



# **GEOTECHNICAL** **INVESTIGATION**

**217 & 227 Cross Avenue and 571 Argus Road  
Oakville, ON**

## **Client**

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## **Project Number**

BIGC-ENV-349B

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# 1 Introduction

B.I.G. Consulting Inc. (BIG) has been retained by Oakville Argus Cross LP (the “Client”) to conduct a geotechnical investigation for the proposed development on the property located at 217 & 227 Cross Avenue and 571 Argus Road in the town of Oakville, Ontario (the “Site”). The Site location plan is shown on Figure 1 in Appendix A.

The investigation was authorized by Mr. Clarence Zichen Qian on the behalf of the Client.

It is our understanding that the proposed development will comprise of 2-condominium towers with 5-levels of underground parking structures.

The field work for this investigation was carried out in conjunction with Phase I & II Environmental Site Assessment (ESA), Preliminary Hydrogeological Investigation (HG) and Filing of Record of Site Condition (RSC). This report addresses the geotechnical aspects of the proposed development only and the reports for ESA, HG and RSC will be issued under separate covers.

The purpose of this geotechnical investigation was to obtain the information on the subsurface soil and groundwater conditions at the Site by means of advancing a limited number of boreholes, in-situ tests as well as laboratory tests of selected soil samples and based on this information to prepare an engineering report on geotechnical perspective pertaining to the design and construction of the proposed development. Final design drawings of the proposed developments were not available to BIG at the time of preparation of this report. Therefore, additional investigation and analysis may be necessary once the detailed design drawings are available. Once the final design drawings are available, this report should be reviewed by BIG and further recommendations will be provided as appropriate.

The comments and recommendations presented in this report are based on factual information and intended only to use for the design engineers. The report is prepared with the condition that the design will be in accordance with all applicable standards and codes, regulations of authorities having jurisdiction, and good engineering practice. The number of boreholes, tests data and their interpretation presented in this report may not be sufficient to determine all the factors that may have effects on the design and construction of the proposed development.

On-going liaison with BIG during the final design and construction phase of the project is recommended to ensure that the recommendations in this report are applicable and/or correctly interpreted and implemented. Also, any queries concerning the geotechnical aspects of the proposed development should be directed to BIG for further elaboration and/or clarification.

The attached ‘Report Limitations’ is an integral part of this report.

# 2 Site Description

The municipal address of the subject Site is at 217 & 227 Cross Avenue and 571 Argus Road in the town of Oakville, Ontario. The Site is located on the north side of Cross Avenue and east side of Argus Road, wrapping around a small parcel of land (568 Argus Road) located immediately northeast corner of the intersection of Cross Avenue and Argus Road as shown on Figure 2. For the simplicity of the description in this report, Cross Avenue and Argus Road have been considered running east-west and north-south respectively.

The 217 and 227 Cross Avenue property is currently occupied by two active Swiss Chalet and McDonald restaurants with their associated paved parking lots to the north sides of the buildings. However, the 571 Argus Road property, located immediate north side of an existing retail building on 568 Argus Road, is currently a vacant lot covered with light vegetation.

The topography of the site was generally flat with gently sloping down from north to south, i.e., towards Lake Ontario.

### **3 Previous Geotechnical Investigations**

A Preliminary Geotechnical Investigation, on the properties 217 Cross Avenue & 571 Argus Road, was conducted by BIG in 2019 (Project No.: BIGC-GEO-349A; Dated: December 3, 2019) that consisted of advancing a total of 6-boreholes BH1 to BH3, BH/MW4, BH5 and BH/MW6, to the auger termination depths varying between 2.3 and 4.0 m below the existing ground surface (BGS). Further, from the auger termination depth of 2.7 mBGS at 1-borehole BH/MW4, bedrock was cored using wire line diamond coring method to the depth of 17.7 mBGS to confirm the presence and quality of bedrock.

The subsurface conditions generally consisted of ground surface covers (asphalt pavement and topsoil) overlying the existing fills, which in turn was underlain by native clayey silt/silty clay till followed by Shale bedrock. Two boreholes BH/MW4 and BBH/MW6 were equipped with Monitoring Wells, one in each borehole, to obtain the stabilized groundwater levels at the Site.

BIG's preliminary geotechnical investigation borehole/core-hole locations are shown on Figure 2 in Appendix A, and Records of Boreholes are included in Appendix B.

### **4 Current Field Investigation Procedures**

Prior to initiating the subsurface investigation activities, the borehole locations were marked at the Site by BIG personnel and all applicable public utility services (Gas, Bell, Rogers, Hydro, Network cables, etc.) were cleared with the assistance of Ontario-One-Call. A Private Utility Locator was also retained to locate underground private utility lines adjacent to the borehole locations to ensure that the lines will not be damaged and safety of the worker during the investigation work.

The fieldwork for this investigation was carried out between January 13 and 27, 2021 that consisted of advancing a total of 15-boreholes BH/MW101 to BH/MW115, to the depths varying between 5.5 and 7.6 m BGS. Further, from auger termination depth of 7.6 mBGS at 3-boreholes BH/MW105, BH/MW114 and BH/MW115, bedrock was cored using wire line diamond coring method to the depths of 23.4, 23.3 and 23.3 mBGS, respectively, to confirm the presence and quality of bedrock. The approximate borehole/core-hole locations established and drilled/cored at the Site are shown on Figure 2 in Appendix A.

The boreholes were advanced by using truck mounted, power operated solid and hollow stem continuous flight augers, supplied and operated by a specialist drilling contractor, working under the full-time supervision of experienced BIG geotechnical personnel. Soil samples of the overburden were generally taken at 0.76 m or 1.5 m intervals while performing the Standard Penetration Test (SPT) in accordance with ASTM D1586. This consisted of freely dropping a 63.5 kg hammer for a vertical distance of 0.76 m to drive a 51 mm outer diameter split-barrel (split-spoon) sampler into the ground. The number of blows of the hammer required to drive the sampler into the ground by a vertical distance of 0.30 m was recorded as SPT 'N' value of the soil which indicates the consistency of cohesive soils or the relative density/compactness of non-cohesive soils.

The BIG's drilling supervisor examined and logged the overburden soil/rock-core samples as they were obtained from the boreholes/core-holes. The recovered soil samples were sealed in clean, airtight plastic bags and rock-core samples were put in wooden box, and transferred to the BIG's Mississauga laboratory for further examination and laboratory testing.

Groundwater observations were made in all boreholes during and immediately upon completion of drilling. In order to obtain the information on stabilized groundwater levels, all boreholes were equipped

with monitoring wells, one in each borehole, upon completion of drilling. Monitoring Wells installation details are shown on the Record of Borehole logs, and the details of the groundwater observation are presented on Section 5.5.

The ground surface elevations at borehole locations were surveyed by BIG personnel with reference to BIG's preliminary geotechnical investigation borehole BH6 with a geodetic elevation of 102.74 mASL.

It should be noted that the ground surface elevations at the borehole locations are approximate and should not be used for design and construction purpose. Contractors performing the work should confirm the elevations prior to construction. The borehole locations plotted on Borehole Location Plan are based on the measurements of the Site features and should be considered to be approximate.

## 5 Subsurface Conditions

The following summary is to assist the designers of the project with an understanding of the anticipated subsurface conditions across the Site. However, it should be noted that the subsurface soil and groundwater conditions between and beyond the drilled borehole locations may differ from those encountered at the borehole locations, and conditions may become apparent during the construction, which could not be detected or anticipated at the time of the Site investigation. The boundaries between the various strata as shown on the Record of Boreholes are based on the non-continuous sampling and represent an inferred transition between the various strata and their lateral continuation, rather than a precise plane of geological change.

Based on the subsurface conditions encountered at the borehole locations, the soil profile generally consisted of ground surface cover (asphalt pavement, topsoil) overlying existing fills, which in turn was underlain by clayey silt till and Shale bedrock.

A brief description of the subsurface stratigraphy and groundwater conditions encountered at the borehole locations are summarized, in order of depth, in the following sections and more information are provided in the Record of Boreholes presented in the Appendix B.

### 5.1 Ground Surface Cover

Except 3-boreholes BH/MW112 to BH/MW114, remaining all 12-boreholes were advanced through the existing asphalt pavement, consisting of approximately 75 to 150 mm thick asphalt concrete over 150 to 300 mm thick granular bases.

Borehole BH/MW113 was advanced through an approximately 50 mm thick gravel. Similarly, boreholes BH/MW112 and BH/MW114 were advanced through an existing ground surface cover consisting of approximately 150 mm thick topsoil. Topsoil, in general, consists of high contents of organics and rootlets. It should be noted that topsoil thickness may also vary between and beyond the borehole locations, and thickness could also have changed significantly due to some on-site activities. Therefore, it is recommended that allowance should be made for possible variations when making construction estimates.

### 5.2 Earth Fills

Below the ground surface cover, existing earth fills, predominantly consisting of clayey silt and sandy silt, were encountered at all borehole locations that extended to depths varying between 0.5 and 1.7 mBGS. Earth fills also contained trace sand, trace gravel, trace rootlets and trace organics.

The SPT 'N' values recorded generally varied between 8 and 37 blows per 300 mm of penetration. The moisture content measurement of the recovered samples were varying between 11 and 23 % by weight, indicating a moist condition.

### **5.3 Clayey Silt Till**

Below the earth fills, a native deposit of glacial clayey silt till was encountered in all boreholes that extended to depths varying between 1.7 and 2.8 mBGS. Clayey silt till deposit also contained trace sand, trace gravel and occasional fragments of Shale.

The SPT 'N' values recorded varied from 12 to over 50 blows per 300 mm of penetration, indicating stiff to hard consistency. The moisture content measurement of the recovered samples varied between 7 and 16 % by weight, indicating a moist condition.

Due to the nature of till formation, cobbles and boulders should be anticipated within the glacial till deposit.

### **5.4 Shale Bedrock**

Below clayey silt till, a highly weathered to excellent quality of Georgian Bay Formation grey Shale bedrock was encountered in all boreholes. All boreholes were drilled into the Shale bedrock and sampled up to the borehole termination depths of 5.5 to 7.8 mBGS. First water strike was also recorded in majority of boreholes between 3.7 and 5.3 mBGS.

The SPT 'N' values recorded were over 50 blows per 300 mm of penetration, indicating a hard consistency. The moisture content measurement of the recovered samples generally varied between 2 and 8 % by weight, indicating a damp condition. However, higher moisture content, in the range from 16 to 30 % by weight, were also determined in few soil samples that may have the effect of first water strike.

Further, from approximate depth of 7.7 mBGS at borehole BH/MW105 and 7.6 mBGS at boreholes BH/MW114 and BH/MW115; HQ size rock core samples were extracted to the depths of 23.4, 23.3 and 23.3 mBGS, respectively. The percentage of recoveries of rock core samples were between 69% to 100%, and the Rock Quality Designation (R.Q.D.) values were found between 27% and 98%, indicating poor to excellent quality of bedrock mass. Interbedded Limestone layers were also present within the core samples.

Pictures of Rock Core Samples are included in Appendix C.

### **5.5 Groundwater Observation**

Groundwater observations were made in all boreholes during and immediately upon completion of drilling. However, it should be noted that the sufficient time was not available for the groundwater to stabilize within the monitoring wells immediately after completion of drilling and its installations.

In order to obtain the information on stabilized groundwater levels, all 15-boreholes were equipped with monitoring wells, one in each borehole, upon completion of drilling. Groundwater observation made in open boreholes during Site exploration as well as the groundwater levels recorded in the installed monitoring wells (including preliminary geotechnical investigation) on February 8, 2021 are tabulated below:

**Groundwater Observation:**

Borehole No.	Ground Elevation (m)	Borehole Depth (mBGS)	MW Depth (mBGS)	Screen Length (m)	Groundwater Depth (mBGS)/Elevation (m)		
					Upon Completion of Drilling	February 8, 2021	
BH/MW101	103.04	6.1	6.1	3	5.18	3.38	99.66
BH/MW102	102.55	6.2	6.1	3	5.18	3.67	98.88
BH/MW103	101.78	5.5	5.5	3	4.57	2.79	98.99
BH/MW104	100.96	6.1	6.1	3	4.88	2.45	98.51
BH/MW105	102.38	23.4	21.9	3	*	21.09	81.29
BH/MW106	102.83	6.1	6.1	3	4.88	3.32	99.51
BH/MW107	102.4	6.1	6.1	3	3.66	3.61	98.79
BH/MW108	102.55	6.1	6.1	3	3.96	3.90	98.65
BH/MW109	102.89	6.1	6.1	3	5.18	4.20	98.69
BH/MW110	101.82	6.1	6.1	3	3.96	3.08	98.74
BH/MW111	101.94	6.1	6.1	3	3.96	3.37	98.57
BH/MW112	102.78	6.1	6.1	3	5.18	4.23	98.55
BH/MW113	103.45	6.1	6.1	3	5.48	4.77	98.68
BH/MW114	103.31	23.3	21.6	3	*	18.88	84.43
BH/MW115	101.72	23.3	21.6	3	*	17.91	83.81
BH/MW3	102.87	2.3	2.3	1.5	Dry	1.72	101.15
BH/MW4	102.32	17.7	10.5	1.5	16.2	3.80	98.52
BH/MW6	102.74	3.7	3.7	1.5	Dry	Dry	Dry

*mBGS: Meter Below Ground Surface*

*\*: Not measured due to introduced drilling water.*

It should also be noted that the groundwater levels at the Site may fluctuate seasonally and should be expected to be somewhat higher during the spring months and in response to major weather events.

## 6 Engineering Discussion and Recommendation

It is our understanding that the proposed development will comprise of 2-condominium towers with 5-levels of underground parking structures. Final design drawings of the proposed developments were not available to BIG at the time of preparation of this report. Therefore, additional investigation and analysis may be necessary once the detailed design drawings are available. Once the final design drawings are available, this report should be reviewed by BIG and further recommendations will be provided as appropriate.

