Proposed Mixed-Use Development

Geotechnical Investigation

Project Location:

3115 Hurontario Street
Mississauga, Ontario

Prepared for:

Clearbrook Developments Ltd.
2345 Yonge Street, Suite 804
Toronto, Ontario M4P 2E5

Prepared by:

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July 26, 2022

MTE File No.: 50347-100

Engineers, Scientists, Surveyors.

Contents

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Appendices

1.0 Introduction

MTE Consultants Inc. (MTE) was retained by Clearbrook Developments Ltd. to conduct a geotechnical investigation for a proposed mixed-use development at 3115 Hurontario Street in Mississauga, Ontario, as shown on **Figure 1 in Appendix A**. The site currently has a low-rise building with a parking lot fronting onto Hurontario Street. The remainder of the Site consists of grassed areas and trees.

A new 35-storey tower with two and six-storey podiums is proposed at the site. Four levels of underground parking are proposed at the site. It is anticipated that the new development will be provided with full municipal services.

The ground surface is relatively flat, with grade differences of 0.1 to 1.1 m between the borehole locations. MTE is also concurrently carrying out an Environmental Phase 2 Site Assessment and a Hydrogeological Assessment at the site and the reports will be provided under separate cover.

The purpose of this geotechnical investigation is to determine the soil and groundwater conditions in the area of the proposed development and provide geotechnical engineering recommendations for site grading, site servicing, foundations, basements, floor slabs, shoring design parameters, pavement design and subdrainage requirements.

2.0 Field and Laboratory Program

The fieldwork for this investigation was carried out on February 14 to 18, 2022 and involved the drilling of ten geotechnical boreholes (Boreholes MW101-22 to MW105-22 and MW107-22 to BH111-22) to depths ranging from 1.2 to 15.6 meters below ground surface (mbgs). The locations of the boreholes are shown on the Site Plan, **Figure 1 in Appendix A**.

Private and public utility companies were contacted prior to the start of drilling activities in order to isolate underground utilities near the boring locations.

With the exception of borehole BH103-22 which was advanced with a pneumatic Pionjar, the boreholes were advanced with a CME55 track mounted drill rig equipped with continuous flight hollow stem augers, supplied and operated by Geo-Environmental Drilling Inc. The encountered bedrock was cored using an HQ diameter core barrel.

Representative soil samples were recovered throughout the depths explored. Standard Penetration Tests (SPT) were carried out during sampling operations in the boreholes using conventional split spoon equipment. Samples of encountered cohesive deposits were tested using a handheld pocket penetrometer to determine the approximate shear strengths. The SPT N-values and approximate shear strengths recorded are plotted on the borehole logs in **Appendix B**.

The bedrock core specimens were measured in the field to determine the Rock Quality Designation (RQD) (ASTM 6032) and returned to our office for further classification. Two samples of the recovered bedrock were submitted for unconfined compressive strength testing.

Upon completion of drilling, 50 mm diameter monitoring wells were installed in MW101-22, MW102-22, and MW104-22 to MW109-22 to allow measurement of stabilized groundwater levels and groundwater sampling and testing, if required. The installation comprised 3.0 m filtered screens and bentonite seals above the screens. Stabilized water level measurements were taken by MTE on March 23, 2022. Details of the installations and groundwater observations and measurements are provided on the appended borehole logs.

The monitoring wells were installed in accordance to Ontario Regulation 468/10. A licensed well technician must properly decommission all wells before construction. The construction, maintenance and abandonment of the wells are regulated under the province's Water Resources Act.

The fieldwork was monitored throughout by a member of our geotechnical engineering staff, who directed the drilling procedures; conducted SPT tests; measured the bedrock cores for RQD; documented the soil and bedrock stratigraphies; monitored groundwater conditions and monitoring well installations; and transported the recovered soil samples back to our office for further classification.

The ground surface elevations at the borehole locations were surveyed by MTE and referenced to a geodetic datum.

All of the soil samples collected were submitted for moisture content testing with the results provided on the borehole logs in **Appendix B**. Additionally, five soil samples were submitted for particle size distribution analyses and the results are provided in **Appendix C**. The remaining soil samples will be stored for a period of 1 month and will be discarded of at that time without prior request from the client to extend storage time.

3.0 Soil Conditions

Reference is provided to the appended borehole logs for soil stratigraphy details, SPT N-values, approximate shear strengths, bedrock RQD values, moisture content profiles, and groundwater observations and measurements. Soil conditions encountered at the site typically include asphaltic concrete and/or fill materials overlying native sand, glacial till, and shale bedrock.

3.1 Asphaltic Concrete

Asphaltic concrete was encountered surficially in Boreholes MW101-22, MW104-22 and MW109-22 and was approximately 100 mm thick. Borehole BH103-22 was advanced within the basement of the existing building through the concrete floor which was also approximately 100 mm thick.

3.2 Fill

Fill was encountered below the pavement structure and concrete floor in Boreholes MW101-22, MW104-22, MW109-22, and BH103-22, as well as surficially in all remaining boreholes and extended to depths ranging from 0.1 m to 2.4 mbgs. The fill was brown to dark brown in colour and typically ranges in composition from sand and gravel to sandy silt. The upper portion of the fill at Boreholes MW102-22, MW107-22, MW108-22, MW110-22, and MW111-22 consisted of topsoil material and was 175 to 760 mm thick (average thickness of approximately 315 mm). N-values measured in the fill soils ranged from 8 to 42 blows per 300 mm penetration of the split spoon sampler indicating loose to dense conditions. Insitu moisture contents in the fill ranged from about 5 to 22% indicating moist to saturated conditions.

3.3 Granular Soil Deposits

Native granular deposits were encountered below the fill material in all boreholes and were underlain by glacial till or shale deposits at depths ranging from 2.4 to 3.8 mbgs with the exception of Borehole BH103-22 where the granular deposits extended beyond the borehole termination depth of 1.2 mbgs. The granular deposits were brown in colour and varied in composition from sand to sand and silt.

The results of four particle size distribution analyses conducted on samples of the granular soils are provided in **Appendix C** and summarized in the following table:

Table 1 – Results of Granular Soil Particle Size Distribution Analyses

Borehole Number	Sample Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
MW101-22	2.3 – 2.9	1	58	40	1
MW102-22	2.3 – 2.9	0	92	7	1
MW104-22	3.0 – 3.7	10	80	9	1
MW109-22	2.3 – 2.9	1	90	7	2

SPT N-values measured in the granular soils ranged from 10 to 20 blows per 300 mm penetration of the split spoon sampler indicating loose to compact conditions. Insitu moisture contents in the native granular soils ranged from about 4 to 22% indicating moist to saturated conditions.

3.4 Glacial Till Deposits

Glacial till was encountered below the granular deposits in Boreholes MW107-22, MW108-22, BH110-22, and BH111-22 and was underlain by shale bedrock at depths of 3.0 to 4.0 mbgs. The till was grey in colour and typically ranges in composition from clayey silt to clayey sandy silt. The results of a particle size distribution analysis conducted on a sample of the till is provided in **Appendix C** and summarized in the following table;

Table 2 - Results of Glacial Till Deposits Particle Size Distribution Analyses

Borehole Number	Sample Depth (mbgs)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
MW107-22	3.0 – 3.7	6	25	43	26

SPT N-values measured in the granular soils ranged from 17 to 27 blows per 300 mm penetration of the split spoon sampler indicating very stiff conditions. Approximate shear strength values of 225 kPa as measured with a pocket penetrometer indicate a hard consistency. 300 mm penetration of the split spoon sampler indicating loose to compact conditions. Insitu moisture contents in the native glacial till ranged from about 11 to 16% indicating drier than the plastic limit conditions.

3.5 Bedrock

Grey shale bedrock was encountered below the granular deposits and/or glacial till in all boreholes with the exception of Borehole BH103-22 and extended beyond the termination depth of each borehole. The bedrock was encountered at depths of approximately 3.0 to 4.0 m (Elevation 114.1 to 115.3 metres above sea level (masl)). Based on mapping by the Ontario Geological Survey, the shale bedrock in the area of the subject site is of the Georgian Bay formation. The upper portions of the shale bedrock was weathered. In general, the weathered zone for shale in this region is typically in the order of 3.0 m thick, becoming more sound with depth.

