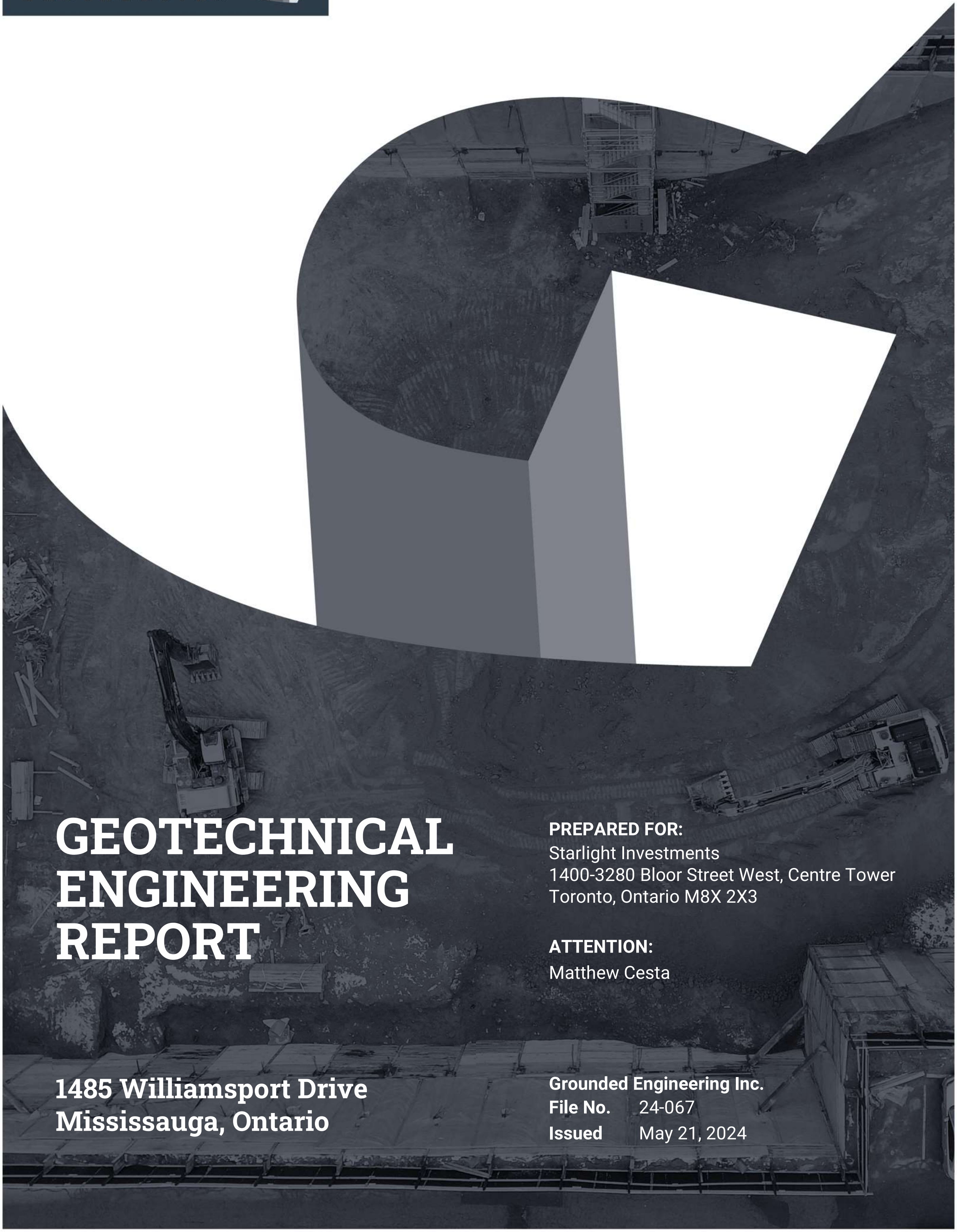

GEOTECHNICAL ENGINEERING REPORT

PREPARED FOR:
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Grounded Engineering Inc.
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Appendix A – Factual Information by Previous Consultant (Terraprobe)
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1 Introduction

Starlight Investments has retained Grounded Engineering Inc. to provide preliminary geotechnical engineering design advice for their proposed development at 1485 Williamsport Drive, in Mississauga, Ontario.

The site is currently occupied by existing structures with a separate underground parking structure (consisting of surface/roof parking and a single underground parking level). The proposed project includes constructing a 10-storey infilled structure, with one basement level set at a lowest (B1) Finished Floor Elevation (FFE) of Elev. 137.6± m; the tower will be built adjacent to the existing apartment building. A new private laneway is also proposed to service the proposed tower. In addition, there is a proposed extension of the existing parking garage towards the north portion of the site, set at a lowest (P1) FFE of Elev. 136.4± m.

Grounded has been provided with the following reports and drawings to assist in our geotechnical scope of work:

- Topographic Survey, "Topographic Plan of Survey of Part of Block G - Registered Plan 733, City of Mississauga"; Job No. 16-132-00, dated May 18, 2016, prepared by Schaeffer Dzaldov Purcell Ltd.
- Architectural Drawings, “Pacific Way, Mississauga, Ontario”; Project 21-15, dated June 22, 2023, prepared by Architecture Unfolded
- Geotechnical Report, “1485 Williamsport Drive, Mississauga, Ontario”, File 1-22-0531-01, dated Sep 11, 2023, prepared by Terraprobe Inc.
- Hydrogeological Assessment Report, “1485 Williamsport Drive, Mississauga, Ontario”, File 1-22-0531-46, dated Dec 8, 2022, prepared by Terraprobe Inc.

Grounded has been provided with factual borehole information for the subject site from other consultants as listed above. Those borehole logs (Terraprobe Boreholes 8 to 11, and 101 to 105) are provided in a report signed and sealed by professional engineers. As such, this borehole information (appended) is taken as factual for present purposes. Unless noted, borehole labels appended with “TP-“ refer to Terraprobe’s boreholes.

Based on the borehole findings, preliminary geotechnical engineering advice for the proposed development is provided for foundations, seismic site classification, earth pressure design, slab on grade design, basement drainage and pavement design. Construction considerations including excavation, groundwater control, and geostructural engineering design advice are also provided.

Grounded Engineering must conduct the on-site evaluation of founding subgrade as foundation and slab construction proceeds. This is a vital and essential part of the geotechnical engineering function and must not be grouped together with other “third-party inspection services”. Grounded will not accept responsibility for foundation performance if Grounded is not retained to carry out all the foundation evaluations during construction.

This geotechnical engineering report provides preliminary recommendations for foundation design. Additional site-specific boreholes, wells, and a detailed geotechnical engineering report will be required for detailed design; Grounded has been retained to complete a site-specific subsurface investigation and provide an updated geotechnical engineering report at a later date.

2 Ground Conditions

The borehole results are detailed on the attached borehole logs (by others). Our assessment of the relevant stratigraphic units is intended to highlight the strata as they relate to geotechnical engineering. The ground conditions reported here will vary between and beyond the borehole locations.

The stratigraphic boundary lines shown on the borehole logs are assessed from non-continuous samples supplemented by drilling observations. These stratigraphic boundary lines represent transitions between soil types and should be regarded as approximate and gradual. They are not exact points of stratigraphic change.

Elevations were measured by Terraprobe using a Trimble R10 GNSS System. The horizontal coordinates were provided by Terraprobe relative to the Universal Transverse Mercator (UTM) geographic coordinate system.

2.1 Stratigraphy

The following stratigraphic summary is based on the results of the boreholes and the geotechnical laboratory testing. A subsurface profile showing stratigraphy and engineering units is appended. A summary of the relevant stratigraphic units is provided as follows. The summary elevations are provided for general guidance only. Details are provided on the borehole logs and in the following subsections.

2.1.1 Surficial Materials and Earth Fill

At existing grade, the boreholes observed surficial materials consisting of topsoil (ranging from 125 to 600 mm thick observed in Terraprobe Boreholes 8, 9, 11, 103 and 104), pavements (125 mm of asphalt underlain by 150 mm of aggregate observed in Terraprobe Boreholes 101, 102 and 105), and a 145 mm thick concrete slab (observed in Terraprobe Borehole 10).

Underlying the surficial materials, the boreholes observed a layer of earth fill extending to depths of 2.3 to 8.4 m below grade (Elev. 132.1 to 138.0 m); the earth fill was observed to be locally thicker in Terraprobe Boreholes 8 to 11, and 103 to 105 (advanced within the area in between the existing concrete block building adjacent to the swimming pool, and the apartment building) extending to depths of 5.3 to 8.4 m below grade (Elev. 132.1 to 134.6 m).

The earth fill varies in composition but generally consists of sand, trace silt, to sand and silt, to sandy silt, with trace to some gravel and clay, and ranges in colour from brown to light brown, and is moist.

Due to inconsistent placement and the inherent heterogeneity of earth fill materials, the relative density of the earth fill could be variable.

2.1.2 Native Soils

Underlying the earth fill, the boreholes observed a native undisturbed deposit consisting of sands at depths of 2.3 to 8.4 m below grade (Elev. 132.1 to 138.0 m). Terraprobe Boreholes 101 to 103 fully penetrated the deposit at depths of 16.8 to 18.3 m below grade (Elev. 122.0 to 123.7 m), whereas the remaining Terraprobe boreholes were terminated in this deposit at target depths of 8.1 to 16.8 m below grade (Elev. 122.5 to 131.8 m).

The sand contains some silt, trace clay and gravel, transitions from brown to grey with increasing depth, and moist to wet at around Elev. 132± m. A surficial layer of sandy silt was observed in Terraprobe Boreholes 101 and 102 at a depth of 2.3 m below grade (Elev. 138.0 m) extending to depths of 10.7 to 13.9 m below grade (Elev. 126.4 to 129.6 m).

The Standard Penetration Test (SPT) results (N-Values) measured in the deposit ranges from 15 to greater than 50 blows per 300 mm of penetration (bpf) or less, indicating a compact to very dense relative density. The lower SPT N-Values indicating compact relative density (15 and 29 bpf observed in Terraprobe Boreholes 10 and 11 at a depth of 7.6 m) are likely due the soil being disturbed from the ingress of groundwater during split-spoon sampling; therefore, it is inferred that these lower N-Values are not representative of the in situ competency of the native soils.

2.1.3 Inferred Bedrock

Underlying the native soils, Boreholes 101 to 103 observed inferred weathered bedrock at depths of 16.8 to 18.3 m below grade (Elev. 122.0 to 123.7 m). Rock coring to confirm bedrock and the transition from weathered to sound bedrock was not completed by Terraprobe at this site.

2.2 Groundwater

The depth to groundwater and caved soils were measured in each of the boreholes immediately following the drilling. Monitoring wells were installed in Terraprobe Boreholes 102, 103, 105, and 10, and stabilized groundwater levels were measured and recorded.

The groundwater observations are shown on the Borehole Logs and are summarized as follows.

Well ID	Well Diameter (mm)	Ground Surface (masl)	Top of Screen (masl)	Bottom of Screen (masl)	Screened Geological Unit
TP-10	50	140.3	131.5	128.4	Sands
TP-102	50	140.3	126.3	123.2	Sands
TP-103	50	140.5	133.8	130.7	Sands / Fill
TP-105	50	139.9	133.8	132.3	Sands

Well ID	Groundwater Elevation (masl)							
	2018-03-23	2018-04-03	2018-10-04	2022-09-19	2022-09-30	2022-10-13	2024-04-19	**Maximum**
TP-10	131.4	131.4	131.6	131.6	131.5	131.5	131.6	**131.6**
TP-102	-	-	-	132.1	131.5	131.5	131.6	**132.1**
TP-103	-	-	-	131.5	130.7	130.5	131.5	**131.5**
TP-105	-	-	-	Dry	Dry	Dry	Dry	**Dry**

Groundwater levels fluctuate with time depending on the amount of precipitation and surface runoff, and may be influenced by known or unknown dewatering activities at nearby sites.

The design groundwater table is at Elev. 132± m. Within the zone of excavation, the earth fill and native soils will permit the free-flow of water when wet. There is also infiltrated stormwater perched in the earth fill which is flowing down towards the groundwater table.

Grounded is preparing a hydrogeological report for this site (File No. 24-067).

3 Preliminary Geotechnical Engineering Recommendations

Based on the factual data summarized above, preliminary geotechnical engineering recommendations are provided. These preliminary recommendations are for due diligence purposes only. They must be supplemented and confirmed by additional boreholes, wells, and a detailed geotechnical engineering report at the detailed design stage.

This report assumes that the design features relevant to the geotechnical analyses will be in accordance with applicable codes, standards, and guidelines of practice. 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 Grounded should be retained to review the implications of these changes with respect to the contents of this report.

3.1 Foundation Design Parameters

The proposed development will consist of a 10-storey tower, with one basement level set at a lowest B1 FFE of 137.6± m. There is also a proposed extension of the existing P1 underground parking structure towards the north portion of the site, set at a lowest (P1) FFE of 136.4± m. The following foundation options have been considered in our analysis.

- 10-Storey Tower – Spread footings on a ground improvement solution, helical piles, continuous flight augers (CFAs), or end-bearing caissons
- P1 Extension – Spread footings

3.1.1 General Foundation Recommendations

The topsoil and earth fill soils are considered unsuitable for the support of the proposed building and P1 extension foundations.

Footings stepped from one elevation to another should be offset at a slope not steeper than 7 vertical to 10 horizontal. This requirement exists to avoid undermining adjacent footings at the higher elevation.

When exposed to ambient environmental temperatures in the Greater Toronto Area, the design earth cover for frost protection of foundations and grade beams is 1.2 metres.

The founding subgrade must be cleaned of all unacceptable materials and approved by Grounded prior to pouring concrete for the footings. Such unacceptable materials may include disturbed or caved soils, ponded water, or similar as indicated by Grounded during founding subgrade inspection. During the winter, adequate temporary frost protection for the footing bases and concrete must be provided if construction proceeds during freezing weather conditions.

3.1.2 Tower Foundations

The earth fill, below the proposed B1 FFE of Elev. 137.6± m, is considered unsuitable for the support of the proposed structure. As such, the following foundation recommendations are proposed:

- Spread Footings on a Ground Improvement Solution
- Helical Piles
- Continuous Flight Auger Piles (“CFA” Piles)
- End-bearing caissons made on the very dense sands at Elev. 132± m

3.1.2.1 Spread Footings on a Ground Improvement Solution

Spread footings bearing on ground improvement consisting of rammed aggregate piers (also known as stone columns or Geopiers) may be considered. The piers are constructed by using displacement methods depending on soil conditions and project requirements. The aggregate is compacted in thin lifts using crowd pressure and a high energy vibratory hammer with a specialized tamper to densify the aggregate vertically and increase lateral stress in the soil matrix. The construction process results in a reinforced soil profile, providing positive settlement control and a resulting high bearing capacity that can support spread and strip footings.

GeoSolv Design/Build Inc., Menard Canada, and Keller are local design-build contractors that install this kind of ground improvement. The geotechnical bearing capacity for shallow spread footings is typically in the range of 300 kPa at SLS (for an estimated 25 mm of settlement) and 450 kPa at ULS where stone column elements are used to modify the subsurface conditions. With further project-specific analysis, these systems may also be used under large area-loaded raft foundations to improve bearing capacity for the raft where required.

3.1.2.2 Helical Piles

Helical piles may also be designed to carry the proposed structural loads. Contractors specializing in helical pile design and installation can provide detailed information on installation methodology, detailed design, product quality, and certification. Local specialist contractors that provide these design-build services can be provided on request.

At this site, helical piles can be installed to bear within the dense to very dense sands, in order to obtain adequate resistance to support the new loads. Following helical pile installation, a pile cap or grade beam is constructed to transfer the building loads onto the underlying competent soils through the helical piles.

There are several helical pile products available. Helical pile detailed design will ultimately depend upon the loading considerations and the ground conditions. The project geotechnical information should be provided to a specialist design/build contractor to assess the feasibility of this foundation system and to determine probable helical pile refusal/installation depths, and capacities.

The actual installation depth of each helical pile is determined on site during installation based on depth and torque measurements made during installation, and the load support requirements. The load carrying capacity of each helical pile is confirmed by the helical pile contractor based on the torque measurements and a full-scale performance test of a prototype pile. Occasionally, field torque measurements indicate that helical piles must be advanced deeper than originally designed. Provision must be made in helical pile contracts to allocate and quantify risks associated with any extra time and materials utilized to achieve the required field torque readings.

The presence of debris/obstructions within fill materials or larger sized cobbles or boulders in native soil (although not specifically encountered in the boreholes) could impede helical pile installation. Refer to the borehole logs for detailed subsurface information. Provision must be made in helical pile contracts to allocate risks associated with the time spent and equipment utilized to remove or work around such obstructions when encountered.

Within the design frost depth, uplift due to frost (also known as 'adfreezing') on the shaft of helical piles must also be considered in the design. Based on the Canadian Foundation Engineering Manual (4th Ed.), design adfreeze bonds vary from 65 kPa (fine grained soils frozen to wood/concrete) to 100 kPa (fine grained soils frozen to steel), to 150 kPa (gravel frozen to steel). These loads act in the upward direction on the portion of shaft that is above the design frost depth. Alternatively, bond breakers can be designed and applied to the shaft of the helical pile.

3.1.2.3 Continuous Flight Auger (CFA) Piles

Continuous flight auger (CFA) piles, also known as auger pressure grouted piles, may also be considered. CFA piles are installed using hollow stem continuous flight augers. When the required depth is reached, high strength fluid grout is pumped under pressure through the hollow stem augers exiting through the tip. A pre-designed grout volume is pumped under pressure prior to lifting the auger to build up a "grout head" around the outside of the auger. The auger is then withdrawn in a controlled manner slowly rotating clockwise as the grout pumping continues to both maintain the head of grout and avoid any intrusion of water or soil into the grout column.

CFA piles are designed based on the combination of tip resistance and skin friction. The typical maximum depth for CFA piles in the Greater Toronto Area is about 23 m. For design purposes, the longer the CFA piles, the greater the resistance provided. Grounded is providing recommendations for locally conventional CFA piles that have a diameter of 610 mm. Other diameters and lengths may be available.

CFA pile capacities may be calculated by neglecting the upper 1.5 m of pile embedment, subdividing the remaining length of the pile into segments of Δz length, using the following equation (adapted from the Canadian Foundation Engineering Manual):

$$Q_{ULT} = \sum_{z=0}^{L} C q_s \Delta z + A_t q_t - W_P$$

C = the circumference of the CFA pile (m)
q_s = the shaft friction at any depth z along the pile (kPa)
qt = the toe resistance at depth L (kPa)
At = the pile toe area (m^2)
W_P = pile weight (kN)

With:

$$q_s = \beta \sigma'_v$$

σ'_v = the average effective vertical stress along segment Δz (kPa)
β = the shaft friction coefficient (0.4 in the dense to very dense sands)

And with:

$$q_t = N_t \sigma'_t$$

σ'_t = the vertical effective stress at the pile toe (kPa)
N_t = the bearing capacity factor (50 in the dense to very dense sands)

The toe depth is taken as 16 m below existing grade (Elev. 124± m) for preliminary purposes. The calculations neglect the materials above Elev. 132± m to account for the existing extensive fill (relative to the proposed tower B1 level set at Elev. 137.6± m).

The factored geotechnical resistance at ULS is provided on the basis of a geotechnical resistance factor of 0.4 as per the Canadian Foundation Engineering Manual and the Ontario Building Code.

Conventional CFA piles (610 mm diameter) may be designed using a maximum factored geotechnical resistance at ULS of about 2,000 kN per pile.

CFA piles spaced apart at greater than 3 diameters (measured centre to centre) will not induce group effects. Piles placed closer than this will induce group effects, which is dependent on caisson sizing, bearing stratum, founding elevation, and separation distance. The individual pile capacity may be reduced if multiple piles (pile group) are to be installed. The pile layout and details must be reviewed by Grounded to assess the pile group efficiency/capacity. A detailed review of the design building loads and pile capacity will have to be conducted for the design for this option.

A static load test (ASTM D1143 - Standard Test Methods for Deep Foundations Under Static Axial Compressive Load) must be performed at this site to confirm or improve the above CFA pile capacities. An Osterberg Cell Load Test is also feasible on CFA piles. The factored geotechnical resistance at ULS provided above uses a factor of 0.4. When the static load test is performed the reduction factor will be 0.6, which will most likely provide a higher factored geotechnical resistance at ULS. The load test will also provide settlement parameters. It is anticipated that the geotechnical reaction at SLS will be similar to the ULS value.

3.1.2.4 End-Bearing Caissons

Foundations made for the proposed B1 level below the 10-storey tower may also consist of end-bearing caissons. End-bearing caissons extending through the extensive earth fill and made to bear on the undisturbed dense to very dense sands at Elev. 132± m may be designed using a maximum factored geotechnical resistance at ultimate limit state (ULS) of 1,800 kPa. The allowable geotechnical reaction at serviceability limit state (SLS) is 1,200 kPa, for an estimated total settlement of 25 mm or less.

Caissons should be separated from each other by at least 3 times the largest caisson diameter (measured on centres) to avoid inducing additional settlement from group effect. Caissons placed closer than this will induce group effects, and a reduced bearing capacity will apply, which is dependent on caisson sizing, bearing stratum, founding elevation, and separation distance. If this situation is unavoidable from a structural engineering perspective, we can review the structural drawings and estimate the expected settlement of the caisson group, on request.

There are zones of soil at this site that are sufficiently cohesionless, permeable and wet that augered boreholes for caissons will need to protected against loss of ground, upheave, and basal disturbance due to the ingress of groundwater. Augered boreholes for caissons may require temporary liners, polymer mud drilling techniques, tremie pour concrete, pre-advancing casing, or other means and methods as deemed necessary by the contractor to prevent groundwater inflow or loss of soil into the drill holes, disturbance to placed concrete, or similar issues. Concrete for caissons must be placed by tremie method where there is more than 300 mm of water or fluid at the base of the hole.

The following construction methodology must be utilized for all structural caisson installations:

- All caisson excavations are to be inspected on a full-time basis by Grounded per the Ontario Building Code (2012).
- Caissons designed to bear on the very dense sands at Elev. 132± m are to be confirmed by Grounded through observation of the drilling and auger cuttings at each location.
- Cleanout bucket or one-eyed bucket cleaning of the hole base is to then take place in each caisson hole, and visually inspected by Grounded to ensure that base cleaning has been carried out as thoroughly as practically possible. The geotechnical engineer of record (Grounded) must probe the bottom of every hole, after the contractor has cleaned with the one-eyed bucket, using a probe consistent with methods described in Section 3.7.3 of the "Drilled Shaft Inspector's Manual", 2nd Edition, ADSC & DFI, 2004.
- Place 30 MPa (min.) concrete to a minimum depth of 600 mm in the base of the hole (volume to be determined based on caisson diameter) to be stirred with the auger without advancing the auger any further for about 5 minutes.
- The auger spun concrete is then removed and wasted, leaving no more than 100 mm depth of concrete at the base of the caisson.
- Tremie placement of concrete is required wherever the drill holes have more than 150 mm of water in the base or are full of drilling fluid.
- Complete construction of the caisson to bearing elevation.

Any recommendations must also satisfy the structural engineering requirements regardless of any interpretation provided herein.

Grounded may recommend sonic caliper testing (or equivalent) to confirm verticality and diameter. Grounded generally recommends carrying such tests on the first five (5) caissons, and 10% of the caissons thereafter. The structural engineer should specify the number of tests to verify the quality of the contractor's installation.

