

Geotechnical Desktop Review: The LeBreton Flats Plan of Subdivision, Ottawa, Ontario

Prepared for: National Capital Commission

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1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) has been retained by National Capital Commission (NCC, the Client) to carry out a geotechnical desktop review for the LeBreton Flats Plan of Subdivision in Ottawa, Ontario. It is understood that a preliminary geotechnical report is required as part of the Plan of Subdivision application to the City of Ottawa.

The geotechnical review was completed to summarize the subsurface conditions at the site and to provide geotechnical recommendations and design parameters. This report presents a summary of the previous investigations at the site and geotechnical design recommendations. Limitations associated with this report and its contents are provided in the Statement of General Conditions included in Appendix A.

2.0 SITE AND PROJECT DESCRIPTIONS

The site is approximately 29 hectare, a largely undeveloped transit oriented brownfield site located at the western edge of the downtown core of Ottawa, within the National Capital Region. The NCC developed a Master Concept Plan (MCP) for LeBreton Flats (approved in April 2021). The MCP area is shown in figure 2.1, the Library Parcel area (665 Albert St., Parcels A9-10) is not included in the MCP. The study area generally bounded by:

- Albert Street and Slater Street to the south;
- Trillium Pathway to the west;
- Sir John A. Macdonald Parkway and Wellington Street to the north; and
- Booth Street, Lett Street, future Empress Avenue extension and the escarpment to the east.

The Confederation Light Rail Transit (LRT) corridor bisects the study area and two O-Train stations, Bayview and Pimisi O-Train, are located within LeBreton Flats. LeBreton Flats is a brownfield site from its industrial legacy, with a portion having been remediated in the mid-2000s.

Two aqueducts cross the site, a partially buried aqueduct (a heritage feature), and a second fully buried aqueduct located on the north side of the LRT corridor between Booth Street and Nepean Bay Inlet. The approximate location of the aqueducts is shown on Drawing No.1 in Appendix B.

The East Flats is an adjacent development east of Booth Street consisting of four to 14 storey residential buildings with a new high rise building currently under construction. To the south of Albert Street is an existing residential neighborhood.

Based on the framework in the MCP, the development will include residential space, office/hotel/loft space and retail space as well as a Park District and open space network comprising approximately 12.5 hectares (43 per cent) of the 29-hectare site. It will include low- to high-rise buildings of up to 45 storeys with underground parking areas, surface pathways and access streets and lanes. The aqueducts will be maintained as a landscaping feature.

The study area is situated in close proximity to major infrastructure. In addition to above-mentioned LRT lines and stations as well as northern covered aqueduct and southern open heritage aqueduct, the following are elements of note:

- Fleet Street Water Pumping Station
- High-Pressure Transmission Watermain
- Low-Pressure Transmission Watermain (within the Open Aqueduct)
- LeBreton Flats Sanitary Pumping Station
- West-Nepean Collector Sewer, Cave Creek Collector Sewer, and Interceptor Outfall Sewer
- Combined Sewage Storage Tunnel
- Miscellaneous Sanitary and Combined Sewer Regulators and Diversion Chambers (Booth-Lloyd and Preston-Lloyd Regulator)



Figure 2.1: LeBreton Flats MCP area

3.0 BACKGROUND INFORMATION

The site was formerly occupied by residences and heavy industries, including a lumber and train yard until the early 1970's. The west portion of the site was formerly part of the Nepean Bay (part of the Ottawa River), which was used as a municipal landfill facility in the late 1950's to the early 1970's. The landfill raised the grade of this land to a level above the Ottawa River and enabled the construction of the Sir John A. Macdonald Parkway. the approximate footprint of the landfill is shown on Drawing No.1 in Appendix B. Most structure were removed from the site in the early 1970's.

A remediation program was conducted in the mid 2010's to remove the contaminated soil located in the central north portion of the site, west of Booth Street. The bedrock surface has been exposed and remains exposed at the time of writing.



The parcels situated south of the LRT alignment are slightly sloped down toward the northwest from Albert Street. The area is generally covered with grass with signs of construction activity and disturbance observed through the area. The west portion of the site, situated south of the Sir John A. Macdonald Parkway and north of the LRT alignment, are generally grass covered with some mature trees dispersed throughout the site.

3.1 SITE GEOLOGY

Based on available information including geological mapping from the Ontario Geological Survey (OGS), available geotechnical reports, historical boreholes, and Stantec's site specific experience, the stratigraphy at the site is generally expected to consist of highly variable fill and overburden native soils, underlain by bedrock.

The bedrock depth varies in different areas of the site and typically ranges from 0 m (existing ground surface) to about 18 m below ground surface. Based on available information obtained from the Geological Survey of Canada (GSC) Surficial Materials and Terrain Features, in the areas to the east of the Nepean Bay to the Pimisi LRT station and to the east of Booth Street Paleozoic bedrock is expected at the ground surface. At the rest of the site, glacial deposits of till (a heterogenous mixture of material ranging from sandy silt to silty sand) on Paleozoic bedrock can be expected.

According to the OGS 1:250 000 scale map of the Bedrock Geology of Ontario, the bedrock at the site is anticipated to be limestone, dolostone, shale, arkose, or sandstone of the Ottawa Group, Simcoe Group, or Shadow Lake Formation. The bedrock geology map produced in Canadian Geology Society, paper 77-11, by Bélanger and Harrison suggests that the site is underlain by limestone and shows a fault (a splays of the regional Gloucester Fault) extending in the east-west direction in the north of the site. The regional Gloucester Fault has a NW-SE strike, extending from Gloucester northwest to Hull. The Gloucester Fault splays at the site area are shown in the following figure. Some of the variations in bedrock surface may be due to presence of these bedrock faulting.

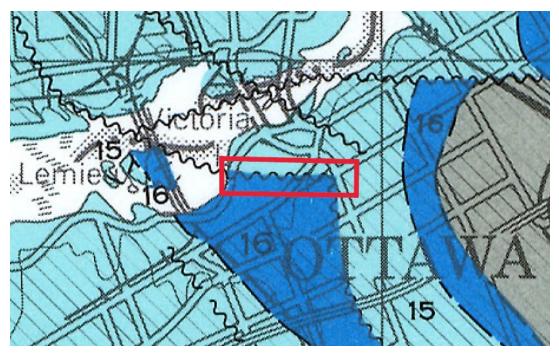


Figure 3.1: The splays of the regional Gloucester Fault at the site area (Bélanger and Harrison, 1976)

A significant number of historical boreholes have been advanced throughout the site. The following studies and reports were reviewed as part of this despot study:

- Data Gap and Remedial Options Analyses Report, Nepean Bay Sector, LeBreton Flats, Ottawa, ON (Geofirma, 2019)
- Geotechnical Desktop Review Report (Paterson Group, 2020)

3.2 SITE TOPOGRAPHY

Based on the recorded ground surface elevation at the previous borehole locations, ground surface elevation contours provided in Geofirma 2019 report for a western portion of the site (based on City of Ottawa 2006 LiDAR, Light Detection and Ranging, digital elevation survey flown in 2006), and publicly available ground surface (Google Earth) date, the ground surface elevation at the site varied between approximately elevations 52 m to 68 m.

Ground surface elevation contours of a portion of the site to the west of the Nepean Bay and between the Kichi Zībī Mīkan (Sir John A. MacDonald Parkway) and the transitway as well as a portion of the site between the transitway and Albert Street and to the west of the access road for the parking lot in the area are provided in Geofirma 2019 report. Topographical relief of this area ranges from a low of about elevation 56 m in the southwest corner to a high of about elevation 67 m in the west part within the footprint of the former landfill. Ground slopes downward from the landfill mound to the southwest and east. Minor elevation highs are also apparent near the western end of this area, along the transitway (elevation 64 m) and in the center of this area, north of the transitway (elevation 63 m). Ground surface elevation 63 m in the center of the area. The central high ground surface is due to landfilling. from the landfill mound ground slopes downward to the north, south and east. South of the transitway, the ground surface slopes



gently from a high of about elevation 64 m at the western end to a low of about elevation 58 m along the parking lot access road.



Figure 3.2: Ground surface elevation contours for a portion of the site to the west of the Nepean Bay (Geofirma 2019 report)

4.0 SUBSURFACE CONDITIONS

4.1 GENERAL

Detailed descriptions of the subsurface soil and bedrock conditions are presented on the Borehole Records and Bedrock Core Log provided in Appendix C.

The stratigraphic boundaries on the borehole records are inferred from non-continuous sampling and, therefore, represent transitions between soil types rather than exact boundaries between geological units. The borehole records depict conditions encountered at the specific locations drilled. The subsurface soil and groundwater



conditions between boreholes and/or at locations away from the borehole locations will vary from those indicated on the borehole records.

It is noted that information provided in the following sections is intended to summarize the conditions encountered; however, the borehole records provided in Appendix C should be used as the primary source of the subsurface information for the site.

A summary of the subsurface conditions encountered in the boreholes is provided in the following sections. The site has been divided into 4 portions with generally similar subsurface conditions. The site divisions identified as the North Portion, East Portion, South Portion and West Portion are shown on the Borehole Location Plan provided in Appendix B.

4.2 OVERBURDEN

North Portion of Site

Generally, a slightly weathered limestone bedrock was encountered at ground surface at the borehole locations (MW13-1 to MW13-6, MW13-10 to MW13-15, and BH11-21). At other borehole locations, the bedrock was encountered at 2.7 m to 4.8 m depth (or elevations of 50.9 m to 52.4 m). The bedrock contains thin interbeds of dark shale and the rock quality generally increase to good to excellent with depth.

The overburden was removed from the land parcels where a remedial program was competed. A silty sand fill and gravel is overlying the bedrock surface at a small section, where Preston Street formerly extended to the Sir John A. Macdonald Parkway. The buried aqueduct runs from west to east at this portion of the site, the cover material consisted of a silty sand with gravel and cobbles fill material.

South Portion of Site

Boreholes located along Albert Street and south of the transitway alignment generally encountered a loose to compact silty sand fill layer containing gravel, cobbles, boulders, construction debris, such as brick, wood, slag, and ashes. The fill layer was generally underlain by a compact to very dense fluvial deposit of gravel, cobbles and boulders within a silty fine sand soil matrix. However, loose/very loose sand/silty sand was encountered at several boreholes.

A silty clay and clayey silt deposit was encountered underlying the fill material between the old Preston Street extension and former Broad Street. A thin deposit of peat was also encountered at some borehole locations.

Bedrock surface is variable in this portion of the site and bedrock was encountered at 3.5 m to 9.2 m depth (or between elevation 48.1 m and elevation 51.9 m) at borehole locations within this area. The bedrock surface appears to be deeper toward the east within this portion of site.

West Portion of Site

The former Nepean Bay landfill was located at the west portion of the site. A layer of silty sand and gravel fill with various amount of debris, including wood, brick and plastic was encounter at borehole locations in this portion of the site. The fill layer is up to 12 m thick in the central portion of the former landfill and could be as high as 19 m at landfill

mounds (Geofirma 2019). The approximate footprint of the former landfill is shown on Drawing No.1 in Appendix C. To the south of the transitway the fill layer is generally 1.5 m to 4.9 m thick.

The fill material was underlain by a variety of deposits. To the north of the transitway, a (0.1 m to 1.5 m thick) peat deposit was encountered at four boreholes (BHW-09, BHW-11, BHW-15, and MW01-7). A firm to stiff silty clay deposit was encountered underlying the fill material in borehole BH10-04 and BH11-17. A compact native grey fluvial deposit of sand, gravel, cobbles and boulders within a silt sand soil matrix was encountered underlying the fill material at the rest of boreholes. Loose/very loose sand/silty sand was encountered at several boreholes. Cobbles and boulders were encountered in some boreholes located south of the transitway (e.g. below 8.5 m at BH10-01, below 4.2 m at BH10-05, and below 3.2 m at BH11-09).

Bedrock, described as a highly weathered black shale, was encountered in some borehole locations in this portion of the site. The bedrock was encountered at 3.7 m to 15.4 m depth (or between elevation 45.0 m to elevation 50.8 m) at borehole locations to the north of the transitway within this portion of the site. To the south of the transitway, the bedrock was encountered at 5.6 m to 11.0 m depth (or between elevation 46.5 m and elevation 50.0 m). No bedrock coring was carried out in boreholes to the west of the City Center Avenue.

East Portion of Site

Generally, a silty sand fill layer overlying a compact native glacial till or bedrock was encountered at boreholes at the east portion of the site, to the east of Booth Street and North of Fleet Street. The bedrock was encountered at 2.2 m to 3.8 m depth (or between elevation 51.5 m to elevation 53.2 m) at the borehole locations within this portion.

At the block situated east of Booth Street and to the south of the open aqueduct, fill material overlain bedrock. Bedrock was cored at one borehole (MW13-8) at 4.9 m (or elevation of 51.0 m). Fill material (3.0 to 4.6 m thick) overlying till were encountered at boreholes located at the parcels situated between Slater Street and Albert Street.

4.3 BEDROCK

Bedrock was proven by rock coring at several boreholes at the site. Bedrock surface depth/elevation encountered along with the measured RQD values are presented in Appendix D. A summary of bedrock surface depth/elevation is presented in the following table. Based on the data provided in the table:

- the bedrock depth ranges from 0 m (existing ground surface) to about 16.6 m below ground surface.
- the bedrock surface was encountered between approximate elevations of 45.0 m and 59.4 m.

Depths/elevations of auger refusal (or split-spoon refusal) encountered at boreholes are also included in the table. Split-spoon driving refusal or auger refusal may be due to the presence of cobbles and boulders or due to the presence of bedrock.

The bedrock encountered in boreholes consisted slightly weathered to fresh, very poor to excellent quality (with Rock Quality Designation, RQD, of zero to 100%), of either limestone with interbedded shale or shale. The RQD reflects the degree of fracturing which is an expression of the cumulated length of the rock pieces longer than 100 mm. The bedrock is generally slightly weathered at and near surface and rock quality increases with depth. Results of two Unconfirmed Compressive Strength (UCS) tests on rock specimens are reported on the available record of



boreholes: 75.9 MPa (7.4 m depth, BH13-7) and 127.9 MPa (9.6 m depth, MW13-8). Based on these results, the limestone bedrock at the site could be classified as strong to very strong.

Location	-	Bedrock Surface Depth (m)	Bedrock Surface Elevation (m)
	Minimum	0.0	50.2
North Portion the Site	Maximum	5.5	55.1
	Average	1.3	53.0
	Minimum	3.1	48.1
South Portion of the Site	Maximum	10.1	53.9
	Average	5.3	51.4
	Minimum	2.2	51.0
East Portion of the Site	Maximum	10.0	59.4
	Average	4.8	55.6
	Minimum	1.6	45.0
West Portion of the Site	Maximum	16.6	59.4
	Average	7.7	49.6

 Table 4.1: Summary of the Encountered Bedrock Surface and Auger (or Split-Spoon) Refusal

 Depth/Elevation and Measured RQD Values

4.4 GROUNDWATER CONDITIONS

Several monitoring wells were installed in boreholes previously advanced at the site. The groundwater levels measured in these monitoring and observed during drilling (inferred groundwater level) are provided in Appendix D and are summarized in the following table.

Location	-	Groundwater Depth (m)	Groundwater Elevation (m)
	Minimum	1.1	49.2
North Portion the Site	Maximum	6.7	52.3
	Average	3.7	51.4
	Minimum	2.1	51.4
East Portion of the Site	Maximum	5.0	59.6
	Average	3.5	52.9
	Minimum	1.7	52.1
West Portion of the Site	Maximum	9.8	54.1
	Average	5.6	53.1

Table 4.2: Summary of Groundwater Levels

Based on the data presented in the preceding table, the groundwater elevation range between 49.2 m to 59.6 m at the site. The groundwater was measured at depths between 1.1 m to 9.8 m.

It should be noted that fluctuations in the groundwater levels should be anticipated during and following periods of sustained precipitation and snowmelt as well as throughout the various seasons. As well, lower water levels would be expected during severe drought conditions.



Considering the vicinity of the site to the Ottawa River, the groundwater level at the site should be expected to be affected by the stage elevation of the river. Based on the data provided by Ottawa River Regulation Planning Board¹, the river water level at upstream and downstream of the site are as follows:

Stage Elevation of the Ottawa River.	On 2024-01-03	Historic Low	Historic High
Lake Deschenes at Britannia (upstream of the site)	58.3 m	57.4 m - 58.1 m	60.7 m – 58.5 m
Gatineau/Hull (downstream of the site)	41.7 m	41.6 m - 40.9 m	41.6 m – 45.2 m

Table 4.3: Stage Elevation of the Ottawa River

5.0 DISCUSSION AND RECOMMENDATIONS

This section provides preliminary engineering input related to the geotechnical design aspects of the proposed development based on our interpretation of the available subsurface information described herein and our understanding of the project requirements.

The discussion and recommendations presented in the following sections of this report are intended to provide the designers with preliminary information for planning and design purposes only. Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the data as it affects their proposed construction techniques, schedule, safety, and equipment capabilities.

The following geotechnical input is based on the information that was available at the time of writing this report. As not all details (e.g., final building configurations and site grades, structural loads etc.) related to the proposed development were available at the time of preparation of this report, all geotechnical comments and input provided herein should be reviewed and revised, as required, as the design progresses and once the final plans become available.

5.1 USING SITE DATA

This geotechnical desktop study is based on the existing/available record of 128 boreholes advanced at the site between 1992 and 2018. This study is preliminary, and the recommendations provided in this report are general in nature and are provided for planning purposes. Considering that this review report is intended for a Plan of Subdivision application, the existing information is deemed sufficient. The provided recommendations and comments should be confirmed prior to use for final design purposes by conducting a supplementary geotechnical investigation. The requirements for a supplementary geotechnical investigation are discussed in Section 7 of this report.

The available borehole data provide information on the depth/elevation and consistency/relative density of native deposits and existing fill layers. These data are sufficient to provide preliminary geotechnical resistance recommendations for shallow footings.

¹ https://ottawariver.ca/conditions/



The existing borehole data included bedrock coring data which provide information on bedrock surface depth/elevation, bedrock type, quality, and conditions that are applicable to current site conditions. These data are used in the design of shallow and deep foundation options.

The groundwater levels/depths measured in the monitoring well installed at the site or inferred groundwater levels at the time of the drilling are also provided on the existing record of boreholes. These data were compiled and the groundwater elevation ranges were determined for each portion of the site and are used in the development of the geotechnical model and foundation design. It should be noted that considering the vicinity of the site to the Ottawa River, the groundwater level at the site should be expected to be affected by the stage elevation of the river.

In summary, the existing borehole data at the site are sufficient to provide general geotechnical comments and recommendations. A geotechnical field investigation should be carried out for each of the properties after the development details such as building locations are determined. The investigation should include, boreholes, groundwater monitoring program and a laboratory testing program.

5.2 KEY GEOTECHNICAL ISSUES

Key geotechnical issues that require consideration for this project include the following:

- The bedrock was encountered at depths varying from 0 (at ground surface) to 16.6 m at borehole locations at the site.
- The subsurface at the site is consisted of either bedrock or fill and/or native soils overlying bedrock. The
 proposed buildings could be founded on conventional shallow footings placed on an approved competent native
 soil subgrade or sound bedrock bearing surface. Where higher geotechnical capacity is required, consideration
 could be given to deep foundation (caisson, steel pipe or h-pile on bedrock, or micropiles socketed into bedrock):
 The preferred foundation options for each portion of the site is provided in Table 5.2.
- The overburden at site includes topsoil, fill, occasionally peat deposit and native soils. Topsoil, peat deposit, and all fills mixed with topsoil and organic soils should be removed from the proposed building footprint and paved areas.
- The former Nepean Bay landfill was located at the west portion of the site. Based on the LeBreton Flats Master Concept plan, this portion of site will be redeveloped to a park Districts. As such, building construction is not expected within the former landfill area. Significant debris and waste (including concrete, ash, mortar, wood, wood chips/fragments, glass, brick, slag, asphalt, plastic, rubber, metal, coal, and construction debris of former roadways, buildings, and sidewalks) were found within the fill material across the site.
- As part of the site preparation works, fill material and loose/very loose native soils which is not suitable for founding foundation and construction of slab-on-grade, need to be removed from the building footprint. Alternatively, in-situ densification of soils at the site via shallow surface compaction or dynamic compaction could be considered. Dynamic compaction ground improvement techniques (such as Deep Dynamic Compaction or Rapid Impact Compaction) are effective for compacting fills as well as loose native sandy or relatively free-draining soils.
- Considering the presence of bedrock at ground surface and shallow depths, bedrock removal may be required to
 construct the proposed underground levels and utilities. Depending on the quantities of bedrock to be removed,
 hoe ramming (where only small need to be removed) or line drilling and controlled blasting (where large
 quantities of bedrock need to be removed) is recommended.
- The blasting operations should be planned and completed under the guidance of a professional engineer with experience in blasting operations. Critical infrastructure sensitive to vibrations is present within and near the site, such as the aqueducts, Fleet Street Water Pumping Station, City of Ottawa High-Pressure Transmission Watermain, City of Ottawa Low-Pressure Transmission Watermain and several large diameter sewers. Vibration monitoring will be required during construction.



- It should be anticipated that an underslab drainage system will be required to control groundwater, particularly during wet seasons, where basement/underground floors are proposed.
- It is recommended that a groundwater monitoring program be implemented to help assess variability in the groundwater levels at the site.
- The silty overburden soils at the site are typically expected to be highly frost susceptible. All foundations founded on frost-susceptible materials should be provided with a minimum of 1.8 m of earth cover or equivalent insulation for frost protection purposes. The bedrock at site could be considered non-frost susceptible provided that the weathered or loose bedrock are removed.
- The liquefaction assessment indicates that a 1.3 m to 1.6 m thick portion of native deposits at the site is considered susceptible to liquefaction at five borehole locations (BH10-1, BH10-2, BH11-18, BH11-19, and BH11-29. Earthquake-induced settlements in the order of 90 mm to 200 mm should be anticipated. For building structures supported on deep foundations, these settlements would apply only to non-pile supported elements, such as the basement floor slab. Shallow foundations are not recommended where soils are considered susceptible to liquefaction. To improve soil resistance against liquefaction consideration could be given to in-situ densification of soils at the site.
- Generally, where liquifiable soils are present, a Site Class F is applicable to the site. If in-situ densification of site soil is conducted, the seismic site class designation could be reviewed based on the results of the final verification testing of the in-situ densification.
- Where soils are not susceptible to liquefaction, the applicable seismic site class to each portion of site is as follows:
 - For the East and North Portions of Site: Where the footing will be placed on bedrock or if the underside of the footings are located within 3 m of the bedrock surface, Site Class 'B' is recommended. If there is more than 3 metres of softer materials present above the bedrock, the use of a Site Class 'C' designation is recommended.
 - For the South Portion of Site: Where the footing will be placed on bedrock or if the underside of the footings are located within 3 m of the bedrock surface, Site Class 'B' is recommended. If there is more than 3 metres of softer materials present above the bedrock, the use of a Site Class 'D' designation is recommended.
 - For the West Portion of Site, the use of a Site Class 'D' designation is recommended.
 - Geophysical testing could be carried out to measure the in-situ shear wave velocity of the subsurface soils and bedrock at the site to potentially improve the recommended Seismic Site Class.

The following sections incorporate the above-mentioned key geotechnical issues.

Based on a recent Methane Monitoring Report for the site (2023 Semi-Annual Nepean Bay Methane Monitoring Report, Former Nepean Bay Landfill, Ottawa, Ontario, NCC Property Asset Numbers 96030 and 96129, prepared by Geofirma, dated January 19, 2024), elevated methane concentrations (above the lower explosive limit, LEL) have been recorded on some monitoring well locations at the site since methane monitoring programs have begun in 1998. The detailed design will need to evaluate the risk of landfill gases presence at the site.

5.3 GEOTECHNICAL MODEL

Based on a compilation of all geotechnical data and testing carried out at the site as presented on the Borehole Records and geotechnical laboratory testing (grain size analyses, Atterberg limits, and moisture contents) carried out at the site. The soil parameters provided in the following table were estimated and were used for geotechnical design in the following section of the report.

Table 5.1: Soil and Bedrock Parameters

	Design Parameters			
Soil/Rock Type	Total Unit Weight, γ (kN/m³)	Friction Angle, φ' (°)	Undrained Shear Strength, Sս (kPa)	
Fill	19	30	-	
Clay	19	-	50	
Till (generally compact to very dense silty sand)	20	30	-	
Limestone with interbedded shale or Shale Bedrock ⁽¹⁾	26	UCS =	70 MPa	

Notes:

¹ The bedrock depth ranges from 0 m (existing ground surface) to about 16.6 m below ground surface. The bedrock surface was encountered between approximate elevations of 45.0 m and 59.4 m.

 2 The groundwater level within the site was approximately 1.1 m to 9.8 m below the ground surface (or at approximate elevations of 49.2 m to 59.6 m).

5.4 SEISMIC DESIGN CONSIDERATIONS

5.4.1 Liquefaction Potential

Loose/very loose sand/silty sand was encountered at several boreholes in southern and west portion of the site (generally south of the transitway between Booth Street and City Center Avenue). Generally, this material if saturated is prone to liquefaction.

The potential liquefaction of the site native soils under seismic loading conditions was assessed using the analysis methodology suggested by Idriss and Boulanger (2008)⁴. The evaluation was completed based on the SPT resistance values (SPT-N values with depth) from the boreholes and based on the following:

- A Site Adjusted PGA of 0.281g.
- An earthquake magnitude of 6.3.

The formulation by Idriss and Boulanger (2008)² compare the earthquake induced cyclic stress ratios (CSR) with the cyclic resistance ratios (CRR) of the soil based on the soil SPT-values. These formulations are discussed in detail in Idriss and Boulanger (2008) with an example illustrated on Page 118 (subsection 3.14).

The factor of Safety values were calculated based on the recorded SPT-N values within the native soils from the different boreholes. The assessment indicates that the native soils are considered susceptible to liquefaction (factor of safety against liquefaction of less than one) at the following depths and locations:

- From 4.3 m to 7.5 m at BH10-1
- From 4.0 m to 7.6 m at BH10-2
- From 4.3 m to 4.9 m, 5.5 m to 6.8 m, and 7.3 m to 8.5 m at BH11-18
- From 4.9 to 7.2 m at BH11-19
- From 1.7 m to 2.4 m and 3.0 m to 3.6 m at BH11-29

² Idriss, I.M. and Boulanger, R.W. (2008). "Soil Liquefaction During Earthquakes", Earthquake Engineering Research Institute, Monograph MNO-12, 2008



As a result of liquefaction, earthquake-induced settlements in the order of 90 mm to 200 mm should be anticipated. For building structures supported on deep foundations, these settlements would apply only to non-pile supported elements, such as the basement floor slab. Shallow foundations are not recommended where soils are considered susceptible to liquefaction (factor of safety against liquefaction of less than one) at the following depths and locations.

Moreover, thin layers of loose sand/silty sand was encountered at several boreholes (such as BH92-C1, BH10-17, BH10-20, MW3-23, BH10-05, BH11-06, BH11-14, BH11-15, BH11-17, BH11-18, BH11-20A, BH11-22, and BH11-28 which should be considered susceptible to liquefaction; however, since the thickness of liquifiable layer is 0.6 m to 0.8 m, the manifestation of liquefaction at surface is less likely and post-liquefaction settlement is expected to be limited.

It should be noted the above assessment was carried out only on native soils, existing loose to very loose sand or silty sand fill, if saturated, will be susceptible to liquefaction at the site.

5.4.1.1 Considerations For In-situ Densification

To improve soil resistance against liquefaction consideration could be given to in-situ densification of soils at the site. Dynamic compaction is a ground improvement technique that is effective for compacting fills as well as loose native soils. The main advantages offered by the process are its low cost, rapidity of execution, and applicability to a large variety of constructed fills and loose natural sandy or relatively free-draining soils. Caution should be applied with other soils.

Dynamic compaction requires a controlled application of dynamic stresses to the ground surface. Dynamic compaction can produce significant vibration outside the treatment area. The effect of this induced vibration on structures must be considered during design.

Deep dynamic compaction (DDC)

One method of dynamic compaction is Deep Dynamic Compaction (DDC) with drop weights, which involves using a crane to drop weights of between 5 to 30 tons, from heights of up to 30 m. DDC compacts to depths of as much as 8–10 m. This technique is best suited to large, open sites where few obstructions are present.

The vibrations caused by dynamic compaction can potentially be detrimental to existing structures. Therefore, it's crucial to conduct a thorough analysis and take necessary precautions when performing dynamic compaction near existing structures to mitigate potential damage. This might include monitoring vibration levels, adjusting the compaction process as needed, and implementing mitigation measures if necessary.

During its execution, the process should be continuously monitored to evaluate the degree of soil improvement being achieved and for other environmental considerations such as potential damage to nearby structures and annoyance to surrounding population from vibrations and noise. Earthworks carried out to level the site after each phase and to replace non-compactable materials with suitable soils are also part of the operation. Final verification testing to ensure that the specification requirements have been fulfilled must be performed upon completion of the treatment.

Rapid impact compaction (RIC)

Rapid impact compaction (RIC) follows the same principles as DDC but utilizes smaller equipment and a faster construction technique that results in compaction depths of up to 6 m. RIC involves the use of a hydraulic



hammer/weight, typically 7.5–12 tonnes, which is dropped from 0.3 to 2 m onto a 1.5–2.0 m diameter plate at a rate of about 40–60 blows per minute.

Like DDC, RIC can produce noise and vibration; however, generally at a higher frequency (lower damage criteria), resulting in a shorter distance propagation than that produced by DDC. An assessment of influence and a vibration study are prudent measures when employing dynamic methods such as DDC and RIC.

Vibration studies involve the identification of the typical zone of influence of a given technique and then, applying a factor of safety, identifying the various receptors, structures, or stakeholder property in the factored zone of influence and determining if further steps are needed, such as site- and structure-specific vibration monitoring during compaction work.

5.4.2 Seismic Site Class

The seismic Site Class value, as defined in Section 4.1.8.4 of the 2012 Ontario Building Code (OBC), contains a seismic analysis and design methodology which uses a seismic site response and site classification system defined by the shear stiffness of the upper 30 m of the ground below the foundation level. There are six site classes (from A to F), decreasing in stiffness from A (hard rock) to E (soft soil); Site Class F denotes problematic soils for which a site-specific evaluation is required.

Generally, where liquifiable soils are present, such as discussed in the previous section, a Site Class F is applicable to the site. Liquifiable soils (more than 0.8 m in thickness) were observed in five boreholes (BH10-1, BH10-2, BH11-18, BH11-19, and BH11-29), and the liquifiable thickness was up to 2.6 m. Considering that the thickness and extend of the liquifiable soil is limited, a site-specific response analysis is not necessary and a Site Class E could be considered in design. If in-situ densification of site soil is conducted, the seismic site class designation could be reviewed based on the results of the final verification testing of the in-situ densification.

The bedrock was encountered at depths varying from 0 (at ground surface) to 16.6 m at borehole locations at the site. Where the footing will be placed on bedrock or if the underside of the footings are located within 3 m of the bedrock surface (i.e. there is 3 metres or less of soil between the bedrock surface and the bottom of the footings), Site Class 'B' is recommended.

Geophysical testing (using the multi-channel analysis of surface waves (MASW) method) could be carried out to measure the in-situ shear wave velocity of the subsurface soils and bedrock at the site to potentially improve the recommended Seismic Site Class.

The seismic site class applicable to the North Portion, East Portion, South Portion and West Portion of the site is discussed in the following paragraphs.

North Portion of Site

Bedrock was generally encountered at ground surface or at 2.7 m to 4.8 m depth at borehole locations. Where the footing will be placed on bedrock or if the underside of the footings are located within 3 m of the bedrock surface (i.e. there is 3 metres or less of soil between the bedrock surface and the bottom of the footings), Site Class 'B' is recommended. If there is more than 3 metres of softer materials (not susceptible to liquefaction) present above the bedrock, the use of a Site Class 'C' designation is recommended.



South Portion of Site

Bedrock surface is variable in this portion of the site and appears to be deeper toward the east within this portion of site. Bedrock was encountered at 3.5 m to 9.2 m depth at borehole locations within this area. Native soil overlain the bedrock generally consisted of a compact to very dense fluvial deposit of gravel, cobbles and boulders within a silty fine sand soil matrix. However, loose/very loose sand/silty sand was encountered at several boreholes

Where the footing will be placed on bedrock or if the underside of the footings are located within 3 m of the bedrock surface (i.e. there is 3 metres or less of soil between the bedrock surface and the bottom of the footings), Site Class 'B' is recommended. If there is more than 3 metres of softer materials (not susceptible to liquefaction) present above the bedrock, the use of a Site Class 'D' designation is recommended.

West Portion of Site - South of the Transitway

To the south of the transitway, the bedrock was encountered at 5.6 m to 11.0 m depth. Considering that loose to compact silty sand and sand deposit was encountered at several borehole within this area of the site, the use of a Site Class 'D' designation is recommended.

A seismic site class cannot be specified for the area to the west of the City Center Avenue as bedrock surface depth was not confirmed by coring in boreholes advanced within this area.

West Portion of Site - South of the Transitway

The bedrock was encountered at 3.7 m to 15.4 m depth at borehole locations to the north of the transitway within this portion of the site. The use of a Site Class 'D' designation is recommended.

East Portion of Site

The bedrock was encountered at 2.2 m to 3.8 m depth at the borehole locations to the east of Booth Street and North of Fleet Street. At the block situated east of Booth Street and to the south of the open aqueduct, bedrock was cored at one borehole (MW13-8) at 4.9 m.

Where the footing will be placed on bedrock or if the underside of the footings are located within 3 m of the bedrock surface (i.e. there is 3 metres or less of soil between the bedrock surface and the bottom of the footings), Site Class 'B' is recommended. If there is more than 3 metres of softer materials (not susceptible to liquefaction) present above the bedrock, the use of a Site Class 'C' designation is recommended.

No borehole was located at the parcels situated between Slater Street and Albert Street. Consequently, a seismic site class cannot be specified for those parcels.

5.5 FROST PENETRATION

The frost penetration depth for foundation design at this site is 1.8 m. All foundations founded on frost-susceptible materials should be provided with a minimum of 1.8 meters of earth cover or equivalent insulation for frost protection purposes.



It is noted that the above frost penetration depth is applicable only to foundation design. Short period deeper frost penetrations, which would have little impacts on foundations, may occur. The typical soil cover for watermain construction is 2.4 m below ground surface in the City of Ottawa.

Exterior slabs-on-grade or slabs-on-grade within unheated areas will also be subject to the risk of heave and deformation/cracking due to frost. Consideration could be given to use rigid insulation to protect structures against frost action; however appropriate frost tapers would need to be incorporated at the ends of the insulation.

The bedrock at site could be considered non-frost susceptible provided that the weathered or loose bedrock are removed.

5.6 SITE PREPARATION

Buildings Footprint

Beneath all building and foundations, all existing surficial topsoil, vegetation, peat/organic material, fill material and/or other deleterious materials (e.g., any loose, wet, and/or otherwise disturbed native materials) should be removed.

Since a relative thick layer of fill materials was encountered at borehole locations in the west and south portions of the site, consideration could be given to conducting soil improvement (such as in-situ densification) to improve the site soils instead of mass fill removal and replacement. Verification tests should be carried to approve improved soil areas as subgrade.

The prepared subgrade soils will require inspection by geotechnical personnel prior to structural fill placement to verify all unsuitable material has been removed.

Beneath all buildings and foundations, site grades should then be raised, if needed, using Structural Fill consisting of Ontario Provincial Standard Specification (OPSS) Granular B Type I or II materials that are placed in lifts no thicker than 300 mm and compacted to at least 100% of the material's Standard Proctor Maximum Dry Density (SPMDD). The final layer of fill should consist of OPSS Granular A materials with a minimum thickness of 300 mm beneath the floor slabs and 200 mm in other areas, excluding basement areas where a drainage system will be required.

Pavement Areas

Beneath pavement areas, all existing surficial topsoil, vegetation, peat/organic material, and other deleterious materials should be removed. Fill material, free of deleterious material, can be left in place and surface compacted to act as a subgrade for the proposed paved areas. However, where layers of fill material are thick (such as the south and west portions of the site) and surface compaction is not effective, consideration could be given to conducting soil improvement (such as in-situ densification) to improve the site soils instead of mass fill removal and replacement. Verification tests should be carried to approve improved soil areas as subgrade.

Beneath pavement and sidewalks, site grades should be raised using OPSS Select Subgrade Material (SSM) compacted in lifts not exceeding 300 mm to 95% of the material's Standard Proctor Maximum Dry Density (SPMDD)



Engineered Fill Placement

The placement of all engineered fill materials should be monitored on a full-time basis by qualified and experienced geotechnical personnel under the supervision of a geotechnical engineer, with the authority to stop the placement of fill at any time when conditions are unacceptable.

All fill materials imported to the site must meet all applicable municipal, provincial, and federal guidelines and requirements associated with environmental characterization of the materials.

Imported fill materials should be tested and approved by a geotechnical engineering firm prior to delivery/use. Monitoring of fill placement and in situ compaction testing should be carried out to confirm that all fill is placed and compacted to the required degree.

5.6.1 Site Drainage and Subgrade Protection

The contractor should be responsible for protecting the subgrade soils from disturbance due to construction traffic. This may require that construction access routes are temporarily overbuilt (i.e., provided with increased granular fill) and/or geotextiles are provided between the granular fill and the subgrade surface.

The clayey/silty soils are susceptible to disturbance due to wet weather and/or construction traffic. Therefore, it is critical to control surface water run-off to prevent pounding of water and/or softening of the underlying soils. The prepared subgrade surface for the site should be shaped to prevent pounding of water. Preparation of subgrade should be scheduled such that the protective cover of overlying granular materials or concrete is placed as quickly as possible after subgrade approval by the geotechnical engineer.

The finished grades should provide surface drainage away from all structures. Within 2 m of structures, the exterior should be graded to slope away from the structure at a sufficient gradient. A gradient of 2% should be used wherever possible.

It should be noted that the surface drainage within the site should be collected and directed towards a storm water management system.

5.6.2 Grade Raise Restriction

A silty clay/clayey silt deposit was encountered at several boreholes, especially at the southern portion. The silty clay/clayey silt deposit was described to have a generally firm to stiff consistency and is 0.3 m 1.5 m. Considering the consistency and thickness of this deposit, the potential settlement of the silty clay/clayey silt deposit at this site due to the placement of the any site grade fill materials is not expected to be significant.

However, in-situ measurement of undrained shear strength of silty clay/clayey silt deposit using field vane test and laboratory testing (plasticity limits and consolidation testing) of silty clay/clayey silt samples are required to assess the compressibility of this deposit and calculation of the potential settlement of due to the placement of any site grade fill.

Large settlements may occur if site grade fills are placed where peat was encountered in boreholes (e.g. BHW-009 BHW-11, BHW-015, MW01-7, etc.)



5.7 FOUNDATION DESIGN

Considering the subsurface conditions encountered at the borehole locations, the foundation options are as follows:

- Shallow footings placed on an approved competent native soil subgrade or sound bedrock bearing surface.
- Deep foundations; The following deep foundation options could be considered.

Driven piles:	applicability depend on the bedrock depth (for axially loaded piles, the minimum driven
	length is typically considered to be 5 m)
Micro-piles:	applicable throughout
Caissons:	applicable throughout

Considering the presence of relatively thick fill layers at some location at the site and high load expected for the multistory building, shallow foundation may not be an option throughout the site. Deep foundation systems are considered technically feasible for the proposed development at this site. The buildings could be supported on deep foundations transferring the foundation loads through the fill layers, down to the bedrock surface.

Lesstian	Preferred Foundation Options		
Location	Shallow Foundations	Deep Foundations	
North Portion of Site	On Bedrock	Micro-piles or Caissons	
South Portion of Site	On Competent Native Soils	Caissons or Micro-piles	
West Portion of Site (north of the transitway)	-	Micro-piles or Caissons (where the bedrock surface is below 5 m depth)	
West Portion of Site (south of the transitway)	On Competent Native Soils	Driven Piles or Caisson (where cobbles/boulders may be present in overburden)	
East Portion of Site	On Bedrock or Competent Native Soils	Micro-piles or Caissons	

Table 5.2: Preferred Foundation Options

5.7.1 Shallow Foundations

5.7.1.1 Geotechnical Bearing Resistances

Based on the subsurface conditions encountered at the boreholes previously advanced at the site, shallow foundations founded on competent native soil (compact to very dense silt sand/sand/till deposit or stiff silty clay/clayey silt), sound bedrock surface, or on structural fill constructed on these natural materials could be considered for buildings at the site; all existing fill materials, disturbed/unsuitable native soils, weathered bedrock will need to be removed as discussed in Section 5.6.

The geotechnical resistance calculations for shallow footings were carried out according to the Canadian Manual of Foundation Engineering, considering a non-inclined and non-eccentric load, for foundations buried at the frost penetration depth or deeper.

The values of the geotechnical bearing resistance (bearing capacity) at the Ultimate Limit States (ULS) and the Serviceability Limit States (SLS), presented in the following table, are recommended for the design of the

foundations founded on the compact to very dense till deposit, stiff silty clay/clayey silt, or on the sound bedrock surface. Alternatively, the building foundations could be founded on structural fill placed on the native soil or bedrock.

Footing Type and Width (m)	Minimum Footing Embedment Below Floor Slab Surface (m)	Factored Geotechnical Resistance at SLS (kPa)	Geotechnical Resistance at ULS (kPa)		
	Squ	are Footings			
0.01.05	0.9	220	220		
0.9 to 2.5	1.8	250	430		
Strip Footings					
0.6 to 1.5	0.9	160	160		
	1.8	220	290		

Table 5.3: Geotechnical Resistance for Shallow Footings on Competent Native Granular Soils

Table 5.4: Geotechnical Resistance for Shallow Footings on Competent Native Cohesive Soils

Footing Type and Width (m)	Minimum Footing Embedment Below Floor Slab Surface (m)	Factored Geotechnical Resistance at SLS (kPa)	Geotechnical Resistance at ULS (kPa)		
	Squ	are Footings			
0.01.05	0.9	180	180		
0.9 to 2.5	1.8	180	200		
Strip Footings					
0 6 to 1 5	0.9	160	160		
0.6 to 1.5	1.8	160	180		

Foundations founded on the sound bedrock surface could be designed based on factored geotechnical resistance of 1,000 kPa at ULS conditions for square and strip footings ($0.6 \le$ footing width ≤ 5.0). Rock settlement is considered negligible (less than 10 mm) and the total settlement should correspond to the elastic deformation of the rock mass and for this reason the SLS resistance is not applicable.

Both ULS and SLS factored bearing resistance are based on the unfactored strength properties of the soils. The ULS bearing resistance does not account for inclined or eccentric loading conditions. The ULS values include a resistance factor of 0.5. The geotechnical reaction at SLS typically corresponds to a maximum total settlement of 25 mm and a maximum differential settlement of 20 mm.

The geotechnical resistances in the above tables are provided for the range of footing widths and the minimum footing embedment depths (below the floor slab surface) listed in the above table. Additional input should be provided by the geotechnical engineer if the foundation sizes or embedment depths are outside of the ranges outlined above.

The native soils could be highly susceptible to disturbance by construction activity especially during wet or freezing weather. Care should be taken to preserve the integrity of the materials as bearing strata. It is essential that the founding level for the footings be inspected by the geotechnical engineer prior to placing concrete. If the concrete for the footings on the native soil cannot be placed immediately after excavation and inspection, it is recommended that a working mat of lean concrete be placed in the excavation to protect the integrity of the bearing stratum.



The unfactored horizontal resistance to sliding of the spread foundations may be calculated using the following unfactored coefficients of friction:

- 0.55 between Structural fill materials and cast-in-place concrete
- 0.40 between native (silty till or cohesive) soil and cast-in-place concrete

In accordance with Table 8.1 of the Canadian Foundation Engineering Manual 4^{th} Edition (CFEM), a resistance factor (ϕ) against sliding of 0.8 should be applied to obtain the factored sliding resistance at ULS.

5.7.1.2 Soil-Bedrock Transition

It should be noted that where footings of a building may cross between subgrade types (i.e. between soil and bedrock), some differential settlement may occur. Such settlements should be accounted for through structural design. Therefore, it may be preferable to have all foundations extend to a bedrock subgrade or on the overburden, in order to avoid potential differential settlements.

Each foundation should be founded on one subgrade material only to limit the differential settlement. Given the variability of rock level, if this is not practical and part of the foundations would be on rock, soil-rock transitions will be required to limit the risk of excessive differential settlement. The transition consists of profiling the bedrock with a slope of 1V:5H and profiling the soils with a slope of 1V:3H, to reach a depth of 600 mm at their contact with the projected level of the foundations. The excavation must be filled with a structural granular material to promote the gradual development of settlements. This backfill should be composed of OPSS Granular A or B Type II materials placed in layers of 300 mm compacted to at least 100% of material's SPMDD. The width of the subexcavation should be at least the proposed footing width plus 0.5 m.

5.7.1.3 Foundation Wall Backfill

To avoid problems with frost adhesion and heaving, foundation walls in these areas should be backfilled with nonfrost susceptible granular fill meeting the gradation requirements of OPSS Granular B Type I materials. The fill should be placed in maximum 300-millimetre thick lifts and should be compacted to at least 98 percent of the material's SPMDD using suitable vibratory compaction equipment.

In areas where hard surfacing (e.g., concrete slabs, sidewalks) surround the building, differential frost heaving will occur between the granular fill backfill zone and other areas. To reduce this differential heaving, a frost taper of the granular backfill is recommended. The frost taper should extend up from 1.2 meters below finished exterior grade (at the foundation wall) at a slope of 3 horizontal to 1 vertical, or flatter, to the surface level.

Exterior grades should be sloped away from the building to prevent ponding of water around the buildings.

5.7.2 Piled Foundations

Depth to bedrock is variable at the site. For axially loaded piles, the minimum driven length is typically considered to be 5 m. As such, driven piled foundations are considered suitable only for portion of the building area where bedrock surface is deeper than 5 m. Where the bedrock is shallower than 5 m or presence of cobble and/or boulder could create heavy driving resistances, impede pile driving, or damage the piles, drilled piles (socketed to bedrock) could be considered.



Suitable pile types for driving would be concrete filled steel pipe piles (driven closed-ended) or H-piles, with the piles end-bearing on bedrock. The piles should be driven to practical refusal within the very dense till or on the bedrock surface. The piles should attain refusal reaching the surface of the bedrock; however, some limited penetration of the piles into the weathered bedrock may occur. Considering the presence of cobbles and boulders in the native till deposit in the South and West portions of the site, some of piles may attain refusal on cobbles or boulders within the till deposit.

Where the quality of the bedrock near surface is poor and/or till (which potentially contains cobbles and/or boulders) is present, it is recommended that rock-points, such as the Titus rock injector points be included to protect the pile tips.

For piles attaining refusal at or slightly below the bedrock surface, settlement at the toe will be negligible and the total pile head settlement will correspond to the elastic deformation of the piles. The ultimate limit states (ULS) axial geotechnical resistance in compression of piles driven to refusal on bedrock (or slightly within) at this site should be considered to be the structural capacity of the pile. For piles driven to refusal within the till deposit, generally, the ULS axial geotechnical resistance in compression is considered to be 80% of the structural capacity of pile.

Due to stresses imposed by the pile driving methods and to avoid damaging the steel during driving, it is recommended that the ULS geotechnical resistance be limited to 140 N/mm² of the steel cross-sectional area of the piles. In the case where pipe piles are to be filled with concrete and the pile driving contractor proposes higher capacities to incorporate the structural benefits of the concrete, the contractor would be required to demonstrate that the piles have achieved the proposed higher capacities by field-testing.

Based on a limiting stress value of 140 N/mm² against steel cross-sectional area for piles driven to refusal on bedrock (or slightly within), the following ULS geotechnical resistances may be considered. For piles driven to refusal within the till deposit, generally, a lower limiting stress value of 112 N/mm² against steel cross-section is used to calculate the ULS geotechnical resistance.

	ULS geotechnical resistances (kN)		
Pile Type	piles driven to refusal on bedrock (or slightly within)	piles driven to refusal within till	
HP 310x110	1975	1580	
Pipe 324 mm diameter, 11 mm thick wall	1530	1220	

Table 5.5: Geotechnical Resistance for Driven Pile at ULS

Note: The sacrificial thickness, if any, does not apply to the geotechnical resistance which will be provided by the bedrock.

The actual piles selected will depend on the pile load requirements and the pile cap configurations. The piles recommended to be spaced at least three diameters apart. Considering that the piles will be on bedrock surface, no group effects is required to be considered in assessment of geotechnical vertical resistance of piles.

For piles driven to bedrock, the geotechnical resistance at serviceability limit state (SLS) exceeds the ULS value and therefore is considered not to be applicable to the design.

The pile driving contractor should be required to submit the following information prior to mobilizing to the site.

- Outline of proposed pile driving equipment
- Pile driving refusal criteria to provide the ULS design value selected for the project

Pile caps/grade beams for unheated areas such as exterior structures should be provided with 1.8 m of soil cover.

10% of the driven piles should be subjected to dynamic pile testing to confirm that they are well seated on bedrock and that the pile driving strategy did damage the piles upon reaching bedrock. Dynamic testing should be carried out using a Pile Driving Analyser (PDA).

Downdrag due to potential soil liquefaction

The granular native soils underlie the site is sporadically considered potentially susceptible to liquefaction during a design seismic event. Based on the conducted liquefaction analyses, settlements associated with liquefaction could reach 90 mm to 200 mm. Therefore, drag loads should be incorporated in the design where liquefaction is expected.

The structural capacity of the pile would need to account for drag load imposed during a seismic event. The geotechnical capacity is not affected by the drag loads. Drags loads should be considered in detailed design of piles.

As discussed elsewhere in this report, clayey soil consolidation due to potential site grade raise at the site is not expected. Therefore, it has been assumed that drag loads due to soil consolidation settlements may not be considered in the design.

5.7.3 Micropile Foundation System

The elevation of the bedrock surface encountered at the site is highly variable. Therefore, the consideration could be given to using a micropile foundation system as an alternative to the piled foundation design.

The following conditions have been assumed in assessing the micropile capacities:

- Assumed Rock Unconfined Compressive Strength 70 MPa
- f'c = 30 MPa for concrete
- Pile capacity calculated strictly based on the rock socket shaft resistance

For Ultimate Limit States (ULS) design, the unfactored bond strength at the grout/rock interface may be taken as 1,500 kPa. Using a resistance factor of 0.4, the factored ULS bond strength is 600 kPa. If higher factored resistance values are required, on-site testing of the micropiles should be carried out. Based on these values, the factored bearing resistances in the following table may be used for micropile design. As the uppermost 1 m of the bedrock mass is often more heavily fractured and less competent, the first metre of rock should not be included as part of the socket length.

Pile Diameter (m)	Socket length in Competent Bedrock ⁽¹⁾ (m)	Factored Bearing Resistance at ULS ⁽²⁾ (kN) Socket Friction
	1.00	285
0.150	2.00	565
	3.00	850
0.175	1.00	330
	2.00	660
	3.00	990
$\begin{array}{c c} 0.150 & 2.00 \\ \hline 3.00 \\ \hline 3.00 \\ \hline 0.175 & 2.00 \\ \hline 3.00 \\ \hline 0.200 & 2.00 \\ \hline 3.00 \\ \hline 0.225 & 1.00 \\ \hline 0.225 & 2.00 \\ \hline \end{array}$	1.00	375
	2.00	750
	3.00	1125
0.225	1.00	425
	2.00	850
	3.00	1275

Table 5.6: Micropile Axial Capacities

Notes:

¹ Micropiles should be socketed into competent bedrock. The socket length in the table above represents the depth socketed into competent bedrock; for design purposes, it should be assumed that uppermost metre of the bedrock is not included in the socket length.

² The above geotechnical resistances at ULS include a resistance factor of 0.4 in compression.

³ Negligible axial deformation would occur and therefore, reactions at SLS are not expected to govern.

The following provides additional considerations that should be accounted for in the design and construction of the micropile foundation system:

- The micropiles should be designed and constructed in accordance with standard practices such as those identified in the US Department of Transportation – Federal Highway Administration Publication No. FHWA NHI-05-039 (Micropile Design and Construction Reference Manual).
- Micropiles intended as permanent structural elements should be provided with double corrosion protection.
- In order to limit the potential for differential foundation settlement, all foundations should for a building should consist of either shallow foundations bearing on bedrock or micropile foundations socketed into bedrock (i.e. shallow foundations bearing on overburden materials should not be used). In this regard, micropile supported grade beams could be considered around the perimeter of the building.
- The resistance values provided above represent the geotechnical capacity of the micropiles; an assessment should be completed to confirm if the geotechnical or structural capacity of the micropiles will govern. Similarly, the structural design of micropiles should take into account other potential failure mechanisms (e.g. buckling).
- Full-time inspection should be carried out by qualified geotechnical personnel during micropile installation. Additionally, sufficient materials testing (e.g. grout compressive strength testing) should be completed to monitor conformance to the pertinent project specifications.
- Stantec's geotechnical group should review the final drawings and specifications for this project prior to tendering/construction to ensure that the guidelines in this report have been adequately interpreted.

5.7.4 Rock Socketed Caissons

Rock socketed caissons may be considered for foundation design. Depending on the prevailing groundwater level at each building location at the time of construction, the use of a steel liner and the tremie technique would be required due to the presence of the highly permeable silty sand/till deposit.

Given the fracture nature of the bedrock at the site, the following should be considered.

• That the top 1.0 m of the rock socket is not to be included in the calculated capacity.



- That the rock socket length, within the calculated zone, be at least three (3) times the caisson diameter.
- A minimum caisson diameter of 0.9 m be considered.
- A factored geotechnical resistance at the concrete-rock shaft interface at ULS of 700 kPa, which includes a resistance factor of 0.4.
- Negligible axial deformation would occur at the concrete-rock shaft interface and therefore, reactions at SLS are not expected to govern.

Construction Inspection

It is anticipated that contractor would use flight augers to construct the caissons. The following should be anticipated.

- That caissons would need be to clean and dewatered to allow for inspection to ensure that all loose materials are removed and that the sidewalks are free of debris.
- That concrete should not be placed within a dewatered caisson since waterflow from the fractured bedrock would wash out the cement paste from the concrete.
- Where the caisson bottom will be below groundwater level, the caissons would need to be filled with water prior to concreting to allow for use of the tremie method where concrete is pumped underwater, from the bottom of the caisson, while displacing the overlying water.
- That full time inspection by a geotechnical engineer's representative would be required while constructing caissons, including placement of concrete by the tremie method.

5.8 EXCAVATIONS AND RETAINING WALLS

5.8.1 Temporary Excavations

5.8.1.1 Temporary Excavation in Overburden

All temporary excavations should be carried out in accordance with the Occupational Health and Safety Act and Regulations for Construction Projects. Shallow open cut excavations (extended to depths of 3 m or less below existing ground surface) could be conducted following the recommendation provided in this section. The potential for instability of excavations extending to greater depths should be reviewed by a geotechnical engineer.

Based on the boreholes advanced within the site, the overburden soils within upper 3 m of existing site grades could be generally classified as Type 3 soils, as defined by the Occupational Health and Safety Act and Regulations for Construction Projects. Provided that appropriate groundwater control is provided to maintain the water level below the base of the excavation, OHSA indicates that temporary excavations made within Type 3 soils should be developed with side slopes no steeper than 1H:1V.

Very loose or soft/very soft portions of the overburden soils should be classified as Type 4 soils. If infiltration of groundwater is encountered, soils should be considered Type 4. For Type 4 soils, OHSA requires that open cut excavations must be sloped no steeper than 3-horizontal to 1-vertical (3H:1V) from the bottom of the excavation.

Based on OHSA requirements, the soil must be classified as the type with highest classification of the types of soils present if an excavation contains more than one soil type (e.g. if both Type 3 and Type 4 soils are present within the excavation, the excavation must be sloped or supported in accordance with the requirements for Type 4 soils).

Steeper side slopes would require shoring to meet the requirements of the OHSA. The stability of the wall of the excavation can also be affected by:

- Surcharge loads
- Stockpiles
- External loads (e.g. from adjacent buildings foundations)
- Groundwater seepage conditions

Regular inspections by qualified geotechnical engineering personnel must be conducted to confirm that conditions in the excavations are safe and consistent with the requirements of the OH&S Act. Care should be taken to direct surface water away from the open excavations.

Stockpiling of any materials adjacent to excavations should be avoided. Similarly, traffic should not be permitted in proximity to open excavations. For this purpose, it is recommended that all storage of materials and traffic be restricted from a 2 m wide strip around the excavations, measured from the crest of the excavation designed and constructed in accordance with the OH&S Act.

The base of excavations should not be exposed for extended periods of time.

If space is restricted such that the side slope cannot be safely cut back in accordance with the OH&S Act & Regulations, or if sloughing and cave-in are encountered in the excavations, or if the excavations are to remain open for a longer period, a trench box system can be used for shallow localized excavations (such as for service trenches), or a shoring system can be used for larger or deeper excavations to maintain safe working conditions. All shoring systems should be designed and approved by a qualified Professional Engineer.

The contractor is fully responsible for the selection of, and the detailed design and performance of the temporary shoring systems. In general, there are three shoring methods that are commonly used in local construction practice:

- soldier piles and timber lagging;
- driven sheet piles; and
- continuous concrete (e.g. secant pile) walls.

Soldier pile and lagging systems are suitable where the objective is to maintain an essentially vertical excavation wall and the movements above and behind the wall need only be sufficiently limited that relatively flexible features (such as roadways) will not be adversely affected. Where foundations or other deformation-sensitive facilities (such as site services) are present within the zone of influence of the shoring, the shoring system will need to be designed to limit deflections/deformations to tolerable levels. Interlocking steel sheet piling systems with pre-stressed tie backs are often used for these conditions. However, for excavations adjacent to aqueducts, the use of tie-back anchors should be limited due to potential conflicts with the aqueduct structures.

