REPORT ON GEOTECHNICAL INVESTIGATION GEORGIAN COURT BURLINGTON, ONTARIO

bcIMC Realty Corp.
o/a Georgian Court Estates

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1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by bcIMC Realty Corporation o/a Georgian Court Estates to undertake a preliminary geotechnical investigation for the proposed redevelopment at 611-633 & 645 Surrey Lane, 610-740 Surrey Lane, 858-916 Warwick Road, 615-693 & 699 Marley Road, and 847-937 Warwick Road in Burlington, Ontario.

We understand that preliminary Geotechnical and Hydrogeological Investigations are required as part of a redevelopment/official plan amendment application and development feasibility study. It is understood that the proposed residential development will consist of mid- to high-rise (6 to 18-storey) apartment buildings with 3 underground basement levels, as well as townhouse units.

This report deals with the geotechnical aspects of the site. Hydrogeological aspects will be discussed in a separate report.

The purpose of this geotechnical investigation is to determine the subsurface conditions at eighteen (18) borehole locations and from the findings in the boreholes make preliminary engineering recommendations for the following:

1. Foundations
2. Floor slabs and permanent drainage
3. Excavations and Backfill
4. Earth pressures
5. Earthquake considerations
6. Temporary Shoring

This report is provided on the basis of the terms of reference presented above and on the assumption that the design will be in accordance with the applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design. It may then be necessary to carry out additional borings and reporting before the recommendations of this office can be relied upon.

The site investigation and recommendations follow generally accepted practice for geotechnical consultants in Ontario. The format and contents are guided by client specific needs and economics and do not conform to generalized standards for services. Laboratory testing for most part follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report has been prepared for bcIMC Realty Corporation o/a Georgian Court Estates and its architect and designers. Third party use of this report without WSP consent is prohibited. The limitation conditions presented in this report form an integral part of the report and they must be considered in conjunction with this report.

2 FIELD AND LABORATORY WORK

Eighteen boreholes (BH16-1 through BH16-18) were drilled at the subject site to depths ranging from 6.2 to 15.5m.

The boreholes were drilled with hollow stem augers under the direction and supervision of WSP personnel. Samples were retrieved at regular intervals with a 50 mm O.D. split-barrel sampler driven with a hammer weighing 624 N and dropping 760 mm in accordance with the Standard Penetration Test (SPT) method. The samples were logged in the field and returned to the WSP laboratory for detailed examination by the project engineer who assigned geotechnical laboratory testing.

As well as visual examination in the laboratory, all soil samples were tested for moisture contents. Grain size distribution testing is conducted for selected soil samples. Selected soil samples were subjected to Atterberg Limits Tests and results are presented on the respective borehole logs. The gradation curves for the grain size analyses and the Plasticity Chart are presented in **Appendix B**.

Water level observations were made during drilling and in open boreholes upon completion of the drilling operations. For the monitoring of the long-term groundwater levels, seven (7) monitoring wells of 50mm dia. were installed in boreholes BH16-1, BH16-3, BH16-6, BH16-7, BH16-11, BH16-16, and BH16-17.

The surface elevations at the borehole locations were surveyed by WSP and were referenced to a geodetic benchmark.

3 SITE AND SUBSURFACE CONDITIONS

The Borehole locations are shown on **Drawing 1**. Generalized subsurface profile is attached in **Drawings 2 and 3**. The subsurface conditions in the boreholes are presented in the individual borehole logs in **Appendix A** and are summarized in the following paragraphs.

3.1 SOIL CONDITIONS

TOPSOIL/ASPHALTIC CONCRETE/FILL MATERIAL

A surficial topsoil layer varying from 200 to 600mm in thickness was found in Boreholes BH16-7, BH16-9, BH16-11, and BH16-14. It should be noted that the thickness of the topsoil explored at the borehole locations may not be representative for the site and should not be relied on to calculate the amount of topsoil at the site.

At the remaining borehole locations, a pavement structure consisting of asphaltic concrete varying from 35 to 150mm underlain by granular base/subbase materials of 75 to 475 mm in thickness was contacted at the surface.

Along the north-east side of the site, fill material consisting of sand to silt with some sand and gravel was found in boreholes BH16-1, BH16-2, BH16-3, and BH16-8 extending to depths varying from 0.9 to 2.3m below ground surface. The fill material was found to be in a very loose to compact state with measured SPT ‘N’ values ranging from 3 to 16 blows per 300mm penetration.

UPPER COHESIONLESS DEPOSITS: SAND TO SILTY SAND

An upper layer of cohesionless deposits of sand, some silt to silty sand with trace to some clay was encountered in most boreholes and was found to be in a very loose to compact state, with measured SPT

'N' values of 1 to 26 blows per 300mm penetration. These deposits were found to be saturated below the depths ranging from 1.5 to 4.5m below ground surface.

Grain size analysis of four samples from the sand to silty sand deposits (BH16-6/SS6, BH16-11/SS5, BH16-16/SS6, and BH16-17/SS6) were conducted and the results are presented in **Figure 1 in Appendix B**, with the following fractions:

Clay: 6 to 18%
Silt: 19 to 28%
Sand: 53 to 73%
Gravel: 1 to 2%

CLAYEY DEPOSITS

Cohesive deposits of clayey silt to silty clay were encountered below the upper cohesionless deposits and/or interbedded with the lower glacial till deposits in BH16-1 through BH16-3, and BH16-5, BH16-6, BH16-9, BH16-13, BH16-14, and BH16-17.

These deposits were found to be in a firm to hard consistency with measured SPT 'N' values ranging from 5 to 41 per 300mm penetration.

Grain size analysis of one sample from the clayey deposits (BH16-1/SS9) was conducted and the results are presented in **Figure 3 in Appendix B**, with the following fractions:

Clay: 29%
Silt: 62%
Sand: 9%
Gravel: -

One sample from the clayey deposits was subjected to Atterberg Limits Testing (BH16-1/SS9). The results are shown on the respective borehole log and on the Plasticity Chart on Figure 4 in Appendix B and are summarized as follows:

Liquid limit (W_L): 31%
Plastic limit (W_P): 18%
Plasticity index (PI): 13%

These values are characteristic of clays of low plasticity.

GLACIAL TILL DEPOSITS

Glacial till deposits consisting of clayey silt to silty clay till, sandy silt to silt to silty sand till were encountered in most boreholes and were found to be in a very stiff to hard consistency or compact to very dense state with measured SPT 'N' values of 15 to more than 50 blows per 300mm penetration.

Grain size analysis of two samples from the till deposits (BH16-3/SS10, BH16-7/SS6) were conducted and the results are presented in **Figure 2 in Appendix B**, with the following fractions:

Clay: 10 to 19%
Silt: 26 to 48%
Sand: 23 to 53%
Gravel: 10 to 11%

Two samples from the glacial till deposits were subjected to Atterberg Limits Testing (BH16-3/SS10, BH16-7/SS6). The results are shown on the respective borehole logs and on the Plasticity Chart on Figure 4 in Appendix B and are summarized as follows:

Liquid limit (W_L): 21 to 24%
Plastic limit (W_P): 15 to 18%
Plasticity index (PI): 6%

These values are characteristic of clayey silts of low plasticity.

TILL/SHALE COMPLEX

Below the glacial till deposits, a clayey silt to silt to silty sand till/shale complex deposit was encountered in BH16-1 through BH16-3 and BH16-6. The till/shale complex consists of a mixture of clayey silt to silt to sandy silt till and highly/completely weathered shale. The consistency/relative density of the till/shale complex was hard/dense to very dense with measured SPT 'N' values of 33 to more than 50 blows per 300 mm penetration. Water contents measured in test samples ranged from 9% to 12%. There is a gradual transition from this till/shale complex into shale bedrock and the shale bedrock surface may vary and can be higher. Some of the contractors may assume the till/shale complex as shale bedrock. The till/shale complex may also contain limestone seams/layers.

INFERRED SHALE BEDROCK

Shale bedrock of the Queenston Formation was encountered in BH16-1 through BH16-7. The inferred top of bedrock level varies from Elev. 77.3m to 80.2m as summarized in Table 3.1. Shale bedrock was not proven by bedrock coring. It is noted that variations in the bedrock surface should be expected. It is often difficult to distinguish where shale/till complex ends and bedrock begins, particularly where the bedrock surface is weathered. As such, the inferred bedrock surface level should not be considered accurate to better than ±1m.

Table 3.1: Approximate Depth and Elevation of Shale Bedrock Surface

BOREHOLE NO.	APPROXIMATE DEPTH OF SHALE BEDROCK SURFACE (m)	APPROXIMATE ELEVATION OF SHALE BEDROCK SURFACE (ASSUMED) (m)	NOTES
BH16-1	11.0	80.2	Hard augering at inferred bedrock surface
BH16-2	11.3	79.4	Hard augering at inferred bedrock surface
BH16-3	12.2	77.3	Sampler refusal at inferred bedrock surface

BOREHOLE NO.	APPROXIMATE DEPTH OF SHALE BEDROCK SURFACE (m)	APPROXIMATE ELEVATION OF SHALE BEDROCK SURFACE (ASSUMED) (m)	NOTES
BH16-4	11.9	80.0	Hard augering at inferred bedrock surface
BH16-5	11.6	80.2	Hard augering at inferred bedrock surface
BH16-6	15.2	79.5	Hard augering/Sampler refusal at inferred bedrock surface
BH16-7	12.5	80.1	Hard augering at inferred bedrock surface

The shale bedrock generally contains layers of sandstone, limestone and dolostone. Typically the hard layers comprise about 15 to 20 percent of the unit. However, higher concentrations of hard layers can be present. The hard layers are usually less than 200 mm thick but some layers are much thicker. The thicker layers have been observed to be as much as 750 to 900 mm at other sites. The layers are actually lenses and they can vary significantly in thickness over short distance.

Methane gas is anticipated in the bedrock. Appropriate care and monitoring is essential in all confined bedrock excavations, particularly for caissons. Stress relief features such as folds and faults are common in the shale bedrock. Appendix C presents more details and general comments about the shale bedrock.

3.2 GROUNDWATER CONDITIONS

During drilling, groundwater was found in the open boreholes at depths ranging from 5.6 to 7.6m below ground surface. The groundwater table observed in the monitoring wells on December 12 and 16, 2016 was reported to be at depths ranging from 4.3 to 10.6m, corresponding to elevations ranging from 171.2 to 177.2m, as listed on Table 3.2.

Table 3.2 - Groundwater Levels Observed in Open Boreholes and Monitoring Wells

BH NO.	GROUND SURFACE ELEV. (m)	SOIL TYPE AT SCREEN LOCATION (DEPTH, m)	DEPTH / WATER LEVEL ELEVATION (M)			NOTES
			ON COMPLETION	DEC. 12, 2016	DEC. 16, 2016	
BH16-1	91.2	Silty Clay (7.6 – 9.1)	-	0.2 / 91.0	0.2 / 91.0	50mm dia. monitoring well
BH16-2	90.7	N/A	7.2 / 83.5	N/A	N/A	-
BH16-3	89.5	Silty Sand Till/Shale Complex (10.6 – 12.1)	-	2.8 / 86.7	2.8 / 86.7	50mm dia. monitoring well
BH16-4	91.9	N/A	3.7 / 88.2	N/A	N/A	-
BH16-5	91.8	N/A	4.3 / 87.5	N/A	N/A	-
BH16-6	94.7	Silty Sand (3.1 – 6.1)	-	4.4 / 90.3	4.3 / 90.4	50mm dia. monitoring well

BH NO.	GROUND SURFACE ELEV. (m)	SOIL TYPE AT SCREEN LOCATION (DEPTH, m)	DEPTH / WATER LEVEL ELEVATION (M)			NOTES
			ON COMPLETION	DEC. 12, 2016	DEC. 16, 2016	
BH16-7	92.6	Silt Till (4.6 – 6.1)	-	2.9 / 89.7	2.8 / 89.8	50mm dia. monitoring well
BH16-8	89.6	N/A	1.5 / 88.1	N/A	N/A	Saturated soils at 1.5 m depth
BH16-9	90.6	N/A	2.4 / 88.2	N/A	N/A	Saturated soils at 2.4 m depth
BH16-10	91.1	N/A	2.1 / 89.0	N/A	N/A	-
BH16-11	91.6	Sand/Silty Clay Till (3.1 – 6.1)	-	2.6 / 89.0	2.6 / 89.0	50mm dia. monitoring well
BH16-12	91.6	N/A	2.3 / 89.3	N/A	N/A	-
BH16-13	93.0	N/A	2.6 / 90.4	N/A	N/A	-
BH16-14	93.1	N/A	2.4 / 90.7	N/A	N/A	Saturated soils at 2.4 m depth
BH16-15	92.8	N/A	2.6 / 90.2	N/A	N/A	-
BH16-16	92.8	Silty Sand (4.6 – 6.1)	-	2.5 / 90.3	2.5 / 90.3	50mm dia. monitoring well
BH16-17	94.2	Silty Sand (3.1 – 6.1)	-	3.4 / 90.3	3.4 / 90.8	50mm dia. monitoring well
BH16-18	93.9	N/A	3.1 / 90.8	N/A	N/A	-

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events.

