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

BARRIE	MISSISSAUGA	OSHAWA	NEWMARKET	MUSKOKA	HAMILTON
TEL: (705) 721-7863	TEL: (905) 542-7605	TEL: (905) 440-2040	TEL: (905) 853-0647	TEL: (705) 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

A REPORT TO
ACORN NE STOUFFVILLE INC.

A GEOTECHNICAL INVESTIGATION FOR PROPOSED RESIDENTIAL DEVELOPMENT

12875 TENTH LINE

TOWN OF WHITCHURCH-STOUFFVILLE

REFERENCE NO. 1804-S036

MARCH 2026
(REVISION TO REPORT DATED MAY 2018)

DISTRIBUTION

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1.0 INTRODUCTION

In accordance with written authorization from Mr. Paul Mintz of Acorn NE Stouffville Inc., dated October 29, 2025, a geotechnical report update is carried out for a parcel of land located at 12875 Tenth Line, in the Town of Whitchurch-Stouffville.

The original geotechnical investigation, as authorized by Mr. Lynn Barkey of The Acorn Development Corporation on April 9, 2018, along with the additional hydrogeological work carried out in 2019, 2020 and 2026, are incorporated into this geotechnical report update.

The purpose of this present report is to review the subsurface conditions from the original geotechnical report from 2018 and the additional hydrogeological work performed in 2019, 2020 and 2026, and to determine the engineering properties of the disclosed soils for the design and construction of a residential development based on the latest Conceptual Demonstration plan prepared by Bousfield Inc., updated January 2026.

2.0 SITE AND PROJECT DESCRIPTION

The subject site, located in the northeastern portion of the Town of Whitchurch-Stouffville, lies within the Physiographic Region of South Slope. A review of the Quaternary Geology data published by Ontario Geological Survey indicates that the overburden at the site consists of the Halton Till plain, which is characterized predominantly as a silt to silty clay matrix, high in matrix carbonate content and clast poor. Beneath the relatively shallow upper Halton Till, the area is underlain by sediments derived from the Oak Ridges Moraine Aquifer Complex (ORAC), which is primarily composed of interbedded fine sand and silt deposits. Based on interpretation of the geological cross-section from the Oak Ridges Moraine Groundwater Program (ORMGP), the ORAC unit within the area has an approximate thickness of 27 to 30 m.

The subject site, encompassing 5.67 hectares in area, is located on the east side of Tenth Line, approximately 300 m south of Bethesda Sideroad in the Town of Whitchurch-Stouffville. At the time of investigation, in 2018, the site was a farm field, with a barn building located adjacent to Tenth Line and a residence situated in the southern portion of the property, accessed by a driveway from Tenth Line. The existing site gradient is undulating, and the grading of the site descends toward the south and east, and toward the Reesor Creek valley system east of the site.

Based on the Conceptual Demonstration Plan prepared by Bousfields Inc., the site will be developed into a residential subdivision consisting of townhouse blocks and mixed-use residential buildings fronting Tenth Line, which will be provided with municipal services and paved roadways. The mixed-use residential buildings are understood to have up to 2 levels of underground parking garage. The remaining areas within the property are reserved for a park block and environmental lands.

3.0 **FIELD WORK**

The field work from the geotechnical and hydrogeological investigations described above, consists of a total of 25 drilled locations and 13 monitoring wells. The boreholes are numbered in the 100-, 200- and 300-series to differentiate them from the original 2018 geotechnical investigation:

- Twelve (12) boreholes (Boreholes 1 to 12, inclusive), extending to depths ranging from 6.3 to 6.5 m below the prevailing ground surface, were completed on April 11 and 12, 2018.
- Six (6) boreholes (Boreholes 101 to 106, inclusive), extending to a depth of 8.1 below the prevailing ground surface, were completed on April 18 and 22, 2019, to facilitate the installation of monitoring wells.
- Three (3) boreholes (Boreholes 201 to 203, inclusive), extending to depths of 7.8 and 8.1 m below the prevailing ground surface, were completed on March 4, 2020, to facilitate the installation of monitoring wells.
- Four (4) boreholes (Boreholes 301 to 304, inclusive), extending to depths of 7.6 to 8.1 m below the prevailing ground surface, were completed on December 8, 2025, to facilitate the installation of monitoring wells.

The borehole and monitoring well locations are shown on the Borehole and Monitoring Well Location Plan, Drawing No. 1, enclosed.

The boreholes were advanced by a track-mounted machine using solid stem augers, and equipped with split spoon sampler for soil sampling. Standard Penetration Tests, using the procedures described on the enclosed “List of Abbreviations and Terms”, were performed at intervals to the sampling depths. The test results are recorded as the Standard Penetration Resistance (or ‘N’ values) of the subsoil. The compactness of the cohesionless 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.

Upon completion of borehole drilling and sampling in 2019 and 2020, 50-mm diameter monitoring wells were installed at 9 borehole locations, with a 2-well cluster at one borehole location. A suffix of ‘S’ or ‘D’, representing the shallow well and deep well, was used to differentiate the well depths at the nested well location. These monitoring wells (100- and 200-series) were subsequently decommissioned in May 2025. In December 2025, 4 replacement monitoring wells were installed at the 300-series borehole locations. The depth and details of the monitoring wells are shown on the corresponding Borehole Logs, enclosed in the Appendix A.

The ground elevation at each borehole location was determined using hand-held Global Navigation Satellite System (GNSS) equipment.

4.0 SUBSURFACE CONDITIONS

The investigation has disclosed that beneath a topsoil veneer and a layer of earth fill in most of the borehole locations, the site is generally underlain by strata of sandy silt till/silty sand till, interstratified with or overlying deposits of silty clay, silty clay till, silt/sandy silt, and sand.

Detailed descriptions of the subsurface conditions are presented on the Borehole Logs, comprising Figures 1 to 12, inclusive. The revealed stratigraphy is plotted on the Subsurface Profile, Drawing Nos. 2A and 2B. The engineering properties of the disclosed soils are discussed herein.

4.1 Topsoil

The revealed topsoil veneer ranges from 13 to 40 cm in thickness. Thicker topsoil layers may occur in places, especially in low-lying areas that have been filled during previous farming activities.

4.2 Earth Fill

A layer of earth fill was contacted below the topsoil at most of the borehole locations. It consists of sand and silt, with clay, gravel, mixture of topsoil and rootlet inclusions, extending to approximate depths of 0.7 to 1.4 m from the prevailing ground surface. At Borehole 7, the fill extends to a depth of 2.2 m below grade.

The earth fill is in moist to wet conditions, with natural water content values ranging from 10% to 35%, and a median of 20%. The high water content values may be attributed to the presence of topsoil and organic inclusions in the earth fill.

One must be aware that the samples retrieved from boreholes may not be truly representative of the geotechnical quality of the earth fill, and do not indicate whether the topsoil beneath the earth fill was completely stripped. This should be further assessed by test pits at the time of construction.

4.3 Sandy Silt Till/Silty Sand Till

Native sandy silt till and silty sand till were contacted across the site in most of the boreholes below the earth fill. They consist of a random mixture of soil particle sizes ranging from clay to gravel, with the sand and silt being the predominant fraction. Hard resistance to augering was encountered in places, showing occasional cobbles and boulders in the till stratum. Grain size analyses were performed on representative samples of the silt and sand tills; the results are plotted on Figure 13.

The obtained ‘N’ values of the deposits range from 2 to more than 100, with a median of 32 blows per 30 cm of penetration, showing the compactness of the tills as very loose to very dense, being generally dense. The very loose and loose tills are generally restricted to the surficial weathered zone near the ground surface.

The natural water content values of the till samples range from 7% to 24%, with a median of 11%, indicating moist to very moist, generally moist conditions.

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

- High frost susceptibility with moderate soil-adfreezing potential.
- Moderately low water erodibility.
- The tills will be stable in relatively steep cuts; however, under prolonged exposure, localized erosion and sheet collapse may occur.

4.4 Silty Clay/Silty Clay Till

The silty clay till deposit, similar in structure and composition as the sandy silt till, was contacted below the earth fill in Boreholes 4, 11 and 105. It consists of a random mixture of soils; the particle sizes range from clay to gravel, with the clay and silt fraction exerting the dominant influence on its soil properties. The obtained ‘N’ values ranged from 7 to 24, with a median of 11 blows per 30 cm of penetration, showing that the clay till deposit is firm to very stiff, being generally stiff in consistency.

The silty clay deposit was contacted below the sandy silt till or silty clay till at depths of 3.3 to 4.6 m at Boreholes 4, 5, 6 and 104. It is laminated with occasional sand and silt seams and layers. The obtained 'N' values ranged from 11 to 42, with a median of 26 blows per 30 cm of penetration, showing that the clay is stiff to hard, being generally very stiff in consistency.

The natural water content values of the clay and clay till samples were determined, and the results are plotted on the Borehole Logs. The values for the clay range from 16% to 23%, with a median of 18%, and varies from 11% to 21%, with a median of 12% for the clay till, showing that the clay and clay till deposits are generally in moist conditions.

The engineering properties of the clay and clay till are presented below:

- High frost susceptibility and high soil-adfreezing potential.
- Low water erodibility.
- They will be stable in relatively steep cut. However, prolonged exposure will allow infiltrating precipitation to saturate the fissures, leading to localized sloughing.

4.5 **Silt/Sandy Silt**

The silt and sandy silt deposits were encountered at various depths in Boreholes 1, 2, 3, 7, 9 and 11, 101, 102, 103D, 203, 301 and 303. It is fine grained with some clay and occasional clay and sand seams and layers. Grain size analyses were performed on 2 representative samples and the results are plotted on Figure 14.

The obtained 'N' values ranged from 4 to over 100, with a median of 42 blows per 30 cm of penetration, showing the compactness of the silts is loose to very dense, being generally dense. The loose silt was encountered within the surficial weathered zone near the ground surface.

The natural water content values of the silt samples were range from 10% to 24%, with a median of 18%, showing that the silts are in moist to wet, generally very moist conditions.

The engineering properties of the silt and sandy silt are presented below:

- High frost susceptibility and moderately high soil-adfreezing potential.

- High water erodibility; they are susceptible to migration through small openings under seepage pressure.
- In excavation, the silts will slough and run slowly with seepage bleeding from the cut face. They will boil with an approximate piezometric head exceeding 0.3 m.

4.6 **Sand**

The sand deposit was encountered below the earth fill at Boreholes 8 and 12. At Boreholes 1, 3, 5 (201), 9 and 303, the sand deposit was contacted in the lower stratigraphy below 4.3, 6.0 or 7.6 m from the prevailing ground surface. A grain size analysis was performed on a silty sand sample; the result is presented on Figure 15.

Sample examinations show that the sand varies from fine grained to well graded, with some silt to being silty. The obtained ‘N’ values range from 15 to over 100, with a median of 45 blows per 30 cm of penetration, showing the compactness of the sand deposit is compact to very dense, being generally dense.

The natural water content values of the sand range from 3% to 19%, with a median of 10%, showing damp to wet conditions, generally being moist.

The engineering properties of the sand are presented below:

- High in frost susceptibility and moderately high soil adfreezing potential.
- Highly water erodible, the sand particles will migrate under the hydrostatic pressure.
- In excavation, the sand will slough, run with seepage and boil under an approximate piezometric head exceeding 0.3 m.

4.7 **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 +
Sandy Silt Till/ Silty Sand Till	7 to 24 (median 11)	12	8 to 15
Silty Clay/ Silty Clay Till	16 to 23 (median 18) 11 to 21 (median 12)	16 to 18	12 to 22
Silt/Sandy Silt	10 to 24 (median 18)	12 to 13	8 to 15
Sand	3 to 19 (median 10)	10	6 to 13

* The above values are provided as a guideline. Standard Proctor Tests must be performed on bulk samples collected from site during construction prior to backfill and compaction.

Based on the above findings, the on-site soils are generally suitable for 95% or + Standard Proctor compaction. However, parts of the silts and sand may be too wet and will require aeration prior to structural compaction. The aeration can be achieved by stockpiling or spreading the wet soils thinly on the ground during dry and warm weather.

In using the existing earth fill for structural backfill, pavement subgrade or slab-on-grade construction, it must be subexcavated, sorted free of concentrated topsoil inclusions or deleterious materials, and properly recompacted in layers. If excessive topsoil is present or cannot be sorted, the earth fill can only be reused in landscaped areas.

5.0 SLOPE STABILITY STUDY

The property is situated on the tableland of the Reesor Creek valley. A slope stability study is carried out for the west valley slope in the southeast corner of the site where the slope gradient is steeper than 6H:1V. The details and results are presented in a separate letter.

6.0 GROUNDWATER CONDITIONS

The boreholes were checked for the presence of groundwater and the occurrence of cave-in upon completion of drilling. All 2018 boreholes remained dry except Boreholes 3, 4, 5, 6, and 12, where groundwater level was measured at depths ranging from 0.9 to 5.9 m, or from El. 287.6 to 289.7 m.

Subsequent to the installation of monitoring wells in 2019 and 2020, groundwater levels were recorded between April 2019 and March 2023. At the time of report preparation, groundwater records for the 300-series monitoring wells are only limited to December 2025 and January 2026. The highest and lowest records to date are summarized in Table 2. The detailed monitoring well records are enclosed in Appendix B for reference.

Table 2 - Groundwater Level in Monitoring Wells

MW [a] No.	**Ground Elevation (m)**	**Well Depth (m)**	**Lowest**		**Highest**	
			Depth (m)	**El. (m)**	**Depth (m)**	**El. (m)**
101	298.2	7.3	7.0	291.2	6.9	291.3
102	299.1	7.6	7.2	291.9	7.1	292.0
103D [b]	292.2	7.6	4.1	288.1	0.4	291.8
103S	292.1	4.6	3.1	289.0	0.4	291.7
104	296.4	7.6	7.4	289.0	5.5	290.9
105	297.1	7.6	5.7	291.4	5.7	291.4
106	295.5	7.6	7.2	288.3	5.1	290.4
201	292.4	7.6	5.3	287.1	3.1	289.3
202 [c]	291.7	7.6	2.6	289.1	1.1	290.6
203	293.1	7.6	4.6	288.5	2.1	291.0
301	297.0	7.6	Dry	-	Dry	-
302	291.7	7.6	1.1	290.6	0.8	290.9
303	294.3	7.6	7.4	286.9	7.2	287.1
304	295.6	7.6	Dry	-	Dry	-

[a] MW101 to 106, and 201 to 203, inclusive, were decommissioned in May 2025.

[b] MW103D was damaged in April 2023.

[c] MW202 was damaged in May 2020 and replaced in June 2020.

Detailed groundwater records and profiles will be provided in the hydrogeological assessment, to be presented under separate cover. The highest groundwater levels range from El. 292.0 to 287.1 m, and are primarily derived from the silt and sand layers in the lower stratigraphy. Based on the water levels recorded in the monitoring wells, the groundwater shows a general easterly drainage pattern toward the low-lying area in the vicinity of Borehole 5 and 201. The groundwater will fluctuate with seasons and may be affected by the water level of the Reesor Creek located to the east of the property. During wet seasons, localized shallow water table derived from infiltrated precipitation may occur in the sand and silt layers embedded in the tills.

7.0 DISCUSSION AND RECOMMENDATIONS

The investigation has revealed that beneath a veneer of topsoil, with a layer of earth fill in most of the borehole locations, the site is generally underlain by strata of sandy silt till or silty sand till, interstratified with or overlying deposits of silty clay, silty clay till, silt/sandy silt, and sand. The earth fill, consisting of a mixture of sand, silt and clay, with topsoil and rootlet inclusions in places, extends to depths ranging from 0.7 to 2.2 m below grade.

The highest groundwater was recorded to range from El. 292.0 to 287.1 m across the site, with an easterly drainage pattern generally following the topography of the site. The groundwater will fluctuate with seasons, and local shallow water table derived from infiltrated precipitation may occur in the sand seams or layers in the tills during wet seasons.

The Conceptual Demonstration Plan prepared by Bousfields Inc. indicates that the site will be developed as a residential subdivision consisting of townhouse blocks and mixed-use residential buildings fronting Tenth Line, which will be provided with municipal services and paved roadways. The mixed-use residential buildings are understood to have up to 2 underground parking levels. The balance of the site is reserved for park and environmental lands. The geotechnical findings warranting special consideration for the proposed project are presented below:

1. The topsoil must be stripped prior to project construction, and can only be reused for landscaping purposes.
2. Due to the unknown history and the presence of topsoil inclusions in the earth fill, it is not suitable for supporting any structure sensitive to movement in its present state. In using the fill for structural backfill, pavement subgrade or slab-on-grade construction, it must be subexcavated, sorted free of concentrated topsoil inclusions or deleterious materials, and properly recompacted in layers.
3. Upon demolishing the existing structures, the debris and any underground utilities must be removed and disposed of off-site. The cavity can be backfilled according to engineered fill standards. Water wells, monitoring wells and septic system should also be removed and properly decommissioned.
4. Where additional earth filling is required for site grading, it is more economical to place an engineered fill for conventional footing, underground services and pavement construction.

5. The sound native soils and engineered fill are suitable for supporting the low-rise structures on conventional footings. For medium rise structures, the foundations should be supported on the native soil stratum.
6. In accordance to the Town of Whitchurch-Stouffville requirement, the underground or basement structures should be designed such that the underside of footings is founded at least 0.6 m above the seasonal high groundwater level, and be provided with a perimeter drainage system connected to a positive outlet.
7. If the underground or basement structure is to be founded in the wet silt or sand below the groundwater table, the submerged structure must be waterproofed and designed to resist the hydrostatic pressure.
8. Any excavation extending below the water-bearing strata must be stabilized by construction dewatering or depressurization. Details of appropriate dewatering methods should be referred to the hydrogeological assessment.
9. A Class ‘B’ bedding, consisting of compacted 19-mm Crusher-Run Limestone (CRL), is recommended for the construction of underground services. In saturated soils or where extensive dewatering is necessary, a Class ‘A’ concrete bedding should be used.

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

7.1 Site Preparation

The existing topsoil and surficial vegetation must be removed for site development. The existing earth fill, due to its unknown history and inclusion of topsoil and organics, should also be removed and assessed before reuse on site.

In the area of the demolished structures, all remaining debris must be removed and disposed off site The cavity can be backfilled according to engineered fill standards. Water wells, monitoring wells and septic system should also be removed and properly decommissioned.

Where additional earth fill is required for site grading, it is more economical to place engineered fill for conventional footing, underground services and pavement construction. The engineering requirements for a certifiable fill for road construction, municipal services, and footings designed with the recommended bearing pressures in Section 7.2 are presented below:

1. The exposed subgrade must be inspected and proof-rolled prior to any fill placement.

Any loose soil identified during proof-rolling must be subexcavated, sorted free of organics and deleterious materials, aerated before reuse for site grading and structural backfill.

2. Inorganic soils must be used for engineered fill construction, and they must be uniformly compacted in lifts of 20 cm thick to at least 98% Standard Proctor Maximum Dry Density (SPMDD) with its moisture content controlled near its optimum. If the foundations are to be built shortly after the fill placement, the densification process for the engineered fill must be increased to 100% SPMDD.
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 must be inorganic soils, free of deleterious or any material with environmental issue (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 it is hauled to the site.
5. The engineered fill must not be placed during the period where 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 fill is to be left over the winter months, adequate earth cover, or equivalent, must be provided for protection against frost action.
6. Where the fill is to be placed on sloping ground steeper than 3 horizontal (H):1 vertical (V), the face of the sloping ground should be benched or flattened so that it is suitable for safe operation of the compactor and the required compaction can be obtained.
7. The fill operation must be inspected on a full-time basis by a geotechnical technician under the direction of a geotechnical engineer.
8. The engineered fill envelope and finished elevations must be clearly and accurately defined in the field, and they must be precisely documented by a surveyor.
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 reinforced, or be designed by the structural engineer for the project to allow distribution of stress induced by the abrupt differential settlement. The total and differential settlements of 25 mm and 20 mm, respectively, should be considered in the design of the foundation founded on both engineered fill and native soils.
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 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.

11. The footing, slab-on-grade and underground services subgrade must be inspected by the geotechnical consulting firm which supervised the engineered fill placement. This is to ensure that the foundations and service pipes 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 any excavation.

7.2 **Foundations**

The Conceptual Demonstration Plan indicates that the development will consist of multi-storey mixed-use residential buildings fronting Tenth Line and townhouse blocks behind the buildings on the west side of Street ‘A’. It is understood that the mixed-use buildings may have up to 2 levels of underground parking structure. According to the Town of Whitchurch-Stouffville’s design requirement, the underside of footing is required to be founded a minimum 0.6 m above the seasonal high groundwater level, otherwise, the underground structure must be waterproofed to eliminate the need for long-term dewatering. Alternatively, a cut-off wall surrounding the underground structure can also be considered, subject to approval from the Town.

Townhouse Blocks

Conventional spread and strip footings can be used to support the house structures. The footings must be placed onto the engineered fill or sound native soil below the existing earth fill and weathered soil. The recommended soil bearing pressures for the design of conventional footings are provided below:

- Maximum Soil Bearing Pressure at Serviceability Limit State (SLS) = 150 kPa
- Factored Ultimate Bearing Pressure at Ultimate Limit State (ULS) = 240 kPa

The total and differential settlements of foundations designed with the recommended bearing pressure at SLS, are estimated to be 25 mm and 20 mm, respectively.

Mixed-Use Residential Buildings

For the construction of the multi-storey mixed-use residential buildings with up to 2 levels of underground parking garage, it is anticipated that the foundations will extend to approximately 8 m below the finished grade. Once the building design becomes available, additional boreholes must be completed to assess and verify the ground condition within the footprint of the building for the future development.

For design of the underground structures supported on conventional spread and strip footings, the underside of footings should be maintained at least 0.6 m above the groundwater level. As a preliminary and general guide, the recommended soil bearing pressures at SLS and ULS for the design of conventional spread and strip footings founded in the sound native soils are presented below:

- Maximum Allowable Bearing Pressure at SLS = 250 to 350 kPa
- Factored Ultimate Bearing Pressure at ULS = 350 to 500 kPa

The total and differential settlements for foundations designed with the recommended bearing pressures at SLS are estimated to be 25 mm and 20 mm, respectively.

Weaker soils were contacted in the clay till beneath the fill in the vicinity of Borehole 11 and 203. Should the proposed underground structure be founded in this soil stratum, lower bearing pressures of 200 kPa (SLS) and 300 kPa (ULS) should be used. This can be assessed during the detailed design stage once additional boreholes are carried out to elaborate on the available data.

Where the separation between the highest groundwater level and the underground structure is less than 0.6 m or the underground structures are submerged into the groundwater, the underground structure must either be provided with a cut-off wall surrounding the structure or the structure must be water-proofed and designed to resist the hydrostatic uplift pressure by a raft foundation.

The recommended soil bearing pressures and Modulus of Subgrade Reaction for the design of a raft foundation is provided below:

- Maximum Allowable Bearing Pressure at SLS = 400 kPa
- Factored Ultimate Bearing Pressure at ULS = 600 kPa
- Modulus of Subgrade Reaction = 30 MPa/m

The total and differential settlements for raft foundations designed using the recommended bearing pressure at SLS are estimated to be less than 30 mm and 20 mm, respectively.

One must be aware that the recommended bearing pressures are given as a guide for assessment. A comprehensive geotechnical investigation must be completed for each

future building within the property at the detailed design stage. Once detailed design of the underground structures is available, it should be reviewed by the project geotechnical engineer to verify the design bearing pressures at the respective underside of footing elevations.