Based on the preliminary information mentioned above, it is anticipated that the slab-on-grade of 5-levels of underground parking structure will be at an approximate depth of 15.0 mBGS.

The comments and recommendations presented in this report are based on factual information and intended only to use for the design engineers. The report is prepared with the condition that the design will be in accordance with all applicable standards and codes, regulations of authorities having jurisdiction, and good engineering practice. The number of boreholes, tests data and their interpretation presented in this report may not be sufficient to determine all the factors that may have effects on the design and construction of the proposed new development.

The following discussion and recommendations should be revised and/or supplemented where necessary, when the conditions of the proposed development are different from the noted conditions/assumptions.

## 6.1 Grading and Site Preparation

Proper grading and site preparation are very important for the success of any planned development. As parts of effective and efficient design and construction of the proposed development, following items highlight the fundamental and essential geotechnical requirements to be considered during grading and site Preparation. Detailed recommendations are provided in the following sections:

- a) All ground surface cover (pavement, topsoil, etc.) should be stripped and removed from the area of the proposed development. Similarly, all existing shrubs, vegetation, trees and scattered debris should be removed from the area of the proposed development.
- b) It is our understanding that all-existing buildings at the site will be demolished, and all components of the demolished buildings, e.g., floor slabs, footings, walls and underground infrastructure, etc. should be sub-excavated and removed completely from the area of the proposed developments.
- c) Any existing infrastructures (e.g., manholes, catch basins, buried structures, etc.) should be sub-excavated and removed from the area of the proposed development, if they are located in the zone of influence of foundations of the proposed development. The zone of influence of the foundation is defined as an area laterally extending 1 m beyond the bottom edge of the foundation with downward slope of 1H:1V. Similarly, any existing underground services, outside of the foundation influence, should be either removed or abandoned by injecting with non-shrinkable grout.
- d) Care must be taken during the excavation near the vicinity of the existing structures and any underground utility services located within or adjacent to the excavation. Foundations of heavily loaded settlement sensitive structures and utilities located within the close proximity to the proposed excavation should be accurately located and supported adequately with the suitable temporary or permanent support system where required, prior to excavation, to preserve the integrity of these structures. Similarly, the excavation near the vicinity of any existing structure should be carried out without disturbing and/or undermining their foundations.
- e) Where open excavation is not feasible, a properly designed perimeter shoring system should be installed prior to the mass excavation for the proposed development. For the drilling and installation of shoring system (e.g., caissons, etc.), travel path and working platform areas of the Site for drill rig must be properly prepared, inspected and approved by a geotechnical engineer from BIG prior to starting the installation of shoring system.
- f) A provision of temporary groundwater control system should be available during the excavation, and the base of excavation should be kept dry all the time.
- g) The base of excavation at design subgrade level should be inspected and approved by a geotechnical engineer from BIG. During inspection, any soft/loose and wet spots identified, should be sub-excavated and replaced with compacted approved material as directed by the geotechnical engineer.
- h) Any fill, required to be used, should be used as an engineered fill. Materials used for engineered fill may consist of imported OPSS Granular B, OPSS Select Sub-grade and/or the on-site soils which do not contain organics and deleterious materials. Some reconditioning (i.e., drying) prior to re-use may require, if the materials are found to be too wet. However, any imported soils to the Site for engineered fill must meet the requirements of O. Reg. 153/04 as determined by BIG.
- i) To reduce the post-construction settlements, all new fills should be placed in thin lifts, not exceeding 200 mm thick loose lifts, within  $\pm 2\%$  of its optimum moisture content, and thoroughly compacted with suitable heavy compactors to at least 98% of Standard Proctor Maximum Dry Density (SPMDD), before placing the next lift.



- j) The existing on-site soils are susceptible to disturbance when exposed to weather and construction traffic. Surface water runoff from the neighboring properties should not be permitted to enter and/or pond within the construction area. This is especially important to the success of the planned construction.

## 6.2 Foundation and Design Parameters

Based on the information obtained from the investigation, the Site is considered suitable for the construction of the proposed development from the geotechnical viewpoint.

Considering the 5-levels of underground parking structure, it is anticipated that the foundations of the proposed buildings will be founded between 16 to 17 mBGS. The proposed building can be supported by conventional spread/strip footings founded on good to excellent conditions of Shale bedrock, and can be designed and constructed by using the following geotechnical bearing resistance subject to inspection and adequate groundwater control during construction:

- Factored Ultimate Limit State (ULS) = 5000 kPa

***It should be noted that higher bearing capacity may be available subject to review and analysis of the final design drawings.***

The minimum footing sizes, footing thickness, excavations and other footing requirements should be designed in accordance with the latest edition of the Ontario Building Code. However, a minimum width of 600 mm is recommended for the strip footings.

A provision of temporary groundwater control system should be available during the excavation, and the base of excavation should be kept dry all the time. In no case should the footing be placed on dilated or disturbed subgrade of bedrock.

The Shale bedrock, if left exposed, will slake. Therefore, we recommend that the foundations should be poured as soon as possible on completion of excavation, or the base of excavation should be skim coated with a lean mix concrete, minimum 75 mm thick, to level and protect the integrity of exposed subgrade.

Where, it is necessary to place foundations at different levels, the upper foundation must be founded below an imaginary 10 horizontal to 7 vertical line drawn up from the base of the lower foundation. The lower footing must be installed first to help minimize the risk of undermining the upper footings/foundations.

Total and differential settlements for footings founded on Shale bedrock and designed as outlined above should not exceed 25 and 19 mm respectively, provided that the founding subgrade is not loosened or softened by construction activities or prolonged exposure to the weather. However, for Shale bedrock, the foundation design is not governed by resistance at Serviceability Limit State (SLS) since the stress required to produce 25 mm of deformation will generally be much larger than the factored resistance at ULS.

It is well recognized that the Shale bedrocks found in Southern Ontario, including the Georgian Bay formation, exhibit stress induced time dependent deformation (TDD) when stress change occurs (i.e., deep excavation). In addition, Shale may also exhibit swelling potential (rock squeeze). Allowance should, therefore, be made for this long term TDD characteristic of the Shale bedrock. In this regard, it may be necessary to apply a layer of spray foam, minimum of 50 mm in thickness, between exposed vertical face of Shale bedrock and exterior side of basement wall. It is recommended that a decision in this regard be made at the time of basement excavation.

Prior to the placement of concrete, all footing subgrades must be inspected and approved by a geotechnical engineer from BIG to ensure that the founding bedrock are similar to those identified in the investigation and capable of supporting the design bearing resistance.

### 6.3 Floor Slab Construction

The subgrade under 5-level of underground parking floor-slab is anticipated to be good to excellent conditions of Shale bedrock. The floor-slab on these materials can be designed and constructed as a conventional slab-on-grade method provided that the proper dewatering measures are in place.

Floor bedding consisting of at least 200 mm of Granular A (OPSS 1010) or its approved equivalent is recommended under the floor slab. The bedding should be compacted to at least 98% of SPMDD. A modulus of subgrade reaction of 50,000 kN/m<sup>3</sup> may be used for the design and construction of the floor-slab, provided that the construction is in accordance with the recommendations provided herein.

The floor slab should not be tied to any load-bearing walls or columns unless they have been designed accordingly. Contraction and expansion joints should be provided for the slabs as required by the designer.

### 6.4 Lateral Earth Pressure

The lateral pressures acting on basement walls, cantilever walls, etc. may be calculated from the following expression:

$$P = K[\gamma(H-h_w) + \gamma' h_w + q] + \gamma_w h_w$$

Where,	P	= Lateral earth pressure at depth H (m)	kPa
	K	= Lateral earth pressure coefficient	0.4
	$\gamma$	= Bulk unit weight of the soil	21.0 kN/m <sup>3</sup>
	$\gamma'$	= Submerged unit weight of soil	11.2 kN/m <sup>3</sup>
	$\gamma_w$	= Unit weight of water	9.8 kN/m <sup>3</sup>
	H	= Depth of the wall below the outer finish grade	m
	h <sub>w</sub>	= Depth of the wall below the groundwater level	m
	q	= Equivalent value of all surcharge loads on the ground surface	kPa

When the development of hydrostatic pressure behind the wall is eliminated with the installation of effective drainage system, the above expression can be simplified as follows:

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

Equivalent value of surcharge loads on the ground surface should also including the loads of heavy construction equipment in the structural design.

### 6.5 Permanent Perimeter and Under-floor Drainage

Permanent perimeter drainage system should be provided around the perimeter walls of the underground parking structure. Where, adequate space is not available for open-cut excavation with slopes, then properly designed vertical shoring system should be installed to support the sides of excavation. In this case, a permanent perimeter drainage system consisting of pre-fabricated continuous vertical blanket, Miradrain 6000 or its equivalent, should be used at and along the shoring location, just outside of the perimeter walls of the underground parking structure. Several collection pipes, installed through the perimeter walls, connect the pre-fabricated perimeter vertical drains with the solid collector pipes. The collector pipes should be installed in a positive grade leading to a frost-free sump. The

installation and connections of pre-fabricated perimeter vertical drains should be carried out as per the manufacturer’s specifications.

Considering the moisture content profiles of the Shale samples obtained from the core-holes, BIG is of the opinion that underfloor drainage system may not be required at this Site provided if any ingress of water under the slab is prevented. However, the need for vertical and underfloor drainage systems and the anticipated volumes of water to be pumped during and post construction should be based on the findings of the hydrogeological investigation report. The underfloor drainage system, if needed, should be kept separate from the perimeter drainage system.

A provision of additional groundwater control measures, consisting of underfloor sump pumps connected to an emergency power grid, should be installed below the lowest floor level of the parking for the consequence arising from a failure of the regular system.

A conceptual design of Permanent Perimeter & Under-floor Drainage System with Shoring is shown in Appendix D.

## 6.6 Frost Protection

The design frost penetration depth for the general Site area is 1.2 m. Therefore, any structural foundation (perimeter and other footings) and buried underground utilities exposed to seasonal freezing conditions should be provided with frost protection comprising at least 1.2 m of earth cover or its equivalent thermal insulation. As a general guidance, a 25 mm of insulation provides the same thermal equivalency as 600 mm of soil cover.

## 6.7 Earthquake Consideration

In conformance to the criteria in Table 4.1.8.4.A, Division B - Part 4 of the Ontario Building Code OBC 2012, the project site may be classified as Site Class “C-Soft Rock”. The four values of the Spectral response acceleration  $S_a(T)$  for different periods and the Peak Ground Acceleration (PGA) can be obtained from Table C-2 in Appendix C, Division B. The design values of  $F_a$  and  $F_v$  for the project site should be calculated in accordance to Table 4.1.8.4.B and C.

## 6.8 Excavation and Temporary Groundwater Control

The excavation through the existing fills, glacial till and highly to moderately weathered shale bedrock can be handled by conventional mechanical excavation equipment. Allowance should be made for cobbles and boulders that may occur randomly in the earth fills and glacial till deposit. Similarly, it is expected that excavation through the good to excellent quality of shale bedrock may also be possible by using a large hydraulic hoe or excavator equipped with rock or tiger-toothed bucket. A jackhammer or hoe ram may also be required to penetrate relatively harder zones within the bedrock. Progressively more difficult conditions should be anticipated with increasing depth of excavation as well as in areas where limestone layers are encountered. The actual equipment required and method of excavation within the bedrock will also dependent upon the geometry of the cut and relative depth of excavation.

All excavations must be carried out in accordance with the Occupational Health and Safety Act (OHSA) and Regulation 213/1991 for Construction Projects to ensure the protection of workers from on-Site contaminants of concerned impacted soil and groundwater. Under the Act, the soils to be excavated can be classified as follows:

Fill soils	Type 3	When submerged/saturated	Type 4
Clayey Silt Till (firm to stiff)	Type 3;	When submerged/saturated	Type 4
Clayey Silt Till (Very stiff)	Type 2	when saturated and/or fissured	Type 3
Clayey Silt Till (hard)	Type 1	when saturated and/or fissured	Type 2

Weathered Shale                                  Type 1      when saturated and/or fissured                                  Type 2

For Type 3 soils, a bank slope of 1H:1V is required. For Type 1 & 2 soils, a 1.2 m high vertical cut at the bottom of excavation may generally be used. Near the ground surface, occasional 3H:1V slopes may be required due to disturbed surficial soils. If an excavation contains more than one soil types, the excavation slope geometry shall be governed by the highest soil type number. In general, above the water table, side slopes of trenches deeper than 1.2 m should be cut to a gradient no steeper than 1V:1H upon the inspection of a qualified geotechnical engineer. Similarly, vertical to near vertical slopes are feasible in weathered shale bedrock, subject to inspection by a professional engineer during construction.

In areas where an open excavation slope cannot be maintained due to the close proximity of the existing structures on the adjacent properties (e.g., buildings, roads, etc.), the excavation within the overburden should be supported by using a shoring system (e.g., tight wooden bracing, sheet pile, trench box, strutted soldier pile & lagging wall etc.), designed by a shoring consultant. Further, the depths of shoring walls should be extended sufficiently below the base of the excavation to ensure that the toe resistance is maintained when the soil is excavated.

Perched water may be encountered in the earth fill and upper portion of the Shale bedrock above the groundwater level (e.g., first water strike). The amount of free water from that source is anticipated to be minor and the water accumulated in the excavation can readily be handled by using temporary filtered sump and pump. However, the hydrogeological investigation report provides details of the anticipated construction dewatering quantities and permit requirements.

Consideration should be given to carrying out the construction during the drier seasons of the year to reduce the need for dewatering and disturbances to the founding soils caused by the excavation below prevailing groundwater table.

## **6.9                  Reuse of On-Site Soils**

In general, portions of on-site excavated soils which do not contain organics and deleterious materials can be re-used for backfill as an engineered fill. However, depending upon the weather condition, the excavated soils may require some reconditioning prior to reuse, i.e., moisture contents of backfill soils should be within  $\pm 2\%$  of SPMDD values to obtain the minimum compaction required. Unsuitable materials such as organic rich pockets, frozen soils, wet clayey soils, cobbles, boulders, remnants of demolished structures, etc., should be wasted. Ideally, dissimilar materials should be stockpiled separately during excavation.

