Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE
90 WEST BEAVER CREEK ROAD, SUITE 100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

BARRIE	MISSISSAUGA	OSHAWA	NEWMARKET	MUSKOKA	HAMILTON
TEL: (705) 721-7863	TEL: (905) 542-7605	TEL: (905) 440-2040	TEL: (905) 853-0647	TEL: (705) 684-4242	TEL: (905) 777-7956
FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 542-2769

A REPORT TO
DIV DEVELOPMENT (BARRIE) LTD.

A GEOTECHNICAL INVESTIGATION FOR PROPOSED RESIDENTIAL DEVELOPMENT

WEST OF 20TH SIDEROAD,
BETWEEN LOCKHART ROAD AND MAPLEVIEW DRIVE EAST

CITY OF BARRIE

REFERENCE NO. 2211-S092

AUGUST 2023

DISTRIBUTION

Digital Copy - DIV Development (Barrie) Ltd.

TABLE OF CONTENTS

1.0 INTRODUCTION 1
2.0 SITE AND PROJECT DESCRIPTION 1
3.0 FIELD WORK 2
4.0 SUBSURFACE CONDITIONS 2
4.1 Topsoil 3
4.2 Silty Sand Till/Sandy Silt Till 3
4.3 Silty Clay Till/Silty Clay 3
4.4 Silty Fine Sand/Sandy Silt/Silt 4
4.5 Sand 5
4.6 Compaction Characteristics of the Revealed Soils 6
5.0 GROUNDWATER CONDITIONS 7
6.0 DISCUSSION AND RECOMMENDATIONS 9
6.1 Site Preparation 10
6.2 Foundation 11
6.3 Basement Construction 12
6.4 Underground Services 13
6.5 Backfilling Trenches and Excavated Areas 14
6.6 Pavement Design 15
6.7 Stormwater Management Ponds 16
6.8 Soil Parameters 17
6.9 Excavation 18
7.0 LIMITATIONS OF REPORT 19

TABLES

Table 1 - Estimated Water Content for Compaction 6
Table 2 - Groundwater Levels 7
Table 3 - Pavement Design 15
Table 4 - Soil Parameters 17
Table 5 - Classification of Soils for Excavation 18

ENCLOSURES

Logs of Borehole ..... Figures 1 to 21
Grain Size Distribution Graphs ..... Figures 22 to 29
Borehole Location Plan ..... Drawing No. 1
Subsurface Profiles ..... Drawing Nos. 2 and 3
Permanent Perimeter Drainage System ..... Drawing No. 4
Details of Under-Floor Weepers ..... Drawing No. 5
Borehole Logs and Subsurface Profile (Ref. No. 1610-S116) ..... Appendix A
Monitoring Well Logs and Location Plan (RJB 2019) ..... Appendix B

1.0 INTRODUCTION

In accordance with the written authorization dated November 2, 2022, from Mr. Geoffrey Greyhurst of DIV Development (Barrie) Ltd., a geotechnical investigation was carried out for a property located on the west side of 20th Sideroad, between Lockhart Road and Mapleview Drive East in the City of Barrie.

The property is generally subdivided into the northern and southern regions, separated by a Natural Heritage System (NHS), encompassing an area of 22.21 ha. In 2016, a geotechnical investigation was carried out for the northern region; the borehole findings were presented in the soils report dated April 2017, our Reference No. 1610-S116.

The purpose of the current investigation was to reveal the subsurface conditions for the southern region, and with the combined borehole findings from the previous investigation, to determine the engineering properties of the disclosed soils for the design and construction of the overall residential subdivision development. The geotechnical findings and recommendations for the proposed development are presented in this Report.

2.0 SITE AND PROJECT DESCRIPTION

The City of Barrie is located within the periphery of Lake Simcoe basin where the glacial till has been partly eroded by glacial Lake Algonquin and filled with lacustrine silts and clay.

The subject property, encompassing an approximate total area of 80.17 hectares, is located on the west side of 20th Sideroad, between Lockhart Road and Mapleview Drive East, in the City of Barrie. At the time of investigation, the site consists of cultivated farm fields and grass-covered areas. Two tributaries of the Sandy Cove Creek flow through the various NHS on site, with one tributary notably flowing along the drainage channel across the northern portion of the site. Topography of the site generally descends towards the drainage features/NHS, with elevations ranging from El. 268± m in the southwest corner of the site to El. 245± m near the tributary exits through culverts at 20th Sideroad.

Based on the Draft Plan of Subdivision prepared by Malone Given Parsons Ltd., the site will be developed as a residential subdivision, with blocks reserved for parks, school, stormwater management (SWM) ponds, pumping station and NHS. The development will be provided with municipal services and paved roadways meeting municipal standards.

3.0 FIELD WORK

The 2016 and 2023 investigations consist of a total of thirty-three (33) sampled boreholes, at the locations shown on the Borehole Location Plan, Drawing No. 1:

- Twelve (12) boreholes (Boreholes 1 to 12), extending to a depth of 6.2 to 17.2 m from grade, completed between November 11 and 18, 2016.
- Twenty-one (21) boreholes (Boreholes 101 to 121), extending to a depth of 6.2 to 11.1 m, completed between December 19, 2022, and January 2, 2023.

The boreholes were advanced at intervals to the sampling depths by a track-mounted machine equipped with solid-stem augers for soil sampling. Split-spoon samples were recovered for soil classification and laboratory testing. Standard Penetration Tests using the procedures described on the enclosed "List of Abbreviations and Terms" were performed at the sampling depths. The relative density of the non-cohesive strata and the consistency of the cohesive strata are inferred from the 'N' values. The field work was supervised and the findings were recorded by a geotechnical technician.

To facilitate the hydrogeological study, 50-mm diameter monitoring wells were installed in 8 selected borehole locations within the northern region, with 6 single wells and a nested well cluster. The depth and details of the monitoring wells are shown on the corresponding Borehole Logs.

The ground elevation at each of the 2016 borehole location was interpolated from the spot elevations and contours shown on the topographic map prepared by Lloyd & Purcell Ltd., dated January 15, 2015. The ground elevation at each of the 2023 borehole location was taken using handheld Global Navigation Satellite System equipment.

4.0 SUBSURFACE CONDITIONS

Beneath the topsoil veneer, the subsoil profile consists of strata of glacial till, sands and silts, with intermittent layers of silty clay at various locations.

The 2016 borehole logs and subsurface profile are enclosed in the Appendix A for reference. Detailed descriptions of the encountered subsurface conditions are presented on the borehole logs, comprising of Figures 1 to 21, inclusive. The stratigraphy is illustrated on the Subsurface Profiles, Drawing Nos. 2 and 3. The engineering properties of the disclosed soils are discussed herein.

4.1 Topsoil

Topsoil is generally contacted at the ground surface of all boreholes. The revealed topsoil thickness ranges from 15 to 41 cm. Thicker topsoil may be encountered in areas beyond the borehole locations, especially in local low-lying areas.

4.2 Silty Sand Till/Sandy Silt Till

Sandy silt till/silty sand till was mainly encountered in the northern region of the site. The till is cemented with a trace to some clay, and is embedded with sand and silt seams and layers. Hard resistance to augering was encountered in places, indicating the potential presence of cobbles and boulders in the till mantle. Grain size analyses were performed on 3 samples of the sand till and 1 sample of the silt till; the results are plotted on Figures 22 and 23, respectively.

The obtained 'N' values range from 4 to over 100, with a median of 34 blows per 30 cm penetration, indicating that the relative density of the till is very loose to very dense, being generally dense. The very loose to loose till is generally restricted to the surficial disturbed or weathered zone, which extends to depths of 0.8 to 2.3 m below grade.

The natural water content values of the till range from 4% to 18%, with a median of 9%, indicating that the till is generally in a moist condition.

The engineering properties of the sandy silt till and silty sand till are listed below:

- Moderately high frost susceptible and moderately low water erodibility.
- The till will generally be stable in relatively steep excavation; however, if the excavation remained open for an extended period of time, localized sloughing may occur, especially under seepage conditions.

4.3 Silty Clay Till/Silty Clay

The silty clay till deposit was predominantly contacted in the upper stratigraphy within the northern region. The silty clay was encountered near the ground surface at various borehole locations, except in Borehole 1 where a clay deposit was found beneath the sandy silt at a depth of 13.7 m below grade.

The clay till consists of a mixture of particle sizes ranging from clay to gravel, with silt and clay being the dominant fraction. Grain size analyses were performed on 3 samples; the results are plotted on Figure 24.

The Atterberg Limits of 2 clay till and 1 clay samples and the natural water content values of all the samples were determined; the results are plotted on the Borehole Logs and summarized below:

	Silty Clay Till	**Silty Clay**
Liquid Limit	23% and 25%	48%
Plastic Limit	16%	24%
Natural Water Content	8% to 21% (median 13%)	13% to 34% (median 23%)

The results indicate that the clay till is low in plasticity and the clay is medium in plasticity. The clay till and clay are generally in moist conditions with natural water content values generally below their plastic limits.

The recorded 'N' values of the clay till range from 4 to 38, with a median of 12 blows per 30 cm of penetration. The 'N' values of the clay range from 5 to 45, with a median of 7 blows per 30 cm of penetration. This indicates that the clay till is generally stiff and the clay is generally firm in consistency. The low 'N' values are generally encountered near the ground surface where the soil was likely disturbed by farming activities and/or weakened by the weathering process.

The engineering properties of the silty clay till and silty clay are listed below:

- High frost susceptibility and low water erodibility.
- In excavation, the clays will be stable in relatively steep cuts; however, prolonged exposure may lead to localized sloughing.

4.4 Silty Fine Sand/Sandy Silt/Silt

Deposits of silty fine sand, sandy silt and silt were encountered in the lower zone of the revealed stratigraphy throughout the site. The silty sand and silts contain a trace of clay with occasional sand layers in places. Grain size analyses were performed on 6 silty fine sand samples and 2 sandy silt samples, and the results are plotted on Figures 25 to 27.

The obtained natural water content values range from 4% to 28%, with a median of 18%, indicating that the deposits are in a damp to wet condition. Sample examination revealed that the silty sand and silts in the lower stratigraphy is generally wet.

The recorded 'N' values range from 2 to over 100, with a median of 41 blows per 30 cm penetration, indicating that the relative density of the silty sand/silts is very loose to very dense, generally being dense. The loose soils near the ground surface were likely disturbed or weakened by weathering.

The engineering properties of the silty sand/silts are listed below:

- High capillarity and water retention capability.
- Highly frost susceptible, with high soil-adfreezing potential.
- High water erodibility, it will migrate through small openings under seepage pressure.
- The shear strength is mainly derived from internal friction. The wet silty sand/silts are susceptible to dynamic disturbance, which will induce a build-up of pore water pressure, resulting in soil dilation and a reduction in shear strength.
- In excavation, the silty sand/silts will remain stable for a short period of time and will slough and run with seepage. The wet silty sand/silts will boil under an approximate piezometric head of 0.4 m.

4.5 **Sand**

In the northern region of the site, the sane deposit was found interstratified with the till mantles. Sand was predominantly encountered in the upper stratigraphy throughout the southern region. The sand is fine and fine to medium grained, with a trace to some silt and a trace of gravel. Localized gravelly sand was observed in places. Grain size analyses were performed on 4 sand samples; the gradations are plotted on Figures 28 and 29.

The sand is very loose to very dense, generally being dense in relative density, with obtained 'N' values ranging from 2 to over 100, and a median of 30 blows per 30 cm of penetration. Similar to other soil types, the loose sand is generally restricted to the surficial weathered/disturbed zone. In Boreholes 109 and 115, the loose sand extends to a depth of 2 m below grade.

Sample examination revealed that the sand is dry in the southernmost boreholes, and becoming wet with depth in boreholes close to the NHS. The natural water content values vary from 2% to 21%, with a median of 9%.

The engineering properties of the sand are listed below:

- Water erodible material.
- In excavation, the sand will slough to its angle of repose, run with water seepage and boil with a piezometric head of about 0.3 to 0.4 m.

4.6 Compaction Characteristics of the Revealed Soils

The obtainable degree of compaction is primarily dependent on the soil moisture and, to a lesser extent, on the type of compactor used and the effort applied. As a general guide, the typical water content values of the revealed soils for Standard Proctor compaction are presented in Table 1.

Table 1 - Estimated Water Content for Compaction

Soil Type	Determined Natural Water Content (%)	Water Content (%) for Standard Proctor Compaction	
		100% (optimum)	Range for 95% or +
Silty Sand Till/Sand Silt Till	4 to 18 (median 9)	10	6 to 15
Silty Fine Sand/Sandy Silt/ Silt	4 to 28 (median 18)	13	8 to 17
Sand	2 to 21 (median 9)	8	6 to 10
Silty Clay Till	8 to 21 (median 13)	16	12 to 20
Silty Clay	13 to 34 (median 23)	21	17 to 25

The above values show that the tills and clay are generally suitable for structural backfill. Wet silts and sandy soils can be stockpiled to drain the excess water prior to structural compaction. Alternatively, the wet soils can be spread thinly on the ground surface for aeration under warm and dry weather. The addition of water may be required for the dry sands in the southernmost portion of the site.

The lifts for compaction should be limited to 20 cm, or to a suitable thickness assessed by test strips performed by the compaction equipment. Boulders larger than 15cm in size must be sorted and removed from the backfill.

5.0 GROUNDWATER CONDITIONS

Groundwater and cave-in levels were measured in all boreholes upon completion of drilling, and shortly after the completion of field work, groundwater levels were measured from the installed monitoring wells on November 18, 2016. As shown in Table 2, the water levels range from a depth of 0.8 to 5.3 metres below ground surface (mbgs), or from El. 254.4 to 248.5 m, in the northern region. In the southern region, the depth ranges from 1.5 to 4.9 mbgs, or from El. 256.2 to 251.1 m, indicating a general flow pattern following the topography towards the low-lying areas and tributaries.

Table 2 - Groundwater Levels

Borehole/ Monitoring Well No.	Ground Elevation (m)	Borehole/ Well Depth (m)	Measured Groundwater/ Cave-In* Level On Completion		Groundwater Level on November 18, 2016	
			Depth (m)	El. (m)	Depth (m)	El. (m)
Northern Region (2016)						
MW1	256.4	17.1	-	-	2.0	254.4
2	252.2	6.7	1.2*	251.0*	-	-
MW3	256.3	7.6	-	-	5.3	251.0
4	251.4	6.6	1.4/1.5*	250.0/249.9*	-	-
MW5	251.5	7.6	-	-	2.0	249.5
6	255.7	6.2	Dry	-	-	-
MW7	253.8	9.0	-	-	3.2	250.6
MW8	252.2	6.2	-	-	0.8	251.4
MW9	253.7	9.0	-	-	1.1	252.6
10	255.4	6.6	2.1/2.1*	253.3/253.3*	-	-
11	252.8	6.6	4.3	248.5	-	-
MW12-D	251.0	5.8	-	-	1.8	249.2
MW12-S	251.0	4.0	-	-	1.8	249.2
Northern Region (2023)						
120	252.9	10.8	3.0	249.9	-	-
121	253.2	11.1	3.7	249.5	-	-

Table 2 - Groundwater Levels (Cont'd)

Borehole/ Monitoring Well No.	Ground Elevation (m)	Borehole/ Well Depth (m)	Measured Groundwater/ Cave-In* Level On Completion		Groundwater Level on November 18, 2016	
			Depth (m)	El. (m)	Depth (m)	El. (m)
Southern Region						
101	265.8	6.2	Dry	-		
102	262.8	6.4	Dry	-		
103	262.8	6.6	Dry	-		
104	261.6	6.2	Dry	-		
105	258.1	6.6	3.7/4.3*	254.4/253.8*		
106	261.4	6.6	5.5*	255.9*		
107	260.1	6.4	4.3/5.2*	255.8/254.9*		
108	261.7	6.6	5.5	256.2		
109	260.0	6.4	4.9/5.5*	255.1/254.5*		
110	260.3	6.6	5.8	254.5		
111	256.5	6.6	1.5/2.4*	255.0/254.1*		
112	259.0	6.6	3.7/4.9*	255.3/254.1*		
113	257.8	6.6	4.3/5.5*	253.5/252.3*		
114	257.6	7.8	4.9/5.5*	252.7/252.1*		
115	257.5	8.1	3.7/4.3*	253.8/253.2*		
116	255.8	6.6	2.7/3.7*	253.1/252.1*		
117	254.4	6.6	3.0/4.9*	251.4/249.5*		
118	254.1	6.6	3.0/4.0*	251.1/250.1*		
119	255.3	6.6	2.1/3.0*	253.2/252.3*		

Subsequently, groundwater levels were recorded on November 30, December 8 and 13, 2016, and the data is documented in the Hydrogeological Assessment report, Reference No. 1610-W116, dated March 2017.

Five additional monitoring wells were installed in the southern region by R.J. Burnside & Associates Limited (RJB) in 2019; the monitoring well logs and borehole location plan is included in Appendix B for reference. Further groundwater monitoring was carried out by

RJB between April 2019 and February 2023. Based on the Interpreted Groundwater Flow map (Figure 10, dated February 2023) from RJB's Hydrogeological Study, the groundwater flow contours vary from El. 258 m at the southwest corner of the site to El. 250 m at the southern Tributary of Sandy Cove Creek, and from El. 255 m towards the northern Tributary at the drainage channel. Detailed groundwater records and profiles should be referred to the hydrogeological report by RJB.

6.0 DISCUSSION AND RECOMMENDATIONS

Beneath the topsoil veneer, the site is underlain by strata of generally dense silty sand till/sandy silt till and stiff silty clay till, interstratified with dense deposits of sands and silts and localized layers of generally firm silty clay. The till is predominantly found in the northern region of the site while sands and silty sands are more prevalent south of the large central NHS. The surficial weathered zone extends to a depth ranging from 0.8 to 1.5 m below grade. In areas, loose soils were encountered up to a depth of 2.3 m below grade.

Upon completion of field work or shortly thereafter, the groundwater levels range from El. 254.4 to 248.5 m in the northern region and from El. 256.2 to 251.1 m in the southern region, indicating a general flow pattern following the topography towards the low-lying areas and tributaries. The groundwater is subject to seasonal fluctuations. Detailed groundwater records and profiles should be referred to the hydrogeological report by RJB.

It is understood that the site will be developed as a residential subdivision, with blocks reserved for parks, school, SWM ponds, pumping station and NHS. The development will be provided with municipal services and paved roadways meeting municipal standards. The following geotechnical considerations warrant special attention:

1. The topsoil must be stripped for development; it can be reused for general landscaping purposes only. Any surplus should be removed off-site.
2. The weathered soil should be inspected prior to any placement of earth fill for site grading purpose. Where required, the weathered soil should be subexcavated, sorted free of any organic, topsoil, and/or other deleterious material, before reusing for structural backfill.
3. Where additional fill is required for site grading, the earth fill can be placed in an engineered manner for conventional footing construction, site services support and road construction.
4. The engineered fill and the sound native soils are suitable for supporting structures founded on conventional spread and strip footings.
5. Basement floors should be founded at least 1 m above the seasonal high groundwater

level. Otherwise, underground subdrain with dewatering from sumps or waterproofing will be required for basements constructed near or below the groundwater table.

6. A Class 'B' bedding, consisting of compacted 19-mm Crusher-Run Limestone (CRL), is recommended for the construction of underground services. Where services installation extends into the saturated sands and silts, a Class 'A' concrete bedding should be considered for pipe support.
7. Groundwater seepage from the tills will likely be removable by conventional pumping from sumps during construction. Excavation extending into the saturated soils will require construction dewatering.

The recommendations appropriate for the project described in Section 2.0 are presented herein. One must be aware that the subsurface conditions may vary between boreholes, and the assessment given herein is general in nature based on the borehole findings. Should this become apparent during construction, a geotechnical engineer must be consulted to determine whether the following recommendations require revision.

6.1 Site Preparation

The topsoil and vegetation at the ground surface must be removed for development. Where additional fill is required for site grading, the earth fill can be placed in an engineered manner for conventional footing construction, site services support and road construction. The engineering requirements for a certifiable fill are presented below:

1. The subgrade must be inspected and proof-rolled prior to any fill placement. Badly weathered soils must also be subexcavated, sorted free of topsoil inclusions and deleterious materials, if any, aerated and properly compacted in layers.
2. Inorganic soils must be used for the fill, and they must be uniformly compacted in lifts of 20 cm thick to at least 98% of their maximum Standard Proctor Dry Density (SPDD) up to the proposed finished grade. The soil moisture must be properly controlled near the optimum. If the foundations are to be built soon after the fill placement, the densification process for the engineered fill must be increased to 100% SPDD.
3. If the engineered fill is compacted with the moisture content on the wet side of the optimum, the underground services and pavement construction should not begin until the pore pressure within the fill mantle has completely dissipated. This must be further assessed at the time of the engineered fill construction.
4. If imported fill is to be used, it should be inorganic soils, free of deleterious or any material with environmental issue or contamination. Any potential imported earth fill from off-site must be reviewed for geotechnical and environmental quality by the

appropriate personnel as authorized by the developer or agency, before being hauled to the site.

