Proposed Residential Development
1840-1850 Bloor Street
Mississauga, Ontario

Geotechnical Investigation Report

Ranee Management
July 18, 2024
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ENGLOBE

Geotechnical Investigation Report

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1 Introduction

Englobe Corp. (Englobe, formerly Terraprobe Inc.) was retained by Ranee Management to conduct a geotechnical investigation for a proposed infill development for a project site located at 1840-1850 Bloor Street, Mississauga, Ontario.

This report encompasses the results of the geotechnical investigation conducted for the proposed infill development to determine the prevailing subsurface soil and groundwater conditions, and on this basis, provides geotechnical design advice and engineering recommendations for the design of foundations, basement floor slab, basement drainage, pavement design, seismic site class, and lateral earth pressure design parameters. Geotechnical comments are also included on pertinent construction aspects, excavation, bedding/embedment, backfill and groundwater control.

Terraprobe has also conducted a Hydrogeological Study for this project. The findings of the investigation are reported under a separate cover.

2 Site and Project Description

The project site is located on the south side of Bloor Street, at the intersection of Bloor Street and Bridgewood Drive in the City of Mississauga, Ontario. The general location of the site is presented in Figure 1 - Site Location Plan.

The site is a trapezoidal parcel of land with a total area of approximately 39,300 m^2 (9.7 acres). The site is an active apartment complex that comprises two 14-storey residential towers with municipal addresses of 1840 and 1850 Bloor Street with an outdoor swimming pool, a basketball court, asphalt-paved parking lots, and landscaped area. Both towers have one level of underground parking that extends beyond the above-ground footprint of the respective towers. The two existing towers and their underground parking structures occupy approximately the northern half of the site. The outdoor swimming pool, basketball court, and landscaped area occupy approximately the southern half of the site.

The following architectural design drawing set was provided to Englobe for our review and the report preparation.

- *Bloor, 1840-1850 Bloor St., City of Mississauga, ON, OPA & ZBA Resubmission, Project No. 120303,* dated June 26, 2024, prepared by Arcadis Architects (Canada) Inc.

Based on the architectural drawings, the proposed infill development will consist of demolition of the outdoor swimming pool and basketball court to facilitate the redevelopment of the site to include two 18-storey residential towers on top of a 4-storey L-shaped podium in the southern half of the site. One level of underground parking garage (P1) will be constructed beneath the podium. New circular at-grade driveway, outdoor amenity, and new landscaped area will be constructed within the central area surrounded by four towers (two new and two existing). The approximate locations of the two existing residential towers, the proposed two new residential towers and the limit of the new basement are shown in the attached Figure 2 - Borehole Location Plan.

The Sections drawing of the above-noted drawing set indicates that the finished floor elevation (FFE) for the proposed ground floor will be set at Elev. 128.5 m. The P1 floor is 3.95 m depth below the ground floor, implying that the P1 FFE will be set at Elev. 124.55 m.

3 Investigation Procedure

The field investigation was conducted on November 27 through 29, 2019, and consisted of drilling and sampling a total of eight (8) boreholes, denoted as BH1 through BH8, extending to about 5.7 to 6.3 mbg. The approximate locations of the boreholes are shown on the enclosed Figure 2 - Borehole Location Plan.

The boreholes were drilled by a specialist drilling contractor using track-mounted drill rig with rubber tires. The boreholes were advanced using continuous flight solid and hollow stem augers, and were sampled at 0.75 or 1.5 m intervals with a conventional 50-mm-diameter split barrel sampler when the Standard Penetration Test (SPT) was carried out (ASTM D1586). The field work (drilling, sampling and testing) was observed and recorded by a member of our field engineering staff, who logged the borings and examined the samples as they were obtained.

All samples obtained during the investigation were sealed into clean plastic jars, and transported to our geotechnical testing laboratory for detailed inspection and testing. All borehole samples were examined (tactile) in detail by a geotechnical engineer, and classified according to visual and index properties. Laboratory tests consisted of water content determination on all samples and a Sieve and Hydrometer analysis on selected native soil samples; and Atterberg Limits tests on one selected cohesive soil sample. The measured natural moisture contents of individual samples and the results of the Sieve and Hydrometer analysis and Atterberg Limits tests are plotted on the enclosed Borehole Logs at respective sampling depths. The results of Sieve and Hydrometer analyses and Atterberg Limits tests are also summarized in Section 4.5 of this report, and attached herein as Appendix A - Borehole Logs and Appendix B - Geotechnical Laboratory Test Results.

Three (3) samples of soil (Borehole 2, Sample 6; Borehole 6, Sample 5; and Borehole 8, Sample 6) were selected and tested for a suite of corrosivity parameters consisting of pH, Resistivity, Electrical Conductivity, Redox Potential, Sulphate, Sulphide, and Chloride. The results of soil corrosivity analyses are summarized in Section 5.11 of this report and a copy of the Certificates of Analyses is included in Appendix C.

Groundwater levels were measured in open boreholes upon completion of drilling. Monitoring wells comprising 50-mm-diameter PVC pipes were installed in selected boreholes (Boreholes 1, 4 and 8) to facilitate groundwater monitoring. The PVC piping was fitted with a bentonite clay seal as shown on the accompanying Borehole Logs. Groundwater levels in the monitoring wells were measured on December 10, 16 and 23 2019 and January 9, 2020, about 11 days, 17 days, 24 days, and 41 days, respectively, following the installation. The results of groundwater monitoring are presented in Section 4.6 of this report.

The borehole ground surface elevations and the coordinates (Universal Transverse Mercator, UTM, Zone 17T) were surveyed by Terraprobe using a Trimble R10® GNSS System. The Trimble R10® system uses the Global Navigation Satellite System and the Can-Net® reference system to determine target location and elevation. The Trimble R10® system is reported to have an accuracy of up to 10 mm horizontally and up to 30 mm vertically. It should be noted that the elevations provided on the Borehole Logs are approximate only, for the purpose of relating soil stratigraphy and should not be used or relied on for other purposes.

4 Subsurface Conditions

The specific soil conditions encountered at each borehole location are described in greater detail on the Borehole Logs, with a summary of the general subsurface soil conditions outlined below. This summary is intended to correlate this data to assist in the interpretation of the subsurface conditions encountered at the site.

It should be noted that the subsurface conditions are confirmed at the borehole locations only and may vary between and beyond the borehole locations. The boundaries between the various strata as shown on the logs are based on non-continuous sampling. These boundaries represent an inferred transition between the various strata, rather than a precise plane of geologic change.

4.1 Fill

Below the 140- to 160-mm topsoil at all boreholes, brown to dark brown miscellaneous fill material consisting of clayey to sandy silt with trace amounts of gravel and organic matters were encountered in all eight boreholes. This fill layer extended to depths ranging from about 0.6 mbg at Boreholes 3 and 4 to about 3.0 mbg at Borehole 2.

Standard Penetration Test results (N-values) obtained from the earth fill zone ranged from 5 to 18 blows per 300 mm of penetration (blows per foot, bpf), indicating firm to very stiff consistency (cohesive soils) or loose to compact relative density (cohesionless soils). The moisture contents of the fill samples ranged from 8 to 20%, indicating a moist condition.

4.2 Silty Sand

Brown silty sand with trace amount of gravel was encountered below the fill material in Borehole 1. This silty sand layer extended to the depth of about 3.0 mbg at Borehole 1.

N-value obtained from the undisturbed silty sand deposit was 17 bpf, indicating a compact compactness. The moisture content of the native soil sample was 14%, indicating a wet condition.

4.3 Glacial Till

Undisturbed native glacial till material consisting of clayey to sandy silt with various amount of sand and gravel (some sand and trace gravel) was encountered below the fill material and extended to the depths of about 4.6 mbg in Boreholes 1 through 4 and about 6.0 mbg in Boreholes 5 through 8.

N-values obtained from the till layer ranged from 12 bpf to 50 blows per 75 mm of penetration, indicating soft to hard consistency. The moisture contents of the till samples ranged from 4 to 18%, indicating damp to wet conditions.

4.4 Inferred Bedrock

Grey weathered shale bedrock fragments were encountered below the sand and gravel layer in Borehole 2, below the sandy silt layer in Borehole 4, and below the glacial till in Boreholes 1, 3, and 5 through 8 to the termination depths of all boreholes.

The inferred bedrock beneath the site is expected to be of the Georgian Bay Formation, which is a deposit predominantly comprised of thin- to medium-bedded grey shale of Ordovician age. The shale contains interbedded grey calcareous shale, limestone/dolostone and calcareous sandstone (conventionally grouped together as “limestone”) which are discontinuous and nominally 25 to 125 mm thick.

The augered borehole method used at this site is conventionally accepted investigative practice. However, the interval sampling method does not define the bedrock surface with precision, particularly where the surface of the rock is weathered, weaker and easily penetrated by auger. The auger refusal is generally indicative of a presence of a relatively less weathered/sound shale and/or limestone/dolostone layers. It should be noted that confirmation and characterization of the bedrock through rock coring was not included in our scope of work. Therefore, the bedrock surface elevations at the borehole locations, as noted on the borehole logs, could not be confirmed, and were inferred from the borehole augering, auger grinding, split barrel sampler refusal and bouncing. Auger grinding or sampler refusal in this case could either be inferred as bedrock or could be due to the presence of boulders/obstruction/limestone slabs which may be present within the overburden, therefore actual bedrock surface elevations may vary from the inferred elevations noted on the borehole logs. It must be noted that inference of bedrock level based on auger grinding and/or sampler refusal does not provide bedrock level accurately.

4.5 Geotechnical Laboratory Test Results

The geotechnical laboratory testing consisted of natural moisture content determination for all samples, while Sieve and Hydrometer analysis and Atterberg Limits tests were conducted on selected soil samples. The test results are plotted on the enclosed Borehole Logs at respective sampling depths.

The results (graphs) of the Sieve and Hydrometer (grain size) analysis are appended and a summary of these results is presented as follow:

Borehole No. Sample No.	Sampling Depth below Grade (m)	Percentage (by mass)				Descriptions (MIT System)
		Gravel	Sand	Silt	Clay	
Borehole 2, Sample 5	3.3	2	44	43	11	SILT AND SAND some clay, trace gravel (TILL)
Borehole 3, Sample 6	4.8	20	42	24	14	SILTY SAND some gravel, some clay (TILL)

Borehole No. Sample No.	Sampling Depth below Grade (m)	Percentage (by mass)				Descriptions (MIT System)
		Gravel	Sand	Silt	Clay	
Borehole 6, Sample 3	1.8	0	7	59	34	CLAYEY SILT trace sand
Borehole 8, Sample 6	4.8	14	30	39	17	SANDY SILT some clay, some gravel (TILL)

Atterberg Limits Test was also carried out on one (1) selected soil sample. The results were plotted on A-Line Graph (refer to enclosed Figure, Atterberg Limits Test Results) and summarized as follows:

Borehole No. Sample No.	Sampling Depth below Grade (m)	Liquid Limit (W_L)	Plastic Limit (W_P)	Plasticity Index (I_P)	Natural Moisture Content (%)	Plasticity
Borehole 3, Sample 6	4.8	19	12	7	7	Slightly Plastic

4.6 Groundwater

Observations pertaining to the depth of groundwater level and caving were made in the open boreholes immediately after completion of drilling, and are noted on the enclosed Borehole Logs. Monitoring well was installed in Boreholes 1, 4 and 8 to facilitate groundwater level monitoring and the purpose of hydrogeological study. The groundwater level measurements in the monitoring wells were taken on on December 10, 16 and 23 2019 and January 9, 2020, about 11 days, 17 days, 24 days, and 41 days, respectively, following the installation and they are noted on the enclosed Borehole Logs. A summary of these observations is provided as follows:

Borehole No.	Ground Surface Elevation (m)	Depth of Boring below Grade (m)	Depth to Cave below Grade (m)	Water Level Depth/Elevation (m) at the Time of Drilling	Water Level Depth/Elevation (m)s			
					Dec 10, 2019	Dec 16, 2019	Dec 23, 2019	Jan 9, 2020
1	128.8	5.9	Open	Dry	1.4 / 127.4	1.6 / 127.2	1.3 / 127.5	1.7 / 127.1
4	127.9	5.7	Open	Dry	0.5 / 127.4	0.4 / 127.5	0.6 / 127.3	0.6 / 127.3
8	128.6	6.3	Open	Dry	3.3 / 125.3	1.9 / 126.7	1.6 / 127.0	2.0 / 126.6

The design groundwater level may be taken at Elev. 127.5 m±.

Construction dewatering at adjacent sites, existing building drains or dewatering systems, and seasonal fluctuations may cause significant changes to the depth of the ground water table over time. Additional information pertaining to groundwater at the site is discussed in the Hydrogeological Study report by Englobe under a separate cover (File No. 02405214.000).

5 Discussions and Recommendations

The following discussion and recommendations are based on the factual data obtained from this investigation and are intended for the use of the owner and the design engineer. Contractors bidding or providing services on this project should review the factual data and determine their own conclusions regarding construction methods and scheduling.

This report is provided on the basis of these terms of reference and on the assumption that the design features relevant to the geotechnical analyses will be in accordance with applicable codes, standards and guidelines of practice. The Ontario Building Code may require additional considerations beyond the recommendations provided in this report and must be followed. If there are any changes to the site development features or there is any additional information relevant to the interpretations made of the subsurface information with respect to the geotechnical analyses or other recommendations, then Englobe Corp. should be retained to review the implications of these changes with respect to the contents of this report.

5.1 Foundations

The boreholes encountered the topsoil layer at the ground surface underlain by clayey silt and sandy silt fill zone, extending to depths ranging from 0.6 to 3.0 mbg (Elev. 125.6 to 127.6 m), which was in turn underlain by undisturbed native soil deposits. The overburden soil graded into inferred bedrock at depths of 4.6 to 6.1 m below grade (Elev. 121.8 to 124.2 m), extending to the full depth of the investigation.

The proposed infill development will include two (2) 18-storey towers situated on a four-storey podium resting on a one-level common underground parking structure. The design drawing implied the P1 FFE would be set at Elev. 124.55 m. The underside of the spread footings may be at Elev. 123.3 m± (1.2 m allowance for the footing depth and frost protection).

Based on the findings from the subsurface investigation, glacial till material was encountered at about Elev. 125.0 m in all boreholes and undisturbed glacial till is considered suitable material to support the proposed structure foundations. We recommend the proposed structure should bear on the glacial till material at about Elev. 125.0 m and lower. A maximum net geotechnical reaction at Serviceability Limit States (SLS) of 400 kPa and a maximum factored geotechnical bearing resistance at Ultimate Limit States (ULS) of 600 kPa are recommended for design of conventional spread footing foundations (for vertical and concentric loads) supported on the underlying competent undisturbed glacial till material. Note that at the Boreholes 1 and 2 locations, the footings would be made to bear on inferred bedrock.

As previously noted, the partially weathered shale bedrock (Georgian Bay Formation) is encountered at Elev. 121.8 to 124.2 m. Bedrock was not cored and proven at this site, and inferred based on drilling observations. Therefore, the depth to sound bedrock was not determined by our investigation.

The P1 FFE is set at Elev. 124.55 mm, which is only up to 2.8 m above the top of the partially weathered shale (about 1.5 m below the footing underside). In addition, the high-rise towers will impose significant structural loads on the foundations. Therefore, the consideration may be given to extend the footings to deeper depths to bear on partially weathered (Zone II) shale bedrock to provide uniform and high bearing capacity foundations for the proposed towers. A maximum factored geotechnical resistance at ULS of 6 MPa and a maximum net geotechnical reaction at SLS of 3 MPa may be used for foundations designed on partially weathered (Zone II) bedrock. A minimum foundation embedment of 300 mm into the weathered bedrock must be provided.

The geotechnical resistance(s) as recommended allow for up to 25 mm of total settlement. This settlement will occur as load is applied and is linear elastic and non-recoverable. Differential settlement is a function of spacing, loading and foundation size.

5.1.1 Foundation Installation

All exterior foundations and foundations in unheated areas must be provided with a minimum soil cover of 1.2 m or equivalent insulation for frost protection.

Depending on the foundation design, some of the footings will need to extend deeper than the nominal founding elevation to be founded on the bedrock. The over-excavation required for the foundations in these areas may be filled with lean mix concrete (strength to be provided by the structural engineer) up to the normal design foundation level, and the foundations may be supported on this lean mix concrete pad. The lean mix concrete pad must extend a minimum of 300 mm beyond the edge of the foundation in every direction.

Footings stepped from one level to another supported on the bedrock should be designed at a slope not exceeding 1 vertical to 1 horizontal in conjunction with the above bearing pressures. There must be a minimum of 500 mm separation between the edge of any footing and the top of a sloped/vertical rock cut down to another footing.

Prior to pouring concrete for the footings, the footing subgrade must be cleaned of all deleterious materials such as softened, disturbed or caved materials, as well as any weathered rock or standing water. If construction proceeds during freezing weather conditions, adequate temporary frost protection for the footing bases and concrete must be provided. It should be noted that the bedrock surface can weather and deteriorate on exposure to the atmosphere or surface water; hence, foundation bases which remain open for an extended period of time should be protected by a skim coat of lean concrete. As per the Ontario Building Code (2012), the foundation excavations must be inspected and approved (by Englobe) to ensure the bearing capacities stated below are applicable. If incompetent soils are encountered at the proposed bearing depths during foundation excavation or due to inadequate dewatering, sub-excavation to competent soil subgrade is required under the direction of the geotechnical engineer.

5.2 Earth Pressure Design Parameters

Walls or bracings subject to unbalanced earth pressures must be designed to resist a pressure that can be calculated based on the following equation:

$$P = K [\gamma (h-h_w) + \gamma' h_w + q] + \gamma_w h_w$$

Where:

P = the horizontal pressure at depth h (kPa)
K = the earth pressure coefficient
h_w = the depth below the ground water level (m)
γ = the bulk unit weight of soil (kN/m^3)
γ_w = the bulk unit weight of water (9.8 kN/m^3)
γ' = the submerged unit weight of the exterior soil, (γ_{sat} - γ_w)
q = the complete surcharge loading (kPa)

Where the wall backfill can be drained effectively to eliminate hydrostatic pressures on the wall, this equation can be simplified to:

$$P = K(\gamma h + q)$$

This equation assumes that free-draining granular backfill is used and positive drainage is provided to ensure that there is no hydrostatic pressure acting in conjunction with the earth pressure.

