁻¹)
BH1 (MW1)	2.28	0.8-2.28	250.31	0.8	249.51	1.5	fine-grained SAND	3.3E-04
BH2 (MW2)	2.12	0.9-2.10	252.95	1.0	251.95	1.1	gravelly SAND	4.4E-02
BH3 (MW3)	16.5	11.9-13.4	254.11	11.9	242.21	4.6	sandy SILT	no data*
BH3A (MW4)	4.58	1.60-4.58	254.13	1.5	252.63	3.1	fine-grained SAND	7.2E-04
BH4 (MW5)	5.63	4.0-5.4	255.06	3.7	251.36	1.9	sandy SILT	3.5E-04
BH4A (MW6)	3.05	0.9-3.0	255.08	1.0	254.08	2.5	fine-grained SAND	9.0E-04
BH5 (MW7)	10.96	1.55-4.0	254.41	1.5	252.91	9.5	fine-grained SAND	1.3E-03
BH6	1.82	n/a	257.02	1.0	256.07	0.8	sandy SILT	-
BH7 (MW8)	3.2	1.7-3.2	254.82	1.5	253.32	1.7	SILT	5.1E-04

*Data from Pressure Transducer Datalogger was lost

Aquifer Thickness ⁽¹⁾

- vertical distance between top of water table to bedrock - BH1 (MW1), BH2 (MW2), BH5 (MW7), BH6 and BH7 (MW8)
- vertical distance between top of lower confined aquifer to bedrock - BH3 (MW3) and BH4 (MW5)
- vertical distance between top of water table to bottom of shallow unconfined aquifer - BH3A (MW4) and BH4A (MW6)

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Table 4
Relative Groundwater Elevations

Monitoring Well	Ground Surface Elevation (mAMSL)	Groundwater Elevations (mAMSL)		
		July 8, 2004	July 21, 2004	August 20, 2004
MW1	250.31	249.72	249.72	249.57
MW2	252.95	251.8	251.76	251.36
MW3	254.11	251.59	251.69	251.43
MW4	254.13	252.48	252.37	251.85
MW5	255.06	253.96	253.71	252.74
MW6	255.08	253.62	253.41	<i>Dry</i>
MW7	254.41	252.25	252.10	251.53
MW8	254.82	253.34	253.21	252.44

Mini-Piezometers

A total of two (2) mini-piezometers were installed in the bed of the small pond and large wetland on July 20, 2004. Figure 4 shows the location of the mini-piezometers. The purpose of the mini-piezometers were to measure the hydraulic gradient between the water body and groundwater; i.e. whether groundwater is discharging (and therefore providing baseflow) to the water body.

Based on measurements from the July 21 and August 20, 2004 monitoring event both piezometers (P1 and P2) were identified as having a higher hydraulic head in the water body than in the piezometer which indicates groundwater recharge (i.e. stream recharging the groundwater).

Table 5 on the next page summarizes the mini-piezometer measurements installed at each water body.

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Table 5			
Mini-Piezometer Measurements			
Piezometer Number	Difference in Hydraulic Head Between Piezometer and Stream Level (m)		Groundwater Discharge?
	July 21, 2004	August 20, 2004	
P1 (small pond)	-0.03	-0.35	No
P2 (large wetland)	-0.15	-0.30	No

Discussion of Groundwater System

Based on the observations noted during the drilling program, each borehole encountered saturated soil conditions at very shallow depths, generally at depths of 1.5 metres. These conditions were generally observed through the full depth of each borehole down to bedrock. This shallow groundwater system represents an unconfined aquifer storing a significant quantity of groundwater in the predominantly sandy matrix. Two of the boreholes, BH3(MW3) and BH4(MW5), encountered a narrow layer of less permeable material (silt) at depths of 10.3 metres in BH3 and 3.5 metres in BH4. This narrow layer appears to represent an aquitard hydraulically separating the shallow unconfined aquifer from the deeper confined aquifer. Groundwater is vertically transmitted through the aquitard but at a very low hydraulic conductivity. It is noted that based on the water level measurements at these two wells, there is a slight upward gradient (groundwater is transmitted upwards from the deep confined aquifer to the shallow unconfined aquifer) at MW5 and a downward gradient in MW3. Due to the limited borehole data, it is difficult to conclude on the extent and hydraulic properties of the aquitard(s) and what effect it has on the overall groundwater regime of the site. However, what is clearly evident is the fact that the site consists of saturated sand overlying an undulating bedrock surface generally trending in a northwest-southeast direction. This basin effect significantly influences the direction of groundwater flow through the site, which is to the southeast. This is confirmed by the water level measurements taken of the monitoring wells on July 8, 2004 which showed a groundwater high of 253.62 mAMSLL at MW6 to a low of 249.72 mAMSLL at MW1. Figure 6 shows the groundwater elevation contours and inferred flow direction. The shallow groundwater system is hydraulically connected to the large wetland discharging as baseflow into the wetland during high flow conditions (spring melt and late fall rain events). However during low flow conditions (summer) the wetland appears to recharge the shallow groundwater system as evidenced by the mini-piezometer measurements.

Single well response tests (falling head tests) were carried out at all installed monitoring wells (MW1 to MW8) on July 9, 2004 to estimate the hydraulic conductivity of the shallow groundwater matrix (sand and silt) in order to estimate horizontal groundwater velocities. The results of the tests (analysed using the Bouwer and Rice Method), which are shown in Table 3, indicate a range of hydraulic conductivities of between $3.3 \times 10^{-4} \text{ ms}^{-1}$ and $4.4 \times 10^{-2} \text{ ms}^{-1}$ with an average of $6.9 \times 10^{-3} \text{ ms}^{-1}$. Based on a hydraulic gradient of 0.016 and soil porosity of 0.40 for a fine to medium sand aquifer, the

estimated horizontal groundwater velocity ranges between 1.1 metres/day (402 metres/year) to 152 m/d (55 km/yr) with an average of 24 m/d (8.8 km/yr). This high groundwater velocity clearly illustrates the dynamics of the shallow groundwater system at the site and the fact that groundwater residence time in the sand matrix is relatively short.

8.3 Soil Sample Screening

The soil sample screening results from the boreholes installed during the subsurface investigation indicated total organic vapour (TOV) readings all below 2 parts per million (ppm).

Ecoplans did not observe any visual or olfactory evidence of contamination in any of the boreholes drilled during the subsurface investigation. The TOV readings for all samples collected are included in the borehole logs found in Appendix B.

8.4 Analytical Results

At the time of the investigation, the following applicable environmental guideline was used to assess the environmental quality of the soil and groundwater at the site.

- Guideline for Use at Contaminated Sites in Ontario; Ontario Ministry of the Environment, June 1996 (Revised September 1998).

In addition, the following applicable environmental standard was used to assess the environmental quality of the groundwater at the site:

- Ontario Drinking Water Standards; Ontario Ministry of the Environment, Revised January 2001

The MOE Guideline

In June 1996, the MOE originally released the “Guideline for Use at Contaminated Sites in Ontario” (MOE Guideline). It provides site assessment/remediation criteria for 117 specific parameters including metals, petroleum hydrocarbon related compounds, volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides, and herbicides in both soil and groundwater media.

The MOE Guideline for contaminated sites uses generic site assessment/remediation designed to protect human health and the natural environment. It incorporates risk assessment through the provision of two clean-up scenarios: 1) Full Depth - restoration of soil quality to the full extent of the contamination; and 2) Stratified Depth - restoration of soil quality of the top 1.5 m following the full depth criteria; however, soil quality deeper than 1.5 m must be restored to stratified depth criteria. Each of these cleanup scenarios follow particular guideline criteria for both soil and groundwater

separated into two different land use designations (i.e. residential/parkland and industrial/commercial) in either a potable or non-potable groundwater situation.

The site is situated in rural forested area southwest of the Town of Gravenhurst, however the operations adjacent to the site, and future operations at the site (i.e. patrol yard), are considered to be industrial/commercial. On-site wells currently service the residential properties along Holmes Road and operations at the existing MTO Patrol Yard. To this end, applicable analytical results from the soil and groundwater samples collected from the site were compared against the **full depth** cleanup scenarios for industrial/commercial land use in a potable groundwater situation (Table A of the MOE Guideline).

Ontario Drinking Water Standards

The Ontario Drinking Water Standards (ODWS) are a set of chemical and physical standards for drinking water implemented by the MOE and adopted from the Canadian Drinking Water Guidelines (CDWG). The objectives are either health-related or not health-related (aesthetic or operational guidelines). To this end, applicable analytical results from the monitoring well samples collected from the site were compared against the ODWS as a general indicator of the groundwater potability.

8.4.1 Results of Soil Analysis (Chemical)

The chemical results of the selected soil samples submitted for analysis were compared to the industrial/commercial land use remediation criteria outlined in Table A of the MOE Guideline (potable groundwater condition), assuming coarse-textured soils. The results of the chemical analysis for all of the soil samples submitted are presented in Tables 6 and 7 at the end of this report.

All soil samples collected and submitted for analysis **met** the applicable MOE Guideline Table A soil criteria.

It should be noted that low levels (well below the MOE Guideline) of TPH (gas/diesel) and toluene were found in BH2-2. This indicates that the soil at this location is slightly impacted with petroleum hydrocarbons.

The full analytical soil results as prepared by AGAT are included in Appendix D.

8.4.2 Results of Soil Analysis (Physical)

Ecoplans submitted a minimum of one (1) soil sample from each borehole for a grain-size and/or soil moisture content analysis to Thurber Engineering Ltd. An attempt was made to submit samples for each geological unit encountered during the subsurface investigation. Based on the results of the grain-size analyses, most of the shallow aquifer lies in a fine-grained sand to sandy silt matrix. The

soil above the water table is predominantly composed of well-sorted fine-grained sands. The deeper soil found in BH3, BH4 and BH7, were reported to be of a silt and clayey silt matrix, respectively.

Based on the results of the soil moisture analyses, the average moisture content of the aquifer and aquitard matrices is between 18.31% and 28.02% for the aquifer matrix and 19.07% and 36.99% for the aquitard matrix.

The reported soil moisture contents and grain-size analyses were typical for the nature of the soils encountered. These reported results are also consistent to what was observed in the field and as reported in the background information (i.e. soils and geological maps).

Three soil samples were submitted to Thurber for determination of the Atterberg Limits (BH3-11, BH4-6 and BH7-4). Thurber reported that the soils were non-cohesive and therefore the Atterberg Limits could not be determined.

The results of the physical analysis for all of the subsurface soil samples submitted are presented in Table 8 at the end of this report. The grain size distribution curves and letter from Thurber indicating that the soil samples submitted for the Atterberg Limits tests represented non-cohesive soil (and therefore could not be tested) are included in Appendix D.

8.4.3 Results of Groundwater Analysis

The chemical results of groundwater samples collected from the monitoring wells MW1 to MW8 on two occasions (July 8 and August 20, 2004) were compared to the criteria presented in Table A of the MOE Guideline (potable groundwater condition), assuming coarse-textured soils and the ODWS. The results of groundwater analysis are summarized in Table 9 and 10 at the end of this report.

All groundwater samples collected from both sampling events *met* the applicable MOE Guideline and ODWS criteria for the parameters analysed, with the *exception* of the following:

July 8 Sampling Event

Petroleum Hydrocarbons

- TPH (g/d) was detected at 1,400 micrograms per litre (µg/L) in the groundwater collected from **MW2**, exceeding the MOE Guideline criterion of 1,000 µg/L.

Metals and General Parameters:

- Elevated levels of **aluminium** were detected at 166 µg/L, 159 µg/L, and 547 µg/L) at **MW1**, **MW2**, and **MW8**, respectively, exceeding the ODWS criterion of 100 µg/L.

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- Elevated levels of **iron** were detected at 11,300 µg/L, and 570 µg/L at **MW1**, and **MW8**, respectively, exceeding the ODWS criterion of 300 µg/L.
- Elevated levels of **manganese** were detected at 729 µg/L, 289 µg/L, and 185 µg/L at **MW1**, **MW3**, and **MW8**, respectively, exceeding the ODWS criterion of 50 µg/L.
- **All** groundwater samples submitted fell outside of the acceptable range for **total hardness** (80,000 ug/L and 100,000 ug/L).
- **All** groundwater samples submitted, with the exception of MW3 were detected below the range of the ODWS criteria for **pH** of 6.5-8.5.

August 20 Sampling Event

Metals and General Parameters:

- Elevated levels of **aluminium** were detected at 131 µg/L, 208 µg/L, and 97,200 µg/L) at **MW1**, **MW2**, and **MW8**, respectively, exceeding the ODWS criterion of 100 µg/L.
- Elevated levels of **iron** were detected at 5,570 µg/L and 26,500 µg/L at **MW1**, and **MW8**, respectively, exceeding the ODWS criterion of 300 µg/L.
- Elevated levels of **manganese** were detected at 277 µg/L, 224 µg/L, and 854 µg/L) at **MW1**, **MW3**, and **MW8**, respectively, exceeding the ODWS criterion of 50 µg/L.
- Elevated level of **copper** was detected at 247 ug/L at **MW8** exceeding the MOE Guideline criterion of 23 ug/L.
- Elevated level of **lead** was detected at 24.3 ug/L at **MW8** exceeding the MOE Guideline and ODWS criteria of 23 ug/L.
- **All** groundwater samples submitted fell outside of the acceptable range for **total hardness** (80,000 ug/L and 100,000 ug/L).
- **All** groundwater samples submitted, with the exception of MW3 were detected below the range of the ODWS criteria for **pH** of 6.5-8.5.

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It should be noted that due to insufficient water in MW8 during the August 20 sampling event, the groundwater sample taken from MW8 for metal analysis was not field filtered. Therefore the metal results represent total metals (not dissolved metals). This is the reason that most of the metals results are significantly higher in the August 20 sampling event than the July 8 sampling event.

The full analytical groundwater results as prepared by AGAT are included in Appendix D.

Discussion of Groundwater Results

The groundwater results for the July 8 sampling event identified the presence of at least one of the following petroleum constituents; TPH (g/d) and TPH (ho), in all of the wells at levels below the MOE Guideline with the exception of MW2 (see above) with levels of TPH (g/d) above the MOE Guideline. The groundwater results for the August 20 sampling event identified the presence of at least one of the following petroleum constituents; TPH (g/d), TPH (ho) or toluene, in MW1, MW2, MW3, MW5 and MW7, at levels below the MOE Guideline. This clearly demonstrates that the groundwater at the site is slightly impacted with petroleum hydrocarbons. It is unknown as to the source and extent of the impacts.

The groundwater results for both sampling events identified the presence of exceeding levels of aluminum, iron and manganese. These parameters are considered as aesthetic objectives (AOs). According to the ODWSOG; “*AOs are established for parameters that may impair the taste, odour or colour of water or which may interfere with good quality control practices*” Aesthetic objectives are set for a number of parameters to produce a drinking water source that is pleasant to consumers. The AOs do not directly affect the safety of a water supply but may cause aesthetically objectionable effects or cause water to be unsuitable or unpleasant for household use. They are not health-related. Copper and lead was identified at exceeding levels at MW8; however as explained earlier, this result represents total metals, not dissolved metals.

Total hardness and pH were identified at levels outside of the acceptable range in all of the samples during both sampling events. These are considered as operational guidelines (OGs). According to the ODWSOG; “*OGs are established for parameters that, if not controlled, may negatively effect the efficient and effective treatment, disinfection and distribution of the water*” Operational guidelines are set for a number of parameters to produce a drinking water treatment system that is both efficient and effective in treating, disinfecting and delivering drinking water to the household user. These are not health-related.

9.0 SUMMARY OF SIGNIFICANT FINDINGS

Based on the results of the background information review, site inspection and field program carried out at the site, the following significant points summarize the results of the hydrogeological study:

- The site is undeveloped with no buildings or structures present. It is irregular in shape covering an area of approximately 5.1 hectares. Most of the site is relatively flat and forested (with the exception of small open pockets on bedrock outcrops), surrounded by bedrock ridges with the most prominent flanking the north side which precipitates sharply to the north into Jevins Lake. The site slopes to a large wetland located southeast of the site. A small number of access roads/trails meander through the site.
- The site is flanked to the west by the current MTO Gravenhurst Patrol Yard and 5 rural residential houses (north of the patrol yard), to the east and south by undeveloped forested land, and to the north by Jevins Lake.
- The site is located on a glaciolacustrine deposit of fine sand and silt overlying PreCambrian bedrock which is typical of the Gravenhurst area. The bedrock in the area exhibits the typical “rock knob” and “rock ridge” topography of the Canadian Shield with the valleys between the ridges filled with glacial outwash deposits of well-stratified and uniformly bedded sand; and/or glaciolacustrine deposits of fine to very fine sand with some gravel and silt.
- The general hydrogeology of the site is characterized by a shallow unconfined aquifer influenced by the bedrock topography. The water table is shallow and extends down to bedrock. It is hydraulically connected to the surface water courses.
- The water well record search identified two wells located within 500 metres of the site. These wells are located southwest of the site; one of the wells services the existing MTO patrol yard; and the other services a private residence located south of the existing patrol yard. Both wells are terminated in sand overburden at depths of 19 metres for the patrol yard well and 34 metres for the other well. No records were found for the site or the five (5) residences to the immediate west of the site.
- The aerial photo review noted that sometime between 1978 and 2002, the forest at the site was thinned by selective logging and the large wetland appeared. It is likely that selective logging in the past resulted in the formation of the wetland. This could have been caused by the increase in surface run-off and soil infiltration with the net effect being water storage in the topographically low wetland area.

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- The site inspection identified a number of notable features across the site. These included:
 - a number of shallow bedrock outcrops, including a few large bedrock ridges and knolls;
 - two existing water bodies, the small pond and large wetland which appear to fluctuate seasonally with the groundwater;
 - a few small depressions are scattered across the site which were noted to be full of water likely indicating shallow groundwater conditions;
 - surficial geology is predominantly sand and gravel overburden with scattered boulders most notably at the southwest portion of the site;
 - miscellaneous garbage and debris scattered throughout the northeast portion of the site;
 - a small network of access roads/trails meander through the site;
 - a possible large borrow pit with some miscellaneous garbage and debris to the immediate west of the site (north of the Patrol Yard),
 - no seepage zones or springs were noted;
- The water well survey identified 7 wells within 500 metres of the site. Five of the wells are associated with the rural residential housing along Holmes Road (north of the existing MTO patrol yard) and the other 2 wells are associated with the existing patrol yard and the residence south of the patrol yard. All of the wells are completed in overburden to depths of between 6.6 and 19 metres bgs. However, the depth of the well identified during the well survey south of the yard is unknown. It should be noted that all of the wells will be decommissioned to accommodate the proposed realignment of the Highway 11/169 interchange.
- The mini-piezometers installed in the substrate of the large wetland and small pond showed a downward hydraulic gradient indicating groundwater recharge (i.e. stream recharging the groundwater).
- Based on the observations and interpretation of the soil samples collected from the boreholes during the drilling program, the site geology generally consists of native sand deposits (fine to medium-grained) overlying bedrock. The sand depth varied significantly across the site, and was found to be as shallow as 1.8 metres at the west central portion of site to as deep as 16.5 metres at the south portion of the site. Wet soil conditions were encountered between 0.6 to 1.75 metres bgs in all Ecoplans boreholes and extended through the full depth of each borehole.
- The shallow groundwater system across the site represents an unconfined aquifer storing a significant quantity of groundwater in the predominantly sandy matrix. Three of the boreholes encountered a narrow layer of less permeable material (silt and clayey silt) at depths of 10.3 metres, 3.5 metres and 2.3 metres. This acts as an aquitard hydraulically separating the shallow unconfined aquifer from the deeper confined aquifer. Due to the limited borehole data, it is difficult to conclude on the extent and hydraulic properties of the aquitard. However, it is clearly evident

that the site consists of saturated sand overlying an undulating bedrock surface generally trending in a northwest-southeast direction.

- The shallow groundwater flows to the southeast towards the large wetland. The groundwater is hydraulically connected to the large wetland, discharging as baseflow into the wetland during high flow conditions (spring melt and late fall rain events). However during low flow conditions (summer) the wetland appears to recharge the shallow groundwater system as evidenced by the mini-piezometer measurements.
- The estimated hydraulic conductivity of the shallow aquifer ranges between $3.3 \times 10^{-4} \text{ ms}^{-1}$ and $4.4 \times 10^{-2} \text{ ms}^{-1}$ with an average of $6.9 \times 10^{-3} \text{ ms}^{-1}$.
- The estimated horizontal groundwater velocity ranges between 1.1 metres/day (402 metres/year) to 152 m/d (55 km/yr) with an average of 24 m/d (8.8 km/yr). This high groundwater velocity clearly illustrates the dynamics of the shallow groundwater system at the site and the fact that groundwater residence time in the sand matrix is relatively short.
- No visual or olfactory evidence of contamination was observed in any of the boreholes drilled during the subsurface investigation.
- Based on the results of the grain-size analyses, most of the shallow aquifer lies in a fine-grained sand to sandy silt matrix. The soil above the water table is predominantly composed of well-sorted fine-grained sands. The deeper soil found was reported to be of a silt and clayey silt matrix.
- Based on the results of the moisture content analysis, the average moisture content of the aquifer and aquitard matrices is between 18.31% and 28.02% for the aquifer matrix and 19.07% and 36.99% for the aquitard matrix.
- All soil samples collected and submitted for analysis *met* the applicable MOE Guideline Table A soil criteria. However, it is noted that low levels (well below the MOE Guideline) of TPH (gas/diesel) and toluene were found in BH2-2. This indicates that the soil at this location is slightly impacted with petroleum hydrocarbons.
- The groundwater results for the July 8 sampling event identified the presence of at least one of the following petroleum constituents; TPH (g/d) and TPH (ho), in all of the wells at levels below the MOE Guideline with the exception of MW2 (see above) with levels of TPH (g/d) above the MOE Guideline. The groundwater results for the August 20 sampling event identified the presence of at least one of the following petroleum constituents; TPH (g/d), TPH (ho) or toluene, in MW1, MW2, MW3, MW5 and MW7, at levels below the MOE Guideline. This clearly demonstrates that the

Hydrogeological Investigation Report

Gravenhurst Patrol Yard Site Selection and Class EA Study – WP 5420-02-00

February 2005

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groundwater at the site is slightly impacted with petroleum hydrocarbons. It is unknown as to the source and extent of the impacts.

- The groundwater results for both sampling events identified the presence of exceeding levels of aluminum, iron and manganese. These metals are considered as aesthetic objectives. They are not health-related.
- Total hardness and pH were identified at levels outside of the acceptable range in all of the samples during both sampling events. These are considered as operational guidelines. These are not health-related.

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Gravenhurst Patrol Yard Site Selection and Class EA Study – WP 5420-02-00

February 2005

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10.0 CLOSURE

There is no warranty, expressed or implied, by Ecoplans Limited that the foregoing subsurface investigation portion of the hydrogeological study has uncovered all potential contaminants or sources of contaminants on the site.

The results of the subsurface investigation are based upon the total number of sampling points and the depth of investigation. These are considered to be fairly representative of the soil and groundwater conditions within each area tested. It should be noted, however, that any assessment regarding the presence of contamination on the property is based on interpretation of conditions determined at specific sampling locations and depths. This assessment cannot guarantee that isolated pockets of contaminated soil and groundwater are not located on the site within areas not addressed by this project. The overall chemical and physical parameters tested have been chosen to reflect the potential contamination sources identified and therefore, conclusions regarding site environmental compliance are limited to those areas and parameters tested.

The distribution of this report is intended solely for the client. Ecoplans does not assume any third-party liability based on the unauthorized distribution of this report.

The report has been peer reviewed by Brian Gray, M.Eng., P.Eng. (MTO Designated Contact for MTO Foundation Engineering projects) and Mori Mortazavi, M.Eng., P.Eng., P.Geo. (Manager and Chief Engineer Geoenvironmental and Hydrogeological Services) both of Peto MacCallum Ltd. Please note the peer review Statement of Limitations enclosed.

We trust the information outlined in this report meets with your requirements.

Yours truly,

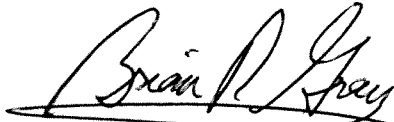
Ecoplans Limited



Derek A. Stewart, B.Sc., P.Geo.
Senior Hydrogeologist



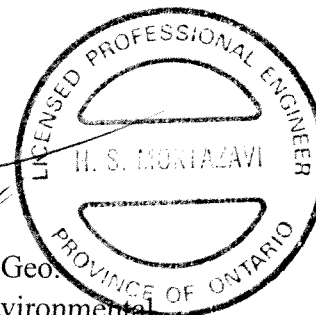
Peto MacCallum Ltd.



Brian R. Gray, M.Eng., P.Eng.
MTO Designated Contact



Mori H. Mortazavi, M.Eng., P.Eng., P.Geo.
Manager and Chief Engineer - Geoenvironmental
and Hydrogeological Services



Peto MacCallum Ltd.

CONSULTING ENGINEERS

DRAFT

PML Ref.: 04TX044

February 3, 2005

**STATEMENT OF LIMITATIONS ON
PEER REVIEW SERVICES BY PETO MACCALLUM LTD. ON
HYDROGEOLOGICAL SCREENING, INVESTIGATION AND DESIGN REPORTS
PREPARED BY ECOPLANS LIMITED, JANUARY 2005 FOR
GRAVENHURST PATROL YARD
WP 5420-02-00**

Peto MacCallum Ltd. (PML) was authorized by McCormick Rankin Corporation (MCR) to carry out peer review services on Hydrogeological studies for the proposed Gravenhurst Patrol Yard in a signed Engineering Services Agreement dated October 25, 2004.

PML was retained to carry out a peer review of the hydrogeological reports prepared by Ecoplans Limited (Ecoplans) when the hydrogeological studies were nearly completed; and therefore, PML did not conduct any peer review during the course of the studies conducted by Ecoplans.

It is understood that the required hydrogeological site assessment services for the subject project were to be undertaken and completed in accordance with the Terms of Reference (TOR) specified in Section 4.8 (Foundation Engineering) of the MTO's Request for Proposals, Total Project Management (TPM) for Preliminary Design Services (Group Work Project No. 5420-02-00 and Purchase Order No. 5005-A-000), dated September 8, 2003, Version 5.0.

After reviewing the Screening Report and Draft Investigation and Design Reports, PML provided initially our draft review comments on November 15, 2004 and upon receiving the Ecoplans Response dated November 25, 2004, we forwarded further comments on November 30, 2004. Upon receiving the final investigation and design reports, PML presented their final comments in a report dated December 15, 2004, and attended in a meeting at MRC's offices on January 24, 2005 to discuss on the comments. Based on the meeting discussions, Ecoplans provided their revised (January 2005) hydrogeological investigation and design reports, and MTO's comments of October 13, 2004. PML e-mailed their comments of the recently revised reports and MTO's comments on February 01, 2005.

In their reply (November 25, 2004) to our initial draft comments (November 15, 2004), Ecoplans indicated that *"Since the MTO has already signed off on this report, there is no requirements for the peer review."* However, the majority of comments we provided on the site background information, inspection and evaluation of the Ground Water Screening Report were closely related to the Hydrogeological Investigation and Design Reports. In order to undertake a complete professional peer review of the subject project hydrogeological study, a review of the Screening Report was also required in our opinion. However, since our comments on the Ecoplans Screening Report will not now have a significant bearing on the site selected, it was decided in the above-noted meeting that those comments will not be incorporated in the screening report.

The results of soils hydraulic conductivity (k-value) calculations conducted by PML based on the field data compiled by Ecoplans indicated values in the range of 8×10^{-3} cm/s similar to the values PML obtained from the grain-size curves using Hazen's equation; nearly two orders of magnitude smaller than the average value reported by Ecoplans, in the Hydrogeological Investigation Report and used to calculate ground water flow velocity. Additional field and laboratory testing may have to be carried out during the design phase of the project.

The preferred scheme of site mitigations to ameliorate potential impacts from the proposed patrol yard operations on human health and ecosystem should be reassessed based on additional hydrogeological field investigations and laboratory testing to be undertaken during the project design stage and consideration of a proper stormwater management system for minimization of potential environmental risks.

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BARRIE, BRAMPTON, HAMILTON, KITCHENER, TORONTO

11.0 REFERENCES

Canadian Standards Association, CSA Standard Z769-00 - Phase II Environmental Site Assessment, March 2000.

Environmental Protection Act, Waste Management – Reg. 347, R.R.O. 1990, plus all applicable amendments.

Ontario Ministry of the Environment, Ontario Drinking Water Standards, revised January 2001.

Ontario Ministry of the Environment, Guideline for Use at Contaminated Sites in Ontario. Revised September 1998.

Ontario Ministry of the Environment, Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario, December 1996.

Ontario Ministry of the Environment Water Well Database.

Town of Gravenhurst Water and Sanitary Services System Plan.

Maps and Aerial Photographs

Department of Energy, Mines and Resources, National Topographic System (NTS), Map 31 D/14 – Gravenhurst. 1994.