5. The fill operation must be inspected on a full-time basis by a technician under direction of a geotechnical engineer.
6. The engineered fill should not be placed during period when freezing ambient temperatures occur either persistently or intermittently. This is to ensure that the fill is free of frozen soils, ice and snow. If the engineered fill is to be left over the winter months, adequate earth cover, or equivalent, must be provided for protection against frost action.
7. The engineered fill must extend over the entire graded area; the engineered fill envelope and finished elevations must be clearly and accurately defined in the field, and they must be precisely documented by qualified surveyors.
8. The foundations and underground services subgrade must be inspected by the geotechnical consulting firm that inspected the engineered fill placement. This is to ensure that the foundations are placed within the engineered fill envelope, and the integrity of the fill has not been compromised by interim construction, environmental degradation and/or disturbance by the footing excavation.
9. Despite stringent control in the placement of the engineered fill, variations in soil type and density may occur in the engineered fill. Therefore, the foundations must be properly reinforced, or be designed by the structural engineer for the project. The total and differential settlements of 25 mm and 20 mm, respectively, should be considered in the design of the foundation founded on engineered fill.
10. Any excavation carried out in certified engineered fill must be reported to the geotechnical consultant who supervised the fill placement in order to document the locations of the excavation and/or to supervise reinstatement of the excavated areas to engineered fill status. If construction on the engineered fill does not commence within a period of 2 years from the date of certification, the condition of the engineered fill must be assessed for re-certification.

6.2 **Foundation**

Based on the borehole information, the following bearing pressures are recommended for structures supported on conventional strip and spread footings founded onto engineered fill or sound native soils below the weathered soils or loose soils at a minimum founding depth of 1.5 m or more below grade. In the vicinity of Boreholes 2, 4, 7, 108, 109 and 115, the founding depth should be increased to at least 2.5 m.

- Maximum Bearing Pressure at Serviceability Limit State (SLS) = 150 kPa
- Factored Ultimate Bearing Pressure at Ultimate Limit State (ULS) = 250 kPa

The total and differential settlements of footing designed for the recommended bearing pressure at SLS are estimated at 25 mm and 20 mm, respectively.

The footing subgrade must be inspected by a geotechnical engineer, or a senior geotechnical technician, under the supervision of a geotechnical engineer, to ensure that the revealed conditions are compatible with the design of the foundation.

Footings exposed to weathering, or in unheated areas, should have at least 1.5 m of earth cover for protection against frost action.

Where the footing excavation consists of wet sands or silts, or the footing subgrade is saturated, a concrete mud-slab of lean mix concrete, 8 to 10 cm in thickness, should be poured immediately after subgrade preparation and inspection to protect the approved subgrade against disturbance by the construction traffic.

The foundation should meet the requirements specified by the latest Ontario Building Code, and the structures can be designed to resist a minimum earthquake force using Site Classification 'D' (stiff soil).

The external grading must be designed to drain surface runoff away from the structures to minimize the frost heave phenomenon generally associated with the disclosed soils.

Higher bearing pressures may be provided depending on location and foundation design depth. This can be confirmed once the design and grading specifications are available for review.

6.3 **Basement Construction**

Underground structures should be designed for the lateral earth pressure using the soil parameters provided in Table 4.

It is recommended that the basement floor be founded at least 1.0 m above the seasonal high groundwater level. In conventional basement design, perimeter walls of the basement structure should be damp-proofed and provided with perimeter subdrains at the wall base. Backfill of the open excavation should consist of free-draining granular material (Drawing No. 4) unless prefabricated drainage board is installed over the entire wall below grade.

Should the basement floor be founded less than 1.0 m above the groundwater table, an underfloor subdrain system (Drawing No. 5) should be provided to supplement the perimeter subdrain system to relieve any groundwater upfiltration due to seasonal fluctuation. The subdrains must be connected to sump-wells or to a positive outlet, and should be encased in a fabric filter to protect them against blockage by silting. If the basement floor is to be founded less than 0.5 m above the groundwater table, the basement structure should be waterproofed and designed for hydrostatic uplift pressure.

The subgrade of the basement slab must consist of sound native soil or well compacted inorganic earth fill or engineered fill. The subgrade should be inspected and assessed by proof-rolling prior to slab-on-grade construction. Where loose or soft subgrade is detected, it should be subexcavated and replaced with inorganic material, compacted to at least 98% SPDD.

The concrete slab should be constructed on a minimum 15 cm thick granular base, consisting of 19-mm CRL, or equivalent, compacted to its maximum SPDD. Where underfloor weepers are required, the bedding should be increased to 30 cm in thickness. In addition, a vapor barrier should be placed between the granular bedding and the concrete slab to prevent upfiltration of water vapour.

6.4 Underground Services

A Class ‘B’ bedding is recommended for construction of the underground services. The bedding material should consist of compacted 19-mm CRL, or equivalent, compacted to at least 98% SPDD. In the saturated sand and silt deposits, a Class ‘A’ bedding should be considered for proper pipe support.

The subgrade for underground services should consist of sound native soils or properly compacted earth fill. Where soft or loose soil is encountered at the invert level, it must be subexcavated and replaced with properly compacted bedding material.

The pipe joints connecting into manholes and catch basins should be leak-proof or wrapped with an appropriate waterproof membrane to prevent migration of fines due to leakage, leading to a loss of subgrade support and subsequent pipe collapse.

Openings to subdrains and catch basins should be shielded by a fabric filter to prevent silting. In order to prevent pipe floatation when the service trench is deluged with water derived from precipitation, a soil cover of at least the diameter of the pipe should be in place at all times after completion of the pipe installation.

The service pipes and metal fittings should be protected against corrosion. For estimation of anode weight requirements, the electrical resistivities of the disclosed soils presented in Table 4 can be used. The proposed anode weight must meet the minimum requirements as specified by the City of Barrie.

6.5 Backfilling Trenches and Excavated Areas

The on-site inorganic soils are suitable for trench backfill. Any wet soils will require aeration prior to its use as structural backfill. The tills should be sorted free of large cobbles and boulders (over 15 cm in size). The backfill material should be compacted to at least 95% SPDD. In areas below the slab-on-grade and in the zone within 1.0 m below the pavement, the backfill should be compacted to at least 98% SPDD with a moisture content 2% to 3% drier than the optimum. This is to provide the required stiffness for floor or pavement construction. The lift of each backfill layer should be limited to a thickness of 20 cm, or the thickness should be determined by test strips at the time of compaction.

In normal construction practice, the problem areas of pavement settlement largely occur adjacent to foundation walls, columns, manholes, catch basins and services crossings. In areas which are inaccessible to a heavy compactor, sand backfill should be used and properly compacted using a smaller vibratory compactor.

One must be aware of possible consequences during trench backfilling and exercise caution as described below:

- To backfill a deep trench, one must be aware that the future settlement is to be expected, unless the sides is flattened to 1V:2H, and the lifts of the fill and its moisture content are stringently controlled; i.e. lifts should be no more than 20 cm (or less if the backfilling conditions dictate) and uniformly compacted to achieve at least 98% SPDD, with the moisture content on the wet side of the optimum.
- It is often difficult to achieve uniform compaction of the backfill in the lower vertical section of a trench which is an open cut or is stabilized by a trench box, particularly in the sector close to the trench walls or the sides of the box. These sectors must be backfilled with sand and the compaction must be carried out diligently, prior to the placement of the backfill above this sector, i.e., in the upper sloped trench section. This measure is necessary in order to prevent consolidation of inadvertent voids and loose backfill which will compromise the compaction of the backfill in the upper section.
- In areas where the underground services construction is carried out during the winter months, prolonged exposure of the trench walls will result in frost heave within the soil

mantle of the walls. This may result in some settlement as the frost recedes, and repair costs will be incurred prior to the final surfacing of the new pavement and slab-on-grade construction.

- When construction is carried out in the winter, frozen soil layers may inadvertently be mixed with the structural trench backfill. Should the in-situ soil have a water content on the dry side of the optimum, it would be impossible to wet the soil due to the freezing condition, rendering difficulties in obtaining uniform and proper compaction. Furthermore, the freezing condition will prevent flooding of the backfill when it is required, such as when the trench box is removed. The above will invariably cause backfill settlement that may become evident within several years after construction.
- Anti-seepage collars should be provided for underground services installed below the groundwater table or where groundwater movement is expected in the sand fill mantle.

6.6 Pavement Design

The recommended pavement design for residential local and minor collector roads is provided in Table 3.

Table 3 - Pavement Design

Course	Thickness (mm)	OPS Specifications
Asphalt Surface	40	HL3
Asphalt Binder Local Residential Minor Collector Residential	 70 100	HL4 or HL8
Granular Base	150	Granular 'A' or equivalent
Granular Sub-base Local Residential Minor Collector Residential	 450 540	Granular 'B' Type I or equivalent

In preparation of the pavement subgrade, all topsoil and compressible material should be removed. The subgrade should be proof-rolled and inspected. Any soft spots identified must be subexcavated and replaced with inorganic earth fill. The subgrade within 1.0 m below the underside of the granular sub-base should be compacted to at least 98% SPDD, with a water content at 2% to 3% drier than the optimum. All the granular bases should be compacted to 100% SPDD.

The pavement subgrade will suffer a strength regression if water is allowed to infiltrate the mantle. The following measures should be incorporated in the construction procedures and pavement design:

- The pavement subgrade should be properly crowned and smooth-rolled to allow interim precipitation to be properly drained.
- Lot areas adjacent to the road pavement should be properly graded to prevent ponding of large amounts of water during the interim construction period.
- If the pavement is to be constructed during the wet seasons and soft subgrade occurs, the granular sub-base may require thickening. This can be further assessed during construction.
- Fabric filter-encased curb subdrains are required to meet the City of Barrie requirements.

6.7 **Stormwater Management Ponds** (Boreholes 4, 5, DS-MW14 and DS-MW16 by RJB)

Four stormwater management (SWM) ponds are proposed within the subdivision, 2 in the northern region, 1 adjacent to the central NHS and 1 in the southern region. Detailed designs of the ponds were not available for review at the time of report preparation.

Based on the borehole findings, the pond areas are underlain by silty sand till, sand and silt deposits, with the exception at Borehole 5, where a layer of silty clay and silty clay till was encountered in the upper stratigraphy. A review of the water level records suggests that the shallow groundwater regime is generally within 2 to 3 m from the ground surface in the pond areas, with seasonal high readings ranging from a depth of 0.35 to 2.32 mbgs.

In view of the abundance of permeable soils within the pond footprints and the relatively high water levels, an earthen clay liner (with a coefficient of permeability of at least 10^{-7} cm/sec) or a geosynthetic clay liner (GCL) with a soil ballast will be required for the pond construction. The appropriate thickness of the clay liner or ballast can be established once the pond elevations are available for review.

The side slopes of the ponds should be graded at 1V:3H or flatter for stability above the wet perimeter, and 1V:4H or flatter below the wet perimeter. All exposed side slopes must be vegetated and/or sodded to prevent surface erosion.

The design bearing pressures in Section 6.2 can also be used for the design of control structures of the pond. The footings must be placed below the scouring depths and be provided with a minimum earth cover of 1.5 m for the protection against frost damage. The

inlets and outlets of the ponds must be lined with gabion mats, rip rap or equivalent measures for protection against scouring.

For construction of earth embankments, the topsoil and weathered soils must be removed and the subgrade must be proof-rolled prior to berm construction. Inorganic soil consisting of silty clay or silty clay till should be used for berm construction, compacted in 20 cm lifts to 98% SPDD.

The excavation for the liner construction may extend below the groundwater table. During construction of the SWM pond, the groundwater should be depressed, or any seepage must be removed by pumping from sumps to provide a stable subgrade for installation.

One should be aware that minor maintenance may be required after rapid drawdown as the water recedes from a flood level to normal level. Routine visual inspection and maintenance will be required to rectify any observed deficiency. Due to the high groundwater levels during wet seasons, regular scheduled pond maintenance should be carried out during the summer low season only.

6.8 Soil Parameters

The recommended soil parameters for the project design are given in Table 4.

Table 4 - Soil Parameters

Unit Weight and Bulk Factor	**Unit Weight (kN/m^3)**		**Estimated Bulk Factor**	
	Bulk	**Submerged**	**Loose**	**Compacted**
Silty Clay Till	22.0	12.0	1.33	1.03
Silty Clay	20.5	10.5	1.30	1.00
Silty Sand Till/Sandy Silt Till	22.5	12.5	1.33	1.05
Silty Sand and Silts	21.0	11.0	1.20	1.00
Sand	20.0	10.0	1.25	1.00
Lateral Earth Pressure Coefficients		**Active K_a**	**At Rest K_o**	**Passive K_p**
Compacted Earth Fill/Silty Clay		0.40	0.55	2.50
Silty Clay Till		0.33	0.50	3.00
Silty Sand Till/Sandy Silt Till/ Silty Sand and Silts		0.32	0.48	3.12
Sand		0.29	0.46	3.39

Table 4 - Soil Parameters (Cont'd)

Estimated Coefficients of Permeability (K) and Percolation Time (T)	**K (cm/sec)**	**T (min/cm)**
Silty Clay Till/Silty Clay	10^{-7}	80+
Sandy Silt Till/Silty Sand Till	10^{-4} to 10^{-7}	12 to 50
Silty Fine Sand/Sandy Silt/Silt	10^{-3} to 10^{-4}	8 to 12
Sand	10^{-2} to 10^{-3}	4 to 4
Estimated Electrical Resistivity		**(ohm·cm)**
Silty Clay Till/Silty Clay		3000 to 3500
Sandy Silt Till/Silty Sand Till		4500
Silty Fine Sand/Sandy Silt/Silt		4500 to 5000
Sand		6000
Coefficients of Friction		
Between Concrete and Granular Base		0.50
Between Concrete and Native Soils or Compacted Earth Fill		0.35

6.9 Excavation

Excavation should be carried out in accordance with Ontario Regulation 213/91. The types of soils to be excavated are classified in Table 5.

Table 5 - Classification of Soils for Excavation

Material	**Type**
Sound Tills	2
Weathered Soils, Silty Clay, Silts and Sands (above groundwater)	3
Saturated Soils	4

In excavation, the groundwater seepage from the tills will likely be limited in quantity and can be removed by conventional pumping from sumps. However, excavation extending into the saturated soils will require more extensive construction dewatering such as dewatering from closely-spaced sumps or well points. In order to provide a stable subgrade for the services or foundation construction, the groundwater should be depressed to at least 1.0 m below the intended bottom of excavation. Detailed groundwater profile and dewatering needs should be referred to the hydrogeological report.

Prospective contractors should assess the in situ subsurface conditions for soil cuts by digging test pits to at least 0.5 m below the intended bottom of excavation prior to excavating. These test pits may be allowed to remain open for a few hours to assess its stability conditions.

7.0 LIMITATIONS OF REPORT

This report was prepared by Soil Engineers Ltd. for the account of DIV Development (Barrie) Ltd. and for review by its designated consultants, contractors and government agencies. The material in the report reflects the judgement of Hui Wing Yang, P.Eng. and Kin Fung Li, P.Eng., in light of the information available to it at the time of preparation.

Use of the report is subject to the conditions and limitations of the contractual agreement. Any use which a Third Party makes of this report, or any reliance on decisions to be made based on it, are the responsibility of such Third Parties. Soil Engineers Ltd. accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

SOIL ENGINEERS LTD.

Hui Wing Yang, P.Eng.

Kin Fung Li, P.Eng.

HWY/KFL

LIST OF ABBREVIATIONS AND DESCRIPTION OF TERMS

The abbreviations and terms commonly employed on the borehole logs and figures, and in the text of the report, are as follows:

SAMPLE TYPES

AS Auger sample
CS Chunk sample
DO Drive open (split spoon)
DS Denison type sample
FS Foil sample
RC Rock core (with size and percentage recovery)
ST Slotted tube
TO Thin-walled, open
TP Thin-walled, piston
WS Wash sample

PENETRATION RESISTANCE

Dynamic Cone Penetration Resistance:

A continuous profile showing the number of blows for each foot of penetration of a 2-inch diameter, 90° point cone driven by a 140-pound hammer falling 30 inches.

Plotted as '—●—'

Standard Penetration Resistance or 'N' Value:

The number of blows of a 140-pound hammer falling 30 inches required to advance a 2-inch O.D. drive open sampler one foot into undisturbed soil.

Plotted as '○'

WH Sampler advanced by static weight
PH Sampler advanced by hydraulic pressure
PM Sampler advanced by manual pressure
NP No penetration

SOIL DESCRIPTION

Cohesionless Soils:

'N' (blows/ft)	Relative Density
0 to 4	very loose
4 to 10	loose
10 to 30	compact
30 to 50	dense
over 50	very dense

Cohesive Soils:

Undrained Shear Strength (ksf)	'N' (blows/ft)	Consistency
less than 0.25	0 to 2	very soft
0.25 to 0.50	2 to 4	soft
0.50 to 1.0	4 to 8	firm
1.0 to 2.0	8 to 16	stiff
2.0 to 4.0	16 to 32	very stiff
over 4.0	over 32	hard

Method of Determination of Undrained Shear Strength of Cohesive Soils:

x 0.0 Field vane test in borehole; the number denotes the sensitivity to remoulding

△ Laboratory vane test

□ Compression test in laboratory

For a saturated cohesive soil, the undrained shear strength is taken as one half of the undrained compressive strength

METRIC CONVERSION FACTORS

1 ft = 0.3048 metres
1lb = 0.454 kg
1 inch = 25.4 mm
1ksf = 47.88 kPa

JOB NO.: 2211-S092

LOG OF BOREHOLE: 101

FIGURE NO.: 1

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger (Solid-Stem)

PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

DRILLING DATE: December 21, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
265.8	Ground Surface							
0.0	**36 cm TOPSOIL**	1	DO	7	0		13	
	Brown, firm, weathered							
265.0	**SILTY CLAY**							
0.8	with topsoil and sand layers	2	DO	18	1		5	
	Brown, compact to very dense							
	SAND	3	DO	64			9	
					2			
	fine grained, some medium sand a trace to some silt	4	DO	50/15			3	
		5	DO	50/15	3		2	
261.8								
4.0	Brown, very dense				4			
	SILTY FINE SAND	6	DO	50/15			4	
	a trace of clay				5			
260.2								
5.6	Brown, very dense **SAND**							
259.6	fine grained, a trace of silt	7	DO	50/15	6		3	
6.2								
	END OF BOREHOLE				7			
					8			
					9			
					10			
					11			
					12			

WATER LEVEL: Dry on completion

Soil Engineers Ltd.

JOB NO.: 2211-S092

LOG OF BOREHOLE: 102

FIGURE NO.: 2

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger (Solid-Stem)

PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

DRILLING DATE: December 20, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
262.8	Ground Surface							
0.0	**30 cm TOPSOIL**				0			
	Brown, very loose to very dense	1	DO	7			19	
	SAND — weathered	2	DO	3	1		3	
	fine to medium grained a trace of silt	3	DO	42			3	
		4	DO	48	2		4	
		5	DO	60	3		4	
	— trace gravel	6	DO	78	4 5		2	
256.4	— some silt, very moist	7	DO	50/15	6		18	
6.4	**END OF BOREHOLE**				7 8 9 10 11 12			Dry on completion

Soil Engineers Ltd.

JOB NO.: 2211-S092

LOG OF BOREHOLE: 103

FIGURE NO.: 3

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger (Solid-Stem)

PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

DRILLING DATE: December 20, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
262.8	Ground Surface							
0.0	**36 cm TOPSOIL**	1	DO	6	0		9	
	Brown, loose to very dense							
	weathered							
	SAND	2	DO	10	1		5	
	fine to medium grained a trace of silt occ. gravel and silt layers	3	DO	36	2		4	
		4	DO	60			3	
		5	DO	50/15	3		16	
	silt layer				4		2	
		6	DO	50/15	5			
256.2	very moist	7	DO	58	6		13	
6.6	**END OF BOREHOLE**				7			
					8			
					9			
					10			
					11			
					12			

Dry on completion

Soil Engineers Ltd.

