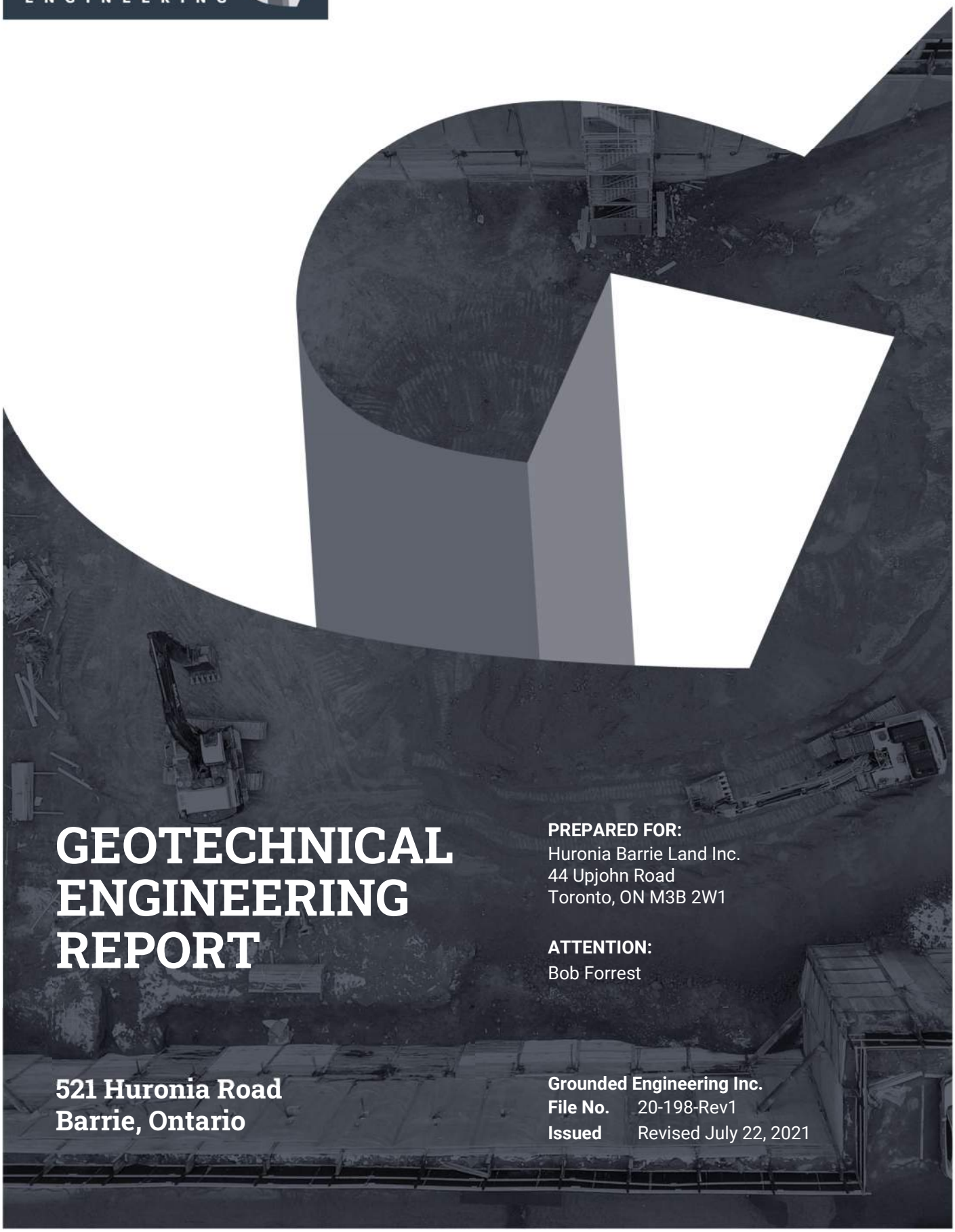


GEOTECHNICAL ENGINEERING REPORT

PREPARED FOR:
Huronia Barrie Land Inc.
44 Upjohn Road
Toronto, ON M3B 2W1

ATTENTION:
Bob Forrest

521 Huronia Road
Barrie, Ontario

Grounded Engineering Inc.
File No. 20-198-Rev1
Issued Revised July 22, 2021

TABLE OF CONTENTS

FIGURES

APPENDICES

1 Introduction

Huronia Barrie Land Inc. has retained Grounded Engineering Inc. ("Grounded") to provide geotechnical engineering design advice for their proposed development at 521 Huronia Road, in Barrie, Ontario.

Revision 1 of this report includes the following changes:

- All townhouse blocks to be made with no basements
- Changes to site grading plan

The proposed project includes constructing new townhome blocks consisting of the following:

- Blocks 1 through 7, consist of a number of 3-storey townhomes, resting at-grade (i.e., no basements). Block details, including the lowest Finished Floor Elevation (FFE), summarized below.
- The townhouses are to be constructed on sloped ground with Elevations ranging from 252.3 ±m on the west side of the property to 245.8 ±m in the east.
- Associated surface parking, private roads and site services are proposed.
- No underground levels will be constructed at the subject site.

Table 1.1 – Proposed development details.

Block	Unit Type	Number of Units	Number of Storeys	FFE (m)
1	Townhomes	Six (6)	Three (3)	251.1 to 252.1
2	Townhomes	Five (5)	Three (3)	251.1 to 250.2
3	Townhomes	Three (3)	Three (3)	250.2 to 249.8
4	Townhomes	Four (4)	Three (3)	249.4
5	Townhomes	Eighteen (18)	Three (3)	248.4 to 247.6
6	Townhomes	Six (6)	Three (3)	248.3 to 247.7
7	Townhomes	Ten (10)	Three (3)	248.1 to 247.5

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

- Counterpoint Engineering, "Conceptual Grad Plan, 521 Huronia Road, Barrie"; Project No 19082, Figure 8, dated June 2021.
- We Merchandise Space Inc. and Forrest Group Inc., "Concept Site Plan v3.3, Proposed Townhome Community 521 Huronia Road, Barrie, ON"; Project No 5214, Rev 12 dated June 29, 2021.
- Terraprobe Inc., "Preliminary Geotechnical Investigation, Proposed Townhome Community, 521 Huronia Road, Barrie, Ontario"; File No 3-19-0101-02, dated March 2, 2020.
- Rudy Mark Surveying Ltd., "Topographic Survey Plan of West Half Lot Concession 12, City of Barrie"; File No 13963, dated November 26, 2019.

Grounded has been provided with factual borehole information from Terraprobe as listed above. Those borehole logs 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 "T-" refer to boreholes advances by Terraprobe.

Grounded's most recent subsurface investigation of the site to date includes four (4) boreholes (Boreholes 201 to 204) which were advanced from December 14th to 16th, 2020. Standard Penetration Test (SPT) results (N-Values) were measured in these boreholes, whereas the remaining Grounded Boreholes 101 to 105 (completed on September 28th, 2020, as part of the previous subsurface investigation) were advanced using direct-push methods; hence SPT N-Values were not measured.

Based on the borehole findings, 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.

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 (ref. to the topographic survey provided by Rudy Mark Surveying Ltd.). The horizontal coordinates are provided relative to the Universal Transverse Mercator (UTM) geographic coordinate system.

Surficial material thicknesses (e.g., topsoil) 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. Our findings are largely consistent with those reported by Terraprobe. A cross-section showing stratigraphy and engineering units is appended and includes the relevant borehole and well information from Terraprobe.

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. In general, the average existing site grade transitions from Elev. 253 ±m in the west portion of the site (immediately adjacent to Huronia Road) to Elev. 245.5 ±m in the southeast portion of the site. Underlying the topsoil at grade, three (3) main stratigraphic units were encountered on site as follows:

1. native **"upper sands",** on average extending to 0.8-3.0 m below grade in the west portion of the site (Blocks 1 and 2) to 0.8 to 1.8 m below grade in the east portion of the site (Blocks 3 to 5) but was not encountered in Borehole 101;
2. a **"silty clay unit"**, extending to 7.6 to 9.1 m below grade in the west portion of the site (Blocks 1 and 2), and to 6.1 to 7.9 m below grade in Boreholes 201 to 204 (Blocks 3 to 5) in the east portion of the site;
3. a lower **"sand glacial till"**, below the silty clay.

The stabilized groundwater table ranges from Elev. 250.5 ±m (T–BH4) in the west portion of the site to Elev. 245.5 ±m in the east portion of the site. Within the anticipated zones of excavation for the proposed blocks, the surficial sands (higher permeability soils) will produce free-flowing water when penetrated below the prevailing groundwater table, whereas the silty clay and sand glacial till (lower permeability soils) will typically preclude the free flow of water when wet.

2.1.1 Topsoil and Upper Sands

At existing grade, Terraprobe Boreholes 1 to 4 and Grounded Boreholes 101 to 105 and Boreholes 201 to 204 observed 100 to 610 mm of topsoil (generally increasing in thickness from west to east across the site) underlain by native upper sands extending to depths of 0.3 to 3.0 m below grade (Elev. 249.0 m in the west portion of the site decreasing to Elev. 244.0 m in the east portion of the site). Grounded Borehole 101 did not observe the native surficial sands.

Localized layers of earth fill were observed by Terraprobe in Boreholes 1 and 2 underlying the topsoil extending to depths of 0.8 to 0.9 m below grade (Elev. 250.8 to 251.2 m); based on our review of the collective soil samples across the site at that particular depth and elevation, we infer that these soils actually consist of the native surficial sands.

The sands contain a variable amount of silt (ranging from trace silt to silty) and gravel (ranging from trace gravel to gravelly), and trace amounts of clay, organics and rootlets. A layer of clayey silt was observed overlying the native sand in Borehole 203 at a depth of 0.6 m below grade (Elev. 245.8 m) extending to a depth of 1.5 m below grade (Elev. 244.9 m). The soils are generally range

in colour from dark brown to orangey-brown, and wet. The Standard Penetration Test (SPT) results (N-Values) measured in the sand ranges from 5 to 18 blows per 300 mm of penetration (bpf), indicating a loose to compact relative density (on average loose).

2.1.2 Silty Clay

Underlying the topsoil and surficial sands, the boreholes observed a cohesive deposit of silty clay at depths of 0.3 to 3.0 m below grade (Elev. 249.0 m in the west portion of the site to Elev. 244.0 m in the east portion of the site). Grounded Boreholes 101 to 105 were terminated in the deposit at a depth of 4.3 m below grade (Elev. 241.5 to 242.6 m) whereas Terraprobe Boreholes 1 to 4 and Grounded Boreholes 201 to 204 fully penetrated the deposit at depths of 6.1 to 9.1 m below grade (Elev. 244.4 m in the west portion of the site decreasing to Elev. 237.8 m in the east portion of the site). The deposit consists of a silty clay matrix, contains a variable amount of sand (ranging from trace sand to sandy), trace gravel, and is grey in colour and moist (generally decreasing in moisture content with increasing depth).

The SPT N-Values measured in the deposit ranges from 3 to 67 bpf, suggesting a soft to hard consistency. In general, the deposit improves in competency from west to east across the site. On average, the deposit transitions from a weaker, firm consistency (in Terraprobe Boreholes 1 to 4, advanced in the west portion of the site) to a stronger, very stiff consistency (in Grounded Boreholes 201 to 204 in the east portion of the site).

2.1.3 Lower Sand Glacial Till

Underlying the silty clay deposit, Terraprobe Boreholes 1 to 4 and Grounded Boreholes 201 to 204 observed a cohesionless glacial till at depths of 6.1 to 9.1 m below grade (Elev. 244.4 m in the west portion of the site decreasing to Elev. 237.8 m in the east portion of the site). The sand till extends past the target depths of 9.6 to 12.8 m below grade (Elev. 234.8 to 239.4 m). The glacial till consists of a sand matrix, contains a variable amount of silt (ranging from some silt to silty), trace to some clay and gravel, and is grey and moist.

A layer of sand was observed in T–BH4 within the glacial till at a depth of 10.7 m below grade (Elev. 241.3 m) extending to the target depth of 12.6 m below grade (Elev. 239.4 m). The SPT N-Values measured in the deposit ranges from 24 to greater than 50 bpf, indicating a compact to very dense relative density (on average very dense).

2.2 Groundwater

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

Table 2.1 – Summary of Groundwater Observations

Borehole No.	Depth of Well (m)	Strata Screened	Water Level in Well, Depth/Elev. (m)			
			Highest Level	Date	Most Recent Level	Date
T - BH1	9.2	Lower Sand Glacial Till	1.6 / 250.4	Dec 17, 2020	2.1 / 249.9	Jun 14, 2021
T - BH2	9.2	Lower Sand Glacial Till	1.6 / 250.1	Dec 17, 2020	2.2 / 249.5	Jun 14, 2021
T - BH3	6.1	Lower Sand Glacial Till	2.4 / 248.1	Dec 17, 2020	3.1 / 247.7	Jun 14, 2021
T - BH4	4.9	Lower Sand Glacial Till	2.9 / 246.4	Dec 17, 2020	3.6 / 245.7	Jun 14, 2021
101	1.2	Silty Clay	0.3 / 246.6	Dec 17, 2020	1.3 / 245.6	Jun 14, 2021
102	1.2	Silty Clay	0.4 / 246.4	Mar 31, 2021	1.0 / 245.8	Jun 14, 2021
103	0.9	Upper Sands and Silty Clay	0.04 / 246.1	Apr 30, 2021	0.5 / 246.6	Jun 14, 2021
104	1.2	Silty Clay	0.1 / 246.5	Apr 30, 2021	0.7 / 245.9	Jun 14, 2021
105	1.2	Upper Sands and Silty Clay	0.2 / 245.6	Apr 30, 2021	0.5 / 245.3	Jun 14, 2021

The design stabilized groundwater table ranges from Elev. 250.4 ±m in the west portion of the site to Elev. 245.6 ±m in the east portion of the site. This translated to 0.04 to 3.2 ±m below existing ground surface across the site. The ground water table has been observed at ground surface elevation as noted about in MW 103 on April 30, 2021. Within the anticipated zones of excavation for the proposed blocks, the surficial sands (higher permeability soils) will produce free-flowing water when penetrated below the prevailing groundwater table, whereas the silty clay (lower permeability soil) will typically preclude the free flow of water.

Grounded has prepared a hydrogeological report for this site (File No. 20-198).

2.3 Corrosivity and Sulphate Attack

Three (3) soil samples were submitted for corrosivity testing parameters (pH, Resistivity, Electrical Conductivity, Redox Potential, Sulphate, Sulphide and Chloride). The Certificate of Analyses is appended. The soil samples were analysed for soluble sulphate concentration and compared to the Canadian Standard CAN3/CSA A23.1-M94 Table 3, *Additional Requirements for Concrete Subjected to Sulphate Attack*. The results are summarized as follows:

Table 2.2 – Corrosivity Results (1 of 2)

Parameter	BH 201 SS 6	BH 202 SS 5	BH 203 SS 4
Soluble Sulphate (SO_4) in soil sample	45 µg/g < 0.1 %	4.4 µg/g < 0.1 %	20 µg/g < 0.1 %
Class of Exposure	**Negligible**	**Negligible**	**Negligible**

Corrosivity parameters are also used for assessing soil corrosivity applicable to cast iron alloys, according to the 10-point soil evaluation procedure described in the American Water Work Association (AWWA) C-105 standard. The results are summarized as follows:

Table 2.3 – Corrosivity Results (2 of 2)

Parameter	AWWA C-105 Standard – Assigned Points					
	BH 201 SS 6		BH 202 SS 5		BH 203 SS 4	
	Result	Points	Result	Points	Result	Points
Resistivity (ohm.cm)	10800	0	9900	0	9520	0
pH	8.92	3	8.65	3	9.03	3
Redox Potential (mV)	154	0	241	0	202	0
Sulfides (%)	<0.04	2	<0.04	2	<0.04	2
Moisture (%)	10.3	2	19.3	2	15.3	2
Corrosion protection recommended?	No		No		No	
Resistivity less than 2000 ohm.cm?	No		No		No	

The analytical results only provide an indication of the potential for corrosion. All three samples scored less than 10 points and corrosion protective measures are therefore not recommended for cast iron alloys. A more recent study by the AWWA has suggested that soil with a resistivity of less than about 2000 ohm.cm should be considered aggressive. All three samples had resistivity measurements exceeding 2000 ohm.cm.

2.4 Frost Heave Susceptibility of Soils

A soil's susceptibility to frost heave is related to the percentage of silt and very fine sand in the soil, as frost heave impacts fine-grained soils with low cohesion and high capillarity. The site soils are classified for susceptibility to frost heave according to their grain size distributions on this basis. Geotechnical laboratory results for this site are appended. Per the Second Edition of the Pavement Design and Rehabilitation Manual by the Ministry of Transportation in Ontario, the following table summarizes the relationship between grain size and frost heave susceptibility:

Table 2.4 – Relationship Between Grain Size and Frost Susceptibility (MTO)

Grain Size Percentage between 5 and 75 µm	Susceptibility to Frost Heaving
0 to 40%	Low
40 to 55%	Moderate
55 to 100%	High

Per the grain size data measured and visual identification of the site soils, frost heave susceptibility is summarized accordingly:

Table 2.5 – Summary of Estimated Frost Heave Susceptibility

Stratum	Grain Size Percentage between 5 and 75 µm	Estimated Susceptibility to Frost Heaving
Earth Fill	Est. 25 to 50%	Low to Moderate
Surficial Sands & Silts	Est. 5 to 25%	Low
Silty Clay	Est. 10 to 25%	Low
Lower Sand Glacial Till	Est. 15 to 20%	Low

3 Geotechnical Engineering Recommendations

Based on the factual data summarized above, we are providing the following geotechnical engineering design recommendations. Contractors must review the factual data while bidding or scoping services for this project and must provide their own opinion as to means, methods, and schedule.

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.

The proposed project includes constructing seven new 3-storey townhome blocks resting at-grade (i.e., no basements). The lowest FFEs ranging from Elev. 251.1 to 247.5 m. Associated surface parking, private roads and site services are proposed.