For reuse as an engineered fill for foundation support, a uniform material must be used. Significant variations in fill type will require thinner lifts, more compaction effort and more field and laboratory testing. Less stringent requirements may be considered for fill quality and placement below slab-on-grade, above footing levels and pavement areas.

Considering this investigation, the on-site soils are not considered to be free draining. The clayey soils will likely be excavated in cohesive blocks and will be difficult to handle and compact. To re-use for backfill, the cohesive blocks will have to be reduced to smaller than 100 mm in size and placed in thin layers/lifts, provided their moisture contents are at or near the optimum moisture content (i.e., Proctor moisture values). The clayey soils will have to be compacted sufficiently using a suitable heavy equipment which may be difficult to operate in the narrow confine areas. Unless the clay soils are properly reduced in size and compacted sufficiently in thin lifts, post construction settlements could occur. Therefore, if the use of heavy equipment for compaction of the clayey soils is not possible in settlement sensitive areas and narrow confined areas (e.g., trenches), free draining on-site and/or imported granular soils (i.e., OPSS Select Subgrade Material or approved equivalent) should be used for backfilling, and compacted adequately with suitable equipment.

## 6.10 Underground Services

It is considered that the sewer depths will not exceed 4.0 m below grades. Trench excavation should be carried out in accordance with the most recent version of the Ontario Occupational Health and Safety Act & Regulations for Construction Projects. The boreholes show that the trenches, generally, will be dug through existing fill, glacial till deposits and highly weathered shale bedrock. Normal conventional excavation equipment will be suitable for excavating trenches within these materials.

Within these soils, above the groundwater table, the side-slopes of excavation are expected to be temporarily stable at 1V:1H. Flatter slopes will be required for the soils located below groundwater table, if encountered as noted on Section 6.8.

In areas where an open excavation slopes cannot be maintained, the excavation within the overburden should be supported using a temporary shoring system (e.g., tight wooden bracing, etc.), designed by a shoring consultant. Excavations can also be carried out at steeper side slopes by using movable trench box, designed in accordance with the Safety Regulations, for the protection of the workers.

Groundwater seepage into the excavations may occur from perched groundwater, surface water flow or wet seams within glacial deposits. Dewatering should be achievable by properly filtered sumps and pumps.

The groundwater level in the trench should be kept below the bottom of the excavation by dewatering. Ideally, to prevent disturbance of the soil/rock at the bedding levels, the groundwater table must be lowered to at least 0.6 m below the base of the trench. In no case should the pipes be placed on disturbed subsoil.

The boreholes show, the anticipated subgrade soils at the base of trench for pipe bedding may comprise of stiff to hard glacial till and/or highly weathered Shale bedrock. These soils, in their undisturbed state, provide adequate support for the pipes, provided the exposed subgrade soils are further assessed and approved by qualified geotechnical personnel from BIG during construction.

Pipe bedding should be in accordance with the pipe manufacture recommendations, appropriate local municipality requirements and standards (e.g., OPS). However, as a guideline, normal Class 'B' Type bedding (OPSD-802) may be considered. The thickness of the bedding material, however, may have to be increased depending on the pipe diameter or if wet or weak subgrade conditions are encountered. Subject to assessment by the geotechnical engineer on Site, the bedding used to support the pipes in weak soils (if any) may need to be wrapped by a geotextile (e.g., Terrafix 270R or equivalent). In general, a minimum of 150 mm thick of OPSS Granular A bedding is recommended for pipes 450 mm diameter or less; for large diameter pipes, the thickness of the bedding should be increased to 200 mm.

Based on visual and tactile examination of the soil samples, the on-site excavated soils can generally be re-used to backfill the service trenches subject to the conditions noted in Sections 6.8 and 6.9.

The backfills should be placed in thin lifts not exceeding 200 mm thick loose lifts, within  $\pm 2$  % of SPMDD values, and thoroughly compacted with suitable equipment to at least 95% of SPMDD, before placing the next lift. This value should be increased to at least 98 % within 0.6 m of the final subgrade of trench for the road pavement.

## 6.11 Shoring Considerations

In areas where an open excavation slope cannot be maintained, the excavation within the overburden should be supported by using a shoring system. Where settlement sensitive structures are located at the close proximity of the proposed excavation, shoring system consisting a series of caisson walls embedded sufficiently below the bottom of the excavation, will have to be used to prevent any movement in the

adjacent properties. Shoring system consisting of soldier piles and timber laggings can be used, on the other sides, where slight movement in the ground surface can be tolerated, i.e., where non-sensitive structures exist.

The shoring system should be designed by an experienced shoring consultant in accordance with the guidelines provided in the latest edition of the Canadian Foundation Engineering Manual (Manual). Similarly, the construction of the shoring system should also be carried out by a contractor, experienced in this type of construction.

The soldier piles should be installed in pre-augured holes which should be filled up to excavation level with 20 MPa (3000 psi) concrete and above that with 1-1/2 bag mix.

The following thicknesses of lagging boards have been recommended in the Manual:

<u>Thickness of lagging</u>	<u>Maximum Spacing of Soldier Piles</u>
50 mm (2 in)	2.0 m (6.5 ft)
75 mm (3 in)	2.5 m (8.0 ft)
100 mm (4 in)	3.0 m (10 ft)

Local experience has indicated that the lagging thickness of 75 mm has been adequate for soldier pile spacing of 3 m for soil conditions similar to those encountered at the subject site. However, it is important to consider all local conditions, such as the duration of excavation, the weather likely to be encountered, seasonal variations in the ground water and ice lensing causing frost heave in determining the lagging thickness.

All spaces behind the lagging must be filled with free draining granular fill. If wet conditions are encountered the space between boards should be packed with geotextile filter fabric or straw to prevent loss of ground.

The shoring system should be designed for a factor of safety of  $F = 2$  for soils and 3 for rocks. The overall factor of safety of the anchored block of soil must be considered. Minimum spacing and the depths of the soil anchors should be as recommended in the Manual.

## **6.12 Pavement Construction**

Pavement design and pavement thicknesses are highly dependent on the subgrade conditions. The pavement subgrade should, therefore, be adequately prepared to receive the granular bases for the pavement construction noted in Section 6.1.

Following the Site grading and prior to the placement of granular bases, the exposed subgrade should be proof-rolled and approved by the qualified geotechnical personnel from BIG. Any wet/soft areas of subgrade, revealed by this process, should be sub-excavated and replaced with an approved on-site or imported fill compatible to the existing subgrade soils.

All new fills should be placed in a maximum of 200 mm loose lifts, within  $\pm 2\%$  of its optimum moisture content, and each lift should be compacted by a suitable heavy equipment to minimum 95% of SPMDD before placing the next lift. The uppermost 600 mm of the pavement subgrade should be compacted to a minimum 98% of SPMDD.

Considering the proposed pavement usage, frost susceptibility and assuming adequate drainage, the following minimum pavement structure thicknesses are recommended for the long-term satisfactory performance of the pavement:

### Recommended Minimum Pavement Structure Thickness

Particulars	Heavy Duty Driveway (mm)	Standard Duty Driveway (mm)
Asphaltic Concrete: OPSS HL3	40	50
Asphaltic Concrete: OPSS HL8	70	50
Base Course - OPSS Granular A or equivalent	150	150
Sub-base Course - OPSS Granular B or equivalent	350	250

The pavement thickness should also confirm to the local regulations and standards inclusive of City of Toronto.

The granular base and subbase materials should conform to the OPSS 1010 and should be compacted to 98% of the ASTM D698 SPMDD within  $\pm 2\%$  of the optimum moisture content.

Hot mix asphalt concrete should conform to OPSS 1150 and OPSS 310 and be placed and compacted to at least 92 to 96.5 % of the Marshall Maximum Relative Density (MMRD). It is recommended that the asphalt mix design be reviewed by BIG prior to the start of the paving.

The pavement thickness considers that construction will be carried out during the drier time of the year and that the subgrade is competent. If the subgrade becomes excessively wet or rutted during construction activities, additional sub-base material may be required. The need for additional subbase material is best determined during construction.

## 7 Construction Monitoring

Qualified Geotechnical personnel should monitor the foundation excavation, subgrade inspection, in-situ density tests and material testing services in all stages of the proposed development, to ensure that the materials and conditions comply with this geotechnical report and project requirements. Should the condition that encountered vary from those described in this report, our office should be informed immediately so that the proper measures are undertaken. The on-Site review of the condition of the foundation soil is an integral part of the geotechnical design function and is required by Section 4.2.2.2 of the Ontario Building Code.

All backfilling should be supervised to ensure that proper materials are used, and that adequate compaction is achieved. Strict quality control guidelines should be followed during the placement of fill materials.

## 8 Closure

The subsoil information and recommendations contained in this report was prepared solely for the purpose to use at the specific project as described in this report and should not be used to any other project or site location. The information contained in this report is for the sole benefit of the Client and his/her Consultants. *In order to properly understand the contents of the report, reference must be made to the whole of the report. BIG cannot be held responsible for the use of portions of the report without reference to the entire report.*

We recommend that BIG be retained to review the recommendations for this specific applicability, once the details of the proposed development are finalized and prior to the final design stage of the project.

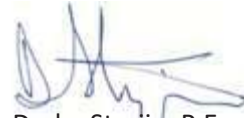
We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact this office.

Yours truly,

**B.I.G. Consulting Inc.**



Subir Shrestha, M.Eng., P.Eng.  
Principal Geotechnical Engineer



Darko Strajin, P.Eng.  
Managing Partner



## 9 Report Limitations

The conclusions and recommendations given in this report are based on information determined at the test hole (borehole, test pit, probe hole, etc.) locations. The information contained herein in no way reflects on the environmental aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the testhole locations, and conditions may become apparent during construction which could not be detected or anticipated at the time of the site investigation. It is a recommended practice that the Geotechnical Engineer be retained during the construction to confirm that the subsurface conditions across the site do not deviate materially from those encountered in the testholes.

The design recommendations and opinions given in this report are applicable only to the project described in the text, and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final design stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.

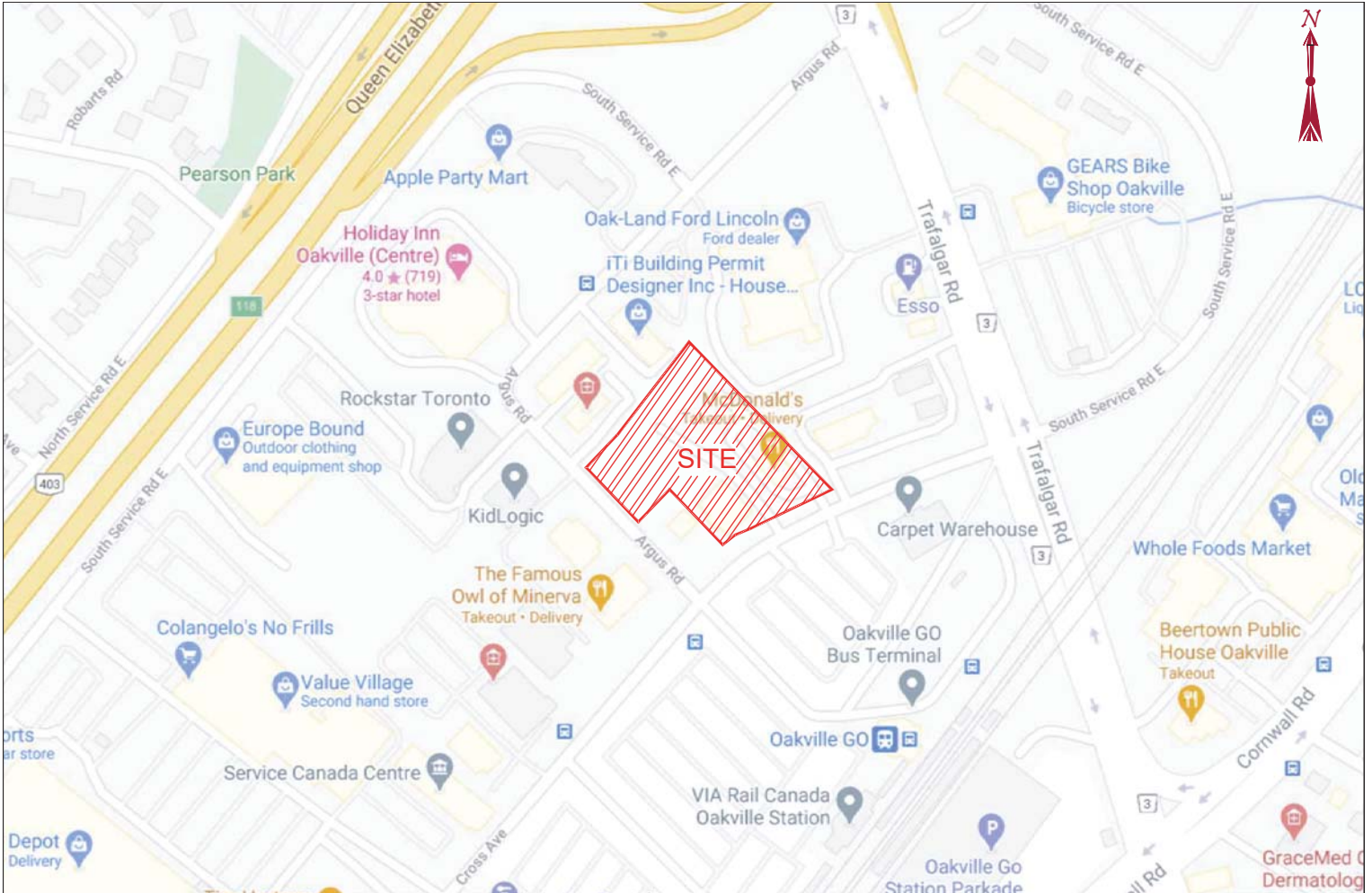
The comments made in this report relating to potential construction problems and possible methods of construction are intended only for the guidance to the designer. The number of testholes may not be sufficient to determine all the factors that may affect construction methods and costs. The anticipated construction conditions are also discussed, but only to the extent that they may influence design decisions. Construction methods discussed, however, express BIG's opinion only and are not intended to direct the contractors on how to carry out the construction. Contractors should also be aware that the data and their interpretation presented in this report may not be sufficient to assess all the factors that may have an effect upon the construction. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably at the site. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices. No other warranty is expressed or implied.