JOB NO.: 2211-S092

LOG OF BOREHOLE: 104

FIGURE NO.: 4

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger (Solid-Stem)

PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

DRILLING DATE: December 19, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
261.6	Ground Surface							
0.0	**30 cm TOPSOIL**	1	DO	7	0		17	
	Brown, loose to very dense weathered, with topsoil							
	SAND	2	DO	18	1		7	
	fine to medium grained a trace of silt occ. silt lenses	3	DO	26	2		4	
		4	DO	34			2	
		5	DO	34	3		2	
		6	DO	50/15	5		3	
255.4		7	DO	50/15	6		7	Dry on completion
6.2	**END OF BOREHOLE**				12			

JOB NO.: 2211-S092

LOG OF BOREHOLE: 105

FIGURE NO.: 5

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger (Solid-Stem)

PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

DRILLING DATE: December 19, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
258.1	Ground Surface							
0.0	**41 cm TOPSOIL**	1	DO	4	0		13	
	Brown, very loose to dense, silty, weathered, with topsoil							
	SAND	2	DO	14	1		6	
	fine and fine to medium grained occ. silt lenses	3	DO	26	2		13	
		4	DO	38			4	
	very moist	5	DO	30	3		18	
254.1					4			
4.0	Brown, dense to very dense, very moist							
	SILTY FINE SAND	6	DO	36	5		17	
	a trace of clay				6			
251.5		7	DO	86			17	
6.6	**END OF BOREHOLE**				7			
					8			
					9			
					10			
					11			
					12			

W.L. @ El. 254.4 m on completion
Cave-In @ El. 253.8 m on completion

Soil Engineers Ltd.

JOB NO.: 2211-S092

LOG OF BOREHOLE: 106

FIGURE NO.: 6

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger (Solid-Stem)

PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

DRILLING DATE: December 19, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
261.4 / 0.0	Ground Surface							
	36 cm TOPSOIL	1	DO	8	0		20	
	Brown, loose to compact							
	SAND weathered	2	DO	6	1		7	
	fine to medium grained occ. gravel and silt lenses	3	DO	22	2		2	
		4	DO	24	3		3	
		5	DO	22			4	
257.4 / 4.0	Brown, dense to very dense, very moist to wet				4			
	SILTY FINE SAND/SANDY SILT	6	DO	36	5		20	
	a trace of clay occ. silt layers				6			
254.8 / 6.6	**END OF BOREHOLE**	7	DO	66	7		18	
					8			
					9			
					10			
					11			
					12			

Cave-In @ El. 255.9 m on completion

Soil Engineers Ltd.

JOB NO.: 2211-S092

LOG OF BOREHOLE: 107

FIGURE NO.: 7

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger (Solid-Stem)

PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

DRILLING DATE: December 20, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
260.1	Ground Surface							
0.0	**15 cm TOPSOIL**				0			
	Brown, loose to dense	1	DO	6			14	
	SAND				1		7	
	weathered	2	DO	6				
	fine to medium grained occ. silt lenses	3	DO	36			4	
258.0					2			
2.1	Brown, compact to very dense, very moist to wet							
	silt	4	DO	23			25	
	SILTY FINE SAND	5	DO	60	3		18	
	a trace of clay occ. silt layers				4			
		6	DO	50/15			18	
					5			
					6		20	
253.7		7	DO	50/15				
6.4	**END OF BOREHOLE**				7			
					8			
					9			
					10			
					11			
					12			

W.L. @ El. 255.8 m on completion

Cave-In @ El. 254.9 m on completion

JOB NO.: 2211-S092

LOG OF BOREHOLE: 108

FIGURE NO.: 8

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger (Solid-Stem)

PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

DRILLING DATE: December 21, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
261.7	Ground Surface							
0.0	**36 cm TOPSOIL**	1	DO	6	0		17	
	Brown, very loose							
	SANDY SILT weathered	2	DO	4	1		16	
	occ. silt pockets	3	DO	5	2		21	
259.6								
2.1	Brown, compact to dense							
	FINE SAND	4	DO	28			4	
	some silt, a trace of medium sand	5	DO	36	3		4	
257.7								
4.0	Brown, dense to very dense, very moist to wet				4			
		6	DO	46	5		19	
	SILTY FINE SAND/SANDY SILT							
	a trace of clay occ. silt layers	7	DO	56	6		17	
255.1								
6.6	**END OF BOREHOLE**				7			
					8			
					9			
					10			
					11			
					12			

W.L. @ El. 256.2 m on completion

Soil Engineers Ltd.

JOB NO.: 2211-S092

LOG OF BOREHOLE: 109

FIGURE NO.: 9

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger (Solid-Stem)

PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

DRILLING DATE: December 21, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
260.0	Ground Surface							
0.0	**36 cm TOPSOIL**	1	DO	4	0		15	
	Brown, very loose to dense with organics							
	SAND weathered	2	DO	2	1		11	
	fine to medium grained occ. silt lenses	3	DO	2	2		6	
		4	DO	30			11	
257.1					3			
2.9	Brown, dense to very dense, wet	5	DO	34			19	
	SANDY SILT/SILT				4			
	a trace of clay							
		6	DO	82	5		19	
254.4								
5.6	Brown, very dense, very moist **SILTY FINE SAND** a trace of clay				6		17	
253.6		7	DO	50/15				
6.4	**END OF BOREHOLE**				7			
					8			
					9			
					10			
					11			
					12			

W.L. @ El. 255.1 m on completion
Cave-In @ El. 254.5 m on completion

Soil Engineers Ltd.

JOB NO.: 2211-S092

LOG OF BOREHOLE: 110

FIGURE NO.: 10

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger (Solid-Stem)

PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

DRILLING DATE: December 21, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
260.3	Ground Surface							
0.0	**36 cm TOPSOIL**	1	DO	4	0		12	
	Brown, very loose to very dense							
	weathered	2	DO	14	1		9	
	SILTY SAND TILL/SANDY SILT TILL	3	DO	23	2		10	
	traces of clay and gravel occ. sand and silty seams and layers	4	DO	52	2		7	
		5	DO	66	3		7	
		6	DO	50/15	4 5		8	
		7	DO	50	6		9	
253.7								
6.6	**END OF BOREHOLE**				7 8 9 10 11 12			W.L. @ El. 254.5 m on completion

JOB NO.: 2211-S092

LOG OF BOREHOLE: 111

FIGURE NO.: 11

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger (Solid-Stem)

PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

DRILLING DATE: December 21, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
256.5	Ground Surface							
0.0	**36 cm TOPSOIL**	1	DO	6	0		34	
	Brown/dark-brown, firm, weathered							
255.7	**SILTY CLAY**							
0.8	with roots and topsoil	2	DO	22	1		11	
	Brown, compact							
	SILTY SAND TILL	3	DO	20			9	
	traces of clay and gravel				2			
254.4								
2.1	Brown, compact to dense, wet	4	DO	28			11	
	SAND							
		5	DO	36	3		8	
	fine to coarse grained some gravel							
					4			
		6	DO	48	5		9	
250.9								
5.6	Brown, compact, wet							
	SILTY FINE SAND	7	DO	18	6		19	
249.9								
6.6	**END OF BOREHOLE**				7			
					8			
					9			
					10			
					11			
					12			

W.L. @ El. 255.0 m on completion

Cave-In @ El. 254.1 m on completion

JOB NO.: 2211-S092

LOG OF BOREHOLE: 112

FIGURE NO.: 12

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger (Solid-Stem)

PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

DRILLING DATE: December 20, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m^2) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
259.0	Ground Surface							
0.0	**36 cm TOPSOIL**	1	DO	6	0		18	
	Brown/dark-brown, firm, weathered							
258.2	**SILTY CLAY**							
0.8	with roots and topsoil	2	DO	22	1		8	
	Brown, compact							
	SAND	3	DO	24			9	
	fine grained				2			
	traces of medium sand and silt							
	occ. gravel and silt lenses	4	DO	26			18	
	becoming wet							
256.1								
2.9	Brown, dense to very dense, very moist to wet	5	DO	34	3		21	
	SILTY FINE SAND/SANDY SILT				4			
	a trace of clay	6	DO	64	5		20	
		7	DO	30	6		23	
252.4								
6.6	**END OF BOREHOLE**				7			
					8			
					9			
					10			
					11			
					12			

W.L. @ El. 255.3 m on completion

Cave-In @ El. 254.1 m on completion

Soil Engineers Ltd.

JOB NO.: 2211-S092

LOG OF BOREHOLE: 113

FIGURE NO.: 13

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger (Solid-Stem)

PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

DRILLING DATE: December 21, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
257.8	Ground Surface							
0.0	**36 cm TOPSOIL**	1	DO	6	0		15	
	Brown, loose, weathered							
	SILTY FINE SAND	2	DO	7	1		22	
256.4	occ. silt and clay lenses							
1.4	Brown, stiff							
	SILTY CLAY	3	DO	16	2		29	
255.7	some sand							
2.1	Brown, stiff							
	SILTY CLAY TILL	4	DO	16			12	
	sandy, a trace of gravel							
254.9								
2.9	Brown, dense				3			
	SAND	5	DO	34			14	
	fine to medium grained, some silt							
253.8					4			
2.9	Brown, compact, wet							
	SILTY FINE SAND							
	a trace of clay	6	DO	28	5		24	
252.2								
5.6	Brown, compact, wet							
	SAND				6			
	fine to medium grained	7	DO	28			17	
251.2								
6.6	**END OF BOREHOLE**				7			
					8			
					9			
					10			
					11			
					12			

W.L. @ El. 253.5 m on completion

Cave-In @ El. 252.3 m on completion

Soil Engineers Ltd.

JOB NO.: 2211-S092

LOG OF BOREHOLE: 114

FIGURE NO.: 14

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger (Solid-Stem)

PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

DRILLING DATE: December 20, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
257.6	Ground Surface							
0.0	**36 cm TOPSOIL**	1	DO	6	0		14	
	Brown, loose to dense							
	SAND weathered	2	DO	5	1		8	
	fine to medium grained some silt, a trace of gravel	3A 3B	DO	12	2		4 11	
	occ. clay layers	4	DO	32			14	
	becoming wet	5	DO	30	3		15	
253.6					4			
4.0	Brown, very dense, very moist to wet							
	SILTY FINE SAND	6	DO	64	5		18	▽ W.L. @ El. 252.7 m on completion
	a trace of clay							▽ Cave-In @ El. 252.1 m on completion
		7	DO	50/15	6		19	
249.8		8	DO	50/15	7		15	
7.8	**END OF BOREHOLE**				8			
					9			
					10			
					11			
					12			

JOB NO.: 2211-S092

LOG OF BOREHOLE: 115

FIGURE NO.: 15

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger (Solid-Stem)

PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

DRILLING DATE: December 19, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
257.5	Ground Surface							
0.0	**36 cm TOPSOIL**	1	DO	6	0		10	
	Brown, loose to very dense							
	weathered	2	DO	7	1		8	
	SAND							
		3	DO	6			7	
	fine and fine to to medium grained some silt wet below 3 m				2			
		4	DO	30			4	
					3			
		5	DO	34			21	
					4			
		6	DO	74			18	
					5			
					6			
		7	DO	50/15			18	
250.3								
7.2	Brown, very dense, very moist				7			
	SILTY FINE SAND a trace of clay, occ. silt pockets	8	DO	52			19	
249.4					8			
8.1	**END OF BOREHOLE**							
					9			
					10			
					11			
					12			

W.L. @ El. 253.8 m on completion
Cave-In @ El. 253.2 m on completion

Soil Engineers Ltd.

JOB NO.: 2211-S092

LOG OF BOREHOLE: 116

FIGURE NO.: 16

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger (Solid-Stem)

PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

DRILLING DATE: December 22, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
255.8	Ground Surface							
0.0	**30 cm TOPSOIL**	1	DO	6	0		18	
	Brown, loose to compact							
	SANDY SILT — weathered	2	DO	12	1		15	
	a trace of clay, occ. gravel	3	DO	26			11	
253.7					2			
2.1	Dense to very dense, very moist to wet	4	DO	38			16	
	SAND							
	fine to medium grained occ. gravel and clayey silt layer	5	DO	40	3		16	
					4			
		6	DO	50/15	5		17	
					6			
249.2	— — brown grey	7	DO	54			15	
6.6	**END OF BOREHOLE**				7			
					8			
					9			
					10			
					11			
					12			

W.L. @ El. 253.1 m on completion
Cave-In @ El. 252.1 m on completion

Soil Engineers Ltd.

JOB NO.: 2211-S092

LOG OF BOREHOLE: 117

FIGURE NO.: 17

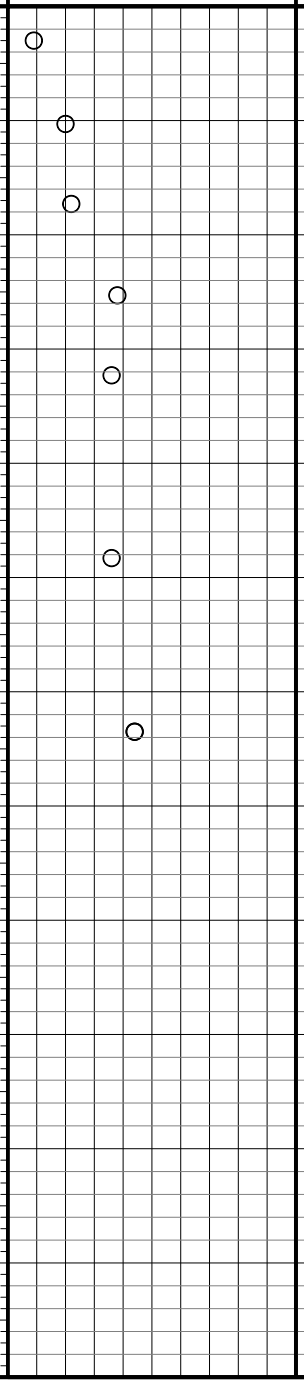
PROJECT DESCRIPTION: Proposed Residential Development

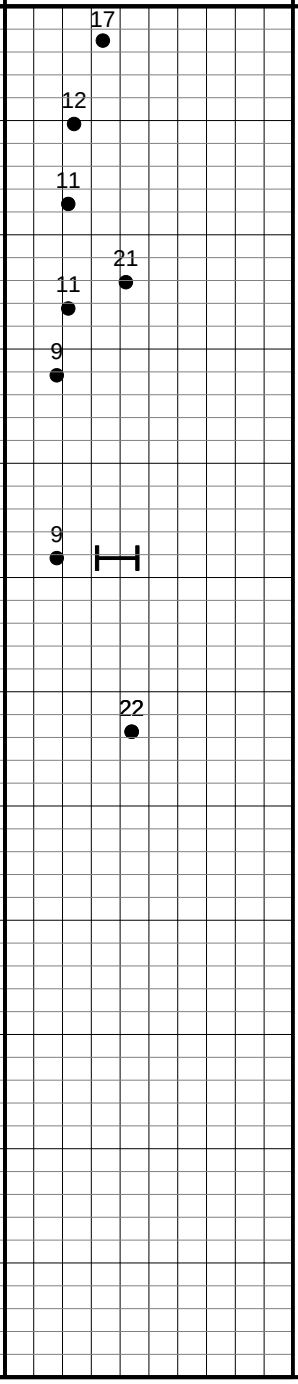
METHOD OF BORING: Flight-Auger (Solid-Stem)

PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

DRILLING DATE: December 22, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
254.4 / 0.0	Ground Surface				
	41 cm TOPSOIL	1	DO	9	0
	Stiff to hard — weathered	2	DO	20	1
	SILTY CLAY TILL	3	DO	22	2
	wet sand layer sandy, a trace of gravel occ. sand and silt seams and layers, cobbles	4A 4B	DO	38	3
	brown grey	5	DO	36	4
248.8 / 5.6	Brown, dense, wet	6	DO	36	5
	SILTY FINE SAND	7	DO	44	6
247.8 / 6.6	**END OF BOREHOLE**				7
					8
					9
					10
					11
					12





WATER LEVEL

W.L. @ El. 251.4 m on completion

Cave-In @ El. 249.5 m on completion

Soil Engineers Ltd.

JOB NO.: 2211-S092

LOG OF BOREHOLE: 118

FIGURE NO.: 18

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger (Solid-Stem)

PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

DRILLING DATE: December 22, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
254.1	Ground Surface							
0.0	**30 cm TOPSOIL**	1	DO	4	0		18	
	Brown, very loose to dense							
	SILTY SAND TILL weathered	2	DO	10	1		8	
	a trace of gravel occ. sand and silt layers	3	DO	14	2		11	
251.4		4	DO	32			15	
2.7	Brown, very dense, very moist to wet				3			
	SAND	5	DO	52			14	
	fine to medium grained a trace of gravel				4			
		6	DO	50/15			12	
					5			
					6			
247.5		7	DO	52			18	
6.6	**END OF BOREHOLE**				7			
					8			
					9			
					10			
					11			
					12			

W.L. @ El. 251.1 m on completion
Cave-In @ El. 250.1 m on completion

Soil Engineers Ltd.

JOB NO.: 2211-S092

LOG OF BOREHOLE: 119

FIGURE NO.: 19

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger (Solid-Stem)

PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

DRILLING DATE: December 20, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
255.3	Ground Surface							
0.0	**36 cm TOPSOIL**	1	DO	9	0		16	
	Brown, loose to very dense, wet							
	weathered	2	DO	10	1		25	
	SILTY FINE SAND/SANDY SILT	3	DO	24	2		21	
	a trace of clay with sand and silt layers	4	DO	24			18	
		5	DO	35	3		21	
		6	DO	56	4		19	
		7	DO	86	5		18	
248.7					6			
6.6	**END OF BOREHOLE**				7			
					8			
					9			
					10			
					11			
					12			

W.L. @ El. 253.2 m on completion
Cave-In @ El. 252.3 m on completion

Soil Engineers Ltd.

JOB NO.: 2211-S092

LOG OF BOREHOLE: 120

FIGURE NO.: 20

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger (Solid-Stem)

PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

DRILLING DATE: January 2,2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
252.9	Ground Surface							
0.0	**36 cm TOPSOIL**	1	DO	5	0		20	
	Brown/dark-brown, firm, weathered							
252.1	**SILTY CLAY**							
0.8	with roots							
	Brown, compact to very dense	2	DO	22	1		10	
		3	DO	32	2		10	
	SANDY SILT TILL							
		4	DO	86	3		9	
	traces of clay and gravel occ. sand seams and layers	5	DO	90	4		9	
248.9								
4.0	Brown, dense to very dense							
	SILTY SAND TILL	6	DO	48	5		9	
	traces of clay and gravel occ. sand layers							
		7	DO	50/15	6		10	
	wet	8	DO	50/15	7		17	
		9	DO	50/15	8		5	
					9			
242.1		10	DO	50/8	10		9	
10.8	**END OF BOREHOLE**				11			
					12			

W.L. @ El. 249.9 m on completion

Soil Engineers Ltd.

JOB NO.: 2211-S092

LOG OF BOREHOLE: 121

FIGURE NO.: 21

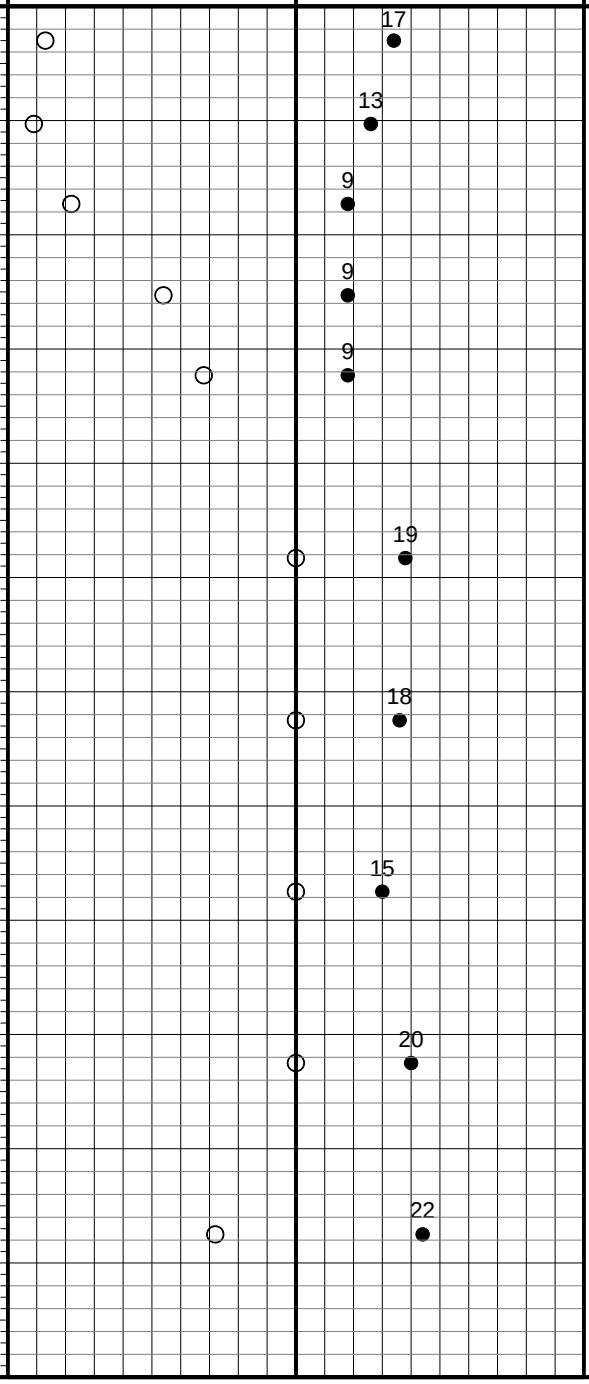
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger (Solid-Stem)

PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

DRILLING DATE: January 2,2023

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
253.2	Ground Surface				
0.0	**36 cm TOPSOIL**	1	DO	13	0
	Brown, stiff, weathered				
	SILTY CLAY TILL	2	DO	9	1
251.8	sandy, a trace of gravel				
1.4	Brown, compact to very dense	3	DO	22	2
	SILTY SAND TILL	4	DO	54	
	a trace to some gravel occ. sand and silt seams and layers	5	DO	68	3
249.2					4
4.0	Brown, very dense, very moist to wet				
	SILTY FINE SAND	6	DO	50/15	5
	a trace of clay occ. silt and clay lenses	7	DO	50/15	6
		8	DO	50/15	7
		9	DO	50/15	8
		10	DO	72	9
242.1					10
11.1	**END OF BOREHOLE**				11
					12



WATER LEVEL

W.L. @ El. 249.5 m on completion

Soil Engineers Ltd.