The groundwater elevation at the site is highest in the north and east (approximately 91 meters above sea level (masl)) and declines toward the south (89 masl) and west (86.7 masl). The groundwater flow direction at the site is consistent with the regional groundwater flow regime, such that groundwater flows towards and discharges into Lake Ontario, located south of the project site.

Grain size analyses were performed on soil samples from seven boreholes. Hydraulic Conductivity was estimated using the Hazen Method for sandy soils and the Puckett et al Method for fine grained soil and the combined results are summarized below:

Geometric Mean K	6.2E-07 m/s
Highest K	5.0E-06 m/s
Lowest K	2.4E-08 m/s

4 FOUNDATIONS

It is understood that the proposed residential development will consist of mid- to high-rise (6 to 18-storey) apartment buildings with 3 underground basement levels in the areas of BH16-1 through BH16-7, as well as townhouse units in the areas of the remaining boreholes.

The basement floor elevations are not known to us at the time of writing this report. The basement floor of P3 will be about 9m below ground surface. The footings are expected to be about 1 to 2m below the P3 basement floor slab. For townhouses with 1 level of basement, the footings are expected to be around 3m below ground surface.

At the anticipated footing levels, the proposed mid to high-rise buildings with 3-level basement can be supported by spread and strip footings/raft foundations founded on the undisturbed hard/very dense till/shale complex for a bearing capacity value of 300 to 400 kPa at SLS (Serviceability Limit State), and 450 to 600 kPa at ULS (Ultimate Limit State), or on shale bedrock bedrock for a bearing capacity value of 1,500 kPa at SLS (Serviceability Limit State), and for a factored geotechnical resistances of 2,250 kPa at ULS.

Townhouses can be supported by spread and strip footings founded on the undisturbed native soils for a bearing capacity values of 150 kPa at SLS (Serviceability Limit State), and 225 kPa at ULS (Ultimate Limit State) in compact sand below 2 to 3m from existing grade, as the upper sandy soils are very loose and not suitable for founding the footings nor the slab-on-grade. The bearing pressures and the founding depth are given in Table 4-1 at the borehole locations.

Table 4-1 Bearing Values and Founding Levels of Spread Footings on native soils

BH No.	Material	Geotechnical Bearing Capacity at SLS (kPa)	Factored Geotechnical Resistance at ULS (kPa)	Founding level at or below (m)	
				Depth Below Existing Grade	Elevation
BH16-1	Silty Clay Till	300	450	3.0	88.2
	Till/Shale Complex	400	600	9.1	82.1
	Bedrock	1500	2250	11.0	80.2
BH16-2	Silty Clay Till	200	300	2.3	88.4
	Till/Shale Complex	400	600	9.1	81.6
	Bedrock	1500	2250	11.3	79.4
BH16-3	Clayey Silt Till	300	450	2.3	87.2
	Silty Clay/Till/Shale Complex	400	600	6.1	83.4
	Bedrock	1500	2250	10.6	78.9
BH16-4	Sand	150	225	1.5	90.4
	Silty Clay Till	300	450	4.5	87.4
	Bedrock	1500	2250	11.9	80.0
BH16-5	Silty Clay	250	375	3.0	88.8
	Silty Clay	300	450	4.5	87.3
	Bedrock	1500	2250	11.6	80.2

BH No.	Material	Geotechnical Bearing Capacity at SLS (kPa)	Factored Geotechnical Resistance at ULS (kPa)	Founding level at or below (m)	
				Depth Below Existing Grade	Elevation
BH16-6	Silty Sand	150	225	4.5	90.2
	Silty Clay Till	300	450	6.1	88.6
	Till/Shale Complex	600	900	12.2	82.5
	Bedrock	1500	2250	15.2	79.5
BH16-7	Sand	150	225	2.3	90.3
	Silt Till	300	450	6.0	86.6
	Bedrock	1500	2250	12.5	80.1
BH16-8	Clayey Silt Till	300	450	2.4	87.2
BH16-9	Sand/Clayey Silt	150	225	0.8	89.8
	Clayey Silt	300	450	4.5	86.1
BH16-10	Sand	150	225	3.5	87.6
	Silty Clay Till	300	450	4.6	86.5
BH16-11	Sand	150	225	1.5	90.1
	Silty Clay Till	300	450	4.6	87.0
BH16-12	Sand	150	225	1.5	90.1
	Silty Clay Till	300	450	4.6	87.0
BH16-13	Sand	200	300	2.3	90.7
	Silty Clay	300	450	4.5	88.5
BH16-14	Sand	150	225	2.3	90.8
	Silty Clay	300	450	6.0	87.1
BH16-15	Sand	200	300	2.3	90.5
	Silty Clay Till	300	450	4.6	88.2
BH16-16	Sand	150	225	3.0	89.8
	Clayey Silt Till	300	450	6.1	86.7
BH16-17	Silty Sand	150	225	2.3	91.9
	Silty Clay	300	450	6.1	88.1
BH16-18	Sand	150	225	3.0	90.9
	Clayey Silt Till	300	450	6.1	87.8

Based on the borehole and monitoring well information, the groundwater at the site is expected to be about 0.2 to 4.4m m below grade (Elev. 86.7 m to 91.0 m). Dewatering will be required prior to the excavation in wet sands, otherwise it will result in loss of soil and bearing capacity. The groundwater table must be lowered to at least 1.0 m below the deepest excavation base. A contractor specializing in dewatering should be retained to design the dewatering systems. Groundwater can be lowered by 0.3 m to 0.5 m by pumping from oversized excavations and flatter side slopes as illustrated on Drawing 4. For deeper excavations, positive dewatering will be required.

If the sandy soils at the anticipated townhouse footing levels are wet, they can be easily disturbed to foot traffic. In this case, the base must be covered with 50 mm thick mud slab immediately after inspection and cleaning.

Footings designed to the specified allowable bearing capacity at the serviceability limit states (SLS) are expected to settle 25 mm total and 19 mm differential.

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

All foundation bases must be inspected by this office prior to pouring concrete. Where the excavated footings base are in wet to saturated sandy deposits these should be covered with 50 mm thick mud slab immediately after inspection and cleaning, in order to avoid disturbance of the founding soil due to construction activity and weathering /drying.

It should be noted that the recommended bearing capacities have been calculated by WSP from the borehole information for the design stage only. The investigation and comments are necessarily on-going as new information of the underground conditions becomes available. For example, more specific information is available with respect to conditions between boreholes when foundation construction is underway. The interpretation between boreholes and the recommendations of this report must therefore be checked through field inspections provided by WSP to validate the information for use during the construction stage.

5 FROST PROTECTION

All foundations exposed to seasonal freezing conditions must have at least 1.2 metres of soil cover for frost protection.

There is no official rule governing the required founding depth for footings below unheated basement floors. Certainly, it will not be greater than the 1.2 m required in Southern Ontario for exterior footings. Un-monitored experience indicates that a shallower depth ranging from 0.82 to 0.9 m for interior column footings and 0.4 m for wall footings has been successful where 2 or more basement levels apply. The 0.82 m depth is believed to be close to the minimum structural requirement for interior column footings. Adjacent to air shafts and entrance and exit doors, a footing depth of 1.2 m below floor level is required or, alternatively, insulation protection must be provided.

It is also emphasized that underfloor drainage and/or an adequate free draining gravel base is required to minimize the risk of floor dampness. Floor dampness could lead to temporary icing and the risk of accidents.

6 FLOOR SLAB AND PERMANENT DRAINAGE

The floor slab can be supported on grade provided all loose to very loose fill and native sands, and any disturbed native soils are removed and the base thoroughly proof rolled. The loose sands must be removed and replaced by engineered fill or improved by dynamic compaction. The fill required to raise the grade can consist of inorganic soil, placed in shallow lifts and compacted to 98 percent of Standard Proctor Maximum Dry Density (SPMDD).

A moisture barrier consisting of at least 200mm of 19mm clear crushed stone should be installed under the floor slab.

A perimeter and underfloor drainage system will be required around the exterior basement walls, as shown on Drawings 5 to 7. Where the exposed subgrade consists of cohesionless soil below the water table, all openings including the subgrade must be covered or wrapped with filter fabric, typically a Class II non-woven textile with a filtration opening size (F.O.S.) of 50 to 100 µm. Above the filter fabric, we recommend that 60 mm thick concrete sand be placed to prevent the loss of silt fines through the filter fabric. It is imperative that both the filter fabric and concrete sand are placed on the subgrade.

As to be discussed in Section 8 of this report, a detailed hydrogeologic study is required for the design of the permanent perimeter and underfloor drainages, as well as for the temporary groundwater control during the construction stage.

7 ELEVATOR PITS AND SUMP PITS

It is anticipated that some elevator pits in the P3 level and sump pits for the townhouses will be installed in cohesionless soils below the water table. In this case, drainage systems at the base level of the elevator pits / sump pits are not recommended, due to the concern of loss of fines. The elevator pits/ sump pits can be designed as water-tight structures, and water pressure on the pit walls and the slab should be considered, assuming the water table at about 0.3m below the adjacent basement floor.

8 EXCAVATIONS AND GROUNDWATER CONTROL

Excavations can be carried out with heavy hydraulic backhoe. Stabilized groundwater table in the monitoring wells was reported to be in the range of 0.2 to 4.4m below ground surface, corresponding to Elev. 86.7 to 91.0m. Any excavation in sandy and silty deposits below the groundwater will require positive dewatering such as well points/eductors; otherwise, it will result in an unstable base and flowing sides. The groundwater encountered at higher elevations may be handled by pumping from sumps/trenches.

The groundwater pressure levels measured in the monitoring wells installed in the lower deposits (aquifer) in BH16-1 and BH16-3 were at about elevation 86.7 to 91.0m. The groundwater table must be lowered to at least 1.0m below the deepest excavation. A contractor specializing in dewatering should be retained to design the dewatering systems.

It should be noted that the till is a non-sorted sediment and therefore may contain boulders. Possible large obstructions such as buried concrete pieces are also anticipated in the fill material. Provisions must be made in the excavation contract for the removal of possible boulders in the till or obstructions in the fill material.

All excavations must be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA). In accordance with OHSA, the existing fill, stiff silty clay to clayey silt can be classified as Type 3 Soil above the groundwater table and Type 4 below groundwater table. The very stiff to hard clayey silt till can be classified as Type 2 Soil above the groundwater table and Type 3 Soil below groundwater table. Cohesionless sands and silts below the groundwater can be classified as Type 4 Soil and Type 3 Soil above groundwater (with dewatering).

Select existing fill and the native soils free from topsoil and organics can be used as general construction backfill. Loose lifts of soil, which are to be compacted, should not exceed 200mm. Depending on the time of construction and weather, some excavated material may be too wet to compact and will require aeration prior to its use.

The excavated soils are not considered to be free draining. Where free draining backfill is required, imported granular fill such as OPSS Granular B should be used. Imported granular fill used in confined areas can be compacted with hand held equipment. Underfloor fill should be compacted to at least 98 percent of Standard Proctor Maximum Dry Density (SPMDD).

It should be noted that the excavated soils are subject to moisture content increase during wet weather which would make these materials too wet for adequate compaction. Stockpiles should be compacted at the surface or be covered with tarpaulins to minimize moisture uptake.

9 TEMPORARY SHORING

A caisson wall may be required to support adjacent structures. The requirement for caisson wall to support adjacent structures is given on **Drawing 8**.

Dewatering will be required for the installation of shoring lagging in the sand, sandy silt till and sandy silt deposits.

The shoring system must be designed in accordance with the Fourth Edition of the Canadian Foundation Engineering Manual. The soil parameters estimated to be applicable for this design are as follows:

1) Earth Pressure Coefficients

   (a) where movement must be minimal K=0.45

   (b) where minor movement (.002H) can be tolerated K=0.28

   (c) passive earth pressure for soldier piles (unfactored) Kp=3.0

2) For stability check

   ϕ= 32°

   c= 0

   γ = 21 kN/m^3

Surcharge is to be determined by shoring contractor

3) For earth anchors

Based on the borehole information, an allowable bond value of 50 kPa is suggested for the dense or hard soils and 30 kPa for very stiff soils; this value depends on anchor installation methods and grouting procedures. Gravity poured concrete can result in low bond values while pressure grouted anchors will give higher values and produce a more satisfactory anchor.

Casing will be required during the construction of the tiebacks to prevent caving of soils. The soldier piles should be installed in pre-augered holes taken below the deepest excavation. The holes should be filled with concrete below the excavation level and half bag mix above the base of the excavation. The concrete strength must be specified by the shoring designer. Temporary liners may be required to help prevent the sandy and sandy silt deposits from caving during the installation period. Positive measures may be required to prevent the loss of soil through the spaces between the lagging boards. This could probably be achieved by placing well-graded sand and gravel behind the lagging boards or by installing a geotextile filter cloth.

Soil anchors will be required to support the shoring. The anchors must be of a length that meets the Canadian Foundation Manual recommendations. It is important to note that the minimum length lies beyond the 45 - $\phi/2$ + .15H line drawn from the base of the soldier pile and the overall stability of the system must be checked at each anchor level.

The top anchor must not be placed lower than 3.0 metres below the top of level ground surface. Anchors will require casing when penetrating through wet sand and sandy silt layers. Allowable bond values suggested above are arbitrary; hence, the contractor must decide on a capacity and confirm its availability. All anchors must be tested as indicated in the Foundation Manual, 4th edition.