Due to the underlying weaker (compressible) native silty clay present below Blocks 1 to 4, net site grade raises/fills greater than 0.5 m will cause long term consolidation settlement, which could take months to years depending on the amount of upfill.

Based on these considerations, we recommend Blocks 1 to 7 to be constructed at-grade (no-basements) supported by conventional spread footings on native soils or on engineered fill pads.

3.1 Site Grading

Existing grade will be altered across the site per the conceptual site grading plan provided by Counterpoint Engineering. Grade raises are summarized below.

Table 3.1 – Summary of Net Site Grade Raises

Block	Boreholes	Borehole Elevations	Proposed FFE	Net Grade Raise (m)	Founding Elevation (m)	Founding Subgrade
1	T-BH1, T-BH2	252.0, 251.7	252.1 to 251.1	-0.6 to +0.1	250.6 to 249.6	Eng Fill / Native Soils
2	T-BH2, T-BH3	251.7, 250.5	251.1 to 250.2	-0.6 to -0.3	249.6 to 248.7	Native Soil
3	T-BH3, T-BH4	250.5, 249.3	250.2 to 249.8	-0.3 to +0.5	248.7 to 248.3	Native Soil
4	T-BH4	249.3	249.4	+0.5	247.9	Native Soil
5	BH 102, 202, 203, 204	247.2 to 245.6	248.4 to 247.6	+1.2 to +1.9	246.9 to 246.1	Eng Fill
6	BH 103, 104, 105, 203	246.6 to 245.8	248.3 to 247.7	+1.6 to +1.9	246.8 to 246.2	Eng Fill
7	BH 101, 201	246.9 to 245.6	248.1 to 247.5	+1.0 to +1.9	246.6 to 246.0	Eng Fill

Due to the underlying weaker (compressible) native silty clay present below Blocks 1 to 4, net site grade raises/fills greater than 0.5 m may cause long term consolidation settlement, which could take months to years depending on the amount of upfill. Based on the conceptual site grading plan provided, there are net site grade raises/fills greater than 0.5 m presently proposed for Blocks 5, 6 and 7.

To avoid the risk of consolidation settlement, net grade raises can be limited to 0.5 m or less. If that is not preferable, mitigation measures may include letting the fill sit for 6-9 months in advance (with a min. 0.3 m winter cap included), preloading above pregrade elevation to speed up consolidation settlement, or ground improvement. Preload heights depend on the amount of time available for consolidation to happen. Regardless, construction will not be possible until monitoring indicates that settlement is finished.

For pavement areas, grade raises may comprise compacted common earth fill.

For building areas for Blocks 1 to 4, it is expected that the overall grading will generally consist of cuts and foundations will bear on native soils. For building areas for Blocks 5 to 7, it is expected that the overall grading will increase in height and foundations will be above existing ground elevations; therefore, grade raises (after stripping of unsuitable soils) using engineered fill to provide structural support for foundations is required.

Compacted fill does not need full-time inspection and testing, although it does need periodic geotechnical engineering testing and inspections for quality control. The frequency of periodic inspections can vary from once a day to once every 3 days and is to be confirmed after the construction schedule is available for review. Compacted fill can be made on an existing earth fill subgrade if it is proof rolled under our inspection and approved by us prior to fill placement. Engineered fill requires an approved subgrade of native soils.

Compacted fill shall comprise earth fill that is inorganic, clean, and geotechnically suitable soil sourced from the site or imported. Although not required, it is recommended that all areas of grade raise be placed as engineered fill to ensure full-time quality control of the placed fill, and to anticipate future structures constructed within the pavement area. An engineered fill earthworks specification is appended.

Across the fill areas, the topsoil and other deleterious materials must be removed. The proposed subgrade must be proof rolled and must be inspected by Grounded to identify any voids, organics, or soft, wet, or weak zones. Any identified areas must be sub-excavated to a competent subgrade (approved existing clean non-organic earth fill, or native soil).

All fill must be placed in loose lifts of 150 mm and compacted to a minimum of 98% SPMDD at a moisture content within 2% of optimum. Engineered fill must be placed under the full-time supervision of a Geotechnical Engineer, who shall perform frequent in situ density measurements to ensure the uniformity and adequacy of the compaction effort.

Prior to the arrival of imported soil materials, they must be test per the requirements of O.Reg 406/19 and approved by the Environmental QP for the site.

Soil that is used as engineered or common earth fill must have a moisture content within 2% of optimum and be free of deleterious materials, cobbles/boulders greater than 150 mm in diameter, topsoil, and other organics. Representative soil samples must be collected from the proposed fill material and tested using the Standard Proctor Maximum Dry Density (SPMDD) method to determine the optimum moisture content and maximum dry density prior to placement and compaction as common or engineered fill.

The existing topsoil is not geotechnically suitable and must be removed from settlement sensitive areas (structures, engineered fill, pavements, etc.) or used in landscaped areas. Within 2 m of the existing grade moisture content measurements made on the fill samples observed by Terraprobe (Boreholes 1 and 2) are less than 5%, and native soil samples from the Terraprobe and Grounded boreholes ranges from 4 to 41% (on average, 21%). These native soils occasionally contain trace organics. Most of the undisturbed native soils at the site are not suitable for immediate re-use on site and will require further sorting/blending to remove excess organics, moisture, and other deleterious materials.

Common earth fill or engineered fill 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.

Frost susceptible soils within 1.5 m of finished grades in unheated areas (e.g., pavements) could potentially cause pavements to heave or crack next to other structures (e.g., curbs, catch basins, etc.). The degree of heaving is unknown. If frost susceptibility is to be considered in design (to be determined by the Owner based on their own pavement performance criteria), all soil placed within 1.5 m of finished grades must be classified to have a low susceptibility to frost heaving, as defined in Section 2.4 above.

3.2 Foundation Design Parameters

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

Where foundations are exposed to typical outdoor temperatures, 1.5 m of earth cover (or equivalent insulation) is required for frost protection in Barrie.

Footings stepped from one elevation to another should be offset at a slope not steeper than 7 vertical to 10 horizontal.

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.

Soils at the base of the foundation excavation shall not exceed a maximum particle size of 75 mm. Backfill shall not exceed a maximum particle size of 75 mm in foundation excavations exceeding 1 m in depth. If cobbles and boulders exceeding this maximum particle size are encountered, they will be deemed unsuitable and must be subexcavated and replaced with suitable material.

Townhome structures can be made as conventional drained structures provided that the underside of the subfloor drainage layer (nominally 0.3 m below FFE) is at least 0.5 m above the groundwater table in each location (i.e. lowest FFE is 0.8 m above the groundwater table in each location).

If higher capacities are required, the proposed structures may be supported on helical piles, extending through the weaker (compressible) silty clay, and made to bear on the stronger, lower sand glacial till.

The proposed structures for Blocks 1 to 7 may be supported on spread footings bearing on native undisturbed soils, and / or Engineered Fill. The following section assumes drained foundations are preferred. If the structures are to be waterproofed, design parameters can be provided.

3.2.1 Blocks 1 to 4 – Spread Footings

The proposed structures for Block 1 to 4 with FFEs ranging from Elev. 252.1 to 249.4 m, may be supported on conventional, lightly-loaded spread footing foundations bearing on native soils. The native, undisturbed (dewatered) loose sands at Elev. 250.8 to 248. 8 ±m is considered suitable to support the proposed building foundations at a reduced capacity in their undisturbed state.

Conventional spread footings made to bear on these undisturbed native soils may be designed using the maximum factored geotechnical resistance at ultimate limit state (ULS) of 175 kPa. The

net geotechnical reaction at serviceability limit state (SLS) is 75 kPa, for an estimated total settlement of 25 mm.

Table 3.2 – Foundation Elevations: Blocks 1 to 4

Block	Proposed FFE	Boreholes	Founding Elevation (m)	Range of Groundwater Table (m)*
1	252.1 to 251.1	T-BH1, T-BH2	250.6 to 249.6	250.4 to 250.1
2	251.1 to 250.2	T-BH2, T-BH3	249.6 to 248.7	250.1 to 248.1
3	250.2 to 249.8	T-BH3, T-BH4	248.7 to 248.3	248.1 to 246.4
4	249.4	T-BH4	247.9	246.4

** Detailed groundwater tables are provided in Grounded's Hydrogeological Report (File No. 20-198).*

To reduce influencing the underlying weaker (compressible) silty clay and mitigate excess long-term settlement, the maximum width of continuous strip footing should be 600 mm, and the maximum size of isolated footings should be 900 mm x 900 mm, in conjunction with the above bearing pressure. Larger footings will have reduced SLS values or more settlement than stipulated above. 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.

The above recommended minimum foundation depths assume minimum embedment depths as summarized above. However, frost cover depth in Barrie is 1.5 m below exterior proposed grade. If it is preferable to keep footings at 1.5 m depth, they can be made on engineered fill (see Section 3.1). Conventional spread footings made to bear on engineered fill (constructed with common earth fill) may be designed using the maximum factored geotechnical resistance at ultimate limit state (ULS) of 225 kPa. The net geotechnical reaction at serviceability limit state (SLS) is 150 kPa, for an estimated total settlement of 25 mm. These bearing values assume a minimum thickness of the engineered fill pad of 1m below all foundations. If this minimum thickness cannot be achieved, then the native bearing pressures (75 kPa SLS / 175 kPa ULS) would apply.

Excavations for typical footings will be about 1.5± m below ground FFE (at grade). Therefore,

- Foundation excavations will extend below the stabilized groundwater table;
- Foundation excavations will penetrate native sands, which will produce free-flowing water when penetrated below the groundwater table.

It will therefore be necessary to positively dewater foundation excavations extending below Block 1 to 4. These excavations must be dewatered to a minimum 1.2 m below proposed excavation elevation prior to excavation, to preserve the in-situ integrity of the native soils. If the subsurface is not dewatered prior to excavation, the native soils will become disturbed by the ingress of groundwater and the above recommendations for bearing capacity will not be valid.

3.2.2 Block 5 to 7 – Spread Footings

The proposed structures for Blocks 5 to 7 with FFEs ranging from Elev. 248.4 to 247.5 m, may be supported on conventional spread footing foundations bearing on Engineered Fill at approximately 1.5 m above existing grade. Engineered Fill is considered suitable to support the proposed building foundations.

Conventional spread footings made to bear on Engineered Fill may be designed using the maximum factored geotechnical resistance at ULS of 225 kPa. The net geotechnical reaction at SLS is 150 KPa, for an estimated total settlement of 25 mm. These bearing values assume a minimum thickness of the engineered fill pad of 1m below all foundations. If this minimum thickness cannot be achieved, then the native bearing pressures (75 kPa SLS / 175 kPa ULS) would apply.

Table 3.3 – Foundation Elevations: Blocks 5 to 7

Block	Proposed FFE	Boreholes	Founding Elevation (m)	Range of Groundwater Table (m)*
5	248.4 to 247.6	BH 102, 202, 203, 204	246.9 to 246.1	246.4
6	248.3 to 247.7	BH 103, 104, 105, 203	246.8 to 246.2	246.1 to 245.6
7	248.1 to 247.5	BH 101, 201	246.6 to 246.0	246.6

** Detailed groundwater tables are provided in Grounded's Hydrogeological Report (File No. 20-198).*

Excavations for typical footings will be about 1.5± m above FFE (at grade). Therefore, footings will bare on Engineered Fill above the groundwater table.

These excavations must be dewatered to a minimum 1.2 m below proposed excavation elevation prior to excavation, to preserve the in-situ integrity of the native soils. If the subsurface is not dewatered prior to excavation, the native soils will become disturbed by the ingress of groundwater and the above recommendations for bearing capacity will not be valid.

3.2.3 Helical Piles

If higher capacities are required, helical piles may be designed to carry the proposed building loads for Blocks 1 to 4. Helical piles can be installed using small equipment, with minimal ground disturbance and minimal excess soil cuttings. Contractors specializing in helical pile design and installation can provide detailed information on installation methodology, detailed design, product quality, and certification. EBS Geostructural is one local specialist contractor that provides design-build services for Chance helical piles.

At this site, helical piles can be installed through the weaker (compressible) silty clay and made to bear on the stronger, lower sand glacial till (observed at Elev. 244.4 m in the west to Elev. 241.7 m in the east), in order to obtain adequate resistance to support the proposed building loads for Blocks 1 to 4. 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. The

design earth cover (or equivalent insulation) for frost protection of grade beams exposed to ambient environmental temperatures is 1.5 metres for this location.

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.

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/production 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 or larger sized cobbles or boulders in native soil (although not specifically encountered in the borehole) 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.

3.3 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.

Based on the site stratigraphy, the site designation for seismic site class is **Class D**, 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.

We have estimated the site designation based on quantitative analysis of penetration resistance (N-values) with assumed N-values for the soil stratigraphy beyond the investigation depth. If an improved seismic site class provides economic benefit to the project, consideration should be given to conducting a site-specific Multichannel Analysis of Surface Waves (MASW, to determine the average shear wave velocity in the top 30 meters of the site stratigraphy. MASW testing may

result in an improved seismic site designation (to a Class C) which may help reduce the cost implication for the structure.

3.4 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.

Table 3.4 – Unbalanced Earth Pressure Design Parameters

Stratigraphic Unit	γ	φ	K_a	K_o	K_p
Compact Granular Fill Granular 'B' (OPSS.MUNI 1010)	21	32	0.31	0.47	3.26
Existing Earth Fill	19	29	0.35	0.52	2.88
Loose Surficial Sands	20	30	0.33	0.50	3.00
Firm Silty Clay	21	28	0.36	0.53	2.77
Very Stiff Silty Clay	21	30	0.33	0.50	3.00
Very Dense Sand Glacial Till	22	36	0.26	0.41	3.85

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)

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 soil subgrade and the base of the footing. The factored geotechnical resistance to friction ($\mathbf{R_f}$) 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)

3.5 Slab on Grade Design Parameters

The proposed structures are to rest at grade, with no basement. A conventional slab on grade would be made on native undisturbed (dewatered) loose sands. In its present state, the native sands are not competent for the support of a slab on grade. The native sands 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 1010) and compacted to a minimum of 98% SPMDD.

The modulus of subgrade reaction appropriate for design of the slab on grade resting on compacted native sands is 16,000 kPa/m.

3.6 Long-Term Groundwater and Seepage Control

Since the final grading and building configurations have not been advanced to detailed design, subfloor drainage (consisting of 100 mm perforated pipes at max. 3 m c/c spacing) is recommended for all blocks. Perimeter and subfloor drainage is not required only if: the finished floor is 200 mm above exterior grades, the finished floor is 1000 mm above the groundwater table, and exterior grade is sloped at min. 2% away from the buildings on all sides for a distance of at least 2 m.

Additional groundwater considerations are provided in Grounded's Hydrogeological Report (File No. 20-198).

3.7 Site Servicing

All services must have at least 1.5 metres of earth cover or equivalent insulation for frost protection.

3.7.1 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. If trenches extend into the high permeability sands below the groundwater table, the groundwater table must be lowered to 1.2 m below the lowest excavation elevation prior to

excavation. Bedding material must consist of well graded granular fill such as Granular A (OPSS.MUNI 1010). Clear stone is specifically prohibited at this site. The bedding material must be compacted to a minimum 95% SPMDD.

3.7.2 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 Design Advice

The following design pertains to asphaltic concrete pavements ('pavement') where the pavement will rest on a soil subgrade. The following Ontario Provincial Standards Specifications (OPSS) apply to the pavement construction and material requirements:

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

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

4.1 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 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.

4.2 Pavement Design

The following **basic pavement design** specification is provided:

Table 4.1 – Basic Pavement Design Specifications

Basic Pavement Structure	**Compaction Requirement**	**Car Parking Minimum Component Thickness**
Asphalt Top Lift HL-3 (OPSS 1150), and PG 58-28 (OPSS 1101)	OPSS 310	40 mm
Asphalt Base Course HL-8 (OPSS 1150), and PG 58-28 (OPSS 1101)	OPSS 310	70 mm
Granular Base Course 19 mm diameter crusher run limestone or Granular A (OPSS 1010)	100% Standard Proctor Maximum Dry Density (ASTM-D698)	150 mm
Granular Subbase Course 50 mm diameter crusher run limestone or Granular B Type II (OPSS 1010)	98% Standard Proctor Maximum Dry Density (ASTM-D698)	400 mm
Total Thickness		**660 mm**

The existing soils have a low to moderate susceptibility to frost heave, and pavement on these materials must be designed accordingly.

The City of Barrie may eventually assume the roads. The municipality has its own minimum pavement design requirements which will have to be followed for the making of any of the pavement surfaces that will eventually become a municipal responsibility. If this is the case, the relevant specifications should be reviewed in detail.

4.3 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, with the zones of excavation:

- Earth fill is a Type 3 soil;
- The wet sands are Type 4 soils, or Type 3 soils if dewatered;
- The silty clay is a Type 3 soil;
- The glacial 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:

Table 5.1 – Soil Types and Associated Safe Excavation Slopes

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.

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.

5.2 Short-Term Groundwater Control

Additional groundwater considerations are provided in Grounded's Hydrogeological Report (File No. 20-198).

The design stabilized groundwater table ranges from Elev. 250.4 ±m in the west portion of the site to Elev. 245.4 ±m in the east portion of the site. Within the anticipated zones of excavation for the proposed blocks, the surficial sands (higher permeability soils) will produce free-flowing

water when penetrated below the prevailing groundwater table, whereas the silty clay (lower permeability soil) will typically preclude the free flow of water when wet.

Bulk and localized excavations in Blocks 1 to 7 will extend below the stabilized groundwater table into high permeability sands, which will yield free-flowing water and requires positive dewatering prior to excavation.

Positive dewatering to lower the groundwater table will be required to facilitate construction as well as to maintain the integrity of the subgrade for foundation and slab-on-grade support. The water level must be kept at least 1.2 m below the lowest excavation elevation during construction. Failure to dewater prior to excavation will result in unrecoverable disturbance of the subgrade, which will render advice provided for undisturbed subgrade conditions inapplicable.

Dewatering will take some time to accomplish prior to the start of excavation.

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.

5.3 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.

5.4 Engineering Review

By issuing this 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.