To confirm concrete placement, thermal integrity profiling (TIP), crosshole logging, or another similar test is recommended. Grounded reserves the right to increase the testing frequency, subject to the results of the initial testing.

Alternatively, if for whatever reason higher capacities are required, end-bearing caissons extending through the overburden soils and made on bedrock may be considered; this foundation option will require additional deeper boreholes with rock coring to confirm bedrock and the transition from weathered to sound bedrock for detailed design (not part of the current scope of work that Grounded is retained to complete).

3.1.3 P1 Extension – Spread Footings

Foundations made for the proposed P1 level extension will bear on the undisturbed dense to very dense sandy silt (based on Terraprobe BH101 and 102). Conventional spread footings made to bear on very dense sandy silt may be designed using a maximum factored geotechnical resistance at ULS of 600 kPa. The geotechnical reaction at SLS is 400 kPa, for an estimated total settlement of 25 mm.

The capacities provided above is based on an individual spread footing foundations that are 1 to 3.5 m wide and embedded a minimum of 1 m below FFE. These minimum requirements apply in conjunction with the above recommended geotechnical resistance regardless of loading considerations. The geotechnical reaction at SLS refers to an estimated settlement which for practical purposes is linear and non-recoverable. Differential settlement is related to column spacing, column loads, and footing sizes.

3.2 Seismic Site Classification

The Ontario Building Code (2012) stipulates the methodology for earthquake design analysis, as set out in Subsection 4.1.8.7. The determination of the type of analysis is predicated on the importance of the structure, the spectral response acceleration, and the site classification.

The parameters for determination of Site Classification for Seismic Site Response are set out in Table 4.1.8.4A of the Ontario Building Code (2012). The classification is based on the determination of the average shear wave velocity in the 30 metres of the site stratigraphy below spread footing/grade beam elevation, where shear wave velocity (v_s) measurements have been taken. Alternatively, the classification is estimated from the rational analysis of undrained shear strength (s_u) or penetration resistance (N-values) according to the OBC and National Building Code of Canada.

Below the nominal footing and grade beam elevations for both the tower and P1 extension (Elev. 136-135± m), the boreholes observe a loose to compact earth fill underlain by dense to very dense sands. Based on this information, the site designation for seismic analysis is **Class C**, per Table 4.1.8.4.A of the Ontario Building Code (2012). Tables 4.1.8.4.B and 4.1.8.4.C. of the same code provide the applicable acceleration- and velocity-based site coefficients.

Consideration should be given to conducting a site-specific Multichannel Analysis of Surface Waves (MASW) as part of a future scope of work, to determine the average shear wave velocity in the top 30 meters of the site stratigraphy. MASW testing is an anticipated requirement for seismic site class determination in the new update to the OBC.

3.3 Earth Pressure Design Parameters

At this site, the design parameters for structures subject to unbalanced earth pressures such as basement walls and retaining walls are shown in the table below.

Stratigraphic Unit	γ	φ	K_a	K_o	K_p
Compact Granular Fill Granular 'B' (OPSS.MUNI 1010)	21	32	0.31	0.47	3.25
Existing Earth Fill	19	29	0.35	0.52	2.88
Sandy Silt	21	36	0.26	0.41	3.85
Sands	21	38	0.24	0.38	4.20

γ = soil bulk unit weight (kN/m^3)
φ = internal friction angle (degrees)
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)

These earth pressure parameters assume that grade is horizontal behind the retaining structure. If retained grade is inclined, these parameters do not apply and must be re-evaluated.

The following equation can be used to calculate the unbalanced earth pressure imposed on walls:

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

P = horizontal pressure (kPa) at depth h
h = the depth at which P is calculated (m)
K = earth pressure coefficient
h_w = height of groundwater (m) above depth h
γ = soil bulk unit weight (kN/m^3)
γ' = submerged soil unit weight (γ - 9.8 kN/m^3)
q = total surcharge load (kPa)

If the wall backfill is drained such that hydrostatic pressures on the wall are effectively eliminated, this equation simplifies to:

$$P = K[\gamma h + q]$$

Where walls are made directly against shoring, prefabricated composite drainage panel covering the blind side of the wall is used to provide drainage. Water from the composite drainage panel is collected and discharged through the basement wall in solid ports directly to the sumps. This is discussed in Section 3.5.

The possible effects of frost on retaining earth structures must be considered. In frost-susceptible soils, pressures induced by freezing pore water are basically irresistible. Insulation typically addresses this issue. Alternatively, non-frost-susceptible backfill may be specified.

Foundation resistance to sliding is proportional to the friction between the subgrade and the base of the footing. The factored geotechnical resistance to friction (**R_f**) at ULS provided in the following equation:

$$R_f = \Phi N \tan\varphi$$

R_f = frictional resistance (kN)
Φ = reduction factor per CFEM 5th Ed. (0.8 for cohesionless soils or rock; 0.6 for cohesive soils)
N = normal load at base of footing (kN)
φ = internal friction angle (see table above)

3.4 Slab on Grade Design Parameters

For the proposed **P1 extension**, the undisturbed native soils will provide adequate subgrade for the support of a conventional slab on grade. The modulus of subgrade reaction for slab-on-grade design supported by undisturbed native soils is 60,000 kPa/m.

For the proposed **tower structure**, a conventional slab on grade for the **B1 basement level** would be made on loose to compact earth fill. In its present state the earth fill is not competent for the support of a slab on grade. The existing earth fill should be compacted in place, proof-rolled, and inspected under the supervision of Grounded for obvious exposed loose or disturbed areas, or for areas containing excessive deleterious materials or moisture. Unacceptable material (as determined by Grounded) must be subexcavated and replaced with Granular B (OPSS.MUNI 1010) compacted to a minimum of 98% SPMDD. The modulus of subgrade reaction appropriate for design of the slab on grade resting on compacted earth fill soils is 10,000 kPa/m.

If the basement and underground parking extension are made as conventional drained structures, a permanent drainage system including subfloor drains is required (see section below). In this case, the slab on grade must be provided with a drainage layer and capillary moisture break, which is achieved by forming the slab on a minimum 200 mm thick layer of 19 mm clear stone (OPSS.MUNI 1004) vibrated to a dense state. Subfloor drainage pipes in trenches must be provided with a minimum 200 mm clearance above for clear stone.

Prior to placement of the capillary moisture break, the cut subgrade shall be proof-rolled and inspected under the supervision of Grounded for obvious exposed loose or disturbed areas, or for areas containing excessive deleterious materials or moisture. These areas shall be recompacted in place and retested, or else replaced with Granular B placed as engineered fill (in lifts 150 mm thick or less and compacted to a minimum of 98% SPMDD). The slab on grade should not be placed on frozen subgrade, to prevent settlement of the slab as the subgrade thaws. Areas of frozen subgrade should be removed during subgrade preparation.

The slab-on-grade will be made on native sands or sand fill, and therefore the drainage layer must be separated from the sands using a non-woven geotextile (with an apparent opening size of less than 0.250 mm and a tear resistance of more than 200 N) with a minimum 600 mm overlap. The stone drainage layer is then placed over the geotextile. Without this filtering layer, fines from the underlying sand subgrade will enter the drainage layer potentially resulting in loss of ground, loss of slab support, and clogging of the subfloor drainage system.

3.5 Long-Term Groundwater and Seepage Control

To limit seepage to the extent practicable, exterior grades adjacent to foundation walls should be sloped at a minimum 2 percent gradient away from the wall for 1.2 m minimum.

For a conventional drained basement approach, perimeter and subfloor drainage systems are required for the underground structures. Subfloor drainage collects and removes the seepage that infiltrates under the floor. Perimeter drainage collects and removes seepage that infiltrates at the foundation walls. Perimeter drainage must be collected and conveyed directly to the building sumps, and not discharged into the subfloor drainage system, the granular layer, or beneath the floor slab.

Subfloor drainage pipes (min. 100 mm diameter) are to be spaced at a maximum 9 m (measured on-centres).

The walls of the substructure are to be fully drained to eliminate hydrostatic pressure. How the drainage system is installed depends on whether the basement wall is made in an open cut or over a shored excavation face. Where drained basement walls are made directly against shoring, prefabricated composite drainage panel covering the blind side of the wall is used to provide drainage. Seepage from the composite drainage panel is collected and discharged through the basement wall in solid ports directly to the sumps.

In an open cut excavation, basement wall drainage is installed directly against the basement wall from the open cut side. Perimeter foundation drains made in this application comprise perforated pipe (minimum 100 mm diameter) surrounded by a granular filter of OPSS.MUNI HL-8 Coarse Aggregate providing a minimum 300 mm of cover over the drain pipe.

A layer of waterproofing placed between the drainage layer and the foundation wall should be considered to protect interior finishes from moisture.

Typical basement drainage details are appended.

The perimeter and subfloor drainage systems are critical structural elements since they eliminate hydrostatic pressure from acting on the basement walls and floor slab. The sumps that ensure the performance of these systems must have a duplexed pump arrangement providing 100% redundancy, and they must be on emergency power. The sumps should be sized by the mechanical engineer to adequately accommodate the estimated volume of water seepage.

The permanent dewatering requirements are provided in Grounded’s Hydrogeological Report (File No. 24-067).

If any water is to be discharged to the storm or sanitary sewers, the City will require Discharge Agreements to be in place.

3.6 Site Servicing

All services must have at least 1.2 metres of earth cover or equivalent insulation for frost protection.

Where site services are not installed below the basement levels of the proposed development, the following recommendations apply.

3.6.1 Bedding

The soil subgrade encountered within utility trenches on site may consist of either earth fill or native soil. If earth fill is encountered, the subgrade must be compacted in place to a minimum 98% SPMDD. The trench base must be inspected for obvious loose, wet, or disturbed material. Any unsuitable material must be subexcavated and replaced with imported fill compacted to 98% SPMDD.

Bedding material must consist of well graded granular fill such as Granular A (OPSS.MUNI 1010). The bedding material must be compacted to a minimum 98% SPMDD. Clear stone is specifically prohibited below the groundwater table.

3.6.2 Backfill

Excavated earth fill and native soils on site will constitute adequate backfill material if the soil meets the backfill specifications:

- Any deleterious material in the earth fill is removed prior to reuse as backfill.
- The moisture content is within 2% of optimum, or moisture conditioned to within 2% of optimum.
- The backfill must be compacted to a minimum 98% SPMDD.

4 Pavement Engineering Recommendations

4.1 Asphalt Pavement

The following design pertains to asphaltic concrete pavements (‘pavement’) where the pavement will rest on a soil subgrade as described above.

The following Ontario Provincial Standards Specifications (OPSS.MUNI) apply to the pavement construction and material requirements:

- OPSS.MUNI 310 - Hot Mix Asphalt
- OPSS.MUNI 501 - Compacting
- OPSS.MUNI 1010 - Aggregates – Base, Subbase, Select Subgrade, and Backfill Material
- OPSS.MUNI 1101 - Performance Graded Asphalt Cement
- OPSS.MUNI 1150 - Hot Mix Asphalt

The pavement construction and material should also follow the relevant city specifications, as applicable.

4.1.1 Pavement Subgrade Preparation

Topsoil and existing wet or organic rich earth fill soils are considered unsuitable for the pavement subgrade. These materials must be stripped down to acceptable subgrade prior to pavement construction.

Existing earth fill, if cleared of organic rich or wet soils, and native subgrade will provide adequate subgrade for the support of the pavement. The subgrade must be proof-rolled and inspected under the supervision of Grounded for obvious loose or disturbed soils or where there is deleterious materials or moisture. These areas can either be recompacted in place and retested, or replaced with Granular B in lifts 150 mm thick or less, and compacted to a minimum of 98% SPMDD.

The existing subgrade may not be readily compacted in small volumes, such as trenches or in areas adjacent to foundations or catch basins. For areas of limited extent, compactable aggregate-source backfills like Granular B (OPSS.MUNI 1010) are recommended for post-construction grade integrity. All new fill shall be compacted to a minimum of 98% SPMDD.

The subgrade for all pavement structures shall be frost tapered at a 3H to 1V slope to match with existing pavement structures, to reduce differential settlements due to frost heave.

4.1.2 Asphalt Pavement Design

Minimum and performance asphaltic concrete pavement designs are outlined in the tables below.

The following **basic pavement design** will last for 8 to 10 years before significant maintenance is required, depending on the traffic volume.

Basic **Pavement Structure**	**Compaction Requirement**	**Car Parking Minimum Component Thickness**	**Bus/Truck Traffic Minimum Component Thickness**
Asphalt Top Lift HL-3 (OPSS.MUNI 1150), and PG 58-28 (OPSS.MUNI 1101)	OPSS.MUNI 310	65 mm	40 mm
Asphalt Base Course HL-8 (OPSS.MUNI 1150), and PG 58-28 (OPSS.MUNI 1101)	OPSS.MUNI 310	N/A	50 mm
Granular Base Course 19 mm diameter crusher run limestone or Granular A (OPSS.MUNI 1010)	100% Standard Proctor Maximum Dry Density (ASTM-D698)	150 mm	150 mm
Granular Subbase Course 50 mm diameter crusher run limestone or Granular B Type II (OPSS.MUNI 1010)	98% Standard Proctor Maximum Dry Density (ASTM-D698)	300 mm	400 mm
Total Thickness		**515 mm**	**640 mm**

The following **performance pavement design** will last approximately twice as long before significant maintenance is required. The performance pavement design considers that the top layer of asphalt will be damaged over time, and therefore, will contribute less to the structural strength of the asphalt.

Performance Pavement Structure	**Compaction Requirement**	**Car Parking Minimum Component Thickness**	**Bus/Truck Traffic Minimum Component Thickness**
Asphalt Top Lift HL-3 (OPSS.MUNI 1150), and PG 58-28 (OPSS.MUNI 1101)	OPSS.MUNI 310	40 mm	40 mm
Asphalt Base Course HL-8 (OPSS.MUNI 1150), and PG 58-28 (OPSS.MUNI 1101)	OPSS.MUNI 310	50 mm	80 mm
Granular Base Course 19 mm diameter crusher run limestone or Granular A (OPSS.MUNI 1010)	100% Standard Proctor Maximum Dry Density (ASTM-D698)	150 mm	150 mm
Granular Subbase Course 50 mm diameter crusher run limestone or Granular B Type II (OPSS.MUNI 1010)	98% Standard Proctor Maximum Dry Density (ASTM-D698)	400 mm	500 mm
Total Thickness		**640 mm**	**770 mm**

The existing subgrade soils have a low to moderate susceptibility to frost heave, and pavement on these materials must be designed accordingly. To reduce frost heave, soil subgrade that is susceptible to frost should be replaced to a depth of 60 to 70 percent of the frost penetration depth with non-frost susceptible soils or with granular materials. The most effective ways of dealing with potential frost heave are to construct a good subsurface drainage system, and to stay above the groundwater table.

4.1.3 Pavement Drainage

Adequate drainage of the pavement subgrade is required. Prior to paving, the subgrade should be free of any depressions and sloped at a minimum grade of 2% to provide positive drainage. Perforated plastic subdrains (100 mm diameter) should be designed to collect subgrade water and positively outlet it at the catch basins. Typical pavement drainage details are appended.

Controlling surface water is important in keeping pavements in good maintenance. Grading adjacent pavement areas must be designed so that water is not allowed to pond adjacent to the outside edges of the pavement or curb.

5 Considerations for Construction

5.1 Excavations

Excavations must be carried out in accordance with the *Occupational Health and Safety Act – Regulation 213/91 – Construction Projects (Part III - Excavations, Section 222 through 242).* These regulations designate four (4) broad classifications of soils to stipulate appropriate measures for excavation safety. For practical purposes, the earth fill and native sands are Type 3 soils (or Type 4 soils when wet)

In accordance with the regulation's requirements, the soil must be suitably sloped and/or braced where workers must enter a trench or excavation deeper than 1.2 m. Safe excavation slopes (of no more than 3 m in height) by soil type are stipulated as follows, per Section 234:

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
4	from bottom of trench	3 horizontal to 1 vertical

Minimum support system requirements for steeper excavations are stipulated in Sections 235 through 239 and 241 of the Act and Regulations and include provisions for timbering, shoring and moveable trench boxes. Any excavation slopes greater than 3 m in height should be checked by Grounded for global stability issues.

Larger obstructions (e.g. buried concrete debris, other obstructions) not directly observed in the boreholes are likely present in the earth fill. Similarly, larger inclusions (e.g. cobbles and boulders) may be encountered in the native soils. The size and distribution of these obstructions cannot be predicted with boreholes, as the split spoon sampler is not large enough to capture particles of this size. Provision must be made in excavation contracts to allocate risks associated with the time spent and equipment utilized to remove or penetrate such obstructions when encountered.

Excess soil is governed by Ontario Regulation 406/19: On-Site and Excess Soil Management (ESM). The Project Leader (typically the owner) may be required to file a notice in the excess soil registry and a Qualified Person (within the meaning of O.Reg. 153/04) may be required to prepare the associated planning documents and/or develop and implement a tracking system in accordance with the Soil Rules, to track each load of excess soil during its transportation and deposit before removing excess soil from the project area.

5.2 Short-Term Groundwater Control

Considerations pertaining to groundwater discharge quantities and quality are discussed in Grounded's hydrogeological report for the site, under separate cover.

The design groundwater table (at Elev. 132± m) is well below the bulk and foundation excavation levels for the proposed B1 level of the tower and P1 extension. There is infiltrated stormwater in the fill. On this basis, it is expected that seepage if encountered will be of limited extent. Seepage may be allowed to drain into the excavation and then pumped out. Regardless, excavation delays will occur as seepage (however limited) is controlled. These delays should be anticipated in the construction schedule.

The City of Mississauga will require a Discharge Agreement in the short term, if any water is to be discharged to the storm or sanitary sewers during construction.

5.3 Earth-Retention Shoring Systems

No excavation shall extend below the foundations of existing adjacent structures without adequate alternative support being provided.

Excavation zone of influence guidelines are appended.

Continuous interlocking caisson wall shoring is to be used where the excavation must be constructed as a rigid shoring system. Caisson wall shoring preserves the support capabilities and integrity of the soil beneath existing foundations of adjacent buildings, in a state akin to the at-rest condition. Otherwise, excavations can be supported using conventional soldier pile and lagging walls.

5.3.1 Lateral Earth Pressure Distribution

If the shoring is supported with a single level of earth anchor or bracing, a triangular earth pressure distribution like that used for the basement wall design is appropriate:

$$\boldsymbol{P = K[\gamma H + q] + \gamma_w h_w}$$

P = maximum horizontal pressure (kPa)
K = earth pressure coefficient (see Section 3.3)
H = total depth of the excavation (m)
h_w = height of groundwater (m) above the base of excavation
γ = soil bulk unit weight (kN/m3)
q = total surcharge loading (kPa)

Where shoring walls are drained to effectively eliminate hydrostatic pressure on the shoring system (e.g. pile and lagging walls), h_w is equal to zero. For the design of impermeable shoring, a design groundwater table at Elev. 132± m must be accounted for. There is infiltrated stormwater perched in the earth fill and upper native soils which may accumulate behind a caisson wall. This hydrostatic pressure needs to be accounted for in shoring design.

5.3.2 Soldier Pile Toe Embedment

Soldier pile toes will be made in dense to very dense native soils. Soldier pile toes resist horizontal movement due to the passive earth pressure acting on the toe below the base of excavation.

The subgrade soils at this site are cohesionless, wet, and permeable. There are zones of soil in the subgrade that are wet, cohesionless, and permeable. Augered holes for piles made into these soils will be prone to caving and blowback. Temporarily cased holes are required to prevent borehole caving during installations in drilled holes. To prevent groundwater issues (groundwater inflow, caving and blowback into the drill holes, disturbance to placed concrete, etc.) during drilling and installation, construction methods such as utilizing temporary liners, pre-advancing liners deeper than the augered holes, mud/slurry/polymer drilling techniques, tremie pour concrete, or other methods as deemed necessary by the shoring contractor are required. Concrete for shoring piles and fillers must be placed by tremie method wherever there is more than 300 mm of water or fluid at the base of the drill hole.

5.3.3 Lateral Bracing Elements

The shoring system at this site will require lateral bracing. If feasible, the shoring system should be supported by pre-stressed soil anchors (tiebacks) extending into the subgrade of the adjacent properties. To limit the movement of the shoring system as much as is practically possible, tiebacks are installed and stressed as excavation proceeds. The use of tiebacks through adjacent properties requires the consent (through encroachment agreements) of the adjacent property owners.

In the dense to very dense sands unit, it is expected that post-grouted anchors can be made such that an anchor will safely carry up to 60 kN/m of adhered anchor length (at a nominal borehole diameter of 150 mm).

At least one prototype anchor per tieback level must be performance-tested to 200% of the design load to demonstrate the anchor capacity and validate design assumptions. Given the potential variability in soil conditions or installation quality, all production anchors must also be proof-tested to 133% of the design load.

The loose to compact earth fill below the proposed **tower B1** FFE is not suitable for the placement of raker foundations. Raker footings should be made to bear on ground improvement elements (maximum factored geotechnical resistance to be confirmed by the design-build contractor); alternatively, the shoring system may be laterally supported by an internal bracing system.

The dense to very dense sandy silt below the proposed FFE of the **P1 extension** is suitable for the placement of raker foundations. Raker footings established on dense to very dense soils at an inclination of 45 degrees can be designed for a maximum factored geotechnical resistance at ULS of 300 kPa.

5.4 Site Work

To better protect wet undisturbed subgrade, excavations exposing wet soils must be cut neat, inspected, and then immediately protected with a skim coat of concrete (i.e. a mud mat). Wet sands are susceptible to degradation and disturbance due to even mild site work, frost, weather, or a combination thereof.

The effects of work on site can greatly impact soil integrity. Care must be taken to prevent this damage. Site work carried out during periods of inclement weather may result in the subgrade becoming disturbed, unless a granular working mat is placed to preserve the subgrade soils in their undisturbed condition. Subgrade preparation activities should not be conducted in wet weather and the project must be scheduled accordingly.

If site work causes disturbance to the subgrade, removal of the disturbed soils and the use of granular fill material for site restoration or underfloor fill will be required at additional cost to the project.

It is construction activity itself that often imparts the most severe loading conditions on the subgrade. Special provisions such as end dumping and forward spreading of earth and aggregate fills, restricted construction lanes, and half-loads during placement of the granular base and other work may be required, especially if construction is carried out during unfavourable weather.

Adequate temporary frost protection for the founding subgrade must be provided if construction proceeds in freezing weather conditions. The subgrade at this site is susceptible to frost damage. The slab on grade should not be placed on frozen subgrade, to prevent excess settlement of the slab as the subgrade thaws. Areas of frozen subgrade should be removed during subgrade preparation. Depending on the project context, consideration should be given to frost effects (heaving, softening, etc.) on exposed subgrade surfaces.

5.5 Engineering Review

By issuing this preliminary report, Grounded Engineering has assumed the role of Geotechnical Engineer of Record for this site. Grounded should be retained to review the structural engineering drawings prior to issue or construction to ensure that the recommendations in this report have been appropriately implemented.