Bedrock core samples were taken in Boreholes MW107-22 and MW109-22. The core samples had rock quality designations (RQD) of about 0 to 74% indicating that the bedrock quality varies from very poor to fair quality. In general, the quality of the shale bedrock increases with depth. Five unconfined compressive strength tests were performed on the shale bedrock as per the following table:

Table 3 - Results of Unconfined Compressive Strength Tests

Borehole and Sample Number	Sample Depth (mbgs)	Sample Elevation (masl)	RQD (%)	Sample Density (Mg/m^3)	Compressive Strength (MPa)
MW107-22 RC10	8.0 – 9.5	110.3 – 108.8	30.2	2.26	6.4
MW107-22 RC12	11.0 – 12.6	107.3 – 105.7	45.0	2.28	6.2
MW107-22 RC13	12.6 – 14.1	105.7 – 104.2	66.4	2.25	6.1
MW109-22 RC11	9.5 – 11.0	108.8 – 107.3	58.2	2.30	8.6
MW109-22 RC14	14.1 – 15.6	104.2 – 102.7	74.3	2.25	34.4

Based on the results of the testing, the strength of the shale bedrock generally improves with RQD rating.

4.0 Groundwater Conditions

Groundwater observations were carried out in the open boreholes at the time of drilling and are summarized on the borehole logs. Water was encountered during drilling at depths of 2.6 to 3.4 mbgs (Elevation 115.0 to 115.7 masl) in all boreholes with the exception of Borehole BH103-22 which was dry to a depth of 1.2 m.

Groundwater levels were measured in the monitoring wells installed at the site in March 2022 and the results of the measured groundwater levels are summarized in the table below:

Table 4 – Groundwater Measurements

Borehole	Date Measured	Ground Surface Elevation (masl)	Water Level Depth (mbgs)	Water Level Elevation (masl)
MW101-22	March 23, 2022	118.7	3.0	115.7
MW102-22	March 22, 2022	118.5	2.9	115.6
MW104-22	March 22, 2022	118.7	3.4	115.3
MW105-22	March 23, 2022	117.8	2.8	115.0
MW107-22	March 23, 2022	118.3	5.8	112.5
MW108-22	March 23, 2022	117.6	2.5	115.1
MW109-22	March 9, 2022	118.3	4.5	113.8

The deeper measurements were recorded in the monitoring wells installed in the bedrock. Additional groundwater levels are available in the hydrogeological report under separate cover. It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations and local variations.

5.0 Discussion and Recommendations

5.1 General

The project involves the design of a proposed new 35-storey mixed-use building at the site, with two and six-storey podiums and four levels of underground parking. The building design is in the preliminary stages and detailed design information was not known at the time of report preparation. Based on the existing ground surface and the four levels of underground parking, the finished floor level for the lowest level of underground parking is understood to be at a depth of approximately 13.5 mbgs (Elevation 105.2 to 103.8 masl). It is assumed that the foundation thicknesses will extend an additional 1 to 2 m below this level.

The subsurface stratigraphy at the site generally comprises pavement structure and/or fill materials overlying granular deposits, glacial till deposits and shale bedrock. Groundwater was measured within the granular deposits and glacial till in the monitoring wells at depths ranging from 2.5 to 3.4 mbgs (Elevation 115.7 to 115.0 masl) and within the bedrock at depths of 4.5 and 5.8 mbgs (Elevation 113.8 to 112.5 masl).

Based on the results of this geotechnical investigation, the proposed development will be feasible. The following subsections of this report contain geotechnical recommendations pertaining to development of the property; including, site servicing, foundations, basements, floor slabs, shoring design parameters, and subdrainage requirements.

5.2 Site Servicing

5.2.1 Excavations and Dewatering

It is assumed that the development will be serviced with full municipal services. It is anticipated that the invert levels for the watermain and sewers will be at conventional depths. It is anticipated that excavations may be required to extend in the shale bedrock for servicing and foundation construction. It is anticipated that excavations will generally be feasible using a large excavator equipped with a single tooth ripper. Where harder shale/limestone layers are encountered, jackhammer equipment may be required to break through the layers.

Temporary excavations to conventional depths for installation of underground pipes at this site must comply with the Ontario Occupational Health and Safety Act and Regulations for Construction Projects. The fill materials and granular deposits encountered in the boreholes would be classified as Type 3 soils (O. Reg. 213/91, s. 226 (4)). Temporary side slopes must be cut at an inclination of 1.0 horizontal to 1.0 vertical or less from the base of the excavation for open cut pipe installation. The glacial till deposits and shale bedrock would be classified as Type 2 soils and temporary side slopes must be cut at an inclination of 1 horizontal to 1 vertical or less at a level 1.2 m above the base of the excavation, exclusive of groundwater effects.

Trench side slopes must be continuously inspected especially after periods of heavy rainfall or snow melt to identify areas of instability. Surface water should be directed away from entering the trench.

Provisions should be made in the excavation contract for excavation through the shale bedrock if depths of the underground pipes are below the shale.

Any nuisance dewatering in areas of isolated saturated deposits in the upper soils should be adequately handled by sumps and pumps. Moderate to significant groundwater inflow should be expected where the excavations extend below the measured groundwater levels of 2.5 to 3.4 mbgs within the granular deposits and glacial till deposits, and below the measured groundwater levels of 4.5 to 5.8 mbgs within the shale bedrock. Every excavation that a worker may be required to enter shall be kept reasonably free of water (O. Reg. 213/91, s. 230).

It should be noted that an Environmental Activity and Sector Registry (EASR) or Permit to Take Water (PTTW) is not anticipated to be required for the dewater system for servicing installations at the site if excavations do not extend beyond the stabilized groundwater levels, however, it is expected that dewatering will be required for the foundation excavations. The design of the dewatering system should be left to the contractor's discretion to control groundwater at least 0.5 m below the underside of the excavations.

Additional dewatering commentary is provided in the hydrogeological assessment report provided under separate cover.

5.2.2 Pipe Bedding

It is anticipated invert elevation of the pipes will be at conventional depths below ground surface. No bearing problems are anticipated for pipes set on properly dewatered native inorganic subsoil or imported structural fill. The bedding material may need to be thickened if sub-excavation encounters soft or spongy soil from the base of the service trench.

If the pipe bedding is placed directly on highly weathered shale with extensive fractures and cracks, it is recommended that a filter cloth cover the shale surface to prevent loss of the bedding material in the cracks. The rock surface should be prepared to avoid any projections which could lead to damage of the pipes.

Pipe bedding for water and sewer services should be conventional Class 'B' pipe bedding comprising a minimum 150 mm thick layer of OPSS Granular 'A' aggregate below the pipe invert. Granular 'A' type aggregate should be provided around the pipe to at least 300 mm above the pipe and the bedding aggregate should be compacted to a minimum 95% Standard Proctor Maximum Dry Density (SPMDD).

A well-graded clear stone such as Coarse Aggregate for HL4 Asphaltic Concrete (OPSS 1003) could be used in the sewer trenches as bedding below the spring line of the pipe to facilitate sump pump dewatering, if necessary. The clear stone should be compacted with a plate tamper and fully wrapped with a non-woven filter cloth.

5.2.3 Trench Backfilling

The trenches above the specified pipe bedding should be backfilled with inorganic onsite soils placed in 300 mm thick lifts and compacted to at least 95% SPMDD. Wet or saturated native soils are not considered suitable for reuse as trench backfill. Any additional material required at the site should comprise imported granular soils such as OPSS Select Subgrade Material.

Shale should not be used as trench backfill unless adequate heavy equipment is used to break down the material. The properties of the shale can drastically change when exposed to air and water; therefore, it is not recommended to use shale as trench backfill.

To minimize potential problems, backfilling operations should follow closely after excavation so that only a minimal length of trench is exposed. Care should be taken to protect side slopes of excavations by diverting surface run-off away from the excavations. If construction extends into the winter, then additional steps should be taken to minimize frost and ensure that frozen material is not used as backfill.

