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	GRAVENHURST	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
THE ELIA CORPORATION

A GEOTECHNICAL INVESTIGATION FOR PROPOSED MIXED-USE DEVELOPMENT WITH 2- TO 5-LEVEL UNDEGROUND PARKING

ELIA LAND
PART OF BLOCK 1, AND BLOCKS 2, 3, 4 AND 5
SORRENTO DRIVE AND ELIA AVENUE
SOUTHEAST OF HURONTARIO STREET AND EGLINTON AVENUE EAST

CITY OF MISSISSAUGA

REFERENCE NO. 2010-S021

ISSUED FOR REZONING
MAY 2021

DISTRIBUTION

2 Copies	- Quadrangle Architects Limited
1 Copy	- The Elia Corporation
1 Copy	- Soil Engineers Ltd. (Mississauga)
1 Copy	- Soil Engineers Ltd. (Richmond Hill)

TABLE OF CONTENTS

TABLES

ENCLOSURES

1.0 INTRODUCTION

In accordance with written authorization from Mr. Vince Burns, Chief Operating Officer, of The Elia Corporation, dated September 30, 2020, a geotechnical investigation was carried out at the property in the southeast quadrant of Hurontario Street and Eglinton Avenue East, in the City of Mississauga.

The purpose of the investigation was to reveal the subsurface conditions and determine the engineering properties of the disclosed soils for the design and construction of the proposed mixed-use development. The geotechnical findings and resulting recommendations are presented in this Report.

2.0 SITE AND PROJECT DESCRIPTION

The City of Mississauga is situated on Halton-Peel till plain where drift extends onto a shale bedrock of either Queenston or Georgian Bay formation at shallow to moderate depths. In places, the drift has been eroded by the glacial lake (Peel Ponding) and filled with lacustrine sand, silt and clay.

The investigated area is comprised of 5 blocks; the blocks are located on the north and south sides of Elia Avenue, from Hurontario Street to James Austin Drive, and on the east side of Sorrento Drive, from Eglinton Avenue East to Elia Avenue. At the time of the investigation. The site consisted of 6 open fields separated by roads, with 2 of the fields separated by a driveway entrance to the existing plaza within the southwest portion of the site. The existing site gradient drops gradually towards the south, having a maximum grade difference of around 8 m.

It is understood that the 5 blocks will be developed with 9 condominium buildings with podium levels ranging from 1- to 8-storeys and towers ranging from 28- to 45-storeys, 8 separate townhouse blocks that are 3-storeys high, and a public park. The development will also include 2 to 5 levels of underground parking beneath most of the blocks, except the public park portion, and retail space located on the ground floor at 3 proposed buildings.

3.0 FIELD WORK

The field work, consisting of 31 boreholes to depths of 1.8 to 17.0 m, was performed between October 19 and November 5, 2020, at the locations shown on the Borehole Location Plan, Drawing No. 1. The boreholes were carried out at the 5 proposed blocks, and are broken down as follows:

- Part of Block 1 at 25, 35 and 55 Elia Avenue: Boreholes 15 to 20, inclusive
- Block 2 at 136 Eglinton Avenue East: Boreholes 1 to 5, inclusive
- Block 3 at 105 Elia Avenue: Boreholes 6 to 14, inclusive
- Block 4 at 4615 Hurontario Street: Boreholes 21 to 26, inclusive
- Block 5 at 110 Elia Avenue: Boreholes 27 to 31, inclusive

The boreholes were advanced at intervals to the sampling depths by track-mounted, continuous-flight power-auger machines equipped for soil sampling. Standard Penetration Tests, using the procedures described on the enclosed "List of Abbreviations and Terms", were performed at the sampling depths. The test results are recorded as the Standard Penetration Resistance (or 'N' values) of the subsoil. The relative density of the granular strata and the consistency of the cohesive strata are inferred from the 'N' values. Split-spoon samples were recovered for soil classification and laboratory testing. The field work was supervised and the findings were recorded by Geotechnical Technicians.

In addition, 'NQ' size (47.6 mm core diameter) and 'HQ' size (63.5 mm core diameter) rock coring was carried out at 5 boreholes to assess the quality and soundness of the encountered shale bedrock. The quality of the rock has been assessed by applying the 'Rock Quality Designation' (RQD) classification, considering the total length of the recovered pieces 10 cm or longer against the length of the core run. The results are expressed as a percentage and are recorded on the Borehole Logs.

Upon completion of borehole drilling, sampling and rock coring, monitoring wells were installed at 15 borehole locations to facilitate a hydrogeological assessment, of which the study will be presented under a separate cover. The remaining boreholes were backfilled to the ground surface using bentonite holeplug and auger cuttings.

The ground elevation at each borehole location was determined with reference to a site benchmark, a manhole located at the southeast intersection of Elia Avenue and Sorrento Drive, as shown on Drawing No. 1. It has a geodetic El. 165.37 m, as provided in the Survey Plan prepared by J.H. Gelbloom Surveying Limited dated October 9, 2020.

4.0 **SUBSURFACE CONDITIONS**

The investigation has disclosed that beneath a topsoil layer, and a layer of earth fill in places, the site is underlain by a stratum of silty clay till, with layers of silty clay, silt, sandy silt and/or sandy silt till at various depths and locations. The soils overlay shale bedrock at shallow to moderate depths throughout the site.

Detailed descriptions of the encountered subsurface conditions at the boreholes are presented on the Borehole Logs, comprising Figures 1 to 31, inclusive. The revealed stratigraphy is plotted on the Subsurface Profile, Drawing Nos. 2 to 6, inclusive, and the engineering properties of the disclosed soils are discussed herein.

4.1 **Topsoil** (All Boreholes)

The revealed topsoil layer is approximately 13 cm and 33 cm thick. It is dark brown in colour, indicating appreciable amounts of roots and humus which are compressible under loads; it should be removed for site development. In order to prevent overstripping, diligent control of the stripping operation will be required.

The topsoil will generate an offensive odour and may produce volatile gases under anaerobic conditions. It can be reused for general landscaping purposes, but it must not be buried below any structures or deeper than 1.2 m below the exterior finished grade so it will not have an adverse impact on the environmental well-being of the developed area.

4.2 **Earth Fill** (All Boreholes except Boreholes 3, 9, 11, 12, 14, 18, 22, 23 and 24)

The earth fill was encountered beneath the topsoil at various locations and extends to depths of 0.8± to 2.3± m below the prevailing ground surface; it consists of silty clay or sandy silt, with varying amounts of gravel, and containing organic inclusions, rock fragments and/or asphalt debris in places.

The obtained ‘N’ values range from 10 blows per 30 cm of penetration to 50 per 3 cm, with a median of 21 per 30 cm, indicating the earth fill was placed with varying degree of compaction.

The natural water content of the samples were determined and the results are plotted on the Borehole Logs; the values range from 6% to 21%, with a median of 12%, indicating that the earth fill is in a damp to very moist condition.

Due to the unknown history of the earth fill, and the presence of organic inclusions and asphalt debris in places, the fill is unsuitable for supporting any structures in its current condition. In using the fill for structural backfill, or in pavement or slab-on-grade construction, it must be subexcavated, inspected, sorted free of peat/organic inclusions and any other deleterious materials, aerated and properly compacted in thin lifts. If it is impractical to sort the deleterious materials from the fill, the fill must be wasted and replaced with properly compacted inorganic earth fill.

The fill is amorphous in structure; it will ravel and is susceptible to collapse in steep cuts, particularly if the fill is in a wet condition.

One must be aware that the samples retrieved from boreholes 10 cm in diameter may not be truly representative of the geotechnical and environmental quality of the fill, and do not indicate whether the topsoil beneath the earth fill was completely stripped. This should be further assessed by laboratory testing and/or test pits.

4.3 **Silty Clay Till** (All Boreholes except Boreholes 11, 12 and 13) and **Silty Clay** (Boreholes 3, 10, 22 and 23)

The silty clay till dominated the soil stratigraphy; it was generally encountered beneath the topsoil and/or earth fill, and extends to the maximum investigated depth throughout most of the site. In contrast, localized layers of silty clay were encountered at varying depths. The clay till consists of a random mixture of soils; the particle sizes range from clay to gravel, with the clay fraction exerting the dominant influence on its soil properties; it is embedded with sand and silt seams and layers, cobbles, boulders and/or shale or rock fragments in places. The structure of the till is heterogeneous, indicating a glacial deposit. The silty clay contains a trace of sand. The laminated structure shows that the silty clay is a lacustrine deposit. Grain size analyses were performed on 5 representative samples of the silty clay till and 2 representative silty clay samples; the results are plotted on Figures 32, 33 and 34.

The obtained ‘N’ values for the silty clay till range from 9 blows per 30 cm of penetration to 50 per 3 cm, with a median of 42 per 30 cm, and the obtained ‘N’ values for the silty clay range from 17 per 30 cm to 65 per 18 cm, with a median of 47 per 30 cm. This indicates that the consistency of the clay till and clay is stiff to hard, being generally hard.

The Atterberg Limits of 2 representative silty clay till samples and 1 representative silty clay sample, and the water content of all of the clay till and clay samples, were determined. The results are plotted on the Borehole Logs and summarized below:

	Silty Clay Till	**Silty Clay**
Liquid Limit	26% and 33%	42%
Plastic Limit	17% and 18%	22%
Natural Water Content	5% to 27% (median 11%)	6% to 26% (median 19%)

The above results and sample examinations show that the clay till and clay have low to medium plasticity. The natural water content ranges from well below the plastic limits to between the plastic and liquid limits, confirming the generally hard consistency of the clay till and clay as disclosed by the ‘N’ values.

Based on the above findings, the deduced engineering properties pertaining to the project are given below:

- High frost susceptibility, low water erodibility, and moderate to high soil-adfreezing potential.
- Low permeability, with an estimated coefficient of permeability of 10^{-7} cm/sec, an estimated percolation time of more than 80 min/cm, and runoff coefficients of:

Slope	
0% - 2%	0.15
2% - 6%	0.20
6% +	0.28

- Cohesive-frictional soils, their shear strength is derived from consistency and augmented by internal friction of the sand and silt. Their strength is moisture dependent and, to a lesser degree, dependent on the soil density.
- The clays will generally be stable in a relatively steep cut. However, prolonged exposure will allow infiltrating precipitation to saturate the sand and silt seams and layers; this may lead to localized sloughing.
- Poor pavement-supportive materials, with an estimated California Bearing Ratio (CBR) value of 3% to 5%.
- Moderately high corrosivity to buried metal, with an estimated electrical resistivity of 2500 to 3500 ohm·cm.

4.4 **Silt** (Boreholes 3, and 7 to 13, inclusive) and **Sandy Silt** (Boreholes 9 and 11)

Localized layers of silt and/or sandy silt were contacted at various depths, primarily at Block 3. The silt contains traces to some clay and sand, with gravel in places, while the sandy silt contains a trace of clay with sand layers. The sorted structure indicates that the soils are glaciolacustrine deposits. Grain size analyses were performed on 5 representative samples of the silt and 1 representative sandy silt sample; the results are plotted on Figures 35, 36 and 37.

The obtained 'N' values for the silt range from 16 blows per 30 cm of penetration to 50 per no penetration (NP), with a median of 42 per 30 cm, and the obtained 'N' values for the sandy silt range from 17 to 37, with a median of 31 per 30 cm. This indicates that the relative density of the silts is compact to very dense, being generally dense.

The natural water content of the soil samples are plotted on the Borehole Logs; the values range from 11% to 24%, with a median of 15%, indicating moist to wet condition, although upon sample examination, the soils did not appear to be saturated. The samples displayed dilatancy when wetted and shaken by hand.

Based on the above findings, the deduced engineering properties pertaining to the project are given below:

- High frost susceptibility and high soil-adfreezing potential.
- High water erodibility; they are susceptible to migration through small openings under seepage pressure.
- The silt has high capillarity and water retention capacity.
- Medium to low permeability, depending on the clay content, with an estimated coefficient of permeability of 10^{-4} to 10^{-6} cm/sec, an estimated percolation time of 20 to 50 min/cm, and runoff coefficients of:

Slope	
0% - 2%	0.07 to 0.15
2% - 6%	0.12 to 0.20
6% +	0.18 to 0.28

- Frictional soils, their shear strength is derived from internal friction and is soil density dependent. Due to their dilatancy, the strength of the saturated silts is susceptible to impact disturbance; i.e., the disturbance will induce a build-up of pore pressure within the soil mantle, resulting in soil dilation and a reduction of shear strength.
- In excavation, the silts will slough in steep slopes, run slowly with water seepage, and boil under a piezometric head of 0.4 m.
- Poor pavement-supportive materials, with an estimated CBR value of 3% to 5%.
- Moderate to moderately low corrosivity to buried metal, with an estimated electrical resistivity of 4000 to 5000 ohm·cm.

4.5 **Sandy Silt Till** (Boreholes 5, 6, 7, 12 and 13)

The sandy silt till was generally encountered directly beneath the earth fill, except at 1 location where it was found below the silt deposit. The till consists of a random mixture of soils; the particle sizes range from clay to gravel, with the silt fraction exerting the dominant influence on its soil properties. The till is heterogeneous in structure, showing it is a glacial deposit; it contains occasional sand and silt seams and layers, cobbles and boulders.

The obtained 'N' values range from 24 blows per 30 cm of penetration to 50 per 10 cm, with a median of 44 per 30 cm, indicating the till stratum is compact to very dense, generally dense in relative density.

The natural water content of the soil samples were determined and the results are plotted on the Borehole Logs; the values range from 6% to 22%, with a median of 13%, indicating the tills are in a damp to wet condition, although, similar to the silts, upon sample examination, the till did not appear to be saturated.

Based on the above findings, the deduced engineering properties pertaining to the project are given below:

- High frost susceptibility and moderately low water erodibility.
- Low permeability, with an estimated coefficient of permeability of 10^{-6} cm/sec, depending on the clay content, an estimated percolation time of 40 to 50 min/cm, and runoff coefficients of:

Slope	
0% - 2%	0.15
2% - 6%	0.20
6% +	0.28

- A frictional soil, its shear strength is primarily derived from the internal friction and is augmented by cementation.
- In steep cuts, the till will be relatively stable; however, under prolonged exposure, localized sheet collapse may occur in the zone where sand and silt layers are prevalent.
- A fair pavement-supportive material, with an estimated CBR value of 8%.
- Moderate corrosivity to buried metal, with an estimated electrical resistivity of 4000 to 4500 ohm·cm.

4.6 **Shale Bedrock** (Boreholes 3, 6, 9, 11, 17, 20, 23, and 27 to 31, inclusive)

Shale bedrock was encountered at depths below 2.4± to 7.6± m from the prevailing ground surface throughout the site. The lower zone of the soils above the shale bedrock, in places, may be derived from a clay-shale reversion rendering the boundary between the soil and shale bedrock interface difficult to delineate. At the remaining boreholes where shale bedrock was not noted on the Borehole logs, refusal to auger was encountered likely indicating the presence of bedrock below the refusal depths.

The shale is grey in colour, indicating that it is of Georgian Bay Formation; it is a laminated, sedimentary, moderately soft rock composed predominantly of clay material, and it is interbedded with about 20% sandstone and limy shale bands. The shale is susceptible to disintegration and swelling upon exposure to air and water, with subsequent reversion to a clay soil, but the laminated limy and sandy layers would remain as rock slabs.

The upper layers of the shale are often fissured as a result of the weathering process and/or overstressing by glaciation. Infiltrated precipitation and groundwater from the overburden soils will often permeate the fissures in the rock and, in places, will be under subterranean artesian pressure. However, because the shale is a clay rock, it is considered to be a material of low permeability and a poor aquifer; upon release through excavation, the water is likely to drain readily with a limited yield.

The upper 1.0± to 2.0± m of the shale is likely weathered and, in places, was penetrable by power augering, with some difficulty grinding through the hard layers. The obtained ‘N’ values in the shale bedrock, where split spoon sampling was able to commence, were 71 blows per 25 cm of penetration to 100 per 3 cm, and the water content values of the shale samples obtained from the sampler range from 4% to 17%, with a median of 7%.

Rock coring was carried out in the shale bedrock starting at depths ranging from 3.2 to 8.3 m, and terminating at depths of 13.7 to 17.0 m, at Boreholes 3, 9, 17, 23 and 28. The recovery of ‘NQ’ size rock cores (Boreholes 3, 9 and 17) and ‘HQ’ size rock cores (Boreholes 23 and 28) ranges from 50% to 100%; however, the RQD values range from 0% to 91%, indicating the shale is a very poor to very good rock, becoming fair to good below depths ranging from 8± to 12± m from the prevailing ground surface.

From examinations, the encountered shale is well cemented with intermittent limestone layers. Uniaxial Compressive Strength (UCS) tests were carried out on 5 core samples of which the results are presented in Table 1.

Table 1 - Uniaxial Compressive Strength (UCS) Results

Borehole No.	Sample No.	Depth (m)	UCS (MPa)
3	15	13.4	13.8
9	11	11.5	12.8
17	14	14.1	32.8
23	12	11.8	66.1
28	12	13.8	35.6

The results of the UCS tests indicate that the inherent compressive strength of the tested specimens show that the rock is a ‘moderately weak’ to ‘strong’ rock.

The weathered rock can be excavated with considerable effort by a heavy-duty backhoe equipped with a rock-ripper; however, excavation will become progressively more difficult with depth into the sound shale. Efficient removal of the sound shale may require the aid of pneumatic hammering.

The excavated spoil may contain large amounts of hard limy and sandy rock slabs, rendering it virtually impossible to obtain uniform compaction. Therefore, unless the spoil is sorted, it is considered unsuitable for engineering applications.

In sound shale excavation, slight lateral displacement of the excavation walls is often experienced. This is due to the release of residual stress stored in the bedrock mantle and the swelling characteristics of the rock.

4.7 Interpretation of Refusal to Auger (All Boreholes except Borehole 13)

Refusal to auger was encountered at all Boreholes at depths ranging from 1.8± to 7.9± m from the prevailing ground surface, except at Borehole 13 which was intended as a shallower borehole for the park. Refusal was encountered likely due to the presence of rock fragments in the till or shale bedrock below refusal depths. At 5 borehole locations, Boreholes 3, 9, 17, 23 and 28, rock coring was carried out upon refusal.

4.8 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 2.

Table 2 - Estimated Water Content for Compaction

Soil Type	**Determined Natural Water Content (%)**	**Water Content (%) for Standard Proctor Compaction**	
		100% (optimum)	**Range for 95% or +**
Earth Fill	6 to 21 (median 12)	12 to 15	8 to 20
Silty Clay Till	5 to 27 (median 11)	15 to 18	11 to 23
Silty Clay	6 to 26 (median 19)	17 to 18	13 to 23
Silt and Sandy Silt	11 to 24 (median 15)	12 to 13	8 to 17
Sandy Silt Till	6 to 22 (median 13)	11	6 to 16
Weathered Shale	4 to 17 (median 7)	15 to 18	11 to 23

The above values show that the in situ soils are generally suitable for a 95% or + Standard Proctor compaction. However, portions of the fill, tills, clay and weathered shale are too dry and will require the addition of water prior to structural compaction. The earth fill and any weathered soils must be sorted free of organic inclusions and any deleterious material prior to structural compaction, otherwise they must be wasted.

The fill, tills and clay should be compacted using a heavy-weight, kneading-type roller. The silts can be compacted by a smooth roller with or without vibration, depending on the moisture content of the soils being compacted. The lifts for compaction should be limited to 20 cm, or to a suitable thickness as assessed by test strips performed by the equipment which will be used at the time of construction.

When compacting the very stiff to hard silty clay till and silty clay, and cemented, dense to very dense sandy silt till on the dry side of the optimum, the compactive energy will frequently bridge over the chunks in the soils and be transmitted laterally into the soil mantle. Therefore, the lifts must be limited to 20 cm or less (before compaction). It is difficult to monitor the lifts of backfill placed in deep trenches; therefore, it is preferable that the compaction of backfill at depths over 1.0 m below the subgrade be carried out on the wet side of the optimum. This would allow a wider latitude of lift thickness.

One should be aware that with considerable effort, a 90%± Standard Proctor compaction of the wet silts is achievable. Further densification is prevented by the pore pressure induced by the compactive effort; however, large random voids will have been expelled and, with time, the pore pressure will dissipate and the percentage of compaction will increase. There are many cases on record where after a few months of rest, the density of the compacted mantle had increased to over 95% of its maximum Standard Proctor dry density (SPDD).

If the compaction of the soils is carried out with the water content within the range for 95% SPDD but on the wet side of the optimum, the surface of the compacted soil mantle will roll under the dynamic compactive load. This is unsuitable for road construction since each component of the pavement structure is to be placed under dynamic conditions which will induce the rolling action of the subgrade surface and cause structural failure of the new pavement. The slab-on-grade, foundations or bedding of the underground services will be placed on a subgrade which will not be subjected to impact loads. Therefore, the structurally compacted soil mantle with the water content on the wet side or dry side of the optimum will provide adequate subgrade strength for the project construction.

The presence of boulders and shale fragments will prevent transmission of the compactive energy into the underlying material to be compacted. If an appreciable amount of boulders and shale fragments over 15 cm in size is mixed with the material, it must either be sorted or must not be used for structural backfill and/or engineered fill.

5.0 **GROUNDWATER CONDITIONS**

The boreholes were checked for the presence of groundwater and the occurrence of cave-in during the drilling operation. The groundwater data are plotted on the Borehole Logs and summarized in Table 3.

Upon completion of borehole drilling and sampling, monitoring wells were installed in 15 selected Boreholes to facilitate a hydrogeological assessment, which will be presented under a separate cover.

Table 3 - Groundwater Levels

Borehole No.	**Ground Elevation (m)**	**Well Depth (m)**	**Measured Groundwater Level/ Cave-in* on Completion**	
			Depth (m)	**Elevation (m)**
1 (MW)	170.7	3.7	3.7*	167.0*
2	171.9	-	Dry/Open	-
3	171.8	-	N/A**	-
4 (MW)	171.1	4.0	4.0*	167.1*
5 (MW)	171.5	5.8	5.8*	165.7*
6	171.0	-	Dry/Open	-
7 (MW)	170.9	5.0	Dry/Open	-
8	170.4	-	Dry/Open	-
9	169.4	-	N/A**	-
10 (MW)	169.7	7.9	7.5	162.2
11 (MW)	168.1	6.1	Dry/Open	-
12	168.4	-	Dry/Open	-
13	168.1	-	Dry/Open	-
14	166.5	-	Dry/Open	-
15	165.4	-	4.0*	161.4*
16 (MW)	166.0	4.3	4.3*	161.7*
17	165.5	-	N/A**	-
18	163.7	-	Dry/Open	-
19 (MW)	165.0	3.7	Dry/Open	-
20 (MW)	165.5	3.7	Dry/Open	-
21	164.2	-	Dry/Open	-
22 (MW)	163.9	1.8	Dry/Open	-
23 (MW)	164.5	13.9	N/A**	-

Table 3 - Groundwater Levels (cont'd)

Borehole No.	Ground Elevation (m)	Well Depth (m)	Measured Groundwater Level/ Cave-in* on Completion	
			Depth (m)	Elevation (m)
24	164.5	-	1.7*	162.8*
25	165.0	-	Dry/Open	-
26 (MW)	165.2	2.1	Dry/Open	-
27	165.2	-	3.0*	162.2*
28 (MW)	166.0	16.5	N/A**	-
29 (MW)	165.2	3.7	Dry/Open	-
30	166.1	-	4.0*	162.1*
31 (MW)	166.0	3.7	3.7*	162.3*

* Cave-in level (In wet sand and silt layers, the level generally represents the groundwater at the time of investigation).

** Water level measurement not taken due to use of water to carry out rock coring.

As shown above, groundwater was recorded at a depth of 7.5± m below the prevailing ground surface at Borehole 10, and 9 boreholes caved at depths of 1.7± to 5.8± m upon their completion prior to backfilling or well installation. The groundwater is subject to seasonal fluctuation, and can be confirmed through the results of the hydrogeological assessment.

The groundwater yield from the tills and clay will be slow in rate and limited in quantity, due to their relatively low to low permeability, while the yield from the silts may be moderate to appreciable. Groundwater under subterranean artesian pressure may occur in places within the shale bedrock, which is generally considered to be a poor aquifer. Therefore, the yield of groundwater from the bedrock, if encountered, will be appreciable initially; however, if allowed to drain freely, it will often dissipate or be depleted with time.

6.0 DISCUSSION AND RECOMMENDATIONS

The investigation has disclosed that beneath a topsoil layer, and a layer of earth fill in places, the site is underlain by a stratum of stiff to hard, generally hard silty clay till, with layers of very stiff to hard, generally hard silty clay, and/or compact to very dense, generally dense silt, sandy silt and/or sandy silt till at various depths and locations. The soils overlay shale bedrock at shallow to moderate depths throughout the site.

Upon completion of the boreholes and prior to backfilling or well installation, groundwater was recorded at a depth of 7.5± m below the prevailing ground surface at Borehole 10, and

9 boreholes caved at depths of 1.7± to 5.8± m. In addition, groundwater monitoring wells were installed at 15 borehole locations to facilitate a hydrogeological assessment, of which the stabilized groundwater readings and study will be presented under a separate cover. The groundwater is subject to seasonal fluctuation.

As previously mentioned, the property development will consist of 9 condominium buildings with podium levels ranging from 1- to 8-storeys and towers ranging from 28- to 45- storeys, 8 separate 3-storey townhouse blocks, and a public park. In addition, 2 to 5 levels of underground parking is proposed through most of the site, except beneath the public park at Block 3. In addition, retail space is proposed at the ground level at 3 of the condominium buildings.

The geotechnical findings which warrant special consideration are presented below:

1. The topsoil must be removed for site development. It can only be reused for general landscaping purposes.
2. In conventional design and construction, the underground structure should be provided with a drainage system connecting into the municipal sewer. If the municipality does not allow the removal of groundwater into the sewer, the subsurface water has to be discharged into a cistern in the building or the underground structure has to be designed and constructed as a watertight structure.
3. In conventional design and construction, with an effective drainage system, the buildings can be constructed on conventional footings founded on the native subsoil or bedrock. However, if the underground structure is designed as a watertight structure, a raft foundation is required to resist the hydrostatic pressure in the underground structure.
4. The excavation for the underground structure is anticipated to extend to approximately 7 to 13 m below the ground surface. Excavation should be carried out in accordance with Ontario Regulation 213/91. Shale bedrock is anticipated for the excavation. Braced shoring walls will be required for the excavation where a safe backing slope is not possible.
5. In general, open-cut excavation can be carried out in the weathered shale by using a backhoe equipped with a rock-ripper; however, where deep excavation is required, particularly for an anticipated 2- to 5-level underground parking, pneumatic hammering with chisel points to break up the shale may be necessary for efficient rock removal.
6. Boulders, shale fragments and rock slabs over 15 cm in size must not be used for structural backfill.

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.

Should subsurface variances become apparent during construction, a geotechnical engineer must be consulted to determine whether the following recommendations require revision.

6.1 **Foundations**

The property will be developed with 9 condominium buildings and 8 townhouse blocks over the spread of 5 parcels labelled Part of Block 1, and Blocks 2 to 5, inclusive. The buildings and adjoined underground parking are broken down as follows:

Part of Block 1

- 2 condominium buildings - upto 36 and 45 storeys aboveground
- 5 levels of underground parking extending to a depth of 15.20 m below the proposed ground level floor elevation

Block 2

- 2 condominium buildings - upto 36 and 42 storeys aboveground
- 2 townhouse blocks - each 3 storeys high
- 4 levels of underground parking extending to a depth of 12.40 m below the proposed ground level floor elevation

Block 3

- 2 condominium buildings - each upto 36 storeys aboveground
- 4 townhouse blocks - each 3 storeys high
- 1 public park within the south portion
- 2 levels of underground parking extending to a depth of 6.80 m below the proposed ground level floor elevation (no parking levels proposed beneath the public park)

Block 4

- 2 condominium buildings - upto 30 and 36 storeys aboveground
- 3 levels of underground parking extending to a depth of 9.60 m below the proposed ground level floor elevation

Block 5

- 1 condominium building - upto 28 storeys aboveground
- 2 townhouse blocks - each 3 storeys high
- 3 levels of underground parking extending to a depth of 9.60 m below the proposed ground level floor elevation

Assuming the proposed ground floor level for the new development remains relatively unchanged from the existing ground surface elevation, it is anticipated that the excavation for the underground parking will extend to depths of approximately 7.0 to 15.5 m from the prevailing ground surface. Therefore, the bottom of excavation will likely lie within the shale bedrock throughout most of the site, or within the hard/very dense silty clay till or silt.

In conventional design and construction, with an effective drainage system in the underground structure, the buildings can be constructed on conventional footings. The design bearing pressures are provided for the design of footings:

<u>On hard silty clay till or very dense silt below a depth of 6.0 m:</u>

- Maximum Bearing Pressure at Serviceability Limit State (SLS) = 500 kPa
- Factored Ultimate Bearing Pressure at Ultimate Limit State (ULS) = 800 kPa

<u>On weathered shale bedrock:</u>

- Maximum Bearing Pressure at Serviceability Limit State (SLS) = 1000 kPa
- Factored Ultimate Bearing Pressure at Ultimate Limit State (ULS) = 1600 kPa

<u>On sound shale bedrock below a depth of 10 m:</u>

- Maximum Bearing Pressure at Serviceability Limit State (SLS) and Factored Ultimate Bearing Pressure at Limit State (ULS) = 2000 kPa

The elevator pit, which normally extends a few metres below the floor level, should be designed as a submerged ‘tank’ structure with waterproofed pit walls and pit floor.

If the drainage system is not practical or the municipality does not allow the removal of groundwater into the sewer, the underground structure has to be waterproofed and constructed on a raft foundation to resist the hydrostatic pressure. The design bearing pressures for raft foundations are provided below:

<u>On hard silty clay till or very dense silt below a depth of 6.0 m:</u>

- Maximum Bearing Pressure at Serviceability Limit State (SLS) = 400 kPa
- Factored Ultimate Bearing Pressure at Ultimate Limit State (ULS) = 640 kPa

<u>On weathered or sound shale bedrock:</u>

- Bearing pressures same as above for conventional footings.

A Modulus of Subgrade Reaction (k_s) of 35 MPa/m can be used for the design of a raft foundation.

The total and differential settlements of foundations designed for the recommended bearing pressures at SLS on native soils above bedrock are estimated to be 25 mm and 20 mm, respectively. The total and differential settlements of foundations in shale bedrock will be negligible. Any part of the building structure founded partially on soil and partially on rock should be provided with expansion joints to allow the possible abrupt differential movement developed between the soil and rock junction.

The building foundation subgrade should be inspected by a geotechnical engineer or a senior geotechnical technician to ensure that the revealed conditions are compatible with the foundation design requirements.

The shale bedrock will slake if left exposed for any length of time. It is, therefore, important that the footings are poured with concrete immediately on excavation and inspection. Alternatively, the footings should be skim coated with lean mix concrete to minimize deterioration of rock at the bearing surface.

A mud slab of lean mix concrete, 8 to 10 cm in thickness, will be required to protect the foundation subsoil if groundwater seepage is anticipated, or if the excavation will be left open for installation of reinforcement in the raft foundation.

Footings founded on soil and weathered shale that are exposed to weathering or in unheated areas, should have at least 1.2 m of earth cover for protection against frost action. For unheated underground parking structure, having the entrance door closed at most of the time, the earth cover can be reduced to 0.6 m for perimeter walls and 0.9 m for interior walls and columns, except in the area in close proximity of the ventilation shafts and door entrances.

The building foundations should meet the requirements specified in the latest Ontario Building Code. The structure should be designed to resist an earthquake force using Site Classification ‘C’ (very dense soil and soft rock).

6.2 **Underground Parking**

It is assumed that the underground parking will extend to a depth of approximately 7.0 to 15.5 m below the prevailing ground surface, where the subgrade will consist of hard/very dense silty clay till or silt, or most likely shale bedrock.

In areas where the perimeter walls extend into the shale bedrock, a compressible material, such as sprayed foam, 100 mm in thickness, should be placed between the concrete wall and the bedrock, or the excavation should provide at least 400 mm space between the bedrock face and the foundation walls to be filled with loose sand afterwards. This is to allow lateral expansion or movement of the rock face without causing damage to the foundation walls.