First Base Solutions Inc. Ontario Ministry of Natural Resources. Ontario Base Map Series. Zone 17 South. 1980- 1989.

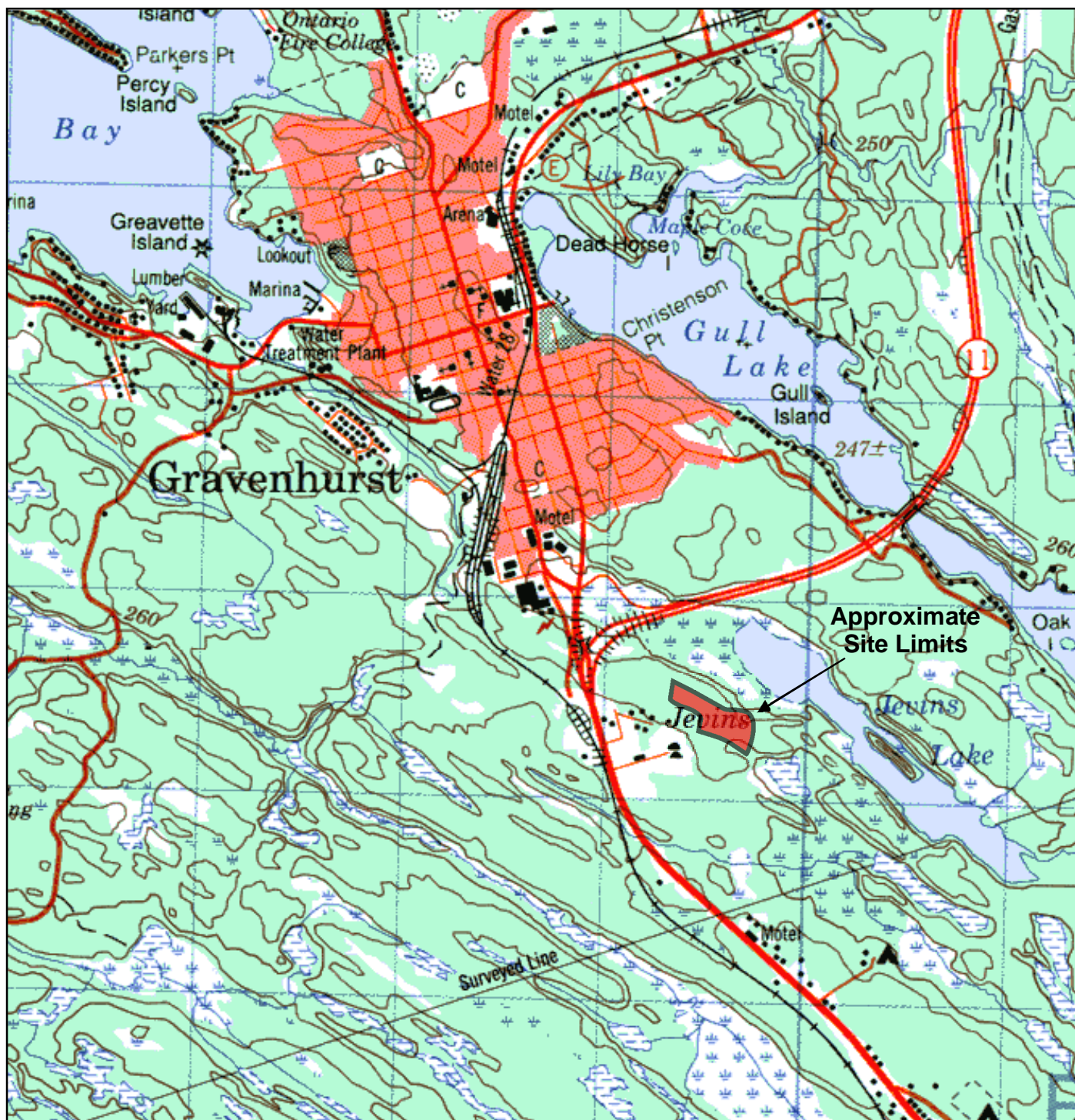
Ministry of Northern Development and Mines. Aggregate Resources Inventory of the Town of Bracebridge and Gravenhurst – Ontario Geological Survey Aggregate Resources Inventory Paper 147. 1990

Ministry of Northern Development and Mines. Open File Map 195 Quaternary Geology of the Gravenhurst Area. 1992.

Ontario Ministry of Natural Resources Air Photo Library. Toronto, Ontario; and Peterborough, Ontario.

- Forest Resource Inventory, Aerial Photograph, 1978;
- Forest Resource Inventory, Aerial Photograph, 1969;
- Forest Resource Inventory, Aerial Photograph, 1960; and
- Forest Resource Inventory, Aerial Photograph, 1956.

Ontario Ministry of Northern Development and Mines, Map 2556 - Quaternary Geology of Ontario – Southern Sheet, 1991.



Source: National Topographic System - Department of Energy, Mines and Resources
Map 31 D/14 Gravenhurst 1994

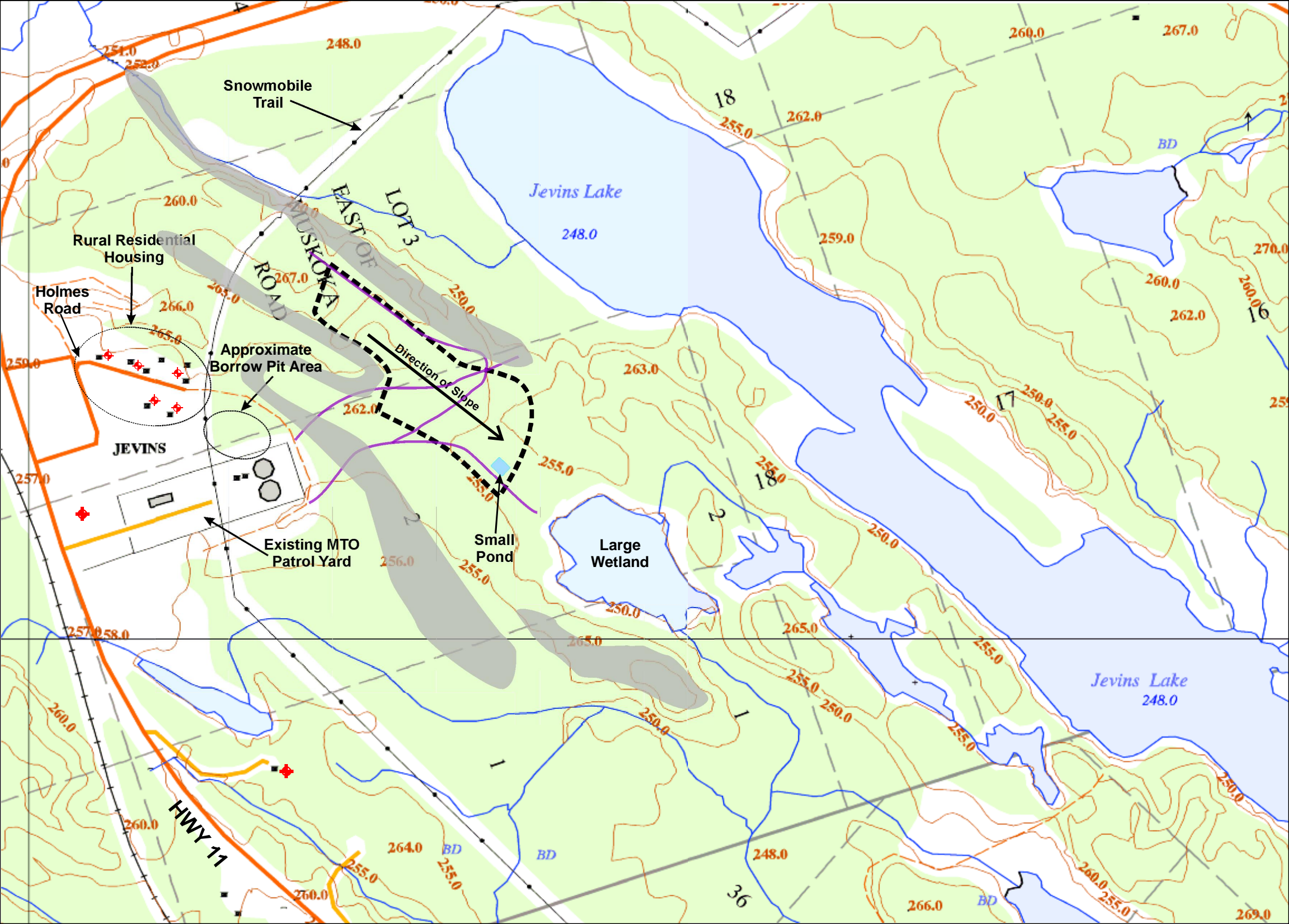
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LEGEND



Proposed Patrol Yard Site

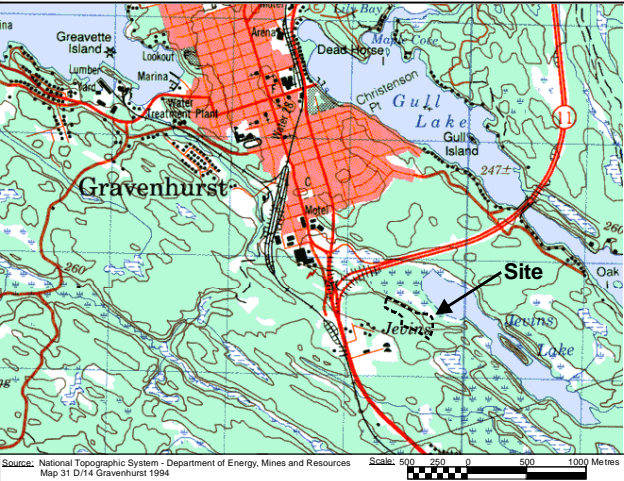




Source: First Base Solutions Inc., Ontario Ministry of Natural Resources, Ontario Base Map Series, Zone 17 South, 1980-1989.



KEY PLAN



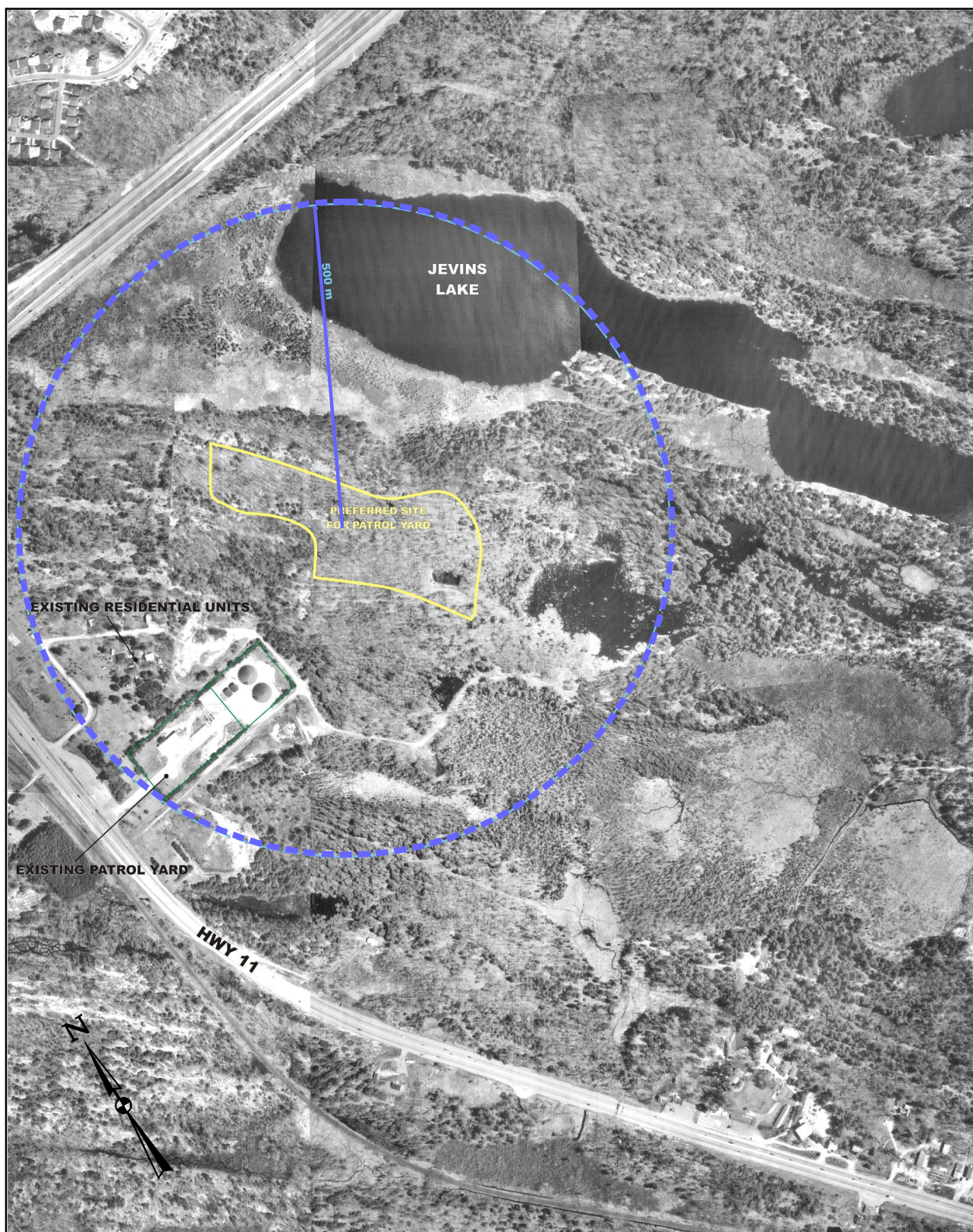
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- Approximate Site Limits
- Approximate Utility Corridor Easement Location
- Approximate Location of Large Bedrock Outcrops
- Existing Water Well

Note:
Water well locations are approximate.

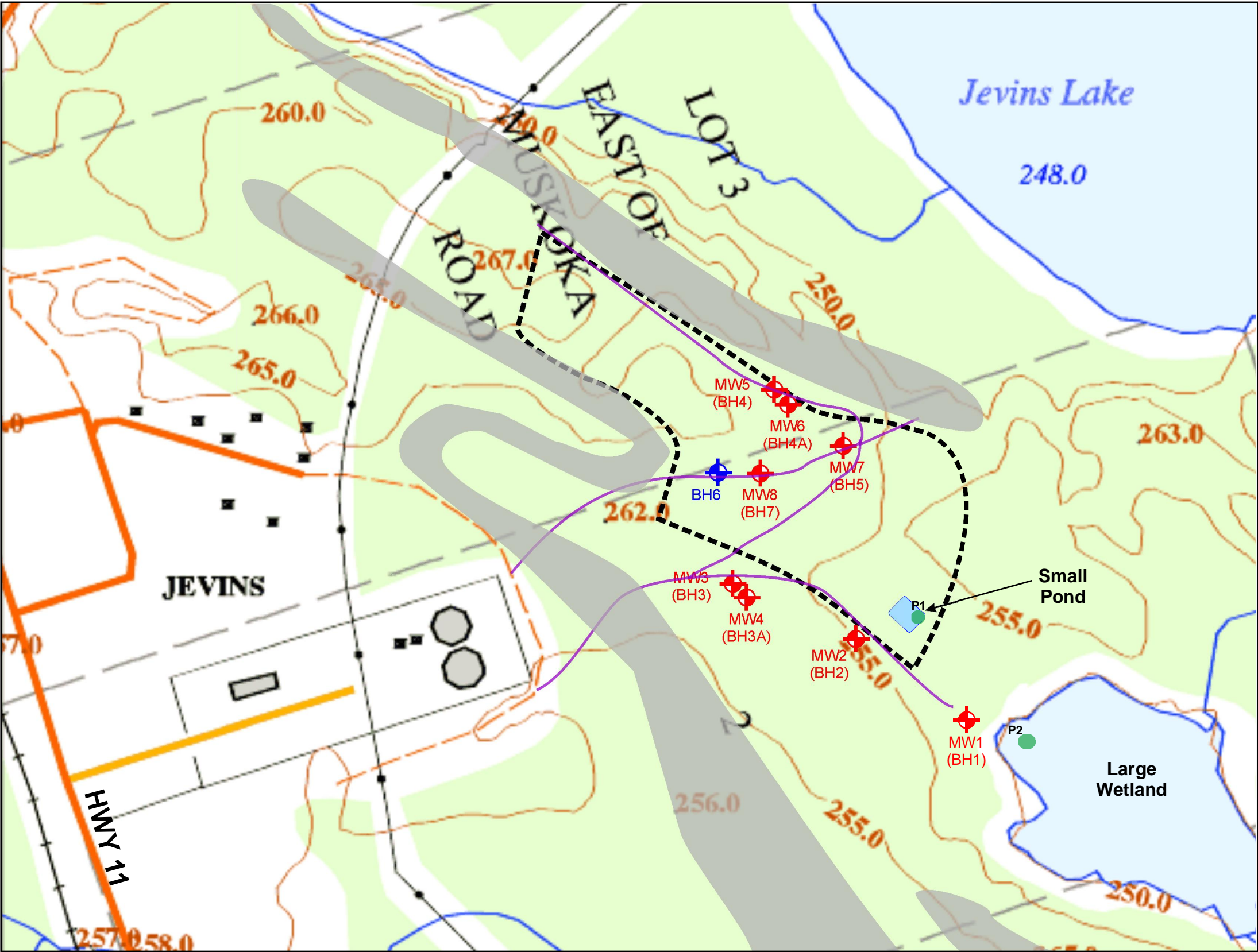
Approximate site limits are based on information obtained through McCormick Rankin Corporation. The exact coordinates have been estimated for the drawing.

The purpose of this plan is to show the location of identified features within the site. It is not intended to show high quality mapping of the area.



Source: McCormick Rankin Corporation, Planning Department,
PIC #2 (revised), 2002

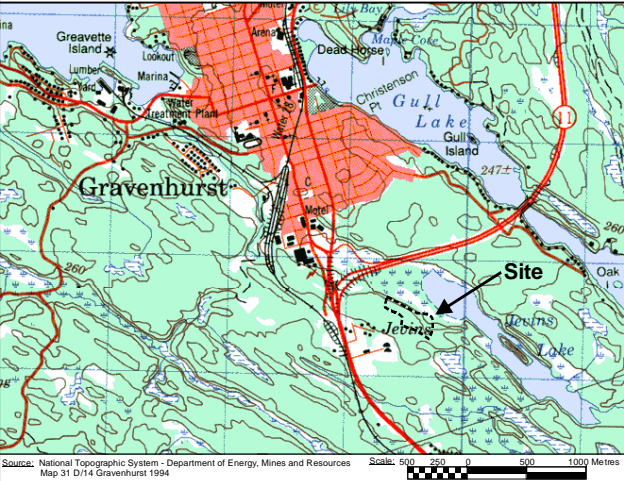
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Source: First Base Solutions Inc., Ontario Ministry of Natural Resources,
Ontario Base Map Series, Zone 17 South, 1980-1989.



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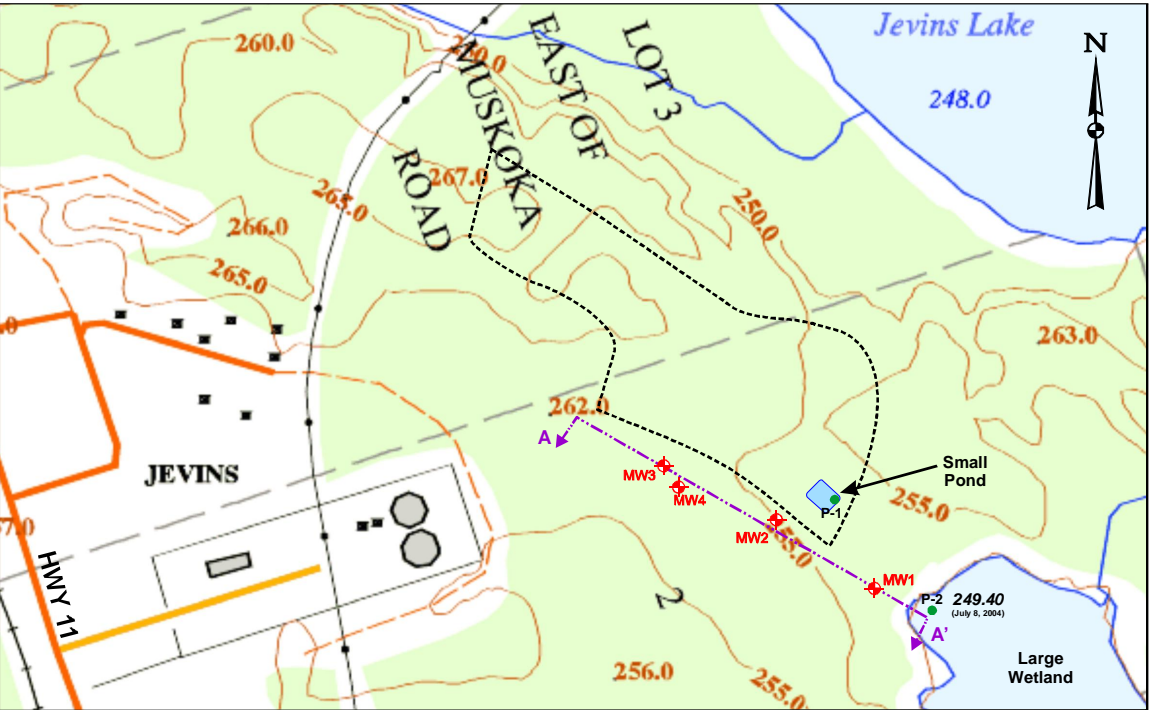
LEGEND

- Approximate Site Limits
- ◆ Borehole (BH)
- ◆ Monitoring Well (MW)
- Mini-Piezometer
- Approximate Utility Corridor Easement Location
- Approximate Location of Large Bedrock Outcrops

Note:
Monitoring well and borehole locations based on UTM coordinates obtained from survey information from J D Barnes Ltd. July 2004.

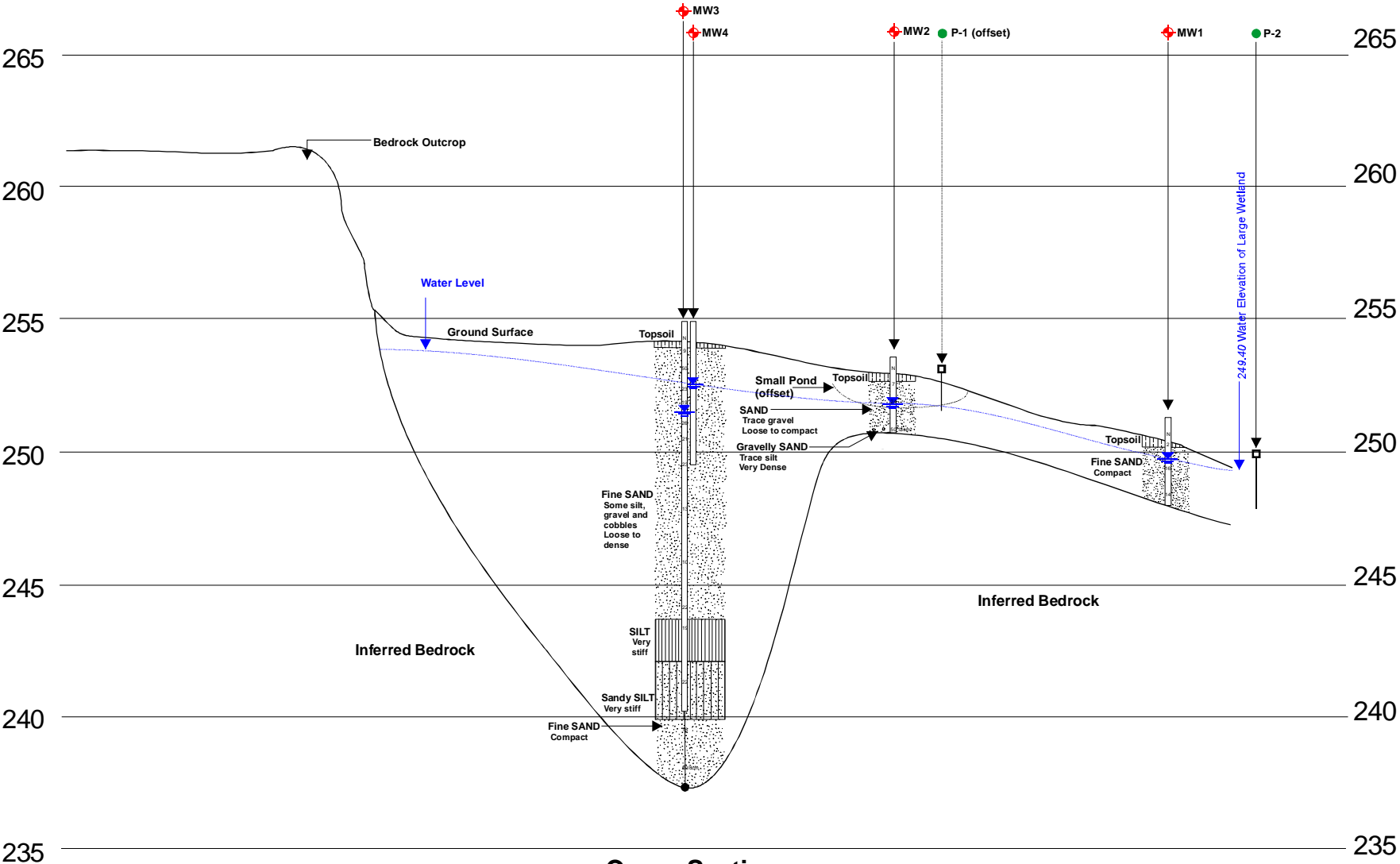
Approximate site limits are based on information obtained through McCormick Rankin Corporation. The exact coordinates have been estimated for the drawing.

The purpose of this plan is to show the locations of borehole investigations within the site. It is not intended to show high quality mapping of the area.