All foundation installations must be reviewed in the field by Grounded, the Geotechnical Engineer of Record, as they are constructed. The on-site review of foundation installations and the condition of the founding subgrade as the foundations are constructed is as much a part of the geotechnical engineering design function as the design itself; it is also required by Section 4.2.2.2 of the Ontario Building Code. If Grounded is not retained to carry out foundation engineering field review during construction, then Grounded accepts no responsibility for the performance or non-performance of the foundations, even if they are constructed in general conformance with the engineering design advice contained in this report.

Strict procedures must be maintained during construction to maintain the integrity of the subgrade to the extent possible. The design advice in this report is based on an assessment of the subgrade support capabilities as indicated by the boreholes. These conditions may vary across the site depending on the final design grades and therefore, the preparation of the subgrade should be monitored by Grounded at the time of construction to confirm material quality, and thickness.

A visual pre-construction survey of adjacent lands and buildings is recommended to be completed prior to the start of any construction. This documents the baseline condition and can prevent unwarranted damage claims. Any shoring system, regardless of the execution and design, has the potential for movement. Small changes in stress or soil volume can cause cracking in adjacent buildings.

6 Limitations and Restrictions

Grounded should be retained to review the structural and geostructural engineering drawings prior to issue or construction to ensure that the recommendations in this report have been appropriately implemented.

This preliminary geotechnical engineering report is intended for due diligence purposes only. At detailed design, additional boreholes, groundwater monitoring wells, and updated detailed geotechnical engineering advice are required. Once completed, the future detailed geotechnical engineering report by Grounded Engineering would then supersede this preliminary report. Note that preliminary findings can vary significantly from the findings of a detailed comprehensive study.

6.1 Investigation Procedures

The geotechnical engineering analysis and advice provided here are based on factual data obtained from investigations at this site conducted by other consultants as described above. This previous consultant subsurface information is provided in a professional engineer's signed and sealed geotechnical report, and as such this borehole information is taken as factual for present purposes.

The Split-Barrel Method technique (ASTM D1586) was used to obtain the soils samples, as reported by Terraprobe. The sampling was conducted at conventional intervals and not continuously. As such, stratigraphic interpolation between samples is required and stratigraphic boundary lines do not represent exact depths of geological change. They should be taken as gradual transition zones between soil or rock types.

A carefully conducted, fully comprehensive investigation and sampling scope of work carried out under the most stringent level of oversight may still fail to detect certain ground conditions. As such, users of this report must be aware of the risks inherent in using engineered field investigations to observe and record subsurface conditions. As a necessary requirement of working with discrete test locations, Grounded has assumed that the conditions between test locations are the same as the test locations themselves, for the purposes of providing geotechnical engineering advice.

It is not possible to design a field investigation with enough test locations that would provide complete subsurface information, nor is it possible to provide geotechnical engineering advice that completely identifies or quantifies every element that could affect construction, scheduling, or tendering. Contractors undertaking work based on this report (in whole or in part) must make their own determination of how they may be affected by the subsurface conditions, based on their own analysis of the factual information provided and based on their own means and methods. Contractors using this report must be aware of the risks implicit in using factual information at discrete test locations to infer subsurface conditions across the site and are directed to conduct their own investigations as needed.

6.2 Site and Scope Changes

Natural occurrences, the passage of time, local construction, and other human activity all have the potential to directly or indirectly alter the subsurface conditions at or near the project site. Contractual obligations related to groundwater or stormwater control, disturbed soils, frost protection, etc. must be considered with attention and care as they relate to potential site alteration.

The preliminary geotechnical engineering advice provided in this report is based on the factual observations made from the site investigations as reported by other consultants. It is intended for use by the owner and their retained design team. If there are changes to the features of the development or to the scope, the interpreted subsurface information, geotechnical engineering design parameters, advice, and discussion on construction considerations may not be relevant or complete for the project. Grounded should be retained to review the implications of such changes with respect to the contents of this report.

This report provides preliminary geotechnical engineering advice intended for use by the owner and their retained design team for due diligence only. These preliminary interpretations, design parameters, advice, and discussion on construction considerations are not complete. A detailed site-specific geotechnical investigation must be conducted by Grounded during detailed design to confirm and update the preliminary recommendations provided here.

6.3 Report Use

The authorized users of this report are Starlight Investments and their design team, for whom this report has been prepared. Grounded Engineering Inc. maintains the copyright and ownership of this document. Reproduction of this report in any format or medium requires explicit prior authorization from Grounded Engineering Inc.

The City of Mississauga may also make use of and rely upon this report, subject to the limitations as stated.

7 Closure

If the design team has any questions regarding the discussion and advice provided, please do not hesitate to have them contact our office. We trust that this report meets your requirements at present.

For and on behalf of our team,

GROUNDED
ENGINEERING

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Project Coordinator

Nick Ng, P.Eng.
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2024-05-21
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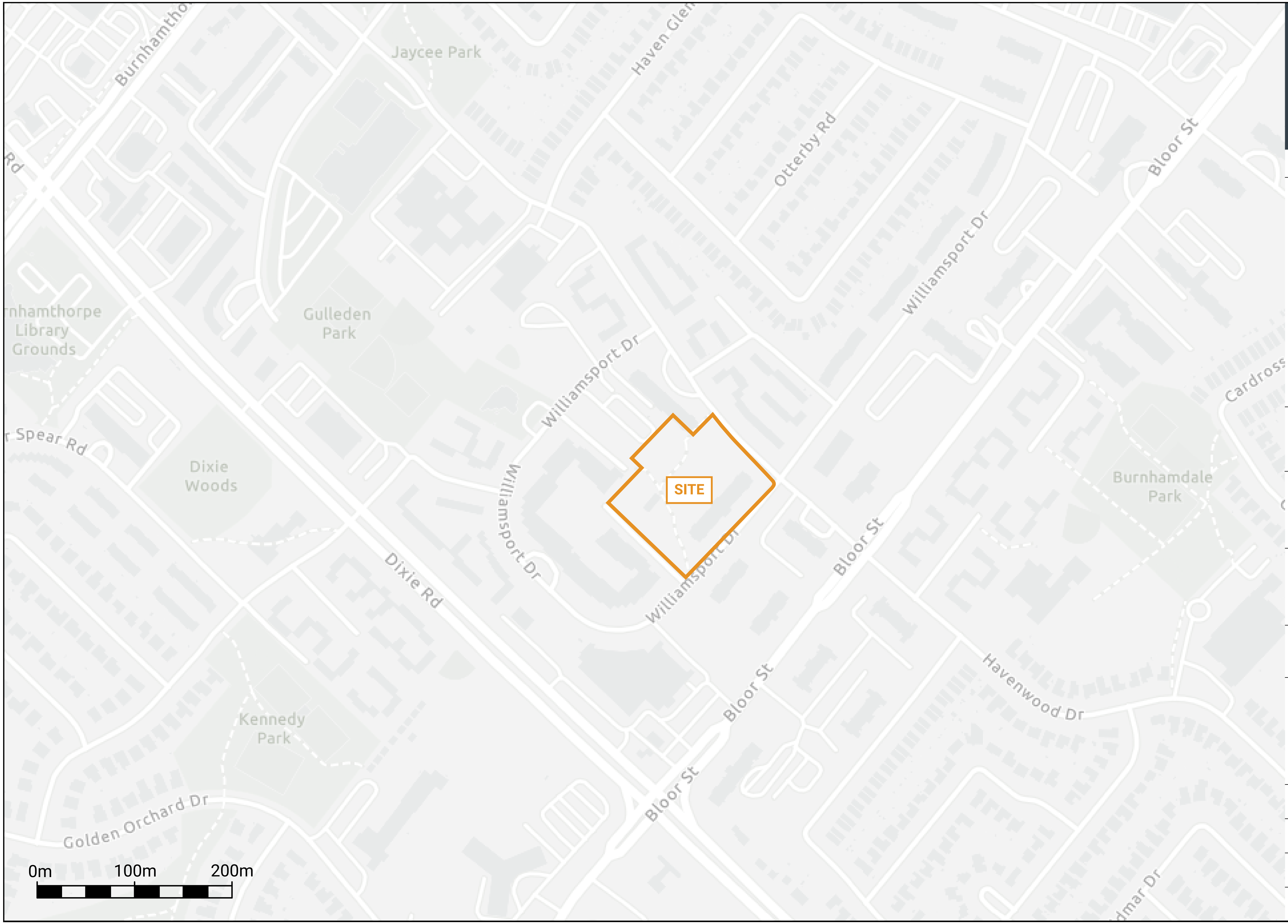
FIGURES



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LEGEND

— APPROXIMATE SITE BOUNDARY

Note

Reference

ArcGIS Online 2024

Project

1485 WILLIAMSPORT DRIVE, MISSISSAUGA, ON

Figure Title

SITE LOCATION PLAN

North

TRUE
PROJECT

Date

MAY 2024

Scale

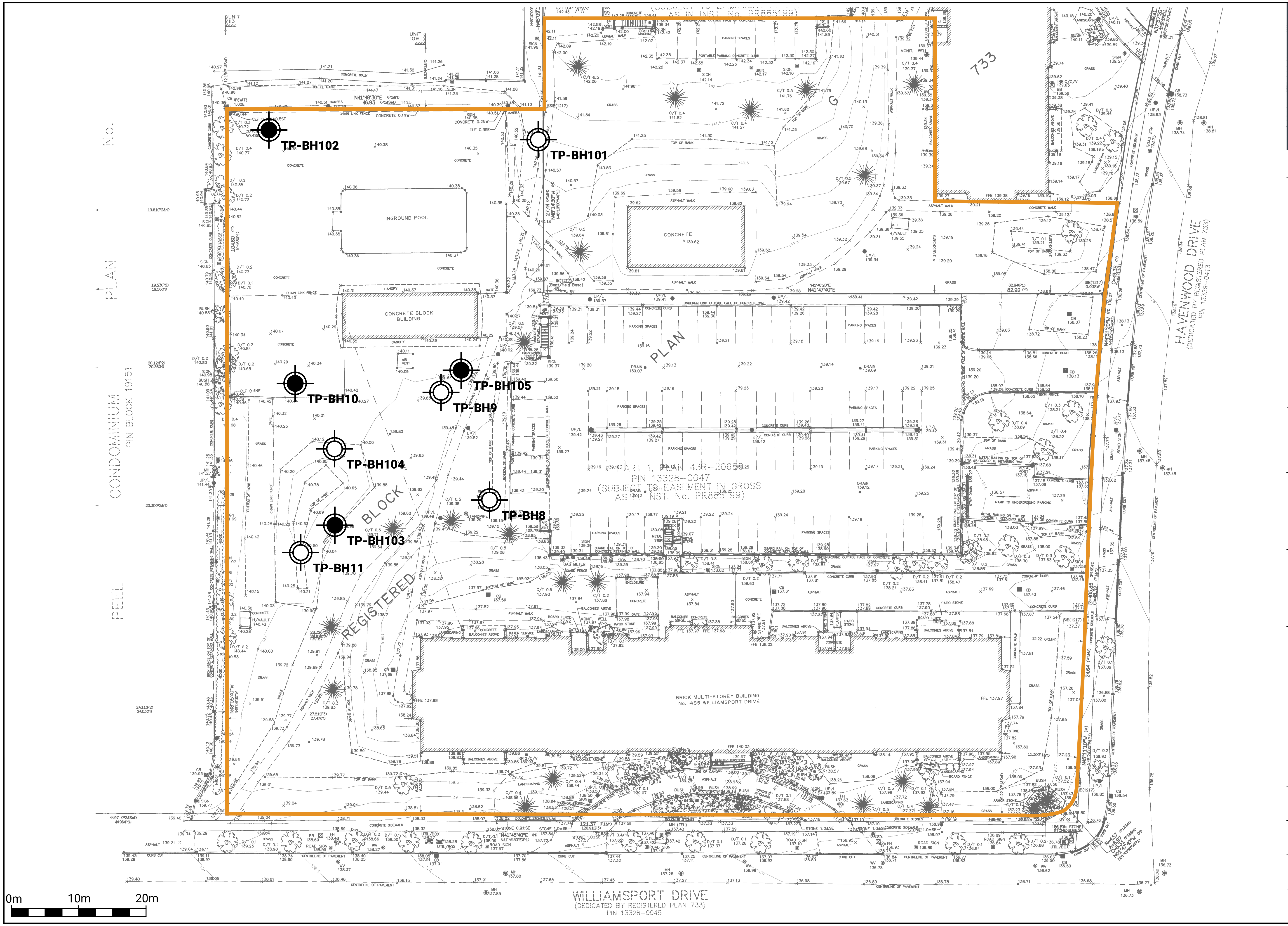
AS INDICATED

Job No

24-067

Figure No

FIGURE 1



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LEGEND

▬	APPROXIMATE SITE LOCATION
● ○	MONITORING WELL/BOREHOLE BY OTHERS

Note

Grounded will complete a confirmatory site-specific investigation for detailed design at a later date.

Reference

Topographic Survey, "Topographic Plan of Survey of Part of Block G - Registered Plan 733, City of Mississauga"; Job No. 16-132-00, dated May 18, 2016, prepared by Schaeffer Dzaldov Purcell Ltd.

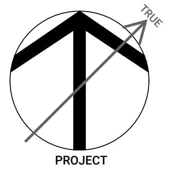
Project

1485 WILLIAMSPORT DRIVE, MISSISSAUGA, ON

Figure Title

BOREHOLE LOCATION PLAN - EXISITING CONDITIONS

North



Date

MAY 2024

Scale

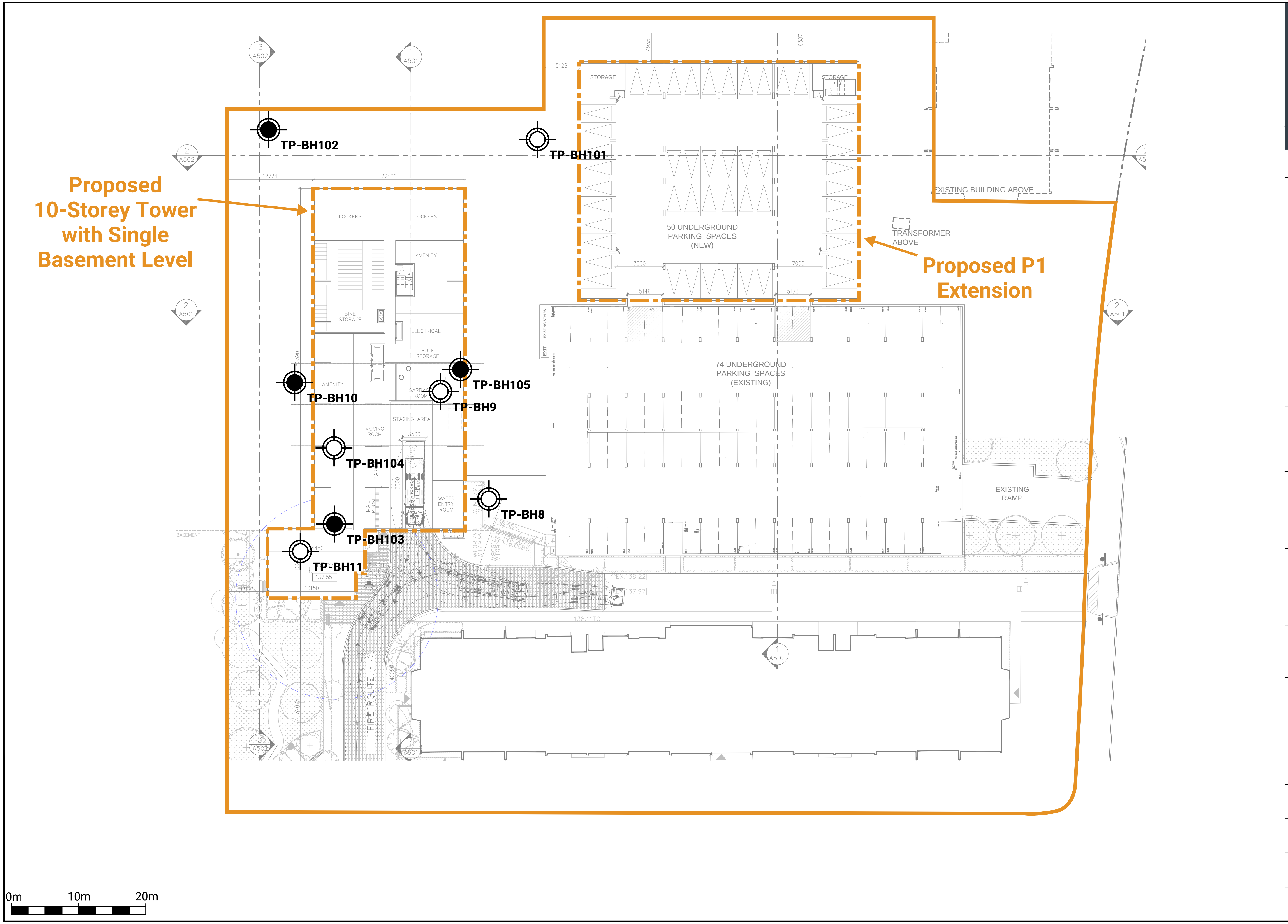
AS INDICATED

Job No

24-067

Figure No

FIGURE 2



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LEGEND

APPROXIMATE SITE LOCATION

MONITORING WELL/BOREHOLE BY OTHERS

Note

Grounded will complete a confirmatory site-specific investigation for detailed design at a later date.

Reference

Architectural Drawing, "Basement Plan Option 1"; Drawing No. A300, Job No. 21-15, dated June 22, 2023, prepared by ArchitectureUnfolded

Project

1485 WILLIAMSPORT DRIVE, MISSISSAUGA, ON

Figure Title

BOREHOLE LOCATION PLAN - PROPOSED CONDITIONS

North

TRUE
PROJECT

Date

MAY 2024

Scale

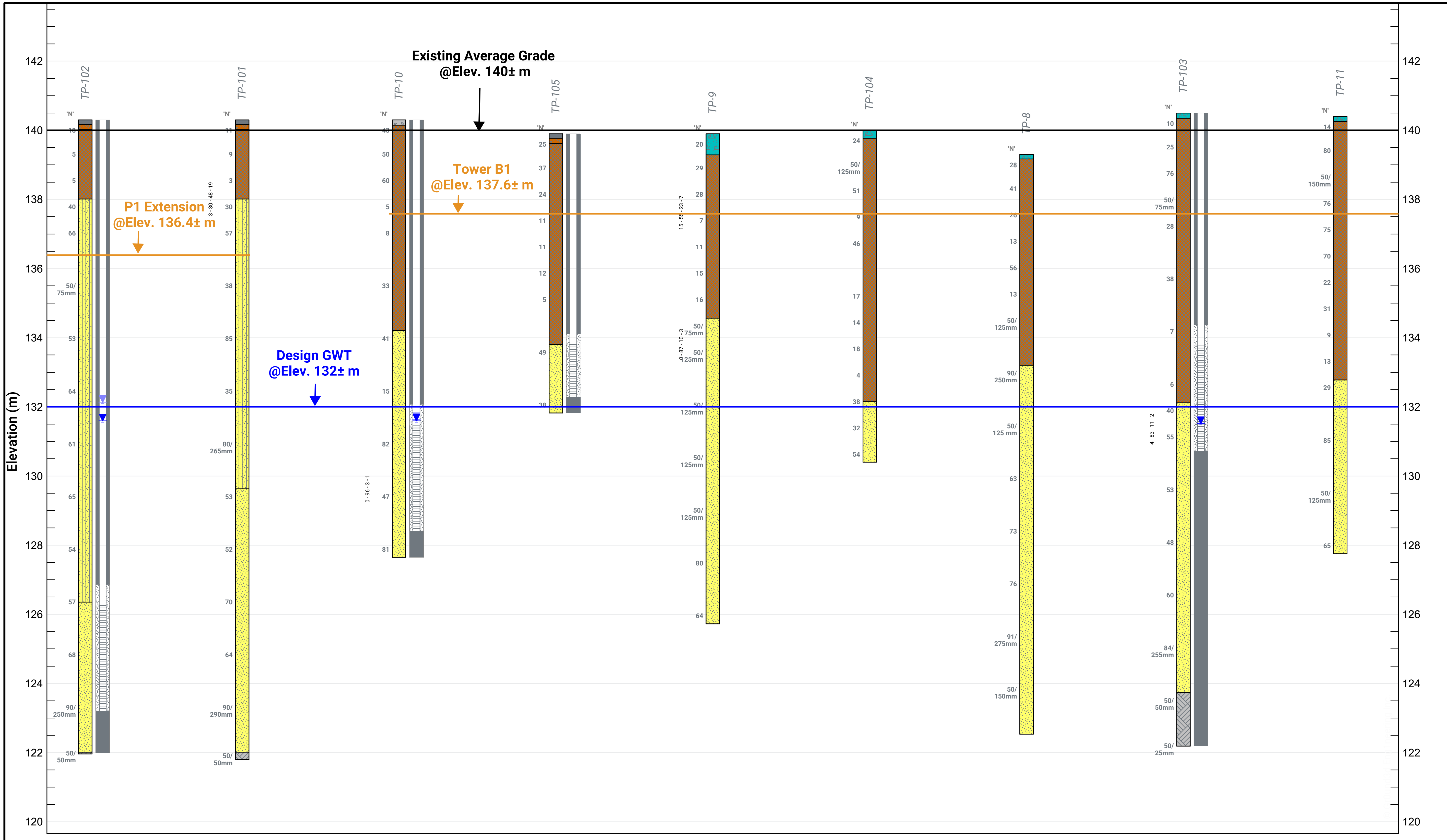
AS INDICATED

Job No

24-067

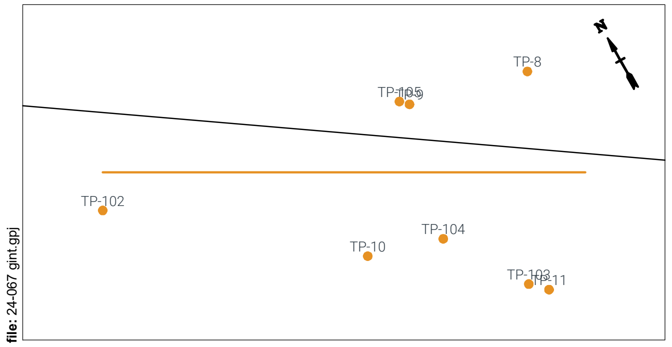
Figure No

FIGURE 3



Boreholes Equally Spaced

SITE MAP



file: 24-067 gint.gpj

BOREHOLE STRATIGRAPHY LEGEND

▨ Topsoil	■ Asphalt
▨ Fill	▨ Aggregate
▨ Sand	▨ Sandy Silt
▨ Concrete	▨ Bedrock (inferred)

The factual borehole information shown is from other consultants only. A full list of references is provided in the body of our report.