6 Limitations and Restrictions

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.

6.1 Investigation Procedures

The geotechnical engineering analysis and advice provided here are based *in part* on factual data obtained from investigations at this site conducted by other consultants as described above, as well as the factual borehole information observed and recorded by Grounded. 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.

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 conventional 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. 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 alter the subsurface conditions directly or indirectly 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.

The geotechnical engineering advice provided in this report is based on the factual observations made from the site investigations as reported. 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.

6.3 Report Use

The authorized users of this report are Huronia Barrie Land Inc. 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.

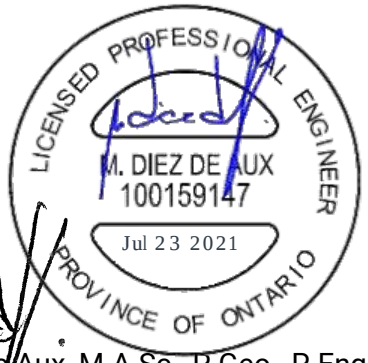
The local municipal/regional governing bodies may also make use of and rely upon this report, subject to the limitations as stated.

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



Katrina Morgenroth, EIT

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

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

FIGURES

GROUNDED ENGINEERING

12 Banigan Drive, Toronto, Ont., M4H 1E9
www.groundedeng.ca

LEGEND

APPROXIMATE SITE LOCATION

Note

Reference

ArcGIS, 2021

Project

521 HURONIA ROAD, BARRIE, ONTARIO

Figure Title

SITE LOCATION PLAN

North

TRUE

PROJECT

Date

JUNE 2021

Scale

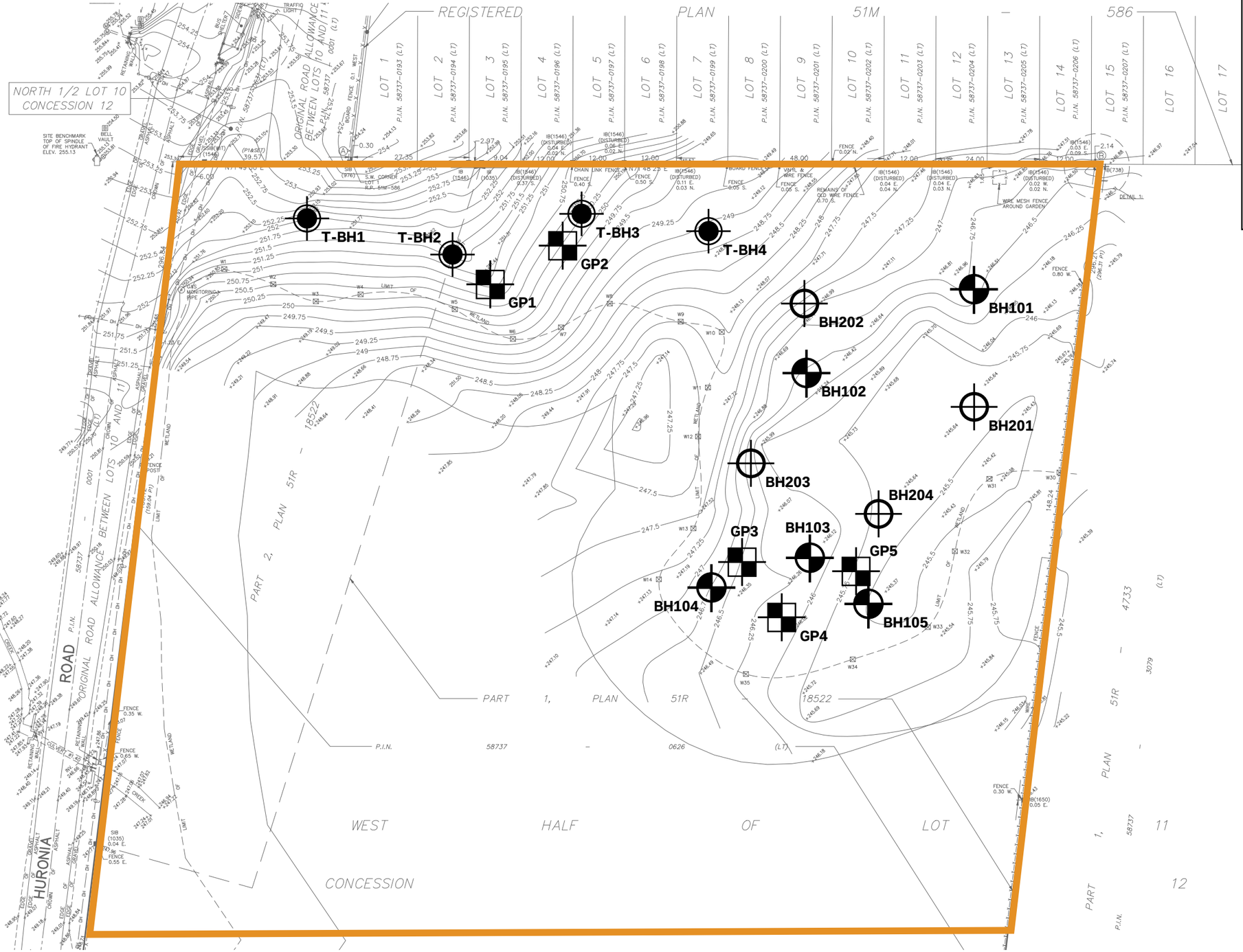
AS INDICATED

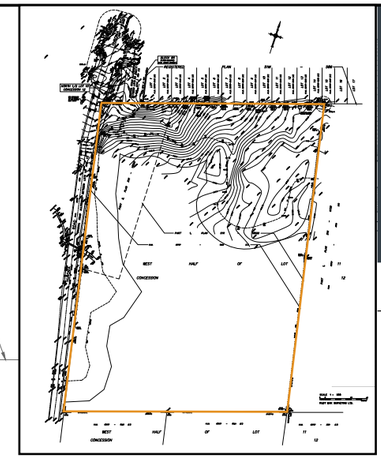
Job No

20-198

Figure No

FIGURE 1





GROUNDED ENGINEERING

12 Banigan Drive, Toronto, Ont., M4H 1E9
www.groundedeng.ca

LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- GROUNDED ENGINEERING BOREHOLE/MONITORING WELL LOCATION (2020)
- GUELPH PERMEAMETER INFILTRATION TEST
- TERRAPROBE INC. BOREHOLE/MONITORING WELL LOCATION (2019)

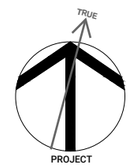
Note
Existing Condition

Reference
Topographic Survey Plan of West Half Lot Concession 12, City of Barrie, File No: 13963, Rudy Mak Surveying Ltd., November 26, 2019

Project
521 HURONIA ROAD, BARRIE, ONTARIO

Figure Title
BOREHOLE LOCATION PLAN (TOPO MAP)

North



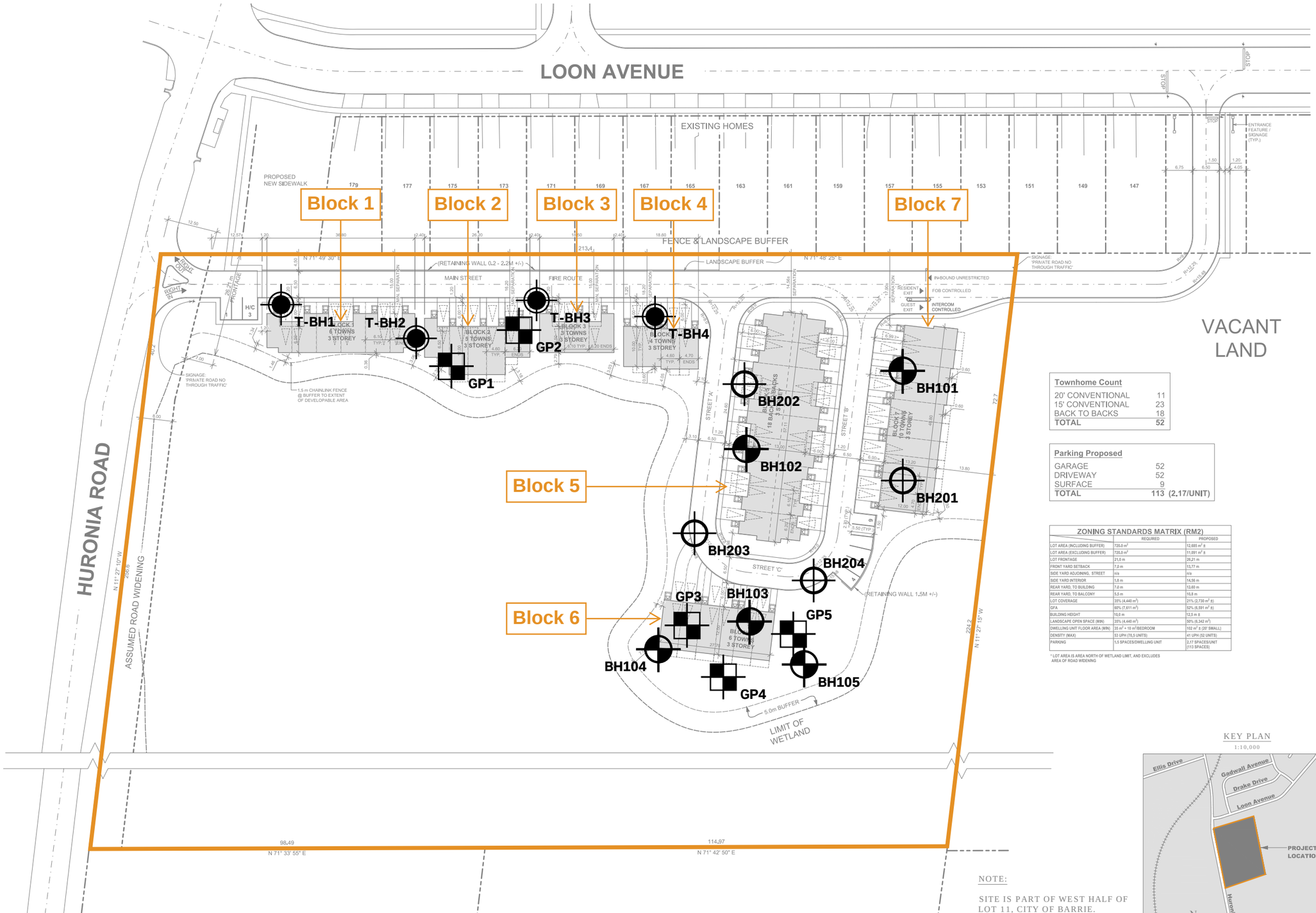
Date
JANUARY 2021

Scale
AS INDICATED

Job No
20-198-901

Figure No
FIGURE 2

SCALE 1 : 500
5 0 25 40
metres
RUDY MAK SURVEYING LTD.



Townhome Count	
20' CONVENTIONAL	11
15' CONVENTIONAL	23
BACK TO BACKS	18
TOTAL	52

Parking Proposed	
GARAGE	52
DRIVEWAY	52
SURFACE	9
TOTAL	113 (2.17/UNIT)

ZONING STANDARDS MATRIX (RM2)

	REQUIRED	PROPOSED
LOT AREA (INCLUDING BUFFER)	720,0 m²	12,685 m² ±
LOT AREA (EXCLUDING BUFFER)	720,0 m²	11,951 m² ±
LOT FRONTAGE	21,0 m	26,21 m
FRONT YARD SETBACK	7,0 m	13,77 m
SIDE YARD ADJOINING, STREET	n/a	n/a
SIDE YARD INTERIOR	1,8 m	14,56 m
REAR YARD, TO BUILDING	7,0 m	13,60 m
REAR YARD, TO BALCONY	5,5 m	10,8 m
LOT COVERAGE	35% (4,440 m²)	21% (2,730 m² ±)
GFA	60% (7,611 m²)	52% (6,591 m² ±)
BUILDING HEIGHT	10,0 m	12,5 m ±
LANDSCAPE OPEN SPACE (MIN)	35% (4,440 m²)	50% (6,342 m²)
DWELLING UNIT FLOOR AREA (MIN)	35 m² + 10 m²/BEDROOM	102 m² ± (20' SMALL)
DENSITY (MAX)	53 UPH (70,5 UNITS)	41 UPH (52 UNITS)
PARKING	1,5 SPACES/DWELLING UNIT	2,17 SPACES/UNIT (113 SPACES)

* LOT AREA IS AREA NORTH OF WETLAND LIMIT, AND EXCLUDES AREA OF ROAD WIDENING

NOTE:

SITE IS PART OF WEST HALF OF LOT 11, CITY OF BARRIE.

SURVEY DATA IS FROM TOPOGRAPHIC SURVEY BY RUDY MAK SURVEYING LTD. ISSUED OCT. 18/2019.

KEY PLAN
1:10,000

0m 25m 50m

GROUNDED ENGINEERING
12 Banigan Drive, Toronto, Ont., M4H 1E9
www.groundedeng.ca

LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- TERRAPROBE INC. BOREHOLE/MONITORING WELL LOCATION (2019)
- GROUNDED ENGINEERING BOREHOLE/MONITORING WELL LOCATION (2020)
- GUELPH PERMEAMETER INFILTRATION TEST

Note

Proposed Development Planes with Finished Floor Elevations (FFE) and Conceptual Grading Plan.

Reference

Conceptual Grading Plan, 521 Huronia Road, Barrie, Project No: 19082, Figure 8, Counterpoint Engineering, June 2021

Project

521 HURONIA ROAD, BARRIE, ONTARIO

Figure Title

BOREHOLE LOCATION PLAN (PROPOSED DEVELOPMENT)

North

TRUE
PROJECT

Date

JUNE 2021

Scale

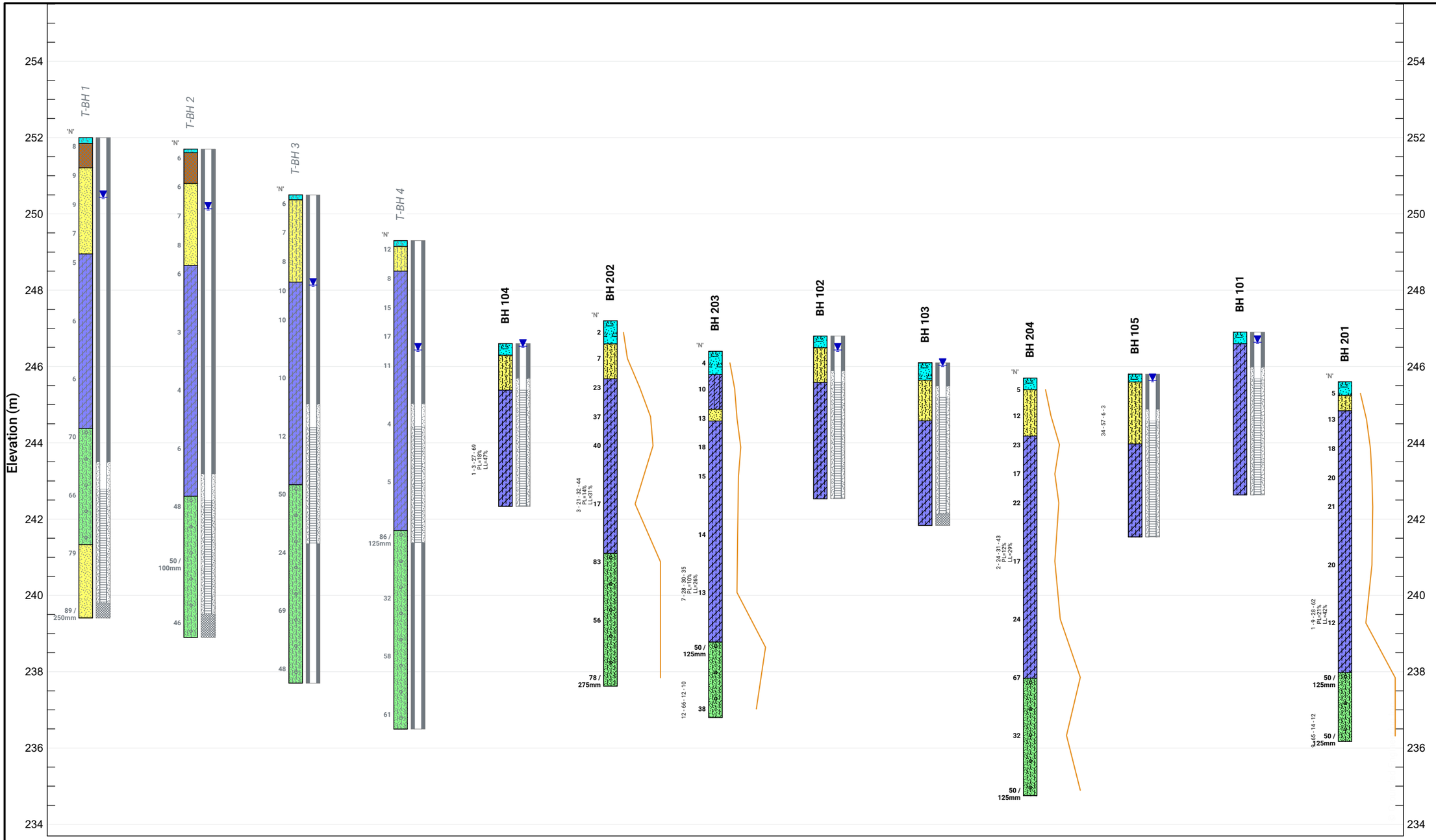
AS INDICATED

Job No

20-198

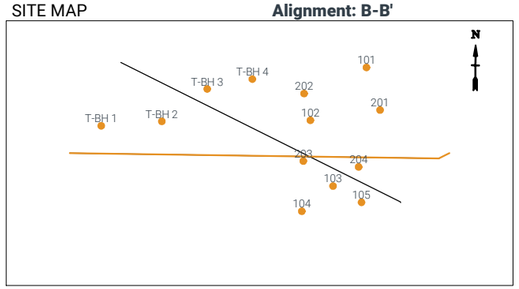
Figure No

FIGURE 3



SITE MAP

Alignment: B-B'



Boreholes Equally Spaced

LITHOLOGY GRAPHIC LEGEND

- Topsoil
- Clayey Silt
- Silty Clay
- Sand
- Silty Sand
- Fill
- Silty Sand Till

GROUNDED ENGINEERING

12 Banigan Drive, Toronto, Ont., M4H 1E9
www.groundedeng.ca

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

521 HURONIA RD BARRIE

Figure Title

SUBSURFACE CROSS-SECTION

EAST-WEST

Date

JULY 2021

Scale

AS INDICATED

Job No

20-198

Figure No

FIGURE 4

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

PI: plasticity index

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

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

COMPOSITION

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

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.