Resistance to sliding of retaining structures is developed by friction between the base of the footing and the soil. This friction (R) depends on the normal load on the soil contact (N) and the frictional resistance of the soil (tan ϕ) expressed as $R = N \tan \phi$. The factored geotechnical resistance at ULS is 0.8 R.

Passive earth pressure resistance is generally not considered as a resisting force against sliding for conventional retaining structure design because a structure must deflect significantly to develop the full passive resistance.

The average values for use in the design of structures subject to unbalanced earth pressures at this site are tabulated as follow:

Parameter	Definition	Units
ϕ	angle of internal friction	degrees
γ	bulk unit weight of soil	kN/ m^3
K_a	active earth pressure coefficient (Rankine)	dimensionless
K_o	at-rest earth pressure coefficient (Rankine)	dimensionless
K_p	passive earth pressure coefficient (Rankine)	dimensionless

Stratum/Parameter	γ (kN/m^3)	Φ (degree)	K_a	K_o	K_p
Fill	19.0	28	0.36	0.53	2.77
Glacial Till	21.0	32	0.31	0.47	3.25
Compacted Granular Material	21.0	32	0.31	0.47	3.25
Georgian Bay Formation Shale	25.0	28	na	na	na

The values of the earth pressure coefficients are for the horizontal backfill grade behind the wall. The earth pressure coefficients for inclined grade will vary based on the inclination of the retained ground surface.

5.3 Earthquake Design Parameters

Under Ontario Regulation 88/19, the ministry amended Ontario's Building Code (O. Reg 332/12) to further harmonize Ontario's Building Code with the 2015 National Codes. These changes will help reduce red tape for businesses and remove barriers to interprovincial trade throughout the country. The amendments are based on code change proposals the ministry consulted in 2016 and 2017. The majority of the amendments came into effect on January 1, 2020, which includes structural sufficiency of buildings to withstand external forces and improve resilience.

Seismic hazard is defined in the 2012 Ontario Building Code (OBC 2012) by uniform hazard spectra (UHS) at spectral coordinates of 0.2 s, 0.5 s, 1.0 s and 2.0 s and a probability of exceedance of 2% in 50 years. The OBC method uses a site classification system defined by the average soil/bedrock properties (e.g. shear wave velocity (v_s), Standard Penetration Test (SPT) resistance, and undrained shear strength (s_u)) in the top 30 meters of the site stratigraphy below the foundation level, as set out in Table 4.1.8.4A of the Ontario Building Code (2012). There are 6 site classes from A to F, decreasing in ground stiffness from A, hard rock, to E, soft soil; with site class F used to denote problematic soils (e.g. sites underlain by thick peat deposits and/or liquefiable soils). The site class is then used to obtain peak ground acceleration (PGA), peak ground velocity (PGV) site coefficients Fa and Fv, respectively, used to modify the UHS to account for the effects of site-specific soil conditions.

For the proposed building, having conventional spread footing foundations bearing uniformly on dense to very dense sandy silt to silty sand till or sandy silt deposit, the site designation for seismic analysis may be taken a Site Class **C**, as per Table 4.1.8.4.A of the Ontario Building Code (2012).

Alternatively, having conventional spread footing foundations to be extended to deep depths bearing uniformly on the partially weathered bedrock of Georgian Bay Formation, the site designation for seismic analysis may be taken a Site Class **B**, as per Table 4.1.8.4.A of the Ontario Building Code (2012).

The values of the site coefficient for design spectral acceleration at period T, F(T), and of similar coefficients F(PGA) and F(PGV) shall conform to Tables 4.1.8.4.B. to 4.1.8.4.I. using linear interpolation for intermediate values of PGA.

5.4 Basement Floor Slab

The excavated surface should be assessed by a qualified geotechnical engineer. The modulus of subgrade reaction appropriate for the slab design constructed on undisturbed clayey silt to sandy silt till/sand and gravel subgrade is 40,000 kPa/m.

Prior to the construction of the slab, it is recommended that the subgrade be cut-neat, approved and inspected under the supervision of Englobe for obvious loose or disturbed areas as exposed, or for areas containing excessively deleterious materials or moisture. All sub-excavated areas shall be replaced with Granular B placed as compacted fill (in lifts 150 mm thick or less and compacted to a minimum of 98 percent Standard Proctor Maximum Dry Density, SPMDD).

The basement floor slab should be provided with a capillary moisture barrier and drainage layer. This can be made by placing the slab on a minimum of 200 mm thick 19 mm clear stone layer (OPSS.MUNI 1004) compacted by vibration to a dense state. This material also serves as the drainage media for the subfloor drainage system. Provision of subfloor drainage is required in conjunction with the perimeter drainage of the structure. Suitable geotextile (for instance OPSS.MUNI 1860 Class II non-woven geotextile) needs to be placed to separate granular base course from the subgrade to prevent migration of soil fines where the silt/sand subgrade soils are encountered.

The subfloor drainage system is an important building element, as such the storm sumps which ensure the performance of this system must have a duplexed pump arrangement for 100 percent pumping redundancy provided with emergency power. Basement and subfloor drainage provisions are further discussed in Section 5.5 of this report.

5.5 Basement Drainage

The groundwater levels measured on December 10, 16 and 23, 2019 and January 9, 2020 in the monitoring wells installed in Boreholes 1, 4 and 8 indicated that the groundwater levels ranged from about 0.4 to 3.3 mbg (about Elev. 127.5 m to Elev. 125.3 m).

To assist in maintaining basement dry from seepage, it is recommended that exterior grades around the new building be sloped away at a 2% gradient or more, for a distance of at least 1.2 m.

In case the basement walls are constructed within an open excavation, perimeter foundation drains should be provided, consisting of perforated pipe with filter fabric (minimum 100 mm diameter) surrounded by a granular filter (minimum 150 mm thick), and freely outletting. The granular filter should consist of 19 mm clear stone (OPSS.MUNI 1004) surrounded by a filter fabric (Terrafix 270R® or equivalent).

The basement wall must be provided with damp-proofing provisions in conformance to the Section 9.13.2 of the Ontario Building Code. The basement wall backfill for a minimum lateral distance of 0.6 m out from the wall should consist of free-draining granular material (OPSS.MUNI 1010 Granular B), or provided with a prefabricated drain material (for instance, CCW MiraDRAIN 6000 series®, Terrafix Terradrain 600® or equivalent), see Appendix D for typical basement wall (open excavation) drainage details. The perimeter drain installation and outlet provisions must conform to the plumbing code requirements.

If the foundation walls are constructed against the shoring system (one-sided wall construction), drainage is provided by forming a drained cavity with prefabricated drain material, such as CCW MiraDRAIN 6000 series® (or Terrafix Terradrain 200®, or approved equivalent) which can be incorporated between the shoring and the cast-in-place concrete foundation wall. The drainage composite material can be outlet into the basement sumps using a solid pipe (separate from the subfloor drainage system) to remove collected water at the building sumps. See Appendix D for typical basement wall (one-sided wall construction) drainage details.

A subfloor drainage system is recommended. The sub-floor drainage system should consist of perforated pipes (minimum 100 mm diameter) located at a maximum spacing of 5.0 m centre-to-centre (Appendix D for typical basement wall drainage details and basement subdrain detail). The subdrain system should be outlet to a suitable discharge point under gravity flow, or connected to a sump located in the lowest level of the basement. The water from the sump must be pumped out to a suitable discharge point/positive outlet. The installation of the drains as well as the outlet must conform to the applicable plumbing code requirements.

The size of the sump should be adequate to accommodate the water seepage. The sub-floor drainage system should be designed to prevent the possibility of back-flow. A duplex pumping arrangement (main pump with a provision of a backup pump) on emergency backup power is recommended. The pump should have sufficient capacity to accommodate a maximum peak flow of water of about 6 to 8 gallons per minute. This flow is not anticipated to be a sustained flow, but could be achieved under certain peak flow conditions.

5.6 Pavement

It is understood that the paved areas at this site would consist of driveway and parking lot. Design recommendations for pavement structure are provided in this section.

5.6.1 Pavement Design

The asphalt pavement design for the entrance driveway and the parking lot is provided in the following table:

Pavement Structural Layers	Light-Duty Pavement	Heavy-Duty Pavement
HMA Surface Course, OPSS.MUNI 1150 HL 3	40 mm	40 mm
HMA Binder Course, OPSS.MUNI 1150 HL 8	50 mm	85 mm
Granular Base Course, OPSS MUNI 1010 Granular A	150 mm	200 mm
Granular Subbase Course, OPSS.MUNI 1010 Granular B Type I	300 mm	300 mm
Total Thickness	**540 mm**	**625 mm**

HL 3 and HL 8 hot mix asphalt (HMA) mixes should be designed, produced and placed in conformance with OPSS.MUNI 1150 and OPSS.MUNI 310 requirements and the relevant City’s requirements.

Both the Granular A and Granular B Type I materials should meet the requirements of OPSS.MUNI 1010 requirements and the relevant City’s standards. Granular materials should be compacted to 100% of SPMDD.

HL3 HS HMA is recommended as padding. Padding should be placed in lifts not exceeding 50 mm.

Performance graded asphalt cement, PG 58-28, conforming to OPSS.MUNI 1101 requirements, should be used in both HMA binder and surface courses.

A tack coat (SS1) should be applied to all construction joints prior to placing hot mix asphalt to create an adhesive bond. SS1 tack coat should also be applied between hot mix asphalt binder and surface courses.

5.6.2 Drainage

Control of water is an important factor in achieving a good pavement life. The need for adequate subgrade drainage cannot be over-emphasized. The subgrade must be free of depressions and sloped (preferably at a minimum grade of 3%) to provide effective drainage toward subgrade drains. Grading adjacent to the pavement areas should be designed to ensure that water is not allowed to pond adjacent to the outside edges of the pavement.

Continuous pavement subdrains should be provided along both sides of the driveway and drained into respective catchbasins to facilitate drainage of the subgrade and granular materials. Continuous subdrains should be also provided for the parking lot/driveway pavement areas along the curb-lines/sidewalk and at all catchbasins within the parking areas. Two lengths of subdrain (each minimum of about 3 m long) should be installed at each catchbasin. The subdrain invert should be maintained at least 0.3 m below subgrade level. All subdrain arrangements should comply with the City of Mississauga Standard Drawing No. 2220.040.

5.6.3 Subgrade Preparation

All topsoil, organics, soft/loose and otherwise disturbed/weathered soils should be stripped from the subgrade areas. The existing asphaltic concrete should be saw cut and removed. The subgrade is expected to consist of silty sand/sand materials or earth fill material, and these soils will be weakened by construction traffic when wet; especially if site work is carried out during the periods of wet weather.

An adequate granular working surface would be likely required in order to minimize subgrade disturbance and protect its integrity in wet periods.

Immediately prior to placing the granular subbase, the exposed subgrade should be compacted and then proof-rolled with a heavy rubber-tired vehicle (such as a loaded gravel truck). The subgrade should be inspected for signs of rutting or displacement. Areas displaying signs of rutting or displacement should be compacted and tested or the material should be excavated and replaced with the Granular B Type I. Backfill material should be placed and compacted to at least 100% of SPMDD. The final subgrade surface should be sloped at a grade of 3% to provide positive subgrade drainage.

5.7 Excavations

The boreholes data indicate that the earth fill and undisturbed native soils would be encountered in the excavations. Excavations must be carried out in accordance with the *Occupational Health and Safety Act and Regulations for Construction Projects*. These regulations designate four (4) broad classifications of soils to stipulate appropriate measures for excavation safety.

TYPE 1 SOIL

a. is hard, very dense and only able to be penetrated with difficulty by a small sharp object;
b. has a low natural moisture content and a high degree of internal strength;
c. has no signs of water seepage; and
d. can be excavated only by mechanical equipment.

TYPE 2 SOIL

a. is very stiff, dense and can be penetrated with moderate difficulty by a small sharp object;
b. has a low to medium natural moisture content and a medium degree of internal strength; and
c. has a damp appearance after it is excavated.

TYPE 3 SOIL

a. is stiff to firm and compact to loose in consistency or is previously-excavated soil;
b. exhibits signs of surface cracking;
c. exhibits signs of water seepage;
d. if it is dry, may run easily into a well-defined conical pile; and
e. has a low degree of internal strength

TYPE 4 SOIL

a. is soft to very soft and very loose in consistency, very sensitive and upon disturbance is significantly reduced in natural strength;
b. runs easily or flows, unless it is completely supported before excavating procedures;
c. has almost no internal strength;
d. is wet or muddy; and
e. exerts substantial fluid pressure on its supporting system.

The fill material as well as undisturbed native soil deposit encountered in the boreholes are classified as Type 3 Soil above and Type 4 Soil below the prevailing groundwater level, while glacial till deposit would be classified as Type 2 above and Type 3 below the prevailing groundwater level.

Where workmen must enter excavations advanced deeper than 1.2 m, the trench walls should be suitably sloped and/or braced in accordance with the Ontario Occupational Health and Safety Act (OHSA) and Regulations for Construction Projects. The regulation stipulates the steepest slopes of excavation by soil type as follows:

Soil Type	Base of Slope	Steepest Slope Inclination
1	within 1.2 metres of bottom of trench	1 horizontal to 1 vertical
2	within 1.2 metres of bottom of trench	1 horizontal to 1 vertical
3	from bottom of trench	1 horizontal to 1 vertical

Soil Type	Base of Slope	Steepest Slope Inclination
4	from bottom of trench	3 horizontal to 1 vertical

Minimum support system requirements for steeper excavations are stipulated in the Occupational Health and Safety Act and Regulations for Construction Projects, and include provisions for timbering, shoring and moveable trench boxes.

Under the Act and Regulations, bedrock of the Georgian Bay Formation is not considered a soil. Where the excavation penetrates the bedrock, a vertical excavation made in sound bedrock is nominally self-supporting provided the rock bedding is horizontally oriented. The vertical rock face must be inspected by a geotechnical engineer to ensure no other support system is required to prevent the spalling of loose rock, and to ensure that all loose material at risk of falling upon a worker is removed (Section 233 of the above noted regulations). Should it be deemed necessary, rock bolts can anchor a layer of protective mesh that will protect workers from loose material spalling from the face of excavation.

It should be noted that the till deposit may contain larger particles (cobbles and boulders) that are not specifically identified in the Borehole Logs. The size and distribution of such obstructions cannot be predicted with borings, because the borehole sampler size is insufficient to secure representative samples of the particles of this size. Provision should be made in excavation contracts to allocate risks associated with time spent and equipment utilized to remove or penetrate such obstructions when encountered.

Georgian Formation is a rippable rock that can be removed with conventional excavation equipment once it has been displaced by a ripper tooth or hoe ram. Excavating detailed shapes for foundations and the edges of the excavation are normally accomplished with hoe mounted hydraulic rams. The ability to remove the rock in a vertical face without over-excavation and dislodging of additional rock is largely dependent on the skill of the machine operator. Where an excavation must be made neat (such as beside an existing footing), the line of excavation can be made neat by line drilling a series of closely-spaced vertical holes into the rock (100 mm diameter, 300 mm on centre) to provide a preferential break path for the excavation in the vertical plane.

While predominantly shale, the bedrock below the site contains beds of harder limestone. Where excavations extend into the bedrock, it is possible that relatively thick layers of hard limestone may be encountered. Hard layers of limestone interbedded within the shale are normally broken with hoe mounted hydraulic rams before excavation.

Upon excavation, thick hard layers may be found to coincide with the founding elevation. Where this situation is encountered, it will be necessary to remove the entire thickness of the hard layer to expose the founding level as it is virtually impossible to remove a portion of one of these layers. This situation can result in excess rock removal not intrinsic to the project requirements. The risk and responsibility for the excess rock removal under these circumstances, and the supply and placement of the extra concrete to restore the foundation grade, must be addressed in the contract documents for foundations, excavation, and shoring contractors.

5.8 Ground Water Control

Englobe has completed Updated Hydrogeological Report (File No. 02405214.000) for this site to provide ground water control measures and estimate ground water discharge volume (Refer to this report for detailed information about ground water volumes, quality and control provisions).

The groundwater levels measured on December 10, 16 and 23 2019 and January 9, 2020 in the monitoring wells installed in Boreholes 1, 4 and 8 indicated that the groundwater levels ranged from about 0.4 to 3.3 mbg (about Elev. 127.5 m to Elev. 125.3 m).

It is anticipated that groundwater seepage will be encountered during the excavation of the basement emanating from wet silt/sand and sand and gravel lenses present within the native soil deposit. The groundwater seepage emanating from above the static groundwater table should diminish slowly and can be controlled by continuous pumping from filtered sumps at the base of the excavation. The amount of perched water seepage is expected to increase with the depth of excavation. The glacial till consists of relatively low permeability material, which should preclude significant amounts of free flowing groundwater seepage into the excavation in the short-term.

For excavations extending through the wet permeable silt/sand layers and below the prevailing groundwater level, it will be necessary to lower the groundwater level and maintain it below the excavation base prior to and during the subsurface construction. In order to avoid loosening and sloughing of the base and sides, consideration should be given to install a skim coat of lean concrete (mud-slab) in conjunction with positive groundwater control to preserve the subgrade integrity to provide support to foundations and utilities, and a working platform, as needed. In general, prior dewatering and groundwater control provisions are required for excavations penetrating about 0.3 m or more into the groundwater table in cohesionless soils. Pumping from the sumps, in general may be effective for shallow excavations, up to about 1.0 m below the groundwater level.

It must be noted that without positive groundwater control, the soil would lose it integrity to support foundations.