Adhesion on the buried caisson shaft or behind the shoring system must be neglected when designing this shoring system.

Movement of the shoring system is inevitable. Vertical movements will result from the vertical load on the soldier piles resulting from the inclined tiebacks and inward horizontal movement results from earth and water pressures. The magnitude of this movement can be controlled by sound construction practices, and it is anticipated that the horizontal movement will be in the range of 0.1 to 0.25%H.

To ensure that movements of the shoring are within an acceptable range, monitoring must be carried out. Vertical and horizontal targets on the soldier piles must be located and surveyed before excavation begins. Weekly readings during excavation should show that the movements will be within those predicted; if not, the monitoring results will enable directions to be given to improve the shoring.

10 EARTH PRESSURES

The lateral earth pressures acting on basement walls may be calculated from the following expression:

$$p = K(\gamma h + q)$$

where p = Lateral earth pressure in kPa acting at depth h

K = Earth pressure coefficient equal to 0.4 for vertical walls and horizontal backfill.

γ = Unit weight of backfill, a value of 21 kN/m^3 may be assumed

h = Depth to point of interest in metres

q = Equivalent value of surcharge on the ground surface in kPa

The above expression assumes that the perimeter drainage system prevents the build-up of any hydrostatic pressure behind the wall. When the foundation wall is poured against the caisson wall, the foundation wall as well as the caisson wall should be designed for hydrostatic pressure, even though the drainage board is provided between the caisson wall and the basement wall.

11 EARTHQUAKE CONSIDERATIONS

Based on the borehole information and according to Table 4.1.8.4.A of OBC 2012, the subject site for the proposed buildings can be classified as Class 'C' for seismic site response for buildings with 1 to 3 levels of basement.

12 LIMITATIONS OF REPORT

This report is intended solely for the Client named. The material in it reflects our best judgment in light of the information available to WSP Canada Inc.at the time of preparation. Unless otherwise agreed in writing by WSP Consultants Limited, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The design recommendations 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.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. 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.

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. WSP Canada Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

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

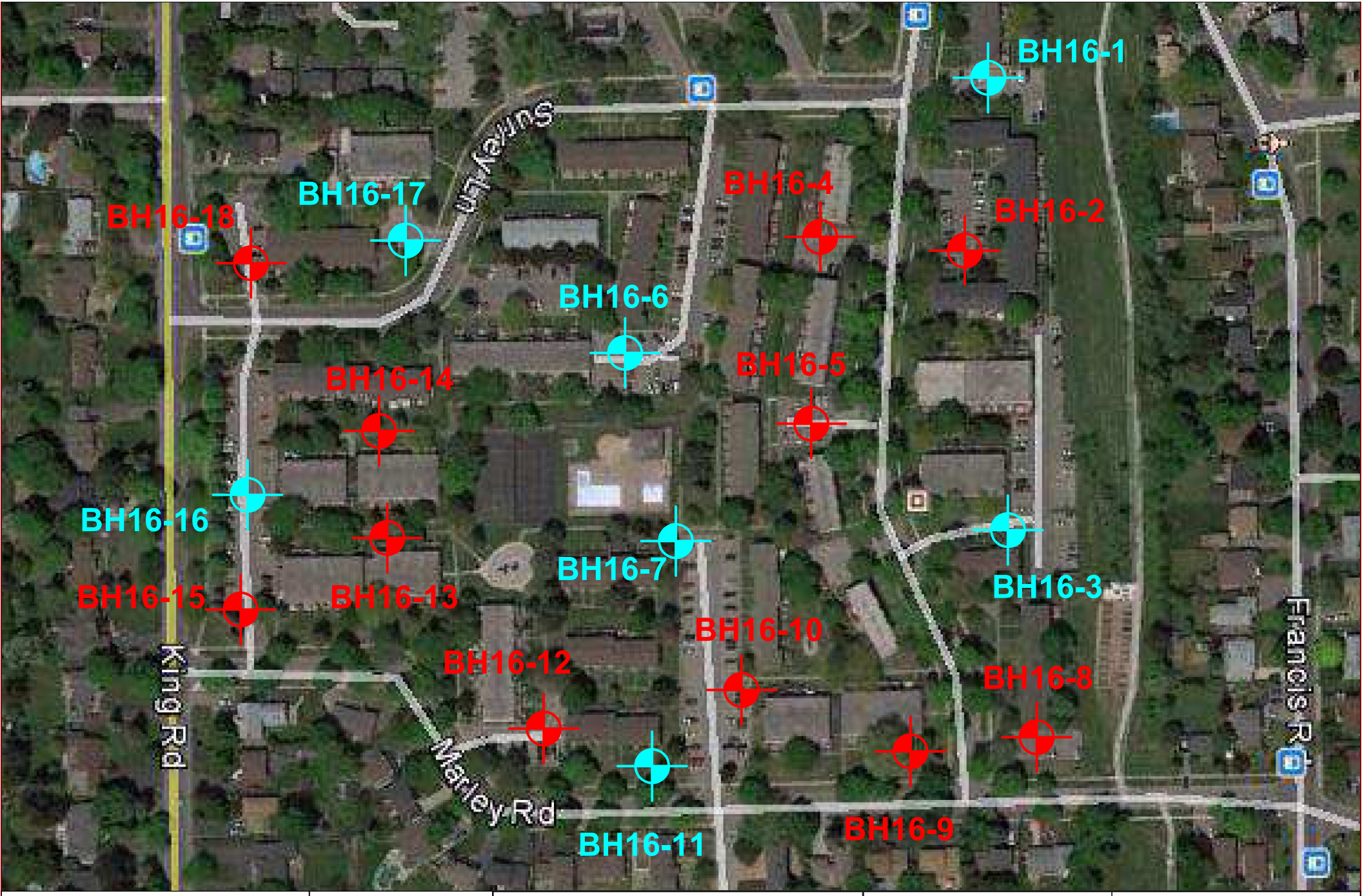
Eva Papp, P.Eng.



Shabbir Bandukwala, M.Eng., P.Eng.

Drawings

BOREHOLE LOCATION PLAN (DRAWING 1)
GENERALIZED SUBSURFACE PROFILES (DRAWINGS 2-3)
TYPICAL EXCAVATION PROCEDURE FOR SHALLOW DEPTHS
BELOW THE WATER TABLE IN SAND (DAWING 4)
DRAINAGE AND BACKFILL RECOMMENDATIONS (DRAWINGS 5-7)
GUIDELINES FOR UNDERPINNING (DRAWING 8)



SCALE:

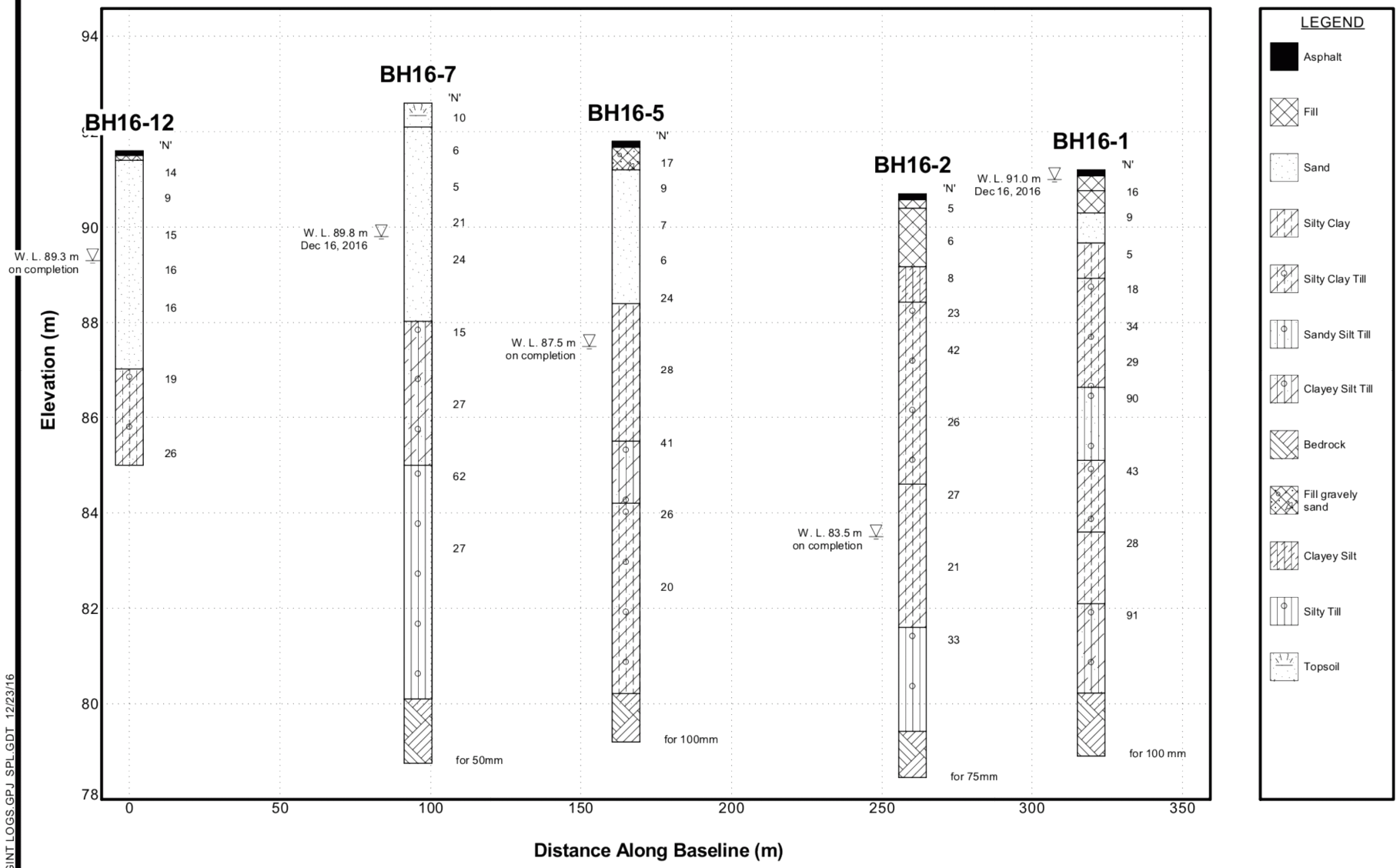
5M

0M 10M 30M 50M 100M

BOREHOLES:
BH16–13

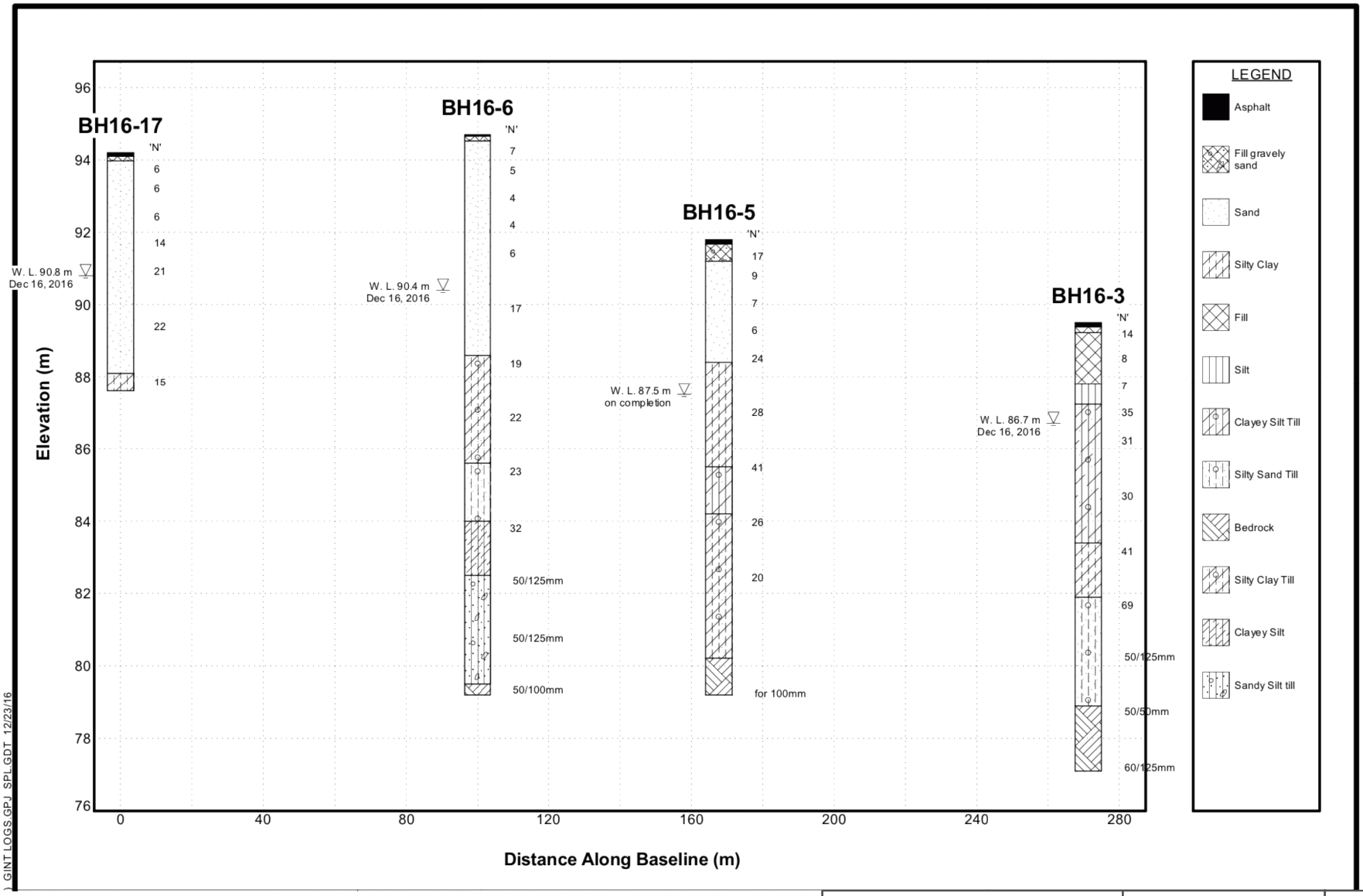
MONITORING WELLS:
BH16–1

Client: **bc IMC Realty Corp. o/a Georgina Court Estates**				Project No.: **161-15952-00**	Drawing No.: **1**
Drawn: **AP**		Approved: **EP**		Title: **Borehole Location Plan**	
Date: **Nov, 2016**		Scale: **As Shown**		Project: **Geotechnical and Hydrogeological Investigation Georgian Court, Burlington, Ontario**	
Original Size: **Tabloid**		Rev: **N/A**		WSP	