In conventional design, the perimeter walls of the underground garage should be dampproofed and provided with a perimeter subdrain encased in a fabric filter at the wall base.

Prefabricated drainage board, such as Miradrain 6000 or equivalent, must be provided between the shoring wall or rock face and the cast-in-place foundation wall, or adjacent to the foundation wall in open excavation, as shown on Drawing Nos. 7 and 8, respectively.

The lower parkade slab should be constructed on a granular bedding, consisting of 20-mm Crusher-Run Limestone, or equivalent, and consisting of underfloor subdrains of 100-mm filter-sleeved weepers, with a centre-to-centre spacing of 5.0 to 6.0 m, connected to a positive outlet or sump pit for discharge. In addition, vapour barrier of 10 mil polyethylene sheet should be placed above the granular bedding to alleviate wetting of the garage floor due to moisture upfiltration. A typical design of the bedding and the underfloor weepers is provided in Drawing No. 9.

If the Municipality does not allow any discharge of subsurface water into the sewer system, a separate storage cistern should be provided or, otherwise, the entire underground structure will have to be waterproofed. In this case, the building will have to be founded on a raft foundation, and designed for the full depth of hydrostatic pressure on the foundation walls and below the foundation. The lower parkade slab will be poured on a granular fill above the raft where the utilities and service pipes will be laid.

The underground structure should be designed to sustain a lateral earth pressure calculated using the soil parameters stated in Section 6.7. Any applicable surcharge loads adjacent to the proposed building must also be considered in the design of the underground structure.

At the garage entrances, the subgrade should be properly insulated, or the subgrade material should be replaced with 1.2 m of non-frost-susceptible granular material and should be provided with subdrains. This will minimize frost action in this area where vertical ground movement cannot be tolerated. The floor at the entrance and in areas of close proximity to air shafts should be insulated, and the insulation should extend 1.2 m internally. This measure is to prevent frost action induced by cold drafts.

The ground around the buildings must be graded to direct water away from the structures to minimize the frost heave phenomenon generally associated with the disclosed soils.

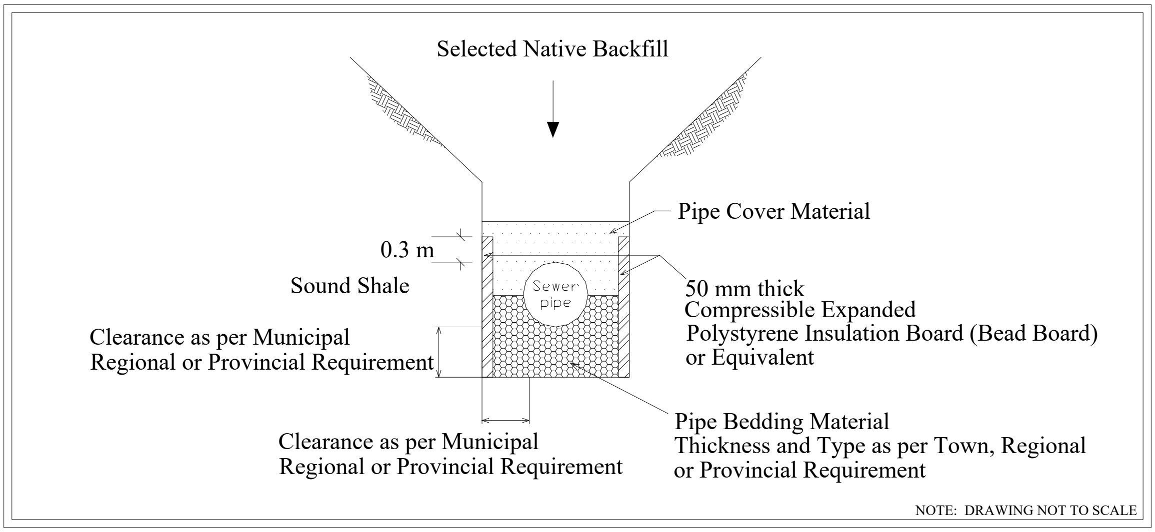
6.3 Underground Services

The subgrade for the underground services should consist of sound natural soils or properly compacted organic-free earth fill. Where topsoil, organic earth fill or badly weathered soil is encountered, it should be subexcavated and replaced with bedding material compacted to at least 98% or + SPDD.

Sewer construction will require rock excavation. In general, it can be carried out by using a backhoe equipped with a rock-ripper, but where trench excavation into the thick limy or sound shale is required, a pneumatic hammer should be used to break up the rock mass for excavation.

Where the pipe is to be placed in sound shale bedrock, the rock face must be lined with a cushioning layer such as Styrofoam, then backfilled with fine sand to 0.3 m above the crown of the pipe and flooded. The recommended scheme is illustrated in Diagram 1.

Diagram 1 - Sewer Installation in Sound Shale



A Class 'B' bedding consisting of compacted 20-mm Crusher-Run Limestone, or equivalent is recommended for the underground services construction. The pipe joints into manholes should be leak-proof and wrapped with a waterproof membrane to prevent subgrade upfiltration through the joints.

In order to prevent pipe floatation when the trench is deluged with water, a soil cover of at least equal two times the diameter of the pipe should be in place at all times after completion of the pipe installation.

Openings to subdrains and catch basins should be shielded with a fabric filter to prevent blockage by silting.

The subgrade of underground services may have moderately high corrosivity to metal pipes and fittings; therefore, the underground services should be protected against soil corrosion.

For estimation for the anode weight requirements, the estimated electrical resistivity given for the disclosed soil can be used. This, however, should be confirmed by testing the soil along the service alignment at the time of construction.

6.4 Backfilling in Trenches and Excavated Areas

The on site inorganic soils are generally suitable for use as trench backfill. However, the soils should be sorted free of any topsoil inclusions and other deleterious materials prior to reuse for backfilling. In addition, the soils should be sorted free of large pieces (over 15 cm in size) of limy shale, sandstone and shale fragments, if encountered, or the large pieces must be broken into sizes suitable for structural compaction.

The backfill in trenches and excavated areas should be compacted to at least 95% of its maximum SPDD and increased to 98% or + SPDD below the floor slab. In the zone within 1.0 m below the pavement subgrade, the material should be compacted with the water content at 2% to 3% drier than the optimum, and the compaction should be increased to at least 98% SPDD. This is to provide the required stiffness for pavement construction. In the lower zone, the compaction should be carried out on the wet side of the optimum; this allows a wider latitude of lift thickness. Wetting of the dry soils will be necessary to achieve this requirement.

In normal underground services construction practice, the problem areas of settlement largely occur adjacent to manholes, catch basins, services crossings, foundation walls and columns. The lumpy clays and broken shale are generally difficult to compact in these close quarters, and it is recommended that a sand backfill should be used. Imported sand backfill should also be used in areas which are inaccessible to a heavy compactor. The interface of the native soils and sand backfill will have to be flooded for a period of several days.

Narrow trenches for services crossings should be cut at 2 or + horizontal (H):1 vertical (V) so that the backfill can be effectively compacted. Otherwise, soil arching will prevent the achievement of proper compaction. In this case, imported sand fill, which can be appropriately compacted by using a smaller vibratory compactor, must be used. The lift of each backfill layer should either be limited to a thickness of 20 cm, or the thickness should be determined by test strips.

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

- When construction is carried out in freezing winter weather, allowance should be made for these following conditions. Despite stringent backfill monitoring, frozen soil layers may inadvertently be mixed with the structural trench backfill. Should the in situ soils have a water content on the dry side of the optimum, it would be impossible to wet the soils due to the freezing condition, rendering difficulties in obtaining uniform and proper compaction. Furthermore, the freezing condition will prevent wetting of the backfill or when it is required, such as in a narrow vertical trench section, when the trench box is removed, or when backfill consists of shale mixture. The above will invariably cause backfill settlement that may become evident within 1 to several years, depending on the depth of the trench which has been backfilled.

- 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 final surfacing of the new pavement.
- In deep trench backfill, one must be aware that future settlement is to be expected, unless the side of the cut is flattened to at least 2H:1V, 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 95% of the maximum 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 groundwater movement is expected in the bedding or sand fill mantle, anti-seepage collars should be provided, unless concrete bedding is used in the service trenches.

6.5 Sidewalks, Interlocking Stone Pavement and Landscaping

The on-site subsoils are mostly frost susceptible, and heaving of the pavement, sidewalk and surface structures is expected to occur during the cold weather.

Interlocking stone pavement, sidewalks and landscaping structures in areas which are sensitive to frost-induced ground movement should be constructed on a free-draining, non-frost-susceptible granular material such as Granular ‘B’. The material must extend to 0.3 to 1.2 m below the ground surface, depending on the degree of tolerance for ground movement, and be provided with positive drainage, such as weeper subdrain connected to manholes or catch basins. Alternatively, the landscaping structures, sidewalks and interlocking stone pavement should be properly insulated with 50-mm Styrofoam, or equivalent.

6.6 Pavement Design

Where the pavement is to be built on structural slabs, such as the rooftop of the underground garage, a sufficient granular base and adequate drainage must be provided to prevent frost damage to the pavement. A waterproof membrane must be placed above the structural slab exposed to weathering to prevent water leakage, as well as to protect the steel reinforcing bars against brine corrosion. The recommended pavement structure to be placed on top of the underground garage is presented in Table 4.

Table 4 - Pavement Design (Roof of Underground Garage)

Course	Thickness (mm)	OPS Specifications
Asphalt Surface	40	HL-3
Asphalt Binder	50	HL-8
Granular Base	250	OPSS Granular 'A' or equivalent
Granular Sub-base	100	Free-draining Sand Fill

Where on-grade pavement may be proposed, such as at access from local roads or any on-grade parking, the pavement structure is given in Table 5.

Table 5 - Pavement Design (On-Grade Access Roadway and Parking Areas)

Course	Thickness (mm)	OPS Specifications
Asphalt Surface	40	HL-3
Asphalt Binder		HL-8
Light-Duty	50	
Fire Route	65	
Granular Base	150	OPSS Granular 'A' or equivalent
Granular Sub-base		OPSS Granular 'B' or equivalent
Light-Duty	300	
Fire Route	450	

In preparation of the subgrade, the final subgrade surface must be proof-rolled. Any soft spot as identified should be subexcavated and replaced with selected on-site material, free of organics. In the zone within 1.0 m below the pavement subgrade, the backfill should be compacted to at least 98% SPDD, with the water content 2% to 3% drier than the optimum. In the lower zone, 95% SPDD compaction is considered adequate.

All the granular bases should be compacted to 100% SPDD.

Along the perimeter where surface runoff may drain onto the pavement, a swale or an intercept subdrain system should be installed to prevent infiltrating precipitation from seeping into the granular bases (since this may inflict frost damage on the pavement). The subdrains should consist of filter wrapped weepers, and they should be connected to the catch basins and storm manholes in the paved areas. The subdrains should be backfilled with free-draining granular material.

At the entrance into the garage, the thickness of the sub-base should be increased accordingly to minimize the frost heaving.

6.7 Soil Parameters

The recommended soil parameters for the project design are given in Table 6.

Table 6 - Soil Parameters

Unit Weight and Bulk Factor

	Unit Weight (kN/m^3)		Estimated Bulk Factor	
	Bulk	**Submerged**	**Loose**	**Compacted**
Existing Earth Fill	20.5	10.8	1.25	0.98
Silty Clay Till	22.0	12.5	1.33	1.03
Silty Clay	20.5	11.5	1.30	1.00
Silt/Sandy Silt	21.0	11.0	1.20	1.00
Sandy Silt Till	22.5	12.5	1.30	1.03
Weathered Shale Bedrock	24.0	13.0	1.40	1.10

Lateral Earth Pressure Coefficients

	Active K_a	At Rest K_0	Passive K_p
Compacted Earth Fill and Silty Clay	0.40	0.55	2.50
Native Tills and Silts	0.33	0.50	3.00
Weathered Shale Bedrock	0.20	0.30	5.00

Coefficients of Friction

Between Concrete and Granular Base	0.50
Between Concrete and Sound Natural Soils or Shale Bedrock	0.40

6.8 Excavation

Where excavation is to be carried out close to any existing underground structure or services, one must be aware that the previous backfill is amorphous in structure and is susceptible to sloughing and sudden side collapse. Extreme caution must be exercised and test pits should be used to evaluate the safety of such excavation. The existing services must be properly secured, where necessary.

Excavation should be carried out in accordance with Ontario Regulation 213/91. The types of soils are classified in Table 7.

Table 7 - Classification of Soils for Excavation

Material	Type
Sound natural Tills and Clay, and weathered Shale Bedrock	1 and 2
Earth Fill, weathered Soil, and drained Silts	3
Saturated Silts	4

For excavation in shale bedrock, a cut slope steeper than 1H:1V can be allowed, provided that the bedding plane of the rock is relatively horizontal and any loose rocks protruding from the excavation are removed for safety.

Excavation into the weathered shale and the hard till containing boulders will require extra effort using mechanical means with a rock-ripper to facilitate the excavation. This method can generally be employed to excavate the weathered shale to a depth of 2.0± m below the bedrock surface. Efficient removal of the sound shale will require the aid of pneumatic hammering.

The shale is susceptible to disintegration and swelling upon exposure to air and water, with subsequent reversion to a clay soil. When excavating the sound shale, slight lateral displacement of the excavation walls is often experienced. This is due to the release of residual stress stored in the bedrock mantle and the swelling characteristic of the rock. A compressible material, such as sprayed foam, 100 mm in thickness, should be placed on the shale bedrock in order to slow down the disintegration if it will be exposed for more than a few weeks.

The groundwater yield from the tills and clay will be slow in rate and limited in quantity, due to their relatively low to low permeability, while the yield from the silts may be moderate to appreciable. Groundwater under subterranean artesian pressure may occur in places within the shale bedrock, which is generally considered to be a poor aquifer. Therefore, the yield of groundwater from the bedrock, if encountered, will be appreciable initially; however, if allowed to drain freely, it will often dissipate or be depleted with time. Any need for dewatering can be confirmed through the hydrogeological assessment.

In areas where a safe backing slope is not possible, the excavation has to be supported by shoring. The overburden load, the surcharge from adjacent structures and the hydrostatic pressure, if any, should be included in the design of the shoring. The design parameters and our recommendations are provided in the Appendix.

6.9 Monitoring of Performance

It is recommended that close monitoring of vertical and lateral movement of the shoring wall should be carried out and frequent site inspections be conducted to ensure that the excavation does not adversely affect the structural stability of the adjacent buildings and the existing underground utilities. Extra bracing or support may be required if any movement is found excessive. The contractor should maintain the shoring to ensure any movement is within the design limit.

Due to the presence of nearby buildings, the foundation details of the adjacent structures must be investigated and incorporated into the design and construction of the proposed project. It is recommended that a pre-construction survey and a monitoring program be carried out for all adjacent structures in order to verify any potential future liability claims.

Vibration control and pre-construction survey is strongly recommended for the adjacent properties and structures prior to any excavation activities at the site. Our office can provide further advice or undertaking the vibration control and pre-construction survey as necessary.

7.0 LIMITATIONS OF REPORT

This report was prepared by Soil Engineers Ltd. for the accounts of The Elia Corporation, and for review by the designated consultants and government agencies. Use of the report is subject to the conditions and limitations of the contractual agreement.

The material in the report reflects the judgement of Mumta Mistry, B.A.Sc., and Bernard Lee, P.Eng., in light of the information available to it at the time of preparation. Any use which a Third Party makes of this report, or any reliance on decisions to be made 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.

LICENSED PROFESSIONAL ENGINEER
May 17, 2021
B. P. Y. LEE
100104568
PROVINCE OF ONTARIO

Mumta Mistry, B.A.Sc.
MM/BL:dd/mm

Bernard Lee, P.Eng.

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.: 2010-S021

LOG OF BOREHOLE NO.: 1

FIGURE NO.: 1

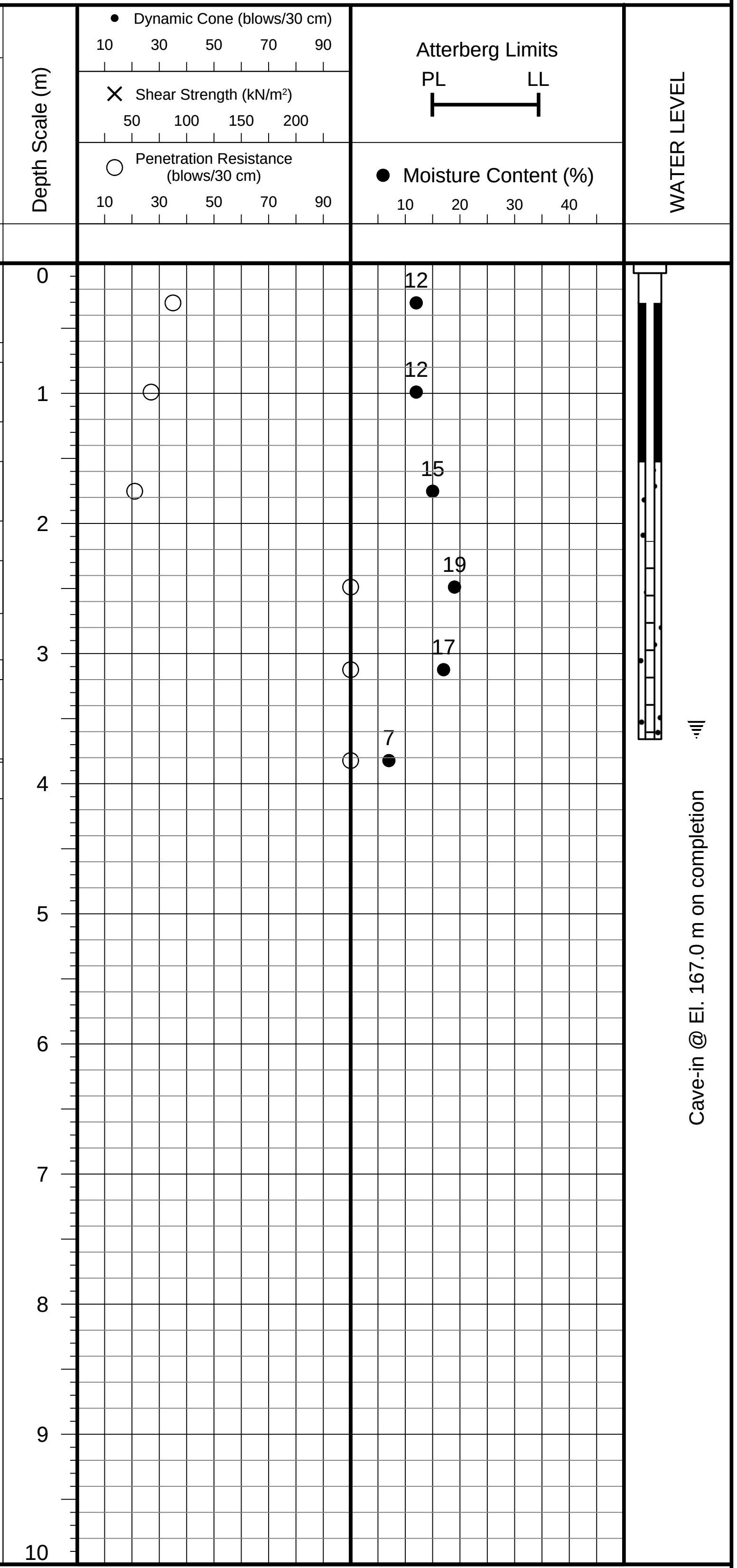
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 23, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
170.7	Ground Surface			
0.0	**20 cm TOPSOIL**			
	Brown **EARTH FILL** **(Silty Clay)** some sand to sandy a trace of gravel with organic inclusions	1	DO	35
		2	DO	27
		3	DO	21
168.4 2.3	Hard **SILTY CLAY TILL** a trace to some sand a trace of gravel occ. sand and silt seams and layers, cobbles, boulders and shale fragments	4	DO	58/25
		5	DO	50/15
	brown grey	6	DO	50/3
166.6 4.1	**END OF BOREHOLE** **(Refusal to Auger)** Installed 50 mm Ø PVC monitoring well to 3.7 m (1.5 m screen) Sand backfill from 1.5 m to 3.7 m Bentonite holeplug from 0.3 m to 1.5 m Provided with a 4x4 steel monument casing with top and bottom caps, and lock			



Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 2

FIGURE NO.: 2

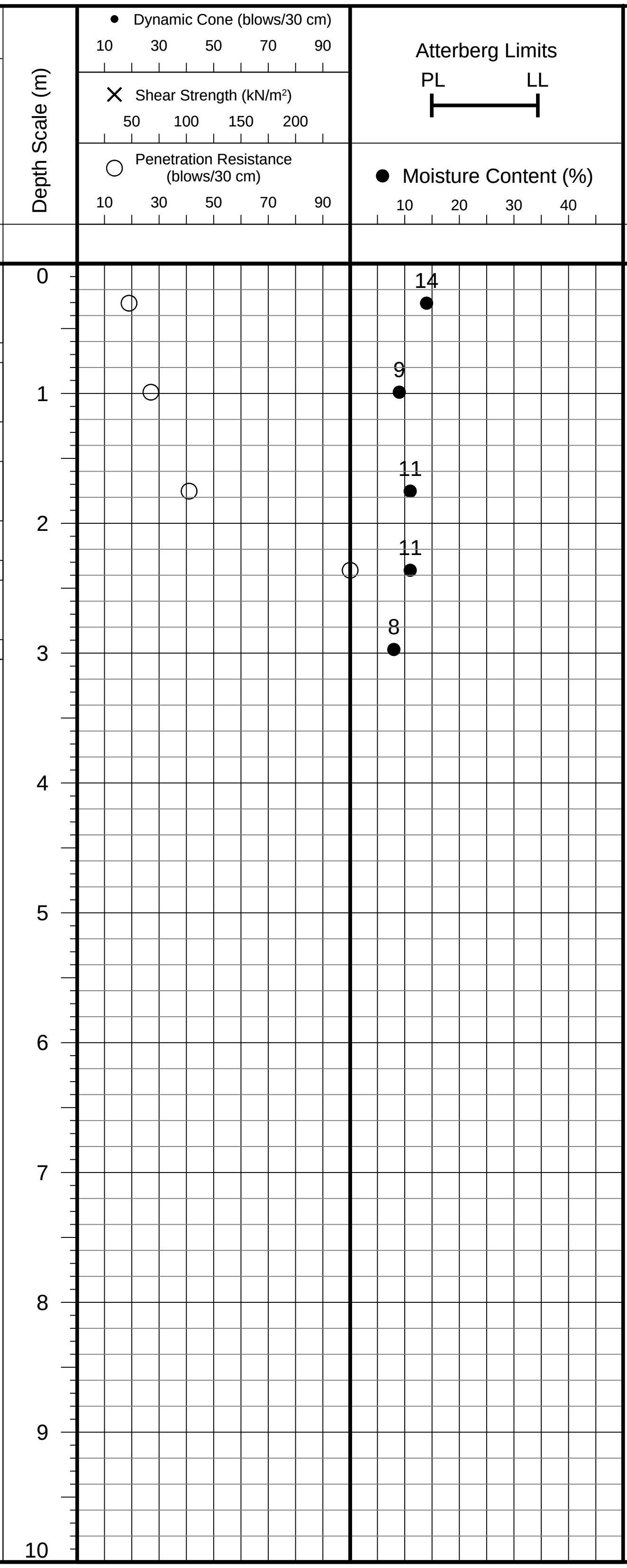
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 23, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value	WATER LEVEL
171.9	Ground Surface				
0.0	**20 cm TOPSOIL**				Dry and open upon completion of the field work
	Brown **EARTH FILL** **(Silty Clay)** some sand to sandy a trace of gravel	1	DO	19	
		2	DO	27	
170.4 1.5	Brown, hard **SILTY CLAY TILL** a trace of sand to sandy a trace of gravel occ. sand and silt seams and layers, cobbles and boulders	3	DO	41	
		4	DO	50/15	
		5	AS	-	
168.9 3.0	**END OF BOREHOLE** **(Refusal to Auger)**				



Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 3

FIGURE NO.: 3

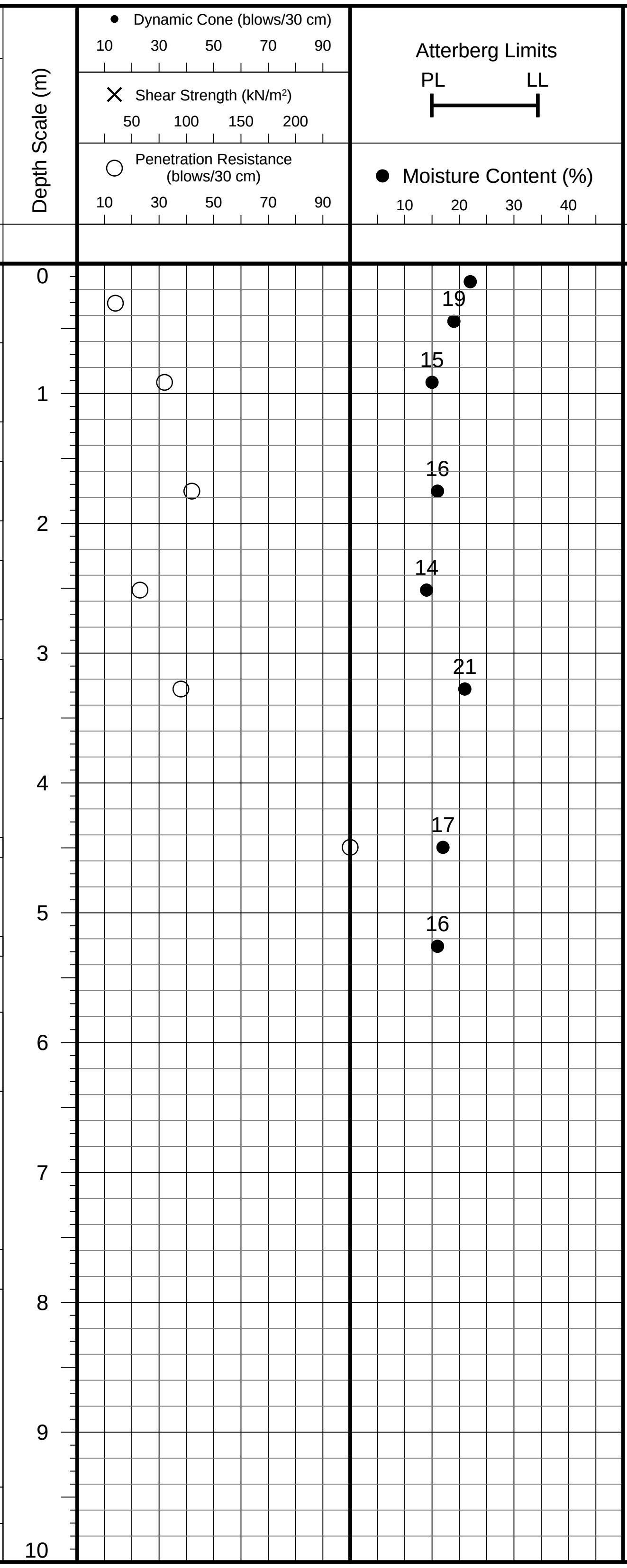
PROJECT DESCRIPTION: Proposed Mixed-Use Development with 2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers and Rock Coring

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 26 to 28, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
171.8	Ground Surface			
0.0	**28 cm TOPSOIL**	1A	DO	14
	Brown, stiff to very stiff, weathered **SILTY CLAY TILL** a trace to some sand a trace of gravel occ. sand and silt seams and layers, cobbles, boulders and rock fragments	1B		
		2	DO	32
170.7 1.1	Compact to very dense **SILT** a trace of clay a trace to some sand — — weathered			
		3	DO	42
		4	DO	23
		5	DO	38
	— — brown grey			
		6	AS	50/NP
166.6 5.2	Grey **SILTY CLAY** a trace of sand	7	AS	-
166.0 5.8	Grey **SHALE BEDROCK** with limestone layers	8	RC RQD	50% 18%
		9	RC RQD	67% 0%
		10	RC RQD	83% 0%
		11	RC RQD	93% 7%
		12	RC RQD	64% 0%
161.8	*(Continued on next page)*			



WATER LEVEL

W.L. not measured due to use of water for rock coring

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 3

FIGURE NO.: 3

PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers
and Rock Coring

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 26 to 28, 2020

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
10.0	*(Continued)* Grey **SHALE BEDROCK** with limestone layers	13	RC RQD	98% 67%	10			
		14	RC RQD	100% 80%	11 12			
		15	RC RQD	100% 74%	13			
		16	RC RQD	100% 77%	14 15			
		17	RC RQD	100% 60%	16			
154.8 17.0	**END OF BOREHOLE**				17 18 19 20			

Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 4

FIGURE NO.: 4

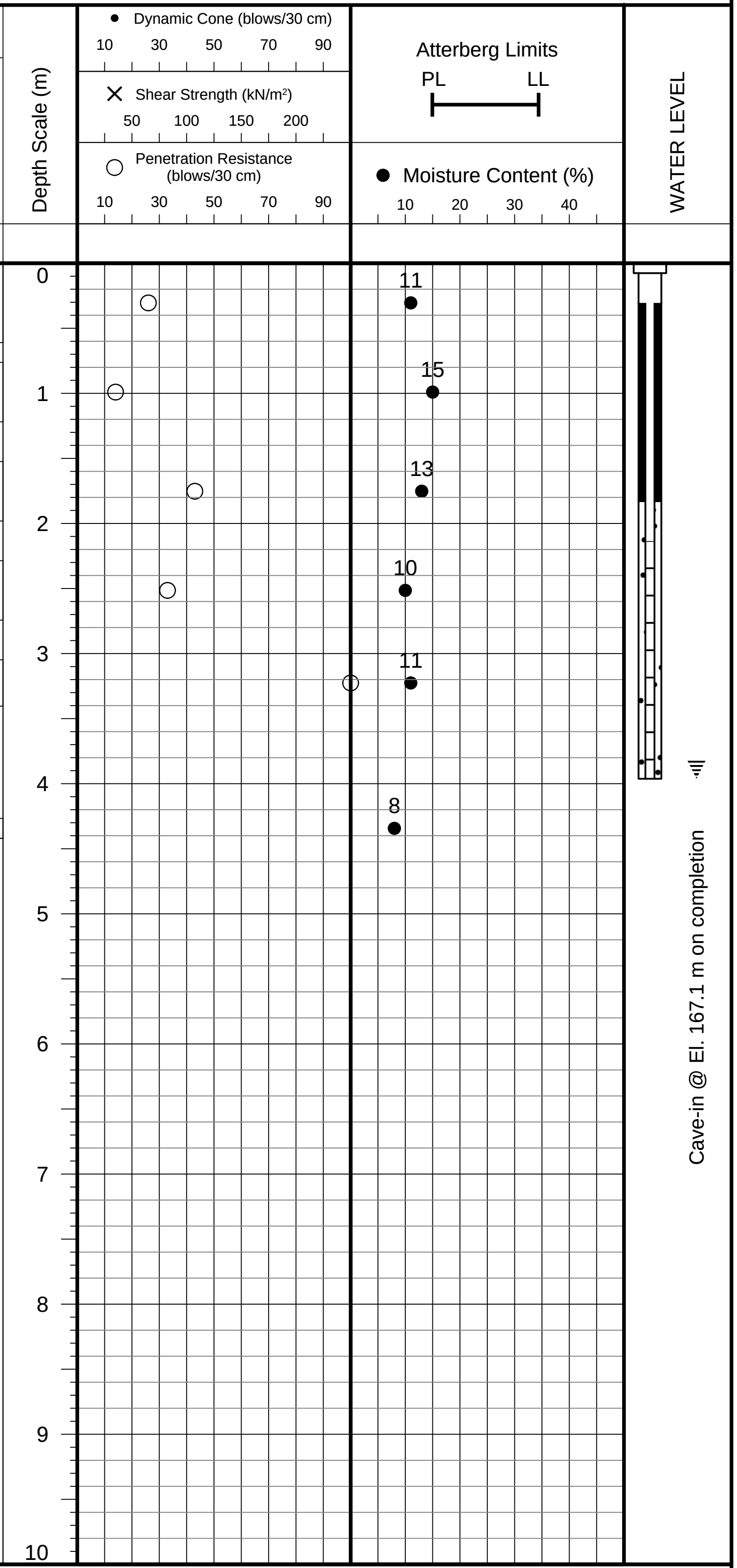
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 23, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES		
		Number	Type	N-Value
171.1	Ground Surface			
0.0	**18 cm TOPSOIL**			
	Brown **EARTH FILL** **(Silty Clay)** sandy, a trace of gravel with organic inclusions	1	DO	26
		2	DO	14
169.3 1.8	Hard **SILTY CLAY TILL** some sand to sandy a trace of gravel occ. sand and silt seams and layers, cobbles, boulders and shale fragments	3	DO	43
		4	DO	33
		5	DO	65/20
	brown grey	6	AS	-
166.7 4.4	**END OF BOREHOLE** **(Refusal to Auger)** Installed 50 mm Ø PVC monitoring well to 4.0 m (1.5 m screen) Sand backfill from 1.8 m to 4.0 m Bentonite holeplug from 0.3 m to 1.8 m Provided with a 4x4 steel monument casing with top and bottom caps, and lock			



