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A REPORT TO
SCHOOL WEST INVESTMENT INC.

A GEOTECHNICAL INVESTIGATION FOR PROPOSED RESIDENTIAL DEVELOPMENT

SOUTHEAST OF OLD SCHOOL ROAD AND
CHINGUACOUSY ROAD

TOWN OF CALEDON

REFERENCE NO. 2310-S043

FEBRUARY 2024

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1.0 INTRODUCTION

In accordance with the email authorization dated October 2, 2023, from Mr. Frank Filippo of School West Investment Inc., a geotechnical investigation was carried out for a property located southeast of Old School Road and Chinguacousy Road in the Town of Caledon.

The purpose of the investigation was to reveal the subsurface conditions and to determine the engineering properties of the disclosed soils for the design and construction of a proposed residential development.

2.0 SITE AND PROJECT DESCRIPTION

The subject site is located in the southeast quadrant of the Old School Road and Chinguacousy Road intersection, in the Town of Caledon. The property is situated within the physiographic region of South Slope with glaciolacustrine-derived silty to clayey till and a modern alluvial deposit along the Etobicoke Creek tributary corridors. The subsoil profile at the site is characterized by sand and silt deposits layered in between the upper Halton Till and the lower Newmarket Till.

At the time of investigation, the property consists of farm fields. The agricultural fields are separated by a Y-shaped Etobicoke Creek tributary system connecting to a wood lot in the southeast corner of the site. The existing site grading generally descends towards the south.

Based on the conceptual site plan, the site will be developed as a low- to medium-density residential subdivision, with park and stormwater management (SWM) pond blocks.

3.0 FIELD WORK

The field work, consisting of 10 boreholes extending to a depth ranging from 6.2 to 6.6 m, was carried out between October 19 and 23, 2023. To facilitate the hydrogeological study by Palmer Environmental Consulting Group (PECG), 50-mm diameter monitoring wells were installed at 4 selected borehole locations. The depth and details of the monitoring wells are shown on the corresponding Borehole Logs. The locations of the boreholes and monitoring wells are shown on Drawing No. 1.

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

The ground elevation at each borehole location was determined using a handheld equipment of the Global Navigation Satellite System.

4.0 SUBSURFACE CONDITIONS

Beneath the topsoil veneer, the subsoil profile generally consists of silty clay till overlying a silt and silty fine sand deposit and in places, bedding onto a sandy silt till stratum. Silty clay was also found beneath the tills at various depths and locations.

Detailed descriptions of the encountered subsurface conditions are presented on the Logs of Borehole, comprising of Figures 1 to 10, inclusive. The soil stratigraphy is illustrated on the Subsurface Profile, Drawing No. 2.

Previous borehole investigations and monitoring well installations were carried out in 2017 by PECG as part of their hydrogeological study. Relevant borehole logs are enclosed in the Appendix for reference and the borehole data is summarized in this report.

The engineering properties of the disclosed soils are discussed herein.

4.1 Topsoil

The revealed topsoil thickness ranges from 18 to 33 cm. Thicker topsoil may be encountered in areas beyond the borehole locations, especially in local low-lying areas.

4.2 Silty Clay Till and Silty Clay

Silty clay till was encountered in the upper stratigraphy across the site, except in Boreholes W-109 and W-110. The till consists of a mixture of particle sizes ranging from clay to gravel, with silt and clay being the dominant fraction. Silty clay, containing a trace to some sand and embedded silt layers, was encountered beneath the silty clay till in Borehole W-101 and beneath the sandy silt till/silty sand till in Borehole W-109. Grain size analyses were performed on representative samples of the silty clay till and silty clay, and the results are plotted on Figures 11 and 12, respectively.

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

	Silty Clay Till	**Silty Clay**
Liquid Limit	27%	40%
Plastic Limit	17%	20%
Natural Water Content	9% to 19% (median 13%)	12% to 21% (median 15%)

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

The recorded ‘N’ values of the silty clay till range from 6 to 62, with a median of 25 blows per 30 cm of penetration. This indicates that the clay till is firm to hard, generally being very stiff in consistency. The low ‘N’ values are generally restricted to the surficial weathered zone, which extends to depths of 0.8 to 1.4 m below grade. Intermittent hard resistance to augering was encountered in places, indicating the presence of cobbles in the till mantle.

The obtained ‘N’ values of the clay range from 11 to 89, with a median of 50 blows per 30 cm of penetration, showing that the clay is stiff to hard, generally being hard in consistency.

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

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

4.3 **Silt** and **Silty Fine Sand**

The silt, containing traces of sand and clay, was generally contacted beneath the silty clay till and silty clay. Boreholes W-101, W-103, W-104 and W-105 were terminated in the silt deposit. At Boreholes W-106 and W-108, a silty fine sand layer was encountered beneath the silt, overlying the sandy silt till. Grain size analyses were performed on 2 representative samples each of the silt and silty fine sand, and the results are plotted on Figures 13 and 14, respectively.

The obtained natural water content values of the silt and silty fine sand range from 13% to 23%, with a median of 20%, indicating that the deposit is moist to wet, generally in a wet condition.

The recorded ‘N’ values range from 5 to 70, with a median of 31 blows per 30 cm penetration, indicating relative densities of loose to very dense, generally being dense. The loose soil was encountered near the ground surface within the weathered zone.

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

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

4.4 **Sandy Silt Till**

Sandy silt till was generally encountered in the northern half of the site, in the lower stratigraphy of Boreholes W-102, W-106 to W-110. In Borehole W-109, sandy silt till/silty sand till was also contacted beneath the topsoil veneer. The till is cemented with a trace of clay, and is laminated with sand and silt seams and layers. Hard resistance to augering was encountered in places, indicating the presence of cobbles. A grain size analysis was performed on a sample of the till; the result is plotted on Figure 15.

The natural water content values of the till range from 7% to 17%, with a median of 10%, indicating that the till is generally in a moist condition.

The obtained ‘N’ values range from 6 to over 50, with a median of over 50 blows per 30 cm penetration, indicating that the relative density of the till is loose to very dense, generally being very dense.

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

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

4.5 Review of Borehole Records by PECG

In 2017, boreholes were carried out and monitoring wells were installed by PECG at 3 select locations within the property as part of the hydrogeological study for the Mayfield West Phase 2 Stage 3 Lands block. The Borehole Records of MW-1, MW-2D/S and MW-3 are enclosed in the Appendix for reference and their locations are shown on Drawing No. 1.

A review of the borehole logs revealed a topsoil layer at the surface, extending to depths of 0.84 and 1.45 m. In MW-1, a medium sand and silt unit is sandwiched between the upper clayey silt till and a lower silty clay till, indicating a makeup similar to the nearby Borehole W-105. In MW-2D/S and MW-3, the fine to medium sand and silt deposit is underlain by a clay layer and silty sand/clayey silt to silty clay till.

The obtained 'N' values indicate that the sand and silt deposit is compact to very dense, and the tills are either very stiff to hard in consistency or dense to very dense in relative density. The sand and silt unit is generally wet.

4.6 Compaction Characteristics of the Revealed Soils

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

Table 1 - Estimated Water Content for Compaction

Soil Type	Determined Natural Water Content (%)	Water Content (%) for Standard Proctor Compaction	
		100% (optimum)	Range for 95% or +
Silty Clay Till	9 to 19 (median 13)	18	15 to 22
Silty Clay	12 to 21 (median 15)	20	16 to 24
Silt/Silty Fine Sand	13 to 23 (median 20)	12	8 to 16
Sandy Silt Till	7 to 17 (median 10)	10	6 to 15

The on-site soils are suitable for structural backfill. The addition of water will be required for the silty clay till and clay prior to structural compaction, especially in the dry and warm seasons and in areas where compaction is best performed on the wet side of the optimum. The silt and silty fine sand are too wet and must be aerated prior to structural backfill. This can be achieved by either stockpiling or spreading the soils thinly on the ground for aeration in the dry warm weather.

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

5.0 GROUNDWATER CONDITION

Groundwater levels were detected in 4 of the 10 boreholes upon completion of drilling in October 2023. Seepage was also detected in Boreholes W-106 and W-108 from the wet silt and silty fine sand at depths of 2.4 and 3.0 m below grade, respectively. In December 2023, stabilized groundwater levels were recorded from the installed monitoring wells in by PECG; these levels are tabulated in Table 2.

Table 2 - Groundwater Levels

Borehole/ Monitoring Well No.	Ground El. (m)	Well Depth (m)	Measured Groundwater Levels					
			On Completion		Dec. 6, 2023		Dec. 12-13, 2023	
			Depth (m)	El. (m)	Depth (m)	El. (m)	Depth (m)	El. (m)
W-101	266.0	-	Dry	-	No Well			
W-102	264.7	-	2.7	262.0	No Well			
W-103	264.9	6.1	Dry	-	1.94	262.96	1.90	263.00
W-104	263.4	-	1.6	261.8	No Well			
W-105	267.6	-	2.4	265.2	No Well			
W-106	265.5	6.1	N/A	-	2.04	263.46	2.09	263.41
W-107	268.7	-	Dry	-	No Well			
W-108	267.5	6.1	N/A	-	2.56	264.94	-	-
W-109	267.7	-	Dry	-	No Well			

Borehole/ Monitoring Well No.	Ground El. (m)	Well Depth (m)	Measured Groundwater Levels					
			On Completion		Dec. 6, 2023		Dec. 12-13, 2023	
			Depth (m)	El. (m)	Depth (m)	El. (m)	Depth (m)	El. (m)
W-110	265.4	-	2.7	262.7	No Well			
MW-1	268.0	6.09	2.28[a]	265.72	Well Not Found			
MW-2D	268.0	8.84	7.60[a]	260.40	1.71	266.29	-	-
MW-2S	268.0	4.88	4.48[a]	263.52	1.46	266.54	-	-
MW-3	263.0	7.62	5.05[a]	257.95	-	-	-	-

[a] Water level measured on completion on November 13, 2017.

Stabilized water levels were recorded at depths ranging from 1.46 to 2.56 metres below ground surface (mbgs), or from El. 266.54 to 262.96 m. The groundwater records are generally consistent with or near the observed wet silt and sand deposit at the boreholes. The groundwater regime is subject to seasonal fluctuations. Detailed groundwater profile and monitoring records should be referred to the hydrogeological study by PECG.

6.0 DISCUSSION AND RECOMMENDATIONS

Beneath the topsoil veneer, the site is underlain by a stratum of generally very stiff silty clay till and/or hard silty clay, overlying a dense silt and sand unit, and in places, bedding onto a very dense sandy silt till deposit. The surficial weathered zone extends to depths of 0.8 to 1.4 m below grade.

Stabilized water levels were recorded at the monitoring wells at depths ranging from 1.46 to 2.56 mbgs, or from El. 266.54 to 262.96 m. The groundwater records are generally consistent with or near the observed wet silt and sand deposit at the boreholes. The groundwater regime is subject to seasonal fluctuations.

Based on the conceptual site plan, the site will be developed as a low- to medium-density residential subdivision, with park and SWM pond blocks. The development will be provided with municipal services and paved roadways meeting municipal standards. The following geotechnical considerations warrant special attention:

1. The topsoil must be stripped for development; it can be reused for general landscaping purposes only.
2. The weathered soil should be inspected prior to any placement of earth fill for site grading purpose. Where required, the badly weathered soil should be subexcavated, sorted free of any organic, topsoil, and/or other deleterious material, before reusing for structural backfill.
3. Where additional fill is required for site grading, the earth fill can be placed in an engineered manner for conventional footing construction, site services support and road construction.
4. The sound native soils are suitable for supporting structures founded on conventional spread and strip footings.
5. In view of the underlying wet silt and sand deposit and the observed groundwater levels, it is recommended that the basement floor be founded at least 1.0 m above the seasonal high groundwater level. Otherwise, underfloor subdrain systems and/or waterproofing of basements should be implemented to relieve any groundwater upfiltration due to seasonal fluctuation of the groundwater.
6. A Class 'B' bedding, consisting of compacted 19-mm Crusher-Run Limestone (CRL), is recommended for the construction of underground services. Where services installation extends into the saturated silt and sand, or where dewatering is required, a Class 'A' concrete bedding should be considered for pipe support.
7. Groundwater seepage from the tills and clay will likely be removable by conventional pumping from sumps during construction. Excavation extending into the saturated soils will require construction dewatering.

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

6.1 **Site Preparation**

The topsoil and vegetation at the ground surface must be removed for development. The topsoil can only be reused for landscaping purposes.

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

1. The subgrade must be inspected and proof-rolled prior to any fill placement. Badly weathered soils should also be subexcavated, sorted free of topsoil inclusions and deleterious materials, if any, aerated and properly compacted in layers.
2. Inorganic soils must be used for the fill, and they must be uniformly compacted in lifts of 20 cm thick to at least 98% Standard Proctor Dry Density (SPDD) up to the proposed finished grade. The soil moisture must be properly controlled near the optimum. If the foundations are to be built soon after the fill placement, the densification process for the engineered fill must be increased to 100% SPDD.
3. If the engineered fill is compacted with the moisture content on the wet side of the optimum, the underground services and pavement construction should not begin until the pore pressure within the fill mantle has completely dissipated. This must be further assessed at the time of the engineered fill construction.
4. If imported fill is to be used, it should be inorganic soils, free of deleterious or any material with environmental issue or contamination. Any potential imported earth fill from off-site must be reviewed for geotechnical and environmental quality by the appropriate personnel as authorized by the developer or agency, before being hauled to the site.
5. The fill operation must be inspected on a full-time basis by a technician under direction of a geotechnical engineer.
6. The engineered fill should not be placed during period when freezing ambient temperatures occur either persistently or intermittently. This is to ensure that the fill is free of frozen soils, ice and snow. If the engineered fill is to be left over the winter months, adequate earth cover, or equivalent, must be provided for protection against frost action.
7. The engineered fill must extend over the entire graded area; the engineered fill envelope and finished elevations must be clearly and accurately defined in the field, and they must be precisely documented by qualified surveyors.
8. The foundations and underground services subgrade must be inspected by the geotechnical consulting firm that inspected the engineered fill placement. This is to ensure that the foundations are placed within the engineered fill envelope, and the integrity of the fill has not been compromised by interim construction, environmental degradation and/or disturbance by the footing excavation.
9. Despite stringent control in the placement of the engineered fill, variations in soil type and density may occur in the engineered fill. Therefore, the foundations must be properly reinforced, or be designed by the structural engineer for the project. The total and differential settlements of 25 mm and 20 mm, respectively, should be considered in the design of the foundation founded on engineered fill.
10. Any excavation carried out in certified engineered fill must be reported to the geotechnical consultant who supervised the fill placement in order to document the

locations of the excavation and/or to supervise reinstatement of the excavated areas to engineered fill status. If construction on the engineered fill does not commence within a period of 2 years from the date of certification, the condition of the engineered fill must be assessed for re-certification.

