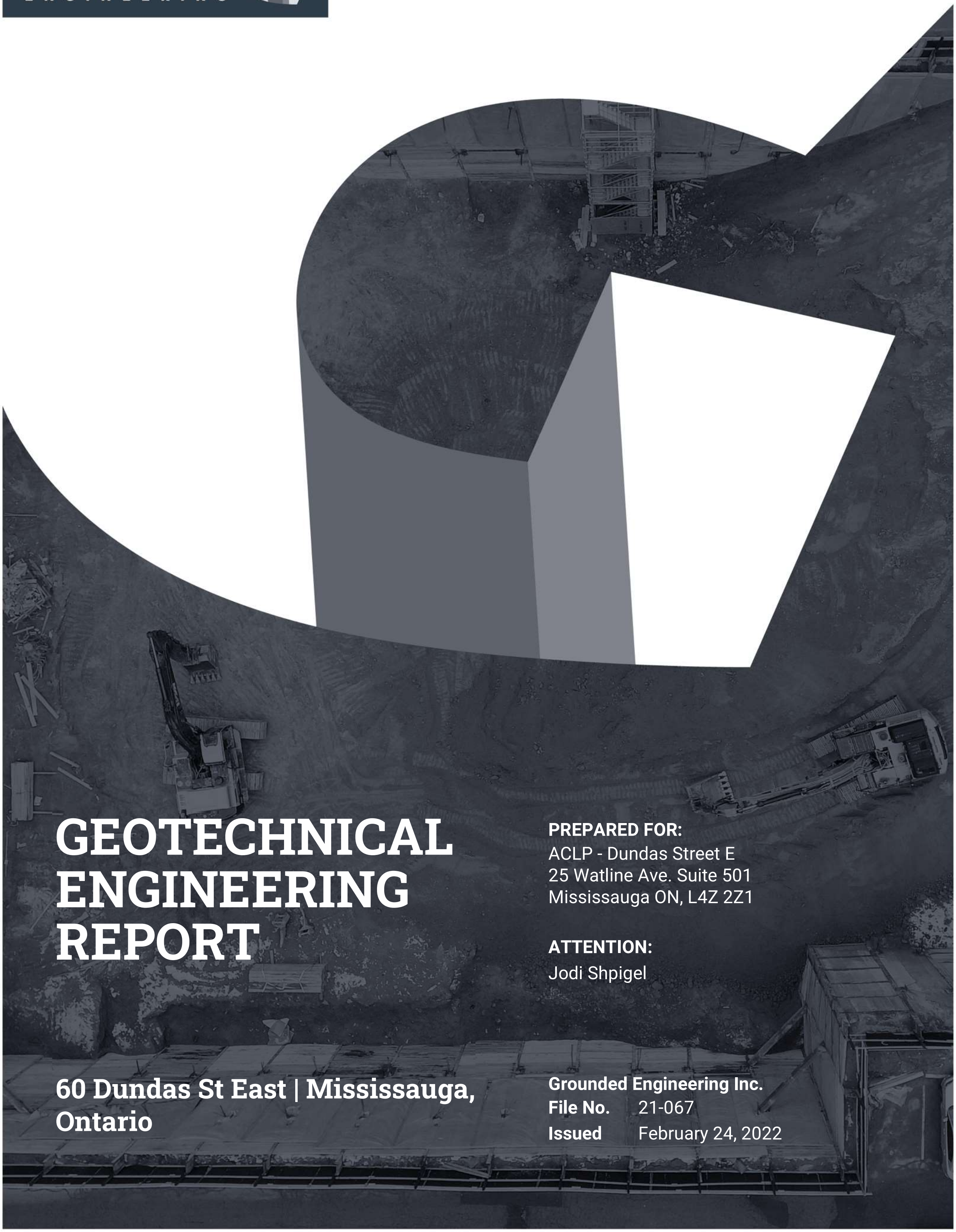

GEOTECHNICAL ENGINEERING REPORT

PREPARED FOR:
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60 Dundas St East | Mississauga, Ontario

Grounded Engineering Inc.
File No. 21-067
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1 Introduction

ACLP - Dundas Street E has retained Grounded Engineering Inc. ("Grounded") to provide preliminary geotechnical engineering design advice for their proposed development at 60 Dundas St East, in Mississauga, Ontario. A detailed investigation is in progress.

The proposed project includes demolishing the existing structure and constructing three new 32-40 storey towers on 3-5 storey podiums, with a common P5 underground parking structure beneath the entire site. The proposed P5 level is set at a Finished Floor Elevation (FFE) of 17 m below grade. Assuming a ground floor elevation of 111± m, this implies a lowest FFE at Elev. 94± m. Spread footing foundations will be nominally 1 to 2 m lower.

As the site backs onto an existing slope, the TRCA requires a slope stability and erosion risk assessment report for the purpose of determining the Long-term Stable Slope Crest (LTSSC). Grounded has already provided a preliminary assessment (21-067 - 60 Dundas St E LTSSC Letter 2021-05-31). A detailed study is in progress.

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

- Architectural Drawings, "60 Dundas Apartments"; Project 121022, dated November 24, 2022, prepared by Chamberlain Architect Services Limited
- EXP, "Due Diligence Phase I Environmental Assessment, 60 Dundas St E, Mississauga, ON, Proj: GOR-00212908-AO", dated May 31, 2013.
- Aksan Piller Corporation Ltd, "Survey, Plan of Part of Lots 1 & 2 & Part of Shepard Avenue, Registered Plan E-19 City of Mississauga, Ref No: 20-21-14108-00", dated April 5, 2021.

Grounded's subsurface investigation of the site to date includes three (3) boreholes (Boreholes 101-103) which were advanced on May 3, 2021.

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.

This preliminary geotechnical engineering report is appropriate for due diligence and planning purposes only. Additional boreholes, wells, and a detailed geotechnical engineering report will be required for detailed design.

2 Ground Conditions

The borehole results are detailed on the attached borehole logs. 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 are measured relative to geodetic datum referenced from Canadian Geodetic Datum, 1928, benchmark # 793, with a referenced elevation of 110.995 m. The horizontal coordinates are provided relative to the Universal Transverse Mercator (UTM) geographic coordinate system.

Asphalt and granular thicknesses reported here are observed in individual borehole locations through the top of the open borehole. Thicknesses may vary between and beyond the boreholes.

2.1 Soil Stratigraphy

The following soil stratigraphy summary is based on the borehole results and the geotechnical laboratory testing.

A cross-section showing stratigraphy and engineering units is appended.

2.1.1 Surficial and Earth Fill

Boreholes 101 and 103 encountered asphalt pavement overlying a 100 mm thick aggregate layer. Borehole 102 encountered 100 mm of topsoil at ground surface.

Underlying the surficial materials, the boreholes observed a layer of earth fill that extends to depths of 1.7 to 4.0 metres below grade (Elev. 108.9 to 106.0 metres). The earth fill varies in composition but generally consists of sand, some silt, trace clay and trace gravel. In Borehole 101, trace rock fragments were observed. The earth fill is typically dark brown, and moist. Due to the variation and inconsistent placement of the earth fill material, the relative density of the earth fill varies but is on average loose.

2.1.2 Glacial Till

Underlying the fill materials, all the boreholes encountered an undisturbed native glacial till deposit with a matrix of cohesive clayey silts. These soils are grouped together as the "**glacial till**". This unit was encountered at 1.7 to 4.0 metres below grade (Elev. 108.9 to 106.0 m) and extends down to depths of 5.1 to 6.3 m below grade (Elev. 104.6 to 103.9 m). It is about 2.1 to 4.3 m thick.

The glacial till is generally grey, and moist. Standard Penetration Test (SPT) results (N-Values) measured in the glacial till range from 12 to 96 blows per 300 mm of penetration ("bpf") indicating a relative density ranging from stiff to hard (on average very stiff to hard, but occasionally stiff to very stiff).

Borehole 103 was terminated due to auger and sampler refusal (at target investigation depth) at Elev. 104.3 m. Shale and limestone fragments were observed at the base of the borehole.

2.1.3 Bedrock

Inferred bedrock was encountered in Boreholes 101 and 102 underlying the clayey silt till at depths of 6.1 to 6.3 m below grade (Elev. 104.6 to 103.9 m). Bedrock was not confirmed by rock cores during ground investigation, therefore future rock coring is required to confirm bedrock conditions (in progress).

Boreholes 101 and 102 indirectly inferred the top of weathered bedrock through auger cuttings, split spoon samples, and auger grinding/resistance observations. Each of these boreholes was terminated due to auger and sampler refusal (at target investigation depth) at elevations ranging from Elev. 103.7 to 103.5 m.

The bedrock beneath the site is the Georgian Bay Formation, which comprises thin to medium bedded grey shale and limestone of Ordovician age. The shale is interbedded with calcareous shale, limestone, dolostone, and calcareous sandstone (conventionally grouped together as "limestone") which are typically laterally discontinuous. Per the appended terminology, the Georgian Bay shale is typically classified as "weak" whereas the limestone interbedding is classified as "strong".

A summary of the engineering properties of the Georgian Bay Formation is presented in the Ontario Ministry of Transportation and Communications document RR229, *Evaluation of Shales for Construction Projects* (March 1983). The relevant parameters from that document are as follows:

	Uniaxial Compressive Strength (MPa)	**Young's Modulus (GPa)**	**Dynamic Modulus (GPa)**	**Poisson's Ratio**
Average	28	4	19	0.19
Range	8 to 41	0.5 to 12	6 to 38	0.1 to 0.25

Directly below the overburden soils, the uppermost portion of bedrock is typically weathered. The MTO (Ontario Ministry of Transportation and Communications document RR229, *Evaluation of Shales for Construction Projects)* provides a *typical weathering profile of a low durability shale* reproduced from Skempton, Davis, and Chandler, which characterizes weathered versus unweathered shale as follows:

Table 2.1 – Typical Weathering Profile of a Low Durability Shale

	Zone	Description	Notes
Fully Weathered	IVb	Soil-like matrix only	indistinguishable from glacial drift deposits, slightly clayey, may be fissured
Partially Weathered	IVa	Soil-like matrix with occasional pellets of shale less than 3 mm dia.	little or no trace of rock structure, although matrix may contain relic fissures
	III	Soil-like matrix with frequent angular shale particles up to 25 mm dia.	moisture content of matrix greater than the shale particles
	II	angular blocks of unweathered shale with virtually no matrix separated by weaker chemically weathered but intact shale	spheroidal chemical weathering of shale pieces emanating from relic joints and fissures, and bedding planes
Unweathered (Sound)	I	shale	regular fissuring

In glacial till overburden soils directly overlying bedrock, a zone of till with fragmented shale is often observed and interpreted as either the lowest portion of the till, or as partially weathered Zone III rock. This interpretation is subjective and depends on the investigator. There is occasionally a concentration of boulders in the soil just above the bedrock that can be mistakenly identified as bedrock where rock coring is not performed. Weathering Zones III and IV are frequently not present due to glacial scouring action, which often removes these zones from the bedrock surface.