GINT LOGS.GPJ SPL.GDT 12/23/16

Client:	bcIMC Realty Corp. o/a Georgina Court Estates			Project No.: 161-15952-00	Drawing No.: 2
Drawn:	AP	Approved:	EP	Title:	Cross Section, South to North
Date:	DEC, 2016	Scale:	NTS	Project:	Geotechnical and Hydrogeological Investigation Georgian Court, Burlington, Ontario
Original Size:	Tabloid	Rev:	N/A		WSP

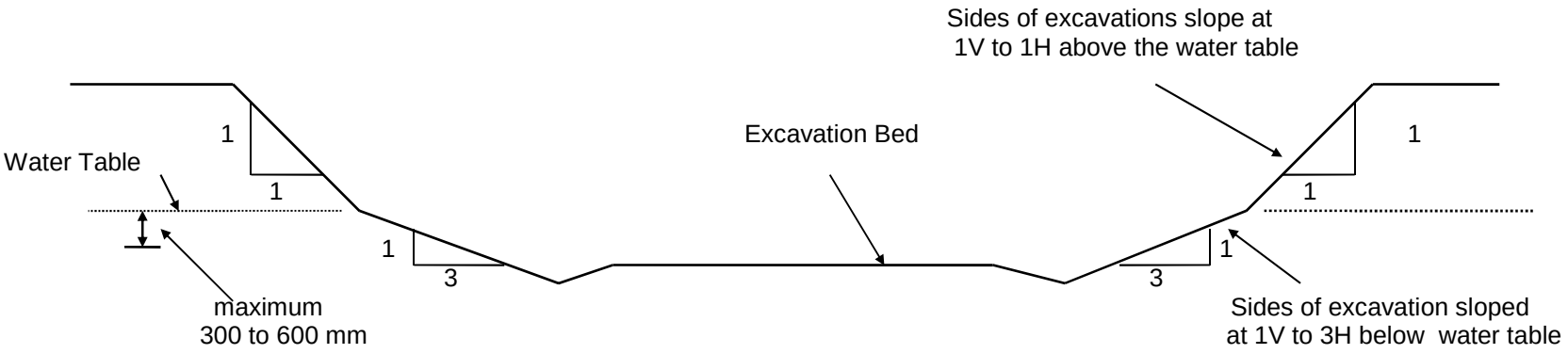


) GINT LOGS.GPJ SPL.GDT 12/23/16

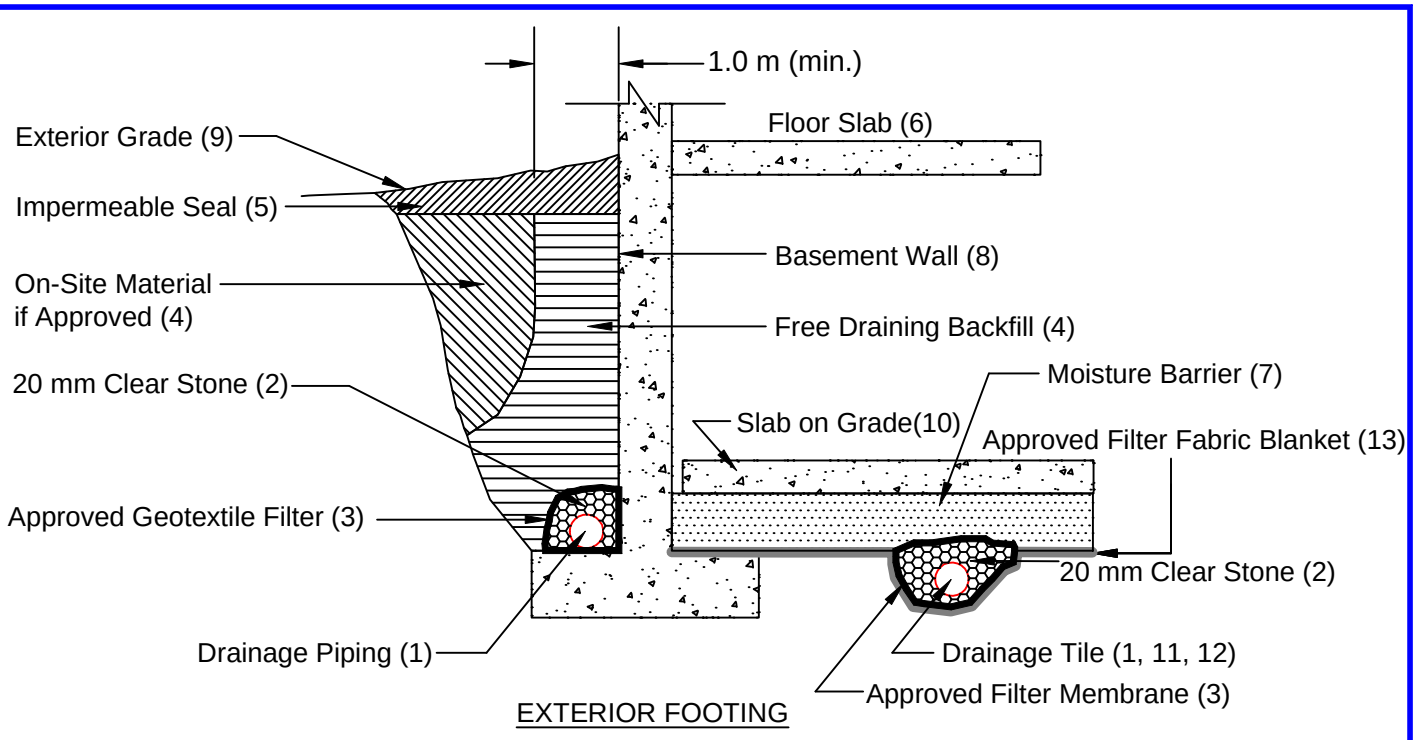
Client:	bc IMC Realty Corp. o/a Georgina Court Estates			Project No.: 161-15952-00	Drawing No.: 3
Drawn:	AP	Approved:	EP	Title:	Cross Section, West to East
Date:	DEC, 2016	Scale:	NTS	Project:	Geotechnical Hydrogeological Investigation Georgian Court, Burlington, Ontario
Original Size:	Tabloid	Rev:	N/A		WSP

PROJECT : 161-15952-00 **DRAWING 4**

TYPICAL EXCAVATION PROCEDURE FOR SHALLOW DEPTHS BELOW THE WATER TABLE IN SAND



Ditches dug at least 300 mm below the excavation bed to depress the water table (May be deeper if necessary)



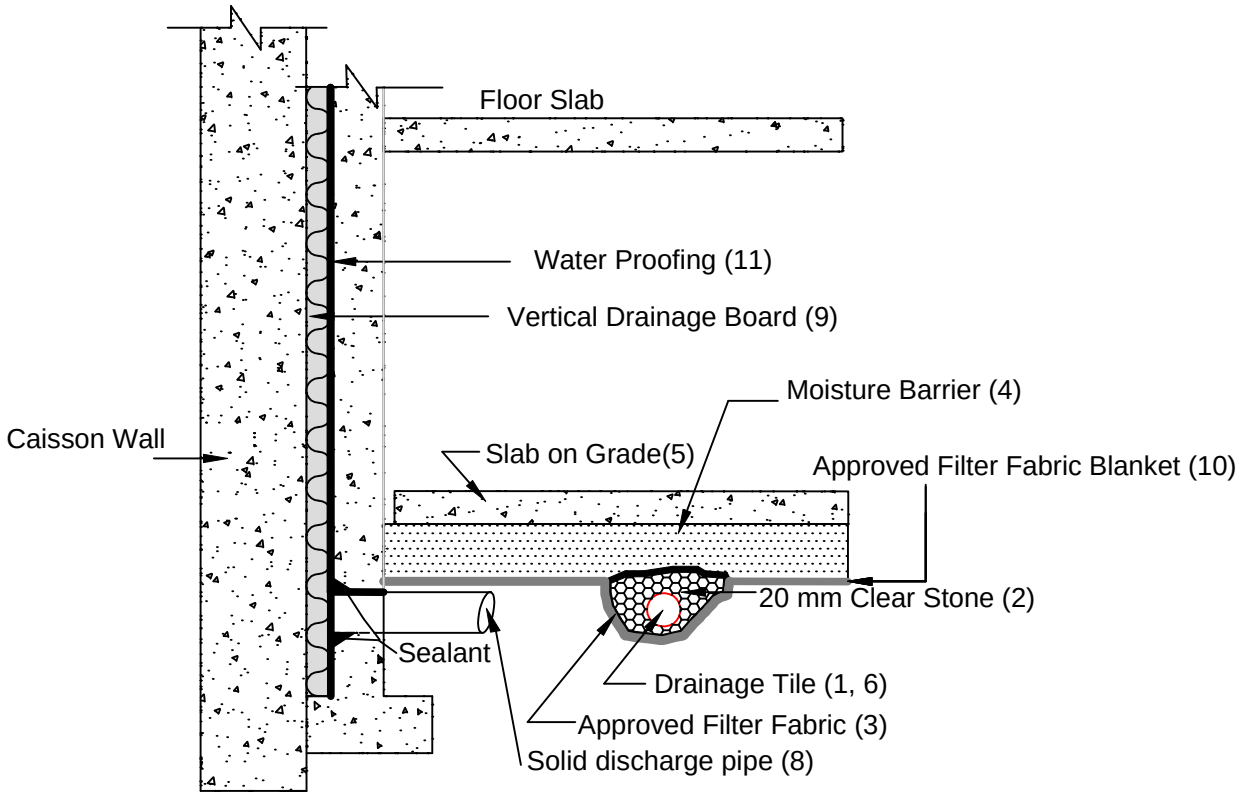
EXTERIOR FOOTING

Notes

1. Drainage piping to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet.
2. 20 mm (3/4") clear stone - 150 mm (6") top and side of drain. If drain is not on footing, place100 mm (4 inches) of stone below drain .
3. Wrap the clear stone with an approved geotextile filter fabrics (Terrafix 270R or equivalent).
4. Free Draining backfill - OPSS Granular B or equivalent compacted to the specified density. Do not use heavy compaction equipment within 450 mm (18") of the wall. Use hand controlled light compaction equipment within 1.8 m (6') of wall. The minimum width of the Granular 'B' backfill must be 1.0 m.
5. Impermeable backfill seal - compacted clay, clayey silt or equivalent. If original soil is free-draining, seal may be omitted. Maximum thickness of seal to be 0.5 m.
6. Do not backfill until wall is supported by basement floor slabs or adequate bracing.
7. Moisture barrier to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material. A vapour barrier may be required for specialty floors.
8. Basement wall to be damp proofed /water proofed as per OBC requirements.
9. Exterior grade to slope away from building min 2%.
10. Slab on grade should not be structurally connected to the wall or footing. Waterproof the slab and the slab-to-wall joint.
11. Underfloor drain invert to be at least 300 mm (12") below underside of floor slab.
12. Drainage piping placed in parallel rows 6 to 8 m (20 to 25') centers one way. Place drain on 100 mm (4") clear stone with 150 mm (6") of clear stone on top and sides. Enclose stone with filter fabric as noted in (3).
13. The entire subgrade to be covered with approved filter fabric (Terrafix 270R or equivalent) if non-cohesive (sandy) soils below ground water table encountered.
14. Do not connect the underfloor drains to perimeter drains.
15. Review the geotechnical report for specific details.