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LEGEND

- 🟧 FILL
- 🟧 GRAVELS (gravel to gravelly sand)
- 🟨 SILT TO SAND (not till)
- 🟩 COHESIONLESS TILLS
- 🟪 COHESIVE SOILS (clayey silt to clay, incl. tills)
- 🟦 DISTURBED/REWORKED/ORGANIC
- *T-BH7* BOREHOLES BY OTHERS

- ▽ water level, unstabilized
- ▼ water level, stabilized (latest)
- ▼ water level, stabilized (highest)

Project
**1485 WILLIAMSPORT DR
MISSISSAUGA, ON**

Figure Title
SUBSURFACE PROFILE

BOREHOLES BY OTHERS

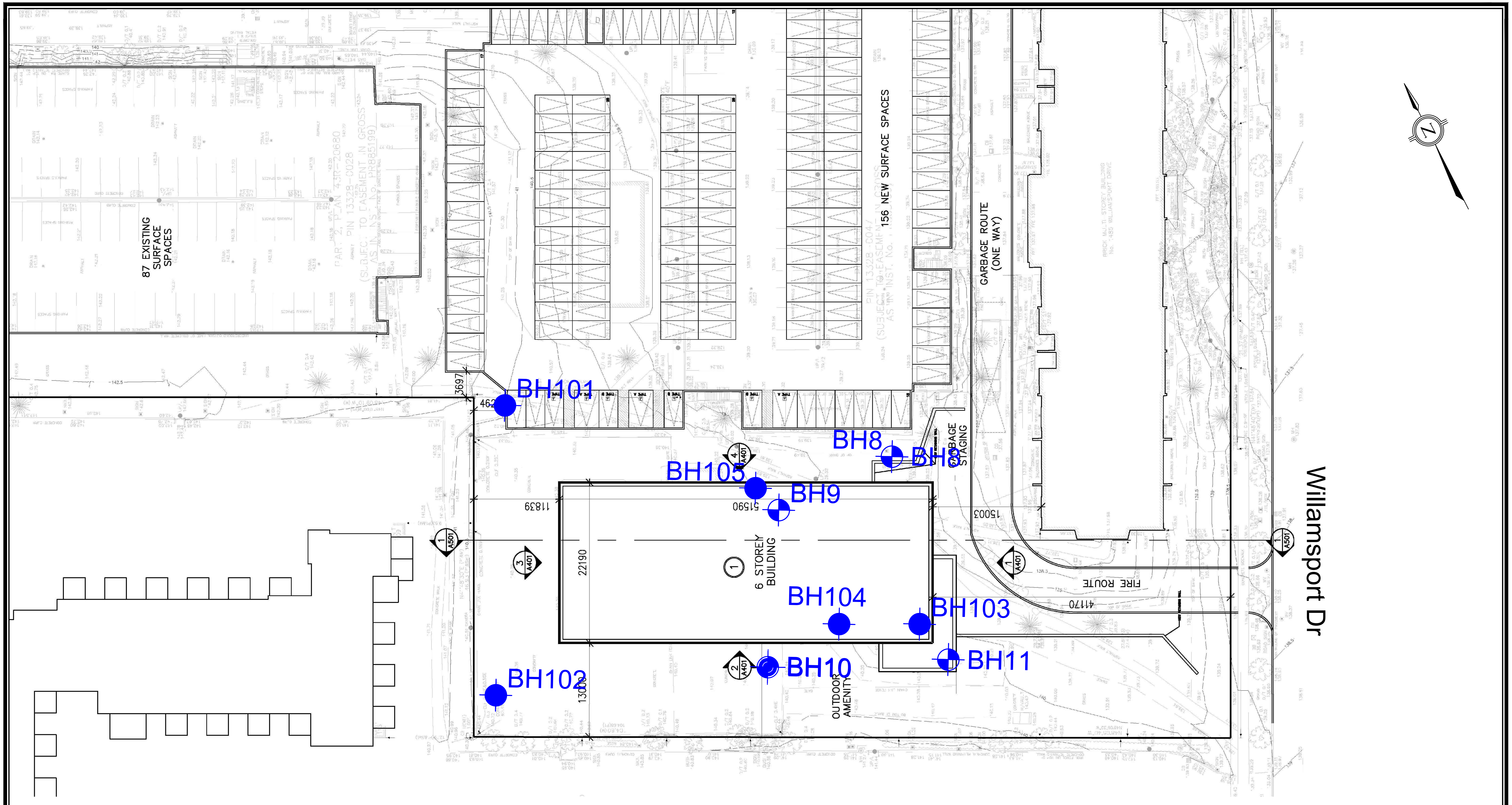
Date
MAY 2024

Scale
AS INDICATED

Job No
24-067

Figure No
FIGURE 4

APPENDIX A



REFERENCE
Project: Pacific Way
Title: Site Plan, Proj. No.: 21-15
Date: Sep 12, 2022, Dwg. No.: A101
By: Architectureunfolded

LEGEND

●	Borehole Location (2022)
⊕	Borehole Location (2018)

0 5 10 15 20
SCALE 1:500

Terraprobe
11 Indell Lane, Brampton, Ontario, L6T 3Y3
Tel: (905) 796-2650 Fax: (905) 796-2250

Title:
BOREHOLE LOCATION PLAN
Proposed Condition

File No.
1-22-0531-46

FIGURE :
2B

Y:\Shared\CA\Terraprobe\Brampton\1-Project Files\2022\1-22-0531 - 1485 Williamsport Drive, Mississauga\01-Geotechnical Investigation\A. Dwgs, Logs\AutoCAD\1-22-0531-01 Figs.dwg,
DWG To PDF.pc3, Kamal Kamal

Terraprobe

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 or close to plastic limit) but does not have visible pore water
Wet	refers to a soil sample that has visible pore water

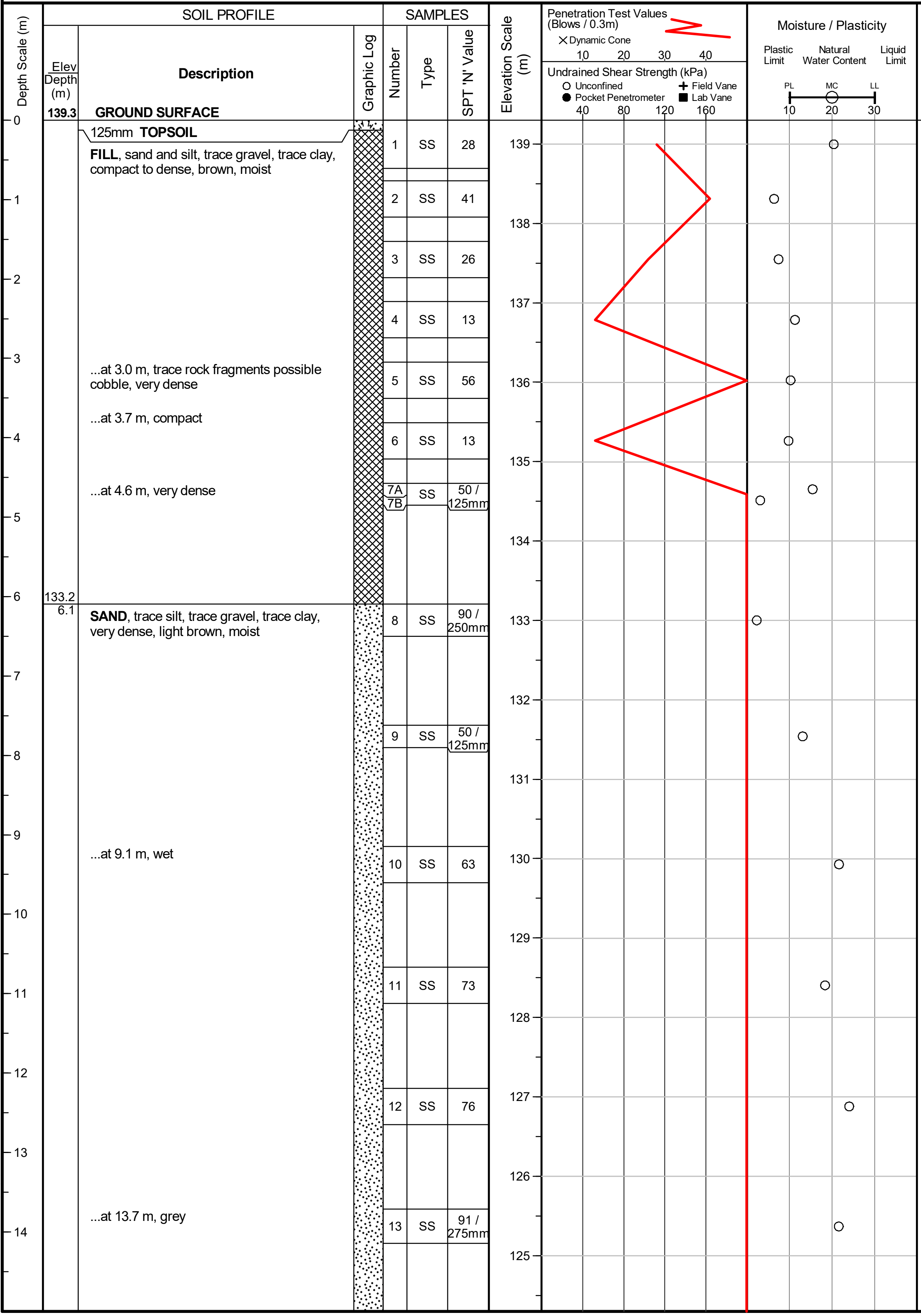
Terraprobe

LOG OF BOREHOLE 8

Project No. : 1-22-0531-01	Client : Starlight Investments	Originated by : SM
Date started : March 7, 2017	Project : 1485 Williamsport Drive	Compiled by : JH
Sheet No. : 1 of 2	Location : Mississauga, Ontario	Checked by : MD

Position : E: 613414, N: 4830578 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Truck-mounted
Drilling Method : Solid stem augers

Elev Depth (m)	SOIL PROFILE Description	SAMPLES Number	Type	SPT 'N' Value	Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL
139.3	**GROUND SURFACE**							
	125mm **TOPSOIL**							
	FILL, sand and silt, trace gravel, trace clay, compact to dense, brown, moist	1	SS	28				
		2	SS	41				
		3	SS	26				
		4	SS	13				
	...at 3.0 m, trace rock fragments possible cobble, very dense	5	SS	56				...at 3.0m, spoon wet
	...at 3.7 m, compact	6	SS	13				...at 3.7m, light auger grinding to 4.3m
							∇	
	...at 4.6 m, very dense	7A 7B	SS	50 / 125mm				
133.2 6.1	**SAND**, trace silt, trace gravel, trace clay, very dense, light brown, moist	8	SS	90 / 250mm				
		9	SS	50 / 125mm				
	...at 9.1 m, wet	10	SS	63				...at 9.1m, spoon wet, cave
		11	SS	73				
		12	SS	76				
	...at 13.7 m, grey	13	SS	91 / 275mm				
								...at 14.9m, very hard



(continued next page)

Terraprobe

LOG OF BOREHOLE 8

Project No. : 1-22-0531-01
Date started : March 7, 2017
Sheet No. : 2 of 2

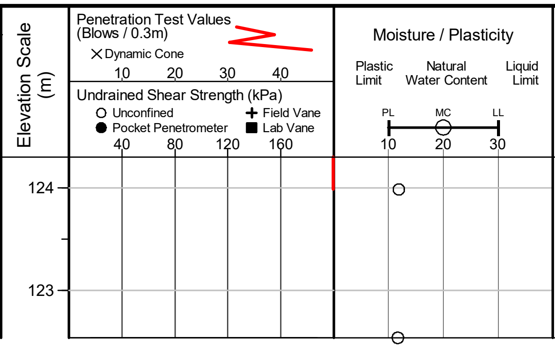
Client : Starlight Investments
Project : 1485 Williamsport Drive
Location : Mississauga, Ontario

Originated by : SM
Compiled by : JH
Checked by : MD

Position : E: 613414, N: 4830578 (UTM 17T)
Rig type : Truck-mounted

Elevation Datum : Geodetic
Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	SOIL PROFILE Description	Graphic Log	SAMPLES Number	Type	SPT 'N' Value	Elevation Scale (m)	Lab Data and Comments GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL
15		*(continued)*						
		SAND, trace silt, trace gravel, trace clay, very dense, light brown, moist *(continued)* ...at 15.2 m, trace shale fragments		14	SS	50 / 150mm	124	auger grinding to 15.2m ...at 15.2m, very hard auger grinding to 16.8m ...at 15.8m, bedrock to 16.2m
16							123	
	122.5 16.8	...at 16.8 m, inferred weathered bedrock		15	AS			



Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

END OF BOREHOLE

Unstabilized water level measured at 4.3 m below ground surface; borehole caved to 7.9 m below ground surface upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 9

Project No. : 1-22-0531-01
Date started : March 14, 2017
Sheet No. : 1 of 1

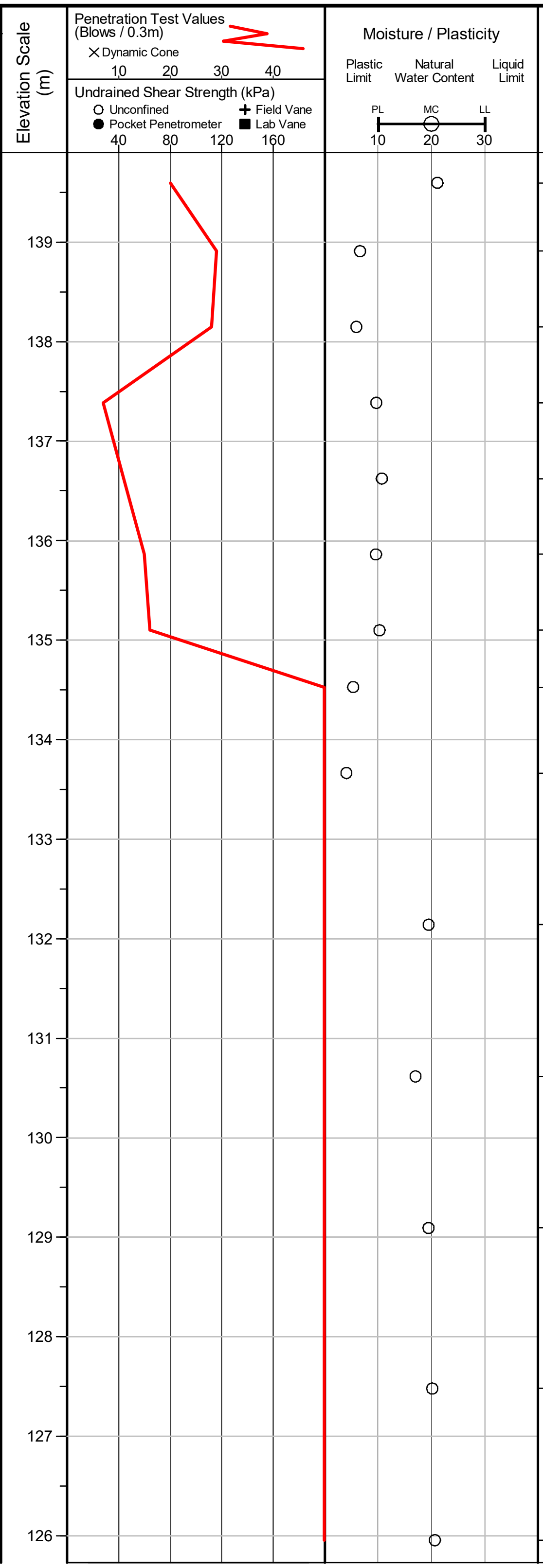
Client : Starlight Investments
Project : 1485 Williamsport Drive
Location : Mississauga, Ontario

Originated by : MC
Compiled by : JH
Checked by : MD

Position : E: 613398, N: 4830582 (UTM 17T)
Rig type : Truck-mounted

Elevation Datum : Geodetic
Drilling Method :

Depth Scale (m)	Elev Depth (m)	Description	Number	Type	SPT 'N' Value	Headspace Vapour (ppm)	Unstabilized Water Level	Lab Data and Comments GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL
0	139.9	**GROUND SURFACE**						
		600mm **TOPSOIL**	1	SS	20	PID: 0		
	139.3 0.6	**FILL**, silty sand, some gravel, trace clay, loose to compact, brown, moist	2	SS	29	PID: 0		
			3	SS	28	PID: 10		
			4	SS	7	PID: 5		15 55 23 7
3		...at 3.0 m, silty	5	SS	11	PID: 5		
			6	SS	15	PID: 5		
			7	SS	16	PID: 0		
	134.6 5.3	**SAND**, trace silt, trace gravel, trace clay, very dense, brown, moist	8	SS	50 / 75mm	PID: 0		
			9	SS	50 / 125mm	PID: 0		0 87 10 3
			10	SS	50 / 125mm	PID: 0		
8							∇	
			11	SS	50 / 125mm	PID: 0		
		...at 10.7 m, wet	12	SS	50 / 125mm	PID: 5		
			13	SS	80	PID: 0		
		...at 13.7 m, grey	14	SS	64	PID: 5		
14	125.7 14.2	**END OF BOREHOLE**						



Wet cave at 8.2 m below ground surface upon completion of drilling.

Terraprobe

LOG OF BOREHOLE 10

Project No. : 1-22-0531-01
Date started : March 15, 2017
Sheet No. : 1 of 1

Client : Starlight Investments
Project : 1485 Williamsport Drive
Location : Mississauga, Ontario

Originated by : JH
Compiled by : JH
Checked by : MD

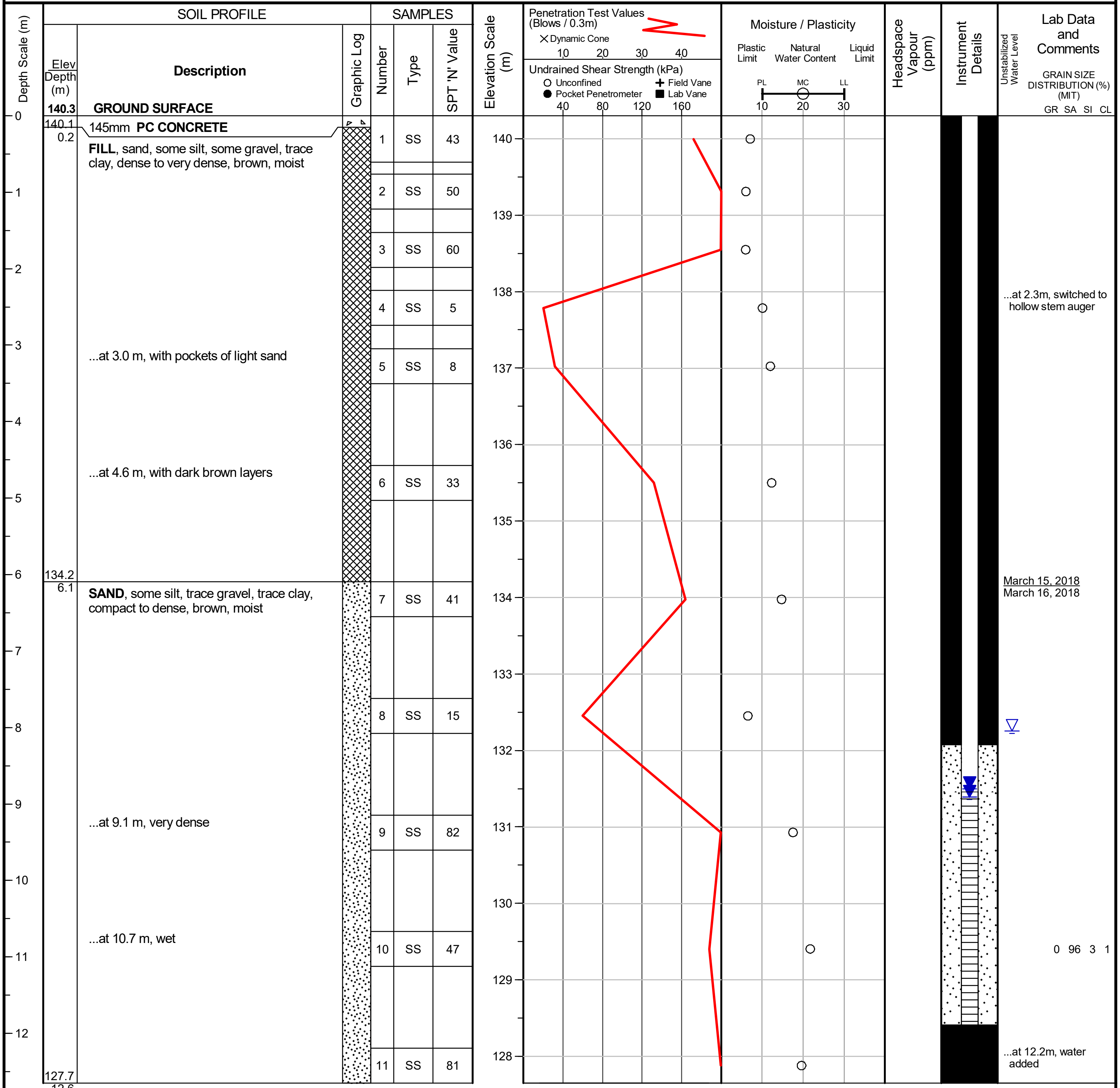
Position : E: 613383, N: 4830567 (UTM 17T)
Rig type : Truck-mounted
Elevation Datum : Geodetic
Drilling Method : Solid stem / hollow stem augers

SOIL PROFILE

Elev Depth (m)	Description
140.3	**GROUND SURFACE**
140.1 0.2	145mm **PC CONCRETE**
	FILL, sand, some silt, some gravel, trace clay, dense to very dense, brown, moist ...at 3.0 m, with pockets of light sand ...at 4.6 m, with dark brown layers
134.2 6.1	**SAND**, some silt, trace gravel, trace clay, compact to dense, brown, moist ...at 9.1 m, very dense ...at 10.7 m, wet
127.7 12.6	**END OF BOREHOLE**

SAMPLES

Number	Type	SPT 'N' Value
1	SS	43
2	SS	50
3	SS	60
4	SS	5
5	SS	8
6	SS	33
7	SS	41
8	SS	15
9	SS	82
10	SS	47
11	SS	81



Lab Data and Comments:

...at 2.3m, switched to hollow stem auger

March 15, 2018
March 16, 2018

0 96 3 1

...at 12.2m, water added

END OF BOREHOLE

Unstabilized water level measured at 8.0 m below ground surface; borehole was open upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 23, 2018	8.9	131.4
Apr 3, 2018	8.9	131.4
Oct 4, 2018	8.7	131.6
Sep 19, 2022	8.7	131.6
Sep 30, 2022	8.8	131.5
Oct 13, 2022	8.8	131.5

Terraprobe

LOG OF BOREHOLE 11

Project No. : 1-22-0531-01
Date started : March 8, 2017
Sheet No. : 1 of 1

Client : Starlight Investments
Project : 1485 Williamsport Drive
Location : Mississauga, Ontario

Originated by : SM
Compiled by : JH
Checked by : MD

Position : E: 613402, N: 4830551 (UTM 17T)
Rig type : Truck-mounted

Elevation Datum : Geodetic
Drilling Method : Hollow stem augers

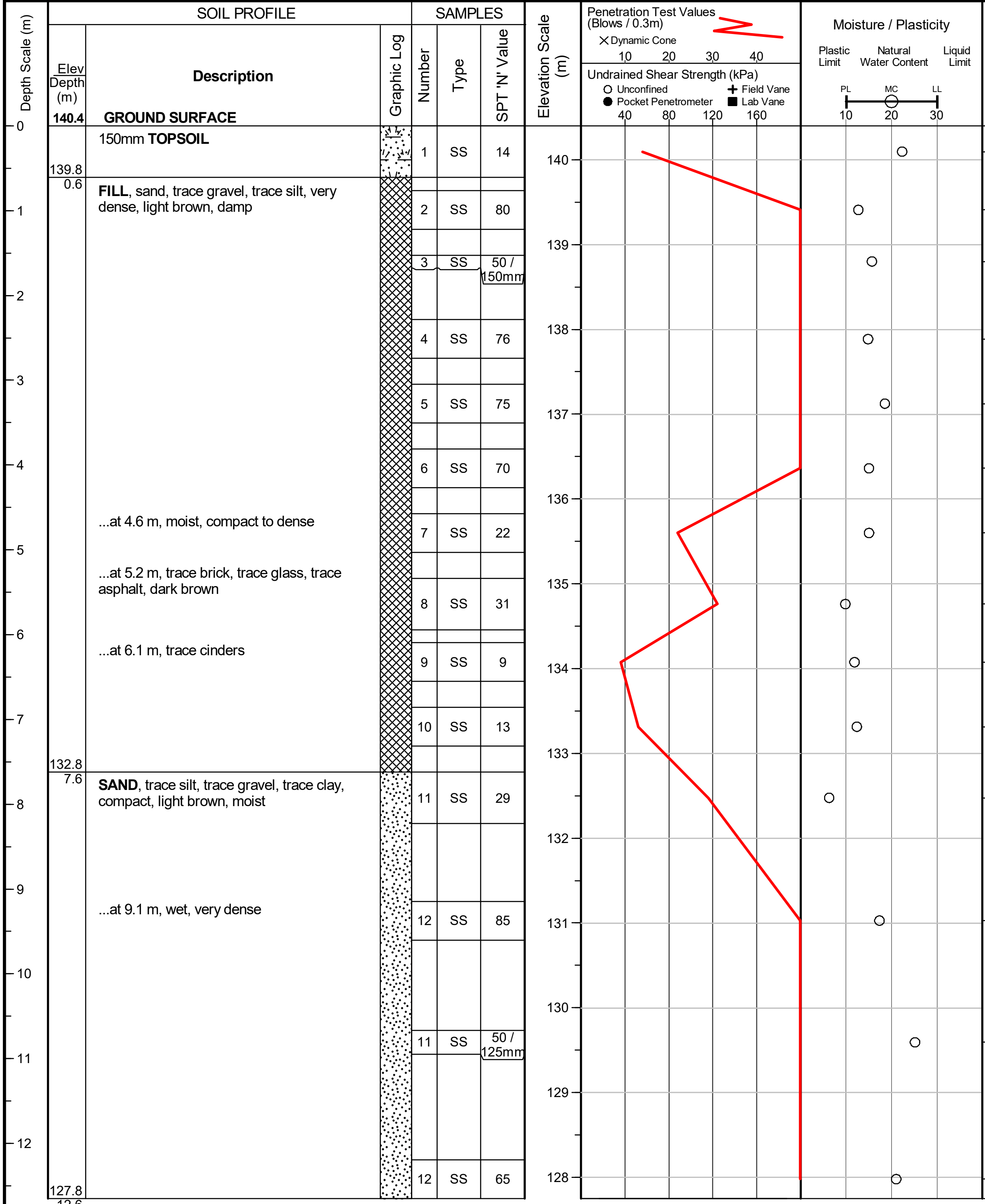
SOIL PROFILE

Elev Depth (m)	Description
140.4	**GROUND SURFACE**
	150mm **TOPSOIL**
139.8 0.6	**FILL**, sand, trace gravel, trace silt, very dense, light brown, damp
	...at 4.6 m, moist, compact to dense
	...at 5.2 m, trace brick, trace glass, trace asphalt, dark brown
	...at 6.1 m, trace cinders
132.8 7.6	**SAND**, trace silt, trace gravel, trace clay, compact, light brown, moist
	...at 9.1 m, wet, very dense
127.8 12.6	**END OF BOREHOLE**

Borehole was dry and caved to 7.9 m below ground surface upon completion of drilling.

SAMPLES

Number	Type	SPT 'N' Value	Headspace Vapour (ppm)	Lab Data and Comments
1	SS	14	PID: 0	SS1 Analysis: OC Pest
2	SS	80	PID: 0	...at 0.8m, light auger grinding to 1.5m
3	SS	50 / 150mm	PID: 0	SS2 Analysis: M&I, PCB
4	SS	76	PID: 0	
5	SS	75	PID: 20	SS5 Analysis: PHC
6	SS	70	PID: 0	
7	SS	22	PID: 0	
8	SS	31	PID: 0	
9	SS	9	PID: 0	
10	SS	13	PID: 0	
11	SS	29	PID: 0	SS11 Analysis: M&I, PHC
12	SS	85	PID: 0	
11	SS	50 / 125mm	PID: 0	...at 10.7m, spoon wet ...at 10.7m, water added
12	SS	65	PID: 0	



Instrument Details

Unstabilized Water Level

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

LOG OF BOREHOLE 101

Terraprobe

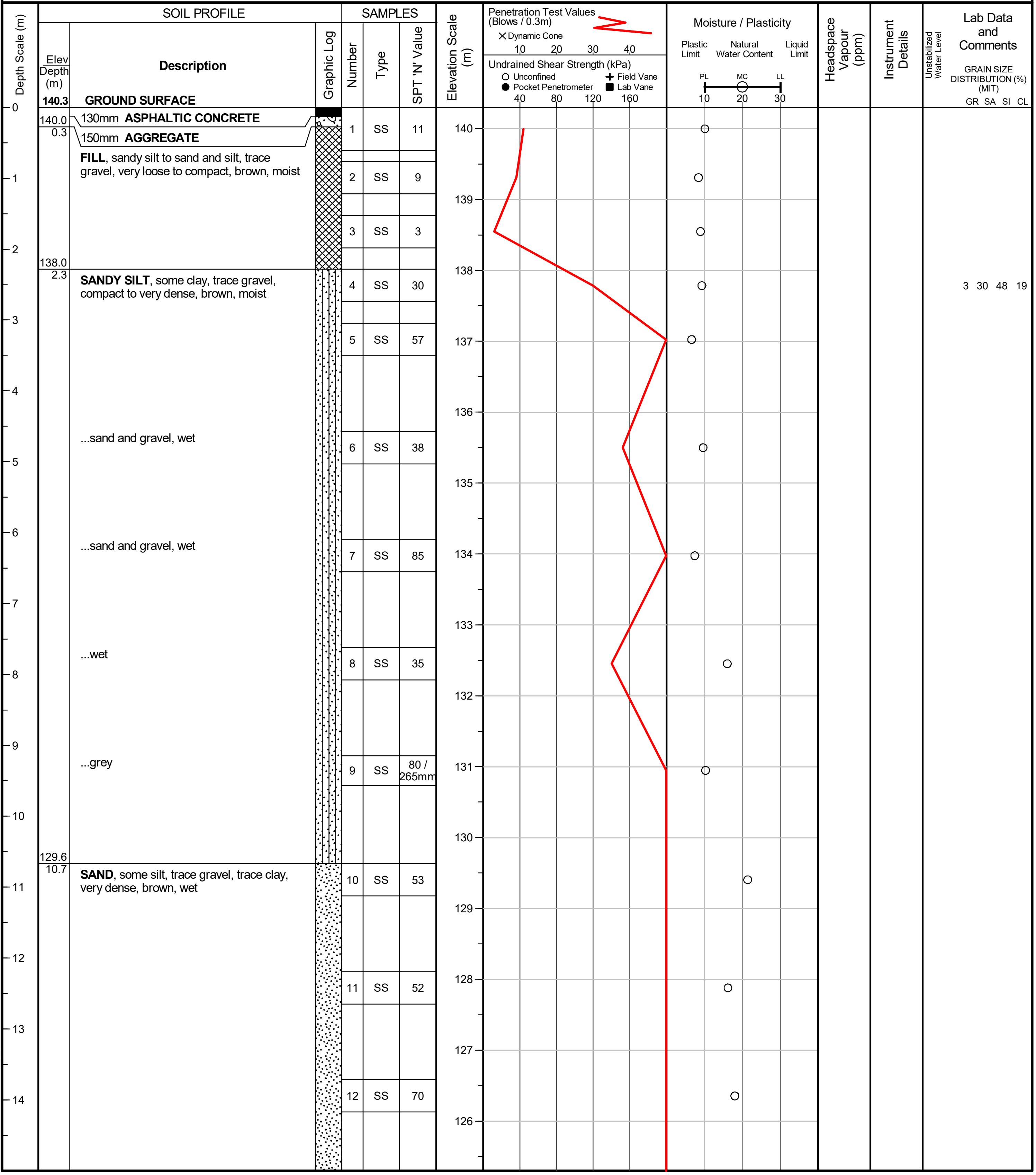
Project No. : 1-22-0531-01
Date started : September 15, 2022
Sheet No. : 1 of 2

Client : Starlight Investments
Project : 1485 Williamsport Drive
Location : Mississauga, Ontario

Originated by : ZJ
Compiled by : FM
Checked by : HR

Position : E: 613375, N: 4830612 (UTM 17T)
Rig type : Track-mounted
Elevation Datum : Geodetic
Drilling Method : Solid stem augers/mud rotary

Elev (m)	Depth (m)	Description	Sample Number	Type	SPT 'N' Value	Lab Data and Comments GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL
140.3		**GROUND SURFACE**				
140.0	0.3	130mm **ASPHALTIC CONCRETE**	1	SS	11	
		150mm **AGGREGATE**				
		FILL, sandy silt to sand and silt, trace gravel, very loose to compact, brown, moist	2	SS	9	
			3	SS	3	
138.0	2.3	**SANDY SILT**, some clay, trace gravel, compact to very dense, brown, moist	4	SS	30	3 30 48 19
			5	SS	57	
		...sand and gravel, wet	6	SS	38	
		...sand and gravel, wet	7	SS	85	
		...wet	8	SS	35	
		...grey	9	SS	80 / 265mm	
129.6	10.7	**SAND**, some silt, trace gravel, trace clay, very dense, brown, wet	10	SS	53	
			11	SS	52	
			12	SS	70	



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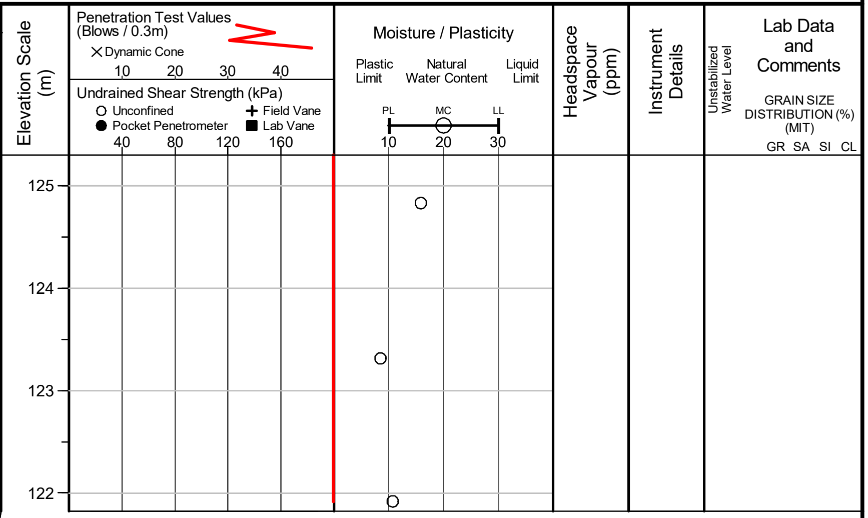
LOG OF BOREHOLE 101

Project No. : 1-22-0531-01	Client : Starlight Investments	Originated by : ZJ
Date started : September 15, 2022	Project : 1485 Williamsport Drive	Compiled by : FM
Sheet No. : 2 of 2	Location : Mississauga, Ontario	Checked by : HR

Position : E: 613375, N: 4830612 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Solid stem augers/mud rotary

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)
15		*(continued)* **SAND**, some silt, trace gravel, trace clay, very dense, brown, wet *(continued)*		13	SS	64	125
16							124
17		...grey below		14	SS	90 / 290mm	123
18	122.0						122
	121.8 18.5	**INFERRED BEDROCK**, shale fragments (GEORGIAN BAY FORMATION)		15	SS	50/ 50mm	



END OF BOREHOLE

Borehole contained drill water upon completion of drilling. Unstabilized water level and cave not measured.

file: 1-22-0531-01 bh logs.gpj

Terraprobe

LOG OF BOREHOLE 102

Project No.	: 1-22-0531-01	Client	: Starlight Investments	Originated by	: ZJ
Date started	: September 14, 2022	Project	: 1485 Williamsport Drive	Compiled by	: FM
Sheet No.	: 1 of 2	Location	: Mississauga, Ontario	Checked by	: HR

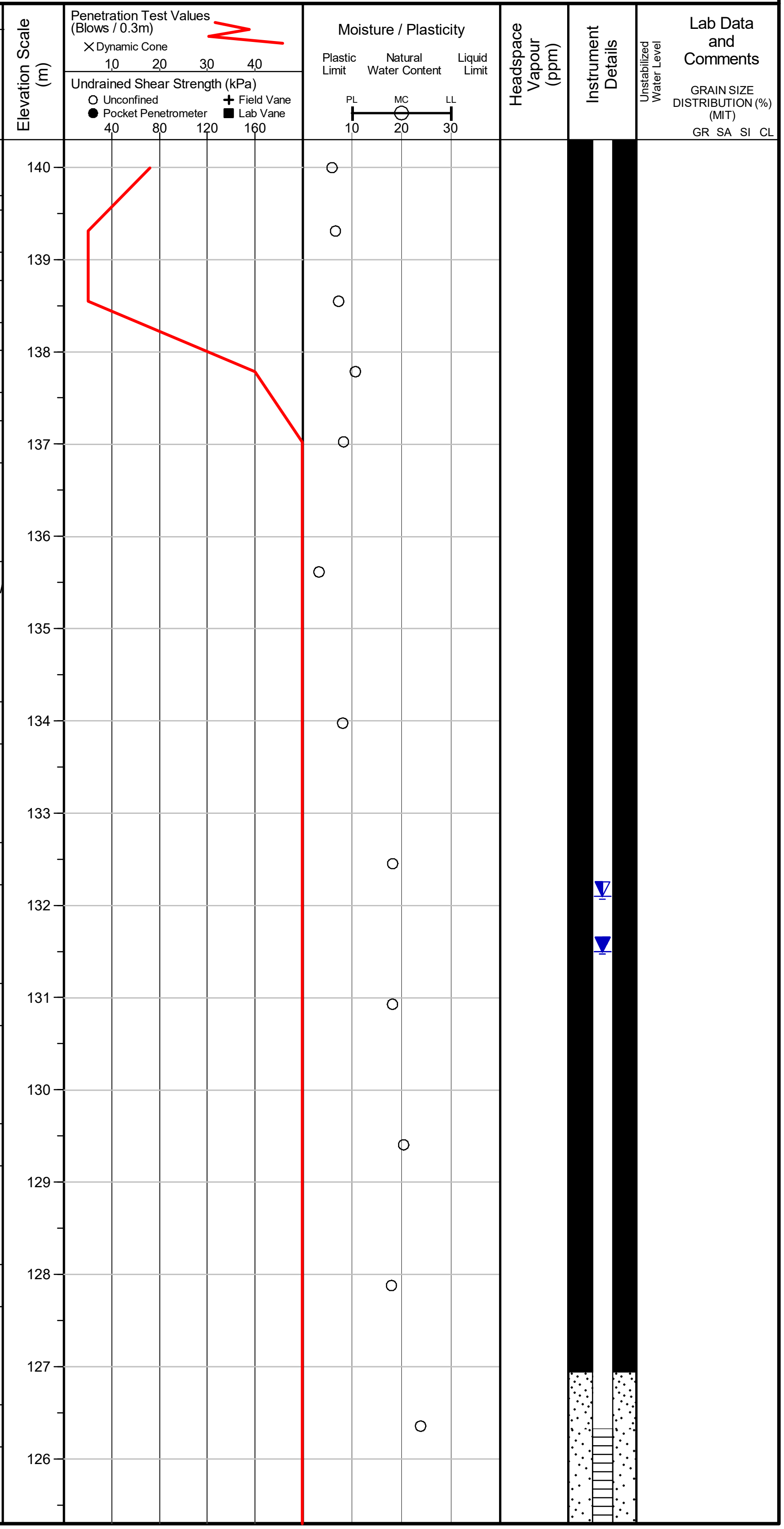
Position : E: 613355, N: 4830590 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Solid stem augers/mud rotary

SOIL PROFILE

Elev Depth (m)	Description
140.3	**GROUND SURFACE**
140.0 0.3	130mm **ASPHALTIC CONCRETE** 150mm **AGGREGATE**
	FILL, sandy silt to sand and silt, trace gravel, very loose to compact, brown, moist
138.0 2.3	**SANDY SILT**, some clay, trace gravel, compact to very dense, brown, moist
126.4 13.9	**SAND**, some silt, trace gravel, trace clay, very dense, brown, wet

SAMPLES

Number	Type	SPT 'N' Value
1	SS	18
2	SS	5
3	SS	5
4	SS	40
5	SS	66
6	SS	50 / 75mm
7	SS	53
8	SS	64
9	SS	61
10	SS	65
11	SS	54
12	SS	57



Depth Scale (m): 0 – 14

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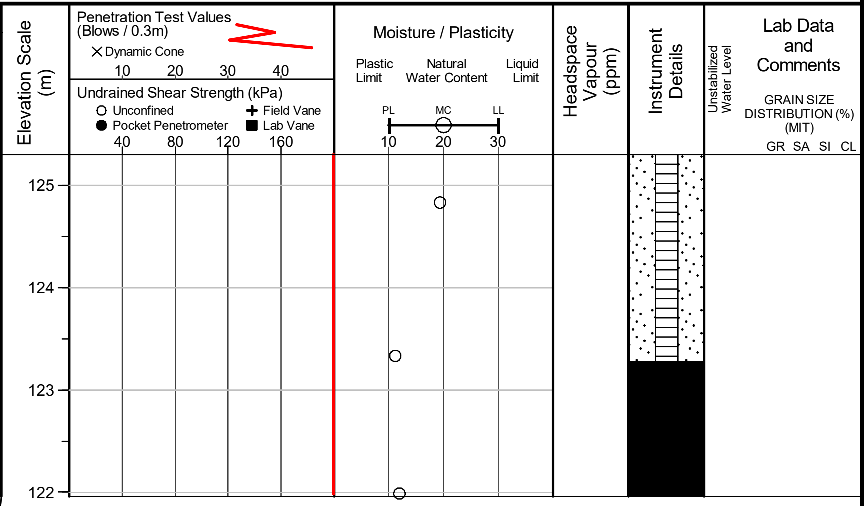
Terraprobe

LOG OF BOREHOLE 102

Project No. : 1-22-0531-01
Client : Starlight Investments
Originated by : ZJ
Date started : September 14, 2022
Project : 1485 Williamsport Drive
Compiled by : FM
Sheet No. : 2 of 2
Location : Mississauga, Ontario
Checked by : HR

Position : E: 613355, N: 4830590 (UTM 17T)
Elevation Datum : Geodetic
Rig type : Track-mounted
Drilling Method : Solid stem augers/mud rotary

Depth Scale (m)	Elev Depth (m)	Description	Sample Number	Type	SPT 'N' Value
15		*(continued)* **SAND**, some silt, trace gravel, trace clay, very dense, brown, wet *(continued)*	13	SS	68
16					
17		...shale fragments	14	SS	90 / 250mm
18	122.0				
	122.0 18.3	**INFERRED BEDROCK**, shale fragments (GEORGIAN BAY FORMATION)	15	SS	50 / 50mm



END OF BOREHOLE

Borehole contained drill water upon completion of drilling. Unstabilized water level and cave not measured.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Sep 19, 2022	8.2	132.1
Sep 30, 2022	8.8	131.5
Oct 13, 2022	8.8	131.5

file: 1-22-0531-01 bh logs.gpj

Terraprobe

LOG OF BOREHOLE 103

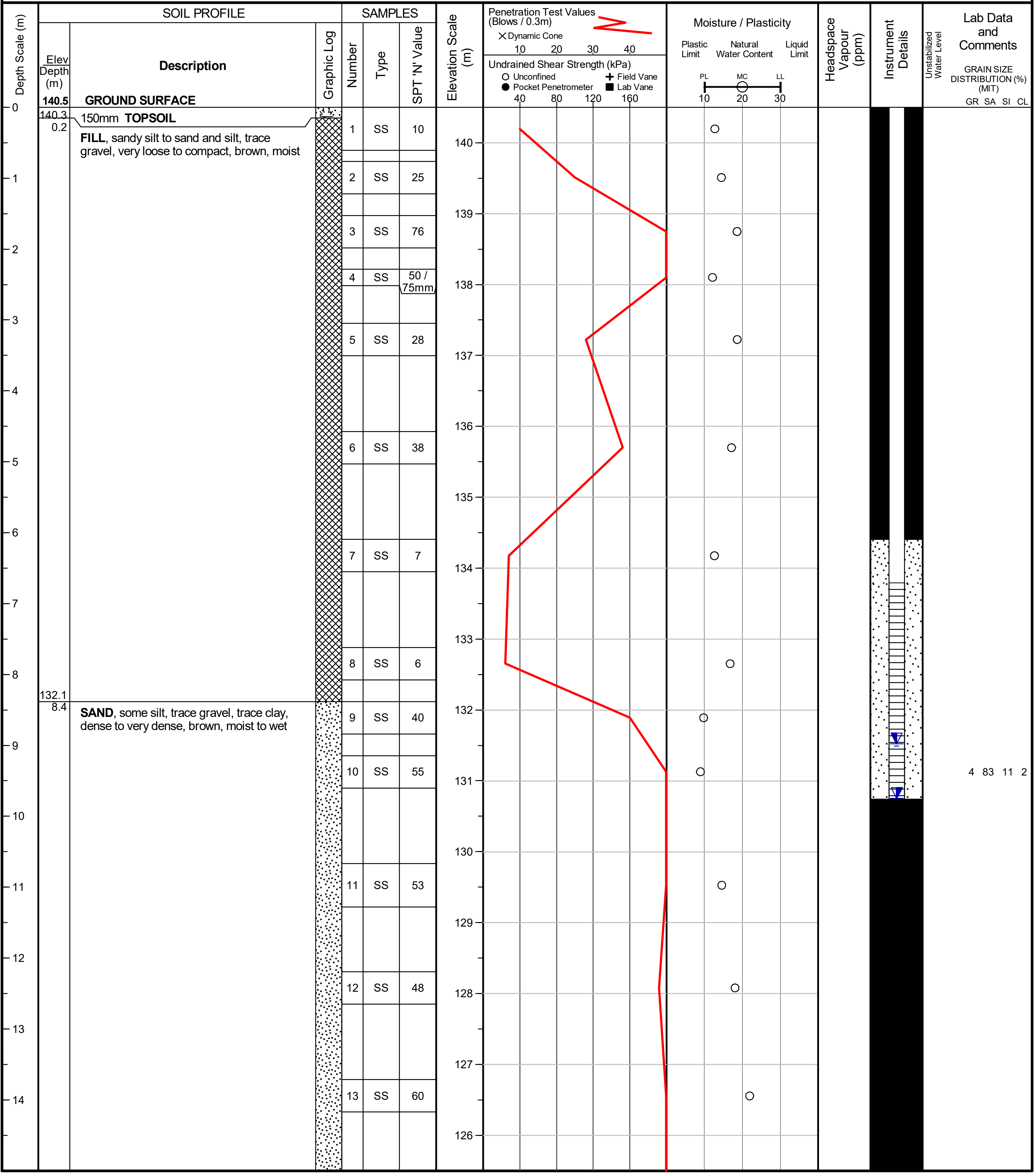
Project No. : 1-22-0531-01
Date started : September 12, 2022
Sheet No. : 1 of 2