5.3 Shallow Foundation Design

It is understood that the proposed building designs will be constructed with four levels of underground parking. It is understood that the finished floor level for the lowest level of underground parking will be at a depth of approximately 13.5 mbgs (Elevation 105.2 to 103.8 masl). It is assumed that the foundation thicknesses will extend an additional 1 to 2 m below this level.

Based on the results of this investigation, conventional footings founded on sound and unweathered shale bedrock may be designed for a factored geotechnical bearing resistance at Ultimate Limit States (ULS) of 3,000 kPa and soil bearing resistance for 25 mm of settlement at Serviceability Limit States (SLS) of 2,500 kPa.

The shale materials are highly susceptible to disintegration of the clay rich material when exposed to water and/or alternate cycles of wetting and drying, and freeze and thaw. It is recommended the length of time the shale is exposed be minimized in the excavation base prior to pouring concrete. If there are conflicts with scheduling, a mud mat could be placed to protect the integrity of the working surface and prevention of the shale being exposed to degradation. The mud mat should comprise a 50 to 75 mm thick layer of low strength concrete (minimum 10 MPa).

The soil in trenches beneath footings for sewer and watermain services shall be filled with concrete having a strength not less than 10 MPa, to support the footing.

The footing areas must be inspected by a geotechnical engineer to ensure that the rock conditions encountered at the time of construction are suitable to support the design resistances prior to pouring concrete. Any loose, disturbed, organic and deleterious material identified during the inspection should be removed from the footing areas and replaced with concrete.

All exterior floor slabs and footings in unheated areas must be provided with a minimum 1.2 m of earth cover after final grading in order to minimize the potential of damage due to frost action, as per Ontario Provincial Standard Drawing, OPSD 3090.101, dated November 2010. If construction is undertaken during the winter, the subgrade soil and concrete should be protected from freezing.

A modulus of subgrade reaction of 40 to 50 MPa/m should be used in the design of the floor slab on bedrock.

A minimum 150 mm thick layer of Granular 'A' material uniformly compacted to 100% SPMDD should be provided directly beneath the floor slab for leveling and support purposes.

Where spread footings are constructed at different elevations, the difference in elevation in the individual footing should not be greater than one half of the clear distance between the footings. The lower footing should be constructed first so that if it is necessary to construct the lower footings at a greater depth than anticipated, the elevation of the upper footings can be adjusted accordingly. Stepped strip footings should be constructed in accordance with OBC Section 9.15.3.8.

A Site Classification ‘C’ should be used for earthquake load and effects in accordance with Table 4.1.8.4.A. of the 2012 Ontario Building Code for foundations on shale bedrock. A higher Site Classification may be available but would need to be confirmed through shear wave testing.

5.4 Earth Pressure on Below Grade Walls

It is understood that the proposed structure will be constructed with four levels of parking below grade. The groundwater table measured in the overburden and bedrock monitoring wells is located at 2.5 to 5.8 mbgs (Elevation 115.7 to 112.5 masl). It is anticipated that the underground parking structure will be constructed with a perimeter drainage system to prevent the buildup of hydrostatic pressures. The lateral earth pressure acting at any depth may be calculated using the following formula:

$$P_{soil} = K_1 (\gamma_1 h_1 + q)$$

$$P_{rock} = K_2 (\gamma_1 H_1 + q + \gamma_2 h_2)$$

where:

P = lateral earth pressure acting at depth h_1 or h_2 (kPa)

K_1 = earth pressure coefficient – assume 0.4 for soil pressure

K_2 = rock pressure coefficient – assume 0.25 for shale pressure

γ_1 = unit weight of soil backfill – assume 22 kN/m^3

γ_2 = unit weight of bedrock – assume 25 kN/m^3

h_1 = depth below ground surface (m)

H_1 = depth of bedrock below ground surface (m)

h_2 = depth below bedrock/overburden interface (m)

q = value of surcharge (kPa)

The above equation assumes that hydrostatic pressures will be dissipated by a perimeter drainage layer. If this is not the case and the below grade parking garage is constructed as a water-tight 'tanked' design, then hydrostatic pressure must be accounted for in the design. If a secant caisson wall is used for temporary shoring and the foundation wall is poured against the caisson wall, both the caisson wall and the foundation wall must be designed to resist hydrostatic pressures. If required, the magnitude of the hydrostatic uplift may be calculated using the following formula:

$$P = \gamma \times d$$

where:

P = hydrostatic uplift pressure acting on the base of the structure (kPa)

γ = unit weight of water - use 9.81 kN/m3

d = depth of base of the structure below the design high water level (m)

The Georgian Bay Formation shale bedrock contains substantial locked-in horizontal stresses. When released, these stresses can impose significant loading on underground structures often referred to as 'rock squeeze'.

This deformation is slow developing over time and will continue past initial elastic deformations. The building foundation should not be designed to resist these forces and it is recommended that a layer of compressible material should be placed between the structure and the rock.

5.5 Subdrainage and Floor Slabs

If discharge of groundwater to a storm sewer is permissible, the site should be provided with perimeter and subfloor weeping tile systems. The drain tile or pipe should be laid on well compacted soil so that the top of the tile or pipe (minimum 100 mm diameter) is below the bottom of the underground parking structure floor slab. The top and sides of the drain tile or pipe shall be surrounded with not less than 150 mm of crushed stone or other clean coarse granular material containing no more than 10% of material that will pass the 4 mm sieve. The crushed stone should be wrapped with filter cloth. The weeping tile must drain to a sump equipped with an automatic pump that will discharge water into a storm sewer service or other suitable frost free outlet.

If the proposed underground parking structure is constructed using conventional slab-on-grade floor techniques, the proposed subgrade will comprise the undisturbed shale bedrock.

Any additional material required to raise grades below the floor slabs should be comprised of sand and gravel and be compacted to 100% SPMDD. A minimum 200 mm thick layer of clear crushed stone (19 mm maximum aggregate) should be placed and compacted directly beneath the slab for leveling and support purposes.

A modulus of subgrade reaction of 40 to 50 MPa/m should be used in the design of the floor slab on bedrock.

The water to cement ratio and slump of the concrete utilized in the floor slab should be strictly controlled to minimize shrinkage of the slab. Control joints should be sawed into the slabs at regular intervals within 12 hours of initial concrete placement in order to prelocate shrinkage cracks.

Concrete testing should be performed onsite to determine the slump, temperature, and air entrainment; and concrete cylinders should be cast for compressive strength testing.

5.6 Shoring Design Parameters

It is anticipated that excavations at the above safe excavation inclinations as per the Ontario Occupational Health and Safety Act and Regulations for Construction Projects will be considered not practicable given the proposed depth of excavation and adjacent site constraints and shoring installation will be required at the site. It is anticipated that conventional shoring systems such as soldier piles with lagging or secant caisson wall would be generally suitable at the site, however, the method of shoring should be left to the contractor's discretion.

If an excavation may affect the stability of the adjacent structure, the contractor shall take precautions to prevent damage to the adjacent building as per O.Reg 213/91, s. 229. Temporary shoring measures must be designed as per the Canadian Foundation Engineering Manual. The surcharge loading from adjacent structures must be accounted for in the design of the shoring system.

The following soil parameters can be utilized in the design of shoring systems at the site;

Table 5 – Shoring Design Parameters

Soil	Unit Weight (kN/m^3)	Friction Angle	K_o	K_a	K_p
Fill	18	27	0.59	0.38	2.66
Granular Deposits	20	30	0.50	0.33	3.00
Glacial Till	22	32	0.47	0.31	3.26
Shale Bedrock	25	40	0.43	0.27	3.69

The at rest earth pressure coefficient (K_0) should be utilized when movement adjacent to the wall must be minimal. The active earth pressure coefficient (K_a) can be utilized when minor movements can be tolerated.

Movement of any shoring system is inevitable but provided sound design and construction practices are employed, horizontal movements would be anticipated in the range of 0.1 to 0.25% of the height retained. Monitoring of the shoring system should be provided on a periodic basis by the site contractor.

Soil anchors at the site may be designed for 30 kPa and rock anchors may be designed with a skin friction of 350 kPa. These design values must be confirmed onsite at the time of construction by load testing carried out to twice the design load.

5.7 Construction inspection and Testing

MTE recommends that geotechnical inspection and testing procedures be conducted throughout the various phases of the project.