Cave-in @ El. 167.1 m on completion

Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 5

FIGURE NO.: 5

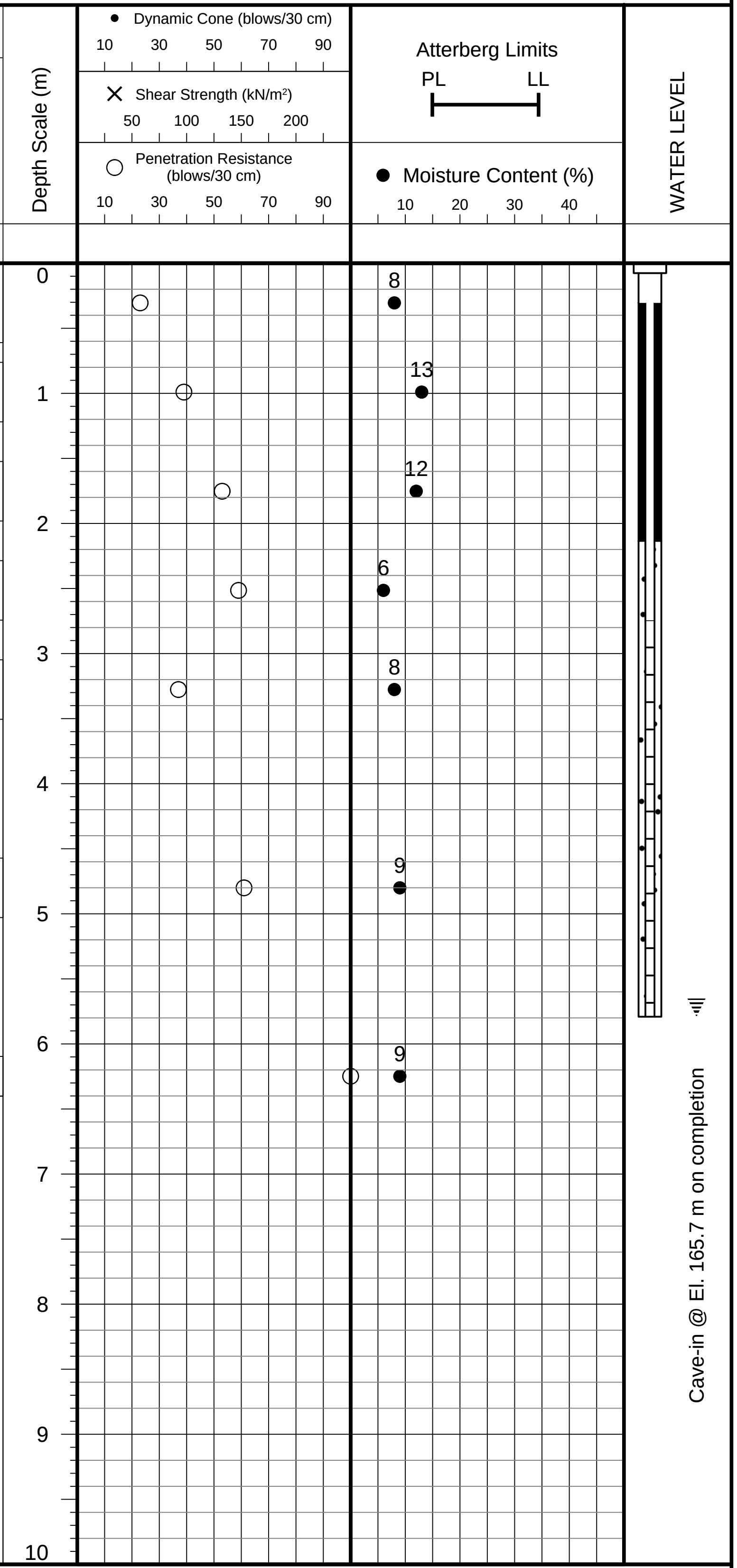
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 23, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
171.5	Ground Surface			
0.0	**18 cm TOPSOIL** Brown **EARTH FILL** **(Silty Clay)** some sand, a trace of gravel with organic inclusions	1	DO	23
		2	DO	39
170.4 1.1	Brown, dense to very dense **SANDY SILT TILL** a trace to some clay a trace of gravel occ. sand and silt seams and layers, cobbles, boulders and rock fragments	3	DO	53
169.2 2.3	Grey, hard **SILTY CLAY TILL** a trace of sand to sandy a trace to some gravel occ. sand and silt seams and layers, cobbles, boulders and rock fragments	4	DO	59
		5	DO	37
		6	DO	61
		7	DO	50/15
165.1 6.4	**END OF BOREHOLE** **(Refusal to Auger)** Installed 50 mm Ø PVC monitoring well to 5.8 m (3.0 m screen) Sand backfill from 2.1 m to 5.8 m Bentonite holeplug from 0.3 m to 2.1 m Provided with a 4x4 steel monument casing with top and bottom caps, and lock			



Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 6

FIGURE NO.: 6

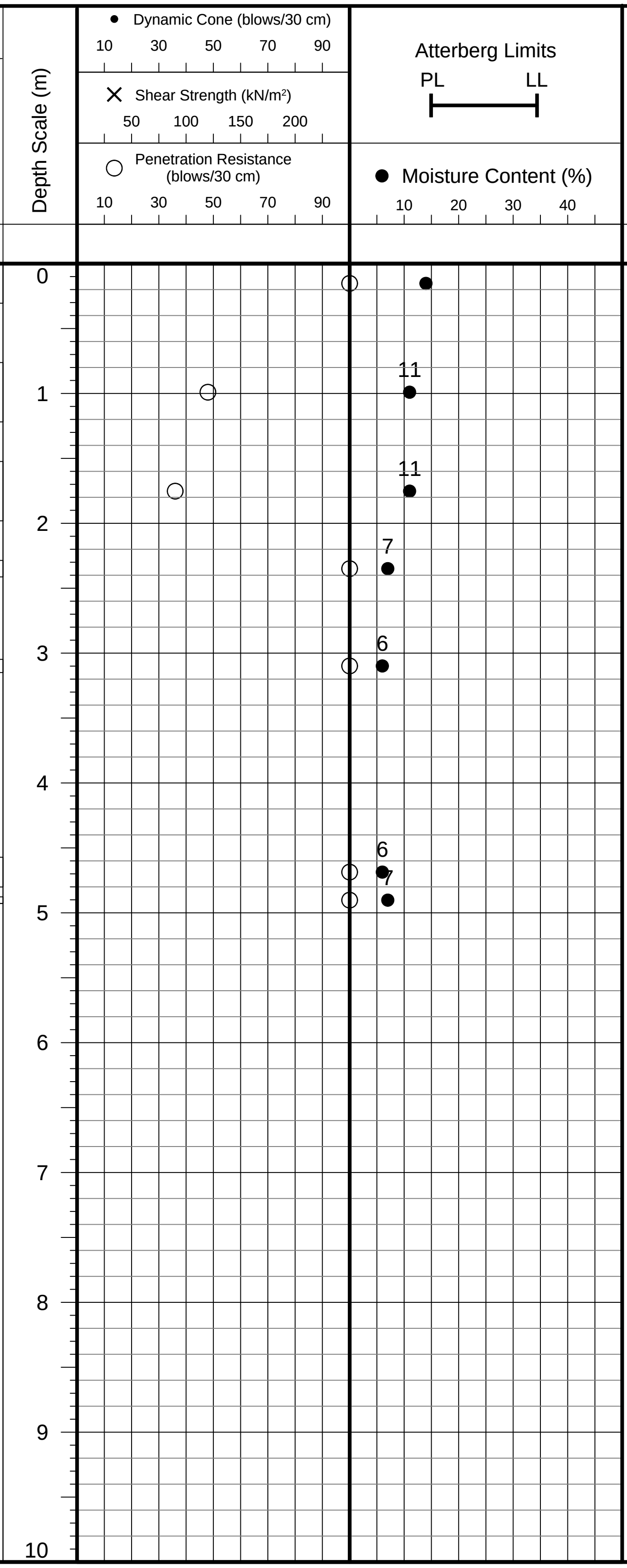
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 20, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
171.0	Ground Surface			
0.0	**25 cm TOPSOIL**	1	DO	50/15
	Brown **EARTH FILL (Sandy Silt)** traces to some clay and gravel	2	DO	48
		3	DO	36
169.2 1.8	Brown, dense to very dense **SANDY SILT TILL** trace of clay and gravel occ. sand and silt seams and layers, cobbles and boulders	4	DO	50/13
		5	DO	50/10
166.4 4.6	Grey, hard **SILTY CLAY TILL** sandy, a trace of gravel occ. sand and silt seams and layers, cobbles, boulders and shale fragments	6	DO	50/8
166.1 4.9	Grey **SHALE BEDROCK**	7	DO	50/5
	END OF BOREHOLE **(Refusal to Auger)**			



WATER LEVEL

Dry and open upon completion of the field work

Soil Engineers Ltd.

Page: 1 of 1

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 7

FIGURE NO.: 7

PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers

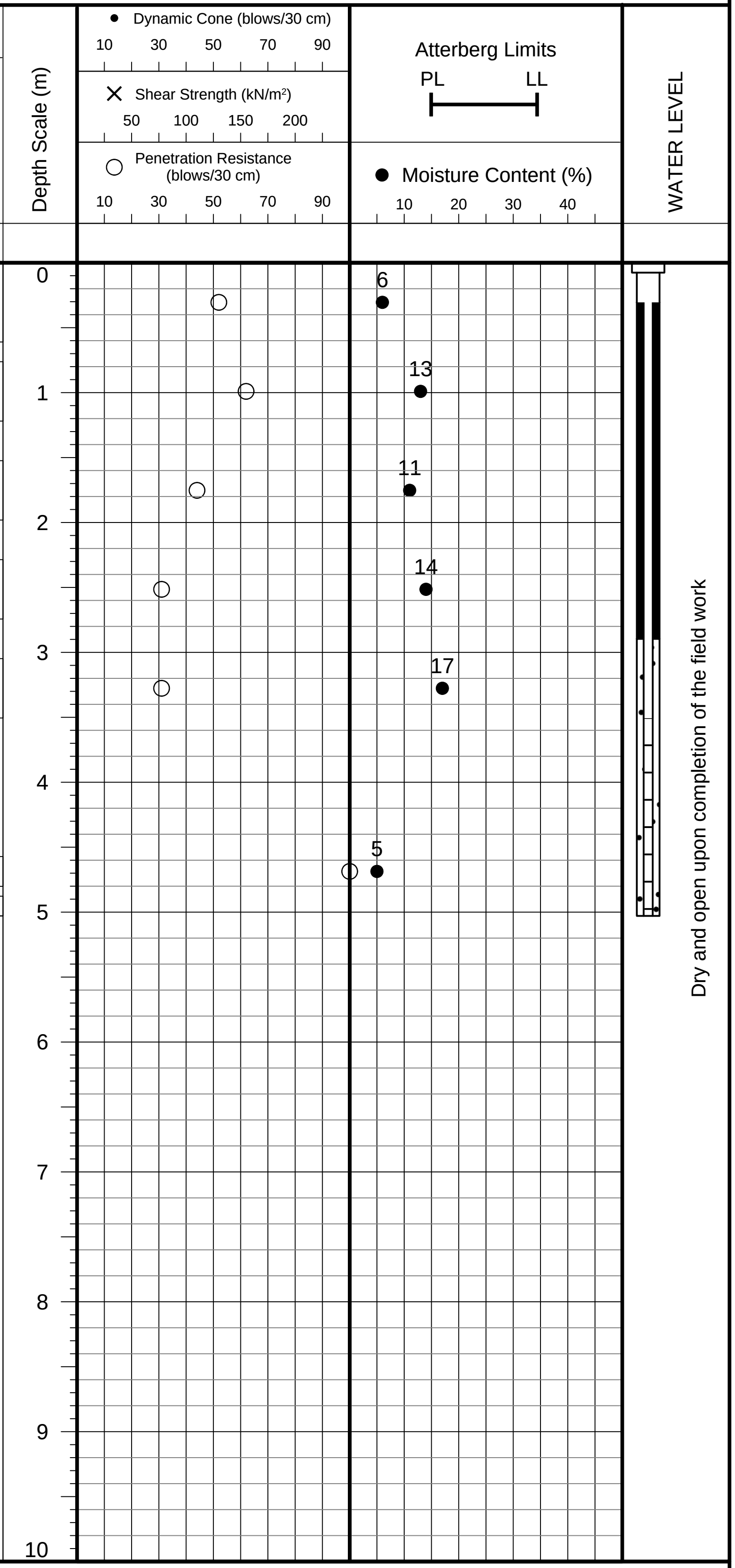
PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 20, 2020

El. (m) Depth (m)	SOIL DESCRIPTION
170.9	Ground Surface
0.0	**18 cm TOPSOIL** Brown **EARTH FILL** **(Sandy Silt)** traces to some clay and gravel occ. rock fragments
170.1 0.8	Brown, very dense **SANDY SILT TILL** traces of clay and gravel occ. sand and silt seams and layers, cobbles and boulders
169.4 1.5	Grey, dense **SILT** a trace to some clay traces of sand and gravel
167.6 3.3	Grey, very stiff to hard **SILTY CLAY TILL** some sand to sandy a trace to some gravel occ. sand and silt seams and layers, cobbles, boulders and rock fragments rock fragments
165.9 5.0	**END OF BOREHOLE** **(Refusal to Auger)**

SAMPLES Number	Type	N-Value
1	DO	52
2	DO	62
3	DO	44
4	DO	31
5	DO	31
6	DO	50/8
7	AS	-

Installed 50 mm Ø PVC monitoring well to
5.0 m (1.5 m screen)
Sand backfill from 2.9 m to 5.0 m
Bentonite holeplug from 0.3 m to 2.9 m
Provided with a 4x4 steel monument casing
with top and bottom caps, and lock



Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 8

FIGURE NO.: 8

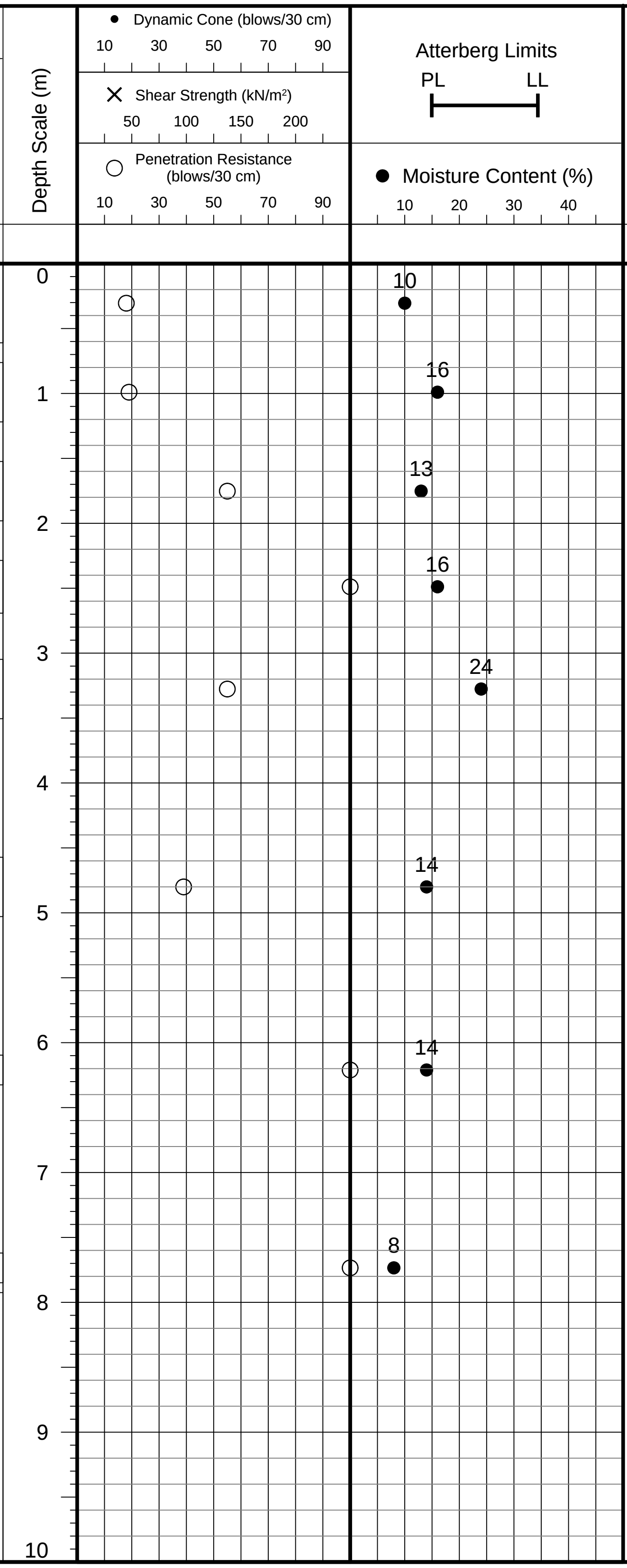
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 21, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	WATER LEVEL
170.4	Ground Surface				
0.0	**20 cm TOPSOIL**				Dry and open upon completion of the field work
	Brown **EARTH FILL** **(Silty Clay)** traces of sand and gravel	1	DO	18	
		2	DO	19	
169.3 1.1	Dense to very dense **SILT** a trace to some clay a trace of sand occ. gravel	3	DO	55	
		4	DO	69/25	
	brown grey	5	DO	55	
		6	DO	39	
		7	DO	50/8	
162.8 7.6	Grey, hard **SILTY CLAY TILL** traces of sand and gravel occ. sand and silt seams and layers, cobbles, boulders and shale fragments	8	DO	50/8	
162.5 7.9	**END OF BOREHOLE** **(Refusal to Auger)**				



Soil Engineers Ltd.

Page: 1 of 1

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 9

FIGURE NO.: 9

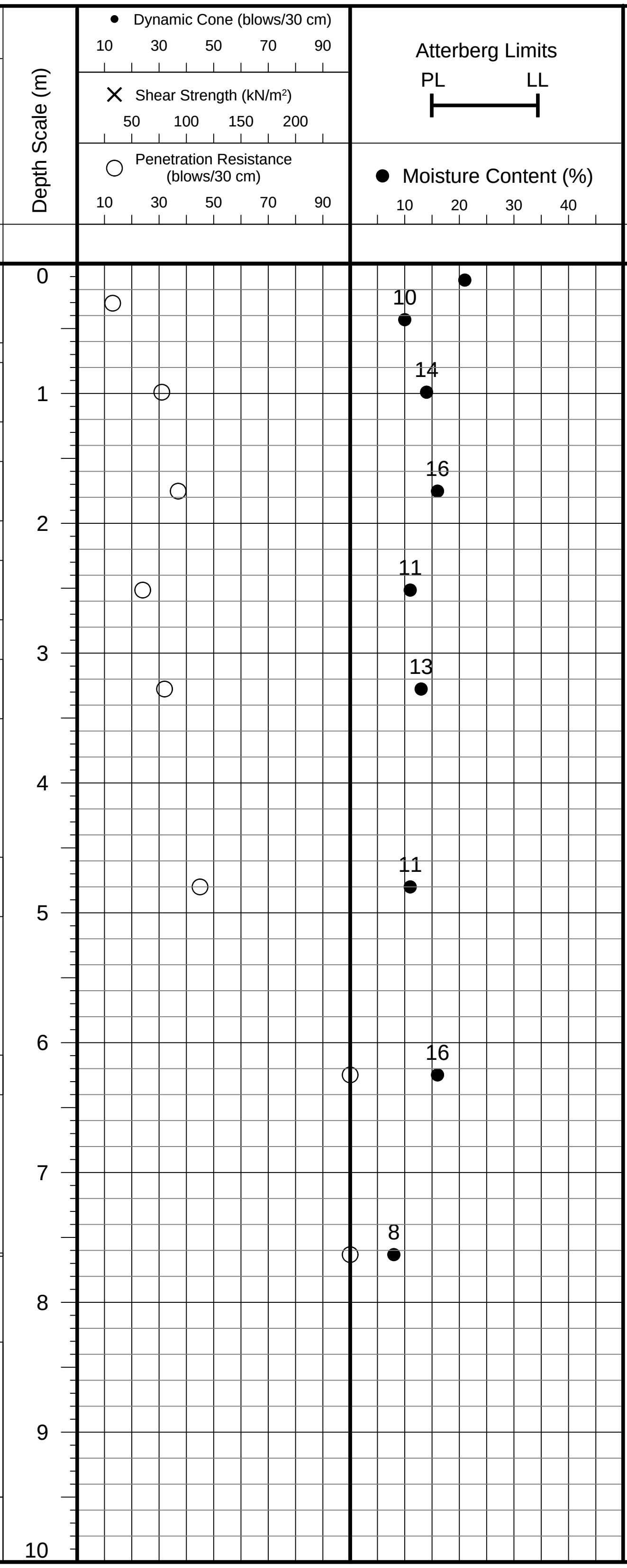
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

METHOD OF BORING: Solid Stem Augers
and Rock Coring

DRILLING DATE: October 28 and 29, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Moisture Content (%)
169.4	Ground Surface				
0.0	**25 cm TOPSOIL**	1A	DO	13	
	Brown, compact, weathered **SILTY CLAY TILL** some sand, a trace of gravel occ. sand and silt seams and layers, cobbles and boulders	1B			10
168.6 0.8	Dense **SANDY SILT** — — brown/grey a trace of clay occ. sand layers	2	DO	31	14
		3	DO	37	16
167.1 2.3	Grey, very stiff to hard **SILTY CLAY TILL** sandy, a trace of gravel occ. sand and silt seams and layers, cobbles and boulders	4	DO	24	11
		5	DO	32	13
		6	DO	45	11
163.3 6.1	Grey, very dense **SILT** some clay, a trace of sand	7	DO	50/15	16
161.8 7.6	Grey **SHALE BEDROCK** with limestone layers	8	DO	100/3	8
		9	RC RQD	96% 50%	
159.4	*(Continued on next page)*				



WATER LEVEL

W.L. not measured due to use of water for rock coring

Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 9

FIGURE NO.: 9

PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

METHOD OF BORING: Solid Stem Augers
and Rock Coring

DRILLING DATE: October 28 and 29, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES			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
		Number	Type	N-Value				
10.0	*(Continued)* Grey **SHALE BEDROCK** with limestone layers	10	RC RQD	100% 78%	10			
		11	RC RQD	100% 91%	11 12			
		12	RC RQD	100% 89%	13			
155.7 13.7	**END OF BOREHOLE**				14 15 16 17 18 19 20			

Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 10

FIGURE NO.: 10

PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

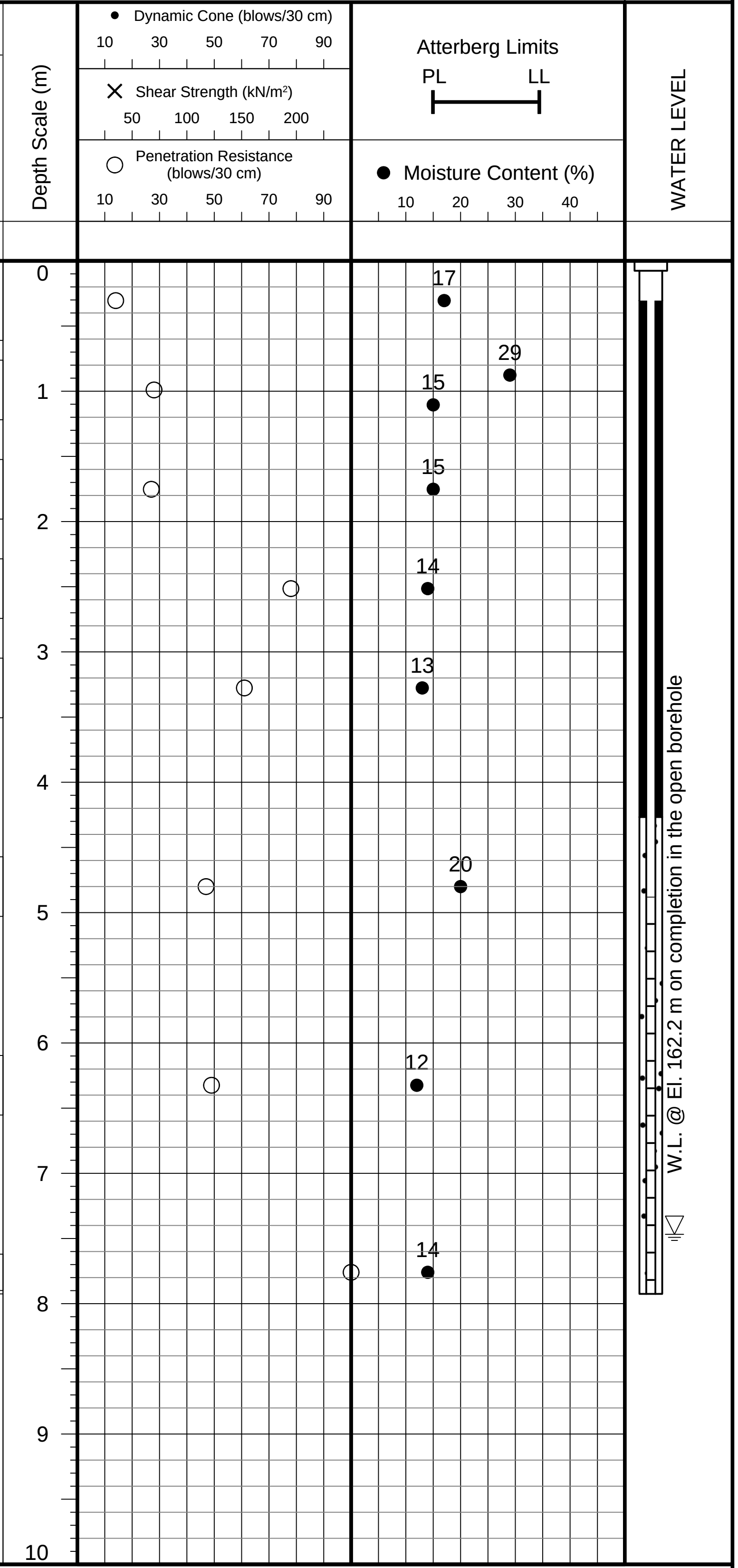
METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 21, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
169.7	Ground Surface			
0.0	**20 cm TOPSOIL**			
	Brown **EARTH FILL** **(Sandy Silt)** some clay, a trace of gravel	1	DO	14
168.9 0.8	Brown, compact to very dense **SILT** traces to some clay and sand occ. gravel topsoil	2A 2B	DO	28
		3	DO	27
		4	DO	78
		5	DO	61
165.1 4.6	Brown, hard **SILTY CLAY** a trace of sand	6	DO	47
163.6 6.1	Grey, hard **SILTY CLAY TILL** sandy, a trace of gravel occ. sand and silt seams and layers, cobbles and boulders	7	DO	49
	silty sand till	8	DO	50/13
161.8 7.9	**END OF BOREHOLE** **(Refusal to Auger)**			

Installed 50 mm Ø PVC monitoring well to 7.9 m (3.0 m screen)
Sand backfill from 4.3 m to 7.9 m
Bentonite holeplug from 0.3 m to 4.3 m
Provided with a 4x4 steel monument casing with top and bottom caps, and lock



Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 11

FIGURE NO.: 11

PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers

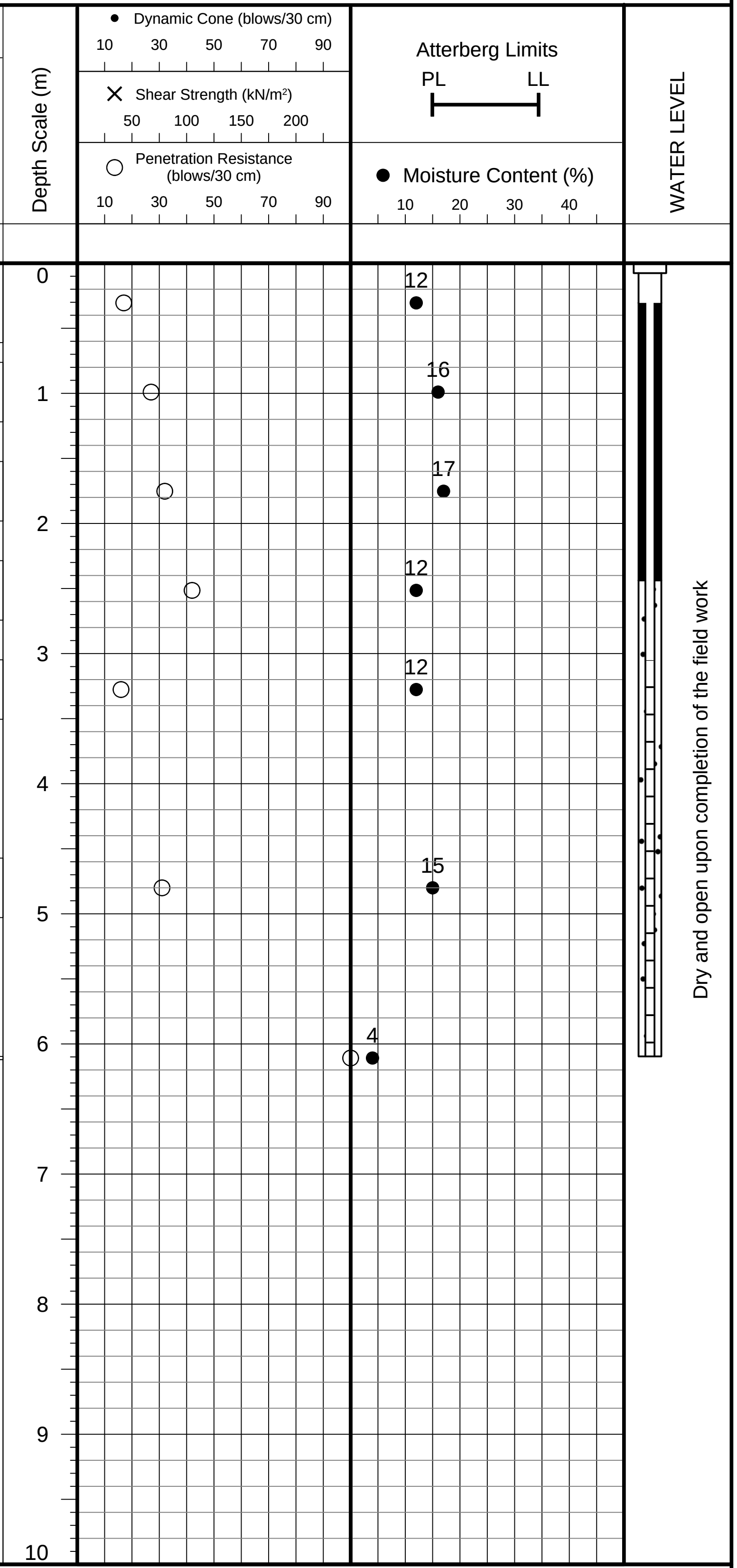
PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 20, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
168.1	Ground Surface			
0.0	**20 cm TOPSOIL**			
	Brown, compact to dense **SANDY SILT** a trace of clay occ. sand layers	1	DO	17
		2	DO	27
		3	DO	32
165.8 2.3	Grey, compact to dense **SILT** traces to some clay and sand occ. gravel	4	DO	42
		5	DO	16
		6	DO	31
162.0 6.1	Grey **SHALE BEDROCK**	7	DO	50/3