Client : Starlight Investments
Project : 1485 Williamsport Drive
Location : Mississauga, Ontario

Originated by : ZJ
Compiled by : FM
Checked by : HR

Position : E: 613400, N: 4830553 (UTM 17T)
Rig type : Track-mounted

Elevation Datum : Geodetic
Drilling Method : Solid stem augers/mud rotary



Elev / Depth (m)	Description
140.5	**GROUND SURFACE**
140.3 0.2	150mm **TOPSOIL**
	FILL, sandy silt to sand and silt, trace gravel, very loose to compact, brown, moist
132.1 8.4	**SAND**, some silt, trace gravel, trace clay, dense to very dense, brown, moist to wet

Number	Type	SPT 'N' Value	Lab Data and Comments
1	SS	10	
2	SS	25	
3	SS	76	
4	SS	50 / 75mm	
5	SS	28	
6	SS	38	
7	SS	7	
8	SS	6	
9	SS	40	
10	SS	55	4 83 11 2
11	SS	53	
12	SS	48	
13	SS	60	

file: 1-22-0531-01 bh logs.gpj

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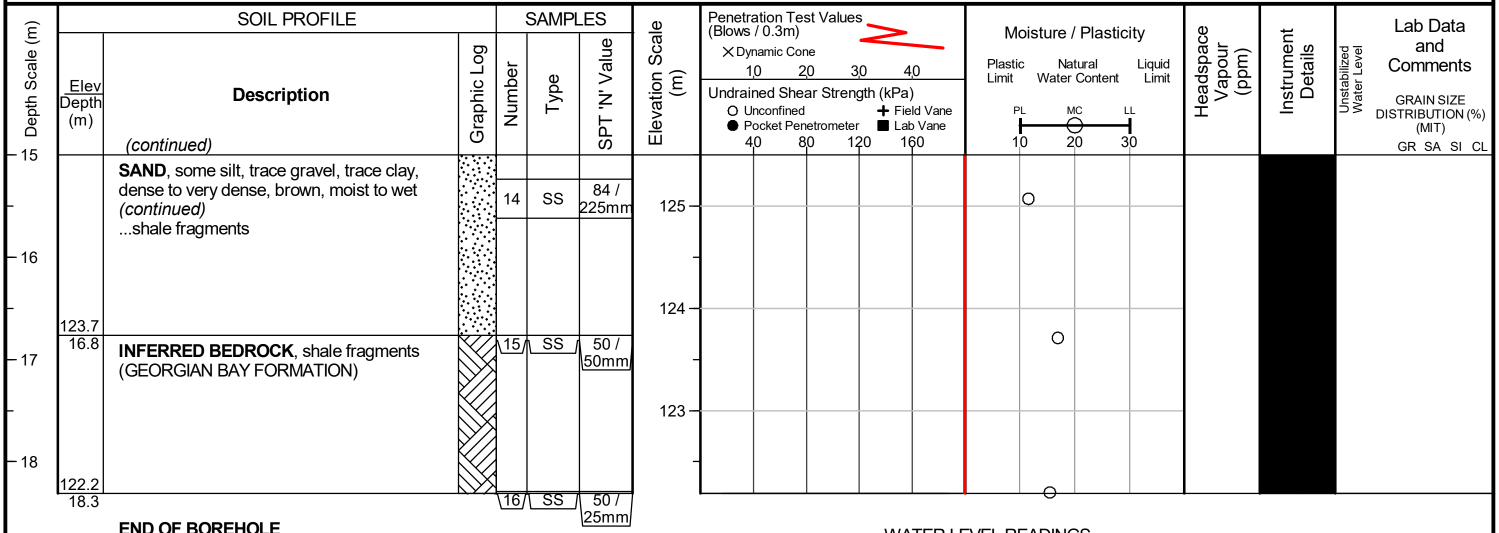
LOG OF BOREHOLE 103

Project No. : 1-22-0531-01
Date started : September 12, 2022
Sheet No. : 2 of 2

Client : Starlight Investments
Project : 1485 Williamsport Drive
Location : Mississauga, Ontario

Originated by : ZJ
Compiled by : FM
Checked by : HR

Position : E: 613400, N: 4830553 (UTM 17T)
Rig type : Track-mounted
Elevation Datum : Geodetic
Drilling Method : Solid stem augers/mud rotary



Elev Depth (m)	Description	Number	Type	SPT 'N' Value
	SAND, some silt, trace gravel, trace clay, dense to very dense, brown, moist to wet *(continued)* ...shale fragments	14	SS	84 / 225mm
123.7 16.8	**INFERRED BEDROCK**, shale fragments (GEORGIAN BAY FORMATION)	15	SS	50 / 50mm
122.2 18.3		16	SS	50 / 25mm

END OF BOREHOLE

Borehole contained drill water upon completion of drilling. Unstabilized water level and cave not measured.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Sep 19, 2022	9.0	131.5
Sep 30, 2022	9.8	130.8
Oct 13, 2022	10.0	130.5

file: 1-22-0531-01 bh logs.gpj

Terraprobe

LOG OF BOREHOLE 104

Project No. : 1-22-0531-01
Date started : September 13, 2022
Sheet No. : 1 of 1

Client : Starlight Investments
Project : 1485 Williamsport Drive
Location : Mississauga, Ontario

Originated by : ZJ
Compiled by : FM
Checked by : HR

Position : E: 613393, N: 4830564 (UTM 17T)
Rig type : Track-mounted

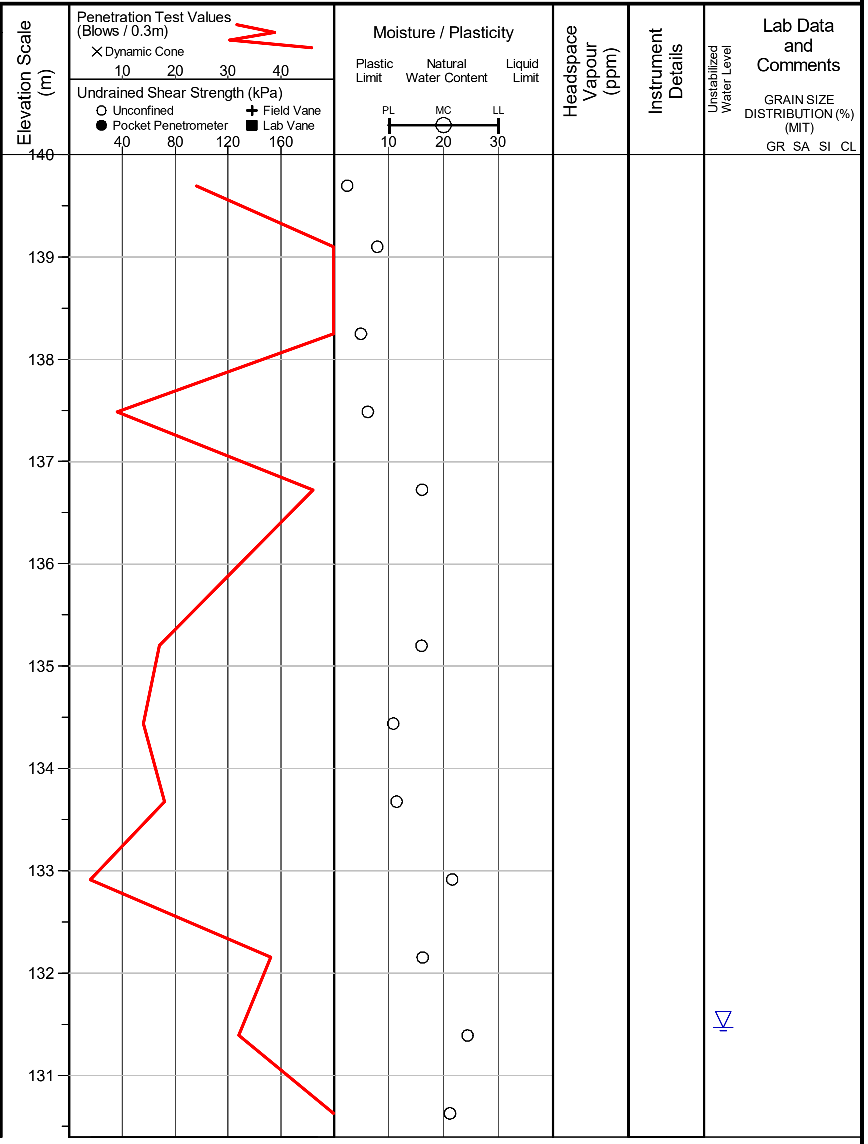
Elevation Datum : Geodetic
Drilling Method : Solid stem augers

SOIL PROFILE

Elev Depth (m)	Description
140.0	**GROUND SURFACE**
139.8 0.2	230mm **TOPSOIL**
	FILL, sandy silt to sand and silt, trace gravel, loose to very dense, brown, moist
	...trace wood pieces
132.2 7.8	**SAND**, some silt, trace gravel, trace clay, dense to very dense, brown, wet
130.4 9.6	

SAMPLES

Number	Type	SPT 'N' Value
1	SS	24
2	SS	50 / 125mm
3	SS	51
4	SS	9
5	SS	46
6	SS	17
7	SS	14
8	SS	18
9	SS	4
10	SS	38
11	SS	32
12	SS	54



END OF BOREHOLE

Unstabilized water level measured at 8.5 m below ground surface; borehole caved to 8.5 m below ground surface upon completion of drilling.

file: 1-22-0531-01 bh logs.gpj

Terraprobe

LOG OF BOREHOLE 105

Project No. : 1-22-0531-01
Date started : September 13, 2022
Sheet No. : 1 of 1

Client : Starlight Investments
Project : 1485 Williamsport Drive
Location : Mississauga, Ontario

Originated by : ZJ
Compiled by : FM
Checked by : HR

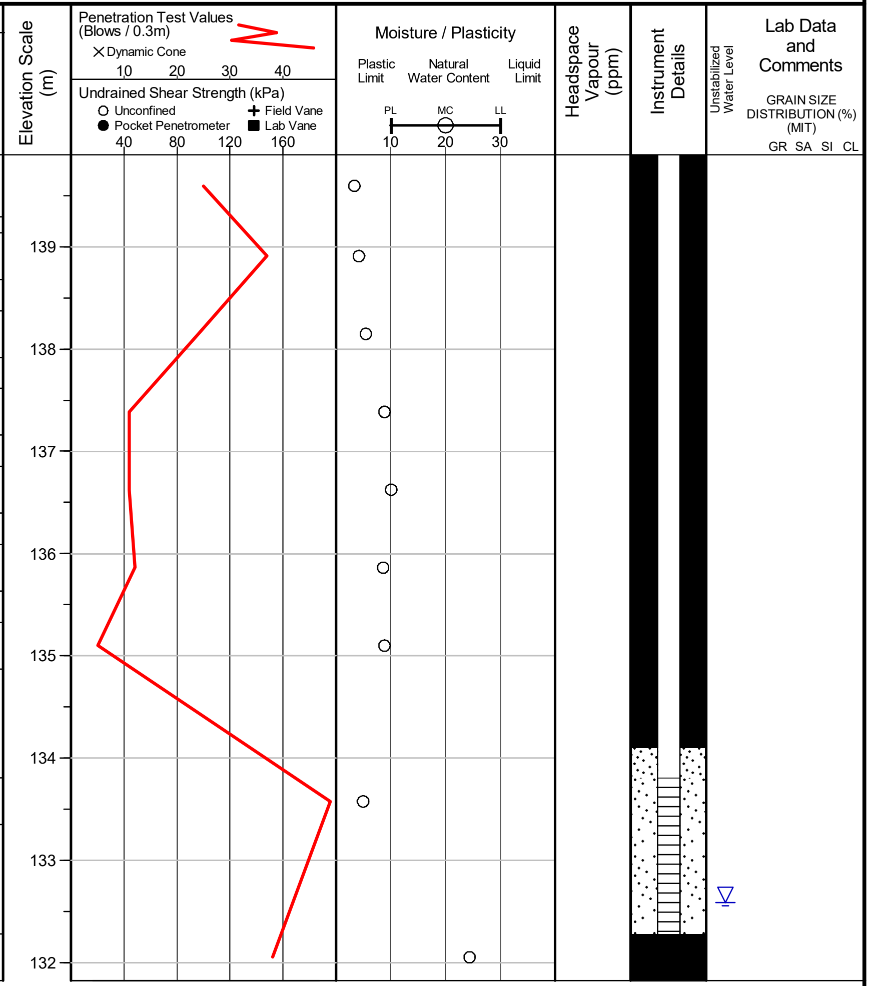
Position : E: 613397, N: 4830583 (UTM 17T)
Rig type : Track-mounted
Elevation Datum : Geodetic
Drilling Method : Solid stem augers

SOIL PROFILE

Elev Depth (m)	Description
139.9	**GROUND SURFACE**
139.6 0.3	130mm **ASPHALTIC CONCRETE**
	150mm **AGGREGATE**
	FILL, sandy silt to sand and silt, trace gravel, loose to dense, brown, moist
133.8 6.1	**SAND**, some silt, trace gravel, trace clay, dense, brown, moist ...wet
131.8 8.1	

SAMPLES

Number	Type	SPT 'N' Value
1	SS	25
2	SS	37
3	SS	24
4	SS	11
5	SS	11
6	SS	12
7	SS	5
8	SS	49
9	SS	38



END OF BOREHOLE

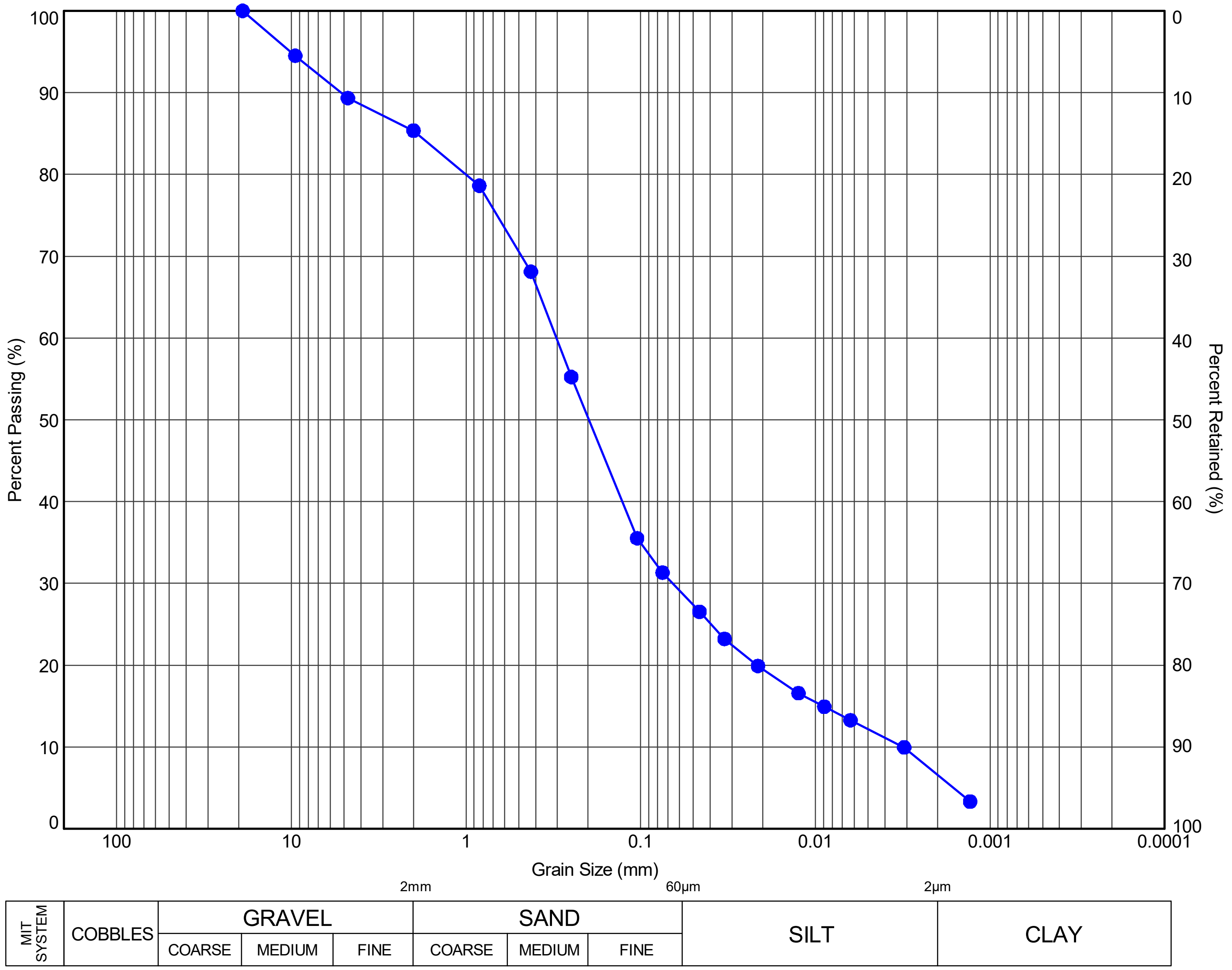
Unstabilized water level measured at 7.3 m below ground surface; borehole was open upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Sep 19, 2022	dry	n/a
Sep 30, 2022	dry	n/a
Oct 13, 2022	dry	n/a

file: 1-22-0531-01 bh logs.gpj



MIT SYSTEM

	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**9**	SS4	2.5	137.4	15	55	23	7	

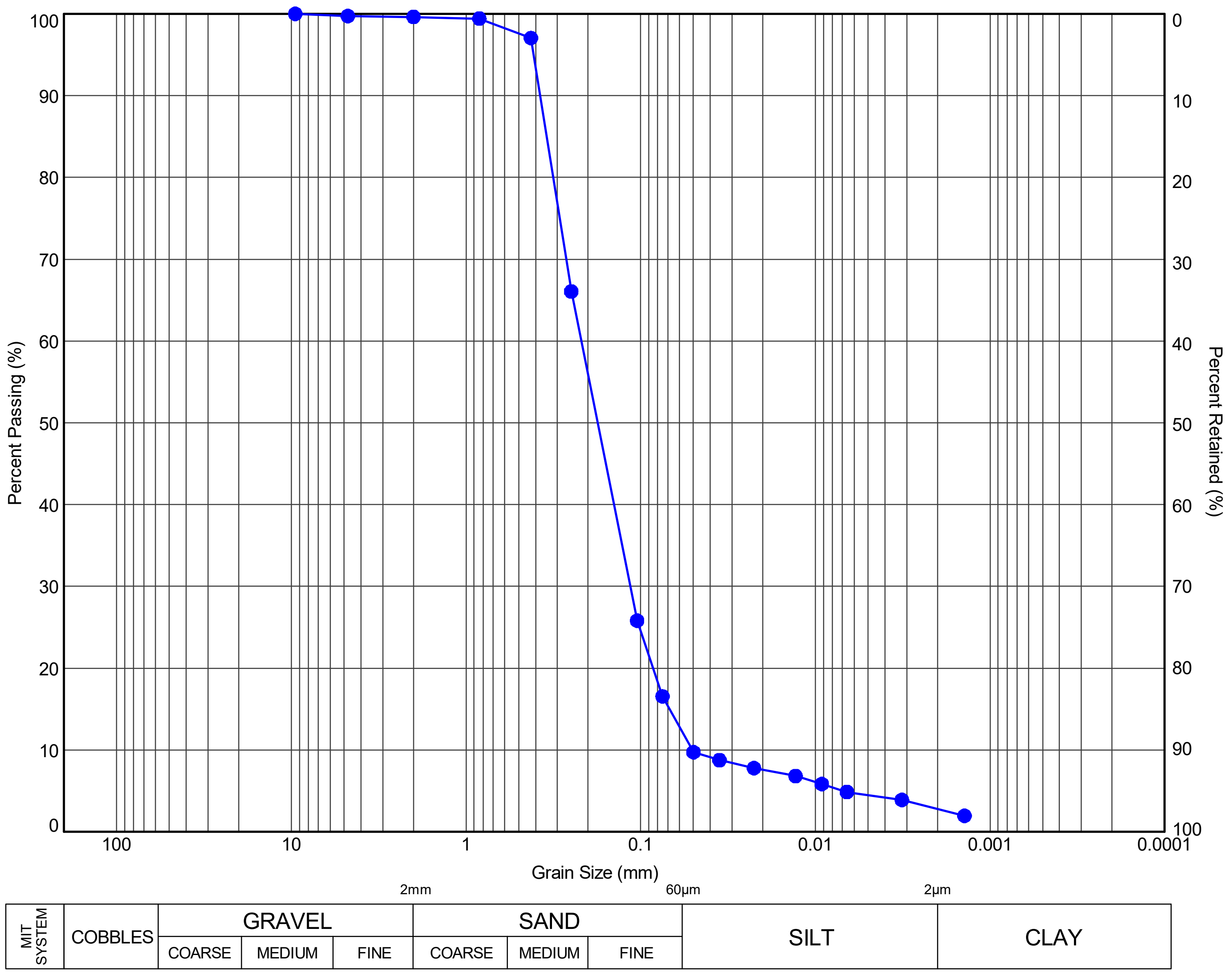
Terraprobe

11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

GRAIN SIZE DISTRIBUTION
SILTY SAND, SOME GRAVEL, TRACE CLAY

File No.: **1-22-0531-01**



MIT SYSTEM

	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**9**	SS9	6.2	133.7	0	87	10	3	

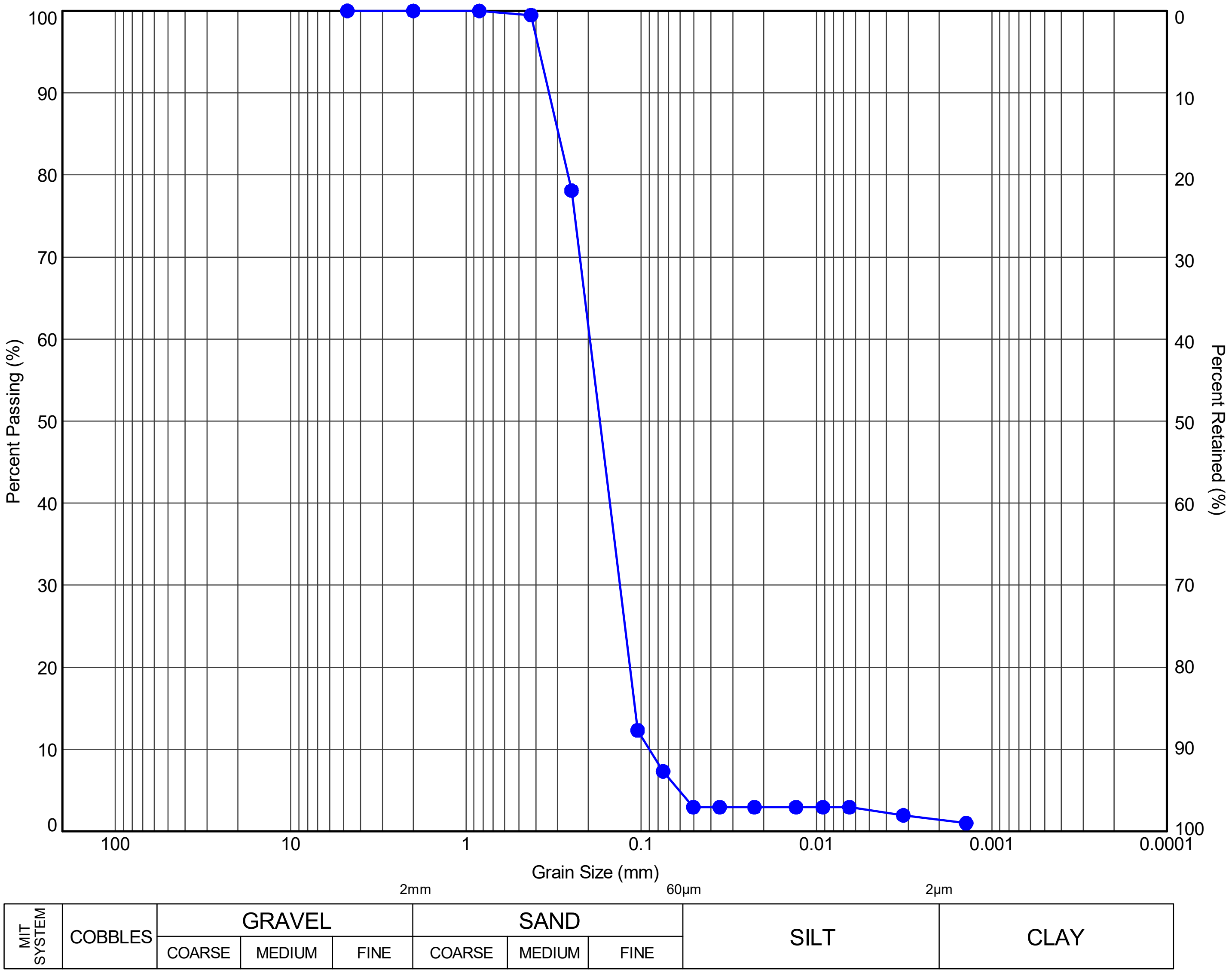
Terraprobe

11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

GRAIN SIZE DISTRIBUTION
SAND, TRACE SILT, TRACE CLAY

File No.: **1-22-0531-01**



					MIT SYSTEM				
	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**10**	SS10	10.9	129.4	0	96	3	1	

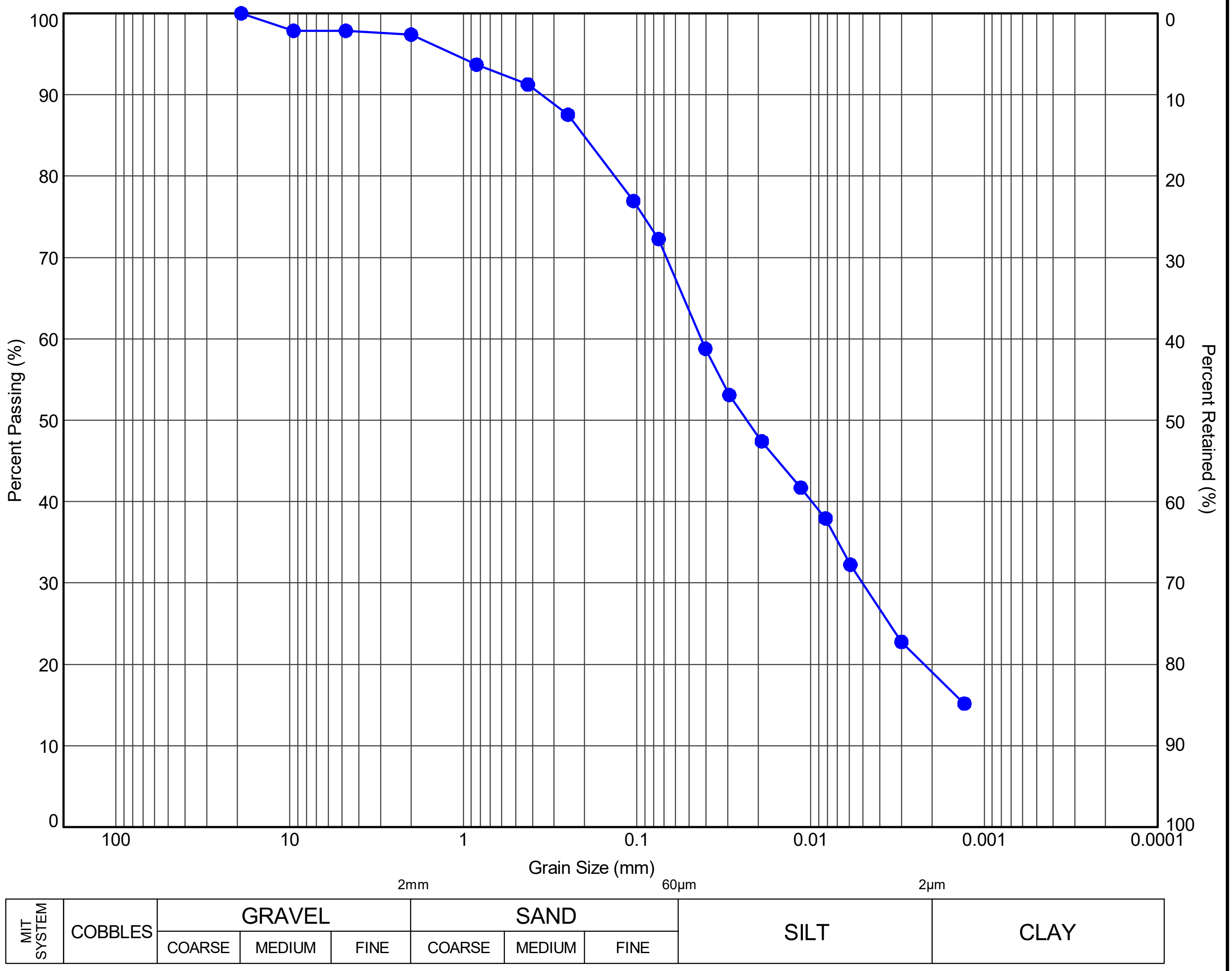
Terraprobe

11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

GRAIN SIZE DISTRIBUTION
SAND, TRACE SILT, TRACE CLAY

File No.: **1-22-0531-01**



MIT SYSTEM

	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**101**	SS4	2.5	137.8	3	30	48	19	

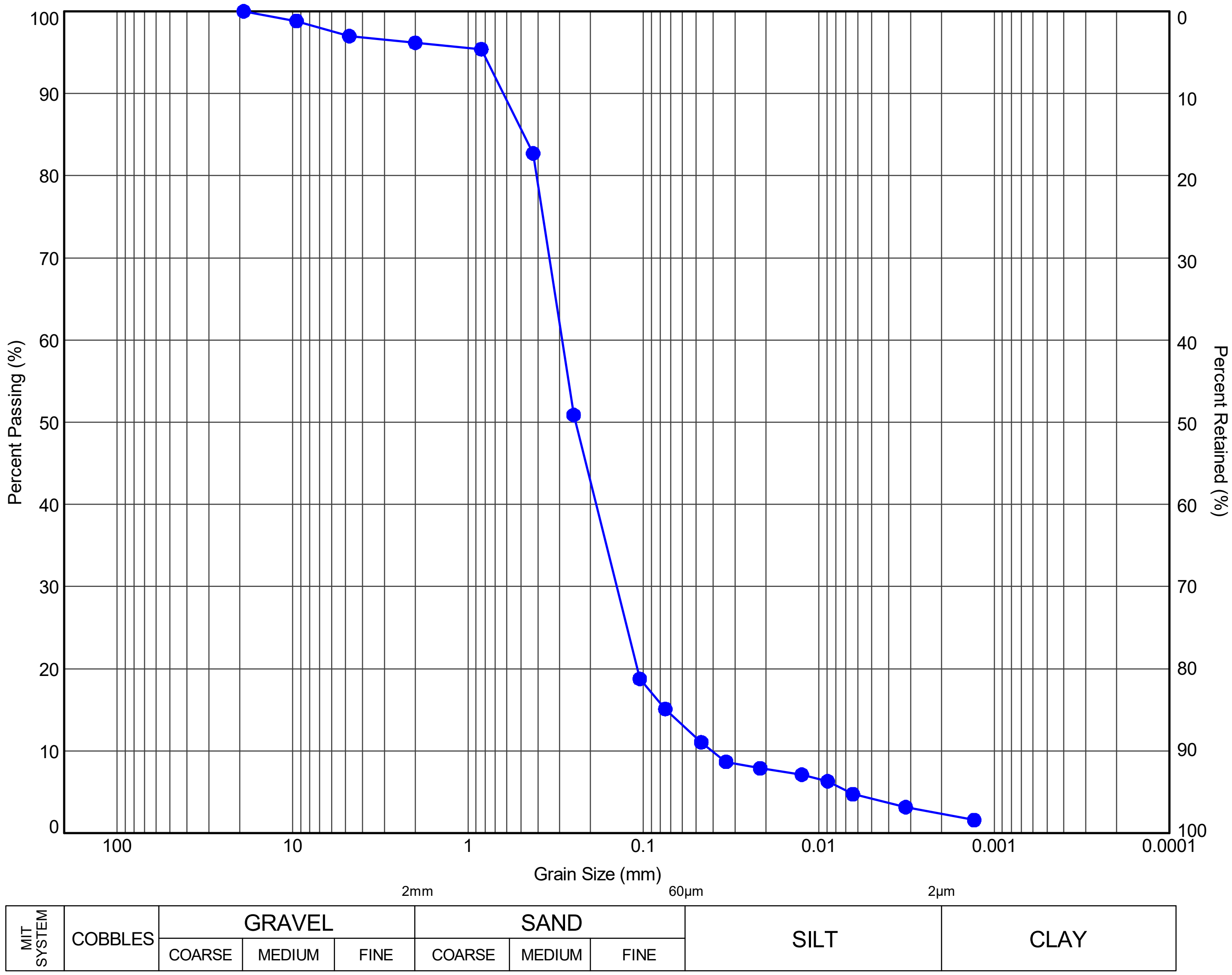
Terraprobe

11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

GRAIN SIZE DISTRIBUTION
SANDY SILT, SOME CLAY, TRACE GRAVEL

File No.: **1-22-0531-01**



MIT SYSTEM

	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**103**	SS10	9.4	131.1	4	83	11	2	

Terraprobe

11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

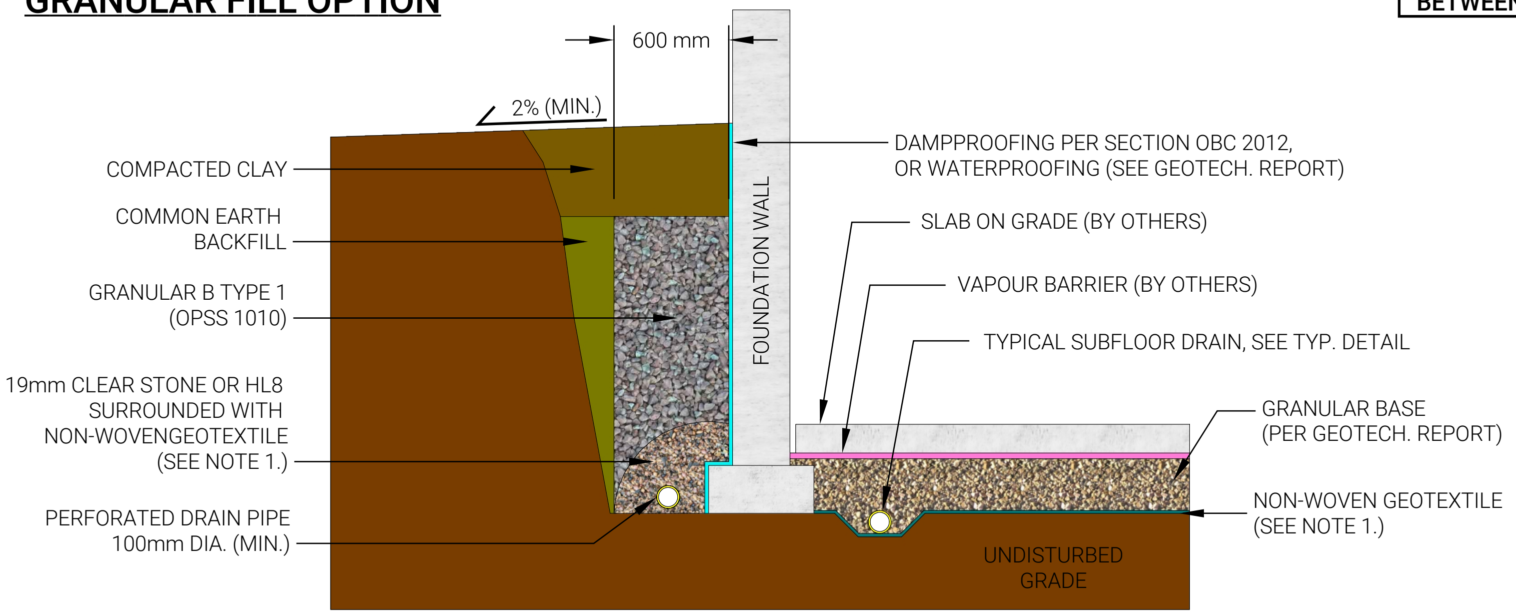
GRAIN SIZE DISTRIBUTION
SAND, SOME SILT, TRACE GRAVEL, TRACE CLAY

File No.: **1-22-0531-01**

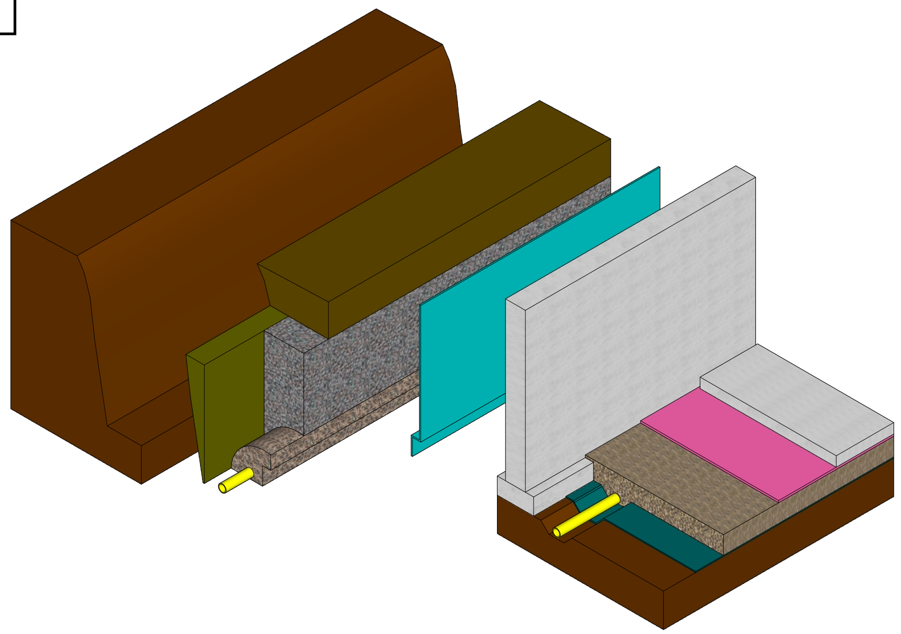
APPENDIX B

GRANULAR FILL OPTION

OBJECTS ARE COLOR-CODED BETWEEN TWO VIEWS FOR CLARITY

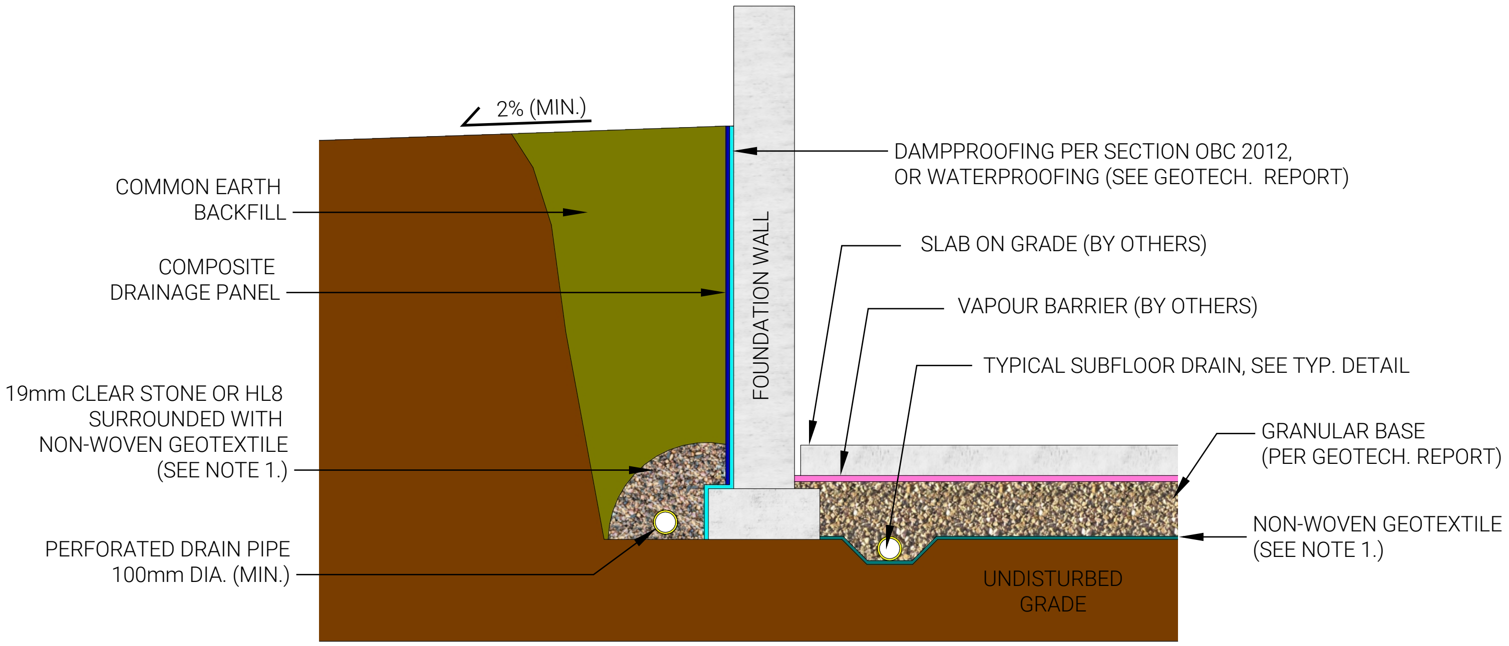


SECTIONAL VIEW

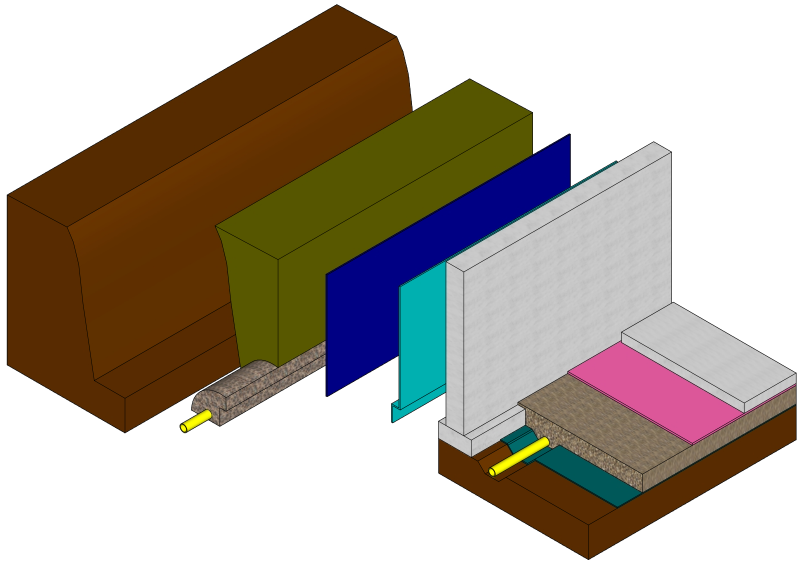


ISOMETRIC VIEW

GEO-COMPOSITE DRAINAGE PANEL OPTION



SECTIONAL VIEW



ISOMETRIC VIEW

NOTES

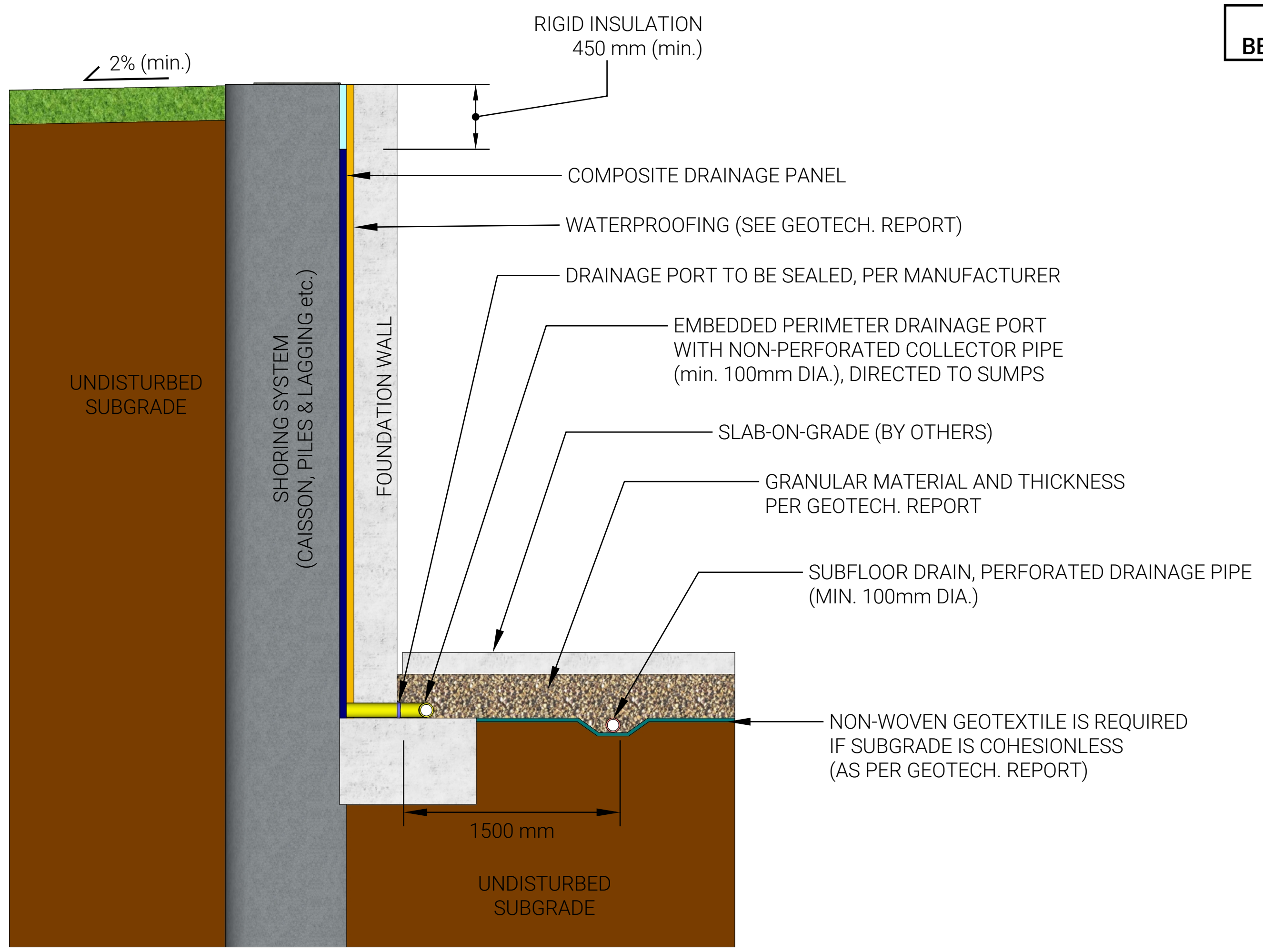
1. A NON-WOVEN GEOTEXTILE WITH AN APPARENT OPENING SIZE OF < 0.250mm AND A TEAR RESISTANCE OF > 200 N.

GROUNDED ENGINEERING

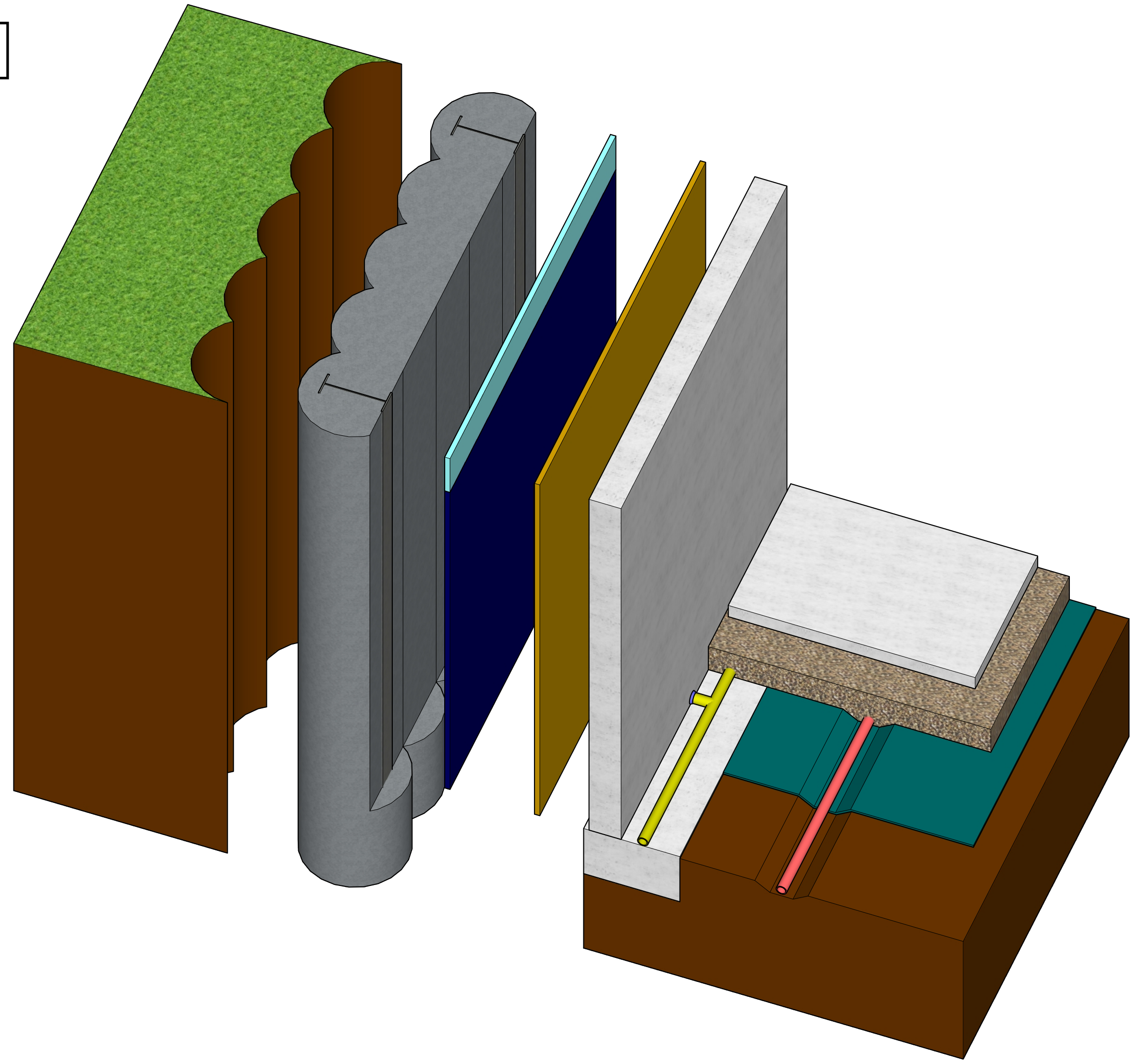
Title

BASEMENT DRAINAGE TYPICAL DETAIL

OBJECTS ARE COLOR-CODED BETWEEN TWO VIEWS FOR CLARITY



SECTIONAL VIEW



ISOMETRIC VIEW

SUBFLOOR DRAINAGE SYSTEM

1. THE SUBFLOOR DRAINS SHOULD BE SET IN PARALLEL ROWS, IN ONE DIRECTION, AND SPACED AS PER THE GEOTECHNICAL REPORT.
2. THE INVERT OF THE PIPES SHOULD BE A MINIMUM OF 300mm BELOW THE UNDERSIDE OF THE SLAB-ON-GRADE.
3. A CAPILLARY MOISTURE BARRIER (I.E. DRAINAGE LAYER) CONSISTING OF A MINIMUM 200 mm LAYER OF CLEAR STONE (OPSS MUNI 1004) COMPACTED TO A DENSE STATE (OR AS PER THE GEOTECHNICAL REPORT). WHERE VEHICULAR TRAFFIC IS REQUIRED, THE UPPER 50 mm OF THE CAPILLARY MOISTURE BARRIER MAY BE REPLACED WITH GRANULAR A (OPSS MUNI 1010) COMPACTED TO A MINIMUM 98% SPMDD.
4. A NON-WOVEN GEOTEXTILE MUST SEPARATE THE SUBGRADE FROM THE SUBFLOOR DRAINAGE LAYER IF THE SUBGRADE IS COHESIONLESS. THE NON-WOVEN GEOTEXTILE MAY CONSIST OF TERRAFIX 360R OR AN APPROVED EQUIVALENT.

PERIMETER DRAINAGE SYSTEM

1. FOR A DISTANCE OF 1.2m FROM THE BUILDING, THE GROUND SURFACE SHOULD HAVE A MINIMUM 2% GRADE.
2. PREFABRICATED COMPOSITE DRAINAGE PANEL (CONTINUOUS COVER, AS PER MANUFACTURER'S REQUIREMENTS) IS RECOMMENDED BETWEEN THE BASEMENT WALL AND RIGID SHORING WALL. THE DRAINAGE PANEL MAY CONSIST OF MIRADRAIN 6000 OR AN APPROVED EQUIVALENT.
3. PERIMETER DRAINAGE IS TO BE COLLECTED IN NON-PERFORATED PIPES AND CONVEYED DIRECTLY TO THE BUILDING SUMPS.
4. PERIMETER DRAINAGE PORTS SHOULD BE SPACED A MAXIMUM 3m ON-CENTRE. EACH PORT SHOULD HAVE A MINIMUM CROSS-SECTIONAL AREA OF 1500 mm2.

GENERAL NOTES

1. THERE SHOULD BE NO STRUCTURAL CONNECTION BETWEEN THE SLAB-ON-GRADE AND THE FOUNDATION WALL OR FOOTING.
2. THERE SHOULD BE NO CONNECTION BETWEEN THE SUBFLOOR AND PERIMETER DRAINAGE SYSTEMS.
3. THIS IS ONLY A TYPICAL BASEMENT DRAINAGE DETAIL. THE GEOTECHNICAL REPORT SHOULD BE CONSULTED FOR SITE SPECIFIC RECOMMENDATIONS.
4. THE FINAL BASEMENT DRAINAGE DESIGN SHOULD BE REVIEWED BY THE GEOTECHNICAL ENGINEER TO CONFIRM THE DESIGN IS ACCEPTABLE.

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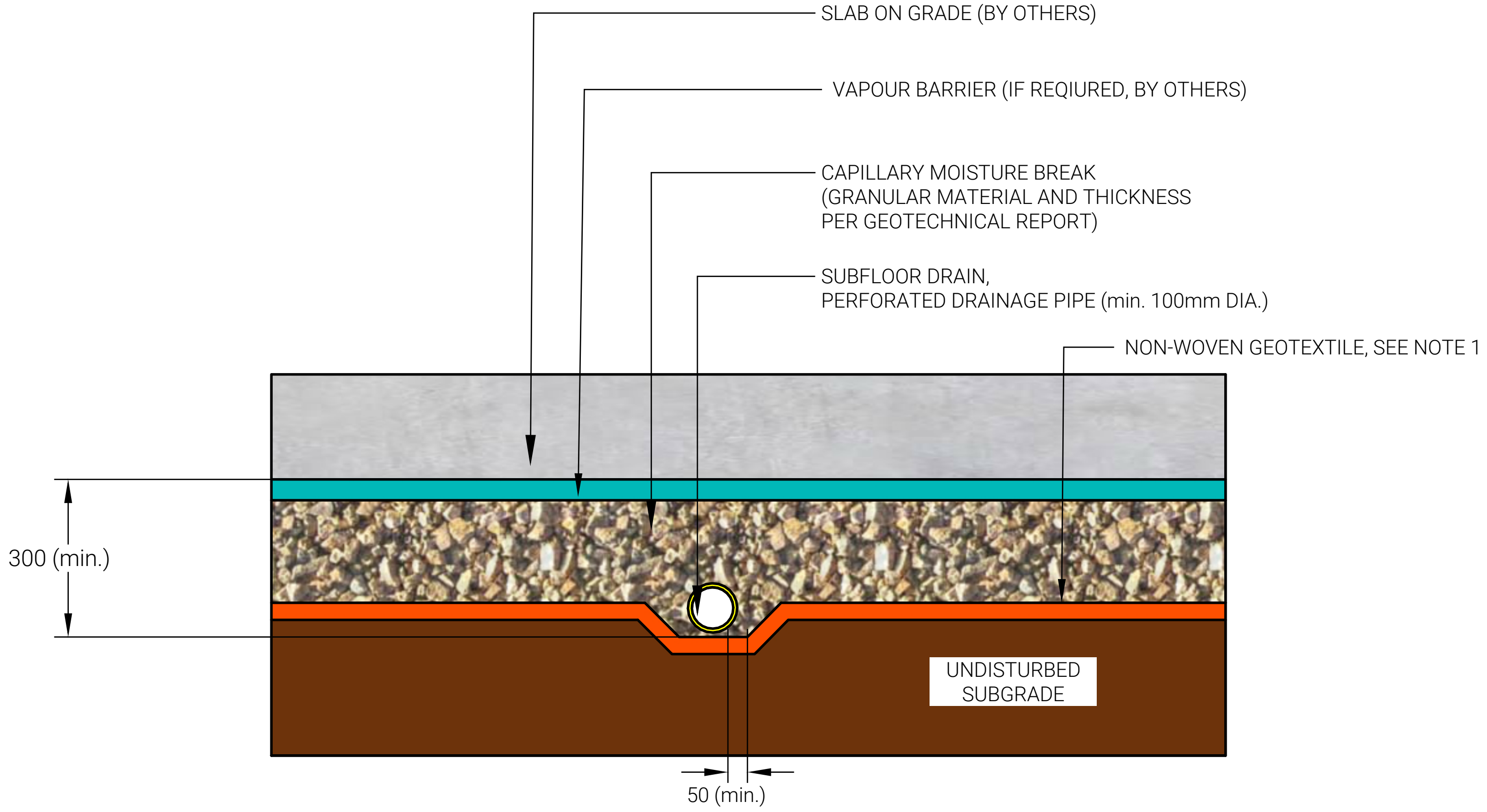
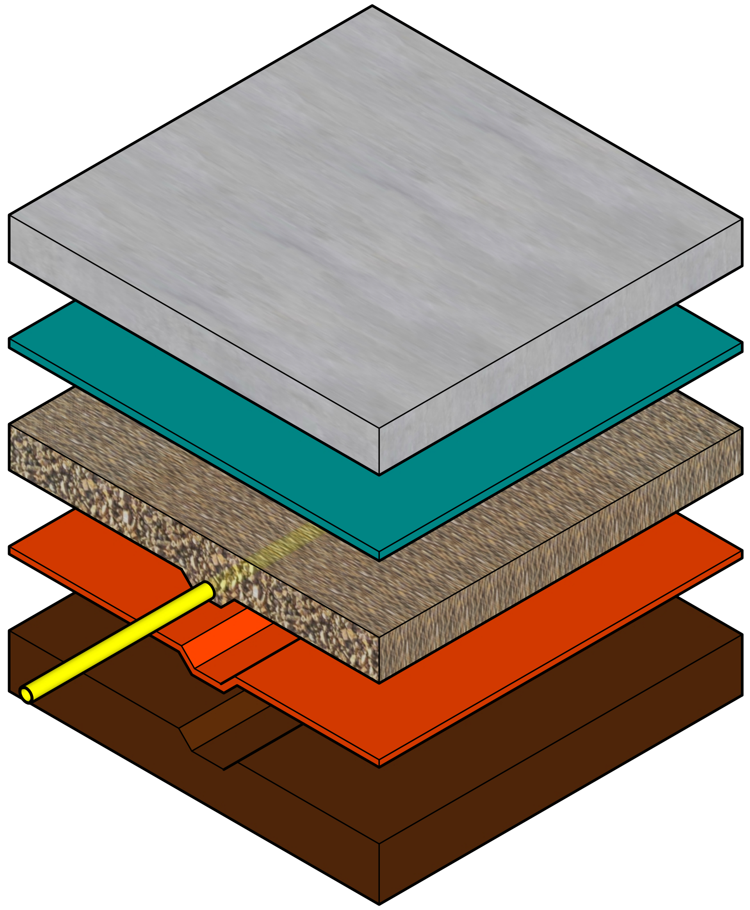
BASEMENT DRAINAGE SHORING SYSTEM TYPICAL DETAILS

OBJECTS ARE COLOR-CODED
BETWEEN TWO VIEWS FOR CLARITY



SECTIONAL VIEW



ISOMETRIC VIEW

NOTES

1. WHEN THE SUBGRADE CONSISTS OF COHESIONLESS SOIL, IT MUST BE SEPARATED FROM THE SUBFLOOR DRAINAGE LAYER USING A NON-WOVEN GEOTEXTILE (WITH AN APPARENT OPENING SIZE OF < 0.250mm AND A TEAR RESISTANCE OF > 200 N).

2. TYPICAL SCHEMATIC ONLY. MUST BE READ IN CONJUNCTION WITH GEOTECHNICAL REPORT.

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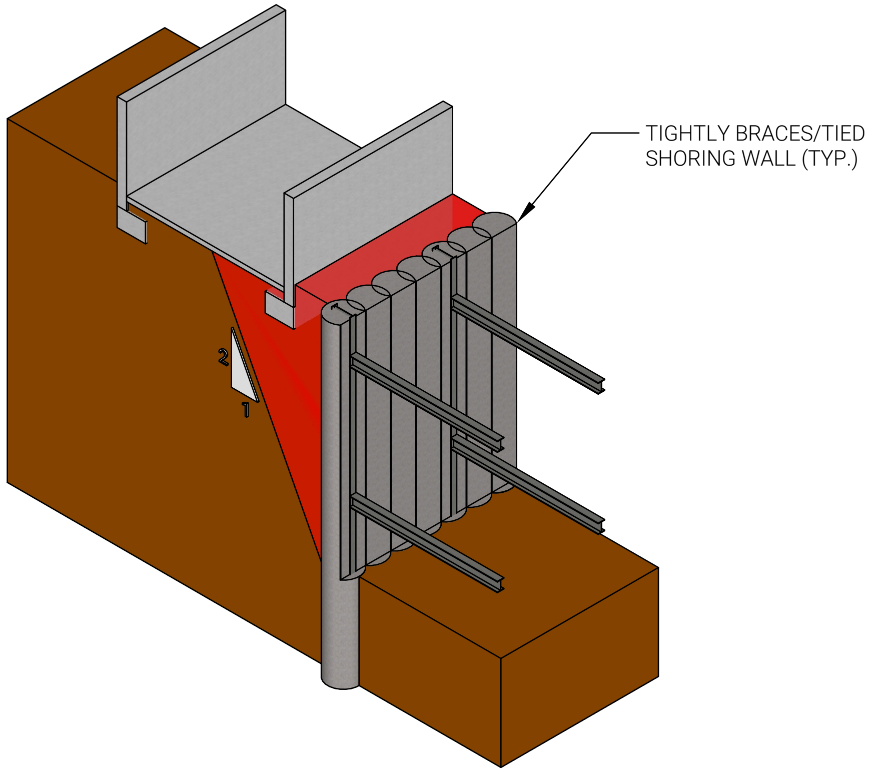
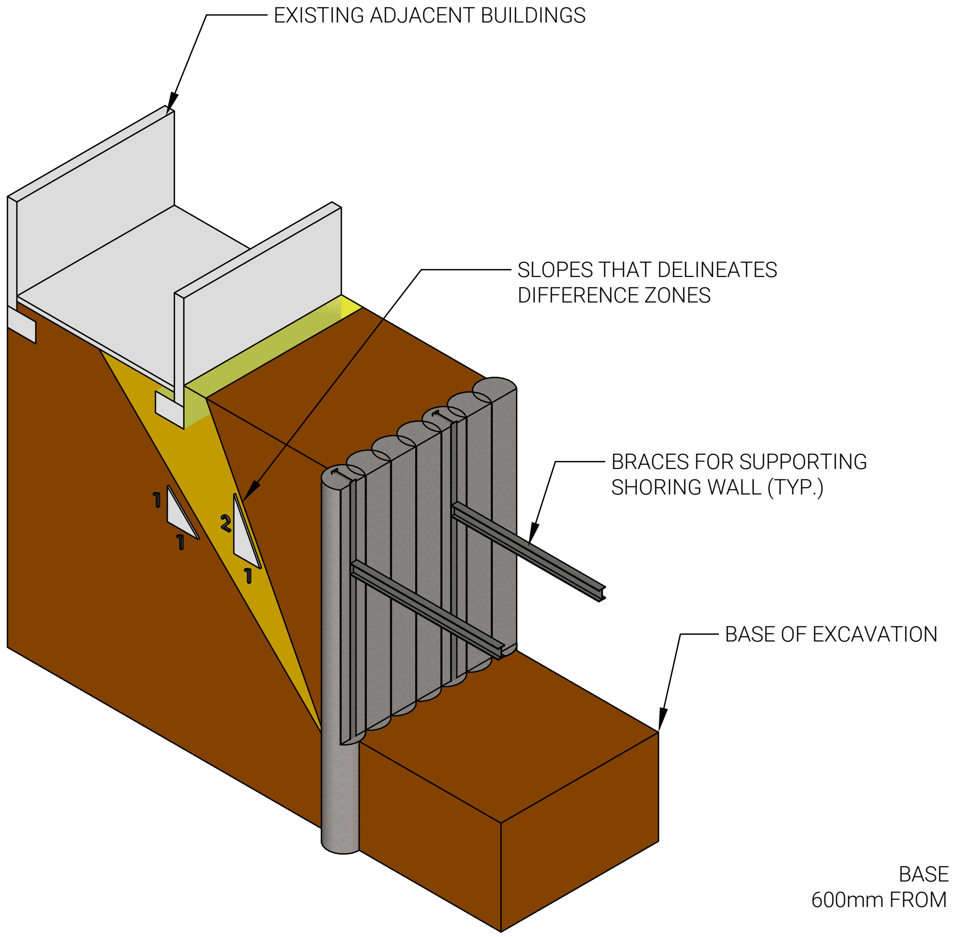
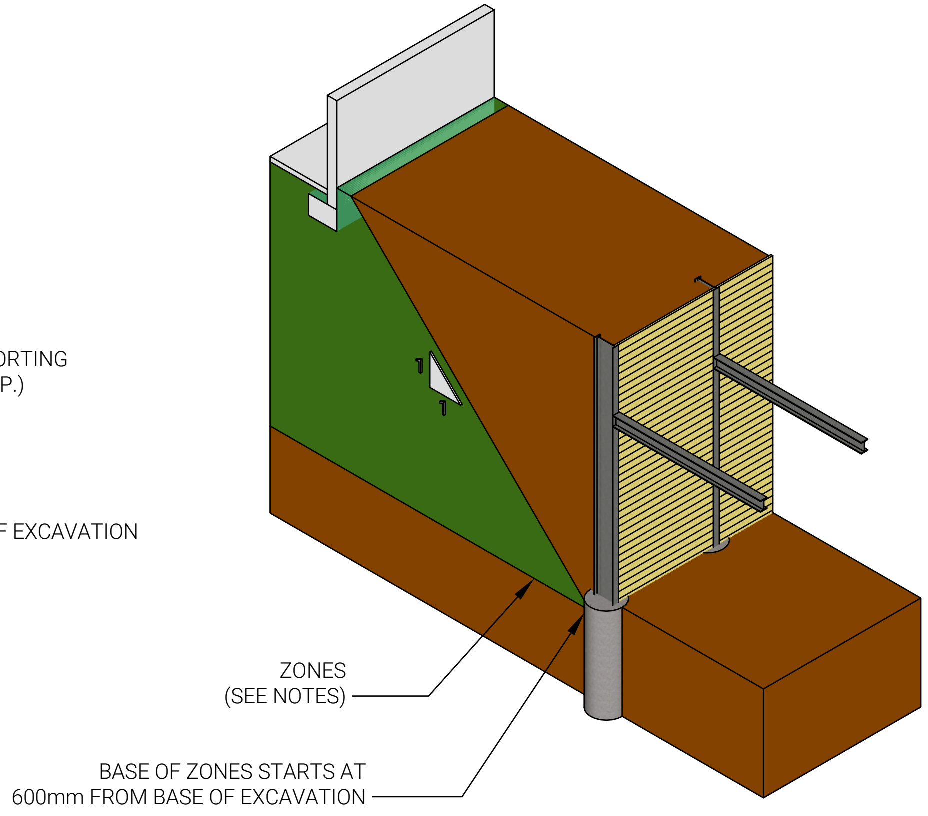
Title

BASEMENT SUBDRAIN TYPICAL DETAIL







ZONE A (RED)

FOUNDATIONS WITHIN THIS ZONE OFTEN REQUIRE UNDERPINNING OR SHORING SYSTEM. HORIZONTAL AND VERTICAL PRESSURES ON EXCAVATION WALL OF NON-UNDERPINNED FOUNDATION MUST BE CONSIDERED

ZONE B (YELLOW)

FOUNDATIONS WITHIN THIS ZONE OFTEN DO NOT REQUIRE UNDERPINNING BUT MAY REQUIRE SHORING SYSTEM. HORIZONTAL AND VERTICAL PRESSURES ON EXCAVATION WALL OF NON-UNDERPINNED FOUNDATION MUST BE CONSIDERED

ZONE C (GREEN)

FOUNDATIONS WITHIN THIS ZONE USUALLY DO NOT REQUIRE UNDERPINNING OR SHORING SYSTEM

NOTES:
1. USER'S GUIDE - NBC 2005 STRUCTURAL COMMENTARIES (PART 4 OF DIVISION B) - COMMENTARY K.

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EXCAVATION ZONE OF INFLUENCE GUIDELINES