6.2 **Foundation**

Based on the conceptual site plan, the development consists of low- to medium-density residential blocks. The following bearing pressures are recommended for houses supported on conventional strip and spread footings founded onto engineered fill or sound native soils below the topsoil and weathered soils:

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

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

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

Footings exposed to weathering, or in unheated areas, should have at least 1.2 m of earth cover for protection against frost action.

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

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

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

6.3 Basement Structure

Where house basements are proposed, they should be designed for the lateral earth pressure using the soil parameters provided in Table 4.

With the recorded groundwater levels and a wet silt and sand unit observed throughout the site at various depths, It is recommended that the basement floor be founded at least 1.0 m above the seasonal high groundwater level.

In conventional basement design, perimeter walls of the basement structure should be damp-proofed and provided with perimeter subdrains at the wall base. Backfill of the open excavation should consist of free-draining granular material (Drawing No. 3) unless prefabricated drainage board is installed over the entire wall below grade.

Should the basement floor be founded less than 1.0 m above the groundwater table, underfloor subdrains (Drawing No. 4) should be provided to supplement the perimeter subdrain system to relieve any groundwater upfiltration due to seasonal fluctuation. If the basement floor is to be founded less than 0.5 m above the groundwater table, the basement structure should be waterproofed and designed for hydrostatic uplift pressure. The subdrains, connected to a positive outlet, should be encased in a fabric filter to protect them against blockage by silting.

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

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

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

6.4 Underground Services

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

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

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

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

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

6.5 Backfilling Trenches and Excavated Areas

The on-site inorganic soils are suitable for trench backfill. The addition of water will be required for the clay till and clay prior to structural compaction during dry and warm weather and in areas where compaction is best performed on the wet side of the optimum. Wet silt and sand will require aeration prior to their use as structural backfill. The tills should be sorted free of large cobbles and boulders (over 15 cm in size).

The backfill material should be compacted to at least 95% SPDD. In areas below the slab-on-grade and in the zone within 1.0 m below the pavement subgrade, the backfill should be compacted to at least 98% SPDD with a moisture content 2% to 3% drier than the optimum. This is to provide the required stiffness for floor or pavement construction. The lift of each backfill layer should be limited to a thickness of 20 cm, or the thickness should be determined by test strips at the time of compaction.

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

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

- To backfill a deep trench, one must be aware that the future settlement is to be expected, unless the sides is flattened to 1V:2H, and the lifts of the fill and its moisture content are stringently controlled; i.e. lifts should be no more than 20 cm (or less if the backfilling conditions dictate) and uniformly compacted to achieve at least 98% SPDD, with the moisture content on the wet side of the optimum.
- It is often difficult to achieve uniform compaction of the backfill in the lower vertical section of a trench which is an open cut or is stabilized by a trench box, particularly in the sector close to the trench walls or the sides of the box. These sectors must be backfilled with sand and the compaction must be carried out diligently, prior to the placement of the backfill above this sector, i.e., in the upper sloped trench section. This measure is necessary in order to prevent consolidation of inadvertent voids and loose backfill which will compromise the compaction of the backfill in the upper section.
- In areas where the underground services construction is carried out during the winter months, prolonged exposure of the trench walls will result in frost heave within the soil mantle of the walls. This may result in some settlement as the frost recedes, and repair costs will be incurred prior to the final surfacing of the new pavement and slab-on-grade construction.
- When construction is carried out in the winter, frozen soil layers may inadvertently be mixed with the structural trench backfill. Should the in-situ soil have a water content on the dry side of the optimum, it would be impossible to wet the soil due to the freezing condition, rendering difficulties in obtaining uniform and proper compaction. Furthermore, the freezing condition will prevent flooding of the backfill when it is required, such as when the trench box is removed. The above will invariably cause backfill settlement that may become evident within several years after construction.
- In areas where groundwater movement is expected in the sand fill mantle, anti-seepage collars should be provided.

6.6 Pavement Design

The recommended pavement design for residential local roads, satisfying the minimum requirement from the Town of Caledon, is provided in Table 3.

Table 3 - Pavement Design

Course	Thickness (mm)	OPS Specifications
Asphalt Surface	40	HL3
Asphalt Binder	65	HL8
Granular Base	150	Granular ‘A’ or equivalent
Granular Sub-base	300	Granular ‘B’ or equivalent

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

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

- The pavement subgrade should be properly crowned and smooth-rolled to allow interim precipitation to be properly drained.
- Lots areas adjacent to the road should be properly graded to prevent ponding of large amounts of water. Otherwise, the water will seep into the subgrade mantle and induce a regression of the subgrade strength, with costly consequences for the pavement construction.
- In extreme cases during the wet seasons, if soft or weak subgrade is identified, it can be replaced by compacted granular material to compensate for the inadequate strength of the soft or weak subgrade. This can be assessed during construction.
- Fabric filter-encased curb subdrains are required to meet the Town of Caledon requirements.

6.7 Stormwater Management Ponds

Two SWM ponds (SWM 3 and 4) are proposed in the northern half of the subdivision, adjacent to the creek tributary system. Detailed designs of the ponds were not available for review at the time of report preparation.

Pond Liner

Based on the borehole information from Boreholes W-106 and W-110, the pond areas are underlain by a silt/silty fine sand deposit overlying sandy silt till at approximate depths of 3 to 4 m below grade. It is anticipated that pond excavation will extend into the permeable deposits. An earthen clay liner (with an estimated permeability of 10^{-7} cm/sec or less) or a geosynthetic clay liner (GCL) with soil ballast will therefore be required to minimize water infiltration through the native soils which will affect the designed capacity of the ponds.

Water levels were recorded at depths ranging from 1.46 to 2.09 mbgs at the nearby monitoring wells, or at approximately El. 263.4 m and El. 266.5 m at SWM 3 and 4, respectively, and may be higher during wet seasons. The appropriate thickness of the clay liner or ballast to counteract the hydrostatic uplift pressures and the extent of the liner can be established once the pond elevations are available for review.

Pond Berm Construction

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

Any proposed earth embankments should be constructed using inorganic clay or clay till material, compacted to at least 98% SPDD in lifts of no more than 20 cm in thickness. The subgrade must be inspected and proof-rolled prior to any fill placement. The construction of the berms must be supervised and certified by the site geotechnical engineer. The pond side slopes should be surface compacted.

Control Structures

The following bearing pressures can be used for the design of control structures supported on conventional footings founded on engineered fill or on sound native soils below the topsoil and weathered soils:

- Soil Bearing Pressure at SLS: 100 kPa
- Factored Ultimate Soil Bearing Pressure at ULS: 120 kPa

The footings must be placed below the scouring depth and be provided with a minimum earth cover of 1.2 m to protect them from frost damage. The inlets and outlets of the ponds must be lined with gabion mats, rip rap or equivalent measures for protection against scouring.

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

General Considerations

One should be aware that minor maintenance may be required after rapid drawdown as the water recedes from a flood level to normal level. Routine visual inspection and maintenance will be required to rectify any observed deficiency.

6.8 Soil Parameters

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

Table 4 - Soil Parameters

Unit Weight and Bulk Factor	**Unit Weight (kN/m^3)**		**Estimated Bulk Factor**	
	Bulk	**Submerged**	**Loose**	**Compacted**
Silty Clay Till	22.0	12.0	1.33	1.03
Silty Clay	20.5	10.5	1.30	1.00
Sandy Silt Till	22.5	12.5	1.33	1.05
Silt/Silty Sand	20.5	10.5	1.25	1.00
Lateral Earth Pressure Coefficients		**Active K_a**	**At Rest K_o**	**Passive K_p**
Compacted Earth Fill and Silty Clay		0.40	0.55	2.50
Silty Clay Till/Silt/Silty Sand		0.33	0.50	3.00
Sandy Silt Till		0.29	0.46	3.39
Estimated Coefficients of Permeability (K) and Percolation Time (T)			**K (cm/sec)**	**T (min/cm)**
Silty Clay Till and Silty Clay			10^{-7}	80+
Sandy Silt Till/Silt			10^{-5}	20
Silty Sand			10^{-3}	8

Table 4 - Soil Parameters (cont'd)

Estimated Electrical Resistivities	**(ohm·cm)**
Silty Clay Till	4000
Silty Clay	3500
Sandy Silt Till	4500
Silt/Silty Sand	5500
Coefficients of Friction	
Between Concrete and Granular Base	0.50
Between Concrete and Native Soils or Compacted Earth Fill	0.35

6.9 Excavation

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

Table 5 - Classification of Soils for Excavation

Material	Type
Sound Tills and Silty Clay	2
Weathered Soils, Silt and Sand (above groundwater)	3
Saturated Soils	4

In excavation, the groundwater seepage from the tills and clay will likely be limited in quantity and can be removed by conventional pumping from sumps. However, excavation extending into the saturated soils will require more extensive construction dewatering. The wet silt/silty sand will slump readily, leading to sloughing and migrate/run with seepage and boil under an approximate piezometric head of 0.4 m.

In order to provide a stable subgrade for the SWM ponds, underground services and foundation construction, the groundwater should be depressed to at least 1.0 m below the intended bottom of excavation. Detailed groundwater profile and dewatering needs should be referred to the hydrogeological report by PEGG.

Excavation into the very stiff to hard and dense to very dense tills containing cobbles and boulders will require extra effort and the use of a heavy-duty, properly equipped backhoe.

Prospective contractors should assess the in situ subsurface conditions for soil cuts by digging test pits to at least 0.5 m below the intended bottom of excavation prior to excavating. These test pits should be allowed to remain open for a period of at least 4 hours to assess the trenching conditions.

7.0 LIMITATIONS OF REPORT

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

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

SOIL ENGINEERS LTD.

Hui Wing Yang, P.Eng.

Kin Fung Li, P.Eng.
HWY/KFL

Feb. 9, 2024
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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

Standard Penetration Resistance or 'N' Value:

The number of blows of a 63.5 kg hammer falling from a height of 76 cm required to advance a 51 mm outer diameter drive open sampler 30 cm into undisturbed soil, after an initial penetration of 15 cm.

Plotted as '○'

Dynamic Cone Penetration Resistance:

A continuous profile showing the number of blows per each 30 cm of penetration of a 51 mm diameter, 90° point cone driven by a 63.5 kg hammer falling from a height of 76 cm.

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/30 cm)	Relative Density
0 to 4	very loose
4 to 10	loose
10 to 30	compact
30 to 50	dense
>50	very dense

Cohesive Soils:

Undrained Shear Strength (kPa)	'N' (blows/30 cm)	Consistency
<12	<2	very soft
12 to <25	2 to <4	soft
25 to <50	4 to <8	firm
50 to <100	8 to <15	stiff
100 to 200	15 to 30	very stiff
>200	>30	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

METRIC CONVERSION FACTORS

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

JOB NO.: 2310-S043

LOG OF BOREHOLE: W-101

FIGURE NO.: 1

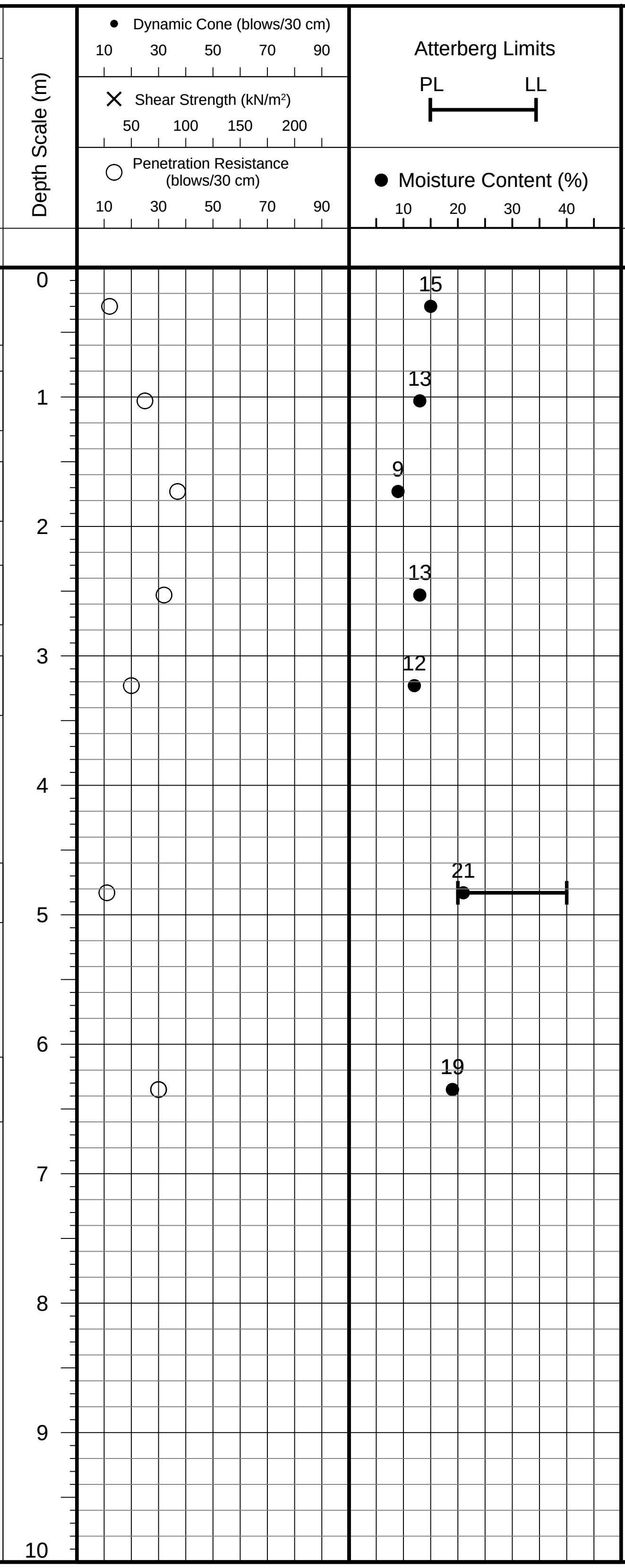
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southeast of Old School Road and Chinguacousy Road,
Town of Caledon

DRILLING DATE: October 23, 2023

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	WATER LEVEL
266.0 0.0	Ground Surface **25 cm TOPSOIL**				
	Stiff to hard **SILTY CLAY TILL** sandy, a trace of gravel occ. sand and silt seams and layers	1	DO	12	
	weathered	2	DO	25	
		3	DO	37	
		4	DO	32	
	brown grey	5	DO	20	
262.0 4.0	Grey, stiff **SILTY CLAY** a trace of sand occ. silt seams and layers	6	DO	11	Dry on completion
260.4 5.6	Grey, compact, very moist to wet **SILT** traces of fine sand and clay	7	DO	30	
259.4 6.6	**END OF BOREHOLE**				



JOB NO.: 2310-S043

LOG OF BOREHOLE: W-102

FIGURE NO.: 2

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southeast of Old School Road and Chinguacousy Road,
Town of Caledon

DRILLING DATE: October 23, 2023

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value	Moisture Content (%)	WATER LEVEL
264.7	Ground Surface					
0.0	**33 cm TOPSOIL**					
	Brown, stiff to hard	1	DO	9	15	
	weathered **SILTY CLAY TILL**	2	DO	34	10	
	sandy, a trace of gravel occ. sand and silt seams and layers	3	DO	39	12	
262.6 2.1	Grey, compact to dense, very moist to wet					
	SILT	4	DO	21	17	▽ W.L. @ El. 262.0 m on completion
	a trace to some sand occ. sand seams and clay layers	5	DO	36	21	
		6	DO	31	23	
258.4 6.3	Reddish-brown, very dense, moist **SANDY SILT TILL**	7A	DO	71	22	
258.1 6.6	traces of clay and gravel	7B			10	
	END OF BOREHOLE					

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

✕ Shear Strength (kN/m²) 50 100 150 200

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

Atterberg Limits PL LL

● Moisture Content (%) 10 20 30 40

Depth Scale (m) 0–10

Soil Engineers Ltd.