Cobbles, boulders, and/or construction debris were encountered in boreholes advanced at the south and west portions of the site. The presence of cobble, boulders, and /or construction debris cold impede installation of sheet piles. Secant pile walls would be appropriate where difficulties may be encountered installing sheet piles, where heavily loaded foundations exist adjacent to the shoring, or where groundwater inflow needs to be controlled.



Underpinning of the existing foundations could also be required if the settlements due to shoring movements would be unacceptable and/or if the loads on the adjacent foundations are large.

Allowance should be made for excavation of cobbles, boulders, construction debris expected to be present both in fill and glacial till at the site, especially at the south and western portion of the site.

5.8.1.2 Temporary Excavation in Bedrock

Bedrock removal may be required for construction of underground structure or utility installation where bedrock is shallow. The bedrock surface was found to be variable and bedrock could also be encountered at shallow depths.

Where the bedrock is highly fractured, it may be possible to carry out the bedrock removal using mechanical methods (such as hydraulic excavators and hoe ramming with pneumatic rock breakers) particularly for shallow bedrock excavation. For deeper excavation or where the bedrock strength and measured RQD values are higher, it is expected that excavation of the majority of the bedrock will require drill and blast techniques or hoe ramming in conjunction with closely spaced line drilling.

Perimeter line drilling should be used to define the excavation limits. Loose rocks should be removed from the sidewalls during excavation.

For shallow localized excavations (such as for service trenches), relatively steep to near-vertical walls in the bedrock should stand unsupported for a short period. The rock walls should be inspected at the time of excavation so that the rock wall stability can be confirmed. Alternatively, work carried out in the excavation can be done within a fully braced, steel trench box for worker safety.

For deeper or larger excavation (such as for the below grade level excavations), the excavation side walls may need to be stabilized with a pattern of grouted rock bolts and dowels. Tieback anchors may also be required to stabilize unstable rock blocks.

Blasting

If blasting is considered, significant caution should be exercised in carrying out the blasting because of the near proximity of underground services and existing buildings. All blasting should therefore be controlled to limit the peak particle velocities at all adjacent structures and services such that blast induced damage will be avoided. This will require blast designs by a specialist in this field.

A pre-construction/blast survey should be carried out of all of the surrounding structures and utilities. Consideration should be given to monitoring selected existing interior and exterior cracks in the structures identified during the preblast survey for lateral or shear movements by means of pins, glass plate telltales and/or movement telltales.

The contractor should be required to submit a complete and detailed blasting design and monitoring proposal prepared by a blasting/vibrations specialist prior to commencing blasting. This would have to be reviewed and accepted in relation to the requirements of the blasting specifications. The contractor should be limited to only small controlled shots. The following frequency dependent peak vibration limits at the nearest structures and services are suggested for all bedrock removal.



Frequency Range (Hz)	Vibration Limits (mm/sec)	
< 10	5	
10 to 40	5 to 50 (sliding scale)	
> 40	50	

Table 5.7: Peak Vibration Limits

Note: For sensitive infrastructure, the vibration limit may need to be reduced to 2.5 mm/sec for all frequencies.

It is recommended that the monitoring of ground vibration intensities (peak ground vibrations and accelerations) from the blasting operations be carried out both in the ground adjacent to the closest structures or within the structures themselves on a continuous basis throughout the blasting process.

If practical, blasting should commence at the furthest points from the closest structure or service to assess the ground vibration attenuation characteristics and to confirm the anticipated ground vibration levels based on the contractor's blasting proposal.

Blasting should be carried out in accordance with the City of Ottawa's Special Provision F-1201 which provides the requirements for blast design and submissions, including pre-blast surveys. Vibration monitoring should be carried out by qualified personnel throughout all blasting operations.

5.8.2 Dewatering

Based on the existing water levels measurement at the site, the groundwater elevation at the site range between 49.2 m to 59.6 m corresponding to depths between 1.1 m to 9.8 m.

Considering the nature of overburden soils at the site (fill and native silty sand/till), groundwater inflows into small and shallow excavations of less than 3.0 m deep developed within the fill material and clay deposit could be handled by pumping from filtered sumps within the excavation areas.

More significant groundwater inflows should be expected for deeper or larger excavations, especially extending below the prevailing groundwater level at site at the time of excavation or penetrating layers containing cobbles and/or boulders. Therefore, more extensive dewatering systems could be required for such conditions requiring Ministry of the Environment and Climate Change (MOECC) permitting.

A hydrogeological study is being prepared by Stantec and will be provided in a separate report, which assesses the dewatering requirement and provides guidance for the PTTW application or EASR registration, if necessary. Comments on calculation of groundwater flow rate, recommended depth to lower the water table, and anticipated pumping rates are provided in the hydrogeological report. All the information regarding ground settlements from dewatering is provided in the hydrogeological report. This information should be considered by the contractor while selecting an appropriate groundwater control system.

5.8.3 Earth Pressures on Retaining Walls

Earth pressures will need to be considered in the design of the foundation and basement walls. Any retaining walls should be backfilled with non-frost susceptible granular fill meeting the gradation requirements of OPSS Granular B Type I materials.



The total active (P_A), passive (P_P), and at-rest (P_O) thrusts acting on the walls can be calculated using the following equations:

$$\begin{split} \mathsf{P}_\mathsf{A} &= \frac{1}{2} \; \mathsf{K}_\mathsf{a} \; \gamma \; \mathsf{H}^2 \\ \mathsf{P}_\mathsf{P} &= \frac{1}{2} \; \mathsf{K}_\mathsf{p} \; \gamma \; \mathsf{H}^2 \\ \mathsf{P}_\mathsf{O} &= \frac{1}{2} \; \mathsf{K}_\mathsf{o} \; \gamma \; \mathsf{H}^2 \end{split}$$

where;

H = height of the wall γ = unit weight of the backfill soil

Values for K_a, K_p, K_o and γ for granular backfill material are provided in the table below. These values are based on the assumption that a horizontal back slope is present behind and adjacent to the wall system(s). The earth pressure coefficients need to be adjusted (i.e., increased) where sloping backfill will be present behind the walls.

At-rest earth pressures should be used in the design of walls that are restrained from movement. The thrust acts at a point one third up the height of the wall.

Table 5.8: Non-Seismic Lateral Earth Pressure Parameters (Horizontal Backfill)

Parameter	OPSS Granular B – Type I
Bulk Unit Weight, γ (kN/m³)	22
Effective Friction Angle	32°
Coefficient of Earth Pressure at Rest (K _o)	0.47
Coefficient of Active Earth Pressure (Ka)	0.31
Coefficient of Passive Earth Pressure (K _p)	3.25

The total active and passive thrusts under earthquake conditions can be calculated using the following equations:

$$P_{AE} = \frac{1}{2} \text{ K}_{AE} \gamma \text{ H}^2$$
$$P_{PE} = \frac{1}{2} \text{ K}_{PE} \gamma \text{ H}^2$$

where;

 K_{AE} = active earth pressure coefficient (combined static and seismic) K_{PE} = passive earth pressure coefficient (combined static and seismic) H = height of wall γ = total unit weight

The recommended seismic earth pressure parameters (based on a seismic Site Class C) are provided in table below. The angle of friction between the soil and the wall has been assumed to be 0° to provide a conservative estimate.

Parameter	OPSS Granular B – Type I	
Bulk Unit Weight, γ (kN/m ³)	22	
Effective Friction Angle	32°	
Site PGA (g)	0.281	
K _{AE} (Non-Yielding Wall)	0.51	
Height of Application of P_{AE} from base as a ratio of wall height, (H) – Non-Yielding Wall	0.440	
Active Earth Pressure (K _{AE}) – Yielding Wall	0.40	
Height of Application of P_{AE} from base as a ratio of wall height, (H) – Yielding Wall	0.393	
Passive Earth Pressure, (KPE)	2.99	
Height of Application of P _{PE} from base as a ratio of wall height, (H)	0.310	

Table 5.9: Seismic Earth Pressure Parameters (Horizontal Backfill)

In order to use the coefficients of active and at-rest pressures for the granular materials presented in the tables above, the granular backfill must be provided within a wedge extending out from the base of the wall at 45 degrees (or smaller) to the horizontal. The coefficient of passive earth pressure applicable to wall design should be confirmed during detailed design when additional information on wall configuration and depths/founding elevations are determined.

5.9 PIPE BEDDING AND BACKFILL

OPSS Granular A materials should be placed below sewer and water pipes as bedding material. The bedding should have a minimum thickness of 150 mm or more to meet City of Ottawa standards. Where unavoidable disturbance to the subgrade surface does occur, it may be necessary to thicken the bedding layer or provide a sub-bedding layer of compacted Granular B Type II materials. Pipe backfill and cover materials should also consist of OPSS Granular A material. A minimum of 300 mm vertical and side cover should be provided. These materials should be compacted to at least 95% of the material's SPMDD in lifts no greater than 300 mm. Clear crushed stone backfill should not be permitted as pipe bedding materials.

Where the pipe trenches will be covered with hard-surfaced areas, the type of native material placed in the frost zone (i.e. between subgrade level and 1.8 meters depth or the top of the pipe cover materials) should match the soil exposed on the trench walls for frost heave compatibility.

Trench backfill should be placed in maximum 300 mm thick lifts and should be compacted to at least 98 percent of the material's standard Proctor maximum dry density using suitable compaction equipment.

If there is insufficient reusable material at the site, any bulk fill required to raise the site grades should consist of imported granular fill meeting the requirements of OPSS Select Subgrade Material (SSM).

All imported fill materials should be tested and approved by a geotechnical engineering firm prior to delivery to the site.

5.10 PAVEMENT DESIGN RECOMMENDATIONS

Provided that subgrade preparation below pavements will comply with the requirements outlined in Section 5.6 of this report, in the absence of traffic data, the pavement structure provided in the following table may be used for the design of the proposed new streets and parking areas. Where required, site grades below pavement structures are to be raised using imported soils meeting the requirements of OPSS Select Subgrade Material (SSM).

Location	Asphalt Thickness	Base Thickness OPSS Granular A (mm)	Subbase Thickness Granular B Type II (mm)
Standard Duty Parking Areas	60 mm SP12.5 mm	150	300
Heavy Duty Parking Areas	40 mm SP12.5 mm 50 mm SP SP19.0 mm	150	400
Local Roads (no bus traffic)	50 mm SP 12.5 FC1 or FC2 50 mm SP 19	150	500
Local Roads (with bus traffic)	60 mm SP 12.5 FC1 or FC2 70 mm SP 19	150	600

Notes:

- The above pavement structure assumes that the subgrade will consist of either the surface compacted existing fill materials or compacted OPSS SSM material.
- The pavement subgrade must be proof rolled under the supervision of geotechnical personnel prior to subbase or engineered fill placement. Any soft areas identified during proof rolling may require subexcavation and replacement with additional Granular 'B'. Where required, site grades below pavement structures are to be raised using OPSS SSM fill.
- The finished subgrade surface and the pavement surface should be crowned and graded to direct runoff water away from the development and associated infrastructure.
- Perimeter drains and pavement subdrains connected to catch basins are recommended to promote drainage of the pavement structure. The subdrains should comprise 100 mm or 150 mm diameter perforated corrugated pipes with filter socks bedded in sand. The top of pipe should be below the lower limit of the granular subbase.
- Asphalt performance grade and PG 64-34 should be used for roadways with bus traffic. PG 58-34 should be specified where bus traffic is not anticipated.
- Based on the Ontario Provincial Standard Specification "Material Specification for Superpave and Stone Mastic Asphalt Mixtures" OPSS.MUNI 1151 (April 2018), the following Superpave Traffic Categories are suitable:
 - Traffic Category A for parking areas
 - Traffic Category B for local roads without bus traffic
 - Traffic Category D for local roads with bus traffic
- A tack coat is recommended between asphalt layers and along the edges of any cuts in asphalt.
- In the event that the asphalt layer is not placed at the same time as the granular sub-base/base and the base is left exposed for a period of time, the top layer of granular material should be re-shaped, surface compacted and replaced with a fresh layer of Granular A prior to the placement of the asphalt surface.
- Control of surface water is a critical factor in achieving good performance over the pavement structure life. In this
 regard, the elevations of the surface of the parking areas should be designed to promote adequate surface
 drainage.

Compaction Requirements:

- The finished sub-grade surface must be compacted to achieve a minimum of 95% of the materials SPMDD immediately prior to placement of the granular materials.
- All granular materials should be in accordance with the requirements of OPSS Specification. These materials should be compacted to at least 100% of the material's Standard Proctor maximum dry density (SPMDD) in lifts no greater than 300 mm.
- The compaction of the asphalt layers should be to at least 92.5% Maximum Theoretical Relative Density (MTRD) in accordance with OPSS 310.

6.0 CONSTRUCTION CONSIDERATIONS AND CONSTRAINTS

6.1 UNDERFLOOR DRAINAGE

For buildings that include basement/underground level(s), both a perimeter drainage and an under-slab drainage system is recommended to be included in the design. The following is recommended for the underslab drainage system.

- Concrete floor
- Vapour barrier
- 50 mm of compacted OPSS Granular A, as a working surface
- 250 mm of 19 mm clearstone
- 100 mm perforated drains placed up to 6 m apart
- Filtering, non-woven geotextile between the clearstone and the native soil

The underfloor drainage system should be designed to accommodate the highwater levels associated with spring conditions. Unless seasonal water levels are taken, it should be assumed that the water level could be as high as 1 m below ground surface for brief periods of time.

6.2 REUSE OF ON-SITE MATERIALS

The surficial topsoil materials are geotechnically unsuitable for reuse in any application except for general landscaping purposes, however environmental impacts to the soil my restrict the reuse of the material.

The fill material is not considered to be suitable for reuse as engineered/structural fill below or adjacent to new foundations. These materials that are free of organic matter and other deleterious materials, may be considered suitable for reuse as trench backfill (outside of foundation areas) or as general site grade fill (i.e. materials used to raise the site grade to the design elevations outside building footprints).

The ability to compact these materials to required levels is dependent on the moisture content of the materials; thus, the amount of re-useable material will be dependent on the natural moisture content, weather conditions and the construction techniques at the time of excavation and placement. Any boulders or cobbles with dimensions greater than 150 mm should be removed from these materials prior to placement.



6.3 COLD WEATHER CONSTRUCTION

Placement of fill materials in cold weather requires a considerable increase in effort from that required in "better" weather conditions. Additional costs are typically incurred as a result, and general productivity can be expected to suffer. In addition to the prevailing weather conditions, the quantity of fill to be placed, the required lateral extent and thickness, the equipment used for placement and compaction, and the protection methods employed by the contractor, will all have an influence on the success of placing fill in adverse weather conditions.

Notwithstanding the comments provided in the previous sections of this report pertaining to backfilling and engineered fill, when construction is undertaken during periods of inclement weather or when freezing conditions exist, the placement of fill materials for any purpose should consider the comments provided below.

- Foundations/pile caps/slabs shall be constructed on non-frozen ground only; where non-frozen ground includes the material at surface and all underlying soils. The non-frozen nature of the ground must be confirmed by a geotechnical inspection within 1 hour of concrete placement.
- Following construction of foundations/pile caps/slabs, protection measures must be provided to prevent freezing
 of the foundation subgrade/bearing soils and for protection of the concrete during curing. The protective
 measures must also keep the subgrade soils beneath the foundations from freezing after the concrete has cured.
- Foundations/pile caps shall be backfilled with free-draining granular material and drainage shall be provided to prevent lifting of the foundations due to adfreeze during the construction period.
- Structural fill shall not be placed on frozen ground and the structural fill materials shall be free of snow and frozen material.
- Overnight frost penetration into the existing sub-grade or the structural fill must be prevented. Alternatively, the frozen fill must be completely removed prior to placing subsequent lifts. Breaking the frost in-situ is not considered acceptable.
- Moisture adjustment of the fill materials (i.e., adding water or allowing fill to dry) is not practical in freezing conditions. Therefore, obtaining the required compaction levels of 100 percent of the materials Standard Proctor maximum dry density for Structural Fill will not be practical if the fill materials are not supplied to the site near their optimum water content for compaction.
- Regular checks of the temperature of the fill should be made. The soil temperature should be greater than +2C to allow for compaction to the specified degree.
- Imported fill should not be stockpiled on site in such a condition where freezing of the material in the stockpile can develop. Direct import, placement, and compaction is recommended.
- Full-time inspection and testing services is required during earthworks in winter conditions.

7.0 SUPPLEMENTARY GEOTECHNICAL INVESTIGATION

The recommendations provided in this report are general in nature and are provided for planning purposes. The provided recommendation and comments should be confirmed to use for final design purposes.

The following should be considered in a supplementary geotechnical investigation:

- The existing borehole data at the site was collected between 1992 and 2018. A new field investigation will provide current geotechnical conditions at the site.
- A supplementary site and project specific geotechnical investigation should be planned for each proposed development at the site once the details (e.g., final building configurations and site grades, structural loads etc.) related to the proposed development are available.
- It is recommended that a groundwater monitoring program be implemented to help assess variability in the groundwater levels at the site. A hydrological investigation is also recommended to assess the dewatering requirements.
- Geophysical testing could be carried out to measure the in-situ shear wave velocity of the subsurface soils and bedrock at the site to potentially improve the recommended Seismic Site Class.
- In-situ measurement of undrained shear strength of silty clay/clayey silt deposit using field vane test and laboratory testing (plasticity limits and consolidation testing) of silty clay/clayey silt samples are required to assess the compressibility of this deposit and calculation of the potential settlement of due to the placement of any site grade fill.
- The bedrock surface was found to be variable, and the bedrock depth ranges from 0 m (existing ground surface) to about 16.6 m below ground surface. Additional boreholes, including bedrock coring and bedrock testing, at each building location to establish the bedrock level at each development and refine the deep foundation recommendations.

8.0 CLOSURE

This report documents work that was performed in accordance with generally accepted professional standards at the time and location in which the services were provided. No other representations, warranties or guarantees are made concerning the accuracy or completeness of the data or conclusions contained within this report, including no assurance that this work has uncovered all potential liabilities associated with the identified property.

This report provides an evaluation of selected geotechnical conditions associated with the identified portion of the property that was assessed at the time the work was conducted and is based on information obtained by and/or provided to Stantec at that time. There are no assurances regarding the accuracy and completeness of this information. All information received from the client or third parties in the preparation of this report has been assumed by Stantec to be correct. Stantec assumes no responsibility for any deficiency or inaccuracy in information received from others.

Conclusions made within this report consist of Stantec's professional opinion as of the time of the writing of this report and are based solely on the scope of work described in the report, the limited data available and the results of the work. They are not a certification of the property's environmental condition. This report should not be construed as legal advice.

This report has been prepared for the exclusive use of the client identified herein and any use by any third party is prohibited. Stantec assumes no responsibility for losses, damages, liabilities, or claims, howsoever arising, from third party use of this report.

Should additional information become available which differs significantly from our understanding of conditions presented in this report, Stantec requests that this information be brought to our attention so that we may reassess the conclusions provided herein.

Respectfully submitted,

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GEOTECHNICAL DESKTOP REVIEW: THE LEBRETON FLATS PLAN OF SUBDIVISION, OTTAWA, ONTARIO

Appendix A January 13, 2025

APPENDIX A

A.1 STATEMENT OF GENERAL CONDITIONS



Stantec

STATEMENT OF GENERAL CONDITIONS

USE OF THIS REPORT: This professional work product ("hereinafter referred to as the Report") has been prepared for the sole benefit of the Client in accordance with Stantec's contract with the Client. While the Report may be provided by the Client to applicable authorities having jurisdiction and to other third parties in connection with the project, Stantec disclaims any legal duty based upon warranty, reliance, or any other theory to any third party, and will not be liable to such third party for any damages or losses of any kind that may result.

BASIS OF THIS REPORT: This Report relates solely to the site-specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The information, opinions, conclusions and/or recommendations made in this Report are in accordance with Stantec's present understanding of the site-specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time the scope of work was conducted and do not take into account any subsequent changes. If the proposed site-specific project differs or is modified from what is described in this Report or if the site conditions are altered, this Report is no longer valid unless Stantec is requested by the Client to review and revise the Report to reflect the differing or modified project specifics and/or the altered site conditions. This Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose or site, and any unauthorized use or reliance is at the recipient's own risk.

STANDARD OF CARE: Preparation of this Report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided to the Client. No other warranty is made.

PROVIDED INFORMATION: Stantec has assumed all information received from the Client and third parties in the preparation of this Report to be correct. While Stantec has exercised a customary level of judgment or due diligence in the use of such information, Stantec assumes no responsibility for the consequences of any error or omission contained therein.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this Report are based on site conditions encountered by Stantec at the time of the scope of work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behaviour. Extrapolation of in-situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this Report or encountered at the test and/or sample locations, Stantec must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the Report conclusions or recommendations are required. Stantec will not be responsible to any party for damages incurred as a result of failing to notify Stantec that differing site or subsurface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec geotechnical engineers, sufficiently ahead of initiating the next project stage (e.g., property acquisition, tender, construction, etc.), to confirm that this Report completely addresses the elaborated project specifics and that the contents of this Report have been properly interpreted. Specialty quality assurance services (e.g., field observations and testing) during construction are a necessary part of the evaluation of subsurface conditions and site work. Site work relating to the recommendations included in this Report should only be carried out in the presence of a qualified geotechnical engineer; Stantec cannot be responsible for site work carried out without being present.

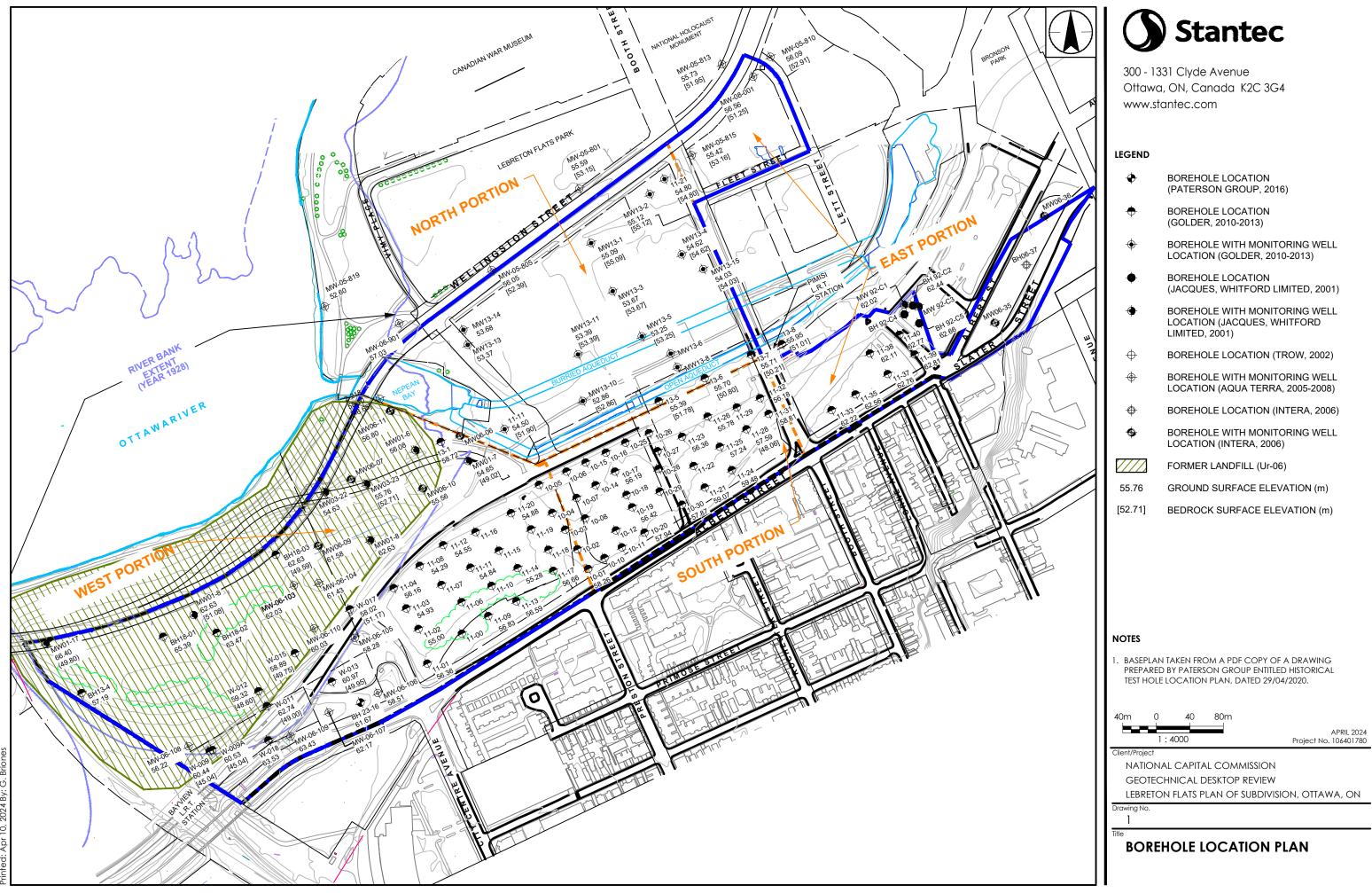
GEOTECHNICAL DESKTOP REVIEW: THE LEBRETON FLATS PLAN OF SUBDIVISION, OTTAWA, ONTARIO

Appendix B January 13, 2025

APPENDIX B

B.1 DRAWING NO. 1 – BOREHOLE LOCATION PLAN





GEOTECHNICAL DESKTOP REVIEW: THE LEBRETON FLATS PLAN OF SUBDIVISION, OTTAWA, ONTARIO

Appendix C January 13, 2025

APPENDIX C

C.1 BOREHOLE RECORDS



SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Rootmat	 vegetation, roots and moss with organic matter and topsoil typically forming a mattress at the ground surface
Topsoil	- mixture of soil and humus capable of supporting vegetative growth
Peat	- mixture of visible and invisible fragments of decayed organic matter
Till	- unstratified glacial deposit which may range from clay to boulders
Fill	- material below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

Desiccated	- having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	- having cracks, and hence a blocky structure
Varved	- composed of regular alternating layers of silt and clay
Stratified	- composed of alternating successions of different soil types, e.g. silt and sand
Layer	- > 75 mm in thickness
Seam	- 2 mm to 75 mm in thickness
Parting	- < 2 mm in thickness

Terminology describing soil types:

The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 or D 2488) which excludes particles larger than 75 mm. For particles larger than 75 mm, and for defining percent clay fraction in hydrometer results, definitions proposed by Canadian Foundation Engineering Manual, 4th Edition are used. The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):

Terminology describing materials outside the USCS, (e.g. particles larger than 75 mm, visible organic matter, and construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%			
Some	10-20%			
Frequent	> 20%			

Terminology describing compactness of cohesionless soils:

The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test (SPT) N-Value - also known as N-Index. The SPT N-Value is described further on page 3. A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
Very Loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

Terminology describing consistency of cohesive soils:

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests. Consistency may be crudely estimated from SPT N-Value based on the correlation shown in the following table (Terzaghi and Peck, 1967). The correlation to SPT N-Value is used with caution as it is only very approximate.

Consistency	Undrained Sh	Approximate			
Consistency	kips/sq.ft.	kPa	SPT N-Value		
Very Soft	<0.25	<12.5	<2		
Soft	Soft 0.25 - 0.5		2-4		
Firm	0.5 - 1.0	25 - 50	4-8		
Stiff	1.0 - 2.0	50 – 100	8-15		
Very Stiff	2.0 - 4.0	100 - 200	15-30		
Hard	>4.0	>200	>30		

ROCK DESCRIPTION

Except where specified below, terminology for describing rock is as defined by the International Society for Rock Mechanics (ISRM) 2007 publication "The Complete ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 1974-2006"

Terminology describing rock quality:

RQD Rock Mass Quality		Alternate (Colloquial) Rock Mass Quality					
0-25	Very Poor Quality Poor Quality Fair Quality		Very Severely Fractured	Crushed			
25-50			Severely Fractured	Shattered or Very Blocky			
50-75			Fractured	Blocky			
75-90	Good Quality		Moderately Jointed	Sound			
90-100	Excellent Quality		Intact	Very Sound			

RQD (Rock Quality Designation) denotes the percentage of intact and sound rock retrieved from a borehole of any orientation. All pieces of intact and sound rock core equal to or greater than 100 mm (4 in.) long are summed and divided by the total length of the core run. RQD is determined in accordance with ASTM D6032.

SCR (Solid Core Recovery) denotes the percentage of solid core (cylindrical) retrieved from a borehole of any orientation. All pieces of solid (cylindrical) core are summed and divided by the total length of the core run (It excludes all portions of core pieces that are not fully cylindrical as well as crushed or rubble zones).

Fracture Index (FI) is defined as the number of naturally occurring fractures within a given length of core. The Fracture Index is reported as a simple count of natural occurring fractures.

Terminology describing rock with respect to discontinuity and bedding spacing:

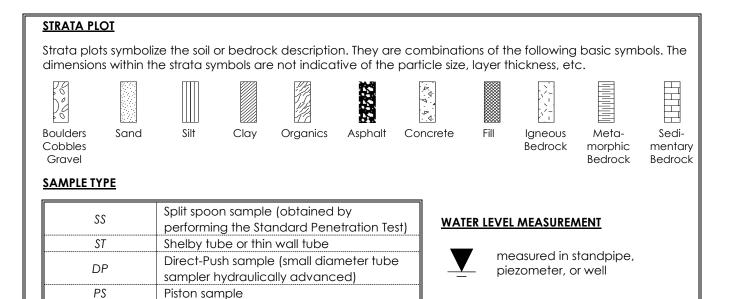
Spacing (mm)	Discontinuities	Bedding
>6000	Extremely Wide	-
2000-6000	Very Wide	Very Thick
600-2000	Wide	Thick
200-600	Moderate	Medium
60-200	Close	Thin
20-60	Very Close	Very Thin
<20	Extremely Close	Laminated
<6	-	Thinly Laminated

Terminology describing rock strength:

Strength Classification	Grade	Unconfined Compressive Strength (MPa)
Extremely Weak	RO	<1
Very Weak	R1	1 – 5
Weak	R2	5 – 25
Medium Strong	R3	25 – 50
Strong	R4	50 – 100
Very Strong	R5	100 – 250
Extremely Strong	R6	>250

Terminology describing rock weathering:

Term	Symbol	Description					
Fresh	W1	No visible signs of rock weathering. Slight discoloration along major discontinuities					
Slightly W		Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discolored.					
Moderately	W3	Less than half the rock is decomposed and/or disintegrated into soil.					
Highly	W4	More than half the rock is decomposed and/or disintegrated into soil.					
Completely	W5	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.					
Residual Soil	W6	All the rock converted to soil. Structure and fabric destroyed.					



HQ, NQ, BQ, etc.

BS

<u>RECOVERY</u> For soil samples, the recovery is recorded as the length of the soil sample recovered. For rock core, recovery is defined as the total cumulative length of all core recovered in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis.

N-VALUE

Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 140 pound (63.5 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (300 mm) into the soil. In accordance with ASTM D1586, the N-Value equals the sum of the number of blows (N) required to drive the sampler over the interval of 6 to 18 in. (150 to 450 mm). However, when a 24 in. (610 mm) sampler is used, the number of blows (N) required to drive the sampler over the interval of 6 to 18 in. (150 to 450 mm). However, when a 24 in. (610 mm) may be reported if this value is lower. For split spoon samples where insufficient penetration was achieved and N-Values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50/75). Some design methods make use of N-values corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

DYNAMIC CONE PENETRATION TEST (DCPT)

Bulk sample

Rock core samples obtained with the use

of standard size diamond coring bits.

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to 'A' size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (300 mm) into the soil. The DCPT is used as a probe to assess soil variability.

OTHER TESTS

S	Sieve analysis
Н	Hydrometer analysis
k	Laboratory permeability
Y	Unit weight
Gs	Specific gravity of soil particles
CD	Consolidated drained triaxial
СU	Consolidated undrained triaxial with pore
<u> </u>	pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
С	Consolidation
Qu	Unconfined compression
	Point Load Index (Ip on Borehole Record equals
Ip	$I_{p}(50)$ in which the index is corrected to a
	reference diameter of 50 mm)

Ţ	Single packer permeability test; test interval from depth shown to bottom of borehole					
	Double packer permeability test; test interval as indicated					
Î	Falling head permeability test using casing					
Ţ	Falling head permeability test using well point or piezometer					

inferred

I												
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		HITFORD ENT LIMITED	мс	N	то	R WELL	RECORD				92-C1	
c	CLIENT National Capital Commission PROJECT No 30203									JECT No. 30203		
LOCATION Site C - Lebreton Flats, Ottawa, Ontario										UMGeodetic		
D	DATES: BORING 92-02-01 WATER LEVEL 92-02-18 TPC ELEV. 61.99											
(m)	(m)		PLOT	LEVEL	(ft)	VAL	POUR	SAM	IPLES			
	NON	STRATA DESCRIPTION		Ē			TRATIONS	ТҮРЕ	50		WELL	
DEPTH	UAT	STRATA DESCRIPTION	STRATA	WATER	DEPTH	• %LEL			RONS		CONSTRUCTION	
ă	ELEVATION		STF	MA.	B	• 70LEL	▲ ppm		1 b			
- 0 -	62.02					● 20 40 ▲ 100 200	60 80 300 400					
		Dark brown, sand and					-					
		gravel : FILL									Bentonite Seal	
					-2 -		-				Dentonito Bour	
	61.3	Tarana da la harana			-2-							
		Loose, dark brown, SILTY SAND, trace									Sand Backfill	
		gravel			-4 -		-	SS	6		Sand Dackini	
	60.6				-4-							
	00.0	Compact, olive brown,								E		
		sand and silt, trace gravel : TILL					-	00	20		Slotted Pipe with	
- 2 -		Braver, TIDD			-6-	1		SS	28	目	Sand Backfill	
	59.8						-	-				
		Dense, olive brown, sand and silt, trace gravel :		¥	¥			-			目	
	59.4	TILL			-8-			SS	42			
		End of Borehole	-				-					
- 3 -		Auger refusal on possible					-					
		bedrock			-10-							
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					-12-							
- 4 -												
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- 5 -					-16-							
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ional Capital Comm C - Lebreton Flats 92-02-01 PATA DESCRIPTION brown, sand and el : FILL pact, brownish ge, sand and gravel, silt : FILL pact, dark brown, and gravel : FILL pact, grey, sand and some gravel : TILL	STRATA PLOT		a. O	WATER LI V CONCI • %LE	EVEL APOUR ENTRAT			PLES In Dor Nor 20	PROJECT No. <u>30203</u> DATUM <u>Geodetic</u> TPC ELEV. <u>N.A.</u> WELL CONSTRUCTION No Monitoring Well Installed
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ge, sand and gravel, silt : FILL pact, dark brown, and gravel : FILL pact, grey, sand and	****	****				-	SS	20	
and gravel : FILL pact, grey, sand and		C 8 X 1	-6-						
						-	SS	28	
dense, grey, sand ilt, trace gravel :			- 8 -				SS	62	
			-10- - - -12-			-	SS	65	
			 -14-	*		-	SS	83	
			 -16-			-	SS	*	
of Borehole it spoon refusal on			-18-						
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ENV CI LC	IRONME	HITFORD NT LIMITED National Capital Commi Site C - Lebreton Flats, ORING 92-02-01	issio	n	a, Or	R WELL RECORD			92-C3 PROJECT No. <u>30203</u> DATUM <u>Geodetic</u> TPC ELEV. <u>62.12</u>
	Ê		E	L	T			IPLES	
DEPTH (m)	ELEVATION (STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	VAPOUR CONCENTRATIONS • %LEL	ТҮРЕ	N-VALUE OR RQD	WELL CONSTRUCTION
- 0 -	62.25		-			● 20 40 60 80 ▲ 100 200 300 400			
		Very dense, brown to dark brown, sand and gravel with trace organics : FILL			-2 -				Bentonite Seal
- 1 -	60.8	Comment and and	+	******	- 4 -		SS	51	Sand Backfill
- 2 -		Compact, grey, sand and silt, trace gravel : TILL			-6-		SS	27	Slotted Pipe with Sand Backfill
					- 8 -		SS	65	
- 3 -	58.8	End of Borehole			-10-		SS	*	
- 4 -		* Split spoon refusal on possible bedrock			-12-	-			
					-14-	-			
- 5 -					-16-	-			
					-18-				
- 6 -									[₩]

		HITFORD NT LIMITED	E	30	REI	HOLE RECORD			92-C4
		National Capital Commi							PROJECT No. 30203
		Site C - Lebreton Flats, ORING 92-02-01	Ott	awa	i, Or	water level <u>N.A.</u>			DATUM <u>Geodetic</u> TPC ELEV. <u>N.A</u>
T	Ê.		F	1		WATER LEVEL		PLES	
DEPTH (m)	ELEVATION	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	VAPOUR CONCENTRATIONS • %LEL	түре	N-VALUE OR RQD	WELL CONSTRUCTION
- 0 -	62.00					● 20 40 60 80 ▲ 100 200 300 400			
	61.3	Brown, sand and gravel, trace silt : FILL							No Monitoring Well Installed
- 1 -	60.6	Compact, brown, sand and silt with some brick, wood and slag : FILL			- 4 -		SS	29	
- 2 -	59.8	Loose, light brown, sand and some cobbles with some black staining at 2 m below grade : FILL			-6-		SS	9	
		Dense, grey, sand and silt, trace to some gravel : TILL			-8-		SS	52	
3-			Ī		-	-	SS	49	
	58.4	End of Borehole	* * * * *		-10- -12-		SS	45	
- 4		Auger refusal on possible bedrock			-14-				
- 5 -					-16- - - - -18-				
- 6 -									[\]

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DATE: DORING 92-02-01 WATER LEVEL N.A. TTPC ELEV. N.A. Image: stream and strength some brick : FILL Image: strea										
STRATA DESCRIPTION No No WELL CONCENTRATIONS SAMPLES 62.66 Compact, brown to dark brown, sand and gravel, some brick : FILL Image: Concentration of the second sec			011	aw2	<u>i, U</u>					
Image: Streate Description Image: Streate Description <td></td> <td>ORING</td> <td>Τ.</td> <td>Ι.</td> <td></td> <td>WATER LEVEL</td> <td></td> <td></td> <td></td> <td></td>		ORING	Τ.	Ι.		WATER LEVEL				
62.66 Compact, brown to dark brown, sand and gravel, some brick : FILL Image: some brick : FILL	-	STRATA DESCRIPTION				CONCENTRA	TIONS		1	
Compact to dense, light brown to grey, sand and silt, trace gravel : TILL 58.2 End of Borehole Auger refusal on possible bedrock End of Borehole Auger refusal on possible bedrock	62.66									
61.2 Compact to dense, light brown to grey, sand and silt, trace gravel : TILL 58.2 End of Borehole Auger refusal on possible bedrock End of Borehole Auger refusal on possible 10 14 14 14 14 14 14 14 14 14 14) - 02.00	brown, sand and gravel,			-2 -					No Monitoring We Installed
brown to grey, sand and silt, trace gravel : TILL 	61.2				-4 -		-	SS	24	
58.2 End of Borehole Auger refusal on possible bedrock	2-	brown to grey, sand and			-6-		-	SS	26	
58.2 End of Borehole Auger refusal on possible bedrock -16 -12 -14 -14 -14 -16 -16 -16 -18 -18 -18 -18 -18	-				- 8 -			SS	50	
58.2 End of Borehole Auger refusal on possible bedrock -16- -18- -18- -18- -18- -16- -18- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -16- -	3					·		SS	31	
End of Borehole Auger refusal on possible bedrock	4-							SS	51	
- bedrock	- 50.2	End of Borehole			- ·					
	5 -	Auger refusal on possible bedrock			-16-					
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	-				L .		-			
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CLI	ENT	Robinson Consultants Inc.	12						BOREHOLE No. MW01-
LO	CATION _	LeBretons Flats, ABC Lines, Ot	taw	<u>a, O</u>	ntario	_			PROJECT No. ONO1135
	TES: BOR						01 04	18	DATUM Geodetic
Т						SAI	MPLES		UNDRAINED SHEAR STRENGTH - kPa 50 100 150 200
	ELEVATION (m)		PLOT	WATER LEVEL		_	2		
	ATIO	SOIL DESCRIPTION	STRATA	TER	TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD	WP W WL WATER CONTENT & ATTERBERG LIMITS
5	ELEV		STR	M	۲	NN	REC (n	N-N NO	DYNAMIC PENETRATION TEST, BLOWS/0.3m *
			-	$\left \right $		_			STANDARD PENETRATION TEST, BLOWS/0.3m
₀ ↓	56.08		J.L.						
Ĩ	56.0	TOPSOIL Compact, brown silt and sand,	\boxtimes		AS	1			
-		trace gravel, trace organics, trace			AS	1			
-		clay: FILL							
1 -					SS	2	200	10	
-	54.6		X	Σ					
-		Stiff, grey brown silty clay, trace	\otimes	X I	SS	3	250	11	
2 -	54.0	gravel, trace organics: FILL							
-		Dense, grey brown silty sand and		X					
-		gravel: FILL	\otimes	X	SS	4	200	27	
		Frequent cobbles and boulders		8					
3 -				₹.	SS	5	150	36	
1				8	22	3	150	30	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
				X	SS	6	150	50/	
4 -	52.0	Grey black limestone and shale		8	35	0	150	280 mr	
		boulders	3		NQ	7	100%	63%	
-				1	SS	8	0	50/	
5 -			2		NQ	9	100%	200 mr	
	50.8	¥7. '1	P		μ		+	100%	
-		Void							
6 -	50.1			×					
0	49.8	Compact, black silty sand and gravel, trace organics (wood	×	×	SS	10	300	19	
		chips): FILL	<u>]</u> :			-			
	-	Loose, grey SAND, trace to some	e .		SS	11	510	7	
7 -	48.9	silt and gravel	::			-			
	-	Installed Well							
		End of Borehole							11110 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 111111 111111 11111 11111 <
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-10						_		_	Field Vane Test, kPa

	IENT	Robinson Consultants Inc.			Durtouri					BOREHOLE PROJECT N			
	CATION	LeBretons Flats, ABC Lines, O RING 01 04 06 WAT				5	01 0	4 18		DATUM		Geo	
	ATES: BUI		EKI			SA	MPLES		UNDRAINED SH		H - kPa		
ê	(m)		10	VEL		5/1			50 100) 15	0	2	0
DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	ТҮРЕ	NUMBER	RECOVERY (mm)	N-VALUE OR RQD	WATER CONTENT & ATTERBER DYNAMIC PENETRATION TEST STANDARD PENETRATION TES	, BLOWS/0.3m	W _P	w • *	1 r
0 -	54.65								10 20 30 40	50 60	70	8	0
	54.6	TOPSOIL Loose, brown black silty sand,										1111	-
	53.9	trace gravel, trace to some clay:			AS	1			1111 1111 1111 1111 1111 1 1111 1111 1111 1111 1 1 1 1111 1111 1111 1 1 1 1 1 1111 1111 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
1 -		Loose, grey black silty sand, trace clay, debris (plastic): FILL			SS	2	330	4	- i i i i i i i i i i i i i i i i i i i			1 1 1 1 1 1 1 1	1
2 -	52.5			Ţ	SS	3	400	2					
	52.5	Soft, black peat, some silt, some sand: ORGANICS			SS	4	260	13					
3			1 2 2		SS	5	270	9					
4	51.0	Compact, grey SILTY SAND, some clay, trace gravel			SS	6	530	10					
												1 1 1 1 1 1 1 1	
- 5 -					SS	7	410	16			1 1 1 1 1 1 1 1		
	49.2	Severely fractured, grey							1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			1111	
- 6 -	-	limestone: BEDROCK		I	NQ	8	100%	0%			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 <u> </u>	
- 7 -		21			NQ	9	79%	36%					
	47.2	Installed Well	T	4	┦┦───					1111 1111	1111	1111	╞
- 8 -	-	End of Borehole							1111 1111 1111 1111 1111 1111 1111 111	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1111		
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-10	A-								1111 1111 1111 1111		1111		

	IENT								BOREHOLE No. M	
		LeBretons Flats, ABC Lines,				0	01.0	4 18	PROJECT No. ONC	
DA	TES: BOI	RING01 04 06WA	TER I	EVE	L			4 10	DATUM Ge	
	(iii		15			SA	MPLES		50 100 150	2
DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	түре	NUMBER	RECOVERY (mm)	N-VALUE OR RQD	WP W WATER CONTENT & ATTERBERG LIMITS DYNAMIC PENETRATION TEST, BLOWS/0.3m STANDARD PENETRATION TEST, BLOWS/0.3m	/
	62.63								10 20 30 40 50 60 70	8
0 -	62.6	TOPSOIL Firm, brown silty clay, trace	-		AS	1				
1 -	61.9	gravel, trace organics, trace debris (wood fragments): FILL Firm to stiff, brown grey sandy	-	~~~~~	SS	2	400	10		
		clay, some silt, trace gravel, trace debris (rubber, brick, wood): FILL			SS	3	520	4	$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	1
2									$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
3					SS	4	270	4	1 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 <td>1</td>	1
					SS	5	530	35		
4					SS	6	140	3		
5				XXXXXX	SS	7	90	8		
	57.3	Stiff, grey silty clay, some sand, trace gravel, rock fragments, tra-	ce 🐹		SS	8	170	3		
6 -		debris (wood, plastic) : FILL			SS	9	310	8	- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - <td></td>	
- 7 -					SS	10	440	13		
						11	470	8		
- 8 -		Sand seam			SS	11	4/0	• 	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	
- 9 -	53.6	Compact, grey silty sand, rock			SS	12	470	17		
	52.7	fragments, trace debris (glass, brick, wood): FILL		Ţ	SS	13	460	19		

CLI	ENT	Robinson Consultants Inc.							BOREHOLE No. MW01 PROJECT No. ONO113
LOC	CATION					0	01.0	4 10	Condet
DA	TES: BOP	UNG01 04 06 WAT	TER I	LEVE	EL		010	4 10	UNDRAINED SHEAR STRENGTH - KPa
	Ê		L			SA	MPLES		50 100 150 200
	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD	Wp W WATER CONTENT & ATTERBERG LIMITS Wp W DYNAMIC PENETRATION TEST, BLOWS/0.3m * STANDARD PENETRATION TEST, BLOWS/0.3m
								-	10 20 30 40 50 60 70 80
0 +		Decomposed paper, trace wood		¥	SS	14	540	50/	
-		fragments: FILL						330 mm	0 1111 1 1111 1111 1111 1111 1111 1111
1-	51.5	Few cobbles Auger Refusal at 10.52 m,		XXXXX	SS	15	170	27	
1		hammered spoon, then continued			SS	16	280	50/	
-	51.1	augering Dense, grey SILTY SAND, some						430 mm	H 1111 11 1111 1111 1111 1111 1
2		to trace gravel, trace clay Auger Refusal Inferred Bedrock at 11.55 m Installed Well							
-		End of Borehole							
3-									
-		3							
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-20									Field Vane Test, kPa

] (Robinson Consultants Inc. LeBreton Flats, ABC Lines, (Ottaw	a, C)ntar				NO11359 Geodetic	ORIGINATED BY BC COMPILED BY SS
Da	ATES BO	RING 2001-04-09	WATI	_	EVEI T	2001-04-18 TPC F	_		60.283	CHECKED BYFG
	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	VAPOUR CONCENTRATIONS • %LEL	TYPE	NUMBER	N-VALUE	WELL
	59.45					● 20 40 60 80 ▲ 100 200 300 400		j,		
	59.4	TOPSOIL Loose, dark brown silty sand, trace clay: FILL			2		AS	l	4	Protective Casing a Concrete Seal Bentonite Seal
	58.2	Firm, grey brown silty clay,		0	4	•	SS	2	8	51 mm, #10. Slotted
	57.2	trace gravel, trace debris (brick): FILL			6		SS	3	4	PVC Screen with Sandpack
		Loose, grey black silty sand, trace gravel, trace debris (steel, wood waste): FILL			8	A	SS	4	3	
	56.1	Firm, grey black silty clay, trace debris (brick, glass):			12	▲ ,	SS	5	8	1
	54_9	FILL			14		SS	6	5	
		Compact, grey black silty sand, trace debris (brick, wood waste): FILL			16		SS	7	3	
					18 20	•	SS	8	15	
					20	•	SS	9	8	
					24		SS	10	5	
					26		SS	11	4	
	50.6 50.3	Compact, grey SAND, some gravel, trace silt			28 30		SS	12	50/ 560 mm	
		Auger Refusal			32					
L	ABORAT	ORY ANALYSES Sample MW	1-10 S el), VC	Slus Slus	ubmit PAHs.	ed for laboratory analysis of PCBs. Chloride, Sulphate and Inorganic	1			

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	QUES WH IRONME		ITOR	INC	WELL RECORD				MW01-17
[(IENT CATION ATES BOI	Robinson Consultants Inc. LeBreton Flats, ABC Lines, C RING 2001-08-15	Ottawa, C WATER I			IM		NO11359 Geodetic 67.315	
DEPIH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT WATER LEVEL	DEPTH (ft)	VAPOUR CONCENTRATIONS • %LEL	-	NUMBER	ES N-VALUE	WELL
	66.40				● 20 40 60 80 ▲ 100 200 300 400				
0 -	66.2	200 mm of TOPSOIL/ROOTMAT Compact to dense, brown sand with silt, trace gravel:		2		GS	1		Protective Casing an Bentonite Seal Bentonite Seal
		FILL		4		SS	2	20	Backfill of Auger
				6	•	SS	3	50/300	
				8	•	SS	4	50/250	
				10	▲ · · · · ·	SS	5	17	
	62.6	Loose, brown sand, trace silt, trace gravel, debris (bricks): FILL		12 14	▲	ss	6	5	
				16	•	ss	7	5	
	61.1	Firm, grey clay, some gravel: FILL		18	A	ss	8	4	
	60.3	Compact, grey brown sand, some silt, trace gravel: FILL		20 22		ss	9	23	
				24		ss	10	22	
				26	•	SS	11	12	Bentonite Seal
				28	A	ss	12	3	51 mm, #10, PVC Casing, with Sandr
				30 32		ss	13	26	51 mm, #10, Slotte PVC Screen with Sandpack

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L O	IENT CATION ATES BOI	Robinson Consultants Inc. LeBreton Flats, ABC Lines, RING 2001-08-15	Ottaw WATI			0 DATU	PM ELEV	(4011359 Teodetic 57.315	
	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	VAPOUR CONCENTRATIONS • %LEL	SA B L L	NUMBER	ES N-VALUE	WELL
0 +	66.40		655	q		20 40 60 80 ▲ 100 200 300 400				1911
1				4 0 C C C C C C C C C C C C C C C C C C	34 36		SS SS	14 15	33 25	
2	54.2				38		ss	16	31	
3	53.5	Stiff, grey brown silty clay, organics, debris (wood): FILI Compact, grey sand, some silt, trace clay, trace gravel, occasional rock fragments and			40 42 44		ss ss	17	50 22	fand -
4		debris : FILL			46		SS	19	6	
5					48 50		SS	20	50/430	
5	50.6	Dense, grey SILTY SAND, some gravel			52		SS	21	35	
	49.8	End of Borehole		1	54		SS	22	61	
,		Auger Refusal on Inferred Bedrock			56					
3		Installed Well			60					
9					62					
					64					

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PT (N) V ynamic (Cone Test	. ×	Pro		ct_Geo								wg. No	19
helby Tu	be	0	 5					ostruct	ure and	d Reha	bilatio	n Proj		
ock Core ield Vane	% Strain at Fallure	10	-	(Ottawa	a, Ont	ario				Projec	ct No.	MA1	5510A
Vater Lev	rel: Est.: 🛛 Measured: 🗴 Perched	d: ¥	Во	rel	hole La	catio	n Refe	r to Di	awing	No. 1				
G Y			Geodetic	D			N Valu	e		Natu		sture C	ontent	Natu
	Soil Description		Elev. m 58.1	epth 0	2 Shear	0 4 Streng	10 E gth	50 8	30		Atterbe % Dry	nd rg Limit Weight 20 3	ts t 30	Uni Weig KN/I
	TOPSOIL ~ 75mm FILL Silty sand with some gravel,				O									
	 trace concrete and brick pieces, occasional cobbles and boulders, 	-												
	grey, wet (compact) -	_		1										
													·····	
	_	_		2	O									
														1
	-	-											·····	
1 1 2	<u>HIL</u> Silty sand and gravel,	~~	55.1	3										
	 occasional cobbles and boulders, some clay , moist, grey to dark 				Ò									
	grey (loose to compact)	-1												2
	-	_		4										77
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	-			7										
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	-Sand blow-up into augers from 8.2 to 7.2m depth													
	, 	-		8		<u>-iO</u> -								
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				9										77
KV)	_					Õ								
														2
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$ K \rangle$														

NOILENAIL A.63	Robinson Consultants Inc. Lemieux Island Low Pressure UNG 05-30-03 STRATA DESCRIPTION 100 mm ASPHALT Granulars Compact to loose, grey to brown sand and gravel, some brick, some wood: FILL	STRATA PLOT			•	(CON %LE 20	06-26 VAPC CENT	-03 DUR RATIC	DATU TPC I	JM ELEV.	(Geodeti 54.55	9-4 ORIGINATED BY C COMPILED BY JF CHECKED BY C WELL CONSTRUCTION Protective Casing Bentonite Seal
S: BOR NOLLANI 34.63 54.5 54.4	STRATA DESCRIPTION 100 mm ASPHALT Granulars Compact to loose, grey to brown sand and gravel, some	STRATA PLOT	WATER LEVEL	EVEL (t) HLdBO	•	(CON %LE 20	06-26 VAPC CENT	-03 DUR RATIC	DNS ppmv 80	SA Bd AL GS	NUMBER NUMBER	N-VALUE	WELL CONSTRUCTION
NOLUCIE 54.63 54.5 54.4	STRATA DESCRIPTION 100 mm ASPHALT Granulars Compact to loose, grey to brown sand and gravel, some			-2-	•	CON %LE	CENT	RATIC	ppmv 80	В GS	NUMBER 1	N-VALUE	CONSTRUCTION
54.63 54.5 54.4	100 mm ASPHALT Granulars Compact to loose, grey to brown sand and gravel, some			-2-	•	CON %LE	CENT	RATIC	ppmv 80	GS	1		CONSTRUCTION
54.5 54.4	Granulars Compact to loose, grey to brown sand and gravel, some			- 4 -		20 100							
54.5 54.4	Granulars Compact to loose, grey to brown sand and gravel, some			- 4 -									
51.0	brown sand and gravel, some		N N N N N N N N N N N N N N N N N N N	- 4 -						SS	2	21	
51.0	12		, V							1	2	21	Bentonite Seal
51.0			****	- 6						SS	3	9	51 mm, Schedule
51.0			XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX							SS	4	6	Sandpack Protective Casing Concrete Seal
51.0			×	- 8						SS	5	7	
51.0			XXXXX	-10						SS	6	7	
	Very loose, sandy gravel, trace organics, wood: FILL	- 👹		-12						SS	7	3	
50.4	Very loose to compact, grey clay, trace gravel, wood: FILL	- 💥		-14						SS	8	2	
			CXXXXX	-16						SS	9	15	
49.1	Compact to dense, grey silty			-18						1			
	sand, some clay: GLACIAL TILL			-20	-					1-			Backfill of Auger
				-22						- SS	11	50/	Cuttings
47.4	End of Borehole	Pl	4	-24	-	-				-		80mm	d XXX
	Auger Refusal on Inferred			-	-								
				-						-			
				-						-			
				-									
				-32	1								
A.E	BORA	sand, some clay: GLACIAL TILL 47.4 End of Borehole Auger Refusal on Inferred Bedrock Monitoring Well Installed BORATORY ANALYSES: MW03-22 VOCs. M Groundwater Level Groundwa	sand, some clay: GLACIAL TILL 47.4 End of Borehole Auger Refusal on Inferred Bedrock Monitoring Well Installed BORATORY ANALYSES: MW03-22 SS8 su VOCs. MW03-22 for analysis of gg Groundwater Level	sand, some clay: GLACIAL TILL 47.4 End of Borehole Auger Refusal on Inferred Bedrock Monitoring Well Installed BORATORY ANALYSES: Groundwater Level MW03-22 SS8 submitt VOCs. MW03-22 SS8 Groundwater sample so	sand, some clay: GLACIAL TILL -20 -22 47.4 End of Borehole -24 Auger Refusal on Inferred Bedrock -26 Monitoring Well Installed -28 -30 -32 BORATORY ANALYSES: MW03-22 SS8 submitted for VOCs. MW03-22 SS8 submitted for VOCS submitted for VOCS	47.4 47.4 End of Borehole Auger Refusal on Inferred Bedrock Monitoring Well Installed 30 32 BORATORY ANALYSES: MW03-22 SS8 submitted for analysis YOCs. MW03-22 SS8 submitted for analysis for analysis of general increasing for analysis	sand, some clay: GLACIAL TILL 47.4 End of Borehole Auger Refusal on Inferred Bedrock Monitoring Well Installed 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 31 32	sand, some clay: GLACIAL TILL 47.4 End of Borehole Auger Refusal on Inferred Bedrock Monitoring Well Installed 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 3	sand, some clay: GLACIAL TILL 47.4 End of Borehole Auger Refusal on Inferred Bedrock Monitoring Well Installed 30 30 30 32 BORATORY ANALYSES:	sand, some clay: GLACIAL TILL 47.4 End of Borehole Auger Refusal on Inferred Bedrock Monitoring Well Installed 30 30 30 30 30 30 30 30 30 30 30 30 30 32	sand, some clay: GLACIAL 20 SS TILL 22 SS 47.4 End of Borehole 24 Auger Refusal on Inferred 26 Bedrock 28 30 30 30 30 32 SS submitted for analysis of BTEX, TPH (g, d, ho), and VOCs, MW03-22 SS6 submitted for PAHs. MW03-22 SS2 submitted for analysis of BTEX, TPH (g, d, ho), and VOCs, MW03-22 SS6 submitted for PAHs. MW03-22 SS2 submitted for analysis of BTEX, TPH (g, d, ho), and VOCs, MW03-22 SS6 submitted for PAHs. MW03-22 SS2 submitted for analysis of BTEX, TPH (g, d, ho), and VOCs, MW03-22 SS6 submitted for PAHs. MW03-22 SS2 submitted for participancies	sand, some clay: GLACIAL 20 SS 10 TILL 20 SS 11 47.4 End of Borehole SS 12 Auger Refusal on Inferred Bedrock 26 SS 12 Monitoring Well Installed 28 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30	Ar.4 Ar.4 Auger Refusal on Inferred Bedrock Monitoring Well Installed BORATORY ANALYSES: MW03-22 SS8 submitted for analysis of BTEX. TPH (g, d, ho), and YOCs. MW03-22 SS8 submitted for analysis of BTEX. TPH (g, d, ho), and YOCs. MW03-22 SS8 submitted for PAHs. MW03-22 SS2 submitted for analysis of BTEX. TPH (g, d, ho), and YOCs. MW03-22 SS8 submitted for PAHs. MW03-22 SS2 submitted for analysis of BTEX. TPH (g, d, ho), and YOCS. MW03-22 SS8 submitted for PAHs. MW03-22 SS2 submitted for analysis of BTEX. TPH (g, d, ho), and YOCS. MW03-22 SS8 submitted for PAHs. MW03-22 SS2 submitted for analysis of BTEX. TPH (g, d, ho), and YOCS. MW03-22 SS8 submitted for PAHs. MW03-22 SS2 submitted for analysis of BTEX. TPH (g, d, ho), and YOCS. MW03-22 SS8 submitted for PAHs. MW03-22 SS2 submitted for analysis of BTEX. TPH (g, d, ho), and YOCS. MW03-22 SS8 submitted for PAHs. MW03-22 SS2 submitted for analysis of BTEX. TPH (g, d, ho), and YOCS. MW03-22 SS8 submitted for PAHs. MW03-22 SS2 submitted for analysis of BTEX. TPH (g, d, ho), and YOCS. MW03-22 SS8 submitted for PAHs. MW03-22 SS2 submitted for analysis of BTEX. TPH (g, d, ho), and YOCS. MW03-22 SS8 submitted for PAHs. MW03-22 SS2 submitted for analysis of BTEX. TPH (g, d, ho), and YOCS. MW03-22 SS8 submitted for PAHs. MW03-22 SS2 submitted for analysis of appendix interesting.