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

The foundations for the multi-storey mixed-use residential buildings should meet the requirements specified in the latest Ontario Building Code. The structures should be designed to resist an earthquake force using Site Classification ‘D’ (stiff soil). A Multi-Channel Analysis of Surface Waves (MASW) survey can be performed to determine the appropriate shear wave velocity (V_s) for seismic design.

The footing 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.

If groundwater seepage is encountered in excavation, or the subgrade of the foundation is found to be wet, the foundation must be poured immediately after subgrade inspection or the subgrade should be protected by a concrete mud-slab immediately after exposure. This will prevent construction disturbance and costly rectification of the bearing subsoil.

7.3 Basement Structures and Slab-On-Grade

With the minimum 0.6 m separation maintained between the underside of footing and the seasonal groundwater level, the basement slab will likewise remain above the groundwater level. In conventional design, the perimeter walls of the basement structure should be provided with a drainage board and subdrain system at the wall base (Drawing No. 3). The perimeter walls of the underground structure should be designed to sustain a lateral earth pressure calculated using the soil parameters stated in Section 7.7. Any applicable surcharge loads adjacent to the proposed building, must also be considered in the design of the underground structure.

The house basement slab should be constructed on a granular base, minimum 15 cm thick, consisting of 19-mm Clear Stone, or equivalent, compacted to 100% SPMDD.

Should the proposed underground parking garage extend below the groundwater level, the underground structure must be waterproofed and designed to resist the hydrostatic pressure and buoyancy uplift forces or be provided with a cut-off wall system. The elevator pit of mixed-use buildings, which normally extends a few meters below the lowest basement floor level, should be designed as a submerged ‘tank’ structure with waterproofed pit walls and pit floor. A Modulus of Subgrade Reaction of 25 MPa/m can be used for the design of the underground parking floor slab.

The floor slab of the lowest underground parking garage should be constructed on a granular base, 20 cm thick, consisting of 19-mm CRL, or equivalent, compacted to the maximum SPMDD.

The subgrade for the floor slabs should consist of sound native soil or properly compacted inorganic earth fill. Any new fill should consist of organic-free soil, compacted to at least 98% SPMDD.

The exterior grade should slope away from the building structures to prevent ponding of water adjacent to the underground structures.

7.4 Underground Services

The subgrade for the underground services should consist of sound native soils or properly compacted, organic-free earth fill. Where earth fill, badly weathered, soft or loose soils are encountered, they should be subexcavated and replaced with bedding material compacted to at least 95% SPMDD.

A Class ‘B’ bedding, consisting of compacted 19-mm CRL, is recommended for the construction of the underground services. Where the subgrade consists of wet sand or silt, or it needs to be stabilized by extensive dewatering, a Class ‘A’ concrete bedding should be used for proper pipe support.

In order to prevent pipe floatation when the sewer trench is deluged with water, 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 pipe joints into manholes and catch basins should be leak-proof, or wrapped with an appropriate waterproof membrane. Openings to subdrains and catch basins should be shielded with a fabric filter to prevent blockage by silting.

All ductile iron pipes and metal fittings for the underground services should be protected against soil corrosion. For estimation for the anode weight requirements, the electrical resistivity of the disclosed soils in Table 4 can be used. The proposed anode weight must meet the minimum requirements as specified by the municipality standard.

7.5 **Backfilling in Trenches and Excavated Areas**

The on-site inorganic soils are suitable for trench backfill. Saturated soils should be properly stockpiled to drain the excess water or they can be spread thinly on the ground for aeration prior to be reused. In using the existing fill for structural backfill, pavement subgrade or slab-on-grade construction, it must be sorted free of concentrated topsoil inclusions or deleterious materials, and properly recompacted in layers. Boulders over 15 cm in size must be sorted and removed from the backfill material.

The backfill should be compacted to at least 95% SPMDD. In areas below the slab-on-grade and in the zone within 1.0 m below the road subgrade, the materials should be compacted to at least 98% SPMDD, with the water content at 2% to 3% drier than the optimum, in order 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 settlement largely occur adjacent to manholes, catch basins, service crossings, foundation walls and columns. In areas which are inaccessible to a heavy compactor, sand backfill which can be appropriately compacted using a smaller/handheld vibratory compactor should be used.

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

- Subsequent to backfilling a trench, one must be aware that minor future settlement is to be expected along the service alignment unless the sides of excavation are flattened to 2H:1V or the excavation is properly benched, and the lifts of the fill is limited to no more than 20 cm (or less if the backfilling conditions dictate) and uniformly compacted to achieve at least 98% SPMDD, with the moisture content stringently controlled within 2% to 3% of the optimum.
- It is often difficult to achieve uniform compaction of the backfill in the lower vertical section of a trench, particularly in the sector close to the trench walls or the sides of the box. These sectors must be backfilled with Granular 'B' Type I or sand, and the compaction must be carried out diligently prior to the placement of the backfill 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 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 groundwater movement is expected in the pipe bedding, trench backfill and/or sand fill mantle, anti-seepage collars (OPSD 802.095) should be provided.

7.6 Pavement Design

The road subgrade is anticipated to consist of silty and sandy subsoils. The recommended minimum pavement design for local residential and collector roads is presented in Table 3.

Table 3 - Road Pavement Design

Course	Thickness (mm)	OPS Specifications
Asphalt Surface	40	HL3
Asphalt Binder Local Residential Collector/Bus Route	 50 100	HL8
Granular Base	150	19-mm CRL
Granular Sub-base Local Residential Collector/Bus Route	 300 450	50-mm CRL

Prior to the placement of granular bases, the subgrade must be proof-rolled. Any weak or soft areas must be subexcavated and replaced with approved material and compacted in layers. In the zone within 1.0 m below the road subgrade, the backfill should be compacted to at least 98% SPMDD, with the water content at 2% to 3% drier than the optimum. In the lower zone, a 95%+ SPMDD compaction is considered adequate. All the granular bases should be compacted to 100% SPMDD.

The subgrade will suffer a strength regression if water is allowed to saturate the mantle. The following measures should therefore be incorporated in the construction procedures and road 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.
- Lot areas adjacent to the roadway should be properly graded to prevent ponding 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, the granular sub-base should be thickened in order to compensate for the inadequate strength of the soft or weak subgrade. This can be assessed during construction.
- Fabric filter-encased curb subdrains will be required on both sides of the roadway to meet the Town of Whitchurch-Stouffville requirements.

7.7 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**
Sandy Silt Till/Silty Sand Till	22.5	12.5	1.33	1.05
Silty Clay Till	22.5	12.5	1.30	1.05
Silty Clay	20.5	10.5	1.35	1.05
Sand and Silts	20.5	10.5	1.20	1.00
Lateral Earth Pressure Coefficients		**Active K_a**	**At Rest K_0**	**Passive K_p**
Compacted Earth Fill, Clay/Clay Till		0.39	0.56	2.56
Sandy Silt Till/Silty Sand Till, Sand and Silts		0.32	0.48	3.12

Table 4 - Soil Parameters (cont'd)

Coefficients of Permeability (k) and Percolation Time (T)	**K (cm/sec)**	**T (min/cm)**
Sand	10^{-3} to 10^{-4}	8 to 12
Silt/Sandy Silt	10^{-4} to 10^{-6}	12 to 50
Sandy Silt Till/Silty Sand Till	10^{-5} to 10^{-6}	20 to 50
Silty Clay/Silty Clay Till	10^{-7}	80+
Electrical Resistivity to Corrosion of Buried Metal		
Silty Clay/Silty Clay Till	3500 ohm·cm	
Sandy Silt Till/Silty Sand Till	4500 ohm·cm	
Silt/Sandy Silt/Sand	4500 ohm·cm	
Coefficients of Friction		
Between Concrete and Granular Base	0.50	
Between Concrete and Sound Native Soils	0.35	

7.8 Excavation

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

Table 5 - Classification of Soils for Excavation

Material	Type
Sound Tills, Silty Clay	2
Existing Earth Fill, Weathered Soils, drained Sand and Silts	3
Saturated Soils	4

In excavation above the saturation level, groundwater yield is expected to be slow in rate and limited in quantity. It can be drained locally and removed by conventional pumping from sumps. Any excavation extending into the saturated sand or silt, construction dewatering will be required to lower the groundwater to at least 1.0 m below the intended excavation depth. Dewatering methods such as vigorous pumping from closely spaced sump-wells or, if necessary, the use of well-point dewatering system may be used. Detailed groundwater conditions and appropriate dewatering methods should be referred to the hydrogeological report, presented under a separate cover.

Prospective contractors must be asked to assess the in situ subsurface conditions for soil cuts by digging test pits to at least 1.0 m below the intended bottom of excavation. Where stable excavation slope is not feasible, the excavation must be supported by shoring, or the service trenches should be supported by trench boxes.

8.0 LIMITATIONS OF REPORT

This report was prepared by Soil Engineers Ltd. for the account of Acorn NE Stouffville Inc. and for review by their designated consultants and government agencies. Use of this report is subject to the conditions and limitations of the contractual agreement.

The material in the report reflects the judgement of Hui Wing Yang, P.Eng. and Kelvin Hung, 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, is the responsibility of such Third Parties. Soil Engineers Ltd. accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

SOIL ENGINEERS LTD.

LICENSED PROFESSIONAL ENGINEER
Mar 30, 2026
H. W. YANG
100126690
PROVINCE OF ONTARIO

Hui Wing Yang, P.Eng.

LICENSED PROFESSIONAL ENGINEER
3/30/26
K. W. K. HUNG
100124295
kH
PROVINCE OF ONTARIO

Kelvin Hung, P.Eng.
HWY/KH:

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)	Compactness
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

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GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE

JOB NO.: 1804-S036

LOG OF BOREHOLE NO.: 1

FIGURE NO.: 1

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger

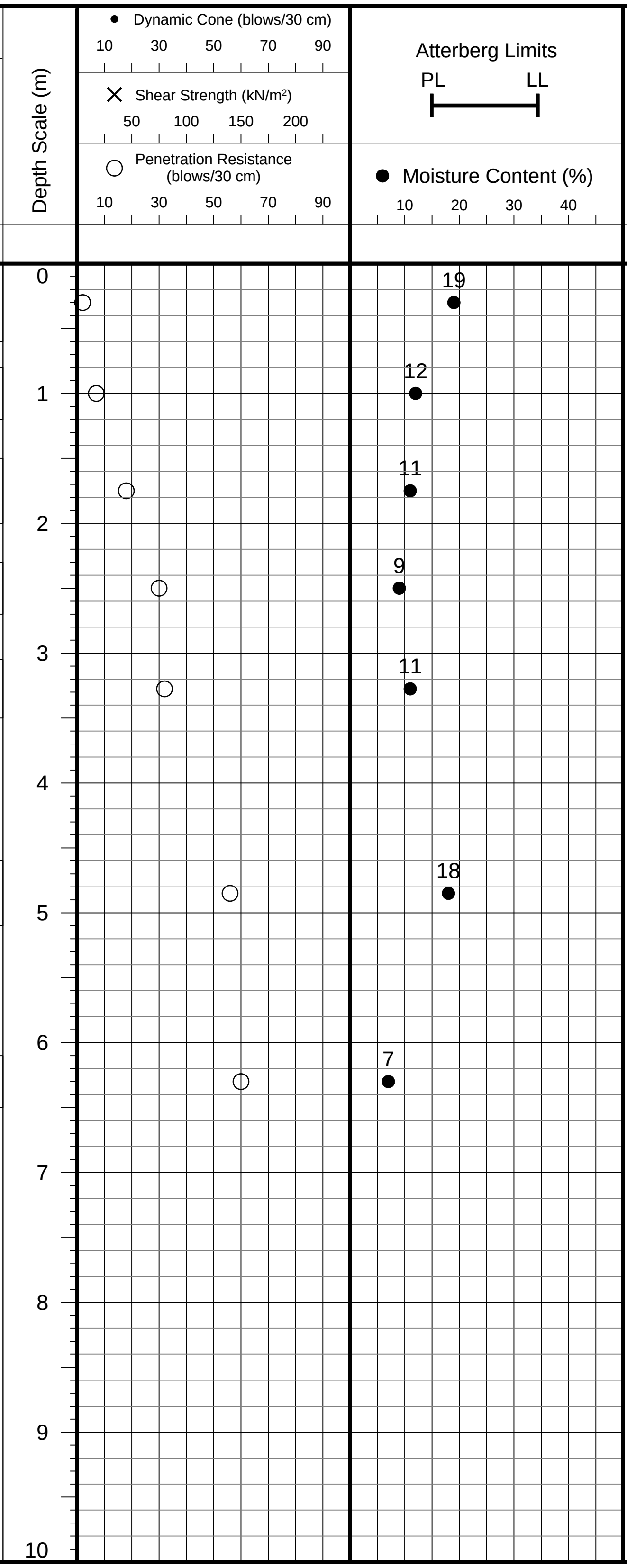
PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

DRILLING DATE: April 11, 2018

El. (m) Depth (m)	SOIL DESCRIPTION
297.2	Ground Surface
0.0	**35 cm TOPSOIL**
	EARTH FILL dark brown to brown sandy silt, some clay and gravel, scattered topsoil
295.8 1.4	Brown, compact to dense **SANDY SILT TILL** some clay and gravel occ. sand seams and layers, cobbles and boulders
292.9 4.3	Brown, very dense **SILT** some clay, occ. sand seams
291.2 6.0	Brown, very dense **SAND** fine grained, some silt
290.7 6.5	**END OF BOREHOLE**

SAMPLES

Number	Type	N-Value
1	DO	2
2	DO	7
3	DO	18
4	DO	30
5	DO	32
6	DO	56
7	DO	60



WATER LEVEL

Dry on completion

JOB NO.: 1804-S036

LOG OF BOREHOLE NO.: 2

FIGURE NO.: 2

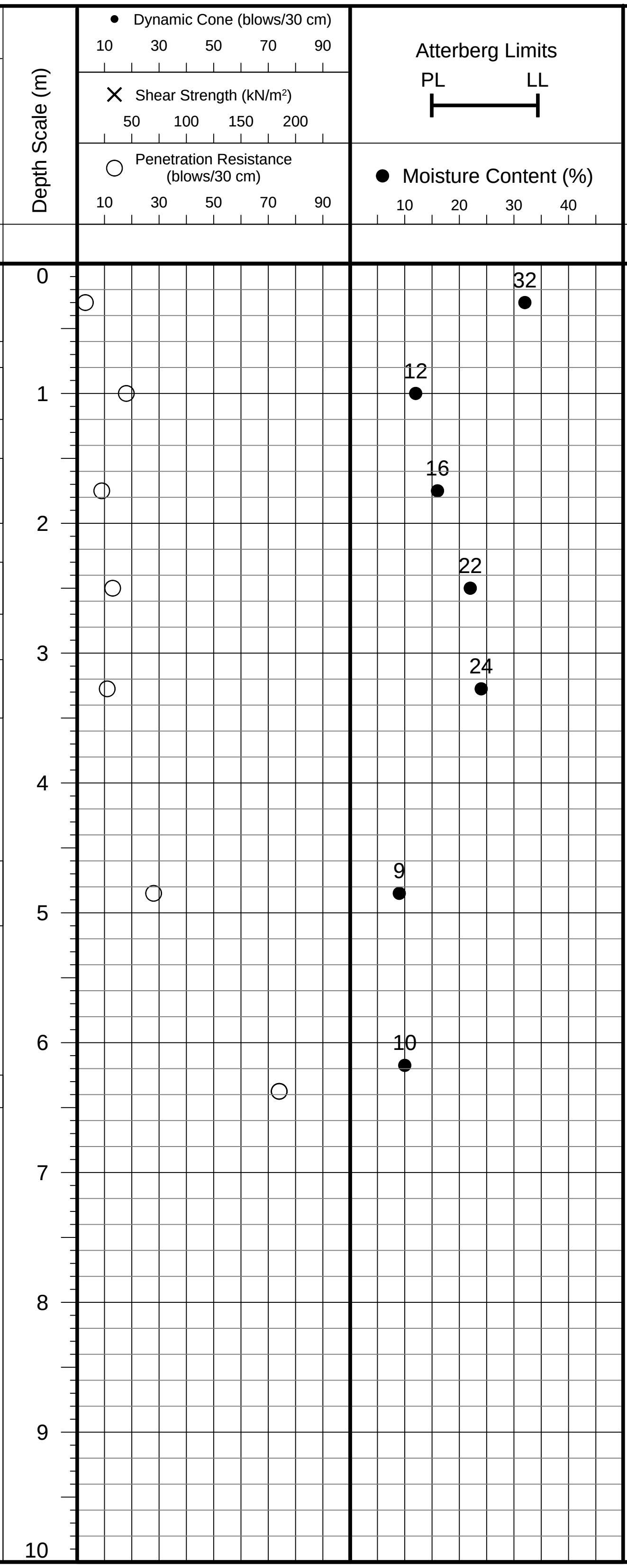
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

DRILLING DATE: April 11, 2018

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value	WATER LEVEL
298.0	Ground Surface				
0.0	**35 cm TOPSOIL**	1	DO	3	Dry on completion
	EARTH FILL dark brown sandy silt mixed with topsoil				
297.2 0.8	Brown, loose to compact **SANDY SILT TILL** some clay and gravel occ. sand seams and layers, cobbles and boulders	2	DO	18	
		3	DO	9	
295.9 2.1	Brown, compact **SILT** occ. clay seams and layers	4	DO	13	
		5	DO	11	
293.7 4.3	Brown, compact to very dense **SANDY SILT TILL** some clay and gravel occ. sand seams and layers, cobbles and boulders	6	DO	28	
		7A	DO		
		7B	DO	74	
291.5 6.5	**END OF BOREHOLE**				



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JOB NO.: 1804-S036

LOG OF BOREHOLE NO.: 3

FIGURE NO.: 3

PROJECT DESCRIPTION: Proposed Residential Development

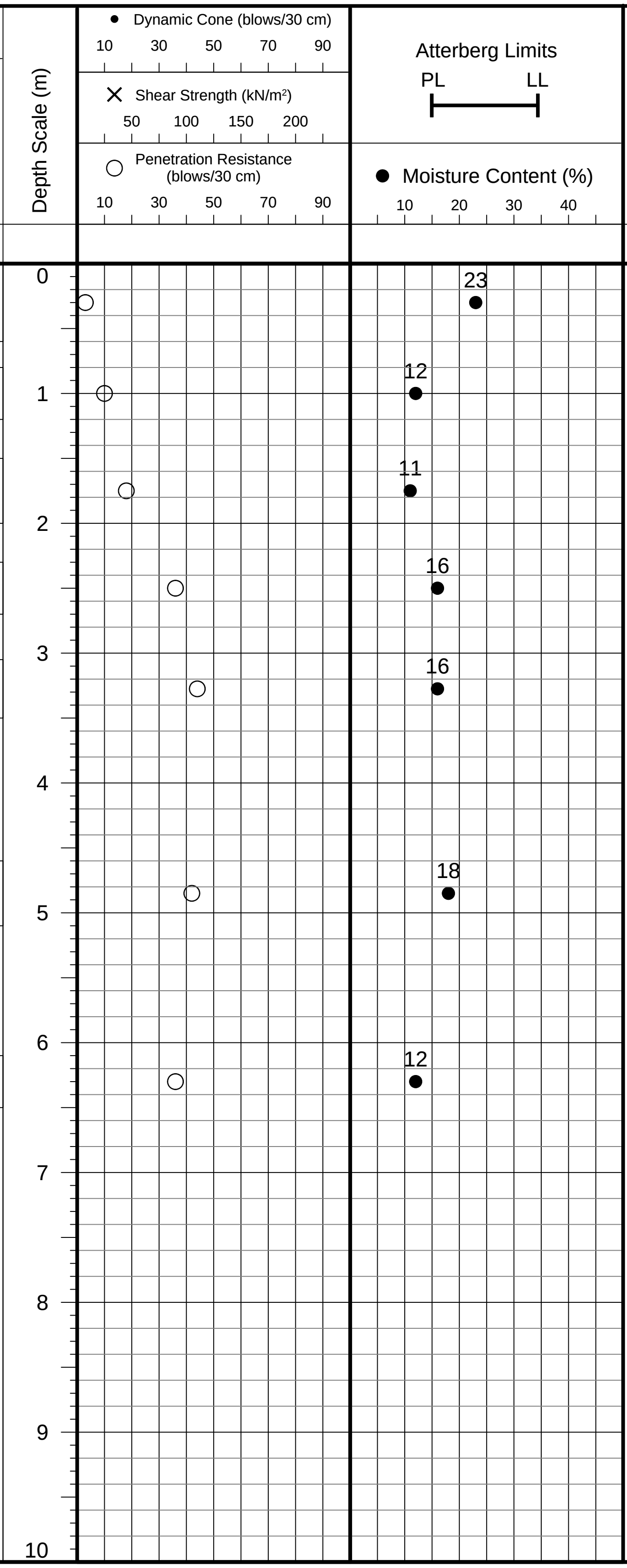
METHOD OF BORING: Flight-Auger

PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

DRILLING DATE: April 11, 2018

El. (m) Depth (m)	SOIL DESCRIPTION
294.4	Ground Surface
0.0	**25 cm TOPSOIL** **EARTH FILL** dark brown to brown sandy silt, some clay, occ. topsoil pockets annd organics
293.0 1.4	Brown, compact to dense **SANDY SILT TILL** some clay and gravel occ. sand seams and layers, cobbles and boulders
291.6 2.8	Brown, dense **SILT** seams of fine sand occ. clay layers
288.4 6.0	Grey, dense **SAND** fine to medium grained, some silt, a trace of gravel
287.9 6.5	**END OF BOREHOLE**

Number	Type	N-Value	Moisture Content (%)
1	DO	3	23
2	DO	10	12
3	DO	18	11
4	DO	36	16
5	DO	44	16
6	DO	42	18
7	DO	36	12