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

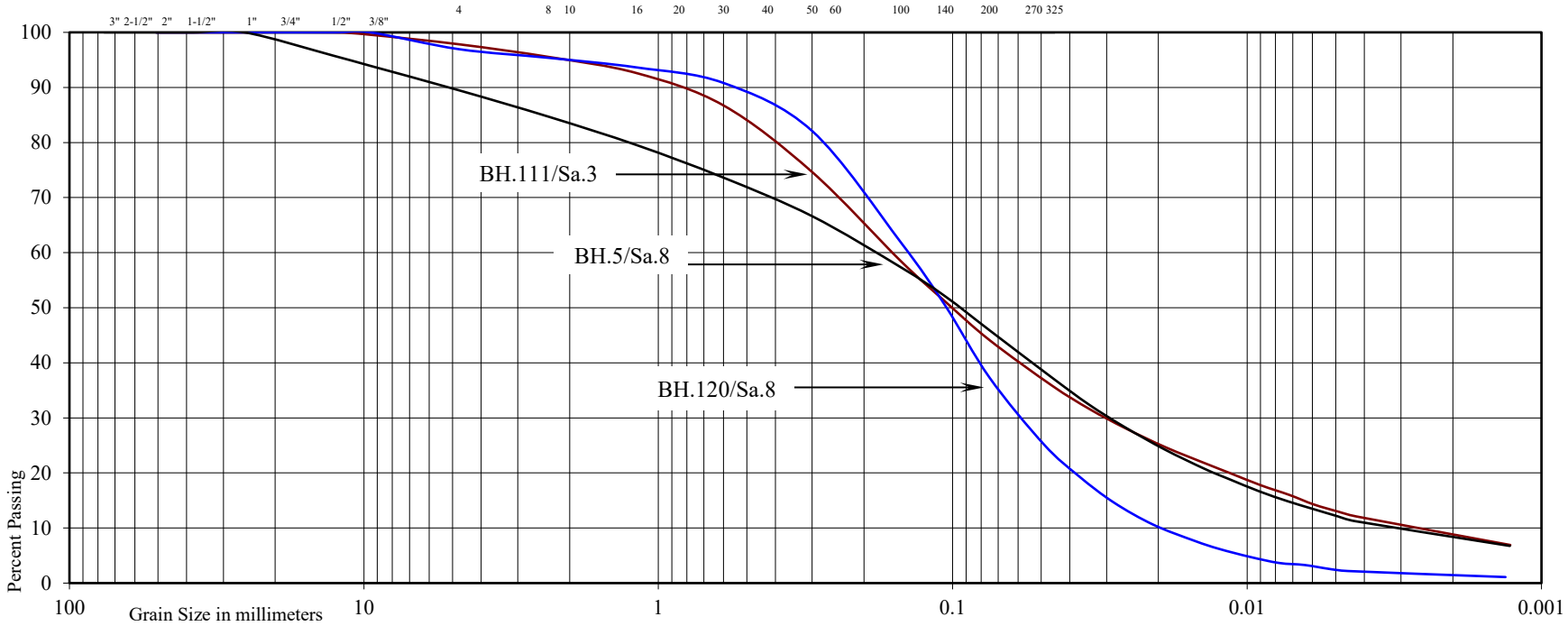
Reference Nos.: 2211-S092

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residental Development

Location: West of 20th Sideroad, between Lockhart Road anf Mapleview Drive East, City of Barrie

Borehole No:	5	111	120
Sample No:	8	3	8
Depth (m):	7.8	1.7	7.8
Elevation (m):	243.7	254.8	245.1

BH./Sa.	5/8	111/3	120/8
Liquid Limit (%) =	-	-	-
Plastic Limit (%) =	-	-	-
Plasticity Index (%) =	-	-	-
Moisture Content (%) =	7	9	17
Estimated Permeability (cm./sec.) =	10^{-5}	10^{-5}	10^{-4}

Classification of Sample [& Group Symbol]: SILTY SAND TILL, a trace to some gravel, a trace of clay

Figure: 22

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

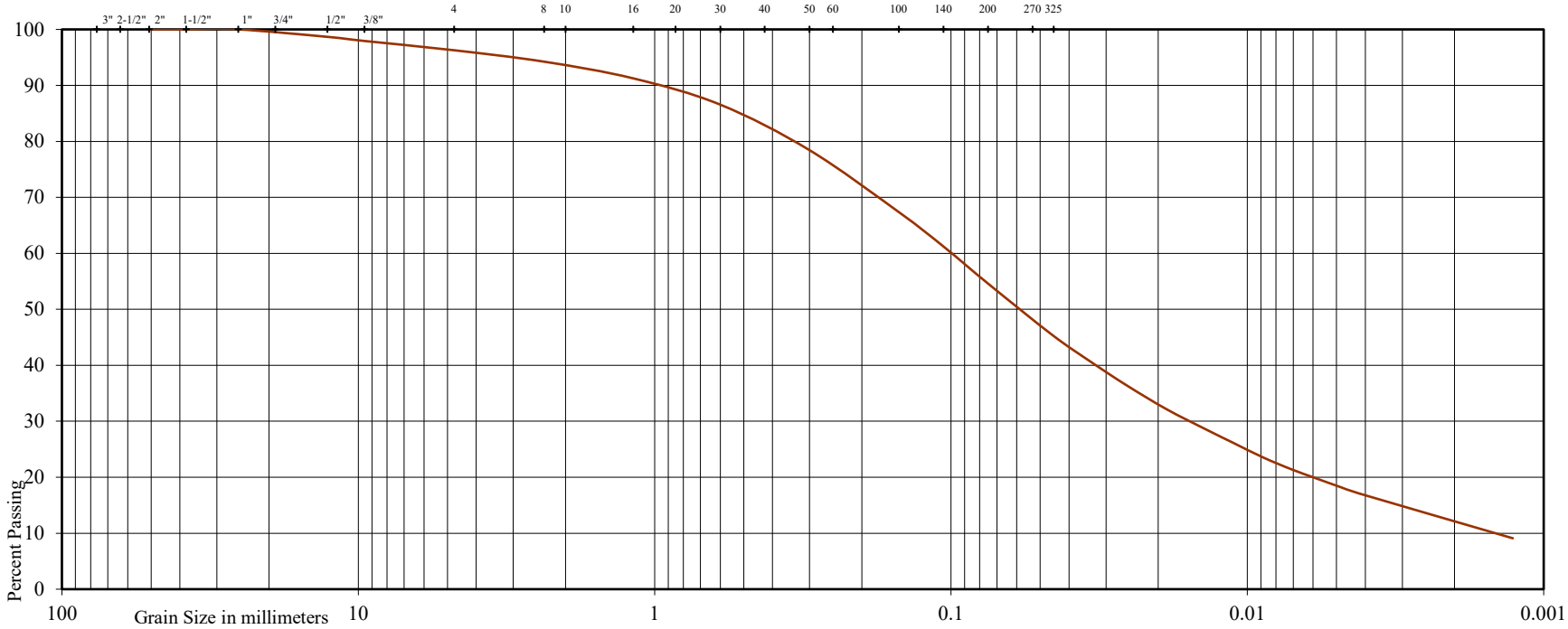
Reference No: 2211-S092

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residential Development

Location: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

Borehole No: 7

Sample No: 10

Depth (m): 7.8

Elevation (m): 246.0

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = 7

Estimated Permeability (cm./sec.) = 10^{-7}

Classification of Sample [& Group Symbol]: SANDY SILT TILL, some clay, a trace of gravel

Figure: 23

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

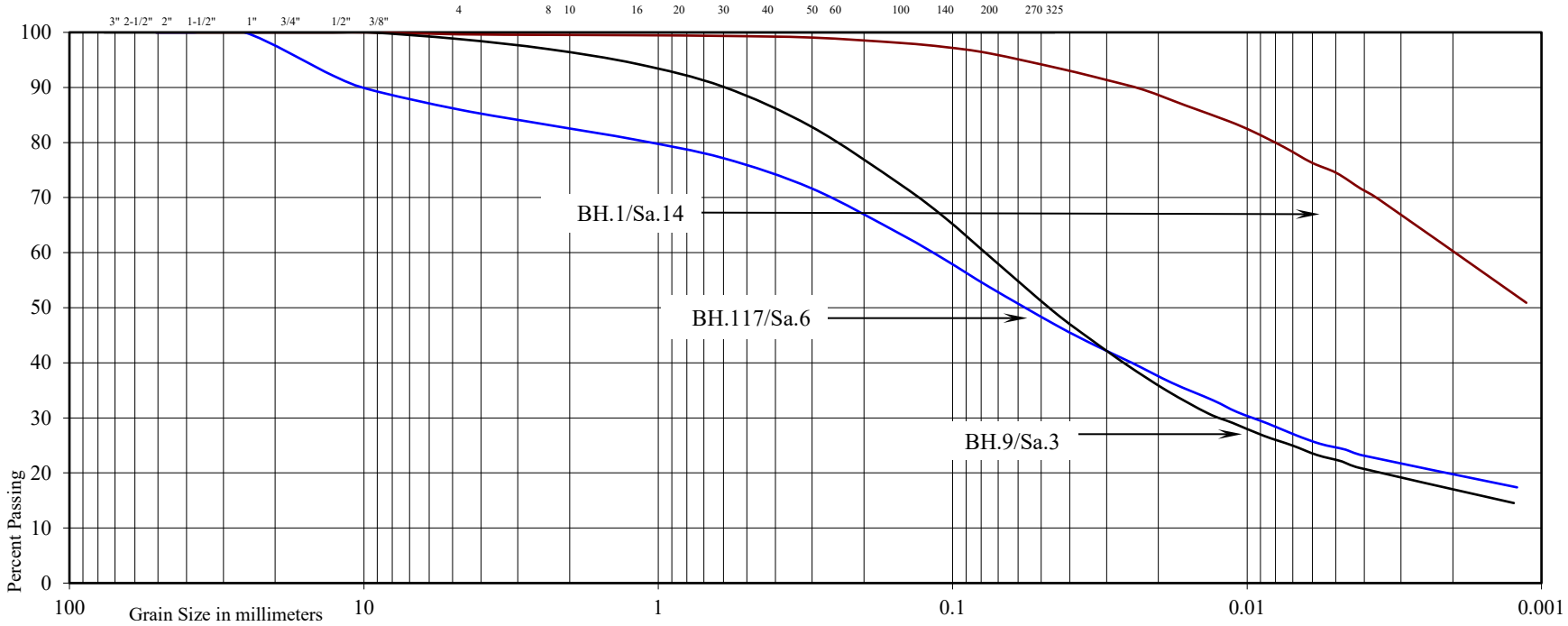
Reference No.: 2211-S092

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residental Development

Location: West of 20th Sideroad, between Lockhart Road anf Mapleview Drive East, City of Barrie

Borehole No:	1	9	117
Sample No:	14	3	6
Depth (m):	13.9	1.8	4.8
Elevation (m):	242.5	251.9	249.6

BH./Sa.	1/14	9/3	117/6
Liquid Limit (%) =	48	25	23
Plastic Limit (%) =	24	16	16
Plasticity Index (%) =	24	9	7
Moisture Content (%) =	23	10	9
Estimated Permeability (cm./sec.) =	10^{-7}	10^{-7}	10^{-7}

Classification of Sample [& Group Symbol]: BH.9/Sa.3 & BH.117/Sa.6 - SILTY CLAY TILL, sandy, a trace to some gravel

BH.1/Sa.14 - SILTY CLAY, a trace of fine sand

Figure: 24

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

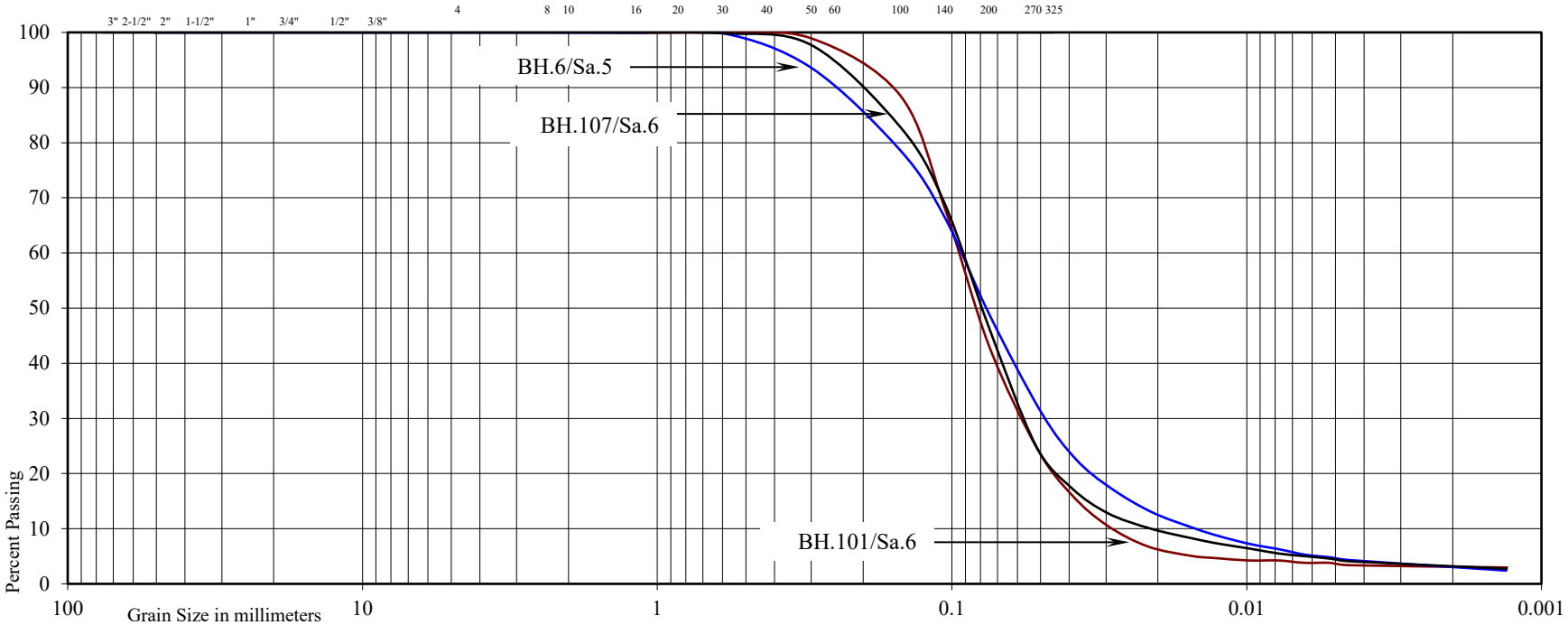
Reference No.: 2211-S092

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residental Development

Location: West of 20th Sideroad, between Lockhart Road anf Mapleview Drive East, City of Barrie

Borehole No:	6	101	107
Sample No:	5	6	6
Depth (m):	3.3	4.8	4.8
Elevation (m):	252.4	261.0	255.3

BH./Sa.	6/5	101/6	107/6
Liquid Limit (%) =	-	-	-
Plastic Limit (%) =	-	-	-
Plasticity Index (%) =	-	-	-
Moisture Content (%) =	6	4	18
Estimated Permeability (cm./sec.) =	10^{-4}	10^{-3}	10^{-3}

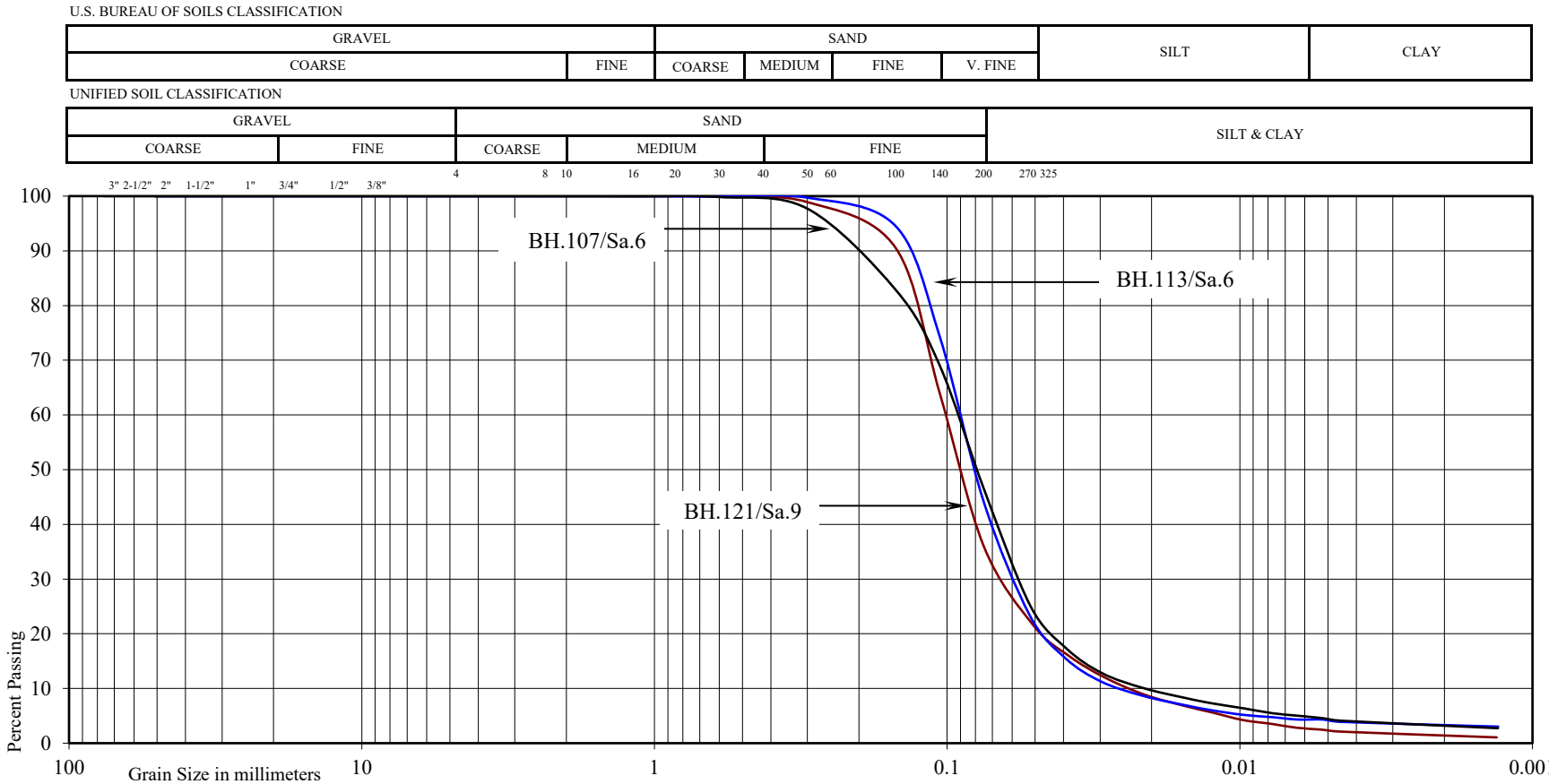
Classification of Sample [& Group Symbol]: SILTY FINE SAND, a trace of clay