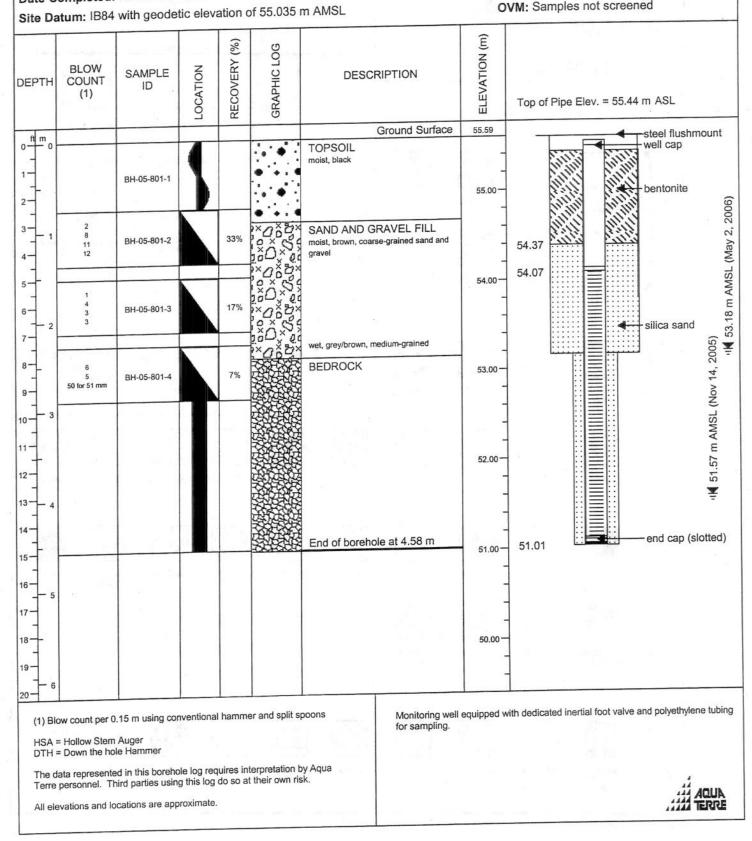
JACQ ENVI	UES WH RONMEN	ITFORD VT LIMITED MONI	го	RI	ING	WEI	LLF	REC	ORD				MW03-23	
CLI	ENT	Robinson Consultants Inc.								ECT No	ON	011359	9-4 ORIGINATED BY CM/EI	
LO	CATION	Lemieux Island Low Pressure	Trar	ısmi	issior	n Main, C)ttawa	, ON	DATU	JM		Geodeti		
DA	TES: BOF	RING 05-30-03 V	VATI	ER LI	EVEL		06-20	5-03	TPC H	ELEV.		55.669	CHECKED BY CM	
(m)	TION		PLOT	LEVEL	H (ft)	<u> </u>	VAP	IONS		MPL	-	WELL		
DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH	● %L	EL.	•	ppmv	ТҮРЕ	NUMBER	N-VALUE	CONSTRUCTION	
0	55.76					 ● 20 ▲ 100 	40 200	60 300	80 400				Destative Casing and	
	55.7 55.6	100 mm ASPHALT Grey sand and gravel: FILL Compact, brown sand: FILL		A A A A	- 2 -					GS	1		Bentonite Seal	
- 1 -	54.5	Compact, brown sand. The		*****						SS	2	12	Bentonite Seal	
- 1		Compact, grey sand, brick, wood: FILL Dense to loose, brown to grey sand and gravel: FILL		(TXXXXX	- 4 -					SS	3	29	51 mm, Schedule 40, PVC Casing, with Auger Cuttings	
2	53.9			XLXXXXX	- 6 -					SS	4	45	Auger Cuttings	
				×××××	- 8 -					SS	5	5		
3					-10					SS	6	11		
- 4 -	52.1	Loose to very loose, grey gravel, some sand, some rock fragments: FILL	- 💥		-12					SS	7	8		
4					-14	-				SS	8	3		
- 5 -						-16					SS	9	3	
					-18					SS	10	7		
- 6 -	49.7	Loose to compact, grey silty			-20									
		sand: GLACIAL TILL			-22					SS	11	6		
- 7 -					-24			•		SS	12	14		
- 8 -	48.1	Compact to dense, grey to brown silty sand, trace gravel:			-26					SS	13	32		
9		GLACIAL TILL			-28					SS SS	14 15	70 50/		
- 9 -				1	-30					- 00	15	100mr	n	
	46.0				-32								Bentonite Seal	
-10 -		and general	/03-2 inorg	3 SS3 anics	tted fo submi	r analysis of tted for ana	lysis of l	Regulati	, d, ho), and ion 347, PAH 'H (g, d, ho),	s		1	A-	

ſ		UES WH	ITFORD NT LIMITED MON	ТС	R	INC	G WEI	LI	REC	ORD				MW03-23
	CL	ient	Robinson Consultants Inc.						101-		ECT No			9-4_ORIGINATED BYCM/EK
	LO	CATION	Lemieux Island Low Pressure										Geodeti 55.669	
-	DA	TES: BOI	RING 05-30-03	WATI		EVEL		06-2	6-03	TPC I	ELEV.	AMPI		
	DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	CO • %L	NCEN	OUR TRATI	ONS ppmv	ТҮРЕ	NUMBER	N-VALUE	WELL
		55.76					● 20 ▲ 100	40 200	60 300	80 400				
	-10 -	55.10	Poor to good, light grey limestone with occasional shale interbeds: BEDROCK			-34 -		200			HQ	16	49 %	PVC Casing, with Sandpack
	-11		shale interbeds. BEDRUCK			-36					HQ	17	80 %	51 mm, Schedule 40, slot #10, PVC Screen with Sandpack
		44.0				-38								
5.0	-12-		End of Borehole Monitoring Well Installed			-40								
01.7	-13-					42								
						-44					-			
4	-14					46					-			
						-48	-				-			
	-15					-50	-							
	-16-					-52					-			
						-54					-			
	-17-					-56					-			
	-18-					-58								
- 20	10					-60								
TT aurorated	-19-					62								
						-64								
JWEL , JWEL	- 20 -		VOCs. M	W03-2. al inorg ter sam	3 SS3 anics ple si	submi	d for analys	ysis of	Regulati	d, ho), and on 347, PAH H (g, d, ho),	ls	_		A-

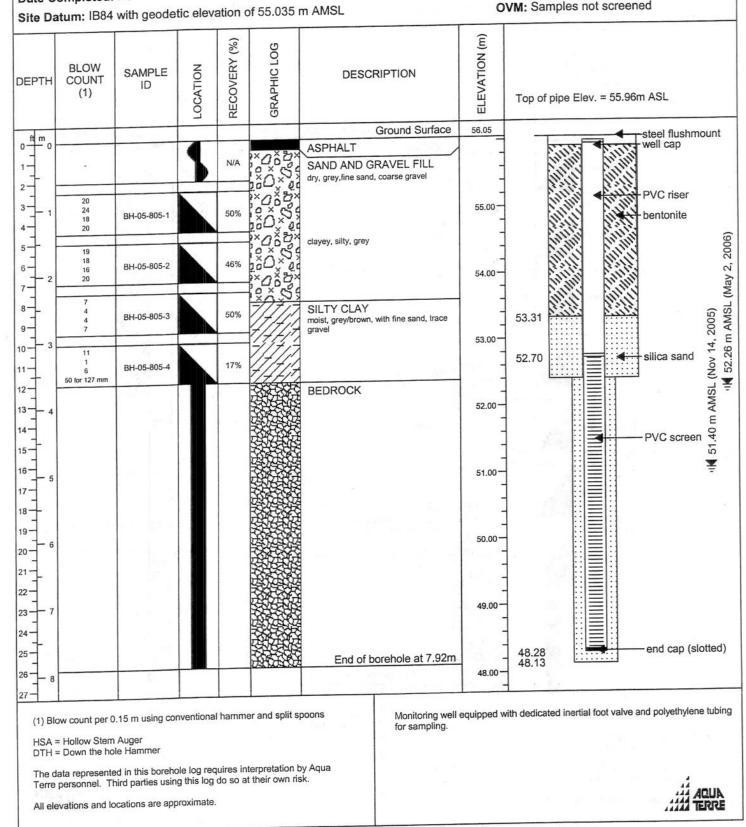


Page 1 of 1

Project No.: 97-142H Client: National Capital Commission Location: LeBreton Flats, Ottawa Date Completed: November 2, 2005 ATSI Supervisor: S.Dingee Drilling Method: HSA/DTH Borehole Diameter: 203 mm/102 mm Monitoring Well Diameter: 51 mm Drilling Company: Downing Drilling Ltd. Drilling Equipment: CME 55 Truck Well Casing: PVC Schedule 40 Well Screen: PVC Schedule 40, Slot 10 OVM: Samples not screened



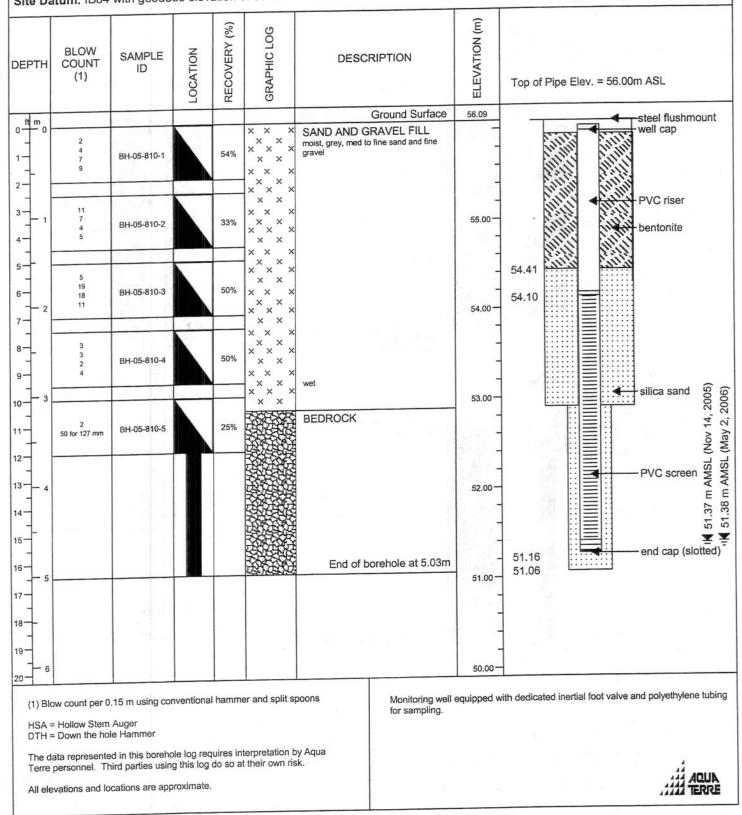
Project No.: 97-142H Client: National Capital Commission Location: LeBreton Flats, Ottawa Date Completed: November 2, 2005 ATSI Supervisor: S.Dingee Drilling Method: HSA/DTH Borehole Diameter: 204 mm/102mm Monitoring Well Diameter: 51 mm Drilling Company: Downing Drilling Ltd. Drilling Equipment: CME 55 Truck Well Casing: PVC Schedule 40 Well Screen: PVC Schedule 40, Slot 10 OVM: Samples not screened



Page 1 of 1

Project No.: 97-142HATSI SupervisoClient: National Capital CommissionDrilling Method:Location: LeBreton Flats, OttawaBorehole DiameDate Completed: November 7, 2005Monitoring WellSite Datum: IB84 with geodetic elevation of 55.035 m AMSL

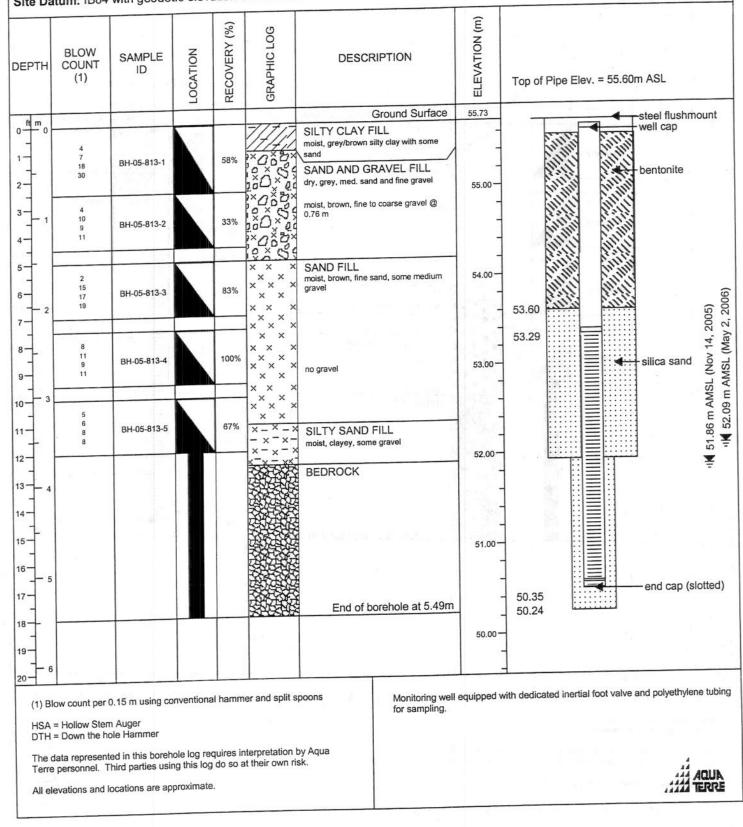
ATSI Supervisor: S.Dingee Drilling Method: HSA/DTH Borehole Diameter: 204 mm/102 Monitoring Well Diameter: 51 mm Drilling Company: Downing Drilling Ltd. Drilling Equipment: CME 45 Track Well Casing: PVC Schedule 40 Well Screen: PVC Schedule 40, Slot 10 OVM: Samples not screened



Page 1 of 1

Project No.: 97-142HATSI SupervisorClient: National Capital CommissionDrilling Method:Location: LeBreton Flats, OttawaBorehole DiameDate Completed: November 7, 2005Monitoring WellSite Datum: IB84 with geodetic elevation of 55.035 m AMSL

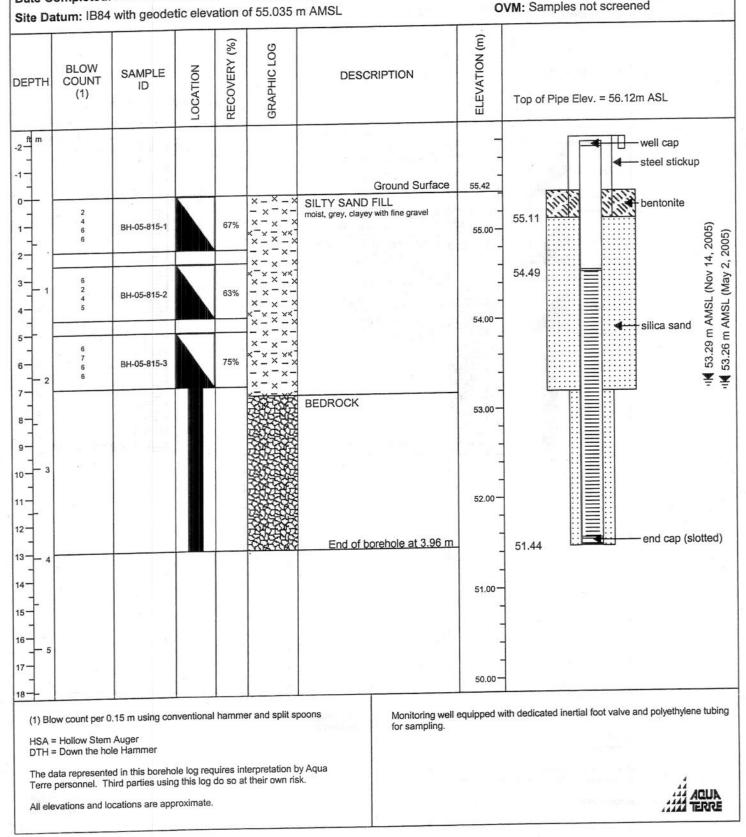
ATSI Supervisor: S.Dingee Drilling Method: HSA/DTH Borehole Diameter: 203 mm/102 mm Monitoring Well Diameter: 51 mm Drilling Company: Downing Drilling Ltd. Drilling Equipment: CME 45 Track Well Casing: PVC Schedule 40 Well Screen: PVC Schedule 40, Slot 10 OVM: Samples not screened



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Project No.: 97-142H Client: National Capital Commission Location: LeBreton Flats, Ottawa Date Completed: November 9, 2005 ATSI Supervisor: S.Dingee Drilling Method: HSA/DTH Borehole Diameter: 203 mm/102 mm Monitoring Well Diameter: 51 mm Drilling Company: Downing Drilling Ltd. Drilling Equipment: CME 45 Track Well Casing: PVC Schedule 40 Well Screen: PVC Schedule 40, Slot 10 OVM: Samples not screened



Page 1 of 1

51.53 m AMSL (Nov 14, 2005)

¥

T

well cap

bentonite

PVC riser

PVC screen

silica sand

end cap (slotted)

51.51 m AMSL (May 2, 2005)

Drilling Company: Downing Drilling Ltd. ATSI Supervisor: S.Dingee Project No.: 97-142H Drilling Equipment: CME 45 Track Drilling Method: HSA/DTH Client: National Capital Commission Well Casing: PVC Schedule 40 Borehole Diameter: 204 mm/102mm Location: LeBreton Flats, Ottawa Well Screen: PVC Schedule 40, Slot 10 Monitoring Well Diameter: 51 mm Date Completed: November 8, 2005 OVM: Samples not screened Site Datum: IB84 with geodetic elevation of 55.035 m AMSL EVATION (m) (%) **GRAPHIC LOG** RECOVERY BLOW LOCATION SAMPLE DESCRIPTION COUNT DEPTH ID (1) Top of Pipe Elev. = 52.80m ASL ᆸ ft m Ground Surface 52.60 0 TOPSOIL moist, dark brown 52.30 47 BH-05-819-1 71% SILTY CLAY FILL 1-12 moist, grey/brown, with sand × X 52.00 2 SAND FILL moist, brown, med. to fine SHALE AND GRAVEL 7 3 12 25% BH-05-819-2 moist, grey/black shale and grey, 7 coarse gravel 4 BOULDER FILL 51.00 5 wet, grey/brown, clay infill 6 7 8 50.00 9. 10 11 End of borehole at 3.66m 49.00 12 13 14 48.00 15 16 5 17 18 47.00 19-Monitoring well equipped with dedicated inertial foot valve and polyethylene tubing (1) Blow count per 0.15 m using conventional hammer and split spoons for sampling HSA = Hollow Stem Auger DTH = Down the hole Hammer The data represented in this borehole log requires interpretation by Aqua Terre personnel. Third parties using this log do so at their own risk. All elevations and locations are approximate.

Borehole Number: BH06-6/MW06-6

Project Number: 05-215-20

Client: National Capital Commission

Site Location: Municipal Lands

Coordinates: MTM NAD83 - 366010 E, 5030649 N

Drilling Method: Hollow stem auger with split spoon

MOE Well ID: A029553

Date Completed: June 20, 2006 Supervisor: ADG/TLJ

Ground Surface Elevation: 54.96 mASL

DEPTH BGS	SAMPLES	LAB SAMPLE	BLOW COUNT	CGI (ppm)	PID (ppm)	LOG	STRATIGRAPHIC DESCRIPTION	INSTALLATION
ft m -4 -3 -4 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 <td></td> <td></td> <td>4 12 15 20 5 9 10 8 2 4 6 18 7 11 1 5 12 6 4</td> <td>055000000000000000000000000000000000000</td> <td></td> <td></td> <td>GROUND SURFACE FILL Topsoil near surface, underlain by dark brown silty sand fill with trace gravel. Dry, no odour. Brown silt and sand fill with brick fragments and minor iron staining. Slightly moist, no odour. Brown silt and sand fill. Dry, no odour. 9 cm of black slag fill with rock fragments at 2.1 mBGS. Moist, no odour. Dark brown silt and sand fill with trace gravel and roots. Wet, no odour.</td> <td>51 mm diameter PVC screen 51 mm diameter PVC riser Silica sand Water level @ 2.1 mBGS</td>			4 12 15 20 5 9 10 8 2 4 6 18 7 11 1 5 12 6 4	055000000000000000000000000000000000000			GROUND SURFACE FILL Topsoil near surface, underlain by dark brown silty sand fill with trace gravel. Dry, no odour. Brown silt and sand fill with brick fragments and minor iron staining. Slightly moist, no odour. Brown silt and sand fill. Dry, no odour. 9 cm of black slag fill with rock fragments at 2.1 mBGS. Moist, no odour. Dark brown silt and sand fill with trace gravel and roots. Wet, no odour.	51 mm diameter PVC screen 51 mm diameter PVC riser Silica sand Water level @ 2.1 mBGS
Page 1	1 of 2							INCERA

Borehole Number: BH06-6/MW06-6

Project Number: 05-215-20

Client: National Capital Commission

Site Location: Municipal Lands

Coordinates: MTM NAD83 - 366010 E, 5030649 N

Drilling Method: Hollow stem auger with split spoon

MOE Well ID: A029553

Date Completed: June 20, 2006 Supervisor: ADG/TLJ Ground Surface Elevation: 54.96 mASL

BLOW COUNT LAB SAMPLE SAMPLES CGI (ppm) PID (ppm) STRATIGRAPHIC DESCRIPTION INSTALLATION LOG 0 1 0 1 0 Borehole terminated at 4.6 mBGS. BOREHOLE TERMINATED Depth of MW06-6 = 4.6 mBGS 5 6 - 7 8 9



Borehole Number: BH06-7/MW06-7

Project Number: 05-215-20

Client: National Capital Commission

Site Location: Municipal Lands

Coordinates: MTM NAD83 - 365882 E, 5030604 N

Drilling Method: Hollow stem auger with split spoon

MOE Well ID: A029553

Date Completed: June 20, 2006 Supervisor: ADG/TLJ Ground Surface Elevation: 55.24 mASL

BLOW COUNT LAB SAMPLE DEPTH BGS SAMPLES CGI (ppm) PID (ppm) STRATIGRAPHIC DESCRIPTION INSTALLATION LOG ft m -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 3 4Stick-up casing Native soil **GROUND SURFACE** 0 3 FILL 5 Brown topsoil. 0 10 Grey/brown silt and sand fill with trace gravel. 12 Slightly moist, no odour. Bentonite 4 @ 2.5 mBGS 10 1 0 9 7 mm diameter PVC riser 3 Water level 7 Brown silt and sand fill with black slag, brick and 10 203 mm diameter borehole gravel. Slightly moist, no odour. 13 2 9 A. H П 50 0 Dark brown silt and sand fill. Dry, no odour. mm diameter PVC screen -51 3 10 11 Dark brown silt and sand fill with black slag fragments. Wet, no odour. 10 18 ŧ 0 11 18 1 76 50 12 Silica sand Grey and black sand with rock fragments. 51-7 13 4 16 0 23 14 13 Page 1 of 2

Borehole Number: BH06-7/MW06-7

Project Number: 05-215-20

Client: National Capital Commission

Site Location: Municipal Lands

Coordinates: MTM NAD83 - 365882 E, 5030604 N

Drilling Method: Hollow stem auger with split spoon

MOE Well ID: A029553

Date Completed: June 20, 2006 Supervisor: ADG/TLJ Ground Surface Elevation: 55.24 mASL

DEPTH BGS	SAMPLES	LAB SAMPLE	BLOW COUNT	CGI (ppm)	PID (ppm)	DOG	STRATIGRAPHIC DESCRIPTION	INSTALLATION
15 							Borehole terminated at 4.6 mBGS.	
							BOREHOLE TERMINATED	Depth of MW06-7 = 4.6 mBGS
16 5								
17								
18								
19								
20								
21								
22								
23 7								
24								
25								
26								
20 - 8 27 - 8								
28								
29 - 9								
29 11 30 11 11 11 11 11								
31 31 32								
32-								
Page 2	2 of 2							INCERA

Borehole Number: BH06-9/MW06-9

Project Number: 05-215-20

Client: National Capital Commission

Site Location: Municipal Lands

Coordinates: MTM NAD83 - 365843 E, 5030527N

Drilling Method: Hollow stem auger with split spoon

MOE Well ID: A029553

Date Completed: June 21, 2006 Supervisor: ADG/SNG Ground Surface Elevation: 61.58 mASL

BLOW COUNT LAB SAMPLE DEPTH BGS SAMPLES CGI (ppm) PID (ppm) STRATIGRAPHIC DESCRIPTION INSTALLATION LOG Stick-up Casing **GROUND SURFACE** 0 FILL 9 Brown topsoil. 50 0 203 mm diameter borehole Brown silty sand fill with organic material near surface. Dry, no odour. Brown silty sand fill with some clay and trace gravel. 7 Moist, no odour. 21 0 15 11 7 Dark brown sand and gravel fill. Dry, no odour. 14 2 10 2 6 mm diameter PVC Riser Brown silty sand fill with trace gravel. Dry, no odour. 5 7 0 10 Native Soil 10 3 8 24 Grey silt fill with some clay. Moist, no odour. 3 9 5 2 Black sand fill with some silt and gravel. Wet, landfill odour. Page 1 of 3

Borehole Number: BH06-9/MW06-9

Project Number: 05-215-20

Client: National Capital Commission

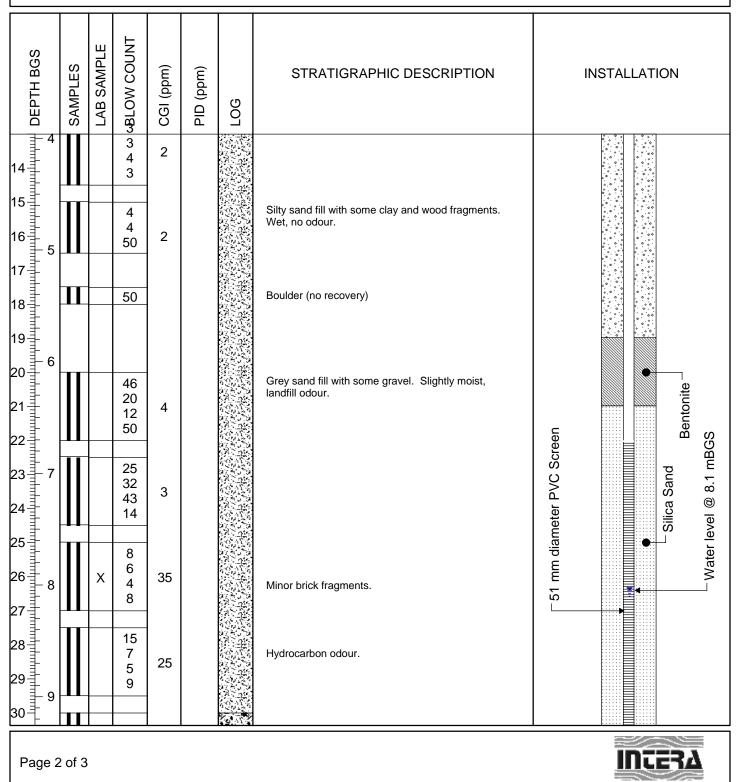
Site Location: Municipal Lands

Coordinates: MTM NAD83 - 365843 E, 5030527N

Drilling Method: Hollow stem auger with split spoon

MOE Well ID: A029553

Date Completed: June 21, 2006 Supervisor: ADG/SNG Ground Surface Elevation: 61.58 mASL



Borehole Number: BH06-9/MW06-9

Project Number: 05-215-20

Client: National Capital Commission

Site Location: Municipal Lands

Coordinates: MTM NAD83 - 365843 E, 5030527N

Drilling Method: Hollow stem auger with split spoon

MOE Well ID: A029553

Date Completed: June 21, 2006 Supervisor: ADG/SNG Ground Surface Elevation: 61.58 mASL

DEPTH BGS	SAMPLES	LAB SAMPLE	BLOW COUNT	CGI (ppm)	PID (ppm)	LOG	STRATIGRAPHIC DESCRIPTION	INSTALLATION
□ 31 32 33 34 35 36 36 36 36 36 36 36 36 36 37 36 36 37 36 41 37 40 41 41 42 41 41 41 41 41 41 41 41 41 41			2 1 1 1	50			Sandy fill with glass and paper debris. Wet, landfill odour. Borehole terminated at 9.8 mBGS. BOREHOLE TERMINATED	Depth of MW06-9 = 9.8 mBGS
47-								
Page	R of 3							INCERA



Borehole Number: BH06-10/MW06-10

Project Number: 05-215-20

Client: National Capital Commission

Site Location: LeBreton Flats

Coordinates: MTM NAD83 - 365965 E, 5030592 N

Drilling Method: Hollow stem auger with split spoon

MOE Well ID: A029553

Date Completed: June 21, 2006 Supervisor: ADG

Ground Surface Elevation: 55.56 mASL

DEPTH BGS	SAMPLES	LAB SAMPLE	BLOW COUNT	CGI (ppm)	PID (ppm)	LOG	STRATIGRAPHIC DESCRIPTION	INSTALLATION
$ \begin{array}{c} - \\ \hline ft \\ -3 \\ -2 \\ -1 \\ 0 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ $			6 22 30 38 19 48 41 36 5 5 12 7 3 6 3 3 6 6 3 3 7 7 8 5 8 22	0 0 0 20 0			GROUND SURFACE FILL Brown sandy topsoil underlain by brown silt and sand fill with trace gravel and brick fragments. Dry, no odour. Grey/brown silty sand fill with gravel and cobbles. Dry, no odour. Grey and black silty sand fill with gravel and wood debris. Dry, no odour. Grey/brown silty sand fill with trace wood debris. Dry, no odour. Grey/brown silty sand fill with trace wood debris. Dry, no odour. Sand fill with garbage, paper, and plastic. Dry, landfill odour. Brown/black silty sand fill with wood debris. Moist, landfill odour.	51 mm diameter PVC Screen Bentonite Stick-up Casing 51 mm diameter PVC Riser 51 mm diameter PVC Riser 7 0 Mative Soil 1 Mative Soil 1 Water level @ 2.8 mBGS
Page	1 of 2							INCERA

Borehole Number: BH06-10/MW06-10

Project Number: 05-215-20

Client: National Capital Commission

Site Location: LeBreton Flats

Coordinates: MTM NAD83 - 365965 E, 5030592 N

Drilling Method: Hollow stem auger with split spoon

MOE Well ID: A029553

Date Completed: June 21, 2006 Supervisor: ADG Ground Surface Elevation: 55.56 mASL

DEPTH BGS	SAMPLES	LAB SAMPLE	BLOW COUNT	CGI (ppm)	PID (ppm)	DOG	STRATIGRAPHIC DESCRIPTION	INSTALLATION
15 16 17			23 11 3 1	0			Grey clay fill with trace silt and gravel. Wet.	Silica Sand
18 19 19			3 9 14 15	0			SAND Grey sand fill with silt seams. Wet, no odour. Borehole terminated at 6.1mBGS.	
18 19 20 21 22 23 7						<u></u>	BOREHOLE TERMINATED	Depth of MW06-10 = 6.1 mBGS
23 1 7 24 1	,							
24 25 26 26 27	5							
27 28 29 11 29	,							
29								
Page	2 of 2)						INCEBA



Borehole Number: BH06-11/MW06-11

Project Number: 05-215-20

Client: National Capital Commission

Site Location: Municipal Lands

Coordinates: MTM NAD83 - 365928 E, 5030683 N

Drilling Method: Hollow stem auger with split spoon

MOE Well ID: A029553

Date Completed: June 21, 2006 Supervisor: ADG

Ground Surface Elevation: 56.80 mASL

DEPTH BGS	SAMPLES	LAB SAMPLE	BLOW COUNT	CGI (ppm)	PID (ppm)	LOG	STRATIGRAPHIC DESCRIPTION	INSTALLATION
$ \begin{array}{c} ft \\ -4 \\ -3 \\ -2 \\ -1 \\ 0 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ $			$ \begin{array}{c} 7\\ 11\\ 50\\ \hline 16\\ 14\\ 22\\ 27\\ \hline 1\\ 5\\ 10\\ \hline 6\\ 9\\ 6\\ 10\\ \hline 4\\ 4\\ 21\\ 19\\ \hline 20\\ 50\\ \hline \end{array} $	0 0 0 0 0			GROUND SURFACE FILL Brown sand fill with gravel and brick. Dry, no odour.	51 mm diameter PVC screen 51 mm diameter PVC riser 51 mm diameter PVC riser 203 mm diameter borehole Water level @ 4 mBGS
Page 1	l of 2							INTERA

Borehole Number: BH06-11/MW06-11

Project Number: 05-215-20

Client: National Capital Commission

Site Location: Municipal Lands

Coordinates: MTM NAD83 - 365928 E, 5030683 N

Drilling Method: Hollow stem auger with split spoon

MOE Well ID: A029553

Date Completed: June 21, 2006 Supervisor: ADG Ground Surface Elevation: 56.80 mASL

DEPTH BGS	SAMPLES	LAB SAMPLE	BLOW COUNT	CGI (ppm)	PID (ppm)	LOG	STRATIGRAPHIC DESCRIPTION	INSTALLATION
15 16 16 17 18 19 19 19 19 19 19 19 19 10 19 10 10 10 10 10 10 10 10 10 10 10 10 10			1 9 5 50	0			Gravel fill with minor sand. Wet, no odour.	Silica sand
18 19 19 20							Borehole terminated at 5.6 mBGS. BOREHOLE TERMINATED	Depth of MW06-11 =5.6 mBGS
21 22 22 23 7								
24 25								
20 27 28								
29 30 31 31 32								
Page 2	2 of 2							INTERA

Borehole Number: BH/MW06-35

Project Number: 05-215-23

Client: National Capital Commission

Site Location: Southern LeBreton Flats

Coordinates: MTM NAD83 - 366650 E, 5030786 N

Drilling Method: Hollow stem auger with split spoons

MOE Well ID: A029553

Date Completed: August 2, 2006

Supervisor: TLJ

Ground Surface Elevation: 62.608 mASL

DEPTH BGS	SAMPLES	LAB SAMPLE	BLOW COUNT	CGI (ppm)	PID (ppm)	LOG	STRATIGRAPHIC DESCRIPTION		INSTALLATION
$ \begin{array}{c} \text{ft} & \text{m} \\ -4 \\ -3 \\ -2 \\ -1 \\ 0 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ $			2 4 6 6 5 8 5 5 5 1 2 4 3 10 9 12 4 10 9 8 2 3 10 15 4 8	0 40 30 20 30 25 20			GROUND SURFACE FILL Brown topsoil underlain with brown silty sand fill. Dry, no odour. Brown silty sand fill with gravel and bricks. Dry, no odour. Brown to grey silty sand fill with clay and gravel. Slightly wet, no odour. Brown and grey silty sand fill with gravel. Dry, no odour. TILL Grey clayey silt till with gravel. Moist, no odour. Grey clayey silt till with gravel. Moist, no odour. Grey clayey silt till with gravel. Moist, no odour.	203 mm diameter borehole 7	51 mm diameter PVC riser Bentonite Water level at 1.60 mBGS
Page 1	of 2								INTERA

Borehole Number: BH/MW06-35

Project Number: 05-215-23

Client: National Capital Commission

Site Location: Southern LeBreton Flats

Coordinates: MTM NAD83 - 366650 E, 5030786 N

Drilling Method: Hollow stem auger with split spoons

MOE Well ID: A029553

Date Completed: August 2, 2006

Supervisor: TLJ

Ground Surface Elevation: 62.608 mASL

DEPTH BGS	SAMPLES	LAB SAMPLE	BLOW COUNT	CGI (ppm)	PID (ppm)	LOG	STRATIGRAPHIC DESCRIPTION	INSTALLATION
Industry 5 17 18 19 20 21 11 22 23 24 25 26 27 26 27 28 29 30 31 32 33 34 35 36 36			50 50 15 30 50 22 50 50	20 5 25 			Grey till with gravel. Dry, no odour. Grey sandy till with gravel. Dry, no odour. Borehole terminated at 8.22 mBGS. BOREHOLE TERMINATED	Depth of MW06-35 = 8.22 mBGS
Page 2	2 of 2	2						INCERA

Borehole Number: BH/MW06-36

Project Number: 05-215-23

Client: National Capital Commission

Site Location: Southern LeBreton Flats

Coordinates: MTM NAD83 - 366710 E, 5030912 N

Drilling Method: Hollow stem auger with split spoons and air hammer

BLOW COUNT LAB SAMPLE DEPTH BGS SAMPLES CGI (ppm) PID (ppm) STRATIGRAPHIC DESCRIPTION INSTALLATION LOG ft m .4 -3 -2 -1 **GROUND SURFACE** 0 0 12 FILL Flush mount casing 14 Brown topsoil underlain by rock fragments and brown 1 60 silty sand fill and gravel. Moist, no odour. 21 203 mm diameter borehole 10 2 Native backfill 2 Brown and grey silty sand fill with gravel. Minor iron 3 ÷. 5 staining. Moist, no odour. 1 70 mm diameter PVC riser 9 4 7 5 2 Brown to grey silty sand fill with gravel. Moist, no 19 odour. 6 75 Х 18 2 Water level at 1.85 mBGS 5 7 8 Brown and grey silty sand fill with gravel. Moist, no 8 12 odour. 5 15 9 55 17 3 10 10 Grey silty sand fill with clay and gravel. Moist, no 16 odour. 11 55 50 Bentonite 12 13 14 15 ഗ്രമ് Ш 50 Rock fragments at 3.78 mBGS. 6 4 0 ഗ്രംറ്റ് <u>ک</u> 2002 TILL 9°9 27 Grey sandy clay till. Moist, no odour. 50 16 70



MOE Well ID: A029553

Date Completed: August 3, 2006

Supervisor: TLJ

Ground Surface Elevation: 65.47 mASL

Borehole Number: BH/MW06-36

Project Number: 05-215-23

Client: National Capital Commission

Site Location: Southern LeBreton Flats

Coordinates: MTM NAD83 - 366710 E, 5030912 N

MOE Well ID: A029553

Date Completed: August 3, 2006 Supervisor: TLJ

Ground Surface Elevation: 65.47 mASL

Drilling Method: Hollow stem auger with split spoons and air hammer

DEPTH BGS	SAMPLES	LAB SAMPLE	BLOW COUNT	CGI (ppm)	PID (ppm)	DOG	STRATIGRAPHIC DESCRIPTION	INS	STALLATION
1 5 17 18 19 20 20 21 21 22 23 7 24 25 26 7 26 27 24 8 27 24 30 10 31 10 34 10 35 10 36 10			11 50 50	60			Borehole teminated at 7.62 mBGS. BOREHOLE TERMINATED	51 mm diameter PVC screen	• pues espiis
Page 2	2 of 2	2							INCERA

Borehole Number: BH06-37

Project Number: 05-215-23

Client: National Capital Commission

Site Location: Southern LeBreton Flats

Coordinates: MTM NAD83 - 366688 E, 5030854 N

Drilling Method: Hollow stem auger with split spoons

MOE Well ID: Not applicable

Date Completed: August 3, 2006 Supervisor: TLJ Ground Surface Elevation: 63.47 mBGS

BLOW COUNT LAB SAMPLE DEPTH BGS SAMPLES CGI (ppm) PID (ppm) STRATIGRAPHIC DESCRIPTION INSTALLATION LOG ft m -4 -3-2-1-0 1-2-3-4 5-6-7-8 9-10-11-12 12-1-12 **GROUND SURFACE** 0 No monitoring well installed 2 9 FILL 3 Brown topsoil underlain by silty sand fill with black 100 ŧ. Х 3 slag and ash. Minor iron staining. Moist, no odour. () () 2 1 Charcoal and ash with brown silty sand fill. Moist, no 2 ÷, odour. 1 1 70 ŧ. 3 2 Dark brown silty sand fill with gravel. Trace clay and 4 minor iron staining. Dry, no odour. 75 4 2 5 6 Brown silty sand fill with gravel. Minor iron staining 8 and ash, white and black sand. Moist, no odour. 6 75 8 3 1 Brown and grey silty sand fill with gravel. Wet, no 2 odour. 60 2 3 13 14 14 5 5 1 Grey silty sand fill with gravel and trace clay. Wet, no 4 3 odour. 50 2 1 1 TILL ò G 3 Grey sandy silt till with gravel. -0 50

Page 1 of 2



Borehole Number: BH06-37

Project Number: 05-215-23

Client: National Capital Commission

Site Location: Southern LeBreton Flats

Coordinates: MTM NAD83 - 366688 E, 5030854 N

Drilling Method: Hollow stem auger with split spoons

MOE Well ID: Not applicable

Date Completed: August 3, 2006 Supervisor: TLJ Ground Surface Elevation: 63.47 mBGS

BLOW COUNT LAB SAMPLE DEPTH BGS SAMPLES CGI (ppm) PID (ppm) STRATIGRAPHIC DESCRIPTION INSTALLATION LOG 25 <u>___</u>___ - 5 36 <u>s - 9</u> ত টু 20 Ö 55 ß 50 ÷. ៍ប ď 6 ΰ π П 50 50 Ö ß ò ß ៍ប ٦F 0°. 36 Rock fragments at 6.8 mBGS. - 7 50 50 Borehole terminated at 7.2 mBGS on refusal. BOREHOLE TERMINATED 8 - 9 10 36 Page 2 of 2



Page 1 of 2

Project No.: 06-830 **Client:** National Capital Commission Location: Nepean Bay, Ottawa, ON Date Completed: July 19 & 20, 2006 Site Datum: Nail in tree on south side of Ottawa River Pkwy, Elevation = 62.621 masl

ATSI Supervisor: M. Nash Drilling Method: Hollow Stem Auger Borehole Diameter: 203 mm Monitoring Well Diameter: 51 mm

Drilling Company: Downing Drilling Drilling Equipment: CME 55 Truck Mount Well Casing: Stickup Well Screen: PVC Schedule 40 Slot 10 OVM: Gastech 1238 ME

EPTH	BLOW COUNT (1)	SAMPLE ID	LOCATION	OVM (2)	RECOVERY (%)	GRAPHIC LOG	DESCRIPTION	ELEVATION (m)	Elevation of top of PVC riser = 62.72 masl
	6 9 12	BH-06-103-1		<25	58%		Ground Surface TOPSOIL	62.03	J-plug Stickup Casing
	15 4 8 30 34 7	BH-06-103-2		45	71%		Dry, brown, sand and gravel, with coal, brick fragments, shale and wood Petroleum odour from 1.5 to 2.9	61 00	PVC Riser
2	18 14 14 6 4 9 9	BH-06-103-3 BH-06-103-4		30	33% 62%		mbgs	60.00	- Bentonite
- 3	1 3 7 17	BH-06-103-5		<25	8%			59.00	
- 4	10 11 13 4 5 6	BH-06-103-6 BH-06-103-7		80	58%		Dry, grey, silty clay, with gravel, coal, brick fragments and wood	58.00 -	
- 5	6 3 5 9 4	BH-06-103-8		55	75%		Dry, grey, silty sand and gravel, with brick fragments and wood	57 00 -	
	20 20 7 4	BH-06-103-9		40	50%		Dry, brown to grey, clay and clayey sand with gravel, coal and brick fragments	56.00	PVC Screen
	4 5 6 3 4 50 for 51 mm	BH-06-103-10 BH-06-103-11		40	50% 33%		Moist to wet, grey, silty sandy clay and gravel	55 00 - - 54 00 -	PVC Screen Silica Sand

(1) Blow count per 0.15 m using conventional hammer and split spoons (2) Organic Vapour Meter (OVM) reading (ppmv unless noted)

The data represented in this borehole log requires interpretation by Aqua Terre personnel. Third parties using this log do so at their own risk

All elevations and locations are approximate

Monitoring well equipped with dedicated inertial foot valve and polyethylene tubing for sampling.

= Sample submitted for laboratory analysis

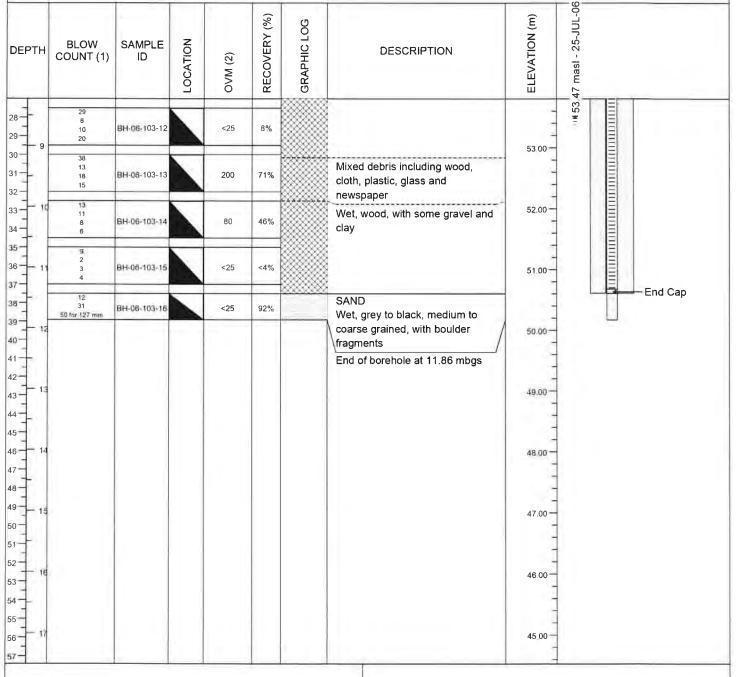
BH-06-103-3 = VOCs, F1-F4 PHCs, PHC Subfractions, PCBs BH-06-103-4 = Metals, PAHs

Page 2 of 2

Project No.: 06-830 Client: National Capital Commission Location: Nepean Bay, Ottawa, ON Date Completed: July 19 & 20, 2006 Site Datum: Nail in tree on south side ATSI Supervisor: M. Nash Drilling Method: Hollow Stem Auger Borehole Diameter: 203 mm Monitoring Well Diameter: 51 mm

Site Datum: Nail in tree on south side of Ottawa River Pkwy, Elevation = 62.621 masl

Drilling Company: Downing Drilling Drilling Equipment: CME 55 Truck Mount Well Casing: Stickup Well Screen: PVC Schedule 40 Slot 10 OVM: Gastech 1238 ME



(1) Blow count per 0.15 m using conventional hammer and split spoons (2) Organic Vapour Meter (OVM) reading (ppmv unless noted)

The data represented in this borehole log requires interpretation by Aqua Terre personnel. Third parties using this log do so at their own risk,

All elevations and locations are approximate.

Monitoring well equipped with dedicated inertial foot valve and polyethylene tubing for sampling.

= Sample submitted for laboratory analysis



Page 1 of 2

Project No.: 06-830

Client: National Capital Commission Location: Nepean Bay, Ottawa, ON Date Completed: July 19, 2006 ATSI Supervisor: M. Nash Drilling Method: Hollow Stem Auger

Borehole Diameter: 203 mm

Monitoring Well Diameter: 51 mm

Drilling Company: Downing Drilling Drilling Equipment: CME 55 Truck Mount Well Casing: Stickup Well Screen: PVC Schedule 40 Slot 10 OVM: Gastech 1238 ME

Site Datum: Nail in tree on south side of Ottawa River Pkwy, Elevation = 62.621 masl

DEPTH	BLOW COUNT (1)	SAMPLE ID	LOCATION	OVM (2)	RECOVERY (%)	GRAPHIC LOG	DESCRIPTION	ELEVATION (m)	Elevation of top of PVC riser = 62.26 masl
-3 m -2 - -1 - 0							Ground Surface	61.43	J-plug
	4 10 24 20	BH-06-104-1		25	62%		TOPSOIL FILL Dry, dark brown, sand, with	61 00 -	
3	19 24 32	BH-06-104-2		75	62%		gravel and asphalt pieces	-	
5 6 7 7	9 13 16 19	BH-06-104-3		80	96%		Dry, dark brown, sand, with gravel and shale	60 00 — - -	PVC Riser
8 9	10 15 9 8	BH-06-104-4		260	42%		Dry, dark brown, silty sand, with shale, gravel and pebbles, trace coal	59.00 -	
0	7 7 6 2	BH-06-104-5		50	8%				
3 - 4 4 -	31 10 13 12	BH-06-104-6		150	46%		Dry, dark brown, sand, with dark grey clay and gravel	- - 57 00 -	
5 6 7 7	44 50 for 51 mm	BH-06-104-7		-1	<4%		Refusal on boulder		
8	1 2 2 1	BH-06-104-8		100	8%		FILL Moist, black to brown, clayey sand, with gravel, glass, slag and	56 00 -	PVC Screen Silica Sand
	1 2 1 3	BH-06-104-9		130	<4%		Gravel, concrete, brick fragments	55.00 -	PVC Screen
22 - 23 - 7 24 - 7	4	BH-06-104-10	K	100	58%		Wet, grey, clay, with gravel and mixed debris (cloth, glass, wood paper, coal, plastic, concrete, newspaper)	- - 54.00	90-70 Silica Sand
25	ז 11 6 7	BH-06-104-11		125	58%				

(1) Blow count per 0_15 m using conventional hammer and split spoons (2) Organic Vapour Meter (OVM) reading (ppmv unless noted)

The data represented in this borehole log requires interpretation by Aqua Terre personnel Third parties using this log do so at their own risk

All elevations and locations are approximate.

Monitoring well equipped with dedicated inertial foot valve and polyethylene tubing for sampling.

= Sample submitted for laboratory analysis

BH-06-104-2 = Fraction Organic Carbon BH-06-104-3 = Metals, PAHs BH-06-104-4 = VOCs, F1-F4 PHCs BH-06-104-10 = Grain Size, pH BH-06-104-15 = Grain Size, pH



Page 2 of 2

Project No.: 06-830 **Client: National Capital Commission** Location: Nepean Bay, Ottawa, ON Date Completed: July 19, 2006 Site Datum: Nail in tree on south side of Ottawa River Pkwy, Elevation = 62.621 masl

ATSI Supervisor: M. Nash Drilling Method: Hollow Stem Auger Borehole Diameter: 203 mm Monitoring Well Diameter: 51 mm

Drilling Equipment: CME 55 Truck Mount Well Casing: Stickup Well Screen: PVC Schedule 40 Slot 10 OVM: Gastech 1238 ME

Drilling Company: Downing Drilling

			LOCATION	OVM (2)	RECOVERY (%)	GRAPHIC LOG	DESCRIPTION	ELEVATION (m)		
9	11 5 7 5	BH-06-104-12		<25	<4%			53.00	Find (
	10 4 4 3	BH-06-104-13		110	29%			52.00 -	End (Сар
- 10	6 5 12 18	BH-06-104-14		30	4%		Wet, gravel, brick fragments, newspaper	51,00		
	9 12 6 3	BH-06-104-15	K	85	83%		SAND Wet, grey, medium to fine grained End of borehole at 11 28 mbgs	50 00		
- 12								49 00 -		
- 13								49 00		
- 14								48 00		
- 19								47.00		
- 16								46.00		
- 17								45 00 -		
								-		

All elevations and locations are approximate.

BH-06-104-2 = Fraction Organic Carbon BH-06-104-3 = Metals, PAHs BH-06-104-4 = VOCs, F1-F4 PHCs BH-06-104-10 = Grain Size, pH BH-06-104-15 = Grain Size, pH



Page 1 of 1

Project No.: 06-830

Client: National Capital Commission Location: Nepean Bay, Ottawa, ON Date Completed: July 18, 2006 Site Datum: Nail in tree on south side of Ottawa River Pkwy, Elevation = 62.621 masl

ATSI Supervisor: M. Nash Drilling Method: Hollow Stem Auger Borehole Diameter: 203 mm

Monitoring Well Diameter: 51 mm

Drilling Company: Downing Drilling Drilling Equipment: CME 55 Truck Mount Well Casing: Flushmount Well Screen: PVC Schedule 40 Slot 10 OVM: Gastech 1238 ME

EPTH	BLOW COUNT (1)	SAMPLE ID	LOCATION	OVM (2)	RECOVERY (%)	GRAPHIC LOG	DESCRIPTION	ELEVATION (m)	Elevatio 58.28 n		of PVC riser =
ft m			_				Ground Surface	58.28	-		Flushmount
	5 10 8 4	BH-06-105-1		<25	75%		TOPSOIL FILL Moist, brown, clayey silty sand,	-		T	— J-plug
	33 34 39 15	BH-06-105-2		<25	25%		with gravel and trace coals	57 00 —		•	— PVC Riser — Bentonite
- 2	50 for 152 mm	BH-06-105-3		<25	<4%			-			
	12 9 3 2	BH-06-105-4		<25	12%		Brick fragments from 2.3 to 2.9 mbgs	56,00 — - -			
- 3	5 7 11 50 for 102 mm	BH-06-105-5		40	12%		Moist, black, sand, with gravel and brick fragments	- 55,00 -	JUL-06	mmm	
4	3 4 4 3	BH-06-105-6		90	54%		Moist, black, sand, with coal, ash, slag and iron ore	 54,00	53.12 masl - 25-JUL-06		- PVC Screen
	2	BH-06-105-7A		50	50%				12	-	- Silica Sand
- 5	2 2 2	BH-06-105-7B		<25	50%		Granular black and orange material with slag and coal	- - 53.00 -	••• 123	HITH	
- 6	1 1 11	BH-06-105-8		25	42%		Wet, black to brown, sand, some silt and coal	1		IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	
	11 13 20 14	BH-06-105-9		30	54%		SAND Wet, grey, medium to coarse grained			UIIIIIIII	
7	28 27 22 14	BH-06-105-10		30	-			51 00 -		THUM I	
8	-						End of borehole at 7 62 mbgs	- 50.00			- End Cap

(1) Blow count per 0.15 m using conventional hammer and split spoons (2) Organic Vapour Meter (OVM) reading (ppmv unless noted)

The data represented in this borehole log requires interpretation by Aqua Terre personnel. Third parties using this log do so at their own risk

All elevations and locations are approximate.

Monitoring well equipped with dedicated inertial foot valve and polyethylene tubing for sampling.

