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TOWN OF CALEDON
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A REPORT TO
PARADISE HOMES CORP.

A SOIL INVESTIGATION FOR PROPOSED RESIDENTIAL DEVELOPMENT

12529 CHINGUACOUSY ROAD, NORTH OF MAYFIELD ROAD

TOWN OF CALEDON

REFERENCE NO. 1506-S092

AUGUST 2015

DISTRIBUTION

3 Copies	- Paradise Homes Corp.
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TABLE OF CONTENTS

TABLES

ENCLOSURES

1.0 INTRODUCTION

In accordance with a written authorization dated June 17, 2015, from Mr. Mitchell Taleski of Paradise Homes Corp., a geotechnical investigation was carried out on a parcel of land located at 12529 Chinguacousy Road, north of Mayfield Road, in the Town of Caledon, for a proposed residential development.

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

2.0 SITE AND PROJECT DESCRIPTION

The south sector of the Town of Caledon is situated on Peel-Markham till plain where the drift dominates the soil stratigraphy. In places, lacustrine sand, silt, clay and drift which has been reworked by the water action of Peel Ponding (glacial lake) have modified the drift stratigraphy.

The subject property, encompassing a total area of 41.66 hectares (102.94 acres), is an existing farmland located at the east side of Chinguacousy Road, approximately 1.2 km north of Mayfield Road, in the Town of Caledon. It is understood that the previous farm buildings have been demolished, leaving the concrete slab and foundations in place.

A majority of the subject property, 29.1 hectares, is classified as Greenbelt Plan Area and Corridor Area so that any development is restricted. Only 12.56 hectares of the property is developable and it is subdivided by the Greenbelt or Corridor into three sections:

- Area A: North portion of the property (4.36 ha)
- Area B: Northwest portion of the property (2.96 ha)
- Area C: Southwest portion of the property (5.25 ha)

We understand that the proposed development will be residential subdivisions on the three land sections. However, detailed design of the subdivisions is not available at the time of this investigation. We recommend that the design of development must be reviewed by Soil Engineers Ltd. Further investigation by additional boreholes would be required according to the details of development.

3.0 FIELD WORK

The field work, consisting of nine (9) boreholes, was performed on June 24 and 25, 2015, at the locations shown on the Borehole Location Plan, Drawing No. 1. Four of the boreholes extended to depths of 9.6 to 12.6 m from the prevailing ground level. The remaining boreholes were terminated at a depth of 6.6 m from grade.

The holes were advanced at intervals to the sampling depths by a track-mounted, continuous-flight power-auger machine 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 a Geotechnical Technician.

The elevation at each of the borehole locations was determined from a survey, using a Trimble Geoexplorer 6000 series GeoXH handheld Global Navigation Satellite System, with an accuracy of 0.1 ± m.

4.0 SUBSURFACE CONDITIONS

Detailed descriptions of the encountered subsurface conditions from the boreholes are presented on the Borehole Logs, comprising Figures 1 to 9, inclusive. The revealed stratigraphy is plotted on the Subsurface Profile, Drawing No. 2, and the engineering properties of the disclosed soils are discussed herein.

This investigation has disclosed that beneath a veneer of topsoil, the site is underlain by strata of silty clay till and silty clay deposits overlying silt and sandy silt deposits at various depths and locations.

4.1 **Topsoil** (All Boreholes)

The site is an existing farmland. Topsoil, approximately 15 to 25 cm thick, was encountered at the ground surface in the borehole areas. Thicker layers of topsoil may occur in treed areas and lower areas, especially near swales and ditches across the site.

The topsoil is dark brown in colour, indicating that it contains appreciable amounts of roots and humus. It is compressible under loads; and is considered to be void of engineering value. Due to its humus content, the topsoil will generate an offensive odour and may produce volatile gases under anaerobic conditions. Therefore, 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.

Since the topsoil is considered void of engineering value, it can only be used for general landscape contouring purposes. Its suitability for planting and sodding purposes must be further assessed by fertility testing.

4.2 **Silty Clay Till** (All Boreholes) and **Silty Clay** (Boreholes 1 to 6, inclusive)

Beneath the topsoil veneer, a silty clay till deposit was encountered in all boreholes. Sample examination reveals that the deposit is heterogeneous in structure, with a mixture of clay, silt, sand, trace of gravel and occasional gravel and cobbles, indicating that it is a glacial deposit.

The clay till extended to depths between 4.6 m and 7.6 m from the prevailing ground surface. The obtained ‘N’ values range from 3 to 65, with a median of 26 blows per 30 cm of penetration, indicating that the till deposit is soft to hard, generally very stiff. The lower range of 7 to 18 blows per 30 cm of penetration was generally recorded in the weathered zone, within a depth of 0.8 to 1.5 m from the prevailing ground surface.

Underlying the clay till at depths ranging from 4.6 to 7.6 m in Boreholes 1 to 6, a silty clay deposit was encountered. Sample examination reveals that the silty clay contains seams or layers of sandy silt. Boreholes 1, 4 and 5 were terminated in the silty clay at a depth of 6.6 m from grade. In Boreholes 2, 3 and 6, the silty clay extended to depths of 9.1 m and 9.4 m from the prevailing ground surface.

The obtained ‘N’ values of the silty clay range from 6 to 21, with a median of 16 blows per 30 cm of penetration, indicating that the clay deposit is firm to very stiff, generally very stiff.

The Atterberg Limits of four representative samples (two in the clay till and two in the clay) and the moisture content 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% and 43%	33% and 52%
Plastic Limit	15% and 21%	17% and 25%
Natural Water Content	8% to 32% (median 13%)	19% to 33% (median 22%)

The above results show that the clay and clay till are cohesive materials, of low to medium plasticity. The natural water content generally lies near the plastic limit range, confirming the consistency of the soils as determined by the 'N' values.

Grain size analyses were performed on 2 representative samples of the silty clay till and 2 representative samples of the silty clay deposit; the results are plotted on Figures 10 and 11.

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

- Highly frost susceptibility and high soil-adfreezing potential.
- Low permeability, with an estimated coefficient of permeability of 10^{-7} cm/sec, a Percolation Time of 80 min/cm and runoff coefficients of:

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

- Cohesive-frictional soils, their shear strengths are primarily derived from consistency which is inversely related to its moisture content. The clay till contains sand and its shear strength is augmented by internal friction. The overall shear strength of the silty clay 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.

- It will generally be stable in a relatively steep cut; however, long exposure will allow the weathered layers and the wet sand seams to become saturated which may lead to localized sloughing.
- Poor pavement-supportive materials, with an estimated California Bearing Ratio (CBR) value of less than 3%.
- Moderately high corrosivity to buried metal, with an estimated electrical resistivity of 3500 ohm·cm.

4.3 **Silt** (Boreholes 2, 3, 6, 7, 8 and 9)

The silt was encountered at depths ranging from 6.1 to 9.4 ± m, below the silty clay or silty clay till. Boreholes 6, 8 and 9 were terminated in the silt deposit at a depth of 6.6 m or 9.6 m from the prevailing ground surface. Sample examination revealed that the silt deposit contains various amount of clay. Grain size analyses were performed on 2 representative samples; the results are plotted on Figure 12.

The obtained ‘N’ values range from 2 to 52, with a median of 14 blows per 30 cm penetration, indicating that the relative density of the silt is very loose to very dense, generally in the compact range. The relatively low ‘N’ values of 2 to 5 could be due to disturbance by the hydrostatic pressure during the drilling and retrieval of augers and it does not represent the true relative density of the silt deposit.

The natural water content values of the silt samples are plotted on the Borehole Logs; the values of 15% to 24%, with a median of 20%, indicate that the silt is in a very moist or wet condition, generally water bearing. The sample displayed appreciable dilatancy when wetted and shaken by hand, indicating that the shear strength of the silt, when wet, is susceptible to impact disturbance.

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

- High frost susceptibility and soil-adfreezing potential.
- Highly water erodible; it is susceptible to migration through small openings under seepage pressure.
- A soil of high capillarity and water retention capacity.
- Semi-permeable, with an estimated coefficient of permeability of 10^{-5} cm/sec, and runoff coefficients of:

Slope	
0% - 2%	0.11
2% - 6%	0.16
6% +	0.23

- A frictional soil, its shear strength is derived from internal friction; therefore, its shear strength is density dependent. Due to its dilatancy, the strength of the wet silt 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.
- When excavated, the wet silt will slough and runs slowly with seepage bleeding from the cut face. It will boil under a piezometric head of 0.4 m.
- A poor pavement-supportive material, with an estimated CBR value of 3%.
- Moderate corrosivity to buried metal, with an estimated electrical resistivity of 4500 ohm·cm.

4.4 **Sandy Silt** (Boreholes 2, 3 and 7)

Sandy silt deposit was encountered below the silt at depths of 9.1 to 12.1± m from the prevailing ground surface. These boreholes were terminated in the sandy silt deposit at depths of 11.1 to 12.6 m from the prevailing ground level.

Sample examination shows that the deposit consists of sandy silt with a trace of clay. The wetted samples dilate when shaken by hand. Grain size analyses were performed on 2 representative samples; the results are plotted on Figure 13.

The obtained ‘N’ values ranged from 9 to 28 per 30 cm penetration, with a median of 19 blows per 30 cm, indicating that its relative density is loose to compact, generally compact.

The natural water content values of the samples were determined, and the results are plotted on the Borehole Logs; the values range from 12% to 22%, with a median of 18%, indicating that the soil is in a very moist to wet condition. It is generally in a saturated condition and is water bearing.

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

- High frost susceptibility and high water erodibility.
- Semi-permeable, with an estimated coefficient of permeability of 10^{-3} to 10^{-4} cm/sec, and runoff coefficients of:

Slope	
0% - 2%	0.04 to 0.07
2% - 6%	0.09 to 0.12
6% +	0.13 to 0.18

- A frictional soil, its shear strength is density dependent. Due to its dilatancy, the strength of the wet silt 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 in shear strength.
- In excavation, the moist silt will be stable in relatively steep cuts, while the wet silt will slough and run slowly with seepage bleeding from the cut face. It will boil with a piezometric head of 0.4 m.
- A fair pavement-supportive material, with an estimated CBR value of 8%.
- Moderately low corrosivity to buried metal, with an estimated electrical resistivity of 5500 ohm·cm.

4.5 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/Silty Clay Till	8 to 33 (median 19)	18	12 to 27
Silt/Sandy Silt	12 to 24 (median 20)	13	8 to 17

The above values show that some of the silty clay and silty clay till and most of the silts are generally not suitable for a 95% or + Standard Proctor compaction. Saturated soils will require aeration prior to structural compaction in layers. Aeration can be achieved by spreading the soils thinly on the ground surface in the dry, warm weather.

The sandy silt and silt should be compacted using a smooth drum roller while the clay and clay till can be compacted using a heavy-weight, kneading-type roller. 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.

If the compaction of the soils is carried out with the water content within the range for 95% Standard Proctor dry density 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.

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 soil mantle has increased to over 95% of its maximum Standard Proctor dry density.

5.0 GROUNDWATER CONDITIONS

The boreholes were checked for the presence of groundwater and the occurrence of cave-in upon their completion, as summarized in Table 2.

Table 2 - Groundwater Condition

Borehole No.	Borehole Depth (m)	Ground Elevation (m)	Measured Groundwater/ Cave-In* Level on Completion	
			Depth (m)	Elevation (m)
1	6.6	259.3	Dry	below 252.7
2	12.6	259.2	5.5	253.7
3	12.6	259.2	4.3	254.9
4	6.6	260.6	4.9	255.7
5	6.6	259.8	Dry	below 253.2
6	9.6	259.1	8.5	250.6
7	11.1	259.0	4.6/6.1*	254.4/252.9*
8	6.6	259.3	5.5	253.8
9	6.6	259.6	5.5	254.1

* Cave-in level measured upon completion of the borehole

The groundwater water level was recorded between El. 250.6 m and 255.7 m. Based on the groundwater levels and the natural water contents, groundwater is generally found within the silt and sandy silt below 6± to 9± m from the prevailing ground surface. It will be subject to seasonal fluctuations. The groundwater could be under subterranean artesian pressure. No structure can be constructed below the saturation level without extensive dewatering.

Groundwater yield from the silty clay and silty clay till is expected to be slow and limited in quantity. The groundwater yield from the silt or sandy silt below the saturation level is expected to be appreciable and persistent.

6.0 DISCUSSION AND RECOMMENDATIONS

A majority of the subject property, 29.1 hectares, is classified as Greenbelt Plan Area and Corridor Area, so that any development is restricted. Only 12.56 hectares of the property subdivided by the Greenbelt or Corridor into three sections is developable. Details of the proposed development, however, are not known at the time of investigation. We recommend that the design of development must be reviewed by Soil Engineers Ltd. Further investigation by additional boreholes would be required according to the details of development.

This investigation has disclosed that beneath a veneer of topsoil, the site is underlain by strata of soft to hard, generally very stiff silty clay and silty clay till, overlying layers of very loose to very dense, generally compact silt, loose to compact, generally compact sandy silt at various depths and locations. The soft and firm layer within the top 0.8 to 1.5 m below the prevailing ground surface has been weathered.

The silt and sandy silt are generally water-bearing and may be under subterranean artesian pressure.

Groundwater was detected in the open boreholes at depths of 4.3 to 8.5± m below the prevailing ground surface (or El. 250.6 m and 255.7 m). It is generally found within the silt and sandy silt below 6± to 9± m from the prevailing ground surface. The groundwater could be under subterranean artesian pressure and it will be subject to seasonal fluctuations. No structure can be constructed below the saturation level without extensive dewatering.

The geotechnical findings which warrant special consideration are presented below:

- The topsoil is unsuitable for engineering applications and must be removed. For the environmental as well as the geotechnical well-being of the future development, the topsoil should not be buried within any building envelopes or deeper than 1.2 m below the exterior finished grade. Fertility testing must be carried out to assess the suitability of the topsoil as landscaping material.
- The weathered soil is unsuitable for supporting structures. In using the weathered soil for structural backfill, or in pavement or slab-on-grade construction, it should be subexcavated, inspected, sorted free of topsoil inclusions and any deleterious materials, aerated and properly recompacted.
- The sound natural soils below the weathered soil are suitable for normal spread and strip footing construction. The footing subgrade must be inspected by a geotechnical engineer, or a geotechnical technician under the supervision of a geotechnical engineer, to ensure that its condition is compatible with the design of the foundation.
- The revealed soils are highly frost susceptible, with high soil-adfreezing potential. Where these soils are used to backfill against foundation walls, special measures must be incorporated into the building construction to prevent serious damage due to soil adfreezing.
- For slab-on-grade construction, the slab should be constructed on a granular base, 20 cm thick, consisting of 20-mm Crusher-Run Limestone, or equivalent, compacted to its maximum Standard Proctor dry density.
- A Class ‘B’ bedding, consisting of compacted 20-mm Crusher-Run Limestone, is recommended for the construction of the underground services. The pipe joints should be leak-proof, or the joints should be wrapped with an appropriate waterproof membrane. In water-bearing silts, where extensive dewatering is required, a Class ‘A’ bedding consisting of concrete will likely be required, and

pipe joints should be leak-proof or wrapped with a waterproof membrane. If subgrade stabilization is required, the stone immersion technique may be applied.

- If excavation is to be carried out into the silt or sandy silt layers below the approximate El. 249 m in Areas A and B and El. 254 m in Area C, a dewatering system will be required to release the hydrostatic pressure and to control the groundwater seepage.
- Excavation should be carried out in accordance with Ontario Regulation 213/91.
- Additional boreholes will be required when the detailed design becomes available.

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**

It is assumed that the proposed development will consist of low-rise residential dwellings with basement. Based on the borehole findings, it is recommended that normal spread and strip footings for the dwellings be placed below the weathered strata and onto the sound native sand deposit or on engineered fill. As a general guide, the recommended soil pressures for use in the design of the foundations, together with the corresponding suitable founding levels, are presented in Table 3.

Table 3 - Founding Levels for Normal Spread and Strip Footings

BH No.	Recommended Maximum Allowable Soil Pressure (SLS)/ Factored Ultimate Soil Bearing Pressure (ULS) and Suitable Founding Level			
	200 kPa (SLS) 300 kPa (ULS)		75 kPa (SLS) 120 kPa (ULS)	
	Depth (m)	**El. (m)**	**Depth (m)**	**El. (m)**
Area A – North Portion of Property				
1	1.2 – 6.6	258.1 – 252.7	-	-
2	1.5 – 4.6	257.7 – 254.6	below 4.6*	below 254.6
3	1.5 – 4.6	257.7 – 254.6	below 4.6*	below 254.6
Area B – Northwest Portion of Property				
4	1.2 – 6.6	259.4 – 254.0	-	-
5	1.5 – 6.6	258.3 – 253.2	-	-
6	1.5 – 7.6	257.6 – 251.5	below 7.6**	below 251.5
Area C – Southwest Portion of Property				
7	1.5 – 5.0***	257.5 – 254.0	-	-
8	1.5 – 5.0***	257.8 – 254.3	-	-
9	1.0 – 5.0***	258.6 – 254.6	-	-

* No footing excavation should extend below 8 m from grade without extensive dewatering.

** No footing excavation should extend below 9 m from grade without extensive dewatering.

*** No footing excavation should extend below 5 m from grade without extensive dewatering.

The recommended soil bearing pressures (SLS) for foundations incorporate a safety factor of 3. The total and differential settlements are estimated to be 25 mm and 15 mm, respectively.

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

The footings must meet the requirements specified in the latest Ontario Building Code. As a guide, the structure should be designed to resist an earthquake force using Site Classification ‘D’ (stiff soil).

Foundation walls must be designed using perimeter subdrains. All the subdrains must be encased in a fabric filter to protect them against blockage by silting. The in situ soils are high in frost susceptibility and soil-adfreezing potential. Special measures must be incorporated into the building construction to prevent serious damage due to soil adfreezing.

The foundation walls should also be designed to sustain a lateral earth pressure calculated using the soil parameters stated in Section 6.8. Any applicable surcharge loads adjacent to the proposed building must also be considered in the design of the underground structures.

It should be noted that if groundwater or groundwater seepage is encountered in the footing excavations, or where the subgrade of the normal foundations is found to be wet, the subgrade should be protected by a concrete mud-slab immediately after exposure. This will prevent construction disturbance and costly rectification.

Due to the presence of weathered soil, the foundation subgrade must be inspected by a geotechnical engineer, or a geotechnical technician under the supervision of a geotechnical engineer, to assess its suitability for bearing the designed foundations.

6.2 **Engineered Fill**

In areas where earth fill is required to raise the site or extended footings are required, it is generally more economical to place engineered fill for normal footing, underground services and pavement construction. The engineering requirements for a certifiable fill for pavement construction, municipal services, slab-on-grade, and footings designed with a Maximum Allowable Soil Pressure (SLS) of 150 kPa and a Factored Ultimate Soil Bearing Pressure (ULS) of 250 kPa are presented below:

1. All of the topsoil and organics must be removed, and the subgrade must be inspected and proof-rolled prior to any fill placement. The weathered till must be subexcavated, sorted free of topsoil inclusions and deleterious materials, if any, aerated and properly compacted.
2. Inorganic soils must be used, and they must be uniformly compacted in lifts 20 cm thick to 98% or + of their maximum Standard Proctor dry density up to the proposed finished grade and/or slab-on-grade subgrade. The soil moisture must be properly controlled on the wet side of 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% of the maximum Standard Proctor compaction.
3. If imported fill is to be used, the hauler is responsible for its environmental quality and must provide a document to certify that the material is free of hazardous contaminants.
4. 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.
5. 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. Foundations partially on engineered fill must be reinforced and designed by a structural engineer to properly distribute the stress induced by the abrupt differential settlement (estimated to be 15± mm) between the natural soils and engineered fill.

6. The engineered fill must not be placed during the period from late November to early April, when freezing ambient temperatures occur either persistently or intermittently. This is to ensure that the fill is free of frozen soils, ice and snow.
7. Where the ground is wet due to subsurface water seepage, an appropriate subdrain scheme must be implemented prior to the fill placement, particularly if it is to be carried out on sloping ground or a bank.
8. Where fill is to be placed on a bank steeper than 1 vertical:3 horizontal, the face of the bank must flattened to 3+ so that it is suitable for safe operation of the compactor and the required compaction can be obtained.
9. The fill operation must be inspected on a full-time basis by a technician under the direction of a geotechnical engineer.
10. The footing 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.
11. Any excavation carried out in certified engineered fill must be reported to the geotechnical consultant who inspected the fill placement in order to document the locations of the excavation and/or to inspect 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.
12. 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 and designed by the structural engineer for the project. The total and differential settlements of 25 mm and 15 mm, respectively, should be considered in the design of the foundations founded on

engineered fill. In sewer construction, the engineered fill is considered to have the same structural proficiency as a natural inorganic soil.

6.3 **Slab-On-Grade**

The subgrade for slab-on grade construction must consist of sound natural soils or properly compacted inorganic earth fill. In preparation of the subgrade, the topsoil, organic earth fill and badly weathered till must be removed and replaced with inorganic material property compacted to 98% or + of its maximum Standard Proctor dry density.

The subgrade should be inspected and assessed by proof-rolling prior to slab-on-grade construction. Where loose inorganic earth fill, weathered till or soft/loose subgrade is detected, it should be inspected and surface compacted.

Any new material for raising the grade should consist of organic-free soil compacted to at least 98% of its maximum Standard Proctor dry density.

If the subgrade has been loosened due to construction traffic, it must be proof-rolled before placement of the granular base.

The slab should be constructed on a granular base, 20 cm thick, consisting of 20-mm Crusher-Run Limestone, or equivalent, compacted to its maximum Standard Proctor dry density.

The slab-on-grade in open areas should be designed to tolerate frost heave, and the grading around the slab-on-grade and building structures must be such that it directs runoff away from the structures.

A Modulus of Subgrade Reaction of 25 MPa/m can be used for the design of the floor slab.

The slab at the entrances into the building(s) should be insulated with 50-mm Styrofoam, or its thermal equivalent, extending 1.2 m internally. This measure is to prevent cold drafts in the winter from inducing frost action in the subgrade and causing heaving or damage to the floor slab.

6.4 **Underground Services**

The subgrade for underground services should consist of sound natural soils or properly compacted organic-free earth fill. Where topsoil, loose and/or organic earth fill, weathered till or soft/loose soil is encountered, it should be subexcavated and replaced with bedding material compacted to at least 95% or + of its Standard Proctor compaction.

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

In water-bearing silts, where extensive dewatering is required, a Class ‘A’ bedding consisting of concrete will likely be required, and pipe joints should be leak proof or wrapped with a waterproof membrane. If subgrade stabilization is required, the stone immersion technique may be applied.

In order to prevent pipe floatation when the sewer trench is deluged with water, a soil cover at least equal in thickness to 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.

All metal fittings for the underground services should be protected against soil corrosion. The in-situ soils have moderate corrosivity to buried metal. In determining the mode of protection, an electrical resistivity of 3500 to 5500 ohm·cm should be used. This, however, should be confirmed by testing the soil along the water main alignment at the time of services construction.

6.5 **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 the backfilling.

The backfill in trenches should be compacted to at least 95% of its maximum Standard Proctor dry density and increased to 98% or + below the floor slab. In the zone within 1.0 m below the road subgrade, the materials should be compacted with the water content 2% to 3% drier than the optimum, and the compaction should be increased to at least 98% of the respective maximum Standard Proctor dry density. 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 wider latitude of lift thickness. Backfill below any slab-on-grade which is sensitive to settlement must be compacted to at least 98% of its maximum Standard Proctor dry density.

In normal underground services construction practice, the problem areas of settlement largely occur adjacent to manholes, catch basins, services crossings, foundation walls and columns. In areas which are inaccessible to a heavy compactor, imported sand backfill should be used. Unless compaction of the backfill is carefully performed, the interface of the native soils and the sand backfill will have to be flooded for a period of several days.

The narrow trenches for services crossings should be cut at 1V:2 or + H so that the backfill can be effectively compacted. Otherwise, soil arching will prevent the achievement of proper compaction. 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 flooding of the backfill when it is required, such as in a narrow vertical trench section, or when the trench box is removed. 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 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 slab-on-grade construction.
- To backfill a deep trench, one must be aware that future settlement is to be expected, unless the side of the cut is flattened to at least 1 V:1.5+ H, 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 Standard Proctor dry density, 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. In a trench stabilized by a trench box, the void left after the removal of the box will be filled by the backfill. It is necessary to backfill this sector with sand, and the compacted backfill must be flooded for 1 day, 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 sand fill mantle, anti-seepage collars should be provided.

6.6 **Sidewalks, Interlocking Stone Pavement and Landscaping**

Due to the high frost susceptibility of the underlying soils, heaving of the pavement 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 must 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 sidewalk, slab or pavement surface, depending on the degree of tolerance for settlement, and be provided with positive drainage, such as weeper subdrains 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.

6.7 Pavement Design

The subgrade soil on driveways is anticipated to consist of frost susceptible silty clay or sandy silt. The recommended pavement design is given in Table 4.

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Table 4 - Pavement Design

Course	Thickness (mm)	OPS Specifications
Asphalt Surface	40	HL-3
Asphalt Binder	65	HL-8
Granular Base	150	Granular 'A' or equivalent
Granular Sub-base		Granular 'B' or equivalent
Local	350	
Minor Collector	400	

In preparation of the subgrade, the topsoil should be stripped and removed. The existing earth fill and weathered soils at the subgrade level can be proof-rolled. Any soft or loose subgrade as identified, or earth fill in which the topsoil inclusions and/or other deleterious materials cannot be sorted, should be subexcavated and replaced by properly compacted, organic-free earth fill or granular materials. Earth fill/engineered fill used to raise the grade for pavement construction should consist of organic-free soil uniformly compacted to 95% or + of its maximum Standard Proctor dry density. In the zone within 1.0 m below the road subgrade, the backfill should be compacted to at least 98% of its maximum Standard Proctor dry density, with the water content 2% to 3% drier than the optimum. In the lower zone, a 95% or + Standard Proctor compaction is considered adequate.

All the granular bases should be compacted to their maximum Standard Proctor dry density.

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

- If the pavement construction does not immediately follow the trench backfilling, the subgrade should be properly crowned and smooth-rolled to allow interim precipitation to be properly drained.
- Areas adjacent to the pavement should be properly graded to prevent ponding of large amounts of water during the interim construction period.
- Curb subdrains will be required. The subdrains should consist of filter-sleeved weepers to prevent blockage by silting.
- If the pavement is to be constructed during wet seasons and extensively soft subgrade occurs, the granular sub-base should be thickened in order to compensate for the inadequate strength of the subgrade. This can be assessed during construction.

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.

6.8 Soil Parameters

The recommended soil parameters for the project design are given in Table 5.

Table 5 - Soil Parameters

Unit Weight and Bulk Factor

	Unit Weight (kN/m^3)		**Estimated Bulk Factor**	
	Bulk	**Submerged**	**Loose**	**Compacted**
Silty Clay Till	21.5	11.5	1.30	1.05
Silty Clay	19.0	9.0	1.33	1.00
Silt/Sandy Silt	20.0	10.0	1.20	1.00

Lateral Earth Pressure Coefficients

	Active K_a	**At Rest K_o**	**Passive K_p**
Silty Clay Till and Silty Clay	0.40	0.55	2.50
Silt/Sandy Silt	0.33	0.45	3.00

6.9 **Excavation**

Excavation should be carried out in accordance with Ontario Regulation 213/91.

Excavations in excess of 1.2 m should be sloped at 1 V:1 H for stability. The sides of excavation into saturated soils may need to be flattened to 1 V:3 or + H for stability.

Groundwater was detected in the open boreholes at a depth of 4.3 to 8.5± m below the prevailing ground surface (or El. 250.6 m and 255.7 m). It is generally found within the silt and sandy silt below 6± to 9± m from the prevailing ground surface. The groundwater could be under subterranean artesian pressure and it will be subject to seasonal fluctuations. No excavation should extend into the saturation level unless the artesian pressure is released by dewatering.

For excavation purposes, the types of soils are classified in Table 6.

Table 6 - Classification of Soils for Excavation

Material	Type
Sound native soil and dewatered Sandy Silt and Silt	3
Weathered soil, and saturated Sandy Silt and Silt	4

The groundwater yield, if encountered, from the silty clay till and silty clay, due to its low permeability, is expected to be small and limited in quantity, while the yield of groundwater from the sandy silt and silt will be appreciable and persistent. In this case, well-point dewatering and groundwater depressurization will be necessary.

Prospective contractors must be asked to 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. 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

It should be noted that Phase One and Two Environmental Site Assessments have been conducted, and the assessment and recommendations will be given under separate cover. Therefore, this report deals only with a study of the geotechnical aspects of the proposed project.

This report was prepared by Soil Engineers Ltd. for the account of Paradise Homes Corp. and for review by their designated consultants and the government agencies. The material in it reflects the judgement of Kin Fung Li, B.Eng. and Bennett Sun, 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 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.

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LICENSED PROFESSIONAL ENGINEER
CHUN C. B. SUN
Aug 10, 2015
PROVINCE OF ONTARIO

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

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GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE

JOB NO: 1506-S092

LOG OF BOREHOLE NO: 1

FIGURE NO: 1

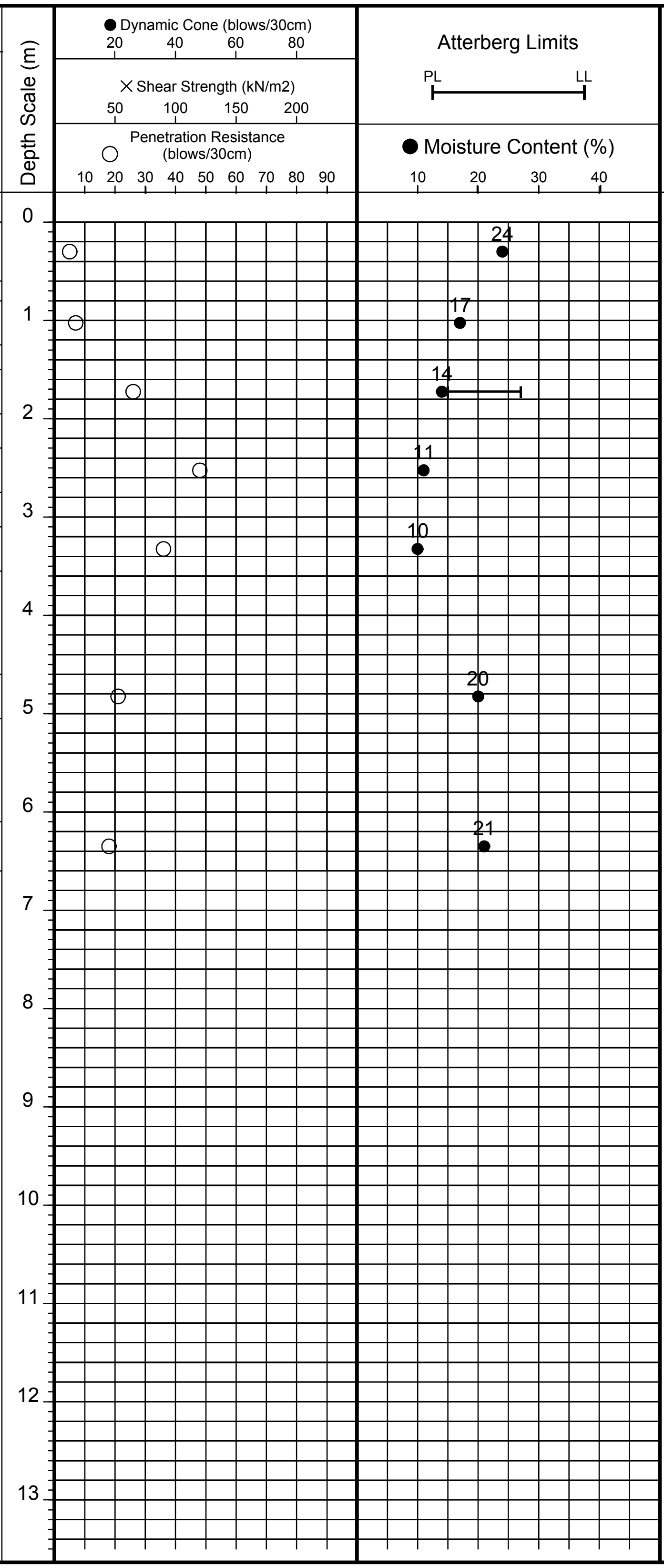
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: 12529 Chinguacousy Road, North of Mayfield Road
Town of Caledon

METHOD OF BORING: Flight Augers

DATE: June 24, 2015

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
0.0 259.3	Ground Surface **15 cm TOPSOIL**			
	Brown, firm to hard **SILTY CLAY, Till** a trace of gravel occ. sand seams, cobbles and boulders	1	DO	5
	weathered	2	DO	7
		3	DO	26
		4	DO	48
		5	DO	36
4.6 254.7	Grey, very stiff **SILTY CLAY** occ. sandy silt seams or layers	6	DO	21
		7	DO	18
6.6 252.7	**END OF BOREHOLE**			



WATER LEVEL

Dry upon completion

Soil Engineers Ltd.

JOB NO: 1506-S092

LOG OF BOREHOLE NO: 2

FIGURE NO: 2

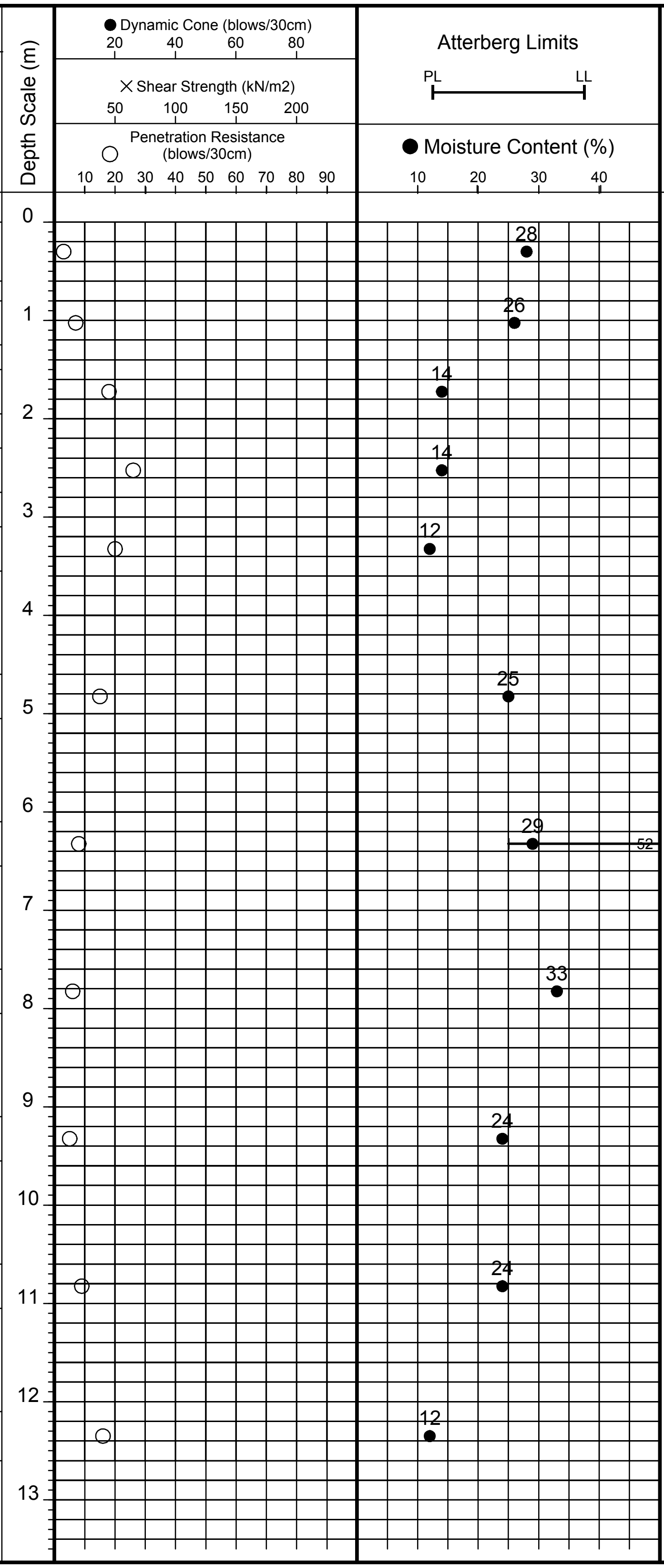
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: 12529 Chinguacousy Road, North of Mayfield Road
Town of Caledon

METHOD OF BORING: Flight Augers

DATE: June 24, 2015

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
0.0	Ground Surface			
259.2	**25 cm TOPSOIL**			
	Soft to very stiff **SILTY CLAY, Till** a trace of gravel occ. sand seams, cobbles and boulders	1	DO	3
	occ. rootlet inclusions	2	DO	7
	weathered	3	DO	18
		4	DO	26
	brown grey	5	DO	20
4.6 254.6	Grey, firm to stiff **SILTY CLAY**	6	DO	15
		7	DO	8
		8	DO	6
9.1 250.1	Grey, loose **SILT** some clay to clayey	9	DO	5
		10	DO	9
12.1 247.1	Grey, compact **SANDY SILT** some clay and gravel	11	DO	16
12.6 246.6	**END OF BOREHOLE**			



WATER LEVEL

∇

W.L. @ El. 253.7 m upon completion

Soil Engineers Ltd.

JOB NO: 1506-S092

LOG OF BOREHOLE NO: 3

FIGURE NO: 3

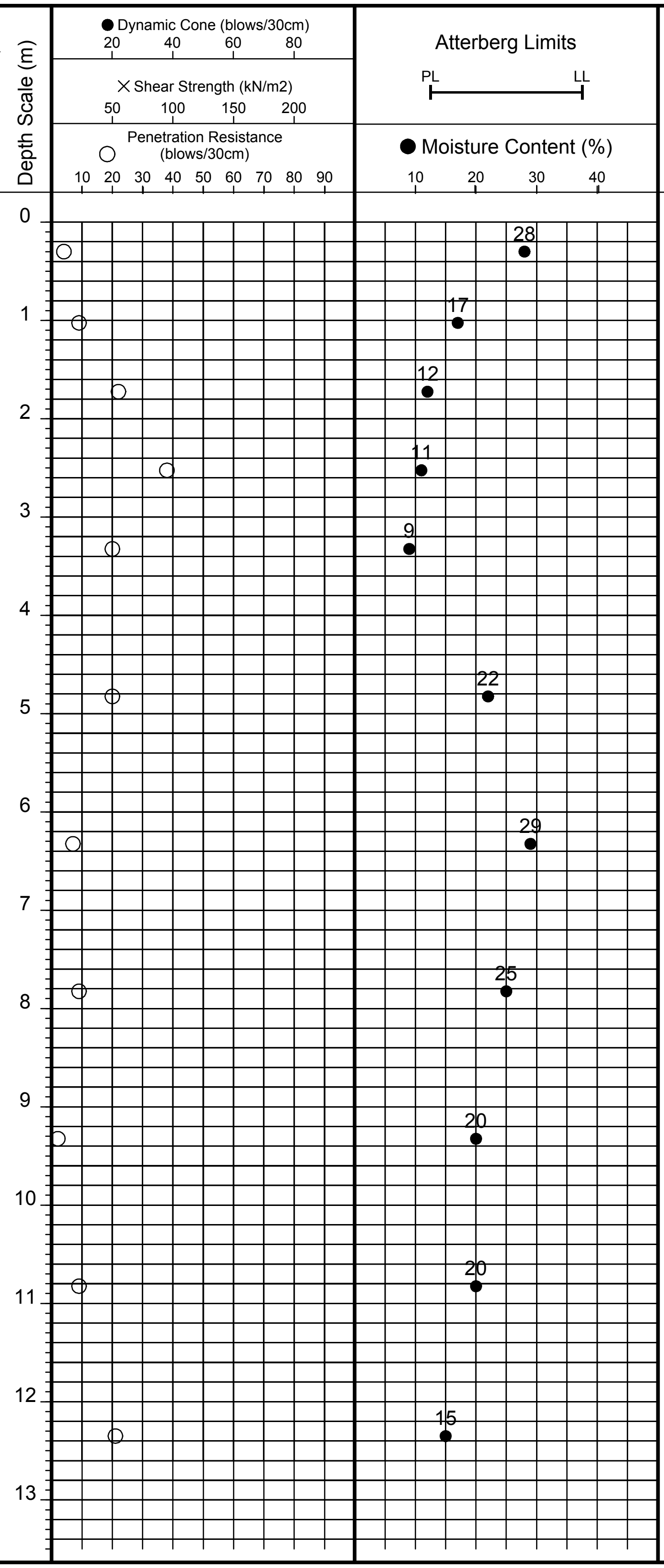
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: 12529 Chinguacousy Road, North of Mayfield Road
Town of Caledon

METHOD OF BORING: Flight Augers

DATE: June 24, 2015

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
0.0	Ground Surface			
259.2	**25 cm TOPSOIL** Firm to hard **SILTY CLAY, Till** a trace of gravel occ. sand seams, cobbles and boulders weathered brown grey	1 2 3 4 5	DO DO DO DO DO	4 9 22 38 20
4.6 254.6	Grey, firm to very stiff **SILTY CLAY**	6 7 8	DO DO DO	20 7 9
9.1 250.1	Grey, very loose **SILT** some clay to clayey	9	DO	2
10.6 248.6	Grey, loose to compact **SANDY SILT**	10 11	DO DO	9 21
12.6 246.6	**END OF BOREHOLE**			



WATER LEVEL

∇

W.L. @ El. 254.9 m upon completion

Soil Engineers Ltd.

JOB NO: 1506-S092

LOG OF BOREHOLE NO: 4

FIGURE NO: 4

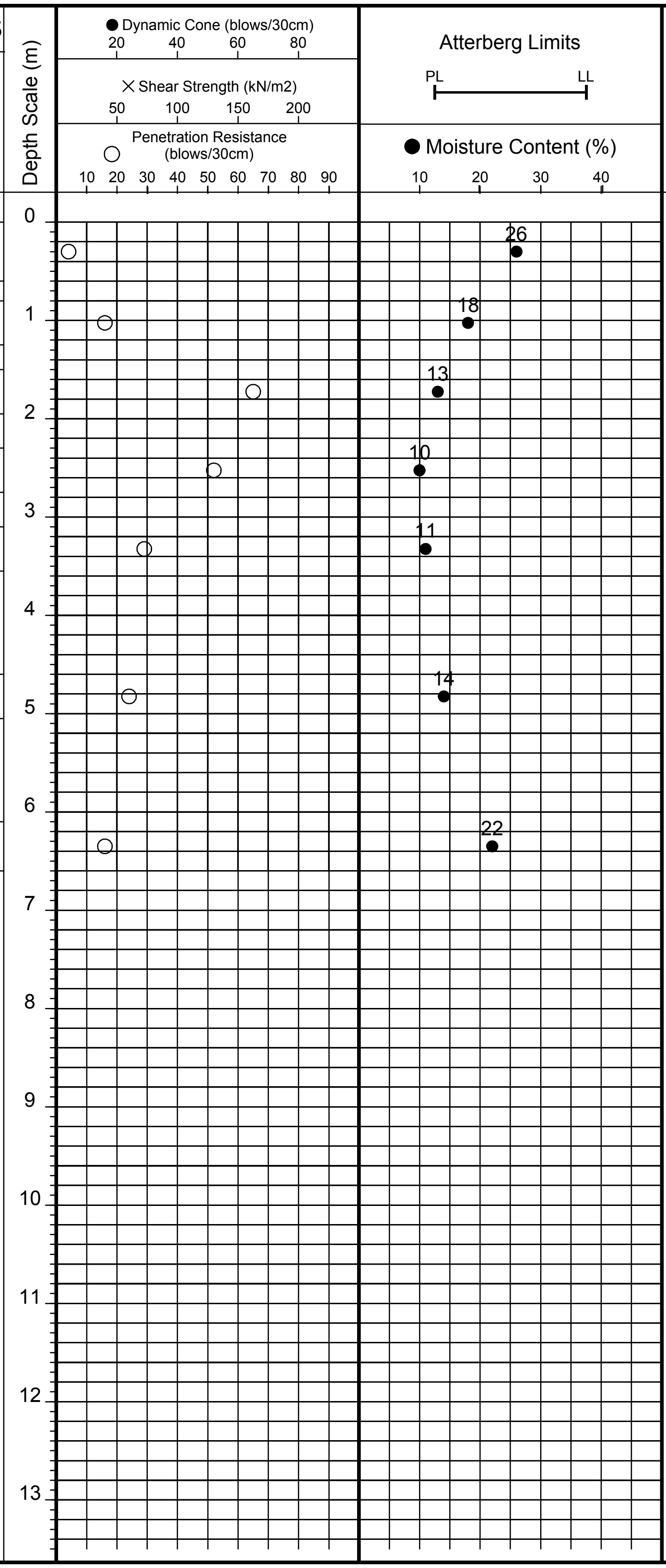
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: 12529 Chinguacousy Road, North of Mayfield Road
Town of Caledon

METHOD OF BORING: Flight Augers

DATE: June 24, 2015

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Moisture Content (%)
0.0	Ground Surface				
260.6	**25 cm TOPSOIL** Firm to hard **SILTY CLAY, Till** traces of gravel occ. sand seams, cobbles and boulders	1	DO	4	26
	weathered	2	DO	16	18
		3	DO	65	13
		4	DO	52	10
	brown grey	5	DO	29	11
		6	DO	24	14
6.1 254.5	Grey, very stiff **SILTY CLAY**	7	DO	16	22
6.6 254.0	**END OF BOREHOLE**				



WATER LEVEL

W.L. @ El. 255.7 m upon completion

Soil Engineers Ltd.

JOB NO: 1506-S092

LOG OF BOREHOLE NO: 5

FIGURE NO: 5

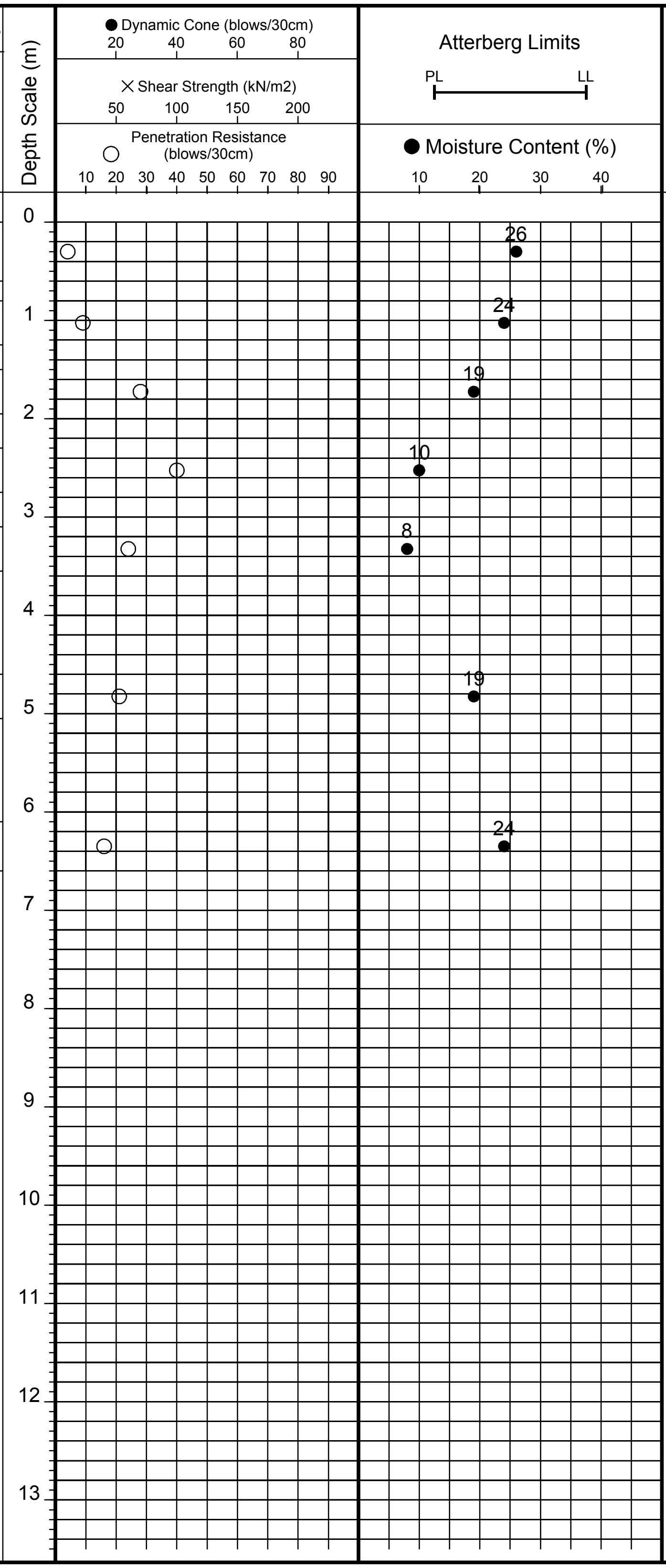
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: 12529 Chinguacousy Road, North of Mayfield Road
Town of Caledon

METHOD OF BORING: Flight Augers

DATE: June 24, 2015

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
0.0	Ground Surface			
259.8	**25 cm TOPSOIL**	1	DO	4
	Firm to hard **SILTY CLAY, Till** weathered	2	DO	9
	a trace of gravel occ. sand seams, cobbles and boulders	3	DO	28
		4	DO	40
	brown grey	5	DO	24
4.6 255.2	Grey, very stiff **SILTY CLAY** a trace of gravel	6	DO	21
		7	DO	16
6.6 253.2	**END OF BOREHOLE**			



WATER LEVEL

Dry upon completion

Soil Engineers Ltd.

JOB NO: 1506-S092

LOG OF BOREHOLE NO: 6

FIGURE NO: 6

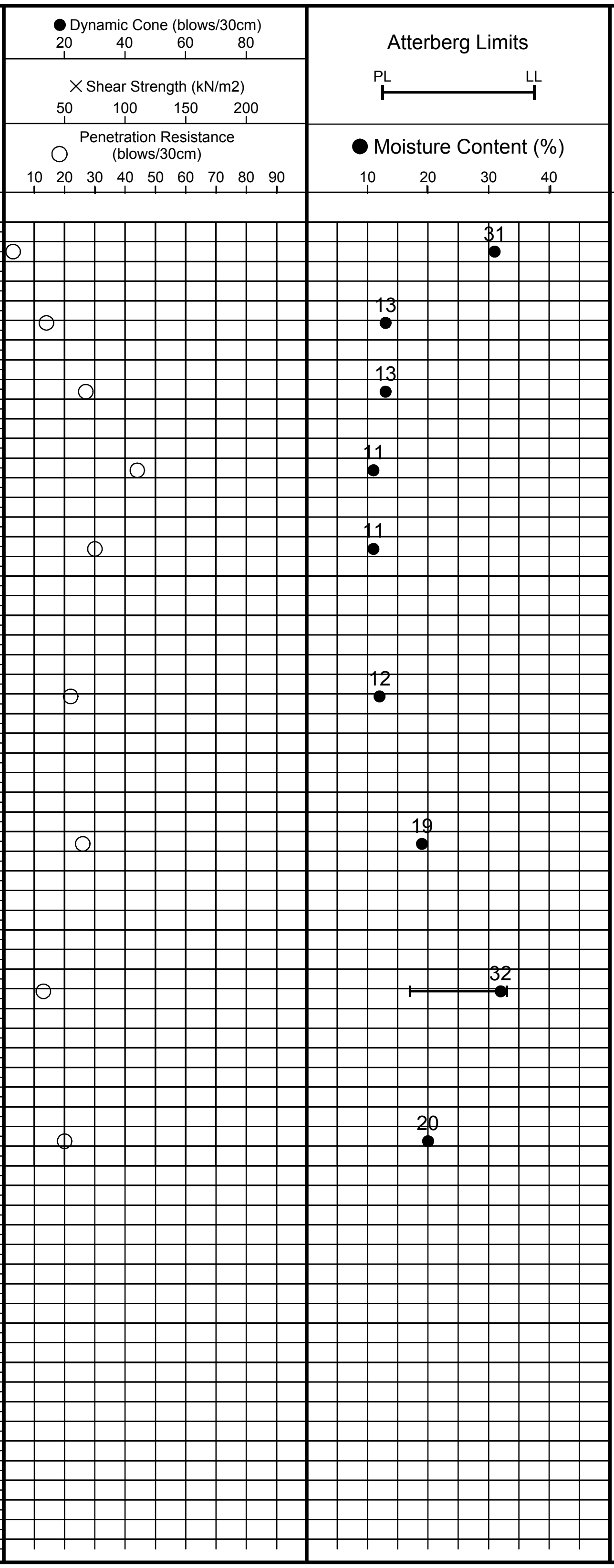
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: 12529 Chinguacousy Road, North of Mayfield Road
Town of Caledon

METHOD OF BORING: Flight Augers

DATE: June 24, 2015

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
0.0	Ground Surface			
259.1	**20 cm TOPSOIL**	1	DO	3
	Soft to hard **SILTY CLAY, Till** a trace of gravel occ. sand seams, cobbles and boulders — weathered	2	DO	14
		3	DO	27
		4	DO	44
	brown / grey	5	DO	30
		6	DO	22
		7	DO	26
7.6 251.5	Grey, stiff **SILTY CLAY**	8	DO	13
9.4 249.7		9	DO	20
9.6 249.5	Grey, compact **SILT** some clay			
	END OF BOREHOLE			



WATER LEVEL

W.L. @ El. 250.6 m upon completion

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JOB NO: 1506-S092

LOG OF BOREHOLE NO: 7

FIGURE NO: 7

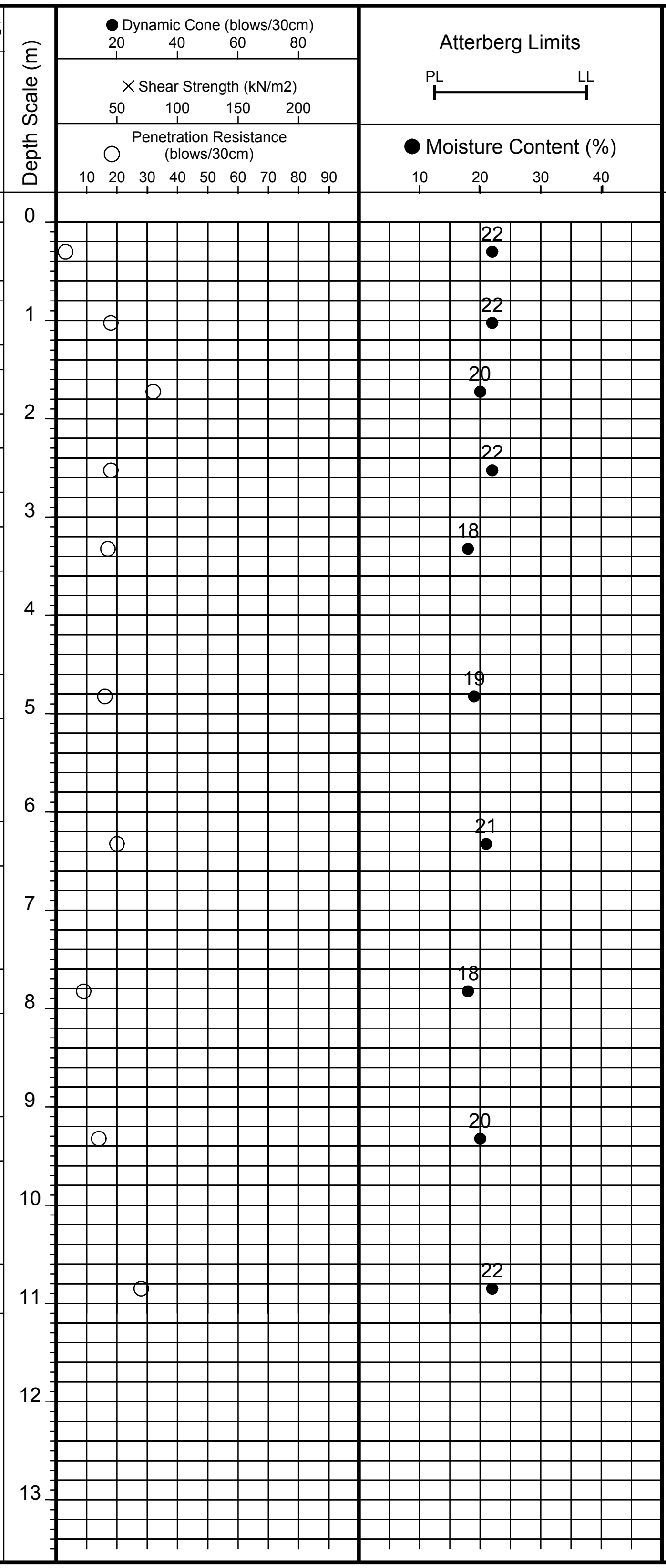
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: 12529 Chinguacousy Road, North of Mayfield Road
Town of Caledon

METHOD OF BORING: Flight Augers

DATE: June 25, 2015

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
0.0	Ground Surface			
259.0	**25 cm TOPSOIL** Soft to very stiff **SILTY CLAY, Till** a trace of gravel occ. sand seams, cobbles and boulders	1	DO	3
		2	DO	18
	weathered	3	DO	32
		4	DO	18
	sandy silt layer	5	DO	17
	brown grey	6	DO	16
6.1 252.9	Grey, loose to compact **SILT** some clay to clayey a trace to some sand	7	DO	20
	sandy silt layer	8	DO	9
9.1 249.9	Grey, compact **SANDY SILT**	9	DO	14
		10	DO	28
11.1 247.9	**END OF BOREHOLE**			



WATER LEVEL

W.L. @ El. 254.4 m and cave in @ El. 252.9 m upon completion

JOB NO: 1506-S092

LOG OF BOREHOLE NO: 8

FIGURE NO: 8

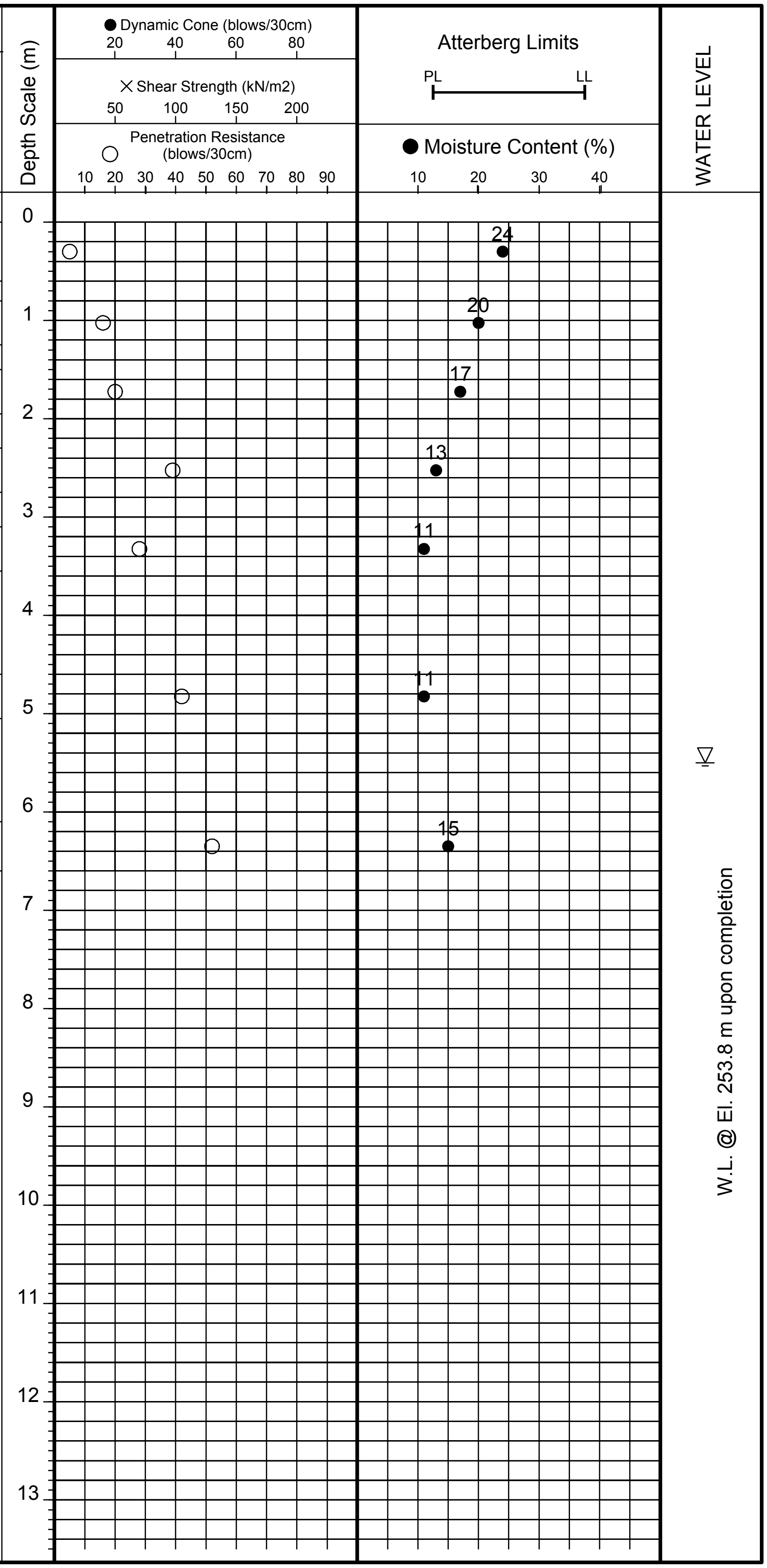
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: 12529 Chinguacousy Road, North of Mayfield Road
Town of Caledon

METHOD OF BORING: Flight Augers

DATE: June 25, 2015

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
0.0	Ground Surface			
259.3	**25 cm TOPSOIL**	1	DO	5
	Firm to hard **SILTY CLAY, Till** a trace of gravel occ. sand seams, cobbles and boulders weathered, some rootlets	2	DO	16
		3	DO	20
		4	DO	39
		5	DO	28
	brown grey	6	DO	42
6.1 253.2	Grey, dense **SILT** a trace to some clay	7	DO	52
6.6 252.7	**END OF BOREHOLE**			



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JOB NO: 1506-S092

LOG OF BOREHOLE NO: 9

FIGURE NO: 9

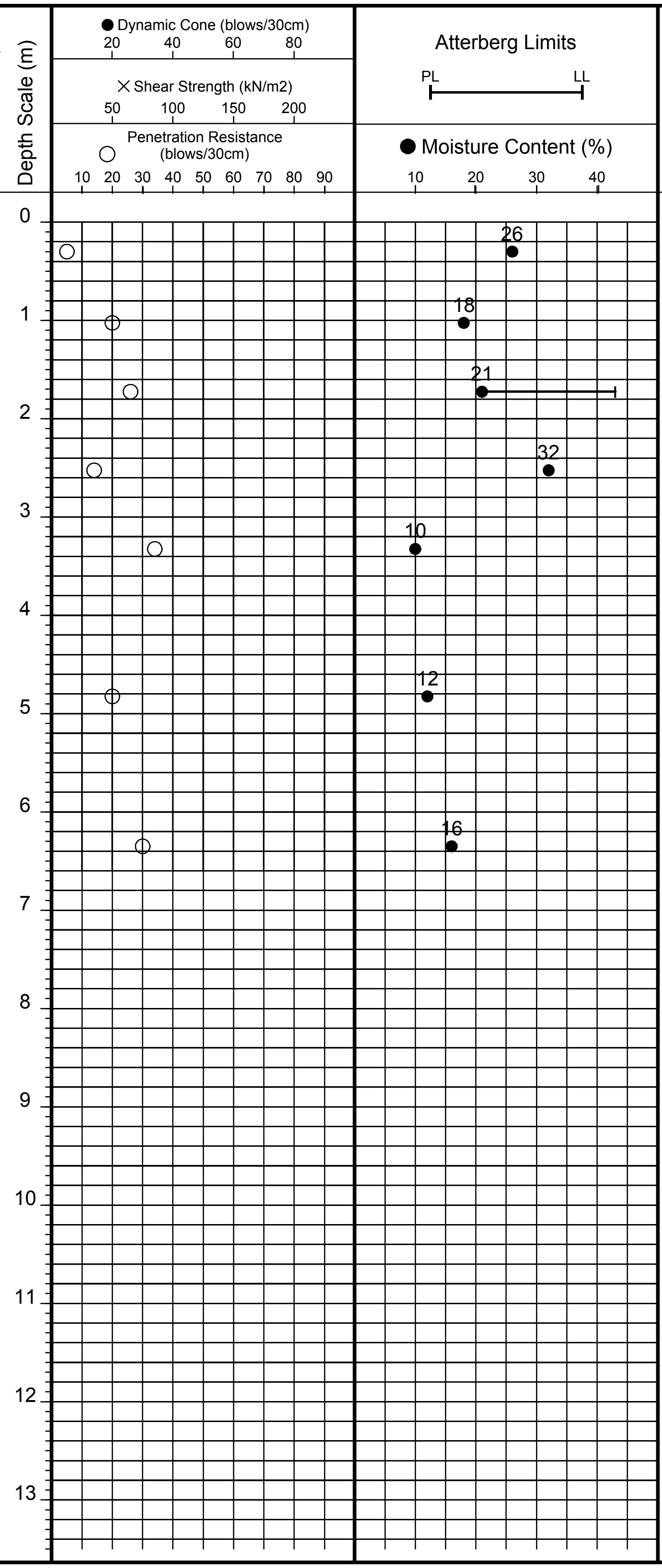
JOB DESCRIPTION: Proposed Residential Development

JOB LOCATION: 12529 Chinguacousy Road, North of Mayfield Road
Town of Caledon

METHOD OF BORING: Flight Augers

DATE: June 25, 2015

Depth Elev. (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
0.0	Ground Surface			
259.6	**15 cm TOPSOIL**			
	rootlets	1	DO	5
	Firm to hard **SILTY CLAY, Till** a trace of gravel occ. sand seams, cobbles and boulders weathered	2	DO	20
		3	DO	26
		4	DO	14
		5	DO	34
	brown grey	6	DO	20
6.1 253.5	Grey, compact **SILT** a trace to some clay	7	DO	30
6.6 253.0	**END OF BOREHOLE**			



WATER LEVEL

▽

W.L. @ El. 254.1 m upon completion

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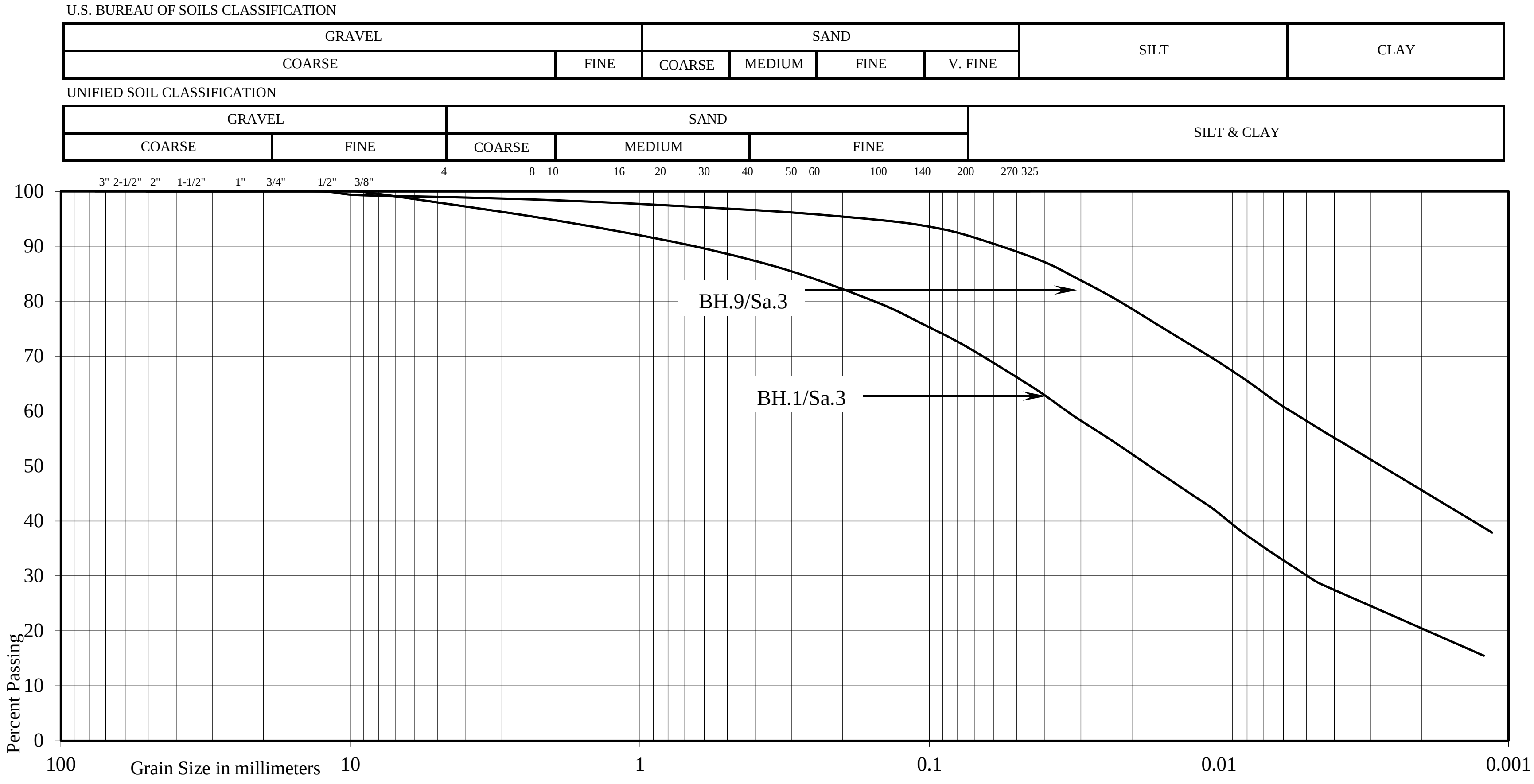
GRAIN SIZE DISTRIBUTION

Reference No: 1506-S092



Project: Proposed Residential Development

Location: 12529 Chinguacousy Road, North of Mayfield Road, Town of Caledon

Borehole No:	1	9
Sample No:	3	3
Depth (m):	1.6	1.5
Elevation (m):	257.7	258.1

BH./Sa.	1/3	9/3
Liquid Limit (%) =	27	43
Plastic Limit (%) =	15	21
Plasticity Index (%) =	12	22
Moisture Content (%) =	14	21
Estimated Permeability (cm./sec.) =	10^{-7}	10^{-7}

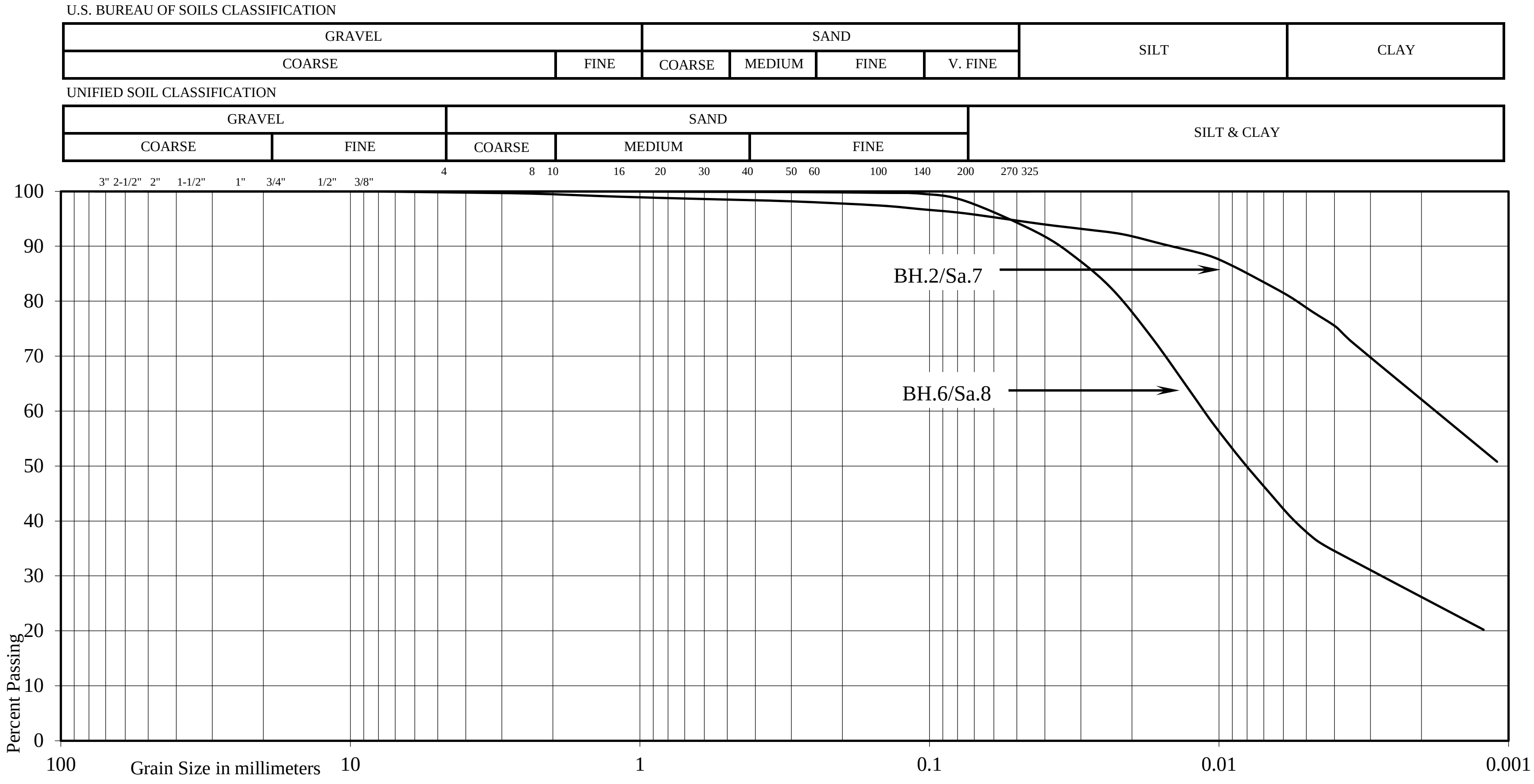
Classification of Sample [& Group Symbol]: SILTY CLAY, Till
a tr. of sand to sandy, a tr. of gravel

Figure: 10

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 1506-S092



Project: Proposed Residential Development

Location: 12529 Chinguacousy Road, North of Mayfield Road, Town of Caledon

Borehole No:	2	6
Sample No:	7	8
Depth (m):	6.3	7.8
Elevation (m):	252.9	251.3

BH./Sa.	2/7	6/8
Liquid Limit (%) =	52	33
Plastic Limit (%) =	25	17
Plasticity Index (%) =	27	16
Moisture Content (%) =	29	32
Estimated Permeability (cm./sec.) =	10^{-7}	10^{-7}

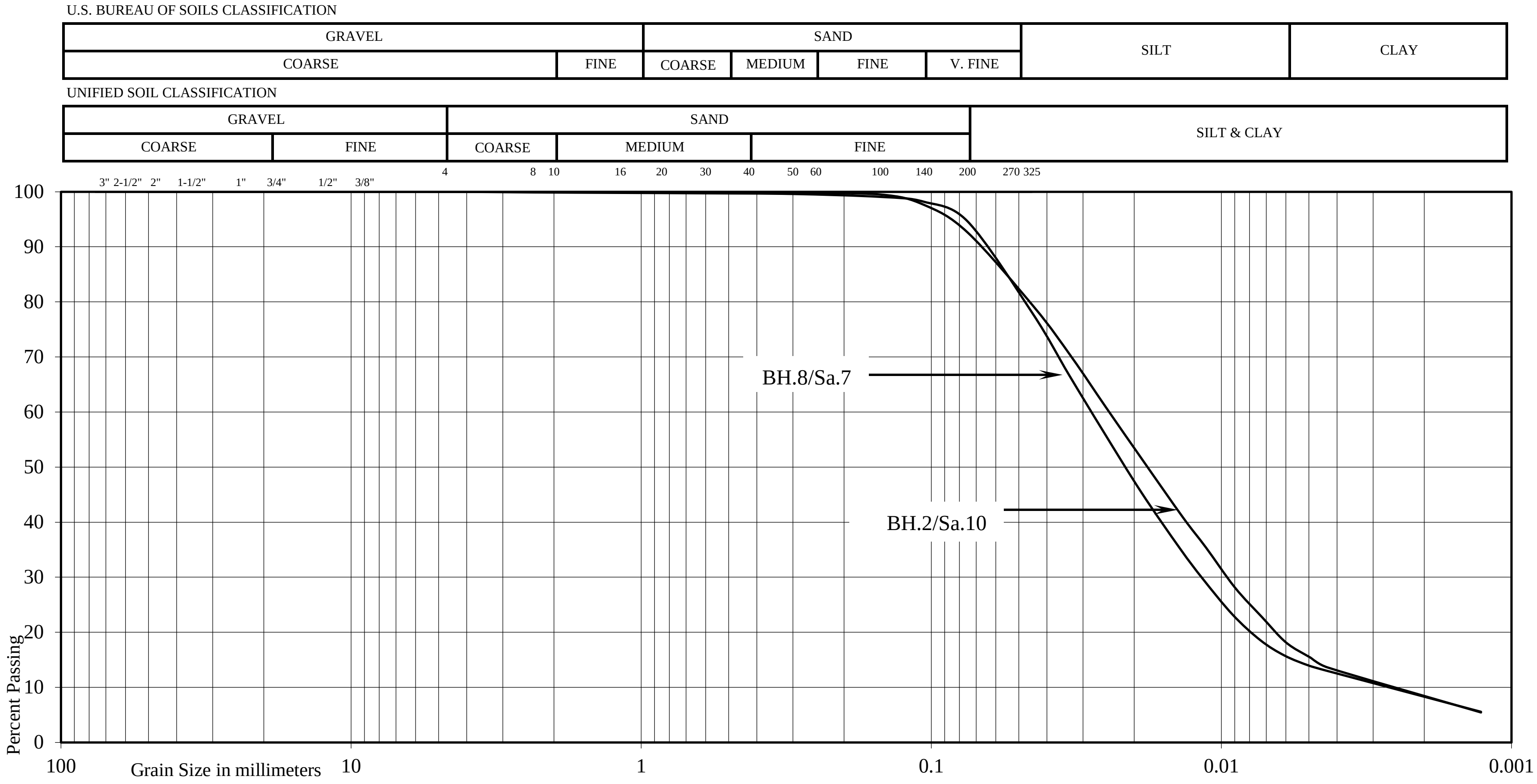
Classification of Sample [& Group Symbol]: SILTY CLAY
a tr. of fine sand

Figure: 11

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 1506-S092



Project: Proposed Residential Development

Location: 12529 Chinguacousy Road, North of Mayfield Road, Town of Caledon

Borehole No:	2	8
Sample No:	10	7
Depth (m):	10.8	6.3
Elevation (m):	248.4	253.0

BH./Sa.	2/10	8/7
Liquid Limit (%) =	-	-
Plastic Limit (%) =	-	-
Plasticity Index (%) =	-	-
Moisture Content (%) =	24	15
Estimated Permeability (cm./sec.) =	10^{-5}	10^{-5}

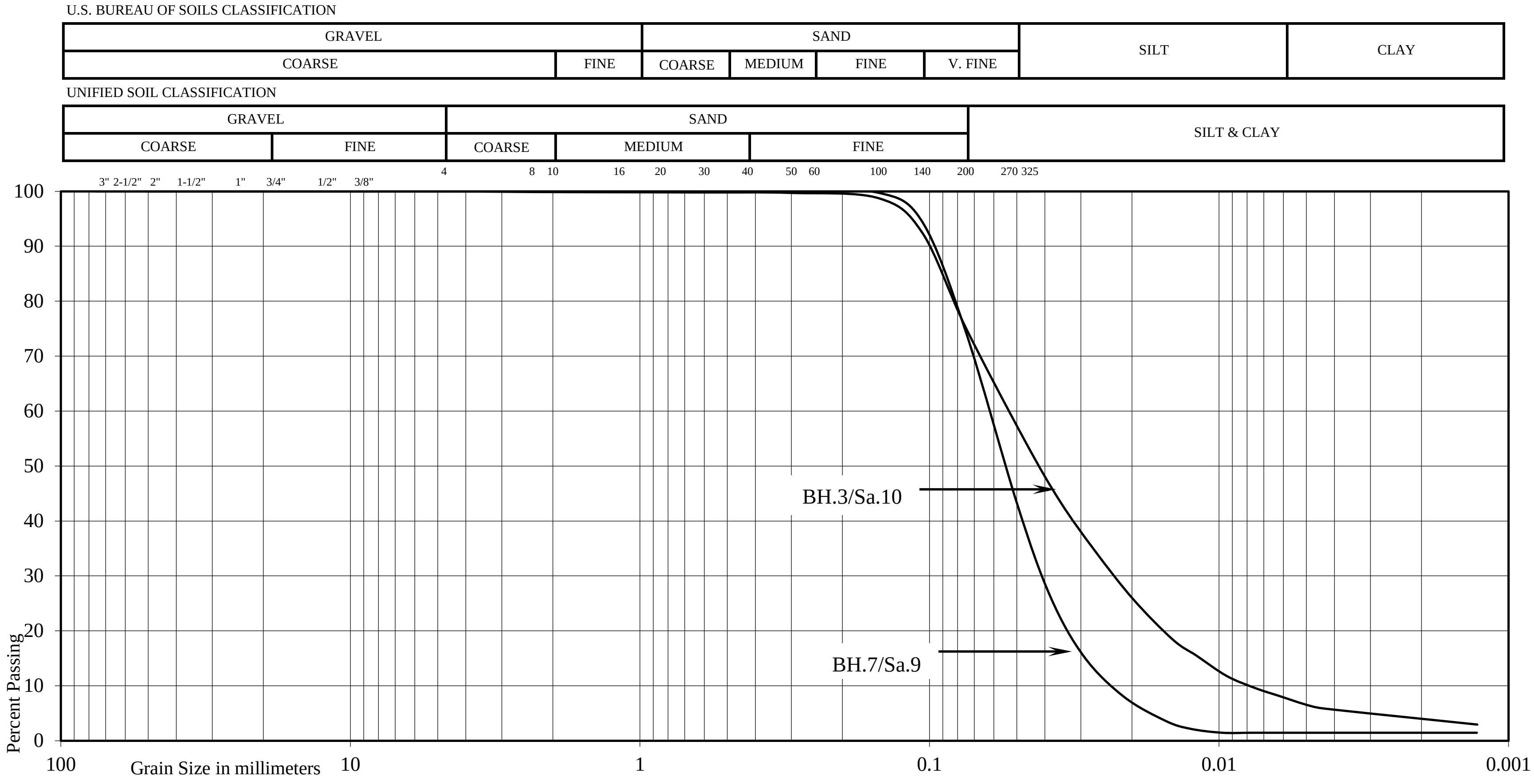
Classification of Sample [& Group Symbol]: SILT
trs. of clay and fine sand

Figure: 12

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 1506-S092



Project:	Proposed Residential Development	
Location:	12529 Chinguacousy Road, North of Mayfield Road, Town of Caledon	
Borehole No:	3	7
Sample No:	10	9
Depth (m):	10.8	9.3
Elevation (m):	248.4	249.7

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

Classification of Sample [& Group Symbol]: SANDY SILT
a tr. of clay

Figure: 13

LEGEND

⊕ Borehole Location

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

Borehole Location Plan

SITE 12529 Chinguacousy Road, North of Mayfield Road, Town of Caledon

DESIGNED BY K.L.
CHECKED BY B.L.
DWG NO. 1
SCALE 1:5000
REF. NO. 1506-S092
DATE July 2015
REV -

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SUBSURFACE PROFILE
DRAWING NO.: 2
SCALE: AS SHOWN

JOB NUMBER: 1506-S092
REPORT DATE: August 2015
JOB LOCATION: 12529 Chinguacousy Road, North of Mayfield Road
Town of Caledon
JOB DESCRIPTION: Proposed Residential Development

LEGEND

▽ Water Level (End of Drilling)	≡ Cave-In	▼ Water Level (Stabilized)
▨ Topsoil/Topsoil Fill	▨ Silty Clay Till	▨ Silty Clay
▥ Silt	▥ Sandy Silt