Figure: 25

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No.: 2211-S092



Project: Proposed Residental Development

Location: West of 20th Sideroad, between Lockhart Road anf Mapleview Drive East, City of Barrie

Borehole No:	109	113	121
Sample No:	7	6	9
Depth (m):	6.2	4.8	9.3
Elevation (m):	253.8	253.0	243.9

BH./Sa.	109/7	113/6	121/9
Liquid Limit (%) =	-	-	-
Plastic Limit (%) =	-	-	-
Plasticity Index (%) =	-	-	-
Moisture Content (%) =	17	24	20
Estimated Permeability (cm./sec.) =	10^{-4}	10^{-3}	10^{-3}

Classification of Sample [& Group Symbol]: SILTY FINE SAND, a trace of clay

Figure: 26

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

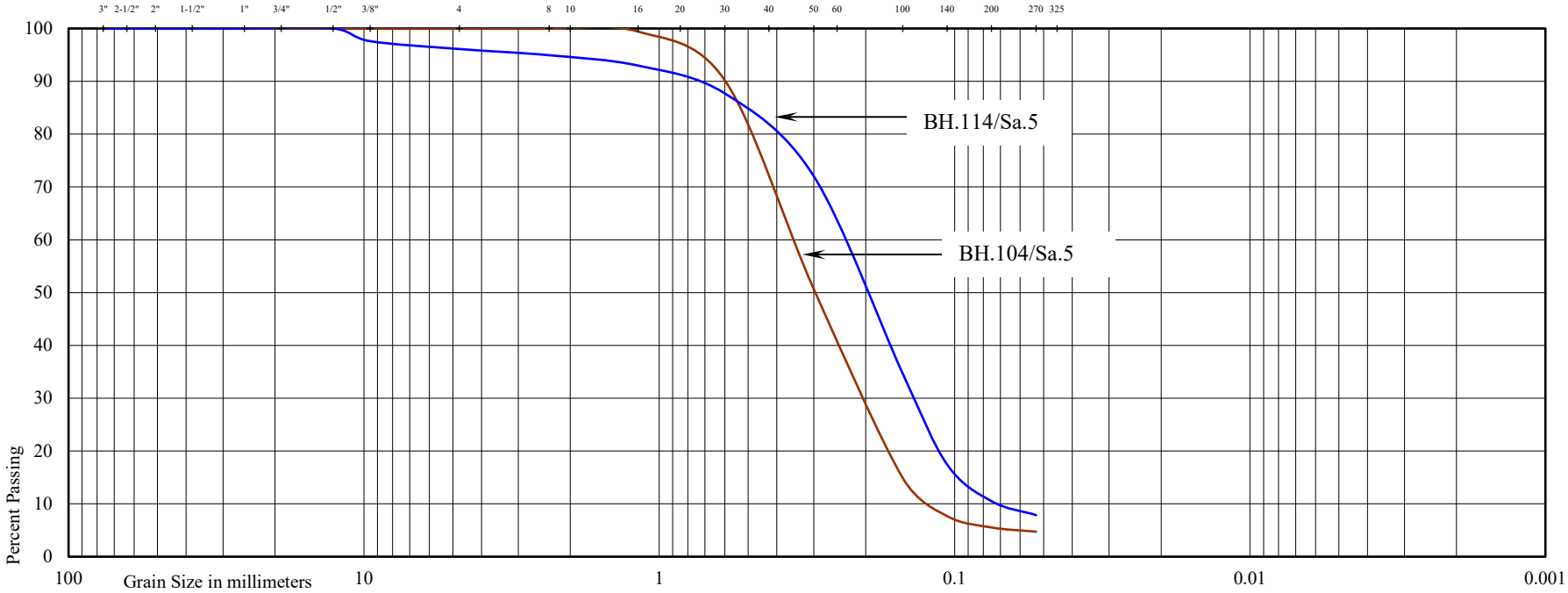
Reference No.: 2211-S092

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residental Development

Location: West of 20th Sideroad, between Lockhart Road anf Mapleview Drive East, City of Barrie

Borehole No:	104	114
Sample No:	5	5
Depth (m):	3.2	3.2
Elevation (m):	258.4	254.4

BH./Sa.	104/5	114/5
Liquid Limit (%) =	-	-
Plastic Limit (%) =	-	-
Plasticity Index (%) =	-	-
Moisture Content (%) =	2	15
Estimated Permeability (cm./sec.) =	10^{-2}	10^{-2}

Classification of Sample [& Group Symbol]: FINE TO MEDIUM SAND, a trace of silt

Figure: 28

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

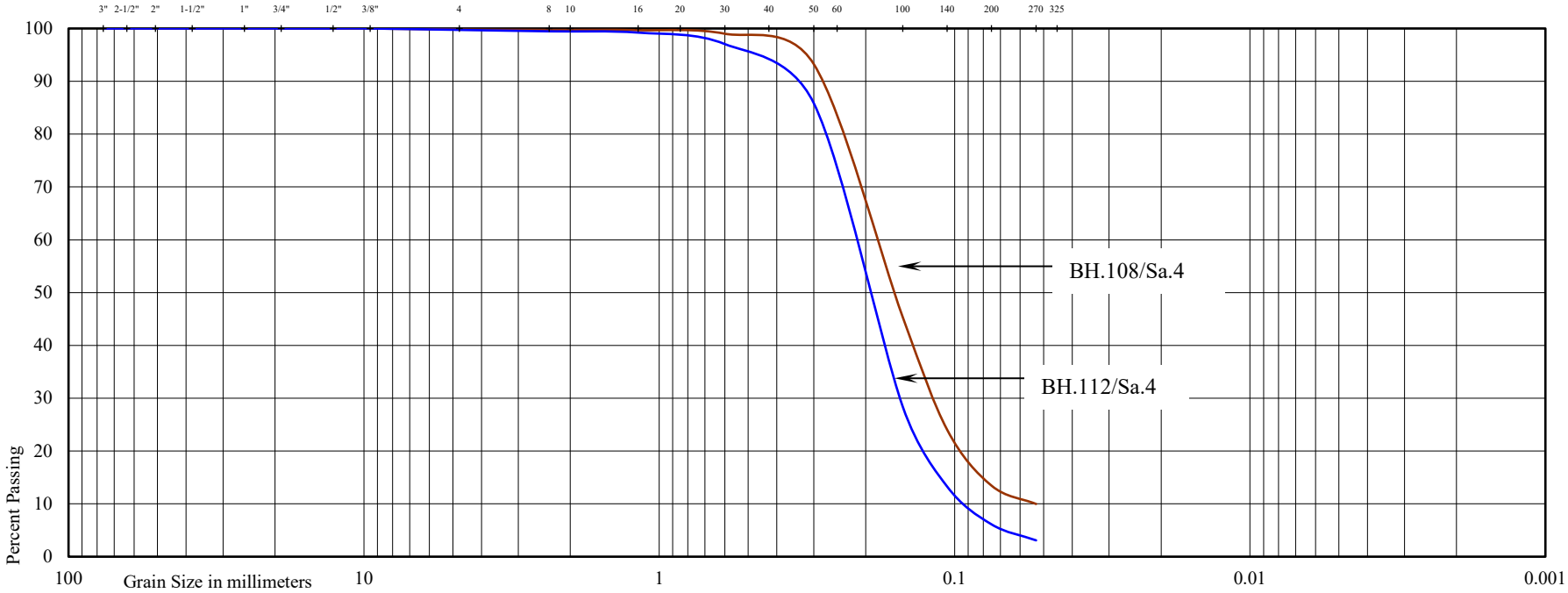
Reference No.: 2211-S092

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Proposed Residental Development

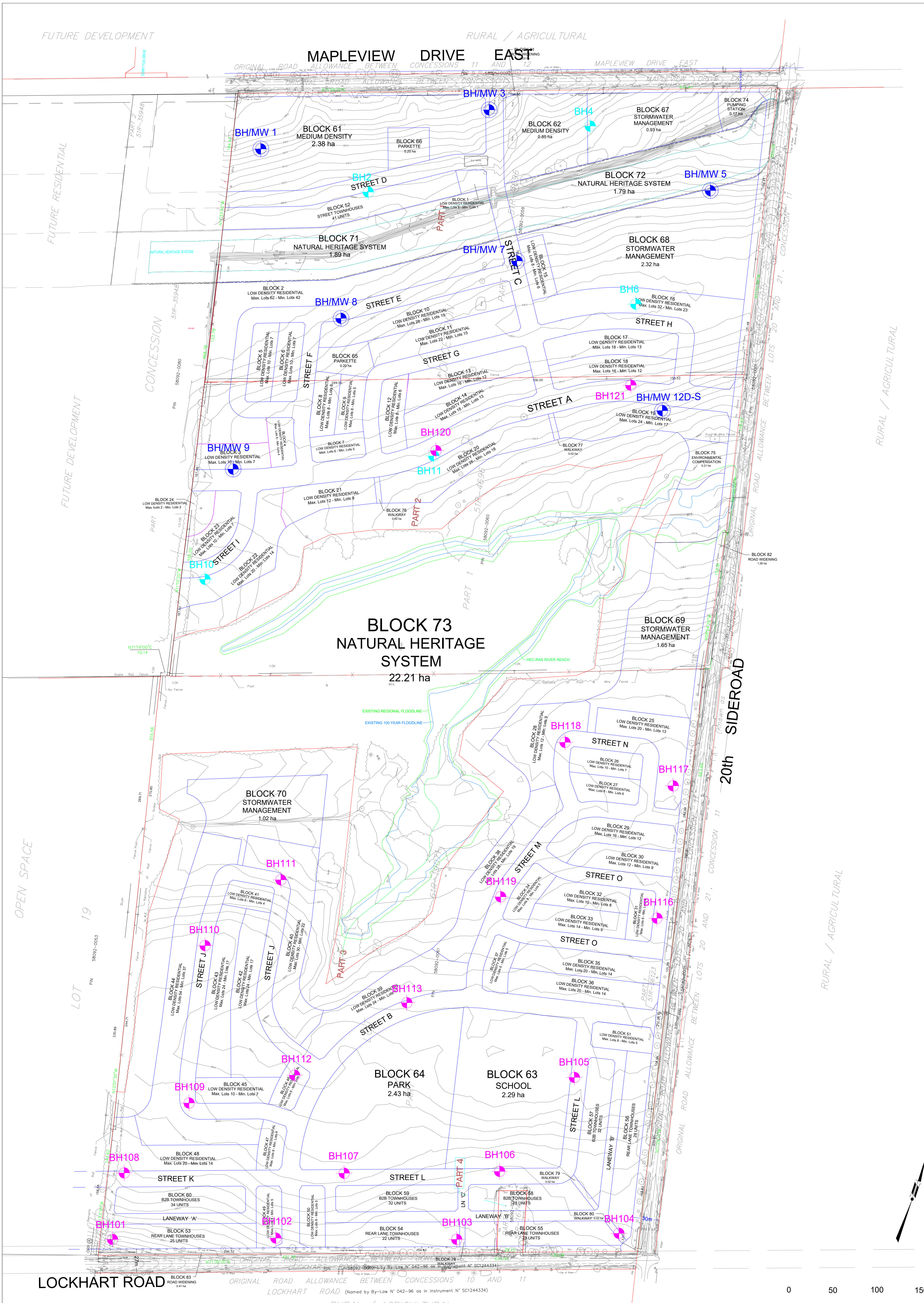
Location: West of 20th Sideroad, between Lockhart Road anf Mapleview Drive East, City of Barrie

Borehole No:	108	112
Sample No:	4	4
Depth (m):	2.5	2.5
Elevation (m):	259.2	256.5

BH./Sa.	108/4	112/4
Liquid Limit (%) =	-	-
Plastic Limit (%) =	-	-
Plasticity Index (%) =	-	-
Moisture Content (%) =	4	18
Estimated Permeability (cm./sec.) =	10^{-3}	10^{-2}

Classification of Sample [& Group Symbol]: FINE SAND, a trace to some silt, a trace of medium sand

Figure: 29



LEGEND

- 2211-S092 Borehole (2023)
- 1610-S116 Borehole (2017)
- 1610-S116 Monitoring Well (2017)

Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL | ENVIRONMENTAL | HYDROGEOLOGICAL | BUILDING SCIENCE
90 WEST BEAVER CREEK ROAD, SUITE #100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

BOREHOLE LOCATION PLAN

SITE: WEST OF 20TH SIDEROAD, BETWEEN LOCKHART ROAD AND MAPLEVIEW DRIVE EAST, CITY OF BARRIE

DESIGNED BY:	**CHECKED BY:**	**DWG NO.:** 1	
SCALE: 1:4000	**REF. NO.:** 2211-S092	**DATE:** AUGUST 2023	**REV** -

Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL | ENVIRONMENTAL | HYDROGEOLOGICAL | BUILDING SCIENCE

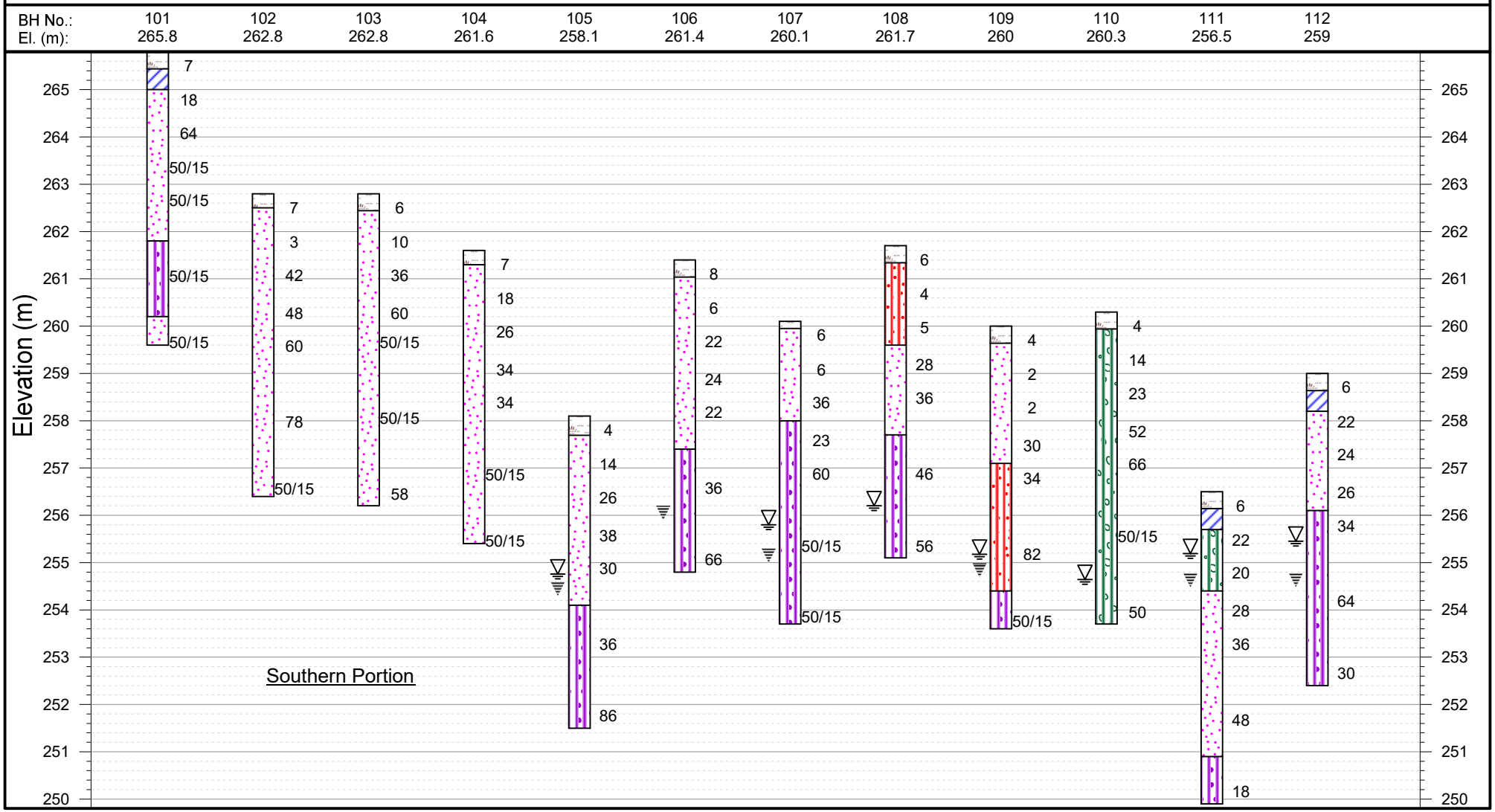
SUBSURFACE PROFILE
DRAWING NO. 2
SCALE: AS SHOWN

JOB NO.: 2211-S092
REPORT DATE: August 2023
PROJECT DESCRIPTION: Proposed Residential Development
PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

LEGEND

SAND | SILTY CLAY | SILTY SAND/SANDY SILT TILL | TOPSOIL
SANDY SILT | SILTY SAND

CAVE-IN | WATER LEVEL (END OF DRILLING)



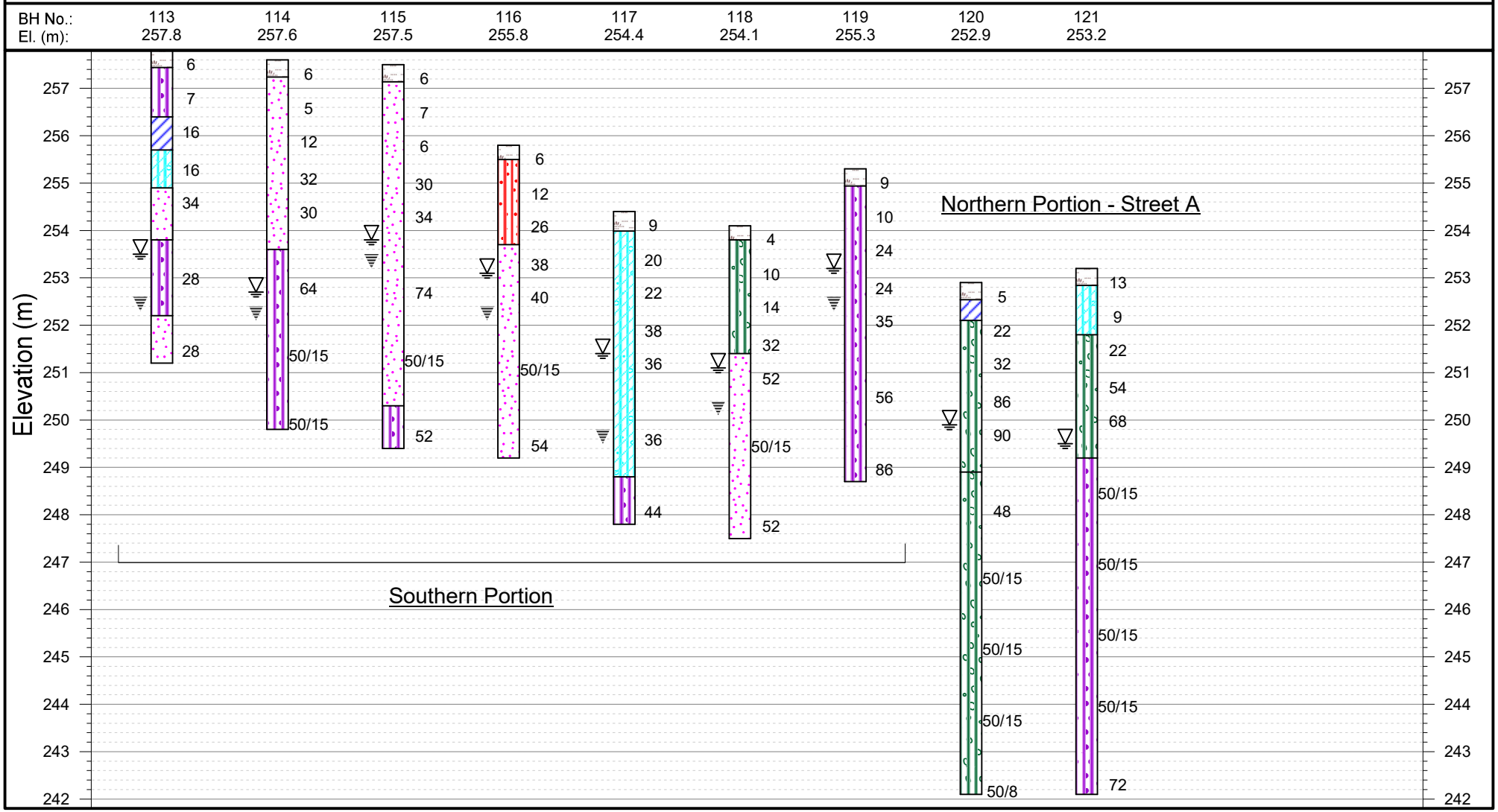
Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL | ENVIRONMENTAL | HYDROGEOLOGICAL | BUILDING SCIENCE