= Sample submitted for laboratory analysis

BH-06-105-6 = VOCs, F1-F4 PHCs, PAHs BH-06-105-7A = Metals



Borehole/Monitoring Well ID: BH/MW-06-106

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Project No.: 06-830 Client: National Capital Commission Location: Nepean Bay, Ottawa, ON D S

ATSI Supervisor: M. Nash Drilling Method: Hollow Stem Auger Borehole Diameter: 203 mm

Drilling Company: Downing Drilling Drilling Equipment: CME 55 Truck Mount Well Casing: Stickup ot 10

ЕРТН	BLOW COUNT (1)	SAMPLE ID	LOCATION	OVM (2)	RECOVERY (%)	GRAPHIC LOG	DESCRIPTION	ELEVATION (m)	Elevatio 59.43 n		p of PVC riser =
n m 3							Ground Surface	59.00			— J-plug — Stickup Casin
	8 10 14 14	BH-06-106-1		<25	50%		TOPSOIL	58.51 - - - 58.00	Law of the second s		
2 3 4 4	15 11 5 3	BH-06-106-2		<25	54%		Dry, brown, sand, with some coal and brick fragments Dry, dark brown to black, clayey			+	- PVC Riser Bentonite
5 6 7 7 2	3 4 4 3	BH-06-106-3		60	38%		silty sand, with gravel, shale, coal, slag, ash, cinders and glass	57_00			
9	1 2 1 3	BH-06-106-4		40	42%						
0 3 1	1 3 9 9	BH-06-106-5		30	58%		Wet, black, coal, slag, wood and brick fragments	55 00	ω	HURBER	
3 4	5 14 15 12	BH-06-106-6		50	46%		Moist, grey to dark brown/black, silty sand and gravel, with coal, ash, cinders and wood	-	- 25-JUL-06	1000	
5 6 7 7	10 15 20 16	BH-06-106-7		71	0%		No recovery	54.00 — - -	84 masl -	•	— Silica Sand
8	6 10 14 16	EH-06-106-8A BH-06-106-8B		110 80	75% 75%		FILL Moist, dark brown/black, silty \sand and gravel, with wood	53 00	··· N 52 8		
	11 50 for 127 mm	BH-06-106-9		100	8%		Wet, brown, sand, some gravel Wet, grey/brown, clayey sand	52.00 -		-	
3 7	23 46 50 for 152 mm	BH-06-106-10		11	0%		and gravel, with wood No recovery	51 00 -		THUR WORK	
5 6 8 7	50 for 25 mm	BH-06-106-11		130	4%		SAND Wet, brown, medium to coarse grained	-	End of		➡ End Cap
(2) Org The da Terre p	w count per 0.1 ganic Vapour M ata represented personnel. Thir vations and loca	eter (OVM) re in this boreho d parties using	ading (pp le log rec g this log	omv unles quires inte do so at t	s noted) on by Aqua	Monitoring well equipped w tubing for sampling	boratory an	alysis		ve and polyethylen



Page 1 of 2

Project No.: 06-830 Client: National Capital Commission Location: Nepean Bay, Ottawa, ON Date Completed: July 18 & 19, 2006 Site Datum: Nail in tree on south side of Ottawa River Pkwy, Elevation = 62.621 masl

ATSI Supervisor: M. Nash Drilling Method: HSA / HQ Coring Borehole Diameter: 203 mm / 96 mm Monitoring Well Diameter: 51 mm

Drilling Company: Downing Drilling Drilling Equipment: CME 55 Truck Mount Well Casing: Stickup Well Screen: PVC Schedule 40 Slot 10 OVM: Gastech 1238 ME

ртн	BLOW COUNT (1)	SAMPLE ID	LOCATION	OVM (2)	RECOVERY (%)	GRAPHIC LOG	DESCRIPTION	ELEVATION (m)	Elevation of top of PVC riser = 63.08 masl
	11						Ground Surface	62.17	J-plug Stickup Casin
	16 12 11	BH-06-107-1		<25	71%		FILL Dry to moist, dark brown, sand, with gravel, coal, ash, slag, shale	62.00 — - -	
	3	BH-06-107-2		30	25%		and glass	61 00	
2	3	BH-06-107-3		125	17%		Asphalt pieces, asphalt paper	- 60 00 -	
3	8 6 3 3	BH-06-107-4 BH-06-107-5		80	4%		and plastic Moist, black, silty clayey sand,		PVC Riser
- 4	4 2 1 1 3	BH-06-107-6		80	62%		with gravel, coal, cinders, brick fragments, wood, glass, rubber, metal and plastic	58.00 -	
- 5	64 64 49 67	BH-06-107-7		90	25%				
6	2 4 4 5	BH-06-107-8		130	46%				
-		BH-06-107-9		75	4%		Refusal on boulder	56 00 — - -	
7	23 20 11 50 for 25 mm	BH-06-107-10		35	29%		FILL Moist, black, clayey sand, with gravel, wood and cinders.	55 00 -	Silica Sand
- 8	10 23 40 50 for 102 mm	BH-06-107-11 25 4%		Refusal on boulders	- 54 00 —	PVC Screen			

(1) Blow count per 0.15 m using conventional hammer and split spoons (2) Organic Vapour Meter (OVM) reading (ppmv unless noted) The data represented in this borehole log requires interpretation by Aqua

Terre personnel Third parties using this log do so at their own risk.

Monitoring well equipped with dedicated inertial foot valve and polyethylene tubing for sampling

= Sample submitted for laboratory analysis

All elevations and locations are approximate

BH-06-107-3 = Grain Size, pH BH-06-107-8 = VOCs, F1-F4 PHCs, Metals, PAHs



Page 2 of 2

Project No.: 06-830 Client: National Capital Commission Location: Nepean Bay, Ottawa, ON Date Completed: July 18 & 19, 2006 Site Datum: Nail in tree on south side ATSI Supervisor: M. Nash Drilling Method: HSA / HQ Coring Borehole Diameter: 203 mm / 96 mm Monitoring Well Diameter: 51 mm Drilling Company: Downing Drilling Drilling Equipment: CME 55 Truck Mount Well Casing: Stickup Well Screen: PVC Schedule 40 Slot 10

OVM: Gastech 1238 ME

Site Datum: Nail in tree on south side of Ottawa River Pkwy, Elevation = 62.621 masl

(%) ELEVATION (m) **GRAPHIC LOG** RECOVERY SAMPLE BLOW LOCATION 25-JUL-06 DEPTH DESCRIPTION OVM (2) COUNT(1) ID masl BOULDERS 28 With seams of sand and gravel ·#52.92 29 g 30 53.00 31 32 10 33 52.00 34 End Cap 35 End of borehole at 10.67 mbgs 36 -51.00 37 38-39 50.00 40 41 42 43 49.00 44 45 46 1 48.00 47 48-49 47 00 50 51 52 1 53 46.00 54 55 56 45.00 57

(1) Blow count per 0.15 m using conventional hammer and split spoons
 (2) Organic Vapour Meter (OVM) reading (ppmv unless noted)

The data represented in this borehole log requires interpretation by Aqua Terre personnel. Third parties using this log do so at their own risk.

All elevations and locations are approximate.

Monitoring well equipped with dedicated inertial foot valve and polyethylene tubing for sampling.

= Sample submitted for laboratory analysis

BH-06-107-3 = Grain Size, pH BH-06-107-8 = VOCs, F1-F4 PHCs, Metals, PAHs



Page 1 of 1

Project No.: 06-830 Client: National Capital Commission Location: Nepean Bay, Ottawa, ON Date Completed: July 19, 2006 ATSI Supervisor: M. Nash Drilling Method: Hollow Stem Auger Borehole Diameter: 203 mm Monitoring Well Diameter: 51 mm Drilling Company: Downing Drilling Drilling Equipment: CME 55 Truck Mount Well Casing: Flushmount Well Screen: PVC Schedule 40 Slot 10 OVM: Gastech 1238 ME

Site Datum: Nail in tree on south side of Ottawa River Pkwy, Elevation = 62.621 masl

PTH	BLOW COUNT (1)	SAMPLE ID	LOCATION	OVM (2)	RECOVERY (%)	GRAPHIC LOG	DESCRIPTION	ELEVATION (m)	Elevati 56.20 r		o of PVC riser =
ft m	4						Ground Surface TOPSOIL	56,22	I		Flushmount
-	6 9	BH-06-108-1		<25	67%		FILL Dry, brown to black, sand, with	1			Bentonite
	1 1 50 for 127 mm	BH-06-108-2		<25	8%		gravel and coal fragments	55.00 -	L-06		- PVC Riser
- 2	6 9 12 11	BH-06-108-3	K	80	54%		and gravel, with slag, glass, plastic, brick fragments and wood		53.26 masl - 25-JUL-06		
	6 4 4 3	BH-06-108-4		180	8%			54 00 — - -	₩ 53.26 m	10000	
	7 4 3 3	BH-06-108-5	K	275	54%		Moist, dark grey clay with glass Moist to wet, mixed refuse (newspaper, plastic, aluminum	53 00 -	-		PVC Screen
4	5 6 50 for 25 mm	BH-06-108-6		<25	4%		∖sheeting, glass, wood) Wet, grey, clay, refusal on	52.00 -		*	— Silica Sand
- 5	18 6 3 4	BH-06-108-7		<25	75%		boulder Wet, grey, sand, medium to coarse grained	51.00 -		minin	
	4 2 3 2	BH-06-108-8		<25	46%						
- 6					1		PEAT With wood and sea shells	50.00 -			- End Cap
							End of borehole at 6.10 mbgs	49.00			

(1) Blow count per 0.15 m using conventional hammer and split spoons(2) Organic Vapour Meter (OVM) reading (ppmv unless noted)

The data represented in this borehole log requires interpretation by Aqua Terre personnel. Third parties using this log do so at their own risk

All elevations and locations are approximate.

Monitoring well equipped with dedicated inertial foot valve and polyethylene tubing for sampling

= Sample submitted for laboratory analysis

BH-06-108-3 = Metals, PAHs BH-06-108-5 = VOCs, F1-F4 PHCs MOE Well Tag A033435



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Project No.: 06-830 Client: National Capital Commission Location: Nepean Bay, Ottawa, ON Date Completed: July 20 & 21, 2006 Site Datum: Nail in tree on south side of Ottawa River Pkwy, Elevation = 62.621 masl

ATSI Supervisor: M. Nash Drilling Method: Hollow Stem Auger Borehole Diameter: 203 mm Monitoring Well Diameter: 51 mm

Drilling Company: Downing Drilling Drilling Equipment: CME 55 Truck Mount Well Casing: Stickup Well Screen: PVC Schedule 40 Slot 10 OVM: Gastech 1238 ME

DEPTH	BLOW COUNT (1)	SAMPLE ID	LOCATION	OVM (2)	RECOVERY (%)	GRAPHIC LOG	DESCRIPTION	ELEVATION (m)	Elevation of top of PVC riser = 64.38 masl
# m 3							Ground Surface	64.00 - 63.43 -	J-plug
	5 6 11 9	BH-06-109-1		<25	62%		TOPSOIL FILL Dry, brown, sand, with gravel,	63.00	
	2 3 1	BH-06-109-2		50	29%		coal, glass, brick fragments and wood	- - 62.00 —	
- 2	1 1 1 2	BH-06-109-3		25	29%		Moist, dark grey, clayey sand, with coal, glass, brick fragments and creosote coated wood	62.00	PVC Riser
	3 3 5 4	BH-06-109-4		25	29%		Moist, brown to black, silty sand, with gravel, coal, glass and brick fragments	61.00-	
	2 5 4 3	BH-06-109-5		180	21%		iraginents	60.00 -	
	Ť 2 2 3	BH-06-109-6		140	46%			- - 59 00 -	
- 5		BH-06-109-7		14			Undisturbed sample collected in shelby tube		
	4 50 for 127 mm	BH-06-109-8		<25	21%		FILL Dry, black, silty clayey sand, with wood and glass	58.00 -	
	39 50 for 76 mm	BH-06-109-9		<25	17%		5 cm wood, 5 cm boulder fragments	57.00 -	PVC Screen
7	14 19 9 6	BH-06-109-10		<25	8%		2.5 cm brown/grey clayey sand and gravel with brick fragments, 2.5 cm of wood and boulder	56 00 -	PVC Screen
5 - 8	9 8 11 14	BH-06-109-11		<25	92%		fragments Moist to wet, grey sand		

(1) Blow count per 0.15 m using conventional hammer and split spoons (2) Organic Vapour Meter (OVM) reading (ppmv unless noted)

The data represented in this borehole log requires interpretation by Aqua Terre personnel. Third parties using this log do so at their own risk.

All elevations and locations are approximate.

Monitoring well equipped with dedicated inertial foot valve and polyethylene tubing for sampling.

= Sample submitted for laboratory analysis

BH-06-109-3 = PAHs BH-06-109-5 = VOCs, F1-F4 PHCs BH-06-109-7 = Bulk Soil Physical Properties BH-06-109-12 = Metals, PAHs



Page 2 of 2

Project No.: 06-830 **Client: National Capital Commission** Location: Nepean Bay, Ottawa, ON Date Completed: July 20 & 21, 2006 Site Datum: Nail in tree on south side of Ottawa River Pkwy, Elevation = 62.621 masl

ATSI Supervisor: M. Nash Drilling Method: Hollow Stem Auger Borehole Diameter: 203 mm Monitoring Well Diameter: 51 mm

Drilling Company: Downing Drilling Drilling Equipment: CME 55 Truck Mount Well Casing: Stickup Well Screen: PVC Schedule 40 Slot 10 OVM: Gastech 1238 ME

EPTH	BLOW COUNT (1)	SAMPLE ID	LOCATION	OVM (2)	RECOVERY (%)	GRAPHIC LOG	DESCRIPTION	ELEVATION (m)	UL/2006
	5 18 40 50 for 102 mm	BH-06-109-12	K	75	100%		Moist, dark brown to black, silty sand, with coal and brick	55 00 -	Source End Cab
	50 for 51 mm	RH-06-109-13		<25	8%		fragments Moist, brown, sand 2.5 cm wood, 2.5 cm boulder End of borehole at 9.20 mbgs	54 00 - 53 00 - 52 00 - 51 .00 - 49 00 - 48 00 - 47 .00 -	End Cap

Blow count per 0.15 m using conventional hammer and split spoons
 Organic Vapour Meter (OVM) reading (ppmv unless noted)

The data represented in this borehole log requires interpretation by Aqua Terre personnel. Third parties using this log do so at their own risk.

All elevations and locations are approximate

Monitoring well equipped with dedicated inertial foot valve and polyethylene tubing for sampling.

= Sample submitted for laboratory analysis

BH-06-109-3 = PAHs BH-06-109-5 = VOCs, F1-F4 PHCs BH-06-109-7 = Bulk Soil Physical Properties BH-06-109-12 = Metals, PAHs



Page 1 of 1

Project No.: 06-830ATSI SuperClient: National Capital CommissionDrilling MetLocation: Nepean Bay, Ottawa, ONBorehole DDate Completed: July 21, 2006MonitoringSite Datum: Nail in tree on aputh side of Ottawa Diver D

ATSI Supervisor: M. Nash Drilling Method: Hollow Stem Auger Borehole Diameter: 203 mm Monitoring Well Diameter: 51 mm

Site Datum: Nail in tree on south side of Ottawa River Pkwy, Elevation = 62.621 masl

Drilling Company: Downing Drilling Drilling Equipment: CME 55 Truck Mount Well Casing: Stickup Well Screen: PVC Schedule 40 Slot 10

OVM: Gastech 1238 ME

PTH	BLOW COUNT (1)	SAMPLE ID	LOCATION	OVM (2)	RECOVERY (%)	GRAPHIC LOG	DESCRIPTION	ELEVATION (m)	Elevatio 60.61 m		of PVC riser =
	6			1			Ground Surface	60.03 60.00			— J-plug — Stickup Casing
	7 6 1	BH-06-110-1		<25	46%		FILL Dry, brown silty sand, with coal,		1000		
		BH-06-110-2	•	8	12		brick fragments and wood Undisturbed sample collected in	- 59.00 — -		+	– Bentonite – PVC Riser
2	3 4 11 12	BH-06-110-3		50	50%		Shelby tube FILL Dry to moist, brown sand, with coal and boulder fragments	- - 58.00 -			
	3 5 50 for 102 mm	BH-06-110-4		45	29%		Wet, grey clayey silty sand, with gravel, coal, wood and slag	1		mmm	
3	т3 11 8 7	BH-06-110-5		180	54%			57.00 — - -		UIIIIIIII	
- 4	2 1 6 3	BH-06-110-6		175	42%					ITIUIIIIII	
- 5	5 4 4 3	BH-06-110-7		50	4%			- 55 00	JL/2006	1111111	– Silica Sand
6	3 10 16 20	BH-06-110-8	2	150	67%				₩53 28 masl - 25/JUL/2006	III MUUU	- PVC Screen
-	13 11 7 6	BH-06-110-9		400	42%			54 00 - -	153 28 m	WHITTHE	
- 7	6 8 14 10	BH-06-110-10		50	33%		Wet, black sand, with mixed refuse (wood, paper, glass and plastic)	- 53 00 — - -			
- 8	3 50 for 51 mm	BH-06-110-11		75	4%		Wet, grey sand, with wood End of borehole at 8.41 mbgs	- - 52.00		THE OTHER	

(1) Blow count per 0.15 m using conventional hammer and split spoons (2) Organic Vapour Meter (OVM) reading (ppmv unless noted)

The data represented in this borehole log requires interpretation by Aqua Terre personnel. Third parties using this log do so at their own risk.

All elevations and locations are approximate

Monitoring well equipped with dedicated inertial foot valve and polyethylene tubing for sampling.

= Sample submitted for laboratory analysis

BH-06-110-2 = Bulk Soil Physical Properties BH-06-110-8 = Metals, PAHs BH-06-110-9 = VOCs, F1-F4 PHCs



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Project No.: 97-142HATSI SupervisorClient: National Capital CommissionDrilling Method:Location: LeBreton Flats, OttawaBorehole DiameDate Completed: November 8, 2006Monitoring WellSite Datum: IB84 with geodetic elevation of 55.035 m AMSL

ATSI Supervisor: Andrey Belokurov Drilling Method: HSA/Air Hammer Borehole Diameter: 203 mm Monitoring Well Diameter: 51 mm Drilling Company: Downing Drilling Ltd. Drilling Equipment: CME 55 Truck Well Casing: PVC Schedule 40 Well Screen: PVC Schedule 40, Slot 10 OVM: Gastech 1238ME

L														
DEPTH	BLOW COUNT (1)	SAMPLE ID	LOCATION	OVM (2)	RECOVERY (%)	GRAPHIC LOG	DES	CRIPTION	ELEVATION (m)	Top of	Pipe E	lev. =	= 56.97	m ASL
ft m								Ground Surface	57.03	_			4	ateal fluchmount
0 - 0 - 1 - 1 - 2	2 5 8 8	BH-06-901-1		75	79%		Dry, grey, compa	GRAVEL (FILL) ct to dense coarse- avel and some cobbles.	-					-steel flushmount well cap
2 3- - 4-	5 7 11 10	BH-06-901-2		25	62%									- bentonite
5 5 6	2 9 12 7	BH-06-901-3		25	88%	× 1 × 1 × 1 × 1 × 1 × 1 × 1 × 1			-					
7-2 7- 8-	12 22 27 25	BH-06-901-4		50	92%		From 2.4 to 3.8 m	1 bgs - moist, grey, dense	55.00-			•		- PVC riser pipe
9- 	5 19 30 34	BH-06-901-5		75	88%		gravel with some							
10 	7 11 13 15	BH-06-901-6		75	83%				-	53.53				5, 2006)
13 — 4 14 —	4 4 7 11	BH-06-901-7		75	67%		SILT (FILL) Moist, grey, grey some coarse grey	/light green, stiff silt, / sand.	53.00-	52.92				52.13 m AMSL (Nov 15, 2006)
 15	3 5 9 10	BH-06-901-8		50	100%		SAND AND (Moist to very wet, coarse gravel with	GRAVEL (FILL) grey/brown, compact, a sand and cobbles.						52.13 m Al
16- 	9 12 10 13	BH-06-901-9		5%	67%	200×00 200×00 200×10 200×10	5 554 65	· · · · · · · · · · · · · · · · · · ·	52.00					Ţ
18 - 19 - 20	4 5 7 7	ВН-06-901-10		50	29%		From 5.5 to 8.5 r	n bgs - Water	51.00					
						а <i>льз :: Л</i> А		· · · · ·	•				75	
(2) Orga	anic Vapour Me	5 m using conve eter (OVM) read in this borehole	ling (ppm	nv unless	noted)		IT A	Monitoring well reco Monitoring well equ sampling.			-			yethylene tubing for
personr	a represented nel. Third partie	es using this log	g do so a	t their ow	n risk.	Jy Aqua Te		sampung.						
		tions are appro												
		ποτιο αι ε αμριυ	ALL RALE.											ATSI BH / MW IO



Project No.: 97-142HATSI SupervisClient: National Capital CommissionDrilling MethodLocation: LeBreton Flats, OttawaBorehole DiarDate Completed: May 7, 2008Monitoring WSite Datum: IB84 with geodetic elevation of 55.035m amsl

ATSI Supervisor: A. Scheepers Drilling Method: HSA/Air Hammer Borehole Diameter: 203 mm/96 mm Monitoring Well Diameter: 51 mm Drilling Company: Downing Drilling Equipment: CME 75 Truck Well Casing: PVC Stickup Well Screen: PVC Schedule 40, Slot 10 OVM: Gastech 1238 ME

DEPTH BLOW (1) SAMPLE NO SAMPLE SAMPLE <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>1</th> <th></th> <th>1</th> <th></th>							1		1	
4-1	DEPTH	BLOW COUNT (1)		LOCATION	OVM (2)	RECOVERY (%)	GRAPHIC LOG	DESCRIPTION	ELEVATION (m)	Top of PVC Elev = 57.57 m amsl
	$\begin{array}{c} -4 \\ -3 \\ -3 \\ -3 \\ -1 \\ -1 \\ 0 \\ -1 \\ 0 \\ -1 \\ 0 \\ -1 \\ 0 \\ -1 \\ 0 \\ -1 \\ 0 \\ -1 \\ 0 \\ -1 \\ 0 \\ -1 \\ 0 \\ -1 \\ -1$	8 9 10 5 2 2 7 8 6 12 16 24 50 for 51 mm 11 13 16 31 14 13 14 13 14 13 14 50 for 25mm	BH-08-001-2 BH-08-001-3 BH-08-001-4 BH-08-001-5 BH-08-001-6		25 50 25 25 25 25	67 86 38 37		SAND AND GRAVEL FILL Moist, brown, compact, medium dark brown wet BEDROCK at 5.3 mbgs	56.56 56.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55.00 55	Bentonite PVC Riser Silica Sand Screen
	26								-	

(1) Blow count per 0.15 m using conventional hammer and split spoons(2) Organic Vapour Meter (OVM) reading (ppmv unless noted)The data represented in this borehole log requires interpretation by Aqua

Terre personnel. Third parties using this log do so at their own risk.

Monitoring well equipped with dedicated inertial foot valve and polyethylene tubing for sampling.

= Sample submitted for laboratory analysis

All elevations and locations are approximate.

RECORD OF BOREHOLE: 10-01

BORING DATE: March 17, 2010

SHEET 1 OF 2

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

s	THOD	SOIL PROFILE	-		SA	MPLE		Headspace Org. Vapour Conc. [PPM]		ING	PIEZOMETER
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	ТҮРЕ	BLOWS/0.3m	6 12 18 24 Headspace Comb. Vapour Conc. [%LEL] ppm □	10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
	BORI		STRA	DEPTH (m)	NU.	-	BLO	20 40 60 80	Wp H OW WI 10 20 30 40	LAF	
0	-	Ground Surface		58.26							
		TOPSOIL Compact brown to dark brown silty sand, some gravel, trace clay with brick		58.11 0.15		50					
		sand, some gravel, trace clay with brick and concrete (FILL)			1	50 DO	16				
1					2	50 DO	21				
					3	50 DO	21	,			
2					4	50 DO	19 🗄	ə			
				55.82							
		Very loose black sand, some gravel (FILL)		2.44 55.52 2.74	E	50 DO	2				
3		Loose grey brown silty clay, trace brick (FILL)		2.74	5	DO	-	*			
Ĵ				54.04							
		Loose to compact grey SILTY SAND, some gravel, trace clay		54.91 3.35	6	50 DO	150				
	Stem)										
4	Iger ollow St				7	50 DO	120				
	Power Auger]							
	200 mm Diam. (Hollow				8	50 DO	5 🖨				
	200										
5					9	50 DO	5 🖶	,			
					10	50 DO	1 🖶				
6				52.16	10	DO	Ì				
		Compact brown fine SAND		6.10		50					
					11	50 DO	16				
		Compact grey fine SAND		51.55 6.71							
7					12	50 DO	13				
		Very dense grey SILTY SAND, some		50.64 7.62							
8		gravel, trace clay			13	50 DO	64				
-	_	COBBLES and BOULDERS		49.75	14	50 DO	500				
					15	NQ RC	DD				
9	ing										
	Rotary Drill NW Casing				16	NQ RC	DD				
	- Z				10	RC	50				
10					17		DD				
10		CONTINUED NEXT PAGE					[
		SCALE									GGED: D.G.

RECORD OF BOREHOLE: 10-01

BORING DATE: March 17, 2010

SHEET 2 OF 2

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

Щ	БЧ	SOIL PROFILE	_		SA	MPL	ES	Head ppm	ispac	e Org	. vapo	our Co	onc. [F	PM]					TIVITY,	T	و ا	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	ТҮРЕ	BLOWS/0.3m	Head ppm	6 I Ispac	1 ce Con		18 I pour (2 Conc.	4 [%LEL]	v	10 ⁻⁶ VATER ∕p —	CON	ITENT	PERCE	10 ⁻³ ENT WI	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
	BO		STR	(m)	z		BL(20	4	0	60	8	0		10	20			40	<u> </u>	
- 10									_			_					+					
		COBBLES and BOULDERS (continued)			17	NQ RC	DD															
	Drill		~																			
	Rotary Drill NW Casing				18	NQ RC	DD															
- 11				47.26 11.00																		
	_	Fresh grey LIMESTONE BEDROCK with interbedded shale						-														
	Rotary Drill				19	NQ RC	DD	8) 22 10	0 S.C.R. (%)	86	.D.	94										
	Rota							T.0	S.O		R.O											
- 12		End of Borehole		46.37 11.89					-								+					
12																						
- 13																						
- 14																						
- 15																						
- 16																						
- 17																						
- 18																						
- 19																						
- 20																						
DF	ртн	SCALE							Å												10	DGGED: D.G.
	50								J.	G	oldo OCi	er										ECKED: K.P.H.

RECORD OF BOREHOLE: 10-02

BORING DATE: March 16, 2010

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

ц	ДОН	SOIL PROFILE			SA	MPL	ES	Headspace Org. Vapour Conc. [PPM]	HYDRAULIC CONDUCTIVITY, k, cm/s	اۋب ^ر	PIEZOMETER
DEP IN SCALE METRES	BORING METHOD	DECODUCTION	STRATA PLOT	ELEV.	BER	ы Ц	BLOWS/0.3m	6 12 18 24 Headspace Comb. Vapour Conc. [%LEL]	10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³	ADDITIONAL LAB. TESTING	OR STANDPIPE
ME	ORIN(DESCRIPTION	'RATA	DEPTH (m)	NUMBER	ТҮРЕ	LOWS	ppm		ADD LAB.	INSTALLATION
	B		ST				ġ	20 40 60 80	10 20 30 40		
• 0		Ground Surface Black sandy silt with organic matter		57.54 57.39			-			\vdash	
		(TOPSOIL) Compact brown silty sand, some	1	0.15	1	50 DO	16€	,			
		Compact brown silty sand, some gravel, trace clay with cobbles and boulders (FILL)									
		. ,			2	50 DO	55€	,			
· 1											
					3	50 DO	8				
					4	50 DO	8€	,			
· 2						00					
						1					
					5	50 DO	13€	,			
		Compact black sand, some gravel,		54.80 2.74							
3		trace silt (FILL) Compact brown silty clay and brown		54.49 3.05	6	50 DO	22	€			
		silty sand layers (FILL)		3.03							
						50					
	(-				7	50 DO	20€				
• 4	w Sterr				-						
	Auger (Hollor	PEAT		53.27	8	50 DO	8 6	>			
	Power Auger 200 mm Diam. (Hollow Stem)	Loose grey SILTY fine SAND, trace gravel		4.34							
	00 mm	9.0701		1	9	50 DO	6€				
- 5	2(1	э	DO	00				
]		1					
]	10	50 DO	4 €				
]		$\left \right $					
• 6					11	50 DO	1 €	,			
				!							
				50.83		50					
		Loose rusty fine SAND, trace gravel Loose grey SANDY SILT		50.68	12	50 DO	3€	'			
• 7		Loose to dense brown coarse SAND		50.53	-						
					13	50 DO	1 €	,			
					14	50 DO	73€				
· 8				49.34	14	DO	, 30				
		Very dense grey SANDY SILT, some gravel, trace clay		8.20							
				48.80	15	50 DO	65€				
		End of Borehole Auger Refusal	141	. 48.80 8.74							
. 9		nuyei nelusai									
• 10											
DE	PTH S	SCALE						Golder		LOGO	GED: D.G.
1:	50						1	Golder		CHECH	KED: K.P.H.

RECORD OF BOREHOLE: 10-03

BORING DATE: March 9, 2010

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

щ	Ъ	SOIL PROFILE			SA	MPL	ES	Headspace Org. Vapour Conc. [PPM] ppm	HYDRAULIC CONDUCTIVITY,	티 코 의 티드 70	METER
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	түре	BLOWS/0.3m				DR DPIPE LATION
	8		ST				8	20 40 60 80	10 20 30 40	+ +	
- 0		Ground Surface Loose black silty clay with organic	***	57.06 0.00						+ +	
		matter (FILL)			1	50 DO	136				
		Brick (FILL)		56.60	'	DO	130				
		Compact brown sand, some gravel,	₩	56.45 0.61							
		trace clay with some brick and concrete (FILL)			2	50 DO	21€	ə			
- 1				55.84							
		Very dense to compact brown to dark grey sandy silt with cobbles and organic matter (FILL)	×	1.22							
		organic matter (FILL)			3	50 DO	70€)			
2											
					4	50 DO	14€)			
				54.62 2.44							
		Compact black sand, some gravel, trace silt (FILL)			_	50					
		Compact, brown, medium to coarse sand (FILL)	×	54.32 2.74	5	50 DO	15€				
• 3	6										
	v Stem)			53.71	6	50 DO	136				
	Power Auger 200 mm Diam. (Hollow	Compact black sand, some gravel, trace silt (FILL)		3.35 53.40							
	Power Auger Diam. (Hollo	Compact, brown, medium to coarse sand (FILL)	×	3.66		1					
• 4	A M	sand (FILL)			7	50 DO	14€)			
	200			52.79							
		Compact grey sand and gravel (FILL)		4.27							
		PEAT		52.39 52.28	8	50 DO	18€	>			
		Compact grey SILTY CLAY	ŢŦŦ	4.88							
• 5		Compact grey fine SAND	2			50 DO	400				
		Compact grey SILTY SAND, some		51.73 5.33	9	DO	18€				
		gravel, trace clay									
					10	50 DO	11€	→			
6				50.96							
		Loose to compact, brown, medium to coarse SAND		6.10							
					11	50 DO	5 €)			
_						50					
- 7					12	50 DO	16€				
		End of Borehole		49.74 7.32	-					+ +	
- 8											
- 9											
-											
· 10											
DE	PTH	SCALE								LOGGED: D.O	Э.
-	50							Golder			

RECORD OF BOREHOLE: 10-04

BORING DATE: March 8, 2010

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

	дон.	SOIL PROFILE	1.		SA	MPL		Headspace Org. ppm			• •••]		k, cm/s				₽₿	PIEZOMETER
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	6 12 Headspace Coml ppm			24 . [%LEL]	10 W/ Wp	ATER CO		PERCE		ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
0	8	Ground Surface Black sandy silt with organic matter (TOPSOIL) Dense grey brown silty sand, some gravel (FILL)		56.57 56.42 0.15		50 DO	₽ 45€	20 40	6	0 8	30	1	0 2	0 3	0 4	10		
1		Compact black sandy silt, some gravel (FILL)		55.99 0.58 55.35		50 DO	21 🤅	,										
		Loose brown silty sand, some gravel (FILL) Loose to dense black sandy silt, some gravel (FILL)		1.22 54.82 1.75	3	50 DO	7 6	,										
2	(mer)	Compact, brown, medium to coarse sand, some gravel (FILL)		54.44 2.13	4	50 DO	476	,										
3	Power Auger				5	50 DO 50 DO	136											
4	000	Stiff grey silty clay (FILL)		53.06 3.51	7	50 DO	5 €											
		PEAT		51.77	8	50 DO	5 €	,										
5		Stiff grey SILTY CLAY Compact grey SANDY SILT, some gravel Compact grey fine SAND		4.88 51.39 5.18 51.08 5.49	9	50 DO	13€	,										
6		End of Borehole Auger Refusal		50.65 5.92	10	50 DO	176	,										
7																		
8																		
9																		
10																		
DEI	РТН	I SCALE						Go	Idor									GGED: D.G.

RECORD OF BOREHOLE: 10-05

BORING DATE: March 10, 2010

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

			SOIL PROFILE	1		SA	AMPL		Head ppm	spac	e Org	. Vap	our	Jonc. [F	PPM]	HYD	RAUL k,	cm/s		TIVITY,	T	RGA	PIEZOMETER
METRES		ING MET	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	түре	BLOWS/0.3m	Head ppm	6 spac	1 e Con		18 ו מאסו/apou		24 [%LEL]	,			NTENT	PERC		ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
		BOR		STRA	(m)	N	-	BLO		20	4	0	60) {	30	V	Vp ⊢ 10	20	<u> </u>	30	WI 40	LAI	
0		_	Ground Surface		55.61					Ĩ											Ĩ		
			Compact to dense black silty sand, some gravel, trace brick with cobbles and boulders (FILL)		0.00	1	50 DO	25€	•														
1					54.39	2	50 DO	42€	•														
			Dense grey brown sand, trace silt with cobbles and boulders (FILL)		1.22	3	50 DO	36€	•														
2		Stem)				4	50 DO	42€	•														
		n Diam. (Hollow Ste	Compact dark brown sandy silt, some gravel (FILL)		53.17 2.44	5	50 DO	18€	•														
3	Po	200 mm Dia	Loose black sandy silt, some gravel, trace wood (FILL)		52.59 3.02	6	50 DO	8€	•														
4			Loose dark grey fine SAND, some gravel		51.95 3.66 51.42	7	50 DO	66	₽														
			COBBLES and BOULDERS		4.19	8	NQ RC	DD	69	9	17		17										
5						9	NQ RC	DD	(%)	(%)		(%)											
-			Grey LIMESTONE BEDROCK with interbedded shale		<u>50.00</u> 5.61	10	NQ RC	DD	T.C.R. (%)	S.C.R. (%)		R.Q.D. (%)											
6	Rotary Drill	NQ Core				11	NQ RC	DD	10	0	32		9										
			End of Borehole		48.90 6.71					+							_						
7																							
8																							
9																							
10																							
DEI	эт	THS	CALE				<u> </u>		Â	1	C		10-			1				<u> </u>		L	OGGED: D.G.
DEI 1 :			CALE						Â	1	Ga	bld	ler	tes) GGED: D.G. ECKED: K.P.H.

RECORD OF BOREHOLE: 10-06

BORING DATE: March 8, 2010

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

		머머	SOIL PROFILE		r	SA	MPL		Headspa ppm	ace Org	j. vapou				AULIC C k, cm/s			T	RGA	PIEZOMETER
METRES		BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	түре	BLOWS/0.3m	6 Headspa ppm			18 J our Cond	24 :. [%LEL]	W	0 ⁻⁶ 1 ATER C	ONTENT	PERCE		ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
5		BOR		STR⊅	(m)	٦٢		BLO	20				80	Wp	o ∣0 2			WI 40		
0			Ground Surface		55.04						Ĺ					Ĺ		Ĺ		
0			Grey sandy silt, some gravel, trace brick (FILL)		0.00															
						1	50 DO	52€	•											
			Black silty sand (FILL)	₩	54.51 0.61															
			Loose to compact, brown, medium to coarse sand (FILL)			2	50 DO	13€	,											
1		Stem)					DO													
	rger	ollow																		
	Power Auger	Diam. (Hollow Stem)				3	50 DO	5 E	,											
	P	mm Di	Compact coarse grey crushed stone		53.21 1.83															
2		200	(FILL)			4	50 DO	29€	,											
							DO													
					-	5	50 DO	766												
			Grey silty clay (FILL)	Ê	52.30 2.74			,00												
3			End of Borehole	- FXZ	51.97 3.07	6	50 DO												-	
			Auger Refusal																	
4																				
5																				
6																				
7																				
8																				
9																				
10																				
										<u> </u>										
DE	PT	TH S	SCALE					(G	olde: socia	r							LC	DGGED: D.G.
1 :	5	50							V.	Ass	ocia	ites							СН	ECKED: K.P.H.

RECORD OF BOREHOLE: 10-07

BORING DATE: March 8, 2010

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

Щ	БОН	SOIL PROFILE			S	AMPL		Heads ppm	pace Or	g. Vap	our Co	onc. [P	PM]	HYDR.		ONDUC	IVITY,	T	٩Ļ	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD		LOT		, <u></u>).3m			12	18		4					0 ⁻³ ⊥	ADDITIONAL LAB. TESTING	
MET	SNG	DESCRIPTION	STRATA PLOT	ELE\		ТҮРЕ	BLOWS/0.3m	Heads ppm	pace Co	omb. Va	apour	Conc.	[%LEL]	W	ATER C		PERCE		DDIT B. TE	STANDPIPE INSTALLATION
DE	BOR		STR∌	(m)	۲	[BLO			40						0 ^W		WI 40		
		Ground Surface		55.		+		2	20	40	60	8	0				i0 4	+0	+	
- 0		Black sandy silt with organic matter	1	0.		\square														
		(TOPSOIL) Compact black sand, some gravel	′₩	1	1	50 DO	23€	Ð												
		(FILL)		54.	77															
		Loose to compact, brown, medium to coarse sand, some gravel (FILL)		0.	51															
- 1					2	50 DO	20€	Ð												
	1	Ē		\$		50														
	-				3	50 DO	12€	Ð												
	Auge					-														
2	Power Auger				4	50 DO	76	•												
		200 mm blan. (Folow Sien)			4	DO	' °	ĺ												
		R R R R R R R R R R R R R R R R R R R			\vdash	1														
				8	5	50 DO	22													
- 3																				
		PEAT		51. 51.	93 6	50 DO	17€	Þ												
		Compact grey SILTY CLAY		1		50 DO	50€	÷.												
	-	Dense grey GRAVEL End of Borehole		51. 3.		- 00		-	-	+				-		-			+	
- 4		Auger Refusal																		
- 5																				
- 6																				
• 7																				
- 8																				
. 9																				
3																				
10																				
DE	PTH	SCALE						Â	A S	د ار	0								L	DGGED: D.G.
	50										er iat	he								ECKED: K.P.H.

RECORD OF BOREHOLE: 10-08

BORING DATE: March 11, 2010

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

	-	물	SOIL PROFILE	1.		SA	MPL	r –	Headsp ppm	ace Or	g. Vap	our C	onc. [F	PM] ⊕	HYDR	AULIC (k, cm/	CONDUC	CTIVITY,	Т	ج الإج	PIEZOMETER
METRES		BORING METHOD		STRATA PLOT	ELEV.	BER	Ш	BLOWS/0.3m	6 Headsp		12 1 mb V	18 1 apour	2 Conc			1		10 ⁻⁴ T PERC	10 ⁻³	ADDITIONAL LAB. TESTING	OR STANDPIPE
ž		BORIN	DESCRIPTION	TRAT/	DEPTH (m)	NUMBER	түре	BLOWS	ppm						w	p	— O ^V	1	WI	ADC LAB.	INSTALLATION
			Ground Surface	ەن ا	55.98	-		ш	20) .	40	60	8	0		10	20	30	40		
0			Loose brown fine sand, some silt, trace gravel, brick (FILL)		0.00																
			gratol, 2000 (1122)			1	50 DO	8 €	€												
			Compact brown silty fine sand, some gravel with cobbles and boulders (FILL)		55.37 0.61		-														
1			gravel with cobbles and boulders (FILL)			2	50 DO	69 (•												
			Compact black sand, some gravel		54.76 1.22																
			Compact black sand, some gravel, trace silt, pieces of wood (FILL)			3	50 DO	27 (Ð												
2						4	50 DO	47 (Ð												
		Ê			53.54		00														
	3r	low Stem)	Firm grey brown SILTY CLAY, some sandy gravel, organic layer from 3.66 to 3.73 m depth		2.44		50														
~	Power Auger	Diam. (Hollow	3.73 m depth			5	50 DO	6€	•												
3	Pow	nm Dia				F															
		200 mm				6	50 DO	11€	•												
			Compact grey SANDY SILT, trace		52.25 3.73	-															
4			gravel			7	50 DO	9 6													
					;	-															
						8	50 DO	23€	•												
				歴	;	_															
5						9	50 DO	26€													
			Dense grey SANDY SILT, some gravel,		50.49 5.49		1														
			trace clay		50.16	10	50 DO	35€	•												
6	Rotary Drill	Casing	Boulders		5.82	11	NQ	DD													
	Rotar	NN O	Grey LIMESTONE BEDROCK with	2	49.63		RC			-	<u> </u> ,										
			interbedded shale				NO														
_	Drill	ore				12	NQ RC	DD	(%) 3	23 %	. (%)	0									
7	Rotary Drill	NQ Core				╞			T.C.R. (%)	S.C.R. (%)	R.Q.D. (%)										
					10.5	13	NQ RC	DD	100	20		0									
		╘	End of Borehole		48.36 7.62												1				
8																					
9																					
10																					
										•											
DE	PT	тнs	CALE						Â	- A.	പപ	0								LC	OGGED: D.G.
1 :	5	0								G Ass	UIU 200	icr iat	es							CH	ECKED: K.P.H.

RECORD OF BOREHOLE: 10-09

BORING DATE: March 9, 2010

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION	TEST	HAMMER,	64kg; DROF	P, 760mm

ij	ООН	SOIL PROFILE	1		SA	MPLI	ES	Headspace Org. ppm	Vapour	Conc. [F	PPM]	HYDRA	ULIC CO k, cm/s	ONDUC.	TIVITY,	T	SP SP	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	түре	BLOWS/0.3m	6 12 Headspace Com ppm			24 [%LEL]	10 1 WA Wp	TER CO		PERCE	0 ⁻³ ⊥ NT WI	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
	B	Orrent Outloat	ST				Ы	20 40	6	<u> </u>	30	10) 2	0 3	30	40		
0 -		Ground Surface Compact to dense grey brown sandy silt, some gravel, trace clay (FILL)		56.97 0.00	1	50 DO	9 €	,										
1				××××××××××××××××××××××××××××××××××××××	2	50 DO	11€)										
				XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	3	50 DO	45€)										
2		Compact black sand, some gravel, trace clay (FILL)		54.68 2.29		50 DO	47€)										
3	item)	Dense brown medium sand with cobbles (FILL) Loose grey to black SILTY CLAY, trace gravel with organic matter		54.33 2.64 53.95 3.02	5	50 DO	36€)										
	Power Auger 200 mm Diam. (Hollow Stem)			53.16		50 DO	9 €											
4	200 mm	Compact brown medium to coarse SAND Compact to dense grey SANDY SILT, some gravel, trace clay		53.01 3.96		50 DO	15€)										
5							20€	,										
							89€											
6							39€											
7						50	49€ 39€											
		End of Borehole Auger Refusal		49.83 7.14														
8																		
9																		
10																		
DEF	ртн 8	SCALE						A Go	lder	•								OGGED: D.G.

RECORD OF BOREHOLE: 10-10

BORING DATE: March 18, 2010

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

Ξ		дон	SOIL PROFILE	1.		SA	MPL		Headspace Org. ppm	Vapour	Conc. [F	PM] ⊕			ONDUCT	IVITY,	T	RG₽	PIEZOMETER
DEPTH SCALE METRES		BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	ТҮРЕ	BLOWS/0.3m	6 12 Headspace Com			4 [%LE <u>L]</u>	w		ONTENT	PERCE		ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
L∑ L∑		BORIN		STRAT	DEPTH (m)	NUN	Ϋ́	BLOW	ppm			Ш	Wp		-0 ^W		WI	ADI LAB.	INGTALLATION
· 0	t		Ground Surface	0	57.82	F			20 40	6	8 0	0		0 2	0 3	0 4	0		
U			Black sandy silt with organic matter (TOPSOIL)	k	0.05		50												
			Compact grey brown silty sand, some gravel with brick (FILL)			1	50 DO	14€											
1						2	50 DO	16€	,										
			Compact black sand some gravel with		56.60 1.22														
		Stem)	Compact black sand, some gravel, with brick and ashes (FILL)			3	50	23											
	der	ollow S			55.99														
2	wer Au	200 mm Diam. (Hollow S	Compact brown to dark brown SAND, some gravel, trace silt		1.83		50												
	P	mm Di				4	DÖ	16	₽										
		200																	
							50 DO	10€											
3			Compact brown SAND and GRAVEL		54.77 3.05	6	50 DO	10											
						0	DO	16€											
			Dense brown coarse SAND		54.16 3.66		50												
4	╞	Ц	End of Borhole		53.88 3.94	7	50 DO	50€	,										
			Auger Refusal																
5																			
6																			
7																			
8																			
9																			
э																			
10																			
DE	P	TH S	SCALE							Ido	•							LC	GGED: D.G.
1 :	: 5	50							H AGO	ocia	tes							СН	ECKED: K.P.H.

PROJECT: 10-1122-0044

RECORD OF BOREHOLE: 10-11

SHEET 1 OF 1 DATUM: Geodetic

LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: March 18, 2010

			SOIL PROFILE		· · · ·	SA	AMPL	1	Heads ppm	pace C				PPM] €		k,	cm/s		TIVITY,	Ţ	- NG NG	PIEZOMETER
METRES			DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	түре	BLOWS/0.3m	Heads	6 pace C	12 omb			24 . [%LEL]				NTENT	PERCE		ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
~				STRA1	DEPTH (m)	NUN	F	BLOW	ppm	20	40	F	0	E0	1	Wp ⊢ 10	20		30	WI 40	AD	
0			Ground Surface		57.86					<u> </u>												
			Black sandy silt with organic matter (TOPSOIL)		0.08	1	50 DO	15€														
			Compact brown silty sand, some gravel (FILL)				DO		Í													
							50															
1			Dense to loose brown and black sand, some gravel with brick, trace concrete		56.87 0.99		50 DO	38	⊕													
			and wood (FILL)																			
						3	50 DO	57	Ð													
2																						
						4	50 DO	6	⊕													
			Compact brown silty sand layers, some clay, trace gravel with cobbles and		55.42 2.44		-															
			boulders (FILL)			5	50 DO	246	Þ													
3						╞	-															
		(me				6	50 DO	28€	ŧ													
		ollow Stem)	Very dense grey CLAYEY SILT, trace very fine sand with cobbles and	- MARANA SANA SANA SANA SANA SANA SANA SANA	54.20 3.66	\vdash	-															
4	Power Auger	200 mm Diam. (Hollow	very fine sand with cobbles and boulders	\mathbb{H}		7	50 DO	536	₽													
	Po	Di Mm			1	╞	-															
		200		$\left \right $		8	50 DO	346	₽													
				M																		
5				И		9	50 DO	80€	₽													
					1																	
						10	50 DO	74														
6				$\left[\right]$																		
				И		11	50 DO	50														
				W	1																	
7						12	50 DO	50														
				$\ $																		
						13	50 DO	79														
				H	49.96					<u> </u>												
8			Fresh grey LIMESTONE BEDROCK with interbedded shale		7.90	14	NQ RC	DD	100	2	29	0										
						┢	1				+											
	Rotary Drill	NQ Core		Ē		15	NQ RC	DD	T.C.R. (%)	S.C.R. (%)	14 UC a	28 										
9	Ro	z		Ħ		╞	-		Ĕ	, vi		2										
				Ħ			NQ RC	DD	100	5	50	36										
			End of Borehole	<u>р</u> -т-т	48.36 9.50					╞╌└	+				+							
40																						
10																						
DF	РТ	ня	CALE						Â												LC	DGGED: D.G.
1:										JG	rO	lde	r ites									ECKED: K.P.H.

RECORD OF BOREHOLE: 10-14

BORING DATE: March 12, 2010

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES		· 1																			I	1 < - 1	PIEZOMETER
Ψ	BORING METHOD		DESCRIPTION	STRATA PLOT	ELE				BLOWS/0.3m	Heads	6 I space	1: Com		18 		24 [%LEL]	v	ATER		PERCE	0 ⁻³ 上 L	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
2	BORIN			STRAT.	DEP (m)				BLOW		20	4		60		⊡ ∞	W	′p				ADI. LAB.	INGTALLATION
0			Ground Surface		55	.85					Ľ												
Ĭ	Ţ	- P	Dark brown sandy silt with organic matter (TOPSOIL)	/	1	.10								T									
			Compact dark brown sand, some gravel, trace silt and brick (FILL)	- 🗱	∛			0	8 🖨														
							_																
							2 5 D	0	26 🖨														
1					54		- D	0															
		ŀ	Compact, brown, medium to coarse sand, some gravel, trace silt (FILL)		1	.22																	
		liter	Sand, Some gravel, trace Sitt (FILL)			:	3 5 D	0 1	160														
	rger	ollow																					
2	Power Auger	an. (H					5	0.															
1	ΡŌ	nn Di				ľ	1 5 D	0	170														
		200 n				┢	\neg																
					\$		5 5 D	001	170														
3																							
					52	.50	5																
		f	Compact light brown SANDY SILT	-Mî		.30	5 D	ŏ 1	120														
		┢	Dense coarse SAND, some gravel		52	.19	, 5	005	50 🖶														
4					51	.86			Ľ														
Γ	T	1	Fresh LIMESTONE BEDROCK with interbedded shale			.99																	
				Ē		8	R		D	96		28		16									
						┢	-			╞	-	\vdash		_									
_ :	Dril	ore							()0) U	(%)	S.C.R. (%)		. (%)										
5	Rotary Drill	ğ									S.C.F		R.Q.D. (%)										
						9	R		D	100		96		96									
					49	.85																	
6		1	End of Borehole			.00	1	╈										1					
7																							
8																							
9																							
10																							
-																							
														1								·	
DEF	11	٦S	CALE						1		W.	C	14		tes							LC	GGED: D.G.

RECORD OF BOREHOLE: 10-15

BORING DATE: March 12, 2010

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

ų į	ğ		SOIL PROFILE		1	SA	MPL		ppm	-			PPM]	AULIC C k, cm/s			μŞ	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD			STRATA PLOT	ELEV.	R		BLOWS/0.3m	6				24	 0 ⁻⁶ 1		0 ⁻³	ADDITIONAL LAB. TESTING	OR STANDPIPE
MET	SING		DESCRIPTION	ATA F	ELEV. DEPTH	NUMBER	түре	WS/0	Headsp: ppm	ace Cor	nb. Vap	our Conc	. [%LEL]		ONTENT		AB. TI	INSTALLATION
ä	BOF			STR/	(m)	ž	ľ.	BLC	20	4	0 0	60	80			WI 40		
_		Ground	Surface		55.34													
• 0		Dark gr (TOPS)	ey silty sand with organic matter		55.14													
		Compa	ct grey silty sand, some gravel, ay with cobbles (FILL)		0.20	1	50 DO	40 €	•									
		trace ci	ay with cobbles (FILL)		54.62													
		Compa	ct black sand, some gravel,		54.63 0.81		50											
- 1		trace si Loose,	brown, fine to medium sand,	/ 🗱		2	50 DO	14 (Ð									
		trace gr	avel (FILL)															
	ger	MOID				3	50 DO	7 6	•									
	Power Auger	E																
- 2	Pov																	
					×	4	50 DO	6 €	•									
		0			52.90 2.44													
		brick an	ct dark brown to black silt, trace id paper (FILL)		2.44		50											
						5	50 DO	20					1					
- 3		Loose o	coarse GRAVEL with dark	R	52.29 . 3.05	_	50						1					
			o black silt	<u>،</u> ۵	51.96 3.38	6	50 DO	9					-					
		Auger F	Borehole Refusal		3.38								1					
- 4																		
- 5																		
- 6																		
- 7																		
'													1					
													1					
													1					
													1					
- 8													1					
													1					
- 9																		
													1					
- 10													1					
-													1					
				•										•	-			
DEI	PTH	SCALE						- 1	7 🛛 🗸 🗛 `			r Mes					LC)GGED: D.G.

RECORD OF BOREHOLE: 10-16

BORING DATE: March 12, 2010

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

<i>"</i>		탈	SOIL PROFILE		1	SA	MPL		Head ppm	space			oour (PPM] ⊕						1	- Br	PIEZOMETER
METRES		BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	түре	BLOWS/0.3m	Head	6 space	1 e Con		18 /apou		24 1 . [%LE <u>L]</u>	W	ATER			PERCE		ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
2		BORIN		STRAT	DEPTH (m)	NUN	∣≿	BLOW	ppm								p — 10					ADI	INGTALLATION
0			Ground Surface		55.72					20	4		60	, i	30			20	30	, ,	40		
			Black sandy silt with organic matter	/	0.08		50	22 (Þ														
			Compact dark brown to brown sand, some gravel, trace silt with pieces of concrete (FILL)				DO	22 1	ν														
							50																
1					54.50		50 DO	53 🤅	Ð														
			Loose to compact brown fine sand (FILL)		1.22																		
		w Stem				3	50 DO	136	Ð														
2	Power Auger	200 mm Diam. (Hollow Stem)																					
	Powe	m Dian				4	50 DO	4 €	Ð														
		200 m																					
							50 DO	з (Ð														
3			Peat with sand and wood (FILL)		52.70 3.02																		
						6	50 DO	2 €	Ð														
						7	50 DO	1 €	÷														
4			Fresh grey LIMESTONE BEDROCK		51.73 3.99		DO		Í –	+													
			with interbedded shale			8	NQ RC	DD	10	D	91		83										
	Drill	ore		臣					(%)	(%)	\vdash	(%)											
5	Rotary Drill	NQ Core		臣臣			NO		T.C.R. (%)	S.C.R. (%)		R.Q.D. (%)											
э						9	NQ RC	DD	10	D	100		100										
			End of Borehole		50.21 5.51													_	-+				
6																							
7																							
_																							
8																							
9																							
9																							
.0																							
DE	PT	TH S	CALE						Â	1		. 1 -										L	DGGED: D.G.
1:									17		G (DIC	ier	tes									ECKED: K.P.H.

RECORD OF BOREHOLE: 10-17

BORING DATE: March 15, 2010

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

10	0		SOIL PROFILE	- -		SA	MPL						PPM]		AULIC C k, cm/s			Ţ	NG AL	PIEZOMETER
METRES		Boring method		STRATA PLOT	ELEV.	3ER	й	BLOWS/0.3m					24		0 ⁻⁶ 1			0 ⁻³	ADDITIONAL LAB. TESTING	OR STANDPIPE
WE			DESCRIPTION	RATA	DEPTH (m)	NUMBER	ТҮРЕ	-ows	ppm	bace Co	mb. vap	our Cond	:. [%LEL]	W					ADD.	INSTALLATION
		ň		ST				В	2	0	40	60	80					40	\vdash	
0		\square	Ground Surface Dark brown silty sand with organic	EEE	56.19 56.06						+									
			material (TOPSOIL)	/	0.13	1	50 DO	13 €	Ð											
			Loose to compact dark brown silty sand, some gravel with brick, cobbles and boulders (FILL)																	
1							50 DO	9	Ð											
			Compact black sand, some gravel,		55.05 1.14															
		2	trace silt (FILL)		54.67	3	50 DO	18 €	Đ											
		200 mm Diam. (Hollow Stem)	Loose to compact, brown, medium to coarse SAND, trace gravel with cobbles and boulders		1.52	-	DO													
2	Power Auger	Hollo	cobbles and boulders																	
-	ower /	Diam.				4	50 DO	7 €	Ð											
	۵.	um U																		
		200				ļ _	50 DO													
_							DÖ	20€												
3			Compact coarse GRAVEL with dark	<u>ې د</u>	53.14 3.05		1													
			brown silty sand	° °	ġ	6	50 DO	18€	Ð											
				。 ^																
					ġ	7	50 DO	23€	Ð											
4		Ц	End of Borehole	• ~	52.08		Ē				<u> </u>								<u> </u>	
			Auger Refusal																	
5																				
6																				
7																				
8																				
0																				
3																				
9																				
10																				
					I		I				1	1		1					1	
DE	PT	ΉS	CALE					(G	olde socia	r							L	DGGED: D.G.
1 :	5	0							V	Ass	<u>soci</u>	ites							CH	ECKED: K.P.H.

RECORD OF BOREHOLE: 10-19

BORING DATE: March 16, 2010

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

10,2010

JLE	6		SOIL PROFILE	<u> </u>		SA	MPL		DYNAMIC PENETRA RESISTANCE, BLOW	TION /S/0.3m	HYDRAULIC CONDUCTIVITY k, cm/s		AL	PIEZOMETER
DEPTH SCALE METRES		BORING METHOD	DECODICTION	STRATA PLOT	ELEV.	BER	щ	BLOWS/0.3m	20 40	60 80	10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴	10 ⁻³	ADDITIONAL LAB. TESTING	OR STANDPIPE
DEPT			DESCRIPTION	TRAT	DEPTH (m)	NUMBER	ТҮРЕ	ROWS	SHEAR STRENGTH Cu, kPa	rem V. ⊕ U - O			ADD LAB.	INSTALLATION
	Ľ	<u> ۱</u>	Ground Surface	5	56.42			m	20 40	60 80	10 20 30	40		
- 0	-		Black sandy silt with organic matter		0.10	1								
			Compact to very dense grey brown silty sand, some gravel with brick, concrete,			1	50 DO	14						
			and asphalt (FILL)											
- 1						2	50 DO	50						
- 1		Stem)												
	uger	Hollow				3	50 DO	10						
	Power Auger	200 mm Diam. (Hollow Stem)	Compact black sand, some gravel		54.74 54.59	5	DO	10						
- 2	ď	mm C	CFILL) Compact brown silty sand, some gravel, trace black sand (FILL)	1	1.83									
		20(gravel, trace black sand (FILL)			4	50 DO	18						
			Dense grey brown silty clay, trace		53.98 2.44									
			gravel (FILL)			5	50 DO	36						
- 3			Dense black SANDY SILT with organic /matter /	Æ	53.45	6	50 DO	50						
		-	Dense brown fine SAND, some silt	<u>,</u>	53.17 3.25									
			Auger Refusal											
- 4														
-														
- 5														
- 6														
. 7														
- 8														
- 9														
э														
- 10														
DE	PT	тнs	CALE					1					LC	OGGED: D.G.
1 :	5	0							Gold	iates			CH	ECKED: K.P.H.