Site Plan

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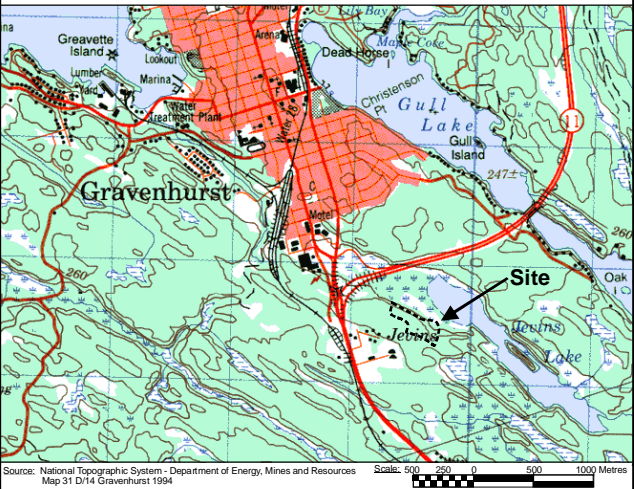


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KEY PLAN



LEGEND

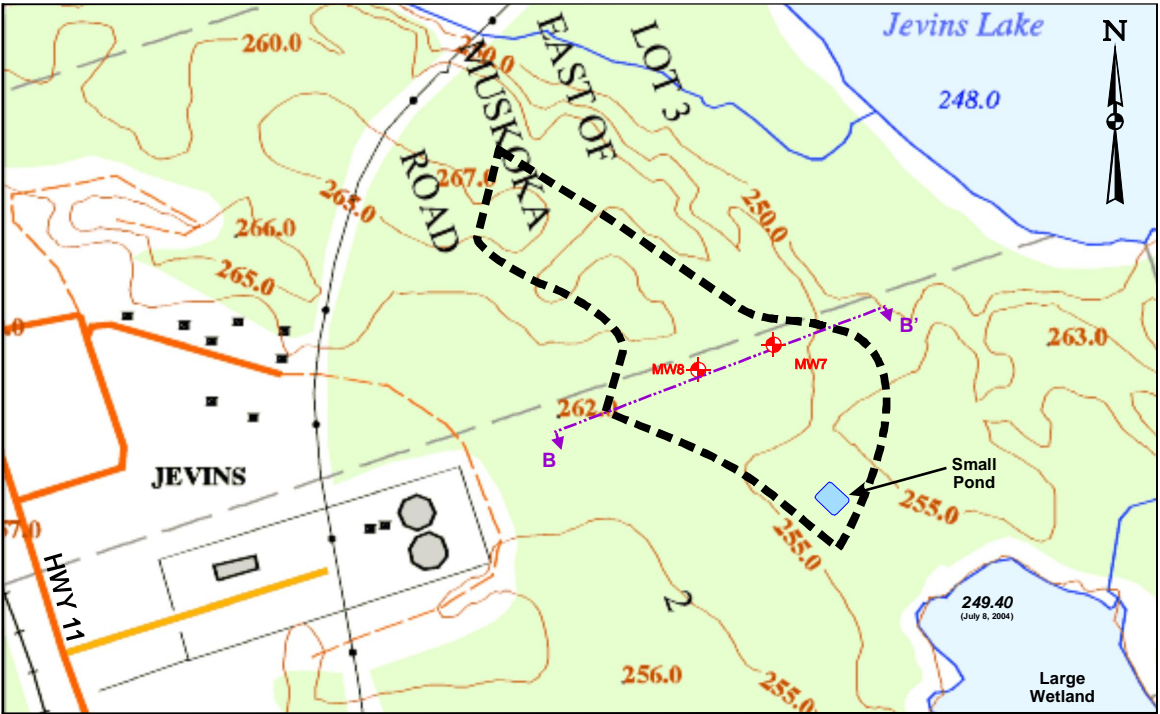
- Approximate Site Limits
- Groundwater Elevation Datum from July 8, 2004
- Borehole (BH)/Monitoring Well (MW)
- Mini-Piezometer
- N Blows/ft (Standard Penetration Test 350 lbs energy)

MW No	Elevation at Ground Surface (mAMS)	UTM Co-ordinates (Zone 17)	
		North	East
1	250.31	4973183.9	629772.0
2	252.95	4973254.1	629682.2
3	254.11	4973277.5	629585.2
4	254.13	4973277.7	629586.6

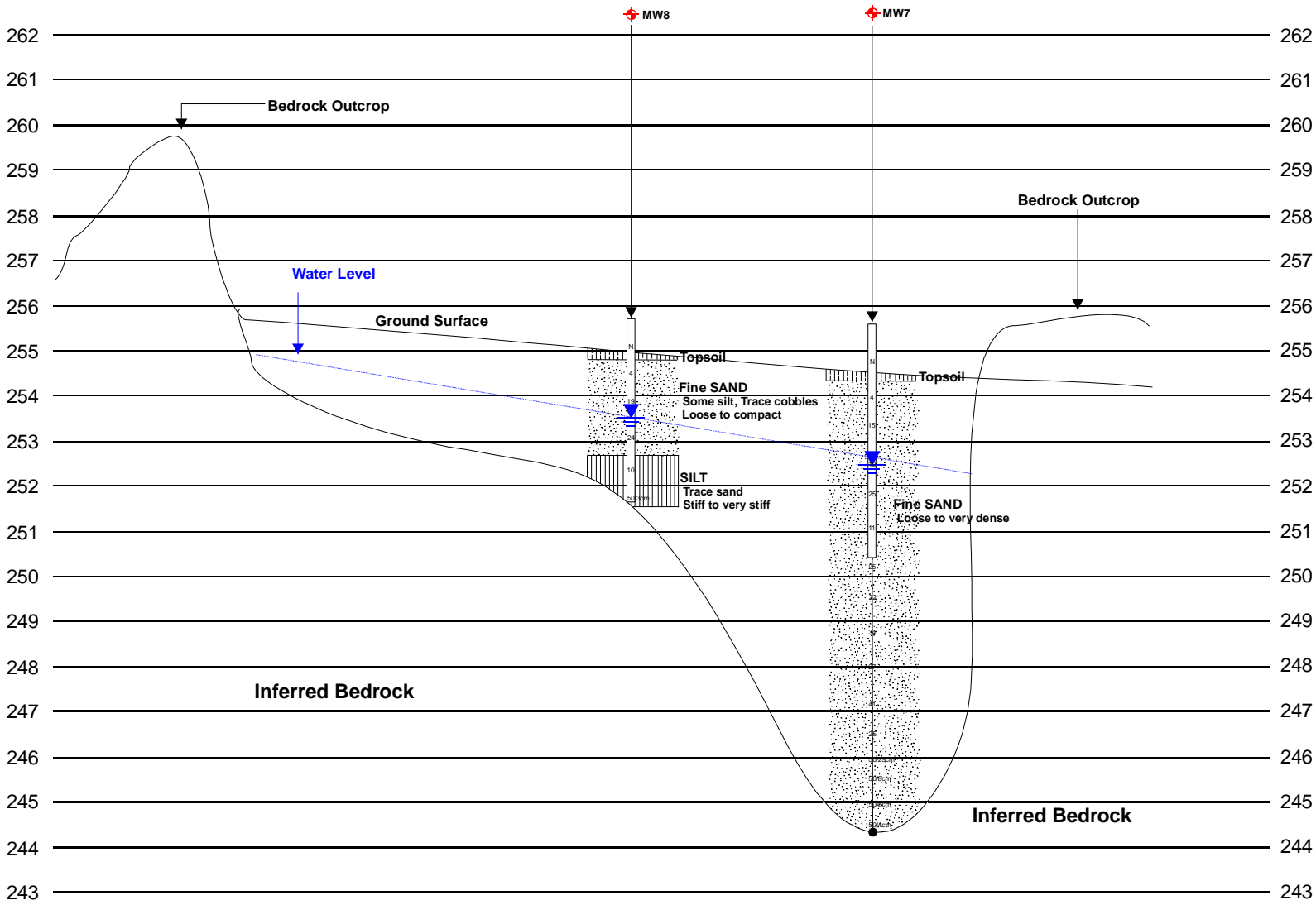
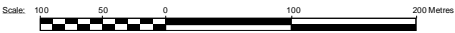
Notes:
Elevation datum based on information obtained from J D Barnes Ltd July 2004.

The purpose of this plan is to show the relative hydrogeologic information obtained through limited borehole investigations within the site. It is not intended to show high quality mapping of the area.

The boundaries between soil strata have been established only at monitoring well locations. Between monitoring well locations the boundaries are assumed from geological evidence.



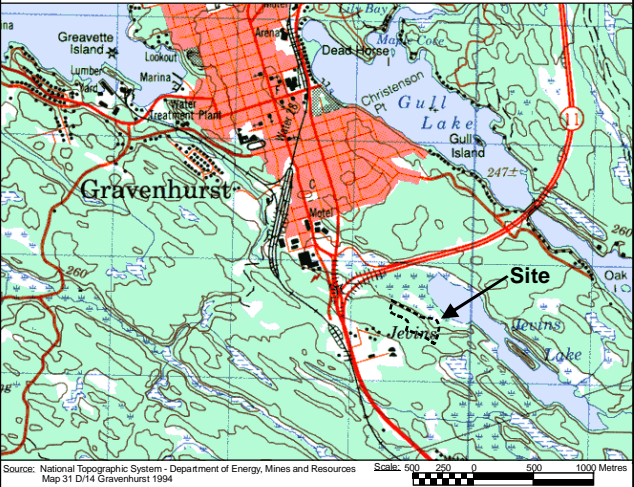
Site Plan



Cross Section



KEY PLAN



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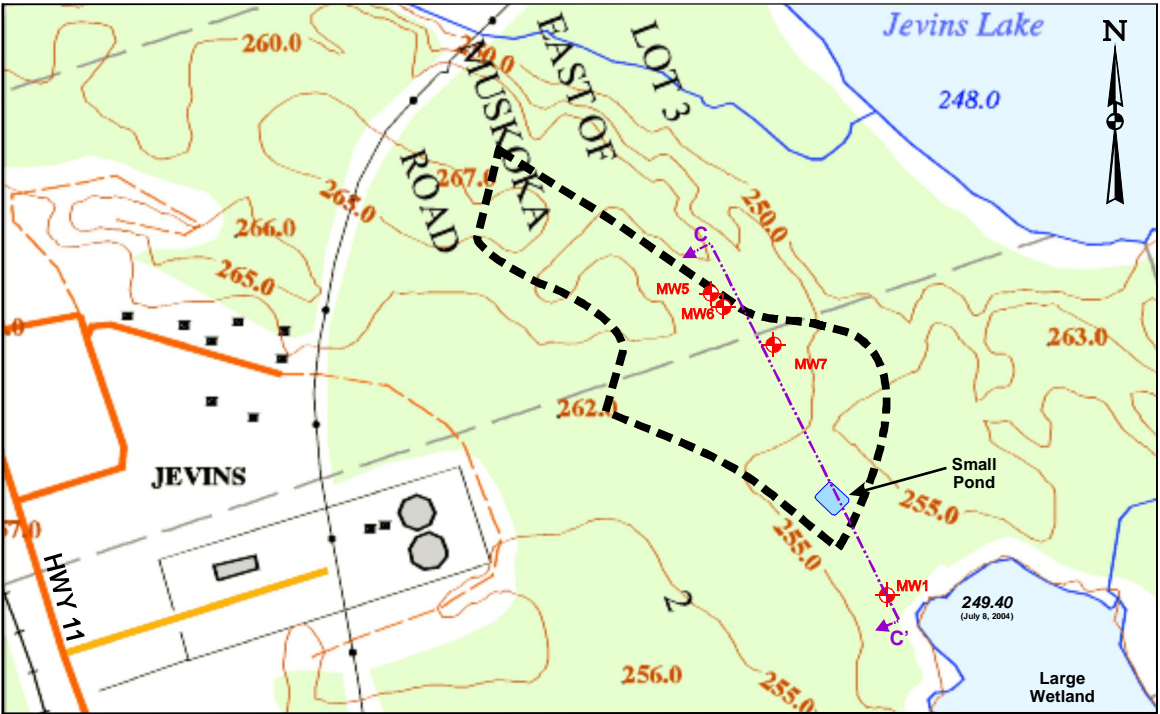
- Approximate Site Limits
- Groundwater Elevation Datum from July 8, 2004
- Borehole (BH)/Monitoring Well (MW)
- N Blows/ft (Standard Penetration Test 350 lbs energy)

MW No	Elevation at Ground Surface (mAMS)	UTM Co-ordinates (Zone 17)	
		North	East
7	254.41	4973398.4	629663.2
8	254.82	4973373.9	629604.6

Notes:
Elevation datum based on information obtained from J D Barnes Ltd July 2004.

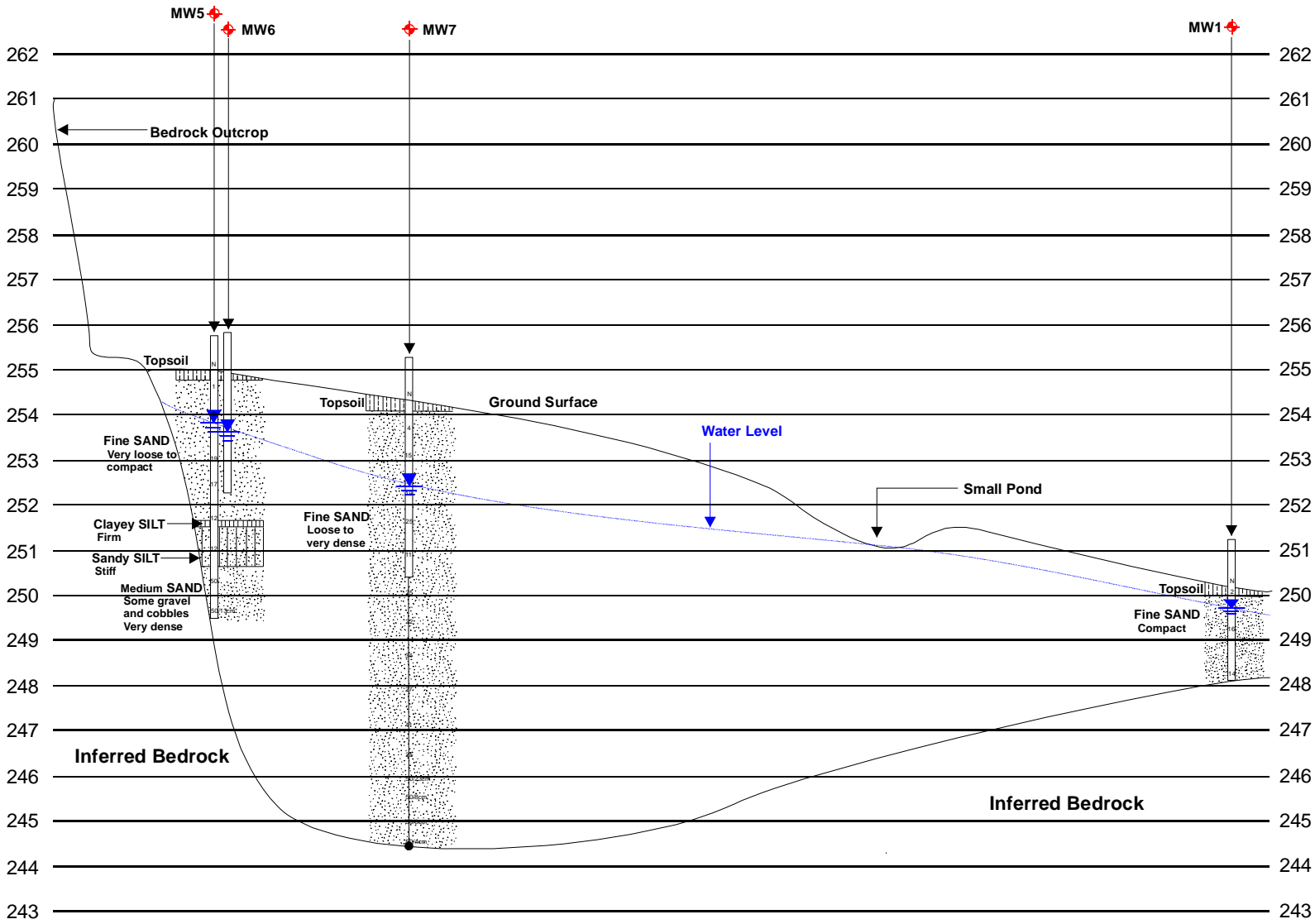
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Site Plan

Scale: 100 50 0 100 200 Metres

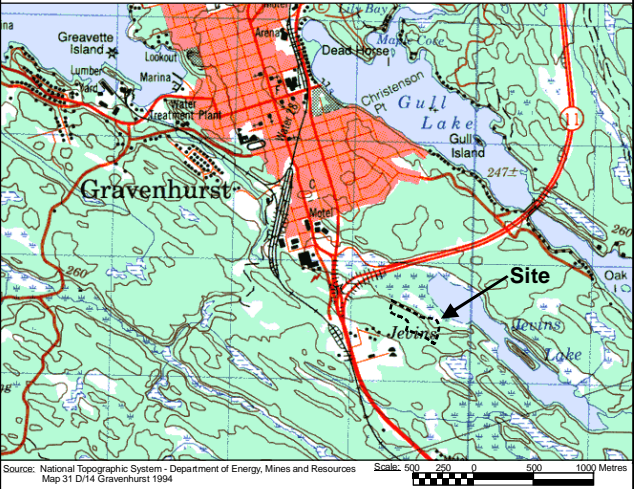


Cross Section

Scale: 50 25 0 50 100 Metres



KEY PLAN



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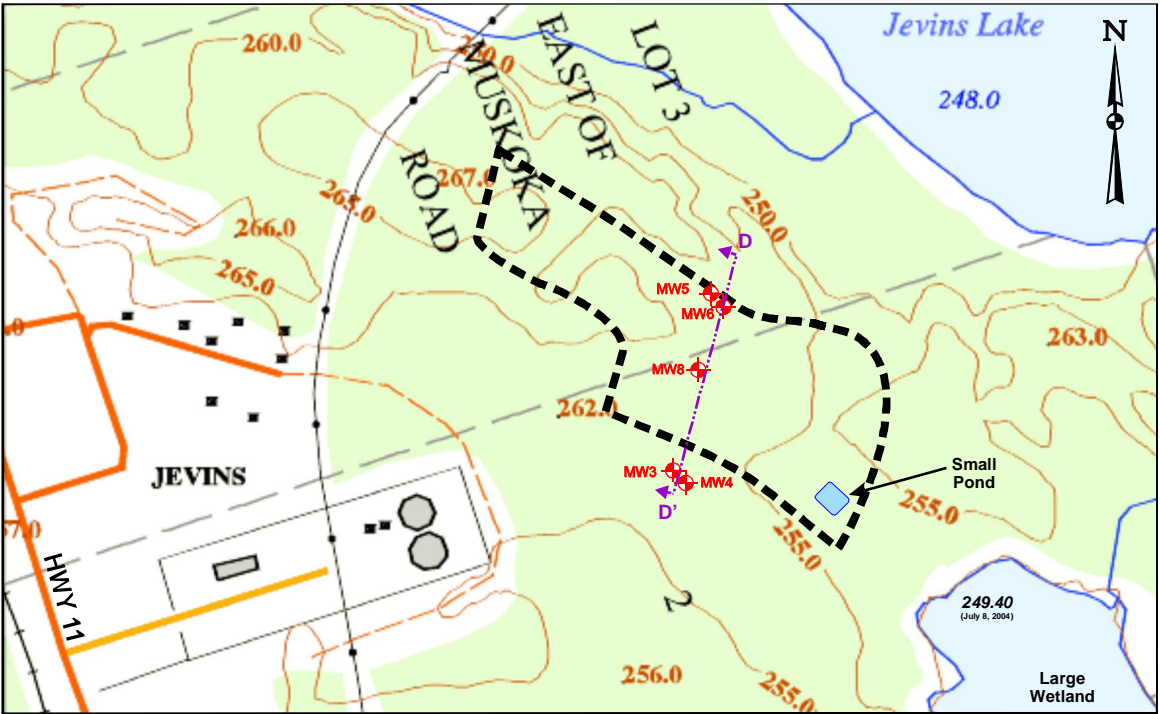
- Approximate Site Limits
- Groundwater Elevation Datum from July 8, 2004
- Borehole (BH)/Monitoring Well (MW)
- N Blows/ft (Standard Penetration Test 350 lbs energy)

MW No	Elevation at Ground Surface (mAMSLL)	UTM Co-ordinates (Zone 17)	
		North	East
1	250.31	4973183.9	629772.0
5	255.06	4973442.9	629615.7
6	255.08	4973442.4	629616.4
7	254.41	4973398.4	629663.2

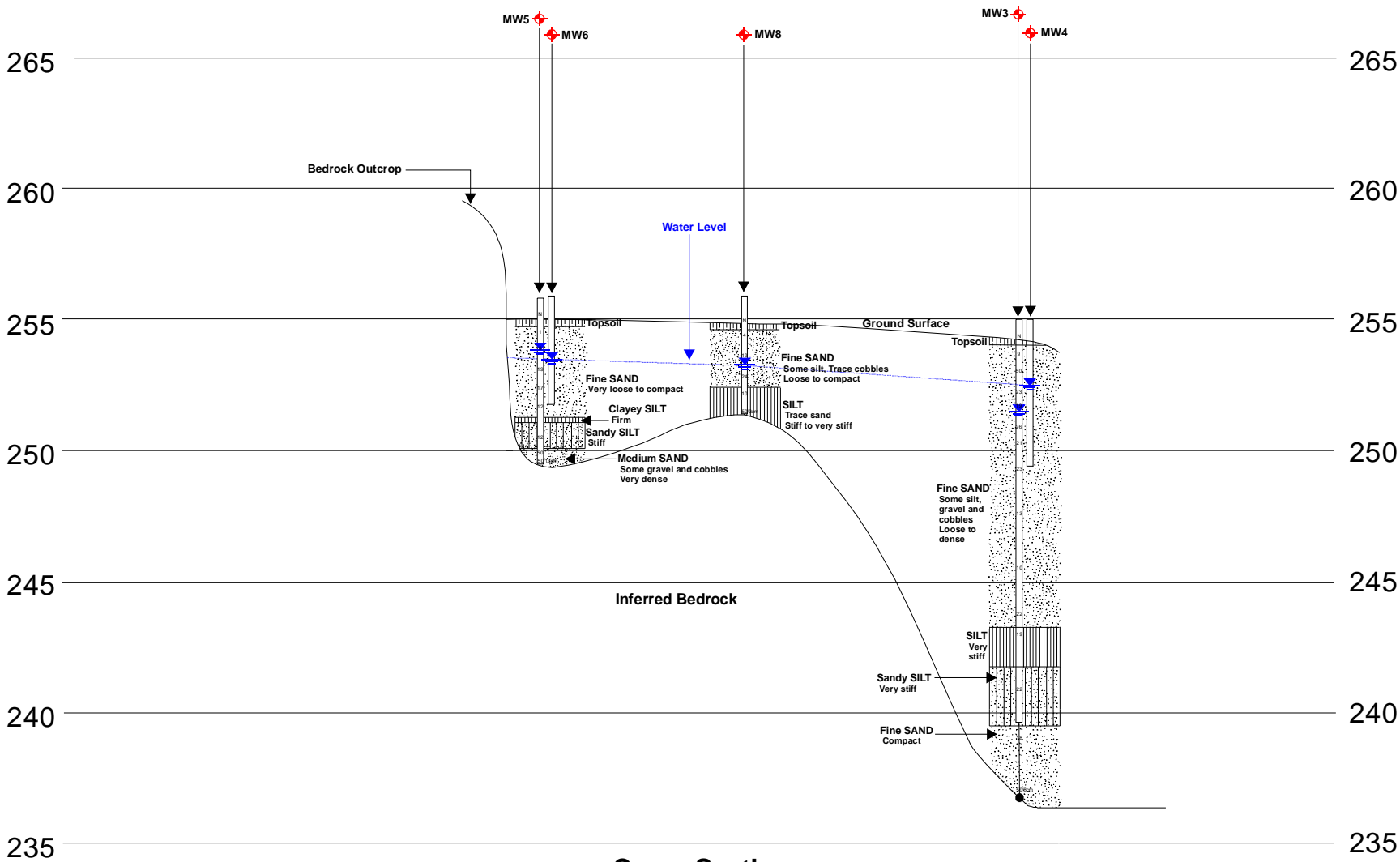
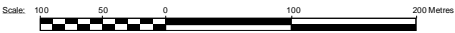
Notes:
Elevation datum based on information obtained from J D Barnes Ltd July 2004.

The purpose of this plan is to show the relative hydrogeologic information obtained through limited borehole investigations within the site. It is not intended to show high quality mapping of the area.

The boundaries between soil strata have been established only at monitoring well locations. Between monitoring well locations the boundaries are assumed from geological evidence.



Site Plan



Cross Section

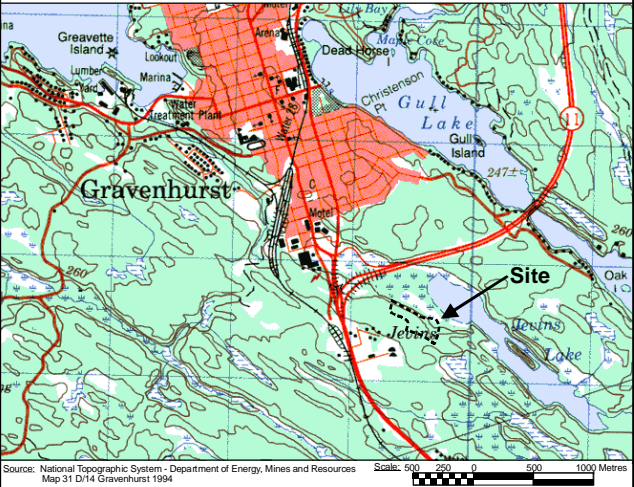


CONT No
WP No 5420-02-00

Gravenhurst Patrol Yard Class EA
Hydrogeological Investigation Report
Cross Section D-D'



KEY PLAN



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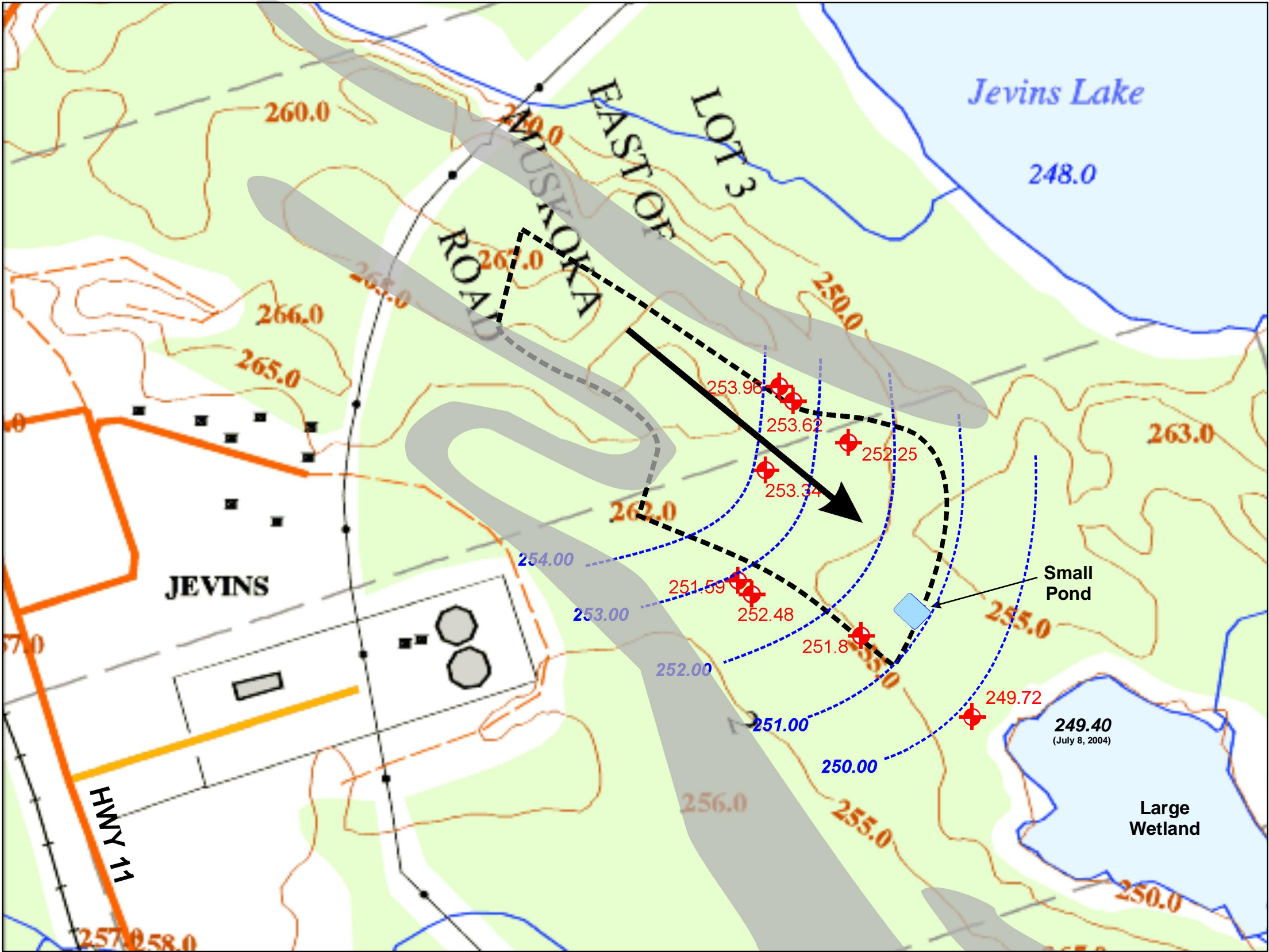
- Approximate Site Limits
- Groundwater Elevation Datum from July 8, 2004
- Borehole (BH)/Monitoring Well (MW)
- N Blows/ft (Standard Penetration Test 350 lbs energy)

MW No	Elevation at Ground Surface (mAMS)	UTM Co-ordinates (Zone 17)	
		North	East
3	254.11	4973277.5	629585.2
4	254.13	4973277.7	629586.6
5	255.06	4973442.9	629615.7
6	255.08	4973442.4	629616.4
8	254.82	4973373.9	629604.6

Notes:
Elevation datum based on information obtained from J D Barnes Ltd July 2004.

The purpose of this plan is to show the relative hydrogeologic information obtained through limited borehole investigations within the site. It is not intended to show high quality mapping of the area.

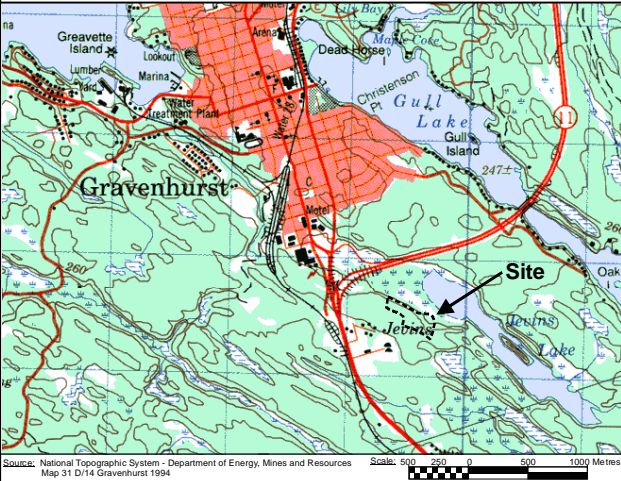
The boundaries between soil strata have been established only at monitoring well locations. Between monitoring well locations the boundaries are assumed from geological evidence.



Source: First Base Solutions Inc., Ontario Ministry of Natural Resources,
Ontario Base Map Series, Zone 17 South, 1980-1989.



KEY PLAN



LEGEND

- Approximate Site Limits
- 250.00 --- Groundwater Elevation Contour (mAMSLL) Based on July 8, 2004 Monitoring
- Monitoring Well
- Interpreted Direction of Shallow Groundwater Flow
- Approximate Location of Large Bedrock Outcrops

Note:
Monitoring well locations based on UTM coordinates obtained from survey information from J D Barnes Ltd. July 2004.