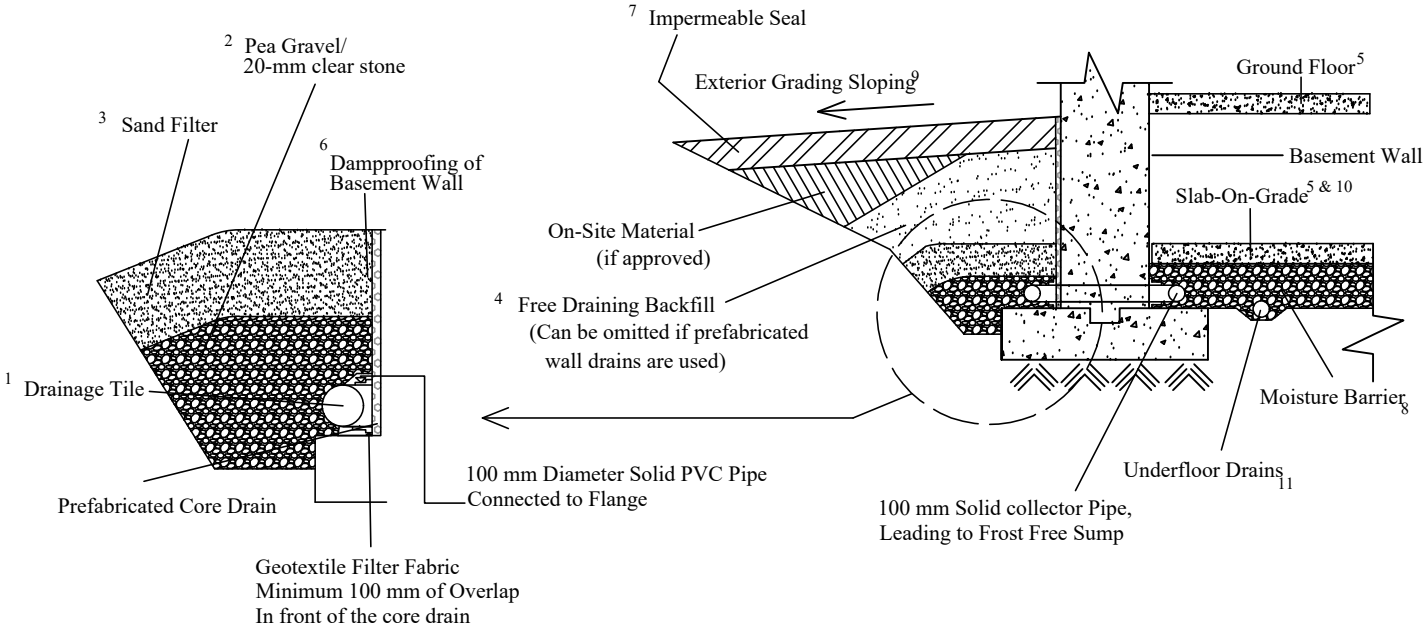
SUBSURFACE PROFILE
DRAWING NO. 3
SCALE: AS SHOWN

JOB NO.: 2211-S092
REPORT DATE: August 2023
PROJECT DESCRIPTION: Proposed Residential Development
PROJECT LOCATION: West of 20th Sideroad, between Lockhart Road and Mapleview Drive East, City of Barrie

LEGEND

SAND | SILTY CLAY | SILTY SAND | TOPSOIL
SANDY SILT | SILTY CLAY TILL | SILTY SAND/SANDY SILT TILL
CAVE-IN | WATER LEVEL (END OF DRILLING)





NOTES:

1. **Drainage tile**: consists of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet. Invert to be at minimum of 150 mm (6") below underside of basement floor slab.

2. **Pea gravel**: at 150 mm (6") on the top and sides of drain. If drain is not placed on concrete footing, provide 100 mm (4") of pea gravel below drain. The pea gravel may be replaced by 19-mm clear stone provided that the drain is covered by a porous geotextile membrane of Terrafix 270R or equivalent.

3. **Filter material**: consists of C.S.A. fine concrete aggregate. A minimum of 300 mm (12") on the top and sides of gravel. This may be replaced by an approved porous geotextile membrane of Terrafix 270R or equivalent.

4. **Free-draining backfill**: OPSS Granular 'B' or equivalent, compacted to 95% to 98% (maximum) Standard Proctor dry density. Do not compact closer than 1.8 m (6') from wall with heavy equipment. This may be replaced by on-site material if prefabricated wall drains (Miradrain) extending from the finished grade to the bottom of the basement wall are used.

5. **Do not backfill** until the wall is supported by the basement floor slab and ground floor framing, or adequate bracing.

6. **Dampproofing** of the basement wall is required before backfilling

7. **Impermeable backfill seal** of compacted clay, clayey silt or equivalent. If the original soil in the vicinity is a free-draining sand, the seal may be omitted.

8. **Moisture barrier**: 19-mm CRL or compacted OPSS Granular 'A', or equivalent. The thickness of this layer should be 150 mm (6") minimum.

9. **Exterior Grade**: slope away from basement wall on all the sides of the building.

10. **Slab-On-Grade** should not be structurally connected to walls or foundations.

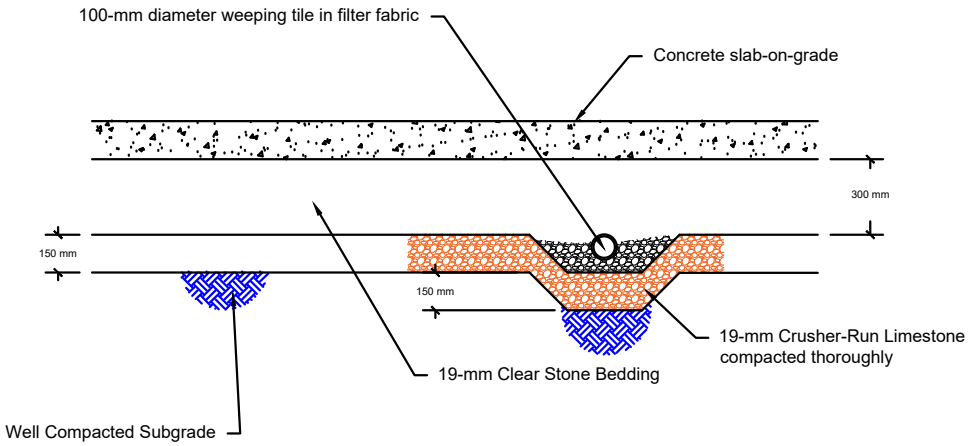
11. **Underfloor drains*** should be placed in parallel rows at 6 to 8 m (20'-25') centre, on 100 mm (4") of pea gravel with 150 mm (6") of pea gravel on top and sides. The spacing should be at least 300 mm (12") between the underside of the floor slab and the top of the pipe. The drains should be connected to positive sumps or outlets. Do not connect the underfloor drains to the perimeter drains.

* Underfloor drains can be deleted where not required.

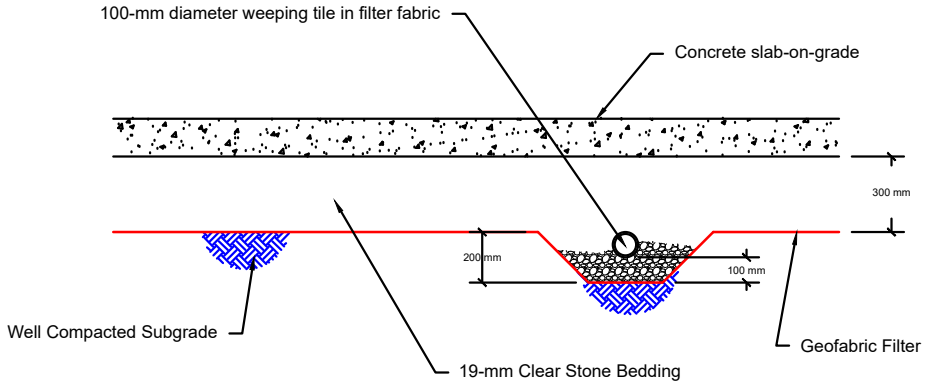
Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL | ENVIRONMENTAL | HYDROGEOLOGICAL | BUILDING SCIENCE
90 WEST BEAVER CREEK ROAD, SUITE #100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

PERMANENT PERIMETER DRAINAGE SYSTEM
(FOR OPEN EXCAVATION)

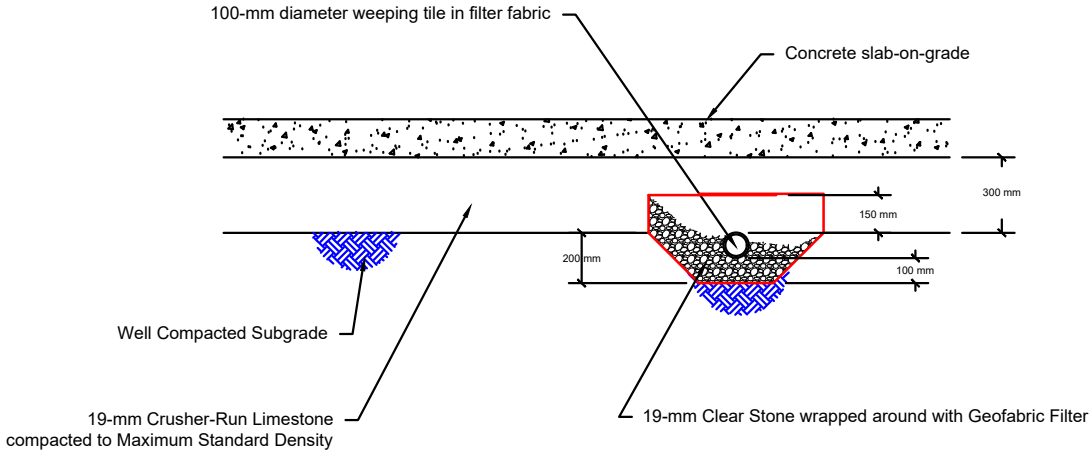
SITE: WEST OF 20TH SIDEROAD, BETWEEN LOCKHART ROAD AND MAPLEVIEW DRIVE EAST, CITY OF BARRIE			
DESIGNED BY: K.L.	**CHECKED BY:** B.S.	**DWG NO.:** 4	
SCALE: N.T.S.	**REF. NO.:** 2211-S092	**DATE:** AUGUST 2023	**REV** -



Option 'A'



Option 'B'



Option 'C'

Note:

1. Weepers should be placed in 6 m grids, draining in a positive gradient towards an outlet or a sump pit for removal by pumping.
2. A 10-mil polyethylene sheet should be specified between the gravel bedding and concrete slab.

Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL | ENVIRONMENTAL | HYDROGEOLOGICAL | BUILDING SCIENCE
90 WEST BEAVER CREEK ROAD, SUITE #100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

DETAILS OF UNDERFLOOR WEEPERS

SITE: WEST OF 20TH SIDEROAD, BETWEEN LOCKHART ROAD AND MAPLEVIEW DRIVE EAST, CITY OF BARRIE			
DESIGNED BY: K.L.	**CHECKED BY:** B.S.	**DWG NO.:** 5	
SCALE: N.T.S.	**REF. NO.:** 2211-S092	**DATE:** AUGUST 2023	**REV** -

Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE
90 WEST BEAVER CREEK ROAD, SUITE 100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

BARRIE	MISSISSAUGA	OSHAWA	NEWMARKET	MUSKOKA	HAMILTON
TEL: (705) 721-7863	TEL: (905) 542-7605	TEL: (905) 440-2040	TEL: (905) 853-0647	TEL: (705) 684-4242	TEL: (905) 777-7956
FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 542-2769

APPENDIX A

BOREHOLE LOGS AND SUBSURFACE PROFILE

REFERENCE NO. 1610-S110

JOB NO.: 1610-S116

LOG OF BOREHOLE NO.: 1

FIGURE NO.: 1

PROJECT DESCRIPTION: Proposed Residential Subdivision

METHOD OF BORING: Flight-Auger (Hollow Stem)

PROJECT LOCATION: Southwest Corner of Mapleview Drive East and 20th Sideroad City of Barrie

DRILLING DATE: November 14, 2016

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
256.4	Ground Surface							
0.0	**25 cm TOPSOIL**	1	DO	5	0		8	
	Brown, loose, weathered **SILTY SAND TILL** a trace to some clay a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders	2	DO	10	1		11	
254.9								
1.5	Brown, dense	3	DO	38	2		12	
	SILTY FINE SAND	4	DO	45			16	
	a trace of clay	5	DO	42	3		16	
		6	DO	50	4		18	
251.8								
4.6	Brown, very dense **SAND** fine to medium grained a trace to some silt	7	DO	53	5		18	
251.1								
5.3	Brown, dense to very dense	8	DO	45	6		18	
	SILTY FINE SAND clay layers	9	DO	51			20	
	a trace of clay				7			
		10	DO	50/15	8		17	
		11	DO	75	9		20	
245.7					10			
10.7		12	DO	52	11		17	
245.4								

W.L. @ El. 254.4 m on November 18, 2016

Soil Engineers Ltd.

JOB NO.: 1610-S116

LOG OF BOREHOLE NO.: 1

FIGURE NO.: 1

PROJECT DESCRIPTION: Proposed Residential Subdivision

METHOD OF BORING: Flight-Auger (Hollow Stem)

PROJECT LOCATION: Southwest Corner of Mapleview Drive East and 20th Sideroad City of Barrie

DRILLING DATE: November 14, 2016

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
11.0	Brown, very dense			
	SAND			
	fine to medium grained			
244.2	a trace to some silt			
12.2	Grey, very dense	13	DO	56
	SANDY SILT			
	a trace of clay			
242.7				
13.7	Grey, hard	14	DO	45
	SILTY CLAY			
	a trace of fine sand			
	occ. wet sand and silt seams and layers	15	DO	33
239.6				
16.8	Grey, dense	16	DO	41
239.2	**SILTY FINE SAND**			
17.2	a trace of clay			
	END OF BOREHOLE			
	Installed 50 mm Ø PVC monitoring well to 17.1 m (3.0 m screen)			
	Sand backfill from 13.4 to 17.1 m			
	Bentonite holeplug from 0.0 to 13.4 m			
	Provided with a 4x4 steel monument casing with top and bottom caps, and lock			

Depth Scale (m): 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22

Dynamic Cone (blows/30 cm) 10 30 50 70 90

Shear Strength (kN/m²) 50 100 150 200

Penetration Resistance (blows/30 cm) 10 30 50 70 90

Atterberg Limits PL LL

Moisture Content (%) 10 20 30 40

Moisture Content values: 20, 23, 29, 19

WATER LEVEL

JOB NO.: 1610-S116

LOG OF BOREHOLE NO.: 2

FIGURE NO.: 2

PROJECT DESCRIPTION: Proposed Residential Subdivision

METHOD OF BORING: Flight-Auger (Solid Stem)

PROJECT LOCATION: Southwest Corner of Mapleview Drive East and 20th Sideroad City of Barrie

DRILLING DATE: November 15, 2016

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
252.2	Ground Surface							
0.0	**33 cm TOPSOIL**	1A	DO	6	0		13	
	Brown, soft to firm, weathered **SILTY CLAY TILL** sandy, a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders — sand layer	1B						
		2	DO	4	1		16	
250.7								
1.5	Brown, very loose, weathered **SILTY SAND TILL** some clay, a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders — clay layer	3	DO	4	2		13	
249.9								
2.3	Brown, compact to very dense	4	DO	11			11	
	SANDY SILT TILL	5	DO	25	3		10	
	a trace to some clay a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders	6	DO	50/15	4		9	
246.1					5			
6.1	Brown, compact **SANDY SILT** a trace of clay	7	DO	13	6		28	
245.5								
6.7	**END OF BOREHOLE**				7			
					8			
					9			
					10			
					11			

Cave-in @ El. 251.0 m on completion

Soil Engineers Ltd.

JOB NO.: 1610-S116

LOG OF BOREHOLE NO.: 3

FIGURE NO.: 3

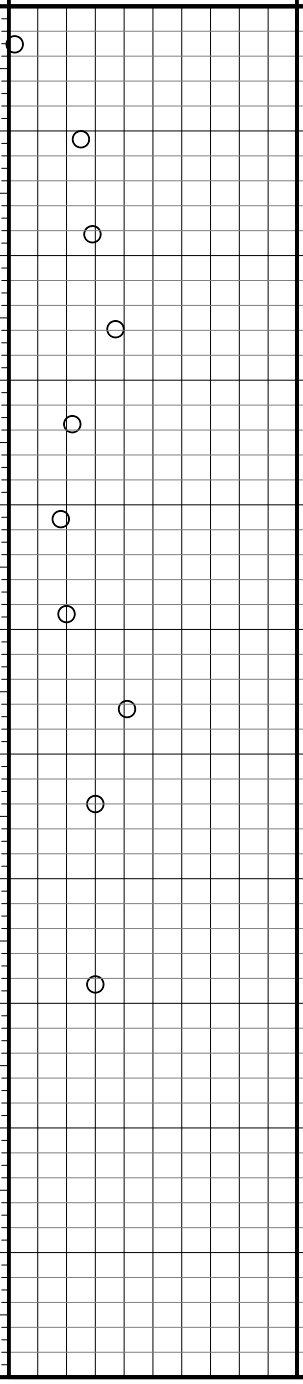
PROJECT DESCRIPTION: Proposed Residential Subdivision

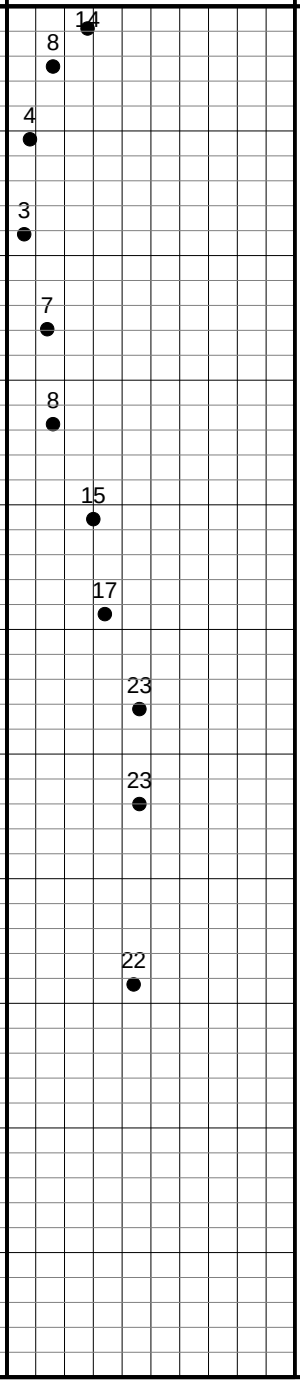
METHOD OF BORING: Flight-Auger (Hollow Stem)

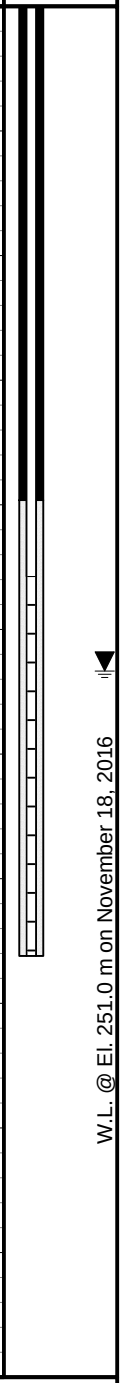
PROJECT LOCATION: Southwest Corner of Mapleview Drive East and 20th Sideroad, City of Barrie

DRILLING DATE: November 11, 2016

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
256.3 / 0.0	Ground Surface				
0.0	**36 cm TOPSOIL**	1A	DO	2	0
	Brown, very loose, weathered **SILTY FINE SAND** a trace of clay with organic inclusions	1B			
255.5 / 0.8	Brown, compact	2	DO	25	1
254.8 / 1.5	**SILTY SAND TILL** traces of clay and gravel occ. wet sand and silt seams and layers, cobbles and boulders	3	DO	29	2
254.0 / 2.3	Brown, compact **SAND** fine grained, clay layer, a trace to some silt, a trace of gravel	4	DO	37	3
	Brown, compact to dense	5	DO	22	
	SILTY FINE SAND	6	DO	18	4
	a trace of clay	7	DO	20	5
250.2		8	DO	41	6
6.1	Brown, compact	9	DO	30	
	SANDY SILT a trace of clay				7
248.2		10	DO	30	8
8.1	**END OF BOREHOLE**				
	Installed 50 mm Ø PVC monitoring well to 7.6 m (3.0 m screen) Sand backfill from 4.0 to 7.6 m Bentonite holeplug from 0.0 to 4.0 m Provided with a 4x4 steel monument casing with top and bottom caps, and lock				9 10 11







Soil Engineers Ltd.

JOB NO.: 1610-S116

LOG OF BOREHOLE NO.: 4

FIGURE NO.: 4

PROJECT DESCRIPTION: Proposed Residential Subdivision

METHOD OF BORING: Flight-Auger (Solid Stem)

PROJECT LOCATION: Southwest Corner of Mapleview Drive East and 20th Sideroad City of Barrie

DRILLING DATE: November 15, 2016

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
251.4 / 0.0	Ground Surface			
	36 cm TOPSOIL	1A	DO	8
	Brown, loose, weathered	1B		
	SILTY SAND TILL traces of clay and gravel occ. wet sand and silt seams and clay layer layers, cobbles and boulders	2A	DO	10
		2B		
249.6 / 1.8	Brown, compact	3	DO	14
	SAND fine to medium grained a trace to some silt	4	DO	20
		5	DO	29
246.8 / 4.6	Brown, compact	6	DO	24
	SANDY SILT a trace of clay	7	DO	30
244.8 / 6.6	**END OF BOREHOLE**			

Dynamic Cone (blows/30 cm) 10 30 50 70 90

Shear Strength (kN/m²) 50 100 150 200

Penetration Resistance (blows/30 cm) 10 30 50 70 90

Depth Scale (m): 0 1 2 3 4 5 6 7 8 9 10 11

Atterberg Limits PL LL

Moisture Content (%) 10 20 30 40

Moisture values: 22, 10, 11, 10, 12, 17, 13, 22, 18

WATER LEVEL

W.L. @ El. 250.0 m on completion
Cave-in @ El. 249.9 m on completion

Soil Engineers Ltd.

JOB NO.: 1610-S116

LOG OF BOREHOLE NO.: 5

FIGURE NO.: 5

PROJECT DESCRIPTION: Proposed Residential Subdivision

METHOD OF BORING: Flight-Auger (Hollow Stem)

PROJECT LOCATION: Southwest Corner of Mapleview Drive East and 20th Sideroad City of Barrie

DRILLING DATE: November 15, 2016

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
251.5 / 0.0	Ground Surface				
0.0	**30 cm TOPSOIL**	1A	DO	6	0
	Brown, firm to stiff	1B			
	weathered **SILTY CLAY**	2	DO	16	1
	a trace of sand				
250.0	occ. wet sand and silt seams and layers				
1.5	Brown, very stiff	3	DO	18	2
	sand layers/ rock fragments **SILTY CLAY TILL**				
	sandy, a trace of gravel	4	DO	27	
	occ. wet sand and silt seams and layers, cobbles and boulders				
248.5					3
3.0	Compact to very dense	5	DO	20	
	SILTY SAND TILL				4
	a trace to some gravel	6	DO	25	
	a trace of clay				5
	occ. wet sand and silt seams and layers, cobbles and boulders				
	brown grey	7	DO	20	6
					7
243.6		8	DO	50/15	
7.9	**END OF BOREHOLE**				8
	Installed 50 mm Ø PVC monitoring well to 7.6 m (3.0 m screen) Sand backfill from 4.0 to 7.6 m Bentonite holeplug from 0.0 to 4.0 m Provided with a 4x4 steel monument casing with top and bottom caps, and lock				9
					10
					11

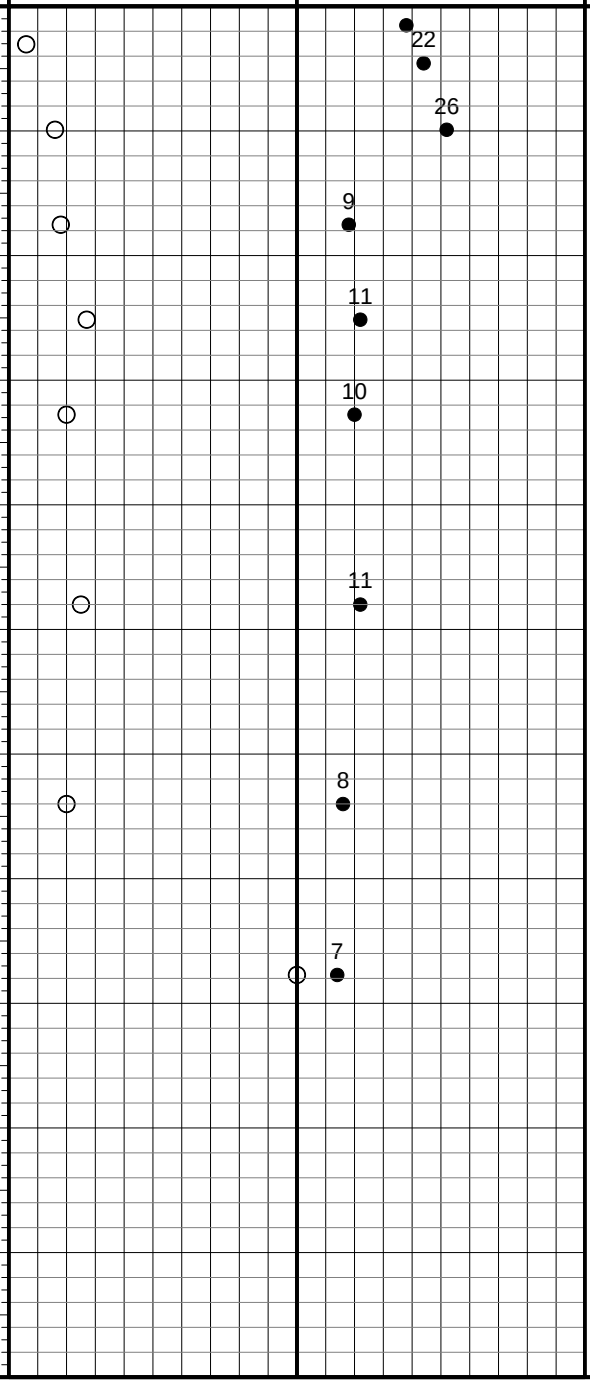
Dynamic Cone (blows/30 cm) 10 30 50 70 90

Shear Strength (kN/m²) 50 100 150 200

Penetration Resistance (blows/30 cm) 10 30 50 70 90

Atterberg Limits PL LL

Moisture Content (%) 10 20 30 40



WATER LEVEL

W.L. @ El. 249.5 m on November 18, 2016

Soil Engineers Ltd.

JOB NO.: 1610-S116

LOG OF BOREHOLE NO.: 6

FIGURE NO.: 6

PROJECT DESCRIPTION: Proposed Residential Subdivision

METHOD OF BORING: Flight-Auger (Solid Stem)

PROJECT LOCATION: Southwest Corner of Mapleview Drive East and 20th Sideroad City of Barrie

DRILLING DATE: November 16, 2016

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
255.7	Ground Surface							
0.0	**30 cm TOPSOIL**	1A	DO	4	0		8	
	Brown, very loose to compact	1B						
	weathered							
	SILTY SAND TILL	2	DO	21	1		7	
	traces of clay and gravel occ. wet sand and silt seams and layers, cobbles and boulders	3	DO	25	2		8	
253.4								
2.3	Brown, very dense	4	DO	60/15			5	
	SILTY FINE SAND				3			
	a trace of clay	5	DO	82			6	
251.9								
3.8	Brown, very dense	6	DO	50/15	4		9	
	SILTY SAND TILL	7	DO	50/15			8	
	traces of clay and gravel occ. wet sand and silt seams and layers, cobbles and boulders	8	DO	50/15	5		7	
249.5		9	DO	50/15	6		7	
6.2	**END OF BOREHOLE**				7			
					8			
					9			
					10			
					11			Dry on completion

Soil Engineers Ltd.

JOB NO.: 1610-S116

LOG OF BOREHOLE NO.: 7

FIGURE NO.: 7

PROJECT DESCRIPTION: Proposed Residential Subdivision

METHOD OF BORING: Flight-Auger (Hollow Stem)

PROJECT LOCATION: Southwest Corner of Mapleview Drive East and 20th Sideroad, City of Barrie

DRILLING DATE: November 17, 2016

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
253.8	Ground Surface							
0.0	**41 cm TOPSOIL**	1A	DO	5	0		16, 15	
	Brown, loose to compact **SAND** fine to medium grained a trace to some silt a trace of gravel (weathered/ fine grained / fine to medium grained)	1B						
		2	DO	24	1		4	
252.0		3A	DO	9			7	
1.8	Brown, stiff **SILTY CLAY TILL** sandy, a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders Compact to very dense	3B			2		21	
251.5								
2.3		4	DO	18			8	
	SANDY SILT TILL	5	DO	22	3		9	
		6	DO	90/15	4			
	a trace to some clay a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders (brown / grey)	7	DO	90	5		6	
		8	DO	72			7	
		9	DO	86	6		9	
		10	DO	80	7		7	
		11	DO	60/15	8		7	
244.4					9			
9.4	**END OF BOREHOLE**				10			
	Installed 50 mm Ø PVC monitoring well to 9.0 m (3.0 m screen) Sand backfill from 5.3 to 9.0 m Bentonite holeplug from 0.0 to 5.3 m Provided with a 4x4 steel monument casing with top and bottom caps, and lock				11			

W.L. @ El. 250.6 m on November 18, 2016

Soil Engineers Ltd.

JOB NO.: 1610-S116

LOG OF BOREHOLE NO.: 8

FIGURE NO.: 8

PROJECT DESCRIPTION: Proposed Residential Subdivision

METHOD OF BORING: Flight-Auger (Hollow Stem)

PROJECT LOCATION: Southwest Corner of Mapleview Drive East and 20th Sideroad, City of Barrie

DRILLING DATE: November 17, 2016

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
252.2	Ground Surface							
0.0	**25 cm TOPSOIL**	1A	DO	7	0		9	
	Brown, firm, weathered **SILTY CLAY TILL** sandy, a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders	1B						
		2	DO	7	1		14	
250.7								
1.5	Grey, compact to dense **SILTY SAND TILL** a trace to some clay a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders	3	DO	11	2		9	
		4	DO	34			8	
249.2								
3.0	Grey, very dense **GRAVELLY SAND** a trace of silt	5	DO	51	3		8	
248.4								
3.8	Grey, compact to very dense	6	DO	30	4		9	
	SANDY SILT TILL	7	DO	50/10			6	
	a trace to some clay a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders	8	DO	50/15	5		7	
246.0		9	DO	70/15	6		8	
6.2	**END OF BOREHOLE**							
	Installed 50 mm Ø PVC monitoring well to 6.2 m (3.0 m screen) Sand backfill from 2.6 to 6.2 m Bentonite holeplug from 0.0 to 2.6 m Provided with a 4x4 steel monument casing with top and bottom caps, and lock				7			
					8			
					9			
					10			
					11			

W.L. @ El. 251.4 m on November 18, 2016

Soil Engineers Ltd.

JOB NO.: 1610-S116

LOG OF BOREHOLE NO.: 9

FIGURE NO.: 9

PROJECT DESCRIPTION: Proposed Residential Subdivision

METHOD OF BORING: Flight-Auger (Hollow Stem)

PROJECT LOCATION: Southwest Corner of Mapleview Drive East and 20th Sideroad City of Barrie

DRILLING DATE: November 16 and 17, 2016

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
253.7	Ground Surface							
0.0	**23 cm TOPSOIL**	1A			0			
	Brown, stiff	1B	DO	10			13	
	SILTY CLAY TILL							
	some sand to sandy, weathered	2	DO	15	1		14	
	a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders	3	DO	11	2		10	
251.4								
2.3	Brown, compact	4	DO	25			9	
	SANDY SILT TILL				3			
	traces of clay and gravel occ. wet sand and silt seams and layers, cobbles and boulders	5	DO	30			8	
249.9								
3.8	Grey, compact **SILTY FINE SAND** a trace of clay	6	DO	15	4		16	
249.1								
4.6	Grey, compact **SAND** fine grained a trace to some silt	7	DO	18	5		17	
248.4								
5.3	occ. cobbles Grey, dense	8	DO	45			9	
	SILTY SAND TILL	9	DO	40	6		11	
	traces of clay and gravel occ. wet sand and silt seams and layers, cobbles and boulders	10	DO	34	7		10	
244.6					8			
9.1	Grey, dense **SILT** some clay, a trace of sand	11	DO	50	9		15	
244.1								
9.6	**END OF BOREHOLE**				10			
	Installed 50 mm Ø PVC monitoring well to 9.0 m (3.0 m screen). Sand backfill from 5.3 to 9.0 m. Bentonite holeplug from 0.0 to 5.3 m. Provided with a 4x4 steel monument casing with top and bottom caps, and lock				11			

W.L. @ El. 252.6 m on November 18, 2016

JOB NO.: 1610-S116

LOG OF BOREHOLE NO.: 10

FIGURE NO.: 10

PROJECT DESCRIPTION: Proposed Residential Subdivision

METHOD OF BORING: Flight-Auger (Solid Stem)

PROJECT LOCATION: Southwest Corner of Mapleview Drive East and 20th Sideroad City of Barrie

DRILLING DATE: November 17, 2016

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
255.4	Ground Surface							
0.0	**25 cm TOPSOIL**	1A	DO	7	0		20	
	Brown, firm, weathered **SILTY CLAY TILL** some sand to sandy a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders	1B						
254.4		2A	DO	18	1		10	
1.0		2B					9	
253.9	Brown, compact							
1.5	**SILTY SAND TILL** traces of clay and gravel occ. wet sand and silt seams and layers, cobbles and boulders Compact to dense	3	DO	21	2		10	
		4	DO	33			19	
	sandy silt layer				3			
	SILTY FINE SAND	5	DO	38			17	
	a trace of clay				4			
		6	DO	50/15			20	
	brown grey				5			
		7	DO	52	6		22	
248.8								
6.6	**END OF BOREHOLE**				7			
					8			
					9			
					10			
					11			

W.L. @ El. 253.3 m on completion
Cave-in @ El. 253.3 m on completion

Soil Engineers Ltd.

JOB NO.: 1610-S116

LOG OF BOREHOLE NO.: 11

FIGURE NO.: 11

PROJECT DESCRIPTION: Proposed Residential Subdivision

METHOD OF BORING: Flight-Auger (Solid Stem)

PROJECT LOCATION: Southwest Corner of Mapleview Drive East and 20th Sideroad, City of Barrie

DRILLING DATE: November 18, 2016

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
252.8	Ground Surface							
0.0	**33 cm TOPSOIL**	1A	DO	8	0		18	
	Brown, firm to stiff organic inclusions/ weathered **SILTY CLAY TILL** some sand to sandy a trace of gravel occ. wet sand and silt seams and layers, cobbles and boulders	1B						
		2	DO	16	1		17	
251.3								
1.5	Brown, compact to very dense **SANDY SILT TILL** traces of clay and gravel occ. wet sand and silt seams and layers, cobbles and boulders	3	DO	25	2		11	
		4	DO	70			8	
249.8					3			
3.0	Grey, dense to very dense **SILTY SAND TILL** traces of clay and gravel occ. wet sand and silt seams and layers, cobbles and boulders	5	DO	64			7	
		6	DO	46	4		8	
	rock fragments	7	DO	33	5		14	
246.2					6			
6.6	**END OF BOREHOLE**				7			
					8			
					9			
					10			
					11			W.L. @ El. 248.5 m on completion

Soil Engineers Ltd.

JOB NO.: 1610-S116

LOG OF BOREHOLE NO.: 12D

FIGURE NO.: 12A

PROJECT DESCRIPTION: Proposed Residential Subdivision

METHOD OF BORING: Flight-Auger (Hollow Stem)

PROJECT LOCATION: Southwest Corner of Mapleview Drive East and 20th Sideroad, City of Barrie

DRILLING DATE: November 16, 2016

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
251.0	Ground Surface							
0.0	**38 cm TOPSOIL**	1A	DO	4	0		15, 18	
	Brown, very loose to compact **SILTY SAND TILL** traces of clay and gravel occ. wet sand and silt seams and layers, cobbles and boulders — organic inclusions/ weathered	1B						
		2	DO	22	1		9	
249.5								
1.5	Brown, compact **SILT** traces of clay and sand	3	DO	27	2		10	
248.7								
2.3	Brown, dense **SILTY SAND TILL** traces of clay and gravel occ. wet sand and silt seams and layers, cobbles and boulders — silt layer	4	DO	47			11	
248.0					3			
3.0	Brown, dense **GRAVELLY SAND** a trace of silt with rock fragments	5	DO	48			12	
247.2								
3.8	Brown, very dense **SILTY SAND TILL** traces of clay and gravel occ. wet sand and silt seams and layers, cobbles and boulders and rock fragments	6	DO	62	4		13	
246.4								
4.6	Brown, very dense **SILTY FINE SAND** a trace of clay	7	DO	85	5		17	
244.9								
6.1	Brown, very dense **SILTY SAND TILL** traces of clay and gravel occ. wet sand and silt seams and layers, cobbles and boulders	8	DO	72	6		10	
244.4								
6.6	**END OF BOREHOLE**				7			
	Installed 50 mm Ø PVC monitoring well to 5.8 m (1.5 m screen) Sand backfill from 3.7 to 5.8 m Bentonite holeplug from 0.0 to 3.7 m Provided with a 4x4 steel monument casing with top and bottom caps, and lock				8			
					9			
					10			
					11			

W.L. @ El. 249.2 m on November 18, 2016

Soil Engineers Ltd.

JOB NO.: 1610-S116

LOG OF BOREHOLE NO.: 12S

FIGURE NO.: 12B

PROJECT DESCRIPTION: Proposed Residential Subdivision

METHOD OF BORING: Flight-Auger (Hollow Stem)

PROJECT LOCATION: Southwest Corner of Mapleview Drive East and 20th Sideroad, City of Barrie

DRILLING DATE: November 16, 2016

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES: Number	SAMPLES: Type	SAMPLES: N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
251.0	Ground Surface							
0.0	**Augered to a depth of 4.0 m**				0			
247.0					1			
4.0	**END OF BOREHOLE**				2			
	Installed 50 mm Ø PVC monitoring well to 4.0 m (1.5 m screen) Sand backfill from 1.8 to 4.0 m Bentonite holeplug from 0.0 to 1.8 m Provided with a 4x4 steel monument casing with top and bottom caps, and lock				3			
					4			
					5			
					6			
					7			
					8			
					9			
					10			
					11			

W.L. @ El. 249.2 m on November 18, 2016

Soil Engineers Ltd.

Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL | ENVIRONMENTAL | HYDROGEOLOGICAL | BUILDING SCIENCE

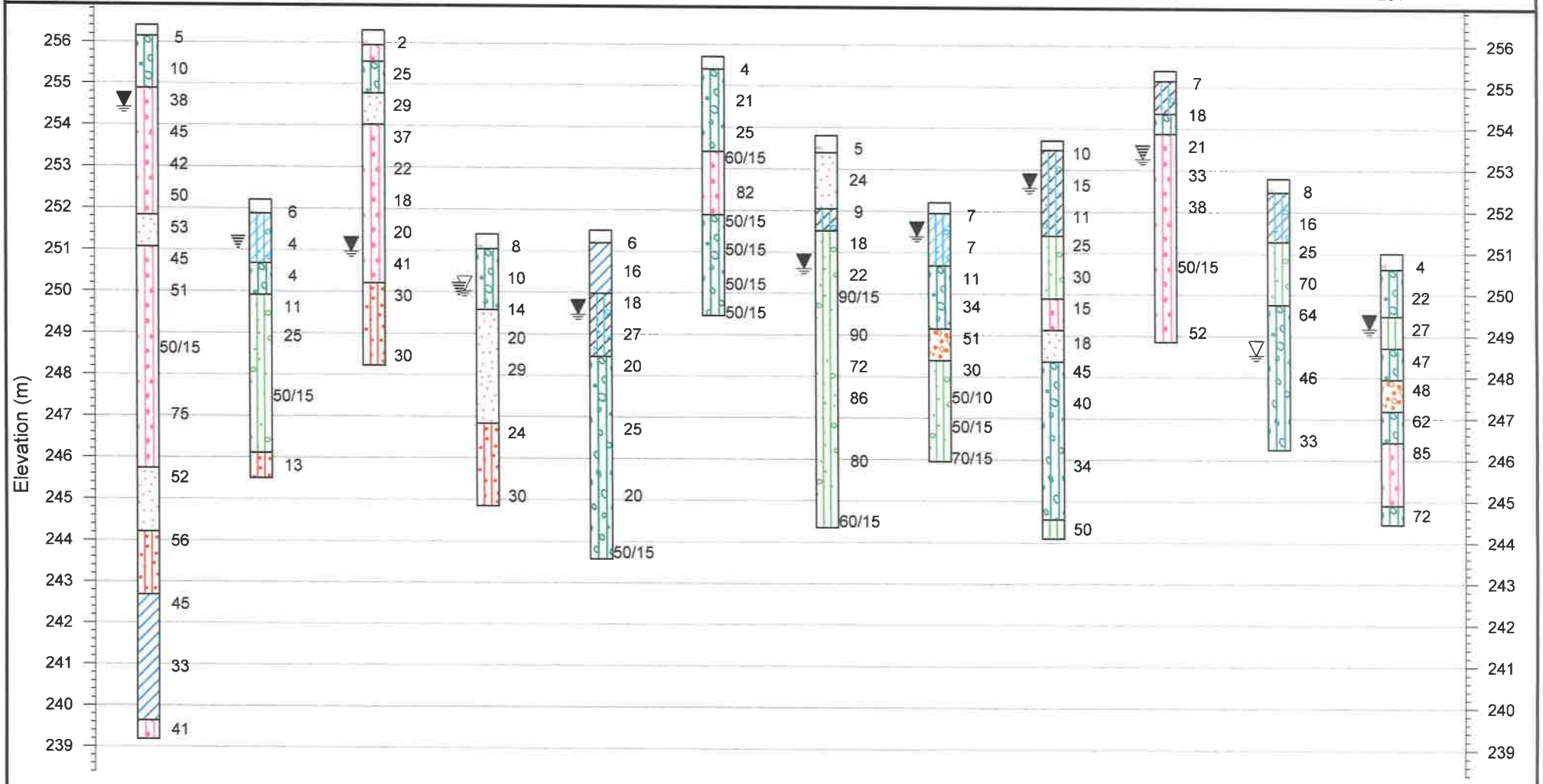
SUBSURFACE PROFILE
DRAWING NO. 2
SCALE: AS SHOWN

JOB NO.: 1610-S116
REPORT DATE: April 2017
PROJECT DESCRIPTION: Proposed Residential Subdivision
PROJECT LOCATION: Southwest Corner of Mapleview Drive East and 20th Sideroad, City of Barrie

LEGEND

TOPSOIL, SAND, SILTY FINE SAND, SILTY SAND TILL, SANDY SILT, SANDY SILT TILL, SILT, SILTY CLAY, SILTY CLAY TILL, GRAVELLY SAND

WATER LEVEL (END OF DRILLING) ▽ CAVE-IN ▼ WATER LEVEL (STABILIZED)



Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE
90 WEST BEAVER CREEK ROAD, SUITE 100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

BARRIE	MISSISSAUGA	OSHAWA	NEWMARKET	MUSKOKA	HAMILTON
TEL: (705) 721-7863	TEL: (905) 542-7605	TEL: (905) 440-2040	TEL: (905) 853-0647	TEL: (705) 684-4242	TEL: (905) 777-7956
FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 542-2769

APPENDIX B

MONITORING WELL LOGS AND LOCATION PLAN BY R.J. BURNSIDE & ASSOCIATES LIMITED

PROJECT NO. 300043693

R.J. Burnside & Associates Limited
15 Townline, Orangeville, Ontario L9W 3R4
telephone (519) 941-5331 fax (519) 941-8120

LOG OF DRILLING OPERATIONS

DS-MW13

Client: **DIV Development (Barrie) Ltd.**	Project Name: **Dorsay**	Logged by: **B.Ward**
Project No.: **300043693**	Location: **Barrie, ON**	Ground (masl): **261.18**
Drilling Co.: **Lantech Drilling Services Inc.**	Date Started: **11/19/2019**	Static Water Level (masl): **255.63**
Drilling Method: **Hollow Stem Auger**	Date Completed: **11/19/2019**	Sand Pack Depth (m): **6.10-7.62**

Depth Scale (ft)	Depth Scale (m)	Stratigraphic Description (Surface Elevation (m): **261.18**)	Strat. Plot	Elev. Depth (m)	SAMPLE Num.	Type	Int.	N.Val.
		TOPSOIL sand uniform, dark brown, damp, friable, soft		260.98 0.20	1	SS		9
	1.0	SAND uniform, fine grained, light brown, dry to damp, friable, soft to medium hardness			2	SS		5
5.0	2.0				3	SS		7
				258.66 2.52	4	SS		7
		SILTY SAND/ SANDY SILT uniform, light brown, dry to damp, stiff						
10.0	3.0	-with depth silt content increases		258.03 3.15	5	SS		22
		SILT uniform, light brown, dry to damp, very stiff						
	4.0	-3.81m - 4.01m sand seam			6	SS		33
15.0		-at 4.01m silt becomes wet with increasing sand content			7	SS		33
	5.0	-with depth becomes saturated						
		-5.33m - 5.67m sand seam			8	SS		44
20.0	6.0			255.16 6.02				
		SAND uniform, light brown, saturated, friable, very stiff to hard			9	SS		47
	7.0				10	SS		62
25.0				253.56 7.62				

bentonite seal

silica sand pack

7.62

Prepared By: **B.Ward** Checked By: **D. Smikle** Date Prepared: **2/10/2020**

This borehole log was prepared for hydrogeological and/or environmental purposes and does not necessarily contain information suitable for a geotechnical assessment of the subsurface conditions. Borehole data requires interpretation by R. J. Burnside & Associates Limited personnel before use by others.

LEGEND
- Water found @ time of drilling
- Static Water Level - 12/16/2019

MONITORING WELL DATA
- Pipe: **51 mm dia. PVC**
- Screen: **51 mm dia. PVC #10 slot**

SAMPLE TYPE
- AC Auger Cutting
- CS Continuous
- RC Rock Core
- SS Split Spoon
- AR Air Rotary
- WC Wash Cuttings

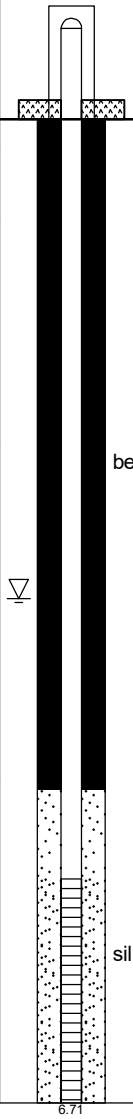
R.J. Burnside & Associates Limited
15 Townline, Orangeville, Ontario L9W 3R4
telephone (519) 941-5331 fax (519) 941-8120

LOG OF DRILLING OPERATIONS

DS-MW14

Client: **DIV Development (Barrie) Ltd.**	Project Name: **Dorsay**	Logged by: **B.Ward**
Project No.: **300043693**	Location: **Barrie, ON**	Ground (masl): **253.62**
Drilling Co.: **Lantech Drilling Services Inc.**	Date Started: **11/19/2019**	Static Water Level (masl): **250.35**
Drilling Method: **Hollow Stem Auger**	Date Completed: **11/20/2019**	Sand Pack Depth (m): **4.57-6.71**

Depth Scale (ft)	Depth Scale (m)	Stratigraphic Description (Surface Elevation (m): **253.62**)	Strat. Plot	Elev. Depth (m)	SAMPLE Num.	Type	Int.	N.Val.
		TOPSOIL, sandy silt/silty sand, dark brown, damp, friable, soft, organic fragments throughout soil		253.42 / 0.20	1	SS		6
		SAND, trace silt, uniform, damp, soft		252.93 / 0.69	2	SS		21
5.0	1.0	SILTY SAND, well graded, light brown, dry, medium density, some gravel						
	2.0	-at 1.52m trace clay, increases with depth, occasional gravel <1cm rounded		251.41 / 2.21	3	SS		38
		-at 1.69m sand and gravel seam			4	SS		28
10.0	3.0	SILT, light brown, damp, medium density, trace sand, occasional gravel			5	SS		36
	4.0	-at 2.47m silt becomes uniform, wet -with depth sample becomes dense			6	SS		44
15.0	5.0	SAND, light brown, saturated, hard, trace silt, occasional gravel <1cm diameter		249.12 / 4.50	7	SS		79
		-at 5.33m sand is uniform			8	SS		43
20.0	6.0			246.91 / 6.71	9	SS		92



Prepared By: **B.Ward** Checked By: **D. Smikle** Date Prepared: **2/10/2020**

This borehole log was prepared for hydrogeological and/or environmental purposes and does not necessarily contain information suitable for a geotechnical assessment of the subsurface conditions. Borehole data requires interpretation by R. J. Burnside & Associates Limited personnel before use by others.

LEGEND
- Water found @ time of drilling
- Static Water Level - 12/16/2019

MONITORING WELL DATA
- Pipe: **51 mm dia. PVC**
- Screen: **51 mm dia. PVC #10 slot**

SAMPLE TYPE
- AC Auger Cutting
- CS Continuous
- RC Rock Core
- SS Split Spoon
- AR Air Rotary
- WC Wash Cuttings

R.J. Burnside & Associates Limited
15 Townline, Orangeville, Ontario L9W 3R4
telephone (519) 941-5331 fax (519) 941-8120

LOG OF DRILLING OPERATIONS

DS-MW15

Client: **DIV Development (Barrie) Ltd.**	Project Name: **Dorsay**	Logged by: **B.Ward**
Project No.: **300043693**	Location: **Barrie, ON**	Ground (masl): **256.66**
Drilling Co.: **Lantech Drilling Services Inc.**	Date Started: **11/20/2019**	Static Water Level (masl): **256.15**
Drilling Method: **Hollow Stem Auger**	Date Completed: **11/20/2019**	Sand Pack Depth (m): **1.52-3.66**

Depth Scale (ft)	Depth Scale (m)	Stratigraphic Description (Surface Elevation (m): **256.66**)	Strat. Plot	Elev. Depth (m)		SAMPLE Num.	Type	Int.	N.Val.
		TOPSOIL dark brown, wet, very soft, sandy silt, occasional rootlets		256.51 0.15		1	SS		3
		CLAYEY SILT uniform, light brown, wet, very soft to soft, iron staining, trace sand		255.97 0.69	bentonite seal	2	SS		28
5.0	1.0	SAND uniform, light brown, saturated, fine grained, very stiff				3	SS		31
	2.0	-0.93m - 1.1m sand and gravel seam							
		-1.05m - 1.57m silt seam			silica sand pack	4	SS		32
10.0	3.0	-at 2.44 m silt seam 1cm in depth				5	SS		40
				253.00 3.66	3.66				

Prepared By: **B.Ward** Checked By: **D. Smikle** Date Prepared: **2/10/2020**

This borehole log was prepared for hydrogeological and/or environmental purposes and does not necessarily contain information suitable for a geotechnical assessment of the subsurface conditions. Borehole data requires interpretation by R. J. Burnside & Associates Limited personnel before use by others.

LEGEND
- Water found @ time of drilling
- Static Water Level - 12/16/2019

MONITORING WELL DATA
- Pipe: **51 mm dia. PVC**
- Screen: **51 mm dia. PVC #10 slot**

SAMPLE TYPE
- AC Auger Cutting
- CS Continuous
- RC Rock Core
- SS Split Spoon
- AR Air Rotary
- WC Wash Cuttings

LOG OF DRILLING OPERATIONS

DS-MW16

R.J. Burnside & Associates Limited
15 Townline, Orangeville, Ontario L9W 3R4
telephone (519) 941-5331 fax (519) 941-8120

BURNSIDE

Client: **DIV Development (Barrie) Ltd.**	Project Name: **Dorsay**	Logged by: **B.Ward**
Project No.: **300043693**	Location: **Barrie, ON**	Ground (masl): **257.73**
Drilling Co.: **Lantech Drilling Services Inc.**	Date Started: **11/20/2019**	Static Water Level (masl): **254.82**
Drilling Method: **Hollow Stem Auger**	Date Completed: **11/20/2019**	Sand Pack Depth (m): **2.43-4.49**

Depth Scale (ft)	Depth Scale (m)	Stratigraphic Description	Strat. Plot	Elev. Depth (m)		SAMPLE Num.	Type	Int.	N.Val.	Depth Scale (ft)	Depth Scale (m)
		Surface Elevation (m): **257.73**									
		TOPSOIL dark brown, damp, friable, soft, occasional rootlets		257.63 0.10		1	SS		4		
	1.0	SAND uniform, light brown, damp, medium to stiff				2	SS		14		1.0
5.0		-0.10m - 0.25m sand is reddish brown with trace silt, with depth becomes light brown			bentonite seal	3	SS		14	5.0	
	2.0	-at 2.29m sand becomes wet, with depth becomes saturated				4	SS		18		2.0
10.0	3.0					5	SS		21	10.0	3.0
	4.0				silica sand pack	6	SS		19		4.0
		SILT uniform, light brown, saturated, stiff		253.37 4.36 253.24 4.49	4.49						

Prepared By: **B.Ward** Checked By: **D. Smikle** Date Prepared: **2/10/2020**

This borehole log was prepared for hydrogeological and/or environmental purposes and does not necessarily contain information suitable for a geotechnical assessment of the subsurface conditions. Borehole data requires interpretation by R. J. Burnside & Associates Limited personnel before use by others.

LEGEND
- Water found @ time of drilling
- Static Water Level - 12/16/2019

MONITORING WELL DATA
- Pipe: **51 mm dia. PVC**
- Screen: **51 mm dia. PVC #10 slot**

SAMPLE TYPE
- AC Auger Cutting
- CS Continuous
- RC Rock Core
- SS Split Spoon
- AR Air Rotary
- WC Wash Cuttings

R.J. Burnside & Associates Limited
15 Townline, Orangeville, Ontario L9W 3R4
telephone (519) 941-5331 fax (519) 941-8120

LOG OF DRILLING OPERATIONS

DS-MW17

Client: **DIV Development (Barrie) Ltd.**	Project Name: **Dorsay**	Logged by: **B.Ward**
Project No.: **300043693**	Location: **Barrie, ON**	Ground (masl): **261.44**
Drilling Co.: **Lantech Drilling Services Inc.**	Date Started: **11/21/2019**	Static Water Level (masl): **257.45**
Drilling Method: **Hollow Stem Auger**	Date Completed: **11/21/2019**	Sand Pack Depth (m): **4.27-6.10**

Depth Scale (ft)	Depth Scale (m)	Stratigraphic Description (Surface Elevation (m): **261.44**)	Strat. Plot	Elev. Depth (m)	SAMPLE Num.	Type	Int.	N.Val.
		TOPSOIL dark brown, damp, soft, sandy silt, occasional rootlets		261.20 0.24	1	SS		9
	1.0	SAND uniform, light brown, damp, friable, soft to medium			2	SS		8
5.0		-0.24m - 0.69m sand is reddish brown, with depth becomes light brown			3	SS		43
	2.0	-1.52m - 2.29m occasional gravel			4	SS		43
		-3.05m - 3.81m sand becomes wet with trace silt			5	SS		78
10.0	3.0	-at 3.81, sand becomes saturated			6	SS		78
		-at 4.11m silt seam 2cm in depth			7	SS		87
15.0	5.0	-4.57m - 4.70m silt seam			8	SS		100
	6.0			255.34 6.10				
20.0								

bentonite seal

silica sand pack

6.10

Depth Scale (ft) (m) — 5.0 / 1.0, 10.0 / 3.0, 15.0 / 5.0, 20.0 / 6.0

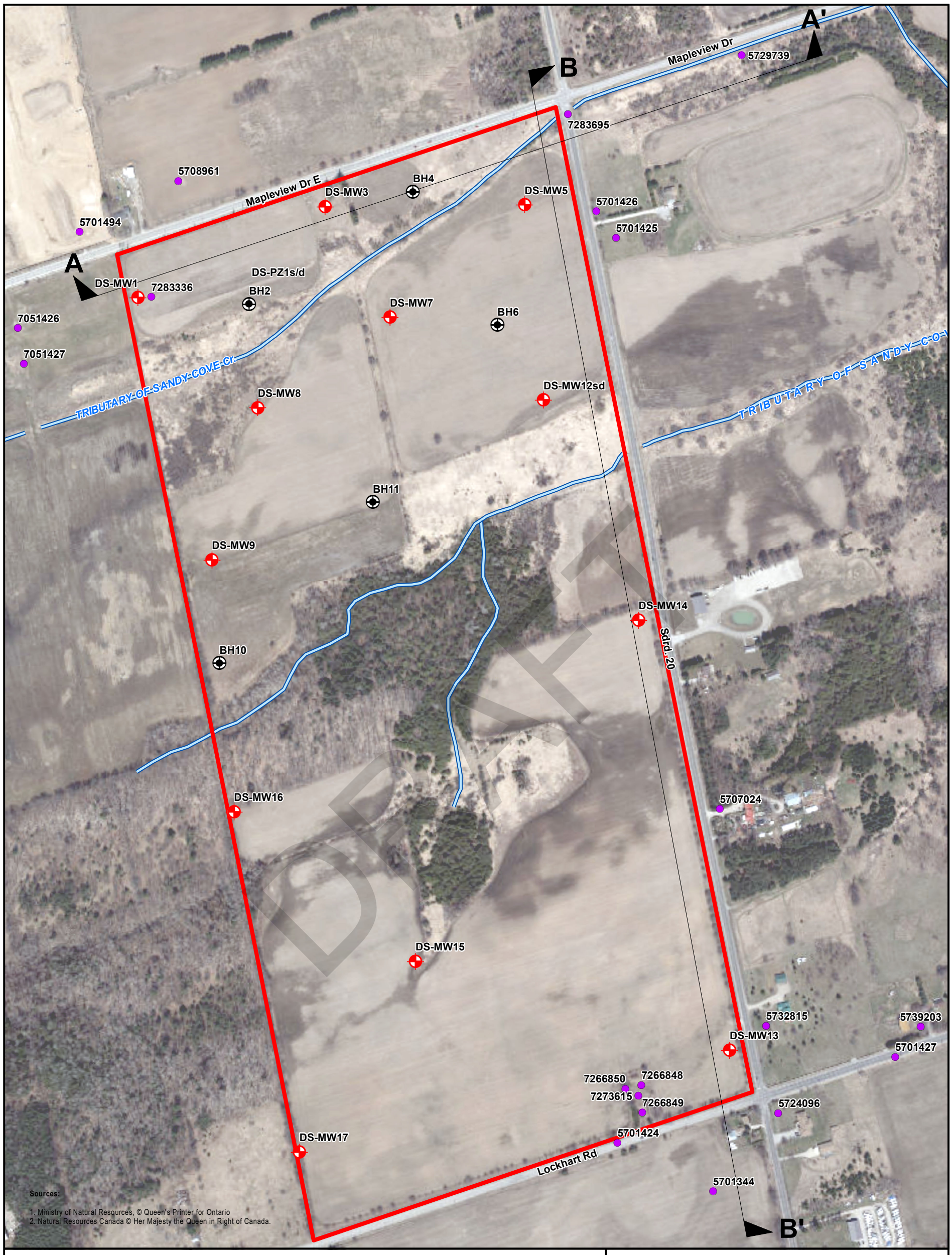
Prepared By: **B.Ward** Checked By: **D. Smikle** Date Prepared: **2/10/2020**

This borehole log was prepared for hydrogeological and/or environmental purposes and does not necessarily contain information suitable for a geotechnical assessment of the subsurface conditions. Borehole data requires interpretation by R. J. Burnside & Associates Limited personnel before use by others.

LEGEND
- Water found @ time of drilling
- Static Water Level - 12/16/2019

MONITORING WELL DATA
- Pipe: **51 mm dia. PVC**
- Screen: **51 mm dia. PVC #10 slot**

SAMPLE TYPE
- AC Auger Cutting
- CS Continuous
- RC Rock Core
- SS Split Spoon
- AR Air Rotary
- WC Wash Cuttings



LEGEND

- SUBJECT LANDS
- WATERCOURSE
- MONITORING WELL (SOIL ENG., 2016)
- BOREHOLE (SOIL ENG. 2016)
- MECP WELL RECORD LOCATION
- CROSS-SECTION LOCATION KEY

0 100 200 300 400 500
Metres

N

BURNSIDE

Client / Report

DIV DEVELOPMENT (BARRIE) LTD.
INNISFIL, ONTARIO

HYDROGEOLOGICAL ASSESSMENT

Figure Title

BOREHOLE, WELL AND CROSS-SECTION LOCATIONS

Drawn	Checked	Date	Figure No.
SK	SC	DECEMBER 2022	6
Scale		Project No.	
1:5,000		300043693	

File Path: Nigel/Shared Work Areas/A:\043693 Dorsay\06_GIS\Hydrogeological Assessment\043693 Borehole, Well & Cross-Section Locations.mxd Print Date: 2022/12/14 Time: 01:43 PM