RECORD OF BOREHOLE: 10-20

BORING DATE: March 22, 2010

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

Ľ			SOIL PROFILE			SA	MPL	ES	Headspace C	org. Vapo	our Conc.	[PPM]	HYDRAUL k,	LIC COND cm/s	UCTIVIT	Y,]		PIEZOMETER
METRES	RORING METHOD		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	6 Headspace C ppm	12 L Comb. Va	18 I pour Cor	24 nc. [%LEL]	10 ⁻⁶ WATE Wp H	10 ⁻⁵ I ER CONTI		10 ⁻³	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
	ă	ā		ST				BI	20	40	60	80	10	20	30	40	-	
0		-	Ground Surface Black sandy silt with organic matter	<u>E</u>	57.94		$\left \right $		————	-			+	_	_	_	-	
			(TOPSOIL) // Compact dark brown silty sand and brick (FILL)		0.08		50 DO	18€	•									
1			Compact sand, some gravel, trace concrete and brick (FILL)		57.33 0.61	2	50 DO	39 (Ð									
					50.44	3	50 DO	16	Ð									
2	ger	ollow Stem)	Loose to compact brown SILTY SAND with cobbles and boulders		56.11 1.83		50 DO	8€	•									
3	Power Auger	200 mm Diam. (Hollow Stem)	Dense grey SILTY SAND, some gravel, trace clay		<u>55.20</u> 2.74	5	50 DO	30€	•									
					54.28	6	50 DO	66€	•									
4			Very dense grey CLAYEY SILT, some very fine sand, trace gravel		3.66	7	50 DO	97€	•									
						8	50 DO	86€	•									
5.			End of Borehole Auger Refusal		52.86 5.08													
6																		
7																		
8																		
9																		
10																		
DE 1 :			CALE							old	er iates							DGGED: D.G. ECKED: K.P.H.

RECORD OF BOREHOLE: 10-25

BORING DATE: March 10, 2010

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

JLE		DE L	SOIL PROFILE		1	SA	MPL		ppm	pace U	rg. Vapo			•1 ⊕			ONDUC		T	RgA	PIEZOMETER
DEPTH SCALE METRES		BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	BLOWS/0.3m	Heads		12 Jomb. Va	18 Joour Co	24 nc. [%l	LEL]				0 ⁻⁴ 1 PERCE	0 ⁻³ ⊥ ⊥ NT	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
DEP				TRAT	DEPTH (m)	NUN	≿	BLOW						Ū	Wp	• 			WI	ADI	
	<u> </u>	-	Ground Surface	s	55.79	-	-		2	20	40	60	80		1	0 2	20 3	30 4	40	<u> </u>	
- 0		\square	Dark brown silty sand with organic		55.64																
			matter (TOPSOIL)	1	0.15	1	50 DO	29€	÷												
			Dense grey brown to brown sand, some gravel, trace silt with cobbles and boulders, trace brick from 1.22 to 1.52		3																
			m depth (FILL)				1														
- 1						2	50 DO	46													
					1																
		(e u	Loose brown fine to medium sand	×	54.27 1.52	3	50 DO	156	Ð												
	Ē	ow S	(FILL)		Š.																
- 2	Power Auger	Hol					50														
	Powe	Diam				4	50 DO	3 €)												
		200 mm Diam. (Hollow Stem)				-	-														
		20				5	50 DO	4				⊕									
- 3			Wood (FILL)	₩	52.89 2.90							1									
э							1														
						6	50 DO	15					€								
					52.13																
			Very dense coarse GRAVEL with dark brown silt (FILL)	。 0	3.66	7	50 DO	53	⊕												
- 4				, 0 , ,	51.65		DO	53	Φ												
		Τ	End of Borehole Auger Refusal		4.14							T									
- 5																					
- 6																					
- 7																					
- 8																					
- 9																					
- 10																					
									۵												
DE	PT	ъ	CALE					(Â	Ŷc	oldo soci	Y								LC	DGGED: D.G.
4.	5	0										.1 0 t 0 t								СН	ECKED: K.P.H.

RECORD OF BOREHOLE: 10-26

BORING DATE: March 24, 2010

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

<u> </u>	0	탈	SOIL PROFILE			SA	MPL		ppm	space	- Olg	, vap	JUUI	JUNU. [P	PM]		k, cm/		TIVILY,	T	- NG -	PIEZOMETER
METRES		BORING METHOD		STRATA PLOT	ELEV.	3ER	щ	BLOWS/0.3m	Hood	6		2 1 mb V	18 		24 					10 ⁻³	ADDITIONAL LAB. TESTING	OR STANDPIPE
ME			DESCRIPTION	RATA	DEPTH	NUMBER	ТҮРЕ	OWS	Head ppm	space	e Cor	11D. V	ароц	ir Conc.	[%LEL]				T PERCE	WI	ADDI -AB. 7	INSTALLATION
	2	ĭ.		STI	(m)	_		В		20	4	0	60) 8	0					40		
0		-	Ground Surface Black sandy silt with organic matter	222	55.27					_								-				
			(TOPSOIL)	/	0.08		50 DO	200														
			Compact grey crushed stone, some sand (FILL)		54.81	1	DO	20€	9													
			Compact black sand, some gravel (FILL)		54.66 0.61																	
			Compact to dense grey crushed stone,			2	50 DO	27€	Ð													
1			some sand (FILL)																			
		Stem					1															
	ıger	200 mm Diam. (Hollow Stem)				3	50 DO	37€	Ð													
	Power Auger	E.			53.44																	
2	Po	m Dia	Compact, brown, medium to coarse sand, trace crushed stone (FILL)		1.83		50															
		200 m				4	50 DO	14€	€													
			Loose grey brown silty sand, trace	-	52.83 2.44	-																
			Loose grey brown silty sand, trace crushed stone (FILL)			5	50 DO	66	Ð													
3					52.22	ľ	סט															
з			Peat, trace wood (FILL)	×	3.05	6	50 DO	50 (Ð													
			Highly weathered LIMESTONE	Ê	51.97 51.79	Ļ	00		[
	8	ž	BĚDŔOCK Grey LIMESTONE BEDROCK with interbedded shale	臣	3.48		1															
			interbedded shale																			
4	=			臣		7	NQ RC	DD	_ي 10	0 _©	59	(%)	27									
	Rotary Drill	NQ Core		Ê					T.C.R. (%)	S.C.R. (%)		R.Q.D. (%)										
	Rota	ğ							T.C	s.c		R.C										
				臣		~	NO						100									
5					50.22	8	NQ RC	DD	10		100		100									
			End of Borehole		5.05																	
6																						
7																						
8																						
J																						
9																						
9																						
10																						
							<u> </u>				\					1		1	1	1		
			CALE					(Y	Ga	old	ler	tes								DGGED: D.G.
1 :	5	0							V	7A	CC	n	ia	tac							CH	ECKED: K.P.H.

RECORD OF BOREHOLE: 10-28

BORING DATE: March 22, 2010

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm	

S		THOD	SOIL PROFILE	1		SA	MPL	_	ppm		g. Vapou		Ð		k, cm/s			I	ING	PIEZOMETER
DEPTH SCALE METRES		BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)		ТҮРЕ	BLOWS/0.3m					24 	w		I ONTENT			ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
		<u>n</u>		ST				B	2	20 4	40	60 	80	1	0 2	20 3	30 4	40		
- 0	-	+	Ground Surface Black sandy silt with organic matter		56.33 56.20								-							
			(TOPSOIL)		0.13		50 DO	17€	_											
			Compact brown coarse sand, some gravel (FILL)			'	DO	1/ 6	9											
					55.42 0.91	2	50 DO	22	Ð											
- 1			Loose to compact black sand, some gravel, some glass, trace wood from 1.83 m depth (FILL)		0.91		00													
			1.83 m depth (FILL)																	
		Ê				3	50 DO	10	⊕											
		w Ste																		
- 2	Auder	(Hollo					50													
	Power Auger	Diam.				4	50 DO	4 €	Ð											
	1	200 mm Diam. (Hollow Stem)	Loose brown to grey brown SILTY	W	53.89 2.44															
		200	CLAY			5	50 DO	9 6	Ð											
- 3																				
						6	50 DO	6 €	Ð											
					52.67	7	50 DO	e	Ð											
			Dense brown SILTY SAND, some gravel with cobbles and boulders		3.66															
- 4					1	8	50 DO	60	⊕											
	-		End of Borehole	11	52.09 4.24															
			Auger Refusal																	
- 5																				
- 6																				
- 7																				
- 8																				
- 9																				
- 10																				
– 9 – 10 – 12									_											
DE	EP	TH S	CALE						Â		014-	**							LC	DGGED: D.G.
1	: 5								V	Ass	olde socia	r Ates								ECKED: K.P.H.

RECORD OF BOREHOLE: 10-29

BORING DATE: March 22, 2010

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

ا _ ل	Ę	₽ŀ	SOIL PROFILE	1,		SA			Headspace C ppm				⊕		, cm/s				₽₽	PIEZOMETER
METRES		NG ME	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	ТҮРЕ	BLOWS/0.3m	6 Headspace C	12 Jomb. Va	18 I Ipour C	24 I Conc. [%L	티		TER CC	NTENT	PERCE		ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
-		ROK		STRA ⁻	DEPTH (m)	INN	μ	BLOV	ppm 20	40	60	80		Wp H 10	2	0 ^W		WI 40	LAE	
0			Ground Surface		56.80						Ť					- 0				
Ũ			Black sandy silt with organic matter (TOPSOIL)		56.67 0.13		50													
			Compact brown silty clay, some sand, trace gravel (FILL)			1	50 DO	10€	•											
		╞	Compact brown silty sand, some		56.19 0.61															
1			gravel, trace concrete (FILL)			2	50 DO	28€	ə											
Ċ					55.58															
			Very dense black sand, some gravel, trace brick (FILL)		1.22		50													
		Ê			54.07	3	50 DO	55	0											
2	F	ow Ste	Compact brown coarse sand (FILL)		54.97 1.83															
-	Power Auger	E Holl	Compact grey brown silty clay (FILL)	- 	54.67 2.13	4	50 DO	18	⊕											
	Powe	n Dian			51.01															
		200 mm Diam. (Hollow Stem)	Loose dark brown silty sand with organic matter (FILL)	×	54.21 2.59	5	50 DO	8 €	·											
3					53.75		00													
		[Hard grey CLAYEY SILT, some very fine sand	III	3.05															
				HI		6	50 DO	28€	>											
					1															
4				$\left[\right] $		7	50 DO	49€	•											
				HI																
		Ч	End of Borehole		52.37 4.43						-		_							
			Auger Refusal																	
5																				
6																				
7																				
8																				
9																				
9																				
10																				
				1																
DE	PΤ	Ъ	CALE					(old soc									LC	GGED: D.G.

RECORD OF BOREHOLE: 10-30

BORING DATE: March 25, 2010

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

S	THOD		SOIL PROFILE			SA	MPL		Headspace Or ppm			Ð	HYDRAU k]	ING ING	PIEZOMETER
METRES	BORING METHOD		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	түре	BLOWS/0.3m	6 Headspace Co ppm			24 . [%LEL]		TER CO	⁵ 10 NTENT O ^W	PERCE		ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
0		Ground Su Black san	dy silt with organic matter	un ST	57.87			B	20	40 6	50	80	10	20) 3	0 4	40		
		(TOPSOII Loose bro (FILL)	L) wn silty sand, some gravel		0.15	1	50 DO	6€)										
1					56.65	2	50 DO	4€)										
		Compact sand, son	to dense light brown silty ne gravel, trace clay (FILL)		1.22	3	50 DO	17€	•										
2						4	50 DO	35€	•										
	uger	Dense to SAND, so cobbles a	very dense grey SILTY ome gravel, trace clay with nd boulders		55.43 2.44	5	50 DO	49€	•										
3	Power Auger	00 mm Uam. (6	50 DO	49€	,										
4		N				7	50 DO	86€	•										
						8	50 DO	92€)										
5																			
						9	50 DO	99 (•										
6	RD	MN				10		50 DD											
		Fresh gre with intert	y LIMESTONE BEDROCK		51.19 6.68														
7	Rotary Drill	NU COR				12	NQ RC	DD	10. 10 S.C.R. (%) S.C.R. (%)	B.O.D. (%)	-								
8						13	NQ RC	DD											
		End of Bo	orehole		49.62 8.25														
9																			
10																			
DE	PTH	I SCALE						(G	olde: socia	r								GGED: D.G. ECKED: K.P.H.

PROJECT: 10-1122-0169

RECORD OF BOREHOLE: 11-11

LOCATION: See Site Plan

SAMPLER HAMMER, 63.5 kg; DROP, 760 mm

BORING DATE: Mar. 4, 2011

SHEET 1 OF 2

DATUM: Geodetic

u J	DOH.	SOIL PROFILE	—	,	SA	MPLE		DYNAMIC PENETRA RESISTANCE, BLOV	/S/0.3m	Ľ.	HYDRAU k	k, cm/s	NDUCI		T	NGR	PIEZOMETER
METRES	BORING METHOD	DECODIDATION	STRATA PLOT	ELEV.	NUMBER	Щ	BLOWS/0.3m	20 40 SHEAR STRENGTH		80 + Q - •	10 ⁻⁶			PERCEI	D-3 ⊥ ⊥ NT	ADDITIONAL LAB. TESTING	OR STANDPIPE
	ORIN	DESCRIPTION	RAT/	DEPTH (m)	MUM	ТҮРЕ	SWO-	SHEAR STRENGTH Cu, kPa	rem V. 6	Đũ-Õ			W			ADD LAB.	INSTALLATION
	ă	GROUND SURFACE	ST	(11)			B	20 40	60	80	20				0 I		
0		Compact black sand and gravel, some		54.5 0.0													X
1	Power Auger 200mm Diam (Hollow Stem)	silt, trace clay, wood and ash (FILL)				50 DO	29									мн	Cuttings
-																	
					3	50 DO	>100										
	_	Slightly weathered grey LIMESTONE		51.9 2.7													
3		Slightly weathered grey LIMESTONE BEDROCK, with interbedded shale				NO											
				51.2	C1	NQ RC	DD										Bentonite Seal
		Fresh grey medium bedded LIMESTONE BEDROCK, with interbedded shale		3.4												UC	
		Interbedded shale			C2	NQ RC	DD										
4	≓ s																
	Rotary Drill NO Coring																
	Ϋ́ Ξ				СЗ	NQ RC	DD										
Ē																	
5																	
					C4	NQ RC	DD										
6		End of Borehole		48.6 5.9													
7																	
8																	
9																	
5																	
10																	
DEI	PTH	SCALE						B Assoc	ler		<u> </u>					L	DGGED: DG

	LOC	CATIC	T: 10-1122-0169 IN: See Site Plan FION: -90° AZIMUTH:		RE	со	RD	O	DR DR	ILLIN	ng [Rig:	DATE: CME :	Ма 55 Т	r. 1,∶ īrack	201	1	1-21					HEET 1 OF 1 ATUM: Geodetic
DEPTH SCALE	MEIKES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No. PENETRATION RATE	(m/min) FLUSH <u>COLOUR</u>	FR/F CL-C SH-S VN-\ R TOT COR	CLEA SHEA VEIN RECO	VAGE \R	F F	F-FAULT J-JOINT P-POLISH S-SLICKE R.Q.D. %	FF INSIE	F S	R-RO		UE-UNEVEN ED W-WAVY C-CURVED SCONTINUITY DATA	MB- B-BI	H. BI		2 DIAMETRAL 4 POINT LOAD 6 INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
-	0	Ê	BEDROCK SURFACE Slightly weathered LIMESTONE		54.8 0.0		_	$\left \right \right $					\parallel		\parallel			+		_		Protective Monument
	1	P.A. (Hollow Stem)	BEDROCK, with shale interbedding		53.3	C1																Bentonite Seal
	2 3	Rotary Drill NQ Coring	interbedded shale			C2 C3	007															Silica Sand
1011220169 (ROCK),GPJ GAL-MISS.GDT 15/06/11 DATAINPUT:	4 5 5 6 6 7 7 8 8 8 9 9		End of Borehole		51.1 3.7																	W.L. in Screen at Elev. 52.12 m on March 7, 2011 W.L. in Screen at Elev. 52.44 m on April 19, 2011
Ř	DEF 1 : {		CALE					Ĝ		À	Go	olde ocia	r Ite	S								ogged: Dg Iecked: Sr

RECORD OF BOREHOLE: W-009

SHEET 1 OF 2 DATUM: Geodetic

BORING DATE: June 2-6, 2011

LOCATION: N 5030282 97 ;E 365715 99

	DOH	SOIL PROFILE	-		S	AMPL	ES	DYNAMIC PENETRATION RESISTANCE, BLOWS/0 3m	HYDRAULIC CONDUCTIVITY, k, cm/s	
METRES	BORING METHOD		LOT		e.) 3m	20 40 60 80	k, cm/s 10 ³ 10 ⁴ 10 ⁴ 10 ² WATER CONTENT PERCENT Wp IW WI	
ME	SING	DESCRIPTION	STRATA PLOT	DEPT		TYPE	BLOWS/0.3m	SHEAR STRENGTH nat V + Q · ● Cu, kPa rem V ⊕ U - O	WATER CONTENT PERCENT	
	BOF		STR4	(m)	, z	1	BLO	20 40 60 80	Wp I WI 4	
		GROUND SURFACE		60.	44	1				MO
0	1	ASPHALTIC CONCRETE		H						Flush Mount Protective Casing
		Grey sand and gravel (Crushed Stone FILL)		59		t.				sel in Asphalt Silica Sand
		Compact brown medium sand, trace		0						
		gravel and silt (FILL)			1					Bentonite Seal
1					1	50 DO	16			
		Loose to dense grey sand and gravel,	-	59.		DO				
		some brown sand, with cobbles (Crushed Stone FILL)								-
2					2	50 DO	14			
2					-					
					T	1				Cave/Backfill
					3	50 DO	61			
					-					
3					-	-				
					4	50 DO	9			Cave/Backfill
						00				
					E					
4				58.	32	50				
		Very loose to compact brown sandy silt, some clay, trace gravel, with wood		4	5	50 DO	5			
	-(u	fragments, occasional cobble and boulders with depth (FILL)			-					
	er ow Silom)	nominera mun nehm (Eithr)								Bentonite Seal
5	Power Auger 200mm Diam (Hollow				6	50 DO	3			
	Diam				-					
	mm0C				-					
	2(7	50 DO	10			
										Silica Sand
0		Compact to dense black sandy silt.	1000	54 6						
		some wood, trace gravel, ash, glass and fabric, creosote odour (WASTE)	14		8	50 DO	12			
		issio, orosolis oddai (WAGTE)	12		ľ	DO	_			
			N							32mm Diam PVC
7			2		9	50 DO	41			#10 Slot Screen
			NS			DO				
			12							
			N	-	T	1				
8		Loose brown to grey fine to coarse sand,	888	52		50 DO	43			Silica Sand
		trace gravel, trace silt (FILL)			-					
					-	-				Bentonite Seal
					11	50 DO	5			
9					-	1				
						50				Cave
					12	50 DO	5		O Mł	1
					1					
10			-888		- 13	+-	5			
		CONTINUED NEXT PAGE								
DEF	TH S	CALE						Maril		LOGGED: RI
1:5	~							Golder		HECKED: SD/HD

PROJECT:	10-1121-0222	

RECORD OF BOREHOLE: W-009

SHEET 2 OF 2

LOCATION: N 5030282 97 ;E 365715.99

BORING DATE: June 2-6, 2011

DATUM: Geodetic

METRES	DOH	SOIL PROFILE			SA	MPL	ES	DYNAMIC PENETRATION RESISTANCE, BLOWS/0 3m	HYDRAULIC CONDUCTIVITY, k, cm/s	2
RES	BORING METHOD		LOT	-	с.		0 3m	20 40 60 80	k, cm/s 10 ⁴ 10 ⁴ 10 ¹ WATER CONTENT PERCENT Wp I OW I WI	
ME	SING	DESCRIPTION		DEPTH	NUMBER	TYPE	BLOWS/0 3m	SHEAR STRENGTH nat V + Q - Cu, kPa rem V + U - O	WATER CONTENT PERCENT	2
	BOF		STR	(m)	ž		BLC	20 40 60 80	Wp → → W WI 20 40 60 80	
10	-	CONTINUED FROM PREVIOUS PAGE								MO
	jer -	Loose brown to grey fine to coarse sand, trace gravel, trace silt (FILL)			10	50 DO	5			
	Power Auger	Loose dark brown silt, with organic		50 07 10 37	13	DO	2			Cave
	Powe	matter, occasional grey fine sand seams	而用	10 52						
	1	Dense brown SILTY SAND, some gravel	U.	49 54	14	50 DO	>50			
11		Dense to very dense grey SILTY SAND to SANDY SILT, some gravel, trace clay, with cobbles and boulders (GLACIAL	30	10.90						Bentonite Seal
21			96			NO				
1			20		15	NQ RC	DD			
12			20		-					-
					15					
			12	<u>}-1</u>						
			10		16	NQ RC	DD			
13	Rulary Drill NO Core									Cave
	NO (2							
			1							
			1		T					
14			1							
					17	NQ RC	סמ			
		1	1							
										Bentonite Seal
15					-	NO				
				45.04	18	NQ RC	DD			W L in Screen at Elev 53 3m on
		Borehole continued on RECORD OF DRILLHOLE W-009	anin.	42.04						Aug 2, 2011
16										
17	1									
	60									
18										
19										
	Ы									
20					N					
20										
-	-		1	-	-	1	-			-
		CALE						Golder		LOGGED: RI
1:5	0							Associates	0	CHECKED: SD/HD

LO	CATI	CT: 10-1121-0222 ON: N 5030282 97 ;E 365715 99 ITION: -90° AZIMUTH:	RECORD OF DRILLHOLE: W-009 DRILLING DATE: June 2-6, 2011 DRILL RIG: CME 75 DRILLING CONTRACTOR: Marathon Drilling	SHEET 1 OF 1 DATUM: Geodetic
METRES	DRILLING RECORD	DESCRIPTION	U ELEV Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z	abbrevations reter to lea of abbreviations &
16	Rotary Dril) NO Core	BEDROCK SURFACE Fresh, interbedded sequence of shale and limestone, comprised of dark brownish black, moderately calcareous SHALE BEDROCK, with thinly to medium bedded, dark brownish grey, fine grained, medium strong micritic LIMESTONE BEDROCK LINDSAY FORMATION UNIT 3	45.04 H = 15.40 	MON V Bentonite Seal Cave
17		End of Drillhole	<u>16.92</u>	W L in Screen at Elev 53 3m on Aug 2. 2011
19				
20				
21				
22				
23				
25				
DE	РТН	SCALE	Golder	LOGGED: RI

PROJECT: 10-1121-0222	
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RECORD OF BOREHOLE: W-009A

SHEET 1 OF 1

LOCATION: N 5030284_17 ;E 365718.48

BORING DATE: June 13, 2011

DATUM: Geodetic

Ş		SOIL PROFILE	-	1	SA	MPL	ES	RESISTANCE, BLOWS/0 3m	HYDRAULIC CONDUCTIVITY, k, cm/s	
		DESCRIPTION	STRATA PLOT	ELEV DEPTH (m)	NUMBER	TYPE	BLOWS/0 3m	20 40 60 80 SHEAR STRENGTH nat V + Q - ● Cu, kPa rem V ⊕ U - O	k, cm/s 10 ⁻³ 10 ⁴ 10 ⁴ 10 ² WATER CONTENT PERCENT Wp I OW I WI	
α		GROUND SURFACE	S		-		60	20 40 60 80	20 40 60 80	GA
1		See RECORD OF BOREHOLE W-009 for subsurface condition details		<u>60.53</u> 0.00						Flush Mount Protective Casing set in Bentonite
2										Bentonite Seal Backfill Pea Gravel
Power Auger	200mm Diam (Hollow Stam)									Bentonite Seal Pea Gravel
5										20mm Diam PVC #10 Slot Screen
7		End of Borehole		53.67 6.86						Pea Gravel
9										

PROJECT: 10-1121-0222

RECORD OF BOREHOLE: W-011

SHEET 1 OF 2 DATUM: Geodetic

LOCATION: N 5030336 81 ;E 365783 53

BORING DATE: June 22-24, 2011

	DO	SOIL PROFILE			SA	MPL	ES	DYNAMIC PENETRATION RESISTANCE, BLOWS/03m	HYDRAULIC CONDUCTIVITY, k, cm/s	0
	BORING METHOD		PLOT		~		3m	20 40 60 80	10 ⁻⁸ 10 ⁻⁴ 10 ⁻⁴ 10 ⁻²	LAB TESTING
	NON	DESCRIPTION	APL	ELEV	NUMBER	түре	1S/0	SHEAR STRENGTH nat V + Q - ●	WATER CONTENT PERCENT	H H H
	BORII		STRATA I	DEPTH (m)	NN	F	BLOWS/0	Cu,kPa rem V 🤁 U - O		2 Z
+	ω	GROUND SURFACE	s,		-	-		20 40 60 80	20 40 60 80	1
	T	Topsoil (FILL)	1000	62 74 8 89	-	-	-			1
l		Grey to brown sand and gravel (Crushed Stone FILL)		0,00		1.				1.
L		Stone FILL)								
I										
I										
1			1000		1	50 DO	10			
1	19	Compact to dense dark brown fine to	188	81.44						
		coarse sand, some silt, trace gravel (FILL)			-					
						50 DO	47			м
2					2	DO	47		0	
		Compact dark brown silty sand, some	1	50.61 2.13	-					
		gravel, trace organic matter, with brick fragments and pockets of silty clay								
		(FILL)			Э	50 DO	28			
				59,84						
3		Compact dark brown to black sandy silt, some gravel, trace to some clay, trace		2.90						
		brick, wood, ash and organic matter (FILL)			4	50 DQ	26			
		tation and a shared		59.18		00				2 Y Y
		Dense grey sand and gravel, trace silt, occasional cobble (FILL)		3.56						11
					1					
					5	50 DO	31			
1	Storn				_					
	>				6	50 DO	46			
	E E				ľ	00				
		Compact dark brown to black sandy silt,	Nº N	57.56						
	200mm	trace to some gravel, trace clay, with wood, brick, ash, organic matter, glass,	22							
		plastic and pockets of silty clay (WASTE)	13		7	50 DO	29			
			2%		-					
			33							
			12		8	50 DO	18			
			2							
			1	4						
7	1		12	1						1.1
			14		9	50 DO	91			
			22	1	-					
			1	1		1				
8			1	54.74	10	50 DO	21			
ľ		Compact brown fine to medium sand, trace gravel and silt (WASTE)	12	8 00 54.51						
		Compact dark brown silty sand to sandy	E)	8 23	_					
		sill, some gravel, trace clay, ash, brick, ceramics and organic matter (WASTE)	KA			50				
			1	1	11	50 DO	27			
9			22	-						
		Loose to compact dark brown to black	17	53.59	1					
		sandy silt, some sand, trace paper, fabric, wood, metal and organic matter	NA.	ť	12	50 DO	28			
		(WASTE)	14							
		and can sugar with	12		13		6	na and a second s		the part of
		CONTINUED NEXT PAGE	1		1	17				
1	-		1	1	1	-		JE:		
EF	тнз	SCALE						Golder		LOGGED: RI
	0							Associates		CHECKED: SD/H

PROJECT: 10-1121-0222

RECORD OF BOREHOLE: W-011

SHEET 2 OF 2 DATUM: Geodetic

LOCATION: N 5030336 81 ;E 365783 53

BORING DATE: June 22-24, 2011

SAMPLER HAMMER, 64kg; DROP, 760m

Ц	9		SOIL PROFILE			SA	AMPL	ES	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	-10
METRES		BORING METHOD		LOT		æ		3m	20 40 60 80	10 ⁻⁸ 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	ADDITIONAL LAB TESTING
Ē		NG.	DESCRIPTION	STRATA PLOT	ELEV DEPTH	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH nat V + Q - ● Cu, kPa rem V ⊕ U - O	WATER CONTENT PERCENT	
		RCK		TRA	(m)	R	-	BLO	· · · · · · · · · · · · · · · · · · ·	Wp H	LAG
-	-	-	- CONTINUED FROM PREVIOUS PAGE -	0)			-	-	20 40 60 80	20 40 60 80	4
10	-	T	Loose to compact dark brown to black	1	\$	-	-				
			sandy silt, some sand, trace paper, fabric, wood, metal and organic matter			13	50 DO	6			
			(WASTE)	1		-					
				14	51.92	-					
			Dark brown amorphous PEAT	1111	10 82		50 DO	13			
11			Very stiff grey SILTY CLAY, some	120	11 05	1	DO	13			
		Ê	organic matter		51.31	11					
	-	w Ste	Very dense grey brown fine to coarse SAND, some gravel, some silt, trace	1	11 43		1				
	Auge	Diam (Hollow	clay and pieces of shale (GLACIAL TILL)	82		15	50 DO	69			
12	DWBr	am (60	8	1					
	۵.	D		22	5						
		200mm		1			50				
				10		16	50 DO	53		0	MH
				1		-	1				
13			Highly weathered, black, very weak	145	49.78						
			SHALE BEDROCK			17	50 DO	>86			
				1000		-					
					49.00	-14	50 DO	>50			
			Sampler Refusal at 13.74m Borehole continued on RECORD OF		1		DO	-00			
14			DRILLHOLE W-011		1 1	2					
15					110						
16											
17											
18											
19											
.3											
20											
					·						
-	-	-		-		-		-			
DE	PTH	H SC	CALE						Golder		LOGGED: RI
1:3	50								Associates		CHECKED: SD/HD

N: -90° AZIMUTH:		í.	DRILLING DATE: June 22-24, 2011 DRILL RIG: CME 55 DRILLING CONTRACTOR: Downing	DATUM: Geodetic
DESCRIPTION	SYMBOLIC LOG (m) (m)	FLUSH RETURN	JN Joint BD- Bedding PL - Planar PO- Polished BR - Britken Reid FLT - Fault FO- Foliation CU- Curved K - Stickensoded MOTE For adstornal VN Vein OR- Orthogonal CU- Curved K - Stickensoded MOTE For adstornal CJ - Conjugate CL - Clean IN - Imregular MOR - Kondy Mote For adstornal RECOVERY R O D FRACT DISCONTINUITY DATA MMDR Mote Turrer TOTAL SOLID PER DISCONTINUITY DATA MOTE For adstornal RESOVER 0.50 m ars TYPE AND SURFACE DESCRIPTION FOR 0 SUBS 0.20 m ars TYPE AND SURFACE DESCRIPTION FOR 0	NOTES
DROCK SURFACE at 12.96m	49 00			
ghly weathered, black, very weak HALE BEDROCK No recovery from 13 74m to 14 26m oderately weathered, laminated, black,	13 74 49 48 14 26	1 00	201110 100 10 10 10 10 10 10 10 10 10 10	
eak SHÁLE BEDROCK LLINGS FORMATION	48 12	1 9	BD PL SM BD PL SM BD CU SM BD CU SM	
Broken core from 14 26m to 14.40m Broken core from 14.55m to 14.62m esh, laminated, black, weak SHALE EDROCK		2 001	BD IR.SM Ca 3mm BD.PL SM BD CU.SM	
nd of Drillhole	46 69	-		
LE				Golder

PROJECT:	10-1121-0222
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RECORD OF BOREHOLE: W-012

SHEET 1 OF 2 DATUM: Geodetic

LOCATION: N 5030354 08 ;E 365772.87

BORING DATE: June 7-8, 2011

PENETRATION TEST HAMMER, 64kg; DROP 760mm

SAMPLER HAMMER 64kg DROP 760m

	- L		LET		T	APLE	-	RESISTANCE, BLOWS/0 3m	k, cm/s	NG AL	V. 1
	BORING METHOD		STRATA PLOT	ELEV	BER	<u>س</u>	BLOWS/0 3m	20 40 60 80	10 ⁸ 10 ⁶ 10 ⁴ 10 ² WATER CONTENT PERCENT	ADDITIONAL LAB TESTING	
MEIRES	DRING	DESCRIPTION	RATA	EPTH	NUMBER	TYPE	OWS	SHEAR STRENGTH nat V + Q - € Cu, kPa rem V ⊕ U - C		ADD	
1	BC		LS I	(m)	-		ā	20 40 60 80	20 40 60 80		1
0		GROUND SURFACE Dark brown sandy sill, trace to some	East	59 32 0 00	+	-	-				MO Flush Mount
		gravel and organic matter (TOPSOIL) Very loose to compact dark brown to	颗	0 00 59 12 0 20							Protective Casing set in Sand Silica Sand
		black sandy silt to silty sand, trace to	22								Drinke Boline
		some gravel and clay, with silty clay pockets, brick, wood, ash, glass, organic	22		-						Bentonite Seal
		matter, mortar, ceramics, paper and plastic (WASTE)	1			50					8
			1		1	50 DO	9				
			2		-						
			1			1					
			2	: - 0	2	50 DO	13				
2			1		_						
			22		-						Cave/Backfill
			15		з	50 DO	16				
			1								
3			1		-						
			1		4	50 DO	16				Cave/Backfill
			12								
			1		-						
4			22		5	50 DO	12				
			55								Bentonite Seal
	Slem)		22								2 J
Juni-			1		6	50 DO	з				
Prwer Multi	Diam (Ho		53			00					Silica Sand
d	nm Diá		2A								X
	200mm		1			50					
			22		7	50 DO	18				
6			15	53 22							
		Dark brown to black wood, plastic and paper, some sand and gravel (WASTE)	X	6 10		50	4				32mm Diam PVC
			1		8	50 DO	19				#10 Slot Screen
7			X								
			1		9	50 DO	69				
			2		-						
			N.								Silica Sand
8			XX		10	50 DO	6				
		·	NY.								
		Very dense grey fine to coarse SAND.	1	50.94 8.38							
		trace gravel, trace to some silt			11	50 DO	98				
9					_						Bentonite Seal
			5		-						
			1		12	50 DO	67				
		Very dense black GRAVELLY SAND,		49 72 9 60		00					
		with shale fragments	1.1.1. 1.1.1.		13		动	in a second second second		-	a como de
10		CONTINUED NEXT PAGE					-		T		
			4		-		-			-	-
000	THIS	CALE						Golder			LOGGED: RI

		ECT: 10-1121-0222 FION: N 5030354 08 ;E 365772.87	RECO	RD	OF BOREHOLE: W BORING DATE: June 7-8, 2011	/-012	SHEET 2 OF 2 DATUM: Geodetic
s	AMPI	LER HAMMER, 64kg; DROP, 760mm				PENETRATION TEST HAM	IMER, 64kg; DROP, 760mm
-	1		SAM	PLES	DYNAMIC PENETRATION RESISTANCE, BLOWS/0 3m	HYDRAULIC CONDUCTIVITY,	11
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	5	BLOWS/0 3m		k, cm/s 10 ⁻⁴ 10 ⁻⁴ 10 ⁻² WATER CONTENT PERCENT Wp I WI 20 40 60 80	ADDITIONAL LAB TESTING
- 10	L	- CONTINUED FROM PREVIOUS PAGE -					MON WE
111111	Power Auger	Highly weathered, black, weak SHALE BEDROCK	10.21	50 >50			W L in Screen at Elev 54 1m on
- - - - -		Sampler Refusal at 10.72m Borehole continued on RECORD OF DRILLHOLE W-012	48.60 14	50 DO >50			Aug. 2, 2011
12							
13							
14 4 4 4 4 4							
15							
16							
17							
18							
18							
- 20							
	EPT⊢ 50	SCALE			Golder		LOGGED: RI CHECKED: SD/HD

METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV DEPTH (m)	RUN No	FLUSH RELUKN	JN - Joint FLT - Fault SH - Shear VN - Vein CJ - Conju RECOVERY TOTAL CORE \$ SOLID CORE \$	gale R Q D %	BD-B FO-Fe CO-C OR-O CL-C INDE PEF 0 25r	edding bliation ontact rthogona ean T X COR n AXUS	IR - Irregular DISCONTINUITY TYPE AND SUR DESCRIPTIC	PO- Polis K - Slick SM- Smo RO- Roug MB- Mect DATA	ensided plh hanical Brook HYDF	NOTE- abbrev of abbrev eak symbol RAULIC ICTIVITY m/sec	Broken Ro For additiona abons refer to eviations & s WEATH- ERING INOEX	a inst	NOTES
		BEDROCK SURFACE at 10 21m		48.60			2235 2335	3893	2 2 2 2		80.PL.5M			TT	\$\$\$\$\$		MON
	Rotary Dill NO Core	Fresh, laminated, black, weak SHALE BEDROCK BILLINGS FORMATION		10 72	T	100					AD PL SM AD PL SM AD PL SM AD PL SM						Bentonite Seat
12	NO	- Subvertical fracture from 11 91m to 12 27m, infilled with calcite (<1mm) - Broken core from 12 04m to 12.10m End of Drillhole		<u>47.05</u> 12.27						-	FR ST Ro	Ca <1mn					
13																	W L in Screen at Elev 54 1m on Aug 2, 2011
14																	
15																	
16																	
17																	
18																	
19																	
20																	

PROJECT:	10-1121-0222
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RECORD OF BOREHOLE: W-013

SHEET 1 OF 2 DATUM: Geodetic

LOCATION: N 5030375 10 ;E 365845.61

BORING DATE: June 22-23, 2011

PENETRATION TEST HAMMER 64kg DROP 760

Power Auger 200mm Diam (Hollew Slein) 3. 또 더 0.0 전 5	DESCRIPTION GROUND SURFACE ASPHALTIC CONCRETE Dense to compact grey sand and gravel (Crushed Stone FILL) Compact to dense brown sand and gravel, trace silt, with cobbles (Crushed Stone FILL)	STRATA PLOT	ELEV DEPTI- (m) 000 011	1 WNNN 7 0 2 1 1 2 4	50 DO 50 DO	WE 0/SMO18 39	20 40 60 80 HEAR STRENGTH nal V + 0 • 0 u, kPa rem V ⊕ U • 0 20 40 60 80 20 40 60 80	10 ⁸ 10 ⁴ 10 ⁴ 10 ² WATER CONTENT PERCENT Wp W WI 20 40 60 80	ADDITIONAL LAB TESTING
Power Auger 200mm Diam (Hellow Stern) 3. 또 더 0.000 201 201 201 201 201 201 201 201 201	GROUND SURFACE ASPHALTIC CONCRETE Dense to compact grey sand and gravel (Crushed Stone FILL) Compact to dense brown sand and gravel, trace silt, with cobbles (Crushed	STRATA	DEPTH (m) 0 00 0 1	7 0 2 1 2 4 4 3	50 DO 50 DO	39	u,kPa rem.V ⊕ U-O	Wp	
Power Auger 200mm Diam (Hellow Stern) 3. 또 더 0.000 201 201 201 201 201 201 201 201 201	ASPHALTIC CONCRETE Dense to compact grey sand and gravel Crushed Slone FILL) Compact to dense brown sand and gravel, trace silt, with cobbles (Crushed		0 00	1	50 DO	39			
Power Auger 200mm Diam (Hollew Stein) 3. 또 다 20	Dense to compact grey sand and gravel Crushed Slone FILL) Compact to dense brown sand and gravel, trace silt, with cobbles (Crushed		0 00	1	50 DO				
Power Auger 200mm Diam (Hollow Sken) 3. 분 등	Compact to dense brown sand and gravel, trace silt, with cobbles (Crushed		58 8	1	50 DO				
Power Auger 200mm Diam (Hollow Stein) 3. 앞 도	gravel, trace silt, with cobbles (Crushed			2	50 DO				
Power Auger 200mm Diam (Hollow Stein) 3. 앞 도	gravel, trace silt, with cobbles (Crushed			4		17			
Power Auger 200mm Diam (Hollow Stein) 3. 앞 도	gravel, trace silt, with cobbles (Crushed			3					
200mm Diam (Hollow 3 썼 도				L	50 DO	15			
200mm Diam (Hollow 3 썼 도				4	50 DO	15			
200mm Diam (Hollow 3 썼 도				5	50 DO	35			
200mm Diam (Hollow 3 썼 도				F					
200mm			55.7		50 DO	24			
	Loose to compact dark grey to black sandy silt, some clay and organic matter, race gravel, with wood, glass and brick (WASTE)	1111	51	7	50 DO	13			
		15	-						
		24.4.4		8	50 DO	6			
		14		-					
		1225	51.5	9	50 DO	15			
pl	Dark gray to black wood, organic matter plastic, glass, brick and paper, some silty sand (WASTE)	12222	14		50 DO	11			
	Van danna ang kanun tan ta matum	N.S.S.	52.0		- 50 DO	37			
5	Very dense grey brown fine to medium SAND, some gravel, with cobbles			12	-	=100			
				12		>100			
	CONTINUED NEXT PAGE			Γ					
TH SCA			1		-		Golder		LOGGED: HEC

-	-	R HAMMER, 64kg; DROP, 760mm SOIL PROFILE	-		SA	MPL	ES	PENETRATION TE DYNAMIC PENETRATION RESISTANCE, BLOWS/0 3m	-1	1
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV DEPTH (m)	NUMBER	TYPE	BLOWS/0 3m	20 40 60 80 10 ⁸ 10 ⁴ 1 SHEAR STRENGTH nat V + Q · ● WATER CONTENT PRECE Cu, kPa rem V ⊕ U · O Wp I · O ^W W	UT DITIO	
10	T		10.0	-	13	50	>100		-	
	Auger	SAND, some gravel, with cobbles	212	50 46		DO				
	Power Auger	Highly weathered, black, weak SHALE BEDROCK		10 51	14	50 DO	> 100			W L in open hole at Elev 52 8m upon completion of
11		Borehole continued on RECORD OF DRILLHOLE W-013		49.95						drilling
13										
14										
15										
16										
17										
18										
19										

LOC	CATIC	T: 10-1121-0222 DN: N 5030375 10 ;E 365845 61 TION: -90° AZIMUTH:		REC	:0	RI	DOF DRILLHOLE: W-013 DRILLING DATE: June 22-23, 2011 DRILL RIG: CME 75 DRILLING CONTRACTOR: Downing		ET 1 OF 1 JM: Geodetic
METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV DEPTH (m)	RUN No	31	FLT - Fault FO - Foliation CU- Curved K - Sickensided North SH - Shakar CO- Contact UN - Undulating SM - Smooth abrew VN - Vein OR - Orthogonal ST - Stepped RO- Rough of abrew CJ - Conjugate CL - Collean IR - Irregutar MB - Mechanical Break symbols RECOVERY R O D FRACT DISCONTINUITY DATA CHORALLC Dobre S, LOORE South Construction Check Children Centrolicit Nith K, convision	Broken Rock For additional items refer to list vettors & WEATH- ERING INDEX	NOTES
	T	BEDROCK SURFACE at 10 51m Slightly weathered, laminated, dark grey	1000	49.95 11.02	-				
		to black, weak SHALE BEDROCK, with thin cross-cutting veins of calcite			1	100	FR,PLRo JN PL SM JN PLSM		
		BILLINGS FORMATION - Broken core from 11 14m to 11 22m - Broken core from 11 59m to 11 68m			1				
12	Rotary Dnll NQ Core	Fractured core from 12 15m to 13,52m			2	100 to 0	JN UN Ro BD, UN Ro		
3					3	0			
14		End of Drillhole		47,45				W	L in open hole Elev 528m
15 116 117 118									
20									

PROJECT: 10-1121-0222

RECORD OF BOREHOLE: W-015

SHEET 1 OF 1

BORING DATE: June 13-14, 2011

DATUM: Geodetic

LOCATION: N 5030400 13 ;E 365816 06

	DO	SOIL PROFILE			SA	MPLE	ES	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	10
MEIRES	BORING METHOD		LoT		œ		Ba	20 40 60 80	10 ⁻⁸ 10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	LAB TESTING
	NG &	DESCRIPTION	181-	ELEV	NUMBER	TYPE	BLOWS/0 3m	SHEAR STRENGTH nat V + Q - ● Cu, kPa rem V ⊕ U - O	WATER CONTENT PERCENT	1 1 1
2	ORI		L RA1	DEPTH (m)	NUN	F	LOV	Cu, kPa rem V ⊕ U - O	Wp	EA
-	60		S	(,	_		60	20 40 60 80	20 40 60 80	
0	-	GROUND SURFACE	Para	58.89						-
		Dark brown sandy silt, Irace organic matter and gravel (TOPSOIL)	1	0.00 0 08						
		Grey brown sand and gravel, trace silt, with cobbles (Crushed Stone FILL)								
		with cobbles (ordaried otone File)								
		I see the second deal because the black	1000	58.08						
1		Loose to compact dark brown to black sandy silt, trace to some clay, trace	RA	0.01	1	50 DO	11			
		gravel, with ash, wood, brick, organic matter, mortar, glass and plastic	15			DO				
		(WASTE)	1		-					
			XX		1					
			153		2	50 DO	13			
2			2							
			54							
			55							
			2		3	50 DO	12			
			14		_					
3			25		-					
			22	-	4	50 DO	3			
			54			DO	0			
			22							
			24							
"	Slem)		53	. 1	5	50 DO	7			
			22	in i						
		Black wood and organic mattler, with	1	54.32	_					
		plastic, paper, glass, metal and sand	14	9.97	6	50 DO	10			
5	200mm	(WASTE)	15	12.1	0	DO	10			
	2(2		-					
			24							
			1		7	50 DO	9			
			23	i = 0						
•			14			1				∇
			22				1.1			-
			12	-	8	50 DO	†5			
			12		_					
		Dark brown organic matter, trace silt	A.V	52.03	-					
7		(PEAT)	1	6 91		50				
		Compact to dense grey brown fine to medium SAND, some gravel and silt	124		9	50 DO	16			
			15			1				
			1.		10	50 DO	150			
8			12	50 63						
		Highly weathered, black, weak SHALE	1	8-26		50				
		BÉDROCK			-11	50 DO	950			
										W L in open hole
9										at Elev 52 8m
	+	Borehole continued on RECORD OF	12222	49.75	1					drilling
		DRILLHOLE W-015								
10	1	4 a								1
	_			111	_		1			
)F	тн ۹	SCALE						Golder		LOGGED: CHM
								Golder		CHECKED: SD/HD

LO	CATIO	T: 10-1121-0222 DN: N 5030400 13 ;E 365816.06 TION: -90° AZIMUTH:					D	RILLING RILL RI	G DATE G: CMI G CONT	Jur 75 RAC	E: W-015 he 13-14, 2011 FOR: Marathon Drilling		SHEET 1 OF 1 DATUM: Geodetic
METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV DEPTH /m)	RUN No.	FLUSH RETURN	JN - Join FLT - Faul SH - She VN - Vein CJ - Con RECOVERY TOTAL DORE & CORE 38328 935	t ar ugale ROC %	PER 0 25m	ation Ilaci Iogona	IR - Irregular MB- Mechanic DISCONTINUITY DATA	BR - Broken Rock abbrevistors refer to is of abbrevistors for a abbrevistors for abbrevistors & al Break symbols HYDRAULC K, cm/sec HDEX 2000 200 200 200 200 ERNS HDEX	NOTES
		BEDROCK SURFACE at 8 26m Slightly weathered, laminated, dark grey,	-	49.75 9.14	_	_				Щ			
		weak SHALE BEDROCK, with thin cross-cutting veins of calcite									FR UN Ro		
		BILLIINGS FORMATION - Broken core from 9 14m to 9.18m									JN.PL.SM CI <1mm JN PL.Ro FR PL Ro		
10		Broken core from 10.00m to 10 05m			1	100					FR PL Ro FR PL.Ro FR PL.Ro		
		- Broken core from 10 18m lo 10 34m									FR,CU Ro		
											FR.PL.Ro FR.PL.Ro FR.CU.Ro		
(1		No recovery from 10 71m to 11 00m			2	-							
		- Broken core from 11 00m to 11 03m			2	00					FR UN Ro		
		- Broken core from 11 08m to 11 11m - Broken core from 11.36m to 11 58m								•	FR PL Ro FR PL,Ro Ca <1mm		
. 1		- Broken core from 11 68m to 11 70m - Broken core from 11.85m to 11 91m			3	100		-			FR PL,Ro Ca <1mm JN UN Ro Ca <1mm FR PL Ro Ca <1mm		
12	ary Dritt Coro	- No recovery from 12 15m to 12 25m			1	_			П	2	FR,PL Ro Ca <1mm FR,PL.Ro Ca <1mm BD UN,Ro Ca <1mm FR PL SM Ca <1mm		
	Rotary NO Co	- Broken core from 12 21m to 12 28m									FR PL SM FR PL,Ro BD PL Ro CI 5mm		
											FR UN,Ro Cl <1mm		
13		Broken core from 12 85m to 12 94m Broken core from 13 07m to 13 16m			4	100					FRPL,Ro Ca<1mm		
											BD CU Ro Cə <1mm FR UN Ro		
		- Broken core from 13.58m to 13 95m											
14									m		FR,UN,Ro Cə <1mm JN UN Ro	1917	
		- Fracture (25°) from 14 25m to 14 90m			5	100							
										1	FR UN Ro Ca <1mm FR UN Ro Ca <1mm FR PL,Ro		
15		-No recovery from 14 93m to 15 12m			5	-							
		End of Drillhole		43 56 15 33	5	100							
													W L in open hole at Elev 528m
16													upon completion of drilling
17													
14													
18													
19													
DE	PTH S	CALE						1	X.		der ciates		LOGGED: CHM

PROJECT:	10-1121-0222	

RECORD OF BOREHOLE: W-017

SHEET 1 OF 1

BORING DATE: June 14, 2011

DATUM: Geodetic

LOCATION: N 5030453 15 ;E 365880.77

	90	SOIL PROFILE			SA	MPL	ES	DYNAMIC PENETRATION RESISTANCE BLOWS/0 3m	YDRAULIC CONDUCTIVITY, k, cm/s	0
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV DEPTH (m)	MBER	ТҮРЕ	BLOWS/0 3m	20 40 60 80 SHEAR STRENGTH nat V + Q - • Cu, kPa rem V • U - •	10 ⁴ 10 ⁴ 10 ⁴ 10 ² WATER CONTENT PERCENT	LAB TESTING
	BOR		STRA	(m)	R		BLO	20 40 60 80	Wp W 40 60 80	
0		GROUND SURFACE		58.02						MOI
Ĭ	117	ASPHALTIC CONCRETE		0 00						Flush Mount Protective Casing set in Asphalt
1		Very dense grey sand and gravel, some cobbles (Crushed Stone FILL)		0 23	1	82 82 82 82 82 82 82	54 >50 >50			Bentonite Seal
3	Powar Augar 200mm Diam (Hollow Stem)	Compact grey sand and gravel (Crushed Stone FILL)		<u>54 97</u> 3 05	4	50 DO 50 DO	16			Silica Sand
5		Compact dark grey brown sand, trace wood, organic matter, glass, metal and plastic fragments, with grey clayey silt pockets (WASTE)		<u>52.69</u> 5.33	6 7 8	50 DO 50 DO 50 DO	68 26 26			32mm Diam PVC #10 Slot Screen
						00				Cave
7		End of Borehole Auger Refusal		<u>51 17</u> 6 85						W L in Screen al Elev 52 7m on Aug 2 2011
8										
9										
	PTH S	CALE						Golder		LOGGED: HC

PROJECT: 10-1121-0222

RECORD OF BOREHOLE: W-018

SHEET 1 OF 1

LOCATION: N 5030296 52 ;E 365785.63

BORING DATE: October 28, 2010

DATUM: Geodetic

INICIACO	DOH	SOIL PROFILE	1		SA	MPL	-	DYNAMIC PENETRATION RESISTANCE, BLOWS/0 3m	HYDRAULIC CONDUCTIVITY, k, cm/s	NG
	BORING METHOD		STRATA PLOT		£		0 3 ^m	20 40 60 80	10 ⁸ 10 ⁸ 10 ⁴ 10 ²	ADDITIONAL LAB TESTING
	RING	DESCRIPTION	ATA	ELEV DEPTH	UMB	TYPE	BLOWS/0 3m	SHEAR STRENGTH nal V + Q - ● Cu, kPa rem V ⊕ U - O		ABDI TAB
	BOI		STR	(m)	Ż		BLG	20 40 60 80	Wρ - Ο ^W WI 20 40 60 80	
		GROUND SURFACE		63.53						
ſ		Dark brown silty sand, some gravel and organic matter (TOPSOIL) 0.00m -		0.02						
		0.02m Compact brown and dark grey silty fine			1	50 DO	20			
		to coarse sand, some gravel (FILL)								
		Loose brown to dark brown silty fine to		62.70	2	50 DO	\$54			
	11	coarse sand, some gravel, trace clay, ash, brick and boulders (FILL)		0.83	-	DO	24			
		asri, brick and boulders (FILL)		11						
				Ų Y		50				
				1	3	50 DO	5			
		Loose to compact dark brown silty fine to		61.40 2.13	-					
		coarse sand to sandy sill, some gravel.								
		trace clay, brick, ash, wood, slag and mortar (FILL)		С I,	4	50 DO	27			
					-					
3					-					
					5	50 DO	5			
	ĉ					00				
	v Sler									
	200mm Diam (Hollow Stem)					50				
	Diam (Hollow				6	50 DO	4			
ľ	D LL				-					
	200									
					7	50 DO	6			
					-					
					-					
					8	50 DO	21			
						00				
				57 43						
		Very loose to dense brown silty sand to sandy silt, with gravel layers, cobbles and boulders (FILL)		8 10	9	50 DO	>58			
		and boulders (FILL)			-					
					6					
7					17					
	18				10	50 DO	3			
					-					
					-					
					11	50 DO	31			
3				55.30						
F		End of Borehole	1	8 23						
EP	TUO	CALE						â		LOGGED: RI
-	113	CALE						Golder		CHECKED: HD

PROJECT: 11-1122-0199

LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

RECORD OF BOREHOLE: 11-01

SHEET 1 OF 1 DATUM: Geodetic

BORING DATE: November 23, 2011

<u>ا</u> , ۲	Ē	SOIL PROFILE	—	,	SAN	-	DYNAMIC PENET RESISTANCE, BL	OWS/0.3m	Ν.	HYDRAULIC k, cr	n/s	2gF	PIEZOMETER
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	20 40 J SHEAR STRENG Cu, kPa 20 40	rem V. + rem V. €	BO - Q - ● 9 U - ○ BO		10 ⁻⁵ 10 CONTENT 	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
0		GROUND SURFACE		56.36			20 40			20			
Ŭ		TOPSOIL Dark brown to black silty sand (FILL)		0.00									
				55.95	1	50 50 2							
		Compact fine to medium brown silty sand, some gravel, trace brick (FILL)		0.41									
						50							
1	Stem)				2	50 DO 5							
	lger												
	Power Auger 200 mm Diam. (Hollow Stem)				3	50 DO 2							
	D Po	L		54.53									
2	200	Gravel (FILL)		1.83 54.23		-							
		Dense medium to fine grey to brown sand, trace gravel and silt (FILL)		54.23 2.13	4	50 20 4							
		GRAVEL and COBBLES (GLACIAL		53.62	5	50							
3		TILL) End of Borehole		2.74 53.44 2.92	-+	+	4						
		Auger Refusal											
4													
5													
Ű													
6													
0													
7													
8													
9													
10													
								[
	этн :	SCALE					Gol	der ciates				LOC	GGED: BM

PROJECT: 11-1122-0199

LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

RECORD OF BOREHOLE: 11-02

BORING DATE: November 24, 2011

SHEET 1 OF 2

DATUM: Geodetic

	БОН	SOIL PROFILE	<u> </u>		SA	AMPLE		DYNAMIC PENETR RESISTANCE, BLC	WS/0.3	n K	HYDRAU k	, cm/s		Ι,	ĘĘ	PIEZOMETER
METRES	BORING METHOD		STRATA PLOT	ELEV.	3ER	<u>ш</u>	3/0.3m	20 40 I I SHEAR STRENGT	60 	80 `	10 ⁻⁶	10 ⁻⁵	10 ⁻⁴		ADDITIONAL LAB. TESTING	OR STANDPIPE
Ξ	ORINC	DESCRIPTION	RATA	DEPTH (m)	I =	түре	BLOWS/0.3m	Cu, kPa	rem	v.⊕ u- 0	WP H		eni pe Ə ^W		ADD LAB.	INSTALLATION
_	á	GROUND SURFACE	ST			$\left \right $	Ē	20 40	60	80	20	40	60	80	+	
0		TOPSOIL	833	55.00	\vdash	+	+				+				+	
		Compact black silty sand, trace ash a clay, occasinal layers of medium brow	nd	0.15	1	50 DO	12									
		sand and gravel (FILL)														
						50										
1		Compact medium to fine brown sand,		53.96	2	50 DO	35									
		some gravel, trace silt (FILL)														
				8	3	50 DO	17									
				8												
2				8	4	50 DO	25									
				52.61		DO										
		Coarse brown sand, some gravel, tra silt and brick, occasional layers of gra	ce ivel	2.39		1_										
	1.000	୍ସି (FILL) କ୍ସ		8	5	50 DO	38									
3	er C	tö 		8												
	Power Auger	우 <u>(</u>)		8	6	50 DO	59									
	Pow	Compact to dense coarse grey sand, some gravel, trace silt, with cobbles a		51.34												
	000	E Compact to dense coarse grey sand, some gravel, trace silt, with cobbles a boulders (FILL)	IND ី	3.66	7	50 DO	24									
4				50.78		DO	24									
		COBBLES, BOULDERS, and GRAVE (GLACIAL TILL)	EL OX	4.22	C1	NQ RC	DD									
					\vdash											
5					C2	NQ RC	DD									
Ū		Very dense grey coarse SAND, some		49.82 5.18		50										
		silt, some gravel (GLACIAL TILL)			8	50 DO	>50									
				49.23												
6		COBBLES, BOULDERS, and GRAVE	L P	5.77 48.90	C3	NQ RC	DD									
		Very dense grey coarse SAND and GRAVEL, trace cobbles		6.10		1										
					9	50 DO	78									
		End of Borehole		48.29 6.71		\vdash										
7																
8																
9																
10																
		- I	I	1	L	<u> </u>				I	I	1				
DE	РΤΗ	1 SCALE						Gol	lor						LO	GGED: BM