JOB NO.: 2310-S043

LOG OF BOREHOLE: W-103

FIGURE NO.: 3

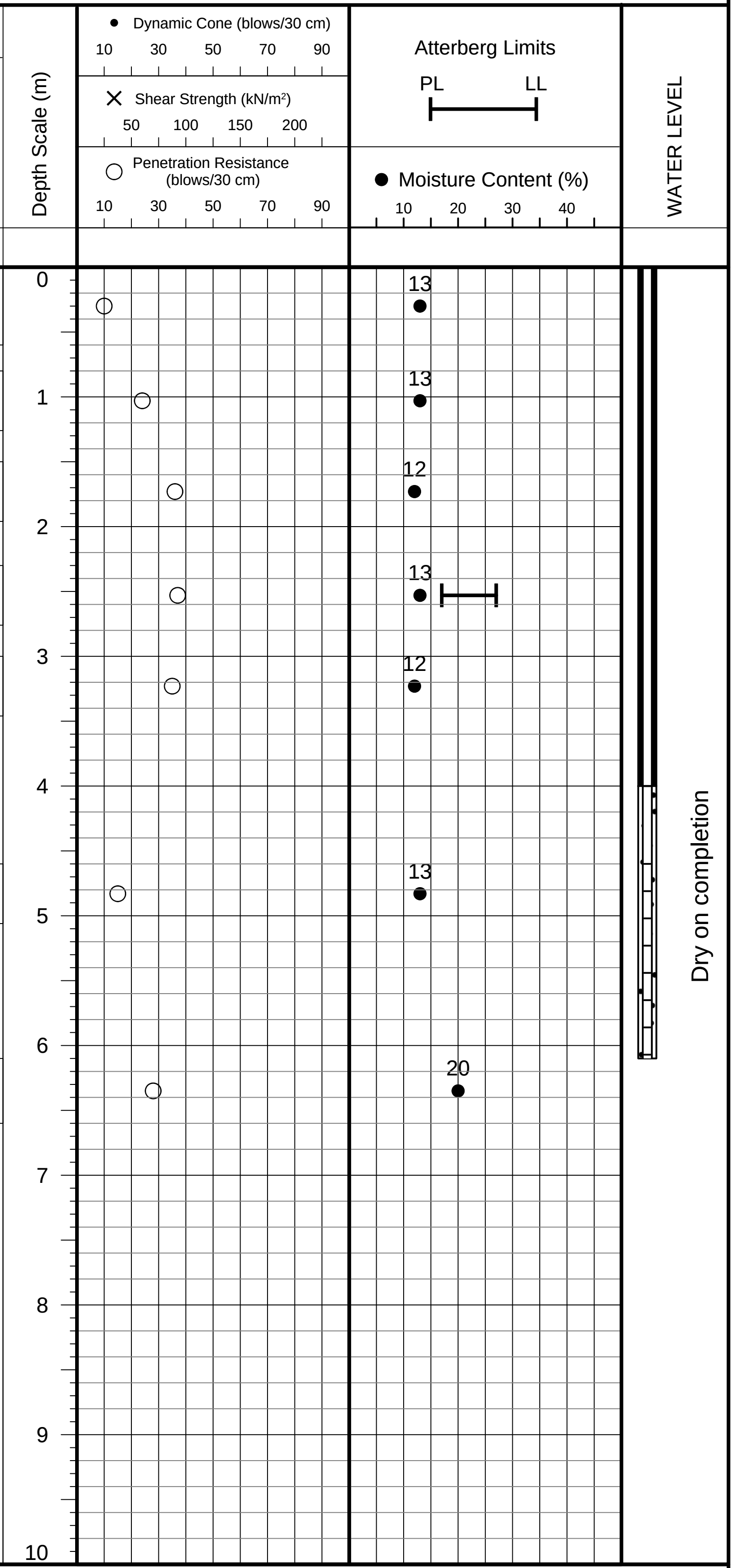
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southeast of Old School Road and Chinguacousy Road,
Town of Caledon

DRILLING DATE: October 19, 2023

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
264.9	Ground Surface			
0.0	**20 cm TOPSOIL**			
	Stiff to hard **SILTY CLAY TILL** some sand to sandy a trace of gravel occ. sand and silt seams and layers, cobbles	1	DO	10
	weathered	2	DO	24
		3	DO	36
		4	DO	37
	brown grey	5	DO	35
		6	DO	15
259.3 5.6	Grey, compact, wet **SILT** traces of fine sand and clay	7	DO	28
258.3 6.6	**END OF BOREHOLE** Installed 50-mm Ø PVC monitoring well to 6.1 m, completed with 1.5 m screen Sand backfill from 4.0 to 6.1 m Bentonite seal from 0.0 to 4.0 m Provided with a steel monument casing			



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JOB NO.: 2310-S043

LOG OF BOREHOLE: W-104

FIGURE NO.: 4

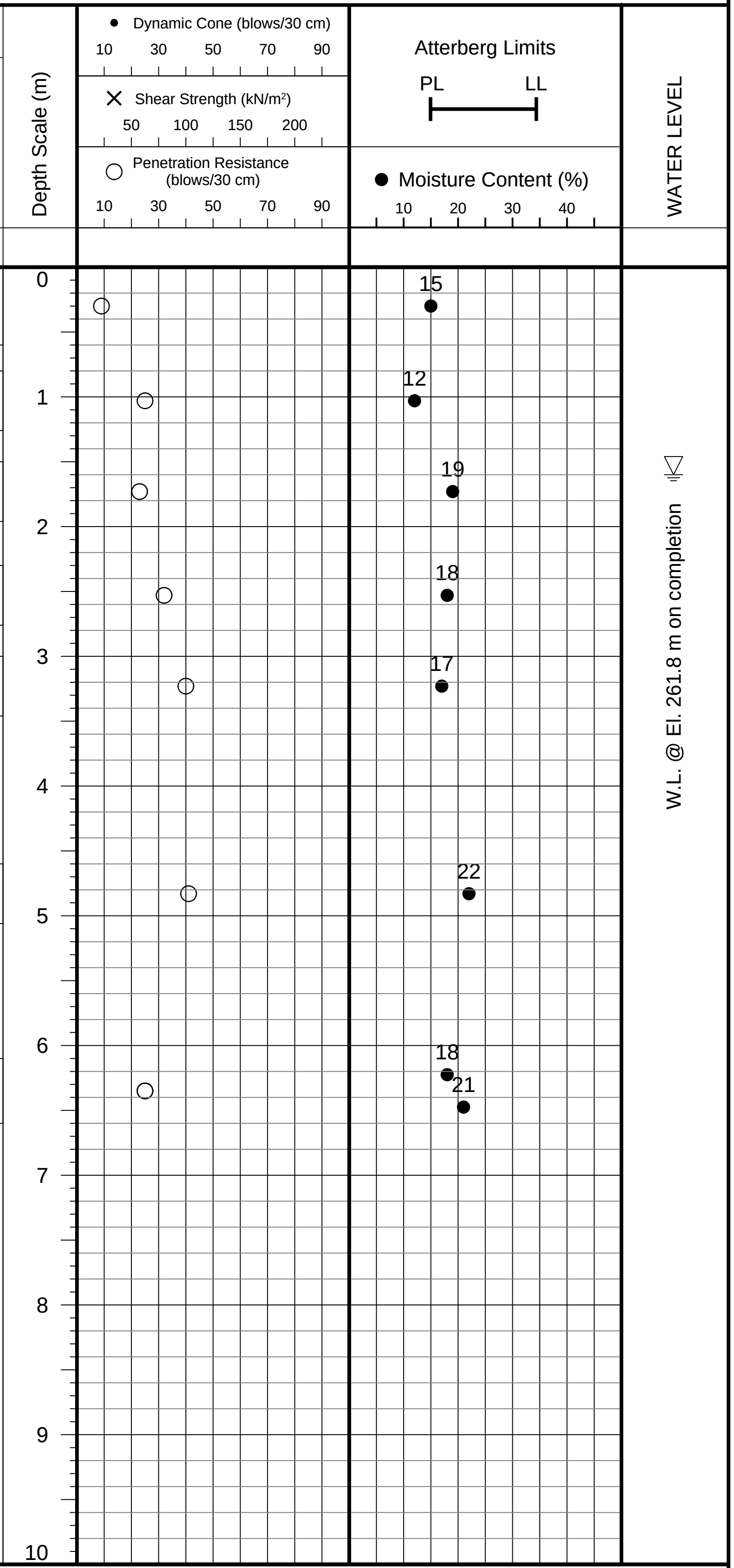
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

DRILLING DATE: October 23, 2023

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
263.4 0.0	Ground Surface **33 cm TOPSOIL**			
	Brown, stiff to very stiff	1	DO	9
	weathered **SILTY CLAY TILL**	2	DO	25
	sandy, a trace of gravel occ. sand and silt seams and layers	3	DO	23
261.3 2.1	Grey, compact to dense, very moist to wet **SILT**	4	DO	32
	some sand to sandy a trace of clay occ. clay layers	5	DO	40
		6	DO	41
	moist, varved clay	7A 7B	DO	25
256.8 6.6	**END OF BOREHOLE**			



JOB NO.: 2310-S043

LOG OF BOREHOLE: W-105

FIGURE NO.: 5

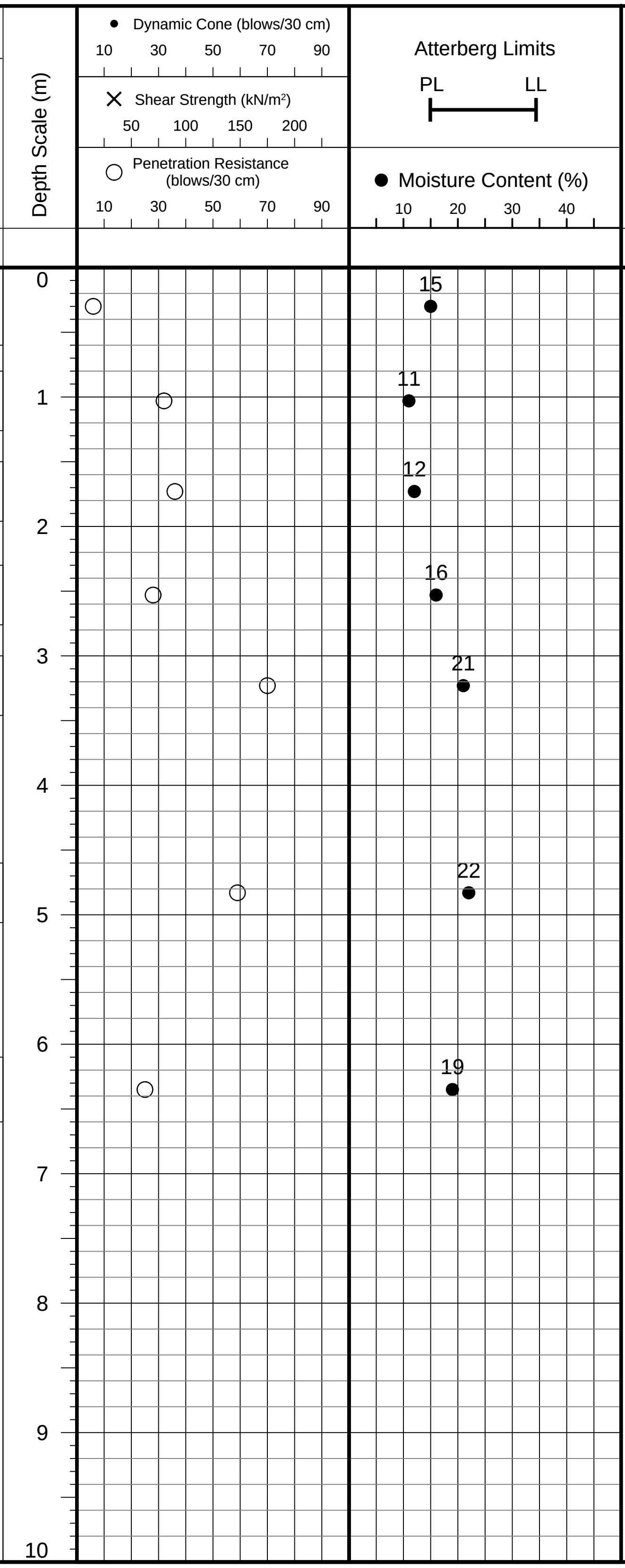
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southeast of Old School Road and Chinguacousy Road,
Town of Caledon