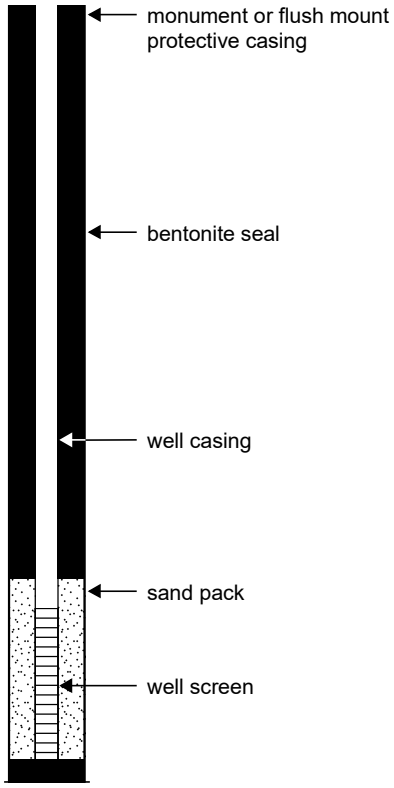
ASTM D3441 Cone Penetration Test (CPT)
Pushing an internal still rod with a outer hollow rod ("sleeve") tipped with a cone with an apex angle of 60° and a cross-sectional area of 1000 mm^2 into soil. The resistance is measured in the sleeve and at the tip to determine the skin friction and the tip resistance.

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 : Sep 28, 2020
Position : E: 606687, N: 4911298 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 101

File No. : 20-198 **Project** : 521 Huronia Rd, Barrie **Client** : Huronia Barrie Land Inc.

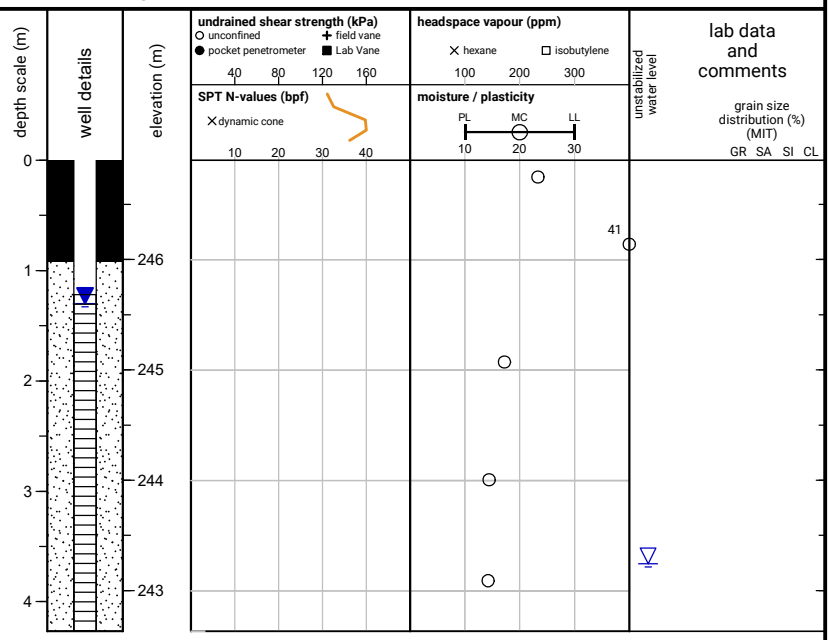
drill method : *MiniProbe*

Dual Tube Direct Push OD=50 mm

elev depth (m)	description	graphic log	sample number	sample type	SPT N-value
246.9	**GROUND SURFACE**				
246.6 / 0.3	305mm **TOPSOIL**		1A		
	SILTY CLAY, trace to some sand, trace gravel, trace organics, brown, moist		1B	DP	
	...at 1.2 m, greyish-brown		2	DP	
	...at 2.4 m, grey		3	DP	
			4	DP	
242.6 / 4.3					

depth scale (m) | well details | elevation (m)

undrained shear strength (kPa): unconfined, field vane, pocket penetrometer, Lab Vane (40, 80, 120, 160)
SPT N-values (bpf): dynamic cone (10, 20, 30, 40)
headspace vapour (ppm): hexane, isobutylene (100, 200, 300)
moisture / plasticity: PL, MC, LL (10, 20, 30)
unstabilized water level
lab data and comments
grain size distribution (%) (MIT): GR SA SI CL



END OF BOREHOLE

Unstabilized water level measured at 3.7 m below ground surface; open upon completion of drilling.

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

GROUNDWATER LEVELS

Date	Water Depth (m)	Elevation (m)
Oct 9, 2020	0.9	246.0
Oct 13, 2020	0.9	246.0
Oct 23, 2020	0.8	246.1
Oct 30, 2020	0.7	246.2
Nov 6, 2020	0.7	246.2
Dec 17, 2020	0.3	246.6
Jan 25, 2021	0.7	246.2
Feb 27, 2021	0.8	246.1
Mar 31, 2021	0.4	246.5
Apr 30, 2021	0.5	246.4
May 18, 2021	0.7	246.2
Jun 14, 2021	1.3	245.6

file: 20-198.gpj

Tech : MC | **PM** : YQ | **Rev** : MD

GROUNDED ENGINEERING

Date Started : Sep 28, 2020
Position : E: 606655, N: 4911267 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 102

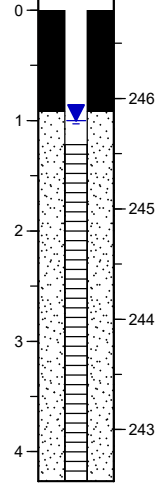
File No. : 20-198 **Project** : 521 Huronia Rd, Barrie **Client** : Huronia Barrie Land Inc.

drill method : *MiniProbe*

elev depth (m)	description	graphic log	samples: number	samples: type	samples: SPT N-value
246.8	**GROUND SURFACE**				
246.5 / 0.3	305mm **TOPSOIL**		1A	DP	
	SILTY SAND, trace gravel, trace organics, trace rootlets, dark brown, wet		1B	DP	
245.6 / 1.2	**SILTY CLAY**, trace to some sand, trace gravel, brownish grey, moist		2	DP	
			3	DP	
	...at 3.4 m, grey		4	DP	
242.5 / 4.3	**END OF BOREHOLE**				

Dual Tube Direct Push OD=50 mm

depth scale (m) / well details / elevation (m)



undrained shear strength (kPa)
○ unconfined + field vane
● pocket penetrometer ■ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene
100 200 300

moisture / plasticity
PL MC LL
10 20 30

unstabilized water level

lab data and comments
grain size distribution (%) (MIT)
GR SA SI CL

Unstabilized water level measured at 3.7 m below ground surface; open upon completion of drilling.

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

GROUNDWATER LEVELS

Date	Water Depth (m)	Elevation (m)
Oct 9, 2020	0.8	246.0
Oct 13, 2020	0.7	246.1
Oct 23, 2020	0.7	246.1
Oct 30, 2020	0.7	246.1
Nov 6, 2020	0.6	246.2
Dec 17, 2020	0.4	246.4
Jan 25, 2021	0.6	246.2
Feb 27, 2021	0.6	246.2
Mar 31, 2021	0.4	246.4
Apr 30, 2021	0.5	246.3
May 18, 2021	0.6	246.2
Jun 14, 2021	1.0	245.8

file: 20-198.gpj

Tech : MC | **PM** : YQ | **Rev** : MD

GROUNDED ENGINEERING

Date Started : Sep 28, 2020
Position : E: 606668, N: 4911229 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 103

File No. : 20-198 **Project** : 521 Huronia Rd, Barrie **Client** : Huronia Barrie Land Inc.

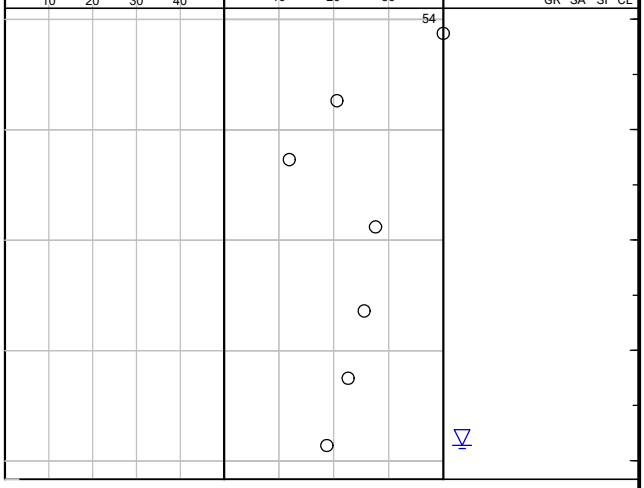
drill method : *MiniProbe*

elev / depth (m)	description	graphic log	sample number	sample type	SPT N-value
246.1	**GROUND SURFACE**				
245.6 / 0.5	455mm **TOPSOIL**		1A	DP	
	SILTY SAND, some gravel, trace organics, dark brown, wet		1B		
	...at 1.2 m, gravelly sand, greyish-brown		2A		
244.6 / 1.5	**SILTY CLAY**, trace sand, trace gravel, grey, moist		2B	DP	
			3	DP	
			4	DP	
			5	DP	
241.8 / 4.3					

Dual Tube Direct Push OD=50 mm

depth scale (m) | well details | elevation (m)

undrained shear strength (kPa): unconfined, pocket penetrometer, field vane, Lab Vane — 40 80 120 160
SPT N-values (bpf): dynamic cone — 10 20 30 40
headspace vapour (ppm): hexane, isobutylene — 100 200 300
moisture / plasticity: PL MC LL — 10 20 30
unstabilized water level
lab data and comments
grain size distribution (%) (MIT): GR SA SI CL



END OF BOREHOLE

Unstabilized water level measured at 4.0 m below ground surface; open upon completion of drilling.

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

GROUNDWATER LEVELS

Date	Water Depth (m)	Elevation (m)
Oct 9, 2020	0.3	245.8
Oct 13, 2020	0.2	245.9
Oct 23, 2020	0.1	246.0
Oct 30, 2020	0.2	245.9
Nov 6, 2020	0.2	245.9
Dec 17, 2020	0.1	246.0
Jan 25, 2021	0.2	245.9
Feb 27, 2021	0.2	245.9
Mar 31, 2021	0.2	245.9
Apr 30, 2021	0.0	246.1
May 18, 2021	0.3	245.8
Jun 14, 2021	0.5	245.6

file: 20-198.gpj

Tech : MC | **PM** : YQ | **Rev** : MD

GROUNDED ENGINEERING

Date Started : Sep 28, 2020
Position : E: 606650, N: 4911214 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 104

File No. : 20-198 **Project** : 521 Huronia Rd, Barrie **Client** : Huronia Barrie Land Inc.

drill method : *MiniProbe*

elev depth (m)	description	graphic log	sample number	sample type	SPT N-value
246.6	**GROUND SURFACE**				
246.3 / 0.3	305mm **TOPSOIL**		1A	DP	
	SILTY SAND, some gravel, trace organics, orangey brown, wet		1B	DP	
245.4 / 1.2	**SILTY CLAY**, trace sand, trace gravel, grey, moist		2	DP	
			3	DP	
			4	DP	
			5	DP	
242.3 / 4.3					

Dual Tube Direct Push OD=50 mm

depth scale (m) 0 1 2 3 4

well details

elevation (m) 246 245 244 243

undrained shear strength (kPa)
○ unconfined + field vane
● pocket penetrometer ■ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene
100 200 300

moisture / plasticity
PL MC LL
10 20 30
LL=47.4

unstabilized water level

lab data and comments
grain size distribution (%) (MIT)
GR SA SI CL
1 3 27 69

END OF BOREHOLE

Unstabilized water level measured at 4.0 m below ground surface; open upon completion of drilling.

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

GROUNDWATER LEVELS

Date	Water Depth (m)	Elevation (m)
Oct 9, 2020	0.4	246.2
Oct 13, 2020	0.3	246.3
Oct 23, 2020	0.2	246.4
Oct 30, 2020	0.2	246.4
Nov 6, 2020	0.2	246.4
Dec 17, 2020	0.1	246.5
Jan 25, 2021	0.3	246.3
Feb 27, 2021	0.3	246.3
Mar 31, 2021	0.2	246.4
Apr 30, 2021	0.1	246.5
May 18, 2021	0.4	246.2
Jun 14, 2021	0.7	245.9

file: 20-198.gpj

Tech : MC | **PM** : YQ | **Rev** : MD

Date Started : Sep 28, 2020
Position : E: 606685, N: 4911220 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 105

File No. : 20-198 **Project** : 521 Huronia Rd, Barrie **Client** : Huronia Barrie Land Inc.

drill method : *MiniProbe*

elev depth (m)	description	graphic log	number	type	SPT N-value
245.8	**GROUND SURFACE**				
245.6	205mm **TOPSOIL**		1A		
0.2	**SILTY SAND**, some gravel, trace organics, orangey brown, wet		1B	DP	
	...at 1.2 m, gravelly sand, trace silt, trace clay		2A	DP	
244.0					
1.8	**SILTY CLAY**, trace sand, trace gravel, grey, moist		2B		
			3	DP	
			4	DP	
241.5					
4.3					

Dual Tube Direct Push OD=50 mm

depth scale (m): 0, 1, 2, 3, 4

well details

elevation (m): 245, 244, 243, 242

undrained shear strength (kPa)
○ unconfined + field vane
● pocket penetrometer ■ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene
100 200 300

moisture / plasticity
PL MC LL
10 20 30

unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL
70
34 57 6 3

END OF BOREHOLE

Unstabilized water level measured at 3.0 m below ground surface; open upon completion of drilling.

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

GROUNDWATER LEVELS

Date	Water Depth (m)	Elevation (m)
Oct 9, 2020	0.3	245.5
Oct 13, 2020	0.3	245.5
Oct 23, 2020	0.2	245.6
Oct 30, 2020	0.2	245.6
Nov 6, 2020	0.2	245.6
Dec 17, 2020	0.2	245.6
Jan 25, 2021	0.2	245.6
Feb 27, 2021	0.2	245.6
Mar 31, 2021	0.2	245.6
Apr 30, 2021	0.2	245.6
May 18, 2021	0.3	245.5
Jun 14, 2021	0.5	245.3

file: 20-198.gpj

Tech : MC | **PM** : YQ | **Rev** : MD

GROUNDED ENGINEERING

Date Started : Dec 15, 2020
Position : E: 606695, N: 4911273 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 201

File No. : 20-198 **Project** : 521 Huronia Rd, Barrie **Client** : Huronia Barrie Land Inc.

drill method : *Big Beaver*

elev depth (m)	description	graphic log	sample number	sample type	SPT N-value
245.6	**GROUND SURFACE**				
245.2 / 0.4	355mm **TOPSOIL**		1	SS	5
244.8 / 0.8	**SILTY SAND**, trace gravel, trace organics, loose, orangey brown, wet				
	SILTY CLAY, some sand, trace gravel, stiff to very stiff, brownish grey, moist		2	SS	13
	...at 1.5 m, grey below		3	SS	18
			4	SS	20
			5	SS	21
	...at 4.6 m, layer of sandy silt, some clay, trace gravel, compact, grey, wet		6	SS	20
	...at 6.1 m, trace sand		7	SS	12
238.0 / 7.6	**SILTY SAND**, some clay, trace to some gravel, very dense, grey, wet (GLACIAL TILL)		8	SS	50 / 125mm
	...at 9.1 m, some silt		9	SS	50 / 125mm
236.2 / 9.4	**END OF BOREHOLE**				

solid stem augers OD=150 mm

depth scale (m): 0 1 2 3 4 5 6 7 8 9

well details

elevation (m): 245 244 243 242 241 240 239 238 237

undrained shear strength (kPa)
○ unconfined + field vane
● pocket penetrometer ■ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene
100 200 300

moisture / plasticity
PL MC LL
10 20 30

unstabilized water level

lab data and comments

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

61
LL=42.4
1 9 28 62
9 65 14 12

Unstabilized water level measured at 0.9 m below ground surface; open upon completion of drilling.

file: 20-198.gpj

Tech : MC | **PM** : NN | **Rev** : JC

GROUNDED ENGINEERING

Date Started : Dec 16, 2020
Position : E: 606651, N: 4911282 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 202

File No. : 20-198 **Project** : 521 Huronia Rd, Barrie **Client** : Huronia Barrie Land Inc.