5.8.1 Regulatory Requirements

The volume of water entering the excavation will be based on both ground water infiltration and precipitation events. Based on recent regulation changes within O.Reg. 63/16, the following dewatering limits and requirements are as follows:

- Construction Dewatering less than 50,000 L/day: The takings of both ground water and storm water **does not require** a Construction Dewatering Assessment Report (CDAR) and **does not require** a Permit to Take Water (PTTW) from the Ministry of the Environment, Conservation and Parks (MECP).
- Construction Dewatering greater than 50,000 L/day and less than 400,000 L/day: The taking of ground water and/or storm water **requires** a Construction Dewatering Assessment Report (CDAR) and **does not** require a Permit to Take Water (PTTW) from the Ministry of the Environment, Conservation and Parks (MECP).
- Construction Dewatering greater than 400,000 L/day: The taking of ground water and/or storm water **requires** a Construction Dewatering Assessment Report (CDAR) and **requires** a Permit to Take Water (PTTW) from the Ministry of the Environment, Conservation and Parks (MECP).

If it is expected that greater than 50,000 L/day of water will be pumped, a CDAR and/or a PTTW should be obtained as soon as possible in advance of construction to avoid possible delays. Depending on the construction methodology for the site servicing (trench boxes or open cut, and length of trench) and the time of year (high versus low ground water levels), there is the possibility that water taking of greater than 50,000 L/day may occur at this site.

A CDAR takes up to 1 month to complete if monitoring wells are already installed on site. Once the CDAR is completed, it is uploaded to the Environmental Activity and Sector Registry (EASR), which registers the construction dewatering with the MECP without the need for a permit. If the results of the CDAR indicate that greater than 400,000 L/day will be pumped, a PTTW application must be submitted to the MECP. A PTTW application can take up to an additional 3 months for the MECP to process upon completion of the CDAR. Note that Environmental Compliance Assessments, Impact Study Reports and applicable municipal, provincial and conservation authority approvals (completed by others) will be required as part of the CDAR.

5.9 Pipe Bedding and Cover/Embedment

The design information of the underground services was not available at the time of preparation of this report. The following subsections provide preliminary geotechnical engineering information for the design of underground services with relatively shallow inverts. Trench excavation should be carried out in accordance with the *Occupational Health and Safety Act (OHSA) and Regulations for Construction Projects* (O.Reg. 213/91 with recent amendments), while trench bedding, backfilling and compaction should be carried out in accordance with OPSD 802.010, OPSD 802.030, OPSD 802.031, OPSD 802.032 and /or OPSS MUNI 401, as appropriate.

The undisturbed native soil or shale bedrock, encountered will be suitable for support of buried services that are properly bedded. Where disturbance of the trench base has occurred, due to groundwater seepage, or construction traffic, the disturbed soils should be sub-excavated and replaced with suitably compacted granular material. Any accumulation of water at the base of the excavation and any soft/loose soils should be removed prior to placement of the pipe bedding/embankment. Placement of the pipe bedding/embedment must be done in dry condition.

Concrete pipe should be installed in conformance with the OPSD 802.030, OPSD 802.031, OPSD 802.032 or OPSD 802.033 requirements, as appropriate, while PVC or HDPE pipe should be installed in conformance with the OPSD 802.010 or OPSD 802.013 requirements, as appropriate. The bedding and embedment material includes OPSS.MUNI 1010 Granular A while the cover material for rigid pipes include OPSS.MUNI 1010 Granular B with 100% passing 26.5 mm sieve. Further detail information on bedding/embedment and cover materials can be provided at the detailed design phase.

The bedding, embedment and cover materials should be placed in layers not exceeding 200 mm in thickness and compacted to a minimum of 95% Standard Proctor Maximum Dry Density (SPMDD) or vibrated into a dense state in the case of clear stone type bedding.

5.10 Backfill

The native soils are considered suitable for backfill provided the moisture content of these soils is within 2% of the Optimum Moisture Content (OMC). It should be noted that there may be wet zones within the subsurface soils (particularly soils excavated from below the prevailing groundwater level) which could be too wet to compact. Any soil material with 3% or higher in-situ moisture content than its OMC, could be put aside to dry or be tilled to reduce the moisture content so that it can be effectively compacted. Alternatively, materials of higher moisture content could be wasted and replaced with imported material which can be readily compacted.

In settlement sensitive areas, the backfill should consist of clean earth and should be placed in lifts of 150 mm thickness or less, and heavily compacted to a minimum of 98% SPMDD at a water content close to optimum (within 2%). The upper 1.2 m of the pavement subgrade must be compacted to a minimum of 100% SPMDD.

It should be noted that the soils encountered on the site are generally not free draining, and will be difficult to handle and compact should they become wetter as a result of inclement weather or seepage. Hence, it can be expected that the earthworks will be difficult and may incur additional costs if carried out during wet periods (i.e. spring and fall) of the year.

5.11 Sulphate Attack

Three (3) samples of soil (Borehole 2, Sample 6; Borehole 6, Sample 5; and Borehole 8, Sample 6) were selected and tested for a suite of corrosivity parameters consisting of pH, Resistivity, Electrical

Conductivity, Redox Potential, Sulphate, Sulphide, and Chloride. A copy of the Certificates of Analyses is included in Appendix C.

Concrete material embedded in soil may be subjected to potential sulphate attack depending upon the site specific soil conditions. The test results indicated that the concentration of sulphate in soil ranged from 33 to 140 µg/g (equivalent to 0.0033 to 0.0140% by mass). The analytical results of soluble sulphate concentration were compared to the *Canadian Standard CAN3/CSA A23.1-M94 Table 3, Additional Requirements for Concrete Subjected to Sulphate Attack*. It is anticipated that these results would be used to determine the type of cementing materials to be used to produce concrete for this project. Comparison of the test results indicates that the water-soluble sulphate concentrations in soil are lower than 0.1%. Based on this result, there is a negligible potential for sulphate attack on the concrete, regardless of cementing material used.

5.12 Shoring Design

Decisions regarding shoring methods and sequencing are the responsibility of the Contractor. Temporary shoring should be carried out by a licensed Professional Engineer experienced in shoring design.

The detailed design of the proposed building was not available at the time of preparation of this report. The sections along the perimeter of the site will likely have to be shored to preserve the integrity of the boundary conditions (adjacent structures and roads). No excavation shall extend below a line cast as one vertical to one horizontal from foundations of the existing structures without adequate alternate support being provided. Where the adjacent building foundations are removed from the excavation, a foundation which lies above a line drawn upward at 10 horizontal to 7 vertical from the closest excavation edge is within the zone of potential influence of the excavation, and support for the existing foundations must be carefully assessed and possibly augmented.

The shoring requirements for the site will have to be examined in detail with respect to the site boundary constraints, once the development details and the building footprint are finalized. Depending upon the boundary conditions and structures located in the vicinity, groundwater condition and dewatering details, the shoring system may consist of a rigid (interlocking drilled caissons) or a steel soldier piles and timber lagging shoring system, or a combination of both. Based on the subsurface soil conditions (predominantly low permeability cohesive soils) a soldier piles and timber lagging shoring system should suffice for the site except in the area where existing structures are located in the close proximity/zone of influence of the excavation where a caisson wall shoring system will be required to provide support to existing foundations at an at-rest condition.

According to the groundwater levels monitored from December 10, 2019 to January 9, 2020, the groundwater levels within the fill layer ranged from 1.3 to 1.7 mbg (Borehole 1) and from 1.6 to 3.3 mbg (Borehole 8). The highest perched groundwater level throughout the monitoring period is 1.3 mbg at Borehole 1 and therefore, we recommend the groundwater level may be designed to be at 1.5 m below grade (about Elev. 127.3 m) across the site.

5.12.1 Earth Pressure Distribution

If a single level of support will be required for shoring system, a triangular earth pressure distribution similar to that used for the basement wall design, is appropriate for this case,

$$P = K(\gamma H + q)$$

Where:

P = the horizontal pressure (kPa)
K = the earth pressure coefficient
H = the total depth of excavation (m)
γ = the bulk unit weight of soil (kN/m^3)

q = the complete surcharge loading (kPa)

Applicable soil parameters are included in the Earth Pressure Design Parameters Section (Section 5.2).

Where with multiple supports are used to support the excavation, research has shown that a distributed pressure diagram more realistically approximates the earth pressure on a shoring system of this type, when restrained by pre-tensioned anchors.

The borehole data indicate that very stiff to hard clayey to sandy silt till would be encountered in the excavations. For the cohesive soils, a multi-level supported shoring system can be designed based on an earth pressure distribution consisting of a trapezoidal pressure distribution with a maximum pressure defined by:

$$P = 0.8\ K(\gamma H + q)$$

Where:

P = the horizontal pressure (kPa)
K = the earth pressure coefficient
γ = the bulk unit weight of soil (kN/m^3)
H = the total depth of excavation (m)
q = the complete surcharge loading (kPa)

The upper quarter of the trapezoid shall be **¼H** with zero pressure at grade level and increasing linearly to the maximum. The maximum pressure is applied to within **¼H** of the excavation base. The pressure distribution can be diminished linearly from this maximum to zero at the excavation base.

For the cohesionless soils, a multi-level supported shoring system can be designed based on an earth pressure distribution consisting of a rectangular pressure distribution with a maximum pressure defined by:

$$P = 0.65\ K(\gamma H + q)$$

Where:

P = the horizontal pressure (kPa)
K = the earth pressure coefficient
γ = the bulk unit weight of soil (kN/m^3)
H = the total depth of excavation (m)
q = the complete surcharge loading (kPa)

For groundwater pressure distribution along the shoring wall in conjunction with the above soil pressures, the static groundwater elevation for shoring design should be taken at the ground surface. This groundwater pressure distribution is applicable where an impermeable boundary condition is created along the perimeter of the excavation, as is the case with an interlocking caisson wall.

The bedrock induces no pressure on shoring systems. Where the excavation penetrates the bedrock, the rock excavation is nominally self-supporting in a vertical face, provided the rock bedding is horizontally oriented.

5.12.2 Pile Toe Design

Pile toes will be made in sound/unweathered bedrock of the Georgian Bay Formation. The maximum factored geotechnical resistance at ULS for the design of a pile, embedded in the sound bedrock is 10 MPa. The maximum factored ultimate lateral geotechnical resistance of the sound rock at ULS is 1 MPa.

The earth fill is sufficiently wet and permeable such that augured borings for soldier piles made into these soils will be unstable. It will be necessary to advance temporarily cased holes to the bedrock surface to prevent excess caving during the soldier pile installations. There may also be seepage from the relatively pervious lenses likely present within the native soils.

5.12.3 Lateral Bracing Elements

It will be necessary to secure encroachment agreements from the Region/City and the adjacent land owners, in order to use soil anchors on the adjoining properties. Pre-construction condition surveys should be carried out for the adjacent structures to establish existing conditions prior to excavation and mitigate the possibility of spurious claims for excavation induced damages. Access to the properties for such surveys must be part of any encroachment agreements.

A careful evaluation of the subsurface soil conditions is required by the shoring designer to establish appropriate levels/elevations and design the soil anchors. The anchor design will be governed by the weakest material in the profile. It is imperative that a detailed design is carried out at different anchor levels and locations, and the anchors must be tested at each level.

Consideration should be given a post-grouted anchor system which may be a more feasible option for this site. The design adhesion for post-grouted earth anchors is controlled as much by the installation technique as the soil and therefore a proto-type anchor must be made and performance tested to 200% of the design load at each anchor level to demonstrate the anchor capacity and validate the design assumptions. This test must be completed before production anchors are made. All production anchors must be proof-tested to 133% of the design load, to validate the design assumptions.

Depending upon the location and elevation, the anchors made in glacial till at this site may be designed based on a working bond adhesion of 40 to 50 kPa. The post-grouted anchors (150-mm-diameter) may carry from about 50 to 60 kN/metre of length depending upon the material type as confirmed by a performance/load test. Anchors made in bedrock of the Georgian Bay Formation may be designed using a factored ULS adhesion of 620 kPa. It should be noted that these values are provided as preliminary guidance only and the actual anchor performance must be verified by a performance/load test.

Regardless, the subsurface soil information should be reviewed by the shoring designer to decide on the suitable type of earth anchors and anchor capacity to be employed at this site.

If adjacent land owners are not agreeable to anchored support then internal bracing or rakers would be necessary. The footings for the rakers would be made in very stiff to hard undisturbed native soils where they could be designed for a bearing pressure of 200 kPa when inclined at 45 degrees.

5.13 Quality Control

All foundations must be monitored by the geotechnical engineer on a continuous basis as they are constructed. The on-site review of the condition of the foundation soil as the foundations are constructed is an integral part of the geotechnical design function and is required by Section 4.2.2.2 of the Ontario Building Code. If Englobe is not retained to carry out foundation evaluations during construction, then Englobe accepts no responsibility for the performance or non-performance of the foundations, even if they are ostensibly constructed in accordance with the conceptual design advice provided in this report.

Concrete for this structure will be specified in accordance with the requirements of CAN/CSA A23.1. Englobe maintains a CSA certified concrete laboratory and can provide concrete sampling and testing services for the project as necessary.

The requirements for fill placement on this project should be stipulated relative to SPMDD, as determined by ASTM D698. In-situ determinations of density during fill placement by Procedure Method B of ASTM D2922 are recommended to demonstrate that the contractor is achieving the specified soil density. Englobe is a CNSC licensed operator of appropriate nuclear density gauges for this work and can provide sampling and testing services for the project as necessary.

Englobe can provide thorough in house resources, quality control services for Building Envelope, Roofing and Structural Steel in accordance with CSA W178, as necessary, for the Structural and Architectural quality control requirements of the project. Englobe is certified by the Canadian Welding Bureau under W178.1-1996.

5

6 Limitations and Risks

6.1 Procedures

This investigation has been carried out using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by Englobe Corp. and other engineering practitioners, working under similar conditions and subject to the time, financial and physical constraints applicable to this project. The discussions and recommendations that have been presented are based on the factual data obtained by Englobe Corp.

It must be recognized that there are special risks whenever engineering or related disciplines are applied to identify subsurface conditions. Even a comprehensive sampling and testing programme implemented in accordance with the most stringent level of care may fail to detect certain conditions. Englobe Corp. has assumed for the purposes of providing design parameters and advice, that the conditions that exist between sampling points are similar to those found at the sample locations. The conditions that Englobe Corp. has interpreted to exist between sampling points can differ from those that actually exist.

It may not be possible to drill a sufficient number of boreholes or sample and report them in a way that would provide all the subsurface information that could affect construction costs, techniques, equipment and scheduling. Contractors bidding on or undertaking work on the project should be directed to draw their own conclusions as to how the subsurface conditions may affect them, based on their own investigations and their own interpretations of the factual investigation results, cognizant of the risks implicit in the subsurface investigation activities so that they may draw their own conclusions as to how the subsurface conditions may affect them.

6.2 Changes in Site and Scope

It must also be recognized that the passage of time, natural occurrences, and direct or indirect human intervention at or near the site have the potential to alter subsurface conditions. Groundwater levels are particularly susceptible to seasonal fluctuations.

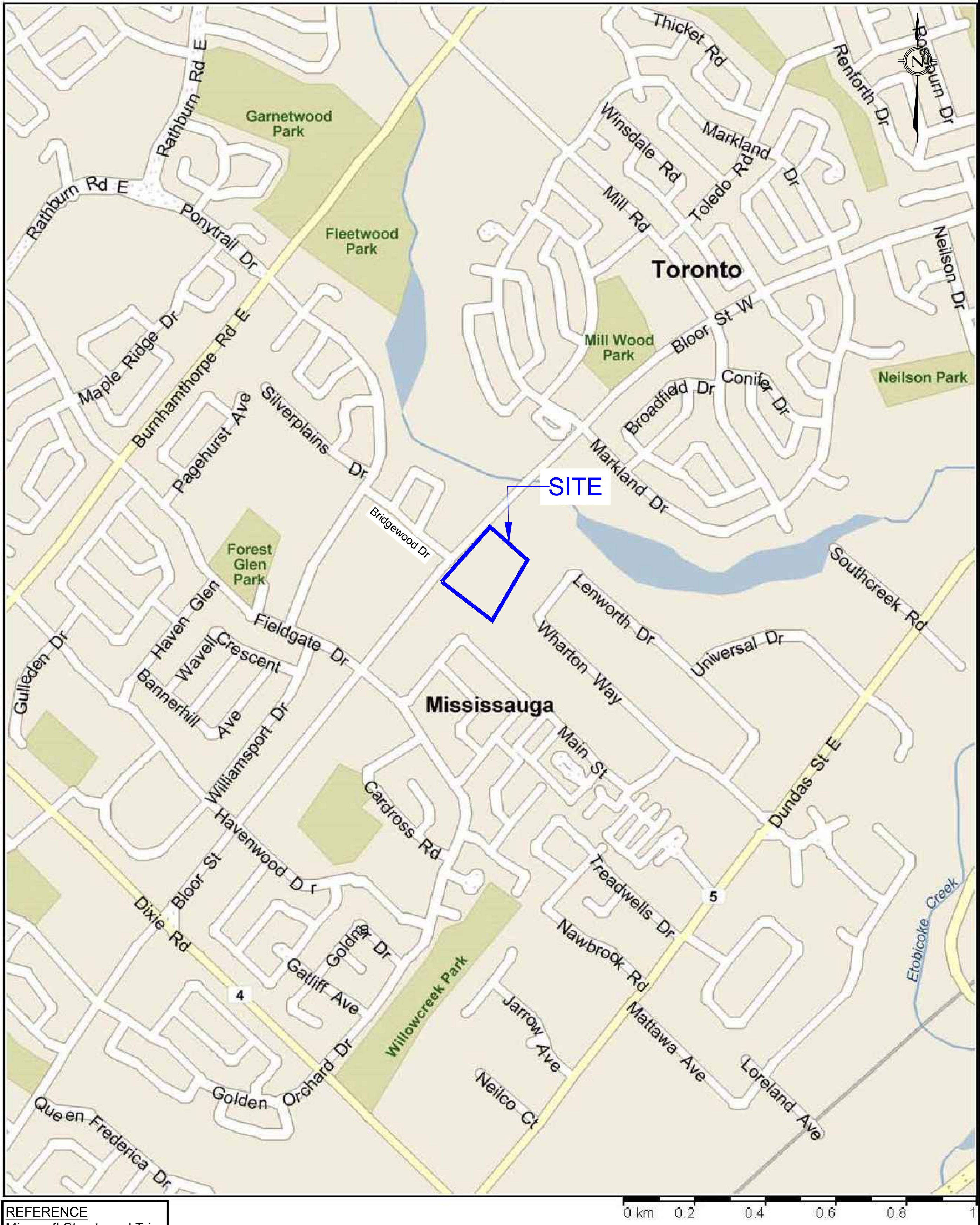
The discussion and recommendations are based on the factual data obtained from this investigation made at the site by Englobe and are intended for use by the owner and its retained designers in the design phase of the project. If there are changes to the project scope and development features, the interpretations made of the subsurface information, the geotechnical design parameters and comments relating to constructability issues and quality control may not be relevant or complete for the revised project. Englobe should be retained to review the implications of such changes with respect to the contents of this report.