WATER LEVEL

W.L @ El. 288.5 m on completion ∇
CAVE-IN @ El. 288.5 m on completion

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JOB NO.: 1804-S036

LOG OF BOREHOLE NO.: 4

FIGURE NO.: 4

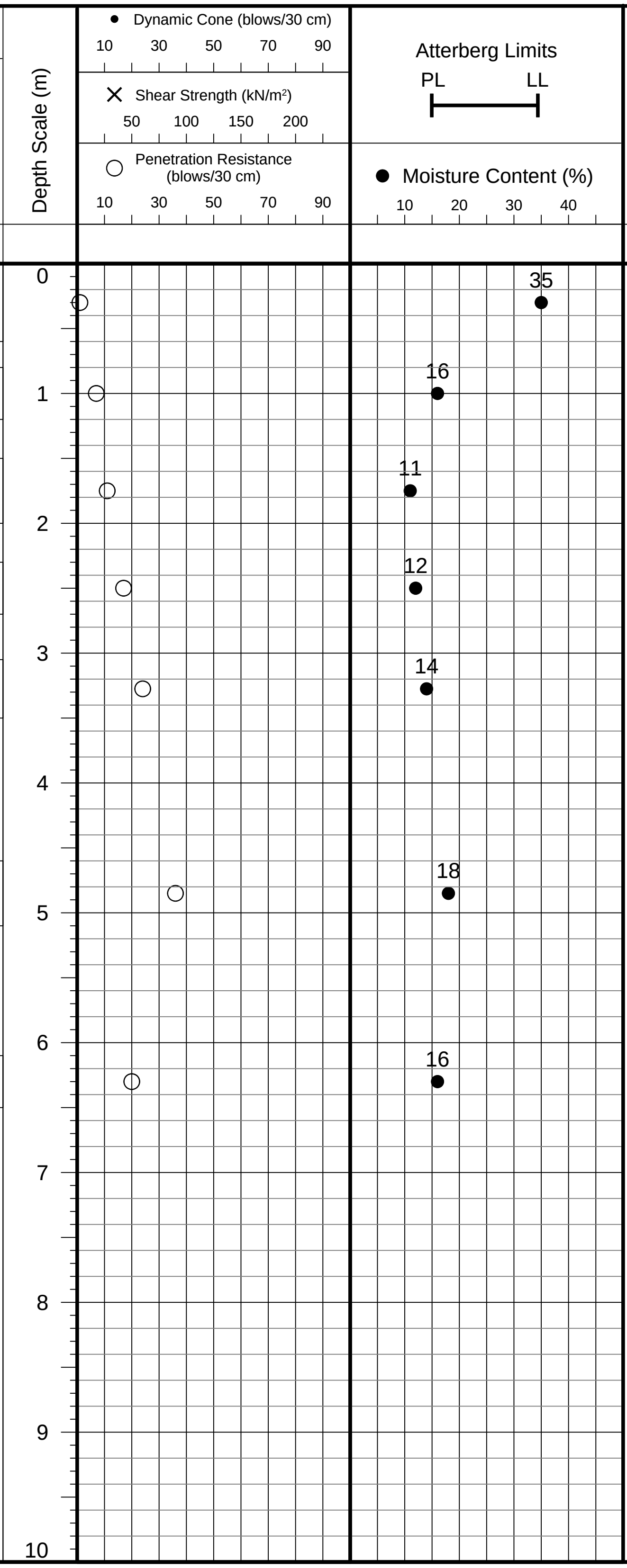
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

DRILLING DATE: April 11, 2018

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	WATER LEVEL
290.6 0.0	Ground Surface **25 cm TOPSOIL** **EARTH FILL** dark brown to grey sandy silt, layers of silty sand mixture of topsoil at 0.6 m	1 2	DO DO	1 7	W.L @ El. 289.7 m on completion ▽
289.1 1.5	Brown, stiff to very stiff **SILTY CLAY TILL** some sand and gravel occ. cobbles and boulders brown / grey	3 4	DO DO	11 17	
287.3 3.3	Grey, very stiff to hard **SILTY CLAY** occ. seams of fine sand	5 6 7	DO DO DO	24 36 20	
284.1 6.5	**END OF BOREHOLE**				



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Page: 1 of 1

JOB NO.: 1804-S036

LOG OF BOREHOLE NO.: 5

FIGURE NO.: 5

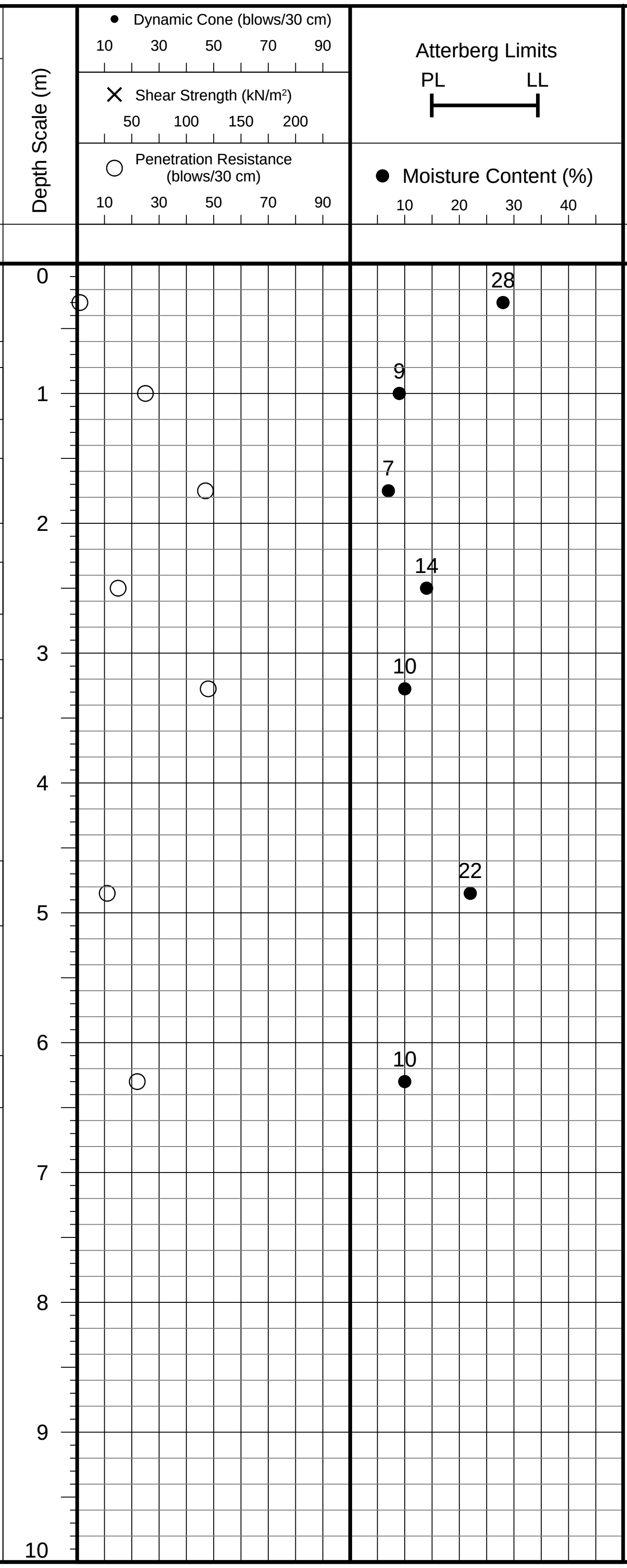
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

DRILLING DATE: April 11, 2018

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
292.1	Ground Surface			
0.0	**25 cm TOPSOIL**	1	DO	1
	EARTH FILL dark brown sandy silt, some clay, organics and rootlets			
291.4 0.7	Brown, compact to dense **SANDY SILT TILL** some clay and gravel occ. sand seams and layers, cobbles and boulders	2	DO	25
		3	DO	47
		4	DO	15
		5	DO	48
287.8 4.3	Grey, stiff **SILTY CLAY** occ. seams of fine sand	6	DO	11
286.1 6.0	Grey, compact **SAND** fine grained, some silt	7	DO	22
285.6 6.5	**END OF BOREHOLE**			



WATER LEVEL

W.L @ El. 289.1 m on completion

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JOB NO.: 1804-S036

LOG OF BOREHOLE NO.: 6

FIGURE NO.: 6

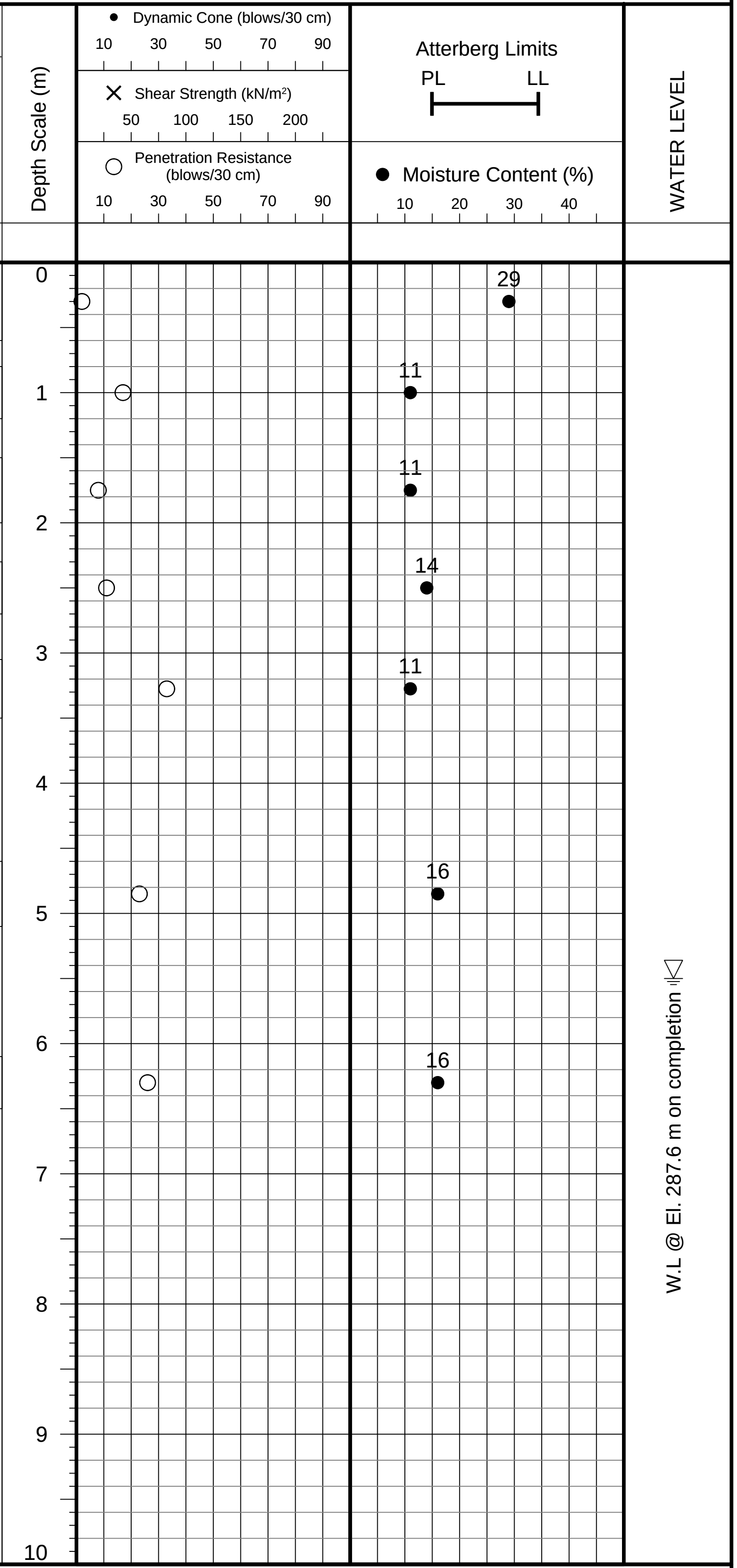
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

DRILLING DATE: April 12, 2018

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
293.1	Ground Surface			
0.0	**30 cm TOPSOIL**	1	DO	2
	EARTH FILL dark brown sandy silt, some clay and gravel, scattered topsoil and organics			
292.2 0.9	Brown, loose to dense **SANDY SILT TILL** some clay and gravel occ. sand seams and layers, cobbles and boulders	2	DO	17
		3	DO	8
		4	DO	11
		5	DO	33
288.9 4.2	Grey, very stiff **SILTY CLAY** layers of sandy silt, occ. wet sand layers	6	DO	23
		7	DO	26
286.6 6.5	**END OF BOREHOLE**			



W.L @ El. 287.6 m on completion ∇

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JOB NO.: 1804-S036

LOG OF BOREHOLE NO.: 7

FIGURE NO.: 7

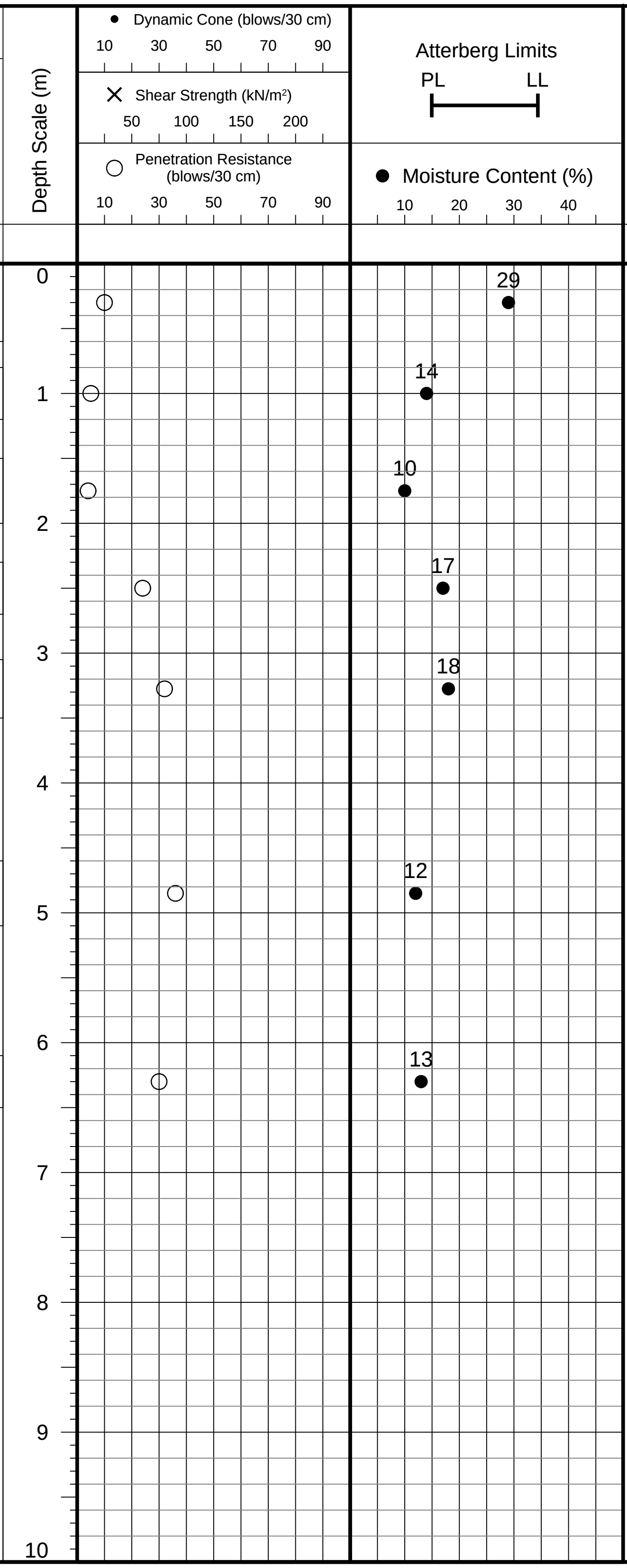
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

DRILLING DATE: April 12, 2018

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
296.4	Ground Surface			
0.0	**40 cm TOPSOIL**	1	DO	10
	EARTH FILL dark brown to brown silty clay, some sand and gravel, scattered topsoil and organics	2	DO	5
		3	DO	4
294.2 2.2	Brown, compact to dense **SILT** layers of silty clay occ. seams of fine sand	4	DO	24
		5	DO	32
292.1 4.3	Brown, dense **SILTY SAND TILL** a trace of gravel, some clay occ. sand seams and layers, cobbles and boulders	6	DO	36
290.4 6.0	Brown, dense **SANDY SILT** layers of silty fine sand	7	DO	30
289.9 6.5	**END OF BOREHOLE**			



WATER LEVEL

Dry on completion

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JOB NO.: 1804-S036

LOG OF BOREHOLE NO.: 8

FIGURE NO.: 8

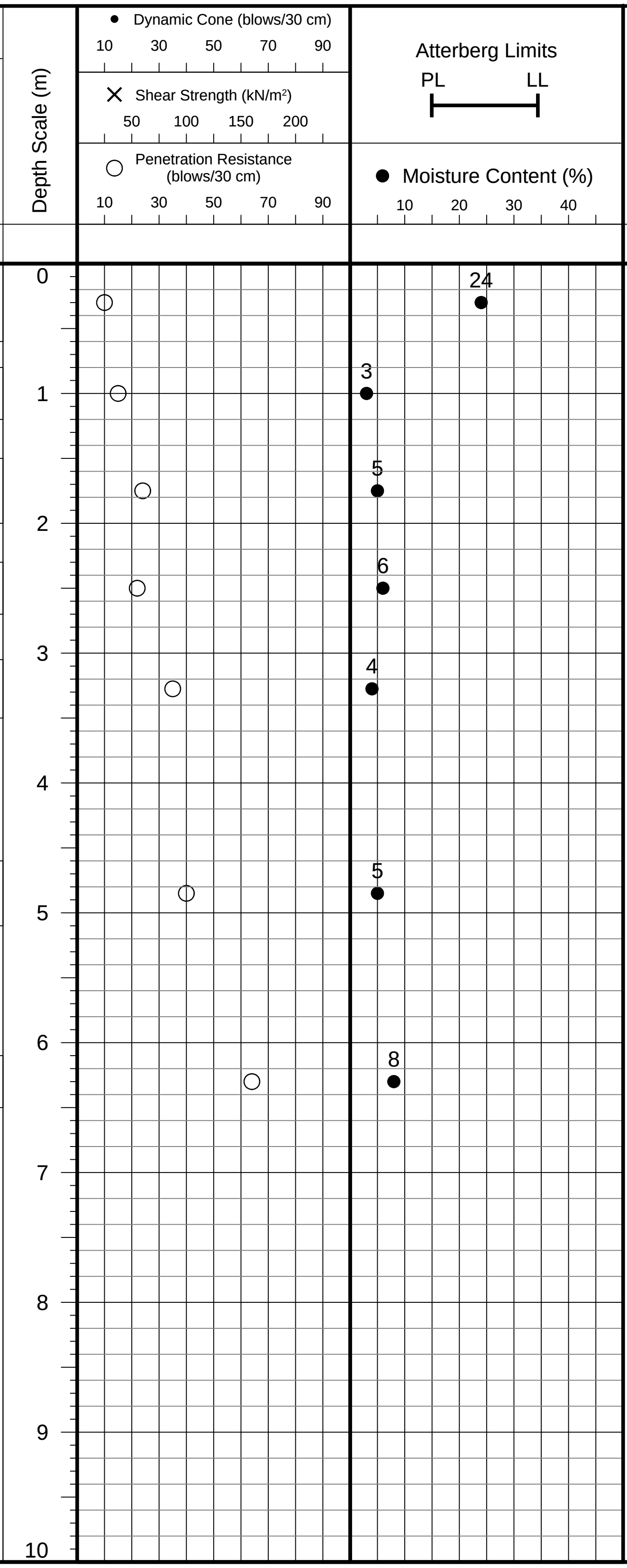
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

DRILLING DATE: April 12, 2018

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value	WATER LEVEL
296.5 0.0	Ground Surface **35 cm TOPSOIL**	1	DO	10	Dry on completion
295.6 0.9	**EARTH FILL** dark brown to brown silty clay, some sand and organics	2	DO	15	
	Brown, compact to dense **SAND** fine grained occ. seams and layers of sandy silt	3	DO	24	
		4	DO	22	
		5	DO	35	
		6	DO	40	
290.5 6.0	Brown, very dense **SANDY SILT TILL** some clay and gravel occ. sand seams and layers, cobbles and boulders	7	DO	64	
290.0 6.5	**END OF BOREHOLE**				



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JOB NO.: 1804-S036

LOG OF BOREHOLE NO.: 9

FIGURE NO.: 9

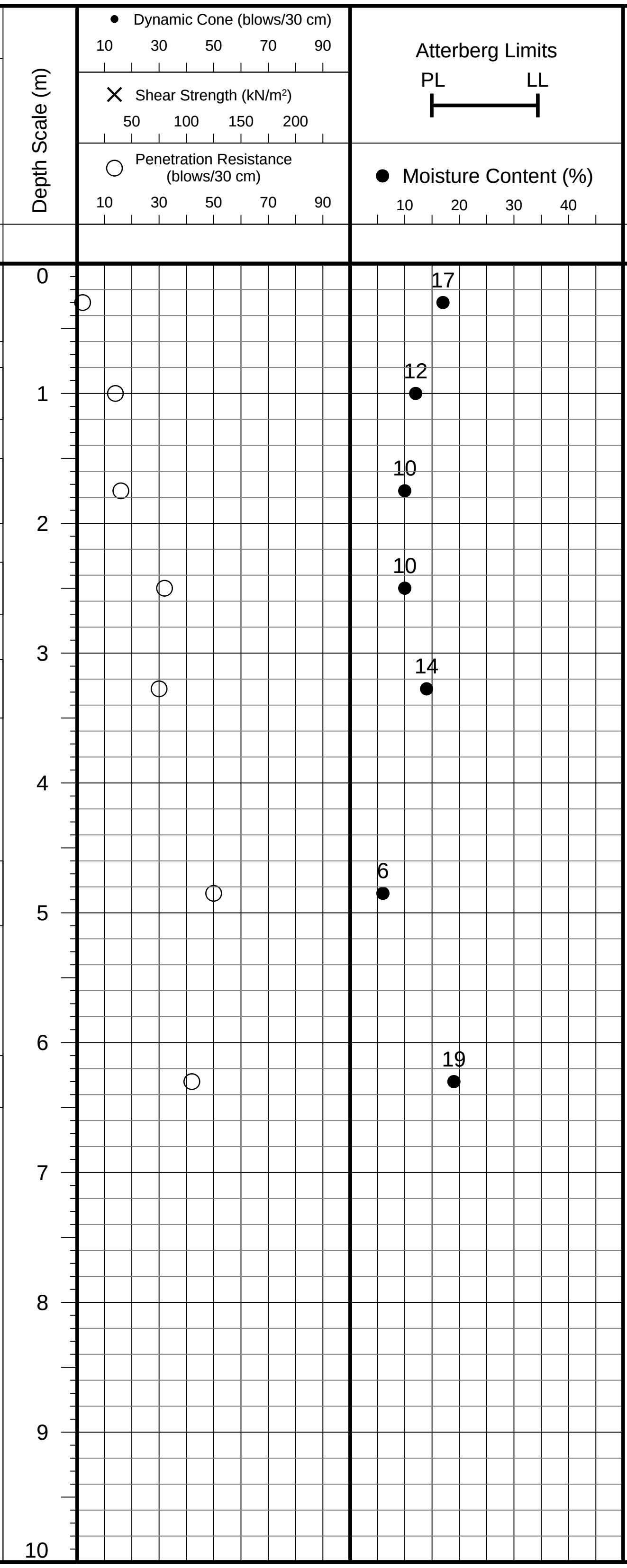
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

DRILLING DATE: April 12, 2018

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Moisture Content (%)	WATER LEVEL
295.3	Ground Surface					
0.0	**25 cm TOPSOIL**					
	Brown, very loose to dense **SANDY SILT TILL** some clay and gravel (weathered) occ. sand seams and layers, cobbles and boulders	1	DO	2	17	
		2	DO	14	12	
		3	DO	16	10	
		4	DO	32	10	
		5	DO	30	14	
291.0 4.3	Brown, dense **SAND** fine grained some gravel	6	DO	50	6	Dry on completion
289.3 6.0	Brown, dense **SILT** layers of silty fine sand	7	DO	42	19	
288.8 6.5	**END OF BOREHOLE**					