The report is prepared with the condition that the design will be in accordance with all applicable standards and codes, regulations of authorities having jurisdiction, and good engineering practice.

The benchmark and elevations mentioned in this report were obtained strictly for use by this office in the geotechnical design of the project. They should not be used by any other party for any other purpose.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. BIG accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

# Appendix A - Figures



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**LEGEND**

— SITE BOUNDARY

**SCALE**



**TITLE AND LOCATION**

**SITE LOCATION PLAN**  
 GEOTECHNICAL INVESTIGATION  
 217,227 CROSS AVENUE AND  
 207 ARGUS ROAD,  
 OAKVILLE, ONTARIO

PROJECT NO. BIGC-ENV-349B	DWN. O.A.
SCALE AS NOTED	CK. S.S.
DATE FEBRUARY 2021	FIG NO. 1



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LEGEND	
	SITE BOUNDARY
	APPROXIMATE BUILDING FOOTPRINT
	BOREHOLE/MONITORING WELL LOCATION (BIG 2021)
	BOREHOLE/PIEZOMETER LOCATION (BIG 2019)
	BOREHOLE LOCATION (BIG 2019)
	BOREHOLE/MONITORING LOCATION (TERRAPEX)
	BOREHOLE LOCATION (TERRAPEX)

TITLE AND LOCATION

**BOREHOLE/MONITORING  
 WELL LOCATION PLAN  
 GEOTECHNICAL INVESTIGATION  
 217,227 CROSS AVENUE AND  
 207 ARGUS ROAD,  
 OAKVILLE, ONTARIO**

PROJECT NO.	DWN.
BIGC-ENV-349B	O.A.
SCALE	CK.
AS NOTED	S.S.
DATE	FIG NO.
FEBRUARY 2021	2

## Appendix B – Records of Boreholes

## **NOTES TO RECORD OF BOREHOLES**

<b>DRILLING METHOD</b>		<b>SAMPLE TYPE</b>		<b>LABORATORY DATA</b>	
SSA	Solid Stem Auger	SS	Split Spoon	W	Water Content
HSA	Hollow Stem Auger	AS	Auger Flight Sample	W <sub>p</sub>	Plastic Limit
WB	Wash Boring	TW	Thin Wall Open	W <sub>l</sub>	Liquid Limit
RM	Rotary Mud Drilling	TP	Thin Wall Piston	γ	Natural Unit Weight (kN/m <sup>3</sup> )
		WS	Washed Sample	C <sub>u</sub>	Undrained Shear Strength (kPa)
		VT	Vane Test	PP	Pocket Penetrometer
		GS	Grab Sample	UC	Unconfined Compression
		RC	Rock Core	UU	Unconsolidated Undrained
		PH	Sample Advanced Hydraulically	CU	Consolidated Undrained
		PM	Sample Advanced Manually	CD	Consolidated Drained
		CC	Continuous Core	TOV	Total Organic Vapors

**STANDARD PENETRATION TEST (SPT 'N')**: The number of blows required to advance a standard 51 mm outer diameter split spoon sampler to penetrate 0.3 m distance into the undisturbed ground in a borehole driven by means of a 63.5 kg hammer falling freely from a distance of 0.76m.

**DYNAMIC CONE PENETRATION TEST (DCPT)**: The number of blows required to advance a 51 mm diameter – 60 degree cone fitted to the end of the drill rods to penetrate 0.3 m distance into the undisturbed ground driven by 475 Joules driving energy per blow.

### **SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR RELATIVE DENSITY**

**CONSISTENCY**: Cohesive soils are described on the basis of their undrained shear strength (Cu) or 'N' values as follows:

N (blows/0.3m)	0 - 2	2 - 4	4 - 8	8 - 15	15 - 30	>30
Consistency	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD
Cu (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	>200

**RELATIVE DENSITY**: Cohesionless soils are described on the basis of their relative density as indicated by 'N' values as follows:

N (blows/0.3m)	0 - 4	4 - 10	10 - 30	30 - 50	>50
Relative Density	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

### **ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND/OR STRENGTH**

**RECOVERY**: Sum of the lengths of all recovered rock core pieces divided by the total length of the core run (expressed as a percent).

**ROCK QUALITY DESIGNATION (RQD)**: Sum of the lengths of intact rock core pieces, 100 mm or more in lengths, divided by the total length of the core run (expressed as a percent). Classifications of a rock based on the RQD value are as follows:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
Quality	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

### **JOINTING AND BEDDING:**

SPACING	50 Millimeters	50 - 300 Millimeters	0.3 – 1.0 Metres	1.0 – 3.0 Metres	> 3.0 Metres
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

# RECORD OF BOREHOLE No. BH/MW101



Project Number: **BIGC-ENV-349B** Drilling Location: **See BH Location Plan** Logged by: **TVH**  
 Project Client: **Distrikt Capital** Drilling Method: **150 mm Solid Stem Augering** Compiled by: **TVH**  
 Project Name: **Geotechnical Investigation** Drilling Machine: **Truck Mounted Drill Rig** Reviewed by: **SS**  
 Project Location: **217 & 227 Cross Ave. and 571 Argus Rd., Oakville, ON** Date Started: **13 Jan 21** Date Completed: **13 Jan 21** Revision No.: **1, 9/2/21**

Lithology Profile	DESCRIPTION	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS
		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RD%*			Penetration Testing	Soil Vapour Reading				
	<b>Geodetic Ground Surface Elevation: 103.04 m</b>												
	<b>ASPHALT:</b> 100 mm asphalt concrete over 200 mm granular base												
	<b>FILL:</b> clayey silt, trace sand, trace gravel, mottled, grey, moist, very stiff to hard	SS	1	41	22			○	○ <sup>23</sup>				SS1 sampled for Metals and Inorganics and PAHs on January 13, 2021
	<b>CLAYEY SILT TILL:</b> trace sand, trace gravel, fragments of Shale, grey, moist, hard	SS	2	100	60	1	102	○	○ <sup>22</sup>				SS2 sampled for VOCs and PHCs on January 13, 2021
		SS	3	93	71			○	○ <sup>10</sup>				
	<b>BEDROCK:</b> Shale, highly weathered, occasional limestone seams, grey, damp, hard	SS	4	53	50/15			○ <sup>50</sup> ○ <sup>15</sup>	○ <sup>18</sup>				
		SS	5	63	50/8	3	100	○ <sup>50</sup> ○ <sup>8</sup>	○ <sup>6</sup>				
	-first water strike												
		SS	6	100	50/3			○ <sup>50</sup> ○ <sup>3</sup>	○ <sup>4</sup>				Groundwater sampled for PHCs, VOCs, Metals and Inorganics on February 3, 2021
		SS	7	100	50/3	6	97	○ <sup>50</sup> ○ <sup>3</sup>	○ <sup>4</sup>				
	<b>End of Borehole</b>												
	Notes: 1. Borehole open upon completion of drilling. 2. Groundwater level at 5.18 m bgs measured upon completion of drilling. 3. Groundwater level reading at 3.38 m bgs on February 8, 2021.												

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▽ Groundwater depth on completion of drilling: 5.18 m.  
 ▼ Groundwater depth observed on 08/02/2021 at a depth of: 3.38 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying Notes to Record of Boreholes.

# RECORD OF BOREHOLE No. BH/MW102



Project Number: **BIGC-ENV-349B** Drilling Location: **See BH Location Plan** Logged by: **TVH**  
 Project Client: **Distrik Capital** Drilling Method: **150 mm Solid Stem Augering** Compiled by: **TVH**  
 Project Name: **Geotechnical Investigation** Drilling Machine: **Truck Mounted Drill Rig** Reviewed by: **SS**  
 Project Location: **217 & 227 Cross Ave. and 571 Argus Rd., Oakville, ON** Date Started: **13 Jan 21** Date Completed: **13 Jan 21** Revision No.: **1, 9/2/21**

Lithology Plot	DESCRIPTION	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS
		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RCD%			Penetration Testing	Soil Vapour Reading				
	<b>Geodetic Ground Surface Elevation: 102.55 m</b>												
	<b>ASPHALT:</b> 100 mm asphalt concrete over 200 mm granular base 102.25	SS	1	90	50/15			○ 50 ○ 15	★ Rinse pH Values 2 4 6 8 10 12 △ Soil Vapour Reading parts per million (ppm) 100 200 300 400 ▲ Lower Explosive Limit (LEL) W <sub>p</sub> W <sub>l</sub> Plastic Liquid 20 40 60 80				
	<b>FILL:</b> sandy silt, some clay, mottled, brown/grey, very moist, compact 101.79					1		○					SS1 sampled for Metals and Inorganics and PAHs on January 13, 2021
	<b>CLAYEY SILT TILL:</b> trace sand, trace sand, trace gravel, fragments of Shale, grey, moist, very stiff to hard - sand seam, 100 mm thick 101	SS	2	46	24			○					SS2 sampled for VOCs and PHCs on January 13, 2021
		SS	3	90	50/15	2		○ 50 ○ 15					
		SS	4	100	50/13	3		○ 50 ○ 13					
	<b>BEDROCK:</b> Shale, highly weathered, occasional limestone fragments, grey, damp, hard 99.96	SS	5	100	50/3	4		○ 50 ○ 3					
						5							
		SS	6	63	50/8	6		○ 50 ○ 8					
						7							
		SS	7	60	50/5	8		○ 50 ○ 5					
	<b>End of Borehole</b> 96.40 6.2												

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▽ Groundwater depth on completion of drilling: 5.18 m.  
 ▼ Groundwater depth observed on 08/02/2021 at a depth of: 3.67 m.  
 Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.



# RECORD OF BOREHOLE No. BH/MW103



Project Number: **BIGC-ENV-349B** Drilling Location: **See BH Location Plan** Logged by: **TVH**  
 Project Client: **Distrik Capital** Drilling Method: **150 mm Solid Stem Augering** Compiled by: **TVH**  
 Project Name: **Geotechnical Investigation** Drilling Machine: **Truck Mounted Drill Rig** Reviewed by: **SS**  
 Project Location: **217 & 227 Cross Ave. and 571 Argus Rd., Oakville, ON** Date Started: **13 Jan 21** Date Completed: **13 Jan 21** Revision No.: **1, 9/2/21**

Lithology Profile	Lithology Plot	DESCRIPTION	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS
			Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RCD%			Penetration Testing		Rinse pH Values	Soil Vapour Reading		
		<b>Geodetic Ground Surface Elevation: 101.78 m</b>												
		<b>ASPHALT:</b> 100 mm asphalt concrete over 300 mm granular bases	SS	1	51	13								
		<b>FILL:</b> sand and gravel, brown, moist, compacted												
		<b>CLAYEY SILT TILL:</b> some sand, trace gravel, fragments of Shale, reddish brown, moist, very stiff to hard	SS	2	84	26	1	101						
			SS	3	93	70	2	100						
		<b>BEDROCK:</b> Shale, highly weathered, occasional limestone fragments, grey, damp, hard	SS	4	87	50/15		99						
			SS	5	100	50/5	3							
			SS	6	60	50/5	4							
		<b>Borehole terminated at 5.49 m due to auger refusal on inferred Limestone bedrock</b>					5							
		Notes: 1. Borehole open upon completion of drilling. 2. Groundwater level at 4.57 m bgs measured upon completion of drilling. 3. Groundwater level reading at 2.79 m bgs on February 8, 2021.												

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∇ Groundwater depth on completion of drilling: **4.57 m.**  
 ▼ Groundwater depth observed on **08/02/2021** at a depth of: **2.79 m.**

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

Scale: 1 : 47

Page: 1 of 1

# RECORD OF BOREHOLE No. BH/MW104



Project Number: **BIGC-ENV-349B** Drilling Location: **See BH Location Plan** Logged by: **TVH**  
 Project Client: **District Capital** Drilling Method: **150 mm Solid Stem Augering** Compiled by: **TVH**  
 Project Name: **Geotechnical Investigation** Drilling Machine: **Truck Mounted Drill Rig** Reviewed by: **SS**  
 Project Location: **217 & 227 Cross Ave. and 571 Argus Rd., Oakville, ON** Date Started: **13 Jan 21** Date Completed: **13 Jan 21** Revision No.: **1, 9/2/21**

Lithology Profile	DESCRIPTION	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS
		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RCD%			Penetration Testing	Soil Vapour Reading				
	<b>Geodetic Ground Surface Elevation: 100.96 m</b>												
	<b>ASPHALT:</b> 100 mm asphalt concrete over 200 mm granular bases	SS	1	62	23								
	<b>FILL:</b> sand and gravel, brown, moist, compact												
	sandy silt, some clay, trace gravel	SS	2	62	13	1	100						
	<b>CLAYEY SILT TILL:</b> some sand, trace gravel, fragments of Shale, brown, moist, hard	SS	3	95	42	2	99						
	<b>BEDROCK:</b> Shale, highly weathered, occasional Limestone fragments, grey, moist, hard	SS	4	63	50/8								
		SS	5	100	50/3	3	98						
		SS	6	100	50/5	4	97						
		SS	7	100	50/3	6	95						
	<b>End of Borehole</b>												

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∇ Groundwater depth on completion of drilling: 4.88 m.  
 ▾ Groundwater depth observed on 08/02/2021 at a depth of: 2.45 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

# RECORD OF BOREHOLE No. BH/MW105



Project Number: **BIGC-ENV-349B** Drilling Location: **See BH Location Plan** Logged by: **TVH**  
 Project Client: **District Capital** Drilling Method: **150 mm Hollow Stem Augering + Rock Coring** Compiled by: **TVH**  
 Project Name: **Geotechnical Investigation** Drilling Machine: **Truck Mounted Drill Rig** Reviewed by: **SS**  
 Project Location: **217 & 227 Cross Ave. and 571 Argus Rd., Oakville, ON** Date Started: **14 Jan 21** Date Completed: **15 Jan 21** Revision No.: **1, 9/2/21**

Lithology Profile	DESCRIPTION	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS
		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RCD%			Penetration Testing	Soil Vapour Reading				
	<b>Geodetic Ground Surface Elevation: 102.38 m</b>												
	<b>ASPHALT:</b> 100 mm asphalt concrete over 200 mm granular base												
	102.08 <b>FILL:</b> clayey silt, trace to some sand and gravel, 0.3 brown/grey, moist, hard to very stiff	SS	1	62	37	102				6		SS1 sampled for Metals and Inorganics and PAHs on January 14, 2021  SS3 sampled for VOCs and PHCs on January 14, 2021	
	101.31 <b>CLAYEY SILT TILL:</b> trace sand, trace gravel, 1.1 fragments of Shale, grey, moist, very stiff to hard	SS	2	70	23	101				14			
		SS	3	84	55	100				9			
	100.09 <b>BEDROCK:</b> Shale, highly weathered to excellent quality, occasional Limestone layers, grey, moist	SS	4	100	50/8	100				7			
		SS	5	100	50/5	99				7			
		SS	6	100	50/5	98				18			
		SS	7	100	50/5	96				16			
		SS	8	100	50/5	95				16			
	<b>ROCK CORE BEGINS</b>	RC	1	78	27	94							
	- Poor Quality												

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Groundwater depth on completion of drilling: **NOT MEASURED DUE TO DRILLING WATER m.**  
 Groundwater depth observed on **08/02/2021** at a depth of: **21.09 m.**

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying Notes to Record of Boreholes.