DRILLING DATE: October 20, 2023

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES		
		Number	Type	N-Value
267.6 0.0	Ground Surface **28 cm TOPSOIL**			
	Brown, firm to hard **SILTY CLAY TILL** sandy, a trace of gravel occ. sand and silt seams and layers, cobbles weathered	1	DO	6
		2	DO	32
		3	DO	36
		4	DO	28
264.7 2.9	Compact to very dense, wet **SILT** some sand, a trace of clay occ. silty fine sand layers brown grey	5	DO	70
		6	DO	59
		7	DO	25
261.0 6.6	**END OF BOREHOLE**			



WATER LEVEL

W.L. @ El. 265.2 m on completion

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Page: 1 of 1

JOB NO.: 2310-S043

LOG OF BOREHOLE: W-106

FIGURE NO.: 6

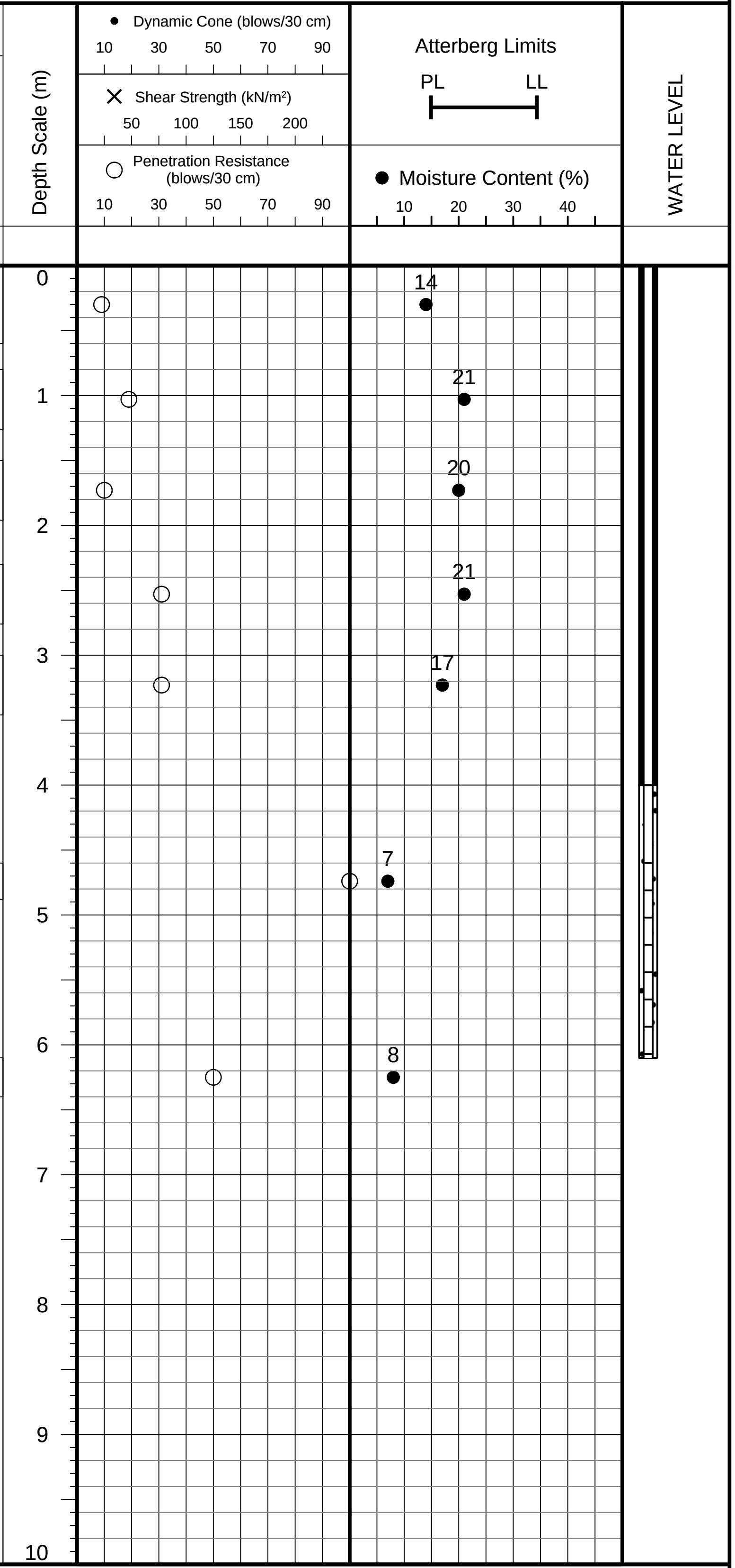
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southeast of Old School Road and Chinguacousy Road,
Town of Caledon

DRILLING DATE: October 19, 2023

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
265.5	Ground Surface			
0.0	**20 cm TOPSOIL** Brown, stiff, weathered **SILTY CLAY TILL** sandy, a trace of gravel	1	DO	9
264.7 0.8	Brown, loose to compact, very moist to wet weathered **SILT** some sand, a trace of clay	2 3	DO DO	19 10
263.4 2.1	Brown, dense, wet seepage **SILTY FINE SAND** a trace of clay	4	DO	31
262.6 2.9	Reddish-brown/grey, dense to very dense grey, silt and clay layers **SANDY SILT TILL** traces of clay and gravel occ. silt and clay layers, cobbles and boulders	5 6 7	DO DO DO	31 50/13 50
259.1 6.4	**END OF BOREHOLE**			



Installed 50-mm Ø PVC monitoring well to 6.1 m, completed with 1.5 m screen
Sand backfill from 4.0 to 6.1 m
Bentonite seal from 0.0 to 4.0 m
Provided with a steel monument casing

Seepage and cave-in detected at 2.4 m

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Page: 1 of 1

JOB NO.: 2310-S043

LOG OF BOREHOLE: W-107

FIGURE NO.: 7

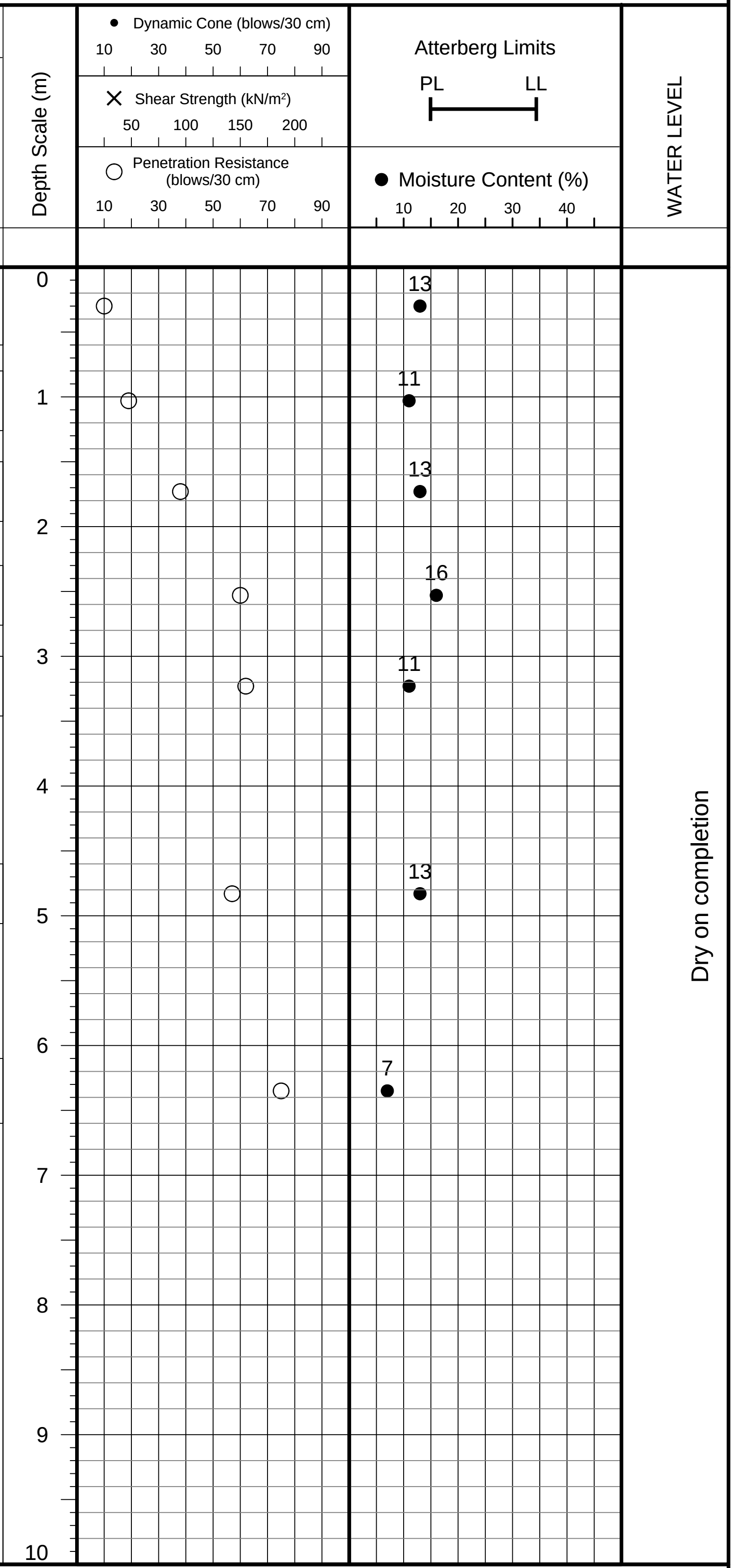
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

DRILLING DATE: October 20, 2023

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
268.7 0.0	Ground Surface			
	18 cm TOPSOIL			
	Stiff to hard	1	DO	10
	weathered			
	SILTY CLAY TILL	2	DO	19
	sandy, a trace of gravel occ. sand and silt seams and layers, cobbles	3	DO	38
	silt	4	DO	60
	brown grey			
		5	DO	62
264.7 4.0	Grey, very dense			
	SILT			
	some clay occ. clay layers	6	DO	57
263.1 5.6	Reddish-brown, very dense			
	SANDY SILT TILL			
	traces of clay and gravel, occ. cobbles	7	DO	75
262.1 6.6	**END OF BOREHOLE**			



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JOB NO.: 2310-S043

LOG OF BOREHOLE: W-108

FIGURE NO.: 8

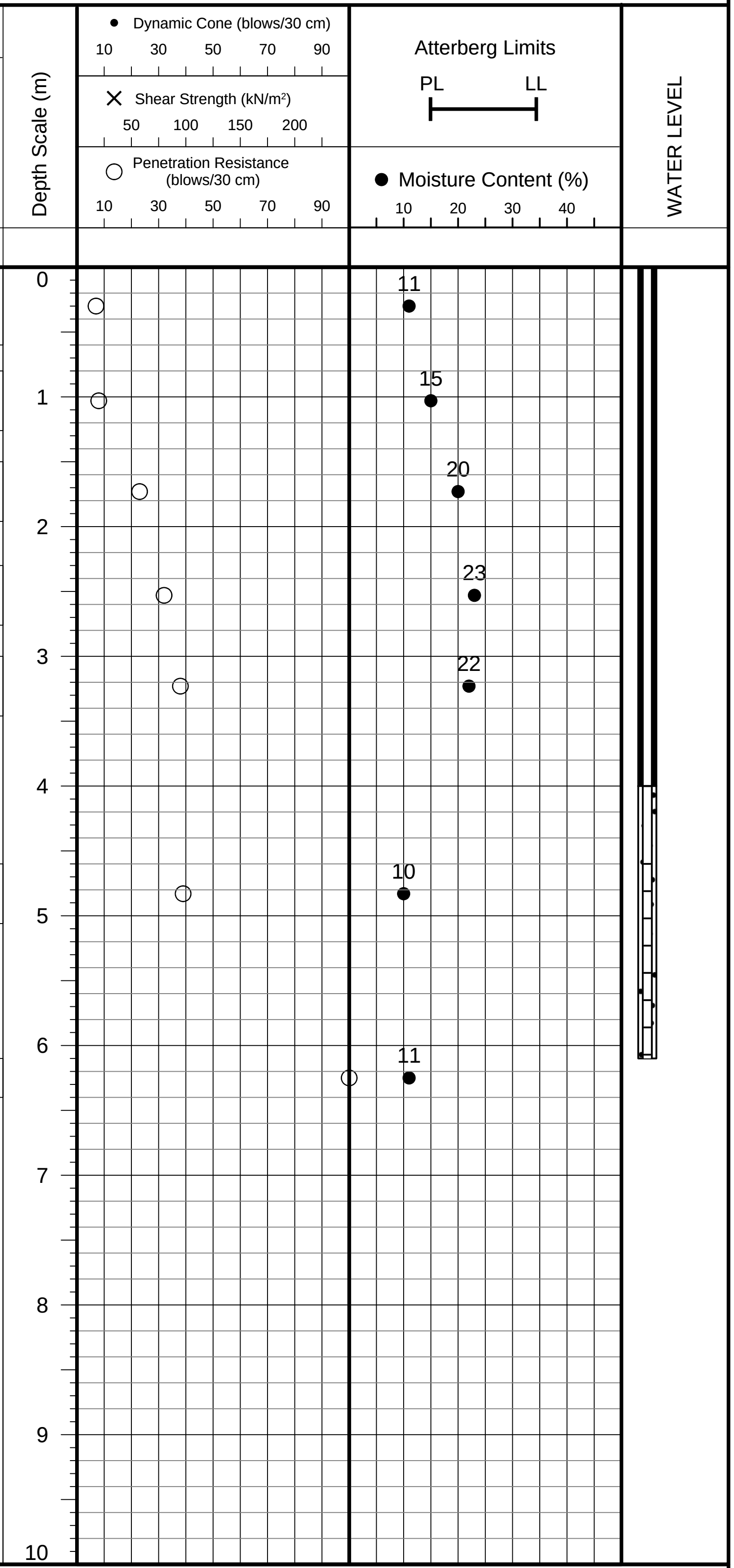
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

DRILLING DATE: October 19, 2023

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES		
		Number	Type	N-Value
267.5	Ground Surface			
0.0	**18 cm TOPSOIL** Brown, firm to stiff, weathered **SILTY CLAY TILL** sandy, a trace of gravel occ. topsoil inclusions	1 2	DO DO	7 8
266.1 1.4	Brown, compact to dense, wet **SILT** some sand, a trace of clay occ. sand layers	3 4	DO DO	23 32
264.6 2.9	Brown, dense, wet — seepage **SILTY FINE SAND** a trace of clay occ. silt lenses and layers	5	DO	38
263.5 4.0	Reddish-brown, dense to very dense **SANDY SILT TILL** traces of clay and gravel occ. silt layers	6 7	DO DO	39 50/10
261.1 6.4	**END OF BOREHOLE**			



Installed 50-mm Ø PVC monitoring well to 6.1 m, completed with 1.5 m screen
Sand backfill from 4.0 to 6.1 m
Bentonite seal from 0.0 to 4.0 m
Provided with a steel monument casing

Seepage and cave-in detected at 3.0 m

Soil Engineers Ltd.