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JOB NO.: 1804-S036

LOG OF BOREHOLE NO.: 10

FIGURE NO.: 10

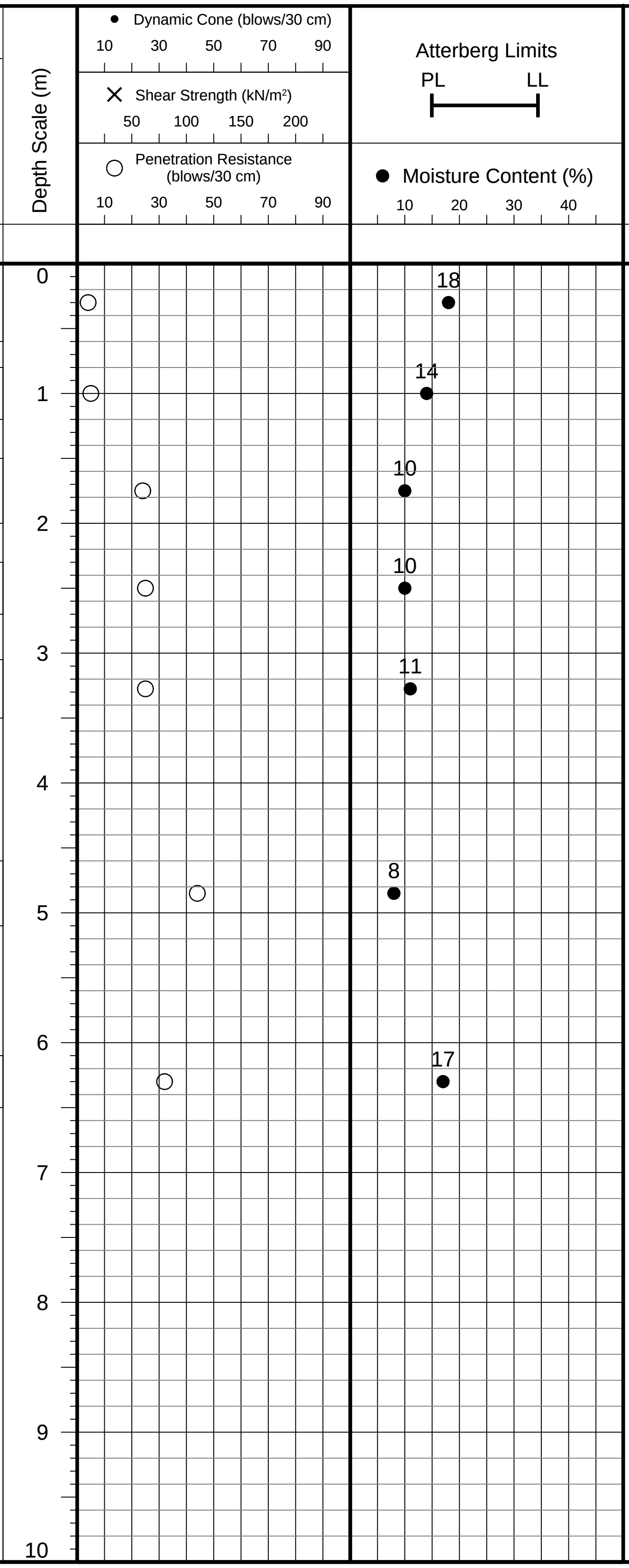
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

DRILLING DATE: April 12, 2018

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
294.7	Ground Surface			
0.0	**25 cm TOPSOIL**			
	EARTH FILL dark brown sandy silt, pockets of topsoil	1	DO	4
293.8 0.9	Brown, loose to compact **SANDY SILT TILL** weathered some clay and gravel occ. sand seams and layers, cobbles and boulders	2	DO	5
		3	DO	24
		4	DO	25
		5	DO	25
290.4 4.3	Brown, dense **SILTY SAND TILL** a trace of gravel, some clay occ. cobbles and boulders, silt layers	6	DO	44
		7	DO	32
288.2 6.5	**END OF BOREHOLE**			



WATER LEVEL

Dry on completion

JOB NO.: 1804-S036

LOG OF BOREHOLE NO.: 11

FIGURE NO.: 11

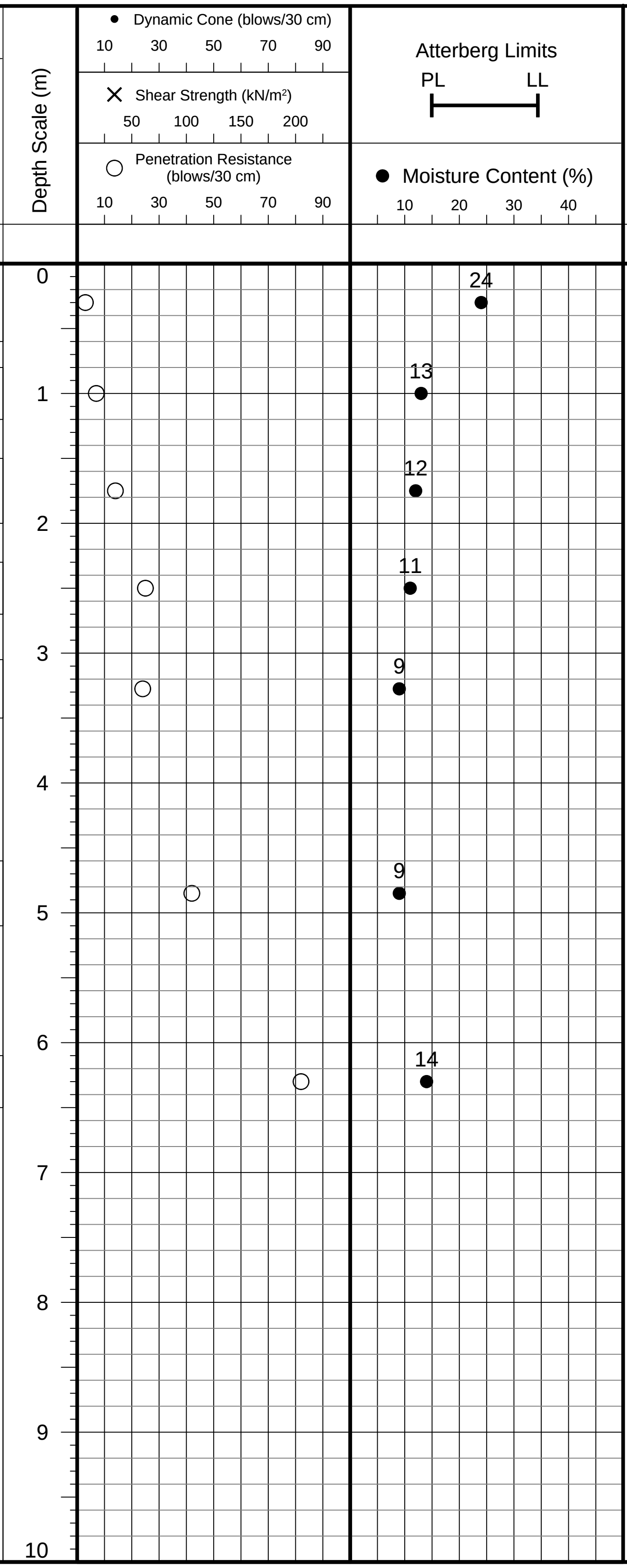
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

DRILLING DATE: April 12, 2018

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
293.9	Ground Surface			
0.0	**40 cm TOPSOIL**	1	DO	3
	EARTH FILL dark brown sandy silt mixed with topsoil, some organics			
293.0 0.9	Brown, stiff weathered **SILTY CLAY TILL** some sand and a trace of gravel	2	DO	7
		3	DO	14
291.7 2.2	Brown, compact to dense **SANDY SILT TILL** some clay and gravel occ. sand seams and layers, cobbles and boulders	4	DO	25
		5	DO	24
		6	DO	42
287.9 6.0	Grey, very dense **SILT** seams of silty clay	7	DO	82
287.4 6.5	**END OF BOREHOLE**			



WATER LEVEL

Dry on completion

Soil Engineers Ltd.

JOB NO.: 1804-S036

LOG OF BOREHOLE NO.: 12

FIGURE NO.: 12

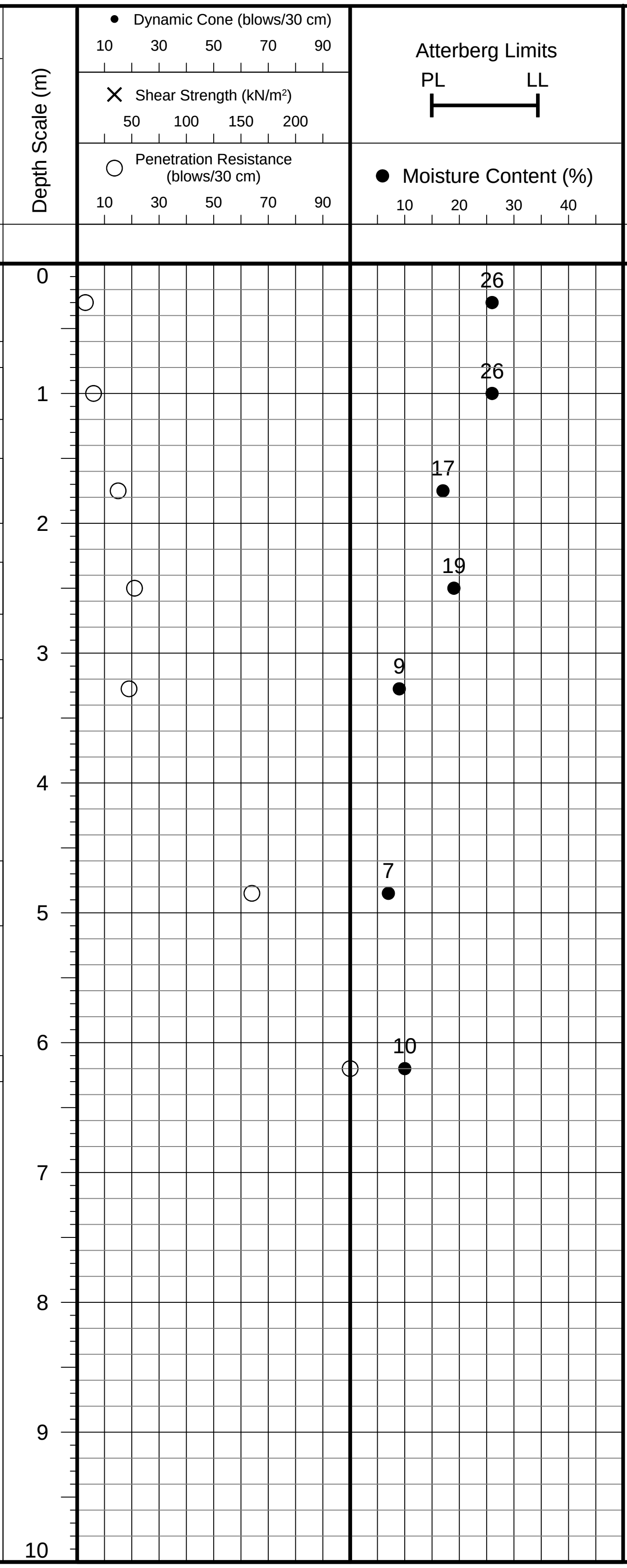
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

DRILLING DATE: April 12, 2018

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
291.8	Ground Surface			
0.0	**40 cm TOPSOIL**	1	DO	3
	EARTH FILL dark brown sandy silt to silty sand layers of topsoil branch fragments at 1.0 m	2	DO	6
290.4 1.4	Brown, compact **SAND** well graded, layers of sandy silt, a trace of gravel	3	DO	15
	— brown / grey	4	DO	21
289.0 2.8	Brown, compact to very dense **SANDY SILT TILL** some clay and gravel occ. sand seams and layers, cobbles and boulders	5	DO	19
		6	DO	64
		7	DO	50/15
285.5 6.3	**END OF BOREHOLE**			



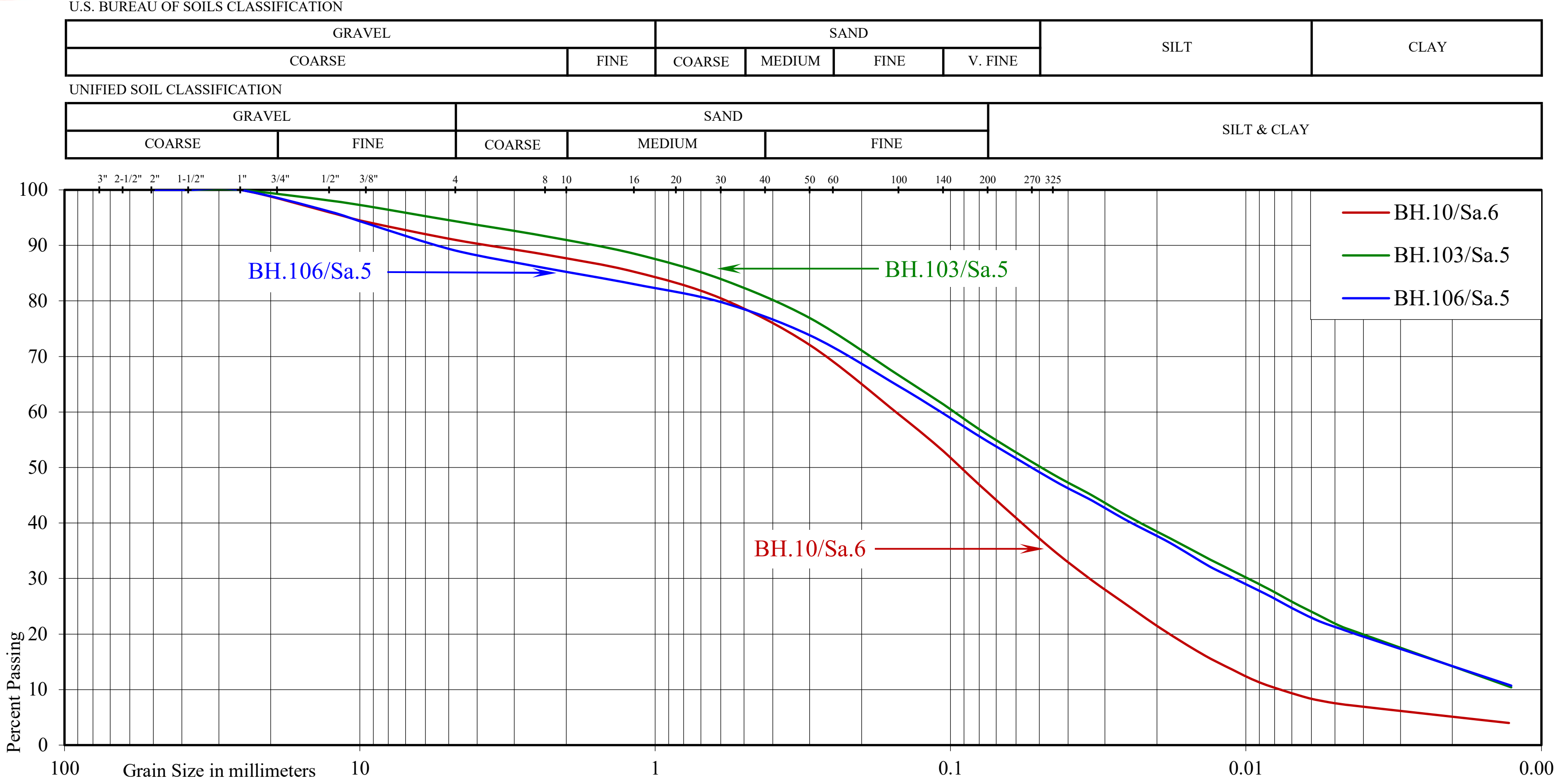
WATER LEVEL

W.L @ El. 289.4 m on completion

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 1804-S036 & 1903-W092



Project: Proposed Residential Development

Location: 12875 Tenth Line, Town of Whitchurch-Stouffville

Borehole No:	10	103	106
Sample No:	6	5	5
Depth (m):	4.8	3.3	3.3
Elevation (m):	289.9	288.9	292.2

BH./Sa.	10/6	103/5	106/5
Liquid Limit (%) =	-	-	-
Plastic Limit (%) =	-	-	-
Plasticity Index (%) =	-	-	-
Moisture Content (%) =	8	9	10
Estimated Permeability (cm./sec.) =	10^{-5}	10^{-6}	10^{-6}

Classification of Sample [& Group Symbol]: BH.10/Sa.6 - SILTY SAND TILL, traces of clay and gravel

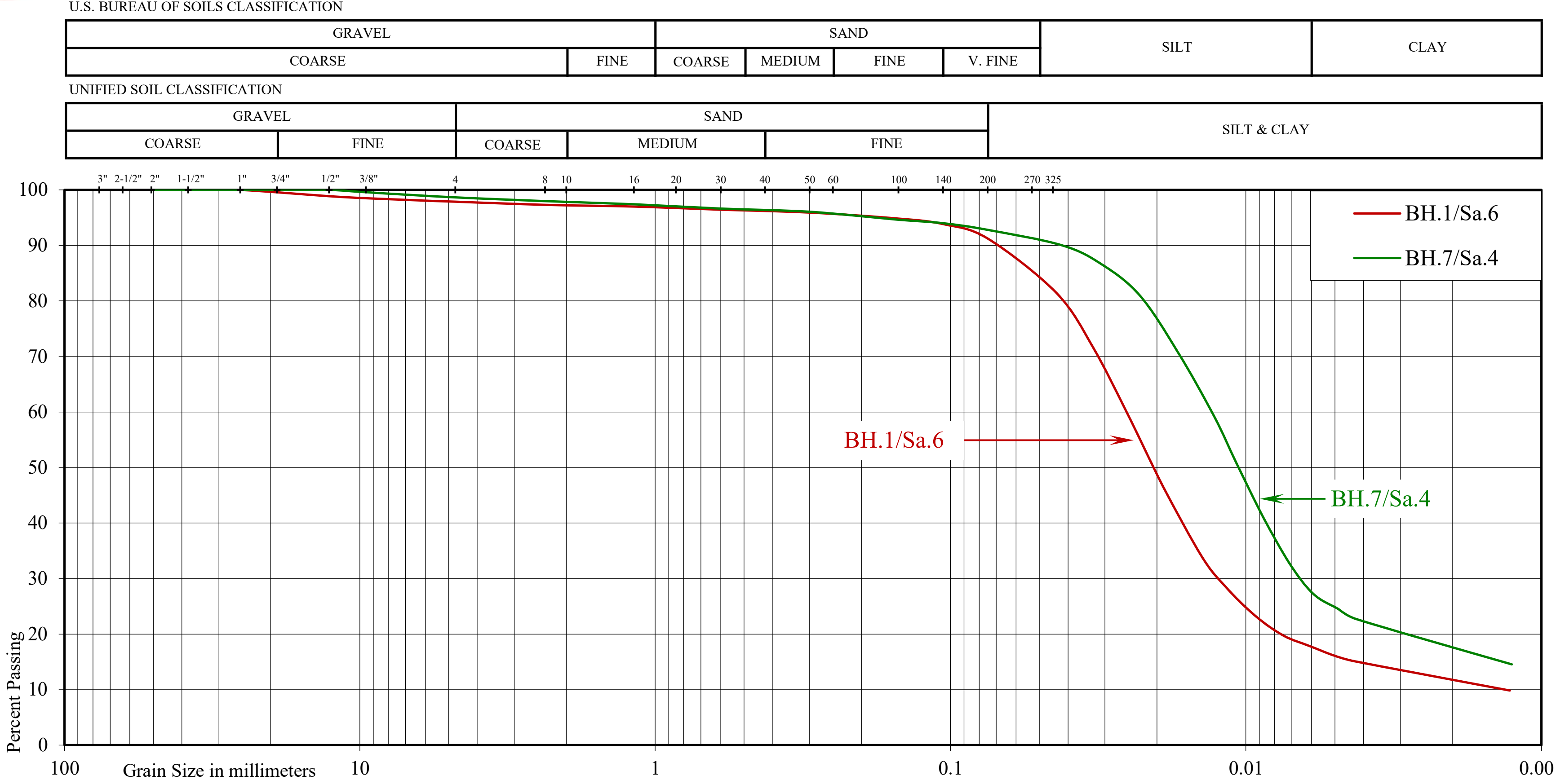
BH.103/Sa.5 and BH.106/Sa.5 - SANDY SILT TILL, some clay and gravel

Figure: 13

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 1804-S036



Project: Proposed Residential Development

Location: 12875 Tenth Line, Town of Whitchurch-Stouffville

Borehole No:	1	7
Sample No:	6	4
Depth (m):	4.8	2.5
Elevation (m):	292.4	293.9

BH./Sa.	1/6	7/4
Liquid Limit (%) =	-	-
Plastic Limit (%) =	-	-
Plasticity Index (%) =	-	-
Moisture Content (%) =	18	17
Estimated Permeability (cm./sec.) =	10^{-6}	10^{-7}