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# RECORD OF BOREHOLE No. BH/MW105



Project Number: **BIGC-ENV-349B**

Drilling Location: **See BH Location Plan**

Logged by: **TVH**

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RQD%	Penetration Testing			MTO Vane*	Nilcon Vane*	Soil Vapour Reading parts per million (ppm)	Lower Explosive Limit (LEL)		
	- Good Quality <b>BEDROCK:</b> Shale, highly weathered to excellent quality, occasional Limestone layers, grey, moist	RC	2	100	81		93							
	- Good Quality	RC	3	99	82		92		○					
	- Excellent Quality	RC	4	99	91		91		○					
	- Excellent Quality	RC	5	99	97		89		○					
	- Excellent Quality	RC	6	99	96		87		○					
	- Excellent Quality	RC	7	99	95		86		○					
	- Excellent Quality	RC	8	97	98		84		○					
							19							

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

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# RECORD OF BOREHOLE No. BH/MW105



Project Number: **BIGC-ENV-349B**

Drilling Location: **See BH Location Plan**

Logged by: **TVH**

Lithology Plot	LITHOLOGY PROFILE	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RQD%			Penetration Testing	Soil Vapour Reading parts per million (ppm)	Lower Explosive Limit (LEL)	W <sub>p</sub>		
	<b>BEDROCK:</b> Shale, highly weathered to excellent quality, occasional Limestone layers, grey, moist	RC	9	98	83	83		○					
	- Good Quality					20							
	- Excellent Quality	RC	10	99	93	21		○					
	- Excellent Quality	RC	11	99	92	22		○					
	78.96 23.4					23							
	<b>Borehole terminated at 23.42</b>  Notes: 1. Borehole open upon completion of drilling. 2. Groundwater level not measured upon completion of drilling due to introduced drilling water. 3. Groundwater level reading at 21.09 m bgs on February 8, 2021.					79							

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

# RECORD OF BOREHOLE No. BH/MW106



Project Number: **BIGC-ENV-349B** Drilling Location: **See BH Location Plan** Logged by: **TVH**  
 Project Client: **Distrikt Capital** Drilling Method: **150 mm Solid Stem Augers** Compiled by: **TVH**  
 Project Name: **Geotechnical Investigation** Drilling Machine: **Truck Mounted Drill Rig** Reviewed by: **SS**  
 Project Location: **217 & 227 Cross Ave. and 571 Argus Rd., Oakville, ON** Date Started: **20 Jan 21** Date Completed: **20 Jan 21** Revision No.: **1, 9/2/21**

Lithology Profile	DESCRIPTION	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS
		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RQD%			Penetration Testing	Soil Vapour Reading				
	<b>Geodetic Ground Surface Elevation: 102.83 m</b>												
	<b>ASPHALT:</b> 75 mm asphalt concrete over 150 mm granular base												
	<b>FILL:</b> clayey silt, trace sand, trace gravel, rootlets, mottled, brown, moist, stiff to hard	SS	1	92	12		102.61	○	○ 14			SS1 sampled for VOCs and PHCs on January 20, 2021	
							102	○ 63 ○ 23	○ 14				
	<b>CLAYEY SILT TILL:</b> trace sand, trace gravel, fragments of Shale, brown, moist, hard	SS	2	95	63/23		101.77					SS2 sampled for Metals and Inorganics and PAHs on January 20, 2021	
							101	○ 50 ○ 15	○ 15				
	<b>BEDROCK:</b> Shale, highly weathered, occasional Limestone fragments, grey, damp, hard	SS	3	93	50/15		101.15						
		SS	4	100	50/5		100	○ 50 ○ 5	○ 6				
		SS	5	100	50/5		100	○ 50 ○ 5	○ 6				
							99						
		SS	6	100	50/3		98	○ 50 ○ 3	○ 3				
							97						
		SS	7	100	50/3		96.71	○ 50 ○ 3	○ 2				
	<b>End of Borehole</b>						6.1						

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▽ Groundwater depth on completion of drilling: 3.96 m.  
 ▽ Groundwater depth observed on 08/02/2021 at a depth of: 3.32 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

# RECORD OF BOREHOLE No. BH/MW107



Project Number: **BIGC-ENV-349B** Drilling Location: **See BH Location Plan** Logged by: **TVH**  
 Project Client: **District Capital** Drilling Method: **150 mm Solid Stem Augers** Compiled by: **TVH**  
 Project Name: **Geotechnical Investigation** Drilling Machine: **Truck Mounted Drill Rig** Reviewed by: **SS**  
 Project Location: **217 & 227 Cross Ave. and 571 Argus Rd., Oakville, ON** Date Started: **20 Jan 21** Date Completed: **20 Jan 21** Revision No.: **1, 9/2/21**

Lithology Plot	LITHOLOGY PROFILE	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS
		DESCRIPTION	Sample Type	Sample Number	Recovery (%)						
	Geodetic Ground Surface Elevation: 102.40 m										
	ASPHALT: 120 mm asphalt concrete over 170 mm granular base					102.11					
	FILL: clayey silt, trace gravel, rootlets, mottled, 0.3 brown, moist, stiff	SS	1	59	12						
	CLAYEY SILT TILL: trace sand, trace gravel, 0.8 oxidized fissures, mottled, brownish grey, moist, very stiff to hard	SS	2	92	28	101.64					
	BEDROCK: Shale, highly weathered, occasional Limestone fragments, grey, damp to moist, hard	SS	3	70	51	100.57					
		SS	4	100	50/5	100		50	50		
		SS	5	60	50/5	99		50	50		
	-first water strike										
		SS	6	100	50/5	98		50	50		
		SS	7	100	50/3	96.28		50	50		
	End of Borehole					6.1					
	Notes: 1. Borehole open upon completion of drilling. 2. Groundwater level at 3.66 m bgs measured upon completion of drilling. 3. Groundwater level reading at 3.61 m bgs on February 8, 2021.										

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Groundwater depth on completion of drilling: 3.66 m.  
 Groundwater depth observed on 08/02/2021 at a depth of: 3.61 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

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# RECORD OF BOREHOLE No. BH/MW108



Project Number: **BIGC-ENV-349B** Drilling Location: **See BH Location Plan** Logged by: **TVH**  
 Project Client: **District Capital** Drilling Method: **150 mm Solid Stem Augers** Compiled by: **TVH**  
 Project Name: **Geotechnical Investigation** Drilling Machine: **Truck Mounted Drill Rig** Reviewed by: **SS**  
 Project Location: **217 & 227 Cross Ave. and 571 Argus Rd., Oakville, ON** Date Started: **20 Jan 21** Date Completed: **20 Jan 21** Revision No.: **1, 9/2/21**

Lithology Profile	DESCRIPTION	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS
		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RCD%			Penetration Testing	Soil Vapour Reading				
	<b>Geodetic Ground Surface Elevation: 102.55 m</b>												
	<b>ASPHALT:</b> 150 mm asphalt concrete over 200 mm granular base												
	102.20	SS	1	75	9		102	○	○15				
	<b>FILL:</b> clayey silt, trace gravel, rootlets, organic staining, mottled, brown, moist, stiff												
	101.79												
	<b>CLAYEY SILT TILL:</b> trace sand, trace gravel, oxidized fissures, mottled, brown, moist, very stiff to hard	SS	2	100	25	1	101	○	○12				
	100.47	SS	3	100	65	2	101	○	○11				
	<b>BEDROCK:</b> Shale, highly weathered, occasional Limestone fragments, grey, moist												
		SS	4	100	50/5		100	○50	○8				
		SS	5	100	50/5	3	100	○50	○6				
	-first water strike						99						
		SS	6	100	50/3	4	98	○50	○5				
		SS	7	100	50/3	6	97	○50	○21				
	<b>End of Borehole</b>												
	96.43												
	6.1												
	Notes: 1. Borehole open upon completion of drilling. 2. Groundwater level at 3.96 m bgs measured upon completion of drilling. 3. Groundwater level reading at 3.90 m bgs on February 8, 2021.												

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▽ Groundwater depth on completion of drilling: 3.96 m.  
 ▼ Groundwater depth observed on 08/02/2021 at a depth of: 3.90 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.



# RECORD OF BOREHOLE No. BH/MW109



Project Number: **BIGC-ENV-349B** Drilling Location: **See BH Location Plan** Logged by: **TVH**  
 Project Client: **District Capital** Drilling Method: **150 mm Solid Stem Augers** Compiled by: **TVH**  
 Project Name: **Geotechnical Investigation** Drilling Machine: **Truck Mounted Drill Rig** Reviewed by: **SS**  
 Project Location: **217 & 227 Cross Ave. and 571 Argus Rd., Oakville, ON** Date Started: **20 Jan 21** Date Completed: **20 Jan 21** Revision No.: **1, 9/2/21**

Lithology Profile	DESCRIPTION	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS
		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RQD%			Penetration Testing	Soil Vapour Reading				
	<b>Geodetic Ground Surface Elevation: 102.89 m</b>												
	<b>ASPHALT:</b> 140 mm asphalt concrete over 160 mm granular base												
	102.59 <b>FILL:</b> clayey silt, trace gravel, rootlets, mottled brown, moist, stiff	SS	1	92	13					14		SS1 sampled for Metals and Inorganics and PAHs on January 20, 2021	
	102.43 <b>CLAYEY SILT TILL:</b> trace sand, trace gravel, fragments of Shale, oxidized fissures, mottled, brownish grey, moist, hard					1	102			11			
	102.33 0.6	SS	2	100	33								
	101.06 <b>BEDROCK:</b> Shale, highly weathered, occasional Limestone fragments, grey, moist to damp, hard	SS	3	83	76/20		101			10			
		SS	4	100	50/5					8			
		SS	5	100	50/3		100			6			
		SS	6	100	50/5		99			4			
	-first water strike												
		SS	7	100	50/3		97			30			
	<b>End of Borehole</b> 96.77 6.1												
	Notes: 1. Borehole open upon completion of drilling. 2. Groundwater level at 5.18 m bgs measured upon completion of drilling. 3. Groundwater level reading at 4.20 m bgs on February 8, 2021.												

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∇ Groundwater depth on completion of drilling: 5.18 m.  
 ▽ Groundwater depth observed on 08/02/2021 at a depth of: 4.20 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying Notes to Record of Boreholes.

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# RECORD OF BOREHOLE No. BH/MW110



Project Number: **BIGC-ENV-349B** Drilling Location: **See BH Location Plan** Logged by: **TVH**  
 Project Client: **District Capital** Drilling Method: **150 mm Solid Stem Augers** Compiled by: **TVH**  
 Project Name: **Geotechnical Investigation** Drilling Machine: **Truck Mounted Drill Rig** Reviewed by: **SS**  
 Project Location: **217 & 227 Cross Ave. and 571 Argus Rd., Oakville, ON** Date Started: **21 Jan 21** Date Completed: **21 Jan 21** Revision No.: **1, 9/2/21**

Lithology Profile	DESCRIPTION	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS
		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RCD%			Penetration Testing	Soil Vapour Reading				
<p><b>Geodetic Ground Surface Elevation: 101.82 m</b></p>													
ASPHALT: 120 mm asphalt concrete over 300 mm granular base		SS	1	79	21		101.40			12		SS1 sampled for Metals and Inorganics and PAHs on January 21, 2021  SS2 sampled for VOCs and PHCs on January 21, 2021	
FILL: sandy silt, some gravel, occasional glass fragments, rootlets, brown, moist, compact							101.75			12			
CLAYEY SILT TILL: trace sand, trace gravel, fragments of Shale, oxidized fissures, mottled, brownish grey, moist, stiff to hard		SS	2	95	12	1	100.75			10			
		SS	3	100	37	2	100.53			10			
BEDROCK: Shale, highly weathered, occasional Limestone fragments, grey, damp, hard		SS	4	100	50/5		99.53	50		7			
		SS	5	100	50/5	3	99.53	50		3			
		SS	6	60	50/5	4	98.53	50		7			
-first water strike						5	97.53						
		SS	7	100	50/3	6	95.70	50		17			
End of Borehole						6.1	95.70						
<p>Notes:                      1. Borehole open upon completion of drilling.                      2. Groundwater level at 3.96 m bgs measured upon completion of drilling.                      3. Groundwater level reading at 3.08 m bgs on February 8, 2021.</p>													

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∇ Groundwater depth on completion of drilling: 3.96 m.  
 ▾ Groundwater depth observed on 08/02/2021 at a depth of: 3.08 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying Notes to Record of Boreholes.