JOB NO.: 2310-S043

LOG OF BOREHOLE: W-109

FIGURE NO.: 9

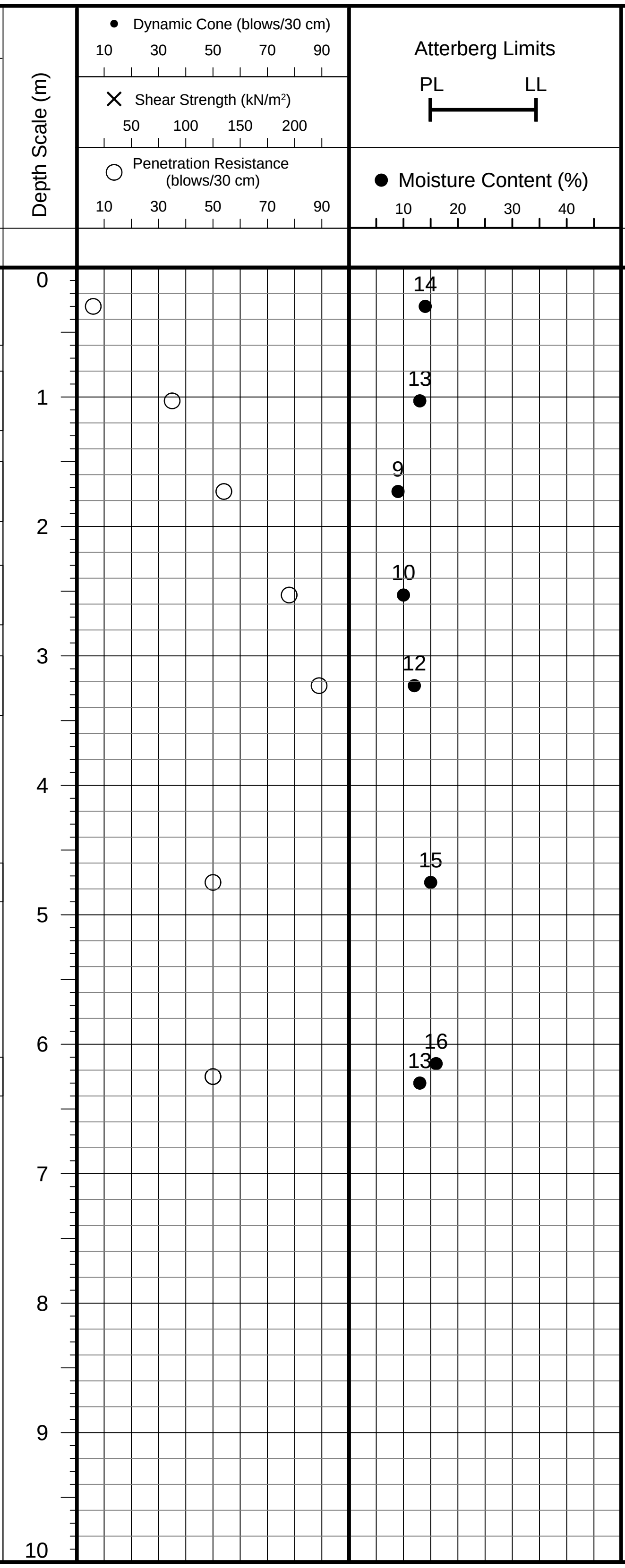
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southeast of Old School Road and Chinguacousy Road,
Town of Caledon

DRILLING DATE: October 20, 2023

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
267.7 0.0	Ground Surface **23 cm TOPSOIL**			
	Brown, loose to very dense **SANDY SILT TILL/SILTY SAND TILL** weathered, cobble traces of clay and gravel occ. cobbles and boulders	1	DO	6
		2	DO	35
		3	DO	54
		4	DO	78
264.8 2.9	Hard **SILTY CLAY** brown grey a trace to some sand frequent silt layers occ. gravel and sand seams	5	DO	89
		6	DO	50
261.5 6.2	Reddish-brown, very dense **SANDY SILT TILL**	7A 7B	DO	50
261.3 6.4	**END OF BOREHOLE**			



WATER LEVEL

Dry on completion

Soil Engineers Ltd.

JOB NO.: 2310-S043

LOG OF BOREHOLE: W-110

FIGURE NO.: 10

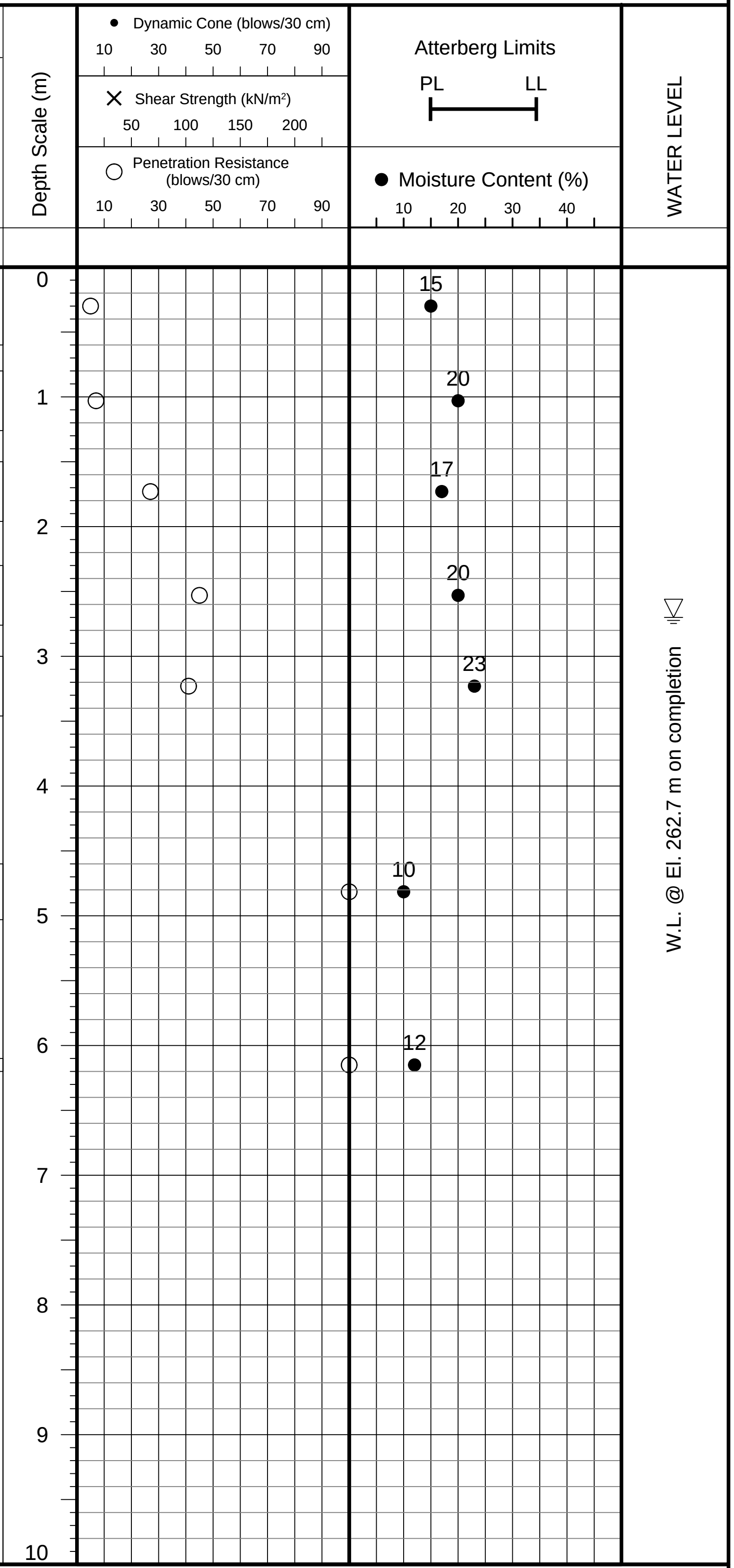
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: Southeast of Old School Road and Chinguacousy Road,
Town of Caledon

DRILLING DATE: October 20, 2023

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
265.4 0.0	Ground Surface **30 cm TOPSOIL**			
	Brown, loose to dense **SILT** weathered some sand to sandy a trace of clay occ. sand layers becoming wet below 3.0 m	1	DO	5
		2	DO	7
		3	DO	27
		4	DO	45
		5	DO	41
261.4 4.0	Reddish-brown/grey, very dense **SANDY SILT TILL** traces of clay and gravel occ. sand and silt seams and layers, cobbles and boulders	6	DO	90/13
		7	DO	50/10
259.2 6.2	**END OF BOREHOLE**			



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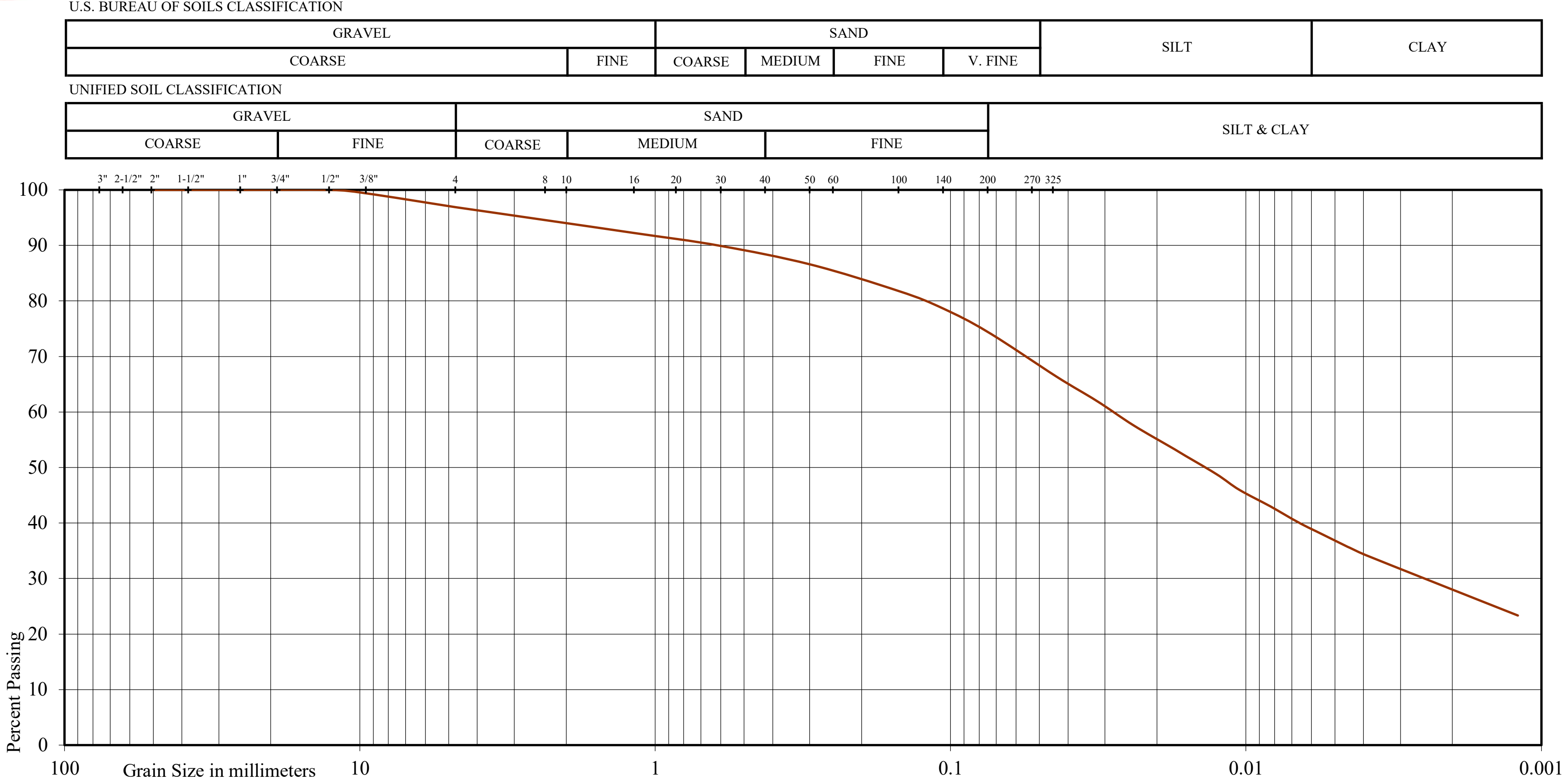
GRAIN SIZE DISTRIBUTION