Engineer site visits should be conducted to confirm geotechnical bearing resistances for footings. Soil compaction testing should be carried out on structural fill beneath the building, foundation wall backfill, subslab granular fill, and trench backfill. Laboratory and field testing of the pavement structure components (granulars and asphaltic concrete) should be conducted, as well as concrete testing for foundations, curbs and sidewalks.

MTE offers soil compaction, concrete, and asphalt testing as well as soil inspection services through our Stratford and London offices.

6.0 Limitations of Report

Services performed by MTE Consultants Inc. (MTE) were conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the Geotechnical Engineering & Consulting profession practicing under similar conditions in the same geographic area were the services are provided. No other warranty or representation expressed or implied as to the accuracy of the information, conclusions or recommendations is included or intended in this report.

This report was completed for the sole use of the Client. This report is not intended to be exhaustive in scope or to imply a risk-free site. As such, this report may not deal with all issues potentially applicable to the site and may omit aspects which are or may be of interest to the reader.

In addition, it should be recognized that a soil sample result represents one distinct portion of a site at the time it is collected, and that the findings of this report are based on conditions as they existed during the time period of the investigation. The material in the report reflects our best judgment using the information available at the time the report was written. The soil and groundwater conditions between and beyond the test holes may differ from those encountered in the test holes. Should subsurface conditions arise that are different from those in the test holes MTE should be notified to determine whether or not changes should be made as a result of these conditions.

It should be recognized that the passage of time may affect the views, conclusions and recommendations (if any) provided in this report because groundwater conditions of a property can change, along with regulatory requirements. All design details were not known at the time of submission of this report and it is recommended MTE should be retained to review the final design documents prior to construction to confirm they are consistent with our report recommendations. Should additional or new information become available, MTE recommends that it be brought to our attention in order that we may determine whether it affects the contents of this report.

Any use which another party makes of this report, or any reliance on, or decisions to be made based upon it, are the responsibility of such parties. MTE accepts no responsibility for liabilities incurred by or damages, if any, suffered by another party as a result of decisions made or actions taken, based upon this report. Others with interest in the site should undertake their own investigations and studies to determine how or if the condition affects them or their plans. The contractors bidding on this project or undertaking the construction should make their own interpretation of the factual information and draw their own conclusions as to how subsurface conditions may affect their work.

The benchmark and elevations provided in this report are primarily established to identify differences between the test hole locations and should not be used for other purposes such as, planning, development, grading, and excavation.

All of which is respectfully submitted,

MTE Consultants Inc.

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KRD/BRT:

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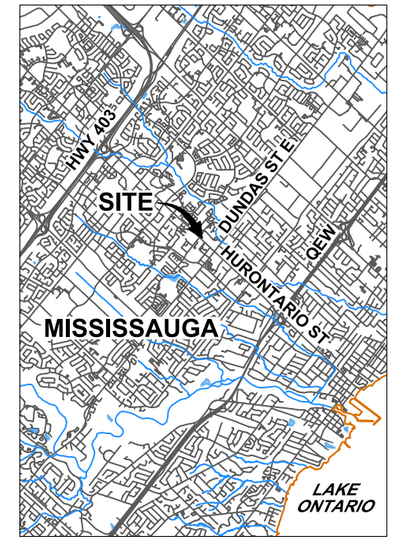
Appendix A

Figures

Figure 1 - Site Plan



KEY PLAN (nts)

LEGEND

— — —	SITE BOUNDARY
●	BOREHOLE
⊕	BOREHOLE/MONITORING WELL
(118.3m)	ELEVATION (m AMSL)

REFERENCES

AERIAL IMAGERY © QUEEN'S PRINTER FOR ONTARIO, 2022;
R-PE SURVEYING LTD., PLAN OF SURVEY AND TOPOGRAPHY, OCTOBER 28 - 2021; AND CITY OF MISSISSAUGA, ROAD, RAIL, AND WATER NETWORK, OPEN DATA SET (key plan).

NOTES

THIS FIGURE IS SCHEMATIC ONLY AND TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

SCALE IN METRES
0 5 10m
1:300

MTE
Engineers, Scientists, Surveyors

PROJECT
GEOTECHNICAL INVESTIGATION
PROPOSED MIXED-USE DEVELOPMENT
3115 HURONTARIO STREET
MISSISSAUGA, ONTARIO

TITLE
SITE PLAN

Drawn DCH	Scale AS SHOWN	**FIGURE 1**
Checked	Project No. 50347-100	
Date May 30/22	Rev No. 0	

Client: Clearbrook Developments Ltd.
Plot Date: 30 May 2022 Time:14:20:59
CAD: P:\P\50347\100\2_PROD\50347-100-R03 GEOTECHNICAL INVESTIGATION\50347-100-R03001.DWG
Original Format in Tabloid (279mm x 432mm; 11" x 17")
0 25mm

Appendix B

Borehole Logs

Abbreviations and Symbols

Boreholes MW101-22 to MW105-22 and MW107-22 to BH111-22

ID No.: MW101-22

Project Name: Proposed Mixed-Use Development

MTE File No.: 50347-100

Client: Clearbrook Developments Ltd.

Site Location: 3115 Hurontario Street, Mississauga, Ontario

Date Completed: 2/18/2022

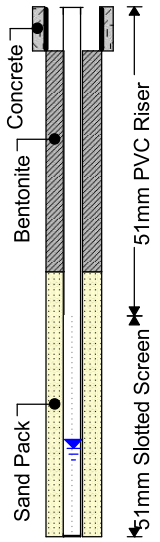
Drilling Contractor: Geo-Environmental Drilling Inc.

Drill Rig: LC 55

Drill Method: Hollow Stem Augers

Protective Cover: Flushmount

Depth (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Dynamic Cone / Standard Penetration (20 40 60 80)	Shear Strength (PP) kPa / Shear Strength (FV) kPa (50 100 150 200)	Water Content % (10 20 30)	Groundwater Observations and Standpipe Details
		Ground Surface	118.7						
0 / 0		**ASPHALTIC CONCRETE** 100 mm	0.0	1	SS	42		19	
		FILL dense brown sand and gravel, trace silt, wet	118.1 / 0.6						
2		dense to compact sand and silt, trace gravel, wet to very moist		2	SS	10		10	
4									
6 / 2				3	SS	10		10	
			116.4						
8		**SAND AND SILT** compact brown sand and silt, trace gravel, very moist	2.3	4	SS	12		13	
10		saturated	115.6 / 3.0						
		SHALE weathered grey shale	115.3 / 3.4	5	SS	32		12	
12		Drilling Terminated	115.0 / 3.7						
14 / 4									
16									
18									
20 / 6									
22									
24									



Field Technician: HXS

Drafted by: HXS

Reviewed by: KRD

Water encountered at 3.1 mbgs (Elevation 115.6masl) during drilling. Water measured at 3.0 mbgs (Elevation 115.7 masl) on March 23, 2022.

ID No.: MW102-22

Project Name: Proposed Mixed-Use Development

MTE File No.: 50347-100

Client: Clearbrook Developments Ltd.

Site Location: 3115 Hurontario Street, Mississauga, Ontario

Date Completed: 2/18/2022

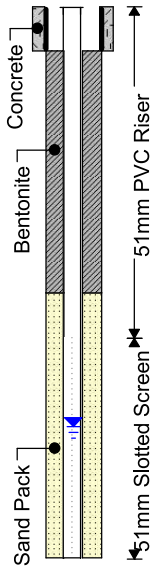
Drilling Contractor: Geo-Environmental Drilling Inc.

Drill Rig: LC 55

Drill Method: Hollow Stem Augers

Protective Cover: Monument Casing

Depth (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Dynamic Cone / Standard Penetration (20 40 60 80)	Shear Strength (PP) kPa / Shear Strength (FV) kPa (50 100 150 200)	Water Content % (10 20 30)	Groundwater Observations and Standpipe Details
		Ground Surface	118.5						
0		**FILL** compact dark brown sandy silt (topsoil), trace sand, gravel, and organics, very moist (760mm)	0.0	1	SS	10		12	
			117.7						
		compact brown sand and silt, trace gravel, moist	0.8	2	SS	11		6	
			116.9						
		loose	1.5	3	SS	8		8	
			116.2						
		SAND compact brown sand, trace silt and clay, very moist	2.3	4	SS	19		13	
			115.6						
		saturated	2.9	5	SS	20		15	
			114.6						
		SHALE weathered grey shale	3.8	6	SS	50/75mm			
		Drilling Terminated							



Field Technician: HXS

Drafted by: HXS

Reviewed by: KRD

Water encountered at 2.9 mbgs (Elevation 115.6 masl) during drilling. Water measured at 2.9 mbgs (Elevation 115.6 masl) on March 22, 2022.