Classification of Sample [& Group Symbol]: SILT

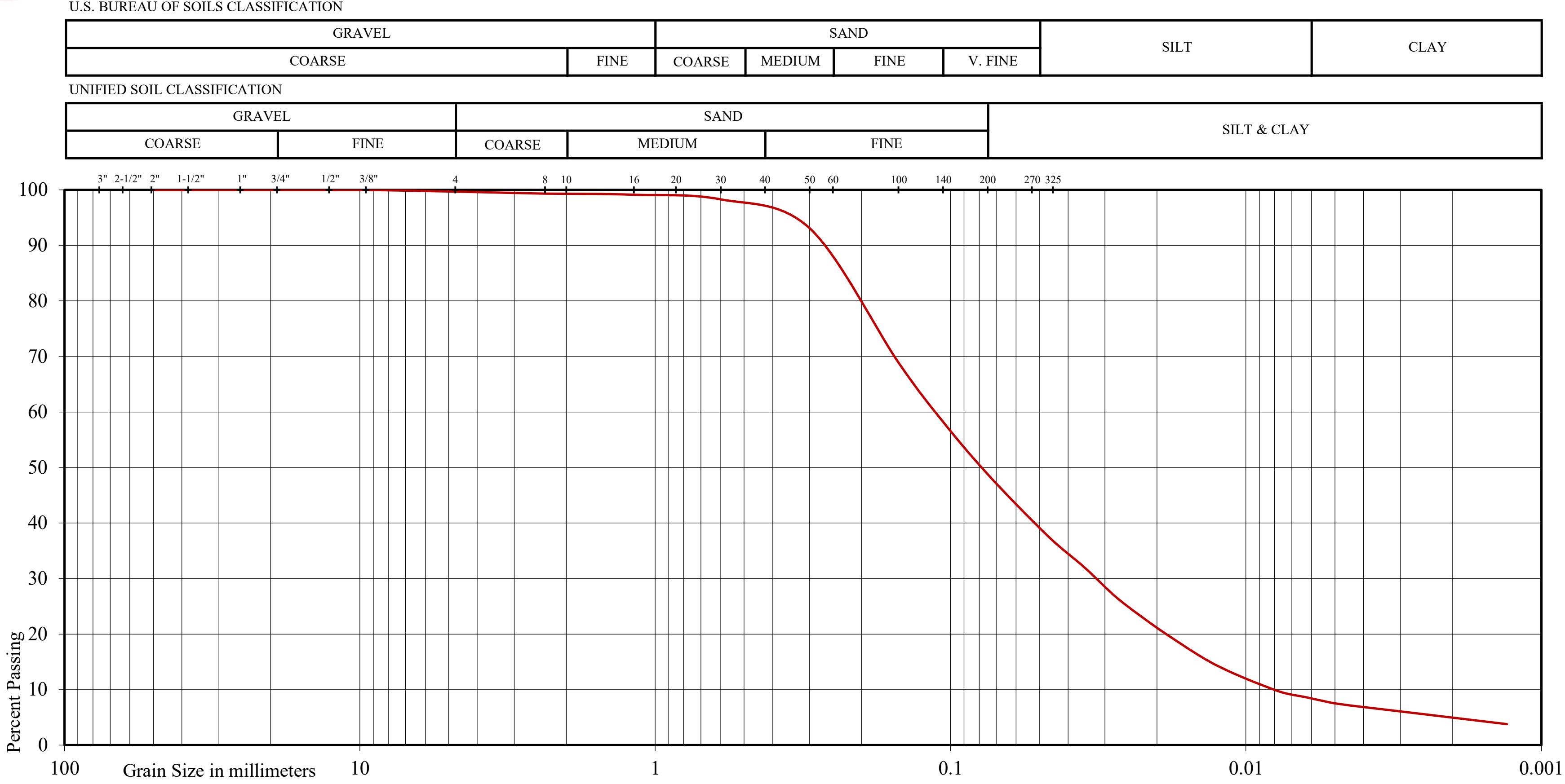
some clay, traces of sand and gravel

Figure: 14

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 1903-W092



Project: Proposed Residential Development

Location: 12875 Tenth Line, Town of Whitchurch-Stouffville

BH./Sa. 106/7

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = 19

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

Borehole No: 106

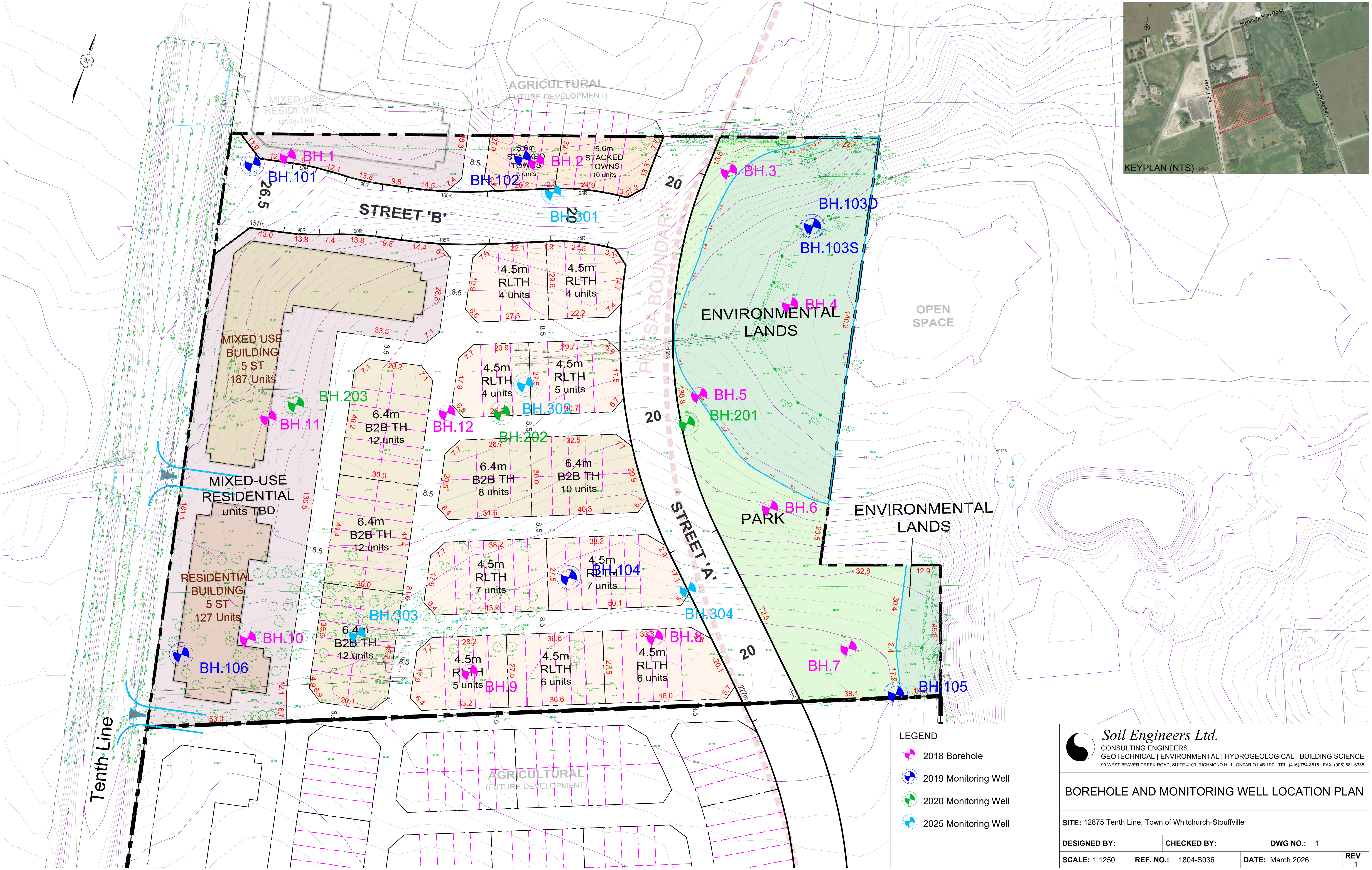
Sample No: 7

Depth (m): 6.3

Elevation (m): 289.2

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

Figure: 15



LEGEND

- ◐ 2018 Borehole
- ◐ 2019 Monitoring Well
- ◐ 2020 Monitoring Well
- ◐ 2025 Monitoring Well

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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 AND MONITORING WELL LOCATION PLAN

SITE: 12875 Tenth Line, Town of Whitchurch-Stouffville					
DESIGNED BY:		**CHECKED BY:**		**DWG NO.:** 1	
SCALE: 1:1250	**REF. NO.:** 1804-S036		**DATE:** March 2026		**REV** 1

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SUBSURFACE PROFILE
DRAWING NO. 2A
SCALE: AS SHOWN

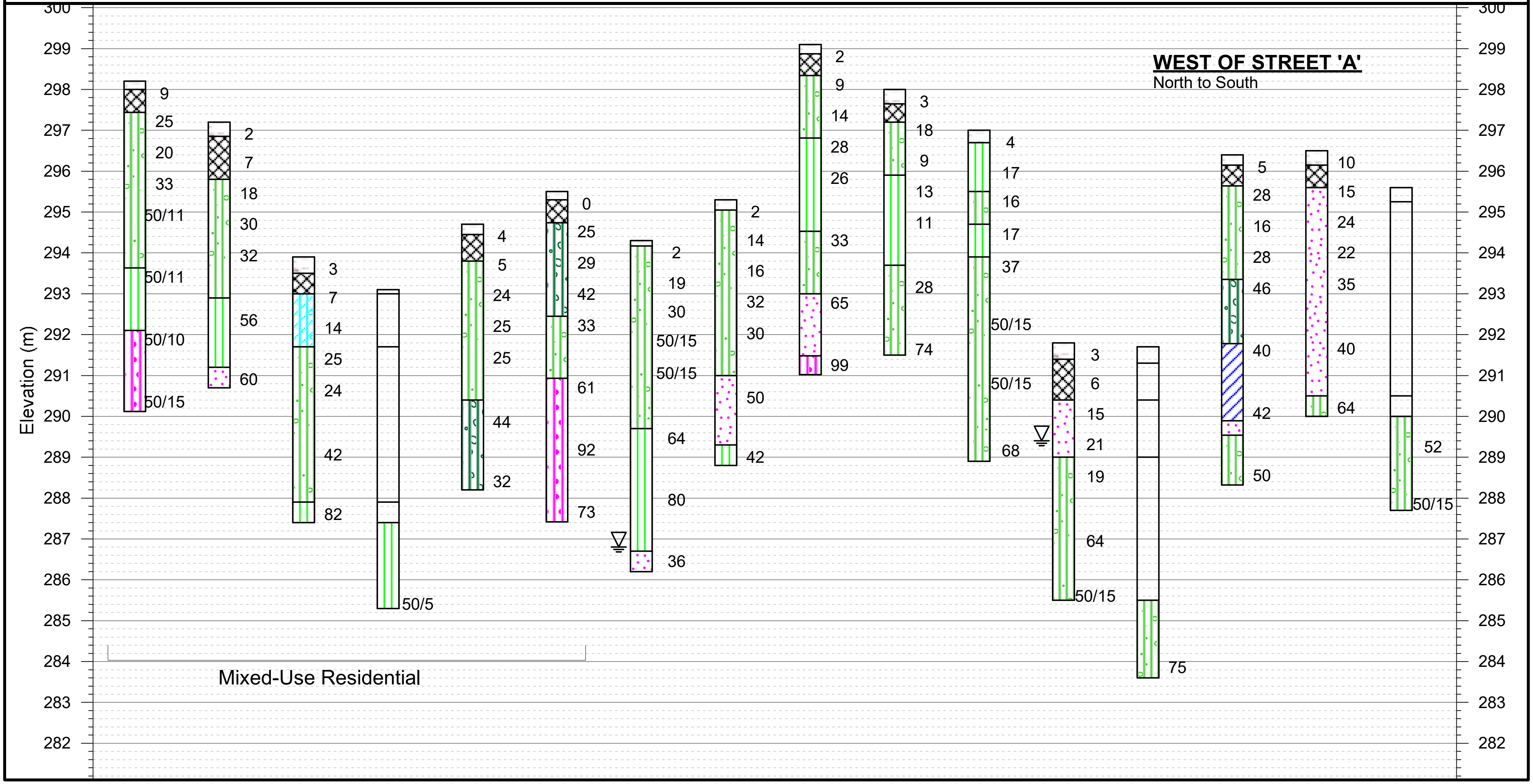
JOB NO.: 1804-S036
REPORT DATE: March 2026
PROJECT DESCRIPTION: Proposed Residential Development
PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

LEGEND

▨ TOPSOIL	▨ SAND	▨ SANDY SILT TILL	▨ SILTY CLAY
☐ VOID	▨ SILTY FINE SAND	▨ SILT	▨ SILTY CLAY TILL
▨ EARTH FILL	▨ SILTY SAND TILL		

▽ WATER LEVEL (END OF DRILLING)

BH No.:	101	1	11	203	10	106	303	9	102	2	301	12	202	104	8	304
El. (m):	298.2	297.2	293.9	293.1	294.7	295.5	294.3	295.3	299.1	298	297	291.8	291.7	296.4	296.5	295.6



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SUBSURFACE PROFILE
DRAWING NO. 2B
SCALE: AS SHOWN

JOB NO.: 1804-S036
REPORT DATE: March 2026
PROJECT DESCRIPTION: Proposed Residential Development

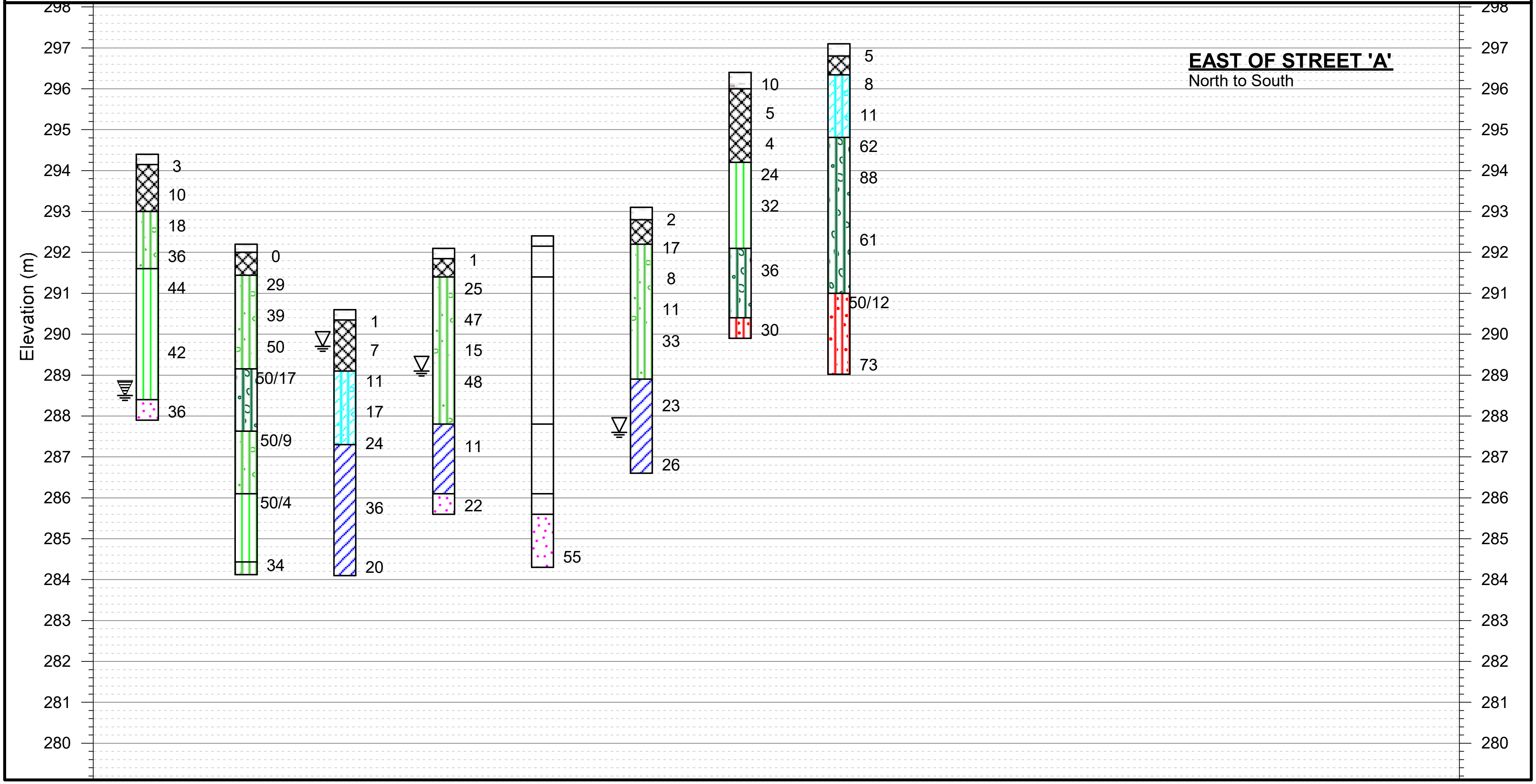
PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

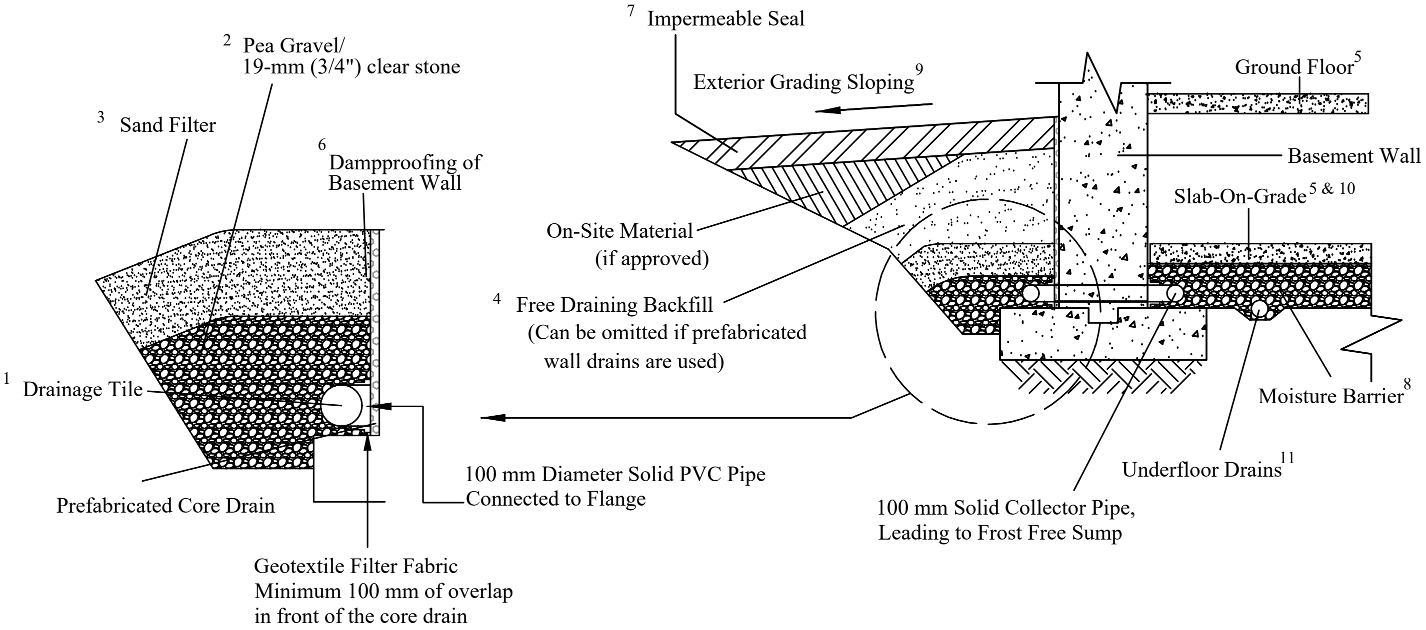
LEGEND

▨	TOPSOIL	⁘	SAND	▥	SANDY SILT TILL	▨	SILTY CLAY
☐	VOID	▥	SILTY SAND TILL	▥	SILT	▨	SILTY CLAY TILL
▩	EARTH FILL	▥	SANDY SILT				

▽ WATER LEVEL (END OF DRILLING) ≡ CAVE-IN

BH No.:	3	103D	4	5	201	6	7	105
El. (m):	294.4	292.2	290.6	292.1	292.4	293.1	296.4	297.1





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 (3/4") 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 (3/4") clear stone. 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 omitted where not required.

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PERMANENT PERIMETER DRAINAGE SYSTEM
(OPEN EXCAVATION FOR PART 9 BUILDINGS)

SITE: 12875 Tenth Line, Town of Whitchurch-Stouffville

DESIGNED BY: K.L. **CHECKED BY:** B.L. **DWG NO.:** 3

SCALE: N.T.S. **REF. NO.:** 1804-S036 **DATE:** March 2026 **REV** -

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

BARRIE	MISSISSAUGA	OSHAWA	NEWMARKET	MUSKOKA	HAMILTON
TEL: (705) 721-7863	TEL: (905) 542-7605	TEL: (905) 440-2040	TEL: (905) 853-0647	TEL: (705) 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 A

BOREHOLE LOGS FROM
HYDROGEOLOGICAL STUDY
1903-W092

REFERENCE NO. 1804-S036

JOB NO.: 1903-W092 **LOG OF BOREHOLE NO.: BH/MW 101** ***FIGURE NO.:*** 1

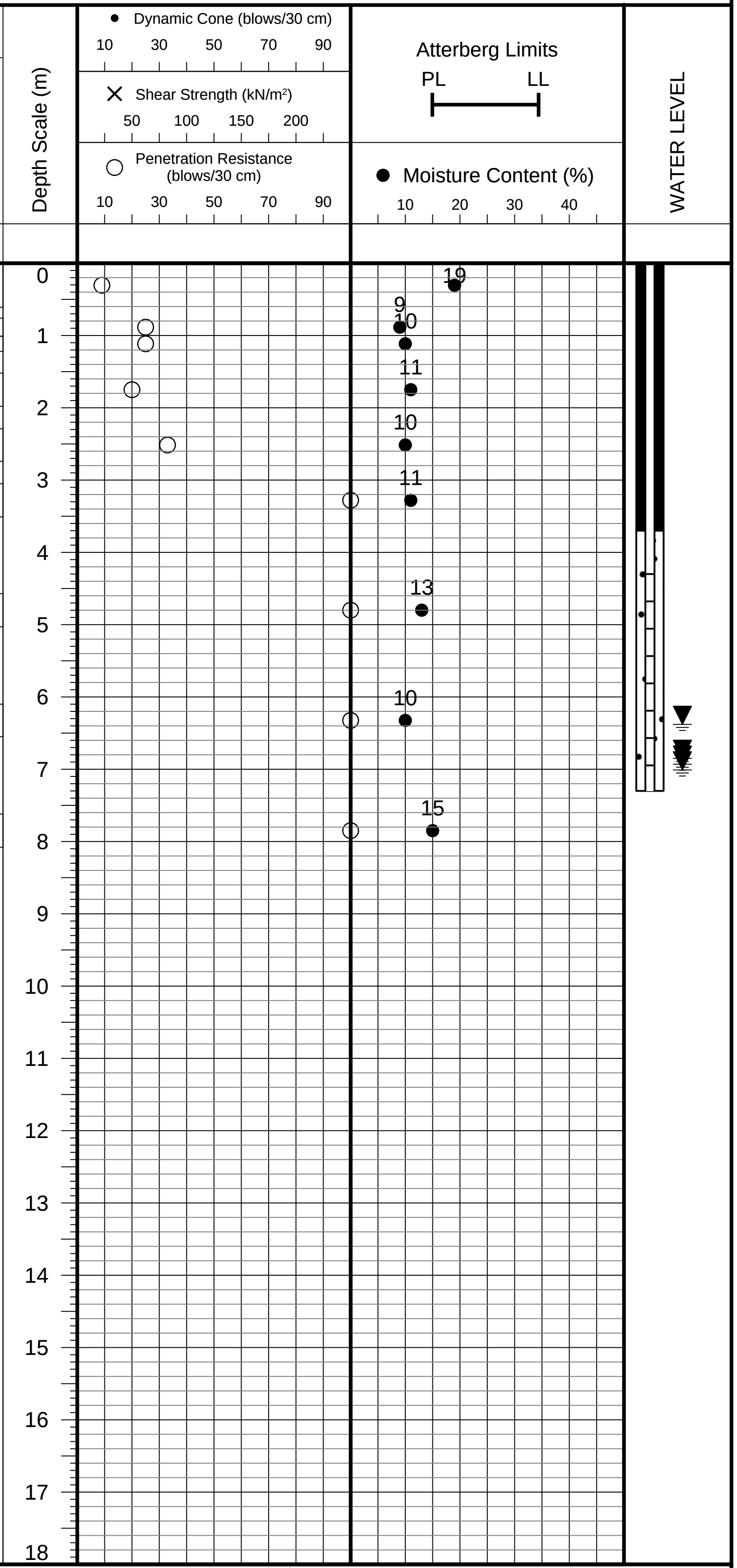
PROJECT DESCRIPTION: Due Diligence For Land Acquistion

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

DRILLING DATE: April 22, 2019

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
298.2	Ground Surface			
0.0	**20 cm TOPSOIL** **EARTH FILL** dark brown sandy silt, some clay and gravel mixed with topsoil	1	DO	9
297.4 0.8	Brown, compact to very dense **SANDY SILT TILL** some gravel trace to some clay occ. sand seams and layers, cobbles and boulders	2A	DO	25
		2B	DO	25
		3	DO	20
		4	DO	33
		5	DO	50/11
293.6 4.6	Brown, very dense **SILT** some clay trace of gravel trace of sand	6	DO	50/11
292.1 6.1	Brown, very dense **SILTY FINE SAND**	7	DO	50/10
		8	DO	50/15
290.1 8.1	**END OF THE BORHOLE** Installed 50 mm Ø monitoring well to 7.3 m 3.0 m screen from 4.3 to 7.3 m Sand backfill from 3.7 to 7.3 m Bentonite seal from 0.0 to 3.7 m Provided with a steel monument casing **Water level reading:** W.L. @ El. 291.82 masl on Apr 30, 2019 W.L. @ El. 291.27 masl on May 23, 2019 W.L. @ El. 291.19 masl on Jun 17, 2019 Dry on Apr 07, 2020 Dry on May 25, 2020 Dry on Jun 29, 2020 W.L. @ El. 291.35 masl on Mar 22, 2023			