This report was prepared for the express use of Ranee Management and their retained design consultants and is not for use by others. This report is copyright of Englobe Corp. and no part of this report may be reproduced by any means, in any form, without the prior written permission of Englobe Corp. and Ranee Management who are the authorized users.

It is recognized that the regulatory agencies in their capacities as the planning and building authorities under Provincial statues, will make use of and rely upon this report, cognizant of the limitations thereof, both expressed and implied.

We trust the foregoing information is sufficient for your present requirements. If you have any questions, or if we can be of further assistance, please do not hesitate to contact us.

Figures



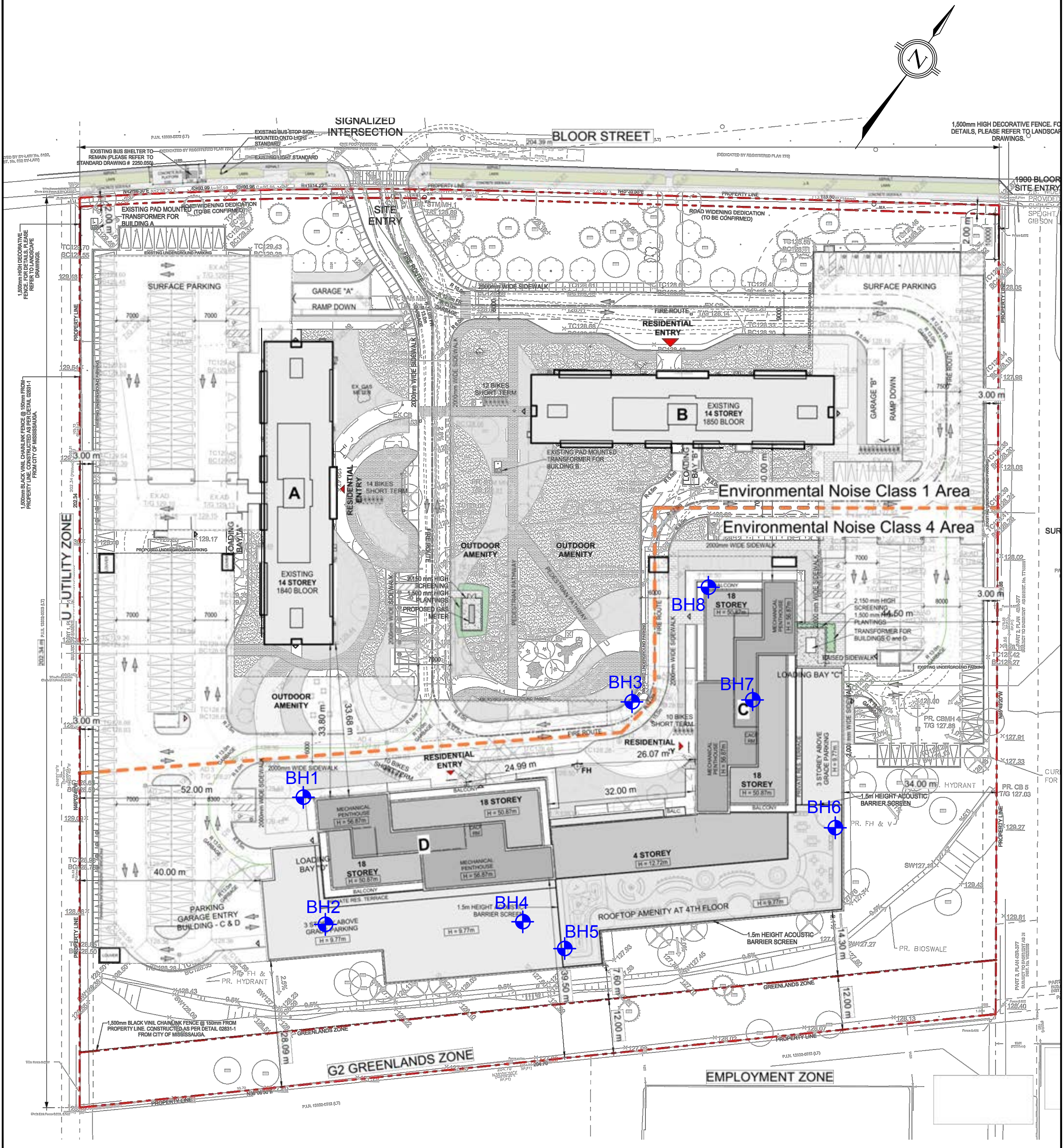
REFERENCE
Microsoft Streets and Trips

Title:

SITE LOCATION PLAN

File. No.: 02405214.000

FIGURE : 1



REFERENCE
Sheet Title: Concept Site Plan
Project No.: 120303, Date: 2024/06/26
Sheet No.: A-003
By: Arcadis Architects (Canada)Inc.

LEGEND

⌖ Approximate Borehole Location

SCALE 8 0 20m

ENGLOBE

Title:

BOREHOLE LOCATION PLAN

File. No.: 02405214.000

FIGURE : 2

Appendix A
Borehole Logs

ENGLOBE

ABBREVIATIONS AND TERMINOLOGY

SAMPLING METHODS

AS	auger sample
CORE	cored sample
DP	direct push
FV	field vane
GS	grab sample
SS	split spoon
ST	shelby tube
WS	wash sample

PENETRATION RESISTANCE

Standard Penetration Test (SPT) resistance ('N' values) is defined as the number of blows by a hammer weighing 63.6 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.) required to advance a standard 50 mm (2 in.) diameter split spoon sampler for a distance of 0.3 m (12 in.).

Dynamic Cone Test (DCT) resistance is defined as the number of blows by a hammer weighing 63.6 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.) required to advance a conical steel point of 50 mm (2 in.) diameter and with 60° sides on 'A' size drill rods for a distance of 0.3 m (12 in.)."

COHESIONLESS SOILS

Compactness	'N' value
very loose	< 4
loose	4 – 10
compact	10 – 30
dense	30 – 50
very dense	> 50

COHESIVE SOILS

Consistency	'N' value	Undrained Shear Strength (kPa)
very soft	< 2	< 12
soft	2 – 4	12 – 25
firm	4 – 8	25 – 50
stiff	8 – 15	50 – 100
very stiff	15 – 30	100 – 200
hard	> 30	> 200

COMPOSITION

Term (e.g)	% by weight
trace silt	< 10
some silt	10 – 20
silty	20 – 35
sand *and* silt	> 35

TESTS AND SYMBOLS

MH	mechanical sieve and hydrometer analysis
w, w_c	water content
w_L, LL	liquid limit
w_P, PL	plastic limit
I_P, PI	plasticity index
k	coefficient of permeability
γ	soil unit weight, bulk
G_s	specific gravity
φ'	internal friction angle
c'	effective cohesion
c_u	undrained shear strength

∇	Unstabilized water level
⧨	1st water level measurement
⧩	2nd water level measurement
▼	Most recent water level measurement
3.0 +	Undrained shear strength from field vane (with sensitivity)
C_c	compression index
c_v	coefficient of consolidation
m_v	coefficient of compressibility
e	void ratio

FIELD MOISTURE DESCRIPTIONS

Damp	refers to a soil sample that does not exhibit any observable pore water from field/hand inspection.
Moist	refers to a soil sample that exhibits evidence of existing pore water (e.g. sample feels cool, cohesive soil is at plastic limit) but does not have visible pore water
Wet	refers to a soil sample that has visible pore water

LOG OF BOREHOLE 1

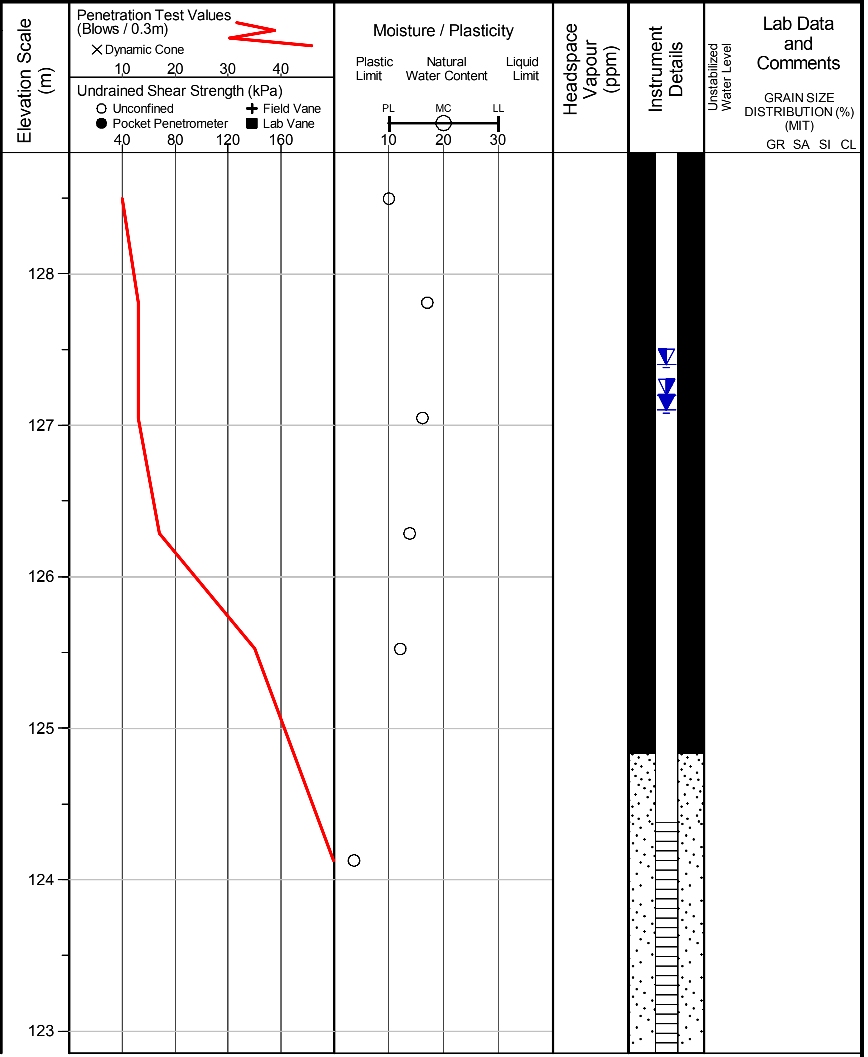
Project No. : 02405214.001
Date started : November 29, 2019
Sheet No. : 1 of 1

Client : Ranee Management
Project : 1840 - 1850 Bloor Street
Location : Mississauga, Ontario

Originated by : DH
Compiled by : JKA
Checked by : BS

Position : E: 614303, N: 4831204 (UTM 17T)
Rig type : Track-mounted
Elevation Datum : Geodetic
Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	SOIL PROFILE Description	SAMPLES Number	Type	SPT 'N' Value
0	128.8	**GROUND SURFACE**			
	128.6 0.2	160mm **TOPSOIL**			
		FILL, sandy silt, trace to some clay, trace gravel, trace organics, compact, greyish brown, moist	1	SS	10
1			2	SS	13
2			3	SS	13
	126.5 2.3	**SILTY SAND**, trace gravel, compact, brown, wet	4	SS	17
3	125.8 3.0	**CLAYEY SILT**, some sand, trace gravel, hard, grey, moist (GLACIAL TILL)	5	SS	35
4					
5	124.2 4.6	**INFERRED BEDROCK**, weathered to partially unweathered shale with intermittent limestone/dolostone stringers **(Georgian Bay Formation)**	6	SS	50 / 50mm
	122.9 5.9				



END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Dec 10, 2019	1.4	127.4
Dec 16, 2019	1.6	127.2
Dec 23, 2019	1.3	127.5
Jan 9, 2020	1.7	127.1

file: 02405214.001 bh logs 2024-07-16.gpj

ENGLOBE

LOG OF BOREHOLE 2

Project No. : 02405214.001	Client : Ranee Management	Originated by : DH
Date started : November 29, 2019	Project : 1840 - 1850 Bloor Street	Compiled by : JKA
Sheet No. : 1 of 1	Location : Mississauga, Ontario	Checked by : BS

Position : E: 614327, N: 4831189 (UTM 17T)	Elevation Datum : Geodetic
Rig type : Track-mounted	Drilling Method : Hollow stem augers

Elev Depth (m)	SOIL PROFILE Description	SAMPLES Number	Type	SPT 'N' Value	Lab Data and Comments GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL
129.6	**GROUND SURFACE**				
	140mm **TOPSOIL**				
	FILL, clayey silt, some sand to sandy, trace gravel, trace organics, firm, greyish brown, moist	1	SS	6	
		2	SS	6	
128.1 1.5	**FILL**, sandy silt, trace to some clay, trace organics, loose to compact, brown to dark brown, moist	3	SS	9	
		4	SS	17	
126.6 3.0	**SILT AND SAND**, some clay, trace gravel, compact, brownish grey, moist (GLACIAL TILL)	5	SS	29	2 44 43 11
125.0 4.6	**SAND AND GRAVEL**, trace silt, very dense, grey, wet	6	SS	86 / 200mm	
123.5 6.1	**INFERRED BEDROCK**, weathered to partially unweathered shale with intermittent limestone/dolostone stringers **(Georgian Bay Formation)**	7	SS	50 / 75mm	
123.3 6.3					

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Depth Scale (m): 0 1 2 3 4 5 6

file: 02405214.001 bh logs 2024-07-16.gpj

LOG OF BOREHOLE 3

Project No. : 02405214.001
Date started : November 27, 2019
Sheet No. : 1 of 1

Client : Ranee Management
Project : 1840 - 1850 Bloor Street
Location : Mississauga, Ontario

Originated by : DH
Compiled by : JKA
Checked by : BS

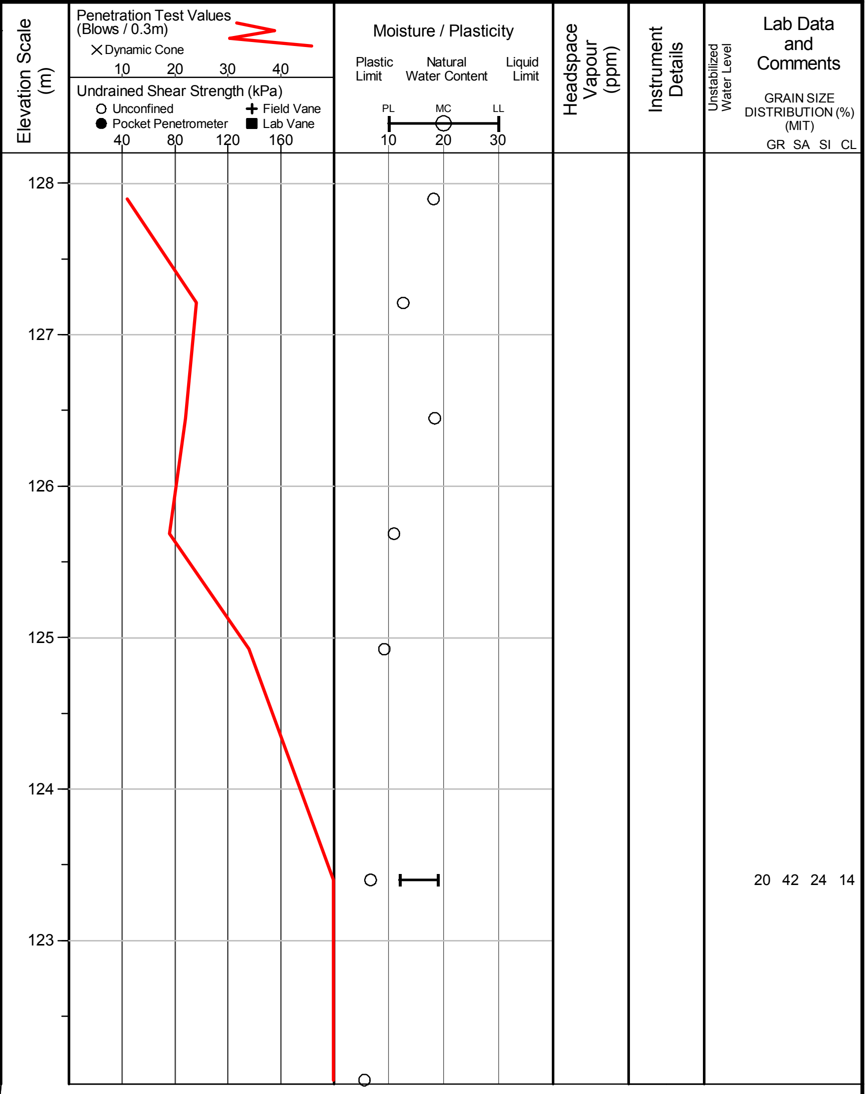
Position : E: 614337, N: 4831274 (UTM 17T)
Rig type : Track-mounted

Elevation Datum : Geodetic
Drilling Method : Hollow stem augers

SOIL PROFILE		SAMPLES			Lab Data and Comments GRAIN SIZE DISTRIBUTION (%) (MIT)			
Elev Depth (m)	Description	Number	Type	SPT 'N' Value	GR	SA	SI	CL
128.2	**GROUND SURFACE**							
	150mm **TOPSOIL**							
128.0 0.2	**FILL**, clayey silt, some sand, trace organics, stiff, brown, moist	1	SS	11				
127.6 0.6	**CLAYEY to SANDY SILT**, trace gravel, very stiff to hard, brown / grey, moist (GLACIAL TILL)	2	SS	24				
	...silt lenses	3	SS	22				
	...grey below	4	SS	19				
		5	SS	34				
123.6 4.6	**SILTY SAND**, some clay, some gravel, very dense, grey, damp (GLACIAL TILL)	6	SS	59	20	42	24	14
122.1								
122.1 6.1	**INFERRED BEDROCK**, weathered to partially unweathered shale with intermittent limestone/dolostone stringers **(Georgian Bay Formation)**	7	SS	50 / 50mm				

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.