ID No.: BH103-22

Project Name: Proposed Mixed-Use Development

MTE File No.: 50347-100

Client: Clearbrook Developments Ltd.

Site Location: 3115 Hurontario Street, Mississauga, Ontario

Date Completed: 2/15/2022

Drilling Contractor: Geo-Environmental Drilling Inc

Drill Rig: N/A

Drill Method: Pneumatic Pionjar

Protective Cover: N/A

Depth (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Dynamic Cone / Standard Penetration (20 40 60 80)	Shear Strength (PP) kPa / Shear Strength (FV) kPa (50 100 150 200)	Water Content % (10 20 30)	Groundwater Observations and Standpipe Details
0 / 0		Ground Surface	117.3						
		Concrete 100 mm	0.0						
		FILL brown gravel, moist		1	SS			4	
2		**SILTY SAND** light brown silty sand, trace gravel, moist; slight odour	116.7 / 0.6	2	SS			5	← Bentonite
4		Drilling Terminated	116.1 / 1.2						← Dry Cave
6 / 2									Borehole dry upon drilling completion
8									
10									
12									

Field Technician: HXS

Drafted by: HXS

Reviewed by: KRD

MTE

Sheet: 1 of 1

ID No.: MW104-22

Project Name: Proposed Mixed-Use Development

MTE File No.: 50347-100

Client: Clearbrook Developments Ltd.

Site Location: 3115 Hurontario Street, Mississauga, Ontario

Date Completed: 2/18/2022

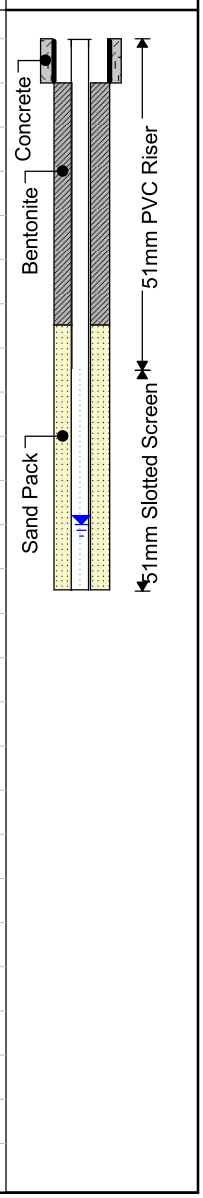
Drilling Contractor: Geo-Environmental Drilling Inc.

Drill Rig: LC 55

Drill Method: Hollow Stem Augers

Protective Cover: Flushmount

Depth (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type
		Ground Surface	118.7		
		ASPHALTIC CONCRETE 100 mm	0.0 / 118.2	1	SS
		FILL compact brown sand and gravel, trace silt, very moist	0.5 / 117.9		
		sand and silt, trace gravel	0.8	2	SS
		sand and gravel, some silt		3	SS
		SAND compact brown sand, trace gravel, silt and clay, moist to very moist	116.2 / 2.4	4	SS
		saturated	115.3 / 3.4	5	SS
		SHALE weathered grey shale	114.9 / 3.8	6	SS
		Drilling Terminated			



Field Technician: HXS

Drafted by: HXS

Reviewed by: KRD

Water encountered at 3.4 mbgs (Elevation 115.3 masl) during drilling. Water measured at 3.4 mbgs (Elevation 115.3 masl) on March 22, 2022.

ID No.: MW105-22

Project Name: Proposed Mixed-Use Development

MTE File No.: 50347-100

Client: Clearbrook Developments Ltd.

Site Location: 3115 Hurontario Street, Mississauga, Ontario

Date Completed: 2/15/2022

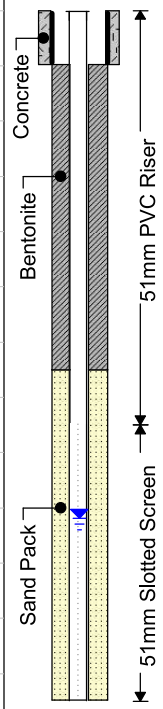
Drilling Contractor: Geo-Environmental Drilling Inc

Drill Rig: LC 55

Drill Method: Hollow Stem Augers

Protective Cover: N/A

Subsurface Profile				Sample		Dynamic Cone / Standard Penetration (20 40 60 80)	Shear Strength (PP) / Shear Strength (FV) kPa (50 100 150 200)	Water Content % (10 20 30)	Groundwater Observations and Standpipe Details
Depth (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Number	Type				
0 / 0		Ground Surface	117.8						
		UNSAMPLED Straight drilled to 3.8 mbgs for monitoring well installation	0.0						
12 / 4		Drilling Terminated	114.0 / 3.8						



Field Technician: HXS

Drafted by: HXS

Reviewed by: KRD

Water measured at 2.8 mbgs (Elevation 115.0 masl) on March 23, 2022.

Sheet: 1 of 1

ID No.: MW107-22

Project Name: Proposed Mixed-Use Development

MTE File No.: 50347-100

Client: Clearbrook Developments Ltd.

Site Location: 3115 Hurontario Street, Mississauga, Ontario

Date Completed: 2/16/2022

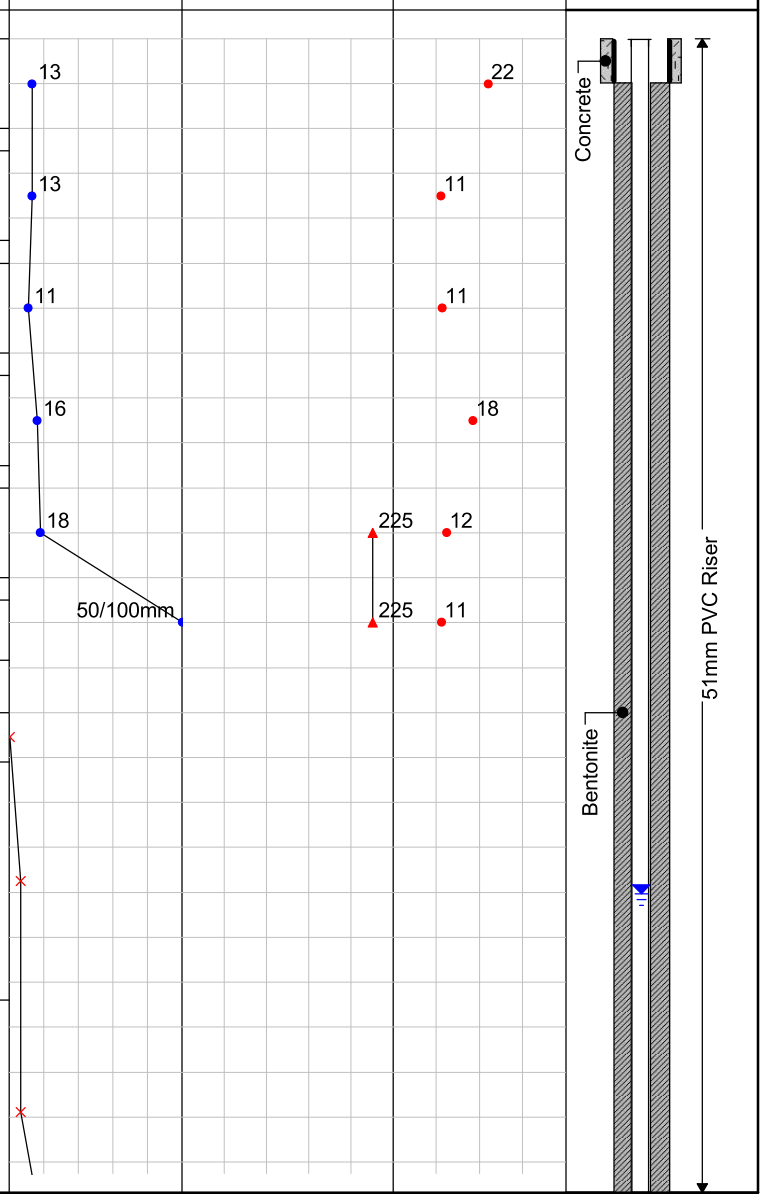
Drilling Contractor: Geo-Environmental Drilling Inc.