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Page: 1 of 1

JOB NO.: 1903-W092

LOG OF BOREHOLE NO.: BH/MW 102

FIGURE NO.: 2

PROJECT DESCRIPTION: Due Diligence For Land Acquistion

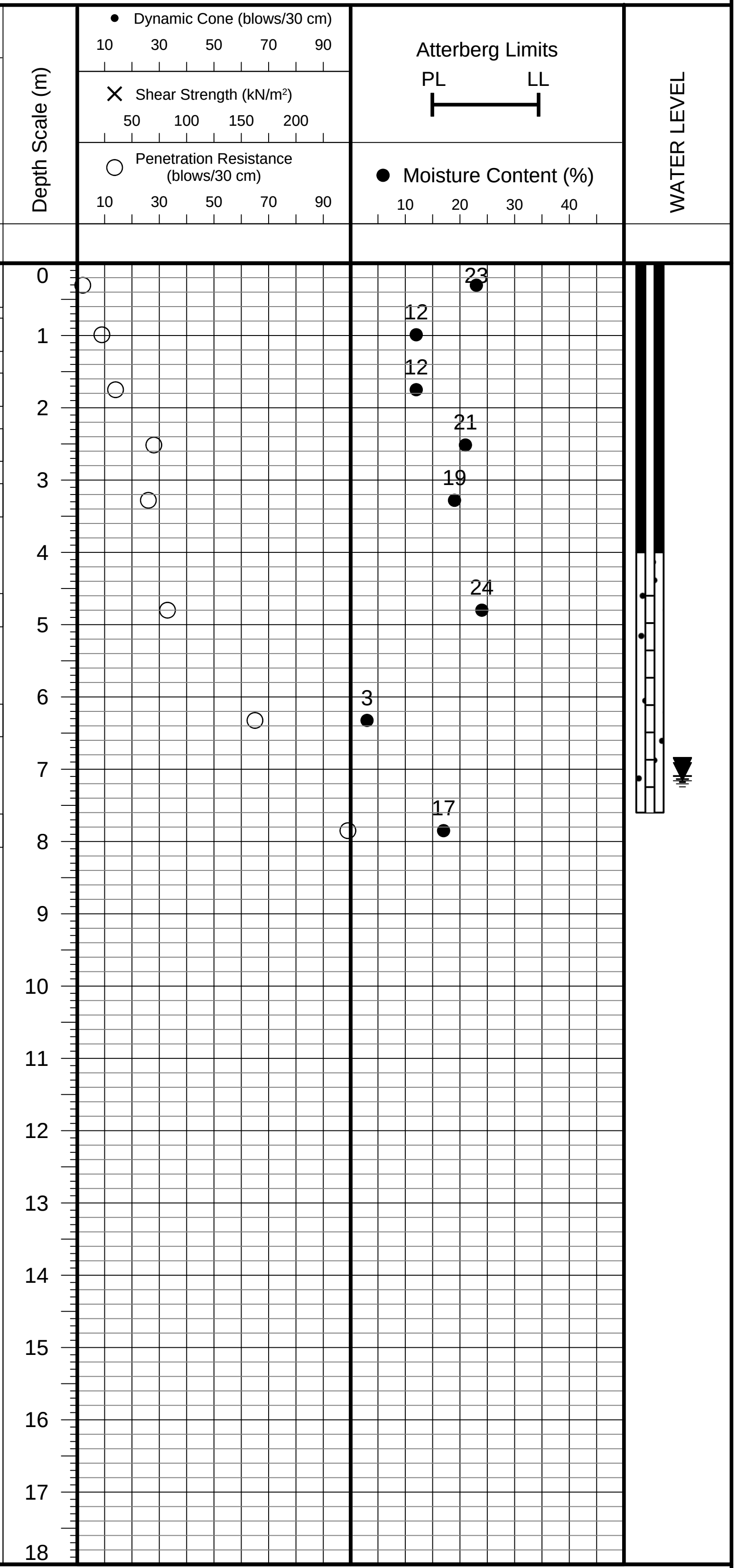
METHOD OF BORING: Flight-Auger

PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

DRILLING DATE: April 22, 2019

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
299.1	Ground Surface			
0.0	**23 cm TOPSOIL** **EARTH FILL** dark brown sandy silt some clay mixed with topsoil	1	DO	2
298.3 0.8	Brown, loose to compact **SANDY SILT TILL** some clay and gravel occ. sand seams and layers, cobbles and boulders	2 3	DO DO	9 14
296.8 2.3	Brown, compact **SILT** trace of gravel some clay occ. sand layers	4 5	DO DO	28 26
294.5 4.6	Brown, dense **SANDY SILT TILL** some clay and gravel occ. sand seams and layers, cobbles and boulders	6	DO	33
293.0 6.1	Brown, very dense **FINE SAND**	7	DO	65
291.4 7.6	Brown, very dense **SILTY FINE SAND** trace of gravel	8	DO	99
291.0 8.1	**END OF THE BORHOLE**			

Installed 50 mm Ø monitoring well to 7.6 m
3.0 m screen from 4.6 to 7.6 m
Sand backfill from 4.0 to 7.6 m
Bentonite seal from 0.0 to 4.0 m
Provided with a steel monument casing
Water level reading:
W.L. @ El. 291.85 masl on Apr 30, 2019
W.L. @ El. 291.89 masl on May 23, 2019
W.L. @ El. 291.89 masl on Jun 17, 2019
Dry on Apr 07, 2020
W.L. @ El. 291.95 masl on May 25, 2020
W.L. @ El. 291.96 masl on Jun 29, 2020
W.L. @ El. 291.96 masl on Mar 22, 2023



JOB NO.: 1903-W092

LOG OF BOREHOLE NO.: BH/MW 103D

FIGURE NO.: 3

PROJECT DESCRIPTION: Due Diligence For Land Acquistion

METHOD OF BORING: Flight-Auger

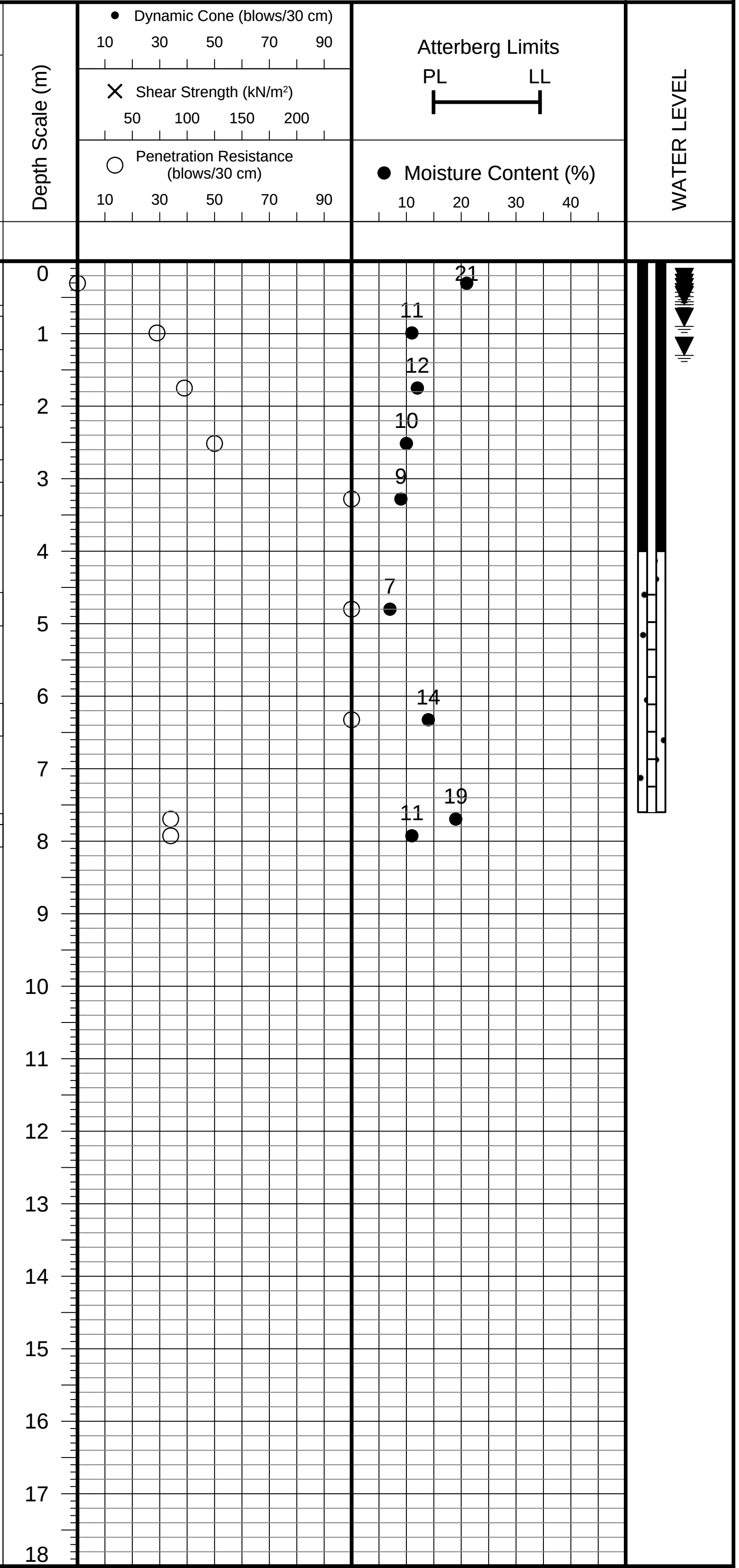
PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

DRILLING DATE: April 22, 2019

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
292.2	Ground Surface			
0.0	**20 cm TOPSOIL** **EARTH FILL** dark brown to brown sandy silt some clay occ. topsoil pockets and organics	1	DO	0
291.4 0.8	Brown, compact to dense **SANDY SILT TILL** trace to some gravel some clay occ. sand seams and layers, cobbles and boulders	2 3 4	DO DO DO	29 39 50
289.1 3.0	Brown, very dense **SILTY SAND TILL** trace to some gravel trace of clay occ. sand seams and layers, cobbles and boulders	5	DO	50/17
287.6 4.6	Grey, very dense **SANDY SILT TILL** some clay and gravel	6	DO	50/9
286.1 6.1	Grey, dense to very dense **SILT** some clay trace of sand and gravel	7 8A	DO DO	50/4 34
284.4	Grey, dense **SANDY SILT TILL** some clay and gravel, occ. sand seams and layers, cobbles and boulders	8B	DO	34
284.1 8.1	**END OF THE BORHOLE**			

Installed 50 mm Ø monitoring well to 7.6 m
3.0 m screen from 4.6 to 7.6 m
Sand backfill from 4.0 to 7.6 m
Bentonite seal from 0.0 to 4.0 m
Provided with a steel monument casing

Water level reading:
W.L. @ El. 291.82 masl on Apr 30, 2019
W.L. @ El. 291.57 masl on May 23, 2019
W.L. @ El. 291.61 masl on Jun 17, 2019
W.L. @ El. 291.68 masl on Apr 07, 2020
W.L. @ El. 291.27 masl on May 25, 2020
W.L. @ El. 290.87 masl on Jun 29, 2020
W.L. @ El. 291.74 masl on Mar 22, 2023



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JOB NO.: 1903-W092

LOG OF BOREHOLE NO.: BH/MW 103S

FIGURE NO.: 4

PROJECT DESCRIPTION: Due Diligence For Land Acquistion

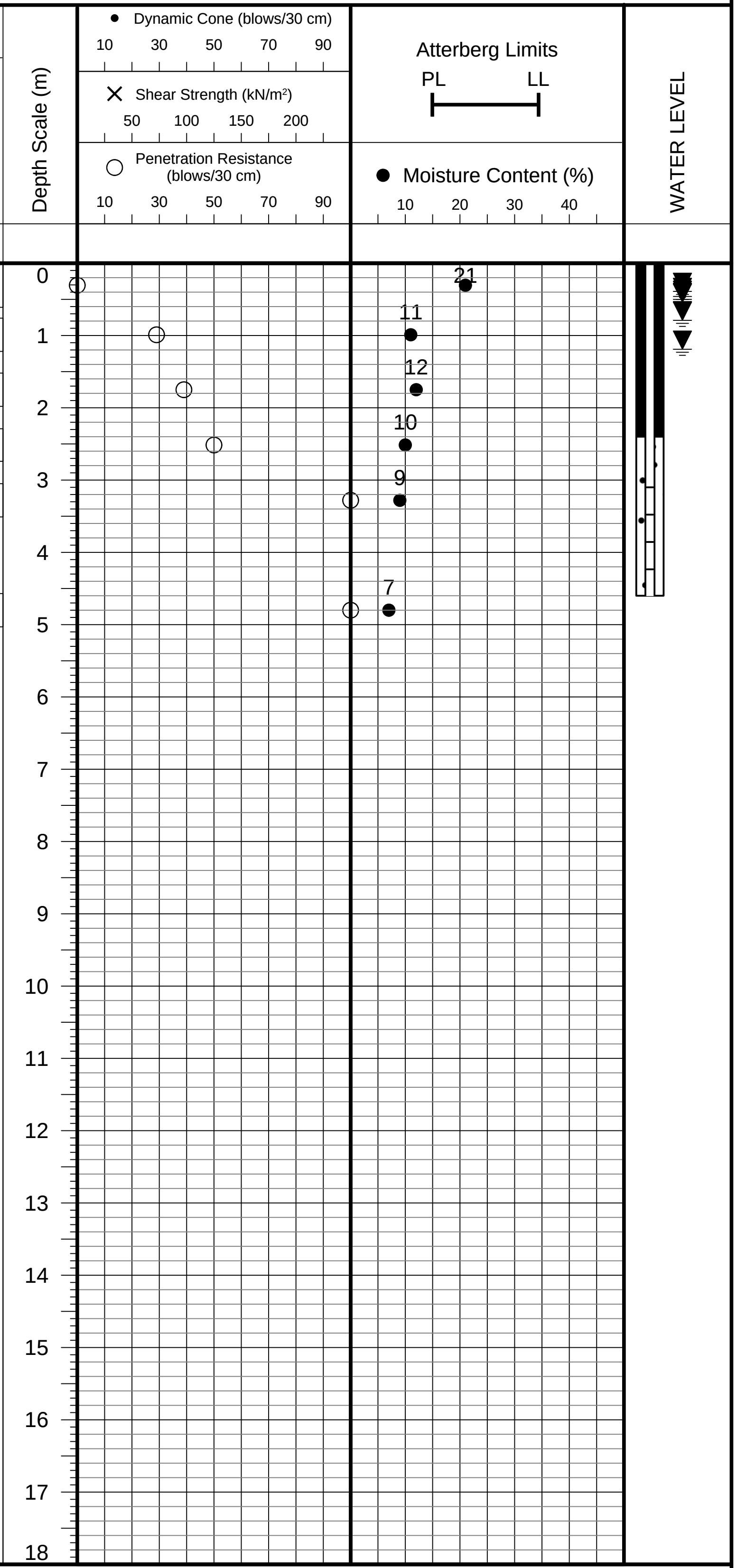
METHOD OF BORING: Flight-Auger

PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

DRILLING DATE: April 22, 2019

El. (m) Depth (m)	SOIL DESCRIPTION
292.1	Ground Surface
0.0	**20 cm TOPSOIL** **EARTH FILL** dark brown to brown sandy silt some clay occ. topsoil pockets and organics
291.3 0.8	Brown, compact to dense **SANDY SILT TILL** trace to some gravel some clay occ. sand seams and layers, cobbles and boulders
289.0 3.0	Brown, very dense **SILTY SAND TILL** trace to some gravel trace of clay occ. sand seams and layers, cobbles and boulders
287.5 4.6	Grey, very dense **SANDY SILT TILL** some clay and gravel
287.0 5.0	

SAMPLES		
Number	Type	N-Value
1	DO	0
2	DO	29
3	DO	39
4	DO	50
5	DO	50/17
6	DO	50/9



END OF THE BORHOLE

Installed 50 mm Ø monitoring well to 4.6 m
1.5 m screen from 3.1 to 4.6 m
Sand backfill from 2.4 to 4.6 m
Bentonite seal from 0.0 to 2.4 m
Provided with a steel monument casing
Water level reading:
W.L. @ El. 291.68 masl on Apr 30, 2019
W.L. @ El. 291.53 masl on May 23, 2019
W.L. @ El. 291.54 masl on Jun 17, 2019
W.L. @ El. 291.57 masl on Apr 07, 2020
W.L. @ El. 291.28 masl on May 25, 2020
W.L. @ El. 290.88 masl on Jun 29, 2020
W.L. @ El. 291.61 masl on Mar 22, 2023

Soil Engineers Ltd.

JOB NO.: 1903-W092

LOG OF BOREHOLE NO.: BH/MW 104

FIGURE NO.: 5

PROJECT DESCRIPTION: Due Diligence For Land Acquistion

METHOD OF BORING: Flight-Auger

PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

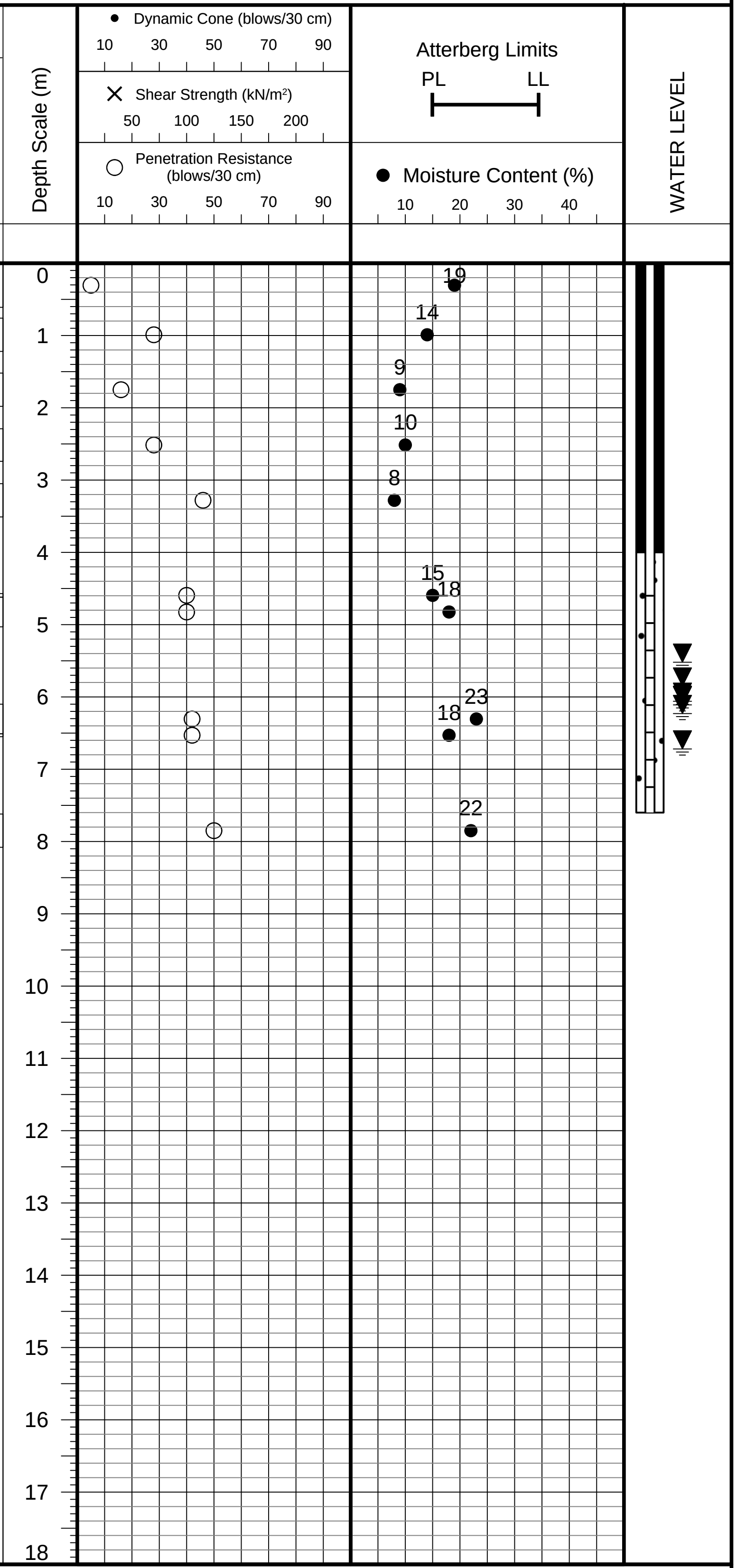
DRILLING DATE: April 18, 2019

El. (m) Depth (m)	SOIL DESCRIPTION
296.4	Ground Surface
0.0	**25 cm TOPSOIL**
	EARTH FILL dark brown to brown silty clay trace to some sand occ. organics
295.6 0.8	Brown, compact **SANDY SILT TILL** some clay and gravel occ. sand seams and layers, cobbles and boulders
293.3 3.0	Brown, dense **SILTY SAND TILL** trace to some clay some gravel occ. sand seams and layers, cobbles and boulders
291.7 4.6	Brown, hard **SILTY CLAY** trace of sand
289.8	
289.5 6.9	Brown, dense **SAND** trace to some silt
288.3 8.1	Brown, dense **SANDY SILT TILL** trace to some gravel some clay

END OF THE BORHOLE

Installed 50 mm Ø monitoring well to 7.6 m
3.0 m screen from 4.6 to 7.6 m
Sand backfill from 4.0 to 7.6 m
Bentonite seal from 0.0 to 4.0 m
Provided with a steel monument casing
Water level reading:
W.L. @ El. 290.24 masl on Apr 30, 2019
W.L. @ El. 290.83 masl on May 23, 2019
W.L. @ El. 290.50 masl on Jun 17, 2019
Dry on Apr 07, 2020
W.L. @ El. 290.12 masl on May 25, 2020
W.L. @ El. 289.63 masl on Jun 29, 2020
W.L. @ El. 290.29 masl on Mar 22, 2023

SAMPLES		
Number	Type	N-Value
1	DO	5
2	DO	28
3	DO	16
4	DO	28
5	DO	46
6A	DO	40
6B	DO	40
7A	DO	42
7B	DO	42
8	DO	50