LOG OF BOREHOLE 4

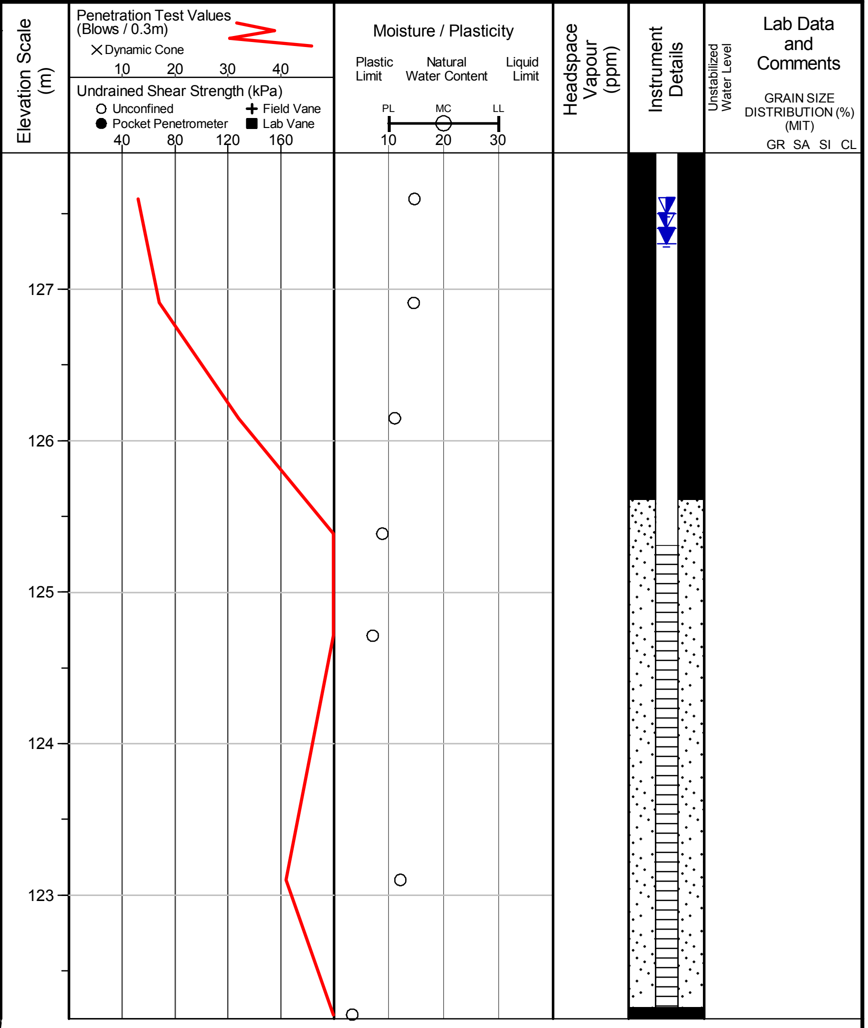
Project No. : 02405214.001
Date started : November 28, 2019
Sheet No. : 1 of 1

Client : Ranee Management
Project : 1840 - 1850 Bloor Street
Location : Mississauga, Ontario

Originated by : DH
Compiled by : JKA
Checked by : BS

Position : E: 614357, N: 4831221 (UTM 17T)
Rig type : Track-mounted
Elevation Datum : Geodetic
Drilling Method : Hollow stem augers

Elev Depth (m)	SOIL PROFILE Description	SAMPLES Number	Type	SPT 'N' Value
127.9	**GROUND SURFACE**			
127.7 0.2	150mm **TOPSOIL**			
	FILL, clayey silt, some sand, trace organics, stiff, brown, moist	1	SS	13
127.1 0.8	**CLAYEY to SANDY SILT**, some sand, trace gravel, very stiff to hard, brown, moist (GLACIAL TILL)	2	SS	17
		3	SS	32
		4	SS	73
		5	SS	50 / 125mm
123.3 4.6	**SANDY SILT**, trace clay, dense, grey, wet	6	SS	41
122.3 122.2 5.7	**INFERRED BEDROCK**, weathered to partially unweathered shale with intermittent limestone/dolostone stringers **(Georgian Bay Formation)**	7	SS	50 / 100mm



END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Dec 10, 2019	0.5	127.4
Dec 16, 2019	0.4	127.5
Dec 23, 2019	0.6	127.3
Jan 9, 2020	0.6	127.3

LOG OF BOREHOLE 5

Project No. : 02405214.001
Date started : November 28, 2019
Sheet No. : 1 of 1

Client : Ranee Management
Project : 1840 - 1850 Bloor Street
Location : Mississauga, Ontario

Originated by : DH
Compiled by : JKA
Checked by : BS

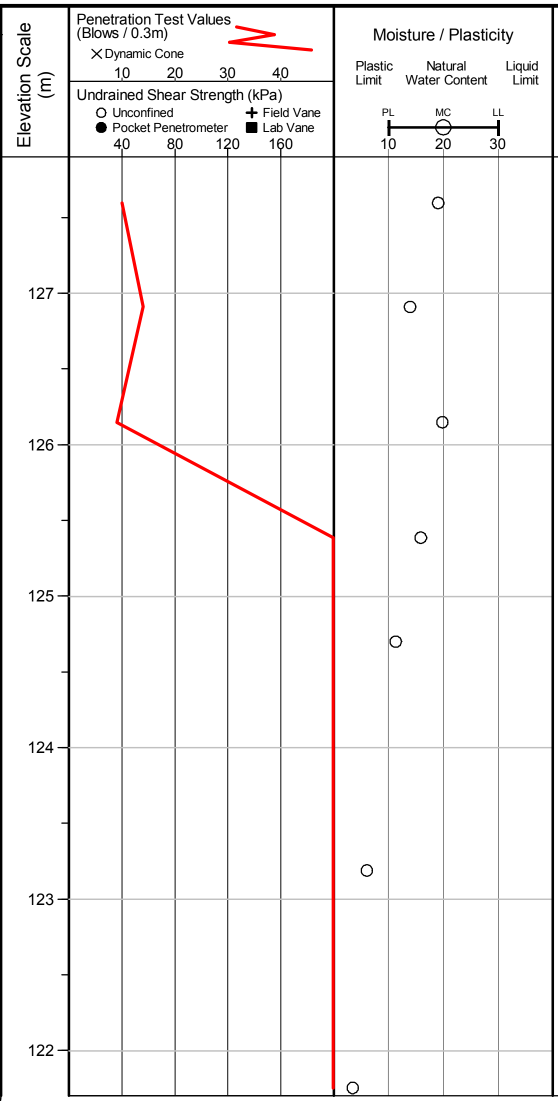
Position : E: 614367, N: 4831224 (UTM 17T)
Rig type : Track-mounted

Elevation Datum : Geodetic
Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	SOIL PROFILE Description	SAMPLES Number	Type	SPT 'N' Value
0	127.9	**GROUND SURFACE**			
	127.7 0.2	150mm **TOPSOIL**			
		FILL, clayey silt, some sand, trace organics, stiff, brown, moist	1	SS	10
1			2	SS	14
2			3	SS	9
	125.6 2.3	**CLAYEY to SANDY SILT**, trace gravel, ocassional silt lenses, hard, brown, moist (GLACIAL TILL)	4	SS	62
3			5	SS	50 / 150mm
4		...grey below	6	SS	50 / 125mm
5					
6	121.8				
	121.7 6.2	**INFERRED BEDROCK**, weathered to partially unweathered shale with intermittent limestone/dolostone stringers **(Georgian Bay Formation)**	7	SS	50 / 100mm

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.



Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

LOG OF BOREHOLE 6

Project No. : 02405214.001
Date started : November 28, 2019
Sheet No. : 1 of 1

Client : Ranee Management
Project : 1840 - 1850 Bloor Street
Location : Mississauga, Ontario

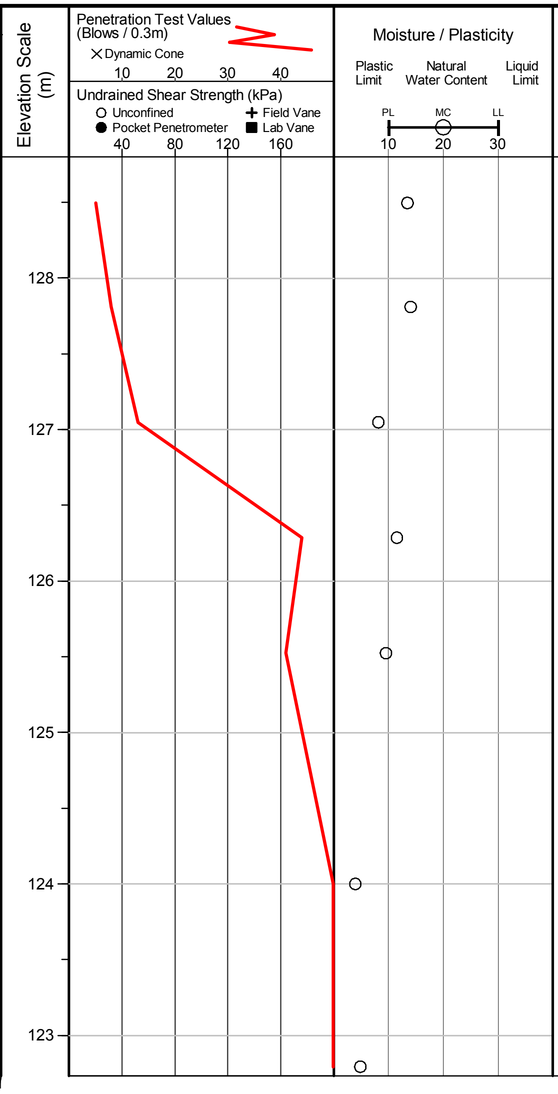
Originated by : DH
Compiled by : JKA
Checked by : BS

Position : E: 614389, N: 4831286 (UTM 17T)
Rig type : Track-mounted
Elevation Datum : Geodetic
Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	SOIL PROFILE Description	SAMPLES Number	SAMPLES Type	SAMPLES SPT 'N' Value	Lab Data and Comments GRAIN SIZE DISTRIBUTION (%) (MIT) GR	SA	SI	CL
0	128.8	**GROUND SURFACE**							
		140mm **TOPSOIL**							
		FILL, clayey silt, trace to some sand, trace organics, stiff, brown, moist	1	SS	5				
1			2	SS	8				
2			3	SS	13	0	7	59	34
	126.5 2.3	**CLAYEY to SANDY SILT**, trace to some gravel, hard, brown, moist (GLACIAL TILL)	4	SS	44				
3			5	SS	41				
4									
5		...sandy, grey below	6	SS	55				
	123.0 5.8	**INFERRED BEDROCK**, weathered to partially unweathered shale with intermittent limestone/dolostone stringers **(Georgian Bay Formation)**	7	SS	50 / 125mm				
6	122.7 6.1								

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.



Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

LOG OF BOREHOLE 7

Project No. : 02405214.001
Date started : November 27, 2019
Sheet No. : 1 of 1

Client : Ranee Management
Project : 1840 - 1850 Bloor Street
Location : Mississauga, Ontario

Originated by : DH
Compiled by : JKA
Checked by : BS

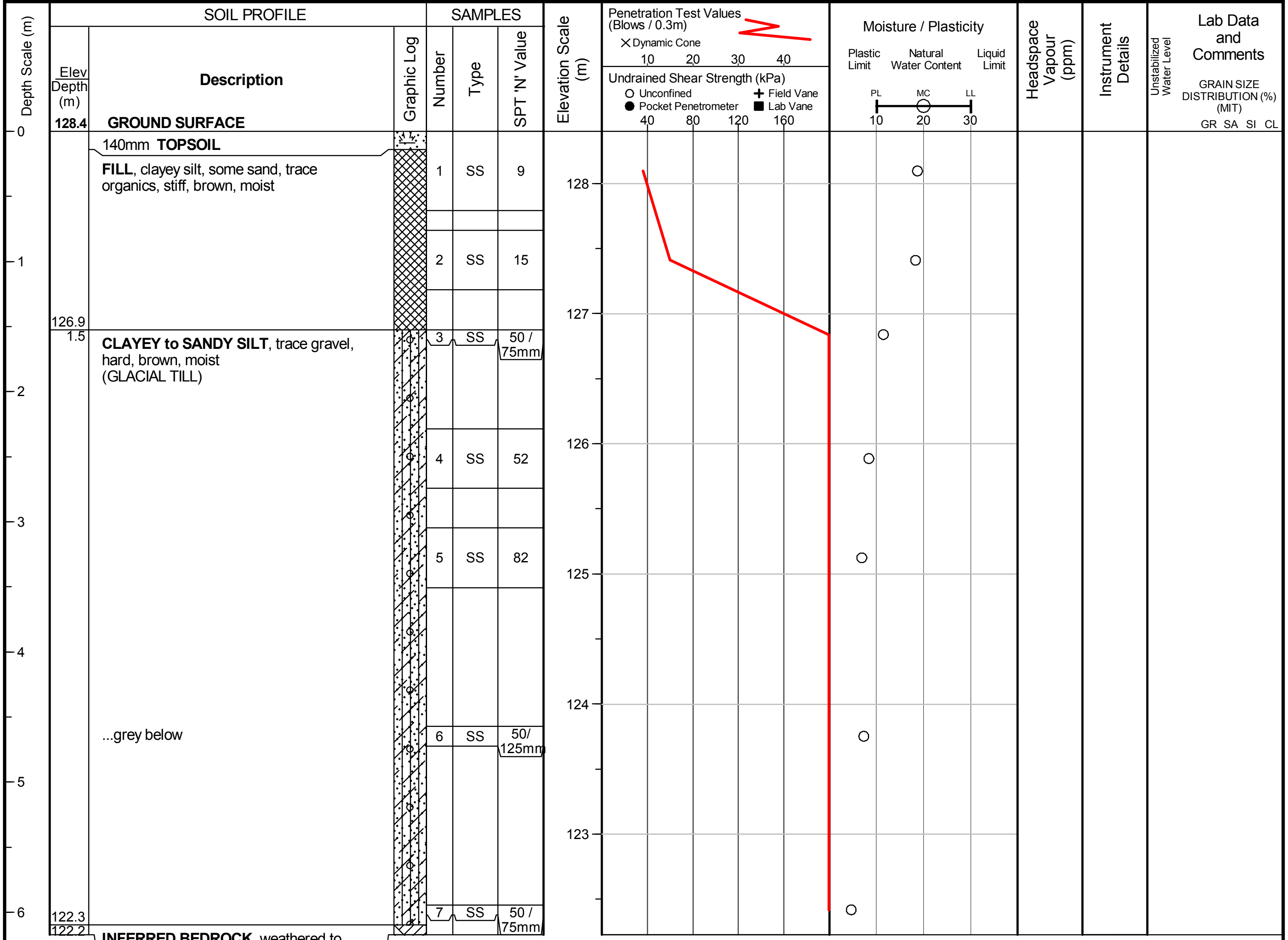
Position : E: 614356, N: 4831292 (UTM 17T)
Rig type : Track-mounted
Elevation Datum : Geodetic
Drilling Method : Hollow stem augers

Elev Depth (m)	SOIL PROFILE Description
128.4	**GROUND SURFACE**
	140mm **TOPSOIL**
	FILL, clayey silt, some sand, trace organics, stiff, brown, moist
126.9 1.5	**CLAYEY to SANDY SILT**, trace gravel, hard, brown, moist (GLACIAL TILL)
	...grey below
122.3 122.2 6.2	**INFERRED BEDROCK**, weathered to partially unweathered shale with intermittent limestone/dolostone stringers **(Georgian Bay Formation)**

END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

SAMPLES Number	Type	SPT 'N' Value
1	SS	9
2	SS	15
3	SS	50 / 75mm
4	SS	52
5	SS	82
6	SS	50/ 125mm
7	SS	50 / 75mm



LOG OF BOREHOLE 8

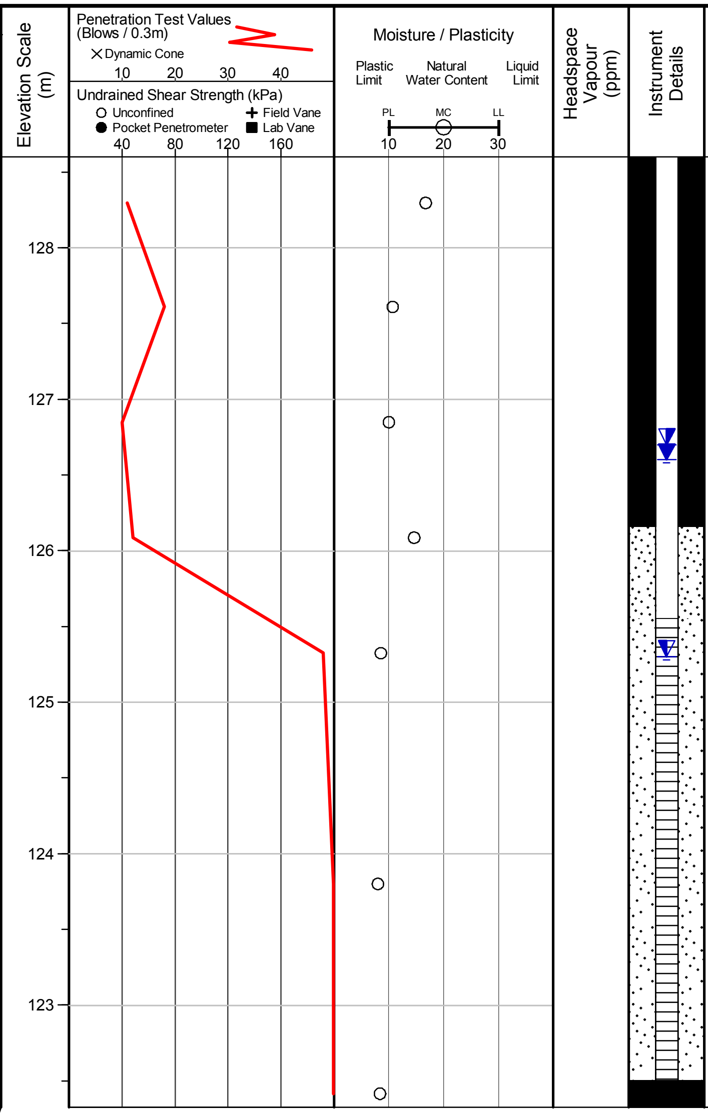
Project No. : 02405214.001
Date started : November 27, 2019
Sheet No. : 1 of 1