Reference No: 2310-S043



Project: Proposed Residential Development

Location: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

BH./Sa. 103/4

Liquid Limit (%) = 27

Borehole No: W-103

Plastic Limit (%) = 17

Sample No: 4

Plasticity Index (%) = 10

Depth (m): 2.5

Moisture Content (%) = 13

Elevation (m): 262.4

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

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

Figure: 11

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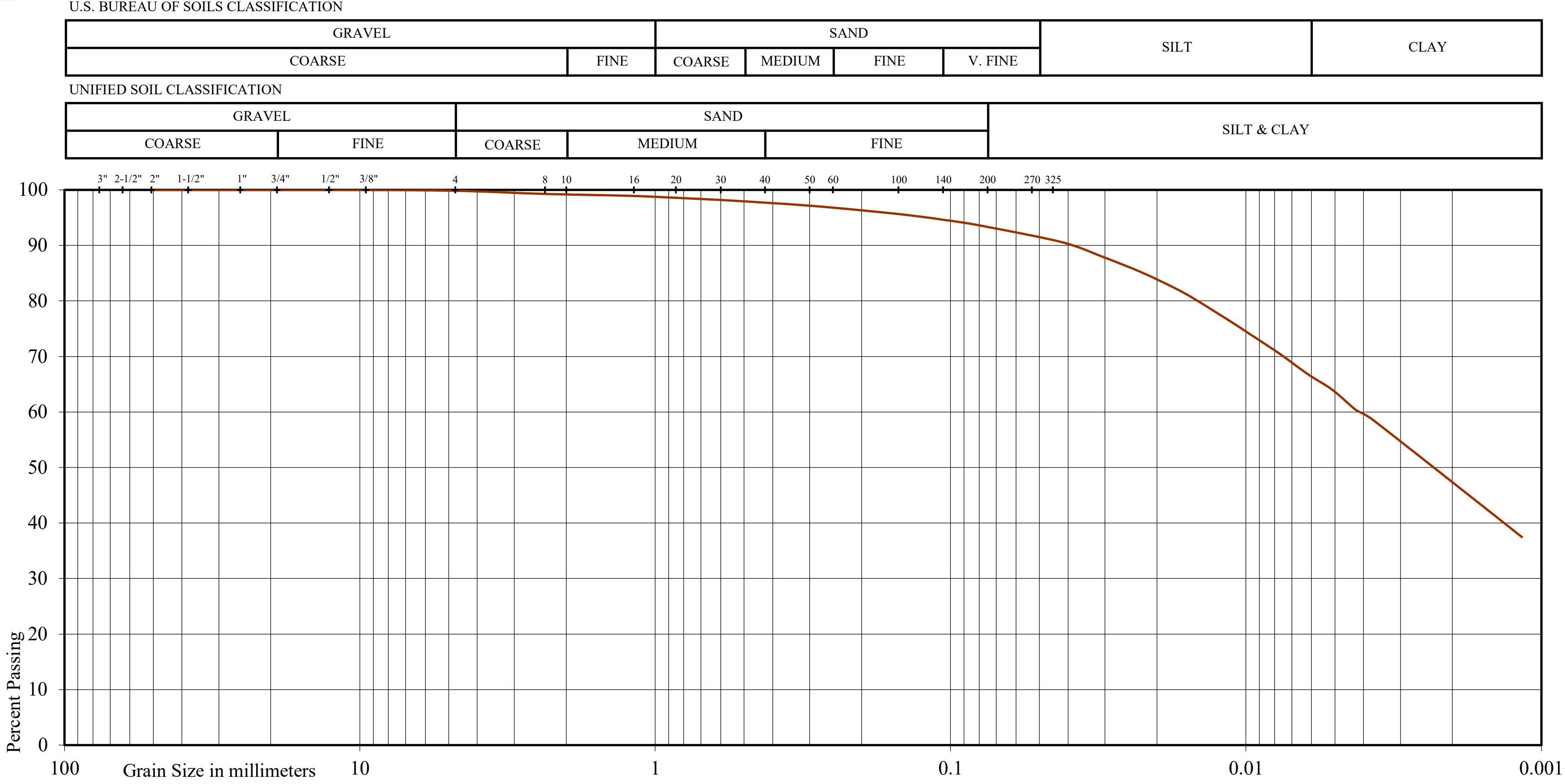
GRAIN SIZE DISTRIBUTION

Reference No: 2310-S043



Project: Proposed Residential Development

Location: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

BH./Sa. 101/6

Liquid Limit (%) = 40

Borehole No: W-101

Plastic Limit (%) = 20

Sample No: 6

Plasticity Index (%) = 20

Depth (m): 4.8

Moisture Content (%) = 21

Elevation (m): 261.2

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

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

Figure: 12

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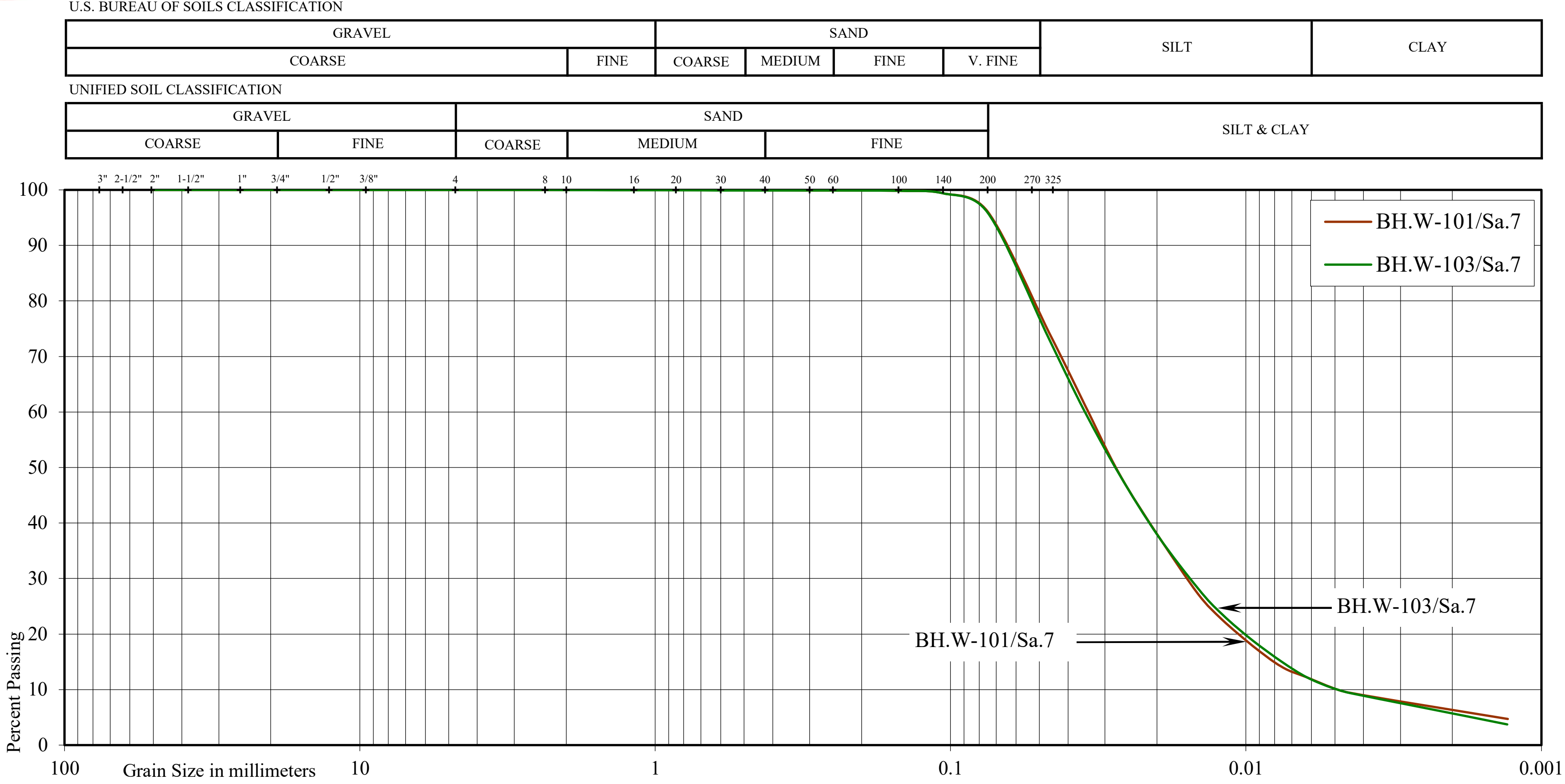
GRAIN SIZE DISTRIBUTION

Reference No: 2310-S043



Project: Proposed Residential Development

Location: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

Borehole No:	W-101	W-103
Sample No:	7	7
Depth (m):	6.3	6.3
Elevation (m):	259.7	258.6

BH./Sa.	101/7	103/7
Liquid Limit (%) =	-	-
Plastic Limit (%) =	-	-
Plasticity Index (%) =	-	-
Moisture Content (%) =	19	20
Estimated Permeability (cm./sec.) =	10^{-5}	10^{-5}

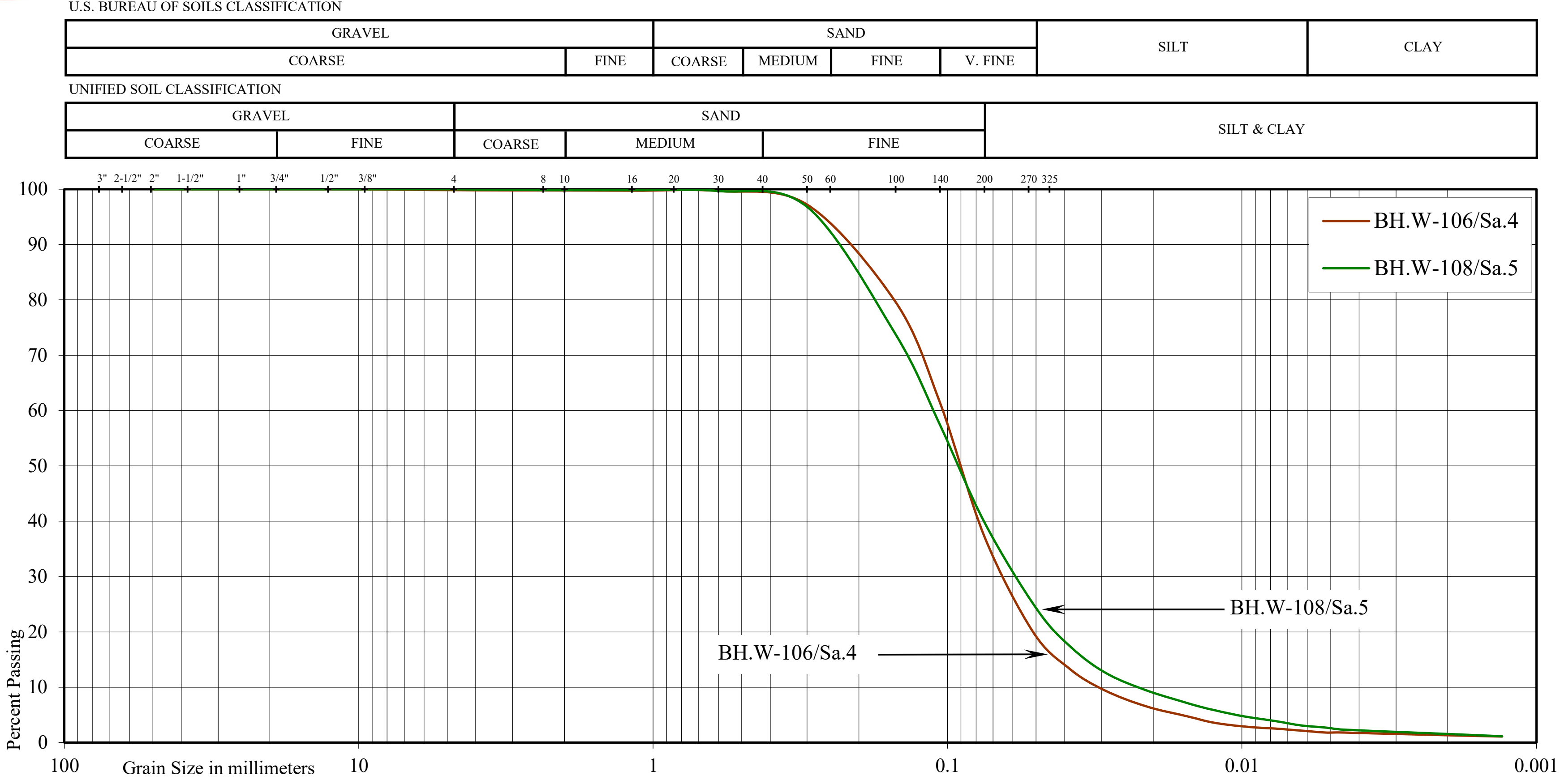
Figure: 13

Classification of Sample [& Group Symbol]:	SILT traces of fine sand and clay

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2310-S043



Project: Proposed Residential Development

Location: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

Borehole No:	W-106	W-108
Sample No:	4	5
Depth (m):	2.5	3.2
Elevation (m):	263.0	264.3

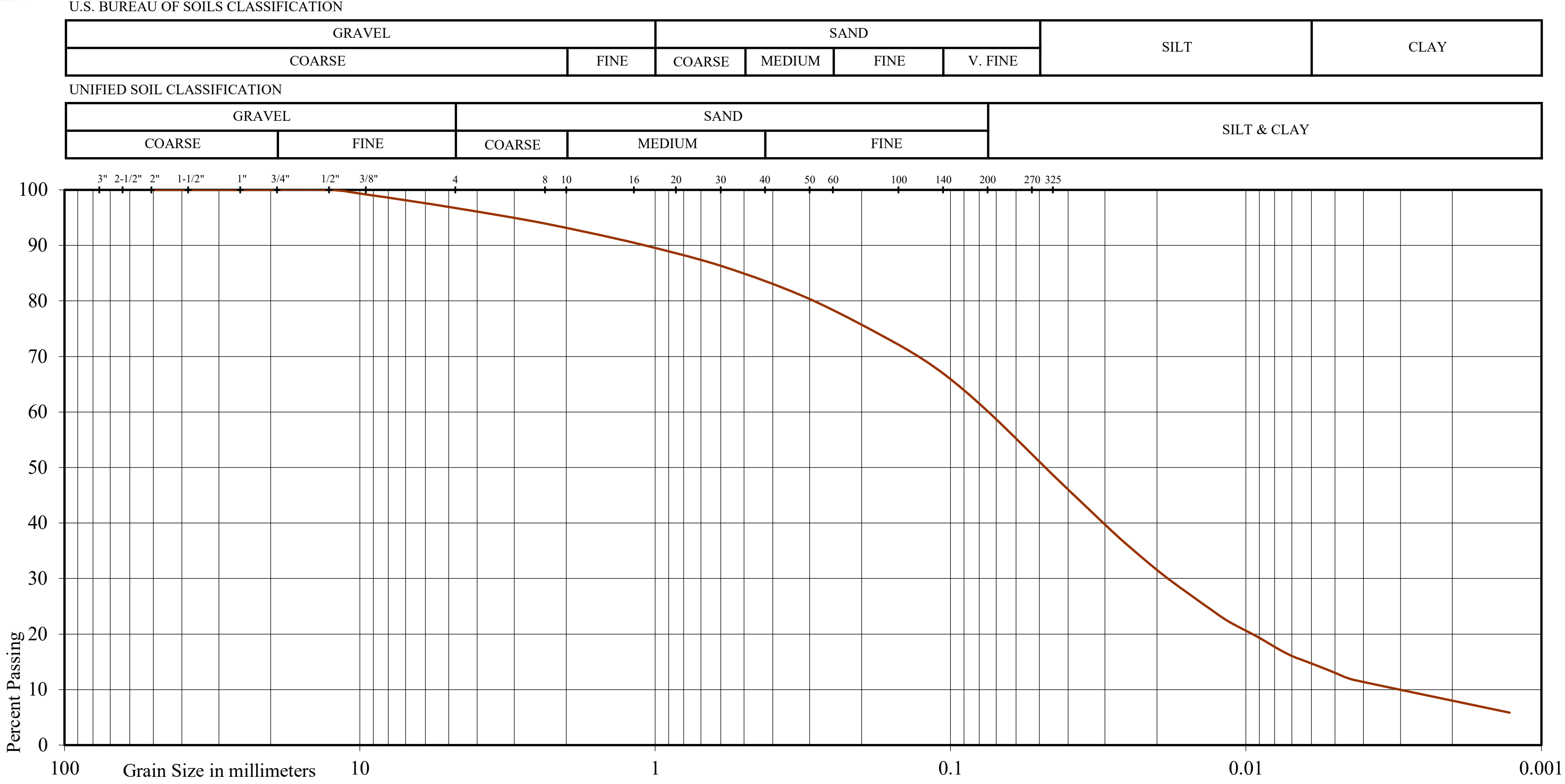
BH./Sa.	106/4	108/5
Liquid Limit (%) =	-	-
Plastic Limit (%) =	-	-
Plasticity Index (%) =	-	-
Moisture Content (%) =	21	22
Estimated Permeability (cm./sec.) =	10^{-3}	10^{-3}

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

Figure: 14

GRAIN SIZE DISTRIBUTION

Reference No: 2310-S043



Project: Proposed Residential Development

Location: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

BH./Sa. 108/6

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = 10

Estimated Permeability (cm./sec.) = 10^{-5}

Borehole No: W-108

Sample No: 6

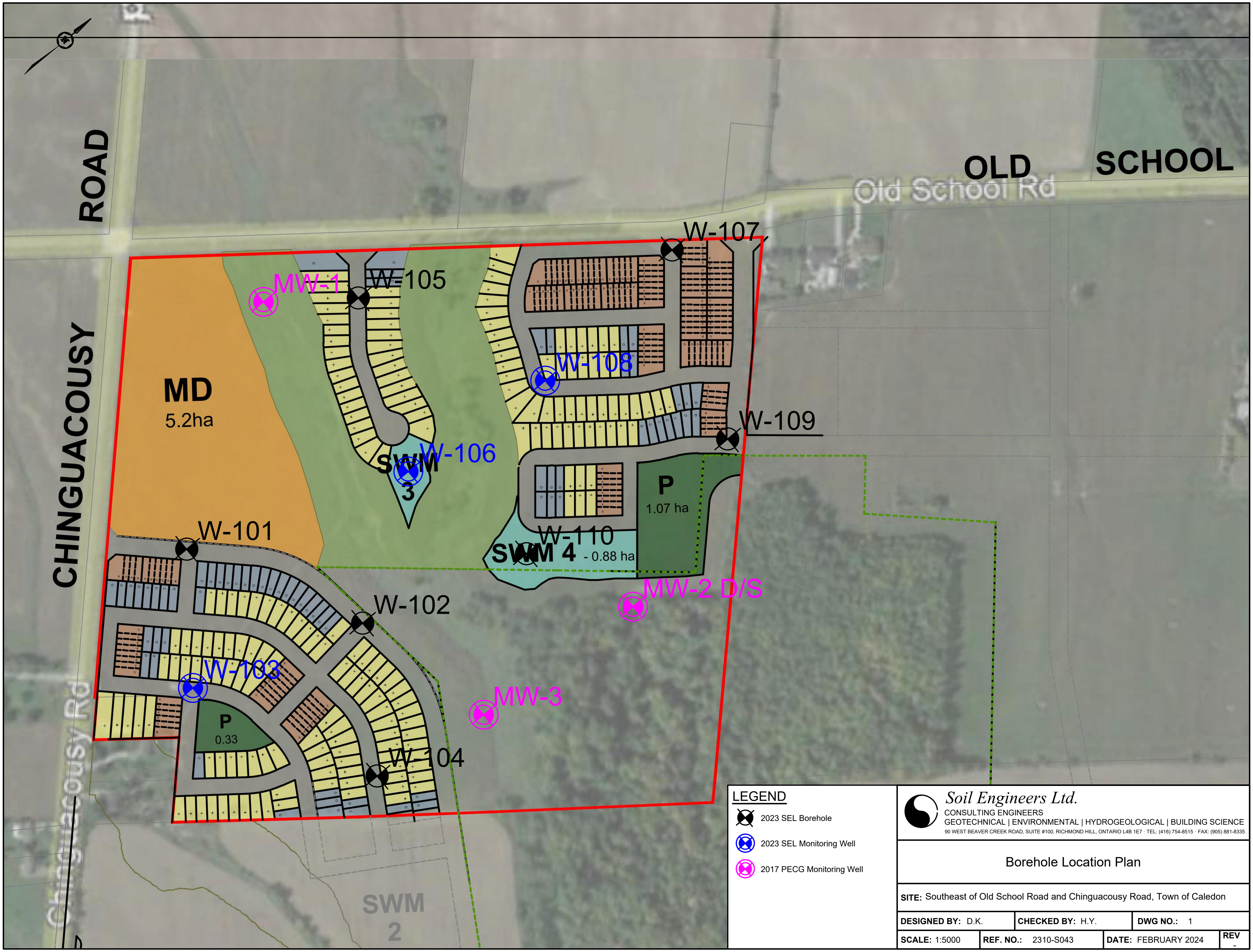
Depth (m): 4.8

Elevation (m): 262.7

Classification of Sample [& Group Symbol]: SANDY SILT TILL

traces of clay and gravel

Figure: 15



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90 WEST BEAVER CREEK ROAD, SUITE #100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

Borehole Location Plan

SITE: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

DESIGNED BY: D.K. **CHECKED BY:** H.Y. **DWG NO.:** 1

SCALE: 1:5000 **REF. NO.:** 2310-S043 **DATE:** FEBRUARY 2024 **REV** -

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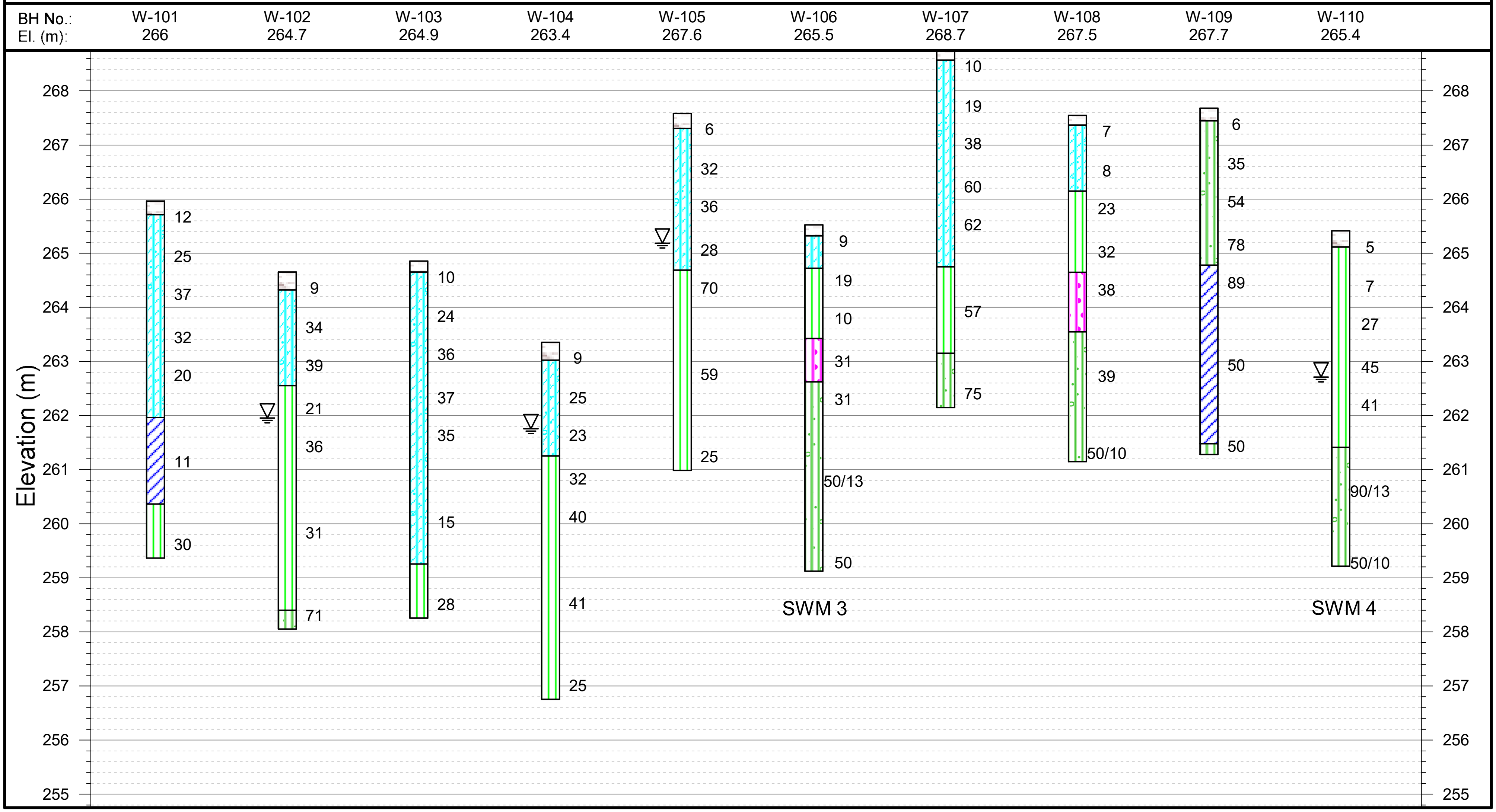
SUBSURFACE PROFILE
DRAWING NO. 2
SCALE: AS SHOWN

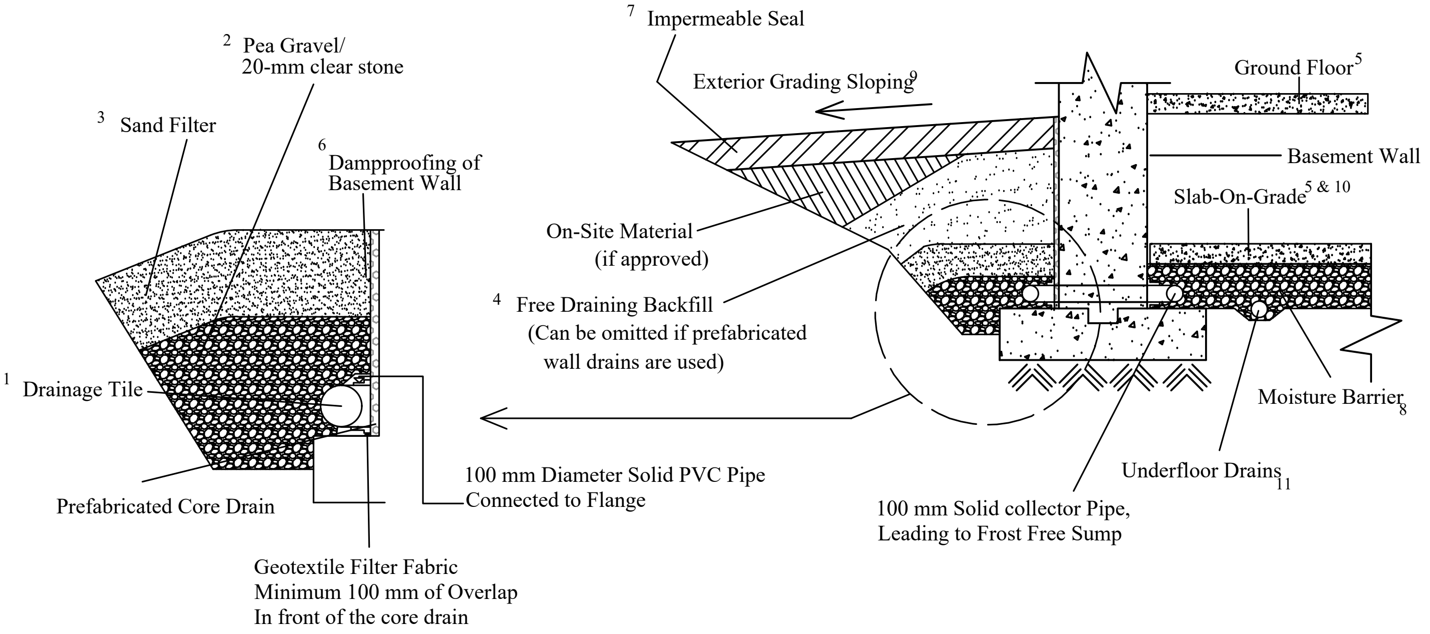
JOB NO.: 2310-S043
REPORT DATE: February 2024
PROJECT DESCRIPTION: Proposed Residential Development
PROJECT LOCATION: Southeast of Old School Road and Chinguacousy Road, Town of Caledon

LEGEND

▨	TOPSOIL	🟩	SANDY SILT TILL	▨	SILTY CLAY	▨	SILTY CLAY TILL
▨	SILTY FINE SAND	🟩	SILT				

▽ WATER LEVEL (END OF DRILLING)





NOTES:

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

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

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

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

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

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

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

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

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

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

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

*Underfloor drains can be deleted where not required.