LO)C	ATIC	T: 11-1122-0199 IN: See Site Plan FION: -90° AZIMUTH:		RE	0	RD	0	D D	rili Rili	LIN(L RI	G D/ G:	ate Cme	: N E 85	ove 0	mb	er :	24, :	20 [.]		g										OF Geod		
DEPTH SCALE METRES		DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	FLUSH <u>COLOUR</u>	R TO CJ	I - J IT - F IR- S I - V ECO ITAL RE %	hear ein onju	gate Y .ID E %		D. 	Conta Ortho	act gona rage			JN - U ST - S R - I	Und Step Irreg CON	nar ved Julating pped gular NTINUITY TYPE AND S DESCRIF		Slick Smoo Roug Mech	ensio oth Ih	al Bi H' COI	YDR NDU K, cn	NOT abbr of al sym	TE: Fe reviati bbrev bols.	Broke or add ions r iation Diame Oint L Diame Oint L Inde (MP	ditiona refer t is & etral Load ex Pa)				
- - - - - - - 5		Stem)	BEDROCK SURFACE COBBLES, BOULDERS, and GRAVEL (GLACIAL TILL)		50.78 4.22	C1 C2																											
	Power Ander	>	Very dense grey coarse SAND, some silt, some gravel (GLACIAL TILL) COBBLES, BOULDERS, and GRAVEL		49.82 5.18 49.23 5.77	СЗ																											-
- 6 - - - - - -		20	Very dense grey coarse SAND and GRAVEL, trace cobbles		48.90 6.10 48.29 6.71																												
- 7 7 7 																																	
MIS-RCK 004 1111220199.GPJ GAL-MISS.GDT 1/28/13 JEM T 30 21 21 21 21 21 21 21 21 21 21 21 21 21																																	
DE VIS-RCK 004			CALE	I	<u> </u>			Ć			G	ol so	de ci	r at	u es		1					1				1					BM JW		

PROJECT: 11-1122-0199

RECORD OF BOREHOLE: 11-03

LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: November 28, 2011

SHEET 1 OF 1

DATUM: Geodetic

4	ç		SOIL PROFILE			SA	MPL	ES	DYNAMIC PENETRATIC RESISTANCE, BLOWS	N).3m	し	HYDRAUI k,	LIC CON cm/s		/IIY,	Q	PIEZOMETER
METRES				STRATA PLOT		н		3m	20 40 6		Ϋ́,	10 ⁻⁶	10 ⁻⁵			ADDITIONAL LAB. TESTING	OR
MET	C 4	2 Z	DESCRIPTION	TAP	ELEV. DEPTH	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH r Cu, kPa r	atV. + C mV.⊕ U	2 - •				PERCENT	B. TE	INSTALLATION
		אַכאַ מכא		TRA	(m)	Ę		3LO/			. 0	Wp H		-0 ^W	WI	LAI	
		-	GROUND SURFACE	0				-	20 40 6) 80		20	40	60	80		
0		Н	Compact dark brown silty sand, trace	EZZ	54.93 0.00 54.75												
			gravel, organics (TOPSOIL) Compact black silty sand, some gravel,		0.18		50 DO	10									
			ash, slag (FILL)		54.32												
			Compact brown fine to medium sand,	×	0.61		1										
1			Compact to loose black sitk brick (FILL) / Compact to loose black sitk sand, some gravel, ash, slag (FILL)		0.74	2	50 DO	14									
'			gravel, ash, slag (FILL)														
			Loose brown fine to coarse sand, some	×××	53.58 1.35												
			gravel, trace silt (FILL)		1.00	3	50 DO	9									
					53.10												
2		[Compact brown medium to coarse sand, some gravel, some fine sand, trace silt		1.83												
			(FILL)			4	50 DO	11									
		Stem)		×	52.49												
	ger	. wollc	Loose dark brown SILTY SAND, some , gravel, trace to some clay, organics	\bigotimes	2.51]_	50										
	er Au	Щ. Щ	Dense to very dense grey brown to brown SILTY SAND, some gravel, with cobbles and boulders		3	5	50 DO	38									
3	Ро	n Dia	cobbles and boulders			<u> </u>											
		200 mm Diam. (Hollow Stem)		\otimes	*	6	50 DO	33									
					3	ľ	DO										
				\otimes]	7	50 DO	>50									
4					*												
, i				\otimes	*												
					2		1										
			Very dense grev SILTY SAND, some		50.36 4.57	8	50 DO	74									
			Very dense grey SILTY SAND, some gravel, cobbles, boulders (GLACIAL TILL)														
5																	
						9	50 DO	54									
		Ц	End of Borehole	6KR	49.24 5.69	10	50 DO	>50									
			Auger Refusal		5.05												
6			Possible Bedrock														
7																	
				1													
				1													
8				1													
				1													
				1													
9				1													
				1													
				1													
				1													
10				1													
DF	рт	Ч¢	CALE					4									GED: RI
JE		.13							Golden							LUU	

LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

RECORD OF BOREHOLE: 11-04

BORING DATE: December 1, 2011

SHEET 1 OF 1

DATUM: Geodetic

ц I	ЦĊ	SOIL PROFILE	_		SA	MPLI	ES	DYNAMIC PENETRA RESISTANCE, BLOW	ION S/0.3m) L	HYDRAU	JLIC CO k, cm/s	ONDUCT	IVITY,		ي ت لـ	PIEZOMETER
METRES	BORING METHOD		LOT		ĸ		3m	20 40	60	80	10-	° 10) ⁻⁵ 1	0 ⁻⁴ 1	0 ⁻³	ADDITIONAL LAB. TESTING	OR
Į.	ΰN	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa	nat V. +	- Q - •				PERCE		3. TE	STANDPIPE INSTALLATION
5	30RI		TRA ⁷	DEPTH (m)	ÎN	-	3LOV									LAE	
_	ш	GROUND SURFACE	ω'		\vdash	$\left - \right $	ш	20 40	60	80	20	4	06	30 0i	30 		
0		TOPSOIL	EEE	56.16 0.00							\vdash		<u> </u>		-		
		Compact black silty sand, some gravel, trace brick, ash, slag, wood and glass		0.15		50 DO											
		trace brick, ash, slag, wood and glass (FILL)			1	DO	8										
						50											
1					2	50 DO	16										
					3	50	10										
					з	50 DO	10										
		Loose dark brown to red coarse sand.		54.33 1.83													
2		Loose dark brown to red coarse sand, some gravel, trace brick, ash, silt and slag (FILL)			4	50 DO	5										
		Sidy (LILL)			4	DO	5										
		L		53.42	5	50 DO	3										
		Loose medium to fine orange sand, trace slag and silt (FILL)	· 🗱	2.74		DO	Ĩ										
3		Very loose red coarse sand, trace silt	- 🗱	53.11 3.05	\vdash												
		(FILL)		52.81 3.35	6	50 DO	2										
		Very loose black crushed asphaltic concrete (FILL)		3.35		00											
4		ORGANICS	_ <u></u>	52.20 3.96	7	50 DO	2										
ŕ		Grey CLAY		4.11													
	1.000		Ň	4.27	8	50 DO	>50										
	Power Auger		-100	51.59 4.57		00											
	r Aug.	Compact to dense grey to brown coarse SAND and GRAVEL, trace silt															
5	Powe																
					9	50 DO	49										
		2	\otimes														
				3	10	50 DO	54										
6				40.00													
		Very dense SAND and GRAVEL, some		49.96 6.20													
		cobbles, trace boulders (GLACIAL TILL)															
7																	
					11	50 DO	112										
						DO											
8					12	50 DO	>75										
					12	DO	-10										
					13	50 DO	58										
9																	
					14	50 DO	27										
		End of Porobolo		46.46													
		End of Borehole Auger Refusal		9.70													
10																	
															<u> </u>		
DE	PTH	SCALE						200 X 4								LC	OGGED: BM
	50							Gold	r								ECKED: JW

LOCATION: See Site Plan

RECORD OF BOREHOLE: 11-05

BORING DATE: November 23, 2011

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

		ПОН	SOIL PROFILE]	SA	MPLE		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	AL	PIEZOMETER
METRES			DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	түре	BLOWS/0.3m	20 40 60 80 SHEAR STRENGTH nat V. + Q - ● Cu, kPa	10 ⁶ 10 ⁵ 10 ⁴ 10 ³ WATER CONTENT PERCENT Wp → W WI	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
_		+	GROUND SURFACE	0	56.91				20 40 60 80	20 40 60 80		
0			TOPSOIL Dark brown to black silty sand, some gravel, trace brick (FILL) Compact brown medium to fine sand, some silt, some gravel (FILL) Dark brown to black silty sand, some		0.00 0.13 0.30 56.20 0.71 56.00			24				
1	Auger	mm Diam. (Hollow Stem)	gravel (FILL) Loose to compact light brown fine sand, trace silt (FILL)		0.91		50 DO 50 DO	15				
2	Power Auger	200 mm Diam.	Compact brown medium to fine SAND, trace silt, gravel		<u>54.81</u> 2.10	4	50 DO	24				
3								21				
			End of Borehole	\bigotimes	53.46	6	50 DO	>50				
4 5 7			Auger Refusal Possible Boulder									
8												
10												
DE			CALE					(Golder			IGGED: BM ECKED: JW