END OF BOREHOLE
(Refusal to Auger)

Installed 50 mm Ø PVC monitoring well to 6.1 m (3.0 m screen)
Sand backfill from 2.4 m to 6.1 m
Bentonite holeplug from 0.3 m to 2.4 m
Provided with a 4x4 steel monument casing with top and bottom caps, and lock



JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 12

FIGURE NO.: 12

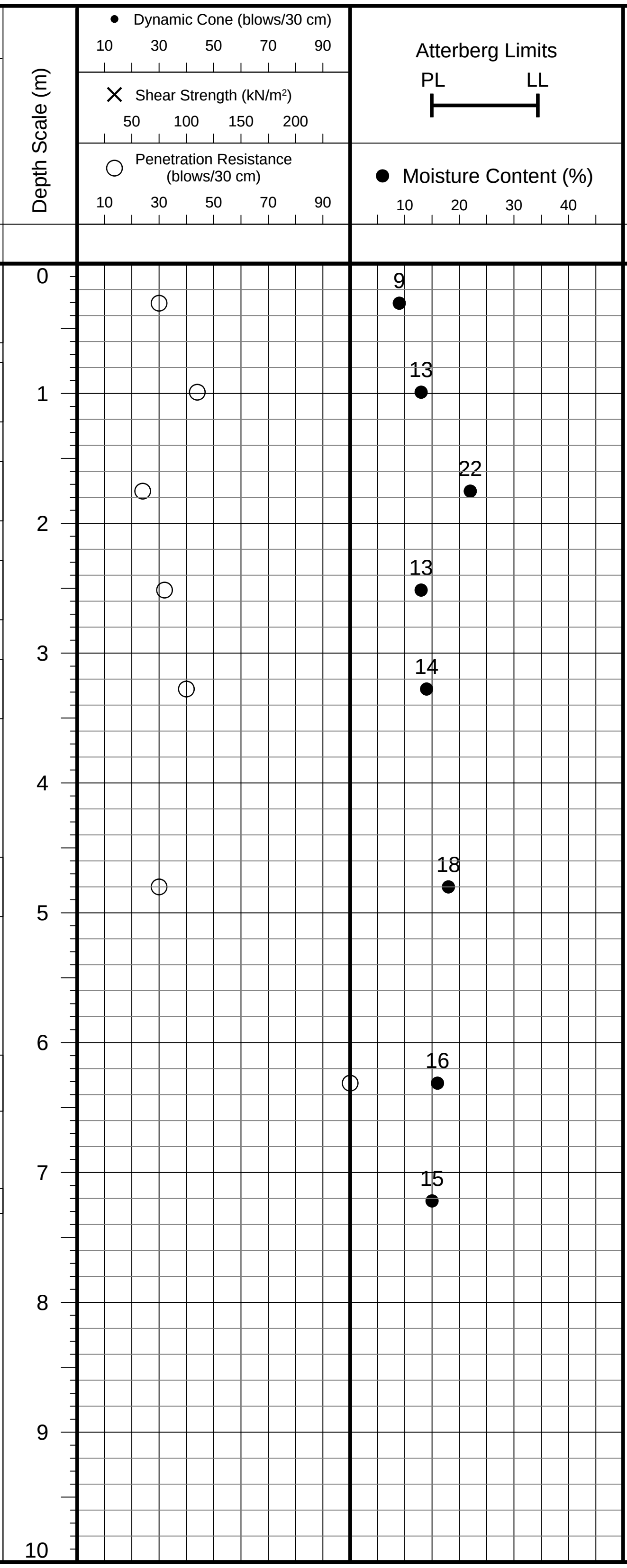
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 20, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	WATER LEVEL
168.4	Ground Surface				
0.0	**25 cm TOPSOIL**				Dry and open upon completion of the field work
	Compact to dense **SANDY SILT TILL** a trace to some clay a trace of gravel occ. sand and silt seams and layers, cobbles and boulders brown grey	1	DO	30	
		2	DO	44	
		3	DO	24	
		4	DO	32	
165.4 3.0	Grey, compact to dense **SILT** a trace to some clay a trace of sand occ. gravel	5	DO	40	
		6	DO	30	
		7	DO	74/28	
		8	AS	-	
161.1 7.3	**END OF BOREHOLE** **(Refusal to Auger)**				



JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 13

FIGURE NO.: 13

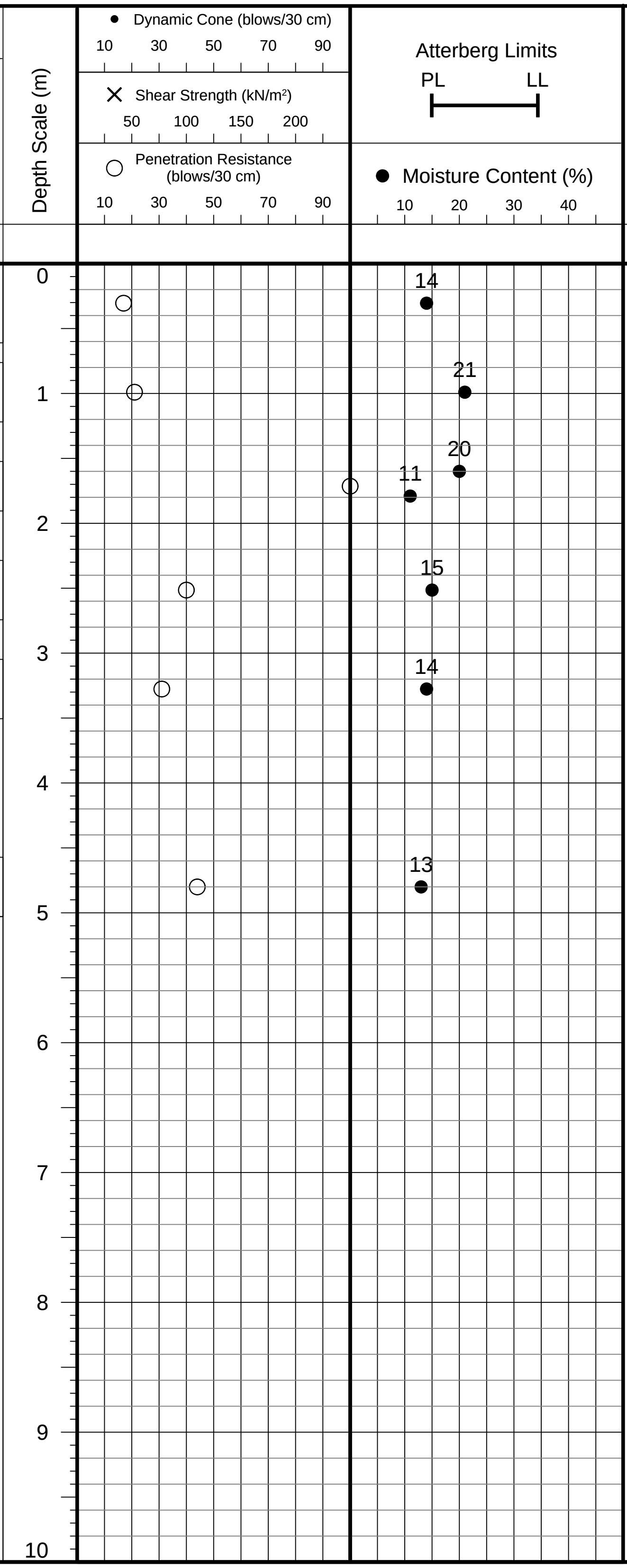
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 20, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
168.1	Ground Surface			
0.0	**25 cm TOPSOIL**			
	Brown/dark grey asphalt debris **EARTH FILL** **(Sandy Silt and Silty Clay)** a trace of gravel with topsoil/organic inclusions	1	DO	17
		2	DO	21
166.4 1.7	Dense to very dense **SILT** traces to some clay and sand	3A 3B	DO	78/23
		4	DO	40
	brown grey	5	DO	31
163.5 4.6	Grey, dense **SANDY SILT TILL** traces of clay and gravel occ. sand and silt seams and layers, cobbles and boulders	6	DO	44
163.1 5.0	**END OF BOREHOLE**			



WATER LEVEL

Dry and open upon completion of the field work

Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 14

FIGURE NO.: 14

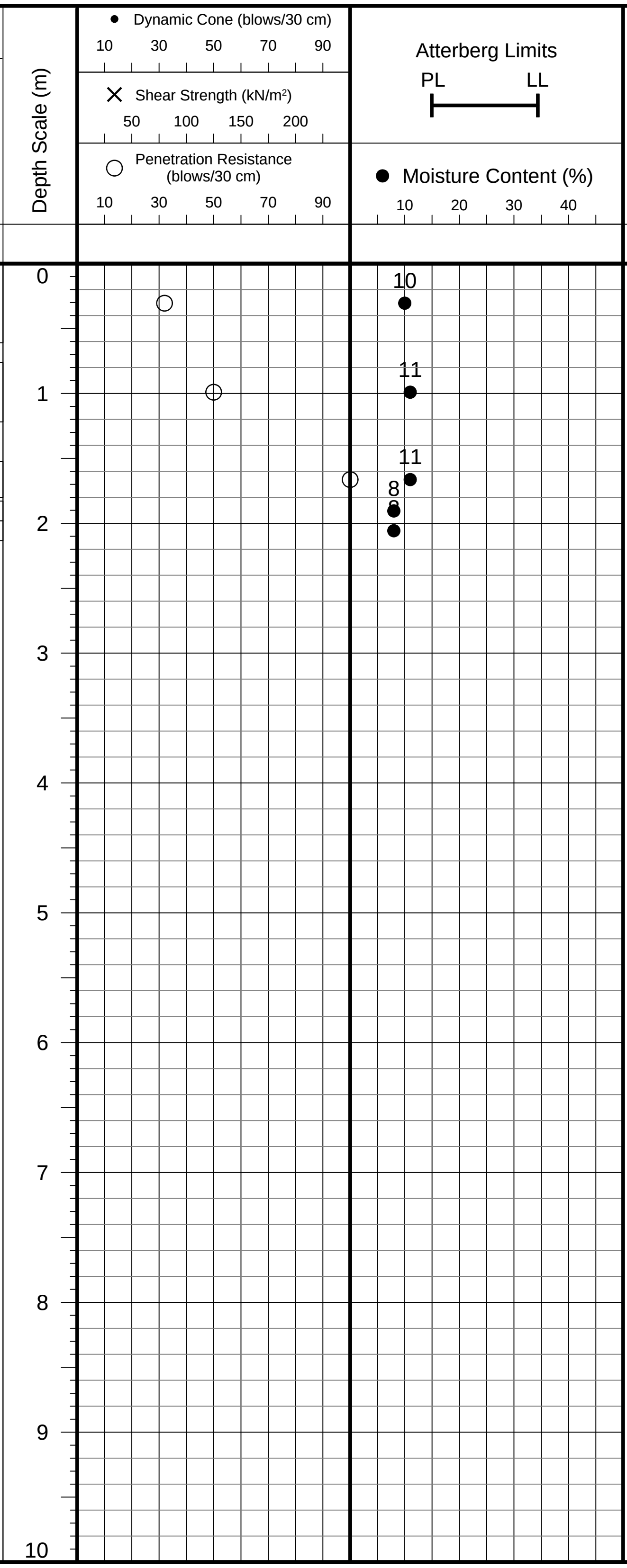
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 20, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
166.5	Ground Surface			
0.0	**20 cm TOPSOIL**			
	Very stiff to hard **SILTY CLAY TILL** brown grey	1	DO	32
	sandy, a trace of gravel occ. sand and silt seams and layers, cobbles, boulders and rock fragments weathered	2	DO	50
		3	DO	50/13
		4	AS	-
164.4 2.1		5	AS	-
	END OF BOREHOLE **(Refusal to Auger)**			



WATER LEVEL

Dry and open upon completion of the field work

Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 15

FIGURE NO.: 15

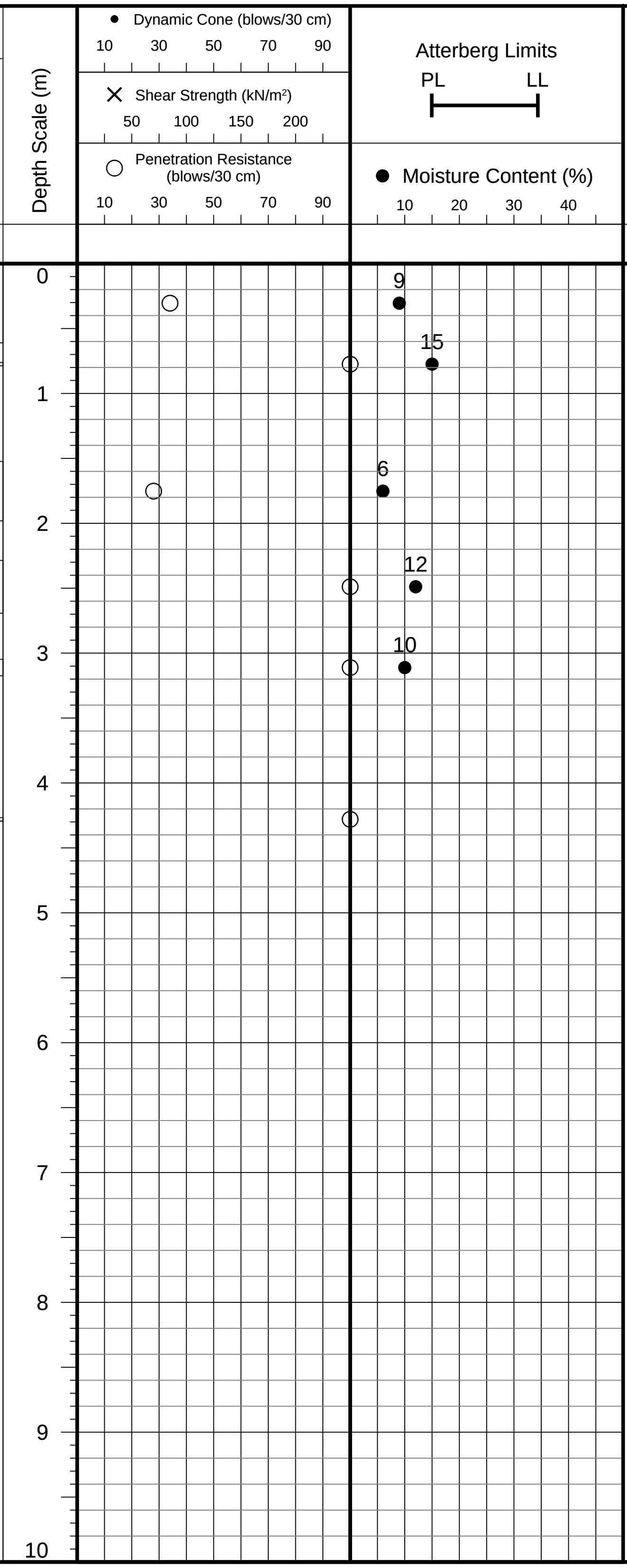
PROJECT DESCRIPTION: Proposed Mixed-Use Development with 2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 19, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
165.4	Ground Surface			
0.0	**18 cm TOPSOIL**			
	Brown **EARTH FILL** **(Silty Clay)** some sand, a trace of gravel	1	DO	34
		2	DO	50/3
164.2 1.2	Very stiff to hard **SILTY CLAY TILL** sandy, a trace of gravel occ. sand and silt seams and layers, cobbles, boulders and rock fragments	3	DO	28
		4	DO	66/25
		5	DO	50/13
	brown grey			
161.1 4.3	**END OF BOREHOLE** **(Refusal to Auger)**	6	DO	50/3



WATER LEVEL

▽

Cave-in @ El. 161.4 m on completion

Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 16

FIGURE NO.: 16

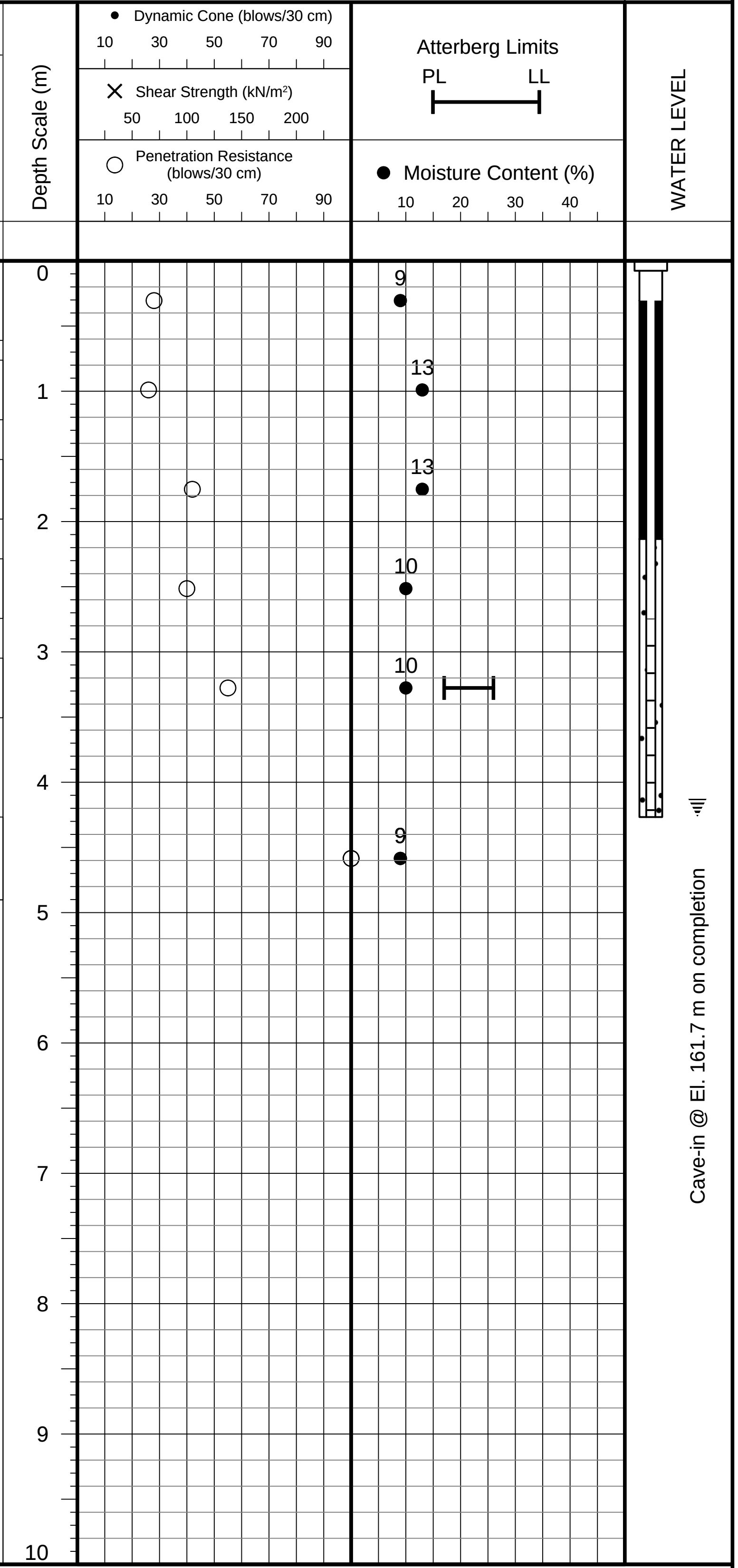
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 19, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
166.0	Ground Surface			
0.0	**13 cm TOPSOIL**			
	Brown **EARTH FILL** **(Silty Clay)** some sand to sandy a trace of gravel	1	DO	28
		2	DO	26
164.5 1.5	Brown, hard **SILTY CLAY TILL** some sand to sandy a trace to some gravel occ. sand and silt seams and layers, cobbles, boulders and rock fragments	3	DO	42
		4	DO	40
		5	DO	55
		6	DO	59/18
161.1 4.9	**END OF BOREHOLE** **(Refusal to Auger)** Installed 50 mm Ø PVC monitoring well to 4.3 m (1.5 m screen) Sand backfill from 2.1 m to 4.3 m Bentonite holeplug from 0.3 m to 2.1 m Provided with a 4x4 steel monument casing with top and bottom caps, and lock			



Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 17

FIGURE NO.: 17

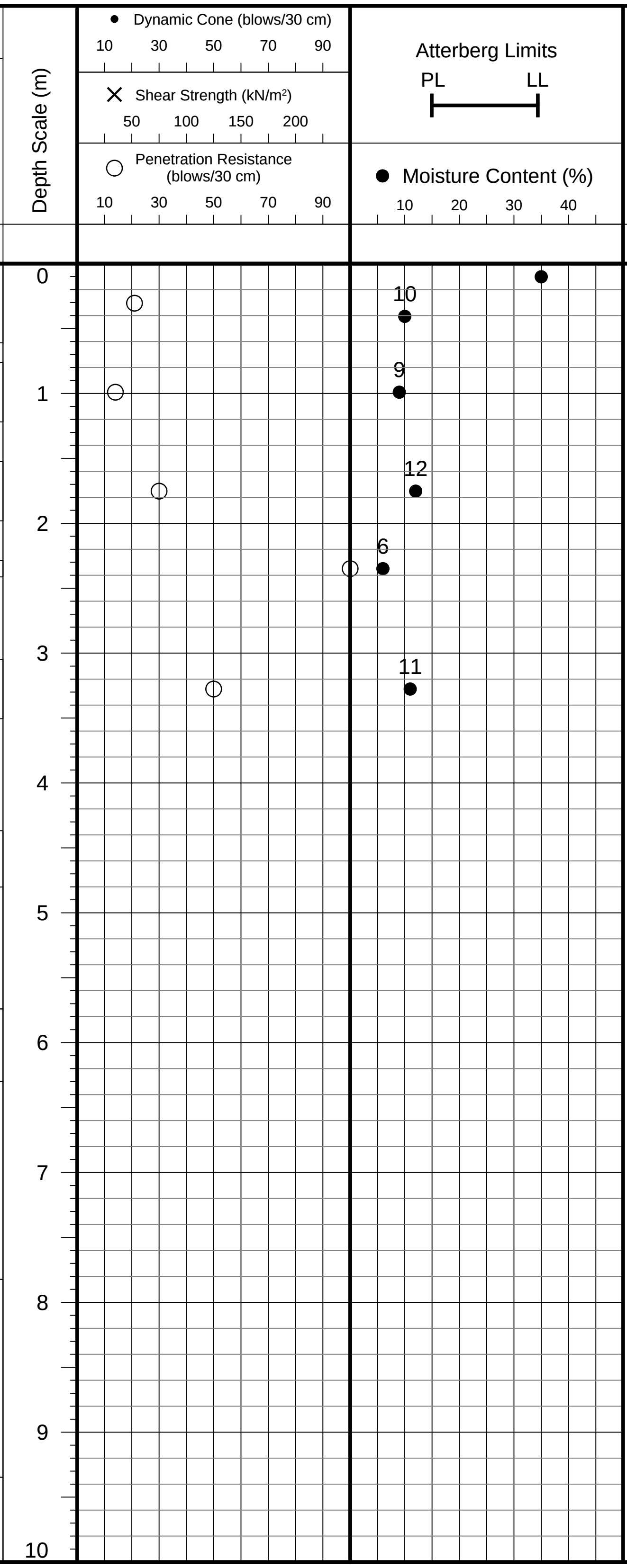
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

METHOD OF BORING: Solid Stem Augers
and Rock Coring

DRILLING DATE: October 20 to 26, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
165.5	Ground Surface			
0.0	**20 cm TOPSOIL**	1A	DO	21
	Brown **EARTH FILL** **(Silty Clay)** some sand to sandy a trace of gravel	1B		
		2	DO	14
164.4 1.1	Brown, very stiff to hard **SILTY CLAY TILL** some sand to sandy a trace to some gravel occ. sand and silt seams and layers, cobbles, boulders and rock fragments	3	DO	30
	rock fragments	4	DO	50/13
		5	DO	50
161.1 4.4	Grey **SHALE BEDROCK** with limestone layers	6	RC RQD	94% 71%
		7	RC RQD	81% 13%
		8	RC RQD	95% 39%
		9	RC RQD	100% 16%
		10	RC RQD	98% 35%
155.5	*(Continued on next page)*			



WATER LEVEL

W.L. not measured due to use of water for rock coring

Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 17

FIGURE NO.: 17

PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers
and Rock Coring

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 20 to 26, 2020

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
10.0	*(Continued)* Grey **SHALE BEDROCK** with limestone layers	11	RC RQD	92% 43%	10			
		12	RC RQD	98% 38%	11 12			
		13	RC RQD	100% 67%	13			
		14	RC RQD	98% 66%	14 15			
		15	RC RQD	97% 57%	16			
148.6 16.9	**END OF BOREHOLE**				17 18 19 20			

Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 18

FIGURE NO.: 18

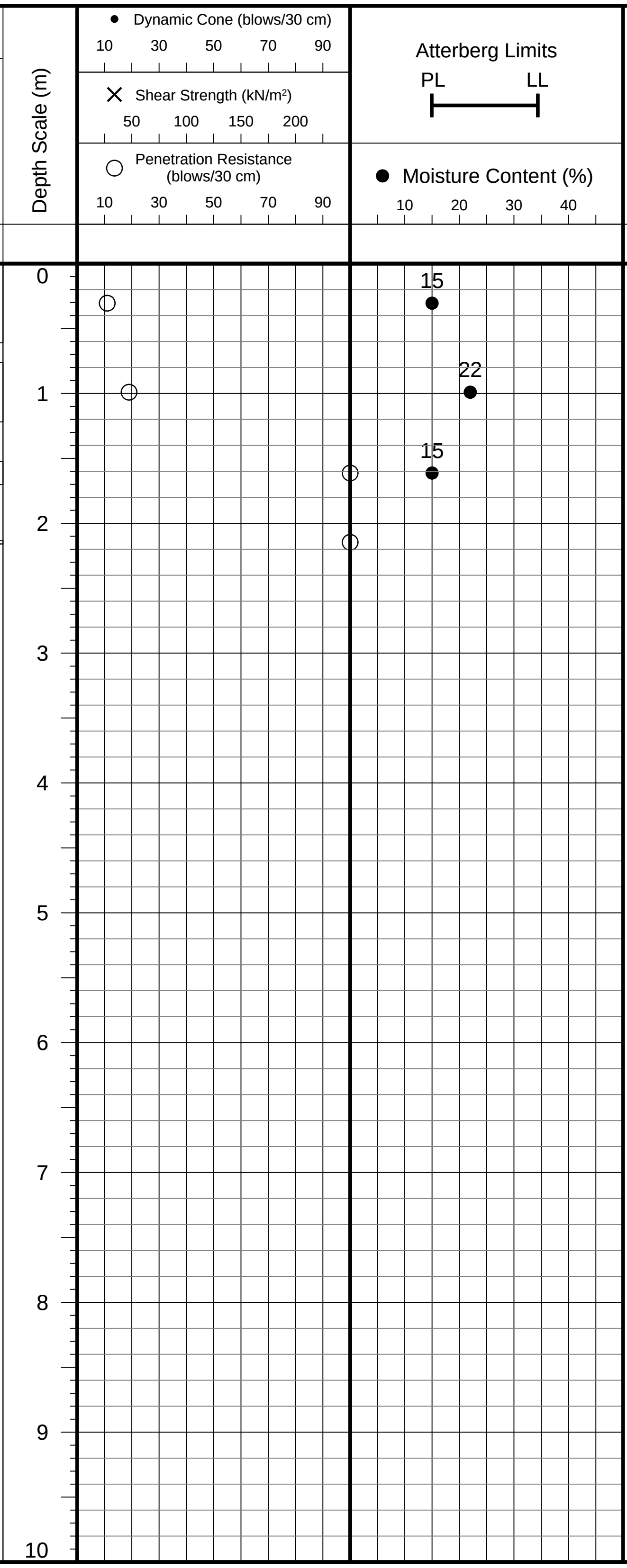
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 19, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
163.7	Ground Surface			
0.0	**23 cm TOPSOIL**			
	Stiff to hard **SILTY CLAY TILL** traces of sand and gravel occ. sand and silt seams and layers, cobbles, boulders and shale fragments	1	DO	11
		2	DO	19
	brown grey	3	DO	50/3
161.5 2.2	**END OF BOREHOLE** **(Refusal to Auger)**	4	DO	50/3



WATER LEVEL

Dry and open upon completion of the field work

Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 19

FIGURE NO.: 19

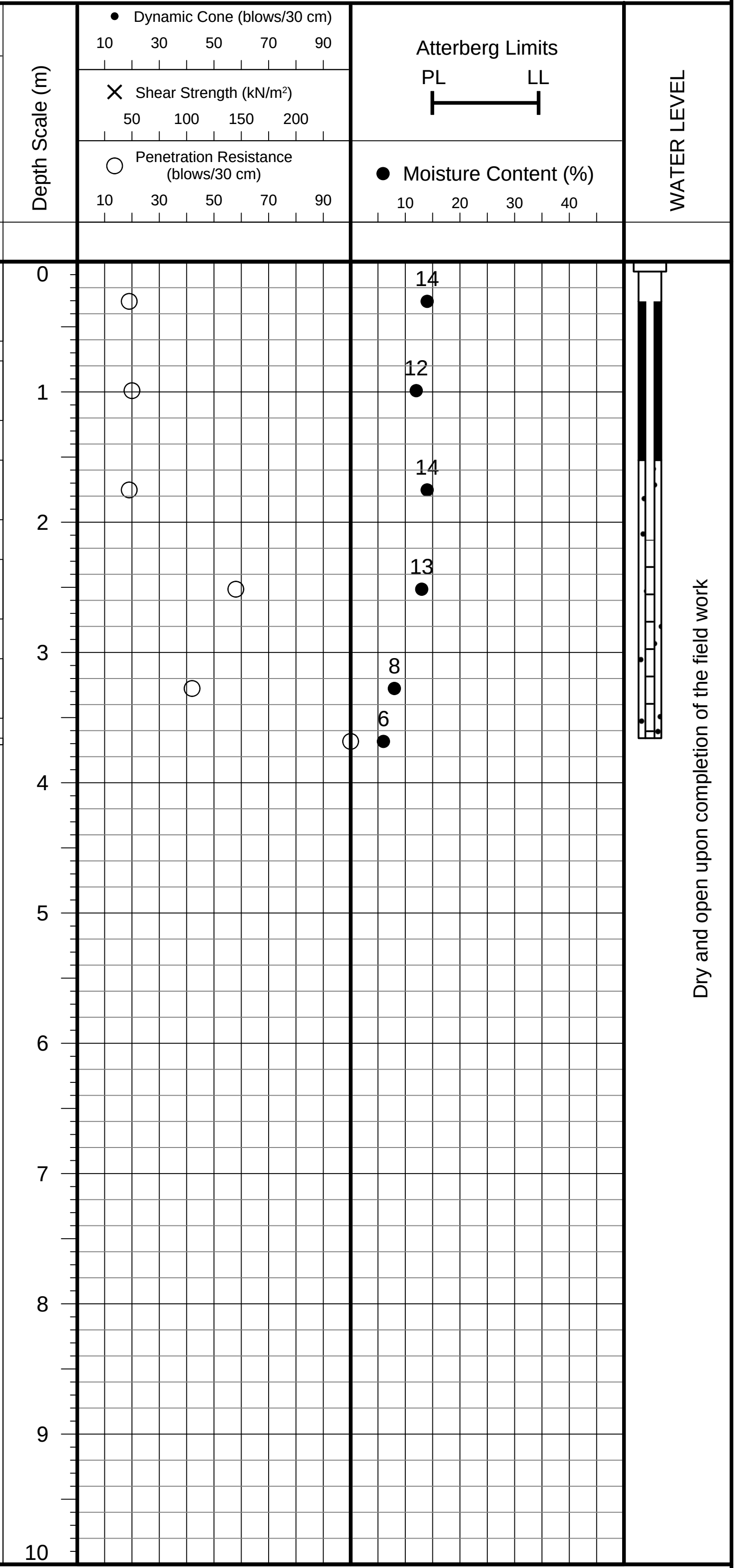
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 19, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
165.0	Ground Surface			
0.0	**20 cm TOPSOIL** Brown **EARTH FILL** **(Silty Clay)** sandy, a trace of gravel occ. sand layers	1	DO	19
		2	DO	20
163.5 1.5	Brown, very stiff to hard **SILTY CLAY TILL** traces to some sand and gravel occ. sand and silt seams and layers, cobbles and boulders	3	DO	19
		4	DO	58
		5	DO	42
		6	DO	50/5
161.3 3.7	**END OF BOREHOLE** **(Refusal to Auger)** Installed 50 mm Ø PVC monitoring well to 3.7 m (1.5 m screen) Sand backfill from 1.5 m to 3.7 m Bentonite holeplug from 0.3 m to 1.5 m Provided with a 4x4 steel monument casing with top and bottom caps, and lock			



JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 20

FIGURE NO.: 20

PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers

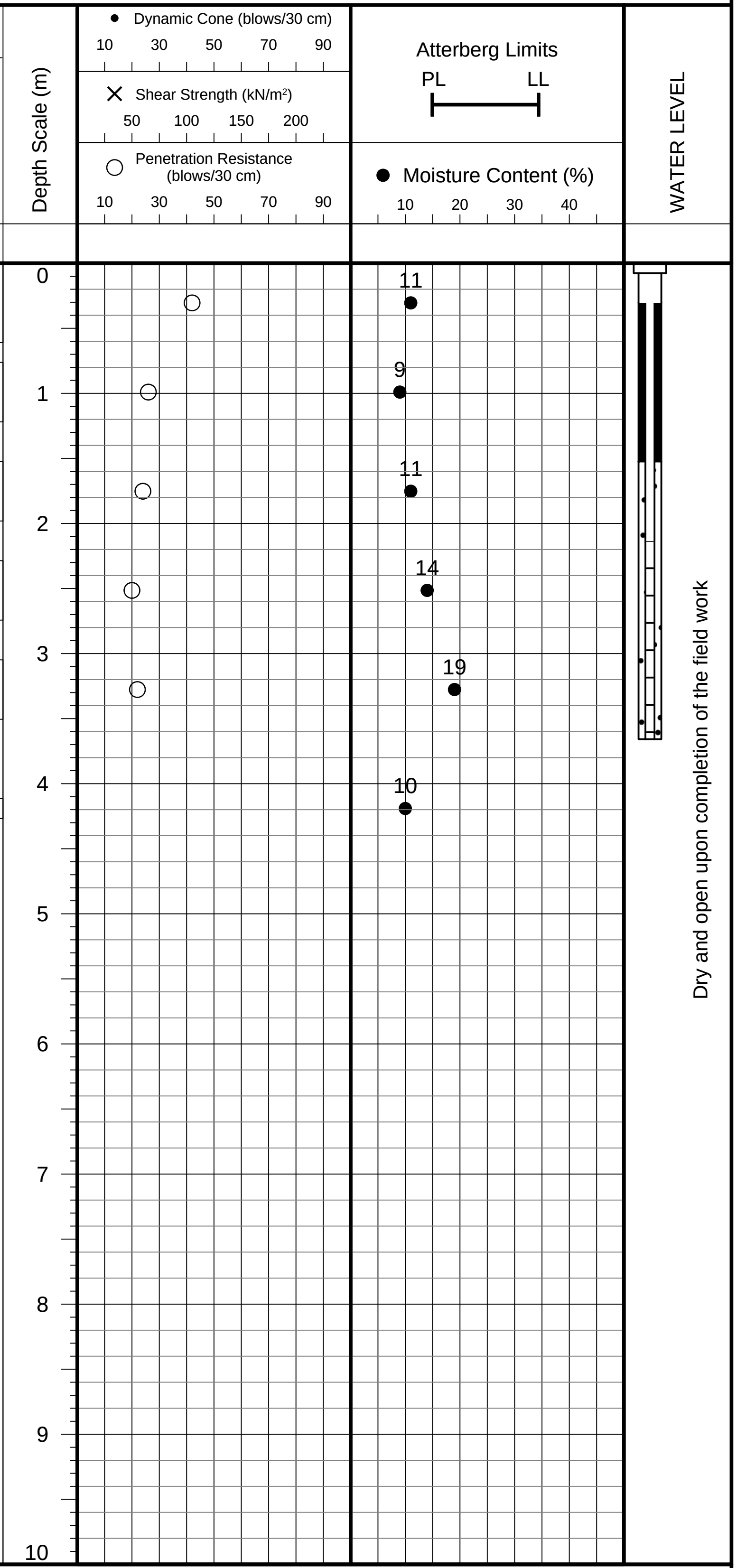
PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 19, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
165.5	Ground Surface			
0.0	**25 cm TOPSOIL**	1	DO	42
	EARTH FILL (Silty Clay) — brown / grey a trace to some sand a trace of gravel	2	DO	26
		3	DO	24
163.2 2.3	Brown, very stiff **SILTY CLAY TILL** some sand to sandy a trace of gravel occ. sand and silt seams and layers, cobbles and boulders	4	DO	20
		5	DO	22
161.4 161.2 4.3	Grey **SHALE BEDROCK**	6	AS	-

END OF BOREHOLE
(Refusal to Auger)

Installed 50 mm Ø PVC monitoring well to 3.7 m (1.5 m screen)
Sand backfill from 1.5 m to 3.7 m
Bentonite holeplug from 0.3 m to 1.5 m
Provided with a 4x4 steel monument casing with top and bottom caps, and lock



Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 21

FIGURE NO.: 21

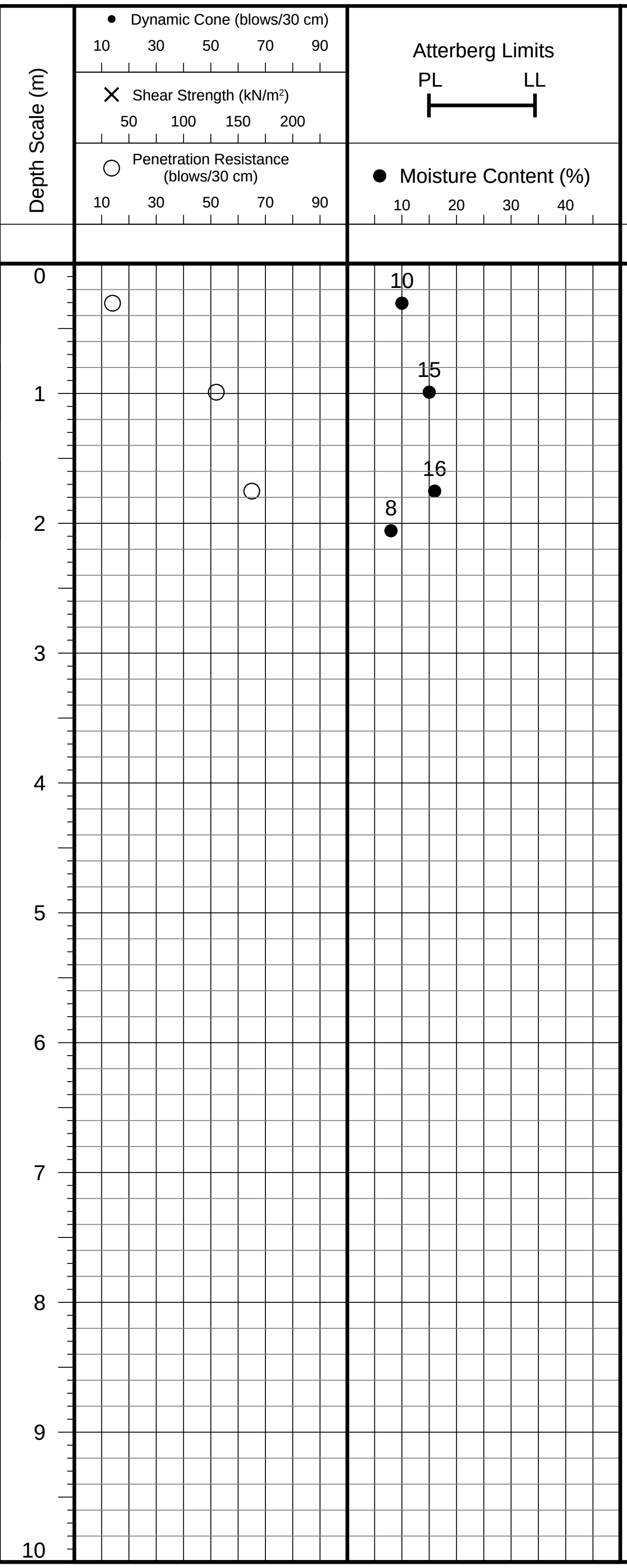
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

METHOD OF BORING: Solid Stem Augers

DRILLING DATE: October 27, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value	WATER LEVEL
164.2	Ground Surface				
0.0	**25 cm TOPSOIL**	1	DO	14	Dry and open upon completion of the field work
	EARTH FILL **(Silty Clay)** — — brown/grey a trace of sand to sandy a trace of gravel	2	DO	52	
		3	DO	65	
162.4 1.8	Hard **SILTY CLAY TILL** — — brown/grey sandy, a trace of gravel occ. sand and silt seams and layers, cobbles, boulders and shale fragments	4	AS	-	
162.1 2.1	**END OF BOREHOLE** **(Refusal to Auger)**				



Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 22

FIGURE NO.: 22

PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

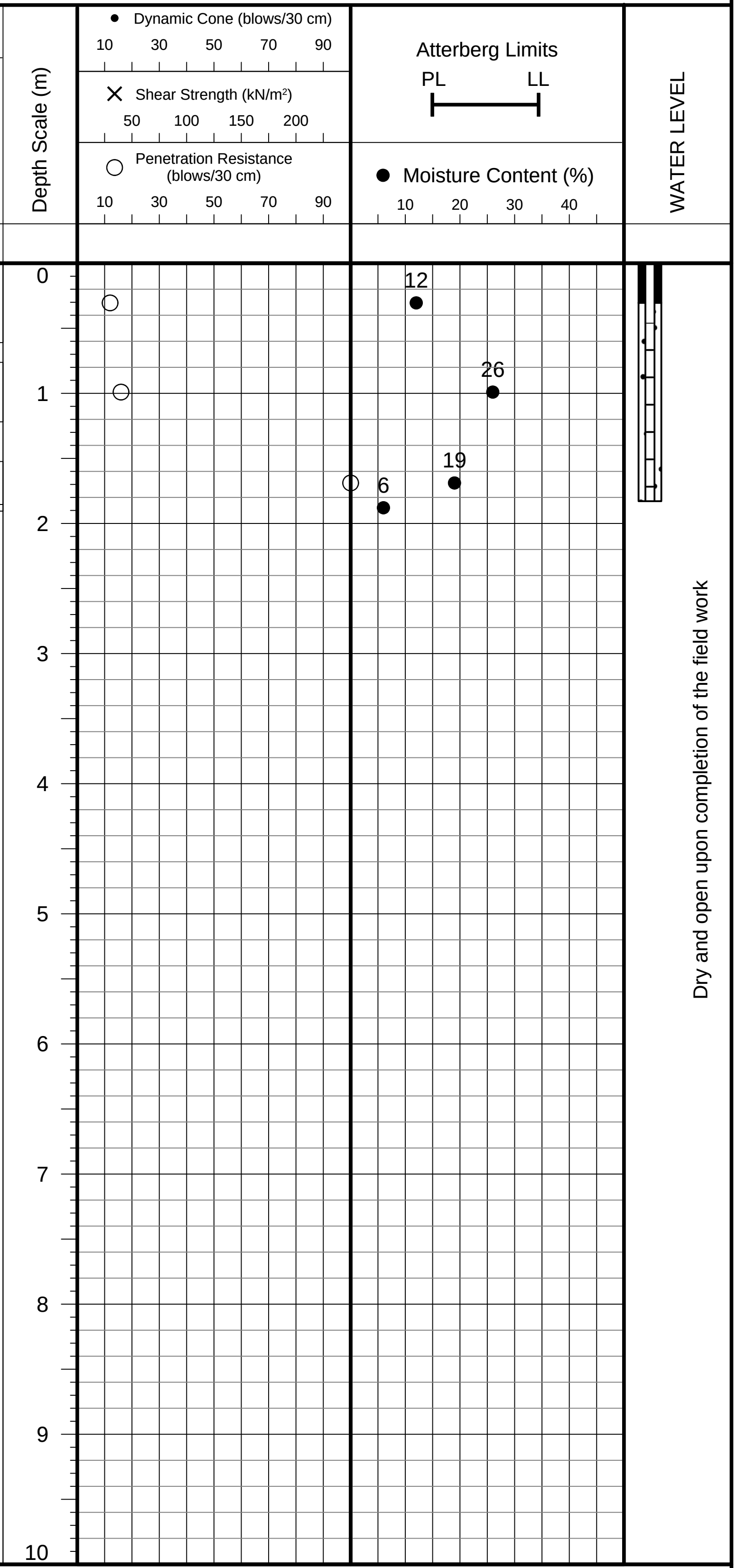
METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 27, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
163.9	Ground Surface			
0.0	**33 cm TOPSOIL**	1	DO	12
	Brown, stiff **SILTY CLAY TILL** traces to some sand and gravel occ. sand and silt seams and layers, cobbles and boulders	2	DO	16
162.4 1.5	Hard **SILTY CLAY** a trace of sand brown / grey	3	DO	65/18
162.0 1.9		4	AS	-
	END OF BOREHOLE **(Refusal to Auger)**			

Installed 50 mm Ø PVC monitoring well to 1.8 m (1.4 m screen)
Sand backfill from 0.3 m to 1.8 m
Bentonite holeplug from 0 m to 0.3 m
Provided with a 4x4 steel monument casing with top and bottom caps, and lock



Dry and open upon completion of the field work

Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 23

FIGURE NO.: 23

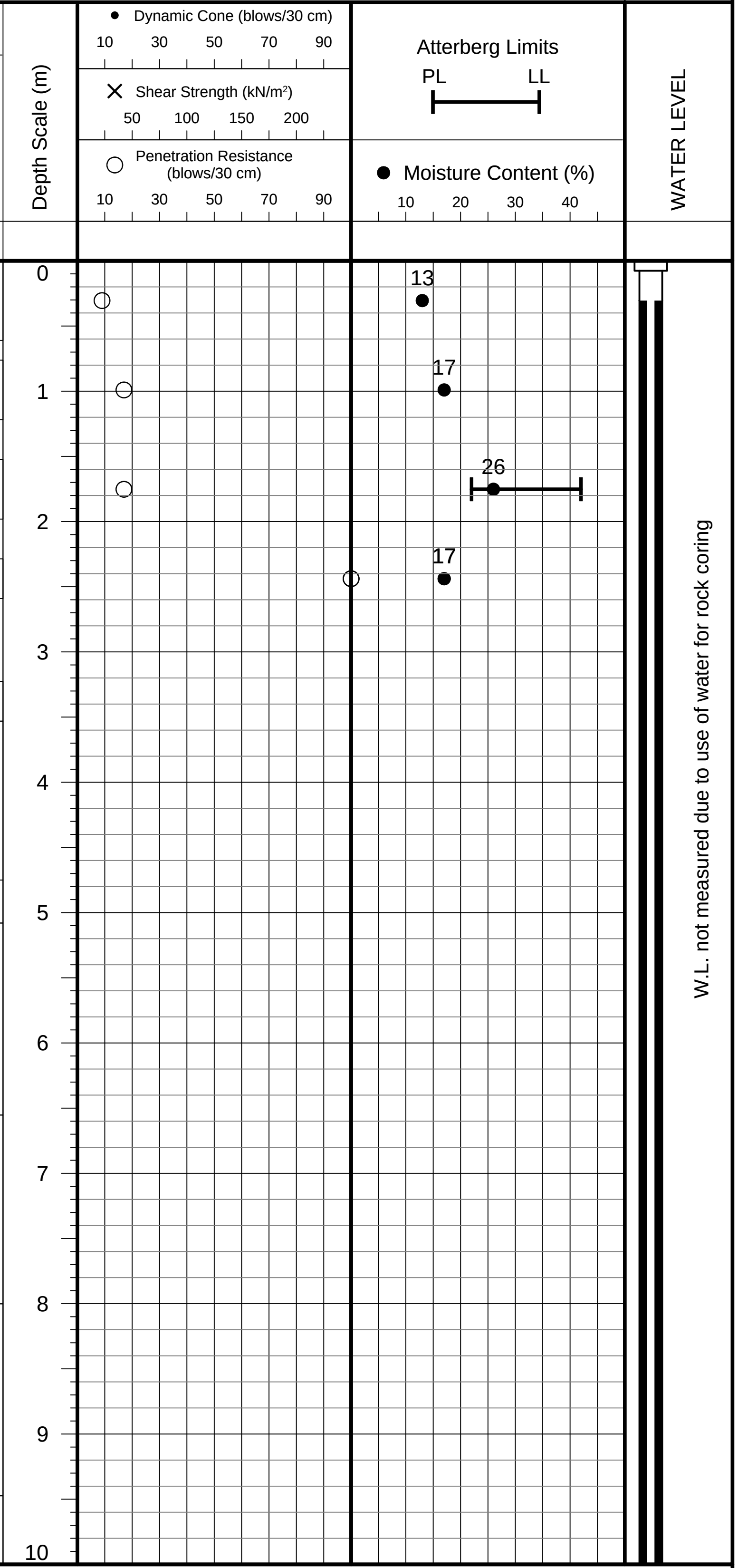
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

METHOD OF BORING: Solid Stem Augers and Rock Coring

DRILLING DATE: November 4 and 5, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
164.5	Ground Surface			
0.0	**15 cm TOPSOIL**			
	Stiff to very **SILTY CLAY TILL** traces to some sand and gravel — — brown/grey occ. sand and silt seams and layers, cobbles and boulders	1	DO	9
		2	DO	17
163.0 1.5	Grey, very stiff **SILTY CLAY** a trace of sand	3	DO	17
162.1 2.4	Grey **SHALE BEDROCK** with limestone layers	4	DO	50/15
		5	RC RQD	100% 0%
		6	RC RQD	88% 29%
		7	RC RQD	100% 35%
		8	RC RQD	95% 32%
		9	RC RQD	100% 50%
		10	RC RQD	90% 41%
154.5	*(Continued on next page)*	11	RC	100%



Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 23

FIGURE NO.: 23

PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers
and Rock Coring

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: November 4 and 5, 2020

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
10.0	*(Continued)* Grey **SHALE BEDROCK** with limestone layers		RQD	68%	10			
		12	RC RQD	100% 77%	11			
		13	RC RQD	84% 62%	12			
		14	RC RQD	83% 74%	13			
150.6 13.9	**END OF BOREHOLE** Installed 50 mm Ø PVC monitoring well to 13.9 m (3.0 m screen) Sand backfill from 10.2 m to 13.9 m Bentonite holeplug from 0.3 m to 10.2 m Provided with a 4x4 steel monument casing with top and bottom caps, and lock				14 15 16 17 18 19 20			

LOG OF BOREHOLE NO.: 24

JOB NO.: 2010-S021

FIGURE NO.: 24

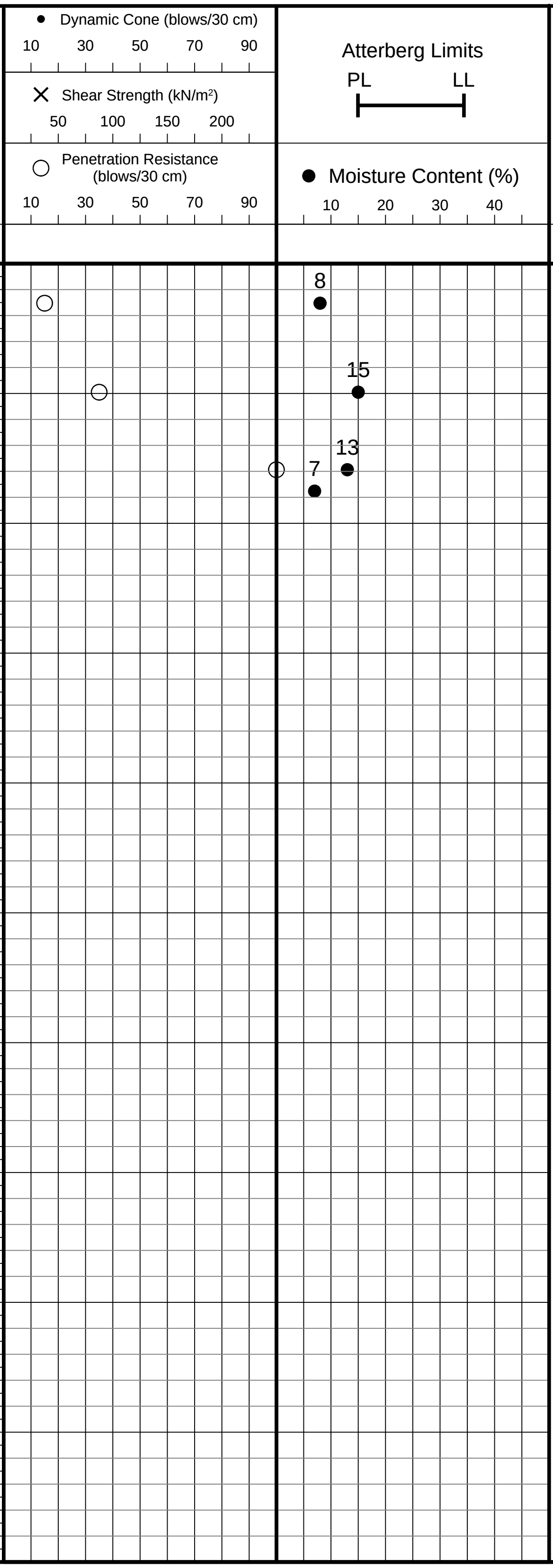
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 27, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
164.5	Ground Surface				
0.0	**25 cm TOPSOIL**				0
	Stiff to hard **SILTY CLAY TILL** a trace of sand to sandy a trace of gravel occ. sand and silt seams and layers, cobbles and boulders	1	DO	15	
		2	DO	35	1
	brown grey	3	DO	50/13	
162.7 1.8		4	AS	-	
	END OF BOREHOLE **(Refusal to Auger)**				2



WATER LEVEL

Cave-in @ El. 162.8 m on completion

Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 25

FIGURE NO.: 25

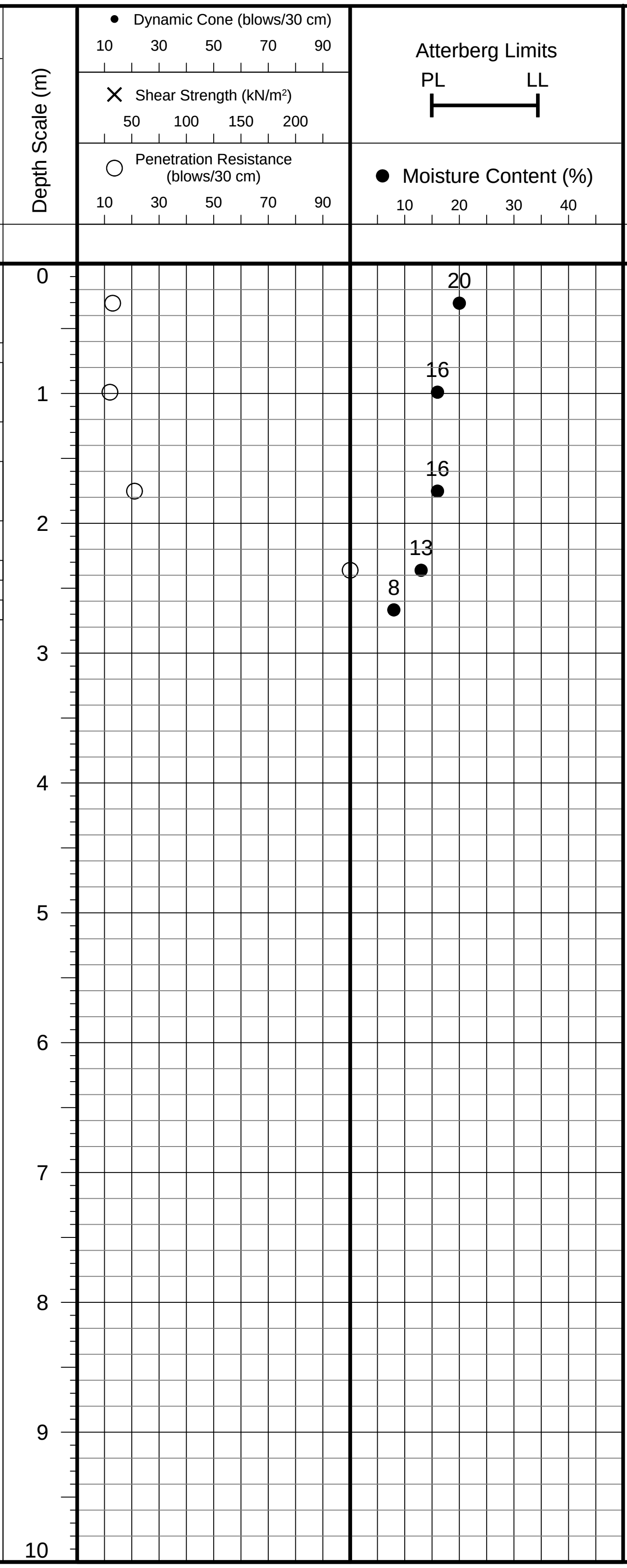
PROJECT DESCRIPTION: Proposed Mixed-Use Development with 2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION:
Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 26, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
165.0	Ground Surface			
0.0	**20 cm TOPSOIL**			
	Brown **EARTH FILL** **(Silty Clay)** a trace of sand to sandy a trace of gravel with organic inclusions	1	DO	13
163.9 1.1		2	DO	12
	Stiff to hard **SILTY CLAY TILL** a trace of sand to sandy a trace of gravel occ. sand and silt seams and layers, cobbles and boulders	3	DO	21
	brown grey	4	DO	50/15
		5	AS	-
162.3 2.7	**END OF BOREHOLE** **(Refusal to Auger)**			



WATER LEVEL

Dry and open upon completion of the field work

Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 26

FIGURE NO.: 26

PROJECT DESCRIPTION: Proposed Mixed-Use Development with 2- to 5-Level Underground Parking

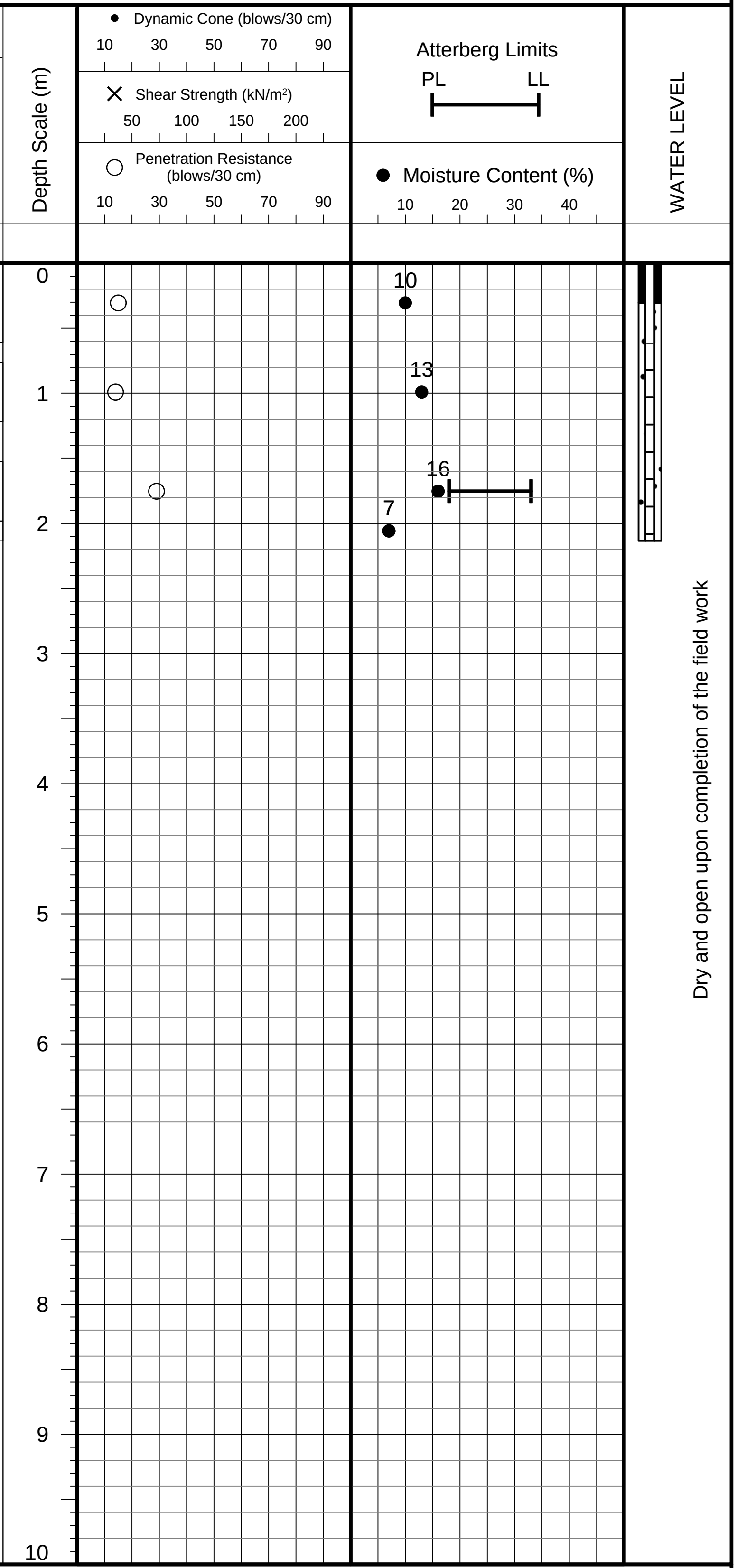
METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 27, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
165.2	Ground Surface			
0.0	**15 cm TOPSOIL** Brown **EARTH FILL** **(Silty Clay)** some sand and gravel	1	DO	15
		2	DO	14
164.1 1.1	Grey, stiff to very stiff **SILTY CLAY TILL** traces to some sand and gravel occ. sand and silt seams and layers, cobbles and boulders	3	DO	29
		4	AS	-
163.1 2.1	**END OF BOREHOLE** **(Refusal to Auger)**			

Installed 50 mm Ø PVC monitoring well to 2.1 m (1.5 m screen)
Sand backfill from 0.3 m to 2.1 m
Bentonite holeplug from 0 m to 0.3 m
Provided with a 4x4 steel monument casing with top and bottom caps, and lock



Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 27

FIGURE NO.: 27

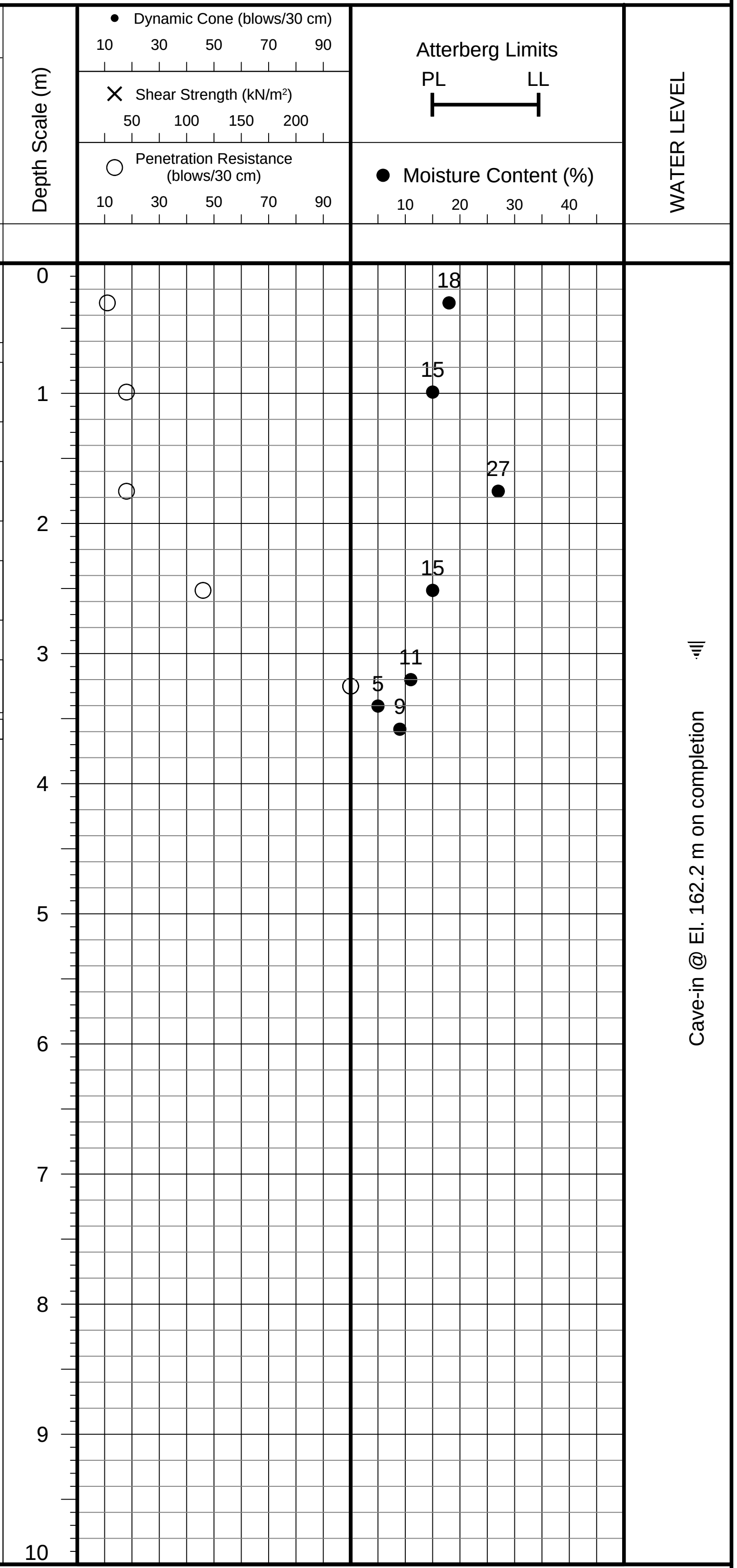
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 26, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
165.2	Ground Surface			
0.0	**18 cm TOPSOIL**			
	Brown/dark grey **EARTH FILL** **(Silty Clay)** a trace to some sand a trace of gravel	1	DO	11
		2	DO	18
163.5 1.7	Grey, very stiff to hard **SILTY CLAY TILL** traces to some sand and gravel occ. sand and silt seams and layers, cobbles, boulders and shale fragments	3	DO	18
		4	DO	46
		5A	DO	71/25
161.8 3.4	Grey **SHALE BEDROCK** with limestone layers	5B		
161.5 3.7	**END OF BOREHOLE** **(Refusal to Auger)**	6	AS	-



JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 28

FIGURE NO.: 28

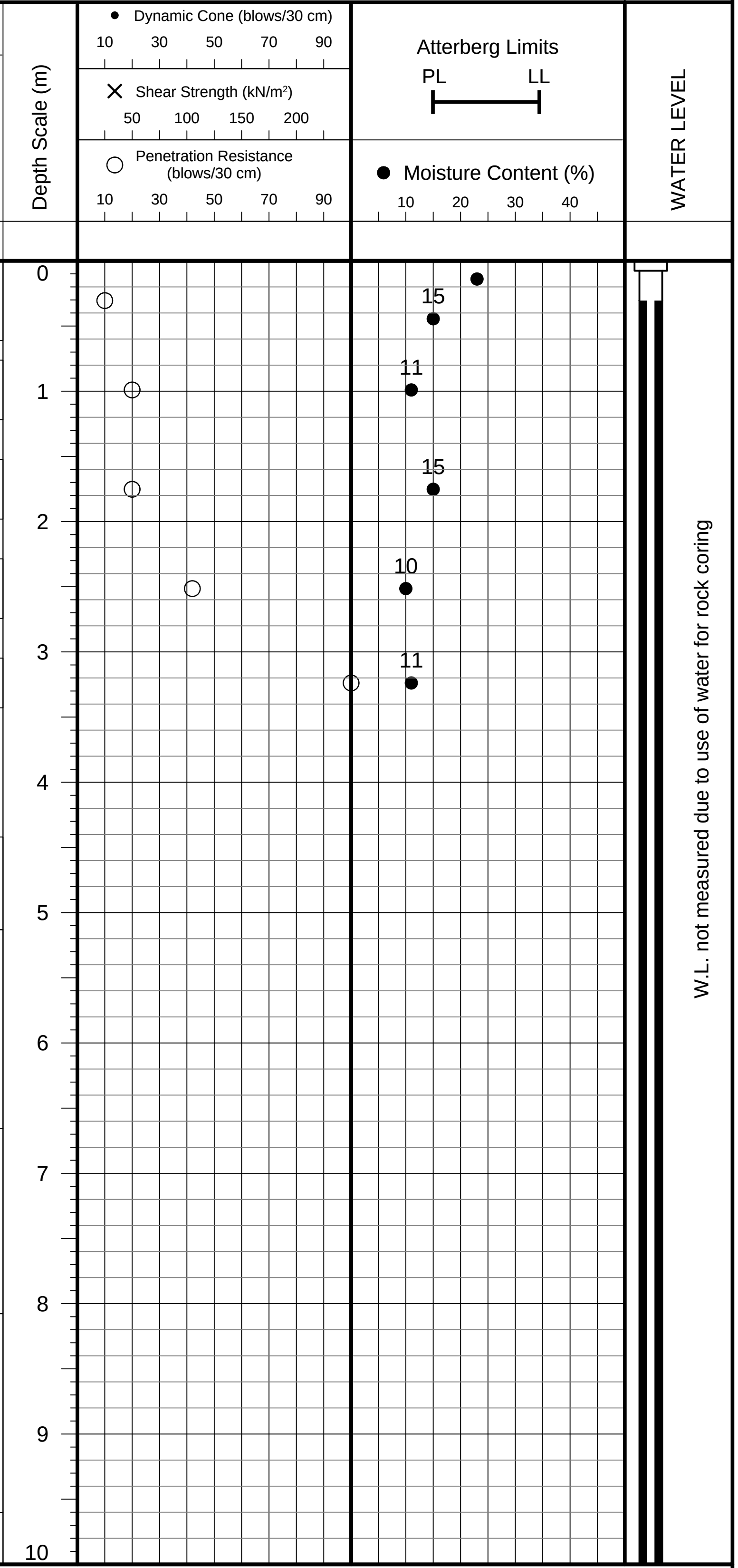
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

METHOD OF BORING: Solid Stem Augers
and Rock Coring

DRILLING DATE: October 29 to
November 3, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
166.0	Ground Surface			
0.0	**28 cm TOPSOIL**	1A 1B	DO	10
	EARTH FILL **(Silty Clay)** sandy, a trace of gravel	2	DO	20
	brown grey	3	DO	20
163.7 2.3	Grey, hard **SILTY CLAY TILL** traces to some sand and gravel occ. sand and silt seams and layers, cobbles, boulders and shale fragments	4	DO	42
		5	DO	38/23 50/NP
161.6 4.4	Grey **SHALE BEDROCK** with limestone layers	6	RC RQD	89% 0%
		7	RC RQD	100% 35%
		8	RC RQD	95% 30%
		9	RC RQD	98% 65%
156.0	*(Continued on next page)*			



Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 28

FIGURE NO.: 28

PROJECT DESCRIPTION: Proposed Mixed-Use Development with 2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers and Rock Coring

PROJECT LOCATION:
Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 29 to November 3, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value	Depth Scale (m)
10.0	*(Continued)* Grey **SHALE BEDROCK** with limestone layers	10	RC RQD	90% 55%	10
					11
		11	RC RQD	97% 88%	12
					13
		12	RC RQD	100% 86%	14
		13	RC RQD	95% 76%	15
		14	RC RQD	88% 68%	16
149.2 16.8	**END OF BOREHOLE** Installed 50 mm Ø PVC monitoring well to 16.5 m (3.0 m screen) Sand backfill from 12.8 m to 16.5 m Bentonite holeplug from 0.3 m to 12.8 m Provided with a 4x4 steel monument casing with top and bottom caps, and lock				17
					18
					19
					20

● 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

Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 29

FIGURE NO.: 29

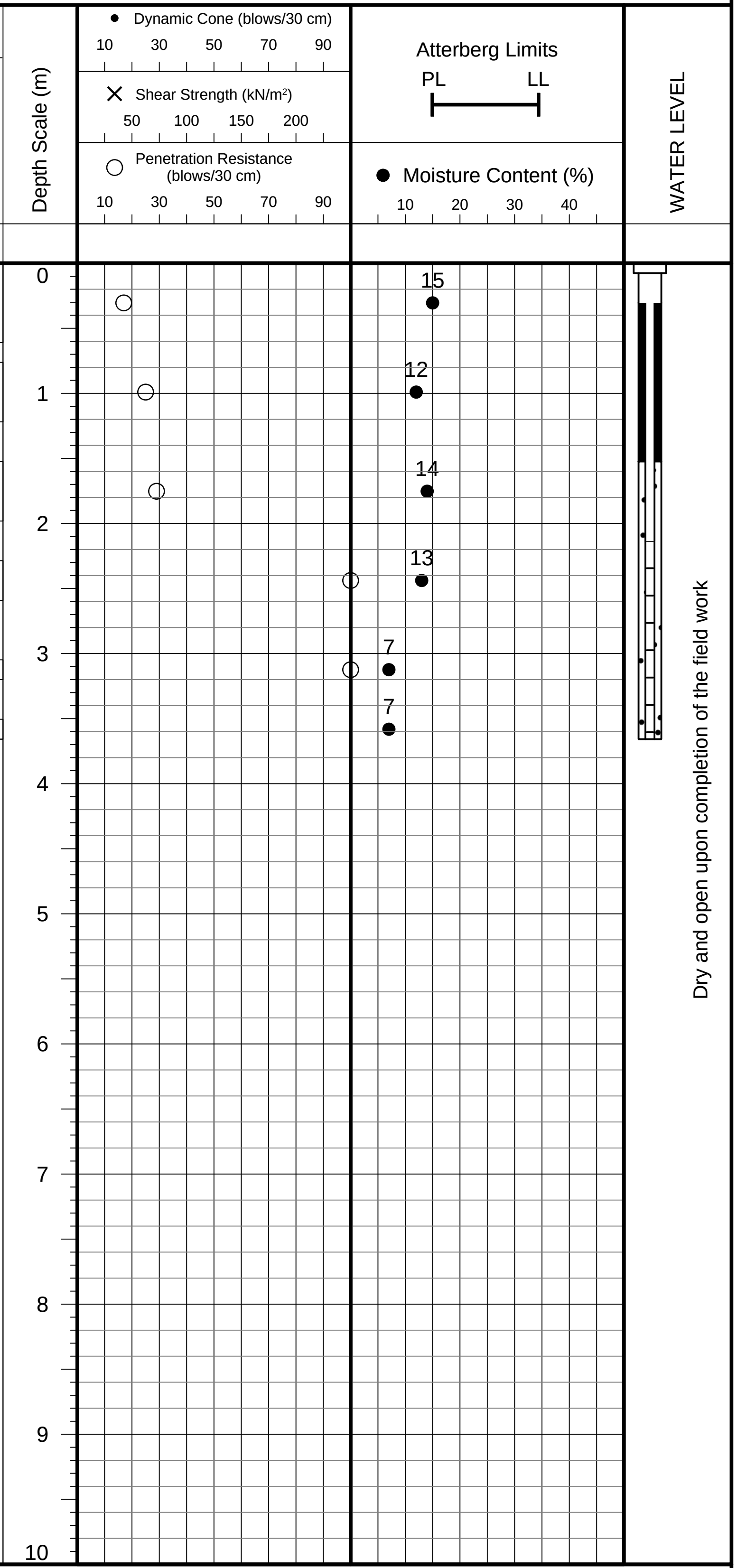
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 26, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
165.2	Ground Surface			
0.0	**23 cm TOPSOIL** Brown **EARTH FILL** **(Silty Clay)** a trace to some sand a trace of gravel	1 2	DO DO	17 25
163.7 1.5	Grey, very stiff to hard **SILTY CLAY TILL** traces to some sand and gravel occ. sand and silt seams and layers, cobbles, boulders and shale fragments	3 4	DO DO	29 50/15
162.7 2.5	Grey **SHALE BEDROCK** with limestone layers	5 6	DO AS	50/15 -
161.5 3.7	**END OF BOREHOLE** **(Refusal to Auger)** Installed 50 mm Ø PVC monitoring well to 3.7 m (1.5 m screen) Sand backfill from 1.5 m to 3.7 m Bentonite holeplug from 0.3 m to 1.5 m Provided with a 4x4 steel monument casing with top and bottom caps, and lock			



Soil Engineers Ltd.

Page: 1 of 1

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 30

FIGURE NO.: 30

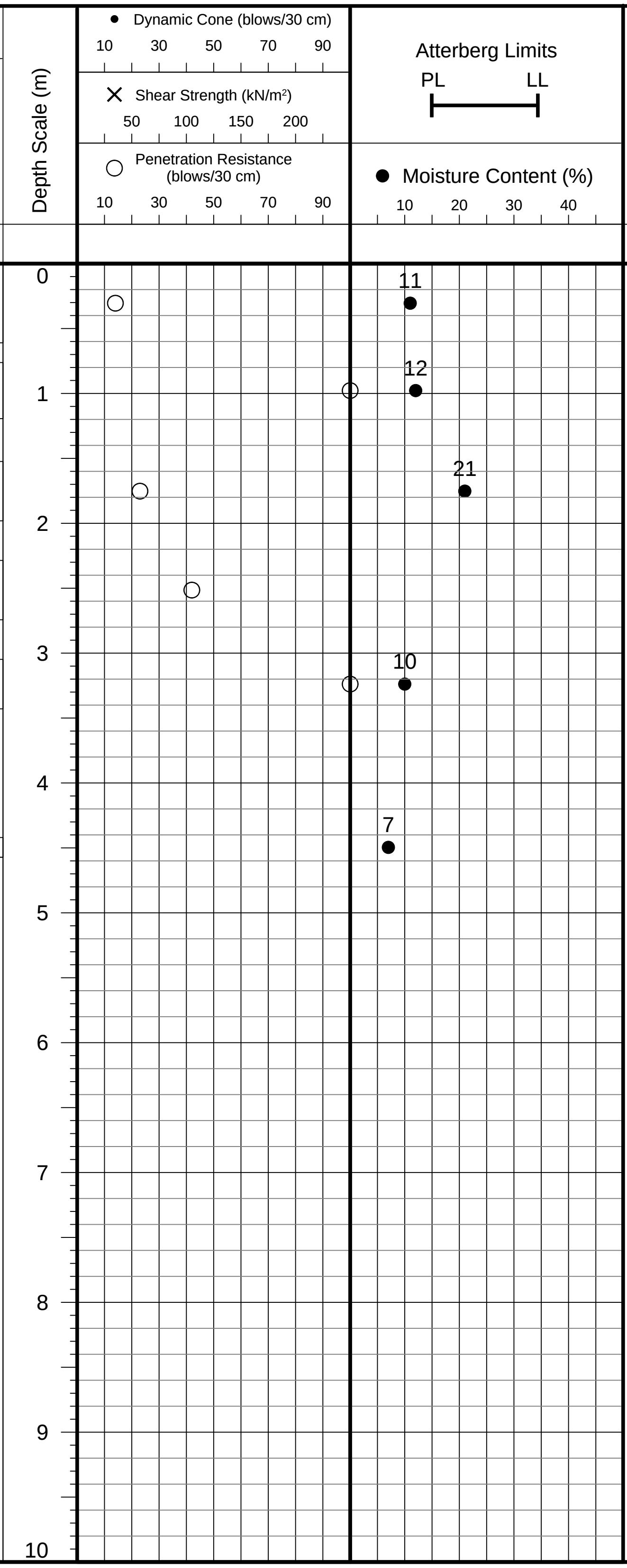
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 26, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
166.1	Ground Surface			
0.0	**25 cm TOPSOIL**			
	Brown **EARTH FILL (Silty Clay)** some sand to sandy a trace of gravel with organic inclusions	1	DO	14
		2	DO	63/28
164.4 1.7	Very stiff to hard (brown / grey) **SILTY CLAY TILL** traces to some sand and gravel occ. sand and silt seams and layers, cobbles, boulders and shale fragments	3	DO	23
		4	DO	42
		5	DO	77/23
162.7 3.4	Grey **SHALE BEDROCK** with limestone layers	6	AS	-
161.5 4.6	**END OF BOREHOLE (Refusal to Auger)**			



WATER LEVEL

Cave-in @ El. 162.1 m on completion

Soil Engineers Ltd.

JOB NO.: 2010-S021

LOG OF BOREHOLE NO.: 31

FIGURE NO.: 31

PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

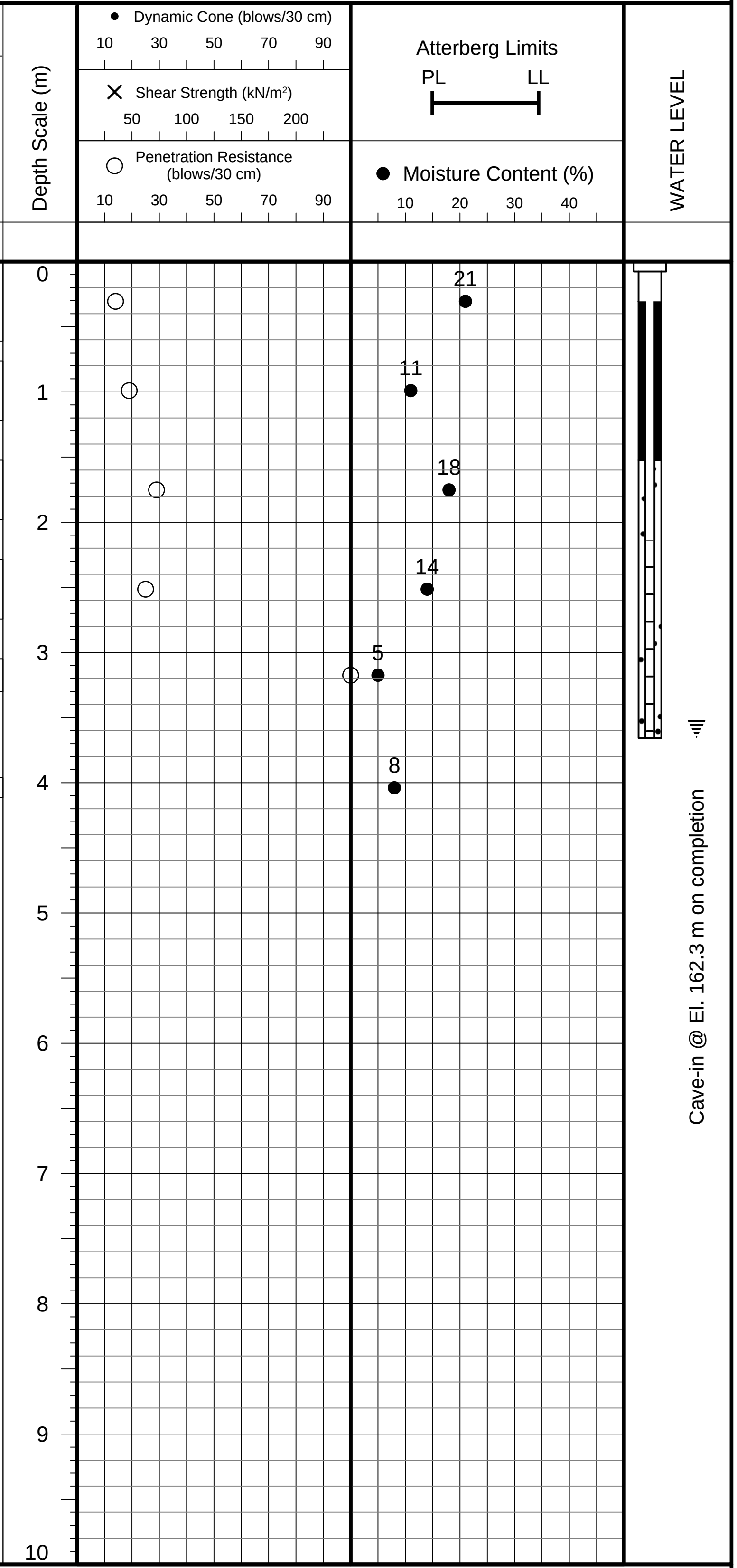
METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

DRILLING DATE: October 26, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
166.0	Ground Surface			
0.0	**25 cm TOPSOIL**			
165.1 0.9	Brown **EARTH FILL** **(Silty Clay)** traces of sand and gravel with topsoil inclusions	1 2	DO DO	14 19
	Brown, very stiff **SILTY CLAY TILL** some sand to sandy a trace of gravel occ. sand and silt seams and layers, cobbles, boulders and shale fragments	3 4	DO DO	29 25
163.3 2.7	Grey **SHALE BEDROCK** with limestone layers	5 6	DO AS	50/10 -
161.9 4.1	**END OF BOREHOLE** **(Refusal to Auger)**			

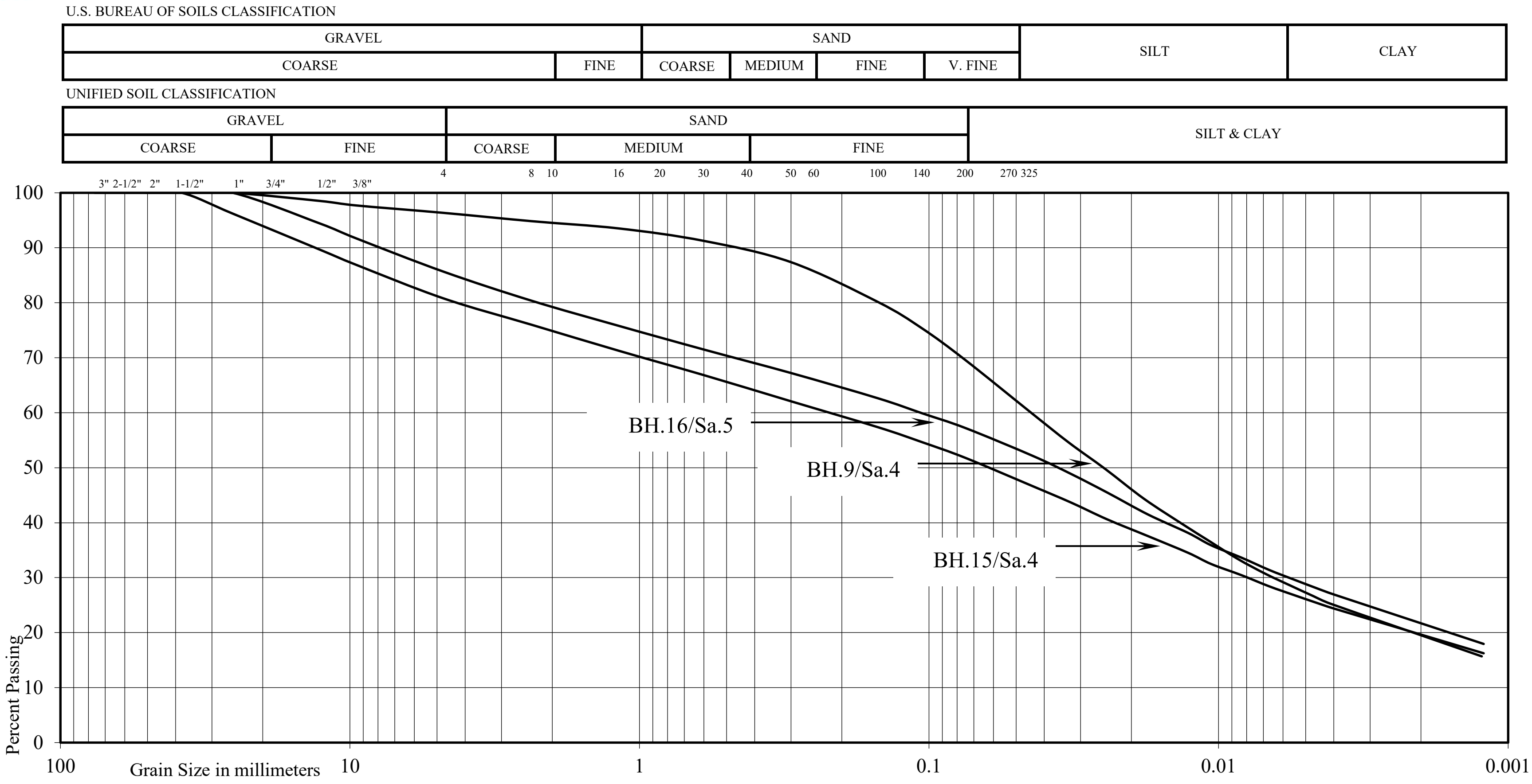
Installed 50 mm Ø PVC monitoring well to 3.7 m (1.5 m screen)
Sand backfill from 1.5 m to 3.7 m
Bentonite holeplug from 0.3 m to 1.5 m
Provided with a 4x4 steel monument casing with top and bottom caps, and lock



Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2010-S021



Project: Proposed Mixed-Use Development With 2- to 5-Level Underground Parking

Location: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5, Sorrento Drive and Elia Avenue,
Southeast of Hurontario Street and Eglinton Avenue East, City of Mississauga

Borehole No:	9	15	16
Sample No:	4	4	5
Depth (m):	2.5	2.5	3.3
Elevation (m):	166.9	162.9	162.7

BH./Sa.	9/4	15/4	16/5
Liquid Limit (%) =	-	-	26
Plastic Limit (%) =	-	-	17
Plasticity Index (%) =	-	-	9
Moisture Content (%) =	11	12	10
Estimated Permeability (cm./sec.) =	10^{-7}	10^{-7}	10^{-7}

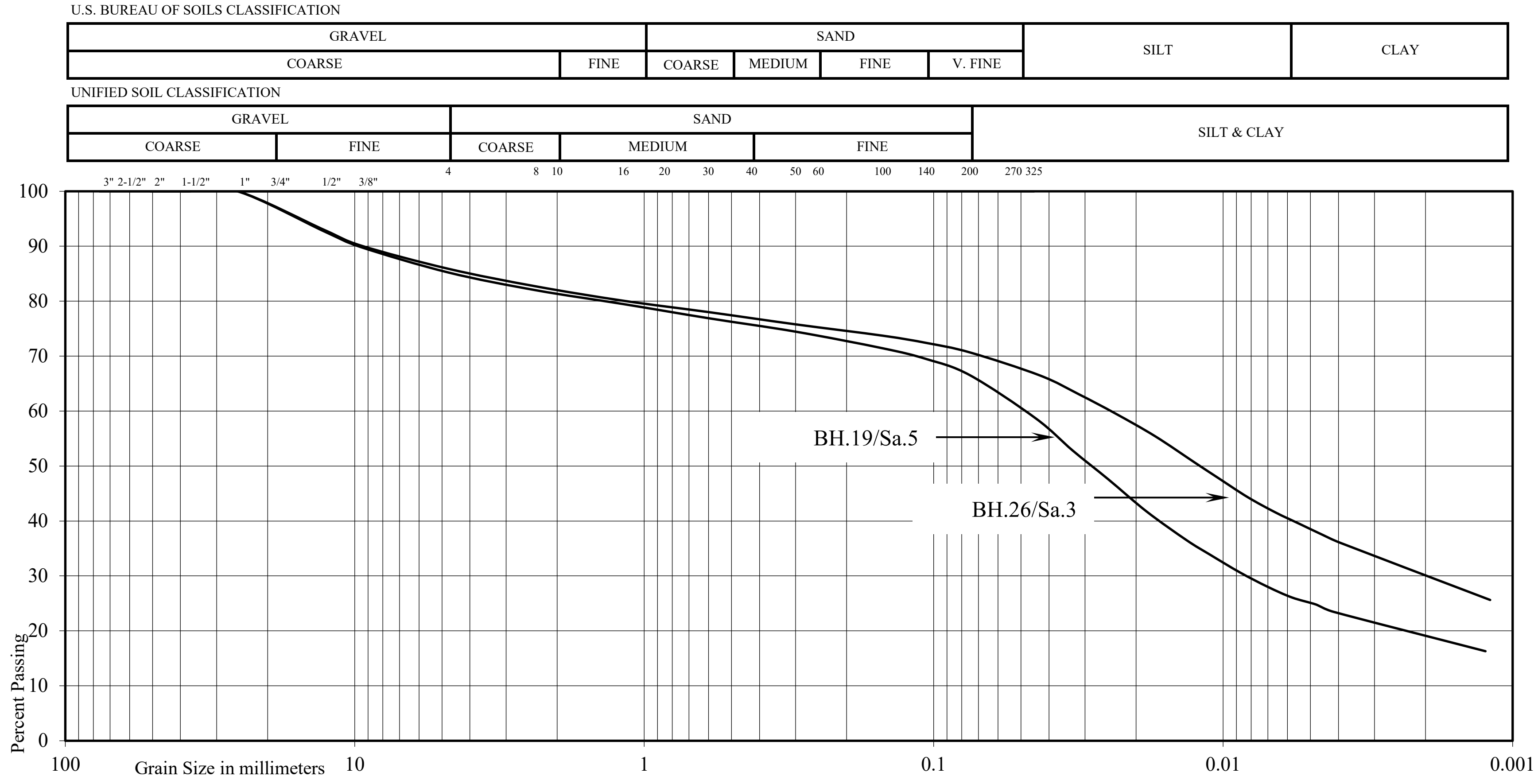
Classification of Sample [& Group Symbol]: SILTY CLAY TILL, sandy, a trace to some gravel

Figure: 32

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2010-S021



Project: Proposed Mixed-Use Development With 2- to 5-Level Underground Parking

Location: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5, Sorrento Drive and Elia Avenue,
Southeast of Hurontario Street and Eglinton Avenue East, City of Mississauga

Borehole No:	19	26
Sample No:	5	3
Depth (m):	3.3	1.8
Elevation (m):	161.7	163.4

BH./Sa.	19/5	26/3
Liquid Limit (%) =	-	33
Plastic Limit (%) =	-	18
Plasticity Index (%) =	-	15
Moisture Content (%) =	8	16
Estimated Permeability (cm./sec.) =	10^{-7}	10^{-7}

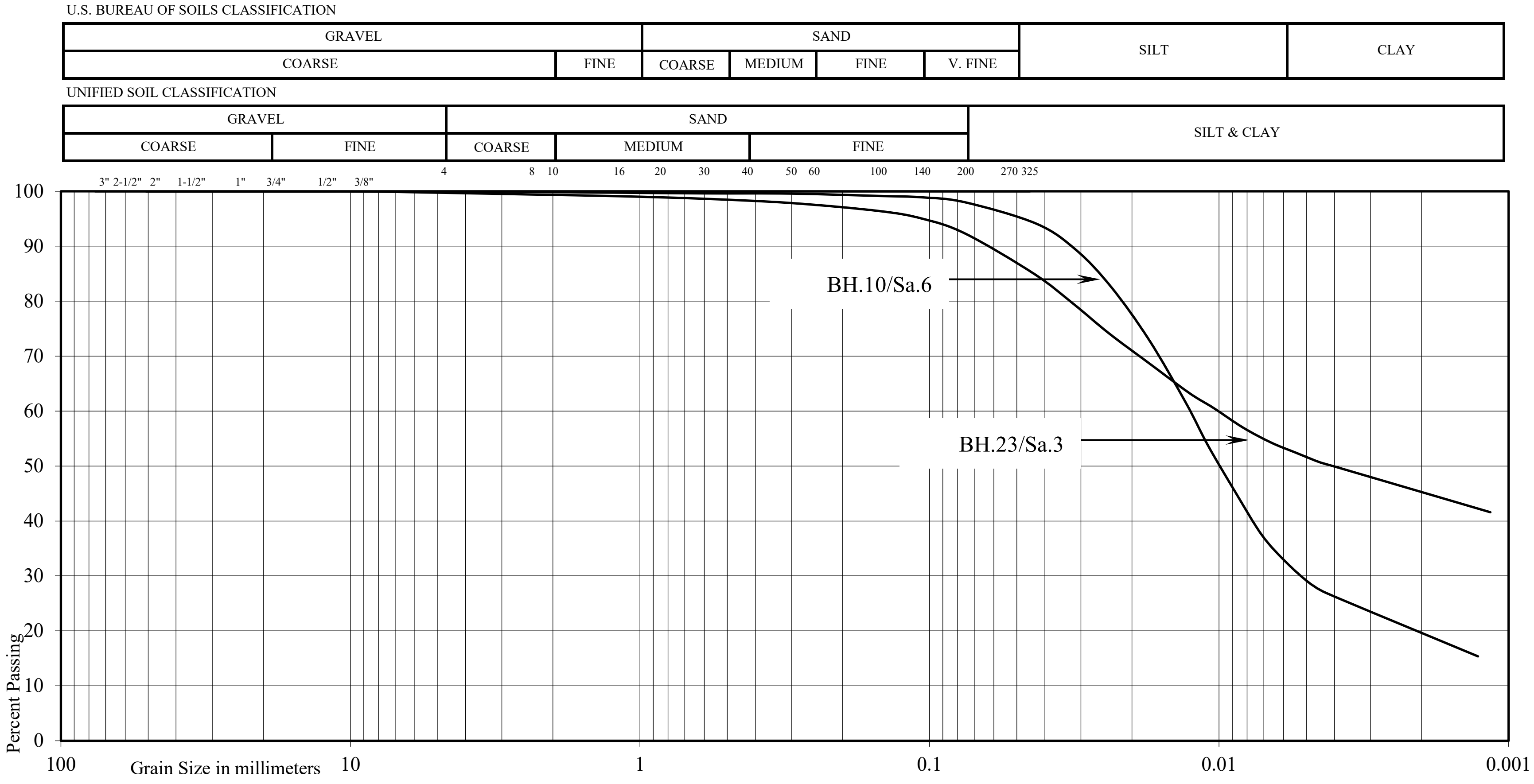
Classification of Sample [& Group Symbol]: SILTY CLAY TILL, some sand and gravel