# RECORD OF BOREHOLE No. BH/MW111



Project Number: **BIGC-ENV-349B** Drilling Location: **See BH Location Plan** Logged by: **TVH**  
 Project Client: **Distrikt Capital** Drilling Method: **150 mm Solid Stem Augers** Compiled by: **TVH**  
 Project Name: **Geotechnical Investigation** Drilling Machine: **Truck Mounted Drill Rig** Reviewed by: **SS**  
 Project Location: **217 & 227 Cross Ave. and 571 Argus Rd., Oakville, ON** Date Started: **21 Jan 21** Date Completed: **21 Jan 21** Revision No.: **1, 9/2/21**

Lithology Profile	DESCRIPTION	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS
		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RQD%			Penetration Testing	Soil Vapour Reading				
	<b>Geodetic Ground Surface Elevation: 101.94 m</b>												
	<b>ASPHALT:</b> 75 mm asphalt concrete over 250 mm granular base												
	<b>FILL:</b> sandy silt, trace gravel, rootlets, organic staining, brown, moist, compact	SS	1	95	15		101.71	○		13			
	clayey silt, firm	SS	2	100	8	1	101	○		15			
	<b>CLAYEY SILT TILL:</b> trace sand, trace gravel, fragments of Shale, oxidized fissures, mottled, grey, moist, hard	SS	3	100	34	2	100	○		13			
	<b>BEDROCK:</b> Shale, highly weathered, occasional Limestone fragments, grey, moist	SS	4	63	50/8		99.65	○	50	5			
		SS	5	100	50/5	3	99	○	50	7			
	-first water strike					4	98						
		SS	6	60	50/5	5	97	○	50	8			
	<b>End of Borehole</b>	SS	7	100	50/3	6	95.82	○	50	7			
	Notes: 1. Borehole open upon completion of drilling. 2. Groundwater level at 3.96 m bgs measured upon completion of drilling. 3. Groundwater level reading at 3.37 m bgs on February 8, 2021.						6.1						

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▽ Groundwater depth on completion of drilling: 3.96 m.  
 ▼ Groundwater depth observed on 08/02/2021 at a depth of: 3.37 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

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# RECORD OF BOREHOLE No. BH/MW112



Project Number: **BIGC-ENV-349B** Drilling Location: **See BH Location Plan** Logged by: **TVH**  
 Project Client: **District Capital** Drilling Method: **150 mm Solid Stem Augers** Compiled by: **TVH**  
 Project Name: **Geotechnical Investigation** Drilling Machine: **Truck Mounted Drill Rig** Reviewed by: **SS**  
 Project Location: **217 & 227 Cross Ave. and 571 Argus Rd., Oakville, ON** Date Started: **21 Jan 21** Date Completed: **21 Jan 21** Revision No.: **1, 9/2/21**

Lithology Plot	LITHOLOGY PROFILE		SOIL SAMPLING				FIELD TESTING		LAB TESTING				INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	DEPTH (m)	ELEVATION (m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RCD%	Penetration Testing	Soil Vapour Reading	Lower Explosive Limit (LEL)	Plastic	Liquid		
	Geodetic Ground Surface Elevation: 102.78 m													
	TOPSOIL: 150 mm	102.63												
	FILL: clayey silt, trace gravel, rootlets, brown, moist, stiff	0.2		SS	1	59	9							
	grey	101.71		SS	2	100	21							
	CLAYEY SILT TILL: trace sand, trace gravel, fragments of Shale, oxidized fissures, mottled, grey, moist, very stiff to hard	1.1		SS	3	95	44							
		100.18		SS	4	100	75/25							
	BEDROCK: Shale, highly weathered, occasional Limestone fragments, grey, moist, hard	2.6		SS	5	100	50/5							
	-first water strike			SS	6	60	50/5							
		96.66		SS	7	100	50/3							
	End of Borehole	6.1												
	Notes: 1. Borehole open upon completion of drilling. 2. Groundwater level at 5.18 m bgs measured upon completion of drilling. 3. Groundwater level reading at 4.23 m bgs on February 8, 2021.													

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Groundwater depth on completion of drilling: 5.18 m.  
 Groundwater depth observed on 08/02/2021 at a depth of: 4.23 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying Notes to Record of Boreholes.

# RECORD OF BOREHOLE No. BH/MW113



Project Number: **BIGC-ENV-349B** Drilling Location: **See BH Location Plan** Logged by: **TVH**  
 Project Client: **District Capital** Drilling Method: **150 mm Solid Stem Augers** Compiled by: **TVH**  
 Project Name: **Geotechnical Investigation** Drilling Machine: **Truck Mounted Drill Rig** Reviewed by: **SS**  
 Project Location: **217 & 227 Cross Ave. and 571 Argus Rd., Oakville, ON** Date Started: **21 Jan 21** Date Completed: **21 Jan 21** Revision No.: **1, 9/2/21**

Lithology Profile	DESCRIPTION	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS
		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RCD%			Penetration Testing	Soil Vapour Reading				
Geodetic Ground Surface Elevation: 103.45 m GRAVEL: 50 mm FILL: clayey silt, trace gravel, rootlets, organic staining, brown, moist, very stiff to stiff													
		SS	1	100	19	103		○	○14				SS1 sampled for Metals and Inorganics and PAHs on January 21, 2021
		SS	2	100	13	102		○	○12				
	CLAYEY SILT TILL: trace sand, trace gravel, fragments of Shale, oxidized fissures, mottled, grey, moist, stiff to hard	SS	3	100	44	101		○	○11				
		SS	4	100	90	100		○	○13				
	BEDROCK: Shale, highly weathered, occasional Limestone fragments, grey, moist	SS	5	100	50/5	99		○50	○5				
		SS	6	100	50/3	98		○50	○7				Groundwater sampled for PAHs on February 3, 2021
		SS	7	100	50/5	97.33		○50	○21				
	End of Borehole					6.1							
Notes: 1. Borehole open upon completion of drilling. 2. Groundwater level at 5.48 m bgs measured upon completion of drilling. 3. Groundwater level reading at 4.77 m bgs on February 8, 2021.													

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▽ Groundwater depth on completion of drilling: 5.48 m.  
 ▽ Groundwater depth observed on 08/02/2021 at a depth of: 4.77 m.

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

# RECORD OF BOREHOLE No. BH/MW114



Project Number: **BIGC-ENV-349B** Drilling Location: **See BH Location Plan** Logged by: **TVH**  
 Project Client: **District Capital** Drilling Method: **150 mm Hollow Stem Augering + Rock Coring** Compiled by: **TVH**  
 Project Name: **Geotechnical Investigation** Drilling Machine: **Truck Mounted Drill Rig** Reviewed by: **SS**  
 Project Location: **217 & 227 Cross Ave. and 571 Argus Rd., Oakville, ON** Date Started: **21 Jan 21** Date Completed: **27 Jan 21** Revision No.: **1, 9/2/21**

Lithology Profile	DESCRIPTION	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS
		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RCD%			Penetration Testing	Soil Vapour Reading (ppm)	Lower Explosive Limit (LEL)	W <sub>p</sub>		
	<b>Geodetic Ground Surface Elevation: 103.31 m</b>												
	<b>TOPSOIL:</b> 150 mm 103.16												
	<b>FILL:</b> clayey silt, trace gravel, mottled, grey, moist, very stiff to firm 0.2	SS	1	100	20	103				11			SS1 sampled for Metals and Inorganics and PAHs on January 21, 2021
		SS	2	100	8	102				19			
	<b>CLAYEY SILT TILL:</b> trace sand, trace gravel, fragments of Shalr, oxidized fissures, mottled, grey, moist, hard 1.7	SS	3	100	37	101				11			
		SS	4	100	57	100				11			
	<b>BEDROCK:</b> Shale, highly weathered to excellent quality, occasional Limestone layers, grey, moist to damp 2.8	SS	5	100	50/5	100				9			
						99				7			
	- first water strike	SS	6	60	50/5	98							
		SS	7	60	50/5	97				19			
						96							
	<b>ROCK CORE BEGINS</b>	RC	1	98	35	95							
	- Poor Quality												
		RC	2	69	28								
	- Poor Quality												

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Groundwater depth on completion of drilling: **NOT MEASURED DUE TO DRILLING WATER m.**  
 Groundwater depth observed on **08/02/2021** at a depth of: **18.88 m.**

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying Notes to Record of Boreholes.

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 Page: 1 of 3

# RECORD OF BOREHOLE No. BH/MW114



Project Number: **BIGC-ENV-349B**

Drilling Location: **See BH Location Plan**

Logged by: **TVH**

Lithology Plot	LITHOLOGY PROFILE	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RQD%			Penetration Testing	Soil Vapour Reading parts per million (ppm)	Lower Explosive Limit (LEL)	W <sub>p</sub>		
	<b>BEDROCK:</b> Shale, highly weathered to excellent quality, occasional Limestone layers, grey, moist to damp					94							
	- Fair Quality	RC	3	98	62	93		○					
	- Good Quality	RC	4	100	87	92		○					
	- Good Quality	RC	5	100	76	90		○					
	- Good Quality	RC	6	100	83	89		○					
	- Excellent Quality	RC	7	100	98	87		○					
	- Good Quality	RC	8	97	89	86		○					
						85							
						19							

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

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# RECORD OF BOREHOLE No. BH/MW114



Project Number: **BIGC-ENV-349B**

Drilling Location: **See BH Location Plan**

Logged by: **TVH**

Lithology Plot	LITHOLOGY PROFILE	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS	
	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RQD%			Penetration Testing	MTO Vane*	Nilcon Vane*	Soil Vapour Reading parts per million (ppm)			Lower Explosive Limit (LEL)
	<b>BEDROCK:</b> Shale, highly weathered to excellent quality, occasional Limestone layers, grey, moist to damp - Excellent Quality  - Excellent Quality  - Excellent Quality	RC	9	100	94	84								
		RC	10	100	90	21								
		RC	11	100	97	97								
	79.99 23.3					80								
	Borehole terminated at 23.32  Notes: 1. Borehole open upon completion of drilling. 2. Groundwater level not measured upon completion of drilling due to introduced drilling water. 3. Groundwater level reading at 18.88 m bgs on February 8, 2021.													

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.



# RECORD OF BOREHOLE No. BH/MW115



Project Number: **BIGC-ENV-349B** Drilling Location: **See BH Location Plan** Logged by: **TVH**  
 Project Client: **Distrikt Capital** Drilling Method: **150 mm Hollow Stem Augering + Rock Coring** Compiled by: **TVH**  
 Project Name: **Geotechnical Investigation** Drilling Machine: **Truck Mounted Drill Rig** Reviewed by: **SS**  
 Project Location: **217 & 227 Cross Ave. and 571 Argus Rd., Oakville, ON** Date Started: **22 Jan 21** Date Completed: **26 Jan 21** Revision No.: **1, 9/2/21**

Lithology Profile	DESCRIPTION	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	COMMENTS	
		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RCD%							
	<b>Geodetic Ground Surface Elevation: 101.72 m</b>											
 <b>ASPHALT:</b> 100 mm asphalt concrete over 300 mm granular bases 101.32  <b>FILL:</b> clayey silt, trace gravel, rootlets, organic staining, dark brown, moist, very stiff 100.88  <b>CLAYEY SILT TILL:</b> trace sand, trace gravel, oxidized fissures, mottled, grey, moist, stiff to hard 99.28  <b>BEDROCK:</b> Shale, highly weathered to excellent quality, occasional Limestone layers, grey, moist to damp - first water strike          ----- <b>ROCK CORE BEGINS</b> - Poor Quality          ----- - Fair Quality	SS	1	59	16		101	○	○ <sub>15</sub>			SS1 sampled for Metals and Inorganics and PAHs on January 22, 2021	
	SS	2	100	12	1	100	○	○ <sub>13</sub>				SS2 sampled for Metals and Inorganics and PAHs on January 22, 2021
	SS	3	84	32	2	100	○	○ <sub>12</sub>				
	SS	4	100	50/13		99	○ <sub>50</sub> ○ <sub>13</sub>	○ <sub>10</sub>				
	SS	5	100	50/5	3	98	○ <sub>50</sub> ○ <sub>5</sub>	○ <sub>6</sub>				
	SS	6	60	50/5	5	97	○ <sub>50</sub> ○ <sub>5</sub>	○ <sub>5</sub>				
	SS	7	60	50/5	6	96	○ <sub>50</sub> ○ <sub>5</sub>	○ <sub>5</sub>				
RC	1	83	30	8	94	○						
RC	2	98	74		93		○					

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∇ Groundwater depth on completion of drilling: **NOT MEASURED DUE TO DRILLING WATER m.**  
 ▾ Groundwater depth observed on **08/02/2021** at a depth of: **17.91 m.**

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

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# RECORD OF BOREHOLE No. BH/MW115



Project Number: **BIGC-ENV-349B**

Drilling Location: **See BH Location Plan**

Logged by: **TVH**

Lithology Plot	LITHOLOGY PROFILE	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS
	DESCRIPTION	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RQD%			Penetration Testing	Soil Vapour Reading parts per million (ppm)	Lower Explosive Limit (LEL)	Rinse pH Values		
	<b>BEDROCK:</b> Shale, highly weathered to excellent quality, occasional Limestone layers, grey, moist to damp  - Fair Quality  - Good Quality  - Excellent Quality  - Good Quality  - Excellent Quality  - Excellent Quality												
		RC	3	99	61	92	10						
		RC	4	99	77	91	11						
		RC	5	100	98	90	12						
		RC	6	98	87	89	13						
		RC	7	100	95	88	14						
		RC	8	100	92	87	15						
		RC				86	16						
					85	17							
					84	18							
					83	19							

Borehole details as presented, do not constitute a thorough understanding of all potential conditions present and requires interpretative assistance from a qualified Geotechnical Engineer. Also, borehole information should be read in conjunction with the geotechnical report for which it was commissioned and the accompanying 'Notes to Record of Boreholes'.