Approximate site limits are based on information obtained through McCormick Rankin Corporation. The exact coordinates have been estimated for the drawing.

The purpose of this plan is to show the locations of borehole investigations within the site. It is not intended to show high quality mapping of the area.

TABLE 6: Soil Analytical Results - Metals and Inorganics

Parameter	MOE Soil Criteria (1) (µg/g) Industrial/Commercial Land Use	Sample Results (µg/g)								
		Gravenhurst Patrol Yard - Class EA Study								
		17-May-04		18-May-04		19-May-04			20-May-04	
		BH1-2	BH2-2	BH3-3	BH3-10	BH4-3	BH4-7	BH5-3	BH6-3	BH7-3
METALS										
Antimony	40	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
Arsenic	40	0.9	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Barium	1500	22.9	7.4	10.5	26.9	12.3	77.2	9.9	33.5	13
Beryllium	1.2	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Boron (Available)	2	0.077	0.109	<0.032	0.047	<0.032	0.1	<0.032	0.056	<0.032
Cadmium	12	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium (Total)	750	11.2	6.3	4.3	5.7	3.2	11.4	3.5	8.6	3.4
Chromium (+6)	8	<0.382	<0.382	<0.382	<0.382	<0.382	<0.382	<0.382	<0.382	<0.382
Cobalt	80	2.7	1.3	1.7	2.4	1.5	4.3	1.6	3.9	1.6
Copper	225	11.7	8.5	8	7.4	5.7	19.5	6.3	20.7	12.3
Cyanide (Free)	100	<7.4	<7.4	<7.4	<7.4	<7.4	<7.4	<7.4	<7.4	<7.4
Lead	1000	5.7	0.8	0.8	0.8	0.5	1.1	0.6	1.1	0.7
Mercury	10	0.013	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011
Molybdenum	40	<0.5	<0.5	<0.5	<0.5	<0.5	1	<0.5	<0.5	<0.5
Nickel	150	8.8	4.7	4.7	6.8	4.2	15	4.2	12.4	5
Selenium	10	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Silver	40	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Thallium	32	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Vanadium	200	21.9	24.6	10.8	14.1	6.6	23.1	9.6	21.5	8.2
Zinc	600	16.4	7.8	8.3	13.1	8.4	32.2	7.4	20.8	9.5
GENERAL PARAMETERS										
pH	5.0-9.0 (2)	5.98	5.88	6.25	8.49	6.42	6.91	6.9	6.13	6.52
Conductivity (mS/cm)	1.4	0.025	0.024	0.013	0.051	0.019	0.044	0.026	0.034	0.051
SAR	12	0.182	0.071	0.166	0.181	0.133	0.568	0.065	0.083	0.057

Notes:

- (1) MOE Guideline for Use at Contaminated Sites in Ontario, Appendix 2, Table A: Surface Soil Criteria for Industrial/Commercial land use in a potable groundwater condition (coarse textured soils)
- (2) MOE Guideline range of applicability for inorganic parameters in soil
- N/V Parameter not included in MOE Guideline
- < Parameter not detected above value specified
- µg/g Micrograms per gram
- mS/cm Millisiemens per centimetre
- SAR Sodium adsorption ratio

TABLE 7: Soil Analytical Results - Petroleum Hydrocarbons and BTEX

Parameter	MOE Soil Criteria (1) (µg/g) Industrial/Commercial Land Use	Sample Results (µg/g)								
		Gravenhurst Patrol Yard - Class EA Study								
		17-May-04		18-May-04		19-May-04			20-May-04	
		BH1-2	BH2-2	BH3-3	BH3-10	BH4-3	BH4-7	BH5-3	BH6-3	BH7-3
PETROLEUM HYDROCARBONS										
TPH Gas/Diesel	100	<6.2	6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2
TPH Heavy Oils	1000	<250	<250	<250	<250	<250	<250	<250	<250	<250
BTEX										
Benzene	0.24	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Toluene	2.1	<0.002	0.62	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Ethylbenzene	0.28	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
m/p-Xylene	25 (2)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
o-Xylene	25 (2)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002

Notes:

- (1) MOE Guideline for Use at Contaminated Sites in Ontario, Appendix 2, Table A: Surface Soil Criteria for Industrial/Commercial land use in a potable groundwater condition (coarse textured soils)
- (2) Criterion for Total Xylenes (meta, para & ortho)
- < Parameter not detected above value specified
- µg/g Micrograms per gram

TABLE 8: Soil Analytical Results - Grain Size and Water Content

Parameter	Sample Results										
	Gravenhurst Patrol Yard - Class EA Study										
	17-May-04			18-May-04					19-May-04		
	BH1-3	BH2-2	BH2-3	BH3-3	BH3-4	BH3-8	BH3-11	BH3-12	BH4-4	BH4-5	BH4-6
GRAIN SIZE											
Cobble Size	fine sand	n/a	gravelly sand	n/a	fine sand	n/a	silt	sandy silt	fine sand	clayey silt	sandy silt
WATER CONTENT											
Percentage (%)	21.35	18.31	n/a	22.19	n/a	21.7	19.07	22.47	22.8	36.99	28.02

Parameter	Sample Results				
	Gravenhurst Patrol Yard - Class EA Study				
	19-May-04		20-May-04		
	BH5-4	BH5-10	BH6-2	BH7-3	BH7-4
GRAIN SIZE					
Cobble Size	fine sand	fine sand	sandy silt	n/a	silt
WATER CONTENT					
Percentage (%)	21.21	21.05	21.64	23	n/a

Notes:

n/a parameter not analysed for

TABLE 9: Groundwater Analytical Results - General Groundwater Chemistry

Parameter	MOE Groundwater Criteria (1) (µg/L)	Ontario Drinking Water Standards (2) (µg/L)	Sample Results (µg/L)					
			Gravenhurst Patrol Yard - Class EA Study					
			8-July-04	20-Aug-04	8-July-04	20-Aug-04	8-July-04	20-Aug-04
			MW-1	MW-1	MW-2	MW-2	MW-3	MW-3
METALS								
Aluminum	N/V	100*	166	131	159	208	41.9	27.5
Antimony	6	N/V	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Arsenic	25	25	0.59	<0.57	<0.57	<0.57	<0.57	0.65
Barium	1000	1000	15.6	15.3	27.1	29.2	36.4	40.3
Beryllium	4	N/V	<1.84	<1.84	<1.84	<1.84	<1.84	<1.84
Bismuth	N/V	N/V	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Boron	5000	5000	10	<8	13	9	20	29
Cadmium	5	5	<0.67	<0.67	<0.67	<0.67	<0.67	<0.67
Chromium (Total)	50	50	0.83	0.7	0.63	<0.57	<0.57	<0.57
Cobalt	100	N/V	9.5	7.25	<0.96	<0.96	2.07	8.22
Copper	23	1000*	4.33	2.9	6.13	4.33	4.81	4.55
Iron	N/V	300*	11300	5570	105	96.6	111	95.1
Lead	10	10	0.87	0.91	1.07	1.04	0.85	1.08
Manganese	N/V	50*	729	277	16.3	18.9	289	224
Molybdenum	7300	N/V	<0.47	<0.47	<0.47	<0.47	8.96	11.9
Nickel	100	N/V	2.88	1.78	1.91	1.24	2.43	3.41
Selenium	100	100	<0.81	<0.81	<0.81	<0.81	<0.81	1.21
Silver	1.2	N/V	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70
Sodium	200000	200000*	1890	1910	1050	1050	16600	26800
Thallium	2	N/V	<0.36	<0.36	<0.36	<0.36	<0.36	<0.36
Titanium	N/V	N/V	2.86	1.9	3.39	1.95	2.0	1.01
Uranium	N/V	100	<0.20	<0.20	<0.20	<0.20	0.83	1.61
Vanadium	200	N/V	1.3	0.9	<0.4	<0.4	1.4	0.8
Zinc	1100	5000*	10.5	22.1	39.5	25.3	14.3	62.8
GENERAL PARAMETERS								
Fluoride	N/V	1500	<50	<50	<50	<50	160	180
Chloride	250000	250000*	2440	3410	710	3760	16100	32900
Bromide	N/V	N/V	<50	<50	<50	<50	<50	110
Nitrate (NO ₃ ⁻) as N	10000	10000 (3)	<50	170	370	330	340	310
Nitrite (NO ₂ ⁻) as N	1000	1000 (3)	<50	<50	<50	<50	<50	50
Sulphate	N/V	500000*	6840	9040	8780	13300	61000	72000
Total Suspended Solids (mg/L)	N/V	N/V	7820	5210	3950	2090	116000	141
Total Hardness, CaCO ₃	N/V	80000-100000*	15400	16000	13300	13000	115000	121000
Ammonia (NH ₃) as N	N/V	N/V	490	210	<50	<50	<50	130
Total Kjeldahl Nitrogen	N/V	N/V	2620	13300	3490	7650	350	920
Total Organic Carbon	N/V	N/V	106000	96000	104000	73000	8000	5000
Total Phosphorus	N/V	N/V	9140	5610	4800	11600	64300	440
pH (pH units)	N/V	6.5-8.5*	5.71	5.39	5.42	5.74	7.32	7.91

Notes:

- (1) MOE Guideline for Use at Contaminated Sites in Ontario, Appendix 2, Table A: Groundwater Criteria in a potable groundwater condition (coarse textured soils)
- (2) Ontario Drinking Water Standards (ODWS), Revised January 2001, Tables 1 and 4
- (3) Total Xylenes (meta, para & ortho-Xylene)
- * Non-health related ODWS criteria (Aesthetic Objective or Operational Guideline)
- N/V Parameter not included in MOE Guideline or ODWS
- < Parameter not detected above value specified
- Parameter not analysed for because no retrieval of groundwater in well MW6 on August 20, 2004
- 6 Denotes exceedance of MOE Guideline or ODWS
- µg/L Micrograms per litre

TABLE 9: Groundwater Analytical Results - General Groundwater Chemistry

Parameter	MOE Groundwater Criteria (1) (µg/L)	Ontario Drinking Water Standards (2) (µg/L)	Sample Results (µg/L)							
			Gravenhurst Patrol Yard - Class EA Study							
			8-July-04		20-Aug-04	8-July-04	20-Aug-04	8-July-04	20-Aug-04	
			MW-4	MW-4D	MW-4	MW-5	MW-5	MW-6	MW-6	
METALS										
Aluminum	N/V	100*	33.5	28.1	22.5	34.2	30.3	48.1	-	
Antimony	6	N/V	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	-	
Arsenic	25	25	<0.57	<0.57	<0.57	<0.57	<0.57	<0.57	-	
Barium	1000	1000	11.9	11.8	9.57	20.8	20.2	15.3	-	
Beryllium	4	N/V	<1.84	<1.84	<1.84	<1.84	<1.84	<1.84	-	
Bismuth	N/V	N/V	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	
Boron	5000	5000	<8	<8	<8	9.0	<8	<8	-	
Cadmium	5	5	<0.67	<0.67	<0.67	<0.67	<0.67	<0.67	-	
Chromium (Total)	50	50	<0.57	<0.57	<0.57	<0.57	<0.57	<0.57	-	
Cobalt	100	N/V	<0.96	<0.96	<0.96	<0.96	<0.96	<0.96	-	
Copper	23	1000*	3.72	6.71	3.34	5.1	2.57	5.62	-	
Iron	N/V	300*	23.2	25.9	17.5	38.5	20.4	30.9	-	
Lead	10	10	0.66	1.53	1.13	1.48	0.47	1.37	-	
Manganese	N/V	50*	41.1	40.1	30.4	39	18.1	17.1	-	
Molybdenum	7300	N/V	<0.47	<0.47	<0.47	<0.47	<0.47	<0.47	-	
Nickel	100	N/V	1.4	2.68	1.22	1.91	0.99	1.78	-	
Selenium	100	100	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	-	
Silver	1.2	N/V	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	-	
Sodium	200000	200000*	959	930	1100	1370	1350	1660	-	
Thallium	2	N/V	<0.36	<0.36	<0.36	<0.36	<0.36	<0.36	-	
Titanium	N/V	N/V	<0.5	<5	<0.5	0.5	<0.5	<0.5	-	
Uranium	N/V	100	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	-	
Vanadium	200	N/V	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	-	
Zinc	1100	5000*	11.3	15.1	5.75	16.1	16.6	13.5	-	
GENERAL PARAMETERS										
Fluoride	N/V	1500	<50	<50	<50	<50	<50	<50	-	
Chloride	250000	250000*	690	650	1820	1280	3410	1320	-	
Bromide	N/V	N/V	<50	<50	<50	<50	<50	<50	-	
Nitrate (NO ₃ ⁻) as N	10000	10000 (3)	<50	<50	80	<50	220	<50	-	
Nitrite (NO ₂ ⁻) as N	1000	1000 (3)	<50	<50	<50	<50	<50	<50	-	
Sulphate	N/V	500000*	4790	4860	6900	6290	8210	5740	-	
Total Suspended Solids (mg/L)	N/V	N/V	24400	63000	4780	10500	7690	10600	-	
Total Hardness, CaCO ₃	N/V	80000-100000*	7160	6850	7000	11200	10000	8170	-	
Ammonia (NH ₃) as N	N/V	N/V	<50	<50	<50	<50	<50	<50	-	
Total Kjeldahl Nitrogen	N/V	N/V	2070	960	5750	330	2790	1920	-	
Total Organic Carbon	N/V	N/V	90000	135000	105000	12000	30000	135000	-	
Total Phosphorus	N/V	N/V	39200	21400	8720	50	7040	7180	-	
pH (pH units)	N/V	6.5-8.5*	6.03	6.03	6.09	5.99	6.28	5.85	-	

Notes:

- (1) MOE Guideline for Use at Contaminated Sites in Ontario, Appendix 2, Tal in a potable groundwater condition (coarse textured soils)
- (2) Ontario Drinking Water Standards (ODWS), Revised January 2001, Table:
- (3) Total Xylenes (meta, para & ortho-Xylene)
- * Non-health related ODWS criteria (Aesthetic Objective or Operational Gu)
- N/V Parameter not included in MOE Guideline or ODWS
- < Parameter not detected above value specified
- Parameter not analysed for because no retrieval of groundwater in well MV
- 6** Denotes exceedance of MOE Guideline or ODWS
- µg/L Micrograms per litre

TABLE 9: Groundwater Analytical Results - General Groundwater Chemistry

Parameter	MOE Groundwater Criteria (1) (µg/L)	Ontario Drinking Water Standards (2) (µg/L)	Sample Results (µg/L)			
			Gravenhurst Patrol Yard - Class EA Study			
			8-July-04	20-Aug-04	8-July-04	20-Aug-04
			MW-7	MW-7	MW-8	MW-8
METALS						
Aluminum	N/V	100*	42.9	35.3	547	97200
Antimony	6	N/V	<1.53	<1.53	<1.53	<1.53
Arsenic	25	25	<0.57	<0.57	<0.57	2.86
Barium	1000	1000	8.68	8.14	25	611
Beryllium	4	N/V	<1.84	<1.84	<1.84	1.85
Bismuth	N/V	N/V	<0.50	<0.50	<0.50	<0.50
Boron	5000	5000	10.0	<8	9	<8
Cadmium	5	5	<0.67	<0.67	<0.67	<0.67
Chromium (Total)	50	50	<0.57	<0.57	1.52	43.5
Cobalt	100	N/V	<0.96	<0.96	3.08	39.3
Copper	23	1000*	4.38	1.43	5.71	247
Iron	N/V	300*	23.3	23.9	570	26500
Lead	10	10	1.14	0.94	1.88	24.3
Manganese	N/V	50*	35.8	23.5	185	854
Molybdenum	7300	N/V	<0.47	<0.47	<0.47	0.57
Nickel	100	N/V	1.89	1.4	3.9	34.3
Selenium	100	100	<0.81	<0.81	<0.81	<0.81
Silver	1.2	N/V	<0.70	<0.70	<0.70	<0.70
Sodium	200000	200000*	1940	1760	1340	2400
Thallium	2	N/V	<0.36	<0.36	<0.36	<0.36
Titanium	N/V	N/V	<0.5	<0.5	3.98	661
Uranium	N/V	100	<0.20	<0.20	0.28	7.29
Vanadium	200	N/V	<0.4	<0.4	2.1	64.9
Zinc	1100	5000*	7.11	43.2	1030	164
GENERAL PARAMETERS						
Fluoride	N/V	1500	<50	<50	<50	<50
Chloride	250000	250000*	940	2660	1050	4960
Bromide	N/V	N/V	<50	<50	<50	<50
Nitrate (NO ₃ ⁻) as N	10000	10000 (3)	<50	140	<50	290
Nitrite (NO ₂ ⁻) as N	1000	1000 (3)	<50	<50	<50	<50
Sulphate	N/V	500000*	6190	7760	5540	9960
Total Suspended Solids (mg/L)	N/V	N/V	24500	18400	15600	45700
Total Hardness, CaCO ₃	N/V	80000-100000*	6810	8000	10400	25000
Ammonia (NH ₃) as N	N/V	N/V	<50	<50	<50	<50
Total Kjeldahl Nitrogen	N/V	N/V	3310	7210	2850	13800
Total Organic Carbon	N/V	N/V	237000	156000	200000	369000
Total Phosphorus	N/V	N/V	9830	5660	14800	36200
pH (pH units)	N/V	6.5-8.5*	6.13	5.92	5.97	6.26

Notes:

- (1) MOE Guideline for Use at Contaminated Sites in Ontario, Appendix 2, Tail in a potable groundwater condition (coarse textured soils)
- (2) Ontario Drinking Water Standards (ODWS), Revised January 2001, Table:
- (3) Total Xylenes (meta, para & ortho-Xylene)
- * Non-health related ODWS criteria (Aesthetic Objective or Operational Gu)
- N/V Parameter not included in MOE Guideline or ODWS
- < Parameter not detected above value specified
- Parameter not analysed for because no retrieval of groundwater in well MW
- 6** Denotes exceedance of MOE Guideline or ODWS
- µg/L Micrograms per litre

TABLE 10: Groundwater Analytical Results - Petroleum Hydrocarbons and BTEX

Parameter	MOE Groundwater Criteria (1) (µg/L)	Ontario Drinking Water Standards (2) (µg/L)	Sample Results (µg/L)								
			Gravenhurst Patrol Yard - Class EA Study								
			8-July-04	20-Aug-04	8-July-04	20-Aug-04	8-July-04	20-Aug-04	8-July-04		20-Aug-04
			MW-1	MW-1	MW-2	MW-2	MW-3	MW-3	MW-4	MW-4D	MW-4
PETROLEUM HYDROCARBONS											
TPH Gas/Diesel	1000	N/V	66	<37	1400	130	340	140	210	230	<37
TPH Heavy Oils	1000	N/V	<500	<500	<500	<500	620	<500	<500	<500	<500
BTEX											
Benzene	5	5	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Ethylbenzene	2.4	2.4*	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Toluene	24	24*	<0.04	0.13	<0.04	<0.04	<0.04	2.2	<0.04	0.09	<0.04
m/p-Xylene	300 (3)	300* (3)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
o-Xylene	300 (3)	300* (3)	<0.04	<0.04	<0.10	<0.04	<0.10	<0.04	<0.10	<0.10	<0.04

Notes:

- (1) MOE Guideline for Use at Contaminated Sites in Ontario, Appendix 2, Table A; Groundwater Criteria in a potable groundwater condition (coarse textured soils)
- (2) Ontario Drinking Water Standards (ODWS), Revised January 2001, Tables 1 and 4
- (3) Total Xylenes (meta, para & ortho-Xylene)
- * Non-health related ODWS criteria (Aesthetic Objective or Operational Guideline)
- N/V Parameter not included in MOE Guideline or ODWS
- < Parameter not detected above value specified
- Well was dry
- 1400 Denotes exceedance of MOE Guideline or ODWS
- µg/L Micrograms per litre

TABLE 10: Groundwater Analytical Results - Petroleum Hydrocarbons and BTEX

Parameter	MOE Groundwater Criteria (1) (µg/L)	Ontario Drinking Water Standards (2) (µg/L)	Sample Results (mg/L)							
			Gravenhurst Patrol Yard - Class EA Study							
			8-July-04	20-Aug-04	8-July-04	20-Aug-04	8-July-04	20-Aug-04	8-July-04	20-Aug-04
			MW-5	MW-5	MW-6	MW-6	MW-7	MW-7	MW-8	MW-8
PETROLEUM HYDROCARBONS										
TPH Gas/Diesel	1000	N/V	110	<37	190	-	72	<37	190	<37
TPH Heavy Oils	1000	N/V	<500	530	<500	-	750	600	<500	<500
BTEX										
Benzene	5	5	<0.04	<0.04	<0.04	-	<0.04	<0.04	<0.04	<0.04
Ethylbenzene	2.4	2.4*	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	<0.05
Toluene	24	24*	<0.04	<0.04	<0.04	-	<0.04	<0.04	<0.04	<0.04
m/p-Xylene	300 (3)	300* (3)	<0.10	<0.10	<0.10	-	<0.10	<0.10	<0.10	<0.10
o-Xylene	300 (3)	300* (3)	<0.10	<0.04	<0.10	-	<0.10	<0.04	<0.10	<0.04

Notes:

- (1) MOE Guideline for Use at Contaminated Sites in Ontario, Appendix 2, Table .
in a potable groundwater condition (coarse textured soils)
- (2) Ontario Drinking Water Standards (ODWS), Revised January 2001, Tables 1 :
- (3) Total Xylenes (meta, para & ortho-Xylene)
- * Non-health related ODWS criteria (Aesthetic Objective or Operational Guidel
- N/V Parameter not included in MOE Guideline or ODWS
- < Parameter not detected above value specified
- Well was dry
- 1400** Denotes exceedance of MOE Guideline or ODWS
- µg/L Micrograms per litre

APPENDIX A

Site Photographs



Photograph #1

General view of the typical landscape of the area noting the large wetland in the photo background. Site is located to the left of the photo. Photo taken facing northeast.



Photograph #2

View of the large wetland located southeast of the site. Photo taken facing east.



Photograph #3

View of the small pond located at the southeast corner of the site. Photo taken facing east.



Photograph #4

General view of the typical landscape of the site noting a bedrock ridge in the photo foreground and the relatively flat land between ridges. Photo taken facing north.



Photograph #5

View of a typical bedrock ridge in the area. (immediately southeast of the site). Photo taken facing southeast.



Photograph #6

View of one of the many small roads/laneways running through the site. Photo taken facing northwest.



Photograph #7

General view of a bedrock ridge/knoll located at the central portion of the site. Photo taken facing southwest.



Photograph #8

View of the large borrow pit located to the west of the site. Photo taken facing southwest.



Photograph #9

View of a small picnic area at the north central portion of the site. Photo taken facing east



Photograph #10

View of Monitoring Wells MW3 and MW4.
Photo taken facing northwest.



Photograph #11

View of Monitoring Well MW8. Photo taken
facing west.



Photograph #12

View of Mini-piezometer P2 located in large
wetland. Photo taken facing east

APPENDIX B

Borehole Logs

Log of Borehole: BH3 (MW3)

Sheet: 1 of 3

WP: 5420-02-00

Co-ordinates: 4 973 277.5 N, 629 585.2 E

Originated By: I. Khan

Project: Gravenhurst Patrol Yard Class EA

Borehole Type: Hollow Stem Augers

Compiled By: I. Khan

Datum: Geodetic

Date: May 18, 2004

Checked By: D. Stewart

SUBSURFACE PROFILE			SAMPLE				Well Details	Water Levels	Moisture Content (%) 20 40 60	Grain Size Distribution (%) GR SA SI CL
Elevation/ Depth (m)	Description	Strata Plot	Number	Type	"N" Value	TOV Reading (ppm) 5				
254.1	Ground Surface									
254.0	Topsoil									
0.1	Dark brown silt and sand with organics and rootlets, loose, moist		1	SS	9	<2				
	SAND Brown and fine-grained with some silt, gravel and cobbles, dense, moist		2	SS	50	<1				
	-becoming moist-wet to wet with depth, no gravel or cobbles, compact		3	SS	23	<1				
			4	SS	19	<1				
			5	SS	26	<1				
			6	SS	21	<1				
			7	SS	23	<1				
			8	SS	13	<2				

July 8, 2004

July 21, 2004

0 90 10 0

SUBSURFACE PROFILE			SAMPLE				Well Details	Water Levels	Moisture Content	Grain Size Distribution
Elevation/ Depth (m)	Description	Strata Plot	Number	Type	"N" Value	TOV Reading				
						(ppm) 5				
243.8			9	SS	10	<1				
10.4	SILT Grey, compact, moist		10	SS	22	<1				
242.2			11	SS	10	<2				
11.9	Sandy SILT Grey with fine-grained sand, compact, wet		12	SS	18	<1				

Sheet: 1 of 1

Co-ordinates: 4 973 442.9 N, 629 615.7 E

Originated By: I. Khan

Borehole Type: Hollow Stew Augers

Compiled By: I. Khan

Date: May 19, 2004

Checked By: D. Stewart

[illegible]



Log of Borehole: BH6

Sheet: 1 of 1

WP: 5420-02-000

Co-ordinates: 4 973 373.9 N, 629 584.6 E

Originated By: I. Khan

Project: Gravenhurst Patrol Yard Class EA

Borehole Type: Hollow Stew Augers

Compiled By: I. Khan

Datum: Geodetic

Date: May 20, 2004

Checked By: D. Stewart

[illegible]

APPENDIX C

Duplicate Analysis Results

**DUPLICATE ANALYSIS: Groundwater Samples
Metals and Inorganics**

Parameter	units	Sample/Duplicate	
		MW1	% Difference
Aluminum	µg/L	33.5 28.1	17.5%
Antimony	µg/L	<1.53 <1.53	0.0%
Arsenic	µg/L	<0.57 <0.57	0.0%
Barium	µg/L	11.9 11.8	0.8%
Beryllium	µg/L	<1.84 <1.84	0.0%
Bismuth	µg/L	<0.50 <0.50	0.0%
Boron	µg/L	<8 <8	0.0%
Cadmium	µg/L	<0.67 <0.67	0.0%
Chromium	µg/L	<0.57 <0.57	0.0%
Cobalt	µg/L	<0.96 <0.96	0.0%
Copper	µg/L	3.72 6.71	57.3%
Iron	µg/L	23.2 25.9	11.0%
Lead	µg/L	0.66 1.53	79.5%
Manganese	µg/L	41.1 40.1	2.5%
Molybdenum	µg/L	<0.47 <0.47	0.0%
Nickel	µg/L	1.4 2.68	62.7%
Phosphorus	µg/L	39.2 21.4	58.7%

**DUPLICATE ANALYSIS: Groundwater Samples
Metals and Inorganics**

Parameter	units	Sample/Duplicate	
		MW1	% Difference
Selenium	µg/L	<0.81 <0.81	0.0%
Silver	µg/L	<0.70 <0.70	0.0%
Sodium	µg/L	959 930	3.1%
Thallium	µg/L	<0.36 <0.36	0.0%
Titanium	µg/L	<0.50 <5	0.0%
Uranium	µg/L	<0.20 <0.20	0.0%
Vanadium	µg/L	<0.40 <0.40	0.0%
Zinc	µg/L	11.3 15.1	28.8%
Flouride	µg/L	<0.05 <0.05	0.0%
Chloride	µg/L	0.69 0.65	6.0%
Bromide	µg/L	<0.05 <0.05	0.0%
Nitrate	µg/L	<0.05 <0.05	0.0%
Nitrite	µg/L	<0.05 <0.05	0.0%
Sulphate	µg/L	4.79 4.86	1.5%
Total Suspended Solids	µg/L	24400 63000	88.3%

**DUPLICATE ANALYSIS: Groundwater Samples
Metals and Inorganics**

Parameter	units	Sample/Duplicate	
		MW1	% Difference
Total Hardness	µg/L	7.16 6.85	4.4%
Ammonia	µg/L	<0.05 <0.05	0.0%
TKN	µg/L	2.07 0.96	73.3%
TOC	µg/L	90 135	40.0%
pH	µg/L	6.03 6.03	0.0%

Relative Percent Difference = $| (X - Y) / \text{Average}(X,Y) | \times 100\%$
 where X = sample and Y = duplicate

Appendix D

Laboratory Certificates of Analysis (Chemical and Physical)

**Certificate of Analysis**CLIENT NAME: **ECOPLANS LTD.**ATTENTION: **Derek Stewart (04-125)****OCS Decom Guidelines [soil]****Date Sampled:** May 17, 2004 **Date Received:** May 26, 2004 **Date Reported:** Jun 2, 2004 **Sample Type:** Soil

	Unit	MDL	Guideline	396461 0171-BH1-2	396462 0171-BH2-2	396463 0171-BH3-3	396464 0171-BH3-10	396465 0171-BH4-3	396466 0171-BH4-7	396467 0171-BH5-3	396468 0171-BH6-3
Antimony	µg/g	1.6		<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
Arsenic	µg/g	0.6		0.9	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Barium	µg/g	0.3		22.9	7.4	10.5	26.9	12.3	77.2	9.9	33.5
Beryllium	µg/g	0.4		<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Boron (Hot Water Extractable)	µg/g	0.032		0.077	0.109	<0.032	0.047	<0.032	0.100	<0.032	0.056
Cadmium	µg/g	0.4		<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	µg/g	0.6		11.2	6.3	4.3	5.7	3.2	11.4	3.5	8.6
Cobalt	µg/g	0.3		2.7	1.3	1.7	2.4	1.5	4.3	1.6	3.9
Copper	µg/g	0.3		11.7	8.5	8.0	7.4	5.7	19.5	6.3	20.7
Lead	µg/g	0.5		5.7	0.8	0.8	0.8	0.5	1.1	0.6	1.1
Molybdenum	µg/g	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	1.0	<0.5	<0.5
Nickel	µg/g	0.6		8.8	4.7	4.7	6.8	4.2	15.0	4.2	12.4
Selenium	µg/g	0.8		<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Silver	µg/g	0.4		<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Thallium	µg/g	0.4		<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Vanadium	µg/g	0.4		21.9	24.6	10.8	14.1	6.6	23.1	9.6	21.5
Zinc	µg/g	0.4		16.4	7.8	8.3	13.1	8.4	32.2	7.4	20.8
Electrical Conductivity (2:1)	mS/cm	0.002		0.025	0.024	0.013	0.051	0.019	0.044	0.026	0.034
Sodium Adsorption Ratio	N/A			0.182	0.071	0.166	0.181	0.133	0.568	0.065	0.083

M.D.L. - Method Detection Limit

Certified By: *Elizabeth Polakowska*

**Certificate of Analysis**CLIENT NAME: **ECOPLANS LTD.**ATTENTION: **Derek Stewart (04-125)****OCS Decom Guidelines [soil]****Date Sampled:** May 17, 2004 **Date Received:** May 26, 2004 **Date Reported:** Jun 2, 2004 **Sample Type:** Soil

	Unit	MDL	Guideline	396461 0171-BH1-2	396462 0171-BH2-2	396463 0171-BH3-3	396464 0171-BH3-10	396465 0171-BH4-3	396466 0171-BH4-7	396467 0171-BH5-3	396468 0171-BH6-3
pH 2:1 Water:Soil Extraction	N/A	N/A		5.98	5.88	6.25	8.49	6.42	6.91	6.90	6.13
Chromium, Hexavalent	µg/g	0.382		<0.382	<0.382	<0.382	<0.382	<0.382	<0.382	<0.382	<0.382
Cyanide, Free	µg/g	7.4		<7.4	<7.4	<7.4	<7.4	<7.4	<7.4	<7.4	<7.4
Mercury	µg/g	0.011		0.013	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011

M.D.L. - Method Detection Limit

Certified By: 



CLIENT NAME: ECOPLANS LTD.