Drill Rig: LC 55

Drill Method: Hollow Stem Augers

Protective Cover: Monument Casing

Depth (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type
		Ground Surface	118.3		
0 / 0		**FILL** compact dark brown sandy silt (topsoil), trace gravel and organics, wet (250 mm)	0.0	1	SS
			117.6 / 0.8		
		brown sand and silt, trace gravel, very moist		2	SS
		some gravel and brick fragments		3	SS
2			116.0		
		SILTY SAND compact brown silty sand, trace gravel, very moist	2.3 / 115.7 / 2.6	4	SS
		saturated	115.3		
		CLAYEY SANDY SILT TILL hard grey clayey sandy silt, trace gravel, DTPL	3.0	5	SS
			114.4		
4		**SHALE** weathered grey shale	4.0	6	SS
			113.8		
		very poor to fair quality	4.6	7	RC
				8	RC
6				9	RC



Field Technician: HXS

Drafted by: HXS

Reviewed by: KRD

Water encountered at 2.6 mbgs (Elevation 115.7 masl) during drilling. Water measured at 5.8 mbgs (Elevation 112.5 masl) on March 23, 2022.

ID No.: MW107-22

Project Name: Proposed Mixed-Use Development

MTE File No.: 50347-100

Client: Clearbrook Developments Ltd.

Site Location: 3115 Hurontario Street, Mississauga, Ontario

Date Completed: 2/16/2022

Drilling Contractor: Geo-Environmental Drilling Inc.

Drill Rig: LC 55

Drill Method: Hollow Stem Augers

Protective Cover: Monument Casing

Subsurface Profile				Sample		Dynamic Cone × / Standard Penetration ● (20 40 60 80)	Shear Strength (PP) ▲ / Shear Strength (FV) ■ kPa (50 100 150 200)	Water Content ● % (10 20 30)	Groundwater Observations and Standpipe Details
Depth	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type				
26									
8									
28				10	RC				
30									
32									
10				11	RC				
34									
36									
38				12	RC				Sand Pack
12									
40									
42									
44				13	RC				51mm Slotted Screen
46	14		104.2						
		Drilling Terminated	14.1						
48									
50									

Field Technician: HXS

Drafted by: HXS

Reviewed by: KRD

MTE

Sheet: 2 of 2

Water encountered at 2.6 mbgs (Elevation 115.7 masl) during drilling. Water measured at 5.8 mbgs (Elevation 112.5 masl) on March 23, 2022.

ID No.: MW108-22

Project Name: Proposed Mixed-Use Development

MTE File No.: 50347-100

Client: Clearbrook Developments Ltd.

Site Location: 3115 Hurontario Street, Mississauga, Ontario

Date Completed: 2/15/2022

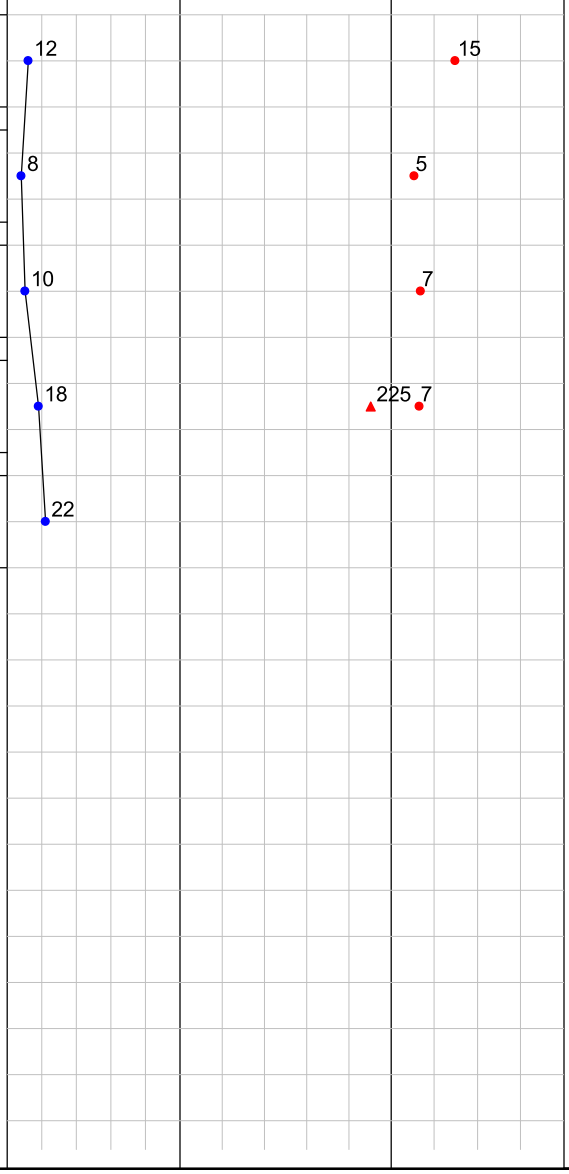
Drilling Contractor: Geo-Environmental Drilling Inc.

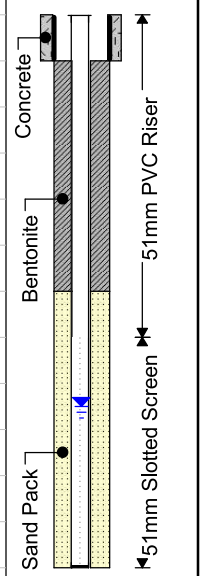
Drill Rig: LC 55

Drill Method: Hollow Stem Augers

Protective Cover: Monument Casing

Depth (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type
		Ground Surface	117.6		
		FILL compact dark brown sandy silt (topsoil), trace gravel and organics, very moist (200 mm)	0.0	1	SS
		sand and silt, trace gravel, very moist to moist	116.9 / 0.8	2	SS
		loose brown silty sand, trace gravel	116.1		
		SILTY SAND compact brown silty sand, trace gravel, very moist	1.5	3	SS
		saturated	115.0 / 2.6	4	SS
		CLAYEY SILT TILL hard grey clayey silt, trace sand and gravel, DTPL	114.6 / 3.0	5	SS
		SHALE weathered grey shale	114.0		
		Drilling Terminated	3.7		





Field Technician: HXS

Drafted by: HXS

Reviewed by: KRD

Water encountered at 2.6 mbgs (Elevation 115.0 masl) during drilling. Water measured at 2.5 mbgs (Elevation 115.1 masl) on March 23, 2022.

ID No.: MW109-22

Project Name: Proposed Mixed-Use Development

MTE File No.: 50347-100

Client: Clearbrook Developments Ltd.