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Page: 1 of 1

JOB NO.: 1903-W092

LOG OF BOREHOLE NO.: BH/MW 105

FIGURE NO.: 6

PROJECT DESCRIPTION: Due Diligence For Land Acquistion

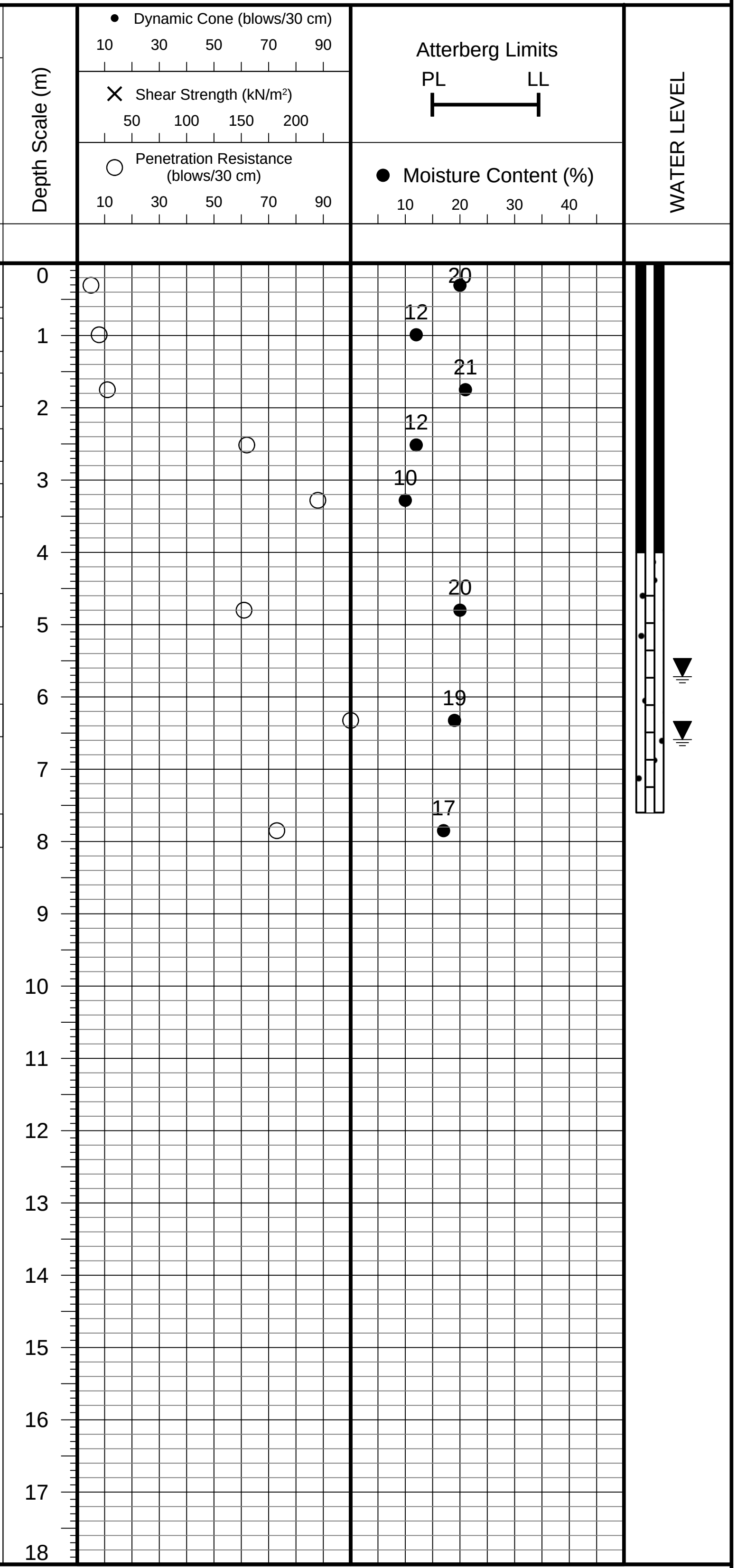
METHOD OF BORING: Flight-Auger

PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

DRILLING DATE: April 18, 2019

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
297.1	Ground Surface			
0.0	**30 cm TOPSOIL**	1	DO	5
296.4 0.8	**EARTH FILL** dark brown to brown sandy silt some clay trace to some gravel occ. organics	2 3	DO DO	8 11
294.8 2.3	Brown, stiff **SILTY CLAY TILL** some sand trace of gravel	4	DO	62
	Brown, very dense **SILTY SAND TILL** trace to some clay and gravel occ. sand seams and layers, cobbles and boulders	5 6	DO DO	88 61
291.0 6.1	Brown, very dense **SANDY SILT** trace of clay	7 8	DO DO	50/12 73
289.0 8.1	**END OF THE BORHOLE**			

Installed 50 mm Ø monitoring well to 7.6 m
3.0 m screen from 4.6 to 7.6 m
Sand backfill from 4.0 to 7.6 m
Bentonite seal from 0.0 to 4.0 m
Provided with a steel monument casing
Water level reading:
W.L. @ El. 290.53 masl on Apr 30, 2019
Dry on May 23, 2019
Dry on Jun 17, 2019
W.L. @ El. 291.40 masl on Apr 07, 2020
Dry on May 25, 2020
Dry on Jun 29, 2020
Dry on Mar 22, 2023



Soil Engineers Ltd.

JOB NO.: 1903-W092

LOG OF BOREHOLE NO.: BH/MW 106

FIGURE NO.: 7

PROJECT DESCRIPTION: Due Diligence For Land Acquistion

METHOD OF BORING: Flight-Auger

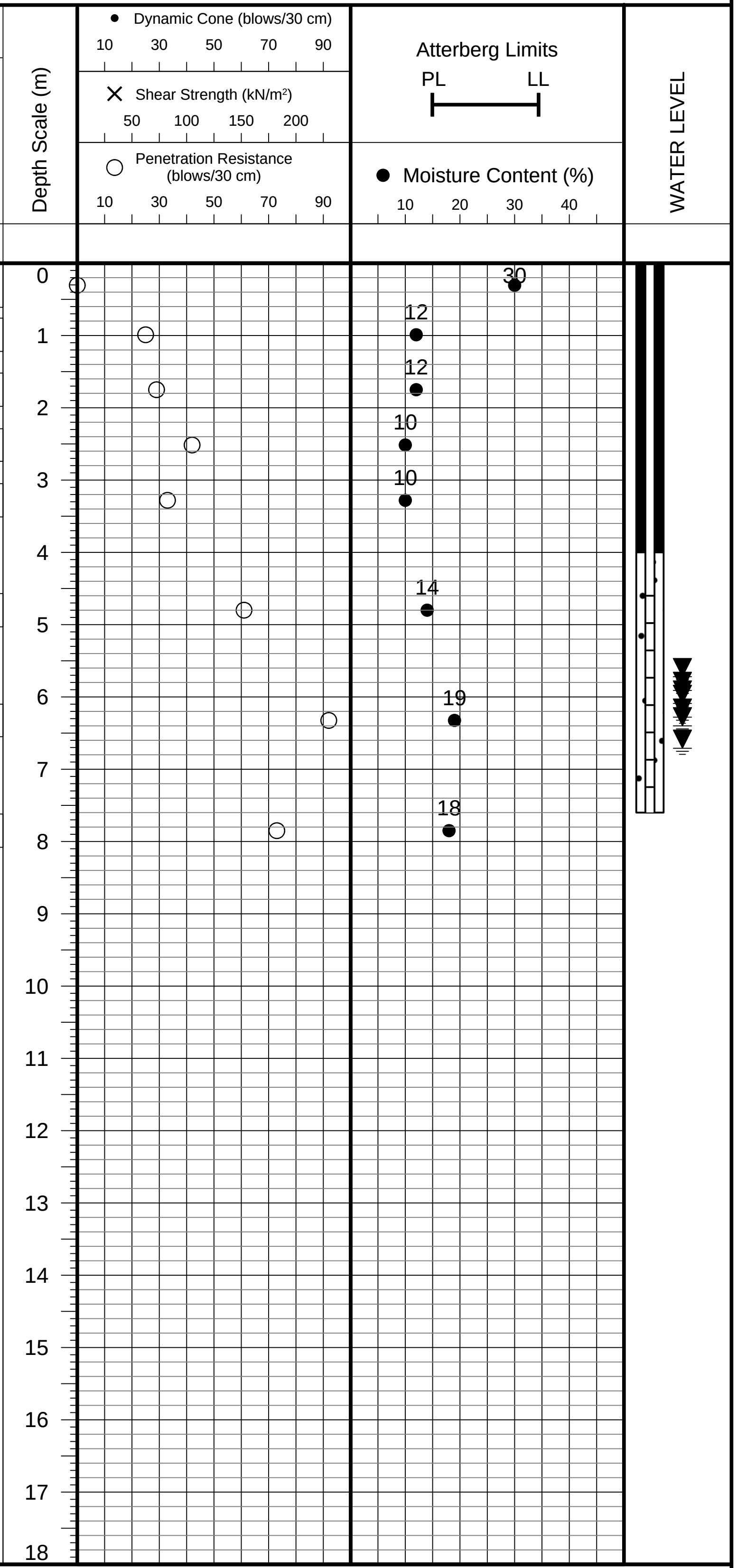
PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

DRILLING DATE: April 18, 2019

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
295.5	Ground Surface			
0.0	**20 cm TOPSOIL** **EARTH FILL** dark brown to brown sandy silt occ. organics	1	DO	0
294.7 0.8	Brown, compact to dense **SILTY SAND TILL** trace to some clay trace of gravel occ. sand seams and layers, cobbles and boulders	2 3 4	DO DO DO	25 29 42
292.4 3.0	Brown, dense **SANDY SILT TILL** some clay and gravel	5	DO	33
290.9 4.6	Brown, very dense **SILTY FINE SAND**	6 7 8	DO DO DO	61 92 73
287.4 8.1	**END OF THE BORHOLE**			

Installed 50 mm Ø monitoring well to 7.6 m
3.0 m screen from 4.6 to 7.6 m
Sand backfill from 4.0 to 7.6 m
Bentonite seal from 0.0 to 4.0 m
Provided with a steel monument casing

Water level reading:
W.L. @ El. 289.08 masl on Apr 30, 2019
W.L. @ El. 289.57 masl on May 23, 2019
W.L. @ El. 289.45 masl on Jun 17, 2019
W.L. @ El. 289.76 masl on Apr 07, 2020
W.L. @ El. 289.20 masl on May 25, 2020
W.L. @ El. 288.77 masl on Jun 29, 2020
W.L. @ El. 289.39 masl on Mar 22, 2023



Soil Engineers Ltd.

JOB NO.: 1903-W092

LOG OF BOREHOLE NO.: BH/MW 201

FIGURE NO.: 8

PROJECT DESCRIPTION: Due Diligence For Land Acquistion

METHOD OF BORING: Flight-Auger

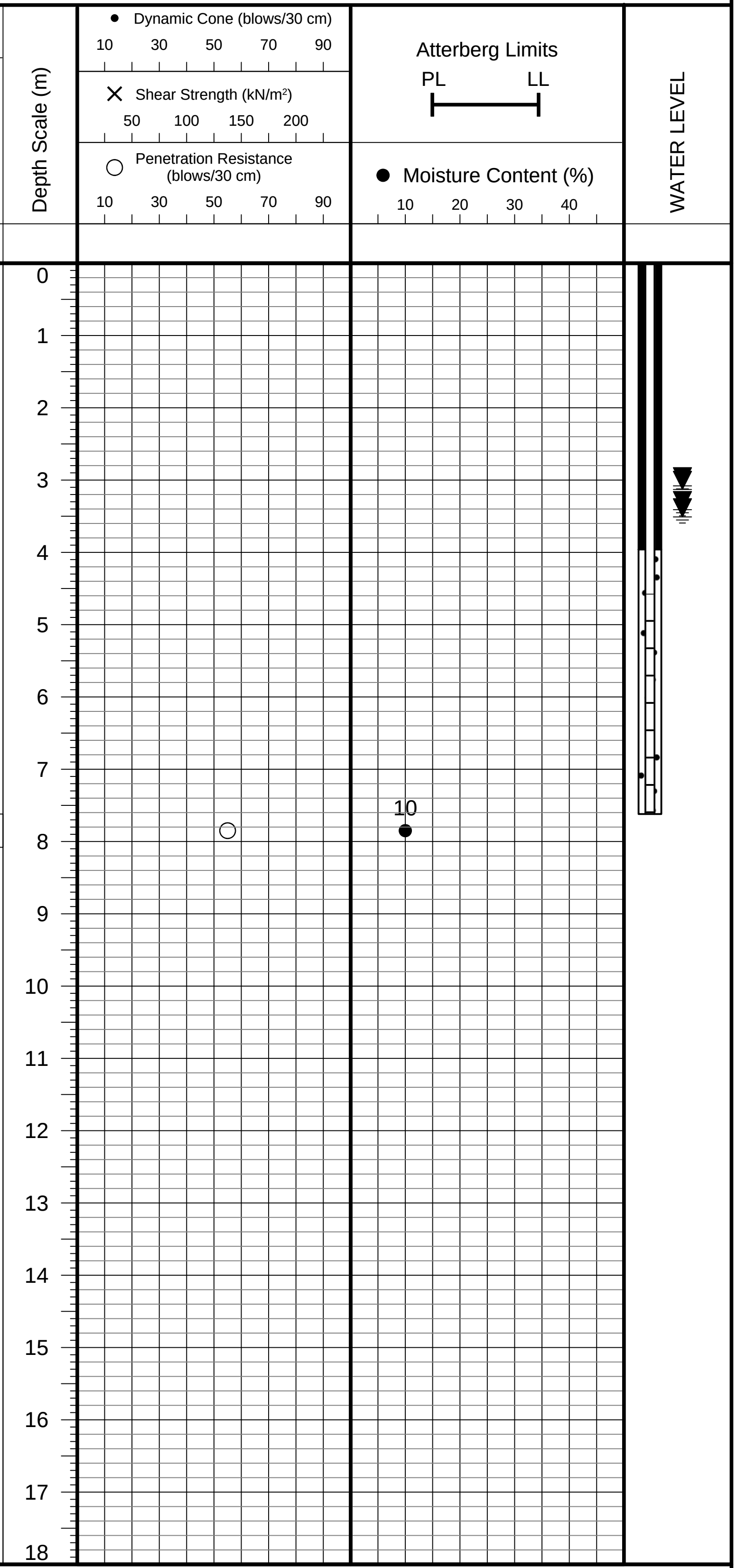
PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

DRILLING DATE: March 4, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
292.4	Ground Surface			
0.0	**25 cm TOPSOIL**			
291.4 1.0	**EARTH FILL** dark brown sandy silt, some clay, organics and rootlets			
	Brown, compact to dense **SANDY SILT TILL** some clay and gravel occ. sand seams and layers, cobbles and boulders			
287.8 4.6	Grey, stiff **SILTY CLAY** occ. seams of fine sand			
286.1 6.3	Grey, compact to very dense **SAND** fine grained, some silt to silty	8	DO	55
284.3 8.1	**END OF THE BOREHOLE**			

Subsoil profile above El. 285.6 m is derived from BH 5 (2016).

Installed 50 mm Ø monotoring well to 7.6 m
3.0 m screen from 4.6 to 7.6 m
sand back fill from 3.9 to 7.6 m
Bentonite seal from 0.0 to 3.9 m
Provided with a Monument Steel Casing
Water level reading:
W.L. @ El. 289.33 masl on Apr 07, 2020
W.L. @ El. 289.28 masl on May 25, 2020
W.L. @ El. 289.00 masl on Jun 29, 2020
W.L. @ El. 288.90 masl on Mar 22, 2023



Soil Engineers Ltd.

JOB NO.: 1903-W092

LOG OF BOREHOLE NO.: BH/MW 202

FIGURE NO.: 9

PROJECT DESCRIPTION: Due Diligence For Land Acquistion

METHOD OF BORING: Flight-Auger

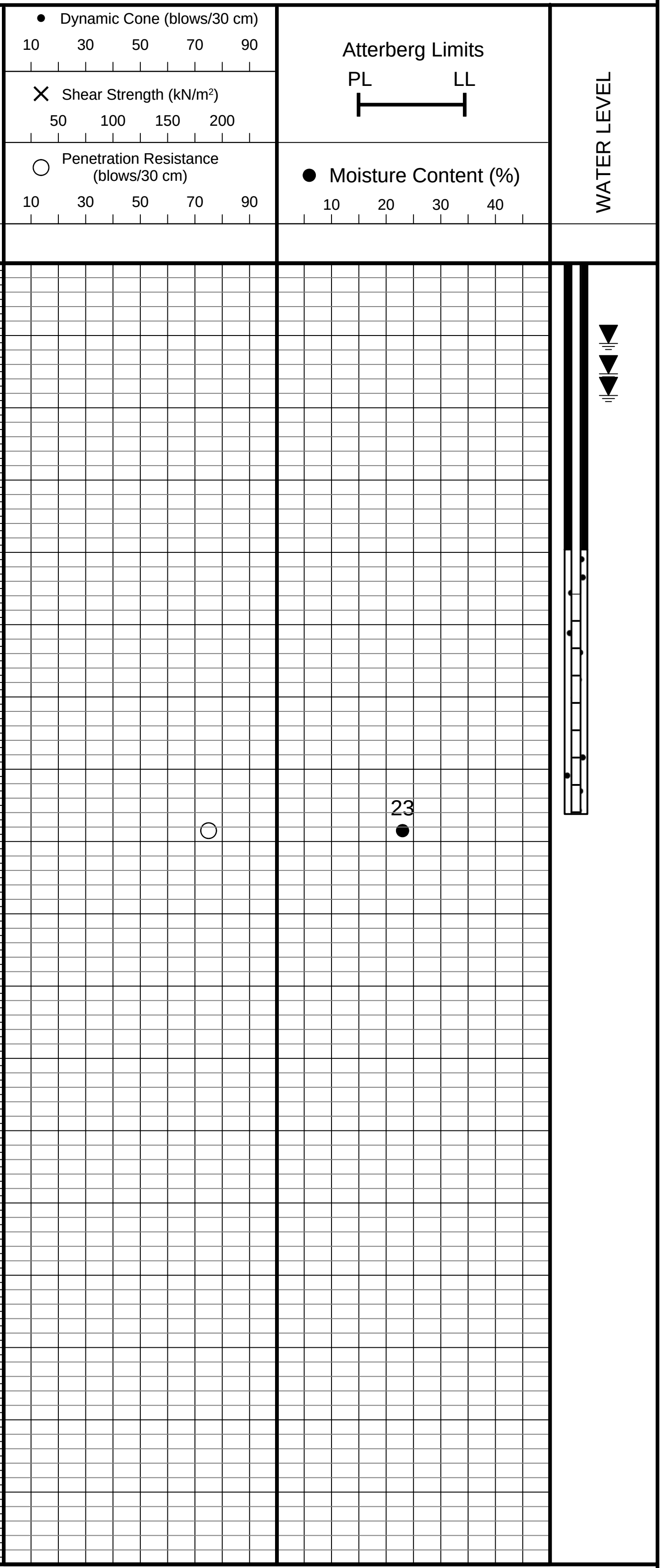
PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

DRILLING DATE: March 4, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
291.7	Ground Surface				
0.0	**40 cm TOPSOIL**				0
290.4 1.3	**EARTH FILL** dark brown sandy silt to silty sand layers of topsoil branch fragments at 1.0 m Brown, compact — brown / grey				1 2
289.0 2.7	**SAND** well graded, layers of sandy silt, a trace of gravel Brown, compact to dense				3
	SANDY SILT TILL some clay and gravel occ. sand seams and layers, cobbles and boulders				4 5 6 7
		8	DO	75	8
283.7 8.1	**END OF THE BOREHOLE**				

Subsoil profile above El. 285.5 m is derived from BH 12 (2016).

Installed 50 mm Ø monotoring well to 7.6 m
3.0 m screen from 4.6 to 7.6 m
sand back fill from 3.9 to 7.6 m
Bentonite seal from 0.0 to 3.9 m
Provided with a Monument Steel Casing
Water level reading:
W.L. @ El. 290.20 masl on Apr 07, 2020
Damaged masl on May 25, 2020
W.L. @ El. 289.90 masl on Jun 29, 2020
W.L. @ El. 290.62 masl on Mar 22, 2023



Soil Engineers Ltd.

JOB NO.: 1903-W092

LOG OF BOREHOLE NO.: BH/MW 203

FIGURE NO.: 10

PROJECT DESCRIPTION: Due Diligence For Land Acquistion

METHOD OF BORING: Flight-Auger

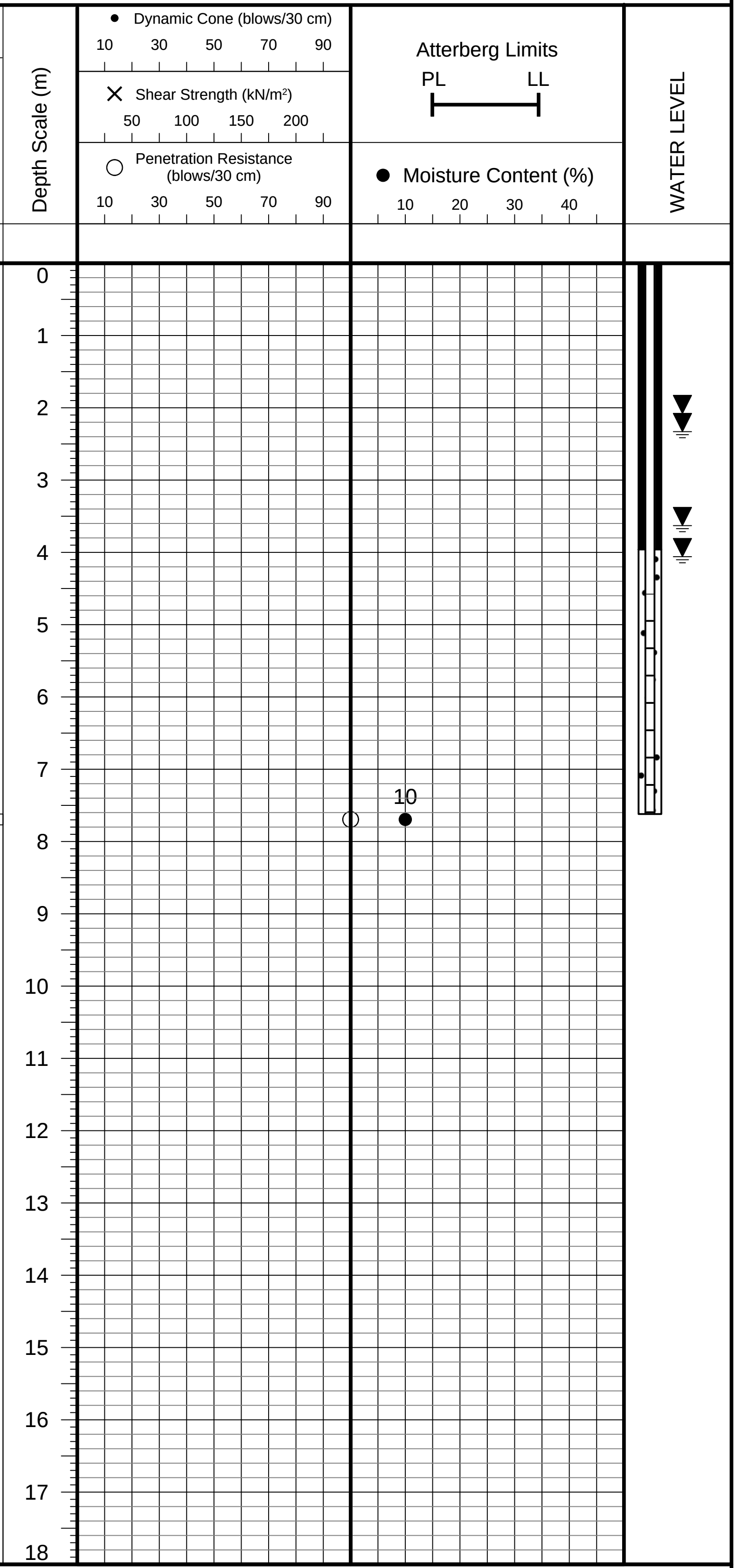
PROJECT LOCATION: 12875 Tenth Line
Town of Whitchurch-Stouffville

DRILLING DATE: March 4, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
293.1	Ground Surface			
293.0 0.0				
0.1	**EARTH FILL** dark brown sandy silt mixed with topsoil, some organics			
291.7 1.4	Brown, stiff **SILTY CLAY TILL** some sand and a trace of gravel			
	Brown, compact to dense **SANDY SILT TILL** some clay and gravel occ. sand seams and layers, cobbles and boulders			
287.9 5.2	Grey, very dense **SILT** seams of silty clay some sand			
285.3		8	DO	50/5
7.8	**END OF THE BOREHOLE**			

Subsoil profile above El. 287.4 m is derived from BH 11 (2016).

Installed 50 mm Ø monotoring well to 7.6 m
3.0 m screen from 4.6 to 7.6 m
sand back fill from 3.9 to 7.6 m
Bentonite seal from 0.0 to 3.9 m
Provided with a Monument Steel Casing
Water level reading:
W.L. @ El. 290.75 masl on Apr 07, 2020
W.L. @ El. 289.45 masl on May 25, 2020
W.L. @ El. 289.02 masl on Jun 29, 2020
W.L. @ El. 291.00 masl on Mar 22, 2023



Soil Engineers Ltd.

JOB NO.: 1903-W092

LOG OF BOREHOLE:BH/MW 301

FIGURE NO.: 1

PROJECT DESCRIPTION: Proposed Residential Development

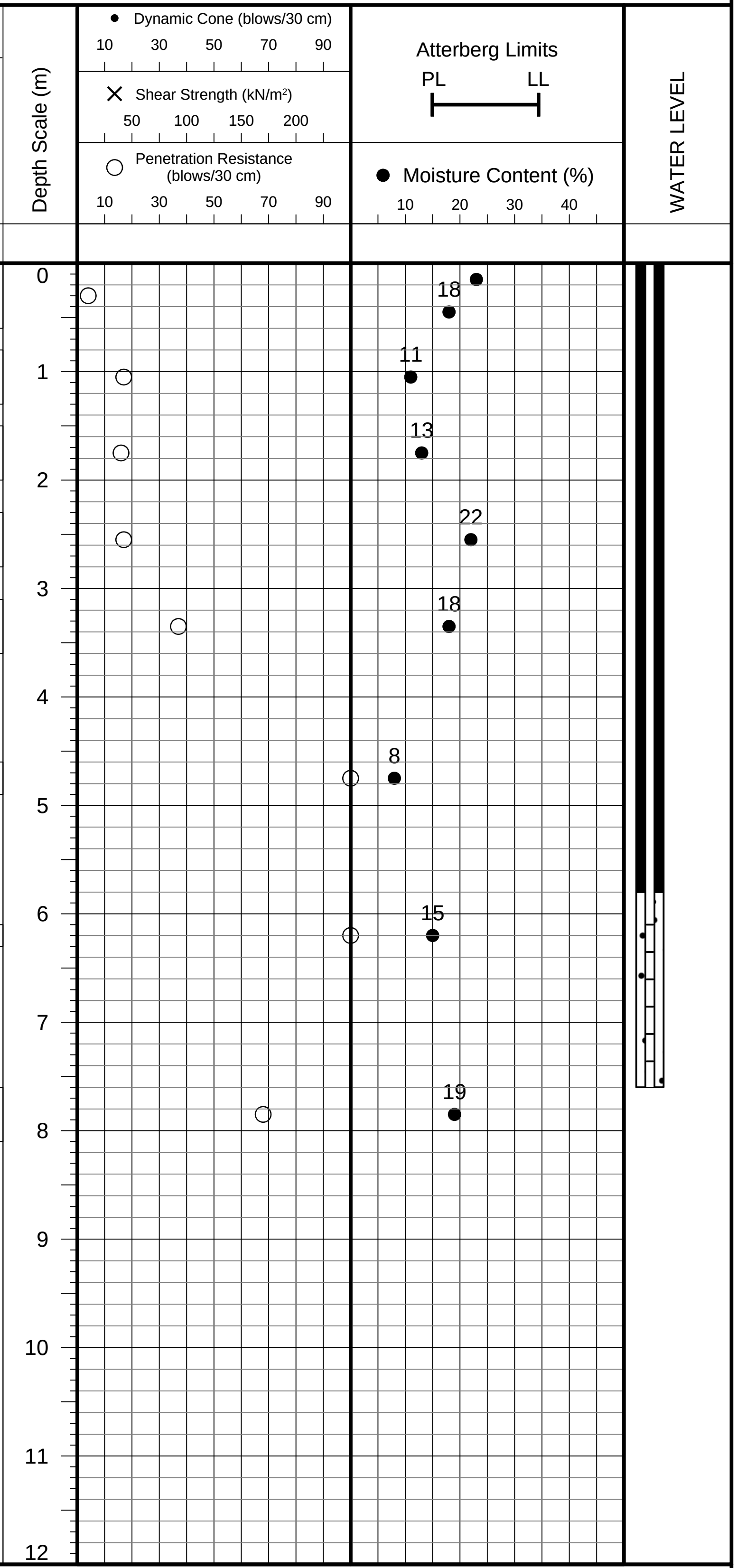
METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 12875 Tenth Line, Town of Whitchurch-Stouffville

DRILLING DATE: December 8, 2025

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
297.0	Ground Surface			
0.0	**30 cm TOPSOIL**	1A	DO	4
	Brown, loose to compact, wet **SILT** a trace of clay weathered	1B		
		2	DO	17
295.5 1.5	Brown, compact **SANDY SILT TILL** traces of clay and gravel	3	DO	16
294.7 2.3	Brown, compact **SILT** some clay	4	DO	17
293.9 3.1	Brown, dense to very dense **SANDY SILT TILL** a trace to some clay a trace of gravel occ. clay layers	5	DO	37
	sand layer	6	DO	50/15
	silt layer	7	DO	50/15
		8	DO	68
288.9 8.1	**END OF BOREHOLE**			

Installed 50 mm Ø monitoring well to 7.6 m
completed with 1.5 m screen
Sand backfill from 5.8 to 7.6 m
Bentonite seal from 0.0 m to 5.8 m
Provided with a momument steel casing
Water level reading:
Dry on Dec 19, 2025
Dry on Jan 07, 2026
Dry on Jan 21, 2026



Soil Engineers Ltd.

JOB NO.: 1903-W092

LOG OF BOREHOLE:BH/MW 302

FIGURE NO.: 2

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

PROJECT LOCATION: 12875 Tenth Line, Town of Whitchurch-Stouffville

DRILLING DATE: December 8, 2025

● 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

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
291.7	Ground Surface			
0.0	**40 cm TOPSOIL** **EARTH FILL** dark brown sandy silt to silty sand layers of topsoil branch fragments at 1.0 m			
290.4 1.3	Brown, compact **SAND** well graded, layers of sandy silt, a trace of gravel brown grey			
289.0 2.7	Brown, compact to very dense **SANDY SILT TILL** some clay and gravel occ. sand seams and layers, cobbles and boulders			
284.1 7.6	**END OF AUGER HOLE**			

Depth Scale (m): 0 1 2 3 4 5 6 7 8 9 10 11 12

WATER LEVEL

Subsoil profile is derived from BH 12 (2016) and BH202 (2020).

Installed 50 mm Ø monitoring well to 7.6 m
completed with 3.0 m screen
Sand backfill from 4.0 to 7.6 m
Bentonite seal from 0.0 m to 4.0 m
Provided with a momument steel casing
Water level reading:
W.L. @ El. 290.20 masl on Dec 19, 2025
W.L. @ El. 290.60 masl on Jan 07, 2026
W.L. @ El. 290.90 masl on Jan 21, 2026

Soil Engineers Ltd.

JOB NO.: 1903-W092

LOG OF BOREHOLE:BH/MW 303

FIGURE NO.: 3

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

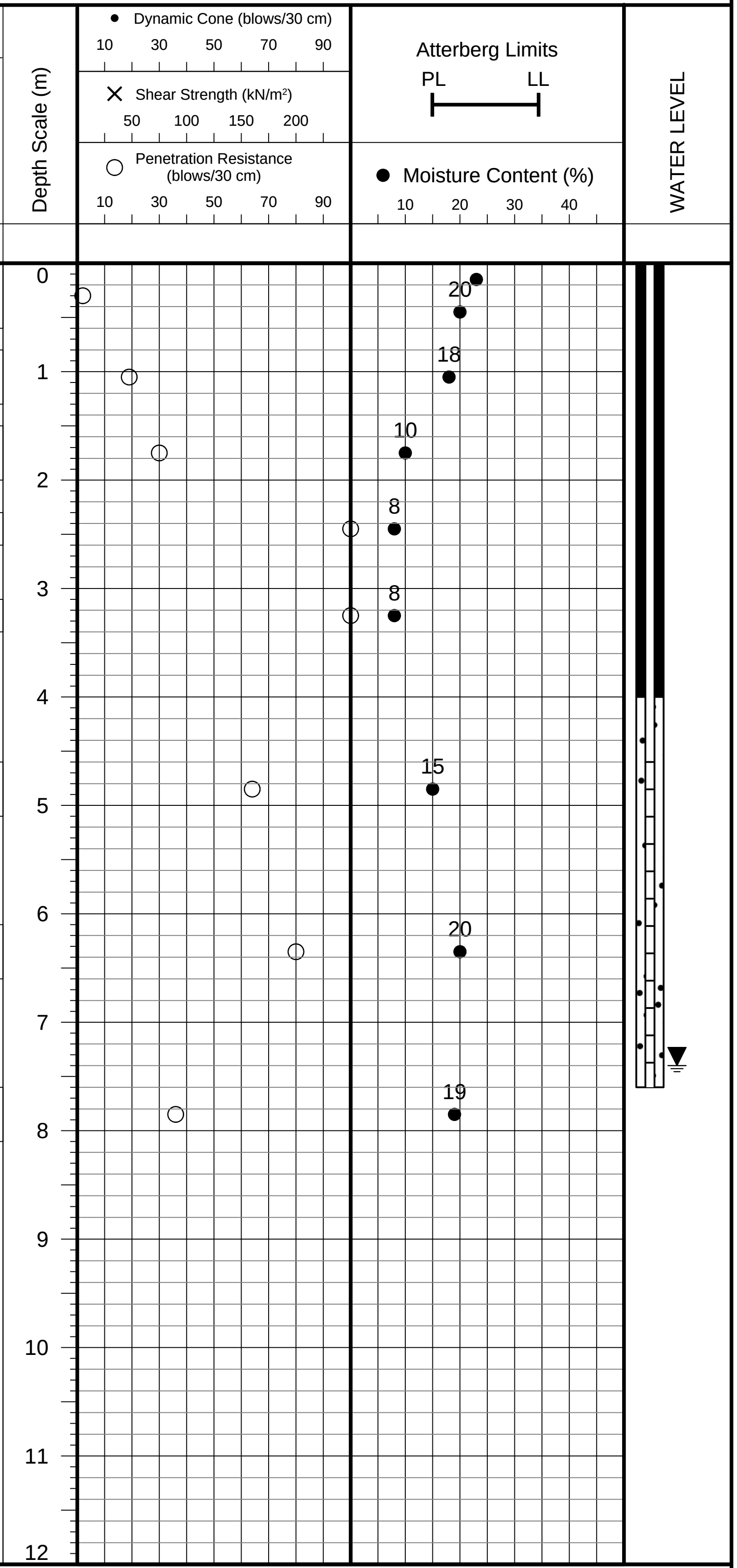
PROJECT LOCATION: 12875 Tenth Line, Town of Whitchurch-Stouffville

DRILLING DATE: December 8, 2025

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
294.3	Ground Surface			
0.0	**13 cm TOPSOIL**	1A 1B	DO	2
	Brown, very loose to very dense weathered **SANDY SILT TILL** traces of clay and gravel	2	DO	19
		3	DO	30
		4	DO	50/15
		5	DO	50/15
289.7 4.6	Brown, very dense **SILT** a trace to some sand wet below 6.1 m	6	DO	64
		7	DO	80
286.7 7.6	Brown, dense, wet **SAND** fine grained, silty	8	DO	36
286.2 8.1				

END OF BOREHOLE

Installed 50 mm Ø monitoring well to 7.6 m
completed with 3.0 m screen
Sand backfill from 4.0 to 7.6 m
Bentonite seal from 0.0 m to 4.0 m
Provided with a momument steel casing
Water level reading:
W.L. @ El. 286.90 masl on Dec 19, 2025
W.L. @ El. 286.90 masl on Jan 07, 2026
W.L. @ El. 287.08 masl on Jan 21, 2026



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JOB NO.: 1903-W092

LOG OF BOREHOLE:BH/MW 304

FIGURE NO.: 4

PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Solid Stem Augers

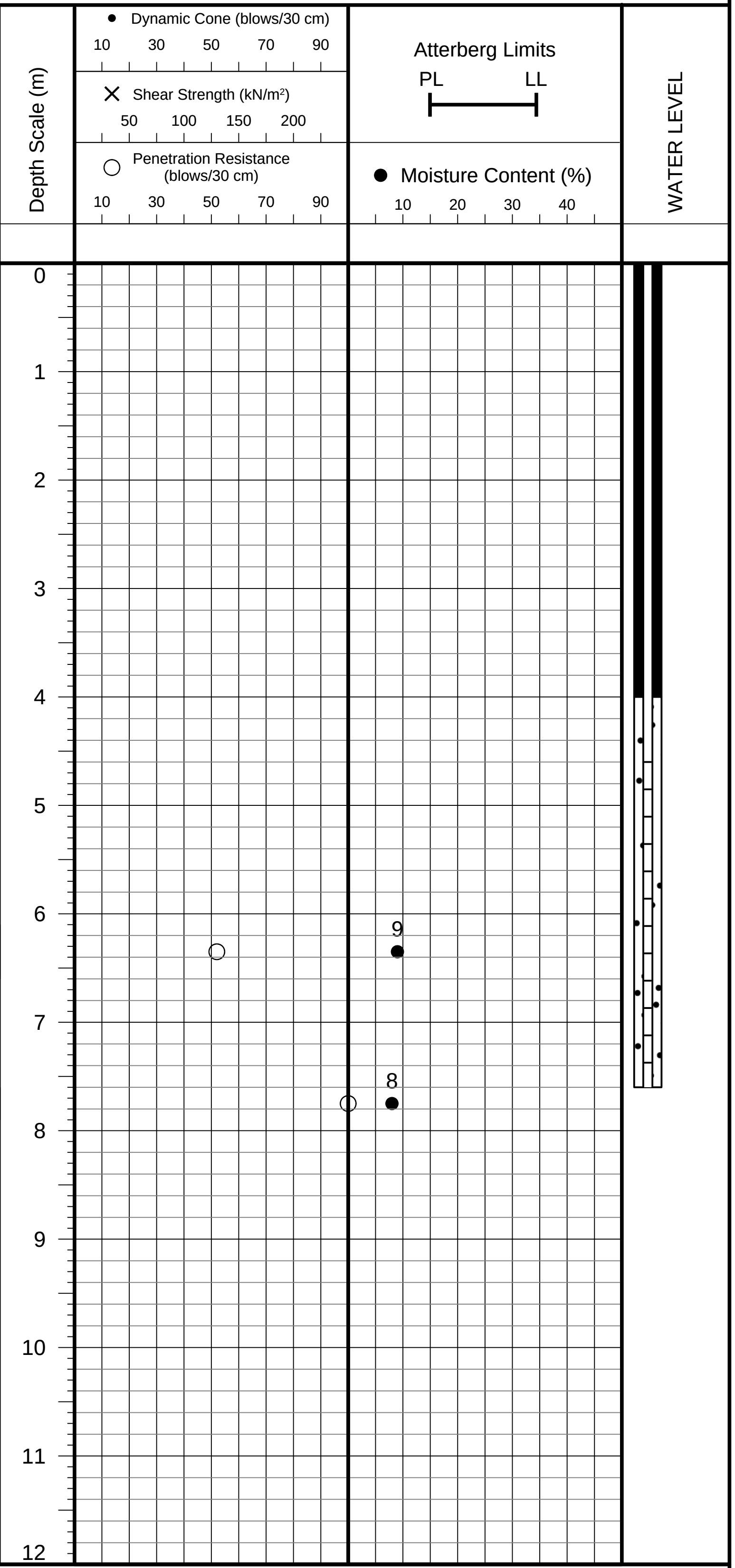
PROJECT LOCATION: 12875 Tenth Line, Town of Whitchurch-Stouffville

DRILLING DATE: December 8, 2025

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
295.6	Ground Surface			
0.0	**35 cm TOPSOIL**			
	Brown, compact to dense **SAND** fine grained occ. seams and layers of sandy silt			
290.5 5.1	Brown, very dense **SANDY SILT TILL** some clay and gravel occ. sand seams and layers, cobbles and boulders			
	sand layer	1	DO	52
		2	DO	50/15
287.7 7.9	**END OF BOREHOLE**			

Subsoil profile above El. 290.0 m is derived from Borehole 8 (2016).

Installed 50 mm Ø monitoring well to 7.6 m
completed with 3.0 m screen
Sand backfill from 4.0 to 7.6 m
Bentonite seal from 0.0 m to 4.0 m
Provided with a momument steel casing
Water level reading:
Dry on Dec 19, 2025
Dry on Jan 07, 2026
Dry on Jan 21, 2026



Soil Engineers Ltd.

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

BARRIE	MISSISSAUGA	OSHAWA	NEWMARKET	MUSKOKA	HAMILTON
TEL: (705) 721-7863	TEL: (905) 542-7605	TEL: (905) 440-2040	TEL: (905) 853-0647	TEL: (705) 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 B

MONITORING WELL RECORDS
1903-W092

REFERENCE NO. 1804-S036

BH/MW	Ground Level Elevation (masl)	Units	30-Apr-19	23-May-19	17-Jun-19	16-Jul-19	7-Apr-20	25-May-20	29-Jun-20	20-Jul-20	28-Aug-20	25-Sep-20	28-Oct-20	27-Nov-20	29-Dec-20
101	298.20	mbgs	6.38	6.93	7.01	7.02	Dry	Dry	Dry	Dry	Dry	Dry	6.91	6.91	6.92
		masl	291.82	291.27	291.19	291.18	<290.9	<290.9	<290.9	<290.9	<290.9	<290.9	291.29	291.29	291.28
102	299.05	mbgs	7.20	7.16	7.16	7.16	Dry	7.10	7.09	7.09	Dry	7.08	7.09	7.10	7.12
		masl	291.85	291.89	291.89	291.89	<291.45	291.95	291.96	291.96	<291.45	291.97	291.96	291.95	291.93
103S	292.07	mbgs	0.39	0.54	0.53	0.90	0.50	0.79	1.19	1.58	2.41	2.62	3.04	3.07	0.57
		masl	291.68	291.53	291.54	291.17	291.57	291.28	290.88	290.49	289.66	289.45	289.03	289.00	291.50
103D	292.17	mbgs	0.35	0.60	0.56	1.03	0.49	0.90	1.30	1.67	4.08	2.59	3.04	3.18	0.59
		masl	291.82	291.57	291.61	291.14	291.68	291.27	290.87	290.50	288.09	289.58	289.13	288.99	291.58
104	296.35	mbgs	6.11	5.52	5.85	6.24	Dry	6.23	6.72	Dry	Dry	7.28	7.29	7.28	7.30
		masl	290.24	290.83	290.50	290.11	<288.75	290.12	289.63	<288.75	<288.75	289.07	289.06	289.07	289.05
105	297.12	mbgs	6.59	Dry	Dry	Dry	5.72	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
		masl	290.53	<289.52	<289.52	<289.52	291.40	<289.52	<289.52	<289.52	<289.52	<289.52	<289.52	<289.52	<289.52
106	295.48	mbgs	6.40	5.91	6.03	6.43	5.72	6.28	6.71	Dry	Dry	Dry	7.10	7.12	7.13
		masl	289.08	289.57	289.45	289.05	289.76	289.20	288.77	<287.88	<287.88	<287.88	288.38	288.36	288.35
201	292.41	mbgs	NI	NI	NI	NI	3.08	3.13	3.41	3.57	4.11	4.23	4.79	4.99	4.69
		masl					289.33	289.28	289.00	288.84	288.30	288.18	287.62	287.42	287.72
202	291.73	mbgs	NI	NI	NI	NI	1.53	Damaged	1.83	2.09	2.53	2.60	2.60	2.40	1.23
		masl					290.20		289.90	289.64	289.20	289.13	289.13	289.33	290.50
203	293.08	mbgs	NI	NI	NI	NI	2.33	3.63	4.06	4.26	4.43	4.57	4.53	4.07	3.11
		masl					290.75	289.45	289.02	288.82	288.65	288.51	288.55	289.01	289.97
301	297.00	mbgs	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
		masl													
302	291.70	mbgs	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
		masl													
303	294.30	mbgs	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
		masl													
304	295.60	mbgs	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
		masl													

NI - Not Installed
NA - Not Available or Decomissioned

BH/MW	Ground Level Elevation (masl)	Units	8-Dec-21	29-Sep-22	27-Oct-22	28-Nov-22	19-Dec-22	22-Mar-23	19-Dec-25	7-Jan-26	21-Jan-26
101	298.20	mbgs	6.90	6.90	6.91	6.90	6.91	6.85	NA	NA	NA
		masl	291.30	291.30	291.29	291.30	291.29	291.35			
102	299.05	mbgs	7.10	7.11	7.11	7.10	7.11	7.09	NA	NA	NA
		masl	291.95	291.94	291.94	291.95	291.94	291.96			
103S	292.07	mbgs	0.43	2.27	2.65	2.80	1.97	0.46	NA	NA	NA
		masl	291.64	289.80	289.42	289.27	290.10	291.61			
103D	292.17	mbgs	0.42	2.29	2.65	2.87	2.14	0.43	NA	NA	NA
		masl	291.75	289.88	289.52	289.30	290.03	291.74			
104	296.35	mbgs	7.31	7.31	7.41	7.41	7.43	6.06	NA	NA	NA
		masl	289.04	289.04	288.94	288.94	288.92	290.29			
105	297.12	mbgs	Dry	Dry	Dry	Dry	Dry	Dry	NA	NA	NA
		masl	<289.52	<289.52	<289.52	<289.52	<289.52	<289.52			
106	295.48	mbgs	7.15	5.13	7.13	7.13	7.14	6.09	NA	NA	NA
		masl	288.33	290.35	288.35	288.35	288.34	289.39			
201	292.41	mbgs	4.30	4.95	5.11	5.23	5.26	3.51	NA	NA	NA
		masl	288.11	287.46	287.30	287.18	287.15	288.90			
202	291.73	mbgs	1.08	2.57	2.57	2.60	2.42	1.11	NA	NA	NA
		masl	290.65	289.16	289.16	289.13	289.31	290.62			
203	293.08	mbgs	2.78	4.25	4.44	4.63	4.09	2.08	NA	NA	NA
		masl	290.30	288.83	288.64	288.45	288.99	291.00			
301	297.00	mbgs	NI	NI	NI	NI	NI	NI	Dry	Dry	Dry
		masl							<289.4	<289.4	<289.4
302	291.70	mbgs	NI	NI	NI	NI	NI	NI	1.50	1.10	0.80
		masl							290.20	290.60	290.90
303	294.30	mbgs	NI	NI	NI	NI	NI	NI	7.40	7.40	7.22
		masl							286.90	286.90	287.08
304	295.60	mbgs	NI	NI	NI	NI	NI	NI	Dry	Dry	Dry
		masl							<288	<288	<288

NI - Not Installed
NA - Not Available or Decomissioned