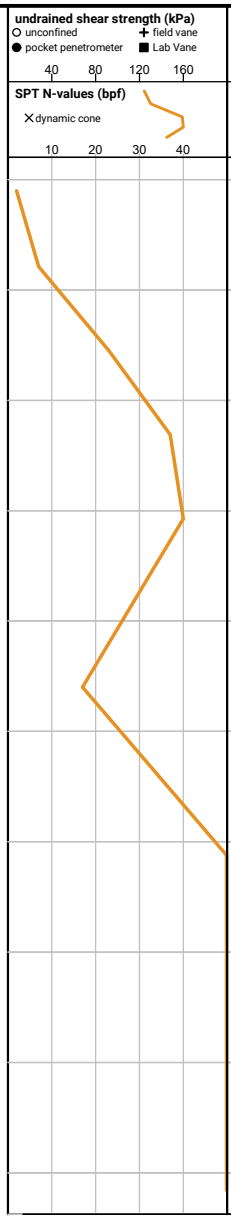
drill method : solid stem augers OD=150 mm

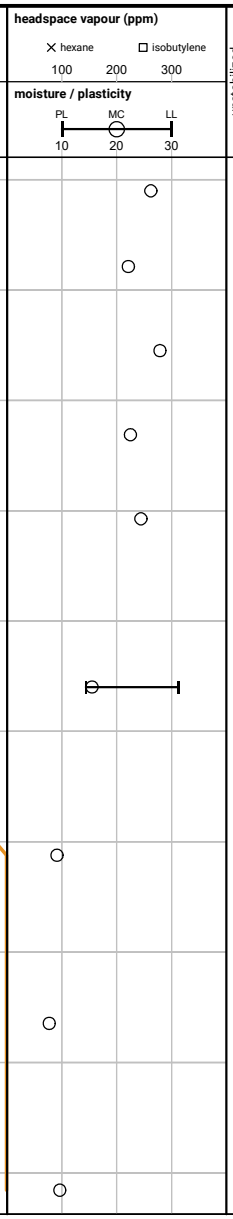
elev depth (m)	description	graphic log	number	type	SPT N-value
247.2	**GROUND SURFACE**				
	610mm **TOPSOIL**		1	SS	2
246.6 / 0.6	**SILTY SAND**, trace gravel, trace clay, trace organics, loose, orangey brown, wet		2	SS	7
245.7 / 1.5	**SILTY CLAY**, some sand, trace gravel, very stiff to hard, brownish grey, moist		3	SS	23
			4	SS	37
			5	SS	40
	...at 4.6 m, sandy, grey		6	SS	17
241.1 / 6.1	**SILTY SAND**, some sand, trace to some gravel, very dense, grey, wet (GLACIAL TILL)		7	SS	83
			8	SS	56
			9	SS	78 / 275mm
237.6 / 9.6	**END OF BOREHOLE**				

depth scale (m): 0 1 2 3 4 5 6 7 8 9

well details

elevation (m): 247 246 245 244 243 242 241 240 239 238





unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL
3 21 32 44

Unstabilized water level measured at 1.5 m below ground surface; open upon completion of drilling.

file: 20-198.gpj

Tech : MC | **PM** : NN | **Rev** : JC

GROUNDED ENGINEERING

Date Started : Dec 16, 2020
Position : E: 606651, N: 4911243 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 203

File No. : 20-198 **Project** : 521 Huronia Rd, Barrie **Client** : Huronia Barrie Land Inc.

drill method : solid stem augers OD=150 mm

elev depth (m)	description	graphic log	number	type	SPT N-value
246.4	**GROUND SURFACE**				
	610mm **TOPSOIL**		1	SS	4
245.8 / 0.6	**CLAYEY SILT**, trace sand, trace gravel, trace rootlets, stiff, greyish brown, moist		2	SS	10
244.9 / 1.5	**SAND**, trace silt, trace gravel, compact, greyish brown, moist		3A	SS	13
244.6 / 1.8			3B		
	SILTY CLAY, some sand, trace gravel, stiff to very stiff, greyish, moist		4	SS	18
			5	SS	15
			6	SS	14
	...at 6.1 m, sandy		7	SS	13
238.8 / 7.6	**SILTY SAND**, some clay, trace to some gravel, dense to very dense, grey, moist to wet (GLACIAL TILL)		8	SS	50 / 125mm
	...at 9.1 m, some silt		9	SS	38
236.8 / 9.6	**END OF BOREHOLE**				

Unstabilized water level measured at 1.2 m below ground surface; open upon completion of drilling.

depth scale (m): 0 1 2 3 4 5 6 7 8 9

well details

elevation (m): 246 245 244 243 242 241 240 239 238 237

undrained shear strength (kPa)
○ unconfined + field vane
● pocket penetrometer ■ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene
100 200 300

moisture / plasticity
PL MC LL
10 20 30

unstabilized water level

lab data and comments

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

45
7 28 30 35
12 66 12 10

file: 20-198.gpj

Tech : MC | **PM** : NN | **Rev** : JC

GROUNDED ENGINEERING

Date Started : Dec 14, 2020
Position : E: 606683, N: 4911240 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 204

File No. : 20-198 **Project** : 521 Huronia Rd, Barrie **Client** : Huronia Barrie Land Inc.

drill method : *Big Beaver*

solid stem augers OD=150 mm

elev / depth (m)	description	graphic log	sample number	sample type	SPT N-value
245.7	**GROUND SURFACE**				
245.4 / 0.3	305mm **TOPSOIL**		1A	SS	5
	SILTY SAND, trace gravel, trace clay, trace rootlets, trace organics, loose to compact, orangey brown, moist		1B		
			2	SS	12
244.2 / 1.5	**SILTY CLAY**, some sand, trace gravel, stiff to very stiff, brownish grey, moist		3	SS	23
	...at 2.3 m, grey below		4	SS	17
			5	SS	22
	...at 4.6 m, sandy		6	SS	17
			7	SS	24
	...at 7.6 m, hard		8A	SS	67
237.8 / 7.9	**SILTY SAND**, some clay, trace to some gravel, dense to very dense, grey, moist (GLACIAL TILL)		8B		
	...at 9.1 m, wet		9	SS	32
234.8 / 10.9	**END OF BOREHOLE**		10	SS	50 / 125mm

depth scale (m): 0 1 2 3 4 5 6 7 8 9 10

well details

elevation (m): 245 244 243 242 241 240 239 238 237 236 235

undrained shear strength (kPa)
○ unconfined + field vane
● pocket penetrometer ■ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene
100 200 300

moisture / plasticity
PL MC LL
10 20 30

unstabilized water level

lab data and comments

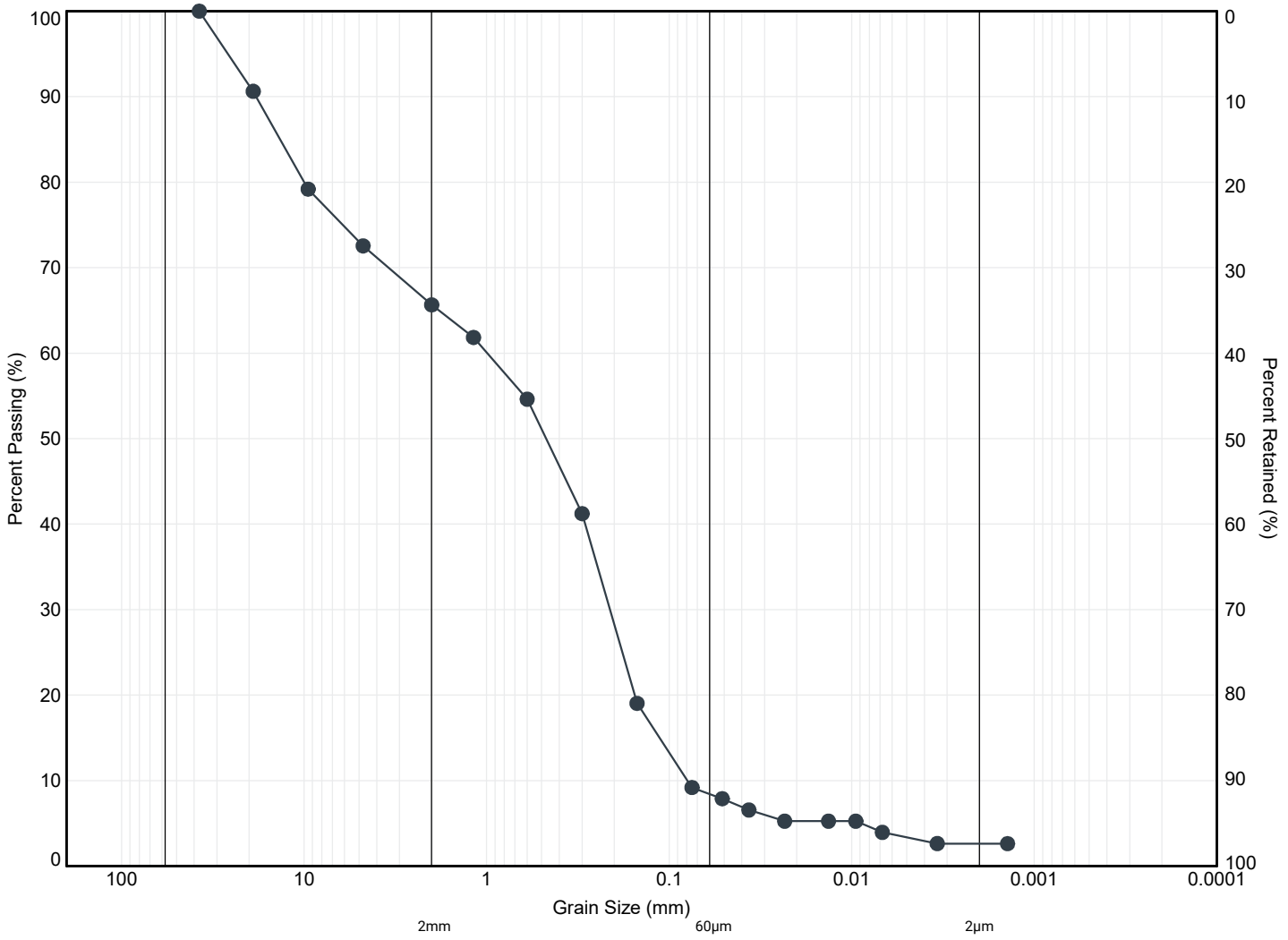
grain size distribution (%) (MIT)
GR SA SI CL
55
2 24 31 43

Unstabilized water level measured at 0.9 m below ground surface; open upon completion of drilling.

file: 20-198.gpj

Tech : MC | **PM** : NN | **Rev** : JC

APPENDIX B



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

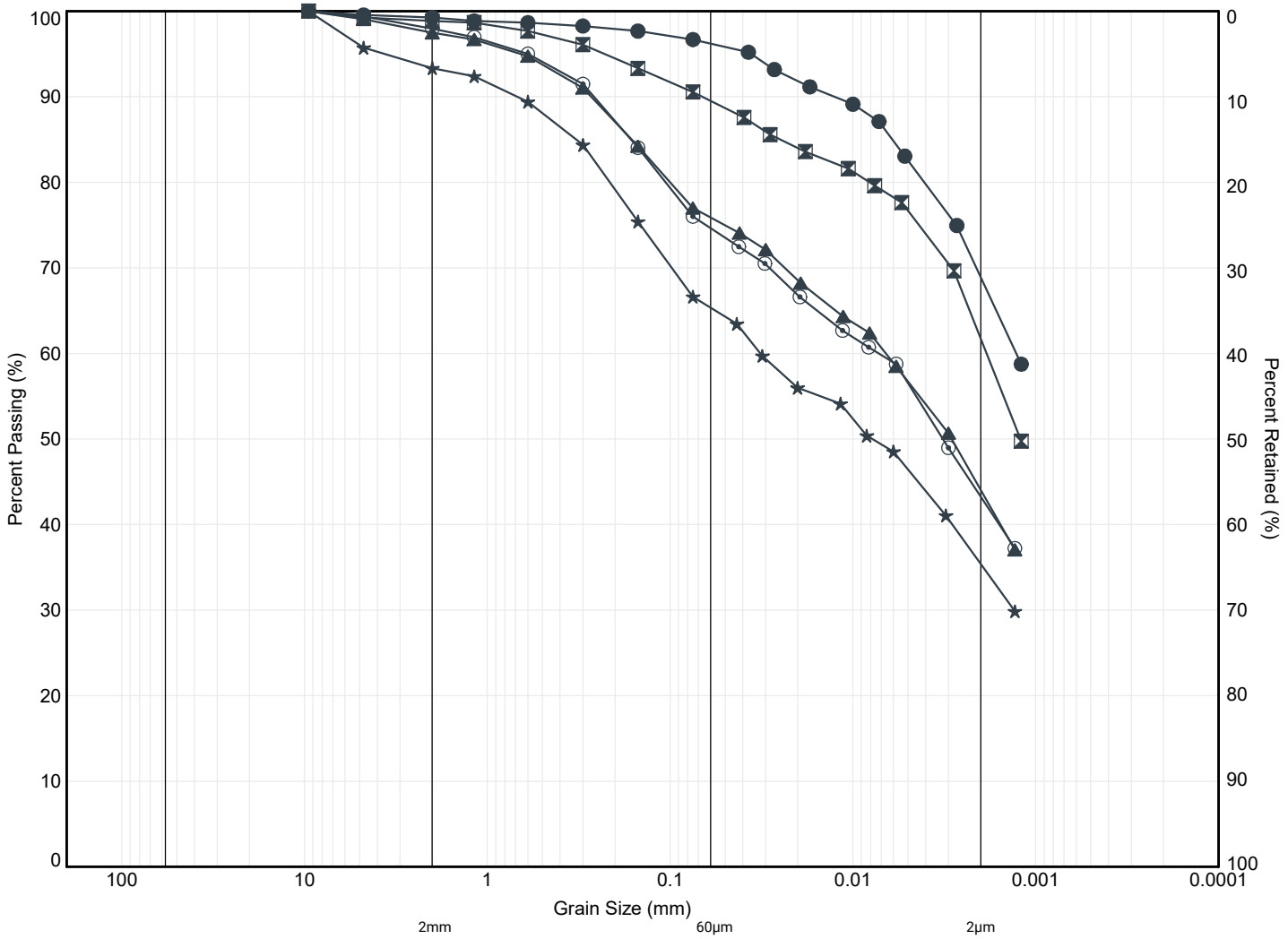
MIT SYSTEM

	Borehole	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
●	**105**	2A	1.5	244.3	34	57	6	3

GROUNDED ENGINEERING

Title: **GRAIN SIZE DISTRIBUTION**
GRAVELLY SAND

File No.: **20-198**



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

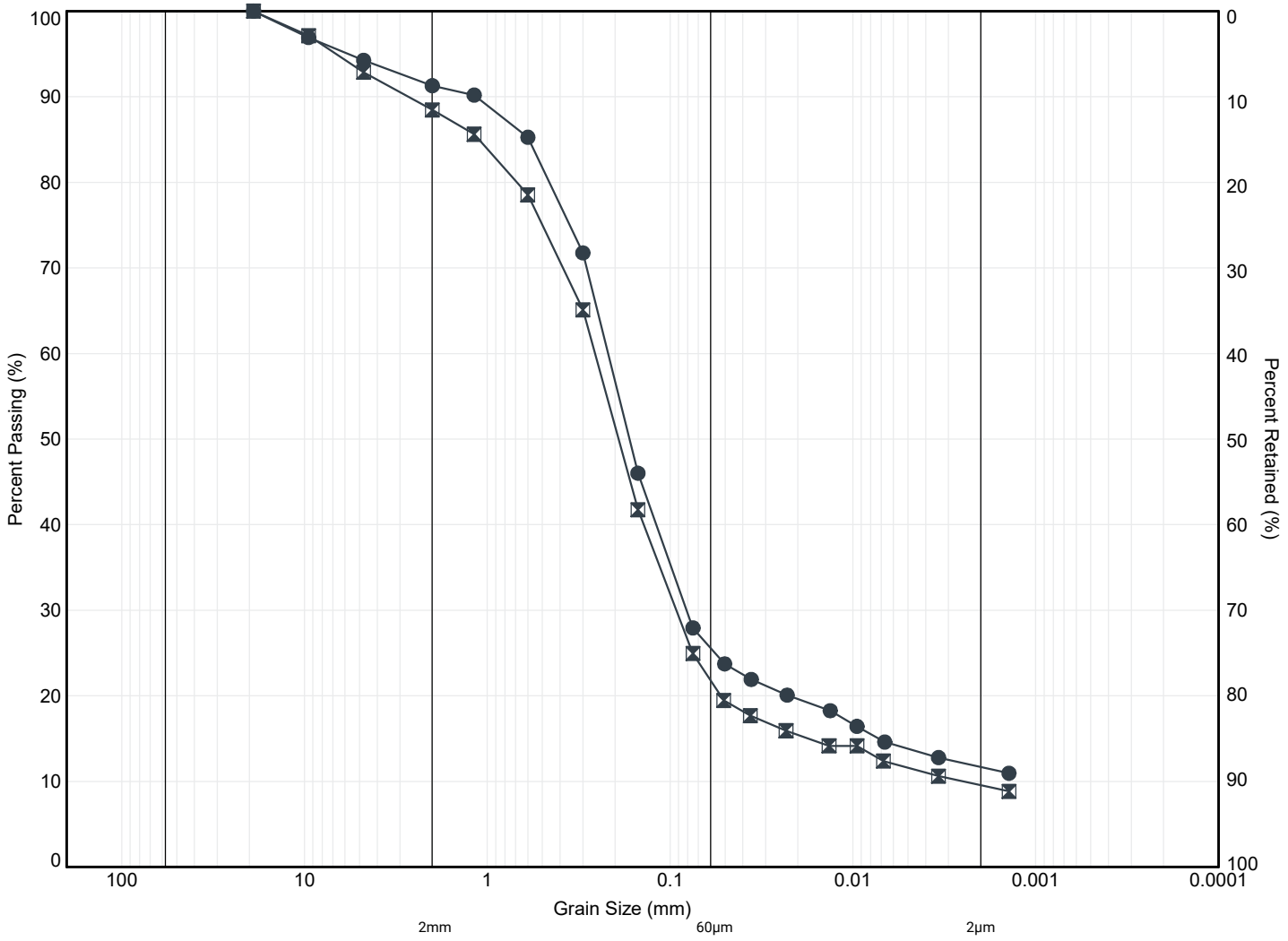
MIT SYSTEM

	Borehole	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
●	**104**	DP4	3.4	243.2	1	3	27	69
⊠	**201**	SS7	6.3	239.3	1	9	28	62
▲	**202**	SS6	4.8	242.4	3	21	32	44
★	**203**	SS7	6.3	240.1	7	28	30	35
⊙	**204**	SS6	4.8	240.9	2	24	31	43

GROUNDED ENGINEERING

Title: **GRAIN SIZE DISTRIBUTION**
SILTY CLAY

File No.: **20-198**



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

MIT SYSTEM

	Borehole	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
●	**201**	SS9	9.3	236.3	9	65	14	12
⊠	**203**	SS9	9.4	237.0	12	66	12	10

GROUNDED ENGINEERING

Title:

GRAIN SIZE DISTRIBUTION
SAND, SOME SILT GLACIAL TILL

File No.:

20-198

APPENDIX C

Terraprobe
220 Bayview Drive, Barrie, Ontario, L4N 4Y8
Tel: (705) 739-8355 Fax: (705) 739-8369

Title: BOREHOLE LOCATION PLAN

FIGURE : 2

File No. 3-19-0101-01

LOG OF BH 1

Terraprobe

Project No. : 3-19-0101-01	Client : Huronia Barrie Land Inc.	Originated by : MC
Date started : September 23, 2019	Project : 521 Huronia Rd.	Compiled by : BH
Sheet No. : 1 of 1	Location : Barrie, Ontario	Checked by : SO

Position : E: 606534, N: 4911262 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : B-57, track-mounted Drilling Method : Hollow stem augers

Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity (PL, MC, LL)	Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
252.0	**GROUND SURFACE**					252					
251.8 / 0.2	150mm **TOPSOIL**		1	SS	8				PID: =5		SS1 Analysis: M&I
251.2 / 0.8	**FILL**, silty sand, trace gravel, trace organics, loose, brown, moist										
	SAND, trace to some gravel, trace silt, loose, brown, moist		2	SS	9	251			PID: <5		SS2 Analysis: PAH, PCB
			3	SS	9	250			PID: =10		SS3 Analysis: VOC, PHC
			4	SS	7				PID: =10		SS4 Analysis: M&I
249.0 / 3.0	**SILTY CLAY**, trace to some sand, trace gravel, firm, brown to grey, moist to wet		5	SS	5	249			PID: =5		SS5 Analysis: PAH, PCB
			6	SS	6	248			PID: <5		
			7	SS	6	247			PID: <5		
244.4 / 7.6	**SAND**, silty to some silt, trace to some clay, trace gravel, very dense, grey, moist (GLACIAL TILL)		8	SS	70	246			PID: =5		
			9A 9B	SS	66	245			PID: =5		
241.3 / 10.7	**SAND**, trace gravel, trace silt, very dense, greenish brown, wet to moist		10	SS	79	244			PID: =10		SS10 Analysis: VOC, PHC
239.4 / 12.6	**END OF BOREHOLE**		11	SS	89 / 250mm	243			PID: =10		
						242					
						241					
						240					

Penetration Test Values (Blows / 0.3m): Dynamic Cone (10, 20, 30, 40)

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane (40, 80, 120, 160)

Moisture / Plasticity: Plastic Limit, Natural Water Content, Liquid Limit (PL, MC, LL) (10, 20, 30)

Unstabilized Water Level

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

Unstabilized water level measured at 7.0 m below ground surface; borehole was open upon completion of drilling.