RECORD OF BOREHOLE: 11-06

LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: November 23, 2011

SHEET 1 OF 1

DATUM: Geodetic

ļ	머머	SOIL PROFILE	1.		SA			DYNAMIC PENETRA RESISTANCE, BLOV	/S/0.3m 🔍	К,	IC CONDUC cm/s		ادِ ا	PIEZOMETER
METRES	BORING METHOD		STRATA PLOT	_	к.).3m	20 40	60 80	10 ⁻⁶	10 ⁻⁵	10 ⁻⁴ 10 ⁻³	ADDITIONAL LAB. TESTING	OR
	DNG	DESCRIPTION	TAP	ELEV. DEPTH	NUMBER	түре	NS/0	SHEAR STRENGTH Cu, kPa	nat V. + Q - ●			T PERCENT	B. TE	STANDPIPE INSTALLATION
5	BOR		١TRA	(m)	ß		BLOWS/0.3m			-		/ wi	LAR	
		GROUND SURFACE	0,	54.79			-	20 40	60 80	20	40	60 80		
0		Loose dark brown silty sand, trace		0.00								+		
		gravel, organics (TOPSOIL)		0.13	1	50 DO	9							
		ash, brick, clay (FILL)												
			~~~~	54.03										
1		Loose brown fine to medium sand, some gravel, trace silt (FILL)		0.76	2	50 DO	9							
·				53.57										
		Loose black silty sand, some gravel, ash, organics (FILL)		1.22										
		Loose brown SILTY SAND, some gravel	×	53.27 1.52	3	50 DO	6							
			$\otimes$											
2			$\bigotimes$	52.66										
		Very dense brown fine to coarse SAND,	Ŵ	52.66 2.13	4	50 DO	53							
		some gravel, some silt	$\mathbb{N}$	52.33										
		End of Borehole Auger Refusal		2.46										
3														
۵														
1														
5														
6														
7														
8														
9														
Ĵ														
10														
					_									
DEI	PTH S	SCALE					1	Gold					LC	GGED: RI

#### LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

## RECORD OF BOREHOLE: 11-07

BORING DATE: November 25 & 28, 2011

SHEET 1 OF 1

DATUM: Geodetic

Ц			SOIL PROFILE	-		SA	MPL	ES	DYNAMIC PENETRATI RESISTANCE, BLOWS	/0.3m	۲.	HYDRAUI k,	cm/s		viiř,		و ب	PIEZOMETER
METRES	BODING METHOD			LOT		<u>ب</u>		.3m		1	80	10 ⁻⁶	10 ⁻⁶	³ 10	-4 10	0 ⁻³	I ADDITIONAL LAB. TESTING	OR
MET			DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa	nat V. +	- Q - •			NTENT			B. TE	STANDPIPE INSTALLATION
۲ ۲				TRA	(m)	P	-	BLO				Wp H		-0 ^W		WI	LAR	
			GROUND SURFACE	0		-		-	20 40	50	80	20	40	60	8 (	80 		
0			Compact dark brown silty sand, trace	EEE	54.92 54.74	-												
			gravel, organics (TOPSOIL)		0.18		50 DO	12										
			Compact black silty sand, some gravel, ash, slag, organics (FILL)			l '	DO	12										
					1													
					54.01	2	50 DO	19										
1			Compact to loose brown fine to coarse sand, some gravel, trace silt, occasional		0.91	2	DO	19										
			brown silt pockets (FILL)															
						3	50 DO	6										
					1		DO	Ŭ										
			Loose dark brown silty sand, some	***	53.09 1.83	-												
2			gravel, trace to some clay, organics, wood, ash, with brown clayey silt layers			4	50 DO	5										
			(FILL)			Ĺ	טט	-										
			Loose dark grey silty clay to clayey silt, trace sand (FILL)	*	52.48 2.44	⊢												
					52.18	5	50 DO	8										
~			Loose to very dense brown silty sand, some gravel (FILL)	Æ	2.74 2.89		00											
3			Very dense to dense grey to brown fine to coarse SAND, some gravel, trace to	$\otimes$	3	⊢												
			some silt, with brown medium to coarse	$\otimes$	]	6	50 DO	94										
			sand, trace to some fine sand, trace silt layers, with cobbles and boulders	$\bigotimes$	\$													
							1											
4		(j		$\otimes$		7	50 DO	127										
		w Ste																
	Power Auger	Holl		$\otimes$	]													
	ower	iam.		$\otimes$		8	50 DO	41										
	ď	E E																
5		200		$\otimes$	X													
					Š	9	50 DO	50										
				$\otimes$														
							50											
						10	50 DO	51										
6						_												
				$\otimes$	}		50											
						11	50 DO	43										
					\$	$\vdash$												
7				$\otimes$	X	10	50	~										
'					]	12	50 DO	63										
				$\otimes$		⊢												
				$ \otimes $	3	13	50 DO	63										
				$\otimes$			00											
8				$\otimes$	]													
				$\otimes$		14	50 DO	46										
				$\otimes$	46.38													
			Compact to dense brown medium to coarse SAND, some gravel, trace fine	Ŵ	8.54		50	_										
			sand, trace silt	$\otimes$	45.95	15	50 DO	>50										
9			End of Borehole		8.97													
			Auger Refusal Possible Bedrock															
10																		
	L			1		L												
DE	PT	нs	CALE						Calda								LC	GGED: RI
	50								Golde	Ľ							CLI	ECKED: JW

#### LOCATION: See Site Plan

# **RECORD OF BOREHOLE: 11-08**

BORING DATE: November 30, 2011

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

Щ. Д	OH.	2	SOIL PROFILE	L		SA	MPLE		DYNAMIC PENETR RESISTANCE, BLC	WS/0.3r	י <i>ג</i>		k, cm/s	NDUCT		RgA	PIEZOMETER
DEP IN SUALE METRES	BORING METHOD			STRATA PLOT	ELEV.	ER		BLOWS/0.3m	20 40	60	80	10			0-3	ADDITIONAL LAB. TESTING	OR STANDPIPE
Ц Ц Ц Ц Ц	RING		DESCRIPTION	ATA	DEPTH	NUMBER	TYPE	/SMC	SHEAR STRENGTH Cu, kPa	۱ nat V rem ۱	+ Q-● .⊕ U-O	W	ATER CC			ADDI AB. T	INSTALLATION
	BO			STR	(m)	z		BL(	20 40	60	80	2			30	[`-]	
0			GROUND SURFACE		54.29												
0			Loose dark brown silty sand and sandy silt, trace gravel, organics (TOPSOIL)		0.00												
			Loose dark brown to black silty sand,		53.88	1	50 DO	8									
		ſ	some gravel, brick (FILL)	1	53.68												
		N	trace to some gravel (FILL)	/	0.61												
1			Compact brown fine to coarse sand, some gravel trace to some silt			2	50 DO	17									
			some gravel, trace to some silt, occasional silty sand seam (FILL)														
						3	50 DO	16									
		ŝ															
2	_	w Ste															
-	Auge	H H H				4	50 DO	15									
	Power Auger	iam.			51.85												
	٩	200 mm Diam. (Hollow Stem)	Very loose black silty ORGANICS		2.44 2.59												
		200	Firm grey SILTY SAND, trace sand,	$\bigotimes$	2.59	5	50 DO	12									
3			Compact to very dense grey SILTY SAND, some gravel, with cobbles and														
			boulders	$\otimes$	]	6	50 DO	100									
							50										
4						7	50 DO	59									
					49.77	8	50 DO	100									
			End of Borehole Auger Refusal		4.52												
_																	
5																	
6																	
7																	
8																	
9																	
-																	
10																	
																_	
DE	PTF	I S	CALE						Gold	0						LC	DGGED: RI

#### LOCATION: See Site Plan

### RECORD OF BOREHOLE: 11-09

BORING DATE: November 23, 2011

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

November 23, 2011

	<u> </u>	P P	SOIL PROFILE		,	SA	MPLI		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	국원 PIEZOMETER
METRES		E WE		STRATA PLOT	ELEV.	BER	щ	BLOWS/0.3m	20 40 60 80	10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³ WATER CONTENT PERCENT	PIEZOMETER OR STANDPIPE INSTALLATION
¥			DESCRIPTION	RATA	DEPTH	NUMBER	ТҮРЕ	OWS	SHEAR STRENGTH Cu, kPanat V. + Q - ● rem V. ⊕ U - O		
·	2	ы Ш		STF	(m)	-		ВГ	20 40 60 80	20 40 60 80	
0			GROUND SURFACE TOPSOIL	====	56.83 0.00			_			
			Dark brown to black silty sand (FILL)		0.13	1	50 DO	33			
			Compact dark brown silty sand (FILL)		0.30	'	DO	33			
			Loose black silty sand, trace brick and		56.22 0.61						
1			glass (FILL)		55.84	2	50 DO	12			
'			Loose medium to fine brown sand, trace silt (FILL)		0.99						
							50				
		v Sten				3	50 DO	9			
	Auger	200 mm Diam. (Hollow Stem)			54.95 1.88						
2	Power Auger	Diam.	Compact medium to fine brown to grey sand, some silt and gravel, trace brick (FILL)			4	50 DO	39			
	α.	] mm [									
		200									
						5	50 DO	32			
3			Brown to grey SILTY SAND, trace gravel		53.78 3.05 53.59	6	50 DO	>50			
			and clay COBBLES and BOULDERS	1	53.59 3.24	-	DO				
				$\otimes$							
						7	50 DO	>60			
4		4	End of Borehole		52.85 3.98	_	DU	_			
			Auger Refusal								
5											
6											
-											
7											
8											
9											
10											
	рт	це	CALE								LOGGED: BM
UE	РТ 50								Golder		CHECKED: JW

#### LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

# RECORD OF BOREHOLE: 11-10

BORING DATE: November 23, 2011

SHEET 1 OF 1

DATUM: Geodetic

щ	Ģ	SOIL PROFILE			SA	MPL	_3	DYNAMIC PENETRA RESISTANCE, BLOW	S/0.3m		k,	cm/s		VITY,	<u>ا</u> و بـ	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD		LOT		н,		.3m	20 40	60	80	10 ⁻⁶	10 ⁻⁵			ADDITIONAL LAB. TESTING	OR
ЧЦ ИШТ ПТ	SING	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	түре	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa	nat V.	+ Q-● ⊕ U- ∩				PERCENT	B. TE	STANDPIPE INSTALLATION
ž	BOR		STR4	(m)	z	-	вго	20 40	60	80	Wp⊢ 20	40	-O ^W 60	WI 80		
		GROUND SURFACE		54.76							20					
0		Loose dark brown sandy silt, trace gravel, organics (TOPSOIL)		0.00 54:58												
		Loose black silty sand, some gravel,		0.18	1	50 DO	8									
		ash, slag (FILL)														
						50										
1				50.50	2	50 DO	8									
	tem)	Very loose brown fine to medium sand,	×	53.59 1.17												
	ger Mow S	Very loose brown fine to medium sand, trace to some silt, some gravel, with black silty sand, organic layers (FILL)			3	50 DO	4									
	er Aug			52.93		DO										
2	Powe	Compact to very dense brown SILTY SAND, some gravel		1.83												
2	Power Auger	SAND, Some graver			4	50 DO	11									
	ſ															
						50										
					5	50 DO	41									
3						_										
				51.33	6	50 DO	>50									
		End of Borehole Auger Refusal		3.43												
4																
5																
6																
0																
7																
8																
9																
- 10																
IU																
		I	-	1						1	I I		1	I		
DE	PTH	SCALE					6	Gold							LC	GGED: RI

# RECORD OF BOREHOLE: 11-11

LOCATION: See Site Plan

### SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: November 24 & 25, 2011

SHEET 1 OF 1

DATUM: Geodetic

	БН	301	PROFILE		i	37	AMPLE		DYNAMIC PENETRA RESISTANCE, BLOW	S/0.3m	×		k, cm/s				μŞ	PIEZOMETER
METRES	BORING METHOD	DESCRIPTIO	ОЛ	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	түре	BLOWS/0.3m	20 40 I I SHEAR STRENGTH Cu, kPa	rem V. (	Ð U- O	Wp	TER CO			NT WI	ADDITIONAL LAB. TESTING	STANDPIPE INSTALLATION
		GROUND SURFACE		S	54.84	$\vdash$	$\square$	-	20 40	60	80	20	40	60	) 8	0		
0 -		Compact dark brown silty gravel, organics (TOPSC Compact black silty sand mortar, ash, slag (FILL)	01L) /		0.00 0.08 54.21	1	50 DO	13										
1		Compact brown fine to m trace gravel, trace silt, so sand, occasional brown s occasional black silty sar Compact brown fine to co	me coarse silt pocket, , id layer (FILL) /		0.63 53.90 0.94	2	50 DO	6										
		trace silt, trace to some g occasional brown silt poo	ravel,		53.01	3	50 DO	26										
2		Loose grey silty clay, trac sand, black staining, occ silty sand layer (FILL)	e gravel, trace asional grey		1.83		50 DO	8										
3		Loose dark brown to blac ORGANICS Loose grey brown SILTY CLAYEY SILT, trace san	CLAY and		52.25 2.59 2.74 2.82 51.79	5	50 DO	6										
	er ow Stem)	Loose grey SILTY SAND Compact to very dense b fine to coarse SAND, trac	, some gravel j rown to grey ce to some		3.05	6	50 DO	28										
4	200 mm Diam. (Hollow					7	50 DO	40										
	200					8	50 DO	36										
5					49.35		50 DO	36										
6		Compact to very dense b to coarse SAND, some g sand, trace silt, occasion medium sand layer, with boulders	ravel, trace fine al fine to		5.49	10	50 DO	21										
		Very dense fine to coarse brown SAND, some grav some silt, with cobbles an (GLACIAL TILL)	el, trace to		48.59 6.25 47.98	11	50 DO	53										
7		Very dense brown silty fin occasional grey silt seam <u>VILL</u> Very dense grey SILTY S gravel, with cobbles and	(GLACIAL /		6.86 7.01			100										
-		(GLACIAL TILL) End of Borehole	boulders		47.07		50 DO	>50										
8		Auger Refusal																
9																		
10																		
DEI	PTH	SCALE			1				Golde									DGGED: RI

#### LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

RECORD OF BOREHOLE: 11-12

SHEET 1 OF 1 DATUM: Geodetic

BORING DATE: December 1, 2011

Ľ.	G	2	SOIL PROFILE	1.	,	SA	MPL		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m		k, cm/s		μŞ	PIEZOMETER
METRES	DODING METHOD	פשבו	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	түре	BLOWS/0.3m	20 40 60 I I I SHEAR STRENGTH nat V. Cu, kPa rem V.	80 <b>`</b>	10 ⁻⁶ 10 WATER CO	⁻⁵ 10 ⁻⁴ 10 ⁻³	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
ΣΞ				STRAT,	DEPTH (m)	NUN	Ϋ́	BLOW			Wp 🛏 🚽		ADI LAB.	INGTALLATION
		+	GROUND SURFACE	55	54.55				20 40 60	80	20 40	0 60 80	+	
0		Π	Loose dark silty sand to sandy silt, trace \gravel, organics (TOPSOIL)		0.00									
			Loose black silty sand to sandy silt, some gravel, ash, slag (FILL)		53.94	1	50 DO	8						
1			Compact brown silty sand, some gravel (FILL)		0.61 53.33	2	50 DO	19						
			Compact to loose brown fine to medium sand, trace to some silt, trace to some gravel (FILL)		1.22	3	50 DO	13						
2	er	low Stem)				4	50 DO	8						
3	Power Auger	200 mm Diam. (Hollow Stem)	Very loose dark brown to black silty ORGANICS Very loose grey SILTY CLAY to CLAY SILT, trace sand		51.96 2.59 2.74 2.90	5	50 DO	4						
-		20(	Very loose to compact grey SILTY SAND, some gravel			6	50 DO	24						
4						7	50 DO	>50						
			Very dense grey brown SILTY fine to course SAND, some gravel, occasional fine to coarse sand pockets (GLACIAL TILL)		50.28 4.27	8	50 DO	66						
5					49.37	9	50 DO	>50						
			End of Borehole Auger Refusal		5.18									
6														
7														
8														
9														
10														
DE	PTI	нs	CALE	1			1		Golder	<b>I</b>	<u> </u>	I	LOC	GGED: RI

#### LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

### RECORD OF BOREHOLE: 11-13

BORING DATE: November 22, 2011

SHEET 1 OF 1

DATUM: Geodetic

L			SOIL PROFILE	· · · ·		SA	MPL	ES	DYNAMIC PENETRATION	HYDRAULIC CONDUCTIVITY, k, cm/s	اوپ	PIEZOMETER
METRES	BORING METHOD			STRATA PLOT	ELEV.	ER	u	ʻ0.3m	20 40 60 80		ADDITIONAL LAB. TESTING	OR
UE:	RING		DESCRIPTION	RATA	DEPTH	NUMBER	түре	BLOWS/0.3m	SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - O	WATER CONTENT PERCENT	ADDI AB. T	INSTALLATION
,	D B O	_		STF	(m)	2		B	20 40 60 80	20 40 60 80		
0	-		GROUND SURFACE		56.59 0.00							
			Dark brown to black silty sand, trace		0.00		50					
		g	gravel and brick (FILL)			1	50 DO	9				
						2	50 DO	17				
1		L			55.37							
		L	Loose to compact medium to fine brown sand, trace gravel and silt (FILL)		1.22		50					
						3	50 DO	4				
2						4	50 DO	14				
						5	50 DO	14				
3												
						6	50 DO	46				
		Stem)			52.93		50					
	uger	§ [	Dense coarse brown to black SAND and GRAVEL, trace cobbles and silt		3.66							
4	Power Auger	iam. (F				7	50 DO	30				
	A	Dun										
		200				8	50 DO	33				
5							50					
						9	50 DO	55				
						10	50 DO	50				
6												
							50					
						11	50 DO	19				
						12	50 DO	>80				
7			Cobbles and boulders (GLACIAL TILL)		49.63 6.96		00					
						10	50	105				
								105				
8		E	End of Borehole	ALC I	48.61 7.98	14	50 DO	>50				
		A A	Auger Refusal									
9												
10												
DE	PTH	H SC/	ALE						Coldor		LOG	GED: BM
1:	50								Golder		CHEC	KED: JW

### LOCATION: See Site Plan

### **RECORD OF BOREHOLE: 11-14**

BORING DATE: November 22 & 23, 2011

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

Ц Д	Ç,	운 ŀ	SOIL PROFILE	⊢	1	+	AMPL	1	DYNAMIC RESISTAI				ς.		k, cm/s				NG	PIEZOMETER
METRES		BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV	_1 =	TYPE	BLOWS/0.3m	20 SHEAR S Cu, kPa	40 TRENG	6 TH n		80 F Q - ●		TER CO	ONTENT	PERCE	0 ⁻³	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
		BORII		STRAT	DEPT (m)	H N	F	BLOW	Cu, kPa 20	40	r 6		€U-O 80	Wp 20		W		WI 80	AD LAB	
			GROUND SURFACE	0,	55.2	28	1			40	0		80	20	4	0 0		80		
0			Compact dark brown silty sand, some gravel, organics (TOPSOIL)		0.0															
			Compact dark brown fine to medium		54.9 0.3		50 DO	26												
			sand, some gravel, asphalt pieces (FILL)		54.8		-													
			Compact black to dark brown silty sand, some gravel, ash, coal (FILL)		0.7		50 DO	22												
1			Some gravel, ash, coal (FILL)		54.0		DO	22												
			Compact brown fine to medium sand, some silt (FILL)	Ŵ	1.2		1													
					53.6	₃₆ 3	50 DO	13												
			Compact black silty sand, some gravel, ash (FILL)		1.6 53.4 1.8	62 45														
2			Compact dark brown sandy silt, some clay, trace to some gravel, organics,		1.0		50													
		Stem)	clay, trace to some gravel, organics, occasional brown fine to medium sand, occasional grey brown clayey silt to silty			4	50 DO	14												
	ler		clay layers (FILL)		52.8 2.4															
	er Auç	, (Но	Very loose to dense grey brown fine to medium SAND, some silt, trace gravel		•	5	50 DO	2												
3	Pov	m Dia																		
		200 mm Diam. (Hollow			51.9	93	50													
		[	Dense to compact to very dense brown medium to coarse SAND, some gravel,	ĬŇ	3.0		50 DO	33												
			trace fine sand, trace silt				1													
4						7	50 DO	15												
							50													
						8	50 DO	85												
5			Very dense grey fine to coarse sand, some gravel, some silt, with cobbles and		50.4 4.8		1													
			boulders (GLACIAL TILL)			9	50 DO	102												
			End of Borehole		49.7															
			Auger Refusal		5.0	51														
6																				
7																				
8																				
-																				
9																				
5																				
10																				
10																				
				1								1	_	<b></b> _			1	1		
DE	ΡT	TH S	CALE							Gol SSO	14								LC	DGGED: RI

# RECORD OF BOREHOLE: 11-15

LOCATION: See Site Plan

### SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: November 24, 2011

SHEET 1 OF 1

DATUM: Geodetic

Ц		ПОН	SOIL PROFILE	1		SA	MPL	ES	DYNAMIC PENETRATI RESISTANCE, BLOWS	5/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	μĒ	PIEZOMETER
METRES		BORING METHOD		LOT		ц		3m		60 80		ADDITIONAL LAB. TESTING	OR
MET		5NG	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	түре	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa	nat V. + Q - ● rem V. ⊕ II - ○	WATER CONTENT PERCE		STANDPIPE INSTALLATION
Ľ		BOR		STRA	(m)	Ŋ	[ ]	BLO					
	$\vdash$		GROUND SURFACE	55	54.87				20 40	60 80	20 40 60	80	
0		Τ	Compact dark brown silty sand, trace		0.05								
			\gravel, organics (TOPSOIL) / Compact black silty sand, some gravel,		54.54	1	50 DO	10					
			ach (FILL)		0.33								
			Compact to very loose brown fine to medium sand, some coarse sand, trace										
1			to some gravel, trace to some silt, occasional brown silt pockets, occasional cobble (FILL)			2	50 DO	14					
			occasional cobble (FILL)										
			Very loose dark brown and black silty		53.55 1.32								
			sand, trace gravel, trace clay, occasional grey silty clay to clayey silt layers			3	50 DO	4					
		Stem)	(ORGANICS)										
2	Jer	allow (					50						
	er Au	n. (Ho				4	50 DO	4					
	Pow	n Diar	Loose dark brown to black fine to		52.43 2.44								
		200 mm Diam. (Hollow Stem)	medium SAND, some silt, some gravel, organics	$\bigotimes$		5	50 DO	9					
3		5		$\bigotimes$	51.82		00						
3			Very dense to compact grey to brown	k	3.05								
			SILTY SAND, some gravel, occasional cobble and boulder, with fine to medium	$\bigotimes$		6	50 DO	57					
			sand, some gravel, some silt layers	$\bigotimes$									
				$\bigotimes$			50						
4				$\bigotimes$		7	50 DO	14					
				$\bigotimes$		8	50 DO	>50					
			End of Borehole	$\bigotimes$	50.35 4.52		00						
			Auger Refusal										
5													
6													
7													
8													
0													
9													
10													
10													
	<u>ا</u>									1			
DE	P	TH S	CALE					(	Colda	r		L	DGGED: RI
1:	50	0							Golde	âtes		СН	ECKED: JW

### LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

## RECORD OF BOREHOLE: 11-16

BORING DATE: November 28 & 29, 2011

SHEET 1 OF 1

DATUM: Geodetic

	ç	SOIL PROFILE		<u>.                                    </u>	SA	MPLE	ES	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	
METRES	BORING METHOD		-OT		۲		Зп	20 40 60 80	10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³	PIEZOMETER OR ULLI STANDPIPE INSTALLATION
METF	N ∩ NG	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - O	WATER CONTENT PERCENT	
<	ORII		<b>TRA</b>	DEPTH (m)	Ŋ.	F	ГO	си, кРа rem V. ⊕ U - O	Wp I O ^W I WI	
	â		ST	,			В	20 40 60 80	20 40 60 80	
0		GROUND SURFACE		54.61						
		TOPSOIL Compact black silty sand, some gravel,		0.00						
		trace ash, brick, occasional layers of fine to medium brown sand and gravel (FILL)			1	50 DO	12			
		to medium brown sand and gravel (FILL)	<u></u>							
					2	50 DO	22			
1				- 						
		Very loose black coarse sand, some ash, gravel, trace silt and brick (FILL)		53.39						
		ash, gravel, trace silt and brick (FILL)			3	50 DO	5			
					ľ	DO	5			
		Very loose brown to grey coarse sand	- <u></u>	52.78 1.83						
2		Very loose brown to grey coarse sand, trace silt and gravel (FILL)				50				
				3	4	50 DO	4			
				3						
				3						
	tem			3	5	50 DO	5			
3	low of				L					
	Aug			3		]				
	200 mm Diam (Hollow Stem)		×	51.26 3.35	6	50 DO	19			
	<u>ل</u> ا	Compact medium to fine grey SAND, trace silt, trace gravel	$\otimes$	× 3.35						
	000		$\otimes$	k		1				
			$\otimes$		7	50 DO	18			
4			$\otimes$		Ľ	DO				
			$\otimes$	Ś	<u> </u>					
			$\otimes$	Ś		50				
			$\otimes$	Ś	8	50 DO	12			
			$\otimes$	Ś						
5			$\otimes$	ß						
			$\otimes$	ß						
			$\otimes$	ß						
			$\otimes$	ß						
			$\otimes$	Ś	9	50 DO	12			
6			$\otimes$	k						
			$\otimes$		10	50 DO	>50			
			$\otimes$	48.18		DO	-00			
		End of Borehole Auger Refusal		6.43						
		Ĭ								
7										
·										
8										
9										
10										
		<u> </u>		1						
DE	ΡΤΗ	SCALE						Golder		LOGGED: BM
								L = E € L + Older		

### RECORD OF BOREHOLE: 11-17 LOCATION: See Site Plan

BORING DATE: November 21, 2011

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

ш			SOIL PROFILE				SAM	IPLES	DYNAMIC RESISTA	NCE, BLO	WS/0.3m	l l	HYDRAU k	ILIC CC , cm/s	JUUUCT	IVITY,		μĥ	PIEZOMETER
METRES		⊥ ≥		STRATA PLOT		,   _f	÷.		20	40	60	80	10 ⁻⁶				0 ⁻³	ADDITIONAL LAB. TESTING	OR
μ			DESCRIPTION	ATA F	ELE DEP			TYPE	SHEAR S Cu, kPa	TRENGT	I nat V. rem V.	+ Q-● ⊕ U-O						B. TE	INSTALLATION
5				STR/	(m)	)	ž   '		20	40	60	80	Wp H 20	4	W6		WI 30	L A	
	F		GROUND SURFACE		56	6.66	+	+	20					4	- 0				
0		Π	Compact dark grey crushed stone with	XXX	0	0.00													
			Compact brown to dark brown silty sand,			).13	1	50 1											
			some gravel, trace clay, brick (FILL)		56	6.05													
			Compact dark brown and black silty sand to sandy silt, some gravel, ash,			).61													
1			brick (FILL)		55		2	50 20 2											
			Compact brown sand, some silt, some gravel, with grey brown silty clay layers			).99													
			(FILL)		₹														
					54	.98	3	50 DO 1											
			Loose to very loose grey brown SILTY	$\bigotimes$		.68													
2			CLAY, trace to some sand, trace gravel, occasional sand pockets	$\otimes$	X			_											
					X		4 (	50 7											
				$\otimes$	8	F													
				$\bigotimes$	8		_  ,	50											
				$\otimes$	X		5 C	50 50											
3				$\otimes$	52	8.46	$\neg$												
			Very dense to loose brown SAND, trace	×		3.20	6	50 DO 1											
			to some silt, some gravel, occasional cobble and boulder, occasional coarse	$ \otimes $	X		-  C	» '											
		ē	sand layers, occasional silty sand layers, occasional fine sand layers		X	F													
4		/ Sten			Š		7	50 30 3											
4	uger	follow		$\otimes$	}														
	Power Auger	200 mm Diam. (Hollow Stem)		$\bigotimes$		F													
	Å	m Di		$\otimes$	X		8 8	50 50 4											
		200 n			Š														
5				$\otimes$															
					X		9	50 DO 2											
				$\otimes$	X	L													
					Š			_											
					)	1	10	50 4											
6																			
					X			50											
					Ś	1	11 C	50 DO 6											
				$\bigotimes$	k	┝	4												
7				$\otimes$	X		12	50											
'					K		" ⁻   C	20 2											
					8	┢	$\neg$												
				$\bigotimes$	k	1	13	50 50 10											
			Very dense grev SANDY SILT. some		48	3.89 7.77													
8	L	$\square$	Very dense grey SANDY SILT, some gravel, trace clay (GLACIAL TILL)			Þ	14	50 <u>&gt;1</u>	2										
								50											
	F	$\square$	End of Borehole	x1/14	48	8.07 8.59	5	20 >7											
			Auger Refusal Possible Bedrock																
9																			
10																			
.0																			
	L				1							- 1	I			I		-	I
DE	PT	нs	CALE							പ്പ	ler							LC	DGGED: RI
1:	50								<b>V</b>	Gold	Tiates	2						СН	ECKED: JW

# RECORD OF BOREHOLE: 11-18

LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: November 22, 2011

SHEET 1 OF 1

DATUM: Geodetic

Ľ	IOH.		SOIL PROFILE	1.		SA			DYNAMIC PENETRA RESISTANCE, BLOV	VS/0.3m	Ľ.		LIC COND , cm/s		.,	2gF	PIEZOMETER
METRES	BORING METHOD			STRATA PLOT		ШШ	, _ш	0.3m	20 40	60	80	10 ⁻⁶		10-4	10 ⁻³	ADDITIONAL LAB. TESTING	OR
ЦЧ	RING		DESCRIPTION	ATA I	ELEV. DEPTH	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa	nat V. rem V.	+ Q-● ∌ U-O		ER CONT			AB. T	INSTALLATION
Ē	BOF			STR/	(m)	ž		BLC	20 40	60	80	Wp H 20	40				
		GROUNE	) SURFACE		56.83							Ī					
0			t dark brown silty sand, trace organics (TOPSOIL)		0.00												
		Compac	t dark brown to brown fine to	1		1	50 DO	18									
		ash, bric	sand, some gravel, some silt, k, with occasional brown clayey		\$												
		silt layers (FILL)	s, some sand, trace gravel				50										
1						2	50 DO	22									
			t to dense dark brown to black		55.69 1.14												
		silt, brick	edium sand, some gravel, some , ash, organics, occasional grey				50										
		brown si	Ity clay layers (FILL)			3	50 DO	11									
							50										
2						4	50 DO	>50									
					54.39												
		Compac	t grey fine to medium sand,	X	2.44		1										
		Compac	avel, some silt, brick (FILL) t black silty sand, some gravel,		2.59	5	50 DO	16									
3		ash (FIL) Compac	L)	/ 🕅	2.90												
		,some gra	avel, trace silt (FILL) t dark brown to black silty sand,	1	3.05 53.48												
		some gra	avel, ash, coal (FILL)	/	3.35	6	50 DO	14									
		Compac	avel, ash, coal (FILL) t grey brown SILTY CLAY to 'SILT, some sand, trace gravel, hal fine to coarse sand layer			<u> </u>	$\left  \right $										
	Auger	occasion	hal fine to coarse sand layer		]	7	50 DO	21									
4	inger			$\otimes$	52.61		DO	21									
	Power Auger	≓   Loose br	rown sandy silt, some clay, trace gravel (FILL)	×	4.22 52.41		$\left  \right $										
	e li	E Loose bl	ack silty ORGANICS		4.42 4.57		50 DO	7									
	000	>   LOOSE to	dense brown fine to medium race to some silt, trace gravel		4.57												
5			,				1										
		Dense to	loose brown medium to coarse		51.65 5.18	9	50 DO	30									
		SAND, ti sand	race gravel, trace silt, trace fine														
							50										
					]	10	50 DO	6									
6		Very loos	se brown fine to medium SAND,	$\mathbb{X}$	50.73 6.10		$\left  \right $										
		trace silt			]	11	50 DO	4									
				$\otimes$	\$		00										
					3		1										
7				$\otimes$		12	50 DO	19									
				×	49.51												
		coarse S	se to compact brown medium to SAND, trace fine sand, trace silt,	$\otimes$	7.32		50										
		occasior	hal fine to medium sand layer			13	50 DO	1									
8					]	-	$\left  \right $										
				$\otimes$	2	14	50 DO	11									
					48.29		00										
		End of B Auger R			8.54												
			Crubal														
9																	
10																	
DE	PTH	SCALE							Gold	~*						LO	GGED: RI

### **RECORD OF BOREHOLE: 11-19**

LOCATION: See Site Plan

BORING DATE: November 25 & December 15, 2011

SHEET 1 OF 3

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

	ЪЧ.	╞	SOIL PROFILE	1,		SA	MPL		DYNAMIC PENETRA RESISTANCE, BLOW	S/0.3m	Ľ.	HYDRAU k	, cm/s		,		RG≮	PIEZOMET
MIE I VEO	BORING METHOD			PLOT		нщ		0.3m	20 40	60	80	10 ⁻⁶				10 ⁻³	ADDITIONAL LAB. TESTING	OR
	RING		DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa	nat V. rem V.	+ Q-● ⊕ U-O					ENT WI	ADDI AB. T	INSTALLAT
	BOI			STR	(m)	z		BLO	20 40	60	80	20 vvp	40			80	1~2	
0		_	GROUND SURFACE		56.03													
			TOPSOIL Compact brown silty sand, some gravel,		0.00													
		L	trace slag (FILL)	×	55.67	1	50 DO	11										
			Compact fine to medium brown sand, some gravel, trace silt (FILL)	XXXX	0.36 55.47 0.56													
		N	Grey clay (FILL)		0.69													
1			Compact grey gravel, some sand, trace silt, slag, and brick (FILL)			2	50 DO	29										
					54.71													
		- I	Black silty sand, trace brick (FILL)		1.32 54.51		50											
		Γ	Grey to brown fine to medium sand, trace silt (FILL)		1.52 54.25	3	50 DO	52										
			Grey to black clay (FILL)		1.78 54.05	-												
2		F	Compact brown coarse sand, some		1.98		50 DO	20										
			gravel and clay, trace silt and brick (FILL)			1	DO	20										
						-												
			Grey to black CLAY		53.29	5	50 DO	5										
3			Grey to DIACK CLAY	$\otimes$	2.74													
ĺ				$\otimes$			1											
					3	6	50 DO	4										
	10000	Stem																
	lger	MOIIO		$\otimes$														
4	Power Auger	E L		$\bigotimes$	51.92	7	50 DO	4										
	S S	- L	Grey to blue CLAY	X	4.11 4.27													
			Dark brown silty ORGANICS		4.2/		50											
	ſ					8	50 DO	27										
5		┢	Loose grey brown SAND and GRAVEL,		51.15 4.88													
			trace silt		]	9	50 DO	9										
							1											
					]	10	50 DO	7										
6				$\otimes$														
				$\otimes$	*													
					3	11	50 DO	10										
		$\vdash$	Loose, coarse to medium brown SAND,	$\otimes$	49.33 6.70													
			some silt	$\otimes$	0.70		50											
7						12	50 DO	6										
		┝	Loose medium to fine grey to brown	$\otimes$	48.71 7.32	12	50	~50										
		L	SAND, trace silt	₩	48.49 7.54	13	50 DO	>50										
			Coarse grey to brown SAND, some gravel, with cobbles and boulders	$\otimes$	]													
8	+	+	Cobbles and boulders (GLACIAL TILL)		48.03 8.00		$\left  \right $											
					1	C1	NQ RC	DD										
		Jore																
9	NO Corro	NG COLE				C2	NQ RC	DD										
	-																	
		┝	Fresh, grey LIMESTONE BEDROCK		46.50 9.53	-												
						СЗ	NQ RC	DD										
5		- -		<u> </u>	∔	┣-	╞┥	_	+	+	_	<b>↓</b>  _	+	·		+	-	
	_		CONTINUED NEXT PAGE															
				•						•								-
EF	ΡТΗ	SC	CALE					1	Golde								L	OGGED: BM



### RECORD OF BOREHOLE: 11-19

SHEET 2 OF 3 DATUM: Geodetic

LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: November 25 & December 15, 2011

Ļ	D H	SOIL PROFILE	1.	i	SA	MPL		DYNAMIC PENETRA RESISTANCE, BLOV		$\langle  $	k, (	IC CONDUC cm/s			RG₽	PIEZOMETER
METRES	BORING METHOD		STRATA PLOT		н.	_	BLOWS/0.3m	20 40	60 80	ì	10 ⁻⁶			0 ⁻³	ADDITIONAL LAB. TESTING	OR
MET	5 NG	DESCRIPTION	TA F	ELEV. DEPTH	NUMBER	түре	WS/C	SHEAR STRENGTH Cu, kPa	nat V. + Q. rem V. ⊕ U.	- 9		R CONTEN			DDIT B. TE	INSTALLATION
	30R		TRA	(m)	l₿	-	3LO/								LAA	
			ί Ο				ш	20 40	60 80		20	40	60 E	30 	+	
10		CONTINUED FROM PREVIOUS PAGE Fresh, grey LIMESTONE BEDROCK		<u> </u>									-		+	
		TOSH, GREY LIVIES TO ME DEDROUR		1	СЗ	NQ RC	DD						1			
				1	_								1			
	≣ e															
11	Rotary Drill NQ Core															
	δ ž				C4	NQ RC	DD									
ŀ		End of Borehole	┝┷┯┷	44.17 11.86		$\left  - \right $							1			
12																
			1										1			
			1										1			
			1										1			
13			1										1			
			1										1			
			1										1			
			1										1			
			1										1			
14			1										1			
			1										1			
			1										1			
15			1										1			
			1										1			
			1										1			
16			1										1			
16																
			1										1			
			1										1			
17			1										1			
			1										1			
			1										1			
18																
			1										1			
			1										1			
			1										1			
			1										1			
19			1										1			
			1										1			
			1										1			
			1										1			
20			1										1			
			1										1			
			I		L								1	1		
DEF	PTH S	CALE						Gold							LC	GGED: BM

-		NTION: -90° AZIMUTH:					JN	C	RIL	LIN		CON		4C1				on Dri anar	-	PO- F	Polis	hed			BR	- E	Broke	n Ro	ick	
	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	FLUSH <u>COLOUR</u>	SH C. F TC CO	I - J T - F HR- S N - \ I - ( RE % RE %	Shea /ein Conji OVEF SC COI	r Jgate RY DLID RE %	R.C	CC OR CL	- Bec - Foli - Cor - Ortl - Cle FRAC INDE 0.3	ntact nogo avag CT. EX R	gle	UN ST IR	I- Ur - St - Irr SCC w.r.t. RE	anar irved indulating epped egular DNTINU TYPE AI DES	g ITY D.	K - S SM- S Ro - F MB- N ATA	Blicke Brood Roug Mech	ensio oth gh	al B H COI	YDR NDU K, cr	NO abb of a	TE: F reviat abbrev abols.	or add tions re viation:	etral oac a)	l blist	
8		BEDROCK SURFACE Cobbles and boulders (GLACIAL TILL)		48.03 8.00	C1																									
9					C2																									
0	Rotary Drill NO Core	Fresh, grey LIMESTONE BEDROCK		46.50 9.53	СЗ																									
1					C4																									
		End of Drillhole		<u>44.17</u> 11.86																										
2																														
3																														
U																														
4																														
5																														
6																														
7																														
8																														

#### LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

# RECORD OF BOREHOLE: 11-20

BORING DATE: November 28, 2011

SHEET 1 OF 1

DATUM: Geodetic

ц	ДOГ	SOIL PROFILE	_		SA	MPLE	S	DYNAMIC PENETRA RESISTANCE, BLO	VS/0.3m		HYDRAU k	LIC CON , cm/s	IDUCTI	VITY,		و ب	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD		LOT		Я		3m	20 40	60 80	ì	10-6				D ⁻³	ADDITIONAL LAB. TESTING	OR
E E	NG N	DESCRIPTION	TA P	ELEV.	NUMBER	TYPE	VS/0.	SHEAR STRENGTH Cu, kPa		2 - •		ER CON		PERCE	NT	EG.	STANDPIPE INSTALLATION
	30RI.		STRATA PLOT	DEPTH (m)	INN	⊢	BLOWS/0.3m			- U						LAE	
	ш		s,	. ,		+	ш	20 40	60 80		20	40	60	) 8	0 	$\left  \right $	
0		GROUND SURFACE TOPSOIL	222	54.88 54.78		-+					$\vdash$					$\left  \right $	
	2			54.70 0.18		50 DO	28										
	/ Ster	Compact dark brown to black silty sand, some gravel, trace ash and brick (FILL)			1	DO	20										
	lollow																
	/er A					50											
1	n Dia				2	50 DO	24										
	Power Auger 200 mm Diam. (Hollow Stem)																
	5			53.30	3	50 DO	>50										
	-	End of Borehole	<u> </u>	1.58													
		Auger Refusal															
2																	
3																	
4																	
4																	
5																	
6																	
7																	
8																	
9																	
Ĩ																	
10																	
											•l		1				
DE	PTH S	CALE						Gold	er							LC	DGGED: BM
1:	50								· ·							011	ECKED: JW

### RECORD OF BOREHOLE: 11-20A

LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: December 1, 2011

SHEET 1 OF 1

DATUM: Geodetic

1	9	员	SOIL PROFILE	1		SA	MPLE		DYNAMIC PENETRA RESISTANCE, BLOW	/S/0.3m	R.		LIC CONDI cm/s	JUTIVITY,		² ₽	PIEZOMETER
METRES		BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	түре	BLOWS/0.3m	20 40 I I SHEAR STRENGTH Cu, kPa		80 + Q - •		10 ⁻⁵ ER CONTE			ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
1		BOR		STRA	(m)	∣₹	-	BLO	20 40		80	Wp ⊢ 20	C 40	W60	WI 80	LAI	
			GROUND SURFACE	0,	54.88				20 40	00	80	20	40	60	80		
0	-		TOPSOIL	EEE	54.88 54.78										+		
			Compact dark brown to black silty sand, some gravel, trace ash and brick (FILL)		0.18	1											
			some gravel, trace ash and brick (FILL)														
1																	
			Compact to dense brown to grey fine to		53.66 1.22												
			medium sand, trace silt, some gravel, concrete, asphalt (FILL)			1	50 DO	21									
						'	DO	21									
2					52.75	2	50 DO	35									
			Dense to loose dark brown with black silty sand, trace to some gravel, trace		2.13	] 2	DO	35									
			clay, ash, mica, organics, brick (FILL)			-											
						3	50 DO	9			1						
		Stem)				3	DO	9									
3	ter	1 > 1	Compact grey brown clayey silt to silty		51.83 3.05	⊢											
	Power Auger		clay, trace to some sand, trace gravel, wood, sheen, odours (FILL)		51.53	Ι.	50 DO	10									
	Powe	Dian	Compact black fine to medium sand, trace silt, trac egravel, black staining,		3.35	1	DO	10									
		200 mm Diam.	trace silt, trac egravel, black staining, odours, sheens (ORGANICS)		51.22 3.66	-											
		5	Compact grey brown fine SAND, with	$\otimes$	1	5	50 DO	10									
4			fine to medium sand seams/layers, trace silt	$\otimes$	1	5	DO	12									
					50.46												
			Compact grey CLAYEY SILT, some silt	$\bigotimes$	4.42	1.	50 DO	14									
			Compact grey brown medium to coarse SAND, trace fine sand	$\otimes$	4.57	ľ	DO	14									
-			Loose to very dense grey to brown fine	₩	50.00 4.88	-											
5			to medium SAND, trace to some coarse sand, trace silt	$\otimes$	1	7	50 DO	7									
			Sand, trace sit		1	ľ	DO	<i>`</i>									
				$\otimes$	}												
				$\otimes$		8	50 DO	36									
6				$\otimes$	1		DO										
0				$\otimes$	1	-											
			Very dense grey fine to coarse SAND,	₩	48.55 6.33		50 DO	35									
			some gravel, trace silt	$\otimes$	48.27												
			End of Borehole Auger Refusal		6.61												
7			C C														
8																	
9											1						
10																	
	L			I	I	<u> </u>					1						
DE	PT	TH S	CALE						Gold	۵r						LO	GGED: RI
	50									intor							CKED: JW

#### LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

## RECORD OF BOREHOLE: 11-21

BORING DATE: December 6, 2011

SHEET 1 OF 1

DATUM: Geodetic

L J			SOIL PROFILE	-		S	AMPL	.ES	DYNAMIC PENETRA RESISTANCE, BLOV	S/0.3m	R.	HYDRAU k	, cm/s	DUCIN	/111,	ĘĖ	PIEZOMETER
METRES	DODING METHOD			LOT		Ľ.		.3m	20 40	60	80	10 ⁻⁶	10 ⁻⁵	10	4 10 ⁻³	ADDITIONAL LAB. TESTING	OR
WEI			DESCRIPTION	STRATA PLOT	ELEV.		TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa	nat V.	+ Q- ●	WAT	ER CON		PERCENT	3. TE	STANDPIPE INSTALLATION
5				TRA ⁻	DEPTH (m)	1 Z	-	3LOV				Wp H		-O ^W	W	LAE	
		-		S.		+		ш	20 40	60	80	20	40	60	80		
0		$ \dashv$	GROUND SURFACE Loose dark brown silty sand, organics	Ezz	59.0 0.0		-			-	-		_				
			(TOPSOIL)				50										
			Compact dark brown silty sand, some		58.7 0.3	1 1 6	50 DO	5									
			gravel, brick, organics, ash (FILL)			$\vdash$	50										
						2	50 DO	>50									
1							1										
						3	50 DO	18									
							1										
		╞	Compact to very dense arey brown		57.2 1.8	4 4	50 DO	15									
2			Compact to very dense grey brown SILTY SAND, trace to some gravel														
							1										
						5	50 DO	54									
		Ê			]												
		v Ster															
3	uger	일이		$\bigotimes$	1	6	50 DO	35									
	ver A	аш. (†		$\otimes$	1	L											
	Power Auger	ы Ш		$\otimes$	1												
		ш 00				7	50 DO	76									
					55.1												
4			Very dense grey brown SILTY SAND, trace to some gravel (GLACIAL TILL)		3.9	6 8	50 DO	>75									
						Ľ	DO	-15									
						9	50 DO	>150									
5						$\vdash$	100										
5					53.8												
			Very dense grey SILTY SAND to SANDY SILT, trace to some gravel		5.1	8 10	50 DO	>102									
			(GLACIAL TILL)			11	50	>100									
						-											
6																	
-						12	50 DO	>85									
					52.6		00										
			End of Borehole Auger Refusal		6.4	5											
7																	
8																	
9																	
10																	
DF	рт	нç	CALE													10	GGED: RI
DE		1.3							Gold	1							JUGLD. RI

#### LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

# RECORD OF BOREHOLE: 11-22

BORING DATE: December 7, 2011

SHEET 1 OF 1

DATUM: Geodetic

LL L	ДОН	SOIL PROFILE	1.		SAI	MPLE		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	≓ຊຶ PIEZOMETER
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	ТҮРЕ	BLOWS/0.3m	20 40 60 80 SHEAR STRENGTH nat V. + Q - € Cu, kPa rem V. ⊕ U - C	10 ⁶ 10 ⁵ 10 ⁴ 10 ³ WATER CONTENT PERCENT Wp	PIEZOMETEI OR STANDPIPE INSTALLATIO
-	BO		STF	(m)	-		В	20 40 60 80	20 40 60 80	ļ- ⁻
0		GROUND SURFACE Very loose dark brown silty sand,	====	57.34 0.00						<u>                                       </u>
		Vorganics (TOPSOIL) Very loose grey brown silty sand to sandy silt, trace to some gravel, trace clay, bricks, organics (FILL)		0.13	1	50 DO	3			
1				-	2	50 DO	4			
		Loose grey brown silty clay, some sand,		55.51 1.83	3	50 DO	4			
2		trace gravel (FILL)		-	4	50 DO	6			
3	Power Auger	Loose dark brown to black silty     ORGANICS     Loose to dense brown silty fine SAND,		54.60 2.74 2.90	5	50 DO	7			
	A S	8 Dense to very dense grev brown SILTY		53.83 3.51	6	50 DO	48			
4		SAND, trace to some gravel, trace clay, black staining (odours), occasional black fine to medium sand layer Very dense grey brown silty sand to sandy silt trace to some gravel		53.27 4.07	_	50	>80			
		sandy silt, trace to some gravel, occasional fine to course sand layer (GLACIAL TILL)				50	42			
5				_		50 DO 50 DO				
		End of Borehole		51.45 5.89		50 DO				
6		Auger Refusal								
7										
8										
9										
10										
DE	PTH	I SCALE	_1	1				Golder		LOGGED: RI

#### LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

# RECORD OF BOREHOLE: 11-23

BORING DATE: December 6, 2011

SHEET 1 OF 1

DATUM: Geodetic

Ц		Ρļ	SOIL PROFILE			54	MPL	E2	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	く	k, cm	/s		μŞ	PIEZOMETER
METRES		BORING METHOD		STRATA PLOT		н.	_	J.3m	20 40 60 80			10 ⁻⁵ 10		ADDITIONAL LAB. TESTING	OR
Ξ		SING	DESCRIPTION	λTA F	ELEV. DEPTH	NUMBER	ТҮРЕ	BLOWS/0.3m	SHEAR STRENGTH nat V. + C Cu, kPa rem V. ⊕ U	) - O		CONTENT		B. T	INSTALLATION
i		BOF		STR/	(m)	۲ ۲		BLO	20 40 60 80	-	Wp	40 60	<b>I</b> WI 0 80		
			GROUND SURFACE		56.36						20	40 60			
0			TOPSOIL	ESS	0.00										
			Compact brown fine to medium sand,		0.15	1	50 DO	13							
			trace silt, gravel, clay, brick, ash and mortar (FILL)				DO								
						2	50 DO	44							
1						2	DO	11							
							50								
						3	50 DO	15							
2		Stem)			54.23		50								
	Je	≥ [	Compact gravel layer (FILL)		54.23 2.13		50 DO	46							
	er Au	Ĕ.	Compact light brown to grey fine to medium sand, some gravel, trace brick, ash and mortar (FILL)		2.29										
	Power Auger	Dian	ash and mortar (FILL)				50								
		200 mm Diam.				5	50 DO	18							
3		20	Loose layers of brick, brown silty sand,		53.31 3.05										
			mortar, ash, fine to medium dark brown		3.05		50								
			sand, and concrete, construction debris (FILL)			6	50 DO	6							
				- <u>***</u>	52.75 3.61	-									
			Loose black silty sand, trace ash, slag, occasional layers of medium brown sand, gravel, brick, clay (FILL)				50								
4			Sand, gravel, blick, clay (TILL)			7	50 DO	7							
			Compact dark grey SILTY CLAY, trace		52.09 4.27										
			gravel, trace brick		4.27		50								
						8	50 DO	32							
				$\bowtie$	51.46										
5			End of Borehole Auger Refusal		4.90										
6															
7				1											
,															
				1											
8				1											
				1											
9				1											
				1											
10															
DE	:P1	IH S	CALE					1	Golder					LO	GGED: BM

#### LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

### RECORD OF BOREHOLE: 11-24

BORING DATE: December 5 & 6, 2011

SHEET 1 OF 1

DATUM: Geodetic

Ц	보	SOIL PROFILE			SA	MPLE	S	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD		STRATA PLOT	ELEV.	ER	 س	ʻ0.3m	20 40 60 80	k, cm/s 10 ⁶ 10 ⁻⁵ 10 ⁴ 10 ³ WATER CONTENT PERCENT Wp - W I WI	OR
ЧЦ ИЦ ИЦ	RING	DESCRIPTION	ATA	DEPTH	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - O		INSTALLATION
د	BO		STR	(m)	z		BL(	20 40 60 80	20 40 60 80	
0		GROUND SURFACE		59.48						
		Very loose dark brown silty sand, trace clay, organics (TOPSOIL) Very loose to very dense dark brown silty sand, trace clay, trace gravel, brick,		0.00 0.10	1	50 DO	4			
• 1		concrete, mortar, ash, metal, slag, concrete slab, grey crushed stone (FILL)			2	50 DO	8			
					3	50 DO	4			
2		Very dense to dense brown grey brown SILTY SAND, some gravel, ashes on top		57.35 2.13	4	50 DO	53			
		of layer		50.40	5	50 DO	34			
3		Dense to very dense grey SILTY SAND, trace to some gravel, black staining (strong odours) (GLACIAL TILL)		56.43 3.05	6	50 DO	43			
• 4					7	50 DO	>70			
	Stem)				8	50 DO	175			
5	Power Auger 200 mm Diam. (Hollow Stem)	Very dense grey SILTY SAND to SANDY SILT, trace to some gravel, odours (GLACIAL TILL)		54.60 4.88	9	50 DO	>150			
	200 mm [				10	50 DO	180			
6					11	50 DO	>150			
7					12	50 DO	>100			
				51.86		50 DO	>50			
8		Very dense grey SILTY SAND to SANDY SILT, trace to some gravel, slight odours (GLACIAL TILL)			14	50 DO	>100			
					15	50 DO	134			
- 9					16	50 DO	125			
						50	>100 >50			
10		End of Borehole Auger Refusal	FLER 	49.37 10.11	,	UU				
• 11										
DE	PTH S	CALE	I					Golder		OGGED: RI

#### LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

## RECORD OF BOREHOLE: 11-25

BORING DATE: December 7, 2011

SHEET 1 OF 1

DATUM: Geodetic

Ц	ç		SOIL PROFILE	-		SA	MPLI	ES	DYNAMIC PENETRATION	HYDRAULIC CONDUCTIVITY, k, cm/s	μġ	PIEZOMETER
DEPTH SCALE METRES	BOPING METHOD		DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	BLOWS/0.3m	20 40 60 80 SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - O	10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³ WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
_ ۲	aCa			STRA.	DEPTH (m)	Ň		BLOV	20 40 60 80	Wp H OW WI 20 40 60 80	LAE	
_			GROUND SURFACE		57.24							
0			TOPSOIL Loose to compact brown fine to medium		0.00							
			sand, trace silt, gravel, ash, brick and		0.15	1	50 DO	7				
			mortar (FILL)									
							50					
1						2	50 DO	9				
			Compact grey clay (FILL)		55.72 1.52	3	50 DO	14				
		╞	Compact dark brown to black silty sand		1.68							
2			(FILL)									
		Stem)				4	50 DO	40				
	uger	Hollow	Compact brown fine to medium sand,	***	54.80 2.44							
	Power Auger	iam. (I	trace gravel, trace concrete (FILL)		54.50 2.74	5	50 DO	14				
3	ď	mm m	Compact dark brown to black silty sand, some mica fragments (FILL)		2.74		50					
Ŭ		200										
			Compact to dense grey fine to medium		53.89 3.35	6	50 DO	8				
			SAND, some gravel, trace silt (GLACIAL TILL)									
						7	50 DO	>50				
4												
						8	50 DO	68				
5					52.01	9	50 DO	>50				
			End of Borehole Auger Refusal	AAAA	5.23							
6												
7												
8												
9												
· 10												
-												
DE	۲T	H S	CALE						Golder		LO	GGED: BM

#### LOCATION: See Site Plan

### SAMPLER HAMMER, 64kg; DROP, 760mm

### RECORD OF BOREHOLE: 11-26

BORING DATE: December 6, 2011

SHEET 1 OF 1

DATUM: Geodetic

ц Г	UCH.		SOIL PROFILE			SA	MPL		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	RGA	PIEZOMETER
DEPTH SCALE METRES	BOBING METHOD		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	20 40 60 80 SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - ○	Wp - O Wi	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
0			GROUND SURFACE	0,	55.78				20 40 60 80	20 40 60 80		
U			TOPSOIL Loose grey clay, some sand (FILL)		0.00							
					55.32	1	50 DO	9				
			Compact dark brown silty sand, some gravel, trace ash, brick and mortar,		0.46							
			occasional layers of fine to coarse sand (FILL)				50					
1						2	50 DO	38				
						3	50 DO	25				
2		em)					50					
	er	low St				4	50 DO	14				
	Power Auger	л. (Но										
	Pow	200 mm Diam. (Hollow Stem)	Very loose black silty sand, trace ash,	<u> </u>	53.04 2.74	5	50 DO	8				
3		200 m	brick, wood and gravel, occasional layers of fine sand (FILL)									
			· · · · · · · · · · · · · · · · · · ·				50					
						6	50 DO	4				
4						7	50 DO	9				
			Very dense arey brown find to modium	1	51.51							
			Very dense grey brown fine to medium SAND, some silt and gravel (GLACIAL TILL)		4.27	8	50 DO	110				
5		Ц	End of Borehole		50.78 5.00	9	50 DO	>75				
			Auger Refusal									
6												
7												
8												
9												
10												
DE	PTI	H S	CALE						Coldor		LO	GGED: BM
1:	50								Golder		CHE	CKED: JW

### LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

### RECORD OF BOREHOLE: 11-28

BORING DATE: December 8, 2011

SHEET 1 OF 3

DATUM: Geodetic

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

SOIL PROFILE		r	SA	MPLE		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	<u>N</u> G NG	PIEZOMETER
SOIL PROFILE	STRATA PLOT	ELEV.	BER	Ы	BLOWS/0.3m	20 40 60 80 SHEAR STRENGTH nat V. + Q - ●	10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³ WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	OR STANDPIPE
	IRATA	DEPTH (m)	NUMBER	түре	ROWS	Cu, kPa rem V. ⊕ U - O	Wp I WI	ADD LAB.	INSTALLATION
GROUND SURFACE	0.				ш	20 40 60 80	20 40 60 80	+	
Very loose brown medium to fine sand	<b>**</b>	57.59 0.00		+	$\neg$			+	
(FILL)		57.13	1	50 DO	2				
Compact black silty sand, some gravel, trace ash (FILL)		0.46							
			2	50 DO	17				
		56.37	-	DO					
Loose to compact brown medium to fine SAND, some gravel, trace silt and brick		1.22		_					
			3	50 DO	13				
			4	50 DO	5				
		54.85							
Very dense brown to grey fine to medium SAND, trace gravel and silt (GLACIAL TILL)		2.74	5	50 DO	70				
			5	DO	10				
			6	50 DO	>50				
Stem)			7	50 DO	112				
Hollow									
200 mm Dian. (Hollow Stem)			8	50 DO	119				
00 00									
20			9	50 DO	>60				
			10	50 DO	108				
			11	50 DO >	·100				
			12	50 DO	>90				
Compact grey SILTY CLAY, some sand, trace gravel (GLACIAL TILL)		49.97 7.62							
trace gravel (GLACIAL TILL)			13	50 DO	80				
			14	50 DO	42				
		48.75		00	-				
Grey CLAYEY SILT, some sand, trace gravel, with cobbles and boulders (GLACIAL TILL)		8.84	C1	NQ RC	DD				
		48.06 9.53	~	NQ RC	DD				
LIMESTONE BEDROCK, with thin beds		3.33	62	RC	00				
L	╧╧╧	1			-	+	<b>⊦</b>   +   + -	_  -	
CONTINUED NEXT PAGE									
	BEDROCK, with thin beds	⁺⁺⁺	^{+_+}		^{+_+}				



### LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

# RECORD OF BOREHOLE: 11-28

BORING DATE: December 8, 2011

SHEET 2 OF 3

DATUM: Geodetic

Ц	ПОН	SOIL PROFILE			SA	MPL	ES	DYNAMIC PENET RESISTANCE, BL	RATI OWS	/0.3m		HYDRAL			IVIIY,		ξĻ	PIEZOMETER
METRES	BORING METHOD		STRATA PLOT	_	<u>ب</u>		3m	20 40			80	10 ⁻⁶	° 10	)-5 10	0 ⁻⁴ 1	0-3	ADDITIONAL LAB. TESTING	OR
WET	5NG	DESCRIPTION	τa f	ELEV. DEPTH	NUMBER	түре	BLOWS/0.3m	SHEAR STRENG Cu, kPa	тн				TER CO	ONTENT	PERCE	NT	DDIT B. TE	STANDPIPE INSTALLATION
Ľ	BOR		STRA	(m)	۲		BLO										PA	
		CONTINUED FROM PREVIOUS PAGE	0)					20 40		50 8	80	20	4	<u>v 6</u>	30 0i	30		
10		Fresh, medium bedded, arev	<u> </u>	1	C2	NQ RC	DD			1								
		LIMESTONE BEDROCK, with thin beds of black shale																
	Drill																	
11	Rotary Drill NQ Core		H		СЗ	NQ RC	DD											
				45.90														
		End of Borehole Auger Refusal		11.69														
12		<b>U</b>	1															
13																		
-			1															
14																		
			1															
			1															
15																		
			1															
			1															
			1															
			1															
16			1															
			1															
			1															
			1															
17			1															
			1															
			1															
			1															
10			1															
18																		
19																		
			1															
20			1															
20																		
			1	I						1	1				1	I	1	
DE	PTH S	CALE					(	Gol	da	r							LC	DGGED: BM
1:	50								in the second	too							СН	ECKED: JW

LO	)CA		T: 11-1122-0199 IN: See Site Plan FION: -90° AZIMUTH:		RE	CC	ORD			ORIL ORIL ORIL	LIN L RI LIN	g d. IG: G C	ATE CMI ON1	:: D E 85 [RA	)ece 50 CT(	emb	er 8 Ma	3, 20 arath	011 hon	Drill											IEET ATUM		с	
DEPTH SCALE METRES		DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	FLUSH <u>COLOUR</u>		HR- 8 N - \ J - 0 RECO	Conju OVER SOI COR	gate Y LID E %		CO- OR- CL - FI D. II	Bedd Foliaf Conta Ortho Cleav RACT NDE> PER 0.3 m	act ogona vage T. K B	Angle		R - S	ONT	lating bed	K S R N Y DA	icker noot ough	nside h	al Br HY CON		NOT abbr of al sym AULI CTIV	C D	or add ons re ations oint L Inde (MP	etral coad a) a)					
			BEDROCK SURFACE Grey CLAYEY SILT, some sand, trace	or set	48.75 8.84			+											-						_		_	$\parallel$	$\left  \right $	_				
- 9 - - -			gravel, with cobbles and boulders (GLACIAL TILL)		48.06	C1																												
- - - - - - - - - - -	Rotary Drill	NQ Core	Fresh, medium bedded, grey LIMESTONE BEDROCK, with thin beds of black shale		9.53	C2							_																-					
- - - - - - - - - - -					45.90	СЗ																												-
- 12 - 13 - 13 - 14 - 14 - 15			End of Drillhole		11.69																													
- - - - - - - - - - - - - - - - - - -																																		- - - - - - -
MIS-RCK 004 1111220199.6FJ 6AL-MISS.6U1 128/13 JEM 1 1 1 12 18 1 1 18 1 1 18																																		- - - - - - - - - - - - - - - - -
IIS-RCK 004 1111220199.GF			CALE								G																				)GGE ECKE			· · ·

#### LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

RECORD OF BOREHOLE: 11-29

SHEET 1 OF 1 DATUM: Geodetic

BORING DATE: December 5, 2011

	L C H		SOIL PROFILE	1.		SA	MPLI		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	2°₽	PIEZOMETER
METRES	BORING METHOD		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	20 40 60 80 SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - O	wp wi	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
_	ú	+	GROUND SURFACE	ەن ا				ш	20 40 60 80	20 40 60 80	+ +	
0		+	ORGANICS/TOPSOIL	EEE	55.66 0.00			_				
			Compact brown fine to medium sand, trace silt, gravel and ash (FILL)		0.15 55.05	1	50 DO	11				
1			Loose to compact dark brown to black silty sand, trace ash and gravel (FILL)		0.61	2	50 DO	11				
			Loose to very loose brown fine to medium SAND		53.98 1.68	3	50 DO	3				
2					53.37	4	50 DO	5				
	ger	ollow Stem)	Compact dark brown to black SILTY SAND, trace gravel and clay		2.29	5	50 DO	14				
3	Power Auger	0 mm Diam. (H.	Loose dark brown SAND and GRAVEL		52.61 3.05 52.05	6	50 DO	6				
4		- 20	Compact dark grey to grey SILTY SAND, trace gravel		3.61	7	50 DO	28				
						8	50 DO	49				
5			Dense dark grey to grey SILTY SAND, trace gravel (GLACIAL TILL)		50.78 4.88	9	50 DO	90				
6						10	50 DO	42				
			End of Borehole Auger Refusal		49.49 6.17							
7												
8												
9												
10												
DE	PTH	1 50	CALE						Golder		LOG	GED: BM

#### LOCATION: See Site Plan

### RECORD OF BOREHOLE: 11-31

BORING DATE: December 2, 2011

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

<u> </u>	오	SOIL PROFILE	1.	,	- SA	MPLE		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	k, cm/s	PIEZOMETER
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	түре	BLOWS/0.3m	20 40 60 80 SHEAR STRENGTH nat V. + Q ● Cu, kPa rem V. ⊕ U ○	10 ⁶ 10 ⁵ 10 ⁴ 10 ³ WATER CONTENT PERCENT Wp	PIEZOMETER OR STANDPIPE INSTALLATION
	ш	GROUND SURFACE	ν,				ш	20 40 60 80	20 40 60 80	
0		TOPSOIL	EEE	58.81 0.00 58.61						
		Compact fine to medium light brown		0.20	1	50 DO	12			
		sand, trace silt (FILL)		58.20		DO				
		Loose dark brown silty sand, trace gravel, ash and brick (FILL)		0.61						
		gravel, ash and brick (FILL)			2	50 DO	7			
1		L		57.64						
		Very loose construction debris made up of layers of brick, ash, slag, mortar, insulation, and wood (FILL)		1.17						
		insulation, and wood (FILL)			3	50 DO	2			
2										
					4	50 DO	9			
				56.37 2.44						
		Compact light brown to grey fine to medium SAND, trace silt and gravel		2.44		50				
	tem)				5	50 DO	15			
3	low S			) }						
	Power Auger Diam. (Hollo				6	50 DO	42			
	n Diar			55.15		DO				
	Power Auger 200 mm Diam. (Hollow Stem)	Dense to very dense grey brown fine to medium SAND, trace silt and gravel	Ĭ	3.66						
4	5	(GLACIAL TILL)			7	50 DO	75			
					8	50 DO	65			
5						50				
					9	50 DO	84			
		Very dense grey fine to coarse SAND.		53.32 5.49						
		Very dense grey fine to coarse SAND, some silt, trace gravel (GLACIAL TILL)				50 DO	97			
6										
					11	50 DO	69			
		End of Borehole		52.18 6.63						
		Auger Refusal		0.00						
7										
8										
-										
9										
10										
		1	_							1 1
DE	этн :	SCALE						Golder		LOGGED: BM

### LOCATION: See Site Plan

RECORD OF BOREHOLE: 11-32

BORING DATE: December 5, 2011

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

1	片		SOIL PROFILE			SA	MPLI		DYNAMIC PENETRA RESISTANCE, BLOW	VS/0.3m	R.	HYDRAUI k,	cm/s		VIIY,		βÅ	PIEZOMETER
METRES	BORING METHOD			STRATA PLOT		н		).3m	20 40	60	80	10 ⁻⁶	10 ⁻⁵				ADDITIONAL LAB. TESTING	OR
MET	DNG		DESCRIPTION	VTA F	ELEV. DEPTH	NUMBER	түре	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa	nat V. rem V	+ Q-● ⊕ U- ∩		ER CON				DDIT B. TE	INSTALLATION
5	BOR			STRA	(m)	٦	-	BLO				Wp⊢ 20	40				LA	
			) SURFACE		56.18			$\neg$	20 40	60	80	20	40	60	, 8	0		
0	Τ	TOPSOI	L	ESS	0.00													
		Loose br (FILL)	rown silty sand, some gravel		0.15	1	50 DO	8										
		l` í			55.57													
		Loose to	compact brown fine to medium me gravel, trace brick, mortar		0.61													
1		and slag	(FILL)			2	50 DO	9										
						3	50 DO	20										
2							50											
						4	50 DO	4										
			rown to black fine to medium		53.74 2.44													
		ສ siltv san	d, occasional wood, brick, ceramic, trace clay (FILL)			5	50 DO	4										
	Power Auger		Granic, adde Gay (I'ILL)			5	DO	1										
3	ower	Diam.																
	"	mortar, c	t grey SANDY SILT, trace gravel	- <b>X</b>	52.83 3.35	6	50 DO	8										
		and clay	L GIER OMINDI OLLI, TROCE GRAVEL		3.33													
4						7	50 DO	42										
					*													
						8	50 DO	34										
		Dense a	rev SANDY SILT trace gravel		51.30 4.88													
5		and clay	rey SANDY SILT, trace gravel (GLACIAL TILL)			9	50 DO	>50										
						10	50 DO	63										
6		End of B	orehole		50.21 5.97													
_																		
7																		
8																		
_																		
9																		
10																		
<b>D</b> -																		
υE	-11-	SCALE							<b>H</b> Gold	er							LC	DGGED: BM

#### LOCATION: See Site Plan

### RECORD OF BOREHOLE: 11-33

BORING DATE: December 8, 2011

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

TE: December 8, 2011

METRES	BORING METHOD	SOIL PROFILE	⊢	1	SA	MPL		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	ING ING	PIEZOMETER
ETRE(	3 ME		STRATA PLOT	ELEV.	3ER	щ	BLOWS/0.3m	20 40 60 80	10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³ WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	OR STANDPIPE
WE	RING	DESCRIPTION	RATA	DEPTH	NUMBER	ТҮРЕ	OWS.	SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - O		ADD - AB.	INSTALLATION
'	BC		STF	(m)			BL	20 40 60 80	20 40 60 80		
0		GROUND SURFACE		62.22							
		(lot BASE)	/	0.08	1	50 DO	46				
		Dense brown fine to medium sand, some coarse sand, some gravel, trace	,	61.69 0.53		DO					
		silt (Gravel lot SUBBASE)	′₩	0.53		_					
1		sand, trace to some gravel, brick, wood, organics, concrete, occasional grev silty			2	50 DO	9				
		clay layer (FILL)									
					3	50 DO	60				
					4	50 DO	12				
2					4	DO	12				
					5	50 DO	56				
						DO					
3		Compact to very dense brown to grey		59.32 2.90		50					
3		Compact to very dense brown to grey brown SILTY SAND to SANDY SILT, trace to some gravel (GLACIAL TILL)			6	50 DO	23				
					7	50 DO	48				
4											
					8	50 DO	74				
	Ctown	< Ster									
	Auger				9	50 DO	49				
5	Power Auger	Dian									
		200 mm Diam. (Hollow Stern)			10	50 DO	55				
	Č	8				DO					
6					11	50 DO	>89				
					12	50 DO	>100				
					13	50 DO	>100				
7					14	50	>100				
		Very dense grey brown SILTY SAND,		54.60 7.62		50					
8		trace to some gravel, occasional grey sill seam, occasional fine to medium sand seam (GLACIAL TILL)			15	50 DO	>111				
Ŭ		seam (GLACIAL TILL)				_					
							>105				
					17	50 DO	>50				
9											
					18	50 DO	>100				
					19	50 DO	>50				
				52.26	20	50 DO	>110				
10		End of Borehole Split Spoon Refusal		9.96							
11											
DE	PTH	+ SCALE								LOGO	GED: RI
	55							Golder			KED: JW

#### LOCATION: See Site Plan

# **RECORD OF BOREHOLE: 11-35**

BORING DATE: December 12, 2011

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

» ALE	BOPING METHOD		SOIL PROFILE	-	r	SA	MPL		DYNAMIC PE RESISTANCE			· ` \		k, cm/s			NG	PIEZOMETER
DEPTH SCALE METRES	, MET			STRATA PLOT	ELEV.	ER	ш	BLOWS/0.3m		40	60	80	10-6			0 ⁻³	ADDITIONAL LAB. TESTING	OR STANDPIPE
ME	DNIG		DESCRIPTION	RATA	DEPTH	NUMBER	түре	OWS,	SHEAR STRE Cu, kPa	:NG [H	nat V. rem V.	+ Q-● ⊕ U-O	WA Wn			NT WI	ADDI .AB. T	INSTALLATION
-	Ca	נ		STF	(m)	Ĺ		BL	20	40	60	80	20			30		
0		$\square$	GROUND SURFACE	- <u>-</u>	62.56							_						
			Dense grey sand and gravel (Gravel lot BASE)		0.00 62.25		50											
			Compact brown medium to fine sand, trace gravel (Gravel lot SUBBASE)		0.31	1	50 DO	52										
			liace graver (Graver Iot SUBBASE)															
					61.65	2	50 DO	17										
1			Compact dark brown to black silty sand, trace gravel, ash, wood, brick, mortar		0.91		00											
			(FILL)															
					60.88	3	50 DO	19										
		Stem	Compact brown fine to medium sand, trace gravel (FILL)		1.68													
2	ıger	ollow			60.43	4	50 DO	24										
	Power Auger	H).	Dense to very dense light brown to brown SILTY SAND, occasional gravel and medium sand layers, trace gravel		2.13	5	50 DO	45										
	Po	Ш Ш	and medium sand layers, trace gravel (GLACIAL TILL)															
		200 r				6	50 DO	65										
3																		
-							50											
						7	50 DO	176										
• 4						8	50 DO	>50										
			E el el Decelecte		58.16													
			End of Borehole Auger Refusal		4.40													
5																		
6																		
7																		
8																		
0																		
• 9																		
- 10																		
DF	ртι	ня	CALE						Â.								10	OGGED: BM
1:		5							<b>G</b>	old	er iates							ECKED: JW

#### LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

RECORD OF BOREHOLE: 11-37

SHEET 1 OF 1 DATUM: Geodetic

BORING DATE: December 12, 2011

	DOH.	SOIL PROFILE	1.	,   I	SAMPI	1	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	RGA	PIEZOMETER
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	TYPE	BLOWS/0.3m	20 40 60 80 SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - O	10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³ WATER CONTENT PERCENT Wp	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
	8	GROUND SURFACE	S	(,	+	В	20 40 60 80	20 40 60 80	+ +	
0		Compact sand and gravel (Gravel lot	<b>**</b>	62.76 0.00	+	+			+ +	
		BASE) Compact brown medium to fine sand, trace gravel (Gravel lot SUBBASE)		62.46 0.30	1 50 DO	29				
1		Loose dark brown to black silty sand, trace gravel, occasional layers of ash, gravel, sandy mortar, glass, construction debris (FILL)		61.85 0.91	2 50 DO	20				
				-	3 ⁵⁰ DO	6				
2		Compact brown medium to fine sand, trace gravel (FILL) Dense to very dense grev brown SILTY		60.63 2.13 60.32 2.44	4 DO	34				
3	Power Auger 200 mm Diam. (Hollow Stem)	Dense to very dense grey brown SILTY SAND, some gravel, trace cobbles (GLACIAL TILL)			5 50 DO	73				
	200 mm Diam				6 50 DO	>75				
4					7 50 DO	>65				
5					8 50 DO	>75				
					9 50 DO	40				
6					10 50 DO	>50				
7		End of Borehole Auger Refusal		56.23 6.53						
8										
9										
10										
DEI	PTH S	SCALE				(	Golder		LOG	GED: BM

#### LOCATION: See Site Plan

## RECORD OF BOREHOLE: 11-38

BORING DATE: December 19, 2011

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING METHOD		6	1			~ 1			レブニー	
RING	DECODIDE S	료	ELEV.	ЯË	ш I	0.31		10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³	EST EST EST EST EST EST EST EST EST EST	OR STANDPIPE
~	DESCRIPTION	STRATA PLOT	DEPTH	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - O		ADDITIONAL LAB. TESTING	INSTALLATION
B		STR	(m)	z		BLO	20 40 60 80	20 40 60 80		
	GROUND SURFACE		62.11							
	Compact to dense brown sand and gravel (Gravel lot BASE)	/ 🗱	0.00 0.10		50					
	gravel (Gravel lot BASE) // Loose to compact brown medium to fine sand, some gravel (Gravel lot SUBBASE)			1	50 DO	35				
	SUBBASE)									
				2	50 DO	8				
			60.89	-	DO	Ĩ				
	Compact to very dense grey brown sand, some gravel, trace silt (FILL)		1.22							
(me	Sand, Some graver, trace Sitt (FILL)			3	50 DO	15				
ow Ste										
(Holl				4	50	52				
Diam										
00 mm	Very dense grey brown SILTY SAND,		59.67 2.44							
5(	some gravel, medium brown sand seams (GLACIAL TILL)			5	50 DO	61				
					50					
				6	DO	12				
				7	50 DO	48				
	End of Borehole	1288	57.94 4.17		-	-				
	Auger Refusal									
		_	1							
TH S	CALE					(	Golder		LOGG	ED: JDR
	200 mm	End of Borehole Auger Refusal	seams (GLACIAL TILL)         End of Borehole         Auger Refusal	End of Borehole Auger Refusal TH SCALE	seams (GLACIAL TILL)       5         End of Borehole       7         Auger Refusal       4.17         Image: Image of the seams o	seams (GLACIAL TILL)       5       50         End of Borehole       7       50         Auger Refusal       4.17       1         Image: Image	seams (GLACIAL TILL)       5       50       61         6       50       112         7       50       148         4.17       1       1         4.17       1       1         4.17       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1       1       1         1<	seams'(GLACIAL TILL)       i       i       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j       j	seams (GLACIAL TILL)       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i       i	Seams (GLACIAL TILL)         6         50         61           Find of Borehole         7         50         140           7,7         50         140           7,80         140           4,17         1

#### LOCATION: See Site Plan

# RECORD OF BOREHOLE: 11-39

BORING DATE: December 15, 2011

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

	DOH.		SOIL PROFILE	L	r	SA	MPL		DYNAMIC F	ENETRA CE, BLO	VS/0.3m	Ľ.		, cm/s				RGAL	PIEZOMETER
METRES	BORING METHOD		DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	BLOWS/0.3m	20 SHEAR STR Cu, kPa	40 RENGTH	60 nat V. rem V	80 + Q-●	10 ⁻⁶	FER CC	NTENT	PERCE		I ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
5	BOR			STRA	(m)	R		BLO	20	40	60	80	Wp 20	4(	<u> </u>		WI BO	LA	
0		GROUND SUR		-	62.81														
-			d and gravel (Gravel lot		0.00		50												
		Compact brow	vn to red sandy silt, trace	. 💥		1	50 DO	15											
		g ()																	
		Compositiond			61.90 0.91	2	50 DO	20											
1		medium sand	ense light brown fine to , trace gravel, silt, and		0.31														
						3	50 DO	40											
2		Donce condu		-	60.68 2.13	4	50 DO	120											
		medium sand	gravel to brown fine to and gravel (FILL)		2.13														
		2					50												
		<pre>Step</pre>				5	50 DO	67											
3	Auger	010H)																	
	Power Auger	Liam.				6	50 DO	99											
					59.15														
		Compact to ve SAND, some	ery dense grey SILTY gravel (GLACIAL TILL)		3.66		50												
4						7	50 DO	34											
						8	50 DO	27											
5							50												
						9	50 DO	33											
							50												
						10	50 DO	>50											
6						11	50	>100											
					56.46	12	50 50	>100											
		End of Boreho Auger Refusa			6.35														
7																			
8																			
9																			
10																			
	ידר				-								- I			-	-		
DE	-1H	SCALE								Gold ssoc	er								ogged: BM/JD Ecked: JW