Figure: 33

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2010-S021



Project: Proposed Mixed-Use Development With 2- to 5-Level Underground Parking

Location: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5, Sorrento Drive and Elia Avenue,
Southeast of Hurontario Street and Eglinton Avenue East, City of Mississauga

Borehole No:	10	23
Sample No:	6	3
Depth (m):	4.8	1.8
Elevation (m):	164.9	162.7

BH./Sa.	10/6	23/3
Liquid Limit (%) =	-	42
Plastic Limit (%) =	-	22
Plasticity Index (%) =	-	20
Moisture Content (%) =	20	26
Estimated Permeability (cm./sec.) =	10^{-7}	10^{-7}

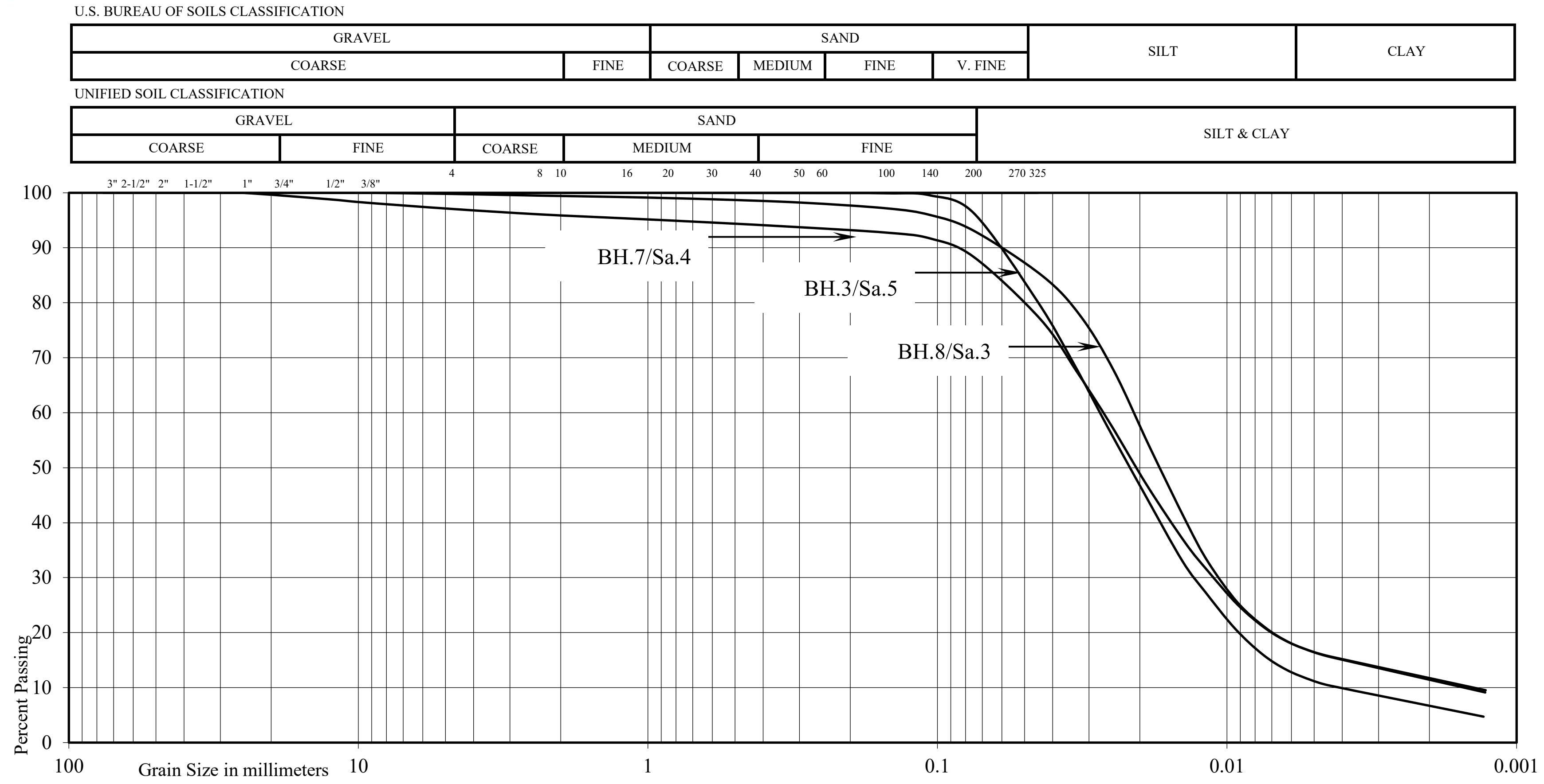
Classification of Sample [& Group Symbol]: SILTY CLAY, a trace of sand

Figure: 34

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2010-S021



Project: Proposed Mixed-Use Development With 2- to 5-Level Underground Parking

Location: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5, Sorrento Drive and Elia Avenue,
Southeast of Hurontario Street and Eglinton Avenue East, City of Mississauga

Borehole No:	3	7	8
Sample No:	5	4	3
Depth (m):	3.3	2.5	1.8
Elevation (m):	168.5	168.4	168.6

BH./Sa.	3/5	7/4	8/3
Liquid Limit (%) =	-	-	-
Plastic Limit (%) =	-	-	-
Plasticity Index (%) =	-	-	-
Moisture Content (%) =	21	14	13
Estimated Permeability (cm./sec.) =	10^{-5}	10^{-6}	10^{-6}

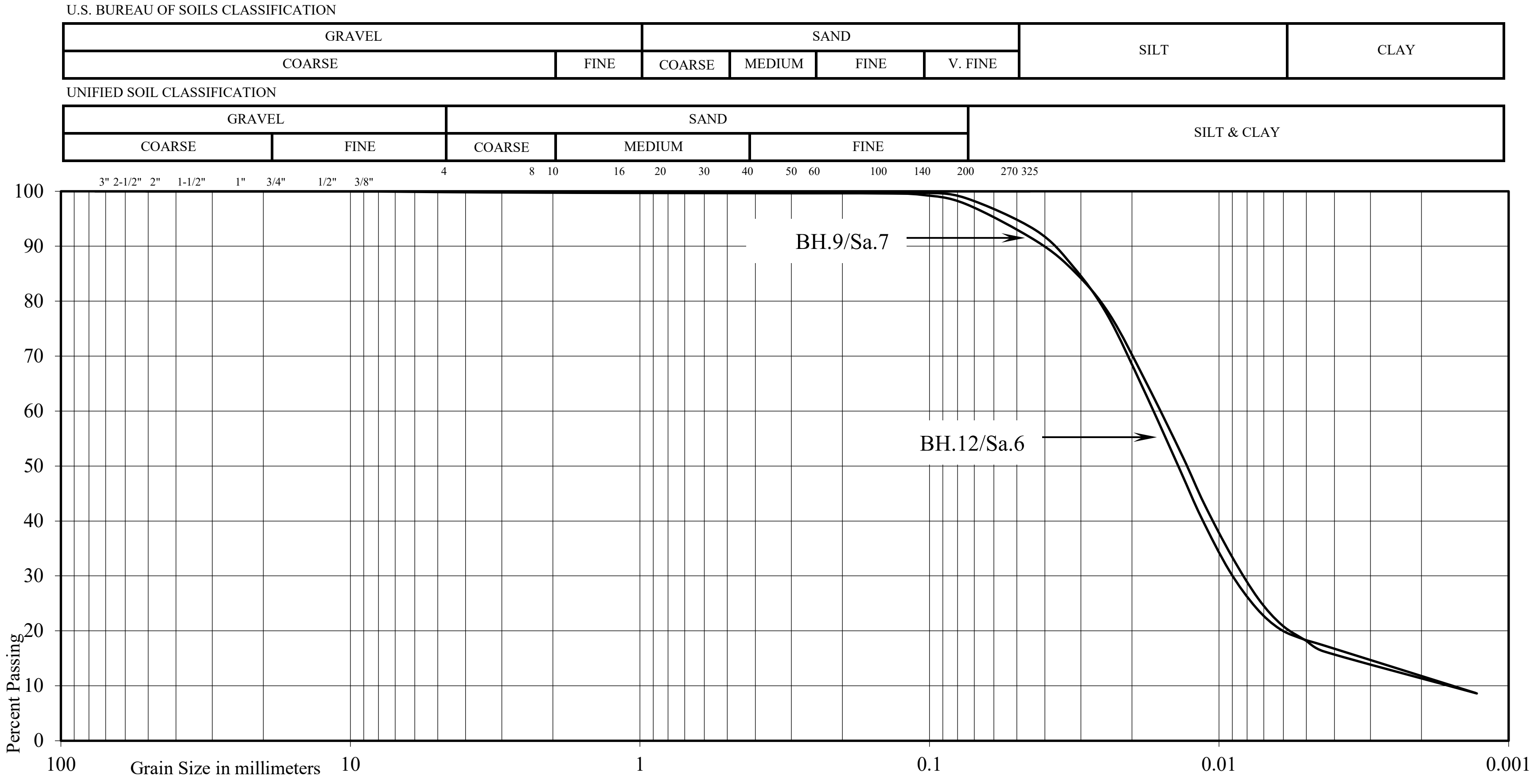
Classification of Sample [& Group Symbol]: SILT, a trace to some clay, traces of sand and gravel

Figure: 35

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2010-S021



Project: Proposed Mixed-Use Development With 2- to 5-Level Underground Parking

Location: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5, Sorrento Drive and Elia Avenue,
Southeast of Hurontario Street and Eglinton Avenue East, City of Mississauga

Borehole No:	9	12
Sample No:	7	6
Depth (m):	6.3	4.8
Elevation (m):	163.1	163.6

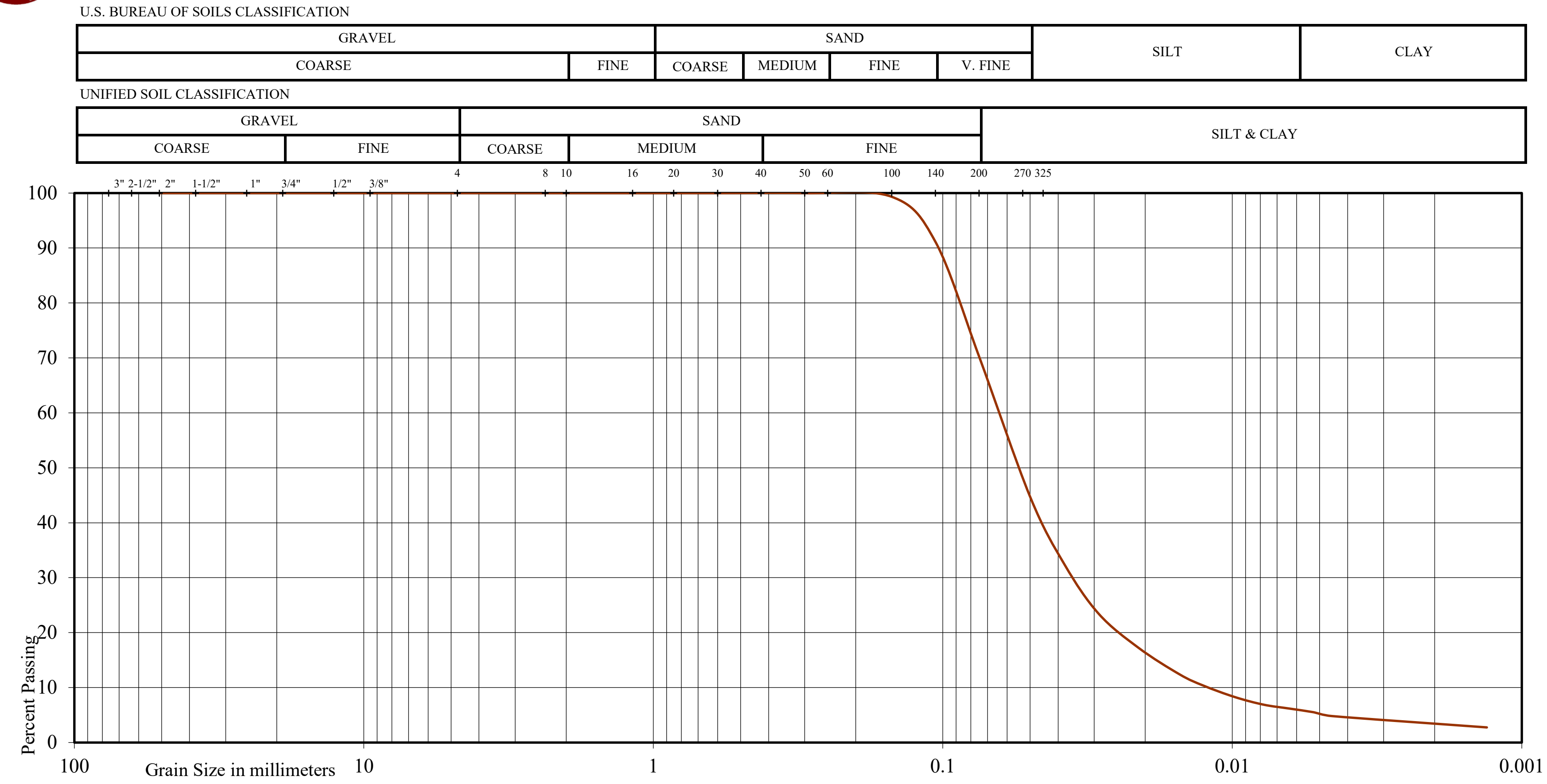
BH./Sa.	9/7	12/6
Liquid Limit (%) =	-	-
Plastic Limit (%) =	-	-
Plasticity Index (%) =	-	-
Moisture Content (%) =	16	18
Estimated Permeability (cm./sec.) =	10^{-6}	10^{-6}

Classification of Sample [& Group Symbol]: SILT, some clay, a trace of sand

Figure: 36

GRAIN SIZE DISTRIBUTION

Reference No: 2010-S021



Project: Proposed Mixed-Use Development With 2- to 5-Level Underground Parking

Location: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5, Sorrento Drive and Elia Avenue, Southeast of Hurontario Street and Eglinton Avenue East, City of Mississauga

Borehole No: 11

Sample No: 2

Depth (m): 1.0

Elevation (m): 167.1

Liquid Limit (%) = -

Plastic Limit (%) = -

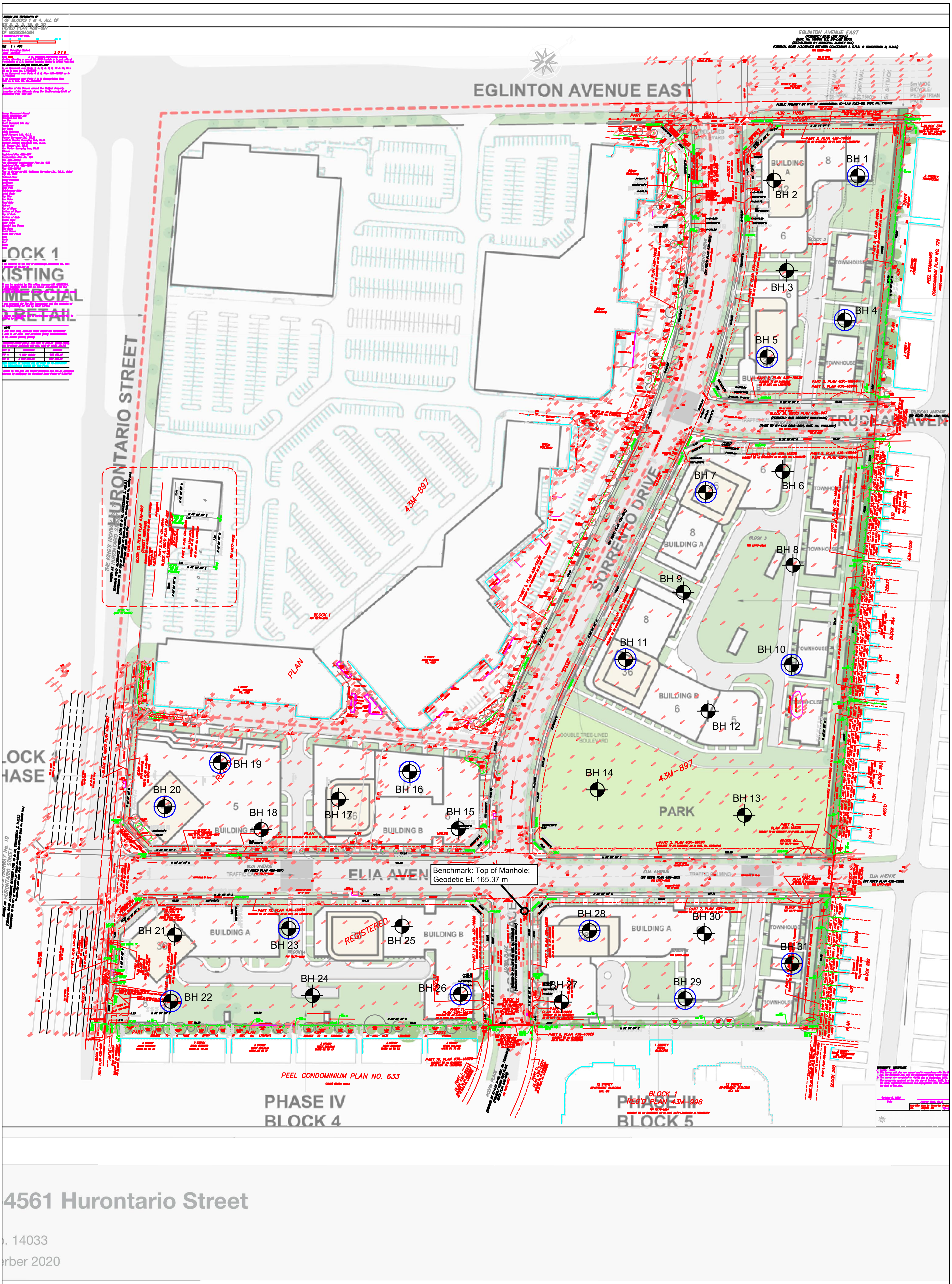
Plasticity Index (%) = -

Moisture Content (%) = 16

Estimated Permeability (cm./sec.) = 10^{-4}

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

Figure: 37



Benchmark: Top of Manhole;
Geodetic El. 165.37 m

LEGEND

⊕ Borehole only

⊕ Borehole with Groundwater Monitoring Well

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: ELIA LAND, PART OF BLOCK 1, AND BLOCKS 2, 3, 4 AND 5, SORRENTO DRIVE AND ELIA AVENUE
SOUTHEAST OF HURONTARIO STREET AND EGLINTON AVENUE EAST
CITY OF MISSISSAUGA

DESIGNED BY:	CHECKED BY:		DWG NO.: 1	
SCALE: 1:2000	REF. NO.: 2010-S021	DATE: DECEMBER 2020		REV -

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

SUBSURFACE PROFILE
DRAWING NO. 2
SCALE: AS SHOWN

JOB NO.: 2010-S021

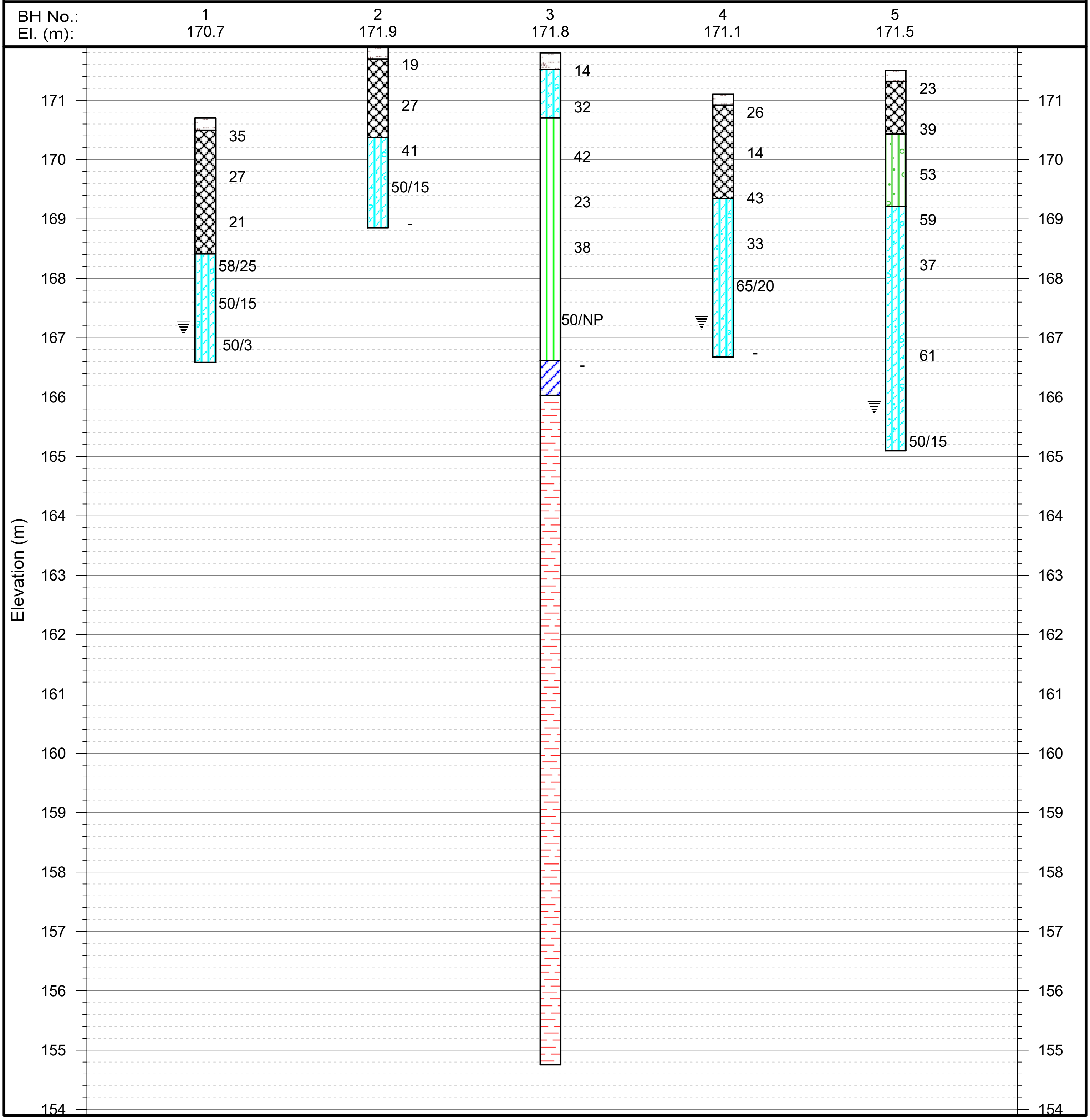
REPORT DATE: December 2020

PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

LEGEND

- TOPSOIL
- FILL
- SANDY SILT TILL
- SILT
- SILTY CLAY
- SILTY CLAY TILL
- SHALE
- ≡ CAVE-IN



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

SUBSURFACE PROFILE
DRAWING NO. 3
SCALE: AS SHOWN

JOB NO.: 2010-S021

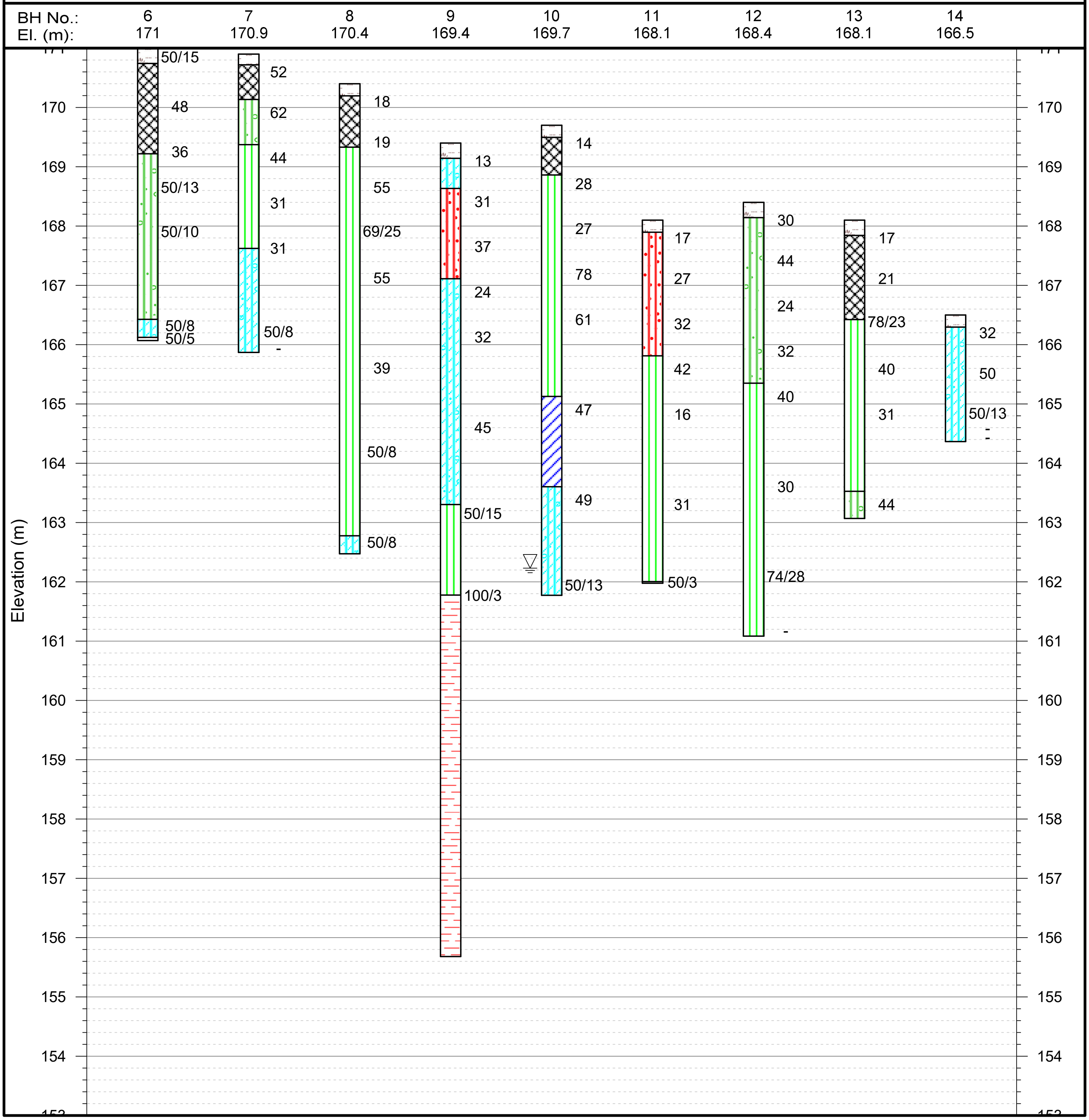
REPORT DATE: December 2020

PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

LEGEND

▨	TOPSOIL	▥	SILT
▩	FILL	▨	SILTY CLAY
▦	SANDY SILT	▥	SILTY CLAY TILL
▥	SANDY SILT TILL	☰	SHALE
∇	WATER LEVEL (END OF DRILLING)		



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

SUBSURFACE PROFILE
DRAWING NO. 4
SCALE: AS SHOWN

JOB NO.: 2010-S021

REPORT DATE: December 2020

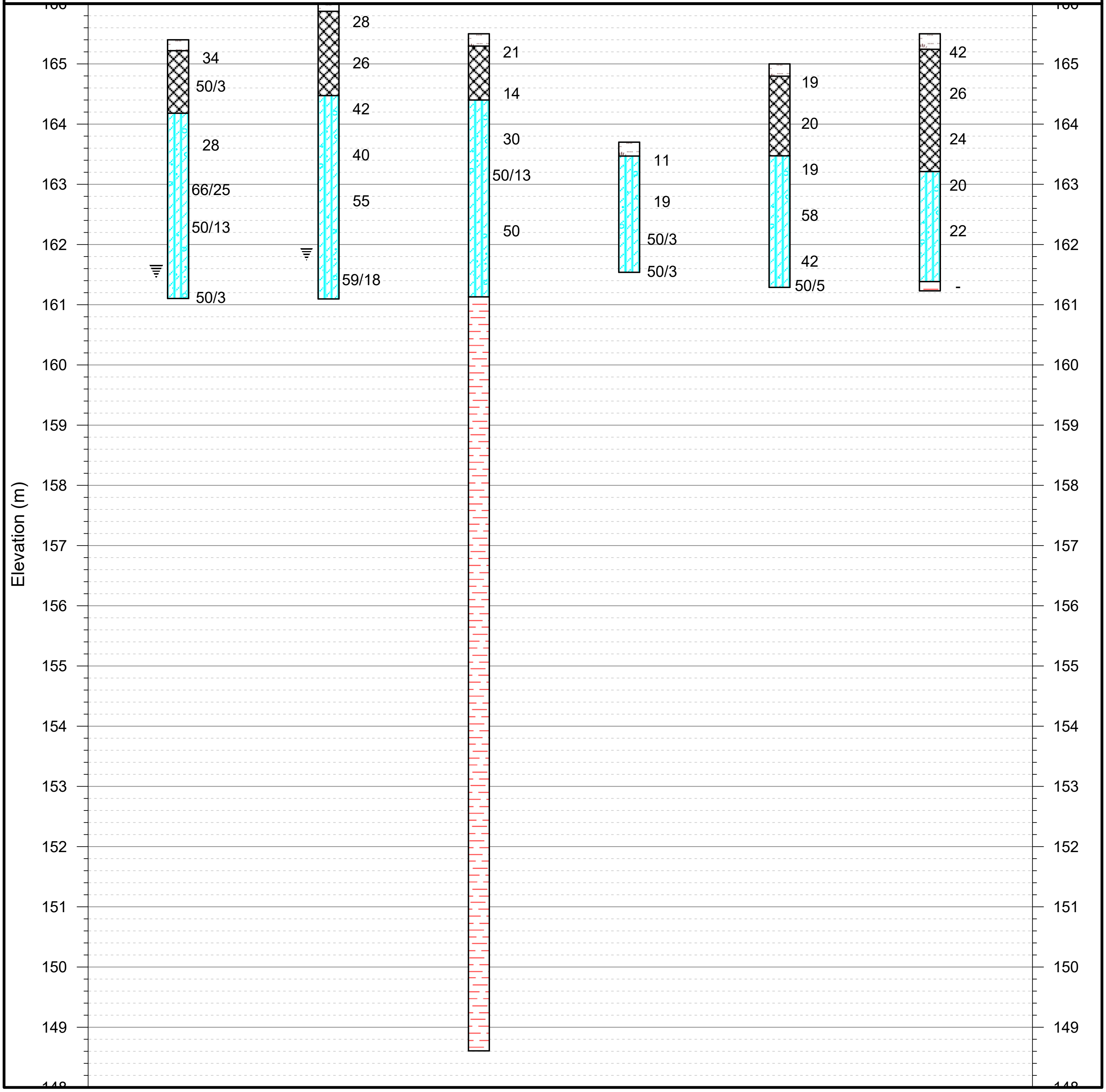
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

LEGEND

▨	TOPSOIL
🟦	SILTY CLAY TILL
🟥	SHALE
▩	FILL
≡	CAVE-IN

BH No.:	15	16	17	18	19	20
El. (m):	165.4	166	165.5	163.7	165	165.5



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

SUBSURFACE PROFILE
DRAWING NO. 5
SCALE: AS SHOWN

JOB NO.: 2010-S021

REPORT DATE: December 2020

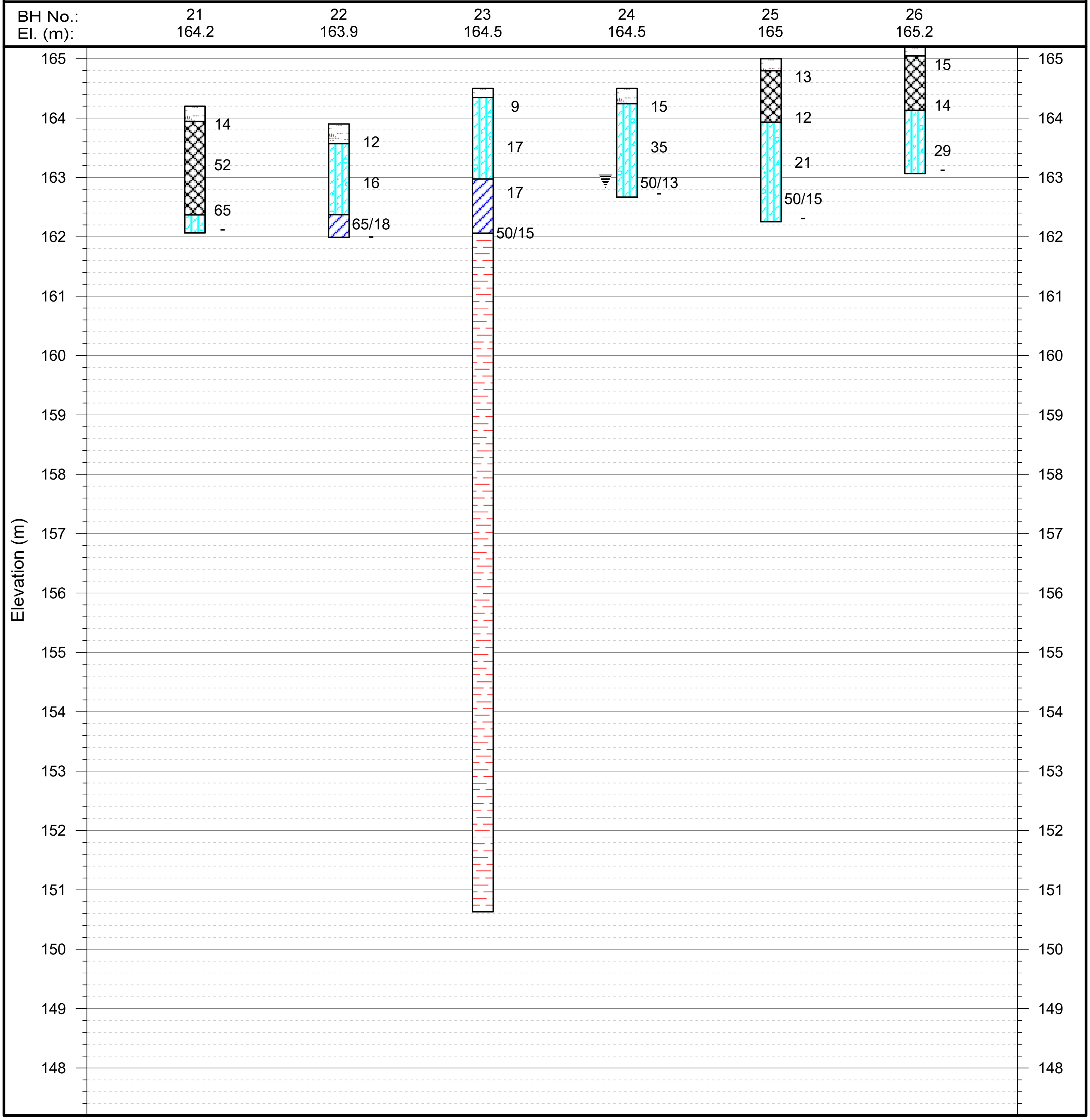
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

LEGEND

▤	TOPSOIL	▨	SILTY CLAY	☰	SHALE
▩	FILL	▥	SILTY CLAY TILL		

≑ CAVE-IN



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

SUBSURFACE PROFILE
DRAWING NO. 6
SCALE: AS SHOWN

JOB NO.: 2010-S021

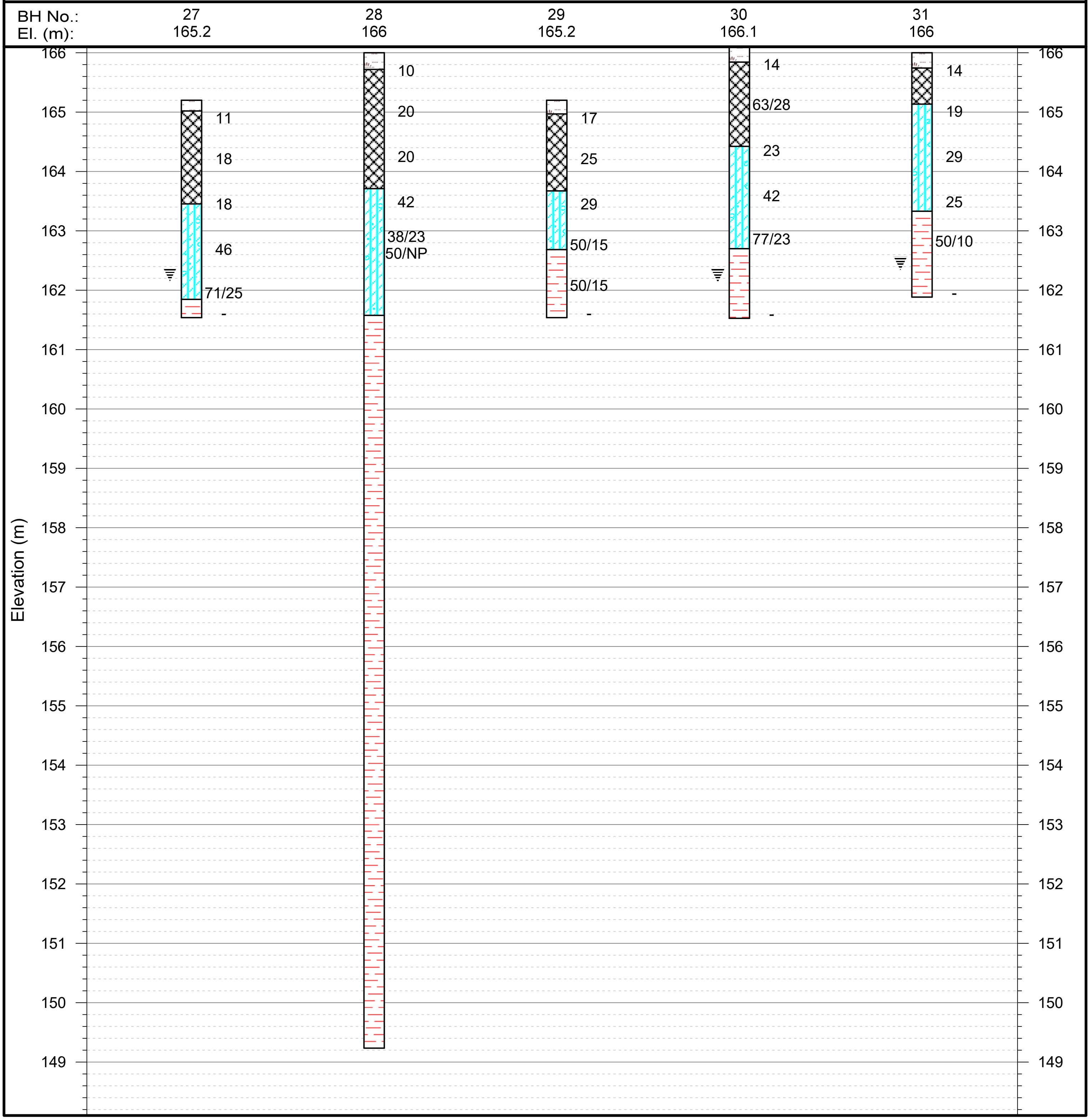
REPORT DATE: December 2020

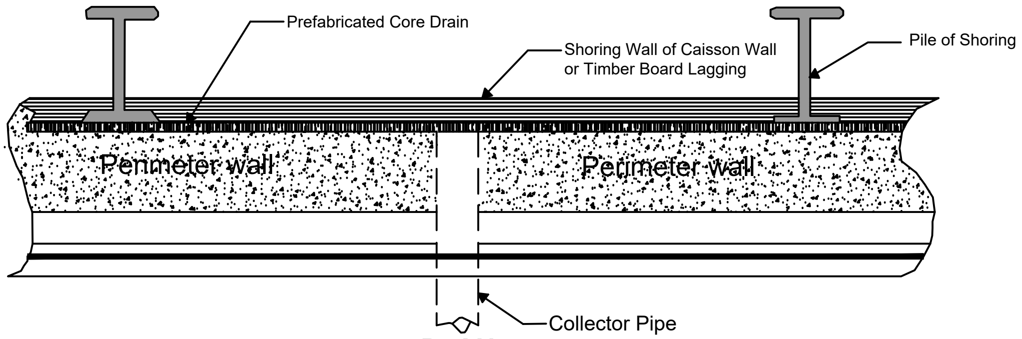
PROJECT DESCRIPTION: Proposed Mixed-Use Development with
2- to 5-Level Underground Parking

PROJECT LOCATION: Elia Land, Part of Block 1, and Blocks 2, 3, 4 and 5
Sorrento Drive and Elia Avenue
Southeast of Hurontario Street and Eglinton Avenue East
City of Mississauga

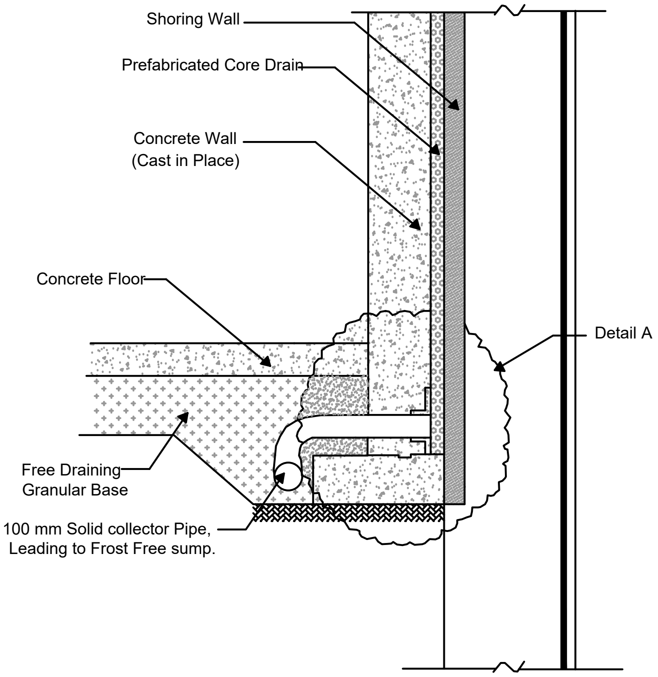
LEGEND

- ▨ TOPSOIL
- ▨ SILTY CLAY TILL
- ▨ SHALE
- ▨ FILL
- ≡ CAVE-IN

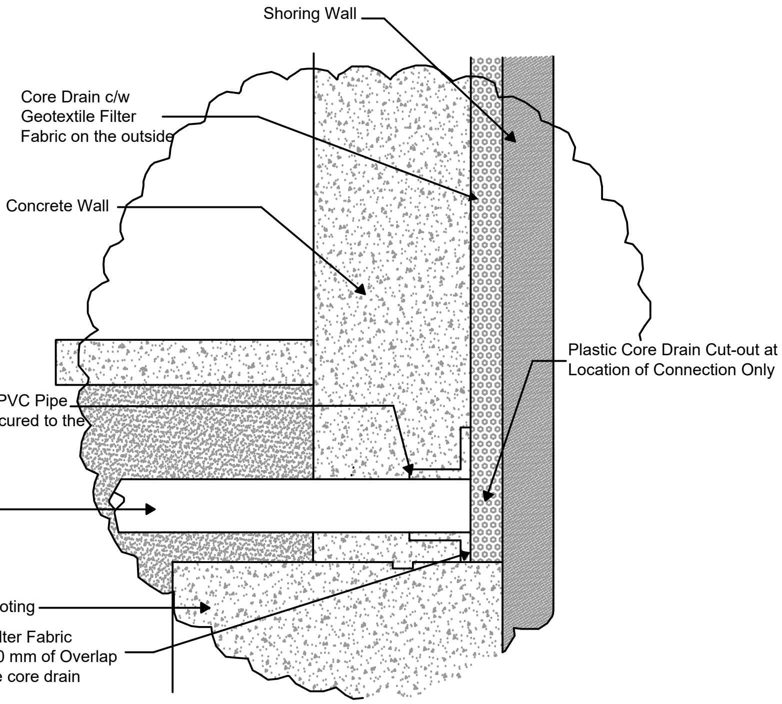




PLAN



TYPICAL SECTION



DETAIL A

NOTES:

1. A continuous blanket of prefabricated drainage system, Miradrain 6000 or equivalent, should extend continuously from the top of footings to the ground surface.

2. All joints of the Miradrain should be taped. All openings above the concrete footing must be covered with filter fabric to prevent intrusion of fresh concrete into the core of the drain.

3. Backfill behind the lagging board must be free draining. Filter fabric or straw should be used to prevent loss of fines behind the lagging.

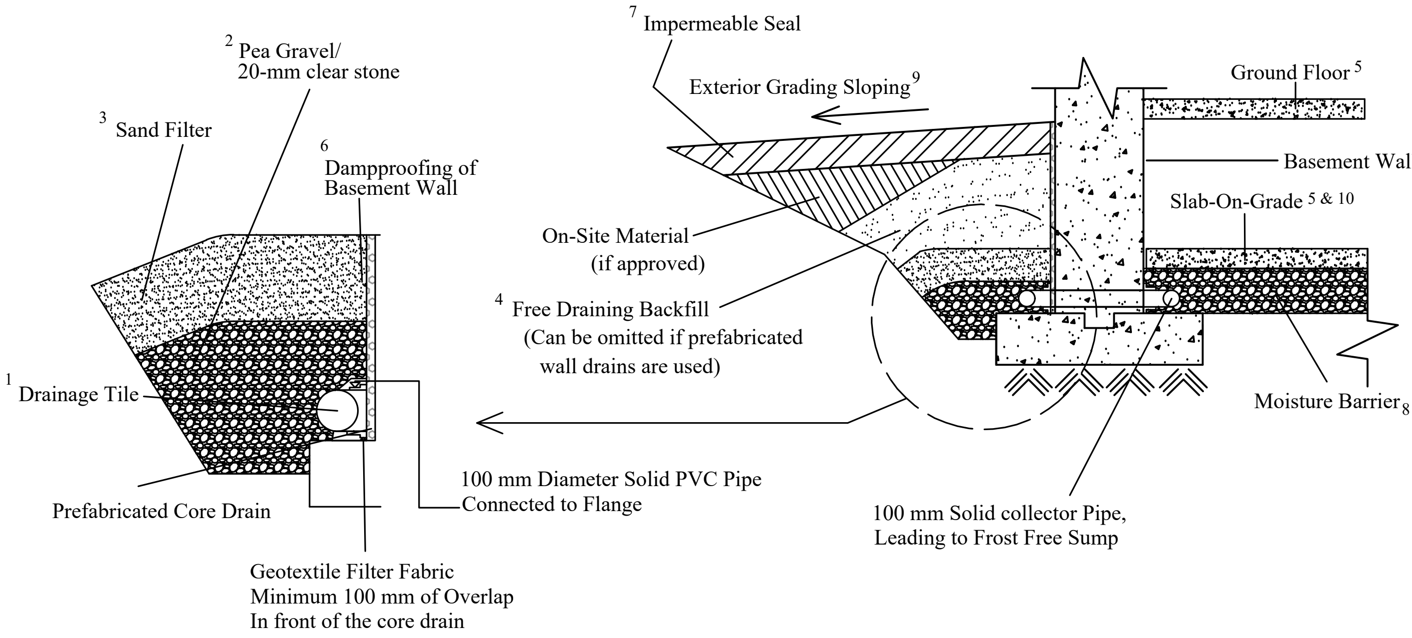
4. The perimeter drainage and any subfloor drainage systems must be kept separate.

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

PERMANENT PERIMETER DRAINAGE SYSTEM
(WITH SHORING)

SITE: ELIA LAND, PART OF BLOCK 1, AND BLOCKS 2, 3, 4 AND 5, SORRENTO DRIVE AND ELIA AVENUE
SOUTHEAST OF HURONTARIO STREET AND EGLINTON AVENUE EAST
CITY OF MISSISSAUGA

DESIGNED BY: K.L.
CHECKED BY: B.S.
DWG NO.: 7
SCALE: N.T.S.
REF. NO.: 2010-S021
DATE: DECEMBER 2020
REV -



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. Weep holes connections should be provided through the foundation walls for the connection between the weeping tile and the collector pipe at 20 m c/c.

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 20 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 adquate bracing.

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

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

8. **Moisture barrier**: 20-mm clear stone lined with fabric filter or compacted OPSS Granular 'A', or equivalent. The thickness of this layer should be 200 mm (8") minimum.

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

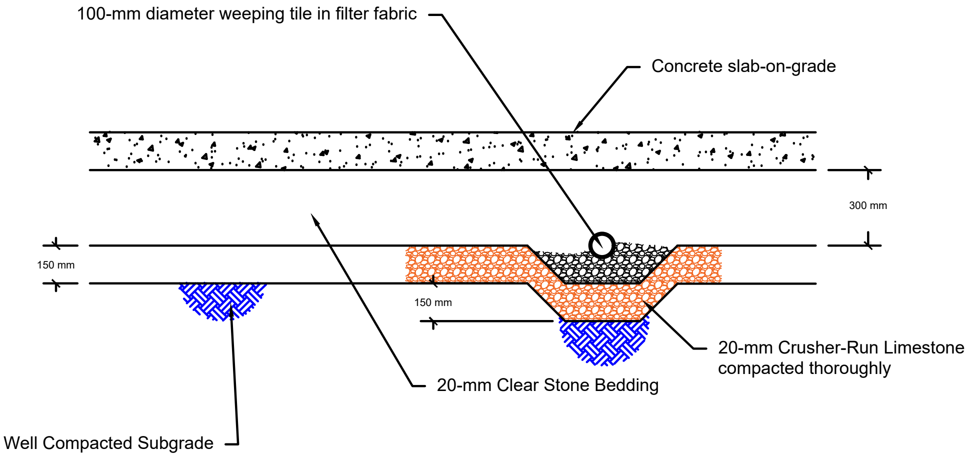
10. **Slab-On-Grade** should not be structurally connected to walls or foundations.

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

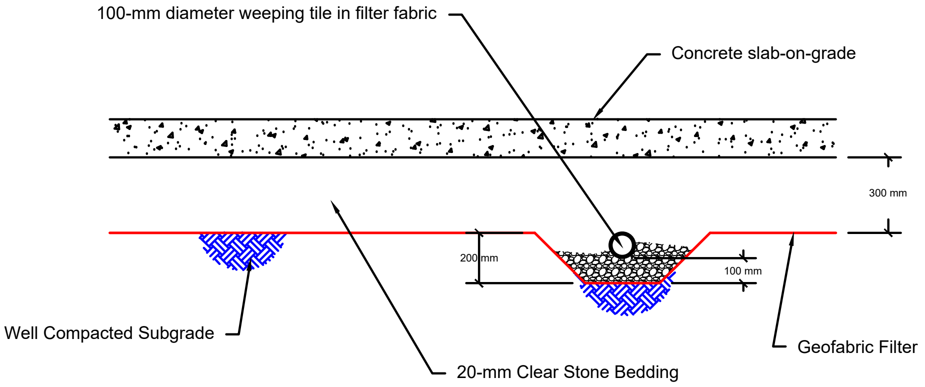
PERMANENT PERIMETER DRAINAGE SYSTEM
(WITHOUT SHORING)

SITE: ELIA LAND, PART OF BLOCK 1, AND BLOCKS 2, 3, 4 AND 5, SORRENTO DRIVE AND ELIA AVENUE
SOUTHEAST OF HURONTARIO STREET AND EGLINTON AVENUE EAST
CITY OF MISSISSAUGA

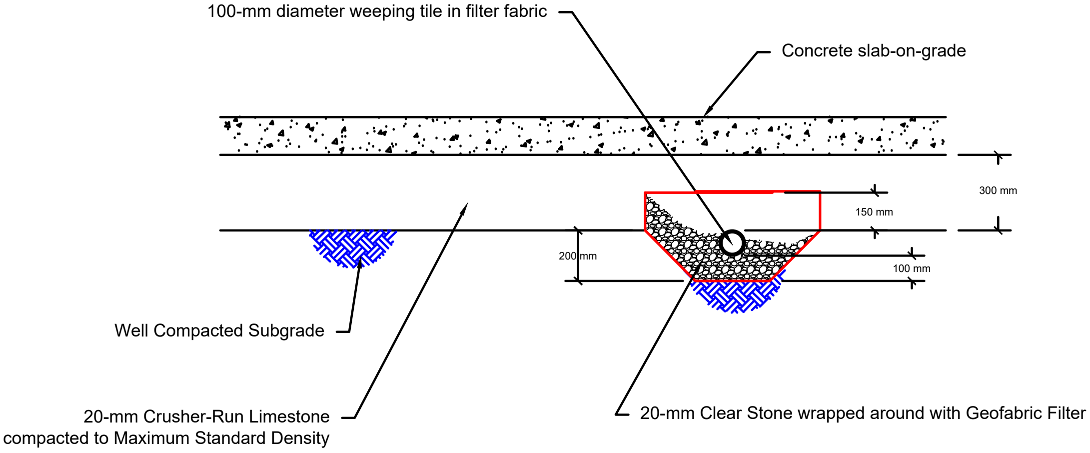
DESIGNED BY: K.L.
CHECKED BY: B.S.
DWG NO.: 8
SCALE: N.T.S.
REF. NO.: 2010-S021
DATE: DECEMBER 2020
REV -



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
100 NUGGET AVENUE, TORONTO, ONTARIO M1S 3A7 · TEL: (416) 754-8515 · FAX: (416) 754-8516

DETAILS OF UNDERFLOOR WEEPERS

SITE: ELIA LAND, PART OF BLOCK 1, AND BLOCKS 2, 3, 4 AND 5, SORRENTO DRIVE AND ELIA AVENUE
SOUTHEAST OF HURONTARIO STREET AND EGLINTON AVENUE EAST
CITY OF MISSISSAUGA

DESIGNED BY: K.L. **CHECKED BY:** B.S. **DWG NO.:** 9

SCALE: N.T.S. **REF. NO.:** 2010-S021 **DATE:** DECEMBER 2020 **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	GRAVENHURST	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

SHORING DESIGN

REFERENCE NO. 2010-S021

SHORING SYSTEM

Shoring will be required in an excavation to limit the horizontal and vertical movements of adjacent properties.

A shoring system consisting of soldier piles and lagging boards can be used in an excavation where slight movement in the adjacent properties is tolerable. In areas in close proximity to adjacent structures and where the excavation will be extending below the foundation level so that any movement in the adjacent properties is a concern, or in an excavation embedding into saturated sand or silt deposits, an interlocking caisson wall is more appropriate.

The design and construction of the shoring system should be carried out by a specialist designer and contractor experienced in this type of construction. All specifications for the design of the shoring system should be in accordance with the latest edition of the Canadian Foundation Engineering Manual (CFEM).

LATERAL EARTH PRESSURE

For single and multiple level supporting systems, the lateral earth pressure distributions on the shoring walls are shown on Drawing A1. The design soil parameters are provided in the geotechnical report.

The lateral earth pressure expressions do not include hydrostatic pressure build up behind the shoring. If the wall is designed to be water tight or undrained, such as a caisson wall, the anticipated hydrostatic pressure must be included behind the structure.

PILE PENETRATION

The depth of pile support should be calculated from the following expressions:

In Cohesive Soils: $R = 9\ c_u\ D\ (L - 1.5\ D)$

where R = Ultimate Load to be restrained (kN)
D = Diameter of concrete filled hole (m)
L = Embedment depth of the pile (m)
c_u = Undrained shear strength of subsoil (kPa)

In Cohesionless Soils: $R = 1.5\ D\ K_p\ L^2\ \gamma$

where R = Ultimate Load to be restrained (kN)
D = Diameter of concrete filled hole (m)
K_p = Passive resistance in the silt till and sand deposits
L = Embedment depth of the pile (m)
γ = unit weight of the soil (kN/m^3)

The shoring system should be designed for a factor of safety of F = 2.

For anchor supported shoring system, the global factor of safety against sliding and overturning of the anchored block of soil must also be considered.

The steel soldier piles in the shoring system must be installed in pre-augured holes. The lower portion will have to be filled with 20 MPa (3000 psi) concrete to the excavation level. The upper portion of the pile within the excavation depth should be filled with lean mix concrete or non-shrinkable cementitious filler (U-fill).

LAGGING

The following thicknesses of lagging boards have been recommended in CFEM:

Thickness of Lagging	**Maximum Spacing of Soldier Piles**
50 mm (2 in)	1.5 m (5 ft)
75 mm (3 in)	2.5 m (8 ft)
100 mm (4 in)	3.0 m (10 ft)

Local experience has indicated that the lagging board thickness of 75 mm has been adequate for soldier pile spacing of 3 m for soil conditions similar to those encountered at the subject site. However, it is important to consider all local conditions, such as the duration of excavation, the weather likely to be encountered through the construction period, seasonal variations in the ground water and ice lensing causing frost heave and softening of soils in determining the lagging thickness. During winter months, the shoring should be covered with thermal blankets to prevent frost penetration behind the shoring system which may result in unacceptable movements.

During construction of shoring, all the spaces behind the lagging board must be filled with free draining granular fill. If wet conditions are encountered, the space between the boards should be packed with a geotextile filter fabric or straw to prevent the loss of fine particles.

TIEBACK ANCHORS

The minimum spacing and the depths of the soil anchors should be as recommended in the CFEM.

All drilled holes for tieback anchors should be temporarily cased or lined to minimize the risk of caving. Systems involving high grout pressures should be avoided if working near other basements or buried services.

The tieback anchor lengths can be estimated using an adhesion value of 60 kPa. Full scale load tests should be carried out on the tieback anchors in each type of soils and at each level of anchor support at the site to confirm the design parameters and the adhesion values. The test anchors should be loaded in a pattern as described in CFEM, to 200% of the design load or until there is a significant increase in the pullout rate. In the latter case, the design load must be limited to 50% of the maximum load at which the pullout increases. Based on the results of the pullout test, it may be necessary to modify the anchor design of the production anchors.

Each tieback anchor must be proof-loaded to 133% of the design load, and the anchor must be capable of sustaining this load for a minimum of 10 minutes without creep. The load may then be relaxed to 100% of the design and locked in. The higher the lock-in loads, the less will be the outward movement on the shoring wall after excavation.

RAKERS

An alternative to tieback anchor support of the shoring is to use raker footings. Rakers inclining at an angle of 45º, founded in the shale bedrock below the bottom of excavation should be designed for the allowable bearing pressure of 500 kPa. Raker footings extending into the sound shale can be designed for the allowable bearing pressure of 1500 kPa.

The raker footings should be located outside the zone of influence of the buried portion of the soldier piles at a distance of not less than 1.5 of the length of embedment of the soldier pile.

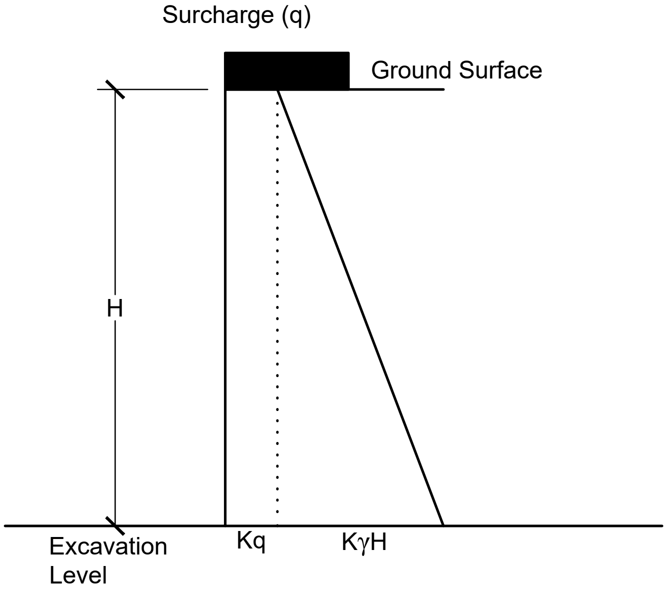
To prevent undermining of the raker footing, no excavation should be made within two times the width of raker footing on the opposite side of the raker.

When sloping berm excavation procedures are used, the rakers should be installed in trenches in the berm to minimize movement of the shoring wall being supported. In addition, the rakers can be pre-loaded and secured in place before removal of the earth berm.

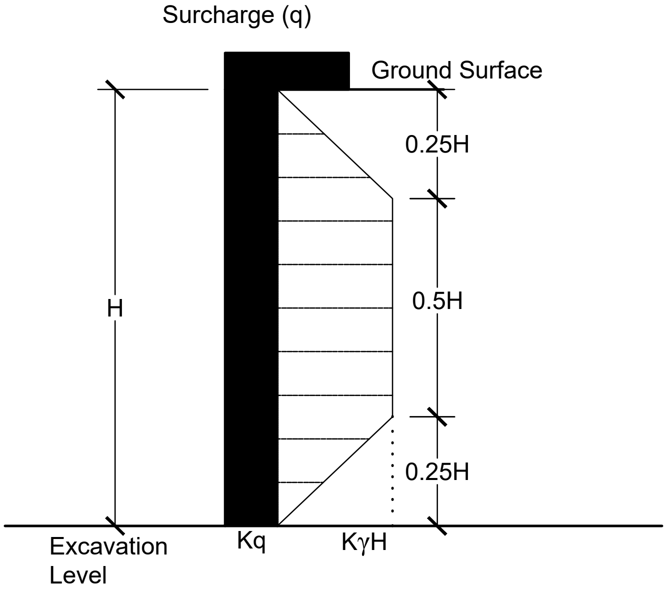
MONITORING OF PERFORMANCE

Close monitoring of the vertical and lateral movement of the shoring system, by inclinometers or by survey on targets, should be carried out at the site. Extra bracing or support may be required if any movement is found excessive. The contractor should maintain the shoring to ensure any movement is within the design limit.

TEMPORARY SHORING
Lateral Earth Pressures



Single Support System



Multiple Support System

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

Where
H = Height of Shoring (m)
γ = Unit Weight of Retained Soil (kN/m^3)
q = Surcharge (kPa)
K = Earth Pressure Coefficient

- If moderate ground and shoring movements are permissible then:
  $K = K_a$ = Active Earth Pressure Coefficient

- if there are building foundations within a distance of 0.5 H behind the shoring then:
  $K = K_o$ = Earth Pressure at rest

- If there are building foundations within a distance of between 0.5 H and H behind the shoring then:
  $K = 0.5 (K_a + K_o)$

Note:
1. The lateral pressure expression assumes effective drainage from behind the temporary shoring.
2. The earth pressure coefficients are specified in the geotechnical report.

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

TEMPORARY SHORING
LATERAL EARTH PRESSURES

SITE: ELIA LAND, PART OF BLOCK 1, AND BLOCKS 2, 3, 4 AND 5, SORRENTO DRIVE AND ELIA AVENUE
SOUTHEAST OF HURONTARIO STREET AND EGLINTON AVENUE EAST
CITY OF MISSISSAUGA

DESIGNED BY: K.L.
CHECKED BY: B.S.
DWG NO.: A1
SCALE: N.T.S.
REF. NO.: 2010-S021
DATE: DECEMBER 2020
REV -