DRAINAGE AND BACKFILL RECOMMENDATIONS
Basement with Underfloor Drainage

(not to scale)

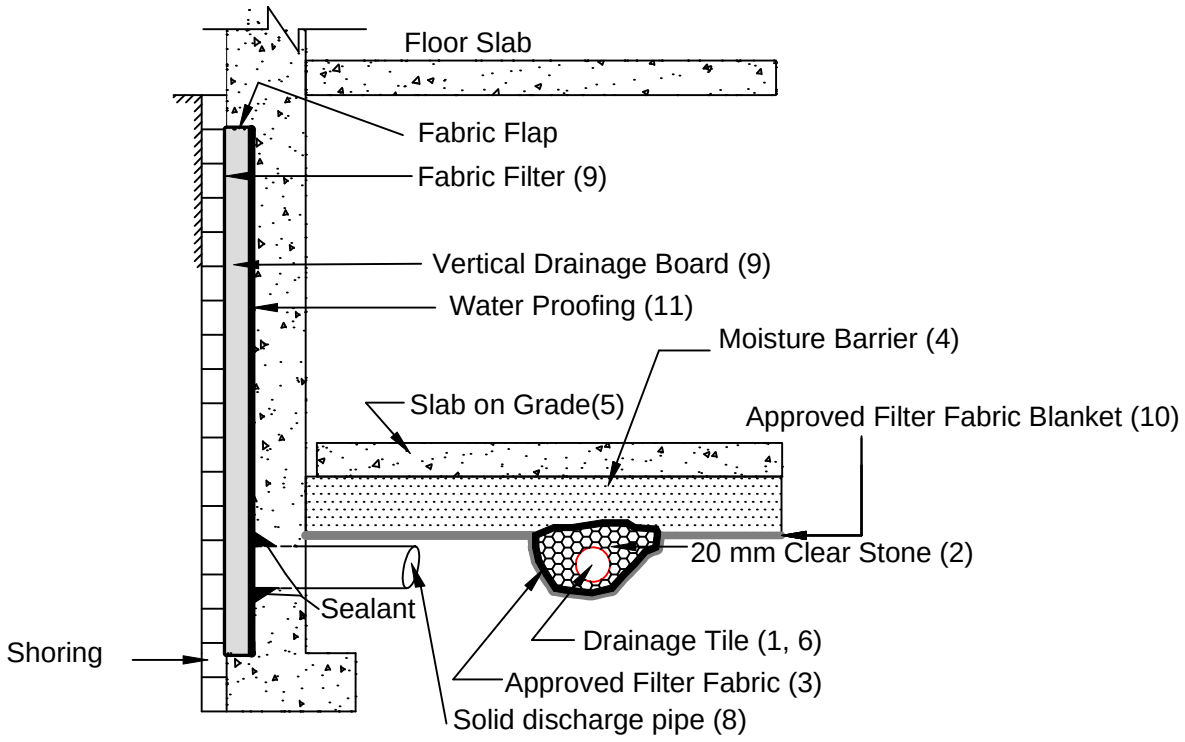


EXTERIOR FOOTING

Notes

1. Drainage tile to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet, spaced between columns.
2. 20 mm (3/4") clear stone - 150 mm (6") top and side of drain. If drain is not on footing, place100 mm (4 inches) of stone below drain .
3. Wrap the clear stone with an approved filter membrane (Terrafix 270R or equivalent).
4. Moisture barrier to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material. A vapour barrier may be required for specialty floors.
5. Slab on grade should not be structurally connected to the wall or footing.
6. Underfloor drain invert to be at least 300 mm (12") below underside of floor slab. Drainage tile placed in parallel rows 6 to 8 m (20 to 25') centers one way. Place drain on 100 mm (4") clear stone with 150 mm (6") of clear stone on top and sides. Enclose stone with filter fabric as noted in (3).
7. Do not connect the underfloor drains to perimeter drains.
8. Solid discharge pipe located at the middle of each bay between the solider piles, approximate spacing 2.5 m, outletting into a solid pipe leading to a sump.
9. Vertical drainage board mira-drain 6000 or eqivalent with filter cloth should be continous from bottom to 1.2 m below exterior finished grade.
10. The entire subgrade to be sealed with approved filter fabric (Terrafix 270R or equivalent) if non-cohesive (sandy) soils below ground water table encountered.
11. The basement walls must be water proofed using bentonite or equivalent water-proofing system.
12. Review the geotechnical report for specific details. Final detail must be approved before system is considered acceptable.

DRAINAGE RECOMMENDATIONS
Shored Basement wall with Underfloor Drainage System
(not to scale)



EXTERIOR FOOTING

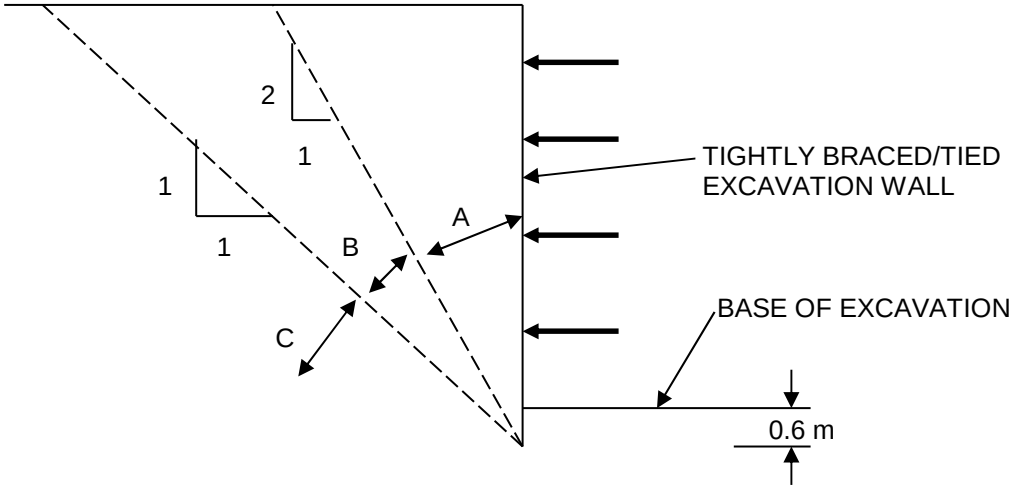
Notes

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7. Do not connect the underfloor drains to perimeter drains.
8. Solid discharge pipe located at the middle of each bay between the solider piles, approximate spacing 2.5 m, outletting into a solid pipe leading to a sump.
9. Vertical drainage board with filter cloth should be kept a minium of 1.2 m below exterior finished grade.
10. The entire subgrade to be sealed with approved filter fabric (Terrafix 270R or equivalent) if non-cohesive (sandy) soils below ground water table encountered.
11. The basement walls should be water proofed using bentonite or equivalent water-proofing system.
12. Review the geotechnical report for specific details. Final detail must be approved before system is considered acceptable.

DRAINAGE RECOMMENDATIONS
Shored Basement wall with Underfloor Drainage System
(not to scale)

Guidelines for Underpinning in Soil and Excavation Support

Existing foundations located within Zone A normally require underpinning, especially for heavy structures. For some foundations in Zone A, it may be possible to eliminate underpinning and control foundation movement by tightly braced excavation walls, such as caisson walls.



Zone A Foundations located within this zone normally require underpinning. Horizontal and vertical pressures on the excavation wall of non underpinned foundations must be considered

Zone B Foundations located within this zone normally do not require underpinning. Horizontal and vertical pressures on the excavation wall of non underpinned foundations must be considered

Zone C Underpinning to structures is normally founded in this zone. Lateral pressure from underpinning is not normally considered

(Reference: Figure 26.27 from Canadian Foundation Engineering Manual, 4th Edition)

Appendix A

EXPLANATION OF TERMS USED IN BOREHOLE LOG
LOGS OF BOREHOLES

Explanation of Terms Used in the Record of Borehole

Sample Type

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO	Drive open
DS	Dimension type sample
FS	Foil sample
NR	No recovery
RC	Rock core
SC	Soil core
SS	Spoon sample
SH	Shelby tube sample
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

Penetration Resistance

Standard Penetration Resistance (SPT), N:
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in) required to drive a 50 mm (2 in) drive open sampler for a distance of 300 mm (12 in).

WH – Samples sinks under "weight of hammer"

Dynamic Cone Penetration Resistance, N_d:
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in) to drive uncased a 50 mm (2 in) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in).

Textural Classification of Soils (ASTM D2487-10)

Classification	Particle Size
Boulders	> 300 mm
Cobbles	75 mm - 300 mm
Gravel	4.75 mm - 75 mm
Sand	0.075 mm - 4.75 mm
Silt	0.002 mm - 0.075 mm
Clay	<0.002 mm(*)

(*) Canadian Foundation Engineering Manual (4th Edition)

Coarse Grain Soil Description (50% greater than 0.075 mm)

Terminology	Proportion
Trace	0-10%
Some	10-20%
Adjective (e.g. silty or sandy)	20-35%
And (e.g. sand and gravel)	> 35%

Soil Description

a) Cohesive Soils(*)

Consistency	Undrained Shear Strength (kPa)	SPT "N" Value
Very soft	<12	0-2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very stiff	100-200	15-30
Hard	>200	>30

(*) Hierarchy of Shear Strength prediction
1. Lab triaxial test
2. Field vane shear test
3. Lab. vane shear test
4. SPT "N" value
5. Pocket penetrometer

b) Cohesionless Soils

Density Index (Relative Density)	SPT "N" Value
Very loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

Soil Tests

w	Water content
w_p	Plastic limit
w_l	Liquid limit
C	Consolidation (oedometer) test
CID	Consolidated isotropically drained triaxial test
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement
D_R	Relative density (specific gravity, Gs)
DS	Direct shear test
ENV	Environmental/ chemical analysis
M	Sieve analysis for particle size
MH	Combined sieve and hydrometer (H) analysis
MPC	Modified proctor compaction test
SPC	Standard proctor compaction test
OC	Organic content test
U	Unconsolidated Undrained Triaxial Test
V	Field vane (LV-laboratory vane test)
γ	Unit weight

LOG OF BOREHOLE BH16-1

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4797248 E 595103

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/01/2016

REF. NO.: 161-15952-00
ENCL NO.: 2

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"
91.2 / 0.0	**ASPHALTIC CONCRETE:** 125mm			
90.8 / 0.1	**GRANULAR BASE/SUBBASE:** 305mm	1	SS	16
90.3 / 0.4	**FILL:** silt with some sand and gravel, reddish brown/brown/black, very moist, compact			
89.7 / 0.9	**SAND:** some silt, trace organics, brown, very moist, loose	2	SS	9
88.9 / 1.5	**SILTY CLAY:** trace organics, dark brown, very moist, firm	3	SS	5
86.6 / 2.3	**SILTY CLAY TILL:** trace sand, brown, moist, very stiff	4	SS	18
	hard	5	SS	34
		6	SS	29
85.1 / 4.6	**SANDY SILT TILL:** trace gravel, trace clay, brown, moist, very dense	7	SS	90
83.6 / 6.1	**SILTY CLAY TILL:** some sand, trace gravel, grey, moist, hard	8	SS	43
82.1 / 7.6	**SILTY CLAY:** grey, moist, very stiff	9	SS	28
81.0 / 9.1	**CLAYEY SILT TILL/ SHALE COMPLEX:** trace sand, trace gravel, trace shale, reddish brown, very moist to wet, hard	10	SS	91

GROUND WATER CONDITIONS: W. L. 91.0 m Dec 16, 2017

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

DEPTH (m)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
1.5	75		
2.3	225		
3.8	225		
4.6			
7.6			9 62 29

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

LOG OF BOREHOLE BH16-1

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4797248 E 595103

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/01/2016

REF. NO.: 161-15952-00
ENCL NO.: 2

SOIL PROFILE (m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	CLAYEY SILT TILL/ SHALE COMPLEX: trace sand, trace gravel, trace shale, reddish brown, very moist to wet, hard(Continued)						81				
80.2											
11.0	**INFERRED BEDROCK:** shale interbedded with siltstone/ limestone, reddish brown **(Queenston Formation)**						80				Hard augering
78.9			11	SS	for 100 mm		79				
12.3	**Refusal:** on assumed bedrock **Notes:** Water levels Dec 12 0.2 m.B.G.S. Dec 16 0.2 m.B.G.S. Combustible gas reading: 1200ppm in open borehole upon completion.										

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH16-2

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4797196 E 595144

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/01/2016

REF. NO.: 161-15952-00
ENCL NO.: 3

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
90.7												
90.6	**ASPHALTIC CONCRETE:** 125mm											
90.4 0.3	**GRANULAR BASE/ SUBBASE:** 175mm		1	SS	5		90					
	FILL: medium to fine sand, trace organics, brown, black layers, wet, loose		2	SS	6							
89.2							89			75		
1.5	**CLAYEY SILT:** trace organics, trace sand, reddish brown, moist, stiff		3	SS	8							
88.4							88			225		
2.3	**SILTY CLAY TILL:** trace sand, brown, moist, very stiff		4	SS	23							
	trace shale fragments, grey, hard		5	SS	42		87					
	very stiff		6	SS	26		86					
84.6							85					
6.1	**SILTY CLAY:** trace sand and gravel, grey, moist, very stiff		7	SS	27	▽	84			225		
								W. L. 83.5 m on completion				
			8	SS	21		83			125		
81.6							82					
9.1	**SILT TILL/ SHALE COMPLEX:** trace sand and gravel, reddish brown, wet, dense		9	SS	33							
							81					

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

LOG OF BOREHOLE BH16-2

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4797196 E 595144

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/01/2016

REF. NO.: 161-15952-00
ENCL NO.: 3

SOIL PROFILE (m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SILT TILL/ SHALE COMPLEX: trace sand and gravel, reddish brown, wet, dense(Continued)						80				
11 79.4											
11.3	**INFERRED BEDROCK:** shale interbedded with siltstone/ limestone, reddish brown **(Queenston Formation)**						79				Hard augering
12 78.5											
12.2	**Refusal:** on assumed bedrock		10	SS	for 75mm						

Notes:
Combustible gas reading: 560 ppm in open borehole upon completion.
Water level at 7.2 m.b.g.l. upon completion.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4797133 E 595244

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/02/2016

REF. NO.: 161-15952-00
ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
89.5												
89.4	**ASPHALTIC CONCRETE:** 115mm											
89.2 / 0.3	**GRANULAR BASE/ SUBBASE:** 165mm		1	SS	14		89					
	FILL: sand, some silt, trace clay, trace organics, dark brown, very moist to wet, compact to loose		2	SS	8		88					
87.8			3	SS	7							
1.7 / 87.2	**SILT:** some sand, some clay, sand layers, brown, satured, loose											
2.3	**CLAYEY SILT TILL:** trace sand and gravel, brown, moist, hard		4	SS	35	▽	87					
								W. L. 86.7 m Dec 16, 2017				
			5	SS	31		86					
			6	SS	30		85					
83.4							84					
6.1	**SILTY CLAY:** trace sand, trace shale, occassional red layers, grey, moist, hard		7	SS	41		83					
81.9							82					
7.6	**SILTY SAND TILL/SHALE COMPLEX:** some clay, some gravel, reddish brown, moist, very dense		8	SS	69		81					
			9	SS	50/ 125mm		80					

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

LOG OF BOREHOLE BH16-3

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4797133 E 595244

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/02/2016

REF. NO.: 161-15952-00
ENCL NO.: 4

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa)	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SILTY SAND TILL/SHALE COMPLEX: some clay, some gravel, reddish brown, moist, very dense(Continued)											
			10	SS	50/ 50mm		79					Hard augering 11 53 26 10
11												
							78					
12												
77.3 12.2	**INFERRED BEDROCK:** shale interbedded with siltstone/ limestone, reddish brown (**Queenston Formation**)		11	SS	60/ 125mm							
77.1 12.4	**Refusal:** on assumed bedrock											

Notes:
Water levels
Dec 12 2.8 m.B.G.S.
Dec 16 2.8 m.B.G.S.
Combustible gas reading: 560 ppm in open borehole upon completion.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ε=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

LOG OF BOREHOLE BH16-4

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4797149 E 595106

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/01/2016

REF. NO.: 161-15952-00
ENCL NO.: 5

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
91.9 / 0.0	**ASPHALTIC CONCRETE:** 125mm				
91.7 / 0.2	**GRANULAR BASE/SUBBASE:** 75mm	1	SS	8	
	SAND: some to trace silt, trace clay, reddish brown, wet, loose				
1	brown	2	SS	9	91
	saturated, compact	3	SS	16	
2		4	SS	18	90
88.9 / 3					89
3.1	**SILTY CLAY TILL:** trace sand, grey, moist, very stiff	5	SS	17	
4					
	trace gravel	6	SS	29	87
5					
6					86
85.6 / 6.3	**CLAYEY SILT TILL:** grey, moist, hard	7	SS	39	
7					85
8		8	SS	43	84
9	very stiff	9	SS	17	83
10					82

GROUND WATER CONDITIONS: ▽ W. L. 88.2 m on completion

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa): 225 (NUMBER 6), 225 (NUMBER 7)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

LOG OF BOREHOLE BH16-4

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4797149 E 595106

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/01/2016

REF. NO.: 161-15952-00
ENCL NO.: 5

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	CLAYEY SILT TILL: grey, moist, hard(Continued)											
11							81					
80.0												
12 11.9	**INFERRED BEDROCK:** shale interbedded with siltstone/ limestone, reddish brown **(Queenston Formation)**						80					Hard augering
79.0			10	SS	for 75mm							
12.9	**Refusal:** on assumed bedrock											

Notes:
Combustible gas reading: 0 ppm in open borehole upon completion.
Water level at 3.7 m.b.g.l. upon completion.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

LOG OF BOREHOLE BH16-5

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4797099 E 595146

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/01/2016

REF. NO.: 161-15952-00
ENCL NO.: 6

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
91.8 / 0.0	**ASPHALTIC CONCRETE:** 125mm				
91.7 / 0.1	**GRANULAR BASE/ SUBBASE:** 475mm	1	SS	17	
91.2 / 0.6	**SAND:** trace silt, reddish brown, very moist trace organics, brown, wet, loose	2	SS	9	91
1	reddish brown, saturated	3	SS	7	90
2		4	SS	6	89
3		5	SS	24	
88.4 / 3.4	**SILTY CLAY:** trace sand, grey, very moist, very stiff				88
4		6	SS	28	87
5					
6					86
85.5 / 6.3	**CLAYEY SILT TILL:** grey, moist, hard	7	SS	41	
7					85
84.2 / 7.6	**SILTY CLAY TILL:** grey, very moist, very stiff	8	SS	26	84
8					
9					83
9		SS	20		
10					82

GROUND WATER CONDITIONS: ▽ W. L. 87.5 m on completion

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa): 125; 225; 225

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%) — GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

LOG OF BOREHOLE BH16-5

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4797099 E 595146

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/01/2016

REF. NO.: 161-15952-00
ENCL NO.: 6

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SILTY CLAY TILL: grey, very moist, very stiff(Continued)											
11							81					
80.2												
11.6	**INFERRED BEDROCK:** shale interbedded with siltstone/ limestone, reddish brown **(Queenston Formation)**											Hard augering
12							80					
79.2			10	SS	for 100mm							
12.6	**Refusal:** on assumed bedrock **Notes:** Combustible gas reading: 590 ppm in open borehole upon completion. Water level at 4.3 m.b.g.l. upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^{3}$, $\times^{3}$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH16-6

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4797069 E 595085

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/05/2016

REF. NO.: 161-15952-00
ENCL NO.: 7

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m	ELEVATION
94.7 / 0.0	**ASPHALTIC CONCRETE:** 35mm				
94.5 / 0.2	**GRANULAR BASE/ SUBBASE:** 145mm				
	SILTY SAND: some clay, trace organics, reddish brown, very moist, loose	1	SS	7	94
		2	SS	5	
	wet	3	SS	4	93
		4	SS	4	92
		5	SS	6	91
	W. L. 90.4 m Dec 16, 2017				
	grey, saturated, compact	6	SS	17	90
88.6 / 6.1	**SILTY CLAY TILL:** trace sand, grey, moist, very stiff	7	SS	19	89
		8	SS	22	88
85.6 / 9.1	**SILTY SAND TILL:** trace clay, grey, very moist, compact	9	SS	23	87
					86
					85

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
		1 53 28 18
225		
175		

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε_f=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

LOG OF BOREHOLE BH16-6

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4797069 E 595085

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/05/2016

REF. NO.: 161-15952-00
ENCL NO.: 7

SOIL PROFILE (m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
84.0	**SILTY SAND TILL:** trace clay, grey, very moist, compact(Continued)										
10.7	**CLAYEY SILT:** grey, moist, hard		10	SS	32		84	○	○	225	
11											
12 82.5							83				
12.2	**SANDY SILT TILL/SHALE COMPLEX:** reddish brown, moist, very dense		11	SS	50/ 125mm				○	150	
13							82				
14			12	SS	50/ 125mm		81		○		
15 79.5							80				
15.2 79.2	**INFERRED BEDROCK:** shale interbedded with siltstone/ limestone, reddish brown **(Queenston Formation)**		13	SS	50/ 100mm				○		Hard augering
15.5	**Refusal:** on assumed bedrock										

Notes:
Water levels
Dec 12 4.4 m.B.G.S.
Dec 16 4.3 m.B.G.S.
Combustible gas reading: 0ppm in open borehole upon completion.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

LOG OF BOREHOLE BH16-7

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4797029 E 595150

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/02/2016

REF. NO.: 161-15952-00
ENCL NO.: 8

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
92.6					
0.0 / 92.1	**TOPSOIL:** dark brown, very moist, loose, 500 mm	1	SS	10	
0.5	**SAND:** trace silt, trace gravel, reddish brown, very moist, loose				92
	wet	2	SS	6	
		3	SS	5	91
	saturated, compact	4	SS	21	90
		5	SS	24	89
88.0					
4.6	**SILT TILL:** some clay to clayey, sandy, trace to some gravel, grey, very moist, very stiff	6	SS	15	88
		7	SS	27	87
85.0					86
7.6	**SILT TILL:** with some sand, trace gravel, trace clay, grey, very moist, very dense	8	SS	62	85
	compact	9	SS	27	84
					83

W. L. 89.8 m
Dec 16, 2017

10 23 48 19

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

LOG OF BOREHOLE BH16-7

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4797029 E 595150

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/02/2016

REF. NO.: 161-15952-00
ENCL NO.: 8

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SILT TILL: with some sand, trace gravel, trace clay, grey, very moist, very dense(Continued)						82					
11												
12							81					
80.1												
12.5	**INFERRED BEDROCK:** shale interbedded with siltstone/ limestone, reddish brown **(Queenston Formation)**						80					Hard augering
13												
78.8			10	SS	for 50mm		79					
13.8	**Refusal:** on assumed bedrock **Notes:** Water levels Dec 12 2.9 m.B.G.S. Dec 16 2.8 m.B.G.S. Combustible gas reaidng: 1200 ppm in open borehole upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

LOG OF BOREHOLE BH16-8

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4797080 E 595312

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/02/2016

REF. NO.: 161-15952-00
ENCL NO.: 9

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
89.6												
89.6	**ASPHALTIC CONCRETE:** 110mm											
89.3 0.3	**GRANULAR BASE/ SUBBASE:** 165mm		1	SS	7							
	FILL: sand, some silt, reddish brown, very moist, loose						89					
1	very loose		2	SS	3							
	saturated		3	SS	3		88					
2 87.2												
2.4	**CLAYEY SILT TILL:** trace sand, red, moist, very stiff		4	SS	19		87			225		
3			5	SS	20					225		
4	with occassional silt layers, hard		6	SS	34		86 85					
5 6			7	SS	30		84					
83.0							83					
6.6	**End of Borehole:**											
	Notes: Borehole dry on completion											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

LOG OF BOREHOLE BH16-9

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4797038 E 595283

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/07/2016

REF. NO.: 161-15952-00
ENCL NO.: 10

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
90.6												
0.0 90.3	**TOPSOIL:** dark brown, very moist, loose, 300 mm		1	SS	6							
0.3	**SAND:** trace topsoil, reddish brown, very moist, compact						90					
1	trace silt		2	SS	17							
	reddish brown/brown layers		3	SS	16		89					
2	saturated		4	SS	21		88					
87.6												
3.1	**CLAYEY SILT:** trace sand, grey, moist, very stiff		5	SS	17		87			225		
4	hard		6	SS	31		86					
5							85					
6	very stiff		7	SS	29							
84.0							84					
6.6	**End of Borehole:** **Notes:** Borehole dry on completion											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

LOG OF BOREHOLE BH16-10

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4797001 E 595211

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/02/2016

REF. NO.: 161-15952-00
ENCL NO.: 11

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
91.1												
90.9	**ASPHALTIC CONCRETE:** 110mm											
90.6	**GRANULAR BASE/ SUBBASE:** 140mm											
0.3	**SAND:** trace to some silt, reddish brown, very moist, compact		1	SS	12		91					
1	loose		2	SS	9		90					
	saturated, loose to very loose		3	SS	4	▽						
2							89	W. L. 89.0 m on completion				
			4	SS	3							
3	compact		5	SS	12		88					
4							87					
86.5												
4.6	**SILTY CLAY TILL:** trace shale, trace sand and gravel, grey, moist, very stiff		6	SS	22					225		
5							86					
6												
84.9			7	SS	50/ 100mm		85			125		
6.2	**End of Borehole:**											

Notes:
Water level at 2.1 m.b.g.l. upon completion.

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH16-11

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4796956 E 595211

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/07/2016

REF. NO.: 161-15952-00
ENCL NO.: 12

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
91.6												
90.6 0.2	**TOPSOIL:** dark brown, very moist, loose, 200 mm		1	SS	5		91					
	SAND: some silt, trace clay, trace gravel, reddish brown, very moist, loose											
1	very moist to wet, compact		2	SS	10							
	trace gravel, very moist		3	SS	13		90					
2												
	saturated		4	SS	19		89					
						▽		W. L. 89.0 m Dec 16, 2017				
3			5	SS	12							2 73 19 6
							88					
4												
87.0 4.6	**SILTY CLAY TILL:** trace gravel, moist, very stiff		6	SS	24		87			225		
5												
							86					
6												
	hard		7	SS	35							
85.0 6.6	**End of Borehole:**						85					
	Notes: Water levels Dec 12 2.6 m.B.G.S. Dec 16 2.6 m.B.G.S.											

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

LOG OF BOREHOLE BH16-12

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4796935 E 595168

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/06/2016

REF. NO.: 161-15952-00
ENCL NO.: 13

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
91.6												
91.4 0.2	**ASPHALTIC CONCRETE:** 100mm **GRANULAR BASE/ SUBBASE:** 100mm **SAND:** trace to some silt, reddish brown, very moist, loose		1	SS	14		91					
1	trace silt, brown, compact		2	SS	9							
2			3	SS	15		90					
	saturated		4	SS	16	▽	W. L. 89.3 m on completion					
3			5	SS	16		89					
4							88					
87.0 4.6	**SILTY CLAY TILL:** trace silt, grey, moist, very stiff		6	SS	19		87			200		
5												
6	trace clay, trace gravel		7	SS	26		86					
85.0 6.6	**End of Borehole:** **Notes:** Water level at 2.3 m.b.g.l. upon completion.						85					

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

LOG OF BOREHOLE BH16-13

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4796947 E 595067

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/07/2016

REF. NO.: 161-15952-00
ENCL NO.: 14

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
93.0												
92.9 / 0.1	**ASPHALTIC CONCRETE:** 50mm											
	GRANULAR BASE/ SUBBASE: 50mm											
92.2	**SAND:** trace silt, reddish brown, very moist, loose		1	SS	6							
0.8 / 91.5	**SILT:** some sand, reddish brown, very moist, loose		2	SS	8		92					
1.5	**SAND:** trace silt, brown/ reddish brown, very moist, loose		3	SS	4		91					
	saturated, compact		4	SS	17	▽						
							W. L. 90.4 m on completion					
88.5			5	SS	20		90					
4.5	**SILTY CLAY:** trace sand, grey, very moist to moist, very stiff		6	SS	15		89			175		
							88					
			7	SS	20		87			225		
86.4												
6.6	**End of Borehole:**											
	Notes: Water level at 2.6 m.b.g.l. upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

LOG OF BOREHOLE BH16-14

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4796974 E 595039

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/07/2016

REF. NO.: 161-15952-00
ENCL NO.: 15

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
93.1												
0.0 / 92.5	**TOPSOIL:** dark brown, very moist, loose, 600 mm		1	SS	10		93					
0.6 / 88.5	**SAND:** trace to some silt, reddish brown, very moist, loose - - - - - - - - - - - - - - - - brown - - - - - - - - - - - - - - - - saturated, compact		2	SS	4		92					
			3	SS	6		91					
			4	SS	15		90					
			5	SS	20		89					
4.6 / 86.5	**SILTY CLAY:** trace sand, grey, moist, stiff - - - - - - - - - - - - - - - - very stiff		6	SS	14		88			225		
			7	SS	25		87					
6.6	**End of Borehole:** **Notes:** Borehole dry on completion											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

LOG OF BOREHOLE BH16-15

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4796884 E 595049

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/05/2016

REF. NO.: 161-15952-00
ENCL NO.: 16

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
92.8												
92.7 0.1	**ASPHALTIC CONCRETE:** 100mm											
92.6 0.3	**GRANULAR BASE/ SUBBASE:** 150mm											
	SAND: some silt, reddish brown, very moist, compact		1	SS	10		92					
1			2	SS	10							
	loose		3	SS	5		91					
2												
	trace silt, grey, compact, saturated		4	SS	23	▽	W. L. 90.2 m on completion					
3			5	SS	26		89					
4												
88.2 4.6	**SILTY CLAY TILL:** trace sand, grey, moist, very stiff		6	SS	17		88			225		
5												
6 86.7							87					
6.1 86.4	**SILT TILL:** some sand, trace gravel, very moist, very dense		7	SS	50/ 150mm							
6.4	**End of Borehole:** **Notes:** Water level at 2.6 m.b.g.l. upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

LOG OF BOREHOLE BH16-16

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4796916 E 595016

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/05/2016

REF. NO.: 161-15952-00
ENCL NO.: 17

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
92.8 / 0.0	**ASPHALTIC CONCRETE:** 100mm				
92.7 / 0.1	**GRANULAR BASE/ SUBBASE:** 100mm				
92.6 / 0.2	**SAND:** trace to some silt, reddish brown, very moist, loose	1	SS	5	
		2	SS	4	92
		3	SS	7	91
	saturated	4	SS	6	W. L. 90.3 m Dec 16, 2017
	compact	5	SS	13	90
					89
88.2 / 4.6	**SILTY SAND:** some clay, trace gravel, grey, very moist, compact	6	SS	18	88
86.7 / 6.1	**CLAYEY SILT TILL:** grey, moist, hard	7	SS	31	87
86.2 / 6.6	**End of Borehole:** **Notes:** Water levels Dec 12 2.5 m.B.G.S. Dec 16 2.5 m.B.G.S.				

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa): 225

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
2	67	20	11

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

LOG OF BOREHOLE BH16-17

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4797035 E 594991

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/06/2016

REF. NO.: 161-15952-00
ENCL NO.: 18

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
94.2												
94.0 0.1	**ASPHALTIC CONCRETE:** 100mm											
93.9 0.2	**GRANULAR BASE/ SUBBASE:** 125mm											
	SILTY SAND: some clay, trace gravel, reddish brown, very moist, loose		1	SS	6		94					
1			2	SS	6							
	trace silt, brown		3	SS	6		93					
2	compact		4	SS	14		92					
3	reddish brown, saturated		5	SS	21		91					
						W. L. 90.8 m Dec 16, 2017						
4							90					
5			6	SS	22							1 61 22 16
6 88.1							89					
6.1 87.6	**SILTY CLAY:** trace sand, grey, very moist, very stiff		7	SS	15		88			150		
6.6	**End of Borehole:**											

Notes:
Water levels
Dec 12 3.4 m.B.G.S.
Dec 16 3.4 m.B.G.S.

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

LOG OF BOREHOLE BH16-18

PROJECT: Geotechnical Investigation
CLIENT: bcIMC Realty Corp. o/a Georgian Court Estates
PROJECT LOCATION: Georgina Court Redevelopment
DATUM: Geodetic
BH LOCATION: N 4796984 E 594949

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 0.2
Date: Dec/06/2016

REF. NO.: 161-15952-00
ENCL NO.: 19

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
93.9												
90.0	**ASPHALTIC CONCRETE:** 150mm											
0.2 / 93.4	**GRANULAR BASE/ SUBBASE:** 350mm		1	SS	22				○			
0.5	**SAND:** trace to some silt, reddish brown, very moist, compact		2	SS	17		93		○			
1	very loose		3	SS	3				○			
2	wet		4	SS	1		92		○			
3	saturated, compact		5	SS	17	▽	91		○			
							W. L. 90.8 m on completion					
4							90					
			6	SS	25				○			
5							89					
6 / 87.8							88					
6.1 / 87.3	**CLAYEY SILT TILL:** trace sand, grey, moist, very stiff		7	SS	24				○			
6.6	**End of Borehole:** **Notes:** Water level at 3.1 m.b.g.l. upon completion.											

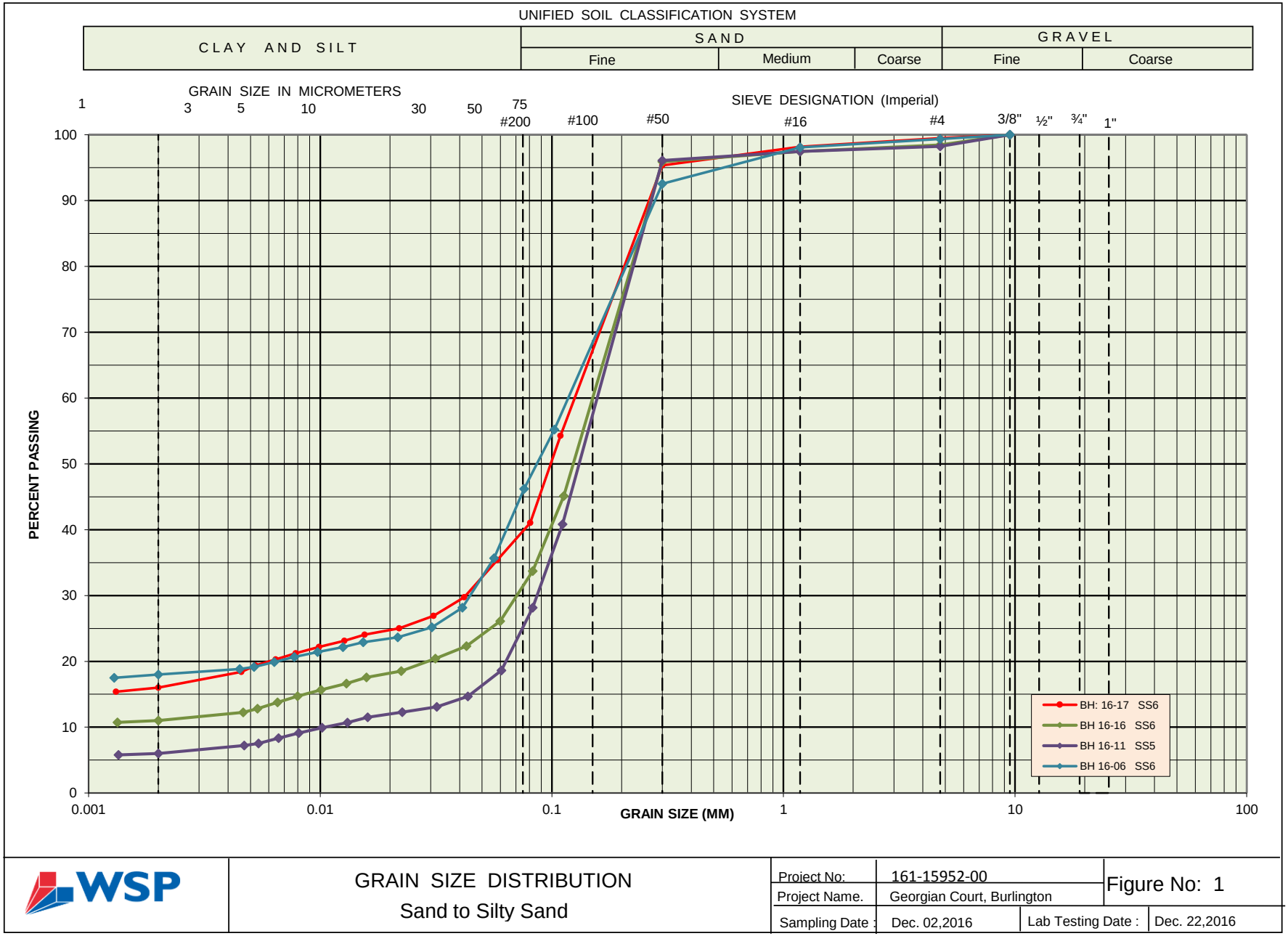
GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

WSP SOIL LOG GINT LOGS.GPJ SPL.GDT 1/3/17

Appendix B

GRAIN SIZE DISTRIBUTION CURVES
PLASTICITY CHART

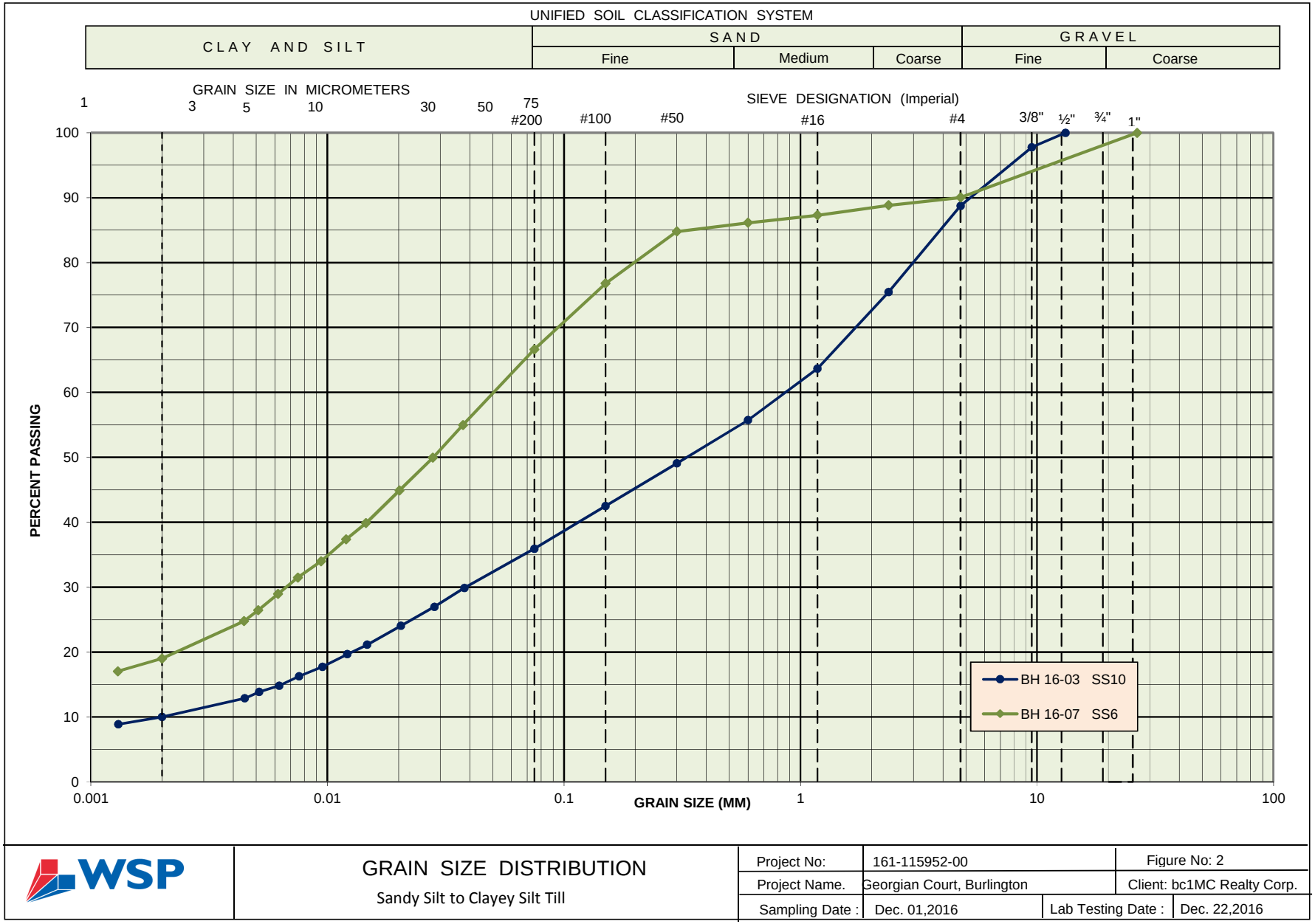


WSP

GRAIN SIZE DISTRIBUTION

Sand to Silty Sand

Project No:	161-15952-00	Figure No: 1	
Project Name.	Georgian Court, Burlington		
Sampling Date :	Dec. 02,2016	Lab Testing Date :	Dec. 22,2016

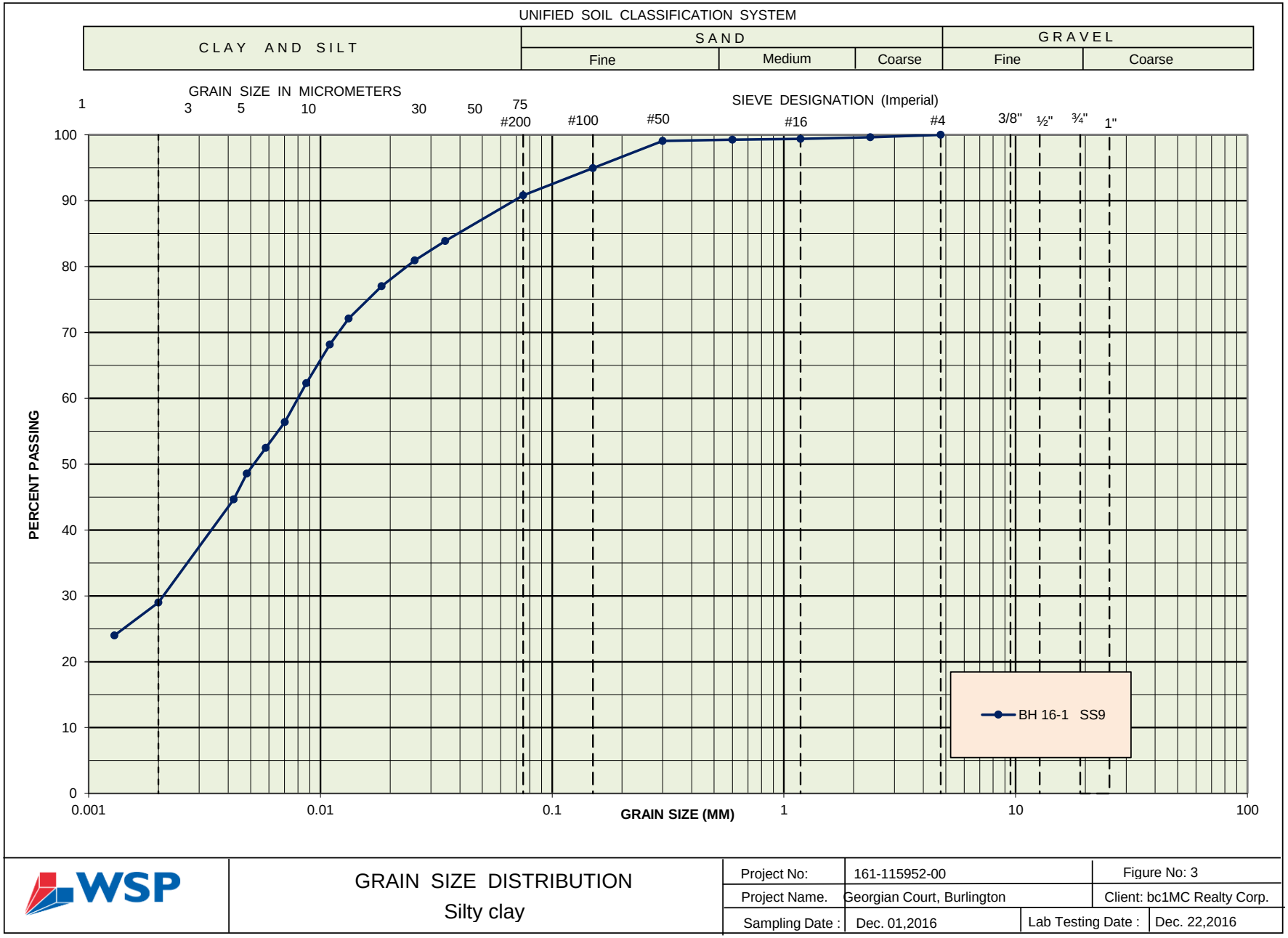


WSP

GRAIN SIZE DISTRIBUTION

Sandy Silt to Clayey Silt Till

Project No:	161-115952-00		Figure No: 2
Project Name.	Georgian Court, Burlington		Client: bc1MC Realty Corp.
Sampling Date :	Dec. 01,2016	Lab Testing Date :	Dec. 22,2016

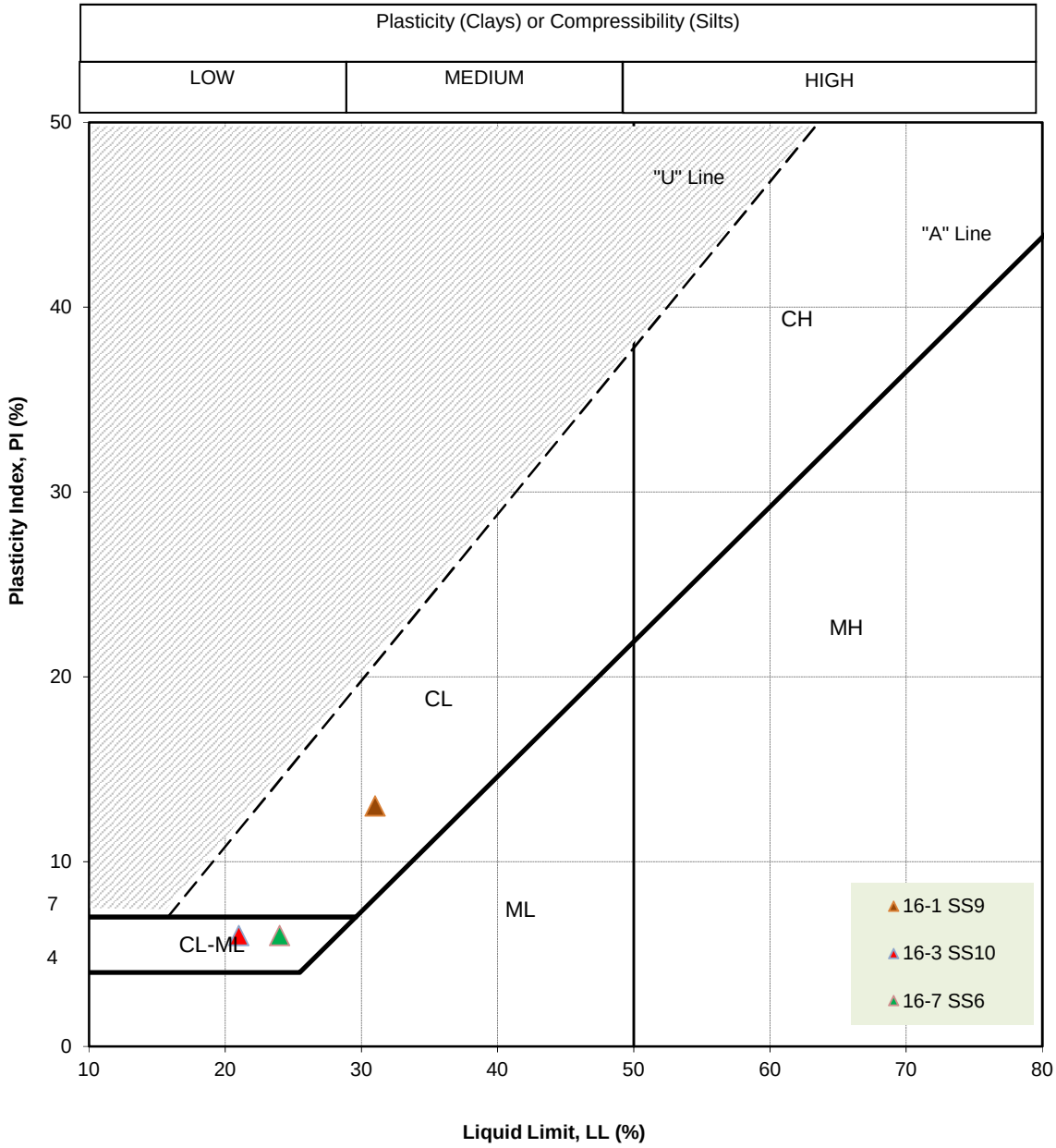


WSP

GRAIN SIZE DISTRIBUTION

Silty clay

Project No:	161-115952-00		Figure No: 3
Project Name.	Georgian Court, Burlington		Client: bc1MC Realty Corp.
Sampling Date :	Dec. 01,2016	Lab Testing Date :	Dec. 22,2016



WSP	**PLASTICITY CHART**	Project No: 161-15952-00
		Project Name: Georgian Court, Burlington
	Sampling Date: Dec. 02,2016	**Figure No**: 4

Appendix C

GENERAL COMMENTS – BEDROCK IN METRO TORONTO AREA

General Comments – Bedrock in Metro Toronto Area

The bedrock that makes spread footings or caissons a popular choice for high-rise foundation support is a shale or shale limestone composition. The highest member, the Queenston Formation, is generally found west of Toronto, while the Georgian Bay Formation underlies most of Metro Toronto, with the Collingwood Formation east of Toronto. The Queenston is, relatively speaking, the weaker of the three formations that are likely to support caissons or footings.

The Georgian Bay as well as the Queenston and Collingwood Formation are of Middle Ordovician Age. It is defined as the rock unit that overlies the bluish grey shales of the Collingwood Formation and is in turn overlain by the red shale of the Queenston Formation. The Georgian Bay Formation consists of bluish and grey shale with interbeds of sandstone, limestone and dolostone. Towards the west where the Georgian Bay formation underlies the Queenston Formation, the limestone content increases significantly and limestone and/or sandstone may comprise as much as 70 to 90 percent of the bedrock. The hard layers are usually less than about 100 to 150 mm thick but some layers are much thicker. The thicker layers have been observed to be as much as 750 to 900 mm at some sites. The layers are actually lenses and they can vary significantly in thickness over short distances.

The upper portion of the bedrock is commonly weathered for a depth of 600 to 1000 mm and within this weathered zone hard limestone layers or lenses are common. These hard limestone layers can result in contractual problems for augers, and can provide misleading bedrock elevations. Where the weathering is more extensive a shale till layer may be found above the bedrock. In the sound bedrock, the limestone, sandstone, dolostone is hard to very hard.

Stress relief features such as folds and faults are common in the bedrock. In these features, the rock is heavily fractured and sheared, and contains layers of shale rubble and clay. Weathering is much deeper than the surrounding rock in these features and often there is a lateral migration of the stress relief features resulting in sound unweathered bedrock overlying fractured and weather bedrock. The stress relief features are usually in the order of 4 to 6 m wide, but the depth can vary from 4 to 5 m to in excess of 10 m. These features occur randomly.

The bedrock contains significant high locked in horizontal stresses. These stresses can impose significant loads on tunnel walls but the slower rate of construction for basements allows for a relaxation of these stresses and they are not normally a problem for basement construction.

Groundwater seepage below the top 1000 mm is generally small, however, at several locations in Toronto and Mississauga large quantities have been encountered.

Bedding joints in the bedrock are very close-to-close, smooth planar in the shale and rough planar in the limestone. Significant vertical jointing is common.

Where the bedrock was cored, a detailed description of the rock core is appended to the borehole log.

Design features related to the bedrock are discussed in other sections of this report, and these general comments must be considered with these comments.

Methane gas exists in the bedrock, normally below the top 1000 mm and more concentrated with depth. Appropriate care and monitoring is essential in all confined bedrock excavations, particularly caissons and tunnels.

The methane is generally more prevalent with depth below the bedrock surface. In the event that methane gas is detected during the construction of the caissons taken to sound bedrock, it will not likely be possible to inspect the caisson base to ensure that it is founded in sound rock and that the recommended safe net bearing value of 5.0 to 7.5 MPa can be used.

If this occurs the design can be changed from end bearing to skin friction where a value of concrete to bedrock of 600 kPa is utilized. In this event the top 0.6 to 1.0 m of bedrock should be ignored in the design of the skin friction. Alternatively, the caissons can terminate at about 0.3 m below the surface of the bedrock and provided no methane is detected, and inspection is possible, the caissons can be designed using a safe net bearing value of 3.0 MPa.

There are significant cost implications in this change of design and the owners and designers should provide in the contract for the possible change in their design, and the higher costs associated with this change must be appreciated.