50 mm dia. monitoring well installed. 3m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Sep 30, 2019	2.4	249.6

file: 3-19-0101-01, bh logs.gpj

LOG OF BH 2

Terraprobe

Project No. : 3-19-0101-01	Client : Huronia Barrie Land Inc.	Originated by : MC
Date started : September 23, 2019	Project : 521 Huronia Rd.	Compiled by : BH
Sheet No. : 1 of 1	Location : Barrie, Ontario	Checked by : SO

Position : E: 606569, N: 4911265 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : B-57, track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	251.7	**GROUND SURFACE**				
		100mm **TOPSOIL**		1	SS	6
	250.8	**FILL**, sand, trace silt, trace gravel, trace organics, loose, brown, moist				
1	0.9	**SAND**, trace to some gravel, trace silt, loose, brown, moist		2	SS	6
2				3	SS	7
				4	SS	8
3	248.7					
	3.0	**SILTY CLAY**, trace to some sand, trace gravel, soft to firm, brown to grey, moist to wet		5	SS	6
4						
				6	SS	3
5						
6				7	SS	4
7						
				8	SS	6
8						
9	242.6					
	9.1	**SAND**, silty to some silt, trace to some clay, trace gravel, very dense to dense, grey, moist (GLACIAL TILL)		9	SS	48
10				10	SS	50 / 125mm
11				11	SS	46
12	238.9					
	12.8	**END OF BOREHOLE**				

Elevation Scale (m): 251, 250, 249, 248, 247, 246, 245, 244, 243, 242, 241, 240, 239

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) Natural Water Content (MC) Liquid Limit (LL) — 10 20 30

Headspace Vapour (ppm): PID: =5 | PID: =5 | PID: =5 | PID: =5 | PID: =5 | PID: <5 | PID: <5 | PID: <5 | PID: =5 | PID: =10 | PID: =10

Instrument Details

Unstabilized Water Level

Lab Data and Comments

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

SS1 Analysis: PAH, PCB

SS2 Analysis: M&I, VOC, PHC

SS3 Analysis: M&I

SS4 Analysis: PAH, PCB

SS11 Analysis: VOC, PHC

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Sep 30, 2019	2.6	249.1

Unstabilized water level measured at 7.0 m below ground surface; borehole was open upon completion of drilling.

50 mm dia. monitoring well installed. 3m screen installed.

file: 3-19-0101-01, bh logs.gpj

LOG OF BH 3

Terraprobe

Project No. : 3-19-0101-01	Client : Huronia Barrie Land Inc.	Originated by : MC
Date started : September 24, 2019	Project : 521 Huronia Rd.	Compiled by : BH
Sheet No. : 1 of 1	Location : Barrie, Ontario	Checked by : SO

Position : E: 606595, N: 4911284 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : B-57, track-mounted Drilling Method : Hollow stem augers

Depth (m)	Elev (m)	Description	Number	Type	SPT 'N' Value
0	250.5	**GROUND SURFACE**			
		130mm **TOPSOIL**	1	SS	8
		SILTY SAND, trace gravel, loose, brown, moist to wet	2	SS	7
2	248.2		3	SS	8
	2.3	**SILTY CLAY**, trace to some sand, trace gravel, stiff, brown to grey, moist	4	SS	10
			5	SS	10
			6	SS	10
			7	SS	12
	242.9				
	7.6	**SAND**, silty to some silt, trace to some clay, trace gravel, very dense, grey, moist (GLACIAL TILL)	8	SS	50 / 125mm
			9	SS	24
			10	SS	69
			11	SS	48
	237.7				
12	12.8	**END OF BOREHOLE**			

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) Natural Water Content (MC) Liquid Limit (LL) 10 20 30

Elevation Scale (m): 250 249 248 247 246 245 244 243 242 241 240 239 238

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

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

SS1 Analysis: PAH, PCB

SS2 Analysis: M&I

SS3 Analysis: VOC, PHC

SS4 Analysis: M&I

SS5 Analysis: PAH, PCB

SS11 Analysis: VOC, PHC

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

50 mm dia. monitoring well installed. 3m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Sep 30, 2019	3.7	246.9

file: 3-19-0101-01, bh logs.gpj

LOG OF BH 4

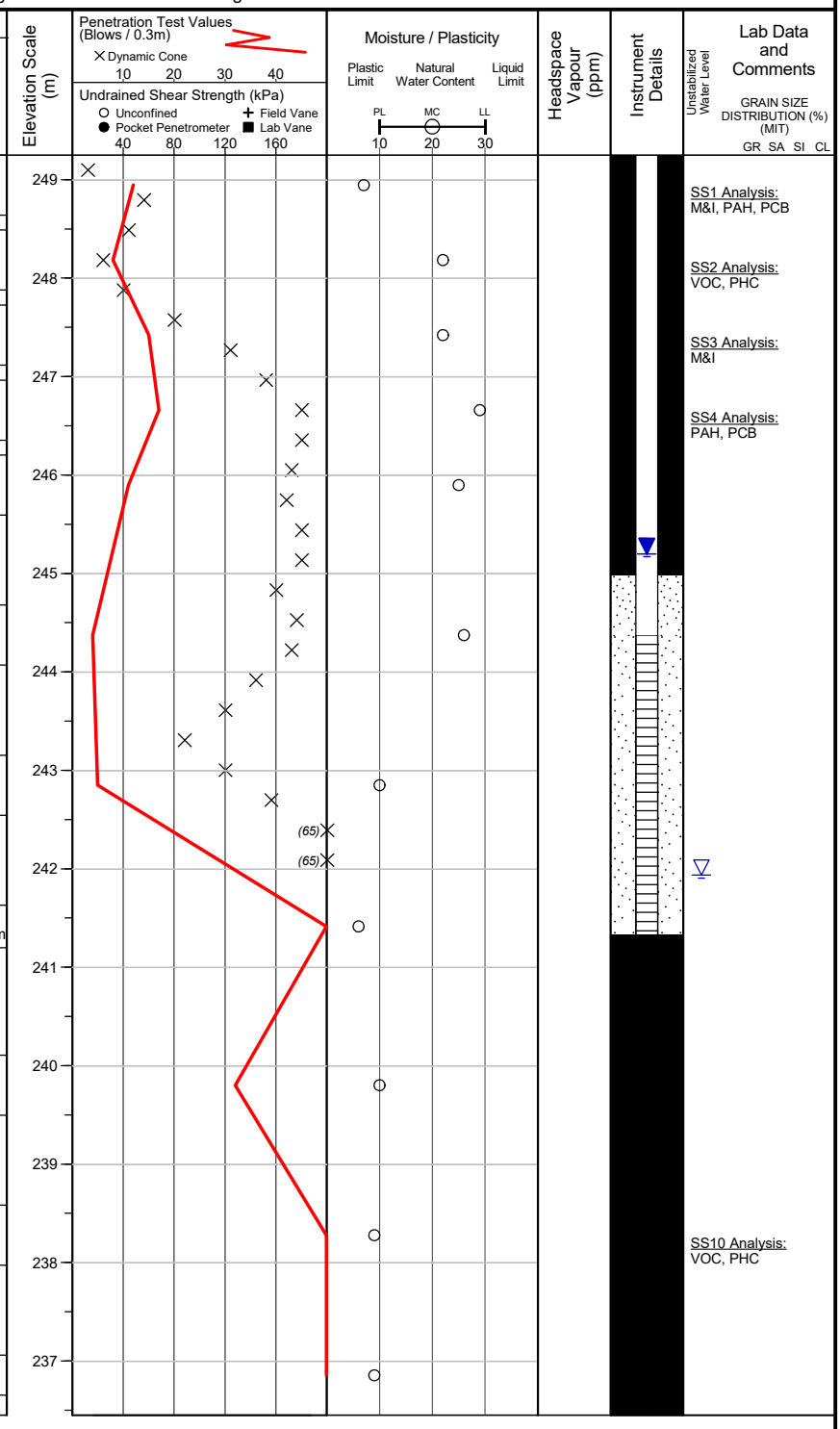
Terraprobe

Project No. : 3-19-0101-01	Client : Huronia Barrie Land Inc.	Originated by : MC
Date started : September 24, 2019	Project : 521 Huronia Rd.	Compiled by : BH
Sheet No. : 1 of 1	Location : Barrie, Ontario	Checked by : SO

Position : E: 606621, N: 4911290 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : B-57, track-mounted Drilling Method : Hollow stem augers

Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
249.3	**GROUND SURFACE**				
249.1 / 0.2	150mm **TOPSOIL**				
248.5 / 0.8	**SILTY SAND**, trace gravel, compact to loose, brown, moist		1	SS	12
	SILTY CLAY, trace to some sand, trace gravel, very stiff to firm, brown to grey, moist to wet		2	SS	8
			3	SS	15
			4	SS	17
			5	SS	11
			6	SS	4
			7	SS	5
241.7 / 7.6	**SAND**, silty to some silt, trace to some clay, trace gravel, very dense, grey, moist to wet (GLACIAL TILL)		8	SS	86 / 275mm
			9	SS	32
			10	SS	58
			11	SS	61
236.5 / 12.8	**END OF BOREHOLE**				



WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Sep 30, 2019	4.1	245.2

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

50 mm dia. monitoring well installed. 3m screen installed.

file: 3-19-0101-01, bh logs.gpj

Terraprobe

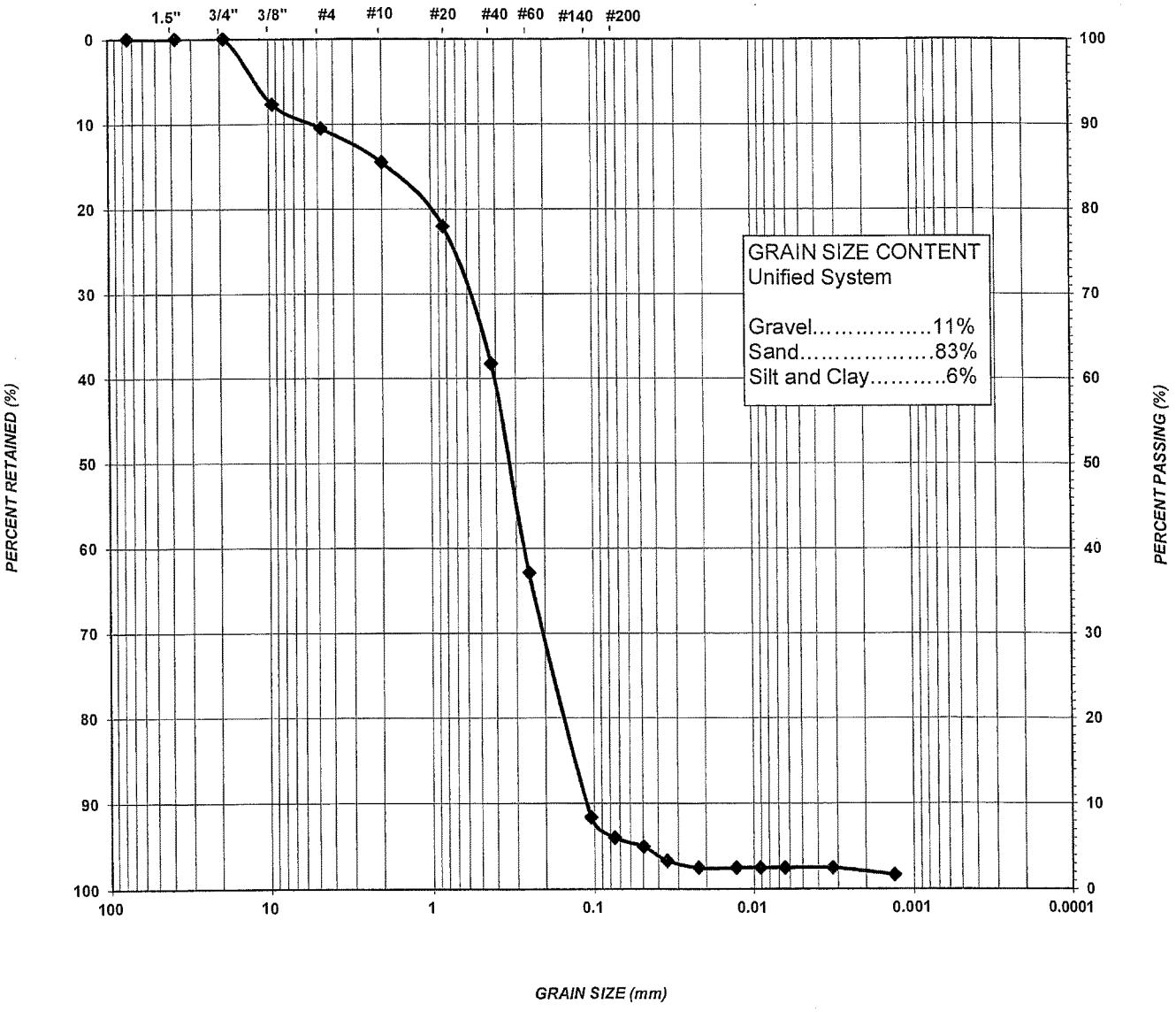
SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **521 Huronia Road**
LOCATION: **Barrie, ON**
CLIENT: **Huronia Road Land Inc.**

FILE NO.: **3-19-0101**
LAB NO.: **1438a**
SAMPLE DATE: **Sept-25-19**
SAMPLED BY: **M.C.**

BOREHOLE NUMBER: **2** SAMPLE DEPTH: **5 to 7'**
SAMPLE NUMBER: **3**
SAMPLE LOCATION: **as above**
SAMPLE DESCRIPTION: **Sand, some gravel, trace silt, trace clay**