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# RECORD OF BOREHOLE No. BH/MW115



Project Number: **BIGC-ENV-349B**

Drilling Location: **See BH Location Plan**

Logged by: **TVH**

Lithology Plot	LITHOLOGY PROFILE  DESCRIPTION	SOIL SAMPLING				DEPTH (m)	ELEVATION (m)	FIELD TESTING		LAB TESTING		INSTRUMENTATION INSTALLATION	COMMENTS
		Sample Type	Sample Number	Recovery (%)	SPT 'N' Value/RQD%			Penetration Testing ○ SPT ● DCPT	MTO Vane* △ Intact ▲ Remould	Nilcon Vane* ◇ Intact ◆ Remould	★ Rinse pH Values 2 4 6 8 10 12		
	<b>BEDROCK:</b> Shale, highly weathered to excellent quality, occasional Limestone layers, grey, moist to damp - Excellent Quality	RC	9	100	91	82							Groundwater sampled for Metals and Inorganics on February 3, 2021
	- Good Quality	RC	10	96	89	21							
	- Excellent Quality	RC	11	100	92	22							
	78.40 Borehole terminated at 23.32 23.3 Notes: 1. Borehole open upon completion of drilling. 2. Groundwater level not measured upon completion of drilling due to introduced drilling water. 3. Groundwater level reading at 17.91 m bgs on February 8, 2021.												



### RECORD OF BOREHOLE No. BH1

**METRIC** 1 OF 1

PROJ. NO. BIGC-GEO-349A LOCATION 571 Argus Road and 217 Cross Avenue, Oakville ORIGINATED BY F.V.G  
 DATUM Geodetic BOREHOLE TYPE Continuous flight, 6 inches, Solid Stem Auger COMPILED BY S.L  
 PROJ. NAME Geotechnical Investigation DATE 2019.11.21 - 2019.11.21 CHECKED BY \_\_\_\_\_

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
						20	40	60	80	100						
101.55 0.0 101.5 0.1	<b>ASPHALT:</b> 90 mm <b>GRANULAR:</b> 350 mm		1	SS1	25											
101.1 0.4	<b>FILL:</b> clayey silt to silty clay, some sand, organic staining, dark brown to black, moist															
100.5 1.1	<b>CLAYEY SILT TILL/SILTY CLAY TILL:</b> brown, moist, hard - trace rootlets between 1.1 m and 1.5 m		2	SS2	6											
98.9 2.7	<b>SHALE:</b> highly weathered, grey, damp		3	SS3	55											
98.4 3.2	<b>Borehole terminated at 3.2 m</b> Notes: 1. Open and dry upon completion of drilling		4	SS4	80											



## RECORD OF BOREHOLE No. BH2

PROJ. NO. BIGC-GEO-349A LOCATION 571 Argus Road and 217 Cross Avenue, Oakville ORIGINATED BY F.V.G  
 DATUM Geodetic BOREHOLE TYPE Continuous flight, 6 inches, Solid Stem Auger COMPILED BY S.L  
 PROJ. NAME Geotechnical Investigation DATE 2019.11.21 - 2019.11.21 CHECKED BY \_\_\_\_\_

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
						20	40	60	80	100						
101.93 109.9	<b>ASPHALT:</b> 75 mm	●														
0.1	<b>GRANULAR:</b> 330 mm	●														
101.5	<b>FILL:</b> clayey silt to silty clay, topsoil inclusion, some rootlets, dark brown to black, moist	●	1	SS1	14											
101.0	<b>SILT TO CLAYEY SILT:</b> trace rootlets, reddish brown, very moist, loose	●	2	SS2	9											
100.4	<b>CLAYEY SILT TILL/SILTY CLAY TILL:</b> brown, moist, hard  - grey below 1.8 m	●	3	SS3	31											
99.6	<b>SHALE:</b> weathered, grey, damp	●	4	SS4	100											
98.7	<b>limestone at 3.2 m</b> <b>Borehole terminated at 3.2 m</b> Notes: 1. Open and dry upon completion of drilling	●	5	SS5	100											

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE



## RECORD OF BOREHOLE No. BH/MW3

PROJ. NO. BIGC-GEO-349A LOCATION 571 Argus Road and 217 Cross Avenue, Oakville ORIGINATED BY F.V.G  
 DATUM Geodetic BOREHOLE TYPE Continuous flight, 8 inches, Hollow Stem Auger COMPILED BY S.L  
 PROJ. NAME Geotechnical Investigation DATE 2019.11.21 - 2019.11.21 CHECKED BY \_\_\_\_\_

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT <b>γ</b> kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
102.87 <del>102.8</del> 0.1	<b>ASPHALT:</b> 65 mm <b>GRANULAR:</b> 330 mm		1	SS1	14											
102.5 0.4	FILL: clayey silt, organic staining, dark brown, moist															
102.3 0.6	CLAYEY SILT TILL/SILTY CLAY TILL: mottled brown, moist, very stiff to hard		2	SS2	60											
	- shale-till complex below 1.5 m, brownish grey, moist, hard		3	SS3	100											
101.1 1.8	SHALE: weathered, grey, damp		4	SS4	100											
100.6 2.3	<b>Borehole terminated at 2.3 m</b> Notes: 1. Open and dry upon completion of drilling 2. Water level at 1.70 m bgs (Elev. 101.17 m asl) on November 29, 2019															

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE



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1. N422 Fi s Bk ai xr  
Awwvx7Vkl Y HDG . X0  
ddd8yWi kv7,tkVW: 8 i s

### RECORD OF BOREHOLE No. BH/MW4

METRIC 1 | V .

DaI "8YI 8I %cNkYl N605C H cCF%Y 4e1CrWv ai xr xkr . 1ecri vvCfok7obl xEwo I a%CFy9 I L v8k  
 9CFPA Koi rotw I I ayJI Hy FLdy ci ktiki 7v -WobSkr: povbJi ,i d mtos C7V6n cI AD%y9 I L m8I  
 DaI "8YCAy Koi to: pkwx, %f ovtWktvk 9CFy . 215818 1 N 215818 4 cJyc&y9 I L

ml %d Dal V%y		mCADHy m			9LYCA% cI Yy DyYyFaCF%Y aym%FCYcy DH F					DHCnF% YCFPaCH H%P% HA% AI %FPay cI YFYF HA% d <sub>B</sub> d d <sub>H</sub>			ayACa&m & KaC% m%y 9%Fa%PF%Y ZMQ	
yHy/ 9yDFJ	9ymca %DF%Y	mFaCF DH F	YPAI ya	FLDy	"Y" / CHPym	Kal PY9 GCFYa cl Y9%Ym	yHy / CF%Y mcCHy	mJYCa mFay YKfJ BDX o PYcl YV%y9 + V%HB / CYy ● ) P% & Fa %X%CH X HCl / CYy	GCFya cl YFYF ZMQ	BY <sup>6</sup>	Ka mC m% cH			
12.8	ASPHALT: e4 s s							.2 02 32 S2 122	.2 02 32					
12.8	GRANULAR: S2 s s													
12.8	CLAYEY SILT TILL/SILTY CLAY TILL: s i tt, or gri d kbs i wtbf orh vt w ti pxrr		1	mm1	14									
				mm	60									
	Nvpx, oNw: i s Qougo, i d 18 s b gri d kwp Wobhs i wtbprr		6	mm6	122									
1228	SHALE: doxtporor bWohr xs O		0	mm0	122									
558	Na7k ( 1E s ti 08 s a) 9 U2 M ao: i forh U40 M NpW6, h doxtporor b-koNwkwor Wob vpx, o dwp, w ovli ko wtorgor v Nw ovli ko xt . 85 s xkr 68 s Nfortwx, -rx: t7ro xt . 85 s Ns i tt, wW7o ti dxtontkrt7vkv xt 68 s Ns or w s ti pxrr ri : B		1	cl ay										
558	Na7k ( . E08 s ti 48 s a) 9 U41 M ao: i forh U55 M NpW6, h doxtporor Wob vpx, o gotdook 08 s xkr 08 s Nw ovli ko gotdook 08 s ti 08 s dwp 122 s s i -wtorgor r or vpx, o xt 08 s Ns i tt, wWxt 08 s N-rx: t7ro -wkwW s xtonw, i gvorf or xt 08 s Nkxt7rx, -rx: t7rov gotdook 08 s xkr 08 s N7kd oxtporor Wob vpx, o gotdook 08 s xkr 48 s			cl ay										
538	Na7k ( 6E48 s ti e s a) 9 U34 M ao: i forh U122 M Nwob vpx, ob-koNwkwor bs or w s ti pxrr Nw, w6h doxtporor ti 7kd oxtporor vo: twkv gotdook 48 s xkr 48 s b gotdook 48 s xkr 38 s bkr gotdook 38 s xkr e8 s NpW6, h doxtporor vo: twkv gotdook 48 s xkr 48 s N: i s Qoto, h doxtporor dwp s xRn -rx: t7rov gotdook 48 s xkr 48 s b -wor dwp Wobh : xhoh vvt tw Ns xRn-rx: t7rov -wor dwp Wobh : xhoh vvt tw gotdook 38 s xkr 38 s N42 s s i -rx: t7ro -wkwW : xhoh vvt tw i gvorf or xt 38 s		6	cl ay										
548	N: i s Qoto, h doxtporor dwp s xRn -rx: t7rov gotdook 48 s xkr 48 s b -wor dwp Wobh : xhoh vvt tw Ns xRn-rx: t7rov -wor dwp Wobh : xhoh vvt tw gotdook 38 s xkr 38 s N42 s s i -rx: t7ro -wkwW : xhoh vvt tw i gvorf or xt 38 s		0	cl ay										
e8	Na7k ( 0Ee s xkr S8 s a) 9 Ue. M ao: i forh U55 M Nw, w6h doxtporor Wob vpx, o dwp . 4 s s i -w ovli ko wtorgor v xt e8 s b i orh -koNwkwor bpxrr N: oxk fortwx, -rx: t7ro xt e8 s Nn 7Vp -rx: t7rov dwp -rx: t7ro -wkwW s xtonw, gotdook e8 s xkr e8 s xkr gotdook e8 s xkr e8 s Nror vbxwVt7xkr wVgotdook e8 s xkr e8 s		4	cl ay										
568														
S8														

ci ktik7or Yout DxW6

+ 6 b x 6 E Y7s gorv ro-onti  
mokvltvth ○ 6M mFaC% CF VC% Pay



### RECORD OF BOREHOLE No. BH/MW4

### METRIC

DaI "8YI 8I %cNKyI N605C H cCF%Y 4e1CrWvai xr xkr . 1ecri vvCfok7obl xEwo I a%CFy9 I L v8 &  
 9CFPA Koi rotw I I ayJI Hy FL Dy ci ktiki 7v -W6bSkr: povbJi ,i d mtos C7V6n cI AD%y9 I L m8I  
 DaI "8YCAy Koi to: pkwx, %f ovtWtkvk 9CFy . 2158 18 1 N 2158 18 4 c Jyc & y9 I L

yHy/ 9yDFJ	ml %d Dal V%y 9ymca %DF%Y	mCADHy m			Kai PYg GCFya cl Y9%Ym	yHy/CF%Y mcChy	9LYCA% cI Yy DyYyFaCF%Y aym%FCYcy DH F					DHCnF% YCFPaCH H%P% HA% AI %FPay cl YFYF HA%			ayACa&m & KaC% m%y 9%Fa%PF%Y ZMQ
		mFaCF DH F	YPAI ya	FLDY			"Y" / CHPym	.2	02	32	S2	122	d <sub>0</sub>	d <sub>H</sub>	
58 128	Na7k ( 4ES8 s xkr 128 s a) 9 Ue2 M ao: i forh U5SM N7oh vpx,o dwp ,s ovti ko vrtorgor vb forh -koN7kvor bf orh pxrri : B Nfortwx, -rx: t7ro xt 58 s Ndwo -rx: t7ro -wor dwp -rx: t7ro -wkwS xtonw, xt 58 s Ns i tt,wgotdook 58 s xkr 58 s Ns i ro tpkx tdofo Zi +Qpi nzi ktx, s o: pxkwx, -rx: t7rov (continued)														
528 118	Na7k ( 3E128 s xkr 118 s a) 9 US2 M ao: i forh U122 M N7kdoxtoporor Woh vpx,o dwp ,s ovti ko vrtorgor vb forh pxrri : B Nfortwx, -rx: t7rov xt 128 s xkr 118 s Nforh dwo -rx: t7ro -wor dwp r xrB Woh xkr forh s i wt vpx,oN7k: i s Qou xt 128 s Ns i tt,or xkr gi t por rw: i j 7rxtkvi - ,wpt ti r xrB Woh														
S58 168	Na7k ( eE188 s xkr 168 s a) 9 USSM ao: i forh U122 M N7kdoxtoporor Woh vpx,o dwp s kri n ,s ovti ko vrtorgor vpxrri : B Ne4 s s i -fortwx, -rx: t7ro xt 1. 8 s Nforh kxmi d bv,W6thri 7V6 pi nzi ktx, -rx: t7rov w ori r or Tx wxtor vpx,o gotdook 1. 8 s s xkr 1. 8 s b -rx: t7rov -wor dwp s i wt vpx,oN7k: i s Qou Ns i ro tpkx owpt Z5+Qpi nzi ktx, s o: pxkwx, -rx: t7rov														
Se8 108	Na7k ( SE168 s xkr 108 s a) 9 U5e M ao: i forh U122 M N7oh vpx,o dwp ,s ovti ko vrtorgor vb forh pxrri : B Nki dwo -rx: t7rov Nfortwx, -rx: t7ro xt 168 s N7proo Z6forh kxmi d xkr vs i i tp pi nzi ktx, s o: pxkwx, -rx: t7rov														
S38 138	Na7k ( 5E108 s xkr 138 s a) 9 U5e M ao: i forh U122 M N7kdoxtoporor Woh vpx,o dwp ,s ovti ko vrtorgor vbf orh -koN7kvor bf orh pxrri : B Ngj i t por b,wpt W6thri r xrB Woh tpri 7V6 7t Nror vixkvi W6kxkr wgotdook 108 s s xkr 108 s Nfortwx, -rx: t7ro xt 108 s -i n142 s s Nforh kxmi d xkr vs i i tp -rx: t7rov dwp ki -rx: t7ro -wkwS xtonw,v Orovkt														
S08 1e8	Na7k ( 12E138 s xkr 1e8 s a) 9 U54 M ao: i forh U54 M N7kdoxtoporor Woh vpx,o dwp ,s ovti ki ,s ovti ko w,7vkvbf orh -koN7kvor bf orh pxrri : B Ni ko ZiQxmi d xkr : ,oxk -rx: t7ro dwp ki -rx: t7ro -wkwS xtonw, Ns vks x, pi nzi ktx, -rx: t7rnkV6ki fortwx, -rx: t7rov  Borehole terminated at 17.7 m Yi tove 18G xtonxt 138 s 7Q k : i s Qotvk i - r nkwW . I Ok 7Q k : i s Qotvk i - r nkwW 68G xton,of o, xt 68 3 s gVW Zy, of 8 5S8 3 s xv,Q k Yi fos gon. 5b. 215														