Certificate of Analysis5623 McADAM ROAD
MISSISSAUGA, ONTARIO
CANADA L4Z 1N9AGAT WORK ORDER **04T084188**TEL: (905) 501-9998
FAX: (905) 501-0589
www.agatlabs.comATTENTION: **Derek Stewart (04-125)****OCS Decom Guidelines [soil]****Date Sampled:** May 20, 2004 **Date Received:** May 26, 2004 **Date Reported:** Jun 2, 2004 **Sample Type:** Soil

	Unit	MDL	Guideline	396469 0171-BH7-3
Antimony	µg/g	1.6		<1.6
Arsenic	µg/g	0.6		<0.6
Barium	µg/g	0.3		13.0
Beryllium	µg/g	0.4		<0.4
Boron (Hot Water Extractable)	µg/g	0.032		<0.032
Cadmium	µg/g	0.4		<0.4
Chromium	µg/g	0.6		3.4
Cobalt	µg/g	0.3		1.6
Copper	µg/g	0.3		12.3
Lead	µg/g	0.5		0.7
Molybdenum	µg/g	0.5		<0.5
Nickel	µg/g	0.6		5.0
Selenium	µg/g	0.8		<0.8
Silver	µg/g	0.4		<0.4
Thallium	µg/g	0.4		<0.4
Vanadium	µg/g	0.4		8.2
Zinc	µg/g	0.4		9.5
Electrical Conductivity (2:1)	mS/cm	0.002		0.051
Sodium Adsorption Ratio	N/A			0.057

M.D.L. - Method Detection Limit

Certified By: *Elizabeth Polakowska*

**Certificate of Analysis**CLIENT NAME: **ECOPLANS LTD.**ATTENTION: **Derek Stewart (04-125)****OCS Decom Guidelines [soil]****Date Sampled:** May 20, 2004 **Date Received:** May 26, 2004 **Date Reported:** Jun 2, 2004 **Sample Type:** Soil

	Unit	MDL	Guideline	396469 0171-BH7-3
pH 2:1 Water:Soil Extraction	N/A	N/A	6.52	
Chromium, Hexavalent	µg/g	0.382	<0.382	
Cyanide, Free	µg/g	7.4	<7.4	
Mercury	µg/g	0.011	<0.011	

M.D.L. - Method Detection Limit

Certified By: 

**Certificate of Analysis**CLIENT NAME: **ECOPLANS LTD.**ATTENTION: **Derek Stewart (04-125)****(P & T) BTEX/TPH - Soil****Date Sampled:** May 17, 2004 **Date Received:** May 26, 2004 **Date Reported:** Jun 2, 2004 **Sample Type:** Soil

	Unit	MDL	Guideline	396461 0171-BH1-2	396462 0171-BH2-2	396463 0171-BH3-3	396464 0171-BH3-10	396465 0171-BH4-3	396466 0171-BH4-7	396467 0171-BH5-3	396468 0171-BH6-3
Benzene	µg/g	0.001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Toluene	µg/g	0.002		<0.002	0.62	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Ethylbenzene	µg/g	0.002		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
m & p - Xylene	µg/g	0.002		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
o - Xylene	µg/g	0.002		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Xylenes (Total)	µg/g	0.002		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
TPgH (Gas, C5-C10)	µg/g	0.2		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TEH (Diesel, C10-C24)	µg/g	6.0		<6.0	6.2	<6.0	<6.0	<6.0	<6.0	<6.0	<6.0
TPH (Gas / Diesel)	µg/g	6.2		<6.2	6.2	<6.2	<6.2	<6.2	<6.2	<6.2	<6.2

M.D.L. - Method Detection Limit

Certified By:

**Certificate of Analysis**CLIENT NAME: **ECOPLANS LTD.**ATTENTION: **Derek Stewart (04-125)****(P & T) BTEX/TPH - Soil****Date Sampled:** May 20, 2004 **Date Received:** May 26, 2004 **Date Reported:** Jun 2, 2004 **Sample Type:** Soil

	Unit	MDL	Guideline	396469 0171-BH7-3
Benzene	µg/g	0.001	<0.001	
Toluene	µg/g	0.002	<0.002	
Ethylbenzene	µg/g	0.002	<0.002	
m & p - Xylene	µg/g	0.002	<0.002	
o - Xylene	µg/g	0.002	<0.002	
Xylenes (Total)	µg/g	0.002	<0.002	
TPgH (Gas, C5-C10)	µg/g	0.2	<0.2	
TEH (Diesel, C10-C24)	µg/g	6.0	<6.0	
TPH (Gas / Diesel)	µg/g	6.2	<6.2	

M.D.L. - Method Detection Limit

Certified By:



CLIENT NAME: ECOPLANS LTD.

Certificate of Analysis5623 McADAM ROAD
MISSISSAUGA, ONTARIO
CANADA L4Z 1N9AGAT WORK ORDER **04T084188**TEL: (905) 501-9998
FAX: (905) 501-0589
www.agatlabs.comATTENTION: **Derek Stewart (04-125)****Petroleum Hydrocarbons (Heavy Oils) [soil]****Date Sampled:** May 17, 2004 **Date Received:** May 26, 2004 **Date Reported:** Jun 2, 2004 **Sample Type:** Soil

	Unit	MDL	Guideline	396461 0171-BH1-2	396462 0171-BH2-2	396463 0171-BH3-3	396464 0171-BH3-10	396465 0171-BH4-3	396466 0171-BH4-7	396467 0171-BH5-3	396468 0171-BH6-3
Petroleum Hydrocarbons (heavy oils)- gravimetric	µg/g	250		<250	<250	<250	<250	<250	<250	<250	<250

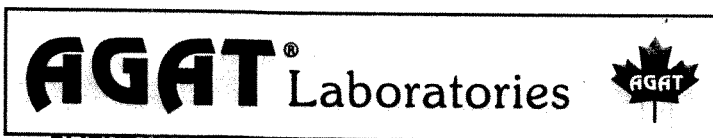
M.D.L. - Method Detection Limit

Certified By:

AGAT Certificate of Analysis

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AGAT Laboratories Calgary is accredited by the American Industrial Hygiene Association (AIHA) for specific tests.



Certificate of Analysis

AGAT WORK ORDER 04T084188

5623 McADAM ROAD
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www.agatlabs.com

CLIENT NAME: ECOPLANS LTD.

ATTENTION: Derek Stewart (04-125)

Petroleum Hydrocarbons (Heavy Oils) [soil]

Date Sampled: May 20, 2004 Date Received: May 26, 2004 Date Reported: Jun 2, 2004 Sample Type: Soil

	Unit	MDL	Guideline	396469 0171-BH7-3
Petroleum Hydrocarbons (heavy oils)- gravimetric	µg/g	250	<250	

M.D.L. - Method Detection Limit

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AGAT Certificate of Analysis

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AGAT Laboratories Calgary is accredited by the American Industrial Hygiene Association (AIHA) for specific tests.



Certificate of Analysis - Sample Comments

Workorder 04T084188
(P & T) BTEX/TPH - Soil
Guideline None

Sample	Comments
396461	M.D.L. - Method Detection Limit Results are based on the dry weight of the soil. Results relate only to the items tested.
396462	M.D.L. - Method Detection Limit Results are based on the dry weight of the soil. Results relate only to the items tested.
396463	M.D.L. - Method Detection Limit Results are based on the dry weight of the soil. Results relate only to the items tested.
396464	M.D.L. - Method Detection Limit Results are based on the dry weight of the soil. Results relate only to the items tested.
396465	M.D.L. - Method Detection Limit Results are based on the dry weight of the soil. Results relate only to the items tested.
396466	M.D.L. - Method Detection Limit Results are based on the dry weight of the soil. Results relate only to the items tested.
396467	M.D.L. - Method Detection Limit

Certified By:



Certificate of Analysis - Sample Comments

Workorder 04T084188**(P & T) BTEX/TPH - Soil**

Guideline None

Sample	Comments
	Results are based on the dry weight of the soil. Results relate only to the items tested.
396468	M.D.L. - Method Detection Limit Results are based on the dry weight of the soil. Results relate only to the items tested.
396469	M.D.L. - Method Detection Limit Results are based on the dry weight of the soil. Results relate only to the items tested.

OCS Decom Guidelines [soil]

Guideline None

Sample	Comments
396461	M.D.L. - Method Detection Limit
396462	M.D.L. - Method Detection Limit
396463	M.D.L. - Method Detection Limit
396464	M.D.L. - Method Detection Limit
396465	M.D.L. - Method Detection Limit

Certified By: 

**Certificate of Analysis - Sample Comments****Workorder** 04T084188**OCS Decom Guidelines [soil]**

Guideline None

Sample	Comments
396466	M.D.L. - Method Detection Limit
396467	M.D.L. - Method Detection Limit
396468	M.D.L. - Method Detection Limit
396469	M.D.L. - Method Detection Limit

**Petroleum Hydrocarbons (Heavy Oils)
[soil]**

Guideline None

Sample	Comments
396461	M.D.L. - Method Detection Limit Result is based on the dry weight of the soil. Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.
396462	M.D.L. - Method Detection Limit Result is based on the dry weight of the soil. Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.

Certified By:

Certificate of Analysis - Sample Comments

Workorder 04T084188

Petroleum Hydrocarbons (Heavy Oils)

[soil]

Guideline None

Sample	Comments
396463	M.D.L. - Method Detection Limit Result is based on the dry weight of the soil. Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.
396464	M.D.L. - Method Detection Limit Result is based on the dry weight of the soil. Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.
396465	M.D.L. - Method Detection Limit Result is based on the dry weight of the soil. Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.
396466	M.D.L. - Method Detection Limit Result is based on the dry weight of the soil. Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.
396467	M.D.L. - Method Detection Limit Result is based on the dry weight of the soil. Silica gel cleanup was used to remove any animal/vegetable oil.

Certified By:



Certificate of Analysis - Sample Comments

Workorder 04T084188

Petroleum Hydrocarbons (Heavy Oils)
[soil]

Guideline None

Sample	Comments
	Results relate only to the items tested.
396468	M.D.L. - Method Detection Limit Result is based on the dry weight of the soil. Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.
396469	M.D.L. - Method Detection Limit Result is based on the dry weight of the soil. Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.

Certified By:





Quality Assurance

CLIENT NAME: ECOPLANS LTD.

AGAT WORK ORDER:

04T084188

ATTENTION TO: Derek Stewart (04-125)

Soil																
DATE		Jun 2, 2004		Duplicate				Reference Material			Method Blank Spike			Matrix Spike		
Parameter	Batch	Sample ID	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits		
								Lower	Upper		Lower	Upper		Lower	Upper	
OCS Decom Guidelines																
[soil]																
Antimony	1	396461	< 1.6	< 1.6	0.0%	< 1.6	76%	70%	130%	69%	60%	140%	73%	70%	130%	
Arsenic	1	396461	0.9	0.9	0.0%	< 0.6	96%	90%	110%	92%	70%	130%	91%	70%	130%	
Barium	1	396461	22.9	22.5	1.8%	< 0.3	105%	90%	110%	98%	70%	130%	94%	70%	130%	
Beryllium	1	396461	< 0.4	< 0.4	0.0%	< 0.4	112%	80%	120%	99%	70%	130%	123%	70%	130%	
Boron (Hot Water Extractable)	1	396469	<0.032	<0.032	0.0%	< 0.032	107%	90%	110%	94%	80%	120%	84%	80%	120%	
Cadmium	1	396461	< 0.4	< 0.4	0.0%	< 0.4	106%	90%	110%	106%	70%	130%	103%	70%	130%	
Chromium	1	396461	11.2	11.3	0.9%	< 0.6	105%	90%	110%	102%	70%	130%	105%	70%	130%	
Cobalt	1	396461	2.7	2.6	3.8%	< 0.3	93%	90%	110%	98%	70%	130%	99%	70%	130%	
Copper	1	396461	11.7	11.5	1.7%	< 0.3	99%	90%	110%	104%	70%	130%	96%	70%	130%	
Lead	1	396461	5.7	5.3	7.3%	< 0.5	102%	90%	110%	101%	70%	130%	99%	70%	130%	
Molybdenum	1	396461	< 0.5	< 0.5	0.0%	< 0.5	100%	90%	110%	102%	70%	130%	94%	70%	130%	
Nickel	1	396461	8.8	8.4	4.7%	< 0.6	106%	90%	110%	99%	70%	130%	98%	70%	130%	
Selenium	1	396461	< 0.8	< 0.8	0.0%	< 0.8	94%	90%	110%	102%	70%	130%	100%	70%	130%	
Silver	1	396461	< 0.4	< 0.4	0.0%	< 0.4	109%	90%	110%	90%	70%	130%	87%	70%	130%	
Thallium	1	396461	< 0.4	< 0.4	0.0%	< 0.4	134%	60%	140%	100%	70%	130%	102%	70%	130%	
Vanadium	1	396461	21.9	22.3	1.8%	< 0.4	104%	90%	110%	100%	70%	130%	104%	70%	130%	
Zinc	1	396461	16.4	16.7	1.8%	< 0.4	111%	80%	120%	107%	70%	130%	103%	70%	130%	
Electrical Conductivity (2:1)	1	396461	0.025	0.05	66.7%	< 0.002	95%	90%	110%							
Sodium Adsorption Ratio	1	396461	0.182	0.188	3.2%											
pH 2:1 Water:Soil	1	396461	5.98	5.96	0.3%	N/A	100%	90%	110%							

Certified By:

Elizabeth Polakowska

AGAT QUALITY ASSURANCE REPORT

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AGAT Laboratories Calgary is accredited by the American Industrial Hygiene Association (AIHA) for specific tests.



Quality Assurance

CLIENT NAME: ECOPLANS LTD.

AGAT WORK ORDER:

04T084188

ATTENTION TO: Derek Stewart (04-125)

Soil														
DATE		Duplicate				Reference Material			Method Blank Spike			Matrix Spike		
Jun 2, 2004		Batch	Sample ID	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery
Parameter									Lower	Upper		Lower	Upper	
OCS Decom Guidelines														
[soil]														
Extraction														
Chromium, Hexavalent	1	396467	<0.382	<0.382	0.0%	< 0.382	101%	90%	110%	103%	90%	110%	89%	80% 120%
Cyanide, Free	1	396464	<7.4	<7.4	0.0%	< 7.4	96%	90%	110%	95%	90%	110%	98%	90% 110%
Mercury	1	396469	<0.011	<0.011	0.0%	< 0.011	104%	90%	110%	106%	70%	130%	96%	70% 130%

Certified By:

Elizabeth Polakowska

AGAT QUALITY ASSURANCE REPORT

AGAT Laboratories is accredited by the Standards Council of Canada (SCC), in co-operation with the Canadian Association for Environmental Analytical Laboratories (CAEAL), for specific tests listed in the scope of accreditation approved by the SCC.

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Quality Assurance

CLIENT NAME: ECOPLANS LTD.

AGAT WORK ORDER:

04T084188

ATTENTION TO: Derek Stewart (04-125)

Trace Organics															
DATE		Jun 2, 2004		Duplicate				Reference Material			Method Blank Spike			Matrix Spike	
Parameter	Batch	Sample ID	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
(P & T) BTEX/TPH - Soil															
Benzene	1	397467	< 0.001	< 0.001	0.0%	< 0.001	109%	60%	140%	128%	60%	140%		60%	140%
Toluene	1	397467	< 0.002	< 0.002	0.0%	< 0.002	76%	60%	140%	93%	60%	140%		60%	140%
Ethylbenzene	1	397467	< 0.002	< 0.002	0.0%	< 0.002	89%	60%	140%	115%	60%	140%		60%	140%
m & p - Xylene	1	397467	< 0.002	< 0.002	0.0%	< 0.002	92%	60%	140%	122%	60%	140%		60%	140%
o - Xylene	1	397467	< 0.002	< 0.002	0.0%	< 0.002	95%	60%	140%	133%	60%	140%		60%	140%
TPgH (Gas, C5-C10)	1	397467	< 0.2	< 0.2	0.0%	< 0.2	75%	60%	140%	77%	60%	140%		60%	140%
TEH (Diesel, C10-C24)	1	397467	< 6.0	< 6.0	0.0%	< 6.0	120%	60%	130%	122%	60%	130%		60%	130%
Petroleum Hydrocarbons (Heavy Oils) [soil]															
Petroleum Hydrocarbons (heavy oils)- gravimetric	1	396469	< 250	< 250	0.0%	< 250		80%	120%	100%	80%	120%		80%	120%

Certified By:

[Signature]

AGAT QUALITY ASSURANCE REPORT

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Method Summary

Client Name: ECOPLANS LTD.

AGAT Work Order:

04T084188

Attention To: Derek Stewart (04-125)

Parameter	AGAT S.O.P.	Literature Reference	Analytical Technique
Soil Parameters			
Antimony	MET 1003	EPA SW 846 3050B & 6020	ICP-MS
Arsenic	MET 1003	EPA SW 846 3050B & 6020	ICP-MS
Barium	MET 1003	EPA SW 846 3050B & 6020	ICP-MS
Beryllium	MET 1003	EPA SW 846 3050B & 6020	ICP-MS
Boron (Hot Water Extractable)	INOR 1033	EPA SW 846 3050B & 6020	ICP-MS
Cadmium	MET 1003	EPA SW 846 3050B & 6020	ICP-MS
Chromium	MET 1003	EPA SW 846 3050B & 6020	ICP-MS
Cobalt	MET 1003	EPA SW 846 3050B & 6020	ICP-MS
Copper	MET 1003	EPA SW 846 3050B & 6020	ICP-MS
Lead	MET 1003	EPA SW 846 3050B & 6020	ICP-MS
Molybdenum	MET 1003	EPA SW 846 3050B & 6020	ICP-MS
Nickel	MET 1003	EPA SW 846 3050B & 6020	ICP-MS
Selenium	MET 1003	EPA SW 846 3050B & 6020	ICP-MS
Silver	MET 1003	EPA SW 846 3050B & 6020	ICP-MS
Thallium	MET 1003	EPA SW 846 3050B & 6020	ICP-MS
Vanadium	MET 1003	EPA SW 846 3050B & 6020	ICP-MS
Zinc	MET 1003	EPA SW 846 3050B & 6020	ICP-MS
Electrical Conductivity (2:1)	INOR 1036		EC Meter
Sodium Adsorption Ratio	SOIL 200	McKeague 3.26	CALCULATION
pH 2:1 Water:Soil Extraction	SOIL 160	McKeague 3.13	pH METER
Chromium, Hexavalent	INOR 1029	SM 3500 D	SPECTROPHOTOMETER
Cyanide, Free	INOR 1038.001	EPA SW 846 9010 & SM 4500 CN- D	TITRATION
Mercury	MET 1001	EPA SW 846 7471A	CVAA



Method Summary

Client Name: ECOPLANS LTD.

AGAT Work Order:

04T084188

Attention To: Derek Stewart (04-125)

Parameter	AGAT S.O.P.	Literature Reference	Analytical Technique
Trace Organics Parameters			
Benzene	VOL 5008	EPA SW-846 5030B & 8015	GC / FID (P & T)
Toluene	VOL 5008	EPA SW-846 5030B & 8015	GC/FID (P & T)
Ethylbenzene	VOL 5008	EPA SW-846 5030B & 8015	GC/FID (P & T)
m & p - Xylene	VOL - 5008	EPA SW - 846 5030B/8015	GC / FID (P & T)
o - Xylene	VOL - 5008	EPA SW - 846 5030B/8015	GC / FID (P & T)
Xylenes (Total)	VOL 5008	EPA SW-846 5030B & 8015	GC/FID (P & T)
TPgH (Gas, C5-C10)	VOL - 5004	EPA SW - 846 5030B/8015	GC / FID (P & T)
TEH (Diesel, C10-C24)	VOL 5006	EPA SW-846 3541 & 8015B	GC/FID
TPH (Gas / Diesel)	VOL 5006 & VOL 5004	EPA SW-846 3541 & 8015B	GC/FID (P & T)
Petroleum Hydrocarbons (heavy oils)- gravimetric		MOE E3398	GRAVIMETRIC ANALYSIS

**Certificate of Analysis**CLIENT NAME: **ECOPLANS LTD.**ATTENTION: **I. Khan (R03-0171)****(P & T) - BTEX/TPH - Water****Date Sampled:** Jul 8, 2004 **Date Received:** Jul 12, 2004 **Date Reported:** Jul 21, 2004 **Sample Type:** Water

	Unit	MDL	Guideline	404927 0171 - MW1	404928 0171 - MW2	404929 0171 - MW3	404930 0171 - MW4	404931 0171 - MW5	404932 0171 - MW6	404933 0171 - MW7	404934 0171 - MW8
Benzene	µg/L	0.04		<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Toluene	µg/L	0.04		<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Ethylbenzene	µg/L	0.05		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
m & p - Xylene	µg/L	0.10		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
o - Xylene	µg/L	0.04		<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Xylenes (Total)	µg/L	0.04		<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
TPgH (gasoline range, C5 to C10)	µg/L	8.0		<8.0	<8.0	<8.0	<8.0	<8.0	<8.0	<8.0	<8.0
TEH (Diesel Range, C10-C24)	µg/L	29		66	1400	340	210	110	190	72	190
TPH Gas/Diesel	µg/L	37		66	1400	340	210	110	190	72	190

M.D.L. - Method Detection Limit

Certified By: 

**Certificate of Analysis**

CLIENT NAME: ECOPLANS LTD.

ATTENTION: I. Khan (R03-0171)

(P & T) - BTEX/TPH - Water

Date Sampled:	Jul 8, 2004	Date Received:	Jul 12, 2004	Date Reported:	Jul 21, 2004	Sample Type:	Water
---------------	-------------	----------------	--------------	----------------	--------------	--------------	-------

	Unit	MDL	Guideline	404935 0171 - MW 4 D
Benzene	µg/L	0.04		<0.04
Toluene	µg/L	0.04		0.09
Ethylbenzene	µg/L	0.05		<0.05
m & p - Xylene	µg/L	0.10		<0.10
o - Xylene	µg/L	0.04		<0.04
Xylenes (Total)	µg/L	0.04		<0.04
TPgH (gasoline range, C5 to C10)	µg/L	8.0		<8.0
TEH (Diesel Range, C10-C24)	µg/L	29		230
TPH Gas/Diesel	µg/L	37		230

M.D.L. - Method Detection Limit

Certified By:

AGAT Certificate of Analysis

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**Certificate of Analysis**CLIENT NAME: **ECOPLANS LTD.**ATTENTION: **I. Khan (R03-0171)****Petroleum Hydrocarbons (Heavy Oils) [water]**

Date Sampled:	Jul 8, 2004	Date Received:	Jul 12, 2004	Date Reported:	Jul 21, 2004	Sample Type:	Water
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	Unit	MDL	Guideline	404927 0171 - MW1	404928 0171 - MW2	404929 0171 - MW3	404930 0171 - MW4	404931 0171 - MW5	404932 0171 - MW6	404933 0171 - MW7	404934 0171 - MW8
Petroleum Hydrocarbons (Heavy oils)	µg/L	500		<500	<500	620	<500	<500	<500	750	<500

M.D.L. - Method Detection Limit

Certified By: Jokey Takumli

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**Certificate of Analysis**AGAT WORK ORDER **04T089206**5623 McADAM ROAD
MISSISSAUGA, ONTARIO
CANADA L4Z 1N9TEL: (905) 501-9998
FAX: (905) 501-0589
www.agatlabs.com

CLIENT NAME: ECOPLANS LTD.

ATTENTION: I. Khan (R03-0171)

Petroleum Hydrocarbons (Heavy Oils) [water]

Date Sampled:	Jul 8, 2004	Date Received:	Jul 12, 2004	Date Reported:	Jul 21, 2004	Sample Type:	Water
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	Unit	MDL	Guideline	404935 0171 - MW 4 D
Petroleum Hydrocarbons (Heavy oils)	µg/L	500		<500

M.D.L. - Method Detection Limit

Certified By:

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**Certificate of Analysis**CLIENT NAME: **ECOPLANS LTD.**ATTENTION: **I. Khan (R03-0171)****OCS Metals [water]**

Date Sampled:	Jul 8, 2004	Date Received:	Jul 12, 2004	Date Reported:	Jul 21, 2004	Sample Type:	Water				
	Unit	MDL	Guideline	404927 0171 - MW1	404928 0171 - MW2	404929 0171 - MW3	404930 0171 - MW4	404931 0171 - MW5	404932 0171 - MW6	404933 0171 - MW7	404934 0171 - MW8
Antimony	ug/L	1.53		<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Arsenic	ug/L	0.57		0.59	<0.57	<0.57	<0.57	<0.57	<0.57	<0.57	<0.57
Barium	ug/L	0.41		15.6	27.1	36.4	11.9	20.8	15.3	8.68	25.0
Beryllium	ug/L	1.84		<1.84	<1.84	<1.84	<1.84	<1.84	<1.84	<1.84	<1.84
Boron	ug/L	8		10	13	20	<8	9	<8	10	9
Cadmium	ug/L	0.67		<0.67	<0.67	<0.67	<0.67	<0.67	<0.67	<0.67	<0.67
Chromium	ug/L	0.57		0.83	0.63	<0.57	<0.57	<0.57	<0.57	<0.57	1.52
Cobalt	ug/L	0.96		9.50	<0.96	2.07	<0.96	<0.96	<0.96	<0.96	3.08
Copper	ug/L	0.78		4.33	6.13	4.81	3.72	5.10	5.62	4.38	5.71
Lead	ug/L	0.44		0.87	1.07	0.85	0.66	1.48	1.37	1.14	1.88
Molybdenum	ug/L	0.47		<0.47	<0.47	8.96	<0.47	<0.47	<0.47	<0.47	<0.47
Nickel	ug/L	0.63		2.88	1.91	2.43	1.40	1.91	1.78	1.89	3.90
Selenium	ug/L	0.81		<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81	<0.81
Silver	ug/L	0.70		<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70
Thallium	ug/L	0.36		<0.36	<0.36	<0.36	<0.36	<0.36	<0.36	<0.36	<0.36
Vanadium	ug/L	0.4		1.3	<0.4	1.4	<0.4	<0.4	<0.4	<0.4	2.1
Zinc	ug/L	0.41		10.5	39.5	14.3	11.3	16.1	13.5	7.11	1030

M.D.L. - Method Detection Limit

Certified By:*Elizabeth Polakowska*

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**Certificate of Analysis**CLIENT NAME: **ECOPLANS LTD.**ATTENTION: **I. Khan (R03-0171)****OCS Metals [water]****Date Sampled:** Jul 8, 2004 **Date Received:** Jul 12, 2004 **Date Reported:** Jul 21, 2004 **Sample Type:** Water

	Unit	MDL	Guideline	404935 0171 - MW 4 D
Antimony	ug/L	1.53		<1.53
Arsenic	ug/L	0.57		<0.57
Barium	ug/L	0.41		11.8
Beryllium	ug/L	1.84		<1.84
Boron	ug/L	8		<8
Cadmium	ug/L	0.67		<0.67
Chromium	ug/L	0.57		<0.57
Cobalt	ug/L	0.96		<0.96
Copper	ug/L	0.78		6.71
Lead	ug/L	0.44		1.53
Molybdenum	ug/L	0.47		<0.47
Nickel	ug/L	0.63		2.68
Selenium	ug/L	0.81		<0.81
Silver	ug/L	0.70		<0.70
Thallium	ug/L	0.36		<0.36
Vanadium	ug/L	0.4		<0.4
Zinc	ug/L	0.41		15.1

M.D.L. - Method Detection Limit

Certified By:*Elizabeth Polakowska*

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**Certificate of Analysis**

CLIENT NAME: ECOPLANS LTD.

ATTENTION: I. Khan (R03-0171)

Water Analysis - Inorganics**Date Sampled:** Jul 8, 2004 **Date Received:** Jul 12, 2004 **Date Reported:** Jul 21, 2004 **Sample Type:** Water

	Unit	MDL	Guideline	404927 0171 - MW1	404928 0171 - MW2	404929 0171 - MW3	404930 0171 - MW4	404931 0171 - MW5	404932 0171 - MW6	404933 0171 - MW7	404934 0171 - MW8
pH	N/A			5.71	5.42	7.32	6.03	5.99	5.85	6.13	5.97
Total Suspended Solids	mg/L	120		7820	3950	116000	24400	10500	10600	24500	15600
Total Hardness (as CaCO ₃)	mg/L	5		15.4	13.3	115	7.16	11.2	8.17	6.81	10.4
Fluoride	mg/L	0.05		<0.05	<0.05	0.16	<0.05	<0.05	<0.05	<0.05	<0.05
Chloride	mg/L	0.05		2.44	0.71	16.1	0.69	1.28	1.32	0.94	1.05
Bromide	mg/L	0.05		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Nitrate as N	mg/L	0.05		<0.05	0.37	0.34	<0.05	<0.05	<0.05	<0.05	<0.05
Nitrite as N	mg/L	0.05		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sulfate	mg/L	0.10		6.84	8.78	61.0	4.79	6.29	5.74	6.19	5.54
Ammonia (as N)	mg/L	0.05		0.49	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen *	mg/L	0.05		2.62	3.49	0.35	2.07	0.33	1.92	3.31	2.85
Total Organic Carbon *	mg/L	1		106	104	8	90	12	135	237	200
Total Phosphorus	mg/L	0.05		9.14	4.80	64.3	39.2	0.05	7.18	9.83	14.8

M.D.L. - Method Detection Limit

Certified By:*Elizabeth Polakowska*

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**Certificate of Analysis**CLIENT NAME: **ECOPLANS LTD.**ATTENTION: **I. Khan (R03-0171)****Water Analysis - Inorganics**

Date Sampled:	Jul 8, 2004	Date Received:	Jul 12, 2004	Date Reported:	Jul 21, 2004	Sample Type:	Water
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	Unit	MDL	Guideline	404935 0171 - MW 4 D
pH	N/A			6.03
Total Suspended Solids	mg/L	120		63000
Total Hardness (as CaCO ₃)	mg/L	5		6.85
Fluoride	mg/L	0.05		<0.05
Chloride	mg/L	0.05		0.65
Bromide	mg/L	0.05		<0.05
Nitrate as N	mg/L	0.05		<0.05
Nitrite as N	mg/L	0.05		<0.05
Sulfate	mg/L	0.10		4.86
Ammonia (as N)	mg/L	0.05		<0.05
Total Kjeldahl Nitrogen *	mg/L	0.05		0.96
Total Organic Carbon *	mg/L	1		135
Total Phosphorus	mg/L	0.05		21.4

M.D.L. - Method Detection Limit

Certified By:

AGAT Certificate of Analysis

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Certificate of Analysis - Sample Comments

Workorder 04T089206
(P & T) - BTEX/TPH - Water
 Guideline None

Sample	Comments
404927	M.D.L. - Method Detection Limit Results relate only to the items tested.
404928	M.D.L. - Method Detection Limit Results relate only to the items tested.
404929	M.D.L. - Method Detection Limit Results relate only to the items tested.
404930	M.D.L. - Method Detection Limit Results relate only to the items tested.
404931	M.D.L. - Method Detection Limit Results relate only to the items tested.
404932	M.D.L. - Method Detection Limit Results relate only to the items tested.
404933	M.D.L. - Method Detection Limit Results relate only to the items tested.
404934	M.D.L. - Method Detection Limit Results relate only to the items tested.
404935	M.D.L. - Method Detection Limit Results relate only to the items tested.

Certified By: 

**OCS Metals [water]**

Guideline None

Sample	Comments
404927	M.D.L. - Method Detection Limit
404928	M.D.L. - Method Detection Limit
404929	M.D.L. - Method Detection Limit
404930	M.D.L. - Method Detection Limit
404931	M.D.L. - Method Detection Limit
404932	M.D.L. - Method Detection Limit
404933	M.D.L. - Method Detection Limit
404934	M.D.L. - Method Detection Limit
404935	M.D.L. - Method Detection Limit

**Petroleum Hydrocarbons (Heavy Oils)
[water]**

Guideline None

Sample	Comments
404927	M.D.L. - Method Detection Limit Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.
404928	M.D.L. - Method Detection Limit Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.

Certified By:

**Certificate of Analysis - Sample Comments****Workorder** 04T089206**Petroleum Hydrocarbons (Heavy Oils)**
[water]

Guideline None

Sample	Comments
404929	M.D.L. - Method Detection Limit Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.
404930	M.D.L. - Method Detection Limit Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.
404931	M.D.L. - Method Detection Limit Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.
404932	M.D.L. - Method Detection Limit Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.
404933	M.D.L. - Method Detection Limit Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.
404934	M.D.L. - Method Detection Limit Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.

Certified By:

Certificate of Analysis - Sample Comments

Workorder 04T089206

Petroleum Hydrocarbons (Heavy Oils)
[water]

Guideline None

Sample	Comments
404935	M.D.L. - Method Detection Limit Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.

Water Analysis - Inorganics

Guideline None

Sample	Comments
404927	M.D.L. - Method Detection Limit * Analysis performed at AGAT Laboratories Calgary. TSS determined on 10 mL - 50 mL sample volume due to high solid content; the reported MDL has been multiplied by factor 10.
404928	M.D.L. - Method Detection Limit * Analysis performed at AGAT Laboratories Calgary.
404929	M.D.L. - Method Detection Limit * Analysis performed at AGAT Laboratories Calgary.
404930	M.D.L. - Method Detection Limit * Analysis performed at AGAT Laboratories Calgary.

Certified By: 

Certificate of Analysis - Sample Comments

Workorder 04T089206

Water Analysis - Inorganics

Guideline None

Sample	Comments
404931	M.D.L. - Method Detection Limit * Analysis performed at AGAT Laboratories Calgary.
404932	M.D.L. - Method Detection Limit * Analysis performed at AGAT Laboratories Calgary.
404933	M.D.L. - Method Detection Limit * Analysis performed at AGAT Laboratories Calgary.
404934	M.D.L. - Method Detection Limit * Analysis performed at AGAT Laboratories Calgary.
404935	M.D.L. - Method Detection Limit * Analysis performed at AGAT Laboratories Calgary.

Certified By: 



Quality Assurance

CLIENT NAME: ECOPLANS LTD.

AGAT WORK ORDER: 04T089206

ATTENTION TO: I. Khan (R03-0171)

Trace Organics															
DATE	Jul 21, 2004	Duplicate				Reference Material			Method Blank Spike			Matrix Spike			
Parameter	Batch	Sample ID	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits	Recovery	Acceptable Limits	Recovery	Acceptable Limits	Recovery	Acceptable Limits	Recovery
								Lower Upper		Lower Upper		Lower Upper		Lower Upper	
Petroleum Hydrocarbons															
(Heavy Oils) [water]															
Petroleum Hydrocarbons (Heavy oils)	1	na	na	na	0.0%	< 500	na	70% 130%	101%	70% 130%	na	70% 130%	na	70% 130%	na

Certified By: *Jacky Takewhi*

AGAT QUALITY ASSURANCE REPORT

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Quality Assurance

CLIENT NAME: ECOPLANS LTD.
ATTENTION TO: I. Khan (R03-0171)

AGAT WORK ORDER: 04T089206

Water																	
DATE		Jul 21, 2004				Duplicate				Reference Material			Method Blank Spike			Matrix Spike	
Parameter	Batch	Sample ID	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits			
								Lower	Upper		Lower	Upper		Lower	Upper		
OCS Metals [water]																	
Antimony	1	404931	< 1.53	< 1.53	0.0%	< 1.53	101%	90%	110%	107%	70%	130%	103%	70%	130%		
Arsenic	1	404931	< 0.57	< 0.57	0.0%	< 0.57	103%	90%	110%	103%	80%	120%	112%	70%	130%		
Barium	1	404931	20.8	21.3	2.4%	< 0.41	100%	80%	120%	102%	90%	110%	96%	70%	130%		
Beryllium	1	404931	< 1.84	< 1.84	0.0%	< 1.84	103%	90%	110%	104%	90%	110%	98%	70%	130%		
Boron	1	404931	9	9	0.0%	< 8	98%	90%	110%		90%	110%		70%	130%		
Cadmium	1	404931	< 0.67	< 0.67	0.0%	< 0.67	102%	90%	110%	105%	90%	110%	98%	70%	130%		
Chromium	1	404931	< 0.57	< 0.57	0.0%	< 0.57	103%	90%	110%	104%	90%	110%	98%	70%	130%		
Cobalt	1	404931	< 0.96	< 0.96	0.0%	< 0.96	103%	90%	110%	104%	90%	110%	98%	70%	130%		
Copper	1	404931	5.10	5.16	1.2%	< 0.78	101%	90%	110%	105%	90%	110%	89%	70%	130%		
Lead	1	404931	1.48	1.52	2.7%	< 0.44	104%	90%	110%	107%	90%	110%	95%	70%	130%		
Molybdenum	1	404931	< 0.47	< 0.47	0.0%	< 0.47	105%	90%	110%	109%	90%	110%	95%	70%	130%		
Nickel	1	404931	1.91	1.83	4.3%	< 0.63	102%	90%	110%	104%	90%	110%	95%	70%	130%		
Selenium	1	404931	< 0.81	< 0.81	0.0%	< 0.81	104%	90%	110%	104%	90%	110%	111%	70%	130%		
Silver	1	404931	< 0.70	< 0.70	0.0%	< 0.70	103%	90%	110%	97%	90%	110%	76%	70%	130%		
Thallium	1	404931	< 0.36	< 0.36	0.0%	< 0.36	101%	90%	110%	101%	90%	110%	94%	70%	130%		
Vanadium	1	404931	< 0.4	< 0.4	0.0%	< 0.4	105%	90%	110%	110%	90%	110%	104%	70%	130%		
Zinc	1	404931	16.1	16.3	1.2%	< 0.41	104%	90%	110%	107%	90%	110%	103%	70%	130%		
Water Analysis - Inorganics																	
pH	1	404927	5.71	5.71	0.0%		101%	80%	120%		90%	110%		80%	120%		
Total Hardness (as CaCO3)	1	404929	115	116	0.9%	< 5											
Fluoride	1	404928	< 0.05	< 0.05	0.0%	< 0.05	98%	80%	120%	97%	90%	110%	103%	80%	120%		
Chloride	1	404928	0.71	0.69	2.9%	< 0.05	91%	90%	110%	92%	90%	110%	90%	90%	110%		

Certified By: *Elizabeth Polakowska*

AGAT QUALITY ASSURANCE REPORT

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Quality Assurance

CLIENT NAME: ECOPLANS LTD.

AGAT WORK ORDER: 04T089206

ATTENTION TO: I. Khan (R03-0171)

Water															
DATE	Jul 21, 2004	Duplicate				Reference Material				Method Blank Spike			Matrix Spike		
Parameter	Batch	Sample ID	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Water Analysis - Inorganics															
Bromide	1	404928	< 0.05	< 0.05	0.0%	< 0.05	102%	80%	120%	98%	90%	110%	91%	80%	120%
Nitrate as N	1	404928	0.37	0.36	2.7%	< 0.05	93%	90%	110%	96%	90%	110%	93%	90%	110%
Nitrite as N	1	404928	< 0.05	< 0.05	0.0%	< 0.05	NA	90%	110%	95%	90%	110%	92%	90%	110%
Sulfate	1	404928	8.78	8.70	0.9%	< 0.10	93%	80%	120%	95%	90%	110%	92%	80%	120%
Ammonia (as N)	1	404927	0.49	0.47	4.2%	< 0.05	97%	80%	120%	94%	90%	110%	86%	80%	120%
Total Kjeldahl Nitrogen *	1725				2.4%	< 0.05	101%	90%	110%	96%	90%	110%	100%	90%	110%
Total Organic Carbon *	1694				1.5%	< 1	105%	90%	110%	101%	90%	110%	114%	85%	115%
Total Phosphorus	1	404927	9.14	8.99	1.7%	< 0.05	99%	80%	120%	105%	90%	110%	98%	80%	120%

Certified By: *Elizabeth Polakowska*

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Method Summary

Client Name: ECOPLANS LTD.

AGAT Work Order:

04T089206

Attention To: I. Khan (R03-0171)

Parameter	AGAT S.O.P.	Literature Reference	Analytical Technique
Trace Organics Parameters			
Benzene	VOL 5007	EPA SW-846 5030B & 8015	GC / FID (P & T)
Toluene	VOL 5007	EPA SW-846 5030B & 8015	GC/FID (P & T)
Ethylbenzene	VOL 5007	EPA SW-846 5030B & 8015	GC/FID (P & T)
m & p - Xylene	VOL - 5007	EPA SW - 846 5030B/8015	GC / FID (P & T)
o - Xylene	VOL - 5007	EPA SW - 846 5030B/8015	GC / FID (P & T)
Xylenes (Total)	VOL 5007	EPA SW-846 5030B & 8015	GC/FID (P & T)
TPgH (gasoline range, C5 to C10)	VOL 5003	EPA 5030B / EPA 8015B	GC / FID (P & T)
TEH (Diesel Range, C10-C24)	VOL 5005	EPA SW-846 3510C & 8015B	GC/FID
TPH Gas/Diesel	VOL - 5003 / VOL - 5505	EPA SW - 846-3510C/8015B	GC / FID
Petroleum Hydrocarbons (Heavy oils)		MOE E3398	GRAVIMETRIC ANALYSIS

Method Summary

Client Name: ECOPLANS LTD.
Attention To: I. Khan (R03-0171)

AGAT Work Order:

04T089206

Parameter	AGAT S.O.P.	Literature Reference	Analytical Technique
Water Parameters			
Antimony	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Arsenic	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Barium	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Beryllium	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Boron	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Cadmium	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Chromium	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Cobalt	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Copper	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Lead	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Molybdenum	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Nickel	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Selenium	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Silver	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Thallium	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Vanadium	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Zinc	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
pH	INOR 1020	SM 4500 H & B	pH METER
Total Suspended Solids	INOR 1028	SM 2540 D	GRAVIMETRIC ANALYSIS
Total Hardness (as CaCO ₃)			CALCULATION
Fluoride	INOR 1004	SM 4011 B	ION CHROMATOGRAPH
Chloride	1004.001	SM 4110 B	ION CHROMATOGRAPH
Bromide	INOR 1004	SM 4110 B	ION CHROMATOGRAPH
Nitrate as N	1004.001	SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	1004.001	SM 4110 B	ION CHROMATOGRAPH
Sulfate	INOR 1004	SM 4110 B	ION CHROMATOGRAPH
Ammonia (as N)	INOR 1002	SM 4500 NH ₃ -F	SPECTROPHOTOMETER
Total Kjeldahl Nitrogen *	TEC 0103	ENVIRODAT VWV 07021 626 METHOD 235; SM 4500-N orgB	TECHNICON
Total Organic Carbon *	INS 0500	SM 5310 B	COMBUSTION INFRARED
Total Phosphorus	INOR 1022	SM 4500 P & E	SPECTROPHOTOMETER

**Certificate of Analysis**CLIENT NAME: **ECOPLANS LTD.**ATTENTION: **IMRAN KHAN (R03-125)****(P & T) - BTEX/TPH - Water****Date Sampled:** Aug 20, 2004 **Date Received:** Aug 23, 2004 **Date Reported:** Sep 3, 2004 **Sample Type:** Water

	Unit	MDL	Guideline	411145 0171 - MW1	411146 0171 - MW2	411147 0171 - MW3	411148 0171 - MW4	411149 0171 - MW5	411150 0171 - MW7	411151 0171 - MW8
Benzene	µg/L	0.04	5	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Toluene	µg/L	0.04	24	0.13	<0.04	2.2	<0.04	<0.04	<0.04	<0.04
Ethylbenzene	µg/L	0.05	2.4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
m & p - Xylene	µg/L	0.10		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
o - Xylene	µg/L	0.04		<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Xylenes (Total)	µg/L	0.04	300	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
TPgH (gasoline range, C5 to C10)	µg/L	8.0	1000	<8.0	<8.0	<8.0	<8.0	<8.0	<8.0	<8.0

M.D.L. - Method Detection Limit

Certified By:

AGAT Certificate of Analysis

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**Certificate of Analysis**AGAT WORK ORDER **04T093516**5623 McADAM ROAD
MISSISSAUGA, ONTARIO
CANADA L4Z 1N9TEL: (905) 501-9998
FAX: (905) 501-0589
www.agatlabs.comCLIENT NAME: **ECOPLANS LTD.**ATTENTION: **IMRAN KHAN (R03-125)****Petroleum Hydrocarbons (Heavy Oils) [water]****Date Sampled:** Aug 20, 2004 **Date Received:** Aug 23, 2004 **Date Reported:** Sep 3, 2004 **Sample Type:** Water

	Unit	MDL	Guideline	411145 0171 - MW1	411146 0171 - MW2	411147 0171 - MW3	411148 0171 - MW4	411149 0171 - MW5	411150 0171 - MW7	411151 0171 - MW8
Petroleum Hydrocarbons (Heavy oils)	µg/L	500	1000	<500	<500	<500	<500	530	600	<500

M.D.L. - Method Detection Limit
Guideline refers to Table A**Certified By:**

**Certificate of Analysis**CLIENT NAME: **ECOPLANS LTD.**ATTENTION: **IMRAN KHAN (R03-125)****Metals Scan [water]****Date Sampled:** Aug 20, 2004 **Date Received:** Aug 23, 2004 **Date Reported:** Sep 3, 2004 **Sample Type:** Water

	Unit	MDL	Guideline	411145 0171 - MW1	411146 0171 - MW2	411147 0171 - MW3	411148 0171 - MW4	411149 0171 - MW5	411150 0171 - MW7	411151 0171 - MW8
Antimony	ug/L	1.53	6.0	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53	<1.53
Arsenic	ug/L	0.57	25	<0.57	<0.57	0.65	<0.57	<0.57	<0.57	2.86
Barium	ug/L	0.41	1000	15.3	29.2	40.3	9.57	20.2	8.14	611
Beryllium	ug/L	1.84	4.0	<1.84	<1.84	<1.84	<1.84	<1.84	<1.84	1.85
Boron	ug/L	8	5000	<8	9	29	<8	<8	<8	<8
Cadmium	ug/L	0.67	5.0	<0.67	<0.67	<0.67	<0.67	<0.67	<0.67	<0.67
Chromium	ug/L	0.57	50	0.70	<0.57	<0.57	<0.57	<0.57	<0.57	43.5
Cobalt	ug/L	0.96	100	7.25	<0.96	8.22	<0.96	<0.96	<0.96	39.3
Copper	ug/L	0.78	23	2.90	4.33	4.55	3.34	2.57	1.43	247
Lead	ug/L	0.44	10	0.91	1.04	1.08	1.13	0.47	0.94	24.3
Molybdenum	ug/L	0.47	7300	<0.47	<0.47	11.9	<0.47	<0.47	<0.47	0.57
Nickel	ug/L	0.63	100	1.78	1.24	3.41	1.22	0.99	1.40	34.3
Selenium	ug/L	0.81	10	<0.81	<0.81	1.21	<0.81	<0.81	<0.81	<0.81
Silver	ug/L	0.70	1.2	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70	<0.70
Thallium	ug/L	0.36	2.0	<0.36	<0.36	<0.36	<0.36	<0.36	<0.36	<0.36
Vanadium	ug/L	0.4	200	0.9	<0.4	0.8	<0.4	<0.4	<0.4	64.9
Zinc	ug/L	0.41	1100	22.1	25.3	62.8	5.75	16.6	43.2	164
Aluminum	ug/L	0.50		131	208	27.5	22.5	30.3	35.3	97200

M.D.L. - Method Detection Limit
Guideline refers to Table A**Certified By:***Elizabeth Potkowska*

**Certificate of Analysis**CLIENT NAME: **ECOPLANS LTD.**ATTENTION: **IMRAN KHAN (R03-125)****Metals Scan [water]****Date Sampled:** Aug 20, 2004 **Date Received:** Aug 23, 2004 **Date Reported:** Sep 3, 2004 **Sample Type:** Water

	Unit	MDL	Guideline	411145 0171 - MW1	411146 0171 - MW2	411147 0171 - MW3	411148 0171 - MW4	411149 0171 - MW5	411150 0171 - MW7	411151 0171 - MW8
Sodium	ug/L	50.0	200000	1910	1050	26800	1100	1350	1760	2400
Titanium	ug/L	0.50		1.90	1.95	1.01	<0.50	<0.50	<0.50	661
Iron	ug/L	0.81		5570	96.6	95.1	17.5	20.4	23.9	26500
Manganese	ug/L	0.40		277	18.9	224	30.4	18.1	23.5	854
Bismuth	ug/L	0.50		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Strontium	ug/L	0.4		20.0	33.2	192	17.7	23.9	23.7	160
Uranium	ug/L	0.20		<0.20	<0.20	1.61	<0.20	<0.20	<0.20	7.29

M.D.L. - Method Detection Limit
Guideline refers to Table A**Certified By:** 

AGAT Certificate of Analysis

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**Certificate of Analysis**AGAT WORK ORDER **04T093516**5623 McADAM ROAD
MISSISSAUGA, ONTARIO
CANADA L4Z 1N9TEL: (905) 501-9998
FAX: (905) 501-0589
www.agatlabs.comCLIENT NAME: **ECOPLANS LTD.**ATTENTION: **IMRAN KHAN (R03-125)****Water Analysis - Inorganics****Date Sampled:** Aug 20, 2004 **Date Received:** Aug 23, 2004 **Date Reported:** Sep 3, 2004 **Sample Type:** Water

	Unit	MDL	Guideline	411145 0171 - MW1	411146 0171 - MW2	411147 0171 - MW3	411148 0171 - MW4	411149 0171 - MW5	411150 0171 - MW7	411151 0171 - MW8
pH	N/A			5.39	5.74	7.91	6.09	6.28	5.92	6.26
Total Suspended Solids	mg/L	12		5210	2090	141	4780	7690	18400	45700
Total Hardness (as CaCO3)	mg/L	5		16	13	121	7	10	8	25
Fluoride	mg/L	0.05		<0.05	<0.05	0.18	<0.05	<0.05	<0.05	<0.05
Chloride	mg/L	0.05	250	3.41	3.76	32.9	1.82	3.41	2.66	4.96
Bromide	mg/L	0.05		<0.05	<0.05	0.11	<0.05	<0.05	<0.05	<0.05
Nitrate as N	mg/L	0.05	10	0.17	0.33	0.31	0.08	0.22	0.14	0.29
Nitrite as N	mg/L	0.05	1.0	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.05
Sulfate	mg/L	0.10		9.04	13.3	72.0	6.90	8.21	7.76	9.96
Ammonia (as N)	mg/L	0.05		0.21	<0.05	0.13	<0.05	<0.05	<0.05	<0.05
Total Kjeldahl Nitrogen *	mg/L	0.05		13.3	7.65	0.92	5.75	2.79	7.21	13.8
Total Organic Carbon *	mg/L	1		96	73	5	105	30	156	369
Total Phosphorus	mg/L	0.05		5.61	11.6	0.44	8.72	7.04	5.66	36.2

M.D.L. - Method Detection Limit
Guideline refers to Table A**Certified By:**

**Certificate of Analysis - Sample Comments**

Workorder 04T093516
(P & T) - BTEX/TPH - Water
Guideline Table A

Sample	Comments
411145	M.D.L. - Method Detection Limit Results relate only to the items tested.
411146	M.D.L. - Method Detection Limit Results relate only to the items tested.
411147	M.D.L. - Method Detection Limit Results relate only to the items tested.
411148	M.D.L. - Method Detection Limit Results relate only to the items tested.
411149	M.D.L. - Method Detection Limit Results relate only to the items tested.
411150	M.D.L. - Method Detection Limit Results relate only to the items tested.
411151	M.D.L. - Method Detection Limit Results relate only to the items tested.

Metals Scan [water]
Guideline Table A

Certified By: *Elizabeth Polakowska*

**Certificate of Analysis - Sample Comments****Workorder** 04T093516

Sample	Comments
411145	M.D.L. - Method Detection Limit
411146	M.D.L. - Method Detection Limit
411147	M.D.L. - Method Detection Limit
411148	M.D.L. - Method Detection Limit
411149	M.D.L. - Method Detection Limit
411150	M.D.L. - Method Detection Limit
411151	M.D.L. - Method Detection Limit

Petroleum Hydrocarbons (Heavy Oils)**[water]**

Guideline Table A

Sample	Comments
411145	M.D.L. - Method Detection Limit Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.
411146	M.D.L. - Method Detection Limit Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.
411147	M.D.L. - Method Detection Limit Silica gel cleanup was used to remove any animal/vegetable oil.

Certified By:

Certificate of Analysis - Sample Comments

Workorder 04T093516
Metals Scan [water]
Guideline Table A

Sample	Comments
	Results relate only to the items tested.
411148	M.D.L. - Method Detection Limit Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.
411149	M.D.L. - Method Detection Limit Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.
411150	M.D.L. - Method Detection Limit Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.
411151	M.D.L. - Method Detection Limit Silica gel cleanup was used to remove any animal/vegetable oil. Results relate only to the items tested.

Water Analysis - Inorganics
Guideline Table A

Sample	Comments
411145	M.D.L. - Method Detection Limit

Certified By: 

Certificate of Analysis - Sample Comments

Workorder 04T093516
Metals Scan [water]
Guideline Table A

Sample	Comments
	* Analysis performed at AGAT Laboratories Calgary.
411146	M.D.L. - Method Detection Limit * Analysis performed at AGAT Laboratories Calgary.
411147	M.D.L. - Method Detection Limit * Analysis performed at AGAT Laboratories Calgary.
411148	M.D.L. - Method Detection Limit * Analysis performed at AGAT Laboratories Calgary.
411149	M.D.L. - Method Detection Limit * Analysis performed at AGAT Laboratories Calgary.
411150	M.D.L. - Method Detection Limit * Analysis performed at AGAT Laboratories Calgary.
411151	M.D.L. - Method Detection Limit * Analysis performed at AGAT Laboratories Calgary.

Certified By: *Elizabeth Polakowska*



Quality Assurance

CLIENT NAME: ECOPLANS LTD.

AGAT WORK ORDER:

04T093516

ATTENTION TO: IMRAN KHAN (R03-125)

Trace Organics													
DATE Sep 3, 2004		Duplicate				Reference Material			Method Blank Spike			Matrix Spike	
Parameter	Batch	Sample ID	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits	Recovery	Acceptable Limits	Recovery	Acceptable Limits	
								Lower Upper		Lower Upper		Lower Upper	
(P & T) - BTEX/TPH - Water													
Benzene	1	411149	< 0.04	< 0.04	0.0%	< 0.04	98%	60% 140%	100%	60% 140%		60% 140%	
Toluene	1	411149	< 0.04	< 0.04	0.0%	< 0.04	94%	60% 140%	96%	60% 140%		60% 140%	
Ethylbenzene	1	411149	< 0.05	< 0.05	0.0%	< 0.05	76%	60% 140%	78%	60% 140%		60% 140%	
m & p - Xylene	1	411149	< 0.10	< 0.10	0.0%	< 0.10	74%	60% 140%	79%	60% 140%		60% 140%	
o - Xylene	1	411149	< 0.04	< 0.04	0.0%	< 0.04	74%	60% 140%	78%	60% 140%		60% 140%	
TPgH (gasoline range, C5 1 to C10)		411149	< 8.0	< 8.0	0.0%	< 8.0		45% 130%		45% 130%		45% 130%	
Petroleum Hydrocarbons (Heavy Oils) [water]													
Petroleum Hydrocarbons (Heavy oils)	1	na	na	na	0.0%	< 500	na	70% 130%	93%	70% 130%	na	70% 130%	

Certified By:

AGAT QUALITY ASSURANCE REPORT

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Quality Assurance

CLIENT NAME: ECOPLANS LTD.

AGAT WORK ORDER:

04T093516

ATTENTION TO: IMRAN KHAN (R03-125)

Water																	
DATE		Sep 3, 2004				Duplicate				Reference Material			Method Blank Spike			Matrix Spike	
Parameter	Batch	Sample ID	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits			
								Lower	Upper		Lower	Upper		Lower	Upper		
Metals Scan [water]																	
Antimony	1	411150	< 1.53	< 1.53	0.0%	< 1.53	101%	90%	110%	107%	90%	110%	109%	70%	130%		
Arsenic	1	411150	< 0.57	< 0.57	0.0%	< 0.57	99%	90%	110%	100%	90%	110%	99%	70%	130%		
Barium	1	411150	8.14	< 0.41	200.0%	< 0.41	99%	90%	110%	102%	90%	110%	102%	70%	130%		
Beryllium	1	411150	< 1.84	< 1.84	0.0%	< 1.84	100%	90%	110%	103%	90%	110%	108%	70%	130%		
Boron	1	411150	< 8	< 8	0.0%	< 8	100%	90%	110%	NA	90%	110%	NA	70%	130%		
Cadmium	1	411150	< 0.67	< 0.67	0.0%	< 0.67	100%	90%	110%	104%	90%	110%	104%	70%	130%		
Chromium	1	411150	< 0.57	< 0.57	0.0%	< 0.57	100%	90%	110%	102%	90%	110%	104%	70%	130%		
Cobalt	1	411150	< 0.96	< 0.96	0.0%	< 0.96	99%	90%	110%	103%	90%	110%	103%	70%	130%		
Copper	1	411150	1.43	1.42	0.7%	< 0.78	100%	90%	110%	99%	90%	110%	108%	70%	130%		
Lead	1	411150	0.94	< 0.44	200.0%	< 0.44	102%	90%	110%	120%	80%	120%	118%	70%	130%		
Molybdenum	1	411150	< 0.47	< 0.47	0.0%	< 0.47	106%	90%	110%	108%	90%	110%	107%	70%	130%		
Nickel	1	411150	1.40	< 0.63	200.0%	< 0.63	99%	90%	110%	100%	90%	110%	100%	70%	130%		
Selenium	1	411150	< 0.81	< 0.81	0.0%	< 0.81	100%	90%	110%	102%	90%	110%	100%	70%	130%		
Silver	1	411150	< 0.70	< 0.70	0.0%	< 0.70	100%	90%	110%	96%	90%	110%	90%	70%	130%		
Thallium	1	411150	< 0.36	< 0.36	0.0%	< 0.36	101%	90%	110%	100%	90%	110%	101%	70%	130%		
Vanadium	1	411150	< 0.4	< 0.4	0.0%	< 0.4	100%	90%	110%	103%	90%	110%	104%	70%	130%		
Zinc	1	411150	43.2	< 0.41	200.0%	< 0.41	104%	90%	110%	104%	90%	110%	102%	70%	130%		
Aluminum	1	411150	35.3	< 0.50	200.0%	< 0.50	101%	90%	110%	91%	90%	110%	89%	70%	130%		
Sodium	1		13600	13500	0.7%	< 50.0	101%	90%	110%	101%	70%	130%	98%	70%	130%		
Titanium	1	411150	< 0.50	< 0.50	0.0%	< 0.50	104%	90%	110%	100%	90%	110%	101%	70%	130%		
Iron	1	411150	23.9	< 0.81	200.0%	< 0.81	98%	90%	110%	102%	90%	130%	101%	70%	130%		

Certified By:

Elizabeth Polakowska

AGAT QUALITY ASSURANCE REPORT

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Quality Assurance

CLIENT NAME: ECOPLANS LTD.
ATTENTION TO: IMRAN KHAN (R03-125)

AGAT WORK ORDER: 04T093516

Water																
DATE		Sep 3, 2004		Duplicate				Reference Material			Method Blank Spike			Matrix Spike		
Parameter	Batch	Sample ID	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits		
								Lower	Upper		Lower	Upper		Lower	Upper	
Metals Scan [water]																
Manganese	1	411150	23.5	< 0.40	200.0%	< 0.40	89%	80%	120%	100%	70%	130%	98%	70%	130%	
Bismuth	1	411150	< 0.50	< 0.50	0.0%	< 0.50	96%	90%	110%	NA	90%	110%	NA	70%	130%	
Strontium	1	411150	23.7	< 0.4	200.0%	< 0.4	91%	90%	110%	107%	90%	110%	97%	70%	130%	
Uranium	1	411150	< 0.20	< 0.20	0.0%	< 0.20	99%	90%	110%	118%	80%	120%	116%	70%	130%	
Water Analysis - Inorganics																
pH	1	411147	7.91	7.92	0.1%	N/A	101%	80%	120%							
Total Suspended Solids	1	411147	141	143	1.4%	< 120		80%	120%							
Fluoride	1				0.0%	< 0.05	96%	90%	110%	95%	90%	110%	97%	80%	120%	
Chloride	1				1.2%	< 0.05	96%	90%	110%	100%	90%	110%	101%	80%	120%	
Bromide	1				0.0%	< 0.05	100%	90%	110%	92%	90%	110%	96%	80%	120%	
Nitrate as N	1				1.9%	< 0.05	92%	90%	110%	92%	90%	110%	94%	80%	120%	
Nitrite as N	1				0.0%	< 0.05	NA	90%	110%	100%	90%	110%	107%	80%	120%	
Sulfate	1				1.3%	< 0.10	98%	90%	110%	105%	90%	110%	102%	80%	120%	
Ammonia (as N)	1	411145	0.21	0.25	17.4%	< 0.05	89%	80%	120%	105%	90%	110%	101%	80%	120%	
Total Organic Carbon *	1710	224			0.0%	< 1	101%	90%	110%	100%	100%	100%	123%	70%	130%	
Total Phosphorus	1	411145	5.61	5.69	1.4%	< 0.05	100%	80%	120%	101%	90%	110%	105%	80%	120%	

Certified By:

Elizabeth Polakowska

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Method Summary

Client Name: ECOPLANS LTD.

AGAT Work Order: 04T093516

Attention To: IMRAN KHAN (R03-125)

Parameter	AGAT S.O.P.	Literature Reference	Analytical Technique
Trace Organics Parameters			
Benzene	VOL 5007	EPA SW-846 5030B & 8015	GC / FID (P & T)
Toluene	VOL 5007	EPA SW-846 5030B & 8015	GC/FID (P & T)
Ethylbenzene	VOL 5007	EPA SW-846 5030B & 8015	GC/FID (P & T)
m & p - Xylene	VOL - 5007	EPA SW - 846 5030B/8015	GC / FID (P & T)
o - Xylene	VOL - 5007	EPA SW - 846 5030B/8015	GC / FID (P & T)
Xylenes (Total)	VOL 5007	EPA SW-846 5030B & 8015	GC/FID (P & T)
TPgH (gasoline range, C5 to C10)	VOL 5003	EPA 5030B / EPA 8015B	GC / FID (P & T)
Petroleum Hydrocarbons (Heavy oils)		MOE E3398	GRAVIMETRIC ANALYSIS



Method Summary

Client Name: ECOPLANS LTD.

AGAT Work Order: 04T093516

Attention To: IMRAN KHAN (R03-125)

Parameter	AGAT S.O.P.	Literature Reference	Analytical Technique
Water Parameters			
Antimony	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Arsenic	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Barium	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Beryllium	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Boron	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Cadmium	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Chromium	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Cobalt	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Copper	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Lead	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Molybdenum	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Nickel	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Selenium	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Silver	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Thallium	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Vanadium	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Zinc	MET 1002	EPA SW-846 6020 & 200.8	ICP-MS
Aluminum	MET 1002		ICP/MS
Sodium	MET 1002	EPA SW-846 6020 & 200.8	ICP
Titanium	MET 1002	EPA SW-846 6020 & 200.8	ICP/MS
Iron	MET 1002	EPA SW-846 6020 & 200.8	ICP/MS
Manganese	MET 1002	EPA SW-846 6020 & 200.8	ICP/MS
Bismuth	MET 1002	EPA SW-846 6020 & 200.8	ICP/MS
Strontium	MET 1002	EPA SW-846 6020 & 200.8	ICP/MS
Uranium	MET 1002	EPA SW-846 6020 & 200.8	ICP/MS
pH	INOR 1020	SM 4500 H & B	pH METER
Total Suspended Solids	INOR 1028	SM 2540 D	GRAVIMETRIC ANALYSIS
Total Hardness (as CaCO ₃)			CALCULATION
Fluoride	INOR 1004	SM 4011 B	ION CHROMATOGRAPH
Chloride	1004.001	SM 4110 B	ION CHROMATOGRAPH
Bromide	INOR 1004	SM 4110 B	ION CHROMATOGRAPH
Nitrate as N	1004.001	SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	1004.001	SM 4110 B	ION CHROMATOGRAPH
Sulfate	INOR 1004	SM 4110 B	ION CHROMATOGRAPH
Ammonia (as N)	INOR 1002	SM 4500 NH ₃ -F	SPECTROPHOTOMETER

Method Summary

Client Name: ECOPLANS LTD.

AGAT Work Order: 04T093516

Attention To: IMRAN KHAN (R03-125)

Parameter	AGAT S.O.P.	Literature Reference	Analytical Technique
Water Parameters			
Total Kjeldahl Nitrogen *	TEC 0103	ENVIRODAT VWV 07021 626 TECHNICON METHOD 235; SM 4500-N orgB	
Total Organic Carbon *	INS 0500	SM 5310 B	COMBUSTION INFRARED
Total Phosphorus	INOR 1022	SM 4500 P & E	SPECTROPHOTOMETER

**Certificate of Analysis**AGAT WORK ORDER **04T093509**5623 McADAM ROAD
MISSISSAUGA, ONTARIO
CANADA L4Z 1N9TEL: (905) 501-9998
FAX: (905) 501-0589
www.agatlabs.com

CLIENT NAME: ECOPLANS LTD.

ATTENTION: Imran Khan (R03-0171)

TEH - Water**Date Sampled:** Aug 20, 2004 **Date Received:** Aug 23, 2004 **Date Reported:** Aug 24, 2004 **Sample Type:** Water

	Unit	MDL	Guideline	411123 0171-MW1	411124 0171-MW2	411125 0171-MW3	411126 0171-MW4	411127 0171-MW5	411128 0171-MW7	411129 0171-MW8
TEH (Diesel Range, C10-C24)	µg/L	29		<29	130	140	<29	<29	<29	<29

M.D.L. - Method Detection Limit

Certified By: 

AGAT Certificate of Analysis

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**Certificate of Analysis - Sample Comments**

Workorder 04T093509
TEH - Water
Guideline None

Sample	Comments
411123	M.D.L. - Method Detection Limit Results relate only to the items tested.
411124	M.D.L. - Method Detection Limit Results relate only to the items tested.
411125	M.D.L. - Method Detection Limit Results relate only to the items tested.
411126	M.D.L. - Method Detection Limit Results relate only to the items tested.
411127	M.D.L. - Method Detection Limit Results relate only to the items tested.
411128	M.D.L. - Method Detection Limit Results relate only to the items tested.
411129	M.D.L. - Method Detection Limit Results relate only to the items tested.

Certified By: *Joely Takumeli*



Quality Assurance

CLIENT NAME: ECOPLANS LTD.

AGAT WORK ORDER:

04T093509

ATTENTION TO: Imran Khan (R03-0171)

Trace Organics										
DATE	Aug 24, 2004	Duplicate	Reference Material			Method Blank Spike			Matrix Spike	
Parameter	Batch	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery
					Lower	Upper		Lower	Upper	
TEH - Water										
TEH (Diesel Range, C10-C24)	1		< 29	89%	70%	130%	82%	60%	130%	70% 130%

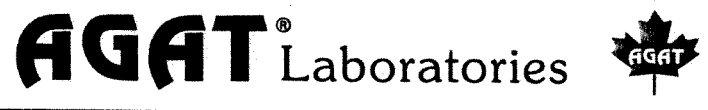
Certified By: *Jokey Takumeli*

AGAT QUALITY ASSURANCE REPORT

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MISSISSAUGA, ONTARIO
CANADA L4Z 1N9



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www.agatlabs.com

Method Summary

Client Name: ECOPLANS LTD.

AGAT Work Order: 04T093509

Attention To: Imran Khan (R03-0171)

Parameter	AGAT S.O.P.	Literature Reference	Analytical Technique
Trace Organics Parameters			
TEH (Diesel Range, C10-C24)	VOL 5005	EPA SW-846 3510C & 8015B	GC/FID

Laboratory Test Results for Project # R03-0171

Sieve Analysis Results:

Particle Sizes (mm)	BH – 1 5-7'	BH-2 2.5-4.5'	BH-3 7.5-9.5'	BH-4 7.5-9.5'	BH-5 7.5-9.5'	BH-5 22.5-24.5'
26.5	100	100	100	100	100	100
19.0	100	83.0	100	100	100	100
13.2	100	77.4	100	100	100	100
9.5	100	73.5	100	100	100	100
4.75	100	64.6	100	100	100	100
2.36	100	59.9	99.8	100	100	100
1.18	100	53.8	99.5	100	100	99.9
0.600	99.9	43.0	97.8	99.7	99.7	97.8
0.300	93.5	27.8	89.1	85.9	93.7	78.0
0.150	27.3	12.2	52.1	29.6	39.5	26.2
0.075	2.4	5.5	9.8	5.0	6.4	3.5

Moisture Content Results:

Location	% Moisture Content	Location	% Moisture Content
BH-1 5-7'	21.35	BH-5 22.5-24.5'	21.05
BH-2 2.5-4.5'	18.31	BH-6 2.5-4.5'	21.64
BH-3 5.5-7'	22.19	BH-7 7.5-9.5'	23.00
BH-3 20-22'	21.70		
BH-3 34-36'	19.07		
BH-3 40-42'	22.47		
BH-4 7.5-9.5'	22.80		
BH-4 11.5-12'	36.99		
BH-4 12.5-14.5'	28.02		
BH-5 7.5-9.5'	21.21		

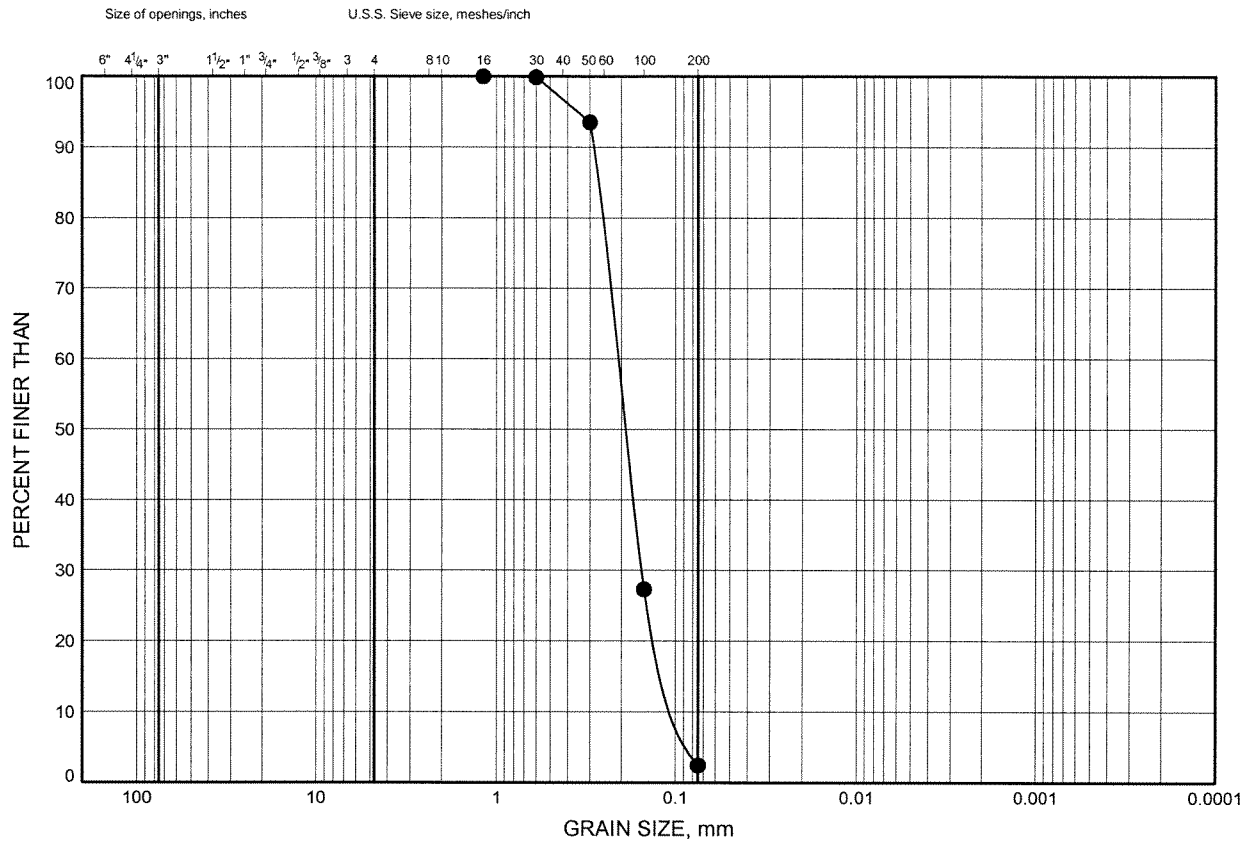
Hydrometer Test Results:

Particle Size (mm)	BH-3 34-36' % Passing	Particle Size (mm)	BH-3 40-42' % Passing	Particle Size (mm)	BH-4 11.5-12' % Passing	Particle Size (mm)	BH-4 12.5-14.5' % Passing	Particle Size (mm)	BH-6 2.5-4.5' % Passing	Particle Size (mm)	BH-7 7.5-9.5' % Passing
19.0	100	19.0	100	19.0	100	19.0	100	19.0	100	19.0	100
12.5	100	12.5	100	12.5	100	12.5	100	12.5	100	12.5	100
9.5	100	9.5	100	9.5	100	9.5	100	9.5	100	9.5	100
4.75	100	4.75	100	4.75	100	4.75	100	4.75	100	4.75	99.8
2.0	100	2.0	100	2.0	100	2.0	100	2.0	100	2.0	99.7
0.85	100	0.85	99.9	0.85	100	0.85	100	0.85	99.9	0.85	99.6
0.425	100	0.425	99.8	0.425	99.8	0.425	99.9	0.425	99.8	0.425	99.4
0.25	99.9	0.25	99.7	0.25	99.0	0.25	99.7	0.25	99.5	0.25	99.0
0.15	99.3	0.15	96.7	0.15	97.4	0.15	95.7	0.15	95.9	0.15	98.3
0.075	90.7	0.075	56.3	0.075	95.2	0.075	57.2	0.075	66.5	0.075	91.4
0.042	70.6	0.048	25.8	0.041	88.2	0.047	26.9	0.046	38.5	0.041	66.1
0.031	56.9	0.036	14.4	0.029	78.2	0.035	16.3	0.034	27.1	0.031	51.9
0.021	37.7	0.023	9.4	0.019	72.1	0.023	8.8	0.023	15	0.022	31.0
0.013	23.0	0.014	7.2	0.011	66.0	0.014	4.4	0.013	7.9	0.013	18.5
0.0093	16.6	0.0096	6.5	0.0082	57.9	0.0097	3.2	0.0096	4.4	0.0095	10.1
0.0067	11.1	0.0068	3.7	0.006	47.8	0.0068	2.6	0.0068	3.6	0.0068	6.8
0.0048	8.4	0.0048	3.7	0.0044	37.6	0.0048	2.6	0.0048	3.6	0.0048	5.1
0.0034	7.4	0.0034	2.9	0.0032	28.5	0.0034	2.6	0.0034	2.9	0.0034	3.4
0.0025	5.6	0.0025	2.9	0.0023	23.4			0.0025	2.9	0.0024	3.4
0.0014	3.8	0.0013	2.9	0.0013	18.4						

Laboratory Testing for Project # R03-0171
GRAIN SIZE DISTRIBUTION

FIGURE 1

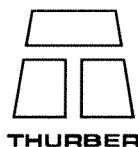
Fine Sand



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BH-1	1.83	

Date February 2005
 Project 19-4378-0

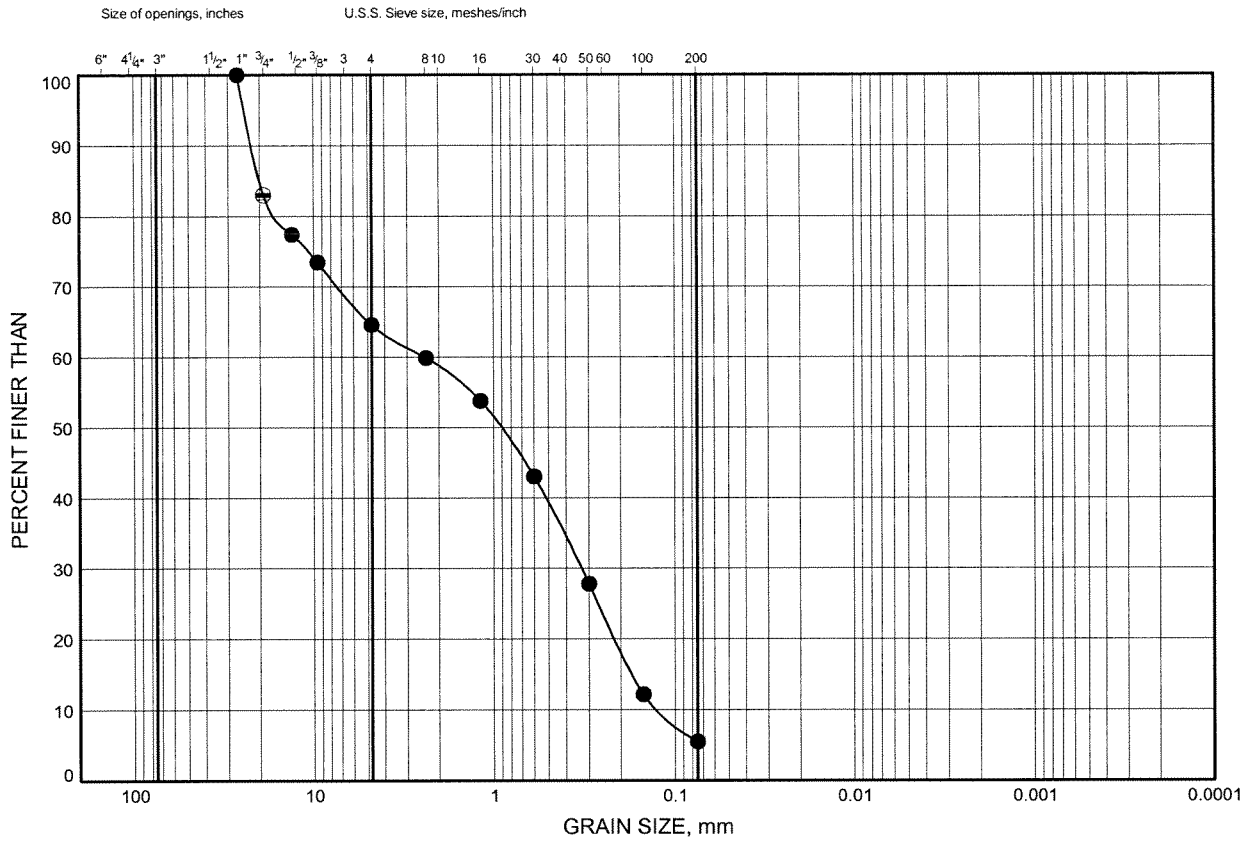


Prep'd EA
 Chkd. WM

Laboratory Testing for Project # R03-0171
GRAIN SIZE DISTRIBUTION

FIGURE 2

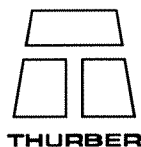
Gravelly Sand



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BH-2	1.68	

Date February 2005
 Project 19-4378-0

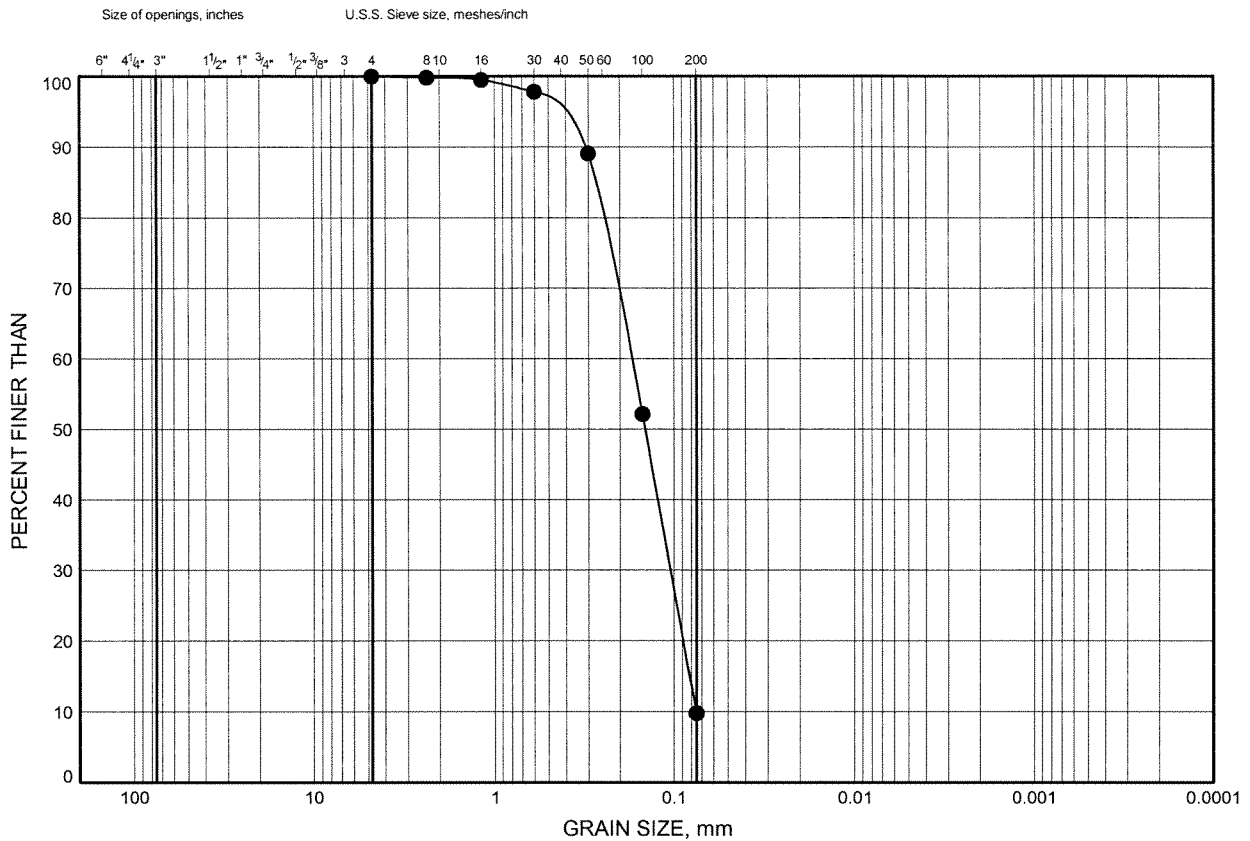


Prep'd EA
 Chkd. WM

Laboratory Testing for Project # R03-0171
GRAIN SIZE DISTRIBUTION

FIGURE 3

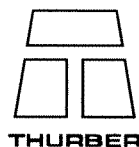
Fine Sand



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BH-3	2.59	

Date February 2005
 Project 19-4378-0

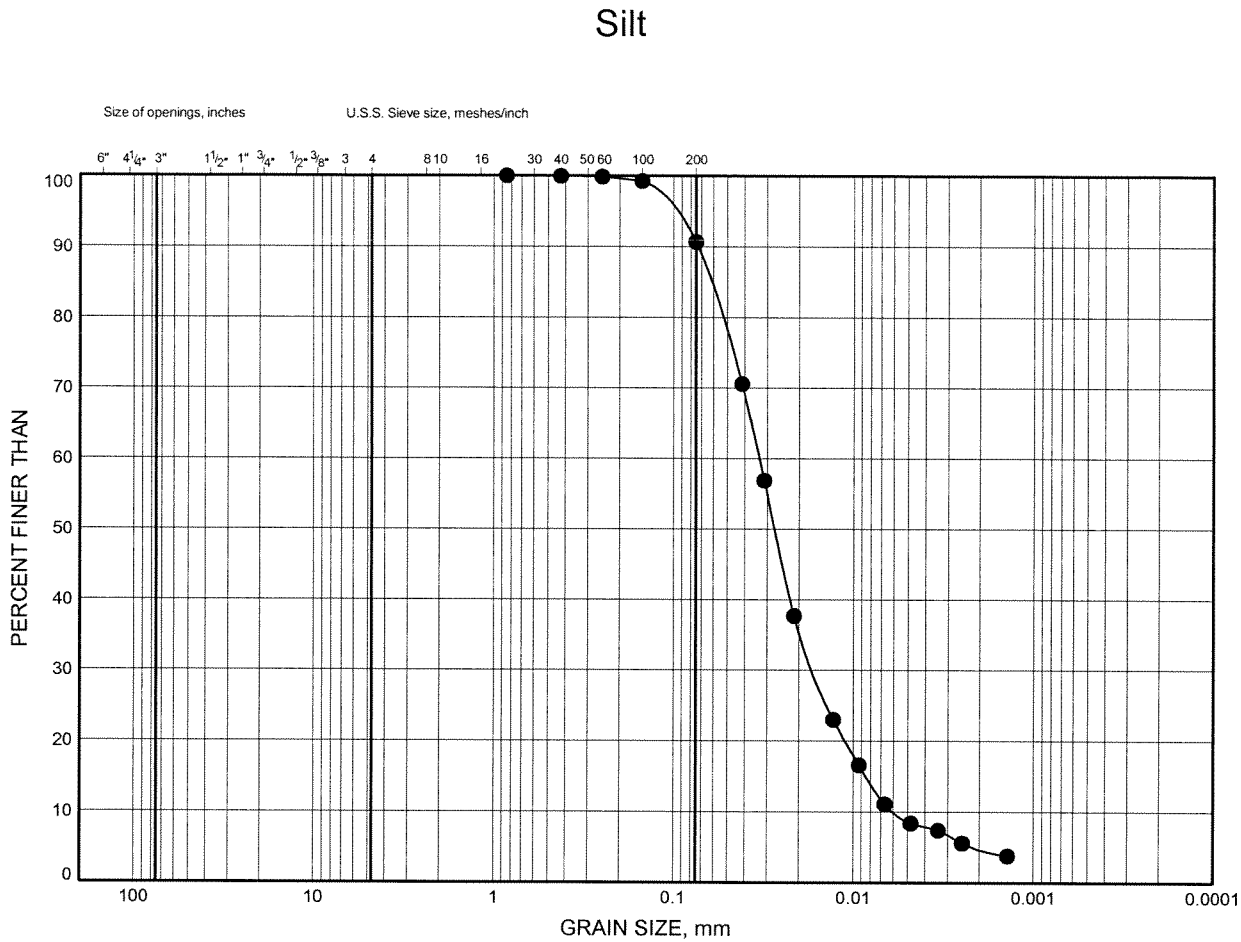


Prep'd EA
 Chkd. WM

Laboratory Testing for Project # R03-0171

GRAIN SIZE DISTRIBUTION

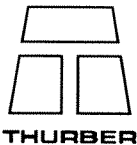
FIGURE 4



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BH-3	10.67	

Date February 2005
Project 19-4378-0



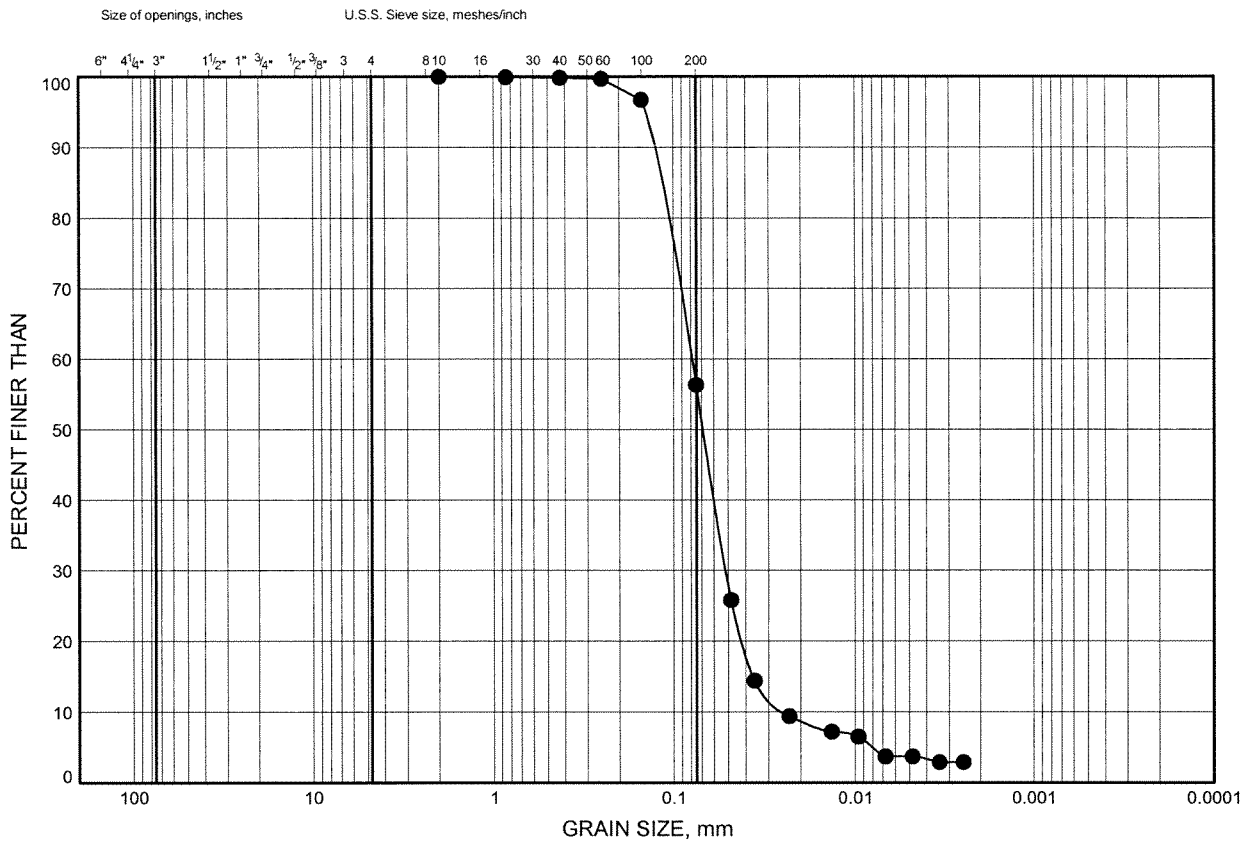
THURBER

Prep'd EA
Chkd. WM

Laboratory Testing for Project # R03-0171
GRAIN SIZE DISTRIBUTION

FIGURE 5

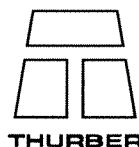
Sandy Silt



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BH-3	12.50	

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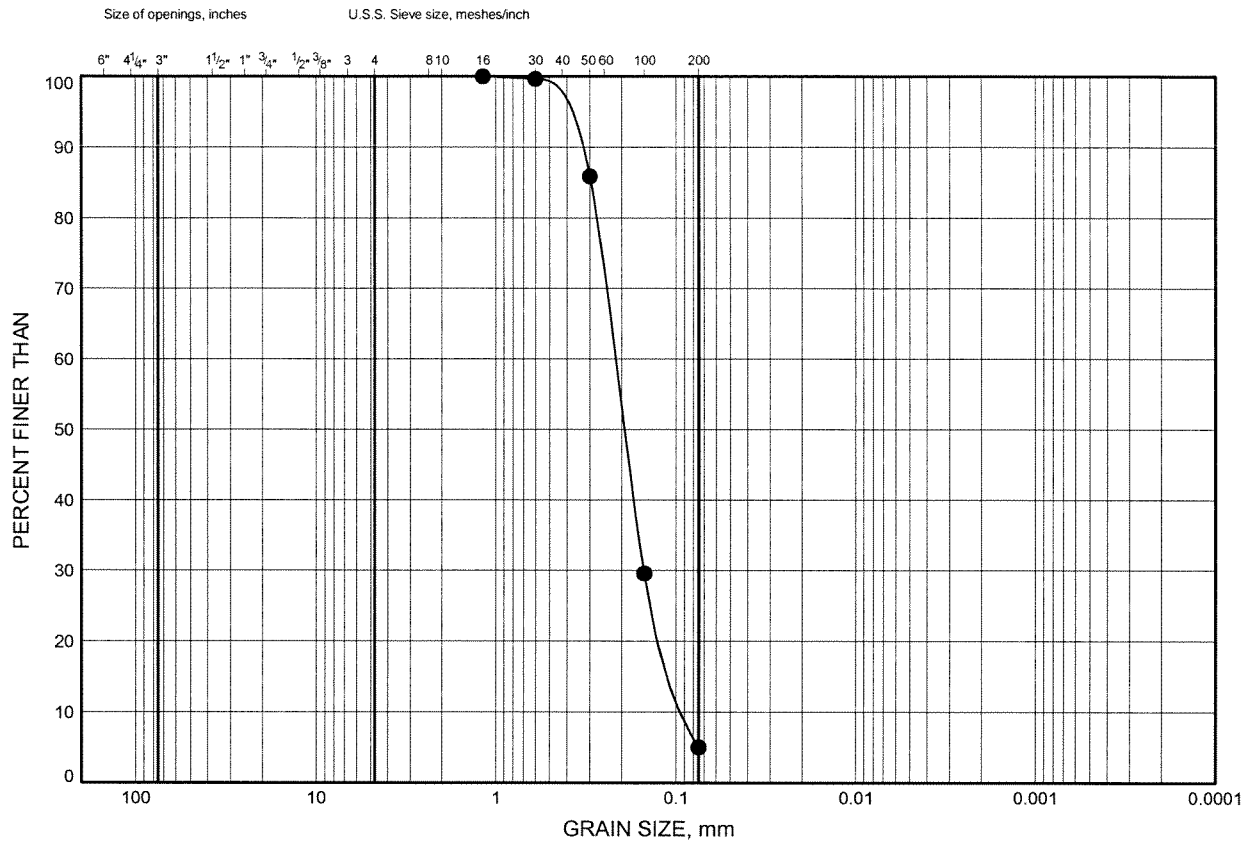


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GRAIN SIZE DISTRIBUTION

FIGURE 6

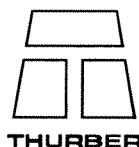
Fine Sand



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BH-4	2.59	

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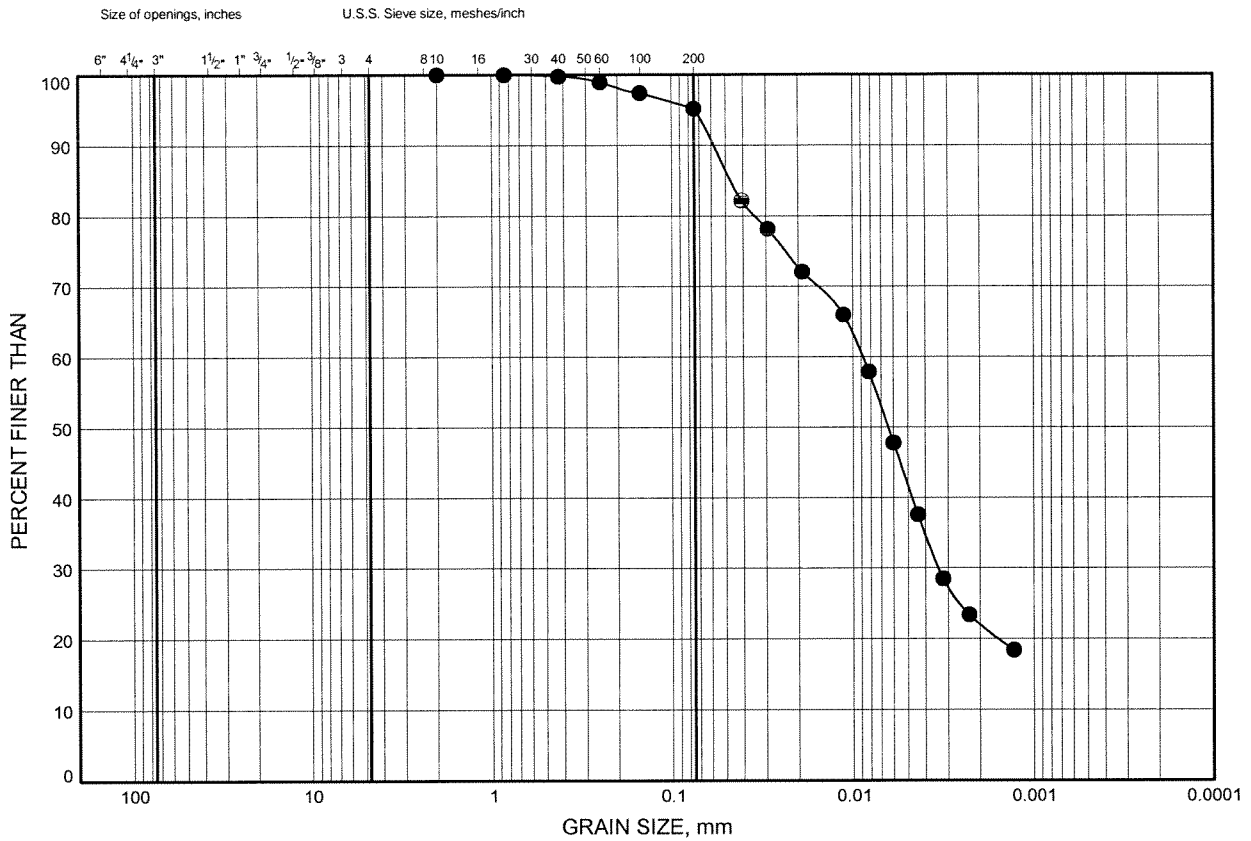


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GRAIN SIZE DISTRIBUTION

FIGURE 7

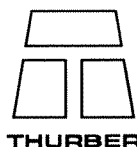
Clayey Silt



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BH-4	3.58	

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FIGURE 8

Size of openings, inches

U.S.S. Sieve size, meshes/inch


PERCENT FINER THAN

GRAIN SIZE, mm

Grain Size (mm)	Percent Finer (%)
100	100
60	100
40	100
30	100
16	100
8	100
4.75	100
2.5	100
1.18	100
0.85	100
0.6	100
0.425	100
0.3	100
0.25	97
0.15	58
0.106	28
0.075	17
0.05	9
0.0375	4
0.025	3
0.015	2
0.01	2
0.0075	2
0.006	2

COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BH-4	4.11	



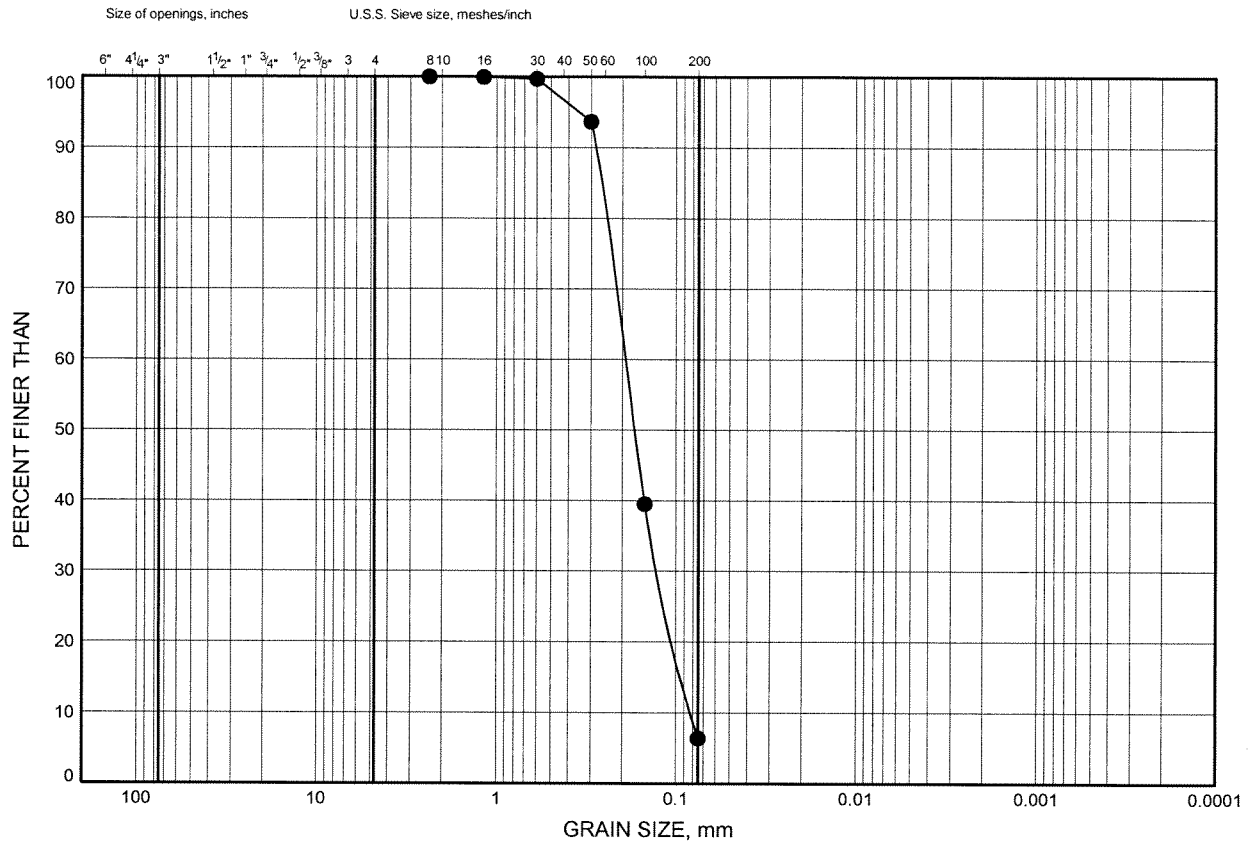
THURBER

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Chkd. WM

Laboratory Testing for Project # R03-0171
GRAIN SIZE DISTRIBUTION

FIGURE 9

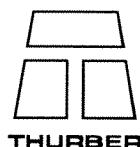
Fine Sand



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BH-5	2.59	

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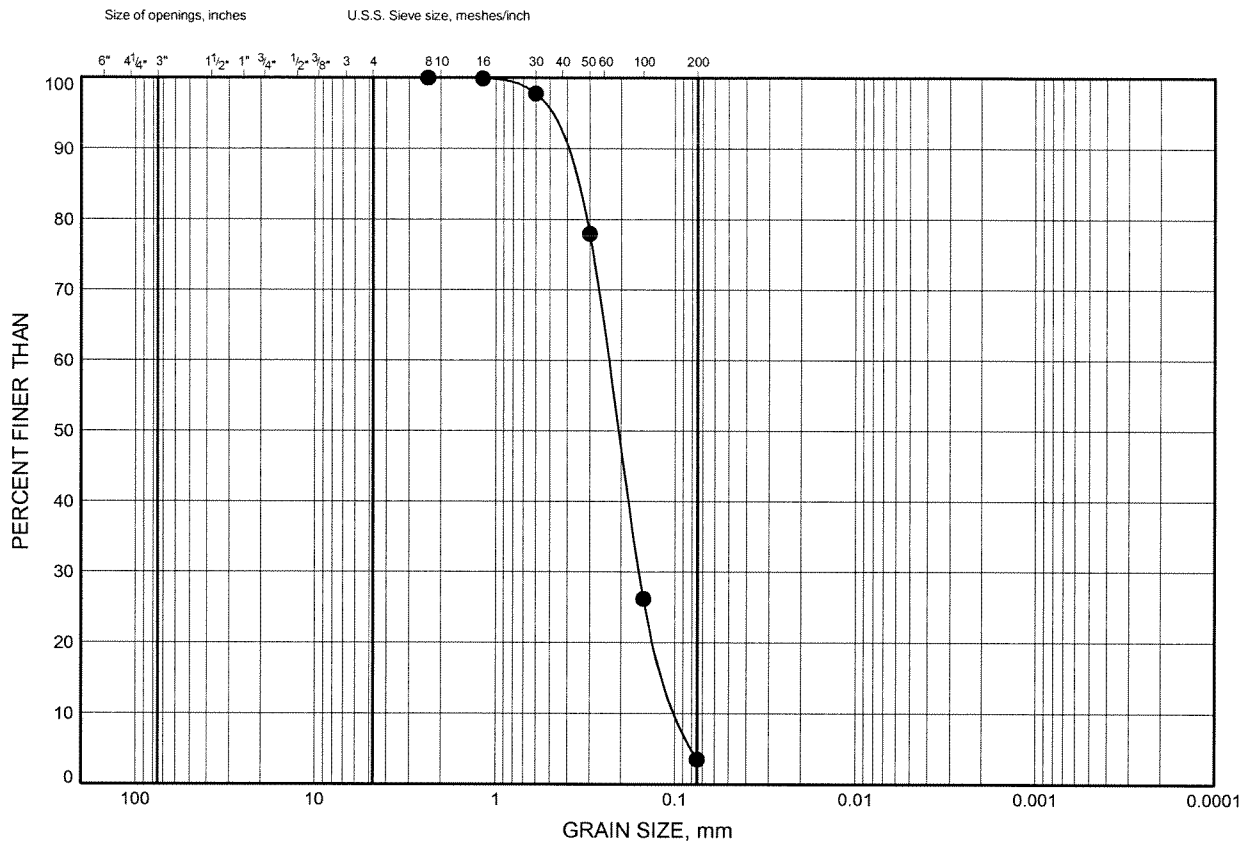


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Laboratory Testing for Project # R03-0171
GRAIN SIZE DISTRIBUTION

FIGURE 10

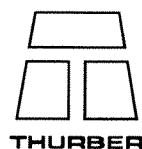
Fine Sand



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BH-5	7.16	

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FIGURE 11

Size of openings, inches

U.S.S. Sieve size, meshes/inch

6" 4 1/4" 3" 1 1/2" 1" 3/4" 1/2" 3/8" 3/4" 4 8 10 16 30 40 50 60 100 200

100 10 1 0.1 0.01 0.001 0.0001

PERCENT FINER THAN

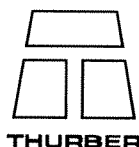
GRAIN SIZE, mm

Grain Size (mm)	Percent Finer (%)
100	100
40	100
20	100
10	100
4	100
2	100
1	100
0.85	100
0.75	97
0.6	100
0.425	100
0.3	100
0.25	100
0.2	100
0.15	97
0.125	97
0.106	97
0.075	66
0.06	38
0.05	27
0.0425	14
0.0375	7
0.03	3
0.025	2
0.02	2
0.015	2
0.0125	1
0.0106	1
0.0085	1
0.0075	1
0.006	1
0.005	1
0.00425	1
0.00375	1
0.003	1
0.0025	1
0.002	1
0.0015	1
0.00125	1
0.00106	1
0.00085	1
0.00075	1
0.0006	1
0.0005	1
0.000425	1
0.000375	1
0.0003	1
0.00025	1
0.0002	1
0.00015	1
0.000125	1
0.000106	1
0.000085	1
0.000075	1
0.00006	1
0.00005	1
0.0000425	1
0.0000375	1
0.00003	1
0.000025	1
0.00002	1
0.000015	1
0.0000125	1
0.0000106	1
0.0000085	1
0.0000075	1
0.000006	1
0.000005	1
0.00000425	1
0.00000375	1
0.000003	1
0.0000025	1
0.000002	1
0.0000015	1
0.00000125	1
0.00000106	1
0.00000085	1
0.00000075	1
0.0000006	1
0.0000005	1
0.000000425	1
0.000000375	1
0.0000003	1
0.00000025	1
0.0000002	1
0.00000015	1
0.000000125	1
0.000000106	1
0.000000085	1
0.000000075	1
0.00000006	1
0.00000005	1
0.0000000425	1
0.0000000375	1
0.00000003	1
0.000000025	1
0.00000002	1
0.000000015	1
0.0000000125	1
0.0000000106	1
0.0000000085	1
0.0000000075	1
0.000000006	1
0.000000005	1
0.00000000425	1
0.00000000375	1
0.000000003	1
0.0000000025	1
0.000000002	1
0.0000000015	1
0.00000000125	1
0.00000000106	1
0.00000000085	1
0.00000000075	1
0.0000000006	1
0.0000000005	1
0.000000000425	1
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0.0000000000375	1
0.00000000003	1
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0.000000000005	1
0.00000000000425	1
0.00000000000375	1
0.000000000003	1
0.0000000000025	1
0.000000000002	1
0.0000000000015	1
0.00000000000125	1
0	

COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BH-6	1.07	

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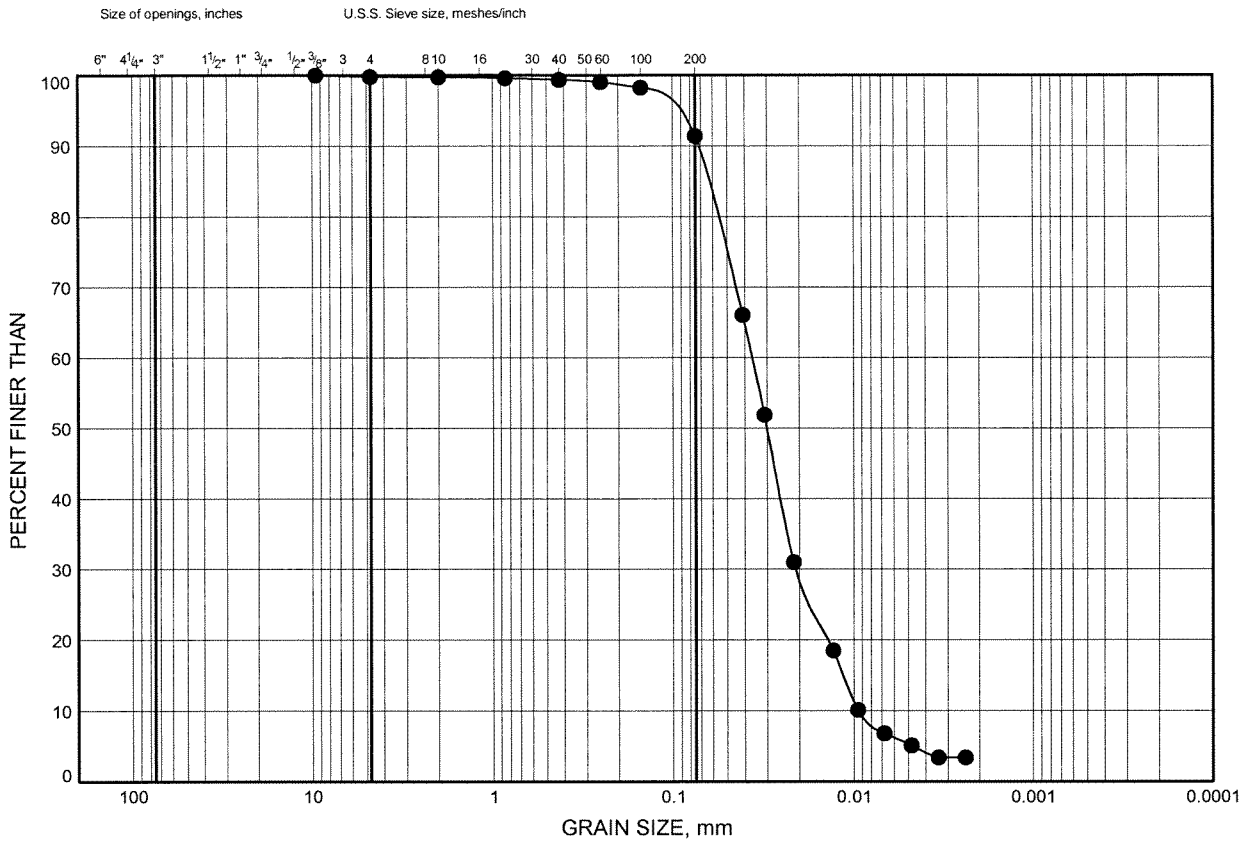


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Laboratory Testing for Project # R03-0171
GRAIN SIZE DISTRIBUTION

FIGURE 12

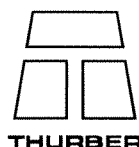
Sandy Silt



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	BH-7	2.59	

Date February 2005
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Prep'd EA
 Chkd. WM



THURBER ENGINEERING LTD.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS

January 31, 2005

File: R03-0171

Ecoplan
2655 North Sheridan Way
Mississauga, Ontario
L5K 2P8

Attention: Ms. Melissa Hamilton

Laboratory Test Results for Project # R03-0171

Dear Ms. Hamilton,

Thurber Engineering Limited received three samples from your firm to conduct Atterberg Limit test. All three samples were visually inspected and tested and turned out to be non-cohesive material, therefore, we were not able to conduct Atterberg Limit test on them.

If you require further information please do not hesitate contact us.

Sincerely,

Weiss Mehdawi, C.E.T.
Laboratory Manager

Sheet: 1 of 1

Co-ordinates: 4 973 442.9 N, 629 615.7 E

Originated By: I. Khan

Borehole Type: Hollow Stew Augers

Compiled By: I. Khan

Date: May 19, 2004

Checked By: D. Stewart

[illegible]