#### LOCATION: See Site Plan

RECORD OF BOREHOLE: 11-40

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: December 16, 2011

Ш		员	SOIL PROFILE	1.		SA	MPL		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	Ì	HYDRAULIC CONDUCTIVITY, k, cm/s	ĘĻ	PIEZOMETE
METRES		BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH nat V. + Cu, kPa rem V. €		wp wi	ADDITIONAL LAB. TESTING	OR STANDPIPI INSTALLATIO
	$\vdash$	-	GROUND SURFACE	ەن ا	62.77			ш	20 40 60	30	20 40 60 80	+	
0	⊢	$\top$	Compact red to fine brown sand, some gravel (Gravel lot BASE)	<b>**</b>	0.00								
					62.39 0.38	1	50 DO	13					
			Compact fine to medium brown sand, some gravel, red brick (FILL)		0.36								
						2	50 DO	19					
1					61.55	-	DO	10					
			Compact light brown fine to medium sand, trace gravel, silt, red brick (FILL)		1.22		1						
			······································			3	50 DO	15					
							-						
2						4	50 DO	25					
		(ma)					FO						
	er	low St			59.78	5	50 DO	51					
3	ver Aug	200 mm Diam. (Hollow Stem)	Very dense grey brown SAND, some gravel, trace silt (GLACIAL TILL)		2.99	-	1						
	Pov	nm Dia	. ,			6	50 DO	59					
		200 r	Very dense grev brown SII TY SAND		59.11 3.66								
4			Very dense grey brown SILTY SAND, some gravel (GLACIAL TILL)		5.00	7	50 DO	100					
4								-					
						8	50 DO	>50					
						9	50 DO	>100					
5													
						10	50 DO	187					
6						11	50 DO	>50					
			End of Borehole		56.52 6.25								
			Auger Refusal		0.25								
7													
8													
9													
10													
DE	PT	TH S	CALE					(	200 (M)			LOO	GGED: JD
1:	50								Golder			CHE	CKED: JW

PROJECT: 11-1121-0229 LOCATION: See Site Plan

## **RECORD OF BOREHOLE: 13-1**

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: March 8, 2013

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

SHEET 1 OF 2

<u>"</u>	오니	SOIL PROFILE	-1		SAI	MPLE		DYNAMIC PENETRA RESISTANCE, BLOV	/S/0.3m	<		k, cm/s				PIEZOMETER
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	BLOWS/0.30m	20 40 SHEAR STRENGTH Cu, kPa		80 - Q - •		ATER C	I ONTEN	T PERCE	ADDITIONAL AB TESTING	OR STANDPIPE INSTALLATIO
	BORI		<b>STRA</b>	DEPTH (m)	ÎN	⊢	BLOW	Cu, kPa 20 40		9 U - () 80						
		GROUND SURFACE		58.72			_	20 40				4				MON
0 -		(SP/GP) SAND and GRAVEL, crushed, inferred presence of cobbles and/or boulders; grey, (FILL); non-cohesive, moist, compact		0.00												Silica Sand
1		(SM) SILTY SAND, some gravel; grey brown; non-cohesive, moist, compact		57.35 1.37	1	SS	28									
2					2	ss	12									Native Backfill and
3		(SM) SILTY SAND, some gravel to		55.67	3	SS	30				0				мн	Bentonite Mix
4	Power Auger mm Diam. (Hollow Stem)	(SM) SILTY SAND, some gravel to gravelly, inferred presence of cobbles and/or boulders; grey brown, (GLACIAL TILL); non-cohesive, moist, dense to very dense		3.05	4	SS	55				0				МН	Native Backfill and Bentonite Mix
5	200 n				5	SS	>50									Bentonite Seal
6					6	SS	>50									Silica Sand
7																32 mm Diam. PVC #10 Slot Screen
8	a N	Borehole continued on RECORD OF		50.75	C1	NQ RC	DD									
9		DRILLHOLE 13-1														
10 DEF	, TH S	CALE						Gold								LOGGED: HEC

#### LOCATION: See Site Plan

### SAMPLER HAMMER, 64kg; DROP, 760mm

# **RECORD OF BOREHOLE: 13-5**

BORING DATE: March 13, 2013

SHEET 1 OF 2

DATUM: Geodetic

ц	₽Ģ	SOIL PROFILE			SA	MPLI	ES	DYNAMIC PENETRAT RESISTANCE, BLOW	10N S/0.3m	ì	HYD	RAULIC C k, cm/s		VITY,		ا ت ا	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD		LOT		ъ		30m	20 40		80			0-6 10		0-2	ADDITIONAL LAB. TESTING	OR
	NG∧	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	BLOWS/0.30m	SHEAR STRENGTH Cu, kPa	nat V. +	- Q- •	1	WATER C		PERCE	NT	E E	STANDPIPE INSTALLATION
5	30RI		TRA.	DEPTH (m)	Ñ		ЧO				'				WI	LAE	
	ш		ò				ш	20 40	60	80		20 4	40 60	) 8	30	+	
0		GROUND SURFACE (SM) SILTY SAND, trace gravel; brown,		55.39 0.00												+	
		(TOPSOIL): non-cohesive, moist	1	0.15													
		(SP/GP) SILTY SAND and GRAVEL, crushed; grey, (FILL); non-cohesive,			1	SS	12										
		moist, dense to loose															
1					2	SS	54				0					м	
	Ster																
	200 mm Diam (Hollow Stem)																
	er Au				3	ss	13										
2	Pod																
	6																
					4	SS	9										
			_	52.49 2.90													
3		(SM) SILTY SAND, fine; grey brown, (FILL); non-cohesive, moist, very loose		2.90 52.19	$\vdash$												
		(OL) ORGANIC SILT; dark brown;		3.20	5	SS	3								0	OC = 24.0%	
		non-cohesvie, moist, very loose		51.86												24.0%	
		LIMESTONE Borehole continued on RECORD OF		3.53													
4		DRILLHOLE 13-5															
4																	
5																	
6																	
7																	
8	I																
٥																	
9																	
10																	
											1						
DE	РТН	SCALE														LO	GGED: HEC
_	50							Golde	r								CKED: MJK

#### LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

**RECORD OF BOREHOLE: 13-6** 

SHEET 1 OF 2 DATUM: Geodetic

BORING DATE: March 14, 2013

Ц	ç	BORING MELHOD	SOIL PROFILE			SA	MPL		DYNAMIC PENETRA RESISTANCE, BLOV	110N /S/0.3m	ì	HYDR	AULIC C k, cm/s		I IVITY,		ا و ب	PIEZOMETER
DEP IN SUALE METRES	Ē	ME		STRATA PLOT		к		BLOWS/0.30m	20 40	60	80	1	0 ⁻⁸ 1	0 ⁻⁶ 1	0-4 10	0-2	ADDITIONAL LAB. TESTING	OR
MET	9	2 Z	DESCRIPTION	TAP	ELEV.	NUMBER	ТҮРЕ	/S/0.	SHEAR STRENGTH Cu, kPa	nat V. + rem V. ∉	Q - •	N			PERCE	NT	B. H	STANDPIPE INSTALLATION
_	Ē	Š		TRA	DEPTH (m)	P	-	ΓΟΜ						W			22	
		-	GROUND SURFACE	ŝ				В	20 40	60	80	2	20 4	10 (	50 8 	0		MON. V
0		-	ASPHALTIC CONCRETE		55.70 0.00 0.08													
			(SP/GP) SAND and GRAVEL, crushed;		0.08													
			grey, (FILL); non-cohesive, moist, compact to dense			1	SS	20										
							-											
1						2	SS	45										
					54.33													
			(CI) SILTY CLAY; grey brown, (FILL);		1.37													Bentonite Seal
			Cohesive, moist, very stiff (SM) SILTY SAND and GRAVEL; grey	1	1.52													Dentonite Gear
			brown, contains orange brick fragments, (FILL); non-cohesive, moist, loose to			3	SS	9										
2		Stem	compact															
	Iger	ollow					-											
	Power Auger	E.																
	Pov	n Dia				4	SS	9				0					м	
3		200 mm Diam. (Hollow Stem)																
з		2																Silica Sand
						5	SS	14										
					52.04													
			(SM) SILTY SAND, some gravel; grey brown, (FILL); non-cohesive, wet,		3.66													
4			compact															
						6	SS	20										32 mm Diam. PVC #10 Slot Screen
						-												
			(OL) ORGANIC SILT, dark brown;		51.05 4.65	-												
			non-cohesive, most, loose		4.65	7	SS	>50							0		OC = 16.2%	2
5		[	LIMESTONE Borehole continued on RECORD OF	1														
			DRILLHOLE 13-6															
6																		
3																		
7																		
8																		
9																		
5																		
		·																
10																		
DE	PT	HS	CALE							<b>.</b>							LC	OGGED: HEC
	50								Gold									ECKED: MJK

#### LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

# RECORD OF BOREHOLE: 13-7

BORING DATE: March 11, 2013

SHEET 1 OF 2

DATUM: Geodetic

щ	Ц		SOIL PROFILE			SA	MPLI		DYNAMIC PENETRA RESISTANCE, BLOW	ГЮN \ 'S/0.3m <		птр	k, c	c cor m/s	NDUCI	IVITY,		ĘĻ	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD		DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	TYPE	BLOWS/0.30m	20 40 SHEAR STRENGTH Cu, kPa	60 80	` • 0				ITENT	PERCE		ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
L	BO	-		STR	(m)	z		BLC	20 40	60 80			20	40	6		30	Ľ	
0		1	GROUND SURFACE (SP/GP) SAND and GRAVEL, crushed; grey, (FILL); non-cohesive, moist, compact		55.71 0.00	1 (	GRAB												
1						2	SS	32											
2		(F	(SM) SILTY SAND; grey brown, contains		53.58 2.13	3	SS	20				0							
	Power Auger	Diam. (Hollow Ster	(SM) SILTY SAND; grey brown, contains fly ash and orange brick fragments, (FILL); non-cohesive, moist, loose to compact			4	SS	10				0							
3					52.05	5	SS	7											
4			(SM) SILTY SAND, some gravel, inferred presence of cobbles and/or boulders; brown, (GLACIAL TILL); non-cohesive, moist to wet, compact		3.66	6	SS	20				C							
5						7	SS	>50											
- 6			Borehole continued on RECORD OF DRILLHOLE 13-7		50.21														
7																			
8																			
9																			
· 10																			
DE	PTH	I SC	CALE					(	Gold	èr								LC	OGGED: HEC

LO	CATIC	T: 11-1121-0229 DN: See Site Plan TION: -90° AZIMUTH:	RECO	DRD OF DRILLHOLE: 13-7 DRILLING DATE: March 11, 2013 DRILL RIG: CME 75 DRILLING CONTRACTOR: Downing Drilling	SHEET 2 OF 2 DATUM: Geodetic
DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG SYMBOLIC LOG DEDLH (m) RUN No.	Image: Stress of the second	dditional refer to list ns & TH- G Q XX AVG.
		BEDROCK SURFACE	50.21		
- - - - - - -		Fresh thinly to medium bedded grey fine to coarse grained non-porous strong nodular LIMESTONE, with black shale partings and interlaminates - Broken core from 6.13 m to 6.18 m - Broken core from 6.34 m to 6.39 m	5.50	00	-
- - - - - 7 - -		- Broken core from 6.78 m to 6.84 m	2	8 .BD,PL,Ro .BD,PL,RO .BD,PL,RO .BD,PL,P	-
- - - - - - - - - -	Rotary Drill NQ Core			8 BD.PL_Ro 1:5 1 BD.PL_Ro 1:5 1 BD.PL_SM 1 1 BD.PL_Ro 1:5	UCS = 75.9 MPa
- - - - - - - - - - - - - - - - - - -				8 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9	
- - - - - - - - - - - 11 -		- Mud seam and vertical fracture from 10.98 m to 11.23 m	5 6 44.48 11.23	8 8 8 8 8 8 8 8 8 8 8 8 8 8	
- - - - - - - - - -		End of Drillhole			-
- - - - - - - - -					-
- - - - - - -					-
- 13 - 14 - 14 - 15 - 15 - 15 - 15 - 15 - 15 - 15 - 15					-
DE 1:		SCALE		Golder	LOGGED: HEC CHECKED: MJK

# **RECORD OF BOREHOLE: 13-8**

LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: March 5, 2013

SHEET 1 OF 2

DATUM: Geodetic

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

4	ē		SOIL PROFILE			SA	MPL		DYNAMIC PENETRA RESISTANCE, BLOV	TION /S/0.3m	k, cm	n/s	<u>ں</u> ب	PIEZOMETER
METRES	BORING METHOD			LOT		ĸ		30m	20 40	60 80	10 ⁻⁸	10 ⁻⁶ 10 ⁻⁴ 10 ⁻²	ADDITIONAL LAB. TESTING	OR
VET:	2 0 7		DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	BLOWS/0.30m	SHEAR STRENGTH	nat V. + Q - ●	WATER	CONTENT PERCENT	Ë E E	STANDPIPE INSTALLATION
-	<b>NORII</b>			TRA	DEPTH (m)	N		NO	Cu, kPa	rem V. 🕀 U - Ŏ		→ W wi	LAE	
_	ш	_	GROUND SURFACE	°,				Ē	20 40	60 80	20	40 60 80		MON. V
0					55.95 0.00									MON. V
			SP/GP) SAND and GRAVEL, crushed;	****	0.00 55.75 0.20 55.57									
		١à	rev (BASE): non-cohesive	₩	55.57 0.38									
		(S	SP/GP) SAND and GRAVEL; brown, FILL); non-cohesive		55.40									
		(	SM) SILTY SAND, some gravel,		55.19 0.76	1	SS	>50						
1		l in	nferred presence of cobbles and/or oulders; grey, contains asphalt											
		fr	ragments, (FILL); non-cohesive, moist, ompact											
			onpact											
						2	SS	18			0			
2		Stem												
	ger	Nolo												
	Power Auger	Ĕ												
	Powe	Diar				3	SS	11						
		200 mm Diam. (Hollow Stem)												
3		2			52.75	$\vdash$								
		((	CI) SILTY CLAY; grey brown; cohesive, noist, stiff to very stiff	Î	3.20	4	SS	7						
		^m	noisi, sun io very sun					·			Í			
					52.14									Pontonite Seel
4		(5	SM) SILTY SAND, some gravel to		3.81									Bentonite Seal
4		a	ravelly, inferred presence of cobbles ind/or boulders; grey, (GLACIAL TILL);			5	SS	32			0		мн	
			on-cohesive, moist, dense to very lense											
						6	SS	33						
5	+	В	Borehole continued on RECORD OF	prxx	51.01									
		D	DRILLHOLE 13-8											
6														
7														
8														
3														
9														
10														
											i			
DE	PTH	I SCA	ALE						Gold				LC	DGGED: HEC

		CT: 11-1121-0229		RE	CC	ORD	0								13-8								HEET 2 OF 2
		ION: See Site Plan ATION: -90° AZIMUTH:						DR	ILL F	NG D. RIG: NG C	CME	E 75			ing Drillir	g						D	ATUM: Geodetic
DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	H <u>COLOUR</u>	SHF VN CJ	COV	ear n njugat		FO- F CO- ( OR- ( CL - ( FF D. IN	Beddir Foliatio Contac Orthog Cleava RACT. NDEX PER	on ct gonal	CU- ( UN- I ST - S IR - I		K - S SM- S Ro - F MB- N ' DATA	Polished Slickens Smooth Rough Mechan	ided		NOTE: I abbrevia of abbre symbols	Broken For addit ations ref wiations s. VEATH- ERING INDEX	tional fer to list &	
	DRII	BEDROCK SURFACE	s	51.01		FLUSH	CORE 889		0RE %	•	0	.3 m 은원입	-986 -986	AXIS	DESCR	SURFACE	Jr Ja	Jn	222		W3 M3		MON. WEL
- 5 - - - - -		Fresh thinly to medium bedded grey fine to coarse grained non-porous strong to very strong nodular LIMESTONE, with black shale partings and interlaminates		4.94	1	0									,BD,C ,BD,C ,BD,P ,BD,P ,BD,P	U,Ro L,Ro L,SM	1 1 1.5 1 1.5 1 1 1						
- 6 - 6 					2	0									BD,P BD,P BD,P BD,C BD,C BD,C BD,C BD,C BD,C	_,Ro _,Ro _,Ro U,SM _,Ro _,Ro U,Ro	1.5 1 1.5 1 1.						Bentonite Seal ∑
- - - - - - - - - - - - - - - -	Rotary Drill NG Core	- Mud seam from 7.11 m to 7.12 m			3	0								•	,BD,P ,BD,P ,BD,P	L,Ro L,SM	1.5 1 1 1 1.5 1						Silica Sand
- - - - - - - - - - - - - - - - - - -					4	0								•	,BD,S ,BD,P ,BD,P ,BD,P ,BD,P ,BD,P ,BD,IF ,BD,IF	L,Ro L,SM L,Ro L,Ro L,Ro	3 1 1.5 1 1.5 1 1.5 1 1.5 1 1.5 1 3 1 3.5 1						32 mm Diam. PVC #10 Slot Screen
- - - - - - - - - - 11 -		End of Drillhole		<u>44.80</u> 11.15	5	0								•	,BD,P ,BD,P	_,Ro _,Ro	1.5 1 1.5 1						Bentonite Seal
- - - - - - - - - - - - - - -																							W.L. in Screen at Elev. 49.24 m on March 25, 2013
SS.GDT 06/07/13 PLG																							
MIS-RCK 004 1111210229-1000.GPJ GAL-MISS.GDT 06/07/13 PLG . T 20 . T																							
MIS-RCK 004 1 DI 1 :	EPTH	SCALE					Ć			Gol Sso	  de <u> oci</u> :	er ato	 25_										DGGED: HEC ECKED: MJK

# RECORD OF BOREHOLE: MW 13-01

LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: March 28, 2013

SHEET 1 OF 1

DATUM: Geodetic

цI	员	SOIL PROFILE		i	SA	AMPL		DYNAMIC PENETRA RESISTANCE, BLO	VS/0.3m	Ż	k, c	C CONDL cm/s			
DEPTH SCALE METRES	BORING METHOD		STRATA PLOT		Ř		BLOWS/0.30m	20 40		80	10 ⁻⁶	10 ⁻⁵	10-4	10 ⁻³ ENT WI	
ц Ч Ц Ц Ц	DNG I	DESCRIPTION	TA P	ELEV.	NUMBER	TYPE	/S/0.	SHEAR STRENGTH Cu, kPa	nat V. +	Q - ●	WATE		NT PERCE	INT	STANDPIPE
5	30RI		TRA'	DEPTH (m)	Ĩ	-	ΓO				vvp —	0			
	ш		s,			-	ā	20 40	<u>60</u> 8	30	20	40	60	80	
0	2	GROUND SURFACE Grey LIMESTONE BEDROCK	-	55.09 0.00		-							_	<u> </u>	
	200 mm Diam. (Hollow Stem)	Sidy LIVIED ONE BEDRUCK		0.00											
	ollow														
-	R E														
	Diar														
1	m														
·	20														
				1											
2															
				1											Bentonite Seal
				1											
3				1											
				1											
				1											
4	₩			1											
	Air Rotary Drill mm Diam. (DF			1											
	m Dia														
	Air Rotary Drill 100 mm Diam. (DHH)														ŀ
	-														Silica Sand
5															
6															
															51 mm Diam. PVC #10 Slot Screen
				1											
7															
															-
				1											
8				46.91											
ŀ		End of Drillhole		8.18		1									
9															
10															
			_	1	L	1									
	DTU C	CALE						Gold							LOGGED: RI

LOCATION: See Site Plan

# RECORD OF BOREHOLE: MW 13-02

BORING DATE: March 28, 2013

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

ł	П Р Г	SOIL PROFILE	1.		SA	AMPLI		DYNAMIC PENETRA RESISTANCE, BLO	TION /S/0.3m	Ì.	HYDRAU k	LIC CON cm/s	IDUCTIVI	TY,	ĘĘ	PIEZOMETER
METRES	BORING METHOD		STRATA PLOT		Ш		BLOWS/0.30m	20 40		80	10-6			10-3	ADDITIONAL LAB. TESTING	OR
Ψ	SING	DESCRIPTION	ATA I	ELEV. DEPTH	NUMBER	TYPE	WS/C	SHEAR STRENGTH Cu, kPa	nat V. + rem V. ∉	- Q - O			ITENT PE		AB. T	INSTALLATION
	BOF		STR/	(m)	Ĭ	$\left[ \right]$	BLO	20 40		80	Wp H 20					.
		GROUND SURFACE	1	55.12												
0	iem)	Grey LIMESTONE BEDROCK								1						
	/er Au ow Sti			1												
	Holt			1												
	Power Auger 200 mm Diam. (Hollow Stem)															
	E E															
1	200			1												
				]												Bentonite Seal
				1						1						
				1						1						
										1						
2				1						1						
				1						1						
										1						
3				1						1						Silica Sand
-										1						
				1						1						
	_ Ĥ									1						
4	Air Rotary Drill 100 mm Diam. (DHH)			1						1						
	n Dia			1						1						
	00 mr									1						
	[~]															
				1						1						
5																51 mm Diam. PVC #10 Slot Screen
				1						1						
				1						1						
				1						1						
6										1						
										1						
										1						Silica Sand
7				1						1						
·										1						
										1						Bentonite Seal
				47.0-						1						
		End of Drillhole		47.37 7.75		$\left  \right $				1						
8																
										1						
										1						
										1						
9																
										1						
										1						
10										1						
10																
DE	PTH S	CALE					(	Gold	er						L	OGGED: RI
	50						1									ECKED: KPH

# RECORD OF BOREHOLE: MW 13-03

LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: March 28, 2013

SHEET 1 OF 1

DATUM: Geodetic

	БŌН	SOIL PROFILE			SA	MPL		DYNAMIC PENET RESISTANCE, BL	OWS/0.3m	,	k https://www.	, cm/s	IDUCTIVI	ΙΥ,	ξĻ	PIEZOMETER
METRES	BORING METHOD		STRATA PLOT	L.	۲.		BLOWS/0.30m	20 40	60	80	10-6	10 ⁻⁵	10 ⁻⁴	10 ⁻³	ADDITIONAL LAB. TESTING	OR
MET	SNG	DESCRIPTION	TA F	ELEV. DEPTH	NUMBER	TYPE	VS/0.	SHEAR STRENGT Cu, kPa	"H nat V. rem V	+ Q-● ⊕ U- ∩	WAT		NTENT PE		DDIT B. TE	INSTALLATIO
2	BOR		зтка	(m)	l₿		3LOV				VVP F		-OW			.
		GROUND SURFACE	0		-			20 40	60	80	20	40	60	80		
0	ger m		- 11	53.67 0.00												
	Power Auger 200 mm Diam. (Hollow Stem)															
	Hollo															
	am.															
	E E															
1	2001															
																Bentonite Seal
2																Donito into Cour
3																
5			_ <u></u> <u> </u>	1												
	HH															
4	ary D iam. (															
	Air Rotary Drill 100 mm Diam. (DHH)															Silica Sand
	A 100 r		甘													
5																
6																51 mm Diam. PVC #10 Slot Screen
																#10 Slot Screen
																2
7			Ħ													
'																
		End of Drillhole		7.65												
8																
9																
10																
DE	PTHS	SCALE						Gol							L	OGGED: RI
-									der						-	

# RECORD OF BOREHOLE: MW 13-04

LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: March 27, 2013

SHEET 1 OF 1

DATUM: Geodetic

	日어	SOIL PROFILE	-1	ı —	S/	MPLE		DYNAMIC PENETRA RESISTANCE, BLO	TION VS/0.3m	Ì,	HYDRAUI k,	LIC CON	DUCTIVI	Γ <b>Υ</b> ,	βŕ	PIEZOMETER
METRES	BORING METHOD		STRATA PLOT		Ľ.		BLOWS/0.30m	20 40		80	10 ⁻⁶	10 ⁻⁵	10-4	10 ⁻³	ADDITIONAL LAB. TESTING	OR
E I	DN D	DESCRIPTION	TAP	ELEV.	NUMBER	TYPE	/S/0.	SHEAR STRENGTH Cu, kPa	nat V.	+ Q- •			TENT PE		EDI	STANDPIPE INSTALLATION
- L	30RI		TRA'	DEPTH (m)	Ī	-	ГO						⊖W		LAE	
			S	,			Ы	20 40	60	80	20	40	60	80		
0	510	GROUND SURFACE	<b>.</b>	54.62						_						
	Pdwer Auger (Hdllow Stem)	Grey LIMESTONE BEDROCK		0.00												
	llow ::			1												
	Pd 200 mm Diam. (Hd															
	Dian															
	E															
1	200															Bentonite Seal
				1												
				1												
2			<u></u>	1												
			μ.													
				1												Silica Sand
				1												
3				1												
				1												
			<u></u> <u> </u>	1												
			ЦЦ,	1												
	Î			1												
4	Air Rotary Drill 100 mm Diam. (DHH)			]												
	Jiam.															
	m Ro															
	100															51 mm Diam. PVC #10 Slot Screen
5																
																12.2
																1. S.
				1												27.7V
				1												( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )
6																
																Silica Sand
				1												
7				1												
				1												
																Bentonite Seal
8				46.49												
	-	End of Drillhole		8.13												
9																
10																
DE	PTH S	CALE					(	Gold	er						L	DGGED: RI
	50														CL	ECKED: KPH

LOCATION: See Site Plan

# RECORD OF BOREHOLE: MW 13-05

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: March 27, 2013

DATUM: Geodetic

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

4	Б Р	SOIL PROFILE			SA	MPL		DYNAMIC PENETRA RESISTANCE, BLOW	TION /S/0.3m	HYDRAU k	LIC CONDUCTIV , cm/s	ITY,	
METRES	BORING METHOD		STRATA PLOT		Ľ.		BLOWS/0.30m	20 40	60 80	10-6	10 ⁻⁵ 10 ⁻⁴	10 ⁻³	OR OR
WEI	- DNI	DESCRIPTION	TA P	ELEV. DEPTH	NUMBER	TYPE	VS/0.	SHEAR STRENGTH Cu, kPa	nat V. + Q -	WAT	ER CONTENT P		
1	BOR		TRA	(m)	₽		NO1			vvp F			LA LA
	-	GROUND SURFACE	S			-		20 40	60 80	20	40 60	80	
0	<u>ک</u> آو	GROUND SURFACE Grey LIMESTONE BEDROCK		53.25 0.00		-	$\vdash$			+			
	Power Auger (Hollow Stem)			1									
	Fowe												
	m U												
	Ē												Bentonite Seal
1	Power 200 mm Diam. (Hollow												
													Silica Sand
				1									
2				1									
				1									
				1									
				1									
3													
													51 mm Diam PVC
				1									51 mm Diam. PVC #10 Slot Screen
4	티			1									
Í	Jiam.			1									
	Air Rotary Drill 100 mm Diam. (DHH)												
	100												
5				1									0.00
				1									Silica Sand
6				1									
													Bentonite Seal
7													
				1									
8				45.12									
		End of Drillhole		8.13									
9													
10													
DEI	PTH S	CALE					(	Gold	(A)1*				LOGGED: RI
	50												

SHEET 1 OF 1

# RECORD OF BOREHOLE: MW 13-06

LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: March 27, 2013

SHEET 1 OF 1

DATUM: Geodetic

щ	탈	SOIL PROFILE		ı —	SA	MPL	-	DYNAMIC PENET RESISTANCE, BL	RATION OWS/0.3m	Ì,	HYDRAU k	LIC CON , cm/s	IDUCTIVIT	Ύ,	μĥ	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD		STRATA PLOT		н Ш		BLOWS/0.30m	20 40		80	10-6	10 ⁻⁵	10-4	10 ⁻³	ADDITIONAL LAB. TESTING	OR
E H	UN CI	DESCRIPTION	TAF	ELEV. DEPTH	NUMBER	TYPE	VS/0.	SHEAR STRENGT Cu, kPa	H nat V	+ Q- •	WAT		ITENT PE		B. TE	INSTALLATIO
5	BOR		TRA	(m)	₹		JLOV				vvp F		⊖ ^W		LAI	
	-	GROUND SURFACE	s			-		20 40	60	80	20	40	60	80	-	
0	jag	Grey LIMESTONE BEDROCK		52.13 0.00			$\left  \right $				+					
	Power Auger 200 mm Diam. (Hollow Stem)			1												
	Hollo															
	am.															Bentonite Seal
	D E															
1	200															
																Silica Sand
				1												
2																
				1												(ž
				1												
3			- FF	1												
																51 mm Diam. PVC #10 Slot Screen
	_ <u>[</u> ]			1												
4	Air Rotary Drill 100 mm Diam. (DHH)			1												
	- Rota m Dia															
	00 m															
	[															
_				1												
5																Silica Sand
				1												
6																
																Pontonita Card
				1												Bentonite Seal
7																
				1												
				44.08												
8		End of Drillhole		8.05												
9																
10																
					I	<u> </u>					L		1	1		
		CALE						Gol	der <u>ciates</u>							OGGED: RI
1:	50							V Asso	ciates						CH	ECKED: KPH

# RECORD OF BOREHOLE: MW 13-08

LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: March 28, 2013

SHEET 1 OF 1

DATUM: Geodetic

Ц			SOIL PROFILE			s/	AMPL		DYNAMIC PENETRA RESISTANCE, BLOV		HYDRAULIC CONDUCTIVITY, k, cm/s	ų ų	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD			STRATA PLOT		ц.		BLOWS/0.30m	20 40	60 80 `	10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³	ADDITIONAL LAB. TESTING	OR
탈	ŰZ		DESCRIPTION	TA Ρ	ELEV.	NUMBER	TYPE	/S/0.	SHEAR STRENGTH Cu, kPa	nat V. + Q -	WATER CONTENT PERCENT		STANDPIPE INSTALLATION
	DRI			IRA.	DEPTH (m)	Ĩ	1	NO			wp	LAE	
				ST	,		-	BL	20 40	60 80	20 40 60 80		
0	L.		GROUND SURFACE		51.82								
	Power Auger	Sterr.	Brown fine to medium sand (Placed FILL)		0.00								
	er Au	No.	Grey LIMESTONE BEDROCK	<u> </u>	51.52 0.30								
	Powe	E.	,										
		Пä											
		E											
1		200											
2				μ.	1								Bentonite Seal
				Ц. Т.									Dentonite Otal
					1								
3					1								
				<u></u> <u> </u>	1								
				р <del>і</del> ті Піті	1								
				Ц. Т.									
4		Ĥ											
	Air Rotary Drill	100 mm Diam. (DHH)		Ħ	1								
	Rotar	n Dia		<u></u> <u></u> <u>−</u> <u>−</u> <u>−</u> <u>−</u> <u>−</u> <u>−</u> <u>−</u> <u>−</u> <u>−</u>	1								
	Αï	20 m		ŢŢ.									Silica Sand
		¥											
5													
													200 C
													100
													100
6													
													51 mm Diam PVC
												\$	51 mm Diam. PVC #10 Slot Screen
													2.X
7				<u></u> <u>−</u> <u>−</u> <u>−</u> <u>−</u>	1								1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1
				<u> </u>	1								
8	Ш	Ц	End of Drillhole		43.77 8.05		-						la la
					0.05								
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10													
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		нS	CALE					(	Gold	er			GGED: RI
1:									Gold	er iates			CKED: KPH

# RECORD OF BOREHOLE: MW 13-10

LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: August 15, 2013

SHEET 1 OF 1

DATUM: Geodetic

ш	员	SOIL PROFILE	-1		SA	MPL		DYNAMIC PENETRA RESISTANCE, BLO	VS/0.3m	ì	k,	cm/s	UCTIVIT	Y,	ξĻ	PIEZOMETE	R
DEPTH SCALE METRES	BORING METHOD		STRATA PLOT		Ľ.		30m	20 40		80	10 ⁻⁶	10 ⁻⁵	10-4	10 ⁻³	ADDITIONAL LAB. TESTING	OR	
E H H H H H H	DNG	DESCRIPTION	TA P	ELEV. DEPTH		TYPE	BLOWS/0.30m	SHEAR STRENGTH Cu, kPa	nat V	+ Q- •	WATE				DDIT B. TE	STANDPIPE INSTALLATIO	_ ∩N
Ľ	BOR		<b>TRA</b>	(m)	∣₽		3LOV				vvp –		⊖ ^W		LAAL		
		GROUND SURFACE	S			-	ш	20 40	60	80	20	40	60	80	-		⊢
0	ja je	Grey LIMESTONE BEDROCK	++++	52.86 0.00		-								_	_	0	
	Power Auger 200 mm Diam. (Hollow Stem)															Concrete	Ľ
	Powe																
	- t																
	n Di																
1	ш 00																
	Ñ																
2																	
			μ.	1												Bentonite Seal	
				1													
3				1													
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	Ę																
4	Air Rotary Drill 100 mm Diam. (DHH)																
	Air Rotary Drill mm Diam. (Dł		<u></u>	1													
	0 mm		<u></u> <u> </u>														
	6																
																Silica Sand	1.2
5																	1.1
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6																	
																54 mm Diam DVO	
																51 mm Diam. PVC #10 Slot Screen	
7																	1.2
																	1.200
																	100.20
8	$\square$				<u> </u>												É
		End of Drillhole		8.13													
9																	
10																	
DE	PTH S	CALE						Gold	0. <b>*</b>						L	DGGED: RI	
								L <b>-77</b> =∦ GOL(	(*ľ						СН		

# RECORD OF BOREHOLE: MW 13-11

LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: August 14, 2013

SHEET 1 OF 1

DATUM: Geodetic

Ц	ПОН	SOIL PROFILE		1	SA	MPL	_	DYNAMIC PENETRA RESISTANCE, BLO	TION VS/0.3m	HYDRAULIC k, cm	CONDUCTIVITY, /s	μĘ	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD		STRATA PLOT		н		BLOWS/0.30m	20 40	60 80		10 ⁻⁵ 10 ⁻⁴ 10 ⁻³	ADDITIONAL LAB. TESTING	OR
ΞЩ	SNIS	DESCRIPTION	VTA F	ELEV. DEPTH	NUMBER	TYPE	NS/0	SHEAR STRENGTH Cu, kPa	nat V. + Q - ● rem V. ⊕ U - C	WATER	CONTENT PERCENT	DDIT B. TE	INSTALLATION
ž	BOF		STR₽	(m)	۲		BLOV	20 40	60 80	vvp	→ ^W WI 40 60 80		
		GROUND SURFACE		53.39			-	20 40		20	40 60 80		
0	em)	Grey LIMESTONE BEDROCK	+								+ + +		Concrete
	Mer Au ow Ste			1									Concrete
	Power Auger 200 mm Diam. (Hollow Stem)												
	liam.												
	mm [												
1	200												
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2			<u> </u>										
2			<u></u> <u> </u>										Bentonite Seal
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3													
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	III (HH												L.
4	Air Rotary Drill 100 mm Diam. (DHH)		Ŧ										
	Rota m Dia												
	00 m												Silica Sand
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Ļ													
5													
6				1									
				1									51 mm Diam. PVC
			臣	1									#10 Slot Screen
			<u> </u>										
7													
			臣	1									
				45.36									
8		End of Drillhole		8.03									
9													
10													
DE	PTH S	CALE					(	Gold	er				OGGED: RI
1:	50							Assoc	iates			CH	ECKED: KPH

LOCATION: See Site Plan

# RECORD OF BOREHOLE: MW 13-12

BORING DATE: August 14, 2013

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

ш	ПОН	SOIL PROFILE	1.		SA	MPL		DYNAMIC PENETRA RESISTANCE, BLOV		HYDRAULIC CONDUCTIVITY, k, cm/s	ا وبر	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD		STRATA PLOT	ELEV.	ER		BLOWS/0.30m	20 40	60 80		ADDITIONAL LAB. TESTING	OR
μW	RING	DESCRIPTION	ATA	DEPTH	NUMBER	TYPE	WS/C	SHEAR STRENGTH Cu, kPa	nat V. + Q - ● rem V. ⊕ U - ○	WATER CONTENT PERCENT	ADDI AB. T	INSTALLATION
	BO		STR	(m)	Ż		BLO	20 40	60 80	Wp <b>→ → W</b> WI 20 40 60 80	<u> </u>	
0		GROUND SURFACE		53.64								
0	Power Auger 200 mm Diam. (Hollow Stem)	Grey LIMESTONE BEDROCK		0.00								
	ollow											Concrete
	비분											
	Dian											
1	L L L L L L L L L L L L L L L L L L L											
	20											
2			- <del></del>									
												entonite Seal
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	III H											
4	m Dr.			1								
	m Dia		臣									
	Air Rotary Drill 100 mm Diam. (DHH)			1								
	-		臣	1							s	ilica Sand
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6				1								
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											5	1 mm Diam. PVC 10 Slot Screen
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												10 M
7			μ.	1								5.XV
			Ŧ									1997 ( 1997 ( 1997 (
				AE 74								
8		End of Drillhole		45.74 7.90								21
9												
10												
		SCALE						Gold	er			GGED: RI
1:	50							V Assoc	iates		CHE	CKED: KPH

# RECORD OF BOREHOLE: MW 13-13

LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: August 14, 2013

SHEET 1 OF 1

DATUM: Geodetic

	G	3	SOIL PROFILE			SA	MPL	ES	DYNAMIC PER RESISTANCE		TON S/0.3m	)	HYDR	AULIC C	ONDUCT	FIVITY,		0		
METRES	Ē	BURING MEI HUU		-OT		r		30m		40		80			, 0 ⁻⁵ 1		0 ⁻³	ADDITIONAL LAB. TESTING	PIEZOMETE OR	
1ETR	0	≥ פ	DESCRIPTION	A PL	ELEV.	NUMBER	TYPE	S/0.3	SHEAR STRE		nat V. +	- Q - ●	W		I ONTENT			DITIC	STANDPIPE INSTALLATIO	
2				STRATA PLOT	DEPTH (m)	Ŋ	F	BLOWS/0.30m	Cu, kPa		rem V. €	• U- O	W		—0 ^W		WI	LAB		
	-	-	GROUND SURFACE	ν				m	20	40	60	80	2	20 4	40 <del>(</del>	50 E	30			+ + +
0			Brown fine to medium sand (FILL)		53.37 0.00						-									÷. •.
					X														Concrete	33
					Š.														Bentonite Seal	
		(m)			X														Silica Sand	ð 8
	Ŀ	ow S			Š.															
	r Aug	I. (Hol			×.															
	Powe	Diam			Š.															XHX 14
		200 mm Diam. (Hollow Stem)			X														51 mm Diam. PVC #10 Slot Screen	
		5			Š.															
					X															
					51.03															2-3
			End of Borehole		2.34															
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Ξ	PT	нs	CALE						<b>A</b> G	-1-1-								L	OGGED: RI	
1:										oldê SOCi	:r ates								IECKED: KPH	

PROJECT:	12-1122-0198/8000/8100

LOCATION: See Site Plan

# RECORD OF BOREHOLE: MW 13-14

BORING DATE: August 14, 2013

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

	-		I						Daure -		TION		10.000			TD (175 /		<del></del>		
щ		BORING METHOD	SOIL PROFILE			SA	MPL		DYNAMIC F RESISTANC	'ENETRA CE, BLOV	VS/0.3m	,	HYDR/	AULIC C k, cm/	CONDUC s	i ivity,		ں وبر	PIEZOMETE	-R
DEPTH SCALE METRES	ì	ΛET		-OT		۲		BLOWS/0.30m	20	40	60	80	1	0-6	10 ⁻⁵ 1	0-4	10 ⁻³	ADDITIONAL LAB. TESTING	OR	
HTH ST		Q N	DESCRIPTION	A PI	ELEV.	1BEI	TYPE	S/0.3	SHEAR STE Cu, kPa	RENGTH	nat V.	+ Q- 🖲	W	ATER C	ONTEN	T PERCE	INT	- EP	STANDPIPE INSTALLATIO	E ON
DEP	2	ORIN		STRATA PLOT	DEPTH (m)	NUMBER	F	Ň	Cu, kPa		rem V. (	⊕ U-O	W	p	W		WI	LAB	into intellating	511
		á		ST	(,,,,)			В	20	40	60	80					80	+	ļ!	++++
	0		GROUND SURFACE		53.68															
E			Brown fine to medium sand (FILL)		0.00														Concrete	
E																				
-																			Bentonite Seal	
F		Ê																	Silica Sand	
F		200 mm Diam. (Hollow Stem)																	Child Calla	<u>8</u> –8
F	1 2	Power Auger Diam. (Hollov																		团团
F	101	an. (																		
È.	å	Ω Ξ Ξ																		
E		00																	51 mm Diam. PVC #10 Slot Screen	
E		Ñ																		(spin)
F	2																			と日本
F																				
-					51.24															Z Z
-			End of Borehole		2.44															
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<u>ا ا</u>		-								33UC	Lates	•								

LOCATION: See Site Plan

# RECORD OF BOREHOLE: MW 13-15

BORING DATE: August 14, 2013

SHEET 1 OF 1

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

9	Ę	SOIL PROFILE			SA	MPL		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	Ì	HYDRAULIC CONDUCTIVITY, k, cm/s	μŪ	PIEZOMETER
METRES	BORING METHOD		STRATA PLOT		Ř		BLOWS/0.30m	20 40 60	80	10 ⁻⁶ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻³	ADDITIONAL LAB. TESTING	OR
MET	DNG	DESCRIPTION	TAP	ELEV. DEPTH	NUMBER	TYPE	VS/0.	SHEAR STRENGTH nat V Cu, kPa rem V. 6	+ Q- ●	WATER CONTENT PERCENT	B. TE	STANDPIPE INSTALLATION
L L	BOR		TRA	(m)	R		ROV			wp wi	LAI	
		GROUND SURFACE	00	E4 00		$\left  \right $		20 40 60	80	20 40 60 80		
0	nger ≊n)	Grey LIMESTONE BEDROCK		54.03 0.00		$\vdash$	+					
	er Au w Ste	-										
	Pow (Holld											
	ä											
	Power Auger 200 mm Diam. (Hollow Stem)											
1	200											
			TT.									
2												Bentonite Seal
3			ļ.									
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	Ę											
4	v Drill		H									
	Air Rotary Drill mm Diam. (DF		₽₽ ₽₽									2
	Air Rotary Drill 100 mm Diam. (DHH)											
	Ĕ		<u></u> <u> </u>									Silica Sand
			Ħ									
5												27.5 N
			<u></u> <u> </u> <u> </u>									
6												280 280
J			Ħ									
												51 mm Diam. PVC 2
												#10 Slot Screen
7			<u> </u>									1. N.
			Ħ									
8		End of Drillhole		46.02 8.01		$\left  \right $						4
_												
9												
10												
.5												
DE	PTH S	CALE						Golder			L	DGGED: RI
1:												ECKED: KPH

PROJECT: 13-1125-0103

# RECORD OF BOREHOLE: 13-4

BORING DATE December 12, 2013

SHEET 1 OF 1 DATUM: Geodetic

LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

	цонт	SOIL PROFILE		1	SA	AMPL	-	DYNAMIC I RESISTAN					;m/s			ING	PIEZOMETER
METRES	BORING METHOD	0500	STRATA PLOT	ELEV,	BER	щ	BLOWS/0.30m	20 SHEAR ST	40 RENGTH	00 nat V	80 + 0 - 0			10" ENT PE	and a second	ADDITIONAL LAB. TESTING	OR STANDPIPE
	ORIN	DESCRIPTION	RATE	DEPTH (m)		TYPE	SMO	SHEAR ST Cu, kPa	RENOTIT	rem V	⊕ มี- ั			⊖W		ADD	INSTALLATIO
1	00	GROUND SURFACE	ST	-		-	В	20	40	60	80	20	40	80	80		
0				57.19 0,00						1							
1	em)																Bentonite Seal
	Power Auger 200 mm Diam. (Hollow Stern)																Silica Sand
2	200				р- 												50 mm Diam, PVC #10 Skt Sureen
3		End of Borehole Note:		54 14 3 05													
4		Elevation of top of pipe: 58.13 masl															
5																	
0																	
7																	
8																	
													1				
9										4							
10																	
DEP 1 : 5		CALE					1	Ø.	Gold	er							OGGED: JD IECKED: <u>Arth</u>

# Ά

patersongr	0	10	Con	sultin	g	SOIL	- PRO	FILE /	ANI	D TE	ST	DAT	Ą
154 Colonnade Road South, Ottawa, Or				ineers	Pr	upplemen op. Comi tawa, Or	nercial D					rt Stree	ət
DATUM Ground surface elevation	s prov	ided b	y Sta	intec (	-				1	FILE NO		G327	2
REMARKS									-	HOLEN		G327	2
BORINGS BY CME-55 Low Clearance	Drill			C	ATE	March 18	, 2016				B	H23-1	6
SOIL DESCRIPTION	PLOT		SAN	IPLE	_	DEPTH	ELEV.	Pen.		sist. E mm D			
	STRATA I	TYPE	NUMBER	* RECOVERY	N VALUE or RQD	(m)	(m)	0	Wa	iter Co	ontent	t %	-
GROUND SURFACE	ST	F	Du	REC	N			20	J	40	60	80	
FILL: Crushed stone with silty sand 0.6		8 AU	1			0-	-61.67						
FILL: Black topsoil with organic matter, sand and gravel 1.3		ss	2	50	6	1-	-60.67						01140
		ss	3	54	4	2	-59.67	$(\frac{1}{2},1$	4-4-6 6-4-5			4	21
		-             	4	17	4								
		ss	5	25	4	3-	-58.67					11-1-1-1-1-	
		4	-		·	4-	-57.67		111				
FILL: Brown silty sand, some clay and gravel		∦ ss	6	33	5		07.07	44.5					1.1.1
		∬ss	7	71	15	5-	56.67					1910-035 (1-1-1-15	48 49 49
		ss	8	42	24		EE 07		5-2-6				
		ss	9	58	32	0	-55.67					100	and light and
6.8	^b	ss	10	58	22	7-	-54.67			ut opinie of utility	iologia Chaina	tha ship a contra	10.00
		X ss	11	50	10		50.07					112	
FILL: Black rail bed material, some coal						8-	-53.67	1211-2-1					
		X ss	12	42	26	9-	-52.67	-3-5-5-1	1.1.1.1	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.		(1-1-12) (2) (1-1-12) (2)	-24
9.6	° 💥	∦ ss	13	75	16								111
FILL: Brown silty sand with gravel,		ss	14	86	86	10	-51.67						110
some coal and rail bed material 11.2	3	∏ ss	15	71	24	11-	-50.67		4 - 11 - (- ) - (-	1000			4
		x ss	16	75	11								100
						12	49.67		4.4				1
GLACIAL TILL: Compact to very dense, grey silty sand with gravel,		∦ ss	17	83	61	13-	48.67		141	1.1.1.1			-
cobbles and boulders		∦ ss	18	77	93		40.07						11.
14.3	3	ss	19	95	72	14	47.67	1918-914 1919-044	Sec.				1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-
End of Borehole									-			10076	
									1000	100		1000	in the second

20 40 60 80 Shear Strength (kPa) ▲ Undisturbed △ Remoulded

Supported for Andread State St

100

# **RECORD OF BOREHOLE: 18-01**

SHEET 1 OF 2 DATUM: CGVD28

LOCATION: N 5030415 3 ;E 365618 8

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: July 21-22, 2018

1	ş	SOIL PROFILE	-		SA	MPL		IEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM] ⊕ HYDRAULIC CONDUC k, cm/s	ی ا	
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV DEPTH (m)	NUMBER	түре	MS/0 30m	ID = Not Detected     20     40     60     80     10 ⁵ 10 ⁵ IEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS     WATER CONTEN       ‰LEL] ND = Not Detected     Wp ⊢W		STANDPIPE INSTALLATIO
0		GROUND SURFACE FILLTOPSOIL - SILTY SAND, trace gravel; brown; non-cohesive, moist, FILL - (SM) SILTY SAND, some gravel to gravelly; brown, contains brick, asphalt and organic matter (rootlets); non-cohesive, moist, compact (15% debris)		65.39 0 00 0 15	1	SS	20( <del>G</del> /	D		
2		FILL - (CI/CL) SILTY CLAY, trace sand, trace gravel; grey to grey brown, contains asphalt; cohesive, w>PL, firm to stiff (5% debris)		<u>63 87</u> 1 52	2	\$5	6⊕,	מ		
3					3	SS	3 +9 /	ס		
5	Power Auger 200 mm Diam (Hollow Stem)	FILL - (SP/GP) SAND and GRAVEL, some silt to silty; dark brown, contains asphalt, cobbles and boulders; non-cohesive, moist (20% debris) FILL - SILTY SAND and GRAVEL; brown to black, contains asphalt, cobbles and boulders; non-cohesive,		60.82 4 57 60.06 5.33	4	SS	>509 /	D		
6		moist (20% debris) FILL - (SC/ML) CLAYEY SILTY SAND to sandy CLAYEY SILT, some gravel; grey, contains cobbles and wood; non-cohesive, w~PL, compact (5% debris)		59 29 6 10	5	ss	17 🕀	סו		
8		FILL - (CI/CL) SILTY CLAY, trace to some sand; grey, contains wood; cohesive, w>PL, stiff (5% debris) FILL - (SM) SILTY SAND, trace to some gravel; grey to black, contains brick, asphalt, wood and glass; non-cohesive, wet, compact (30-60% debris)		57 77 7 62 57 31 8 08	δ	SS	6 🕀			
9		CONTINUED NEXT PAGE			7	SS	23 Ø			
-		CALE	-	-	-	1224		GOLDER		-

# **RECORD OF BOREHOLE: 18-01**

SHEET 2 OF 2 DATUM: CGVD28

LOCATION: N 5030415 3 ;E 365618 8

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: July 21-22, 2018

	Q	SOIL PROFILE		Ξ.	SA	MPL	_	HEADSPACE ORGANIC VAPOUR CONCENTRATIONS (PPM) ⊕ ND = Not Delected 20 40 60 80	HYDRAULIC CONDUCTIVITY, k, cm/s	로 PIEZOMETER
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV DEPTH (m)	NUMBER	TYPE	BLOWS/0 30m	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [%LEL] ND = Not Detected	10 ⁻⁵ 10 ⁻⁵ 10 ⁻⁴ 10 ⁻² WATER CONTENT PERCENT Wp	PIEZOMETER OR STANDPIPE INSTALLATION
	ш	- CONTINUED FROM PREVIOUS PAGE -	N.	5	-		8	20 40 60 80	20 40 60 80	
10		FILL - (SM) SILTY SAND, trace to some gravel; grey to black, contains brick, asphalt, wood and glass; non-cohesive, wet, compact (30-60% debris) (0-5% debris) FILL - (SM) SILTY SAND, medium to coarse, trace gravel; black, contains asphalt and wood; non-cohesive, wet, compact (20% debris)		54.49 10.90	8	SS	>50	Ð		
12	w Stern)				ğ	55	225			
14	Power Auger 200 mm Diam (Hollow Stem)				10	55	230	a ND		
15		FILL - (CI) SILTY CLAY trace sand; grey, contains wood; cohesive, w>PL (No debris)		<u>50.15</u> 15.24	11	SS	v502	ND		
17		(SM/GM) gravelly SILTY SAND: grey, contains cobbles and boulders (GLACIAL TILL); non-cohesive, wet End of Borehole		49.63 16.76 48.17 17.22	12	SS	>508	D		
18										
19										
20										
DEF	PTH S	CALE	-			6		GOLDER		LOGGED: SS

# **RECORD OF BOREHOLE: 18-02**

SHEET 1 OF 2 DATUM: CGVD28

LOCATION: N 5030424 4 ;E 365719 8

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: June 11, 2018

DESCRIPTION GROUND SURFACE FILL/TOPSOIL - (ML) sandy SILT, trace gravel; brown; moist FILL - (SM) SILTY SAND, some gravel; brown, contains brick; non-cohesive, moist, compact (No debris) FILL - (CL) SILTY CLAY, some sand, some gravel; grey, contains brick; cohesive, w-PL (5% debris) FILL - (GP) sandy GRAVEL; brown, contains asphalt and brick; non-cohesive, moist, compact (5% debris) FILL - (CL/ML) SILTY CLAY to sandy CLAYEY SILT; brown, contains brick and wood; cohesive, w>PL, stiff to very stiff (10-20% debris)	< L	ELEV DEPTH (m) 63 47 0 00 63 17 0 30 62 25 1 22 1 65 61 34 2 13	1 I NUMBER	SS SS TYPE	LIDE 0/SMOTB 22 C 16 C 17 C	ND 9 ND		METER DPIPE LATION
GROUND SURFACE FILL/TOPSOIL - (ML) sandy SILT, trace gravel; brown; moist FILL - (SM) SILTY SAND, some gravel; brown, contains brick; non-cohesive, moist, compact (No debris) FILL - (CL) SILTY CLAY, some sand, some gravel; grey, contains brick; cohesive, w-PL (5% debris) FILL - (GP) sandy GRAVEL; brown, contains asphalt and brick; non-cohesive, moist, compact (5% debris) FILL - (CL/ML) SILTY CLAY to sandy CLAYEY SILT; brown, contains brick and wood; cohesive, w-PL, stiff to very stiff		63 47 0 00 63 17 0 30 62 25 1 22 61.82 1 65 61.34	1	55	22 (	20 40 60 80 20 40 60 80		
FILL/TOPSOIL - (ML) sandy SILT, trace gravel; brown; moist         FILL - (SM) SILTY SAND, some gravel; brown, contains brick; non-cohesive, moist, compact (No debris)         FILL - (CL) SILTY CLAY, some sand, some gravel; grey, contains brick; cohesive, w-PL (5% debris)         FILL - (GP) sandy GRAVEL; brown, contains asphalt and brick; non-cohesive, moist, compact (5% debris)         FILL - (CL/ML) SILTY CLAY to sandy         CLAYEY SILT; brown, contains brick and wood; cohesive, w-PL, stiff to very stiff		0 00 63 17 0 30 62 25 1 22 61.82 1 65 61.34	2	55	16@	ND ND		
gravel; brown; moist FILL - (SM) SILTY SAND, some gravel; brown, contains brick; non-cohesive, moist, compact (No debris) FILL - (CL) SILTY CLAY, some sand, some gravel; grey, contains brick; cohesive, w-PL (5% debris) FILL - (GP) sandy GRAVEL; brown, contains asphalt and brick; non-cohesive, moist, compact (5% debris) FILL - (CL/ML) SILTY CLAY to sandy CLAYEY SILT; brown, contains brick and wood; cohesive, w-PL, stiff to very stiff		63 17 0 30 62 25 1 22 61.82 1 65 61.34	2	55	16@	ND ND		
brown, contains brick; non-cohesive, moist, compact (No debns) FILL - (CL) SILTY CLAY, some sand, some gravel; grey, contains brick; cohesive, w-PL (5% debris) FILL - (GP) sandy GRAVEL; brown, contains asphalt and brick; non-cohesive, moist, compact (5% debris) FILL - (CL/ML) SILTY CLAY to sandy CLAYEY SILT; brown, contains brick and wood; cohesive, w-PL, stiff to very stiff		62 25 1 22 61.82 1 65 61.34	2	55	16 🤤	ND ND		
some gravel; grey, contains brick; cohesive, w~PL (5% debris) FILL - (GP) sandy GRAVEL; brown, contains asphalt and brick; non-cohesive, moist, compact (5% debris) FILL - (CL/ML) SILTY CLAY to sandy CLAYEY SILT; brown, contains brick and wood; cohesive, w>PL, stiff to very stiff		1.22 61.82 1.65 61.34	-	SS	17€	s		
cohesive, w~PL (5% debris) FILL - (GP) sandy GRAVEL; brown, contains asphalt and brick; non-cohesive, moist, compact (5% debris) FILL - (CL/ML) SILTY CLAY to sandy CLAYEY SILT; brown, contains brick and wood; cohesive, w>PL, stiff to very stiff		1.65	-	SS	17€	ND		
contains asphalt and brick; non-cohesive, moist, compact (5% debris) FILL - (CL/ML) SILTY CLAY to sandy CLAYEY SILT; brown, contains brick and wood; cohesive, w>PL, stiff to very stiff			-	33		ND		
CLAYEY SILT; brown, contains brick and wood; cohesive, w>PL, stiff to very stiff			4					
				<b>S</b> 5	24 🤅	) ND		
	883		5	SS	24 🤆	ND		
EX. 10								
			6	ss	86	ND		
FILL - (SM) GRAVEL and SILTY SAND; brown, contains brick; non-cohesive (5% debris)		58.90 4.57	7	SS	>506	9 ND		
	8	58.14	_					
FILL - (CL) SILTY CLAY and GRAVEL, some sand, brown, contains brick; cohesive, moist, compact (5% debris)		5 33	8	SS	13€	D ND		
FILL - (SM) SILTY SAND, some gravel; grey brown, contains brick, wood and asphalt; non-cohesive, moist, compact (15% debris)		57 37 6 10	9	SS	196	ND		
FILL - (CL) sandy SILTY CLAY, grey brown, contains brick and wood; cohesive, w>PL (5% debris)		56.61 6.88	10	55	32	9		
FILL - (SM) SILTY SAND, some gravel; grey, contains brick, asphalt, wood and plastic (garbage); non-cohesive, moist, dense to compact (15-20% debris)		55 85 7 82	11	ss	450	€ •		
		_	12	55	12 0			
FILL - (SM) SILTY SAND, trace to some gravel; brown, contains brick, asphalt, wood and mortar; non-cohesive, moist to wet, compact (50% debris)		54.33 9.14	13	55	12	a ND		
CONTINUED NEXT PAGE	×		_14	55	<u>19</u>	+		
	brown, contains brick; non-cohesive (5% debris) FILL - (CL) SILTY CLAY and GRAVEL, some sand, brown, contains brick; cohesive, moist, compact (5% debris) FILL - (SM) SILTY SAND, some gravel; grey brown, contains brick, wood and asphalt; non-cohesive, moist, compact (15% debris) FILL - (CL) sandy SILTY CLAY; grey brown, contains brick and wood; cohesive, w?PL (5% debris) FILL - (SM) SILTY SAND, some gravel; grey, contains brick, asphalt, wood and plastic (garbage); non-cohesive, moist, dense to compact (15-20% debris) FILL - (SM) SILTY SAND, trace to some gravel; brown, contains brick, asphalt, wood and mortar; non-cohesive, moist to wet, compact (50% debris)	brown, contains brick; non-cohesive (5% debris) FILL - (CL) SILTY CLAY and GRAVEL, some sand, brown, contains brick; cohesive, moist, compact (5% debris) FILL - (SM) SILTY SAND, some gravel; grey brown, contains brick, wood and asphalt; non-cohesive, moist, compact (15% debris) FILL - (CL) sandy SILTY CLAY; grey brown, contains brick and wood; cohesive, w>PL (5% debris) FILL - (SM) SILTY SAND, some gravel; grey, contains brick, asphalt, wood and plastic (grabage); non-cohesive, moist, dense to compact (15-20% debris) FILL - (SM) SILTY SAND, trace to some gravel; brown, contains brick, asphall, wood and mortar; non-cohesive, moist to wet, compact (50% debris)	FILL - (SM) GRAVEL and SILTY SAND;       4 57         brown, contains brick; non-cohesive       58 14         FILL - (CL) SILTY CLAY and GRAVEL,       53         some sand brown, contains brick;       53         cohesive, moist, compact       57 37         FILL - (SM) SILTY SAND, some gravel;       9 10         grey brown, contains brick, wood and       asphalt; non-cohesive, moist, compact         (15% debris)       56 ā1         FILL - (CL) sandy SILTY CLAY; grey       6 86         prown, contains brick, and wood;       56 ā1         (5% debris)       56 ā1         FILL - (CL) sandy SILTY CLAY; grey       6 86         prown, contains brick, asphalt, wood and       88         cohesive, w>PL       55 85         FILL - (SM) SILTY SAND, some gravel;       782         grey, contains brick, asphalt, wood and       914         plastic (garbage); non-cohesive, moist,       914         (15-20% debris)       54.33         FILL - (SM) SILTY SAND, trace to some       914         wood and mortar; non-cohesive, moist to       914	FILL - (SM) GRAVEL and SILTY SAND; brown, contains brick; non-cohesive (5% debris)       4 57       7         FILL - (CL) SILTY CLAY and GRAVEL, some sand, brown, contains brick; cohesive, moist, compact (5% debris)       533       8         FILL - (CL) SILTY CLAY and GRAVEL, some sand, brown, contains brick; cohesive, moist, compact (15% debris)       57 37       9         FILL - (SM) SILTY SAND, some gravel; grey brown, contains brick, wood and asphalt; non-cohesive, moist, compact (15% debris)       9       9         FILL - (CL) sandy SILTY CLAY; grey brown, contains brick, and wood; cohesive, w>PL (5% debris)       9       10         FILL - (SM) SILTY SAND, some gravel; grey, contains brick, asphall, wood and plastic (grabage); non-cohesive, moist, dense to compact (15-20% debris)       762         FILL - (SM) SILTY SAND, trace to some gravel; brown, contains brick, asphall, wood and mortar; non-cohesive, moist to wet, compact (50% debris)       9         FILL - (SM) SILTY SAND, trace to some gravel; brown, contains brick, asphall, wood and mortar; non-cohesive, moist to wet, compact (50% debris)       9         13       13         CONTINUED NEXT PAGE       13	FILL - (SM) GRAVEL and SILTY SAND; brown, contains brick; non-cohesive (5% debris)       4 57 7       7       SS         FILL - (CL) SILTY CLAY and GRAVEL, some sand, brown, contains brick; cohesive, moist, compact (5% debris)       533 8       8       SS         FILL - (CL) SILTY CLAY and GRAVEL, some sand, brown, contains brick; cohesive, moist, compact (5% debris)       57 37       9         FILL - (SM) SILTY SAND, some gravel; grey brown, contains brick, wood and asphalt; non-cohesive, moist, compact (15% debris)       9       SS         FILL - (CL) sandy SILTY CLAY; grey brown, contains brick, and wood; cohesive, w>PL (5% debris)       56 81 10       9         FILL - (SM) SILTY SAND, some gravel; grey, contains brick, asphall, wood and plastic (garbage); non-cohesive, moist, dense to compact (15-20% debris)       11       SS         FILL - (SM) SILTY SAND, trace to some gravel; brown, contains brick, asphall, wood and mortar; non-cohesive, moist to wet, compact (50% debris)       9       54.33         I2       55         G50% debris)       11       SS         FILL - (SM) SILTY SAND, trace to some gravel; brown, contains brick, asphalt, wood and mortar; non-cohesive, moist to wet, compact (50% debris)       9       54.33         I3       SS         CONTINUED NEXT PAGE       14       55	FILL - (SM) GRAVEL and SILTY SAND; brown, contains brick; non-cohesive (5% debris)       4 57       7       55       >50         FILL - (CL) SILTY CLAY and GRAVEL, some sand, brown, contains brick; cohesive, moist, compact (5% debris)       533       8       55       136         FILL - (SM) SILTY SAND, some gravel; grey brown, contains brick, wood and asphalt; non-cohesive, moist, compact (15% debris)       9       55       196         FILL - (CL) sandy SILTY CLAY; grey brown, contains brick, and wood; cohesive, w>PL (5% debris)       9       55       326         FILL - (SM) SILTY SAND, some gravel; grey, contains brick, asphalt, dense to compact (15-20% debris)       10       55       326         FILL - (SM) SILTY SAND, some gravel; grey, contains brick, asphalt, wood and plastic (grabdage); non-cohesive, moist, dense to compact (15-20% debris)       11       55       450         FILL - (SM) SILTY SAND, trace to some gravel; brown, contains brick, asphalt, wood and mortar; non-cohesive, moist to wet, compact (50% debris)       9       14       13       55       12         G0% debris)       14       55       19       14       55       19         CONTINUED NEXT PAGE       14       55       19	FIL - (SM) GRAVEL and SILTY SAND.       457       7       55       -508         MD       457       7       55       -508         FIL - (CL) SILTY CLAY and GRAVEL, some sand. brown, contains brick, compact (5% debris)       531       8       53         FIL - (SM) SILTY SAND, some gravel, grey brown, contains brick, mod and aphatin non-cohesive, moist, compact (15% debris)       9       55       198         FIL - (CSM) SILTY CLAY, grey brown, contains brick, and wood; cohesive, moist, compact (15% debris)       66.81       9       55       198         FIL - (CSM) SILTY CLAY, grey brown, contains brick, and wood; cohesive, moist, compact (15% debris)       66.88       10       55       12.9         FIL - (SM) SILTY SAND, some gravel; grey, contains brick, and wood; cohesive, moist, compact (15* 20% debris)       68.81       10       55       12.9         FIL - (SM) SILTY SAND, some gravel; grey, contains brick, asphall, wood and platic (garbage); non-cohesive, moist, dense to compact (15* 20% debris)       11       55       15.9         FIL - (SM) SILTY SAND, trace to some gravel; grey, contains brick, asphall, wood and platic (garbage); non-cohesive, moist to garball, mod and platic (garbage); non-cohesive, moist to garball, mod and platic (garbage); non-cohesive, moist to garball (garbage); non-cohesive, moist to ga	FILL - (SM) GRAVEL and SILTY SAND: ⁵⁹ ⁶⁹ ⁴⁵⁷ ⁷ ⁵⁵ ⁵⁶⁰ ND ⁵⁹ ¹⁶⁷ ⁷ ⁵⁵ ⁵⁶⁰ ND ⁵⁹ ¹⁶⁷ ¹⁶⁷ ¹⁶⁷ ¹⁶⁷ ¹⁶⁷ ¹⁶⁷ ¹⁶⁸ ¹⁶⁹

# **RECORD OF BOREHOLE: 18-02**

BORING DATE: June 11, 2018

SHEET 2 OF 2

DATUM: CGVD28

LOCATION: N 5030424 4 ;E 365719 8 SAMPLER HAMMER, 64kg; DROP, 760mm

u	DOH	SOIL PROFILE		_	SA	MPLE	ES	HEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM] (b) C Abit Control of Contro	28	PIEZOMETER
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV DEPTH (m)	NUMBER	TYPE	BLOWS/0 30m	HEADSPACE ORGANIC VAPOUR CONCENTRATIONS (PPM)         ⊕         HYDRAULIC CONDUCTIVITY, k, cnvs           ND = Not Detected 20         40         60         80         10 ⁴ 10 ² HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS (%LEL) ND = Not Detected         WATER CONTENT PERCENT WP I         WI           20         40         60         80         20         40         60         80	ADDITIONAL LAB TESTING	OR STANDPIPE INSTALLATION
10		CONTINUED FROM PREVIOUS PAGE FILL - (SM) SILTY SAND, trace to some gravel; brown, contains brick, asphalt, wood and mortar; non-cohesive, moist to wet, compact (50% debris) FILL - (SM) SILTY SAND, trace to some gravel; grey brown, contains brick, asphalt, wood, glass, ceramic and aluminum; non-cohesive, wet, compact (70% debris)		<u>52 80</u> 10 67	15	SS SS SS	18 (8			
12	Rotary Drill HW Casing					55 55		ND		
13	Ro HM	FILL - (CL) SILTY CLAY, some sand; grey, contains brick and plastic (garbage); cohesive, w>PL, very stiff (20% debris) FILL - COBBLES and BOULDERS (ROCK FILL) (No debris)		50 52 12 95 50 31 13 16		SS		ND		
14		End of Borobala		<u>48 10</u>	20	RC	DD			
16		End of Borehole		15 37						
17										
18										
19										
20		CALE						GOLDER		GGED: SS

# **RECORD OF BOREHOLE: 18-03**

BORING DATE: June 6-7 2018

SHEET 1 OF 3

DATUM: CGVD28

LOCATION: N 5030518 9 ;E 365789 7 SAMPLER HAMMER, 64kg; DROP, 760mm

7

щΙ	Q	SOIL PROFILE			SA	MPLE	HEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM] ⊕ HYDRAULIC CONDUCTIVITY. k, cm/s	-9	PIEZOMETER
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV DEPTH (m)	NUMBER	TYPE	HEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM]         ⊕         HYDRAULIC CONDUCTIVITY. k, cm/s           ND = Not Detected 20         40         60         80         10 ⁻⁵ 10 ⁴ 10 ⁻² HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [%LEL] ND = Not Detected 20         40         60         80         WATER CONTENT PERCENT Wp I         WP I         W           20         40         60         80         20         40         60         80	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE FILL/TOPSOIL - (SM) SILTY SAND, some gravel; dark brown; moist FILL - (SM) SILTY SAND, some gravel; grey brown, contains brick;		62.63 0.00 62.43 0.20	1	35			
1		(0-5% debris) FILL - (SP) SAND; light brawn, non-cohesive, moist, dense (No debris)		61.87 0.76	2	SS	a ND		
		FILL - (GP) sandy GRAVEL; brown, contains cobbles; non-cohesive, moist, very dense to compact		61 11 1 52	à	\$5	9 ND		
2					4	SS			
3						-			
4					3	SS	³ ND		
×					Æ	SS	P ND		
5	Rotary Drail HW Gasing	some sand and gravel; grey (ROCK		57 45 5 18	4	SS SS	ND	e	ientonite Seal
6		FILL) (No debris)			9	RC	P		
7					10	RC			
8					11	RC	Ð ND		
10		CONTINUED NEXT PAGE			12	RC			Ž Ž
DEF	PTH S	SCALE				1	GOLDER	LC	GGED: SS

## **RECORD OF BOREHOLE: 18-03**

SHEET 2 OF 3 DATUM: CGVD28

LOCATION: N 5030518 9 ;E 365789 7

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: June 6-7, 2018

	GOH	SOIL PROFILE		s	AMPL	-	HEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM] ⊕ ND = Not Detected	HYDRAULIC CONDUCTIVITY, k, cm/s	
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT (W) (W)	H N	TYPE	BLOWS/0 30m	ND = Not Delected 20 40 60 80 HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS □ [%LEL] ND = Not Detected	10 ⁸ 10 ⁵ 10 ⁴ 10 ⁻² WATER CONTENT PERCENT Wp I OW I WI	PIEZOMETER OR STANDPIPE INSTALLATION
_	BO		-	Z	-	BLC	[%LEL] ND = Not Detected $20  40  60  80$	20 40 60 80	
10		<ul> <li>— CONTINUED FROM PREVIOUS PAGE — FILL - COBBLES and BOULDERS,</li> </ul>		-	-	-			-
11		some sand and gravel; grey (ROCK FILL) (No debris)		12	RC	DD	ND		Bentonite Seal Silica Sand
11	Rolary Drill HW Casing			13	RC	DD			32 mm Diam PVC 2 #10 Slot Screen 'B'
13		FILL - (SM) gravelly SILTY SAND, dark brown to black, contains wood; non-cohesive, wet, dense (5% debris) Borehole continued on RECORD OF	50 1 12 4 49.6	14	SS	316	e ND		Silica Sand
		DRILLHOLE 18-03							Bentonile Seal
14									
15									
16									
17									
18									
19									
20									
	тн s	CALE		-			GOLDER		LOGGED: SS CHECKED: WC

LO	CATI	CT: 18100285 ON: N 5030518 9 (E 365789 7 ATION: -90° AZIMUTH:	RECORI	D OF DRILLHOLE: 18-03 DRILLING DATE: June 6-7, 2018 DRILL RIG: CME Track	SHEET 3 OF 3 DATUM: CGVD28
DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	S S	RECOVERY TOTAL SOUD & CORE DISCONTINUITY DATA	xensided NOTE: For additional with althoughtings refer to init
- 14		BEDROCK SURFACE Fresh, thinly to medium bedded, grey, fine to medium grained, non-porous, medium strong LIMESTONE, with thin to thick laminations of black shale VERUIAM FORMATION	49.59 13.04 1 (2)		Bentonite Seal
- 15					Silica Sand
- 16	Rotary Drill HO3 Core		3 Q2		Silica Sand
- 18					Bentonite Seat
- 19		End of Drillhole Note(s): 1. Falling head packer test results and slug test results are shown on the log above	43 42 19 21		WL in Screen 'A' at Elev 52 77 m on June 26, 2018 WL in Screen 'B' at
- 21					Elev 52 97 m on June 29, 2018
- 22					
DE 1::		SCALE		GOLDER	LOGGED: SS CHECKED: WC

GEOTECHNICAL DESKTOP REVIEW: THE LEBRETON FLATS PLAN OF SUBDIVISION, OTTAWA, ONTARIO

Appendix D January 13, 2025

# **APPENDIX D**

- D.1 TABLE D.1: SUMMARY OF THE ENCOUNTERED BEDROCK SURFACE AND AUGER (OR SPLIT-SPOON) REFUSAL DEPTH/ELEVATION AND MEASURED RQD VALUES
- D.2 TABLE D.2: SUMMARY OF GROUNDWATER LEVELS

ioon) Refusal at Borenoles			Encountered Be	
Comment	Approximate Bedrock Surface Elevation (m)	Approximate Bedrock Surface Depth (m)	Approximate Ground Surface Elevation (m)	Borehole No.
Bedrock was proven by rock coring	52.4	3.65	56.05	MW-05-805
Bedrock was proven by rock coring	53.2	2.39	55.59	MW-05-801
Bedrock was proven by rock coring	52.9	3.19	56.09	MW-05-810
Bedrock was proven by rock coring	51.9	3.83	55.73	MW-05-813
Bedrock was proven by rock coring	53.2	2.22	55.42	MW-05-815
Bedrock was proven by rock coring	51.46	5.1	56.56	MW-08-001
Auger refusal	51.97	3.07	55.04	BH10-06
Auger refusal	51.55	3.83	55.38	BH10-07
Limestone bedrock with interbedded shale (RQD of 0)	49.63	6.35	55.98	BH10-08
Auger refusal	49.83	7.14	56.97	BH10-09
Auger refusal	53.88	3.94	57.82	BH10-10
Limestone bedrock with interbedded shale (RQD of 0, 28%, and 36%)	49.96	7.9	57.86	BH10-11
Limestone bedrock with interbedded shale (RQD of 16% and 96%)	51.86	3.99	55.85	BH10-14
Auger refusal	51.96	3.38	55.34	BH10-15
Limestone bedrock with interbedded shale (RQD of 83% and 100%)	51.73	3.99	55.72	BH10-16
Auger refusal	52.08	4.11	56.19	BH10-17
Auger refusal	53.17	3.25	56.42	BH10-19
Auger refusal	52.86	5.08	57.94	BH10-20
Auger refusal	51.65	4.14	55.79	BH10-25
Limestone bedrock with interbedded shale (RQD of 27% and 100%)	51.79	3.48	55.27	BH10-26
Auger refusal	52.09	4.24	56.33	BH10-28
Auger refusal	52.37	4.43	56.8	BH10-29
Limestone bedrock with interbedded shale (RQD of 100% and 91%)	51.19	6.68	57.87	BH10-30
Limestone bedrock with interbedded shale	51.9	2.7	54.5	BH11-11
Limestone bedrock with interbedded shale (RQD of 30%, 80%, and 90%)	54.8	0	54.8	BH11-21
Interbedded sequence of shale and limestone bedrock (RQD of 90%)	45.04	15.4	60.44	BHW-009

 
 Table D.1: Summary of Encountered Bedrock Surface Depth/Elevation, the Measured RQD Values, and Encountered Depths/Elevations of Auger (or Split-Spoon) Refusal at Boreholes

Borehole No.	Approximate Ground Surface Elevation (m)	Approximate Bedrock Surface Depth (m)	Approximate Bedrock Surface Elevation (m)	Comment
BHW-11	62.74	13.74	49	Shale bedrock (RQD of 0%, 30%, and 100%)
BHW-012	59.32	10.72	48.6	Shale bedrock (RQD of 90%)
BHW-013	60.97	10.51	50.46	Shale bedrock (RQD of 70%, 30%, and 0)
BHW-015	58.89	9.14	49.75	Shale bedrock (RQD of 20%, 0, 30%, 20%, 0, 80%, 40%, 0, and 100%)
BHW-017	58.02	6.85	51.17	Auger refusal
BHW-018	63.53	n/a	n/a	n/a
MW92-C3	62.25	3.5	58.75	Split spoon refusal on possible bedrock
MW01-7	54.65	5.45	49.2	Severely fractured limestone Bedrock (RQD of 0 and 36%)
MW01-8	62.63	11.55	51.1	Auger refusal on inferred bedrock
MW01-10	59.45	9.14	50.3	Auger refusal on inferred bedrock
MW01-17	66.4	16.6	49.8	Auger refusal on inferred bedrock
MW03-22	54.63	7.23	47.4	Auger refusal on inferred bedrock
MW03-23	55.76	9.7	46	Limestone with occasional shale interbeds bedrock (RQD of 49% and 80%)
BH06-37	63.47	7.2	56.3	Auger refusal
BH10-01	58.26	11	47.26	Limestone bedrock with interbedded shale (RQD of 94%)
BH10-02	57.54	8.74	48.8	Auger refusal
BH10-04	56.57	5.92	50.65	Auger refusal
BH10-05	55.61	5.61	50	Limestone bedrock with interbedded shale (RQD of 9%)
BH11-01	56.36	2.92	53.44	Auger refusal
BH11-03	54.93	5.69	49.24	Auger refusal on possible bedrock
BH11-04	56.16	9.7	46.46	Auger refusal
BH11-05	56.91	3.45	53.46	Auger refusal on possible bedrock
BH11-06	54.79	2.46	52.33	Auger refusal on possible bedrock
BH11-07	54.92	8.97	45.95	Auger refusal on possible bedrock
BH11-08	54.29	4.52	49.77	Auger refusal
BH11-09	56.83	3.98	52.85	Auger refusal
BH11-10	54.76	3.43	51.33	Auger refusal
BH11-11	54.84	7.77	47.07	Auger refusal
BH11-12	54.55	5.18	49.37	Auger refusal

Borehole No.	Approximate Ground Surface Elevation (m)	Approximate Bedrock Surface Depth (m)	Approximate Bedrock Surface Elevation (m)	Comment
BH11-13	56.59	7.98	48.61	Auger refusal
BH11-14	55.28	5.51	49.77	Auger refusal
BH11-15	54.87	4.52	50.35	Auger refusal
BH11-16	54.61	6.43	48.18	Auger refusal
BH11-17	56.66	8.59	48.07	Auger refusal on possible bedrock
BH11-18	56.83	8.54	48.29	Auger refusal
BH11-19	56.03	9.53	46.5	Limestone bedrock (RQD of 70% and 80%)
BH11-20	54.88	1.58	53.3	Auger refusal
BH11-20A	54.88	6.61	48.27	Auger refusal
BH11-21	59.07	6.45	52.62	Auger refusal
BH11-22	57.34	5.89	51.45	Auger refusal
BH11-23	56.36	4.9	51.46	Auger refusal
BH11-24	59.48	10.11	49.37	Auger refusal
BH11-25	57.24	5.23	52.01	Auger refusal
BH11-26	55.78	5	50.78	Auger refusal
BH11-28	57.59	9.53	48.06	Limestone bedrock
BH11-29	55.66	6.17	49.49	Auger refusal
BH11-31	58.81	6.63	52.18	Auger refusal
BH13-1	58.72	3.65	50.75	Coring
BH13-5	55.39	3.53	51.86	Limestone bedrock
MW13-1	55.09	0	55.09	Limestone bedrock
MW13-2	55.12	0	55.12	Limestone bedrock
MW13-3	53.67	0	53.67	Limestone bedrock
MW13-4	54.62	0	54.62	Limestone bedrock
MW13-5	53.25	0	53.25	Limestone bedrock
MW13-6	52.13	0	52.13	Limestone bedrock
MW13-6	55.7	4.8	50.9	Limestone bedrock
BH13-7	55.71	5.5	50.21	Limestone bedrock (RQD of 90%, 80%, 90%, 95%, 0, and 60%)
MW13-8	51.82	0.3	51.52	Limestone bedrock
MW13-10	52.86	0	52.86	Limestone bedrock
MW13-11	53.39	0	53.39	Limestone bedrock
MW13-12	53.64	0	53.64	Limestone bedrock
MW13-15	54.03	0	54.03	Limestone bedrock
MW18-3	62.63	13.04	49.59	Limestone bedrock (RQD of 70%, 65%, 90%, 95%, and 85%)

Borehole No.	Approximate Ground Surface Elevation (m)	Approximate Bedrock Surface Depth (m)	Approximate Bedrock Surface Elevation (m)	Comment
BH92-C1	62.02	2.6	59.42	Auger refusal on possible bedrock
BH92-C2	62.44	4.9	57.54	Split spoon refusal on possible bedrock
BH92-C4	62	3.6	58.4	Auger refusal on possible bedrock
BH92-C5	62.66	4.46	58.2	Auger refusal on possible bedrock
BH11-33	62.22	9.96	52.26	Split Spoon Refusal
BH11-35	62.56	4.4	58.16	Auger refusal
BH11-37	62.76	6.53	56.23	Auger refusal
BH11-38	62.11	4.17	57.94	Auger refusal
BH11-39	62.81	6.35	56.46	Auger refusal
BH11-40	62.77	6.25	56.52	Auger refusal
MW13-8	55.95	4.94	51.01	Limestone bedrock (RQD of 90% and 95%)

Note: bedrock surface depth/elevation confirmed by coring are shown with bold font.

### Table D.2: Summary of Groundwater Levels

Borehole No.	Approximate Ground Surface Elevation (m)	Groundwater Depth (m)	Approximate Groundwater Elevation (m)	Date of Measurement
MW-05-805	56.1	4.7	51.4	Measured on Nov 14, 2005
		3.8	52.3	Measured on May 2, 2006
MW92-C1	62.0	2.4	59.6	Measured on Feb 18, 1992
	55.6	4.0	51.6	Measured on Nov 14, 2005
MW-05-801		2.4	53.2	Measured on May 2, 2006
MW-05-810	56.1	4.7	51.4	Measured on Nov 14, 2005
1010-00-010		4.7	51.4	Measured on May 2, 2006
MW-05-813	55.7	3.9	51.9	Measured on Nov 14, 2005
		3.6	52.1	Measured on May 2, 2006
MW-05-815	55.4	2.1	53.3	Measured on Nov 14, 2005
		2.2	53.3	Measured on May 2, 2006
MW-05-819	52.6	1.1	51.5	Measured on Nov 14, 2005
		1.1	51.5	Measured on May 2, 2006
MW06-6	55.0	2.1	52.9	N. A / installed on June 20, 2006
MW06-7	55.2	2.5	52.7	N. A / installed on June 20, 2006
MW06-9	61.6	8.1	53.5	N. A / installed on June 21, 2006
MW06-10	55.6	2.8	52.8	N. A / installed on June 21, 2006
MW06-11	56.8	4.0	52.8	N. A / installed on June 21, 2006
BH/MW06-	62.6	1.6	61.0	N. A / installed on August 2, 2006

Borehole No.	Approximate Ground Surface Elevation (m)	Groundwater Depth (m)	Approximate Groundwater Elevation (m)	Date of Measurement
BH/MW06-	65.5	1.9	63.6	N. A / installed on August 3, 2006
MW-06-103	62.0	8.6	53.5	Measured on July 25, 2006
MW-06-104	61.4	7.3	54.1	Measured on July 25, 2006
MW-06-105	58.3	5.2	53.1	Measured on July 25, 2006
MW-06-106	59.4	6.6	52.8	Measured on July 25, 2006
MW-06-107	62.2	9.3	52.9	Measured on July 25, 2006
MW-06-108	56.2	3.0	53.3	Measured on July 25, 2006
MW-06-109	63.4	dry	dry	Dry on July 25, 2006
MW-06-110	60.0	6.8	53.3	Measured on July 25, 2006
MW-06-901	57.0	4.9	52.1	Measured on July 25, 2006
MW-08-001	56.6	5.0	51.6	Measured on May 13, 2008
BHW-009	60.4	7.1	53.3	Measured on August 2, 2011
BHW-012	59.3	7.1	54.1	Measured on August 2, 2011
MW92-C3	62.3	< 3.5	<58.8	Dry on Feb 18, 1992
MW01-6	56.1	3.2	52.9	Measured on April 18, 2001
MW01-7	54.7	1.7	53.0	Measured on April 18, 2001
MW01-8	62.6	9.4	53.2	Measured on April 18, 2001
MW03-22	54.6	1.7	52.9	Inferred at the time of drilling (May 30, 2003)
MW03-23	55.8	2.7	53.1	Inferred at the time of drilling (May 30, 2003)
BHW-013	61.0	8.2	52.8	Inferred at the time of drilling (June 23, 2011)
BHW-015	58.9	6.1	52.8	Inferred at the time of drilling (June 14, 2011)
BHW-017	58.0	5.3	52.7	Inferred at the time of drilling (June 14, 2011)
MW13-1	58.7	6.6	52.1	Inferred at the time of drilling (March 8, 2013)
MW13-6	55.7	3.9	51.8	Inferred at the time of drilling (March 14, 2013)
MW13-8	56.0	6.7	49.2	Measured on March 25, 2013
MW18-3	62.6	9.8	52.9	Measured on June 29, 2018