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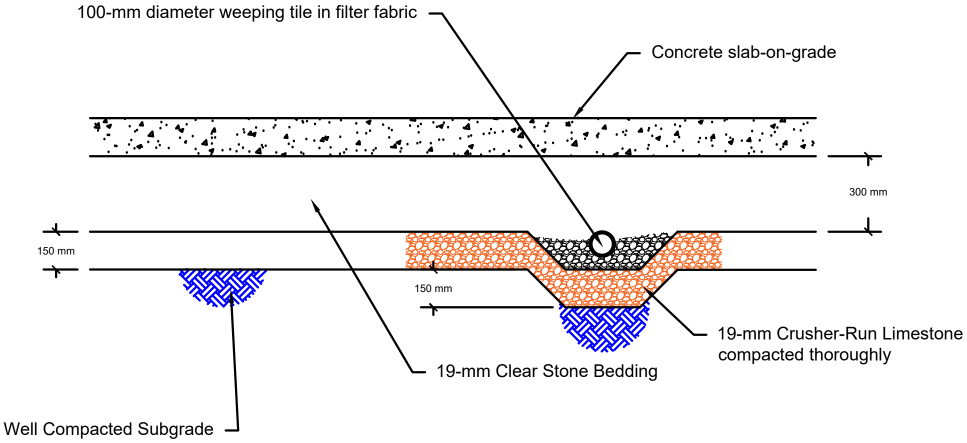
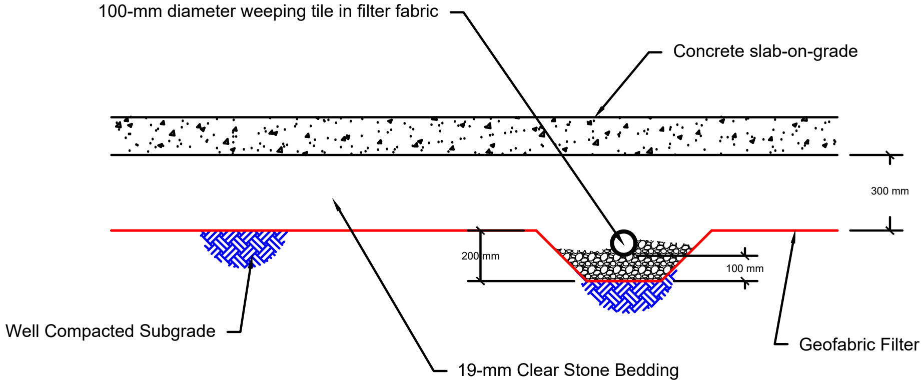
PERMANENT PERIMETER DRAINAGE SYSTEM
(FOR OPEN EXCAVATION)

SITE: SOUTHEAST OF OLD SCHOOL ROAD AND CHINGUACOUSY ROAD
TOWN OF CALEDON

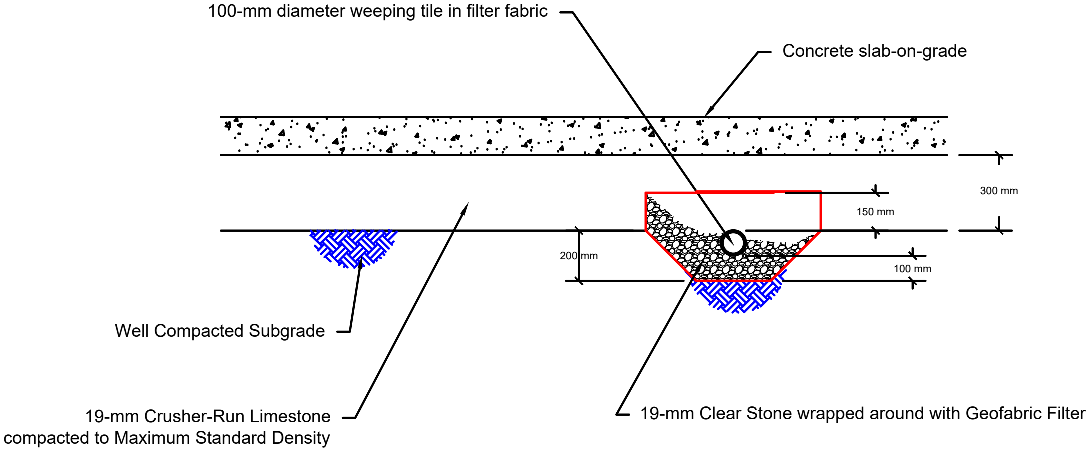
DESIGNED BY: K.L.
CHECKED BY: B.S.
DWG NO.: 3
SCALE: N.T.S.
REF. NO.: 2310-S043
DATE: FEBRUARY 2024
REV -



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.

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DETAILS OF UNDERFLOOR WEEPERS

SITE: SOUTHEAST OF OLD SCHOOL ROAD AND CHINGUACOUSY ROAD
TOWN OF CALEDON

DESIGNED BY: K.L.
CHECKED BY: B.S.
DWG NO.: 4
SCALE: N.T.S.
REF. NO.: 2310-S043
DATE: FEBRUARY 2024
REV -

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

APPENDIX

BOREHOLE LOGS BY PECG

REFERENCE NO. 2310-S043

BOREHOLE RECORD OF MW-1

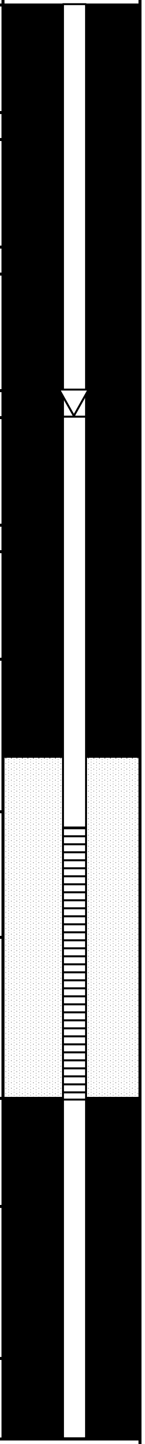
Project: Mayfield West Stage 3	**Drilling Method:** Stolid Stem Augers	**Coordinates:** 590926.7 E, 4843008.5 N
Project #: 170162	**Borehole Diameter:** 0.12 m	**Well Diameter:** 0.0508 m
Location: Caledon, Ontario	**Rig Type:** Marl M-5	**S. Screened Interval:** N/A
Date: November 13, 2017	**Drilling Contractor:** DrillTech	**D. Screened Interval:** 4.57 m - 6.09 m

Depth (mbgs)	Soil Profile		Elevation Depth
	Description	Strata	
0 – 0.84	Topsoil: clay and silt, some sand, organics, loose, moist, brown	▦	267.16 0.84
0.84 – 2.21	Clayey silt till, some sand, some gravel, very stiff to hard, moist, brown	▩	265.79 2.21
2.21 – 6.4	Medium sand and silt, medium dense to very dense, wet, grey	░	261.6 6.4
6.4 – 7.9	Silty clay till, some sand, very dense, moist, red/brown	▩	260.1 7.9

END OF BOREHOLE AT 7.9 m

Depth (mbgs)	Samples		Sample Description	
	Number	Type	Recovery (m)	N-Value
0 – 0.6	1	SS	0.254 / 0.609	8
0.75 – 1.36	2	SS	0.432 / 0.609	30
1.52 – 2.13	3	SS	0.432 / 0.609	44
2.28 – 2.89	4	SS	0.533 / 0.609	55
3.04 – 3.65	5	SS	0.609 / 0.609	26
4.57 – 5.18	6	SS	0.609 / 0.609	47
6.09 – 6.7	N/A	N/A	N/A	N/A
7.62 – 7.9	7	SS	0.279 / 0.279	83 / 0.28m

Piezometer Installation



Well Installation Details

Stick Up Height: 0.65 m	**W.L. upon Well Completion (D.):** 2.93 mbtoc, 2.28 mbgs
Ground Elevation: 268 masl	**W.L. upon Well Completion (S.):** N/A

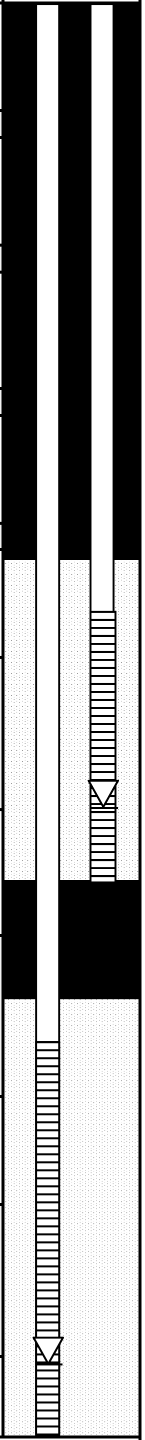
BOREHOLE RECORD OF MW-2 s/d

Project: Mayfield West Stage 3	**Drilling Method:** Stolid Stem Augers	**Coordinates:** 591429.4 E, 4843101.6 N
Project #: 170162	**Borehole Diameter:** 0.12 m	**Well Diameter:** 0.0508 m
Location: Caledon, Ontario	**Rig Type:** Marl M-5	**S. Screened Interval:** 3.35 m - 4.88 m
Date: November 13, 2017	**Drilling Contractor:** DrillTech	**D. Screened Interval:** 5.79 m - 8.84 m

Soil Profile		
Description	Strata	Elevation Depth
Topsoil: Fine and medium sand and silt, some clay, organics, loose, moist to dry, dark brown	▦	266.55 1.45
Fine to medium sand and silt, medium dense, moist to wet, brown/grey	░	265.76 2.24
Clay, very stiff, cohesive, moist, grey	☰	265.4 2.6
4.11 m - 4.65 m: Gravel with silt matrix, very wet, grey Clayey silt to silty clay till, some sand, gravel and cobbles, very dense, moist, red/brown	▩	

Depth (mbgs)	Number	Type	Recovery (m)	N-Value
0 0.6	1	SS	0.330 / 0.609	7
0.75 1.36	2	SS	0.305 / 0.609	10
1.52 2.13	3	SS	0.609 / 0.609	22
2.28 2.89	4	SS	0.609 / 0.609	28
3.04 3.65	5	SS	0.508 / 0.609	49
4.57 5.18	6	SS	0.356 / 0.381	71 / 0.23
6.09 6.7	7	SS	0.102 / 0.102	50 / 0.10
7.62	8	SS	0.076 / 0.076	50 / 0.08

Piezometer Installation



Well Installation Details

S. Stick Up Height: 0.66 m; **D. Stick Up Height:** 0.75 m

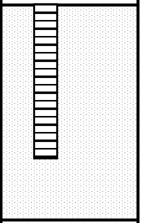
W.L. upon Well Completion (D.): 8.35 mbtoc, 7.60 mbgs

Ground Elevation: 268 masl

W.L. upon Well Completion (S.): 5.14 mbtoc, 4.48 mbgs

BOREHOLE RECORD OF MW-2 s/d

Project: Mayfield West Stage 3	**Drilling Method:** Stolid Stem Augers	**Coordinates:** 591429.4 E, 4843101.6 N
Project #: 170162	**Borehole Diameter:** 0.12 m	**Well Diameter:** 0.0508 m
Location: Caledon, Ontario	**Rig Type:** Marl M-5	**S. Screened Interval:** 3.35 m - 4.88 m
Date: November 13, 2017	**Drilling Contractor:** DrillTech	**D. Screened Interval:** 5.79 m - 8.84 m

Depth (mbgs)	Soil Profile			Samples		Sample Description		Piezometer Installation
	Description	Strata	Elevation Depth	Number	Type	Recovery (m)	N-Value	
8.22	*Continued* Clayey silt to silty clay till, some sand, gravel and cobbles, very dense, moist, red/brown	▩	258.78					
9								
9.14	END OF BOREHOLE AT 9.22 m		9.22	9	SS	0.076 / 0.076	50 / 0.08	
9.75								
10								
10.66								
11								
11.27								
12								
12.19								
12.8								
13								
13.71								
14								
14.32								
15								
15.24								
15.84								
16								

Well Installation Details

S. Stick Up Height: 0.66 m; **D. Stick Up Height**: 0.75 m	**W.L. upon Well Completion (D.):** 8.35 mbtoc, 7.60 mbgs
Ground Elevation: 268 masl	**W.L. upon Well Completion (S.):** 5.14 mbtoc, 4.48 mbgs

BOREHOLE RECORD OF MW-3

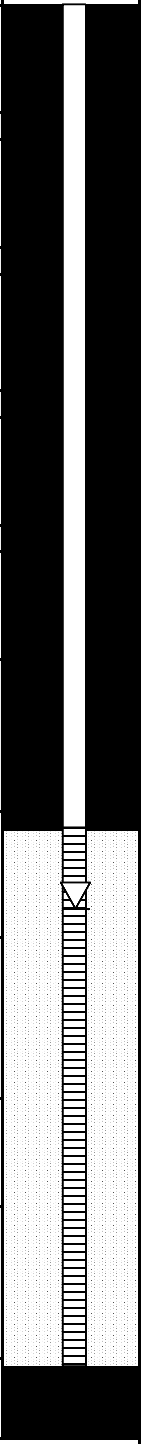
Project: Mayfield West Stage 3	**Drilling Method:** Stolid Stem Augers	**Coordinates:** 591415.3 E, 4842905.2 N
Project #: 170162	**Borehole Diameter:** 0.12 m	**Well Diameter:** 0.0508 m
Location: Caledon, Ontario	**Rig Type:** Marl M-5	**S. Screened Interval:** N/A
Date: November 13, 2017	**Drilling Contractor:** DrillTech	**D. Screened Interval:** 4.57 m - 7.62 m

Soil Profile: Description	Strata	Elevation / Depth
Topsoil: silt and fine sand, some clay, some organics, loose, moist to wet, brown *1.12 m: soils turn grey*	▦	261.55 1.45
Fine sand and silt, some clay, laminae, medium dense, wet, grey	░	260.64 2.36
Clay, some silt, cohesive, hard, wet, grey	☰	260.38 2.62
Silty sand to silty clay till, gravel and cobbles, dense to very dense, moist, red/brown	▩	255.08 7.92

END OF BOREHOLE AT 7.92 m

Depth (mbgs)	Samples: Number	Type	Sample Description: Recovery (m)	N-Value
0 - 0.6	1	SS	0.254 / 0.609	5
0.75 - 1.36	2	SS	0.483 / 0.609	7
1.52 - 2.13	3	SS	0.584 / 0.609	22
2.28 - 2.89	4	SS	0.533 / 0.609	27
3.04 - 3.65	5	SS	0.609 / 0.609	47
4.57 - 5.18	6	SS	0.381 / 0.609	37
6.09 - 6.7	7	SS	0.279 / 0.279	73 / 0.28
7.62 - 7.92	8	SS	0.305 / 0.305	59

Piezometer Installation



Well Installation Details

Stick Up Height: 0.75 m	**W.L. upon Well Completion (D.):** 5.80 mbtoc, 5.05 mbgs
Ground Elevation: 263 masl	**W.L. upon Well Completion (S.):** N/A