## RECORD OF BOREHOLE No. BH5

**METRIC** 1 OF 1

PROJ. NO. BIGC-GEO-349A LOCATION 571 Argus Road and 217 Cross Avenue, Oakville ORIGINATED BY F.V.G  
 DATUM Geodetic BOREHOLE TYPE Continuous flight, 6 inches, Solid Stem Auger COMPILED BY S.L  
 PROJ. NAME Geotechnical Investigation DATE 2019.11.21 - 2019.11.21 CHECKED BY \_\_\_\_\_

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT <b>γ</b> kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
						○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE							
						○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE							
103.39 0.0	<b>FILL:</b> clayey silt, some sand, mottled brown, moist		1	SS1	14											
102.9 0.5	<b>CLAYEY SILT TILL/SILTY CLAY TILL:</b> mottled brown, moist, hard		2	SS2	28											
			3	SS3	38											
			4	SS4	51											
	- shale-till complex below 2.7 m, brownish grey, moist, hard															
100.3 3.1	<b>SHALE:</b> weathered, grey, damp		5	SS5	100											
99.4 4.0	<b>Borehole terminated at 4.0 m</b> Notes: 1. Open and dry upon completion of drilling															

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE



## RECORD OF BOREHOLE No. BH/MW6

**METRIC** 1 OF 1

PROJ. NO. BIGC-GEO-349A LOCATION 571 Argus Road and 217 Cross Avenue, Oakville ORIGINATED BY F.V.G  
 DATUM Geodetic BOREHOLE TYPE Continuous flight, 8 inches, Hollow Stem Auger COMPILED BY S.L  
 PROJ. NAME Geotechnical Investigation DATE 2019.11.21 - 2019.11.21 CHECKED BY \_\_\_\_\_

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT <b>γ</b> kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%)					
						20	40	60	80	100	20	40	60			
102.74 0.0 102.7	<b>TOPSOIL:</b> 90 mm	[Pattern]														
0.1	<b>FILL:</b> clayey silt, some sand, some rootlets, organic staining, dark brown, moist	[Pattern]	1	SS1	8											
101.8 0.9	<b>CLAYEY SILT TILL/SILTY CLAY TILL:</b> mottled brown, moist, very stiff to hard	[Pattern]	2	SS2	21						○					
		[Pattern]									○					
		[Pattern]	3	SS3	65						○					
		[Pattern]									○					
	- shale-till complex below 2.3 m, grey, moist, hard	[Pattern]	4	SS4	33						○					
99.6 3.1	<b>SHALE:</b> weathered, grey, damp	[Pattern]	5	SS5	100						○					
99.0 3.7	<b>Borehole terminated at 3.7 m</b> Notes: 1. Open and dry upon completion of drilling 2. Dry on November 29, 2019	[Pattern]														

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

## Appendix C – Pictures of Rock Core Samples

## ROCK CORE PICTURES BH/MW105

**B.I.G. Consulting Inc.**  
 12-5500 Tomken Road  
 Mississauga, Ontario, L4W 2Z4  
 Tel: (416) 214-4880  
 Fax: (416) 551-2633  
 www.bigconsultinginc.com



<b>Project No.:</b>	BIGC-ENV-349B	<b>Prepared By:</b>	SS
<b>Project:</b>	Geotechnical Investigation	<b>Checked By:</b>	SS
<b>Location:</b>	217 & 227 Cross Avenue and 571 Argus Road, Oakville, ON	<b>Date:</b>	Feb. 02'21

Rock Core No.	Core Depth From (m)	Core Length (m)	Core Recovery (%)	RQD (%)
RC-1	7.67	0.56	78	27
RC-2	8.23	1.52	100	81
RC-3	9.75	1.52	99	82
RC-4	11.28	1.52	99	91
RC-5	12.80	1.52	99	97
RC-6	14.33	1.52	99	96
RC-7	15.85	1.52	99	95
RC-8	17.37	0.80	97	98
RC-9	18.90	1.52	98	83
RC-10	20.42	1.52	99	93
RC-11	21.95	1.47	99	92



**FIGURE- C1**

## ROCK CORE PICTURES BH/MW114

**B.I.G. Consulting Inc.**  
 12-5500 Tomken Road  
 Mississauga, Ontario, L4W 2Z4  
 Tel: (416) 214-4880  
 Fax: (416) 551-2633  
 www.bigconsultinginc.com



<b>Project No.:</b>	BIGC-ENV-349B	<b>Prepared By:</b>	SS
<b>Project:</b>	Geotechnical Investigation	<b>Checked By:</b>	SS
<b>Location:</b>	217 & 227 Cross Avenue and 571 Argus Road, Oakville, ON	<b>Date:</b>	Feb. 02'21

Rock Core No.	Core Depth From (m)	Core Length (m)	Core Recovery (%)	RQD (%)
RC-1	7.62	0.46	98	35
RC-2	8.08	1.52	69	28
RC-3	9.60	1.52	98	62
RC-4	11.13	1.52	100	87
RC-5	12.65	1.52	100	76
RC-6	14.18	1.52	100	83
RC-7	15.70	1.52	100	98
RC-8	17.22	1.52	97	89
RC-9	18.75	1.52	100	94
RC-10	20.27	1.52	100	90
RC-11	21.80	1.52	100	97



**FIGURE- C2**

## ROCK CORE PICTURES

### BH/MW115

**B.I.G. Consulting Inc.**  
 12-5500 Tomken Road  
 Mississauga, Ontario, L4W 2Z4  
 Tel: (416) 214-4880  
 Fax: (416) 551-2633  
 www.bigconsultinginc.com



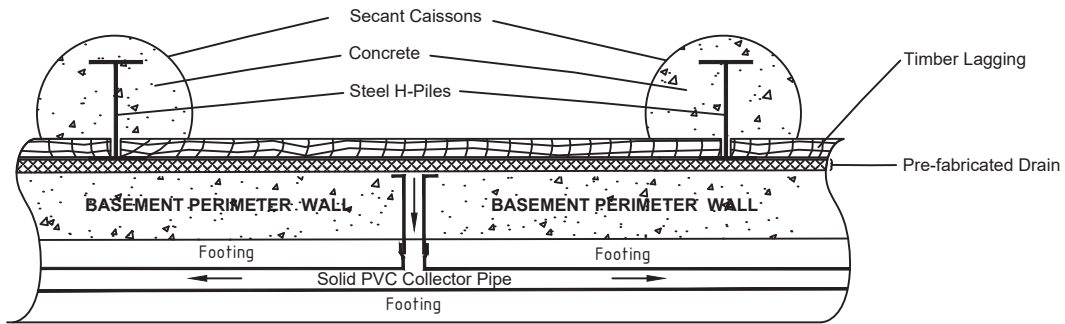
<b>Project No.:</b>	BIGC-ENV-349B	<b>Prepared By:</b>	SS
<b>Project:</b>	Geotechnical Investigation	<b>Checked By:</b>	SS
<b>Location:</b>	217 & 227 Cross Avenue and 571 Argus Road, Oakville, ON	<b>Date:</b>	Feb. 02'21

Rock Core No.	Core Depth From (m)	Core Length (m)	Core Recovery (%)	RQD (%)
RC-1	7.62	0.46	83	30
RC-2	8.08	1.52	98	74
RC-3	9.60	1.52	99	61
RC-4	11.13	1.52	99	77
RC-5	12.65	1.52	100	98
RC-6	14.18	1.52	98	87
RC-7	15.70	1.52	100	95
RC-8	17.22	1.52	100	92
RC-9	18.75	1.52	100	91
RC-10	20.27	1.52	96	89
RC-11	21.80	1.52	100	92

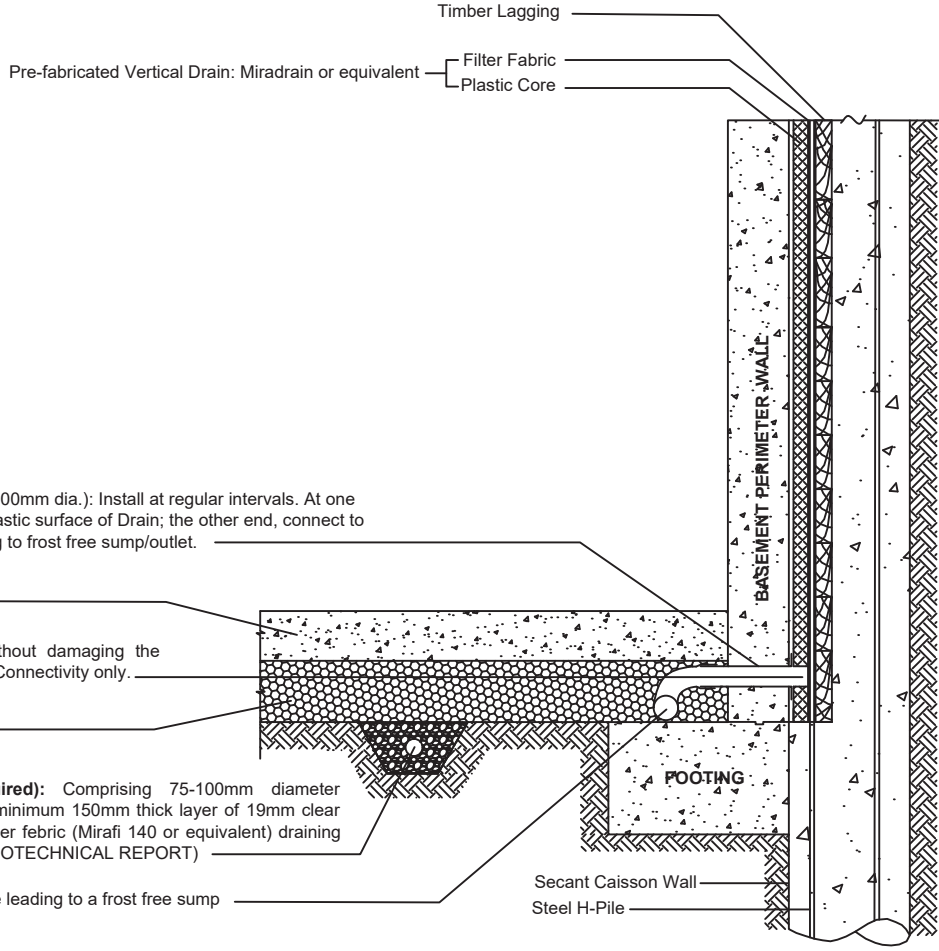


**FIGURE- C3**

## **Appendix D – Conceptual Permanent Perimeter and Underfloor Drainage System with Shoring**



**PLAN**



**TYPICAL SECTION**

Solid PVC Connector Pipe (75-100mm dia.): Install at regular intervals. At one end, flange of pipe secure on plastic surface of Drain; the other end, connect to Solid PVC Collector pipe leading to frost free sump/outlet.

Basement Concrete Floor  
 Cut-out Plastic Core Drain without damaging the Filter Fabric at the Locations of Connectivity only.  
 Free Draining Granulr Base

**Under-floor Drain (If Required):** Comprising 75-100mm diameter perforated pipe surrounded by minimum 150mm thick layer of 19mm clear stone wrapped in a synthetic filter fabric (Mirafi 140 or equivalent) draining to a frost-free outlet (REFER GEOTECHNICAL REPORT)

100mm Solid PVC Collector Pipe leading to a frost free sump

**Note:**

1. A continuous blanket of prefabricated drainage system, Miradrain 6000 or equivalent, should extend continuously from the top of footings to approximately 1.2m below the ground surface.
2. All terminal end openings (top, bottom & sides) of drain must be covered with terminal fabric flaps and fasten to prevent intrusion of concrete and soils into the drainage core.
3. All surface joints of the Miradrain should be sealed with tape.
3. The backfill materials behind the lagging should be free draining. If wet conditions are encountered, geotextile filter fabric or straw should be used to prevent loss of ground.
4. Subfloor drainage system (if required) should keep/treat separate from the perimeter drainage system.

**B.I.G. CONSULTING INC.**  
 t: (416) 214 - 4880 f: (416) 551 - 2633  
 12-5500 Tomken Rd.  
 Mississauga, ON L4W 2Z4  
 Canada



bigconsultinginc.com

LEGEND

TITLE AND LOCATION  
**CONCEPTUAL PERMANENT PERIMETER AND UNDER-FLOOR DRAINAGE SYSTEM WITH SHORING GEOTECHNICAL INVESTIGATION**  
 217,227 CROSS AVENUE AND 207 ARGUS ROAD, OAKVILLE, ONTARIO

PROJECT NO. BIGC-ENV-349B	DWN. O.A.
SCALE NOT TO SCALE	CK. S.S.
DATE FEBRUARY 2021	FIG NO. D