GRAIN SIZE DISTRIBUTION



MIT SYSTEM	GRAVEL	COARSE	MEDIUM	FINE	SILT	CLAY
		SAND				

UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY
	GRAVEL		SAND			

Terraprobe

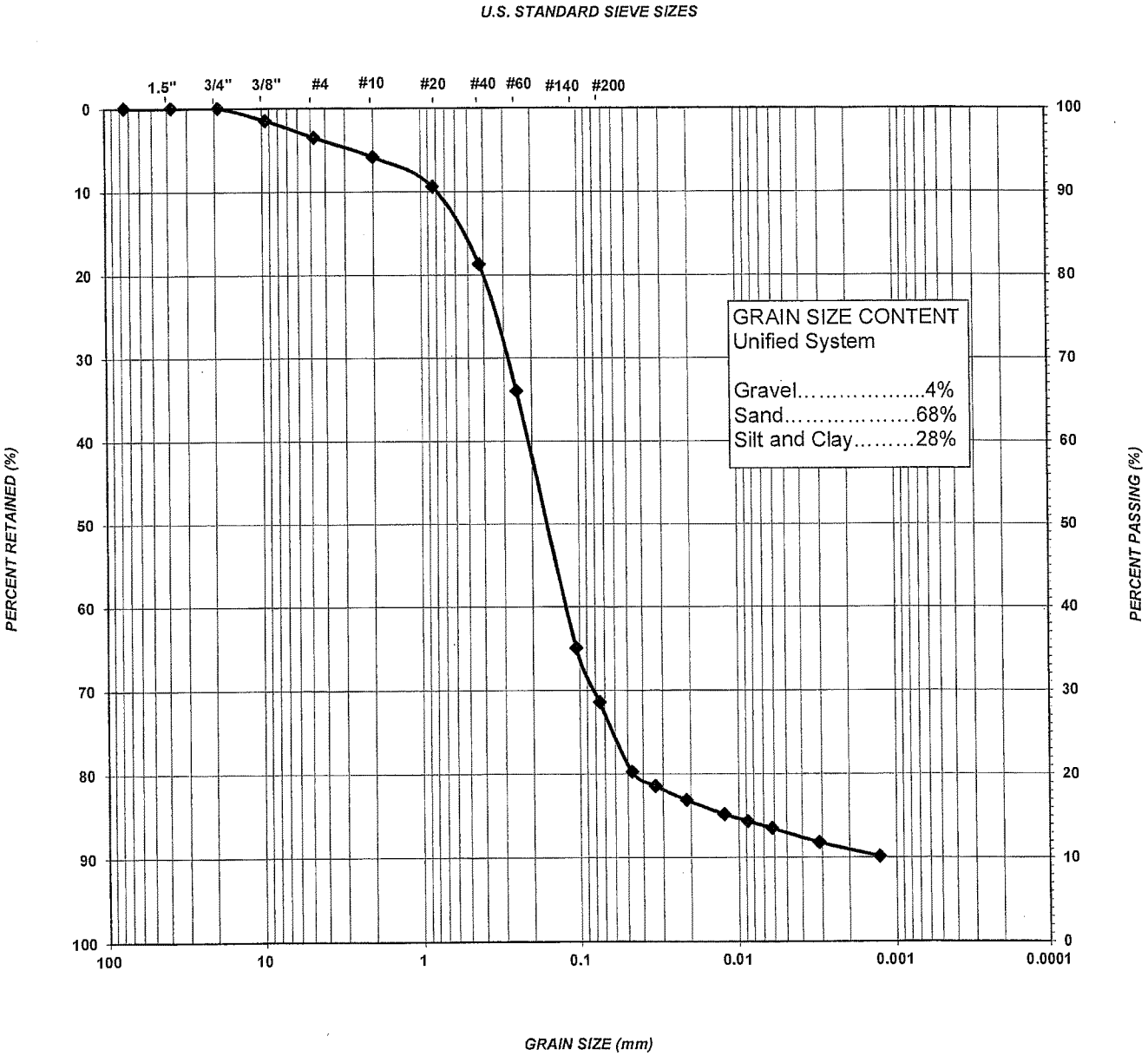
SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **521 Huronia Road**
LOCATION: **Barrie, ON**
CLIENT: **Huronia Road Land Inc.**

FILE NO.: **3-19-0101**
LAB NO.: **1438b**
SAMPLE DATE: **Sept-25-19**
SAMPLED BY: **M.C.**

BOREHOLE NUMBER: **3** SAMPLE DEPTH: **30 to 32'**
SAMPLE NUMBER: **9**
SAMPLE LOCATION: **as above**
SAMPLE DESCRIPTION: **Sand, some silt, some clay, trace gravel**

GRAIN SIZE DISTRIBUTION



MIT SYSTEM	GRAVEL	COARSE	MEDIUM	FINE	SAND	SILT	CLAY

UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY
	GRAVEL		SAND			

Terraprobe

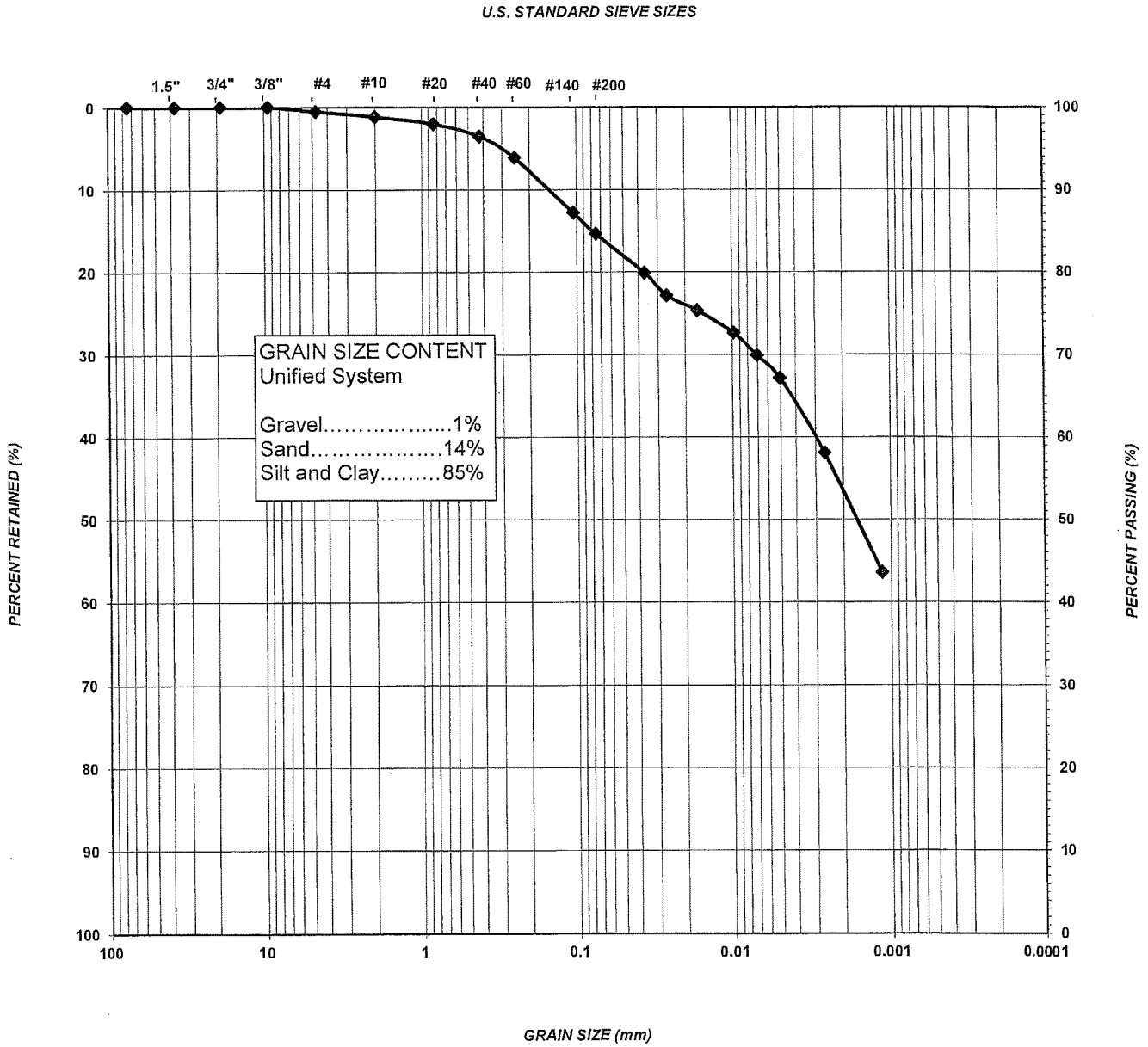
SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **521 Huronia Road**
LOCATION: **Barrie, ON**
CLIENT: **Huronia Road Land Inc.**

FILE NO.: **3-19-0101**
LAB NO.: **1438c**
SAMPLE DATE: **Sept-25-19**
SAMPLED BY: **M.C.**

BOREHOLE NUMBER: **4** SAMPLE DEPTH: **10 to 12'**
SAMPLE NUMBER: **5**
SAMPLE LOCATION: **as above**
SAMPLE DESCRIPTION: **Silty clay, some sand, trace gravel**

GRAIN SIZE DISTRIBUTION



MIT SYSTEM	GRAVEL	COARSE	MEDIUM	FINE	SILT	CLAY
		SAND				

UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY
	GRAVEL		SAND			

APPENDIX D

FINAL REPORT

CA14258-JAN21 R1

20-198, 521 Huronia Rd

Prepared for

Grounded Engineering Inc.

FINAL REPORT

First Page

CLIENT DETAILS

Client	Grounded Engineering Inc.
Address	12 Banigan Drive Toronto, Ontario M4H1E9. Canada
Contact	Nick Ng
Telephone	
Facsimile	
Email	nng@groundedeng.ca
Project	20-198, 521 Huronia Rd
Order Number	
Samples	Soil (3)

LABORATORY DETAILS

Project Specialist	Brad Moore Hon. B.Sc
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	705-652-2143
Facsimile	705-652-6365
Email	brad.moore@sgs.com
SGS Reference	CA14258-JAN21
Received	01/13/2021
Approved	01/19/2021
Report Number	CA14258-JAN21 R1
Date Reported	01/19/2021

COMMENTS

Temperature of Sample upon Receipt: 7 degrees C
Cooling Agent Present:Yes
Custody Seal Present:Yes

Chain of Custody Number:017990

Corrosivity Index is based on the American Water Works Corrosivity Scale according to AWWA C-105. An index greater than 10 indicates the soil matrix may be corrosive to cast iron alloys.

SIGNATORIES

Brad Moore Hon. B.Sc

TABLE OF CONTENTS

Client: Grounded Engineering Inc.
Project: 20-198, 521 Huronia Rd
Project Manager: Nick Ng
Samplers: Tanvir Chana

PACKAGE: **- Corrosivity Index** (SOIL)

Sample Number			5	6	7
Sample Name			BH201-SS6	BH202-SS5	BH203-SS4
Sample Matrix			Soil	Soil	Soil
Sample Date			12/01/2021	12/01/2021	12/01/2021
Parameter	**Units**	**RL**	**Result**	**Result**	**Result**
Corrosivity Index					
Corrosivity Index	none	1	4	4	4
Soil Redox Potential	mV	-	154	241	202
Sulphide (Na2CO3)	%	0.04	< 0.04	< 0.04	< 0.04
pH	pH Units	0.05	8.92	8.65	9.03
Resistivity (calculated)	ohms.cm	-9999	10800	9900	9520

PACKAGE: **- General Chemistry** (SOIL)

Sample Number			5	6	7
Sample Name			BH201-SS6	BH202-SS5	BH203-SS4
Sample Matrix			Soil	Soil	Soil
Sample Date			12/01/2021	12/01/2021	12/01/2021
Parameter	**Units**	**RL**	**Result**	**Result**	**Result**
General Chemistry					
Conductivity	uS/cm	2	93	101	105

PACKAGE: **- Metals and Inorganics** (SOIL)

Sample Number			5	6	7
Sample Name			BH201-SS6	BH202-SS5	BH203-SS4
Sample Matrix			Soil	Soil	Soil
Sample Date			12/01/2021	12/01/2021	12/01/2021
Parameter	**Units**	**RL**	**Result**	**Result**	**Result**
Metals and Inorganics					
Moisture Content	%	0.1	10.3	19.3	15.3
Sulphate	µg/g	0.4	45	4.4	20

FINAL REPORT

CA14258-JAN21 R1

Client: Grounded Engineering Inc.
Project: 20-198, 521 Huronia Rd
Project Manager: Nick Ng
Samplers: Tanvir Chana

PACKAGE: **- Other (ORP)** (SOIL)

Sample Number	5	6	7
Sample Name	BH201-SS6	BH202-SS5	BH203-SS4
Sample Matrix	Soil	Soil	Soil
Sample Date	12/01/2021	12/01/2021	12/01/2021

Parameter	Units	RL		Result	Result	Result
Other (ORP)						
Chloride	µg/g	0.4		21	18	26

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENV]IC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chloride	DIO0159-JAN21	µg/g	0.4	<0.4	7	20	95	80	120	103	75	125
Sulphate	DIO0159-JAN21	µg/g	0.4	<0.4	12	20	96	80	120	96	75	125

Carbon/Sulphur

Method: ASTM E1915-07A | Internal ref.: ME-CA-[ENV]ARD-LAK-AN-020

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Sulphide (Na2CO3)	ECS0028-JAN21	%	0.04	< 0.04	3	20	116	80	120			

Conductivity

Method: SM 2510 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0170-JAN21	uS/cm	2	2	0	20	99	90	110	NA		

QC SUMMARY

pH

Method: SM 4500 I Internal ref.: ME-CA-[ENV]EWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0170-JAN21	pH Units	0.05	NA	0		101			NA		

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS Insufficient sample for analysis.
RL Reporting Limit.
↑ Reporting limit raised.
↓ Reporting limit lowered.
NA The sample was not analysed for this analyte
ND Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

-- End of Analytical Report --

Request for Laboratory Services and CHAIN OF CUSTODY

SGS Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

No: 017990 Page ____ of ____

Laboratory Information Section - Lab use only

Received By: Oleg Mozhr
Received Date: 1/13/21 (mm/dd/yy)
Received Time: 10:50 (hr : min)
Received By (signature):
Custody Seal Present: Yes ☑ No ☐
Custody Seal Intact: Yes ☑ No ☐
Cooling Agent Present: Yes ☑ No ☐ Type: Ice pack
Temperature Upon Receipt (°C): 2.2.7
LAB LIMS #: CA14258-JAN21

REPORT INFORMATION	INVOICE INFORMATION
Company: Grounded Engineering	☐ (same as Report Information)
Contact: Nick Ng	Company:
Address: 12 Banigan Drive, Toronto ON, M4H 1E9	Contact:
Phone: 647 264-7936	Address:
Fax:	Phone:
Email: nng@groundedeng.ca	Email:

Quotation #: P.O. #:
Project #: 20-198 Site Location/ID: 521 Huronia Rd

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days) — TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐1 Day ☐2 Days ☐3 Days ☐4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: *NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

☐ O.Reg 153/04 ☐ O.Reg 406/19
☐ Table 1 ☐ Res/Park Soil Texture: ☐ Coarse
☐ Table 2 ☐ Ind/Com ☐ Medium/Fine
☐ Table 3 ☐ Agri/Other
☐ Table ____
Soil Volume ☐ <350m3 ☐ >350m3

Other Regulations: ☐ Reg 347/558 (3 Day min TAT) ☐ PWQO ☐ MMER ☐ CCME ☐ Other: ☐ MISA ☐ ODWS Not Reportable *See note

Sewer By-Law: ☐ Sanitary ☐ Storm Municipality:

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	M&I: Metals & Inorganics (incl CrVI, CN, Hg pH,(BHWS),EC,SAR–soil) (Cl, Na–water)	M&I: Full Metals Suite (ICP metals plus B(HWS-soil only) Hg, CrVI	M&I: ICP Metals only Sb,As,Ba,Be,B,Cd,Cr,Co,Cu,Pb,Mo,Ni,	SVOC: PAHs only	SVOC: SVOCs all incl PAHs, ABNs, CPs	PCB: PCBs ☐ Total ☐ Aroclor	PHC: F1-F4 + BTEX	PHC: F1-F4 only no BTEX	VOC: VOCs all incl BTEX	VOC: BTEX only	Pest: Pesticides Organochlorine or specify other	Other: Soil Corrosivity	Other	Other	Other	Other: Appendix 2: 406/19 Leachate Screening Levels Table :	Other: Sewer Use: Specify pkg:	Other: Water Characterization Pkg ☐ General ☐ Extended	TCLP: Specify TCLP tests ☐M&I ☐VOC ☐PCB ☐B(a)P ☐ABN ☐Ignit.	COMMENTS:
1	BH201-SS6	Jan 12	3PM	1	Soil													X							
2	BH202-SS5	Jan 12	3PM	1	Soil													X							
3	BH203-SS4	Jan 12	3PM	1	Soil													X							
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									

Observations/Comments/Special Instructions

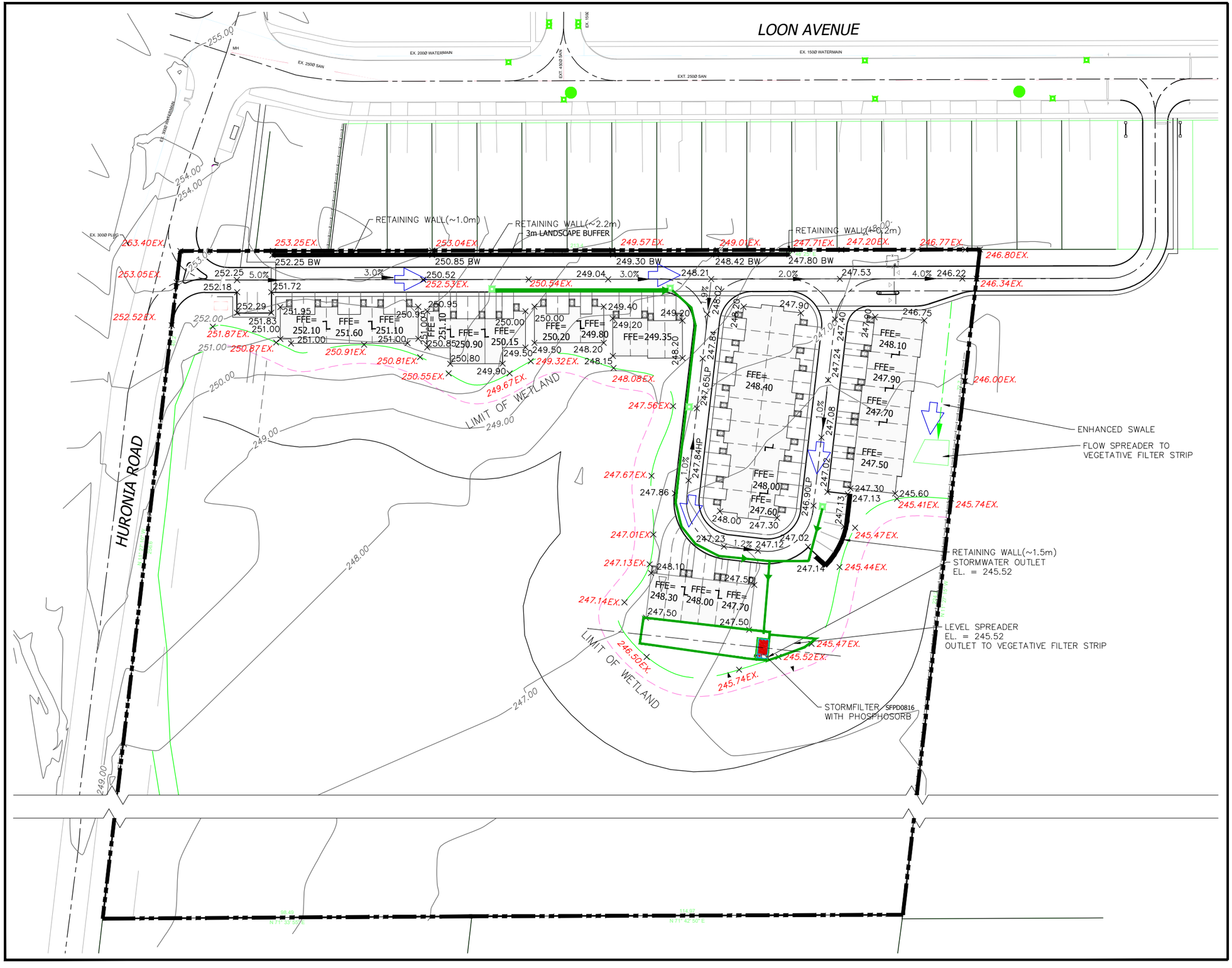
Sampled By (NAME): TANVIR CHANA Signature: Date: 01/12/21 (mm/dd/yy)
Relinquished by (NAME): Signature: Date: ____/____/____ (mm/dd/yy)

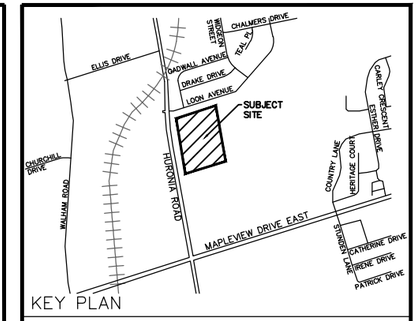
Pink Copy - Client
Yellow & White Copy - SGS

Revision #: 1.4
Date of Issue: 22 May. 2020

Note: Submission of samples to SGS is acknowledgement that you have been provided direction on sample collection/handling and transportation of samples. {2} Submission of samples to SGS is considered authorization for completion of work. Signatures may appear on this form or be retained on file in the contract, or in an alternative format (e.g. shipping documents). {3} Results may be sent by email to an unlimited number of addresses for no additional cost. Fax is available upon request. This document is issued by the Company under its General Conditions of Service accessible at http://www.sgs.com/terms_and_conditions.htm. (Printed copies are available upon request.) Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

APPENDIX E





LEGEND

- PROPERTY LINE
- ×246.80EX. EXISTING ELEVATION
- ×246.80 PROPOSED ELEVATION
- 1.0% PROPOSED SLOPE
- OVERLAND FLOW ROUTE
- EXISTING STORM MANHOLE
- PROPOSED SWALE
- PROPOSED STORMTECH SYSTEM FOR VOLUME CONTROL
- PROPOSED STORMTECH SYSTEM FOR DETENTION AND VOLUME CONTROL

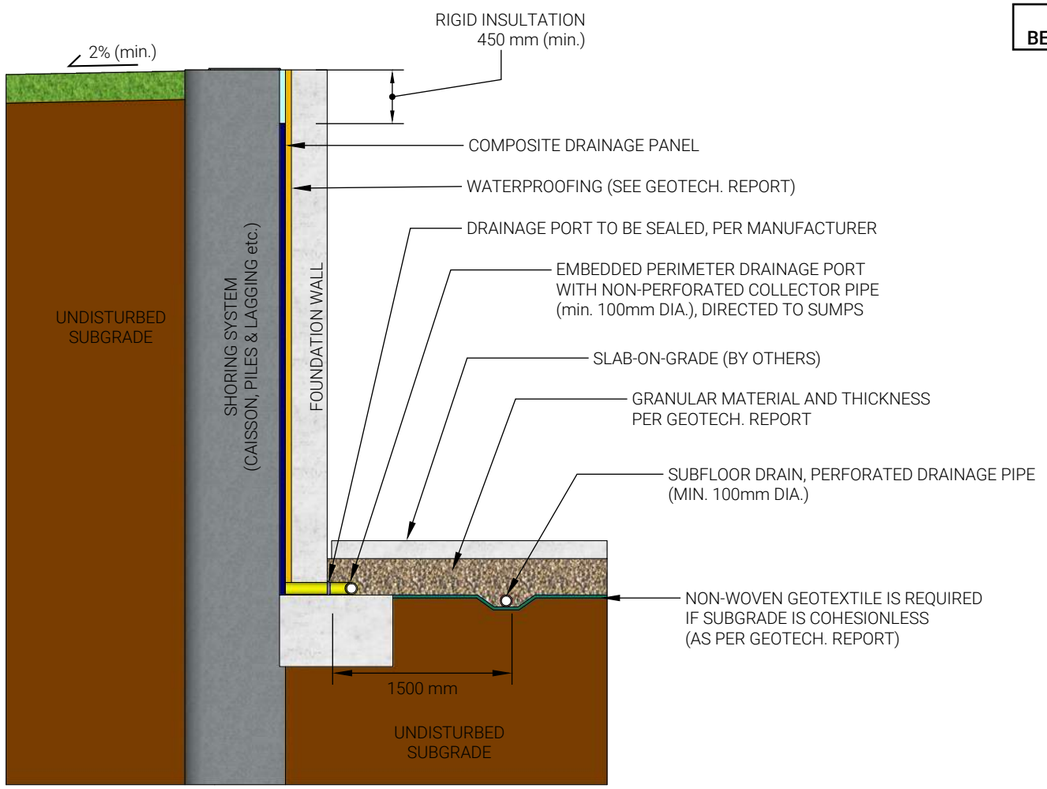
counterpoint ENGINEERING
COUNTERPOINT ENGINEERING INC.
8395 Jane St., Suite 100, Vaughan, ON L4K 5Y2 Phone 905.326.1404 Fax 905.326.1405

521 HURONIA ROAD
PROPOSED TOWNHOME COMMUNITY
BARRIE, ONTARIO

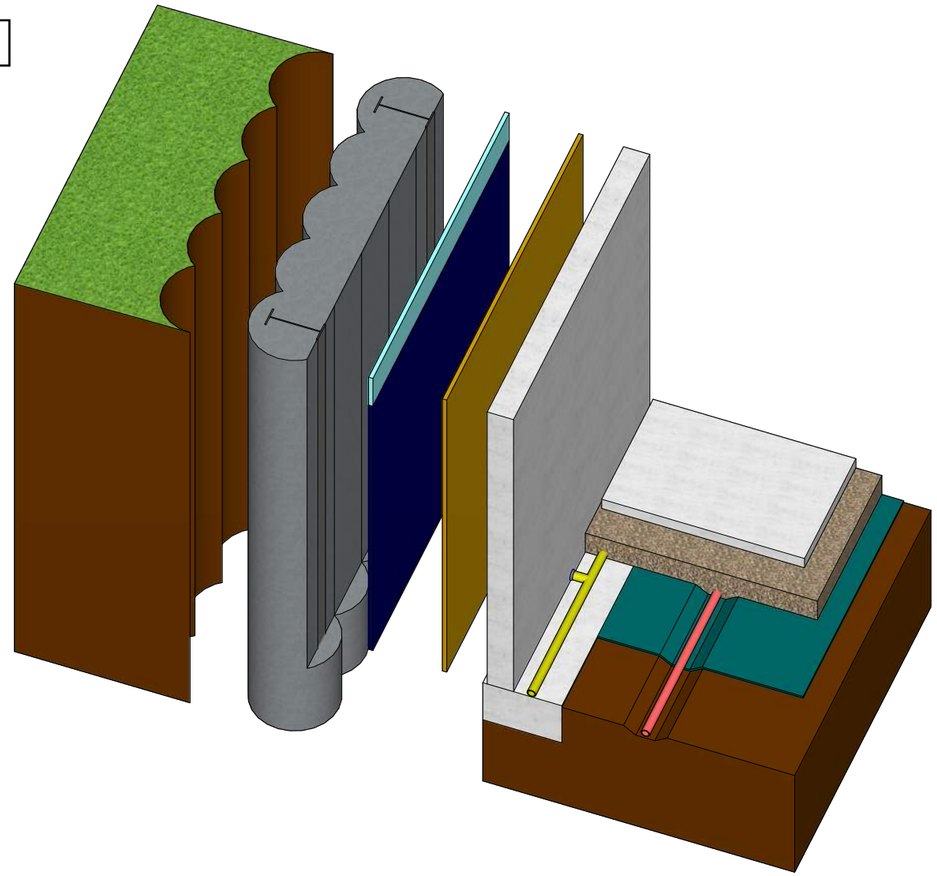
CONCEPTUAL GRADING PLAN

DESIGNED BY:	DATE: JUNE 2021
CHECKED BY: KR	PROJECT No. 19082
DRAWING BY:	
CHECKED BY: KR	FIGURE No. 8
SCALE: 1:1000	

APPENDIX F



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

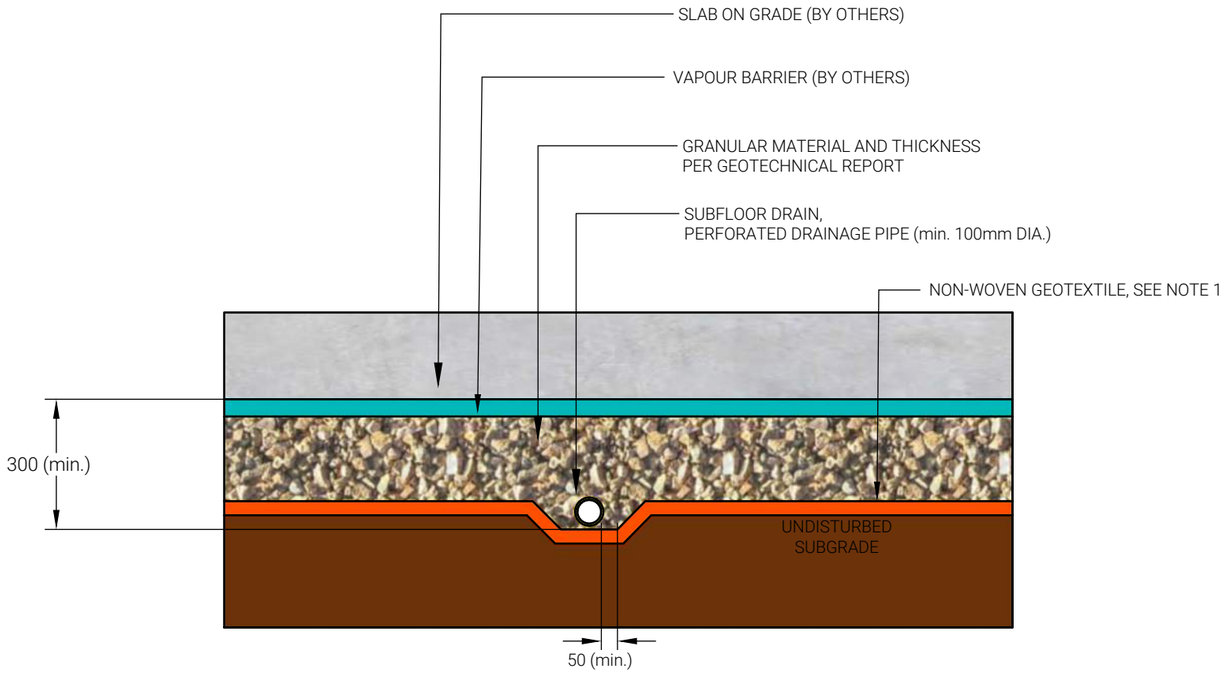
1. THERE SHOULD BE NO STRUCTURAL CONNECTION BETWEEN THE SLAB-ON-GRADE AND THE FOUNDATION WALL OR FOOTING.
2. THERE SHOULD BE NO CONNECTION BETWEEN THE SUBFLOOR AND PERIMETER DRAINAGE SYSTEMS.
3. THIS IS ONLY A TYPICAL BASEMENT DRAINAGE DETAIL. THE GEOTECHNICAL REPORT SHOULD BE CONSULTED FOR SITE SPECIFIC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

GROUNDED ENGINEERING

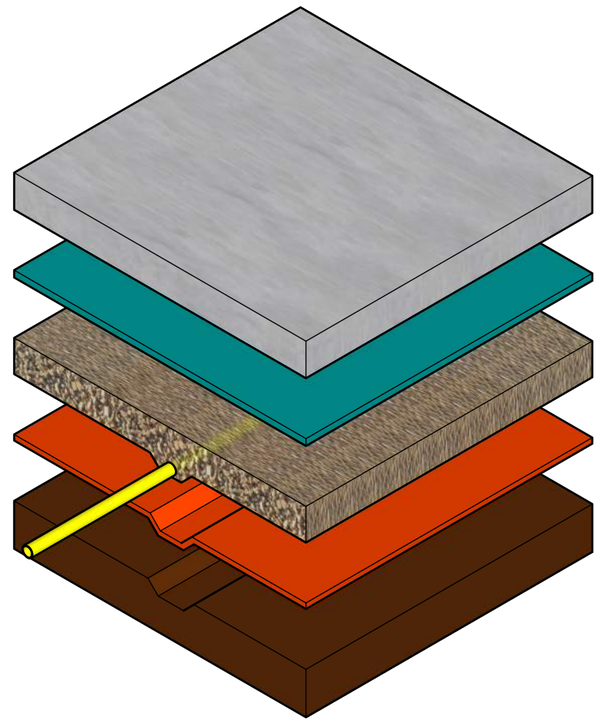
Title

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).

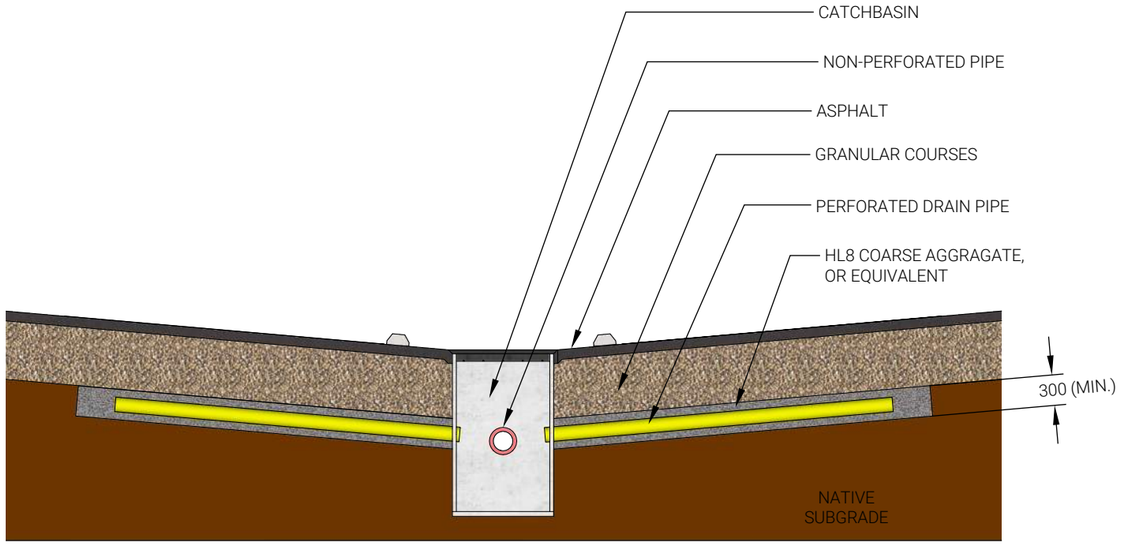
2. TYPICAL SCHEMATIC ONLY. MUST BE READ IN CONJUNCTION WITH GEOTECHNICAL REPORT.

GROUNDED ENGINEERING

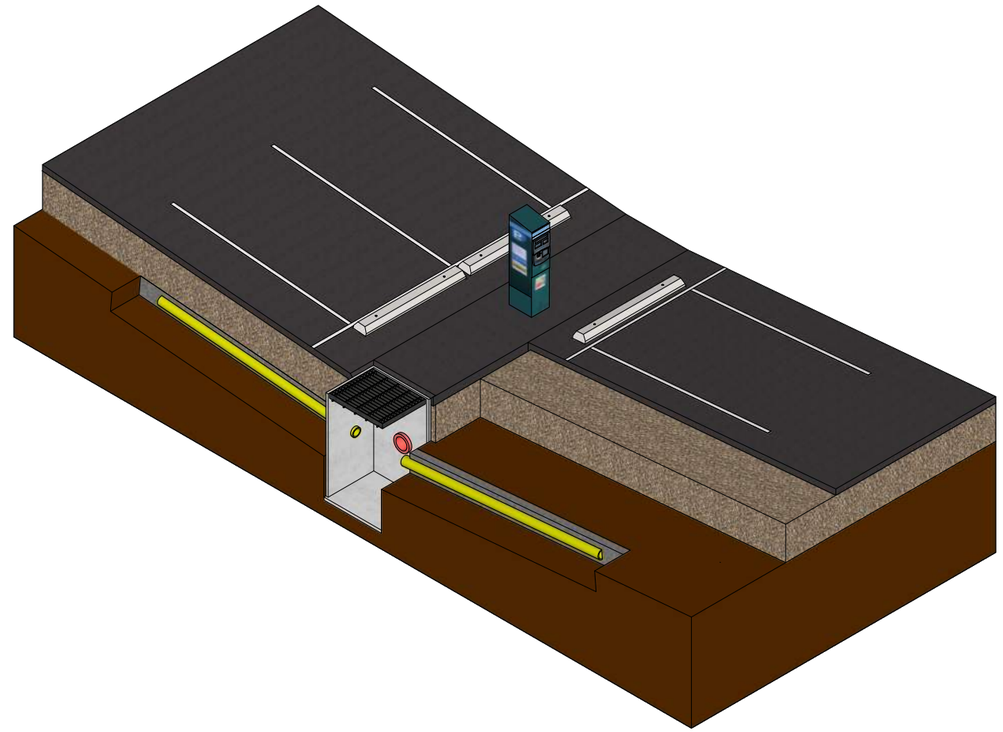
Title

BASEMENT SUBDRAIN TYPICAL DETAIL

OBJECTS ARE COLOR-CODED BETWEEN TWO VIEWS FOR CLARITY



SECTIONAL VIEW



ISOMETRIC

GROUNDED ENGINEERING

Title

LONGITUDINAL SUBDRAIN CONNECTION TO CATCHBASIN