The bedrock surface as indicated on the Borehole Logs from this investigation is intended to be consistently interpreted as the surface of Zone II. Weathered bedrock elevations are summarized as follows:

Borehole	Ground Surface Elevation (m)	Inferred Partially Weathered (Zone II) Bedrock	
		Depth (m)	Elevation (m)
101	110.9	6.3	104.6
102	110.0	6.1	103.9
103	109.4	n/a	n/a

2.2 Groundwater

The depth to groundwater was measured in each of the boreholes immediately following the drilling. Monitoring wells were installed in each of the boreholes, and stabilized groundwater levels were measured in each of the monitoring wells one week after the completion of drilling.

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

Borehole No.	Borehole depth (m)	Upon completion of drilling		Strata Screened	Water Level in Well on May 21, 2021 (m)	
		Depth to cave (m)	Unstabilized water level (m)		Depth	Elevation
101	7.4	N/A	dry	Clayey silt till (Elev. 106.3 - 104.8± m)	3.2	107.7
102	6.3	N/A	dry	Clayey silt till (Elev. 105.4 - 103.9± m)	3.8	106.2
103	5.1	N/A	dry	Clayey silt till (Elev. 106.0 - 104.5± m)	4.0	105.4

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 for engineering purposes is at Elev. 107.7 m.

The groundwater table is in the clayey silt till. This deposit has a very low permeability and will yield only minor seepage in the long-term.

Grounded has prepared a preliminary hydrogeological report for this site (File No. 21-067).

3 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 Preliminary Foundation Design Parameters

Foundations made for the proposed P5 level will bear on undisturbed sound bedrock (to be confirmed by rock coring, in progress). Conventional spread footings made to bear on sound bedrock may be designed using a maximum factored geotechnical resistance at ULS of 10 MPa. The net geotechnical reaction at SLS is 6 MPa, for an estimated total settlement of 25 mm.

Spread footing foundations must be at least 1000 mm wide and must be embedded a minimum of 1000 mm 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 a settlement which for practical purposes is linear and non-recoverable. Differential settlement is related to column spacing, column loads, and footing sizes.

Footings stepped from one level to another should be at a slope not exceeding 1 vertical to 1 horizontal for the above bearing pressures to be applicable. There must be a minimum of 300 mm between the edge of any footing and the top of a sloped 2V:1H sound rock cut down to another footing.

The lowest levels of unheated underground parking structures two or more levels deep are, although unheated, still warmer than typical outdoor winter temperatures in the Greater Toronto Area. Interior foundations (or pile caps) with 900 mm of frost cover perform adequately, as do perimeter foundations with 600 mm of frost cover. Where foundations are next to ventilation shafts or are exposed to typical outdoor temperatures, 1.2 m of earth cover (or equivalent insulation) is required for frost protection.

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. 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.

3.2 Earthquake Design Parameters

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 top 30 metres of the site stratigraphy, 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 founding elevations for spread footings of 94± metres, the boreholes observe inferred bedrock. Based on this information, the site designation for seismic analysis is **Class B** 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.

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
Clayey Silt Till	22	32	0.31	0.47	3.25
Sound Bedrock	26	28	n/a		

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:

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

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 rock 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 Canadian Foundation Engineering Manual (CFEM) Ed. 4 (0.8)
N = normal load at base of footing (kN)
φ = internal friction angle (see table above)

3.4 Slab on Grade Design Parameters

The lowest (P5) basement slab of the proposed structure is at 17± metres below grade; it will therefore be set on sound bedrock of the Georgian Bay Formation. The bedrock at this site constitutes an adequate subgrade for support of a slab on grade. The modulus of subgrade reaction appropriate for design of the slab resting on an aggregate drainage layer overlying unweathered (sound) bedrock is 80,000 kPa/m.

Subfloor drains are typically installed in trenches below the capillary moisture break drainage layer per the typical detail appended. If trenches are to be avoided for whatever reason, the subfloor drainage system can be incorporated into the capillary moisture break and drainage layer. In this case, the subfloor drains are laid directly on the flat subgrade and backfilled with a minimum 300 mm thick layer of HL8 coarse aggregate (OPSS.MUNI 1150) or HPB, vibrated to a dense state. Any solid collection pipes must be sloped so that they positively discharge to the sumps.

The use of excavated bedrock spoil to restore subgrade elevations is to be specifically prohibited. This bedrock spoil cannot be adequately compacted to provide support for the slab on grade and is not to be reused below any settlement sensitive areas.

A permanent drainage system including subfloor drains is required (see Section 3.5).

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 structure. Subfloor drainage collects and removes the seepage that infiltrates under the floor. Perimeter drainage collects and removes seepage that infiltrates at the foundation walls.

Subfloor drainage pipes are to be spaced at an average 6 m (measured on-centres). If subdrain elevation conflicts with top of footing elevation, footings should be lowered as necessary.

The walls of the substructure are to be fully drained to eliminate hydrostatic pressure. 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. A layer of waterproofing placed between the drain core product and the basement 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. 20-088).

4 Considerations for Construction

4.1 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 is a Type 3 soil
- The cohesive till is a Type 2 soil

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:

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 238 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.

Bedrock is not considered a soil under the Act. Vertical excavations made in sound bedrock are generally self-supporting provided the rock bedding is horizontally oriented. If deemed necessary, rock bolts can be used to anchor a layer of protective mesh that will protect workers from loose rock spalling from the face of excavation. The rock face must be inspected by Grounded to determine that no other support system is required to prevent the spalling of loose rock, and to confirm that all loose spall material at risk of falling upon a worker is removed (Section 233 of the above noted regulations).

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.

Excavations will penetrate weathered and sound bedrock. Georgian Bay Formation bedrock is a rippable rock that can be removed with conventional excavation equipment once it has been broken by ripper tooth or hoe ram. Creating detailed excavation shapes for foundations etc. is normally accomplished by hoe ram. The removal of rock from a vertical face without over-excavation, which can happen inadvertently by dislodging additional rock, is largely dependent on machine operator skill. If excavation faces must be made neat (such as beside an existing footing), a line of excavation can be provided by line drilling the rock a series of closely-spaced vertical holes (100 mm diameter, spaced at 300 mm on centre) to provide a preferential vertical break path for the excavation face.

Georgian Bay Formation bedrock contains beds of harder limestone. When excavating this bedrock, it should be expected that these beds will be encountered. Hard layers of limestone interbedded within the shale are normally broken with hoe mounted hydraulic rams before excavation.

Limestone beds may also be found to straddle the founding elevation, in which case the entire thickness of the hard limestone layer must be removed to expose founding subgrade as it is not possible to remove part of one of these layers. This will in turn 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.

4.2 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 groundwater table at Elev. 107.7± m is above the bulk excavation level for P5. There is infiltrated stormwater in the fill. Groundwater may be allowed to drain into the excavation and then pumped out. The volume of seepage anticipated in open excavations is limited to the extent that temporary pumping from the excavations is expected to sufficiently control groundwater seepage. Regardless, excavation delays will occur as seepage (however limited) is controlled. These delays should be anticipated in the construction schedule.

Dewatering of the bedrock is not required.

It is recommended that a professional dewatering contractor be consulted to review the subsurface conditions and to design a site-specific dewatering system. It is the dewatering contractor's responsibility to assess the factual data and to provide recommendations on dewatering system requirements.

The City of Mississauga will require Discharge Agreements in the short and long-terms, if any water is to be discharged to the storm or sanitary sewers.

4.3 Earth-Retention Shoring Systems

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

Underpinning 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.

The excavation for the P5 level will extend below the foundations of existing adjacent structures in bedrock. The excavation walls must be inspected by the geotechnical engineer for any fracturing or movement during excavation and construction. Based on the inspection, Grounded may recommend additional monitoring (e.g. multi-point borehole extensometers (MPBX)) or additional rock mass support such as a combination of shotcrete, rock pins, or rock bolts for alternative support. Rock mass support must be designed by the Geostructural Engineer, in consultation with the Geotechnical Engineer of Record.

4.3.1 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.

Where multiple rows of lateral supports are used to support the shoring walls, 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. A multi-level supported shoring system can be designed based on an earth pressure distribution with a maximum pressure defined by:

$$\boldsymbol{P = 0.8\,K[\gamma H + q] + \gamma_w h_w}$$

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. 107.7 m must be accounted for.

In cohesive soils, the lateral earth pressure distribution is trapezoidal, uniformly increasing from zero to the maximum pressure defined in the equation above over the top and bottom quarter (H/4) of the shoring.

Where the excavation penetrates the bedrock, the rock excavation is nominally self-supporting in a vertical face, provided the rock bedding is horizontally oriented. The requirement for extending lagging into partially weathered rock depends on the quality of the excavation cut and the degree of weathering.

4.3.2 Soldier Pile Toe Embedment

Soldier pile toes will be made in sound bedrock. Soldier pile toes resist horizontal movement due to the passive earth pressure acting on the toe below the base of excavation. The maximum factored vertical geotechnical resistance at ULS for the design of a pile embedded in the sound bedrock is 10 MPa. The maximum factored lateral geotechnical resistance at ULS of the undisturbed rock is 1 MPa.

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 augured holes, mud/slurry/polymer drilling techniques, or other methods as deemed necessary by the shoring contractor are required.

Exposed bedrock of the Georgian Bay Formation deteriorates with time. Within 12 months of exposure, excavation faces made within this bedrock flake and recede as much as 300 mm, generally in the form of coin-size shale particles dropping from the face on a constant basis. The deteriorated rock loses internal integrity and bearing capability. Solider piles for the shoring system are typically advanced at least 1 metre below the base of the excavation (to be confirmed by the geostructural engineer) to accommodate this weathering and still ensure that the required lateral and vertical bearing resistances can be utilized.

4.3.3 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.

Conventional earth anchors made in Georgian Bay Formation bedrock can be designed using a working adhesion of 620 kPa.

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 bedrock below the proposed FFE is suitable for the placement of raker foundations. Raker footings established on bedrock at an inclination of 45 degrees can be designed using a maximum factored geotechnical resistance at ULS of 2500 kPa.

4.4 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. Depending on the project context, consideration should be given to frost effects (heaving, softening, etc.) on exposed subgrade surfaces.

The exposed Georgian Bay Formation deteriorates with time. Exposed excavation faces have been found to flake and recede as much as 300 mm with 12 months exposure. This recession generally takes the form of coin size shale particles dropping from the face on a constant basis. The deteriorated rock loses internal integrity and bearing capability. If bedrock is to be exposed for prolonged periods of time, it is recommended that a skim coat of concrete be used to protect the surface of bedrock from slaking and other degradation resulting from weathering.

4.5 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 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.

The long-term performance of a slab on grade is highly dependent upon the subgrade support and drainage conditions. 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 and the compaction of all fill should be monitored by Grounded at the time of construction to confirm material quality, thickness, and to ensure adequate compaction.

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.