Site Location: 3115 Hurontario Street, Mississauga, Ontario

Date Completed: 2/17/2022

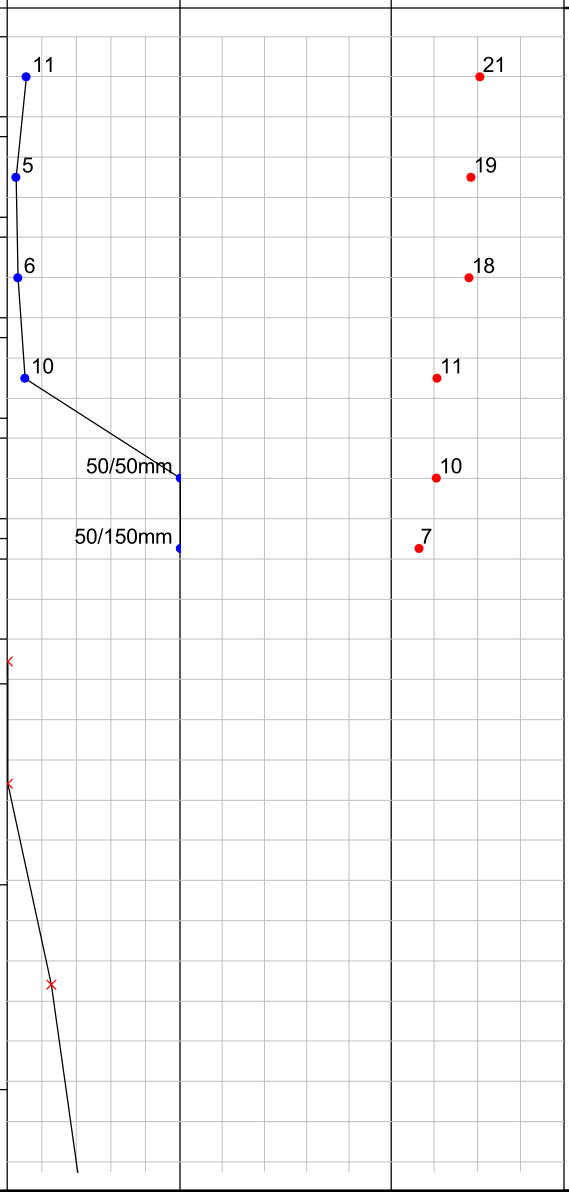
Drilling Contractor: Geo-Environmental Drilling Inc.

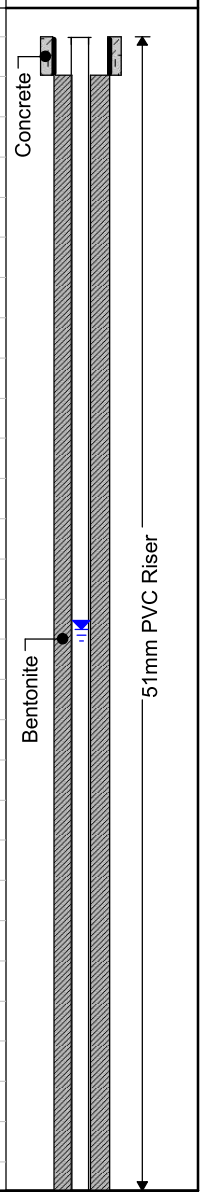
Drill Rig: LC 55

Drill Method: Hollow Stem Augers

Protective Cover: Monument Casing

Depth (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type
0 / 0		Ground Surface	118.3		
		ASPHALTIC CONCRETE 100 mm	0.0	1	SS
		FILL compact brown sand and gravel, trace silt, wet	117.5 / 0.8	2	SS
		sand and silt, trace gravel			
		loose		3	SS
2 / 2			116.0		
		SAND compact brown sand, trace silt, clay and gravel, very moist	2.3	4	SS
		saturated	115.2 / 3.0		
		SHALE weathered grey shale		5	SS
4 / 4				6	SS
		very poor to fair quality	113.7 / 4.6	7	RC
6 / 6				8	RC
8 / 8				9	RC





Field Technician: HXS

Drafted by: HXS

Reviewed by: KRD

Water encountered at 3.1 mbgs (Elevation 115.2 masl) during drilling. Water measured at 4.5 mbgs (Elevation 113.8 masl) on March 9, 2022.

ID No.: MW109-22

Project Name: Proposed Mixed-Use Development

MTE File No.: 50347-100

Client: Clearbrook Developments Ltd.

Site Location: 3115 Hurontario Street, Mississauga, Ontario

Date Completed: 2/17/2022

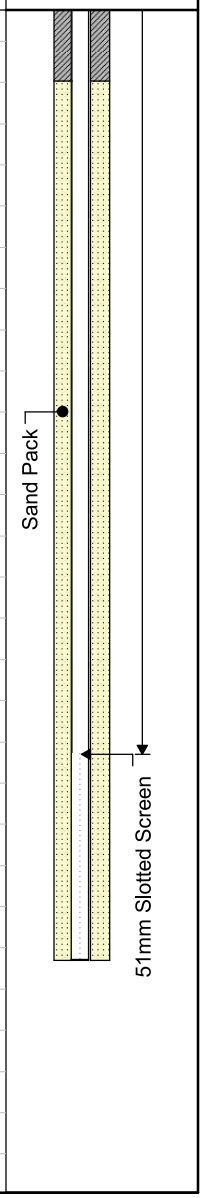
Drilling Contractor: Geo-Environmental Drilling Inc.

Drill Rig: LC 55

Drill Method: Hollow Stem Augers

Protective Cover: Monument Casing

Subsurface Profile				Sample		Dynamic Cone × / Standard Penetration ● (20 40 60 80)	Shear Strength (PP) ▲ / Shear Strength (FV) ■ kPa (50 100 150 200)	Water Content ● % (10 20 30)	Groundwater Observations and Standpipe Details
Depth	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type				
30				10	RC				
32									
34 (10)				11	RC				
36									
38				12	RC				
40 (12)									
42									
44				13	RC				
46 (14)									
48				14	RC				
50			102.6						
52 (16)		Drilling Terminated	15.6						
54									
56									



Field Technician: HXS

Drafted by: HXS

Reviewed by: KRD

Water encountered at 3.1 mbgs (Elevation 115.2 masl) during drilling. Water measured at 4.5 mbgs (Elevation 113.8 masl) on March 9, 2022.

ID No.: BH110-22

Project Name: Proposed Mixed-Use Development

MTE File No.: 50347-100

Client: Clearbrook Developments Ltd.

Site Location: 3115 Hurontario Street, Mississauga, Ontario

Date Completed: 2/15/2022

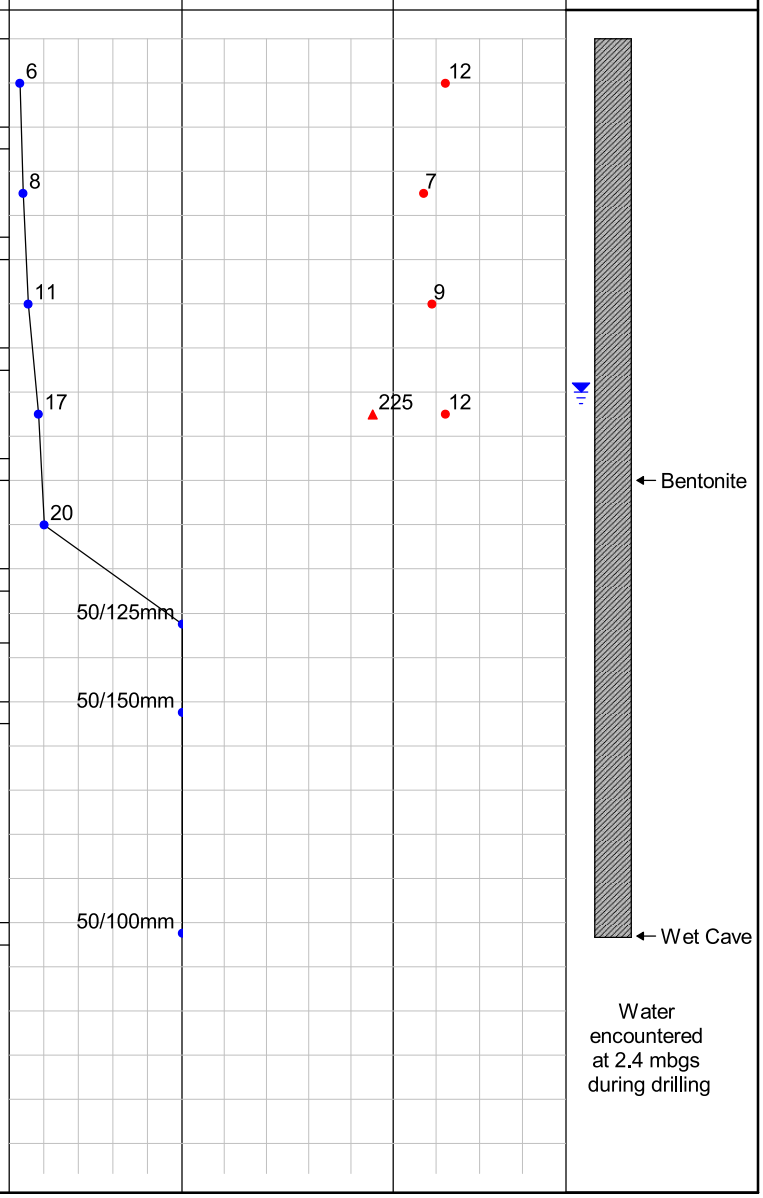
Drilling Contractor: Geo-Environmental Drilling Inc.