Client : Ranee Management
Project : 1840 - 1850 Bloor Street
Location : Mississauga, Ontario

Originated by : DH
Compiled by : JKA
Checked by : BS

Position : E: 614331, N: 4831302 (UTM 17T)
Rig type : Track-mounted
Elevation Datum : Geodetic
Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Number	Type	SPT 'N' Value	GR SA SI CL
0	**128.6**	**GROUND SURFACE**				
		140mm **TOPSOIL**				
		FILL, clayey silt, some sand, trace organics, stiff, brown to greyish brown, moist	1	SS	11	
1			2	SS	18	
2			3	SS	10	
	126.3 2.3	**CLAYEY to SANDY SILT**, trace gravel, stiff to hard, brown, moist (GLACIAL TILL)	4	SS	12	
3			5	SS	48	
4		...grey below				
5			6	SS	79	14 30 39 17
6	122.5					
	122.3 6.3	**INFERRED BEDROCK**, weathered to partially unweathered shale with intermittent limestone/dolostone stringers **(Georgian Bay Formation)**	7	SS	50 / 25mm	



Lab Data and Comments
GRAIN SIZE DISTRIBUTION (%) (MIT)

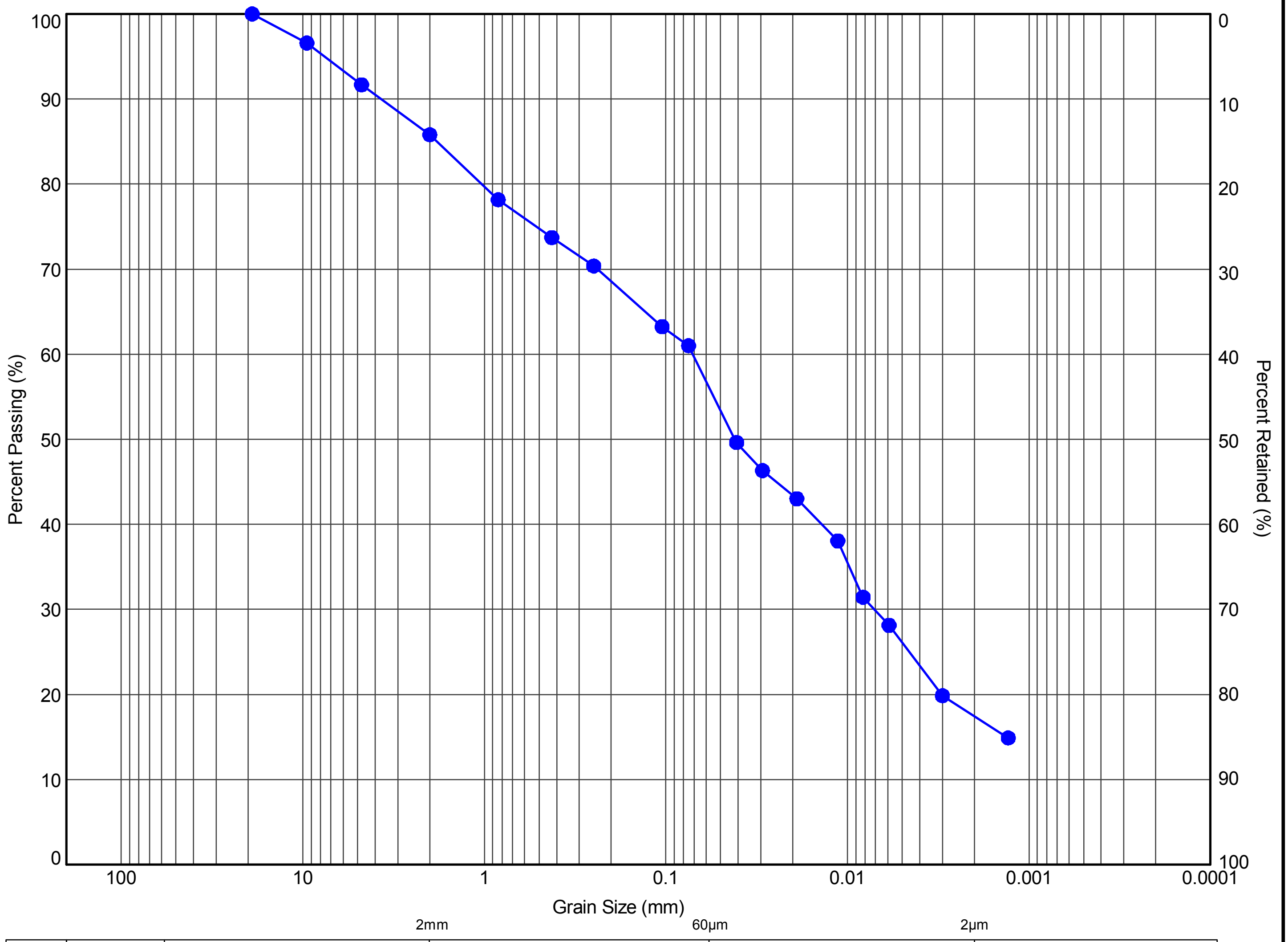
END OF BOREHOLE

Borehole was dry and open upon completion of drilling.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Dec 10, 2019	3.3	125.3
Dec 16, 2019	1.9	126.7
Dec 23, 2019	1.6	127.0
Jan 9, 2020	2.0	126.6

Appendix B
Borehole Logs



MIT SYSTEM	COBBLES	GRAVEL			SAND			SILT	CLAY
		COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE		

					MIT SYSTEM				
	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**8**	SS6	4.8	123.8	14	30	39	17	

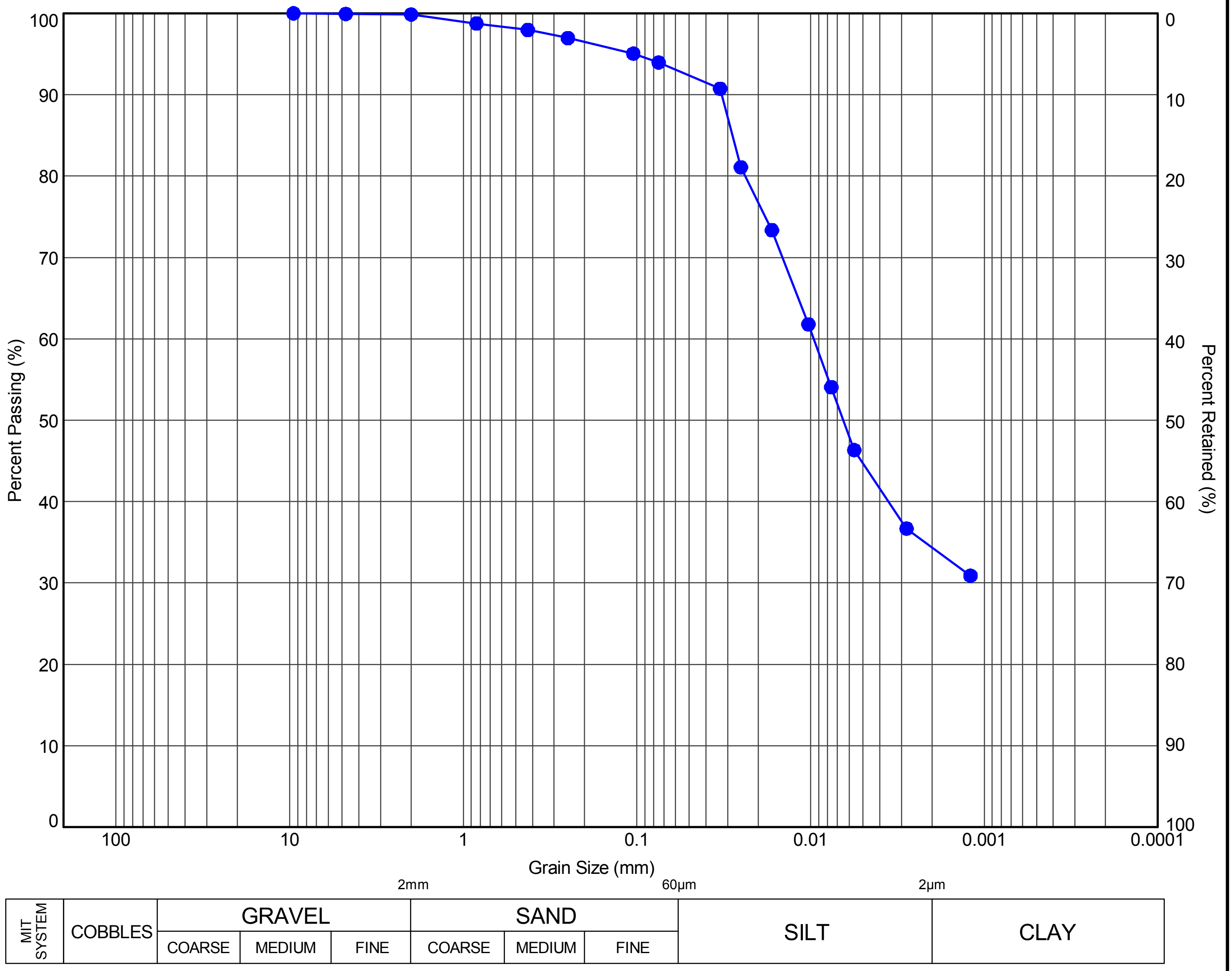
ENGLOBE

Title:

GRAIN SIZE DISTRIBUTION
SANDY SILT, SOME CLAY, SOME GRAVEL

File No.:

02405214.001



MIT SYSTEM

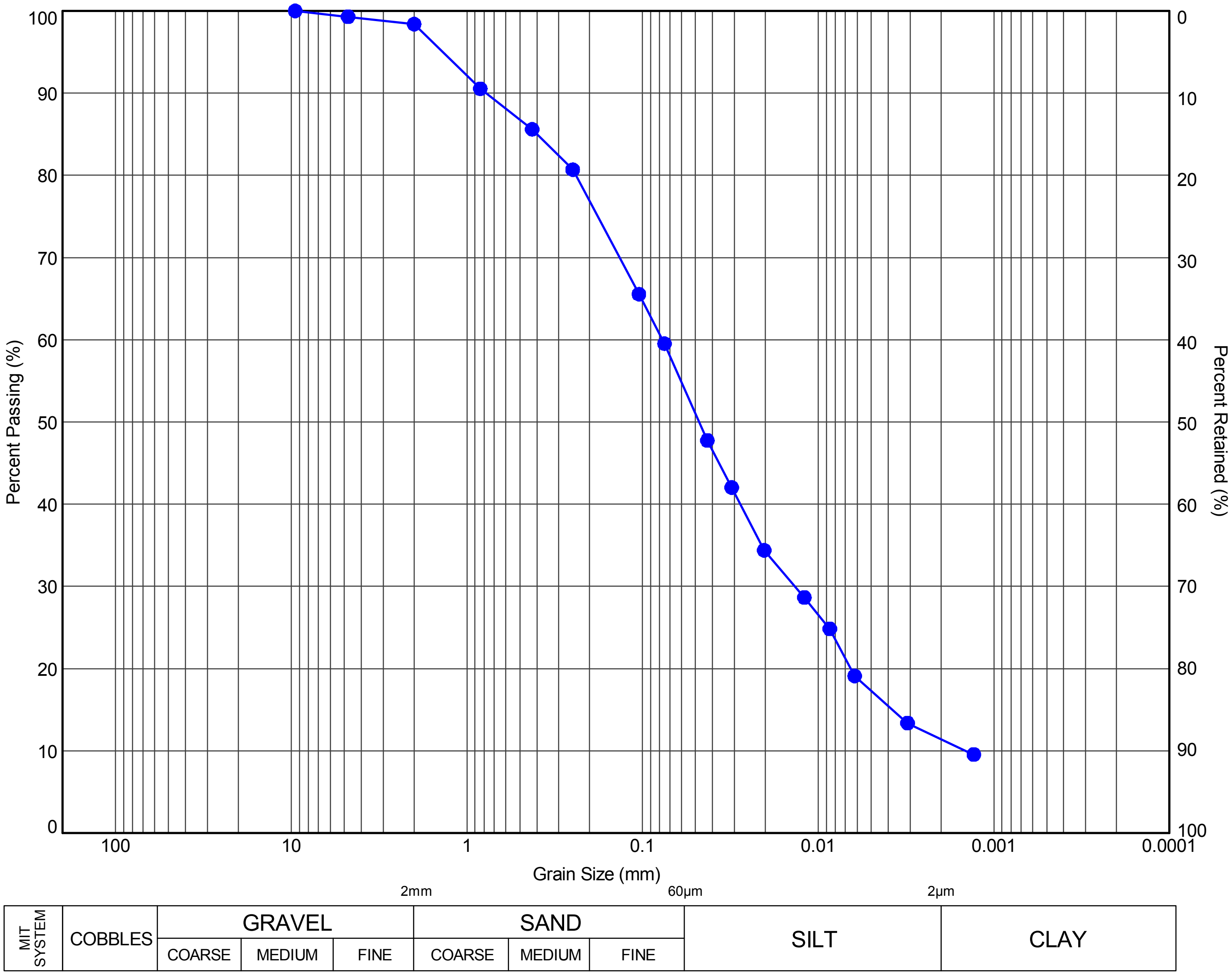
	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**6**	SS3	1.8	127.0	0	7	59	34	

Title:

GRAIN SIZE DISTRIBUTION
CLAYEY SILT, TRACE SAND

File No.:

02405214.001



	Hole ID	Sample	Depth (m)	Elev. (m)	MIT SYSTEM				
					Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**2**	SS5	3.3	126.3	2	44	43	11	

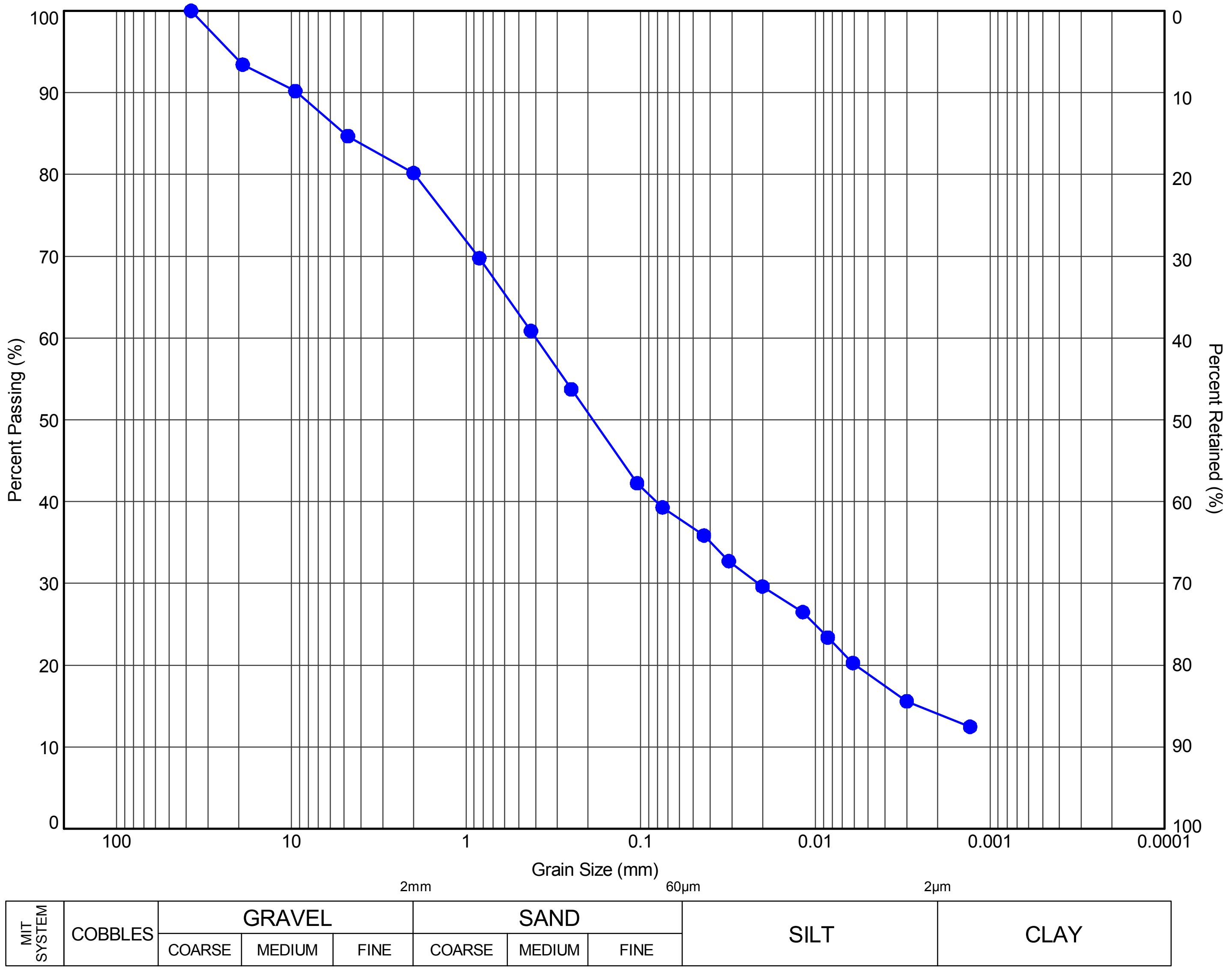
ENGLOBE

Title:

GRAIN SIZE DISTRIBUTION

SILT AND SAND, SOME CLAY, TRACE GRAVEL

File No.: **02405214.001**



					MIT SYSTEM				
	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**3**	SS6	4.8	123.4	20	42	24	14	

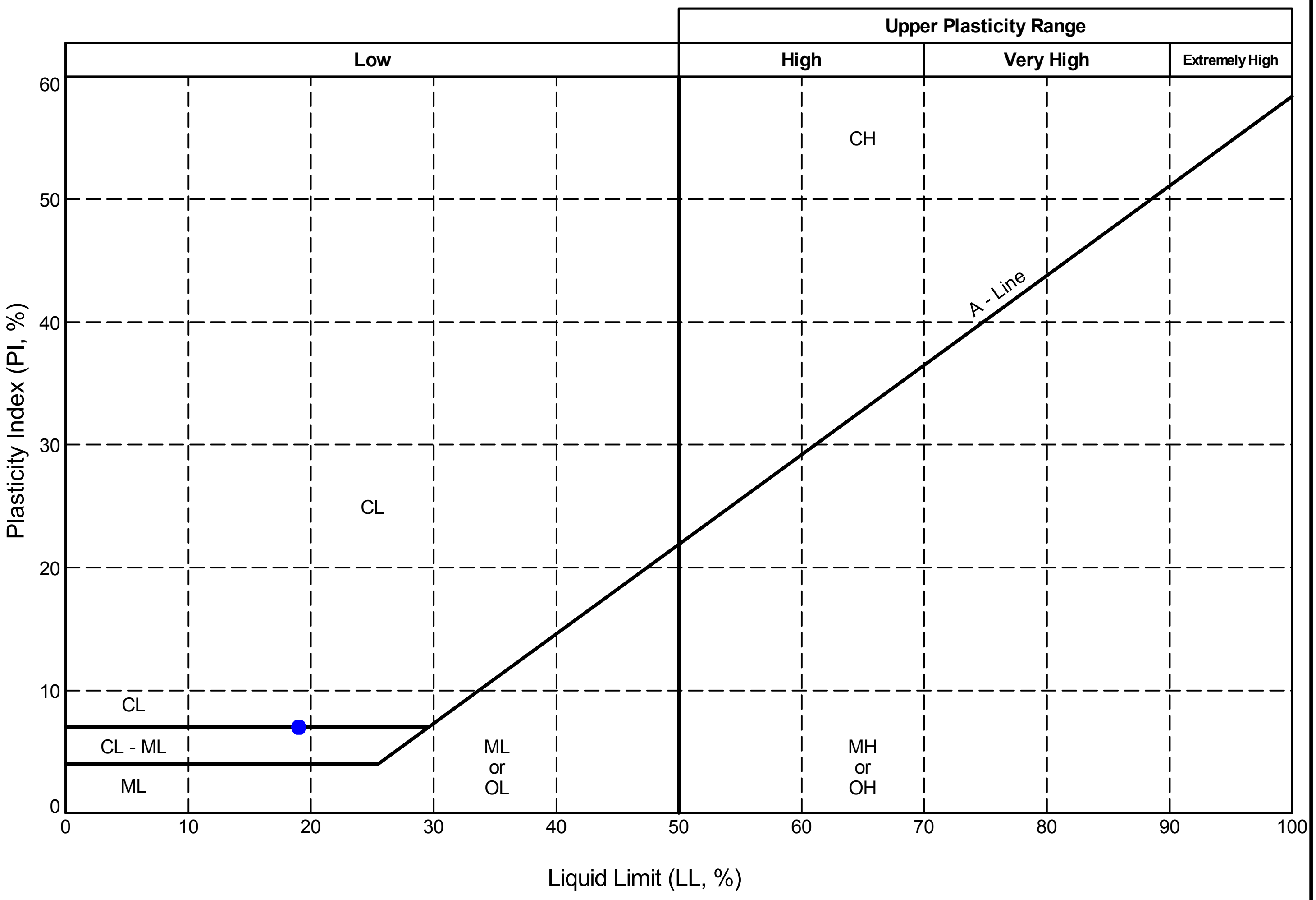
ENGLOBE

Title:

GRAIN SIZE DISTRIBUTION
SILTY SAND, SOME GRAVEL, SOME CLAY

File No.:

02405214.001



	Borehole	Sample	Depth (m)	Elev. (m)	LL (%)	PL (%)	PI (%)	Description
●	3	SS6	4.8	123.4	19	12	7	SLIGHTLY PLASTIC

ENGLOBE

Title:

ATTERBERG LIMITS CHART

File No.:

02405214.001

Appendix C
Certificate of Analysis

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: **TERRAPROBE INC.**
11 INDELL LANE
BRAMPTON, ON L6T3Y3
(905) 796-2650

ATTENTION TO: **Jeff Au**

PROJECT: **1840-1850 BLOOR ST CONDO**

AGAT WORK ORDER: **19T555887**

SOIL ANALYSIS REVIEWED BY: **Yris Verastegui, Report Reviewer**

DATE REPORTED: **Dec 30, 2019**

PAGES (INCLUDING COVER): **5**

VERSION*: **1**

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

Certificate of Analysis

AGAT WORK ORDER: 19T555887

PROJECT: 1840-1850 BLOOR ST CONDO

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: TERRAPROBE INC.

ATTENTION TO: Jeff Au

SAMPLING SITE:

SAMPLED BY:

Corrosivity Package

DATE RECEIVED: 2019-12-13

DATE REPORTED: 2019-12-30

			SAMPLE DESCRIPTION:	BH2/SS6	BH6/SS5	BH8/SS6
			SAMPLE TYPE:	Soil	Soil	Soil
			DATE SAMPLED:	2019-11-29	2019-11-28	2019-11-27
Parameter	**Unit**	**G / S**	**RDL**	**799225**	**799226**	**799227**
Chloride (2:1)	µg/g		2	117	36	6
Sulphate (2:1)	µg/g		2	33	43	140
pH (2:1)	pH Units		NA	8.13	8.16	8.17
Electrical Conductivity (2:1)	mS/cm		0.005	0.328	0.225	0.266
Resistivity (2:1) (Calculated)	ohm.cm		1	3050	4440	3760
Redox Potential 1	mV		NA	273	350	344
Redox Potential 2	mV		NA	273	353	314
Redox Potential 3	mV		NA	270	352	303

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

799225-799227 EC, pH, Chloride and Sulphate were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil). Resistivity is a calculated parameter.
Redox potential measured on as received sample. Due to the potential for rapid change in sample equilibrium chemistry with exposure to oxidative/reduction conditions laboratory results may differ from field measured results.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Iris Verástegui

Quality Assurance

CLIENT NAME: TERRAPROBE INC.

PROJECT: 1840-1850 BLOOR ST CONDO

SAMPLING SITE:

AGAT WORK ORDER: 19T555887

ATTENTION TO: Jeff Au

SAMPLED BY:

Soil Analysis

RPT Date: Dec 30, 2019			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Corrosivity Package															
Chloride (2:1)	797276		110	109	0.9%	< 2	98%	80%	120%	106%	80%	120%	98%	70%	130%
Sulphate (2:1)	797276		3430	3420	0.3%	< 2	104%	80%	120%	106%	80%	120%	101%	70%	130%
pH (2:1)	770878		7.88	7.90	0.3%	NA	101%	90%	110%	NA			NA		
Electrical Conductivity (2:1)	799262		0.104	0.105	1.0%	< 0.005	NA	90%	110%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.

Certified By: Iris Verástegui

Method Summary

CLIENT NAME: TERRAPROBE INC.

PROJECT: 1840-1850 BLOOR ST CONDO

SAMPLING SITE:

AGAT WORK ORDER: 19T555887

ATTENTION TO: Jeff Au

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Electrical Conductivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Resistivity (2:1) (Calculated)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Redox Potential 1	INOR-93-6066	G200-09, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 2	INOR-93-6066	G200-09, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 3	INOR-93-6066	G200-09, SM 2580 B	REDOX POTENTIAL ELECTRODE

AGAT Laboratories

/ BMS

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Laboratory Use Only

Work Order #: 19T555887

Cooler Quantity:

Arrival Temperatures: 6.4 | 6.5 | 6.5 / 6.3 | 6.4 | 6.4

Custody Seal Intact: ☐Yes ☐No ☐N/A

Notes:

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Report Information:

Company: Terraprobe
Contact: Jeff Au
Address: 11 Indell Lane
Brampton, ONT
Phone: 905.796.2650 X171 Fax:
Reports to be sent to:
1. Email: jau@terraprobe.ca
2. Email:

Regulatory Requirements:

☐ No Regulatory Requirement

(Please check all applicable boxes)

☐ Regulation 153/04
Table *Indicate One*
☐Ind/Com
☐Res/Park
☐Agriculture
Soil Texture *(Check One)*
☐Coarse
☐Fine

☐ Sewer Use
☐Sanitary
☐Storm
Region *Indicate One*
☐ MISA

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
Indicate One

Is this submission for a Record of Site Condition? ☐ Yes ☒ No

Report Guideline on Certificate of Analysis ☐ Yes ☒ No

Turnaround Time (TAT) Required:

Regular TAT ☒ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 1840-1850 BLOOR ST CONDO
Site Location: 1840 Bloor St, Mississauga
Sampled By: Dhruvish
AGAT Quote #: PO: 1-19-0720-01
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☒ No ☐

Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI Y / N	Metals and Inorganics	O. Reg 153: ☐ All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (Incl. Hydrides)	O. Reg 153: ORPs: ☐B-HWS ☐Cl ☐CN ☐Cr⁶⁺ ☐EC ☐FOC ☐Hg ☐pH ☐SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐TP ☐NH$_3$ ☐TKN ☐NO$_3$ ☐NO$_2$ ☐NO$_3$+NO$_2$	Volatiles: ☐VOC ☐BTEX ☐THM	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐Total ☐Aroclors	Organochlorine Pesticides	TCLP: ☐M&I ☐VOCs ☐ABNs ☐B(a)P ☐PCBs	Sewer Use	Corrosivity package					Potentially Hazardous or High Concentration (Y/N)
BH2/SS6	11/29/19		1	Soil	Soil																X					
BH6/SS5	11/28/19		1	Soil	Soil																X					
BH8/SS6	11/29/19		1	Soil	Soil																X					

Samples Relinquished By (Print Name and Sign): Jeff Au	Date 12/13/19	Time	Samples Received By (Print Name and Sign): 2019/12/13	Date	Time 4:35
Samples Relinquished By (Print Name and Sign): 2019/12/13	Date	Time 5:05	Samples Received By (Print Name and Sign):	Date	Time
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time

Page ______ of ______

Nº: T 095890

Pink Copy - Client I Yellow Copy - AGAT I White Copy- AGAT

5623 McADAM ROAD
MISSISSAUGA, ONTARIO
CANADA L4Z 1N9
TEL (905)501-9998
FAX (905)501-0589
http://www.agatlabs.com

CLIENT NAME: TERRAPROBE INC.
11 INDELL LANE
BRAMPTON, ON   L6T3Y3
(905) 796-2650

ATTENTION TO: Jeff Au

PROJECT: 19T555887

AGAT WORK ORDER: 19T557316

SOLID ANALYSIS REVIEWED BY: Jing Xiao, Data Reviewer

DATE REPORTED: Dec 30, 2019

PAGES (INCLUDING COVER): 5

Should you require any information regarding this analysis please contact your client services representative at (905) 501-9998

*NOTES

All samples are stored at no charge for 90 days. Please contact the lab if you require additional sample storage time.

Certificate of Analysis

AGAT WORK ORDER: 19T557316
PROJECT: 19T555887

CLIENT NAME: TERRAPROBE INC.

ATTENTION TO: Jeff Au

(201-042) Sulfide

DATE SAMPLED: Dec 17, 2019

DATE RECEIVED: Dec 18, 2019

DATE REPORTED: Dec 30, 2019

SAMPLE TYPE: Other

	Analyte:	Sulfide
	Unit:	%
Sample ID (AGAT ID)	RDL:	0.05
BH2/SS6 (811970)		<0.05
BH6/SS5 (811971)		<0.05
BH8/SS6 (811972)		0.17

Comments: RDL - Reported Detection Limit

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

Quality Assurance - Replicate

AGAT WORK ORDER: 19T557316
PROJECT: 19T555887

CLIENT NAME: TERRAPROBE INC.
ATTENTION TO: Jeff Au

(201-042) Sulfide

	REPLICATE #1				REPLICATE #2											
Parameter	Sample ID	Original	Replicate	RPD	Sample ID	Original	Replicate	RPD								
S	811970	0.027	0.019	34.8%	811972	0.167	0.172	2.9%								
Sulfate	811970	< 0.01	<0.01	0.0%	811972	< 0.01	<0.01	0.0%								
Sulfide	811970	< 0.05	<0.05	0.0%	811972	0.17	0.17	0.0%								

(201-042) Sulfide

	CRM #1				CRM #2											
Parameter	Expect	Actual	Recovery	Limits	Expect	Actual	Recovery	Limits								
S	0.80	0.79	98%	90% - 110%	0.80	0.79	98%	90% - 110%								
Sulfate	0.01	0.01	100%	90% - 110%	0.01	0.01	100%	90% - 110%								
Sulfide	0.80	0.78	97%	90% - 110%	0.80	0.78	97%	90% - 110%								

Method Summary

CLIENT NAME: TERRAPROBE INC.

AGAT WORK ORDER: 19T557316

PROJECT: 19T555887

ATTENTION TO: Jeff Au

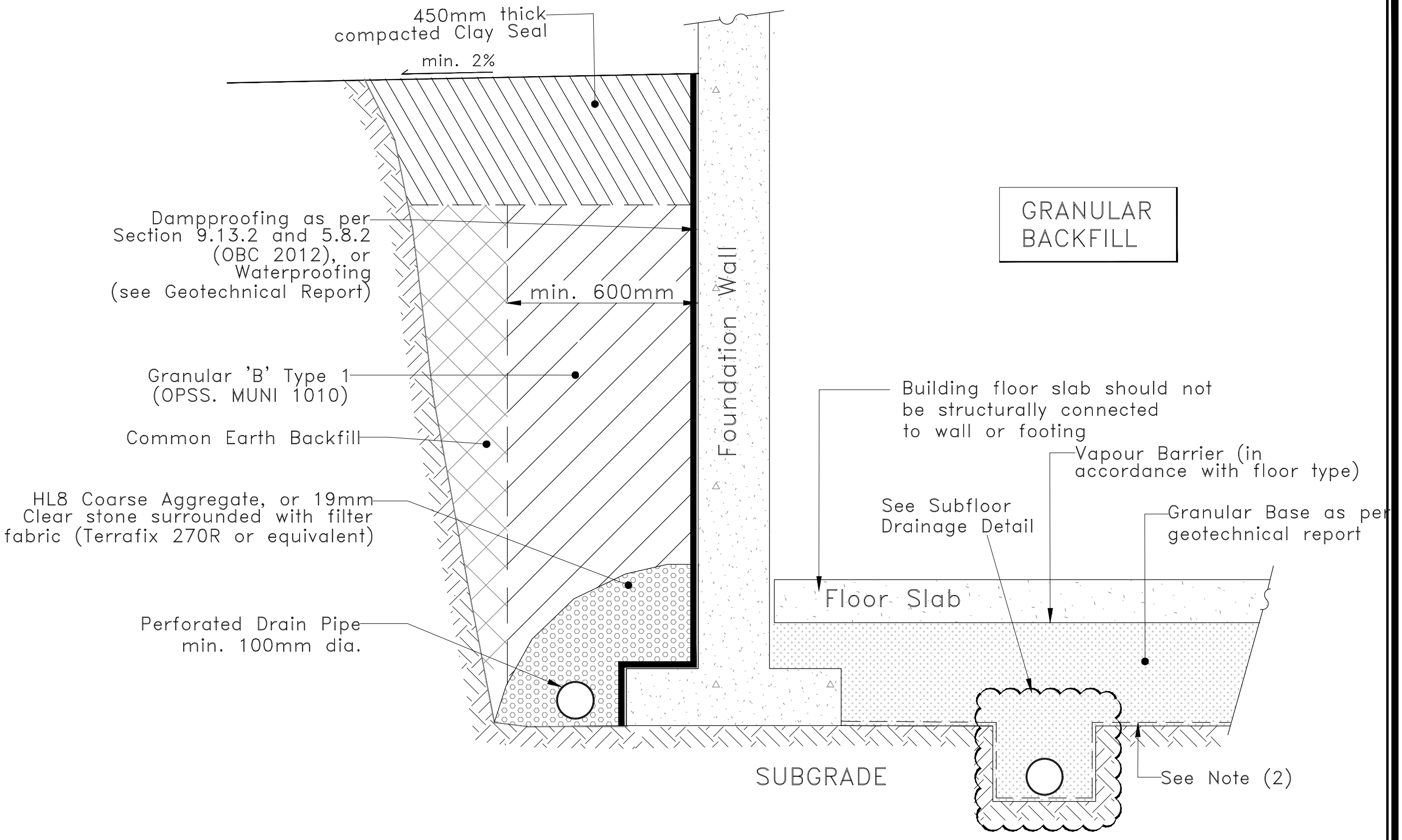
SAMPLING SITE:

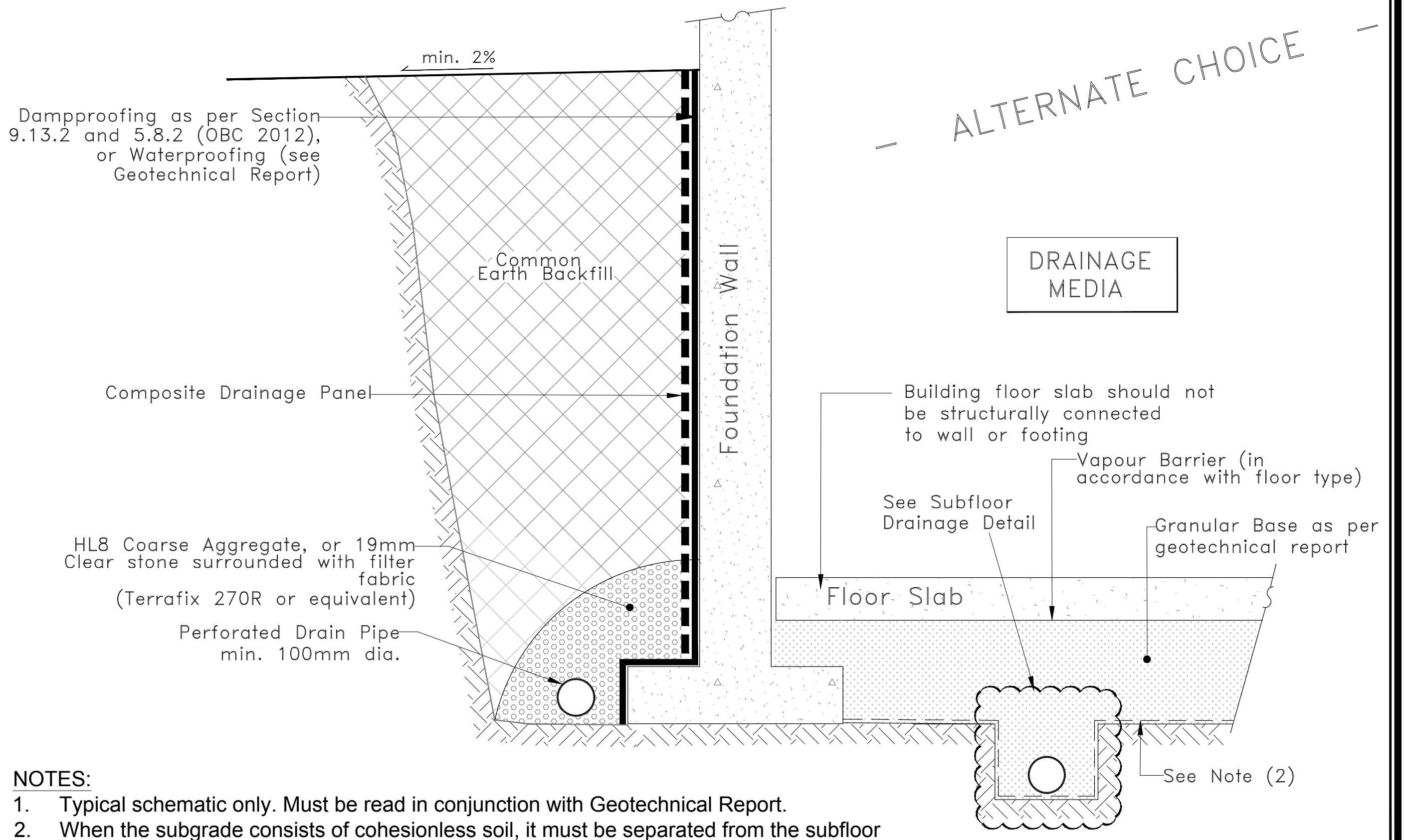
SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Solid Analysis			
Sulfide	MIN-200-12037		LECO

Appendix D
Basement Drainage Figures

ENGLOBE





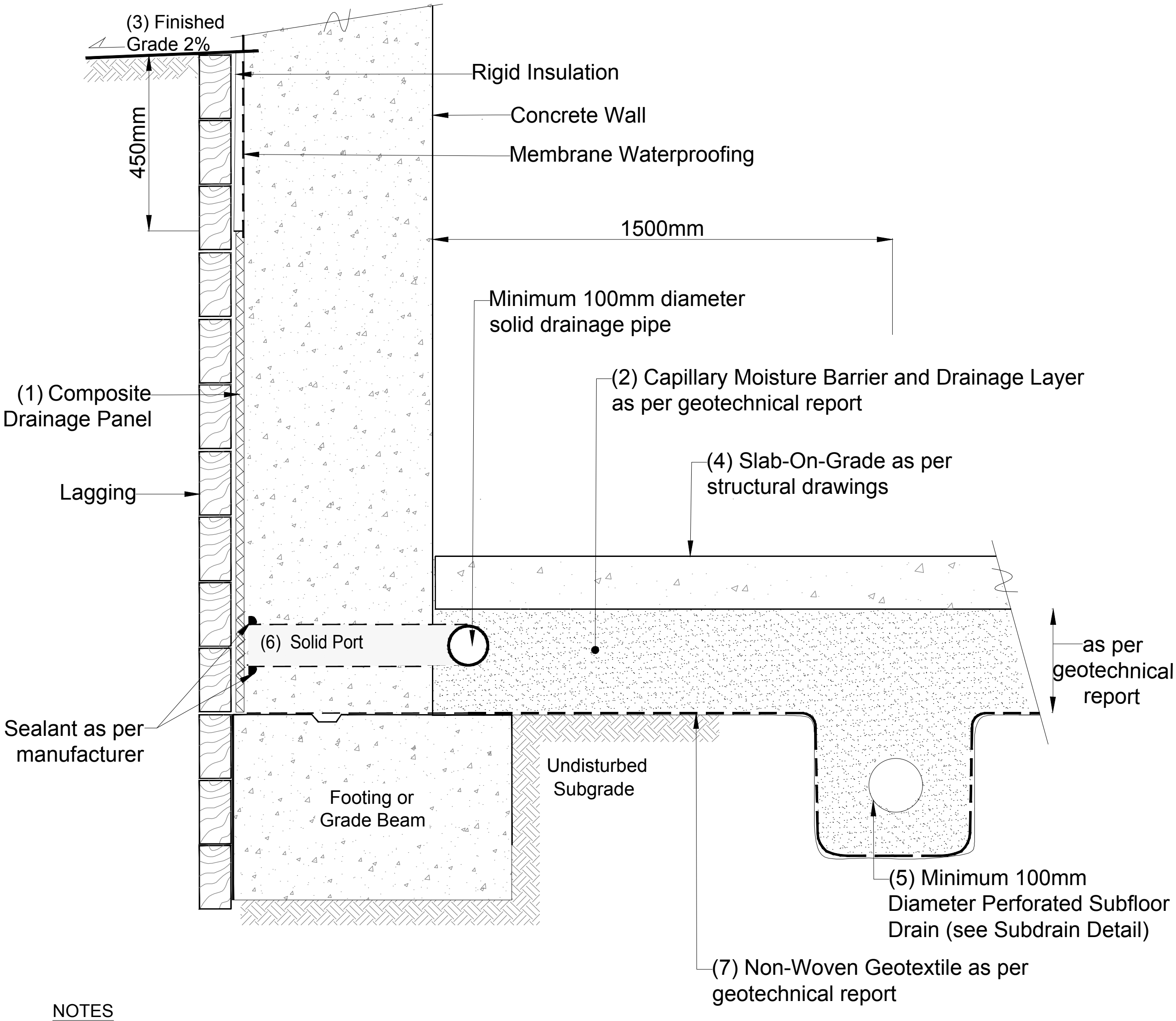
NOTES:

1. Typical schematic only. Must be read in conjunction with Geotechnical Report.
2. When the subgrade consists of cohesionless soil, it must be separated from the subfloor drainage layer using a non-woven geotextile (Terrafix 360R or approved equivalent).
3. Not to Scale

ENGLOBE

Title:

TYPICAL BASEMENT DRAINAGE SCHEMATIC



NOTES

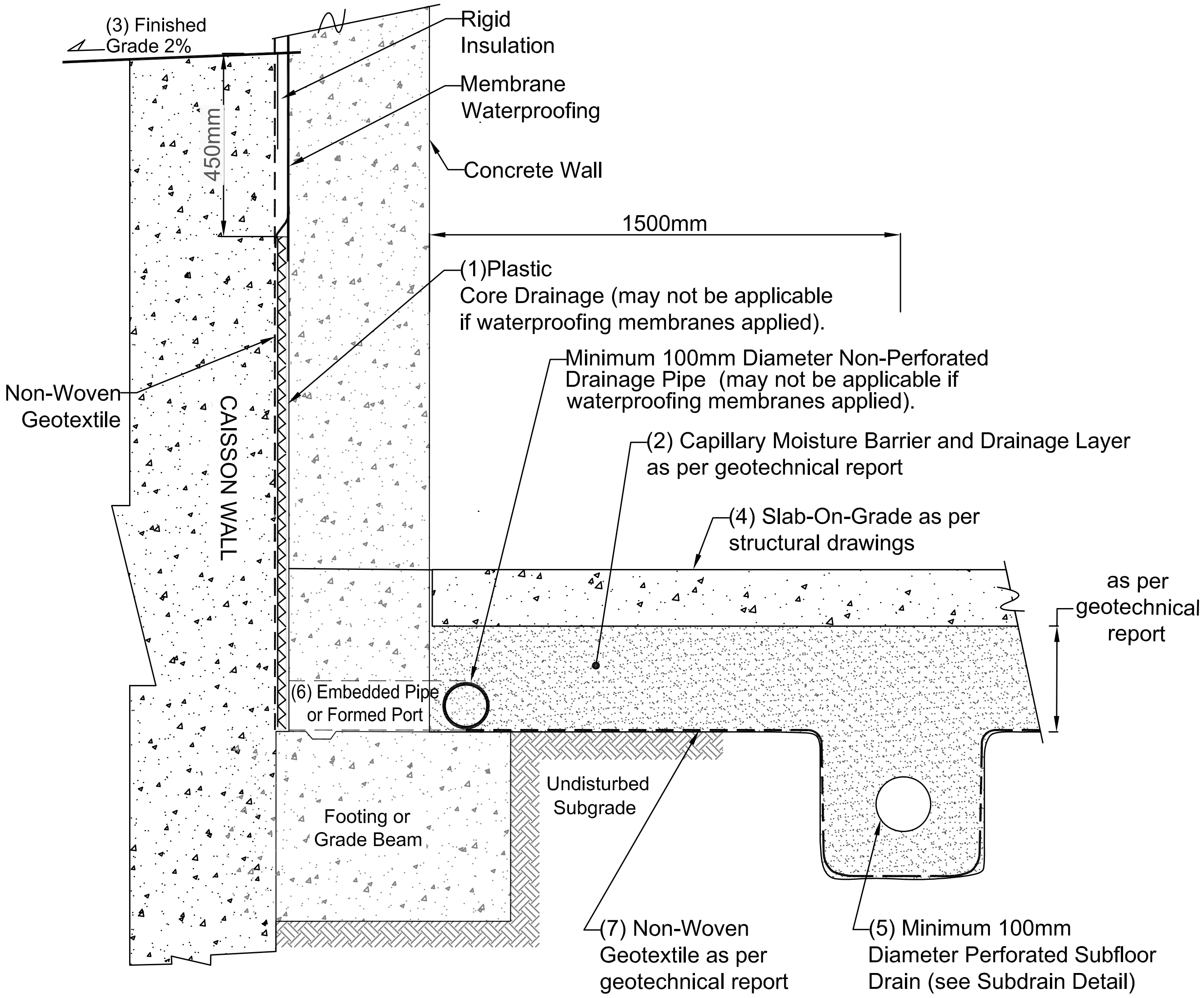
1) Prefabricated composite drainage panels to consist of Miradrain 6000, or approved equivalent. Panels should provide continuous cover as per manufacturer's requirements.
2) Capillary moisture barrier/drainage layer to consist of a minimum 200mm layer of 19mm clear stone (OPSS. MUNI 1004), or as indicated in geotechnical report, compacted to a dense state. Upper 50mm can be replaced with Granular “A” (OPSS. MUNI 1010) compacted to 98% SPMDD where vehicular traffic is required. A vapour barrier may be required depending on floor type.
3) Exterior finished grade away from wall at a minimum grade of 2% for min. 1.2m.
4) Building floor slab-on-grade shall not be structurally connected to foundation wall or footing.
5) Subfloor drain invert to be a minimum of 300mm below underside of floor slab, to be set in parallel rows, one way, and at the spacing specified in the geotechnical report. Don't connect subfloor drains to perimeter drains.
6) Embedded ports to be set a distance of maximum 3m on-centre. Each port to have a minimum cross-sectional area of 1500mm². Perimeter drainage must be collected and conveyed directly to the building sumps in solidpipe.
7) When the subgrade consists of a cohesionless soil, the subgrade must be separated from the subfloor drainage layer using a non-woven geotextile (Terrafix 360R or approved equivalent).
8) Geotechnical report contains specific details. Final detail must be reviewed before system is considered acceptable to use.

N.T.S.

ENGLOBE

Title:

SCHEMATIC DRAINAGE DETAIL
SOLDIER PILE & LAGGING SHORING SYSTEM
(DRAINED BASEMENT CONDITION)



NOTES

1) Prefabricated drainage panels to consist of Terrafix - TERRADRAIN 200, Mirafi - Miradrain 6000, or approved equivalent. Panels should provide continuous cover with a minimum overlap of 300mm (may not be applicable if waterproofing membranes applied).

2) Capillary moisture barrier/drainage layer to consist of a minimum 200mm layer of 19mm clear stone (OPSS 1004), as indicated in geotechnical report, compacted to a dense state. Upper 50mm can be replaced with Granular “A” (OPSS 1010) compacted to 98% SPMDD where vehicular traffic is required.

3) Exterior finished grade away from wall at a minimum grade of 2% for min. 1.2m.

4) Building floor slab-on-grade shall not be structurally connected to foundation wall or footing.

5) Subfloor drain invert to be a minimum of 300mm below underside of floor slab, to be set in parallel rows, one way, and at the spacing specified in the geotechnical report.

6) Embedded pipes/formed ports to be set a distance of maximum 3m on-centre. Each port to have a minimum cross-sectional area of 1500mm². Perimeter drainage must be collected and conveyed directly to the building sump in non-perforated pipe (may not be applicable if waterproofing membranes applied).

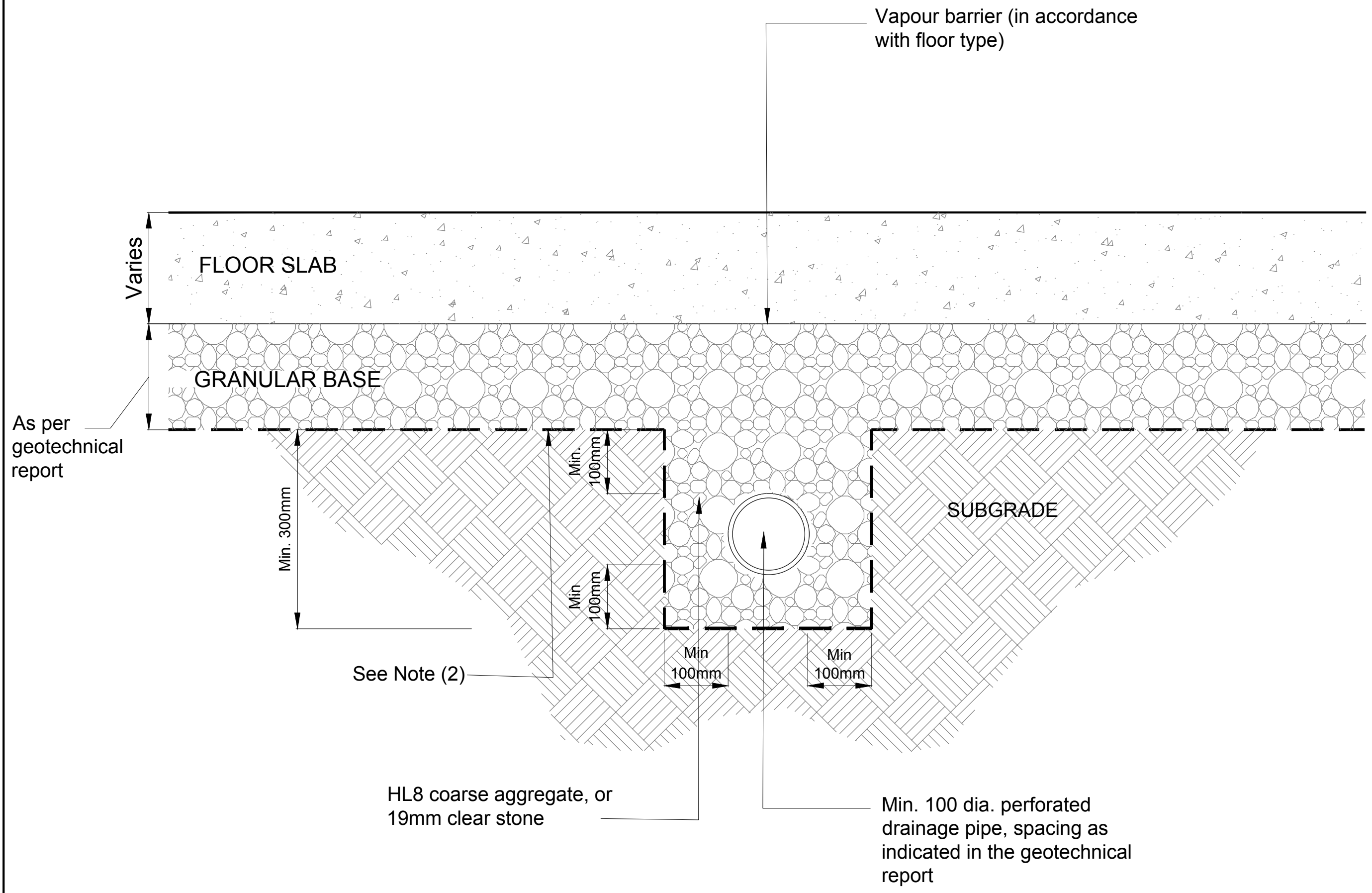
7) When the subgrade consists of a cohesionless soil, the subgrade must be separated from the subfloor drainage lay using a non-woven geotextile (Terrafix 360R or approved equivalent).

N.T.S.

ENGLOBE

Title:

SCHEMATIC DRAINAGE DETAIL
CAISSON WALL SHORING SYSTEM



NOTES:

1. Typical schematic only. Must be read in conjunction with Geotechnical Report.
2. When the subgrade consists of cohesionless soil, it must be separated from the subfloor drainage layer using a non-woven geotextile (Terrafix 360R or approved equivalent).
3. Not to Scale

englobe

Title:

TYPICAL BASEMENT SUBDRAIN DETAIL

ENGLOBE