5 Limitations and Restrictions

This preliminary geotechnical engineering feasibility study is intended for due diligence purposes only. At detailed design, site-specific 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.

5.1 Investigation Procedures

The preliminary geotechnical engineering analysis and advice provided are based on the factual borehole information observed and recorded by Grounded. The investigation methodology and engineering analysis methods used to carry out this scope of work are consistent with conventional standard practice by Grounded as well as other geotechnical consultants, working under similar conditions and constraints (time, financial and physical).

Borehole drilling services were provided to Grounded by a specialist professional contractor. The drilling was observed and recorded by Grounded's field supervisor on a full-time basis. Drilling was conducted using conventional drilling rigs equipped with solid stem augers. As drilling proceeded, groundwater observations were made in the boreholes. Based on examination of recovered borehole samples, our field supervisor made a record of borehole and drilling observations. The field samples were secured in air-tight clean jars and bags and taken to the Grounded soil laboratory where they were each logged and reviewed by the geotechnical engineering team and the senior reviewer.

The Split-Barrel Method technique (ASTM D1586) was used to obtain the soils samples. 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.

5.2 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 this potential site alteration.

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.

5.3 Report Use

The authorized users of this report are ACLP - Dundas Street E 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 local municipal/regional governing bodies may also make use of and rely upon this report, subject to the limitations as stated.

6 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

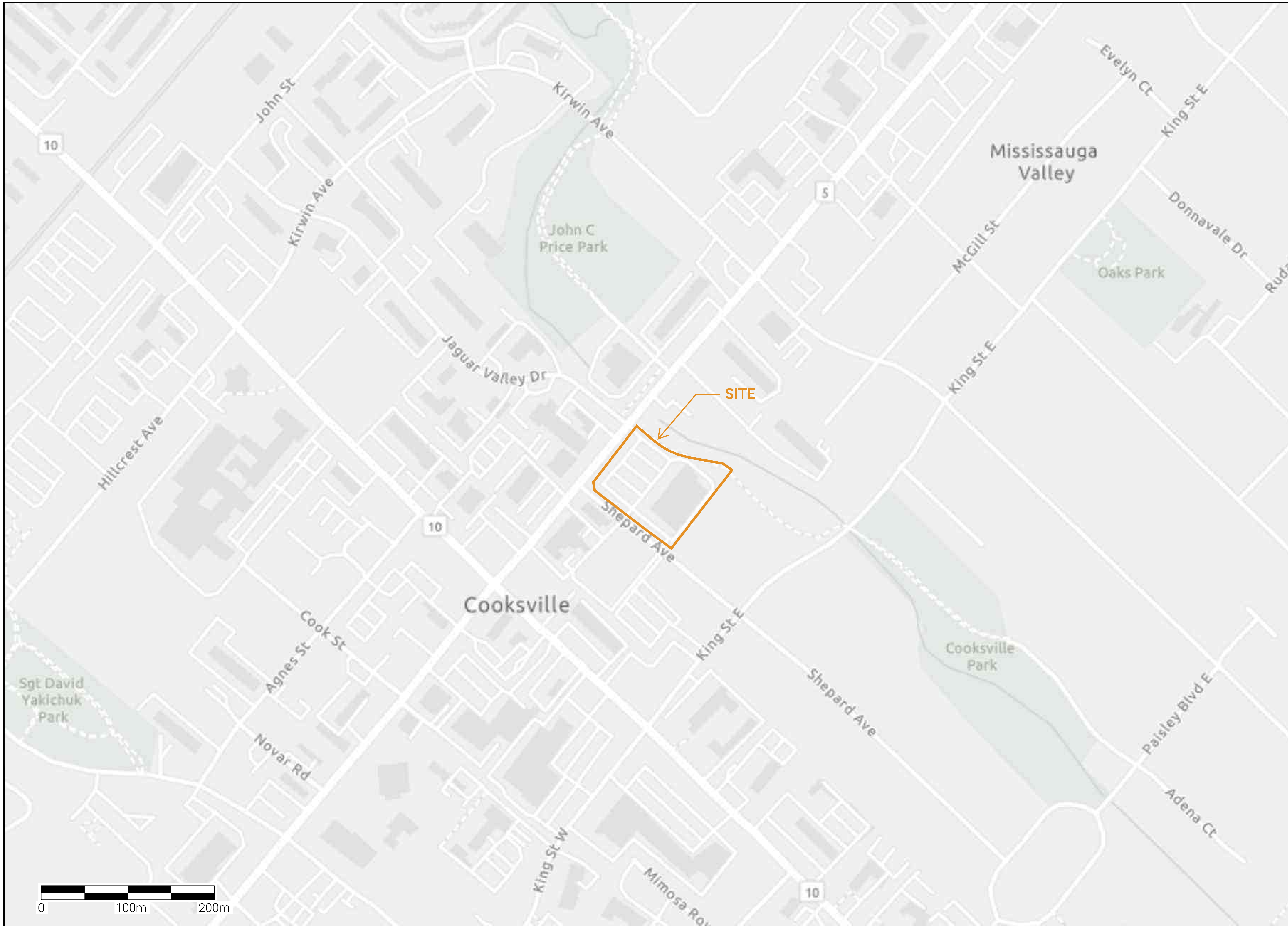
Nico Piers, EIT

Michael Diez de Aux, M.A.Sc., P.Geo., P.Eng.
Associate

LICENSED PROFESSIONAL ENGINEER
M. DIEZ DE AUX
100159147
24/02/2022
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
J. J. CROWDER
100077148
24/02/2022
PROVINCE OF ONTARIO

Jason Crowder, Ph.D., P.Eng.
Principal



GROUNDED
ENGINEERING

1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
www.groundedeng.ca

LEGEND

APROXIMATE PROPERTY BOUNDARY

Note

Reference

ArcGIS Map 2021

Project

60 DUNDAS STREET EAST, MISSISSAUGA, ON

Figure Title

SITE LOCATION PLAN

North

TRUE
PROJECT

Date

FEBRUARY 2022

Scale

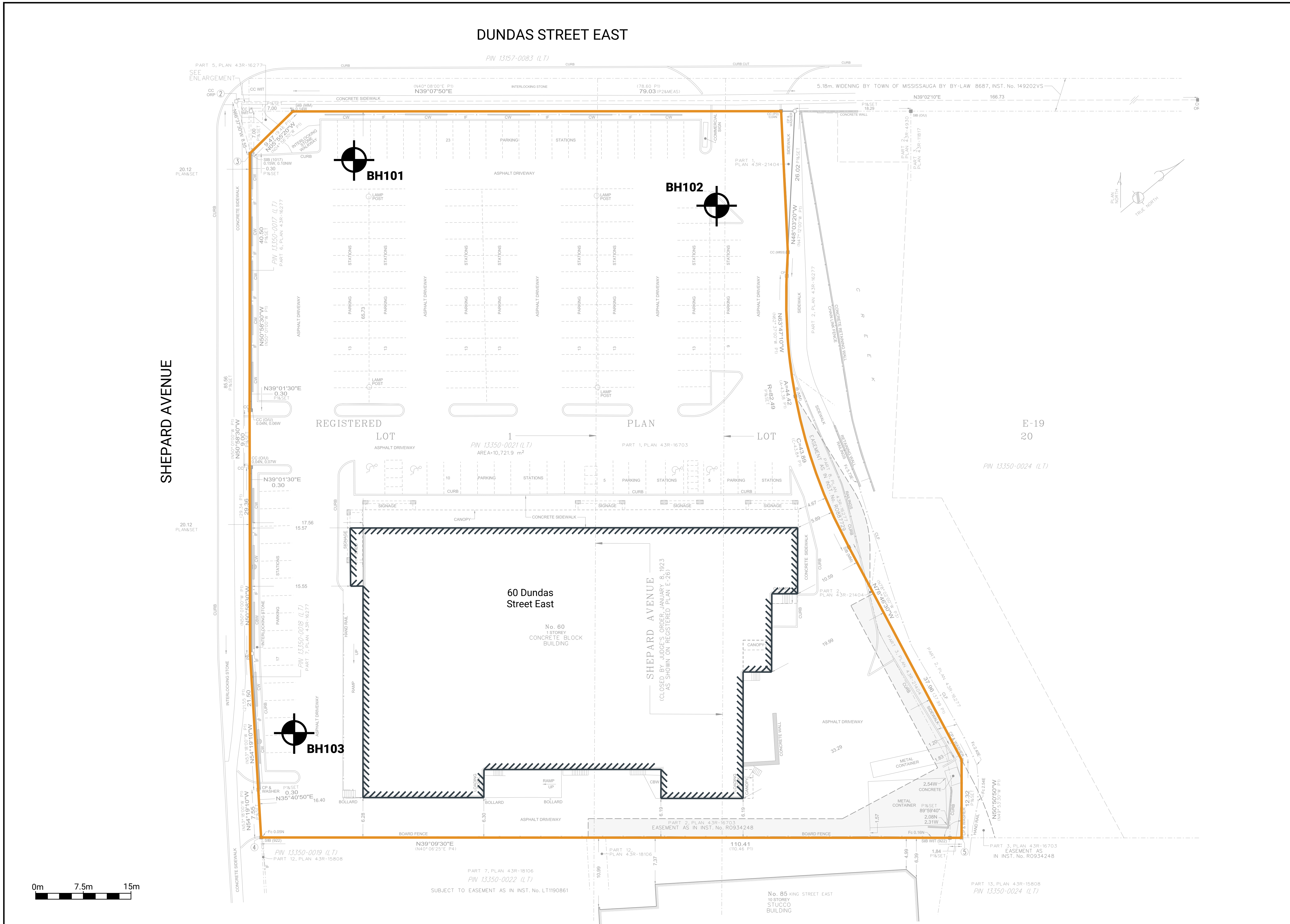
AS INDICATED

Job No

21-067

Figure No

FIGURE 1



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LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- EXISTING BUILDING STRUCTURE
- MONITORING WELL BY GROUNDED

Note

Reference

Survey Drawing no. 20-21-14108-00.
Prepared by Aksan Piller Corporation Ltd.
Dated April 5, 2021.

Project

60 DUNDAS STREET EAST, MISSISSAUGA, ON

Figure Title

BOREHOLE LOCATION PLAN

North

TRUE

PROJECT

Date

FEBRUARY 2022

Scale

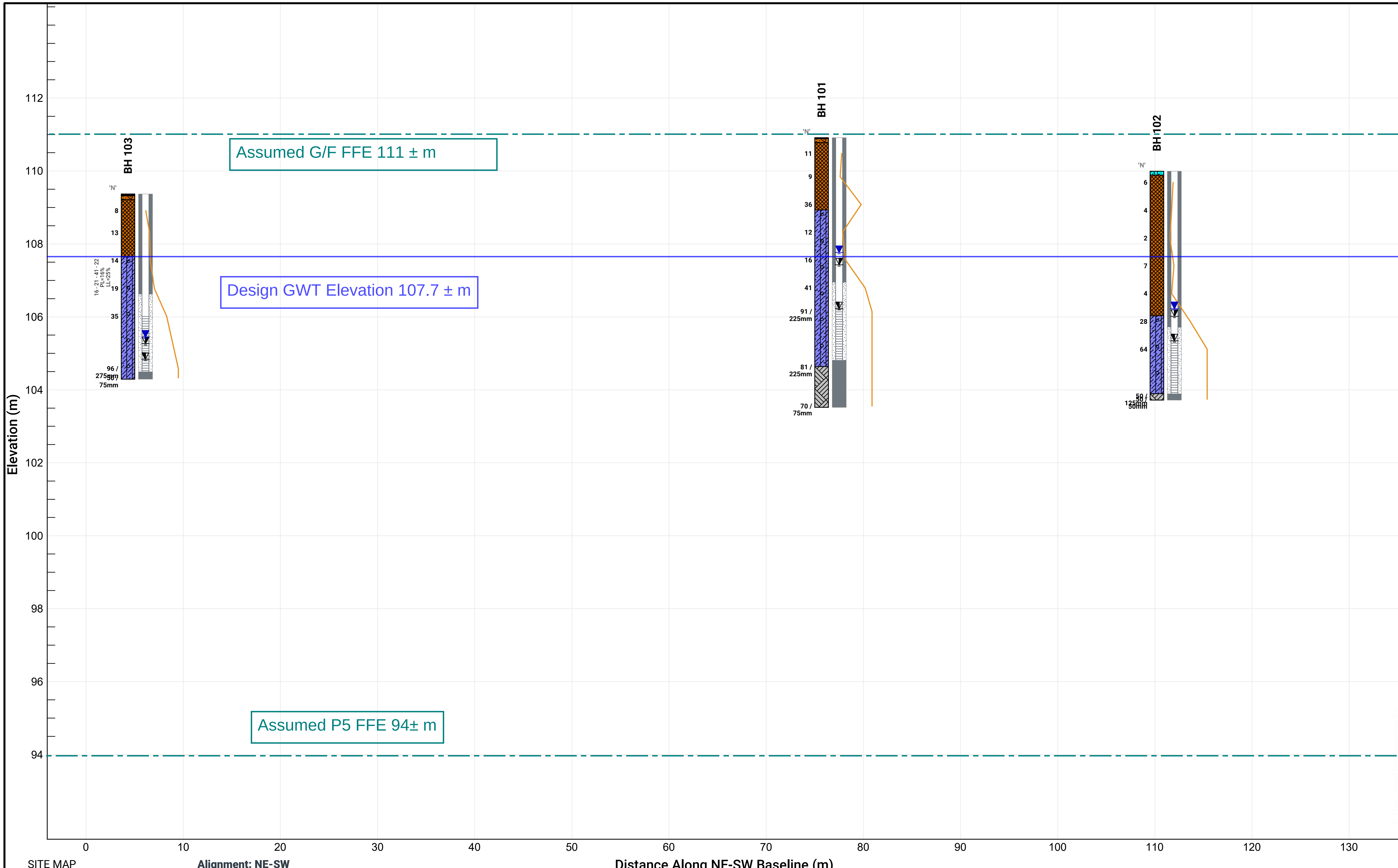
AS INDICATED

Job No

21-067

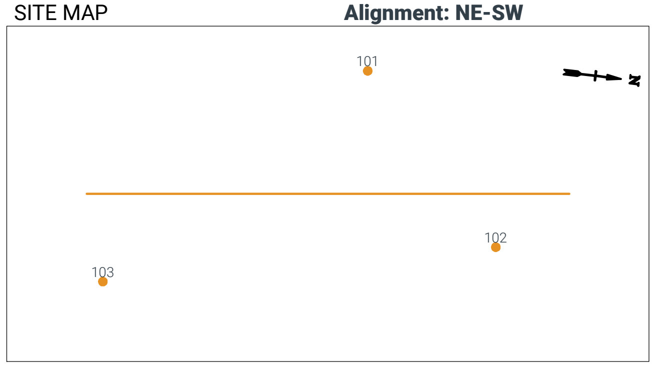
Figure No

FIGURE 2



SITE MAP

Alignment: NE-SW



LITHOLOGY GRAPHIC LEGEND

- Asphalt
- Bedrock (inferred)
- Aggregate
- Topsoil
- Fill
- Clayey Silt Till

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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 SOILS

- water level, unstabilized
- water level, stabilized

Project

60 DUNDAS STREET EAST
MISSISSAUGA, ON

Figure Title

SUBSURFACE CROSS-SECTION

NE-SW

Date

FEBRUARY 2022

Scale

AS INDICATED

Job No

21-067

Figure No

FIGURE 3

APPENDIX A

BOREHOLE LOG TERMINOLOGY

GROUNDED ENGINEERING

SAMPLING/TESTING METHODS

SS: split spoon sample

AS: auger sample

GS: grab sample

FV: shear vane

DP: direct push

PMT: pressuremeter test

ST: shelby tube

CORE: soil coring

RUN: rock coring

SYMBOLS & ABBREVIATIONS

MC: moisture content

LL: liquid limit

PL: plastic limit

NP: non-plastic

γ: soil unit weight (bulk)

G_s: specific gravity

S_u: undrained shear strength

▽ unstabilized water level

▼ 1st water level measurement

▼ 2nd water level measurement most recent

▼ water level measurement

ENVIRONMENTAL SAMPLES

M&I: metals and inorganic parameters

PAH: polycyclic aromatic hydrocarbon

PCB: polychlorinated biphenyl

VOC: volatile organic compound

PHC: petroleum hydrocarbon

BTEX: benzene, toluene, ethylbenzene and xylene

PPM: parts per million

FIELD MOISTURE (based on tactile inspection)

DRY: no observable pore water

MOIST: inferred pore water, not observable (i.e. grey, cool, etc.)

WET: visible pore water

COMPOSITION

Term	% by weight
trace silt	<10
some silt	10 - 20
silt***y***	20 - 35
sand ***and*** silt	>35

COHESIONLESS

Relative Density	N-Value
Very Loose	<4
Loose	4 - 10
Compact	10 - 30
Dense	30 - 50
Very Dense	>50

COHESIVE

Consistency	N-Value	Su (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

ASTM STANDARDS

ASTM D1586 Standard Penetration Test (SPT)
Driving a 51 mm O.D. split-barrel sampler ("split spoon") into soil with a 63.5 kg weight free falling 760 mm. The blows required to drive the split spoon 300 mm ("bpf") after an initial penetration of 150 mm is referred to as the N-Value.

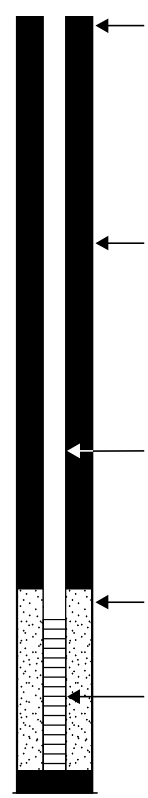
ASTM D3441 Cone Penetration Test (CPT)
Pushing an internal still rod with a outer hollow rod ("sleeve") tipped with a cone with an apex angle of 60° and a cross-sectional area of 1000 mm^2 into soil. The resistance is measured in the sleeve and at the tip to determine the skin friction and the tip resistance.

ASTM D2573 Field Vane Test (FVT)
Pushing a four blade vane into soil and rotating it from the surface to determine the torque required to shear a cylindrical surface with the vane. The torque is converted to the shear strength of the soil using a limit equilibrium analysis.

ASTM D1587 Shelby Tubes (ST)
Pushing a thin-walled metal tube into the in-situ soil at the bottom of a borehole, removing the tube and sealing the ends to prevent soil movement or changes in moisture content for the purposes of extracting a relatively undisturbed sample.

ASTM D4719 Pressuremeter Test (PMT)
Place an inflatable cylindrical probe into a pre-drilled hole and expanding it while measuring the change in volume and pressure in the probe. It is inflated under either equal pressure increments or equal volume increments. This provides the stress-strain response of the soil.

WELL LEGEND



GROUNDED ENGINEERING

Date Started : May 3, 2021
Position : E: 611836, N: 4826307 (UTM 17T)
Elev. Datum : Geodetic

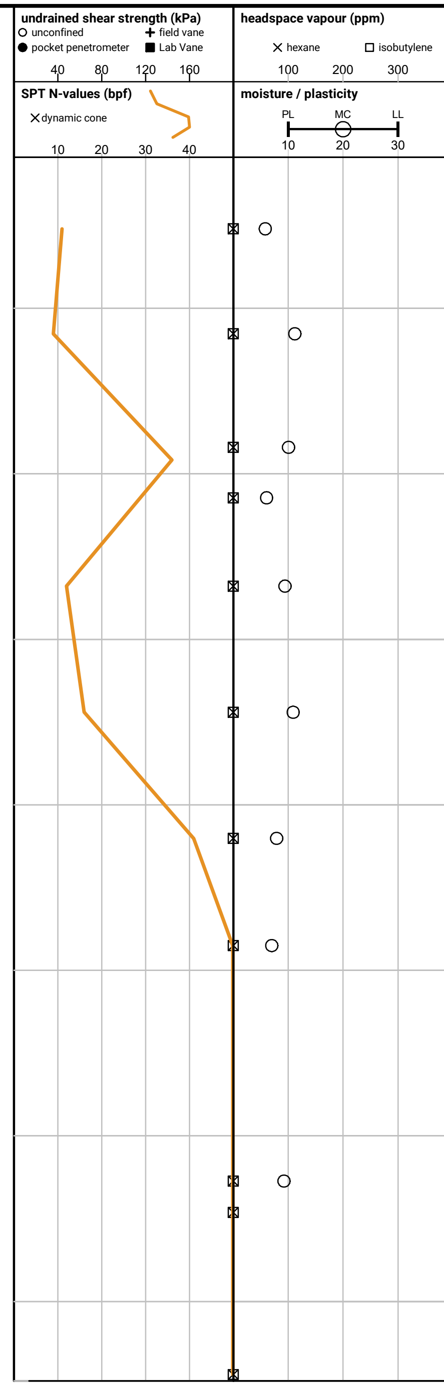
BOREHOLE LOG 101

File No. : 21-067 **Project** : 60 Dundas Street East, Mississauga, ON **Client** : Almega Asset Management

drill method : Truck-mounted rig; solid stem augers OD=150 mm

elev / depth (m)	description	sample number	type	SPT N-value	lab data and comments
110.9	**GROUND SURFACE**				
	25mm **ASPHALT**				
	100mm **AGGREGATE**				
	FILL, sand, some silt, trace organics, organic odour, loose to compact, dark brown, moist	1	SS	11	SS1: PAHs
		2	SS	9	SS2: H-Ms, Metals, ORPs
	...at 1.5 m, dense, some gravel	3A	SS	36	
108.9 / 2.0	...at 2.0 m, trace rock fragments, inferred cobbles	3B	SS		SS3B: PCBs
	CLAYEY SILT, sandy, some gravel, stiff to very stiff, grey, moist (GLACIAL TILL)	4	SS	12	SS4: BTEX, PHCs
		5	SS	16	
	...at 3.8 m, hard, trace rock fragments, inferred cobbles	6	SS	41	
		7	SS	91 / 225mm	SS7: BTEX, VOCs
104.6 / 6.3		8A	SS	81 / 225mm	
	INFERRED BEDROCK, shale and limestone fragments, grey	8B	SS		
103.5 / 7.4		9	SS	70 / 75mm	

depth scale (m): 0, 1, 2, 3, 4, 5, 6, 7
elevation (m): 110, 109, 108, 107, 106, 105, 104



grain size distribution (%) (MIT): GR SA SI CL

END OF BOREHOLE

Dry and open upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

Date	Water Depth (m)	Elevation (m)
May 4, 2021	4.7	106.2
May 6, 2021	3.5	107.4
May 10, 2021	3.3	107.6
May 21, 2021	3.2	107.7

file: 21-067.gpj

 Tech : OM | **PM** : DK / JH | **Rev** : MD

BOREHOLE LOG 102

GROUNDED ENGINEERING

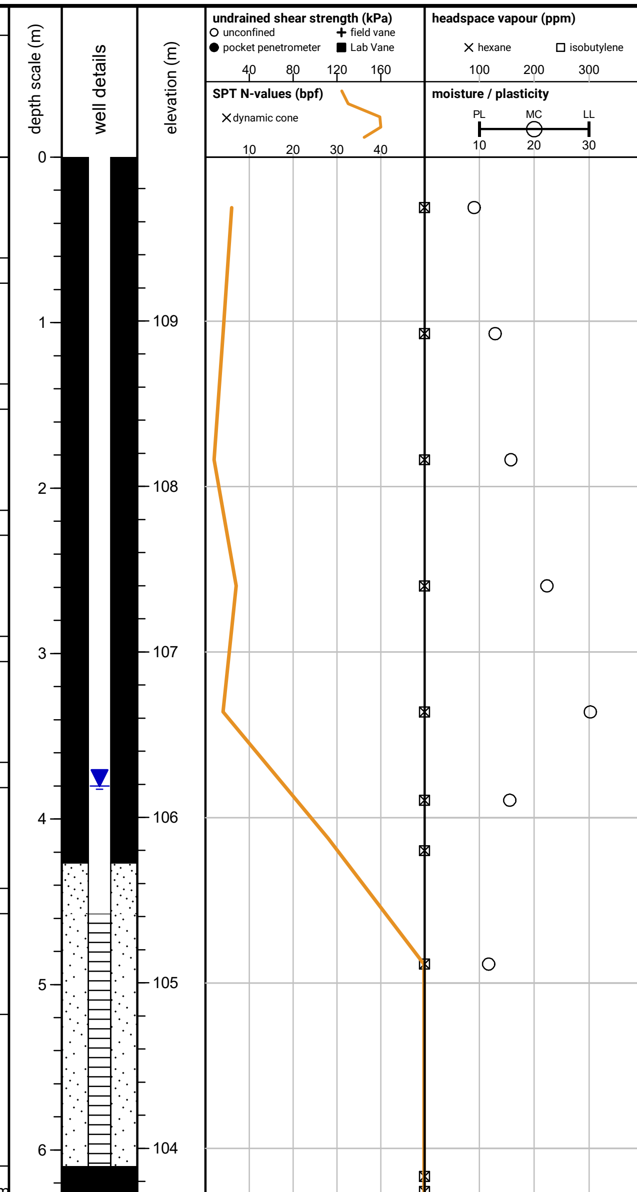
Date Started : May 3, 2021
Position : E: 611879, N: 4826347 (UTM 17T)
Elev. Datum : Geodetic

File No. : 21-067 **Project** : 60 Dundas Street East, Mississauga, ON **Client** : Almega Asset Management

drill method : *Truck-mounted rig*

solid stem augers OD=150 mm

elev depth (m)	description (stratigraphy)	sample number	type	SPT N-value	lab data and comments
110.0	**GROUND SURFACE**				
	100mm **TOPSOIL**				
	FILL, sand, some silt, trace clay, trace gravel, trace rootlets, trace organics, organic odour, loose to very loose, dark brown, moist	1	SS	6	
	...at 0.8 m, trace cinders	2	SS	4	
		3	SS	2	<u>SS3:</u> H-Ms, Metals, ORPs
	...at 2.3 m, silty	4	SS	7	
	...at 3.0 m, dark grey and black	5	SS	4	<u>SS5:</u> PAHs
		6A	SS	28	
106.0 4.0	**CLAYEY SILT**, sandy, some gravel, very stiff to hard, grey, moist (GLACIAL TILL)	6B	SS		<u>SS6B:</u> BTEX, PCBs, PHCs
		7	SS	64	<u>SS7:</u> BTEX, VOCs
103.9		8	SS	50 / 125mm	
103.7 6.3	**INFERRED BEDROCK**, shale and limestone fragments, grey	9	SS	50 / 50mm	**6.1m:** Auger grinding for 10 mins; auger refusal



END OF BOREHOLE
Auger refusal on inferred bedrock

Dry and open upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

Date	Water Depth (m)	Elevation (m)
May 4, 2021	4.7	105.3
May 6, 2021	4.0	106.0
May 10, 2021	3.8	106.2
May 21, 2021	3.8	106.2

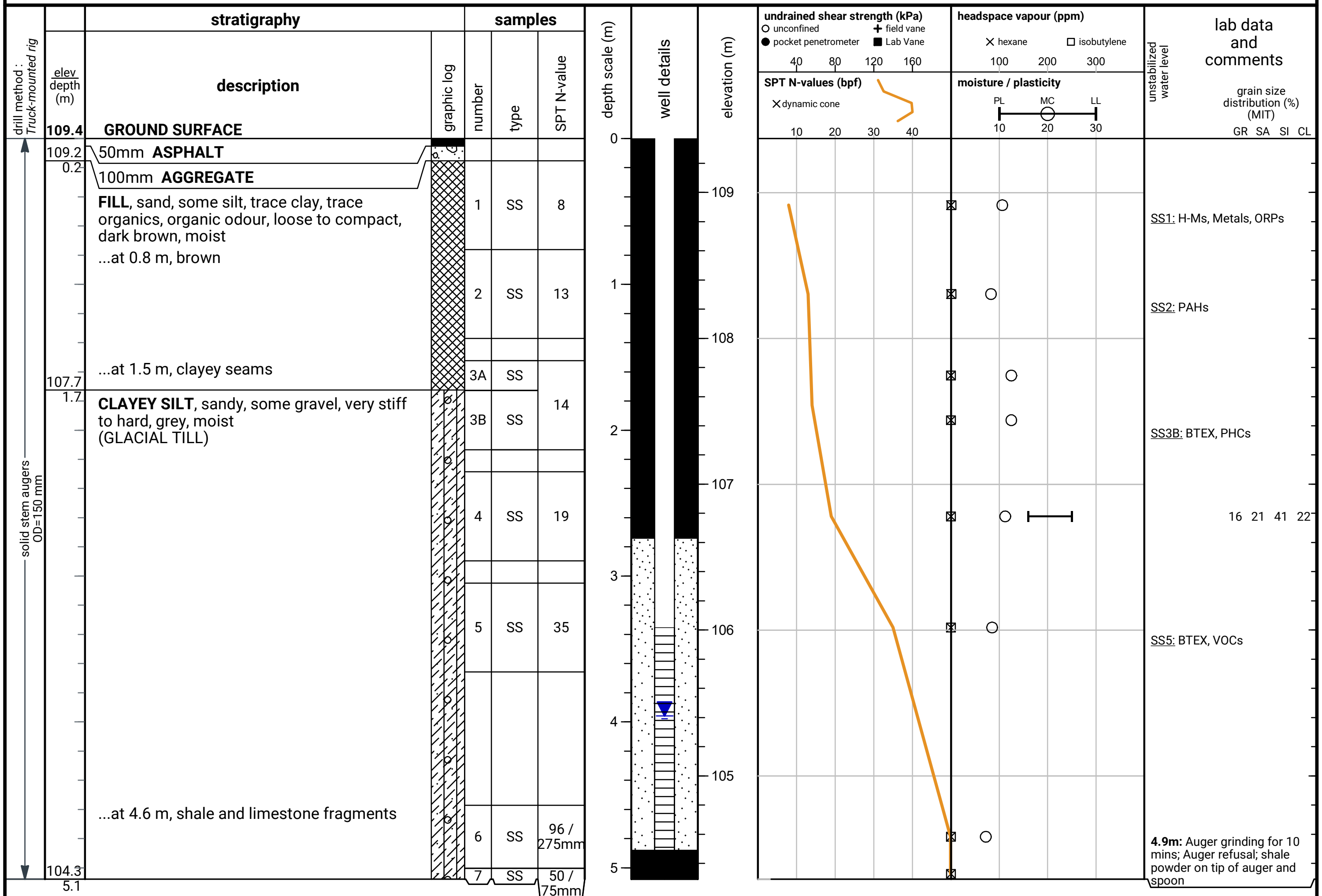
file: 21-067.gpj

Tech : OM | **PM** : DK / JH | **Rev** : MD

BOREHOLE LOG 103

Date Started : May 3, 2021
Position : E: 611901, N: 4826243 (UTM 17T)
Elev. Datum : Geodetic

File No. : 21-067 **Project** : 60 Dundas Street East, Mississauga, ON **Client** : Almega Asset Management



END OF BOREHOLE
Auger refusal on inferred bedrock

Dry and open upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

Date	Water Depth (m)	Elevation (m)
May 4, 2021	4.6	104.8
May 6, 2021	4.1	105.3
May 10, 2021	4.1	105.3
May 21, 2021	4.0	105.4

file: 21-067.gpj

 Tech : OM | **PM** : DK / JH | **Rev** : MD

APPENDIX B

Peto MacCallum Ltd.
CONSULTING ENGINEERS

ATTERBERG LIMITS - LIQUID AND PLASTIC

LABORATORY NO.:	2102782 B	PROJECT NO.:	21TM720	DATE:	May 18, 2021
BOREHOLE NO.:	103	SAMPLE NO.:	SS4	TESTED BY:	L. Gowry
SAMPLE DEPTH:	7.5-9 ft	DESCRIPTION:		CHECKED BY:	J. Noor

LIQUID LIMIT

TRIAL	1	2	3	4	5
NUMBER OF BLOWS	30	20	15		
TARE NUMBER	H1	P4	N4		
WT. TARE & WET SOIL	43.42	42.92	39.09		
WT. TARE & DRY SOIL	38.79	38.21	35.09		
WT. OF WATER	4.63	4.71	4.00		
WT. OF TARE	19.96	19.98	20.14		
WT. OF DRY SAMPLE	18.83	18.23	14.95		
MOISTURE CONTENT	24.6	25.8	26.8		

ATTERBERG LIMITS

LIQUID LIMIT	25
PLASTIC LIMIT	16
PLASTICITY INDEX	9

PLASTIC LIMIT

TRIAL	1	2
TARE NUMBER	P10	x23
WT. TARE & WET SOIL	27.75	27.57
WT. TARE & DRY SOIL	26.65	26.53
WT. OF WATER	1.10	1.04
WT. OF TARE	19.83	20.03
WT. OF DRY SAMPLE	6.82	6.50
MOISTURE CONTENT	16.1	16.0

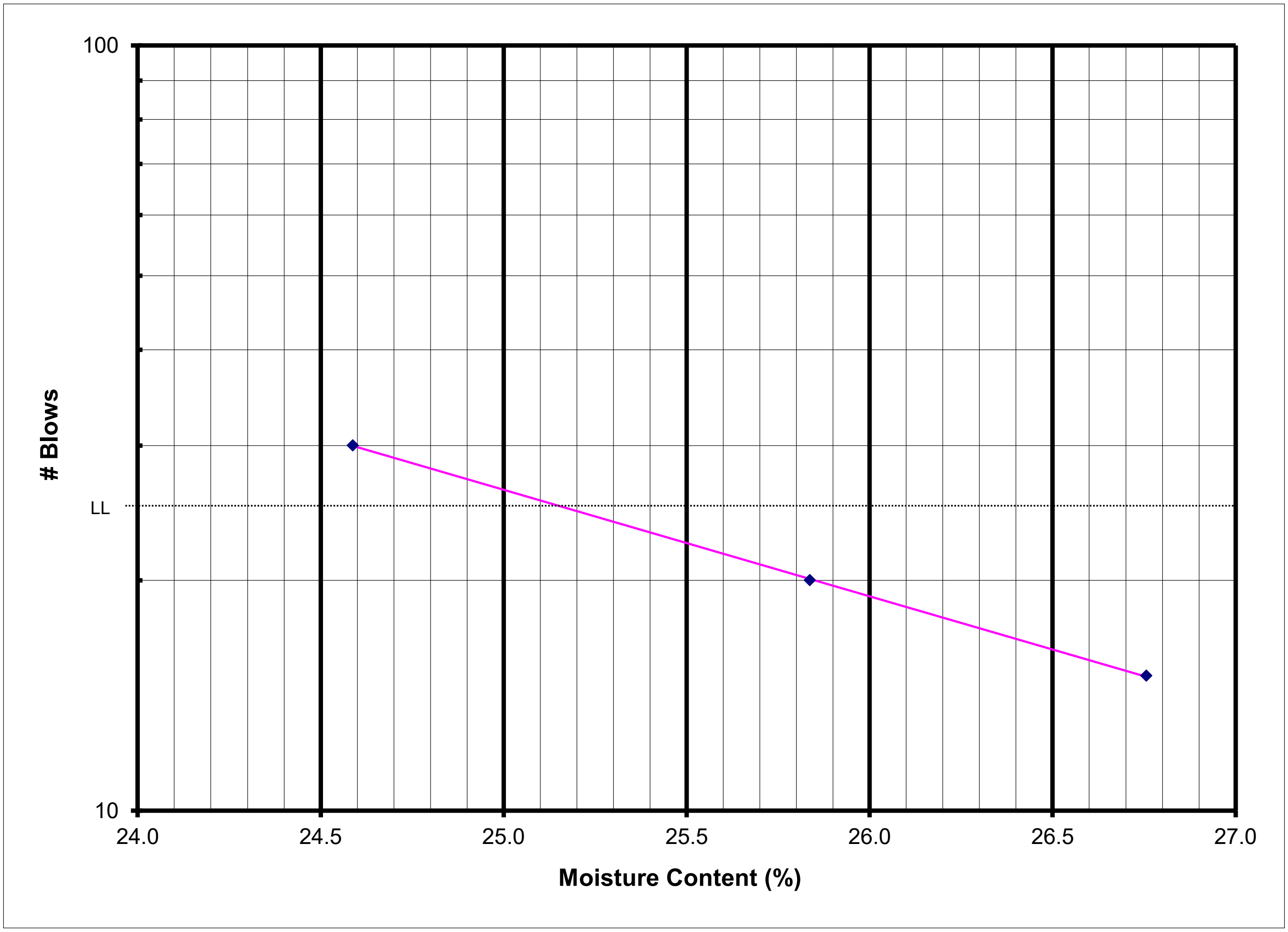
LIQUID LIMIT BEST-LINE CALCULATION & ASSESSMENT

LOG OF BLOWS	MOISTURE CONTENTS		ERROR EVALUATION			
			BLOW COUNT	MOISTURE CONTENT	DIFFERENCE	WITHIN 1%?
1.4771213	24.6					
1.30103	25.8		30	24.6	0.0	TRUE
1.1760913	26.8		20	25.8	0.0	TRUE
			15	26.7	0.0	TRUE
SLOPE	INTERCEPT					
-7.19268	35.20747		ERROR ASSESSMENT			PASSES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

ATTERBERG LIMITS - LIQUID AND PLASTIC

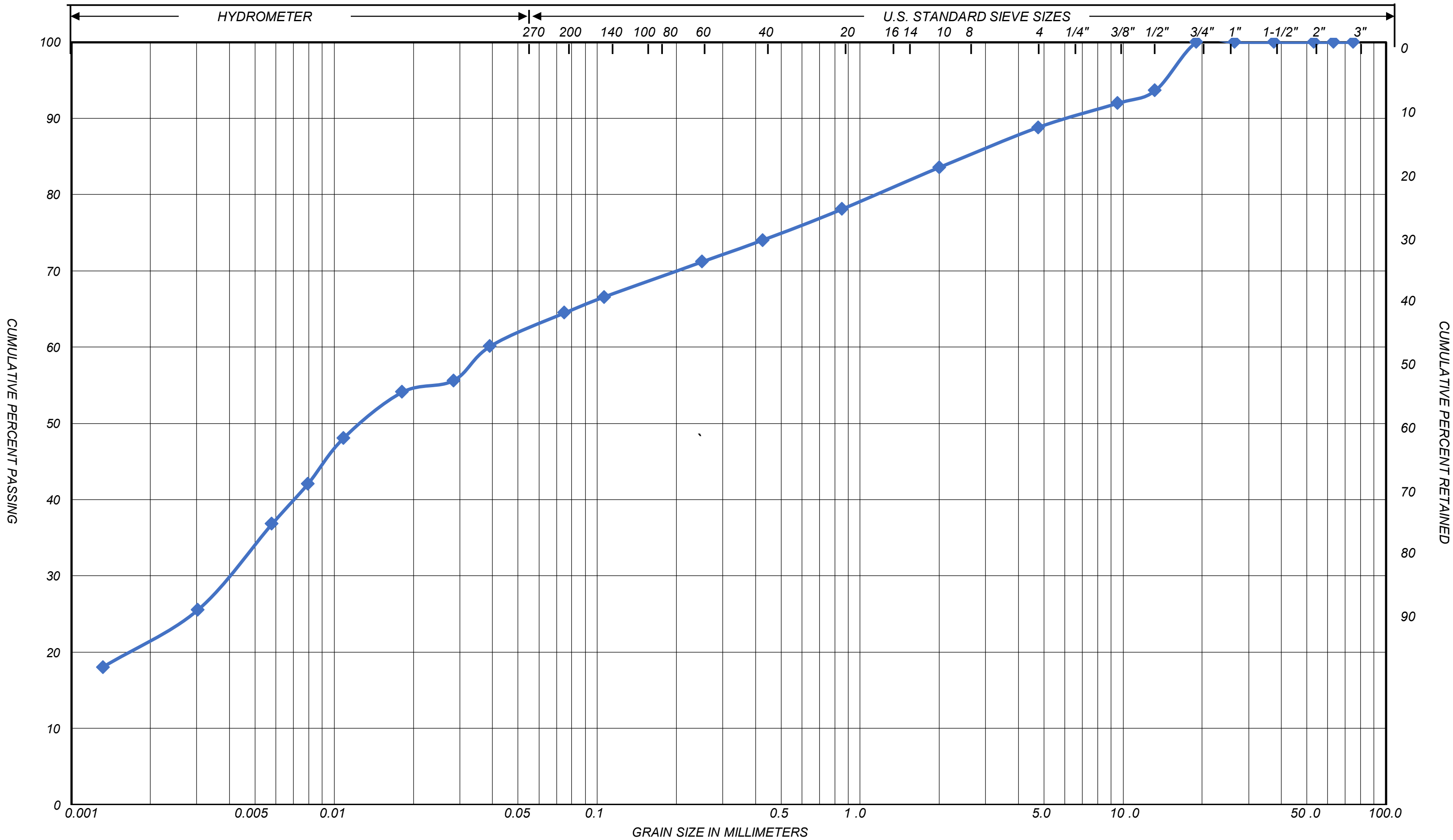
LABORATORY NO.:	2102782 B	PROJECT NO.:	21TM720	DATE:	May 18, 2021
BOREHOLE NO.:	103	SAMPLE NO.:	SS4	TESTED BY:	L. Gowry
SAMPLE DEPTH:	7.5-9 ft	DESCRIPTION:		CHECKED BY:	J. Noor



Peto MacCallum Ltd.
CONSULTING ENGINEERS

PML REF. 21TM720
REPORT NO.
ENCLOSURE

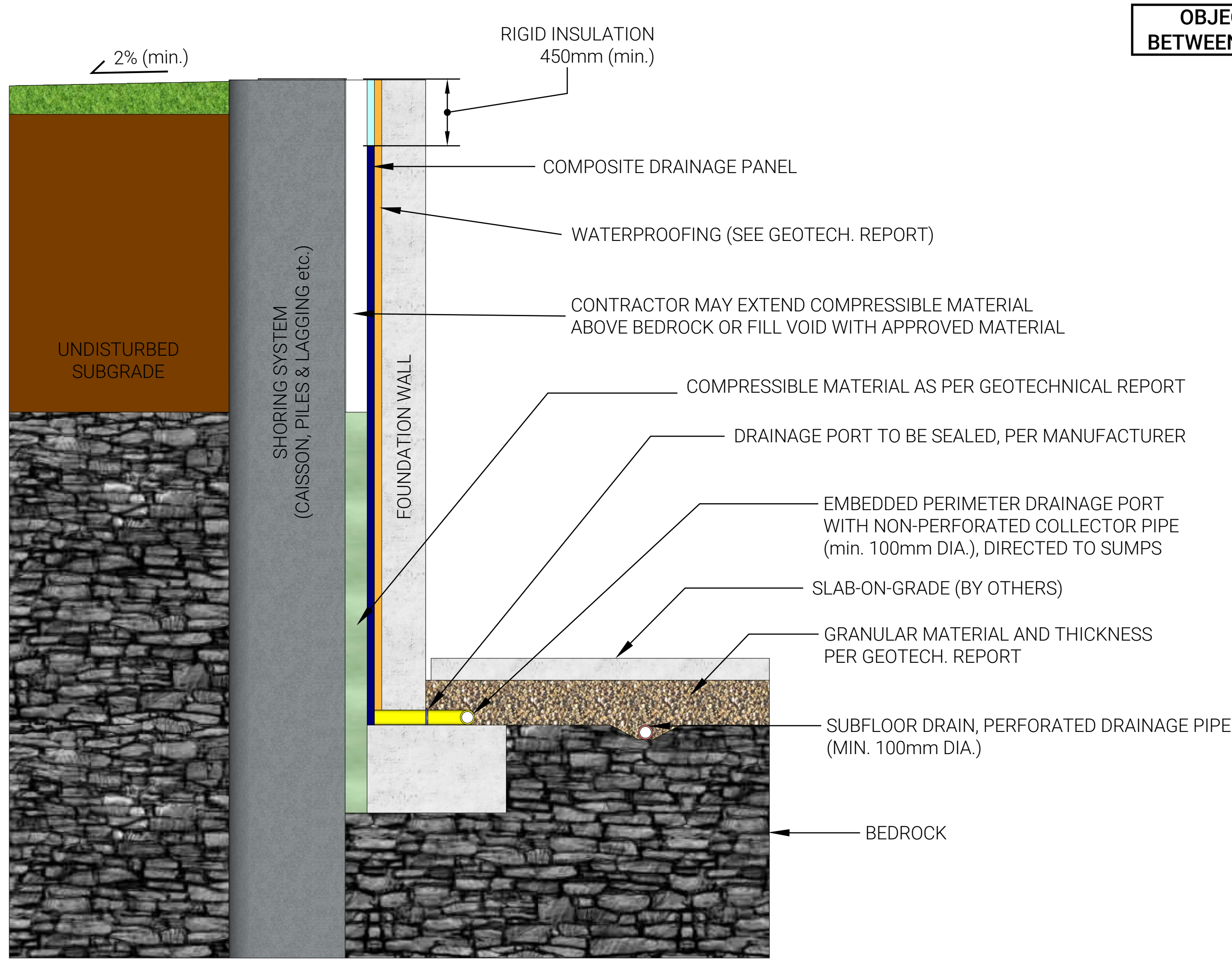
PARTICLE SIZE DISTRIBUTION CHART



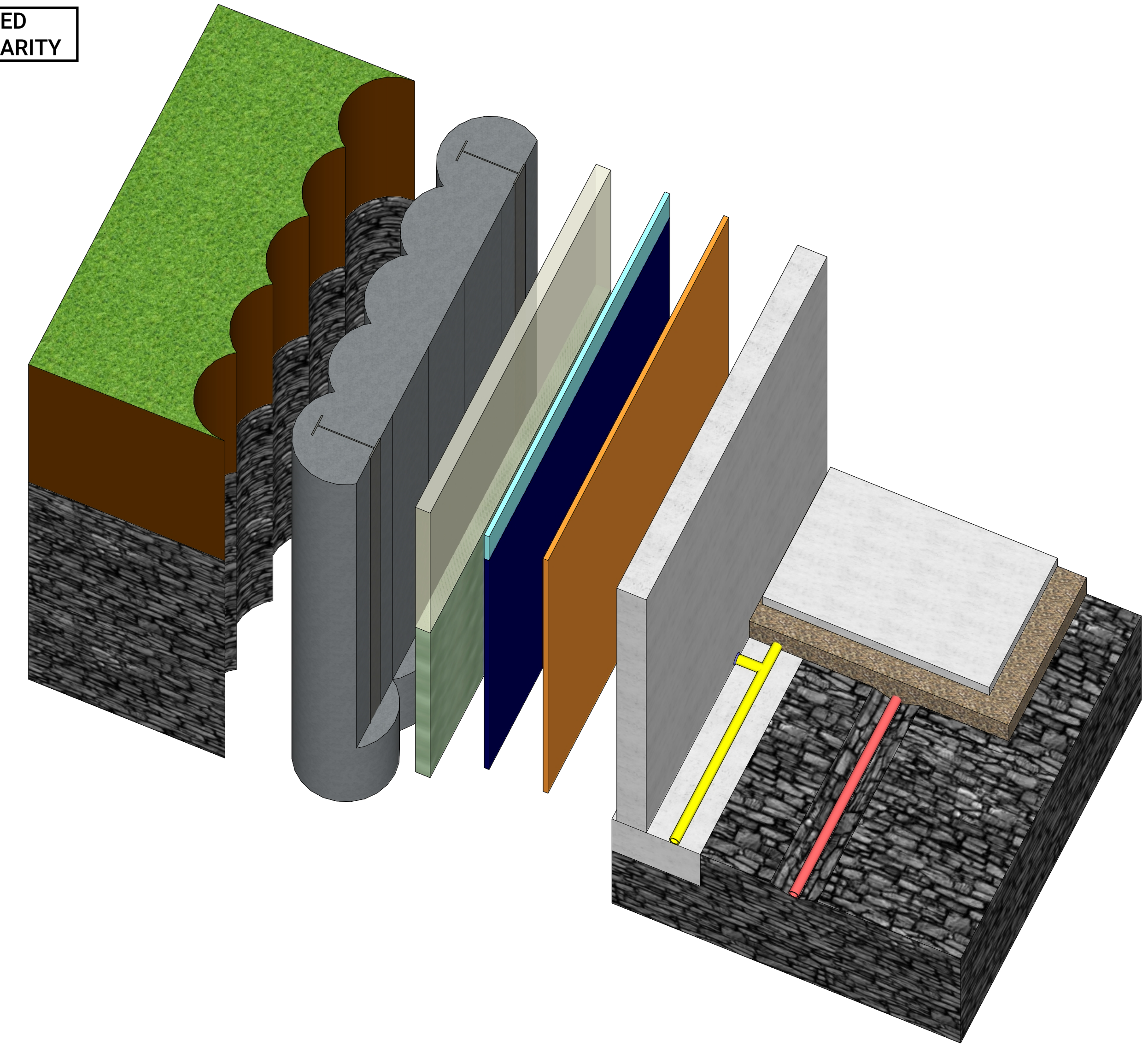
SILT & CLAY		FINE SAND	MEDIUM SAND	COARSE SAND	GRAVEL	COBBLES	UNIFIED
CLAY	FINE / MEDIUM / COARSE SILT	FINE SAND	MEDIUM SAND	COARSE SAND	GRAVEL	COBBLES	M.I.T.
CLAY	SILT	VERY FINE / FINE SAND	MEDIUM SAND	COARSE SAND	GRAVEL		U.S. BUREAU

REMARKS Bore Hole 103, Sample No.SS4, Depth 7.5-9, Lab No.2102782-B,

APPENDIX C



SECTIONAL VIEW



ISOMETERIC 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.

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

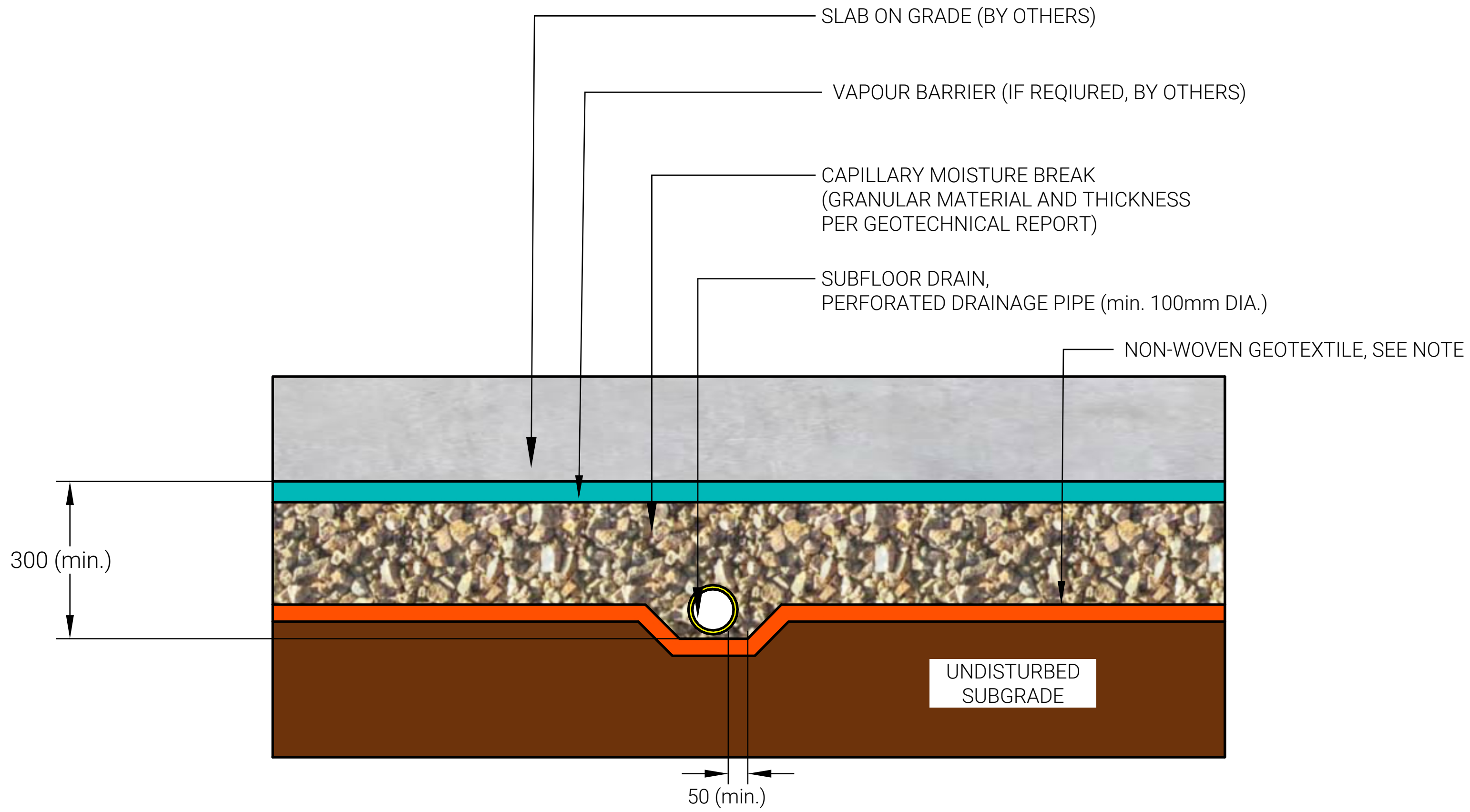
1. THERE SHOULD BE NO STRUCTURAL CONNECTION BETWEEN THE SLAB-ON-GRADE AND THE FOUNDATION WALL OR FOOTING.
2. THERE SHOULD BE NO CONNECTION BETWEEN THE SUBFLOOR AND PERIMETER DRAINAGE SYSTEMS.
3. THIS IS ONLY A TYPICAL BASEMENT DRAINAGE DETAIL. THE GEOTECHNICAL REPORT SHOULD BE CONSULTED FOR SITE SPECIFIC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

GROUNDED ENGINEERING

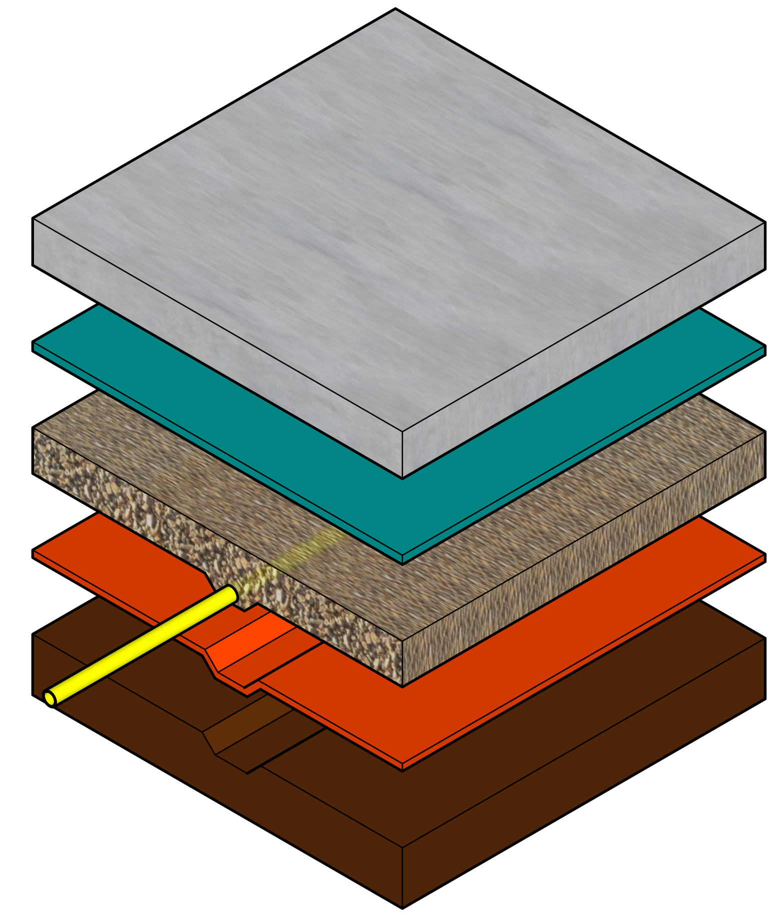
Title

FOUNDATION WALL BLINDSIDE DRAINAGE SYSTEM (IN DEEP ROCK) DETAIL

OBJECTS ARE COLOR-CODED BETWEEN TWO VIEWS FOR CLARITY



SECTIONAL VIEW



ISOMETRIC VIEW

NOTES

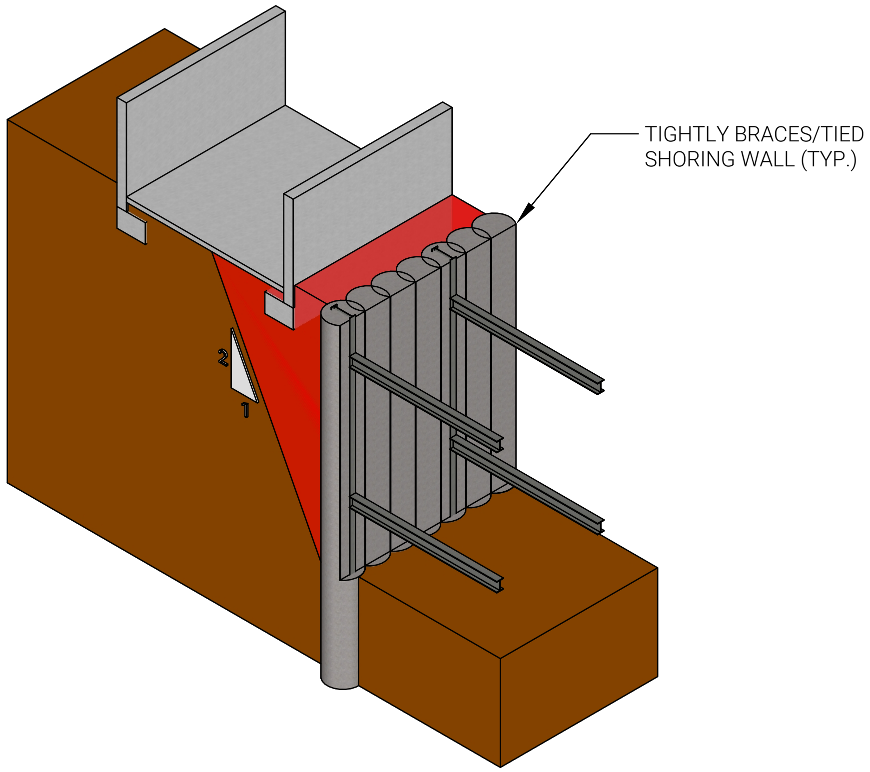
1. WHEN THE SUBGRADE CONSISTS OF COHESIONLESS SOIL, IT MUST BE SEPARATED FROM THE SUBFLOOR DRAINAGE LAYER USING A NON-WOVEN GEOTEXTILE (WITH AN APPARENT OPENING SIZE OF < 0.250mm AND A TEAR RESISTANCE OF > 200 N).

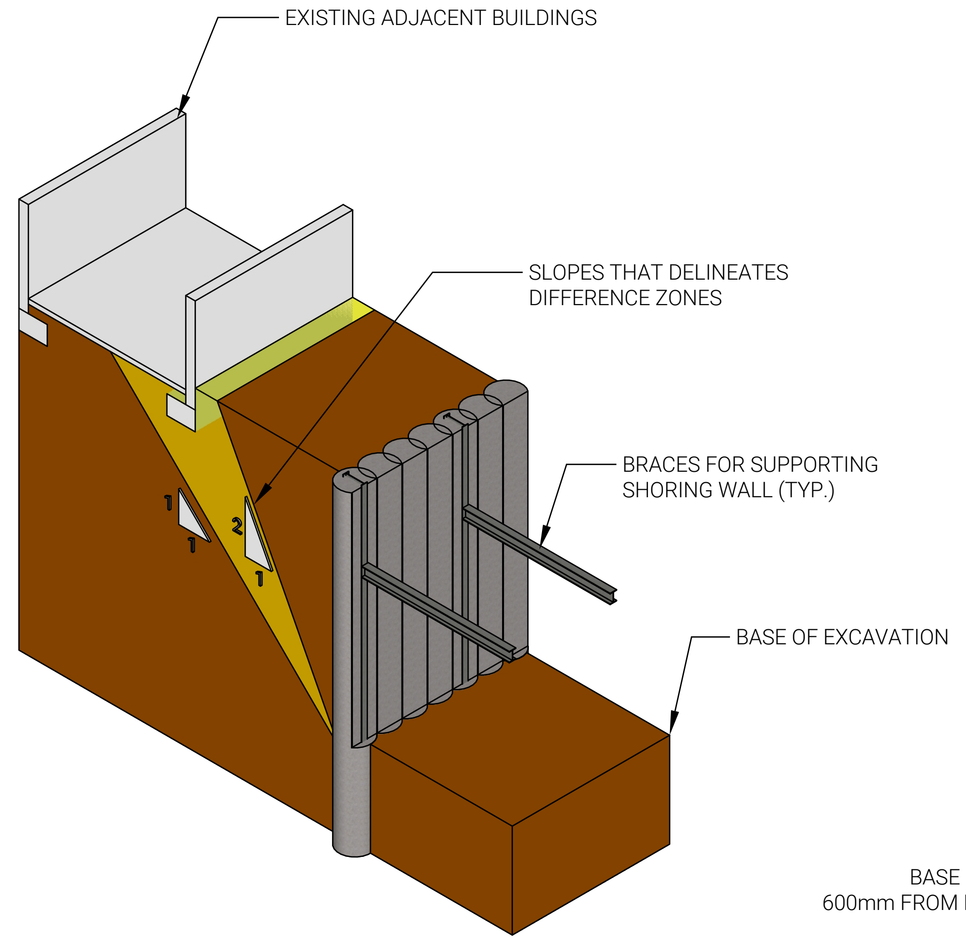
2. TYPICAL SCHEMATIC ONLY. MUST BE READ IN CONJUNCTION WITH GEOTECHNICAL REPORT.

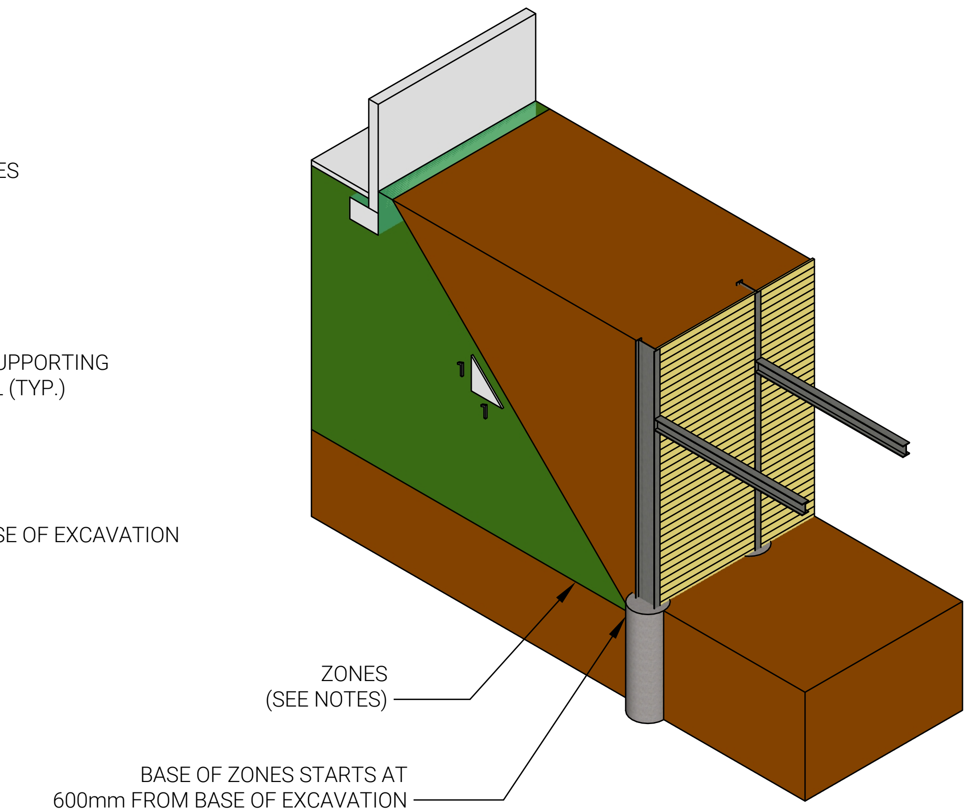
GROUNDED ENGINEERING

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.

GROUNDED ENGINEERING

Title

EXCAVATION ZONE OF INFLUENCE GUIDELINES