Drill Rig: LC 55

Drill Method: Hollow Stem Augers

Protective Cover: N/A

Depth (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type
		Ground Surface	117.8		
0 / 0		**FILL** loose dark brown sandy silt (topsoill), trace gravel and organics, very moist (200 mm)	0.0	1	SS
		brown sand and silt, trace gravel, moist		2	SS
			115.9	3	SS
6 / 2		**SILTY SAND** compact brown sand and silt, some gravel, moist to very moist	1.8		
		saturated	115.3 / 2.4	4	SS
		CLAYEY SILT TILL hard grey clayey silt, trace sand and gravel, DTPL	114.7 / 3.0		
		SHALE weathered grey shale		5	SS
				6	SS
				7	SS
20 / 6			111.5 / 6.2	8	SS
		Drilling Terminated			



Groundwater Observations and Standpipe Details

Water encountered at 2.4 mbgs during drilling

Field Technician: HXS

Drafted by: HXS

Reviewed by: KRD

Sheet: 1 of 1

ID No.: BH111-22

Project Name: Proposed Mixed-Use Development

MTE File No.: 50347-100

Client: Clearbrook Developments Ltd.

Site Location: 3115 Hurontario Street, Mississauga, Ontario

Date Completed: 2/14/2022

Drilling Contractor: Geo-Environmental Drilling Inc.

Drill Rig: LC 55

Drill Method: Hollow Stem Augers

Protective Cover: N/A

Depth (ft)	Depth (m)	Symbol	Soil Description	Elevation (masl)	Depth (m)
			Ground Surface	117.9	
0	0		**FILL** compact dark brown sandy silt (topsoil), trace gravel and organics, wet (175 mm)	0.0	
			brown sand, some gravel, very moist	117.2	0.8
4			sand and silt, some gravel	116.4	
6	2		**SILTY SAND** compact brown silty sand, trace gravel, moist to wet	1.5	
10			saturated	114.9	3.0
			CLAYEY SILT TILL hard grey clayey silt, trace sand and gravel, DTPL	114.6	3.4
12	4		**SHALE** weathered grey shale	114.1	3.8

Sample Number	Type	Dynamic Cone / Standard Penetration (20 40 60 80)	Shear Strength (PP) kPa	Shear Strength (FV) kPa (50 100 150 200)	Water Content % (10 20 30)
1	SS	11			34
2	SS	11			12
3	SS	14			8
4	SS	12			22
5	SS	27		225	16
6	SS	50/50mm			
7	SS	50/125mm			
8	SS	50/125mm			
9	SS	50/75mm			

Groundwater Observations and Standpipe Details: ← Bentonite

Field Technician: HXS

Drafted by: HXS

Reviewed by: KRD

MTE

ID No.: BH111-22

Project Name: Proposed Mixed-Use Development

MTE File No.: 50347-100

Client: Clearbrook Developments Ltd.

Site Location: 3115 Hurontario Street, Mississauga, Ontario

Date Completed: 2/14/2022

Drilling Contractor: Geo-Environmental Drilling Inc.

Drill Rig: LC 55

Drill Method: Hollow Stem Augers

Protective Cover: N/A

Subsurface Profile				Sample		Dynamic Cone × Standard Penetration ● (20 40 60 80)	Shear Strength (PP) ▲ kPa ▲ Shear Strength (FV) ■ kPa ■ (50 100 150 200)	Water Content ● % ● (10 20 30)	Groundwater Observations and Standpipe Details
Depth	Symbol	Soil Description	Elevation (masl) Depth (m)	Number	Type				
26									Wet Cave
28									Water encountered at 3.1 mbgs during drilling
30			108.6	10	SS	50/75mm			
		Drilling Terminated	9.3						
32									
34									
36									
38									
40									
42									
44									
46									
48									
50									

8 10 12 14

Field Technician: HXS

Drafted by: HXS

Reviewed by: KRD

MTE

Appendix C

Laboratory Test Results

Table 101

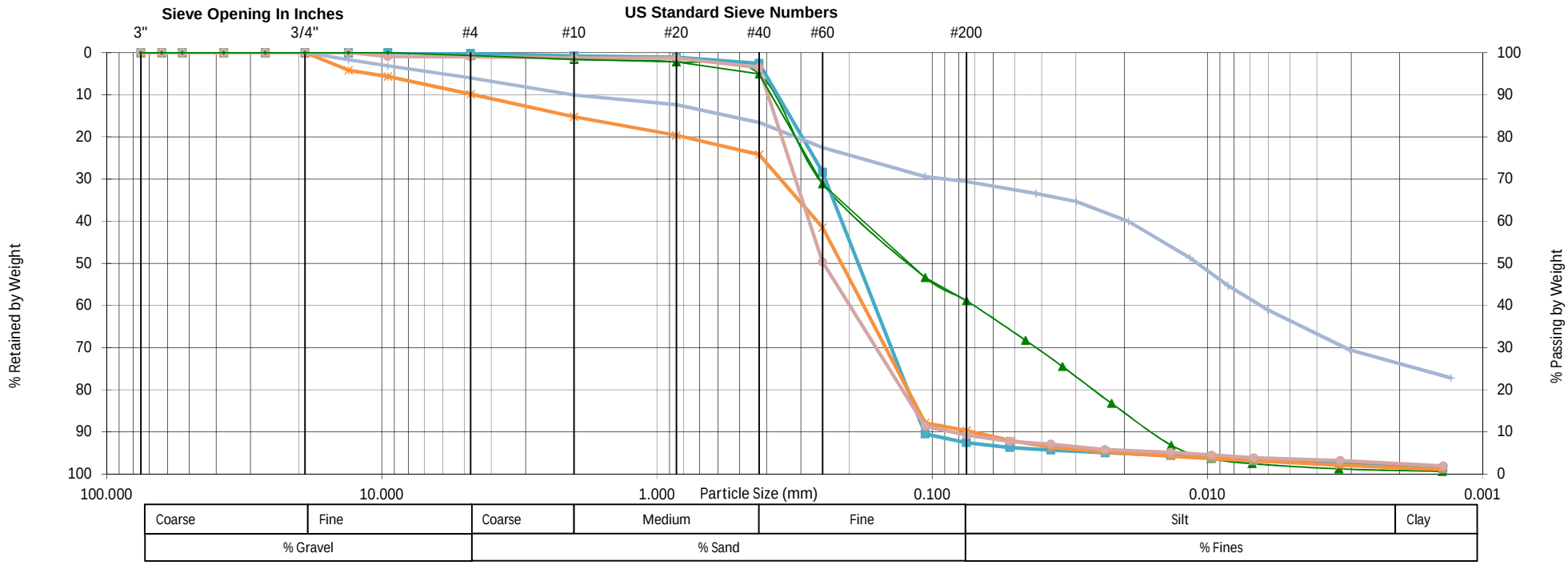
Particle Size Distribution Analysis Test Results

Project Name: Proposed Mixed-Use Development
Client: Clearbrook Developments Ltd.
Project Location: 3115 Hurontario Street, Mississauga, ON

Date Sampled: Feb. 14-18, 2022
Date Tested: Mar. 3-10, 2022

MTE File No.: 50347-100
Table No: 101

Unified Soil Classification



Symbol	Borehole ID	Sample #	Sample Depth	Description
▲	MW101-22	SS-4	2.3-2.9 mbgs	SAND and SILT, trace Gravel
■	MW102-22	SS-4	2.3-2.9 mbgs	SAND, trace Silt and Clay
✳	MW104-22	SS-5	3.0-3.7 mbgs	SAND, trace Gravel, Silt, and Clay
+	MW107-22	SS-5	3.0-3.7 mbgs	Clayey Sandy SILT, trace Gravel
●	MW109-22	SS-4	2.3-2.9 mbgs	SAND, trace Silt, Clay, and Gravel

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Canadian Council of Independent Laboratories
For specific tests as listed on www.ccil.com

NOTES: