#### BRADFORD HIGHLANDS JOINT VENTURE

# PRELIMINARY GEOTECHNICAL INVESTIGATION- BRADFORD HIGHLANDS GOLF COURSE REDEVELOPMENT, BRADFORD, ONTARIO

AUGUST 02, 2023

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**FINAL** 





# PRELIMINARY GEOTECHNICAL INVESTIGATION-BRADFORD HIGHLANDS GOLF COURSE REDEVELOPMENT, BRADFORD, ONTARIO

#### **BRADFORD HIGHLANDS JOINT VENTURE**

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August 02, 2023

BRADFORD HIGHLANDS JOINT VENTURE 111 Creditstone Road, Concord, Ontario L4K 1N3

Attention: Mr. Neil Palmer

#### Subject: Preliminary Geotechnical Investigation - Bradford Highlands Golf Course Redevelopment, Bradford, Ontario

Dear Sir:

WSP Canada Inc. (WSP) is pleased to provide our Geotechnical Investigation Report for the proposed residential development at the above noted site. The purpose of the geotechnical investigation is to identify the subsurface conditions at select borehole locations and to provide design recommendations in support of the proposed development, consisting of a total of 946 residential units and two Storm Water Management (SWM) ponds along with associated roadways and municipal servicing, as well as identify any potential constraints which may be encountered during construction.

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

Kind regards,

MLR

Nick La Posta, P.Eng. Team Lead, Ground Engineering East

FJ/kj Report ref.: 22517668

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August 2, 2023

Nick La Posta, P.Eng. Team Lead - Ground Engineering East

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# **1 INTRODUCTION**

WSP Canada Inc. (WSP) was retained by the Bradford Highlands Joint Venture (Client) to undertake a geotechnical investigation to determine the existing subsurface conditions at the site and provide geotechnical recommendations in support of the preliminary design of the proposed development, which currently consists of a total of 946 residential units, two Storm Water Management (SWM) ponds, along with associated roadways and municipal servicing, in the Bradford Highlands Golf Course, Bradford, Ontario (Site).

A previous geotechnical and hydrogeological investigation has been completed by Golder for the Site in March 2016. Details regarding the previous investigation reports are provided below.

- Golder Associates Ltd. 2017. Draft Report: Preliminary Geotechnical Investigations Bradford Highlands Golf Course Redevelopment, Bradford, Ontario. February 2017
- Golder Associates Ltd. 2018. Hydrogeological Investigations Bradford Highlands Golf Course Redevelopment, Bradford, Ontario. March 2018

Based on the conceptual plan (dated December 16, 2021) provided to our office, the proposed development will consist of a total of 946 residential units and two SWM ponds along with associated roadways and municipal servicing. It should be noted that, Golder advanced a total of nineteen (19) boreholes across the site in 2016 and at that time, the spacing of the boreholes was restricted by the active golf course.

The purpose of the current geotechnical investigation was to supplement the existing borehole information by advancing a total of eighteen (18) additional boreholes to provide sufficient borehole coverage across the site. Four additional monitoring wells were installed for long term groundwater monitoring at these specific locations.

The objective of this report is to characterize the subsurface conditions through the advancement of the eighteen (18) boreholes at the Site and to provide geotechnical recommendations for the design and construction of the proposed residential development. The hydrogeological aspects of the project will be addressed under a separate cover.

This report is provided on the basis of the terms of reference for WSP's mandate, and on the assumption that the design will be in accordance with all applicable codes, guidelines, and standards. If there are any changes in the design features relevant to the geotechnical analyses or recommendations, or if any questions arise concerning the geotechnical aspects of the codes and standards, WSP must be contacted immediately to review the design where deemed required. In some circumstances, it may be necessary to carry out additional investigations, analysis and reporting before the recommendations of this report can be relied upon.

The site investigation and recommendations of this report follow generally accepted practice for geotechnical consultants in Ontario. Laboratory testing for the most part generally follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report has been prepared for the Bradford Highlands Joint Venture and its architect and designers. Use of this report by a third party without WSP Canada Inc. written consent is strictly prohibited. The limitation conditions presented in this report form an integral part of the report. Therefore, the recommendations provided in the report must be considered in conjunction with these limitations.

# 2 SITE AND PROJECT DESCRIPTION

The project site extends from Line 6 in the north to 5<sup>th</sup> Line / Canal Road (and the associated canal) in the south, and from Brownlee Drive in the west to Inverness Way in the east, in Bradford, Ontario.

The site generally slopes from north (approximate Elevation 250 m) to south (approximate Elevation 220 m) and slopes from west (approximate Elevation 245 m – approximate Elevation 230 m) to east (approximate Elevation 235 m – approximate Elevation 220 m).

Based on information provided to our office, it is understood that the development comprises the design and construction of a total of 946 residential units and includes two SWM ponds along with associated roadways and municipal servicing. At the time of this report, the proposed design grades (i.e. finished floor elevations, pavement subgrade and utility inverts, etc.) were not available. As such, the engineering recommendation provided herein regarding geotechnical design aspects of the project should be considered preliminary in nature only.

A preliminary concept plan is attached to this report in the Figure 1-Preliminary Concept Plan, dated December 2021.

# **3 METHOD OF INVESTIGATION**

#### 3.1 AVAILABLE GEOTECHNICAL INFORMATION

In 2016, a geotechnical investigation work was completed by Golder Associated Ltd. (Golder); the investigation included advancing a total of nineteen boreholes, with ten boreholes being outfitted with monitoring wells. These boreholes were drilled to 3.5 m below existing ground surface (mbgs) to 7.3 mbgs. The approximate locations of these previous boreholes, as well as the borehole logs are provided in *Appendix A*. The subsurface soils in those previous boreholes generally consisted of topsoil and/or fill materials overlying firm to hard clayey silt to silty clay and stiff to hard glacial till. A hard sandy silt deposit was encountered in one of the borehole locations underlying the cohesive deposit.

#### 3.2 CURRENT GEOTECHNICAL INVESTIGATION

The current borehole investigation was conducted at the site between March 23 to 29, 2022. A total of eighteen boreholes (designated as BH22-01 to BH22-18) were advanced at the site. The boreholes were advanced to depths ranging between 6.2 mbgs and about 11.0 mbgs. Boreholes BH22-03, BH22-05, BH22-06, and BH22-09 were advanced within, or in proximity to, the proposed SWM ponds. The remainder of the boreholes were advanced in proximity/within the footprint of the proposed building structures. The borehole locations should be considered approximate. the borehole locations are shown on the attached *Borehole Location Plan - Figure 2*. Previously drilled borehole and monitoring well locations, are also indicated on the Borehole Location Plan (grey borehole symbols).

Drilling equipment was supplied and operated by a drilling sub-contractor under the direction and supervision of Golder's technical staff. Samples were retrieved at regular intervals with a 50 mm O.D. split-barrel sampler driven with a hammer in accordance with the Standard Penetration Test (ASTM D 1586) method. This sampling method recovers samples from the soil strata, and the number of blows required to drive the sampler a 0.3 m depth into the undisturbed soil (SPT 'N' values) gives an indication of the relative density condition or consistency of the sampled soil material. The SPT 'N' values are indicated on the attached **Borehole Log** - *Appendix A*.

Soil samples were visually classified in the field and re-evaluated by engineering personnel in our laboratory. All soil samples were tested for moisture contents. Laboratory Grain Size Analyses were carried out on representative samples and the results are provided in **Geotechnical Laboratory Test Result** - *Appendix B*.

A summary of the boreholes and monitoring wells information is presented in Table 3.1 below.

Table 3.1Borehole Elevation, Depth, and Monitoring Well Installation	able 3.1	Borehole Elevation,	Depth, and Monit	toring Well Installation	
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BOREHOLE NO.	APPROX. GROUND SURFACE ELEV. (m) BOREHOLE COORDINATES DEPTH (m)		MONITORING WELL INSTALLATION		
NO.	SURFACE ELEV. (III)	Northing	Easting	DEPTH (m)	INSTALLATION
BH22-01	237.1	4883640	613921	8.1	-
BH22-02	234.5	4883457	613966	6.2	-
BH22-03	231.5	4883181	613955	11.0	50 mm dia. monitoring well
BH22-04	229.9	4883052	614065	11.0	-
BH22-05	224.0	4882763	614075	11.0	50 mm dia. monitoring well
BH22-06	220.7	4882644	614056	11.0	50 mm dia. monitoring well
BH22-07	229.1	4882740	613889	8.0	-
BH22-08	228.1	4882862	613947	8.0	-
BH22-09	231.6	4883030	613927	11.0	50 mm dia. monitoring well
BH22-10	238.3	4883347	613849	8.0	-
BH22-11	241.9	4883581	613829	8.0	-

BOREHOLE APPROX. GROUND NO. SURFACE ELEV. (m)		-	HOLE INATES		MONITORING WELL INSTALLATION
NO.	SURFACE ELEV. (m)	Northing	Easting	DEPTH (m)	INSTALLATION
BH22-12	213.2	4883516	613608	8.0	-
BH22-13	241.6	4883307	613701	8.0	-
BH22-14	242.8	4883207	613647	8.0	-
BH22-15	235.6	4883102	613793	8.0	-
BH22-16	238.9	4882952	613636	8.0	-
BH22-17	219.9	4882531	613929	8.0	-
BH22-18	232.4	4882455	613650	8.0	-

Water level observations were made during the drilling and in the open boreholes upon the completion of drilling operations. Monitoring wells were installed at four borehole locations, WSP Golder's technical staff returned to the site subsequent to the drilling operations to obtain groundwater levels at the site. The groundwater levels in the monitoring wells were measured on April 26, 2022. These data are summarized at the bottom of the borehole log sheets and also in **Table 4.7**.

The boreholes were staked in the field by WSP Golder's technical staff and the ground surface elevations and coordinates at the borehole locations were surveyed using a Trimble GPS; as such these elevations and coordinates are for the purpose of engineering analysis herein only and should be considered approximate. Contractors performing any work referenced to the borehole elevations should confirm the borehole elevations for their work.

### 3.3 GEOTECHNICAL LABORATORY TESTING

Representative samples were selected for geotechnical index testing. The testing program consisted of the measurement of the natural moisture content of all available soil samples, grain size analyses on eleven (11) selected samples, consistency (Atterberg) limits for nine (9) soil samples. Test results are shown on the individual borehole logs presented in **Borehole Log** - *Appendix A*. The grain size analysis curves and results of the consistency (Atterberg) limit tests are attached to this report in **Geotechnical Laboratory Test Result** - *Appendix B*.

# **4** SUBSURFACE CONDITIONS

Based on the OGS Earth Quaternary Geology GIS map of Ontario issued by Ministry of Northern Development and Mines, the Site is situated within coarse-textured glaciolacustrine deposits consisting of sand, gravel including minor silt and clay, foreshore and basinal deposits; and till consisting of sandy silt to silty sand textured till on paleozoic terrain.

Based on the results of the field investigation, the subsurface conditions at the borehole locations generally comprised a topsoil overlying cohesive deposit (silty clay to clay and silt) and the cohesive deposit is underlain by a glacial till (clayey sandy silt to clayey silty sand and sand and silt) and non-cohesive deposit (silty sand to sand).

For details of the subsurface conditions encountered at the borehole locations, reference should be made to the individual borehole log sheets presented in **Borehole Log** - *Appendix A* and the associated laboratory test results in *Appendix B*. The properties of the soil types encountered at the boreholes are described briefly in the following sections.

#### 4.1 TOPSOIL

Topsoil was encountered in each of the boreholes advanced within the property boundary. The recorded approximate topsoil thicknesses at the borehole locations are summarized in **Table 4.1** below.

BOREHOLE NO	APPROX. TOPSOIL THICKNESS (mm)	BOREHOLE NO	APPROX. TOPSOIL THICKNESS (mm)
BH22-01	500	BH22-10	400
BH22-02	400	BH22-11	450
BH22-03	500	BH22-12	600
BH22-04	300	BH22-13	510
BH22-05	450	BH22-14	510
BH22-06	450	BH22-15	410
BH22-07	250	BH22-16	200
BH22-08	300	BH22-17	300
BH22-09	450	BH22-18	610

#### Table 4.1 Topsoil Thickness

It should be noted that topsoil quantities should not be calculated from the borehole information, as large variations in depth may exist between boreholes. A detailed topsoil layer thickness survey is required to determine an accurate evaluation of quantity.

### 4.2 COHESIVE DEPOSITS - SILTY CLAY TO CLAY AND SILT

Native cohesive deposits were encountered in all of the boreholes beneath the topsoil except boreholes BH22-05 and BH22-16. These cohesive deposits ranged between brown to grey silty clay to clay and silt with trace to some sand and trace gravel. The in-situ water contents of this deposit were variable and ranged between drier than the plastic limit to wetter than the plastic limit. The cohesive deposit extended to depths ranging between 2.1 mbgs and 5.5 mbgs. The native cohesive deposits were generally interlayered with the glacial till encountered at the site.

The measured SPT 'N' values in the cohesive deposits ranged between 4 blows to greater than 50 blows per 0.3 m of penetration, suggestive of a soft to hard consistency. The natural moisture contents, as determined by laboratory tests, ranged approximately from 10% to 13%.

Three (3) laboratory particle size distribution analyses were conducted on selected samples obtained from the cohesive deposits. Test results are provided in **Table 4.2**, according to the Unified Soil Classification System (USCS), and are shown on the borehole logs in *Appendix A*. The particle size distribution curves are provided in *Appendix B*.

	SAMPLE DEPTH		PTH SOIL -		GRAIN SIZE	DISTRIBUTI	ON
BOREHOLE NO.	NO.	(mbgs)	DESCRIPTION	% GRAVEL	% SAND	% SILT	% CLAY
BH22-4	SS6	4.6-5.1	Sandy silt and clay, trace gravel 7.9 25.9		66	5.2	
BH22-08	SS4	2.3-2.8	Clay and silt, some sand, trace gravel	1.6	11	37.9	49.5
BH22-13	SS3	1.5-1.9	Sandy clayey Silt, trace gravel	3.5	27.5	38.1	30.9
BH22-17	SS3	1.5-1.9	Silty clay, trace sand	0.0	0.8	32.5	66.7

Table 4.2	Grain Size Distribution for cohesive deposits
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Three Atterberg Limit tests were carried out on the above-noted samples from borehole BH22-08, BH22-13, and BH22-17. The results are summarized in **Table 4.3** and are shown on the borehole logs in *Appendix A*. A plasticity chart with the test results is provided in *Appendix B*.

BOREHOLE NO.	SAMPLE NO	DEPTH (mbgs)	SOIL DESCRIPTION	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)
BH22-08	SS4	2.3-2.8	Clay and silt, some sand, trace gravel	26	16	10
BH22-13	SS3	1.5-1.9	Sandy clayey Silt, trace gravel	20	13	7
BH22-17	SS3	1.5-1.9	Silty clay, trace sand	30	18	12

Table 4.3	Atterberg Limits for cohesive deposits
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#### 4.3 GLACIAL TILL

A variable glacial till was encountered in all boreholes except BH22-07 and BH22-08. The till was generally interlayered with the non-cohesive and cohesive deposits. The till ranged between brown to grey non-cohesive till (sand and silt to sandy silt with some clay and trace gravel) to cohesive till (clayey sandy silt to clayey silty sand with some sand and trace gravel). The water contents of this layer were variable from drier than the plastic limit to wetter than plastic limits. This deposit was encountered at a depth ranging between 2.8 mbgs and 5.5 mbgs and extended to depths ranging between 5.5 mbgs to 11.1 mbgs (termination depth in boreholes BH22-02, BH22-04, BH22-05, BH22-06, BH22-09, BH22-12, BH22-13, BH22-14, BH22-16, and BH22-17).

The measured SPT 'N' values in the non-cohesive till deposits ranged between 23 blows to greater than 50 blows per 0.3 m of penetration, indicating that the non-cohesive till deposits were generally compact to very dense.

The measured SPT 'N' values in the cohesive till deposits ranged between 15 blows to greater than 50 blows per 0.3 m of penetration, indicating of a very stiff to hard consistency.

The natural moisture contents, as determined by laboratory tests, ranged approximately from 7% to 22%.

Laboratory particle size distribution analyses were conducted on six selected samples obtained from the glacial till. Test results are provided in **Table 4.4**, according to the Unified Soil Classification System (USCS), and are shown on the borehole logs in *Appendix A*. The particle size distribution curves are provided in *Appendix B*.

BOREHOLE NO.	SAMPLE	AMPLE DEPTH SOIL GRAI				IN SIZE DISTRIBUTION			
BOREHOLE NO.	NO.	(mbgs)	DESCRIPTION	% GRAVEL	% SAND	% SILT	% CLAY		
BH22-2	SS4	2.3-2.8	Clayey sandy silt, trace gravel	1.6	25.9	38.3	34.2		
BH22-3	SS8	7.6-8.0	Sandy silt and clay till, trace gravel	3.8	27	34.5	34.7		
BH22-5	SS5	3.1-3.4	Silty clay, trace sand, trace gravel	2.4	5	34.6	58		
BH22-6	SS8	7.6-8.0	Clayey silt, some sand, trace gravel	1.8	17.2	48.1	32.9		
BH22-12	SS4	2.9-2.8	Sand and silt, some clay, trace gravel	1.8	48.1	35.6	14.5		
BH22-18	SS5	3.1-3.5	Clayey silty sand, trace gravel	2.9	42.1	34.9	20.1		

Atterberg Limit testing was carried out on the above-noted samples from boreholes BH22-2, BH22-3, BH22-5, BH22-6, BH22-12 and BH22-18. The results are summarized in **Table 4.5** and are shown on the borehole logs in *Appendix A*. The results indicated that the sand and silt from BH22-12 was non-plastic, in accordance with the Canadian Foundation Engineering Manual (2006). A plasticity chart with the test results is provided in *Appendix B*.

BOREHOLE NO.	SAMPLE NO.	DEPTH (mbgs)	SOIL DESCRIPTION	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)
BH22-2	SS4	2.3-2.8	Clayey sandy silt, trace gravel	20	12	8
BH22-3	SS8	7.6-8.0	Sandy Silt and Clay till, , trace gravel	18	11	7
BH22-5	SS5	3.1-3.4	Silty clay, trace sand, trace gravel	26	16	10
BH22-6	SS8	7.6-8.0	Clayey silt, some sand, trace gravel	19	12	7
BH22-12	SS4	2.9-2.8	Sand and silt, some clay, trace gravel	NP	NP	NP
BH22-18	SS5	3.1-3.5	Clayey silty sand, trace gravel	16	12	4

Table 4.5 Atterberg Limits for Glacial Till

**Grain Size Distribution for Glacial Till** 

Table 4.4

#### 4.4 NON-COHESIVE DEPOSITS – SILTY SAND TO SAND

A brown to grey native non-cohesive deposits were encountered below the topsoil, glacial till and silty clay in boreholes BH22-01, BH22-03, BH22-05, BH22-07, BH22-08, BH22-10, BH22-11, BH22-15, BH22-16 and BH22-18 respectively. This soil layer ranged between sandy silt and clay to sand material and generally moist to wet at the time of investigation. This soil layer was encountered at a depth ranging between 0.2 mbgs and 10.7 mbgs and extended to the depth ranging between 0.6 mbgs and termination depth in boreholes BH22-01, BH22-03, BH22-07, BH22-08, BH22-10, BH22-10, BH22-15, and BH22-18 respectively.

The measured SPT 'N' values in the non-cohesive deposits ranged from 8 blows to greater than 50 blows per 0.3 m of penetration, indicating that the non-cohesive deposits were generally loose to very dense. Based on the laboratory test, the natural moisture content of this non-cohesive deposits ranged between 7.0% and 24%.

Two (2) laboratory particle size distribution analyses were conducted on selected sample obtained from noncohesive deposits. Test results are provided in **Table 4.6**, according to the Unified Soil Classification System (USCS), and are shown on the borehole logs in *Appendix A*. The particle size distribution curves are provided in *Appendix B*.

BOREHOLE NO.	SAMPLE	DEPTH	SOIL	SOIL GRA		RIBUTION	
BOREHULE NO.	NO.	(mbgs)	DESCRIPTION	% GRAVEL	% SAND	% SILT	% CLAY
BH22-5	SS3	1.5-1.9	Sand, some silt and clay, trace gravel	6.3	73.9	19	.8

 Table 4.6
 Grain Size Distribution for non-cohesive deposits

#### 4.5 GROUNDWATER

Groundwater (free water) and caving were noted in some boreholes advanced at the site during the investigation immediately upon completion of drilling. Monitoring wells were installed in four boreholes. The groundwater levels in monitoring wells were recorded on April 26, 2022.

A summary of the groundwater levels measured in the monitoring wells installed at the site is provided below in **Table 4.7**; Minimum and maximum groundwater levels recorded in the monitoring wells, are indicated in **red** in the table below.

BOREHOLE	DATE	BH ELEVATION (masl)	GROUNDWATER DEPTH (mbgs)	GROUNDWATER ELEVATION (masl)	MEASUREMENT SOURCE
BH22-03	April 26, 2022	231.5	-	-	**Monitoring Well
BH22-05	April 26, 2022	224.0	<u>0.2</u>	223.8	Monitoring Well
BH22-06	April 26, 2022	220.7	0.3	220.4	Monitoring Well
BH22-09	April 26, 2022	231.6	0.9	230.7	Monitoring Well
*BH2	Dec 8, 2016	242.46	3.4	242.3	Monitoring Well
*BH3	Dec 8, 2016	242.56	3.4	241.9	Monitoring Well
*BH5	Dec 8, 2016	244.76	3.2	244.9	Monitoring Well
*BH8	Sep 23, 2016	234.42	1.5	235.1	Monitoring Well
*BH11	Dec 8, 2016	226.23	<u>4.4</u>	229.2	Monitoring Well
*BH14	Dec 8, 2016	218.88	0.2	220.2	Monitoring Well
*BH16	Dec 8, 2016	230.16	4.0	227.6	Monitoring Well
*BH18	Dec 8, 2016	236.05	1.3	235.7	Monitoring Well

Table 4.7Groundwater and Caving Observation

\* Groundwater level data from previous field investigation conducted in 2016.

\*\* Water was at the top of casing and unable to read water level from monitoring well on April 26, 2022.

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

# 5 PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

The following sections provide geotechnical design recommendations for the proposed residential development at the aforementioned site based on the information obtained from the borehole investigation and laboratory testing, which we believe fairly represents the subsurface conditions of the Site. These recommendations are intended for the guidance of the design engineer to establish constructability and should not be construed as instructions to contractors. If significant differences in the subsurface conditions described above are found, we request to be contacted immediately to review and revise our findings and recommendations, if necessary.

The construction methods described in this report must not be considered as being specifications or recommendations to the prospective contractors, or as being the only suitable methods. Prospective contractors should evaluate all of the factual information, obtain additional subsurface information as they might deem necessary and should select their construction methods, sequencing and equipment based on their own experience in similar ground conditions. The readers of this report are also reminded that the conditions are known only at the borehole locations and in view of the spacing of the boreholes, conditions may vary significantly between boreholes.

### 5.1 SITE BACKGROUND

Based on the concept plan provided to our office the proposed development is comprised of:

- 946 units of single detached, semi detached and townhouses, each two to three storeys in height;
- Two Storm Water Management (SWM) Ponds in the southeast portion of the site; and,
- Associated driveway/parking areas and municipal servicing.

Design details for the proposed building structures, such as underside of footing elevations, were not available at the time when this report was prepared. Based on discussions with the client, it is understood that one level of basement is to be constructed for the majority of the buildings at the Site. A preliminary concept plan is attached to this report in the Figures section (**Preliminary Concept Plan, dated December 16, 2021**).

#### 5.2 OVERVIEW OF SUBSURFACE CONDITIONS

Based on the results of the field investigation, the subsurface conditions consist of topsoil overlying soft to hard cohesive deposits (silty clay to clay and silt); the cohesive deposits are underlain by compact to very dense and very stiff to hard glacial till (clayey sandy silt to clayey silty sand and sand and silt) and loose to very dense non-cohesive deposits (silty sand to sand).

Based on the groundwater levels recorded in the monitoring wells, groundwater was observed at depths ranging between 0.2 m and 4.4 mbgs (between approximately Elevation 223.8 m and 229.2 m) and it should be noted that, groundwater was observed at the surface of the borehole BH22-03 close to the ground surface elevation.

#### 5.3 SITE PREPARATION AND GRADING

The details of site grading were not yet available at the time of this report writing. However, it is anticipated that the site will require some regrading as part of the redevelopment of the site. As indicated above, the surface of the majority of the boreholes encountered topsoil.

Removal of all topsoil /reworked soils will be required to facilitate the proposed development on the site. It is recommended that a topsoil test pit program be completed at the site by WSP prior to construction to refine the topsoil thicknesses across the site. Regarding the reuse of the site topsoil, the topsoil may be reused in landscaping applications or other non-structural fill applications. WSP should be contacted to review all proposed topsoil reuse on site.

Subsequent to the completion of the required stripping and removal of unsuitable materials, the sub-grade should be proof-rolled and inspected by experienced WSP geotechnical engineering personnel. The proof-rolling and compaction of the exposed sub-grade is recommended to be conducted using a vibratory compactor with a minimum static weight of ten (10) tonnes. The proof-rolling program should consist of a minimum of six (6) passes per unit area and be tested to assure that the sub-grade is compacted to a minimum of 100% of the exposed material's Standard Proctor Maximum Dry Density (SPMDD). Any loose/soft or wet areas identified at the time of proof-rolling that cannot be uniformly compacted are recommended to be sub-excavated and backfilled with approved engineered fill consistent with the recommendations provided in *Engineered Fill - Appendix C*.

Based on the measured natural water contents, the majority of the native tills deposits are generally expected to have moisture contents within an acceptable range of the estimated optimum water contents for compaction. The non-cohesive subsoils are generally wetter than their estimated optimum water contents for compaction; in addition, the near-surface loose/soft silty/clayey soils (i.e. silty clay to silty sand and sand) are expected to be generally wetter than their estimated optimum water contents for compaction; then their estimated optimum water contents for compacting prior to being reused as engineered fill. The clayey soils may be difficult to be adequately dried by aeration and should, therefore be considered for reuse as non-structural fill (i.e. in landscaping areas). Experience also indicates that clay fills, even when adequately compacted have a tendency to settle over a long period of time. It should also be noted that due to the fine-grained nature of the soils encountered at the site, their workability is sensitive to moisture conditions and some difficulty would be expected in achieving adequate compaction during wet weather. In this regard, imported materials may have to be used for engineered fill subject to the approval of WSP at the source(s), prior to hauling them to the site.

Where engineered fill is required to develop the design grades and elevations or for use in backfilling excavations created through the removal of unsuitable materials or soils as described above, the excavated on-site materials may be re-used, subject that these are free of organic and other unsuitable materials and have appropriate moisture content. Boulders or cobbles greater than 200 mm in size should be removed from the fill.

Alternatively, Ontario Provincial Standard Specification (OPSS) Granular B – Type I, OPSS Select Subgrade Material (SSM) or approved equal may be used.

All fill materials imported to the site must meet all applicable municipal, provincial and federal guidelines and requirements associated with environmental characterization of the materials.

Engineered fill is to be placed in maximum 200 mm thick loose lifts under full time supervision of qualified geotechnical personnel. Each lift is to be uniformly compacted to achieve a minimum of 100% of the material's SPMDD. Additional information related to the placement and compaction of engineered fill can be found in *Engineered Fill - Appendix C*.

In any areas where fill depths of greater than 1 m will be placed, WSP should review these areas to determine the potential for long-term consolidation settlement in areas where soft / firm cohesive soils are located. As such it is recommended that WSP complete an overall review of the proposed grading once the site grading plans are available.

#### 5.4 PRELIMINARY FOUNDATION RECOMMENDATIONS

Details of the proposed residential development such as underside of footing elevations were not available at the time when this report was prepared. When this information is available, the recommendations provided below should be reviewed by WSP to confirm that the recommendations are still valid based on the design information.

Based on discussions with the client, it is understood that one level of basement will be constructed for the residential structures at the Site and the finished basement floor will be at about 3.0 m below final site grades.

Based on the soil conditions encountered in the boreholes and provided that the site is prepared in accordance with the recommendations presented in this report, the proposed buildings may be supported with conventional spread and strip footings that are founded directly on the competent, native and undisturbed deposits. These footings may be designed based on a preliminary factored ultimate geotechnical resistance at Ultimate Limit States (ULS) of 200 kPa. A preliminary serviceability geotechnical resistance at Serviceability Limit States (SLS) of 130 kPa may be used in the design of the foundations.

When the engineered fill is completed in accordance with the requirements provided in *Appendix C*, footings may be designed based on a preliminary factored ultimate geotechnical resistance at Ultimate Limit States (ULS) of

150 kPa. A preliminary serviceability geotechnical resistance at Serviceability Limit States (SLS) of 100 kPa may be used in the design of the foundations.

We note that in some areas of the site, relatively shallow, soft to firm cohesive soils were encountered which are unsuitable for structural support. These areas will require subexcavation and replacement with engineered fill or granular materials.

Foundations designed to the specified bearing capacities at the serviceability limit states (SLS) are expected to settle less than 25 mm total and 19 mm differential.

#### 5.4.1 GENERAL FOUNDATION COMMENTS

All footings exposed to seasonal freezing conditions should be provided with at least 1.5 m of earth cover or equivalent thermal insulation against frost. It is recommended to keep footings as high as possible to avoid or minimize penetration below groundwater levels while considering the minimum frost cover requirement.

Variations in the soil conditions are expected in between the borehole locations, and during construction, the geotechnical resistances should be confirmed by experienced WSP site personnel.

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 foundations.

The non-cohesive soils at the base of footings can be easily disturbed by construction machinery and foot traffic or lose their strength in contact with surface water. We recommend that an allowance be made for placing a 50 mm thick skim coat of low-strength concrete on the founding subgrade immediately after its approval, to prevent its disturbance by construction activities and from ground or surface water, where necessary.

During winter construction, foundations and slab on grades must not be poured on frozen soil. Foundations must be adequately protected at all times from cold weather and freezing conditions.

In the vicinity of the existing buried utilities, all footings must be lowered to undisturbed native soils, or alternatively the services must be structurally bridged.

It should be noted that the recommended geotechnical resistances have been calculated by WSP from the borehole information for the preliminary design stage only. Additional input may be required as new design information becomes available and is refined. For example, more specific information is available with respect to conditions between boreholes when construction is underway. In this regard, 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.

### 5.5 FLOOR SLAB CONSTRUCTION AND DRAINAGE

The floor slabs can be a slab-on-grade supported on either competent native soils or engineered fill, provided disturbed, softened or loose native soils are removed and the base thoroughly inspected by a WSP geotechnical engineer and proof-rolled before placing granular base materials. Any fill required to raise the grade below the floor slab can consist of inorganic soil, placed in shallow lifts and compacted to 98 percent of its Standard Proctor Maximum Dry Density (SPMDD).

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

A review of the slab elevations should be completed once site grading information is available to determine the potential need for a perimeter and/or underfloor drainage system.

#### 5.6 LATERAL EARTH PRESSURES PARAMETERS

The lateral earth pressure for the design of retaining walls, foundation walls, shoring, or trench boxes can be estimated from the following expressions:

Above groundwater table:  $p = K (\gamma z + q)$ 

Where:

- p = Lateral earth and water pressure in kPa acting at depth z;
- z = Depth below ground surface, in meters;
- $K = Active earth pressure coefficient, (K_a);$
- $\gamma$  = Unit weight of soil above groundwater table, in kN/m<sup>3</sup>;
- $\gamma_1$  = Submerged unit weight of soil below water table;
- h = Thickness of soil above groundwater table, in meters;
- q = Value of Surcharge (kPa);
- $p_w$  = Hydrostatic water pressure

The suggested soil parameters (unfactored) for the retaining wall design and/or ground support systems are summarized in **Table 5.1**. The suggested soil parameters are based on SPT N-values, soil laboratory test results and supplemented by the judgement based on local and regional experience with these soil types.

SOIL TYPE	NE GRAN FII	ULAR	NON-COHESIVE NATIVE SOILS (INCLUDING NON-COHESIVE TILL)			COHESIVE NATIVE SOILS (INCLUDING COHESIVE TILL)				UDING	
SPT 'N'	'A'	'B'	15-29	30-39	40–50	>50	3-9	10-14	15-29	30-50	>50
Unit weight (kN/m <sup>3</sup> )	22	21	21	21	22	22	18	20	21	21	22
Effective angle of internal friction (°), ¢'	35	32	30	32	34	35	26	28	30	32	34
Effective cohesion, c' (kPa)	-	-	-	-	-	-	0	2	5	10	10
Undrained shear strength (kPa) (**)	-	-	-	-	-	-	40	75	100	200	250
Coefficient of lateral earth pressure											
Active, Ka	0.27	0.31	0.33	0.31	0.28	0.27	0.39	0.36	0.33	0.31	0.28
At rest, Ko	0.43	0.47	0.50	0.47	0.44	0.43	0.56	0.53	0.50	0.47	0.44
Passive, K <sub>p</sub>	3.69	3.25	3.00	3.25	3.54	3.69	2.56	2.77	3.00	3.25	3.54

Table 5.1 Recommended Unfactored Soil Parameters

Backfilling of the footing wall excavations is recommended to be placed in 200 mm thick lifts, uniformly compacted to 100% SPMDD to proposed sub-grade elevations.

#### 5.7 TEMPORARY EXCAVATIONS

The details for the proposed services installations are not available at the time of preparing this report. The recommendations provided below assume that conventional depths for services will be carried out (approximately 3 mbgs to 5 mbgs).

Based upon the subsurface conditions at the borehole locations, excavations can be carried out with heavy hydraulic back-hoes. It is recommended that provision be carried in the contract for the excavation and disposal of obstructions on site, including cobbles and boulders within the till deposits.

All temporary excavations must be carried out in accordance with the Occupational Health and Safety Act (OHSA). The firm to hard cohesive and compact to very dense native non-cohesive deposits can be classified as Type 3 soils above the groundwater table and Type 4 below the groundwater table. Soft / loose soils can be classified as Type 4 soils. For excavations through multiple soil types, the side slope geometry is governed by the soil with the highest number Type designation.

Temporary excavation walls should not exceed 3.0 horizontal to 1.0 vertical (3H:1V) and 1.0 horizontal to 1.0 vertical (1H:1V) in Type 4 and 3 soils, respectively. All excavated spoil should be placed at least the depth of the trench away from the edge of the trench for safety reasons.

#### 5.8 GROUNDWATER CONTROL

Groundwater was encountered in most of the boreholes after the completion of drilling and varied in depth as measured in the monitoring wells (April 26, 2022). Based on these observations and the previous field investigation conducted by Golder (2016), groundwater in the project area is anticipated to be generally between 0.2 m and 4.4 m below ground surface (mbgs). The ground water levels, and caving depths are provided in Table 4.7. As noted above, groundwater levels can vary between borehole / monitoring well locations and are subject to seasonal fluctuations in response to major weather events.

Where excavations are completed for the proposed work, it is assumed that excavations will need to be extended below the groundwater table in many areas of the site. As such, it is likely that dewatering will be required at the site and an Environmental Activity and Sector Registry (EASR) or a Permit to Take Water (PTTW) will be required for the excavations along specific areas of the proposed roadway alignment. Daily water takings of 50 m<sup>3</sup>/day require registration of the MECP EASR database, and daily water takings of 400 m<sup>3</sup>/day require a PTTW. Both the EASR and the PTTW require a hydrogeological assessment report to support the specific application. In addition, a permit to discharge the collected water to the sewer system/water body will be required from the applicable agency. A PTTW application requires a minimum of 90 days for the MOECC to process; in this regard, appropriate lead time should be factored into the overall project schedule to accommodate the PTTW process, if required. Additional detailed information will be provided within our hydrogeological report, which will be provided under a separate cover.

In any areas requiring dewatering, the groundwater table must be lowered a minimum of one (1) meter below the lowest excavation level. A specialized dewatering contractor should be retained to design and install the dewatering system.

In order to minimize predictable water issues and costs, it is recommended that excavation and in-ground construction be performed in drier seasons.

## 5.9 PIPE BEDDING AND COVER

The native subsoils are considered to be suitable for supporting the pipes, provided the integrity of the base can be maintained during construction. It should be noted that some difficulty may be encountered in excavating very dense/hard glacial till at some locations. In addition, the tills are glacially derived and as such, should be expected to contain cobbles and/or boulders.

The soils above the groundwater level, or properly dewatered if encountered below the groundwater level, will provide adequate support for the sewer pipes and allow the use of normal Class B type bedding. The recommended minimum thickness of granular bedding below the invert of the pipes is 150 mm. The thickness of the bedding may, however, must be increased depending on the pipe diameter or in accordance with local standards or if wet or weak subgrade conditions are encountered, especially when the soil at the trench base level consists of wet, dilatant silt.

The bedding material should consist of well graded granular material such as Granular 'A' or equivalent. The bedding material should be compacted to at least 98 percent of its SPMDD. After installing the pipe on the bedding, a granular surround of approved bedding material, which extends at least 300 mm above the obvert of the pipe, or as

set out by the local authority or municipality, should be placed. It is recommended that WSP be on site during excavations to assess the suitability of the subgrade materials to support the pipes.

If localized wet trench conditions are encountered, a uniformly graded clear stone may be used provided a suitable, approved filter fabric (geotextile) is placed in conjunction with the clear stone. The geotextile must extend underneath the clear stone, along the sides of the trench, and wrapped on top of the clear stone such that the clear stone is fully wrapped by the geotextile. A minimum geotextile overlap of 1 m is required; alternatively stitching of the geotextile could be considered. WSP should be on site on a full-time basis if this method is being considered.

Localized, wet and unstable soils encountered within generally stable soil zones can be generally stabilized by 'punching' a 50 mm well graded crusher run limestone pad into the soft subgrade prior to bedding placement. The thickness of the 'pad' will depend on field conditions and should be examined by WSP personnel during the construction operations.

#### 5.10 TRENCH BACKFILL

The excavated native soils can be used as construction backfill provided their moisture content at the time of placement is within 2% of the optimum moisture content. Boulders or cobbles greater than 200 mm in size should be removed from the trench backfill.

For the non-cohesive soils, smooth drum type vibratory rollers are recommended. Cohesive soils should be compacted with sheepsfoot type vibratory compactors. The trench backfill should be placed in maximum 0.3 m lift thickness and compacted to at least 98 percent of its SPMDD. Trench backfilling operations should be avoided during freezing weather.

It is preferable that the native soils be re-used from approximately the position at which they are excavated so that frost response characteristics of the soils after construction remain essentially similar. If required, consideration may also be given to backfilling trenches with a well graded, compacted granular soil such as Granular 'B' material.

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 the compaction requirements noted above. Stockpiles should therefore be covered with tarpaulins to help minimize moisture increases.

#### 5.11 STORMWATER MANAGEMENT (SWM) POND

Based on the concept plan provided to our office, two SWM Ponds (**Pond#1 near Block 639** and **Pond#2 near Block 638**) are proposed as part of this development at the southeast portion of the site. At the time of this report, design details were not available for the SWM Pond (i.e. design grades, normal water level, side slopes, etc.). In this regard the recommendations below should be considered preliminary in nature.

The proposed pond elevations and the approximate existing ground surface elevations at the locations of the boreholes are summarized in the following table:

SWM POND NO.	BH NO.	EXISTING GROUND SURFACE ELEVATIONS AT BH LOCATION (m)	GROUNDWATER ELEVATION (MASL) (APRIL 26, 2022)
D 1//1	BH22-03	231.5	231.4*
Pond #1	BH22-09	231.6	230.7
Pond #2	BH22-05	224.0	223.8
Pond #2	BH22-06	220.7	220.4

\* Groundwater observed in monitoring well to be at the top of the casing (relatively level with the existing grade)

Boreholes BH22-03 and BH22-09 were advanced in proximity to/within the footprint of the proposed SWM Pond **1**. The subsurface conditions at these two boreholes comprise surficial topsoil overlying silty clay to a depth ranging between 3.1 mbgs and 6.1 mbgs respectively; the silty clay was underlain by clayey silt till and silty sand to the termination depth of about 11.0 mbgs. Groundwater levels are indicated in the table above.

Boreholes BH22-05 and BH22-06 were advanced in proximity to/within the footprint of the proposed SWM Pond **2**. The subsurface conditions at these boreholes comprise surficial topsoil overlying non-cohesive deposits (silty sand to sand) and cohesive deposits (silty clay) to a depth ranging between 2.7 mbgs and 6.1 mbgs; the non-cohesive and cohesive deposits were underlain by glacial till (clayey silt to sandy clayey silt) to the termination depth of about 11.0 mbgs. Groundwater levels are indicated in the table above.

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

Based on the subsurface conditions encountered in the boreholes within the proposed ponds footprint, excavation depths for the proposed ponds are expected within the glacial tills. In one borehole (Borehole BH22-05), non-cohesive sands were encountered underlying the topsoil and extended to a depth of 2.7 mbgs. As relatively high groundwater was measured in the monitoring wells with the SWM Ponds, groundwater control will likely be required during the pond excavation.

A preliminary review of the encountered cohesive soils, (cohesive deposits and cohesive till deposits) including the laboratory results, indicate that these materials have relatively low permeabilities and as such, a SWM Pond liner may not be required to be constructed at the SWM Pond locations. As noted above, a sand deposit was encountered at a relatively shallow depth in Borehole BH22-05; in this regard, some areas of the SWM Ponds may require for a hydraulic barrier to be constructed in select areas of the SWM Pond footprints.

It is noted that design drawings are not available for the SWM Ponds at this time. It is strongly recommended that when these drawings become available, that a complete review of the SWM pond design from a geotechnical perspective be completed. In particular, it is noted that the groundwater level in Borehole BH22-03 was noted to be at grade (and possibly above grade) during the April 26, 2022, visit; it will be critical to review the SWM Pond depth(s) as input toward potential basal instability / aquifer depressurization both during construction, and during long-term maintenance activities.

#### 5.12 PRELIMINARY PAVEMENT DESIGN

Based on the borehole results, the subgrade for the pavement structure will generally comprise competent highly frost susceptible variable glacial till and both cohesive and non-cohesive deposits- and potentially engineered fill (depending on site grading). Prior to placing any granular material, the exposed subgrade should be prepared and heavily proof-rolled under the supervision of the geotechnical engineer. Remedial work should be carried out on any disturbed, softened or poorly performing zones, as directed by the geotechnical engineer. The recommended preliminary pavement design for this proposed redevelopment is outlined below and is consistent with Town of Bradford Standards.

N/A T	TEDIAI	THICKNESS OF PAVEMENT ELEMENTS (mm)		
MAI	MATERIAL		Arterial Road	
Asphaltic Material	HL3 Surface	40	40	
(OPSS 1150)	HL8 8 Binder	50	100	
Granular Material	Granular A Base	150	150	
(OPSS 1010	Granular B Subbase	375	450	
Total Pavemen	t Thickness (mm)	615	740	
		Over Prepared and	Approved Subgrade	

Granular materials should be uniformly compacted to 100 percent of the Standard Proctor Maximum Dry Density (SPMDD). The asphalt materials should be compacted to between 92.0 and 96.5 percent of their Marshall Maximum Relative Densities (MRDs), as measured in the field using a nuclear density gauge.

It should be noted that the pavement structure provided above is not intended to support heavy construction traffic. In this regard, heavy construction traffic, including triaxials, graders, etc., should be limited to areas of the site where suitable temporary access roads have been constructed so that disturbance to the native soils will be

minimized. The contractor should be responsible for determining the locations of, and constructing, these temporary access roads.

WSP should provide additional design recommendations regarding the pavement design once final grades have been determined and traffic data is provided.

#### 5.13 DESIGN REVIEW, TESTING AND INSPECTIONS

WSP requests to be afforded the opportunity to complete a final review of the proposed development discussed in this report to verify that geotechnical recommendations are appropriate. If not given this opportunity, we cannot assume liability for omissions, misinterpretations or deficiencies in our recommendations.

WSP should be contacted to provide geotechnical testing and inspections during construction operations. Exposed subgrade soils for all structures are to be inspected to confirm the material is stable and competent. Inspections of seepage and groundwater conditions during construction are also required, as discussed in this report. Testing and inspections for general QA/QC are to include sampling and laboratory testing of fill materials and asphalt, compaction testing for the placement of fill materials and asphalt, and field and laboratory testing of concrete (including mix design reviews).

# 6 LIMITATIONS OF REPORT

This report is intended solely for the Bradford Highlands Joint Venture. The material in it reflects our best judgment in light of the information available to WSP at the time of preparation. Unless otherwise agreed in writing by WSP, 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.

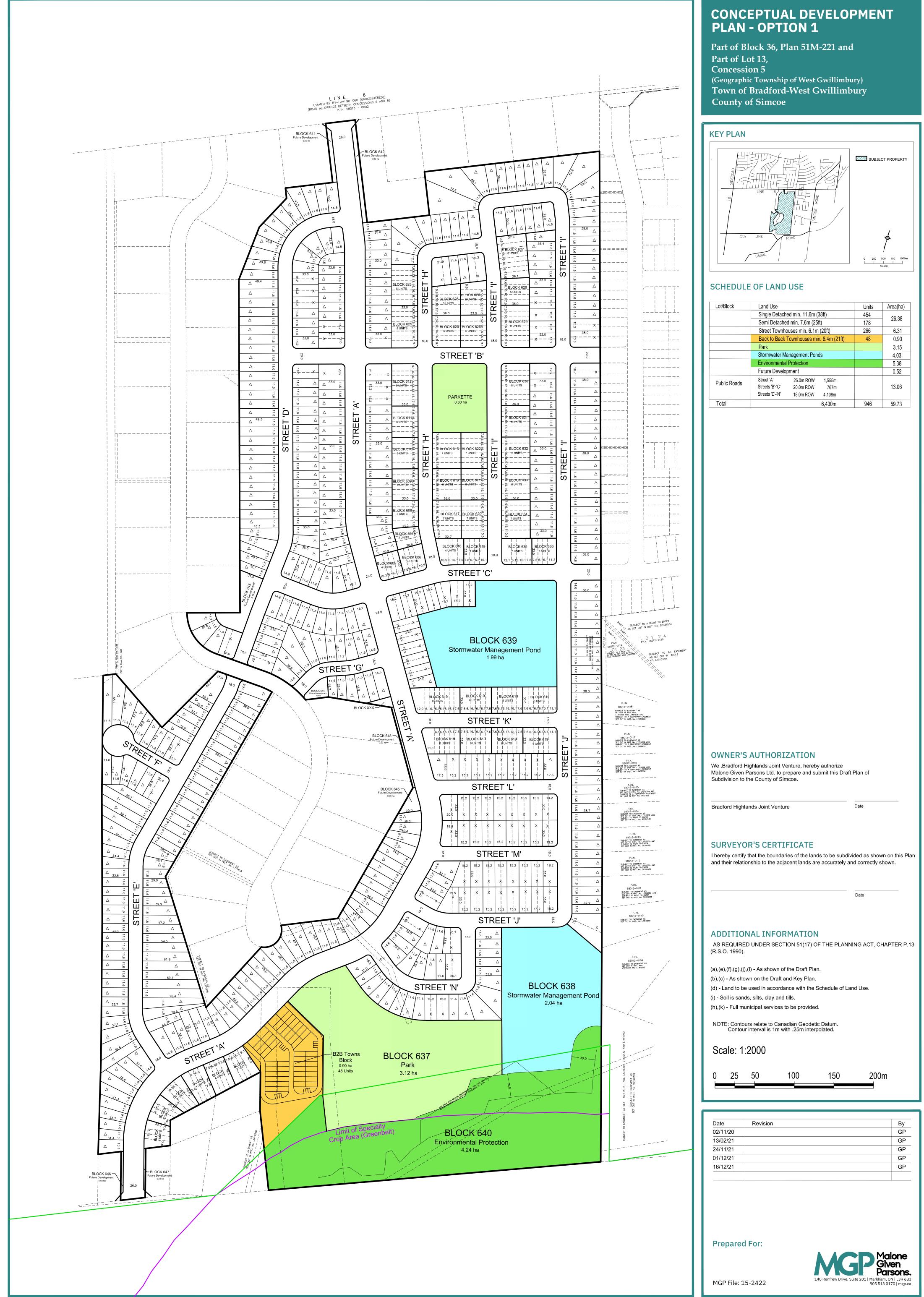
The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the 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.

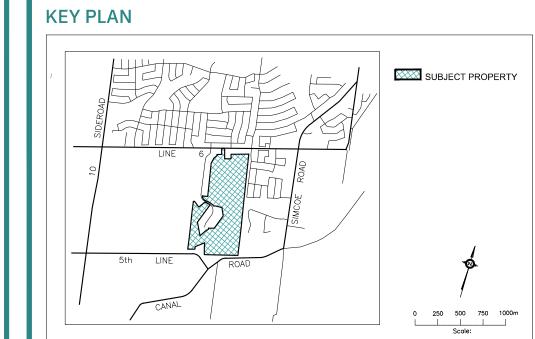
The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report.

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.

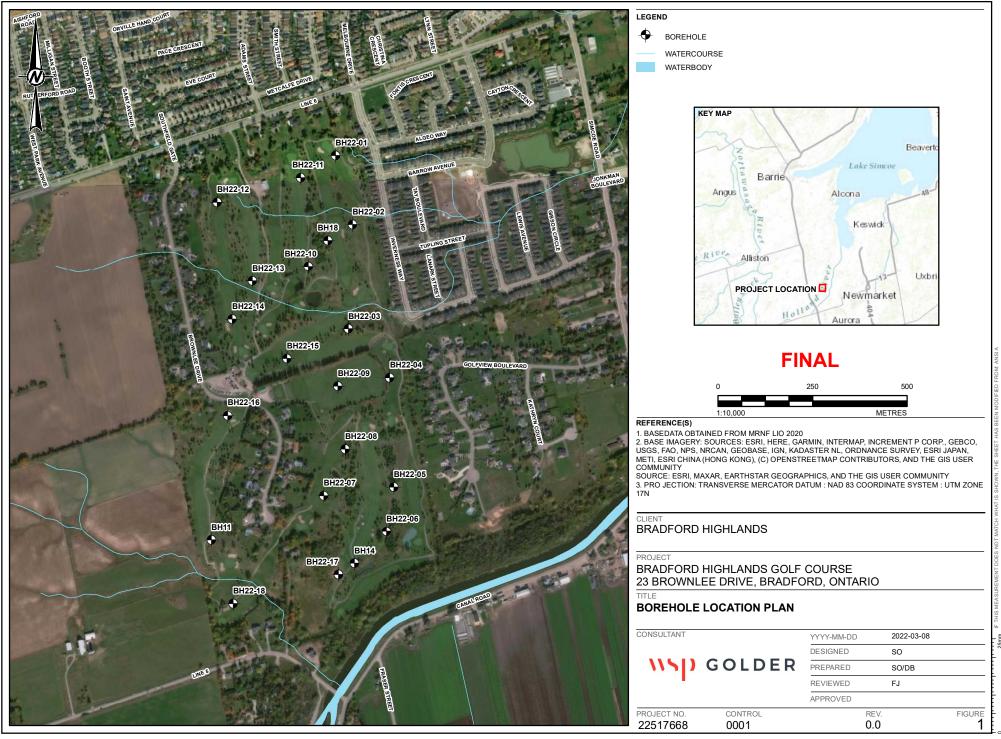
Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. We accept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





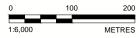


Lot/Block	Land Use	Units	Area(ha)		
	Single Detach	ed min. 11.6m (	38ft)	454	00.00
	Semi Detache	d min. 7.6m (25	ft)	178	26.38
	Street Townho	ouses min. 6.1m	(20ft)	266	6.31
	Back to Back	Townhouses mi	n. 6.4m (21ft)	48	0.90
	Park		3.15		
	Stormwater Ma	Stormwater Management Ponds			
	Environmental	Protection			5.38
	Future Develo	pment			0.52
Public Roads	Street 'A' Streets 'B'-'C' Streets 'D'-'N'	26.0m ROW 20.0m ROW 18.0m ROW	1,555m 767m 4,108m		13.06
Total			6,430m	946	59.73





LEGEND	
$\Phi$	BOREHOLE LOCATION
	APPROXIMATE PHASE TWO BOUNDARY
	APPROXIMATE MNR NATURAL HERITAGE BOUNDARY



REFERENCE(S) BASE DATA - MNR LIO, OBTAINED 2015 PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2017 BOREHOLE LOCATION SURVEY: RADY-PENTEK & EDWARD SURVEYING LTD., JULY 28, 2016 PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N BASE IMAGERY SOURCE: GOOGLE EARTH, 2015

## CLIENT BRADFORD HIGHLANDS JOINT VENTURE

PROJECT

PRELIMINARY GEOTECHNICAL INVESTIGATION BRADFORD HIGHLANDS GOLF COURSE

## TITLE BOREHOLE LOCATION PLAN

CONSULTANT

PROJECT No. 1543120



Phase 2000

YYYY-MM-DD	)	2017-02-13	
PREPARED		SB	
DESIGN			
REVIEW		NL	
APPROVED			
	Rev.		Figure
	AA		2





**BOREHOLE AND** 

**BOREHOLE LOGS** 

#### **Enclosure 1-A: Notes on Sample Descriptions**

- All sample descriptions included in this report generally follow the Unified Soil Classification. Laboratory grain size analyses provided by WSP also follow the same system. Different classification systems may be used by others, such as the system by the International Society for Soil Mechanics and Foundation Engineering (ISSMFE). Please note that, with the exception of those samples where a grain size analysis and/or Atterberg Limits testing have been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.
- 2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional preliminary geotechnical site investigation.
- 3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

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PRO	JECT: GEOTECHNICAL INVESTIGATIO	ON Fo	or Pro	oposed	d Resi	dential S	Subdivi	sion									REF.	NO.	: 22	517668	
CLIE	NT: Bradford Highlands Joint Venture							Meth	od: So	lid Ster	n Aug	ger					ENC	L NC	<b>)</b> .:		
	JECT LOCATION: 23 Brownlee Drive, B	radfo	rd, O	ntario				Diam	eter: 1	52 mm							ORIC				
	JM: UTM NAD , ZONE											Mar-29					CON	1PILE	ED BY	γ FJ	
BH L	OCATION: N 4883640 E 613921		<u> </u>			1		Eqipr DYNA	nent: [		Ch G		be 420	M				-	-		
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PRO	JECT: GEOTECHNICAL INVESTIGATIO	ON F	or Pro	oposed	Resid	lential S	Subdivi	sion									REF.	NO.:	: 225	517668	
	NT: Bradford Highlands Joint Venture								od: So	lid Stei	m Aug	er					ENC	L NO	.:		
PRO	JECT LOCATION: 23 Brownlee Drive, B	radfo	rd, O	ntario				Diam	eter: 1	52 mm	า						ORIG	SINA	TED	BY PN	Л
	JM: UTM NAD , ZONE							Date	Mar-2	29-202	2 to 1	Mar-29	-2022				COM	PILE	D BY	, FJ	
BHL	OCATION: N 4883640 E 613921							Eqipi	nent: [	Drill Te	ch G	eoprob	e 420	М							
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	Notes: 1). Upon completion of drilling, borehole had caved at 6.1 meter below ground surface (mbgs).																				
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GROUN	NDWATER ELEVATIONS	1	1	I		<u>GRAPH</u> NOTES	+ 3,	× <sup>3</sup> :	Number to Sensi	s refer	0	8=3%	Strain a	<b>L</b> at Failur	e	1	1		I		

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PROJ	ECT: GEOTECHNICAL INVESTIGATI	ON F	or Pro	oposed	d Resid	dential	Subdivi	sion									REF.	. NO.	: 22	517668	
CLIEN	NT: Bradford Highlands Joint Venture			•				Meth	od: Sol	id Ste	m Aug	ger					ENC	L NC	<b>)</b> .:		
PROJ	ECT LOCATION: 23 Brownlee Drive, E	Bradfo	ord, O	ntario				Diam	eter: 1	52 mn	n						ORIC	GINA <sup>:</sup>	TED	BY PI	М
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(m)		Ŀ				GROUND WATER CONDITIONS						30 1	00	LIMIT	IC NAT MOIS CON	TURE	Liquid Limit	EN.	NATURAL UNIT WT (kN/m <sup>3</sup> )	AI	ND
ELEV	DECODIDITION	PLO	~		BLOWS 0.3 m	AW C	N		AR ST	RENG	TH (k	Pa)		W <sub>P</sub>		w 0	WL	POCKET PEN. (Cu) (kPa)	SAL UI		N SIZE BUTION
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-	Brown to grey, trace sand, trace							F													
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6.20	END OF BOREHOLE	-1.1.	$\mathbf{f}$																1		
	Notes:																	1	1		
	<ol> <li>Borehole was terminated due to auger refusal.</li> </ol>																	1	1		
	<ol><li>Upon completion of drilling,</li></ol>		1									1							1		
	borehole had caved at 5.5 meters below ground surface (mbgs) and																	1	1		
	groundwater level was at approximately at 0.7 meters below																	1	1		
	ground surface (mbgs).																	1	1		
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PRO	JECT: GEOTECHNICAL INVESTIGATIO	ON Fo	or Pro	oposed	d Resid	dential \$	Subdivi	sion									REF.	NO.	: 225	517668	
CLIE	NT: Bradford Highlands Joint Venture							Meth	od: So	lid Ster	n Aug	ger					ENC	L NO	.:		
	JECT LOCATION: 23 Brownlee Drive, Br	radfor	rd, O	ntario						52 mm							ORIC				
	JM: UTM NAD , ZONE											Mar-24					COM	IPILE	DB	, FJ	
BHL	OCATION: N 4883181 E 613955 SOIL PROFILE			SAMPL	<b>F</b> 0	1	<b></b>	Eqipi DYNA	nent: [ MIC CC		Ch G	eoprot	be 420	M							
			3		_ES	н								PLAST LIMIT	IC NAT	URAL	LIQUID LIMIT	z	TWT	REMA AN	
(m)		LOT			S F	GROUND WATER CONDITIONS	z		1	RENG			00	WP		TENT N	WL	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	GRAIN	I SIZE
ELEV DEPTH	DESCRIPTION	STRATA PLOT	BER		BLOWS 0.3 m		EVATION	ου	NCONF	INED	÷	FIÉLD V & Sensit	ANE ivity			0		POCKI (Cu)	TURA (kN	DISTRIE (%	
231 50	Ground Surface	STR/	NUMBER	ТҮРЕ	z	GRO	ELEV			RIAXIAL 10 6		LAB V/ 80 1	ANE 00		TER CO		1 (%) 30		ž	GR SA	
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231.00		<u>. \ l</u> j					231	_													
0.50	SILTY CLAY: Brown, cohesive w~PL, firm to very						201	_													
	stiff.																				
1	wet spon		2	SS	15			-								0					
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5.50	SANDY SILT AND CLAY TILL: Grey, trace gravel, cohesive w~PL,						226	-													
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<u> </u>	Continued Next Page			r.		<u>GR</u> APH	, 3	<b>√</b> 3.	Numbe	rs refer		<b>8</b> =3%	C+'				1				
	$\begin{array}{c} \underline{\text{NDWATER ELEVATIONS}}\\ \underline{\text{rement}} & \underline{\underline{\text{Tst}}} & \underline{\underline{\text{2nd}}} & \underline{\underline{\text{3rd}}} & \underline{\underline{\text{4th}}} \\ \underline{\underline{\text{VT}}} & \underline{\underline{\text{VT}}} & \underline{\underline{\text{VT}}} & \underline{\underline{\text{VT}}} \end{array}$					<u>GRAPH</u> NOTES	Τ',	<u>~</u> ·	Numbe to Sens	itivity	C	,	orain	ai Fàllui	e						
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PRO	JECT: GEOTECHNICAL INVESTIGATI	ON F	or Pr	opose	d Resid	dential \$	Subdivi	sion									REF.	NO.	: 225	517668
CLIEI	NT: Bradford Highlands Joint Venture							Meth	od: So	lid Ste	m Aug	er					ENC	L NO	).:	
PRO.	JECT LOCATION: 23 Brownlee Drive, B	Bradfo	ord, C	Intario				Diam	eter: 1	52 mm	ı						ORIC	SINA	TED	BY PM
DATU	JM: UTM NAD , ZONE							Date	Mar-2	24-202	2 to I	Mar-24	-2022				COM	IPILE	D B	, FJ
BH LO	OCATION: N 4883181 E 613955											eoprob	e 420	М				1		
	SOIL PROFILE		5	SAMPL	ES	~		RESIS	MIC CC	NE PER		HON		PLASTI	NAT	URAL	LIQUID		5	REMARKS
(m)		15				GROUND WATER CONDITIONS		:	20 4	10 6	8 0	0 10	20	C.I.VII I	CON	TENT	LIMIT	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	AND GRAIN SIZE
ELEV	DESCRIPTION	A PLO	2		BLOWS 0.3 m	NOL	NOL			RENG	TH (kF	Pa)		W <sub>P</sub>		w o	WL	E KET	RAL L (kN/m	DISTRIBUTION
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-	SANDY SILT AND CLAY TILL: Grey, trace gravel, cohesive w~PL,		1					-												
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10.00	SILTY SAND:							F												
-	Grey, wet, very dense.	指						E												
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-		臣				に目じ	221	-												
- 220.63		臣	10	SS5	0/127m			-							0					
10.87	END OF BOREHOLE																			
	Notes:																			
	1). Upon completion of drilling, groundwater level was at																			
	approximately 0.30 meter below																			
	ground surface (mbgs). 2). A 50mm diameter monitoring																			
	well was installed with screens from 7.6 mbgs to 10.6 mbgs.																			
	Water Level Reading: Date Depth (m bgs.)																			
	April 26, 2022 Water was at the																			
	top of casing and unable to read water level from monitoring well																			
	_																			
19.22																				
VD GPU 5																				
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PO-68400																				
221-02423-																				
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GROUN	NDWATER ELEVATIONS					<u>GRAPH</u> NOTES	+ 3,	×۶:	Numbei to Sens	sieier	С	•=3%	Strain a	at Failur	е					



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PRO	IECT: GEOTECHNICAL INVESTIGATI	ON Fo	or Pro	oposed	d Resi	dential S	Subdivi	sion									REF.	NO.	: 225	517668	
CLIE	NT: Bradford Highlands Joint Venture							Meth	od: So	lid Ste	n Aug	ger					ENC	L NO	.:		
	JECT LOCATION: 23 Brownlee Drive, E	Bradfo	rd, O	ntario						52 mm							ORIC				M
	JM: UTM NAD , ZONE											Mar-2					COM	PILE	DBY	γ F.	J
BHL	OCATION: N 4883052 E 614065 SOIL PROFILE			SAMPL	ES					Drill Te NE PEI PLOT		Geopro	be 420	1				<u> </u>			
	GOILT NOT ILL					Ë							00	PLAST	IC NAT MOIS CON	URAL	LIQUID LIMIT WL T (%)	z	T WT	REM A	ARKS ND
(m) ELEV		LOT			SSE	WAT NS	z		1	RENG	L TH (k	Pa)	1	WP		W	WL	(KPa) (KPa)	AL UNI N/m <sup>3</sup> )	GRAI	N SIZE
DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	ш	BLOWS 0.3 m		EVATION	οu	NCONF		÷	FIELD \ & Sensi LAB V	ANE tivity	WA	TER CO		T (%)	DO DO DO	ATUR. (k	DISTRI ('	BUTION %)
229.90	Ground Surface		NUN	түре	ż	GROUND WATER CONDITIONS	ELE						00				30		2	GR SA	SI CL
0.00	TOPSOIL: (300 mm)	<u>x 1/</u>						_													
229.60 0.30	SILTY CLAY:	<u>// · · //</u> //X	1	SS	4			-								0					
-	Brown, cohesive w <pl, soft="" stiff.<="" td="" to="" very=""><td></td><td>1</td><td></td><td></td><td></td><td></td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,>		1					-													
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227.77 - 2.13	SANDY SILT AND CLAY :							_													
2.10	Brown, trace gravel, cohesive w <pl, stiff.<="" td="" very=""><td></td><td>╞──</td><td></td><td></td><td>-</td><td></td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,>		╞──			-		-													
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- 5.45	CLAYEY SILT TILL:							_													
Ł	Grey, trace sand, trace gravel, cohesive w <pl, hard.<="" stiff="" td="" to="" very=""><td></td><td></td><td></td><td></td><td></td><td></td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,>							-													
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GROUM	Continued Next Page					<u>GRAPH</u> NOTES	+ 3	× <sup>3</sup> :	Number to Sens	s refer	(	S <sup>8=3%</sup>	Strain	at Failu	re						
Measur	1st 2nd 3rd 4th					NUTES			io Sens	uvity											

CLIENT: Bradford Highlands Joint Venture     Method: Solid Stem Auger     ENCL NO.:       PROJECT LOCATION: 23 Brownlee Drive, Bradford, Ontario     Diameter: 152 mm     ORIGINATED BY       DATUM: UTM NAD, ZONE     Date: Mar-23-2022 to Mar-23-2022     COMPILED BY       BH LOCATION: N 4883052 E 614065     Eqipment: Drill Tech Geoprobe 420M       V     V     V       (m)     ELEV     SAMPLES       DEPTH     DESCRIPTION     V       UNCONFINED     +     FIELD VANE       0     UNCONFINED     +       0     UNCONFINED       0     UNCONF	BH22-04 2 OF 2
PROJECT LOCATION: 23 Browniee Drive, Bradford, Ontario     Diameter: 152 mm     ORIGINATED BY       DATUM: UTM NAD , ZONE     Diameter: 152 mm     ORIGINATED BY       BH LOCATION: N 483052 E 614065     Experiment: Drill Tech Geoprote 420M     Completed 20M       Image: Continued     SAMPLES     Image: Continued 20M     Image: Continued 20M       Continued     Image: Continued 20M     Image: Continued 20M     Image: Continued 20M       Continued     Image: Continued 20M     Image: Continued 20M     Image: Continued 20M       Image: Continued 20M     Image: Continued 20M     Image: Continued 20M     Image: Continued 20M       Image: Continued 20M     Image: Continued 20M     Image: Continued 20M     Image: Continued 20M       Image: Continued 20M     Image: Continued 20M     Image: Continued 20M     Image: Continued 20M       Image: Continued 20M     Image: Continued 20M     Image: Continued 20M     Image: Continued 20M       Image: Continued 20M     Image: Continue 20M     Image: Continue 20M     Image: Continue 20M       Image: Continued 20M     Image: Continue 20M     Image: Continue 20M     Image: Continue 20M       Image: Continued 20M     Image: Continue 20M     Image: Continue 20M     Image: Continue 20M       Image: Continued 20M     Image: Continue 20M     Image: Continue 20M     Image: Continue 20M       Image: Continue 20M     Ima	REF. NO.: 22517668
DATUM: UTM NAD, ZONE         Date:         Mar-23-2022         Io Mar-23-2022         COMPLED BY           BH LOCATION:         N 4883062 E 614065         Exipment: Drill Tech: Geoprobe 420M         Exipment: Drill Tech: Geoprobe 420M           (m)         SOIL PROFILE         SAMPLES         Image: Same constraints	blid Stem Auger ENCL NO.:
BILLOCATION: N 4883052 E 614065         SOIL PROFILE       SAMPLES       TOTAMAC COME PROFILATION         (m)       DESCRIPTION       total       g <thg< th="">       g       g</thg<>	152 mm ORIGINATED BY PM
SOIL PROFILE         SAMPLES           (m) <u>LEEY</u> DEPTH         DESCRIPTION         0 4 4 5 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	23-2022 to Mar-23-2022 COMPILED BY FJ
(m)     DESCRIPTION     Unit of the product of	Drill Tech Geoprobe 420M
UNIC       DESCRIPTION       UNIC       Solution       Solu	
CLAYEY SILT TILL: Grey, trace gravel, cohesive w <pl, stift="" to<br="" very="">hard.(Continued)       Image: Clayer of the second secon</pl,>	40 60 80 100 LIMIT $CONTENT$ LIMIT $\frac{1}{2}$ $\frac{1}{2}$ AND $\frac{1}{2}$ GRAIN SIZE
CLAYEY SILT TILL: Grey, trace gravel, cohesive w <pl, stiff="" to<br="" very="">hard.(Continued)       Image: state gravel, cohesive w<pl, stiff="" to<br="" very="">hard.(Continued)         Image: state gravel, cohesive w<pl, stiff="" to<br="" very="">hard.(Continued)       Image: state gravel, state gravel, cohesive w<pl, stiff="" to<br="" very="">hard.(Continued)         Image: state gravel, cohesive w<pl, stiff="" to<br="" very="">hard.(Continued)       Image: state gravel, state gravel, state gravel, gravel, wery stiff to hard.(Continued)       Image: state gravel, state gravel, gravel, wery stiff to hard.(Continued)         Image: state gravel, cohesive w<pl, stiff="" to<br="" very="">hard.(Continued)       Image: state gravel, gravel, wery stiff to hard.(Continued)       Image: state gravel, gravel, wery stiff to hard.(Continued)         Image: state gravel, gravel, wery stiff to hard.(Continued)       Image: state gravel, gravel, wery stiff to hard.(Continued)       Image: state gravel, gravel, wery stiff to hard.(Continued)       Image: state gravel, gravel, wery stiff to hard.(Continued)         Image: state gravel, wery stiff to hard.(Continued)       Image: state gravel, wery stiff to hard.(Continued)       Image: state gravel, wery stiff to hard.(Continued)         Image: state gravel, wery stiff to hard.(Continued)       Image: state gravel, wery stiff to hard.(Continued)       Image: state gravel, wery stiff to hard.(Continued)         Image: state gravel, wery stat</pl,></pl,></pl,></pl,></pl,></pl,>	
CLAYEY SILT TILL: Grey, trace gravel, cohesive w <pl, stift="" to<br="" very="">hard.(Continued)       Image: Clayer of the second secon</pl,>	
Grey, trace sand, trace gravel, cohesive w-PL, very stiff to hard.(Continued) 9 SS 39 9 SS 39 10 SS 28 220 220 220 220 20 20 20 20 20	40 60 80 100 10 20 30 GR SA SI CL
220 220 220 220 220 219 219 219 219 219 219 219 219	
220 220 220 220 220 219 219 219 219 219 219 219 219	
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10 SS 28 219 10 SS 28 219	
11.13     END OF BOREHOLE       Notes:       1). Upon completion of drilling, groundwater level was at approximately 0.91 meter below	
11.13     END OF BOREHOLE       Notes:       1). Upon completion of drilling, groundwater level was at approximately 0.91 meter below	
11.13     END OF BOREHOLE       Notes:       1). Upon completion of drilling, groundwater level was at approximately 0.91 meter below	
11.13 END OF BOREHOLE Notes: 1). Upon completion of drilling, groundwater level was at approximately 0.91 meter below	

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PROJ	JECT: GEOTECHNICAL INVESTIGATIO	ON Fo	or Pro	opose	d Resi	dential	Subdivi	sion									REF.	NO.	: 22	51766	8	
CLIEN	NT: Bradford Highlands Joint Venture							Meth	nod: Sc	lid Ster	n Auge	r					ENC	L NO	).:			
PROJ	IECT LOCATION: 23 Brownlee Drive, B	radfo	rd, O	ntario				Dian	neter: 1	52 mm	I						ORIC	GINA	TED	01	PM	
	JM: UTM NAD , ZONE							Date	: Mar-	25-202	2 to M	ar-25-	2022				COM	IPILE	D B	(	FJ	
BH LO	DCATION: N 4882763 E 614075		1			1							e 4201	N				-	-			
<u> </u>	SOIL PROFILE		S	SAMPL	ES	с	1	RESI	STANC	E PLOT				PLASTI	C NAT MOIS		LIQUID		ħ		MARKS	3
(m)		ы			ω.	GROUND WATER CONDITIONS	_			40 6			D	LIMIT	CON	TURE ITENT W	LIMIT WL	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )		AND AIN SIZI	E
ELEV DEPTH	DESCRIPTION	STRATA PLOT	Ë		BLOWS 0.3 m	ND V TION	ELEVATION		AR ST		TH (kPa	ELD VAI	ŅE			 o	—	OCKE (Cu)	URAL (KN/r		RIBUTIC	
		TRAT	NUMBER	ТҮРЕ	<u>ت</u>	ROU	EVA	• (	QUICK T	RIAXIAL	ΧĹ	AB VAN	νĒ			ONTEN		ď.	NAT		(%)	
224.00	Ground Surface TOPSOIL: (450 mm)	0 	Ī	ŕ	£				20	40 6	0 80	100	0	1	0 2	20 :	30			GR S	SA SI	CL
- 0.00		1/ 5/						-														
- 223.55		1.3 6	1	SS	16			Ę							0							
- 0.45	SAND: Brown, some silt, trace to some						·	-														
	gravel, cobble fragment, moist to	臣																				
1	wet, compact to dense.		2	SS	19		000	-							0							
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010 50							Í	ţ										1				
218.50 _ 5.50	SILTY CLAY TILL:	K						F										1				
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GROUN	Continued Next Page					<u>GRAPH</u> NOTES	+ 3	× <sup>3</sup> :	Numbe to Sens	rs refer	0	<b>s</b> =3% s	Strain a	ıt Failur	e							
Measure	1st 2nd 3rd 4th					NULES			IO SENS	suvity												
mousui																						

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## LOG OF BOREHOLE BH22-05

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PRO	JECT: GEOTECHNICAL INVESTIGATI	ON Fo	or Pro	oposed	d Resid	dential S	Subdivi	sion								REF.	NO.	: 225	517668	
CLIE	NT: Bradford Highlands Joint Venture							Metho	od: So	lid Ste	m Aug	er				ENC	L NO	).:		
PRO	JECT LOCATION: 23 Brownlee Drive, B	radfo	rd, O	ntario				Diam	eter: 1	52 mn	n					ORIC	SINA	TED	BY P	М
	JM: UTM NAD , ZONE												5-2022			COM	IPILE	D B)	γ F.	J
BH L	OCATION: N 4882763 E 614075					<del></del>							be 420	М			1	<b></b>		
	SOIL PROFILE	-		SAMPL	LES	с К								PLASTI LIMIT		LIQUID		WT	REM	ARKS
(m)		LOT			ଷ୍ଟ	NATE NS	z			I			00	LIMI I W <sub>P</sub>	ITENT W	LIMIT W <sub>L</sub>	ET PEN KPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	A GRAI	ND N SIZE
ELEV DEPTH	DESCRIPTION	TA PI	Ë		BLOWS 0.3 m		ATIO		AR ST NCONF		iTH (kl +	FIELD V & Sensit	ANE	⊢	 o		OCKE	TURAI (KN)	DISTRI	BUTION %)
	Continued	STRATA PLOT	NUMBER	ТҮРЕ	z.	GROUND WATER CONDITIONS	ELEVATION			RIAXIAL 10 é	- ×	LAB V/	ANE 00		ONTEN 20 ;	T (%) 30	1	M		SI CL
	Continued SILTY CLAY TILL:		-	,	-		8	_												
-	Grey, trace gravel, trace sand, cohesive w <pl, stiff="" td="" to<="" very=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,>																			
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213.13 10.87	END OF BOREHOLE		10	SS	40										0					
10.07																				
	Notes: 1). Upon completion of drilling,																			
	groundwater level was at approximately 0.30 meter below																			
	ground surface (mbgs). 2). A 50mm diameter monitoring																			
	well was installed with screens from 6.10mbgs to 9.14 mbgs.																			
	Water Level Reading:																			
	Date Depth (m bgs.)																			
	April 26, 2021 0.2																			
2																				
D.GPU 5-16:																				
RDHOLLAN																				
00-88-00																				
5-221-03423-																				
FUBHLOOS																				
10.20																				
XLL00 200																				
76 d8M																				
0001	DWATER ELEVATIONS					<u>GRAPH</u>	3	<b>√</b> 3. ∣	Number	s refer	~	8=3%	Strain a							

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11	sp				LOC	g of	BOR	EHC	DLE E	3H22	-06									1 C	DF 2
PRO	JECT: GEOTECHNICAL INVESTIGATIC	DN Fo	or Pro	oposed	d Resi	dential	Subdivi	sion									REF.	NO.	: 225	517668	
CLIEI	NT: Bradford Highlands Joint Venture							Meth	od: So	lid Ste	m Aug	ger					ENC	L NO	.:		
	JECT LOCATION: 23 Brownlee Drive, Br	radfor	rd, O	ntario						52 mm							ORIC				
	JM: UTM NAD , ZONE									29-202							COM	PILE	DBY	, FJ	
BHL	OCATION: N 4882644 E 614056					1	<u> </u>	Eqip	MIC CO		ch G	eoprol	be 420	M							
	SOIL PROFILE		5	SAMPL	LES	н.				one pei E plot				PLAST	IC NAT MOIS CON	URAL	LIQUID LIMIT WL T (%)		TW.	REMAR AND	
(m)		LOT			ଧ୍ୟ	GROUND WATER CONDITIONS	z		-	1		1	00	W <sub>P</sub>		ITENT W	WL	ET PEr (kPa)	L UNIT /m <sup>3</sup> )	GRAIN S	SIZE
ELEV DEPTH	DESCRIPTION	TAP	ËR		BLOWS 0.3 m		EVATION	οι	INCONF		+	FIELD V & Sensi	/ANE tivity			0		(CU)	TURAI (KN	DISTRIBU (%)	ITION
000 70	Conversion Constants	STRATA PLOT	NUMBER	ТҮРЕ	ż	SONE	ELEV			RIAXIAL 40 6	. X	LAB V	ANE 00		TER CO		T (%) 30		A	GR SA S	
220.70	Ground Surface TOPSOIL: (450 mm)	<u>x11/2</u>	~	-	-			-	1	1		+	1			1	1			GR SA C	
-		4 2	1	SS	10			-							0						
<u>220.25</u> - 0.45	SILTY CLAY:	. \ I; X X		00				-													
0.40	Brown to grey, cohesive w <pl to="" w="">PL, soft to very stiff.</pl>						220	-													
L	w>PL, soft to very stiff.						220	ŀ													
1			2	SS	7			-								0					
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-	 w>PL						0.10	-													
-	W>PL		3	SS	3		219	-								0					
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-	no soil sample recovery		4	SS	15			-													
-	no soli sample recovery							-													
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3								ŀ													
-	grey		5	SS	16			-								0					
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215.20	CLAYEY SILT TILL:							-													
_ 5.50 -	Grey, some sand, trace gravel,						215	<b> </b>													
E.	cobbles fragment, cohesive w <pl, hard.</pl, 	H						ŀ													
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<u>GROUN</u> Measur	15t 2nd 3rd 4th					<u>GRAPH</u> NOTES	+ 3	×3:	Numbe to Sens	rs refer sitivity	C	8=3%	' Strain	at Failu	re						

11	sp				LOC	GOF	BOR	EHO	LE B	8H22-	-06									2 OF 2
PRO	JECT: GEOTECHNICAL INVESTIGATIO	DN F	or Pro	posed	Resid	dential S	Subdivi	sion									REF	NO.	: 22	517668
CLIEI	NT: Bradford Highlands Joint Venture							Metho	od: Sol	id Ster	n Auge	er					ENC	L NO	).:	
PRO	JECT LOCATION: 23 Brownlee Drive, B	radfo	ord, O	ntario				Diam	eter: 1	52 mm							ORIC	SINA <sup>-</sup>	TED	BY PM
DATU	JM: UTM NAD , ZONE							Date:	Mar-2	29-2022	2 to N	/lar-29	-2022				CON	IPILE	D B	γ FJ
BH L	OCATION: N 4882644 E 614056		_			-		Eqipr	nent: D	Drill Teo	h Ge	eoprob	e 420	М					_	
	SOIL PROFILE		s	AMPL	ES			DYNA RESIS	MIC CO	NE PEN PLOT		ION		DIAGT	_ NAT	URAL			⊢	REMARKS
(m)		F				GROUND WATER CONDITIONS				0 60			00	PLASTI LIMIT	C MOIS	STURE	LIQUID LIMIT WL T (%) 30	EN.	NT √	AND
ELEV	DESCRIPTION	STRATA PLOT	~		BLOWS 0.3 m		NO			RENG	ΓΗ (kP	Pa)		W <sub>P</sub>		w 0	WL	u) (kP.	RN/m <sup>3</sup>	GRAIN SIZE DISTRIBUTION
DEPTH	DESCRIPTION	RATA	NUMBER	щ			EVATION		NCONF	INED RIAXIAL	+ ;	FIELD VA & Sensitiv LAB VA	/ity NF	WA	TER CO	ONTEN	T (%)	80 00	INTATU	(%)
	Continued		NUN	ТҮРЕ	ŗ	CO GR	ELE			0 60							30		[-	GR SA SI CL
-	CLAYEY SILT TILL: Grey, some sand, trace gravel,							-												
-	cobbles fragment, cohesive w <pl,< td=""><td></td><td></td><td></td><td></td><td>し目</td><td></td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,<>					し目		-												
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			10	555	)/152m		210								0					
209.78 10.92	END OF BOREHOLE	HCS1																		
	Notes: 1). Upon completion of drilling,																			
	groundwater level was at approximately 1.5 meter below																			
	around surface (mbas).																			
	2). A 50mm diameter monitoring well was installed with screens from																			
	7.62 mbgs to 10.67 mbgs.																			
	Water Level Reading:																			
	Date Depth (m bgs.) April 26, 2021 0.3																			
																		1		
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GROUM		-				<u>GRAPH</u>	3	2	Number			<b>e</b> -20/		at Failur			1	•		



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PROJ	ECT: GEOTECHNICAL INVESTIGATIC	DN Fo	or Pro	oposed	d Resi	dential S	Subdivi	sion									REF.	NO.	: 225	517668
CLIEN	NT: Bradford Highlands Joint Venture							Meth	od: So	lid Ster	n Aug	ger					ENC	L NO	).:	
PROJ	IECT LOCATION: 23 Brownlee Drive, Br	radfo	rd, O	ntario				Diam	eter: 1	52 mm	n						ORIC	SINA	TED	
DATU	IM: UTM NAD , ZONE							Date	Mar-	23-202	2 to	Mar-23	3-2022				COM	IPILE	D B	r FJ
BH LO	DCATION: N 4882740 E 613889												be 420	M						
	SOIL PROFILE		s	SAMPL	ES	~		RESIS	STANCE	DNE PEN E PLOT		-		PLAST LIMIT		URAL	LIQUID		M	REMARKS
(m)		5			0	GROUND WATER CONDITIONS		:	20 4	40 6	0	80 1	00	LIMIT W <sub>P</sub>		ITENT W	Liquid Limit W <sub>L</sub>	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	AND GRAIN SIZE
ELEV DEPTH	DESCRIPTION	STRATA PLOT	۲.		BLOWS 0.3 m	VD V	ELEVATION		AR ST NCONF		TH (k	Pa) FIELD V & Sensit	ANE	•••p		• •		Cu) (K	URAL (kN/m	DISTRIBUTION
DEPTH		RAT	NUMBER	ТҮРЕ		NDI	EVA	• 0	UICK T	RIAXIAL	. X	LAB V	ANE		TER CO			P C	NATI	(%)
	Ground Surface	5 5 1/2	ž	7	ż	5 2		:	20 4	10 6	0	80 1	00	1	0 :	20	30			GR SA SI C
_ 0.00 228.85	TOPSOIL: (250 mm)	<u> </u>					229	_										1		
0.25	SILTY CLAY: Brown, trace sand, trace gravel,	R	1	SS	6			_								0				
	cobble fragment, cohesive w~PL,	R						-												
-	firm to hard.	1						-												
-		H	2	SS	7			-								o				
-	wet spon	K	1	33	'		228	-								<u> </u>				
-		H.						-												
-		R						_												
-		H						-												
-		H.	3	SS	17			-							0					
2			1—			-		-												
-			1				227	-										1		
-		R				1		-												
-			4	SS	20			-							0					
-		H	┢					-												
-			1					-												
-			╞			-	226										-			
-		R	5	SS	38			-							0					
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-			1					-												
-			1					-												
2 <u>25.10</u> 4.00	SILTY SAND:	<u>k</u> k	1					-												
- 4.00	Brown, trace gravel, rock fragments,	臣	i				225	_										1		
-	moist, very dense.	臣臣	1					-												
-		臣				_		-												
-			6	SS5	)/152r	nm		-							þ					
-		臣				-		-												
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-		間						-												
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-		뮘						-												
6								-												
-		[]]]	7	SS5	0/25m	im	223	_										1		
-	no soil sample recovery	臣	1					-												
-		臣						_												
			1			1		ŀ										1		
7		臣	:			1		Ł										1		
-		臣	1			1	222										+	-		
		臣	1			1		F										1		
-		旧	1			1		ŀ										1		
221.41			8	<u>\$\$5</u>	0/25m			-												
7.69	END OF BOREHOLE					1														
	Notes: Continued Next Page		L			I	L		<u> </u>	1				I	<u> </u>			1		
GROUN	IDWATER ELEVATIONS					<u>GRAPH</u> <u>NOTES</u>	+ 3	×3:	Numbe to Sens	rs refer itivity	C	S <sup>8</sup> =3%	Strain	at Failu	re					
Measure	ement $\underbrace{\overset{1st}{\underline{\nabla}}}_{2} \underbrace{\overset{2nd}{\underline{\nabla}}}_{2} \underbrace{\overset{3rd}{\underline{\nabla}}}_{2} \underbrace{\overset{4th}{\underline{\nabla}}}_{2}$																			

					LOG	GOF	BOR	EHO	LEE	3H22	-07									2 (	OF 2
PRO	JECT: GEOTECHNICAL INVESTIGATI	Resid	lential S	Subdivi	sion									REF.	NO.	: 225	517668				
CLIEI	NT: Bradford Highlands Joint Venture				Metho	od: So	lid Ste	m Aug	er					ENC	L NO	).:					
PRO	IECT LOCATION: 23 Brownlee Drive, E	Bradfo	rd, O	ntario				Diam	eter: 1	52 mm	ı						ORIC	SINA <sup>-</sup>	TED	BY PM	
DATU	JM: UTM NAD , ZONE							Date:	Mar-2	23-202	2 to I	Mar-23	3-2022				COM	IPILE	D B)	∕ FJ	
BH L	DCATION: N 4882740 E 613889							Eqipr	nent: D	Drill Te	ch G	eoprot	be 420	М							
	SOIL PROFILE		s	AMPL	ES	~		DYNA RESIS	MIC CC	NE PER		TION			_ NAT	URAL			ь	REMAR	RKS
(m)		1				ATEF S							00	PLASTI LIMIT	C MOIS CON	TURE	LIQUID LIMIT	POCKET PEN. (Cu) (kPa)	NIT (	ANE	
ELEV	DESCRIPTION	A PLO	ъ		BLOWS 0.3 m	NOL	NOL			RENG	TH (kl	Pa)		W <sub>P</sub>	\	N 0	WL	E K	RAL L (kN/m	GRAIN : DISTRIBL	
DEPTH		STRATA PLOT	NUMBER	ТҮРЕ		GROUND WATER CONDITIONS	ELEVATION		NCONF UICK TI	INED RIAXIAL	. ×	FIELD V. & Sensiti LAB VA	ivity ANE	WAT	TER CO	ONTEN	T (%)	0 <u>0</u> 9	NATURAL UNIT WT (kN/m <sup>3</sup> )	(%)	)
	Continued	ST	R	₽	ż	GR C GR	EL	2	20 4	0 6	60 E	80 10	00	1	0 2	20 3	30			GR SA	SI CL
	<ol> <li>Upon completion of drilling, borehole had caved at 5.4 meter</li> </ol>																				
	below ground surface (mbgs).																				
																		1			
																		1			
																		1			
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3																		1			
																		1			
0r-1240/r-12																					
7-6000 LLG																		1			
20-1-77 (R-11-																		1			
0 0070																		1			
01100 M																		1			
·L			-						1	1		<b>s</b> =3%	1		1	1	1	·	-		



11	sp				LOC	g of	BOR	EHO	LEE	3H22	-08									1	OF 2
PRO	JECT: GEOTECHNICAL INVESTIGATIO	ON Fo	or Pro	oposed	d Resi	dential S	Subdivi	sion									REF.	NO.	: 22	517668	;
CLIEI	NT: Bradford Highlands Joint Venture							Meth	od: So	lid Ster	n Aug	ger					ENC	L NO	).:		
	JECT LOCATION: 23 Brownlee Drive, B	radfo	rd, O	ntario						52 mm							ORIC				M
	JM: UTM NAD , ZONE									24-202							COM	IPILE	D B	/ F	J
BH L	OCATION: N 4882862 E 613947		1			<u> </u>	<u> </u>		nent: [				be 420	M					-		
	SOIL PROFILE		5	SAMPL	.ES	Ľ.		RESIS	STANCE	DNE PEN E PLOT	$\geq$	-		PLAST LIMIT			LIQUID		μ		ARKS
(m)		10			S	GROUND WATER CONDITIONS	-		I	40 6		1	00	LIMIT W <sub>P</sub>		ITENT	LIMIT W <sub>L</sub>	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )		ND IN SIZE
ELEV DEPTH	DESCRIPTION	A PL	Ë		BLOWS 0.3 m		OL		AR ST NCONF		TH (k +	Pa) FIELD V & Sensit	ANE			o	I	OCKE (Cu)	URAL (KN/r		BUTION
		STRATA PLOT	NUMBER	ТҮРЕ	<u>اھ</u>	ROU	ELEVATION	• Q	UICK T	RIAXIAL	Х	LAB V	ANE			ONTEN		ă.	TAT		(%)
228.10 _ 0.00	Ground Surface TOPSOIL: (300 mm)	0 1/1/2	ž	í-	£	σŏ			20 4	40 6	0 8	80 1	00		0 2	20 :	30			GR SA	SI C
227.80		1/					228	-										1			
0.30		Ī	1	SS	6			ŀ								0					
-	Brown to grey, some sand, trace gravel, cohesive w <pl, firm="" hard.<="" td="" to=""><td></td><td>1</td><td></td><td></td><td></td><td></td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,>		1					-													
-			1			-		-													
- 1			2	SS	7											0					
-			1-				227														
-								-													
-			1			-		-													
-			3	SS	15			-							0						
-								-							Ĩ						
-							226														
-			<u> </u>				-	-													
-			4	SS	29										Þ					2 11	38 5
			1	33	29			-												2 1	30 0
-						-		-													
3			1				005	-													
-			5	SS	34		225	-							0						
-				33	34			ŀ							0						
-						-		-													
-			1					-													
224.10			1					-													
4.00	SILTY SAND: Grey, trace gravel, moist to wet,						224														
-	very dense.																				
_						_		_													
-			6	SS	97			-							0						
5		帯						-													
-							223							-				-			
-		臣						ŀ													
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6		闘					222	-													
-			7	SS5(	) )/101n	m		L							o						
-			<u> </u>			-		-													
-								F													
-			1					F										1			
7		臣						ŀ										1			
-			1				221	-						1				1			
_		臣						-										1			
_			L					-													
220.35 7.75	END OF BOREHOLE	<u>    </u>	8	SS	50			-							0						
1.15																					
GROUN	Continued Next Page NDWATER ELEVATIONS 1st 2nd 3rd 4th	_	_	_	_	<u>GRAPH</u> NOTES	+ 3	× <sup>3</sup> :	Numbe to Sens	rs refer itivity	C	S <sup>8=3%</sup>	Strain	at Failu	e	_	_	_	_	_	_
Measur	ement $\underbrace{\overset{1st}{\underline{\nabla}}} \overset{2nd}{\underline{\Psi}} \overset{3rd}{\underline{\Psi}} \overset{4th}{\underline{\Psi}}$																				

ELEV     DESCRIPTION     Image: Construction of the second	in the			L	_OG 0	F BOF	REHO	LE E	3H22	-08								2	OF 2
PROJECT LOCATION: 23 Brownlee Drive, Bradford, Ontario     Diameter: 152 mm     ORIGINATED BY       DATUM: UTM NAD , ZONE     Date: Mar-24-2022 to Mar-24-2022     COMPILED BY       BH LOCATION: N 4882862 E 613947     Eqipment: Drill Tech Geoprobe 420M     COMPILED BY       Image: Solid PROFILE     SAMPLES     Image: Stander Drive, Bradford, Ontario     Date: Mar-24-2022 to Mar-24-2022     COMPILED BY       Image: Solid PROFILE     SAMPLES     Image: Stander Drive, Bradford, Ontario       Image: Solid PROFILE     SAMPLES     Image: Stander Drive, Bradford, Ontario	ROJECT: GE	EOTECHNICAL INVESTIGAT	ION For Pro	oposed F	Residenti	al Subdiv	/ision								REF.	NO.	: 225	517668	
DATUM: UTM NAD , ZONE     Date: Mar-24-2022 to Mar-24-2022     COMPILED BY       BH LOCATION: N 4882862 E 613947     Eqipment: Drill Tech Geoprobe 420M       Solic PROFILE     SAMPLES     Plastic Missure Light Molecular	_IENT: Brad	lford Highlands Joint Venture				Meth	od: Sol	lid Ster	n Aug	er				ENC	L NO	.:			
BH LOCATION: N 4882862 E 613947     Eqipment: Drill Tech Geoprobe 420M       SOIL PROFILE     SAMPLES     VIAMIC CONE PENETRATION       (m)     Location     Continued     Continued <t< td=""><td>ROJECT LO</td><td>CATION: 23 Brownlee Drive, I</td><td>Bradford, O</td><td>Ontario</td><td></td><td></td><td>Diam</td><td>eter: 1</td><td>52 mm</td><td></td><td></td><td></td><td></td><td></td><td>ORIC</td><td>SINA<sup>-</sup></td><td>TED</td><td>BY PN</td><td>Λ</td></t<>	ROJECT LO	CATION: 23 Brownlee Drive, I	Bradford, O	Ontario			Diam	eter: 1	52 mm						ORIC	SINA <sup>-</sup>	TED	BY PN	Λ
SOIL PROFILE     SAMPLES       (m)     DESCRIPTION     Image: Section of the section of th	ATUM: UTM	1 NAD , ZONE					Date:	Mar-2	24-202	2 to M	Mar-24-202	2			COM	IPILE	DΒY	۲ FJ	
(m)     DESCRIPTION     Image: Continued     Image:	H LOCATION	N: N 4882862 E 613947										0M							
Continued     O I V V V V V V V V V V V V V V V V V V		SOIL PROFILE	S	SAMPLE	S		DYNA RESIS	MIC CO STANCE	NE PEN PLOT		FION	DIAST		URAL			F	REMA	RKS
Continued       b       b       b       b       b       b       b       b       b       b       c       b       c <thc< th="">       c       <thc< th=""> <thc< t<="" td=""><td>ı)</td><td></td><td>DT</td><td></td><td>ATEF</td><td><i>"</i></td><td>2</td><td>20 4</td><td>10 6</td><td>0 8</td><td>0 100</td><td>LIMIT</td><td>CON</td><td>TURE</td><td></td><td>a) PEN.</td><td>) NIT W</td><td>AN</td><td></td></thc<></thc<></thc<>	ı)		DT		ATEF	<i>"</i>	2	20 4	10 6	0 8	0 100	LIMIT	CON	TURE		a) PEN.	) NIT W	AN	
Continued       b       b       b       b       b       b       b       b       b       b       c       b       c <thc< th="">       c       <thc< th=""> <thc< t<="" td=""><td>EV</td><td></td><td>R PLO</td><td></td><td></td><td>NOI NOI</td><td></td><td></td><td></td><td>TH (kF</td><td></td><td>W<sub>P</sub></td><td>\ ز</td><td>w o</td><td>WL</td><td>u) (kP</td><td>RAL U</td><td>GRAIN DISTRIB</td><td></td></thc<></thc<></thc<>	EV		R PLO			NOI NOI				TH (kF		W <sub>P</sub>	\ ز	w o	WL	u) (kP	RAL U	GRAIN DISTRIB	
Continued       b       b       b       b       b       b       b       b       b       b       c       b       c <thc< th="">       c       <thc< th=""> <thc< t<="" td=""><td>TH</td><td></td><td>RAT/</td><td>u i</td><td></td><td></td><td></td><td></td><td></td><td>+ ×</td><td>&amp; Sensitivity</td><td>WA</td><td>TER CO</td><td></td><td>T (%)</td><td>90 00</td><td>NATU</td><td>(%</td><td><b>b</b>)</td></thc<></thc<></thc<>	TH		RAT/	u i						+ ×	& Sensitivity	WA	TER CO		T (%)	90 00	NATU	(%	<b>b</b> )
1). Upon completion of drilling, borehole had caved at 4.2 meter below ground surface (mbgs) and groundwater was at approximate			STI NU	Σ	"N R	S H	2	20 4	10 6	0 8	0 100	1	0 2	20 3	30			GR SA	SI CL
	Notes 1). Up boreh below ground	s: pon completion of drilling, lole had caved at 4.2 meter / ground surface (mbgs) and dwater was at approximate																	oi CL
GRAPH																			





	4				LOC	g of	BOR	EHC	DLE E	3H22	-09									1 OF 2
PROJ	JECT: GEOTECHNICAL INVESTIGATIO	ON Fo	or Pro	opose	d Resi	dential \$	Subdiv	sion									REF.	NO.	: 225	517668
	NT: Bradford Highlands Joint Venture								od: So	lid Ste	m Aug	jer					ENC	L NO	).:	
PRO	IECT LOCATION: 23 Brownlee Drive, B	sradfo	rd, O	ntario				Diam	neter: 1	52 mm	ı						ORIG	SINA	TED	BY PM
DATU	JM: UTM NAD , ZONE							Date	: Mar-	23-202	2 to	Mar-23	3-2022				COM	IPILE	D B)	γ FJ
BH LO	DCATION: N 4883030 E 613927									Drill Te			be 420	М						
	SOIL PROFILE		S	SAMPL	ES	~		DYNA RESIS	MIC CO	DNE PEI E PLOT		TION		DIAGT	NAT	URAL			F	REMARKS
(m)		1 T				GROUND WATER CONDITIONS		:	20 4	40 €	i0 8	30 1	00	LIMIT	IC NAT MOIS CON		LIQUID LIMIT	a) EN.	NATURAL UNIT WT (kN/m <sup>3</sup> )	
ELEV	DESCRIPTION	STRATA PLOT	~		BLOWS 0.3 m	D W	NOI			RENG	TH (k	Pa)		W <sub>P</sub>		w o	WL	POCKET PEN. (Cu) (kPa)	RAL U (kN/m <sup>5</sup>	GRAIN SIZE DISTRIBUTION
DEPTH	DESCRIPTION	<b>ATP</b>	NUMBER	щ		NUN	ELEVATION		INCONF	FINED RIAXIAL	+ . ×	FIELD V & Sensit		WA	TER CO		Г (%)	90 00	NATU	(%)
231.60	Ground Surface		R	туре	ŗ			:	20 4	40 €			00	1	10 2	20 3	30			GR SA SI CL
0.00	<b>TOPSOIL:</b> (450 mm)	<u>× 1/</u>						E												
004.45		<u>// · × ·</u>	1	SS	4		}	-								0				
2 <u>31.15</u> - 0.45	SILTY CLAY:							-												
	Brown, trace sand, trace organics, cohesive w <pl, firm.<="" td=""><td></td><td> </td><td></td><td></td><td>• •</td><td>231</td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,>					• •	231	-												
								-												
1			2	SS	4			-								0				
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							228	-												
								-												
227.60								-												
_ 4.00	CLAYEY SILT TILL: Brown to grey, trace sand, trace							-												
-	gravel, cohesive w <pl to="" w~pl,<br="">very stiff to hard.</pl>							-												
	very stiff to hard.							-												
		Ø	6	SS	34		227	-												
								E												
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21-02423-0								-												
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0:302+							224	Ŀ												
0 200 1							224	-												
ASP SOLLES			8	SS	28			F							0					
	Continued Next Page		a			GRAPH	. 3	<b>√</b> 3.	Numbe	rs refer	·	8=3%	Strain	• • • • • •						
GROUN	$\begin{array}{c} \begin{array}{c} \begin{array}{c} \\ \text{NDWATER ELEVATIONS} \end{array} \end{array} \\ \begin{array}{c} \begin{array}{c} \\ \text{stress} \end{array} \end{array} \end{array} \begin{array}{c} \begin{array}{c} \\ \text{stress} \end{array} \end{array} \begin{array}{c} \begin{array}{c} \\ \text{stress} \end{array} \end{array} \begin{array}{c} \\ \end{array} \end{array} \end{array} \begin{array}{c} \\ \end{array} \end{array} \end{array} \begin{array}{c} \\ \end{array} \end{array} \begin{array}{c} \\ \end{array} \end{array} \end{array} \end{array} \begin{array}{c} \\ \end{array} \end{array} \end{array} \begin{array}{c} \\ \end{array} \end{array} \end{array} \end{array} \end{array} \end{array} \begin{array}{c} \\ \end{array} \end{array} \end{array} \end{array} \end{array} \end{array} \begin{array}{c} \\ \end{array} \end{array} \end{array} \end{array} \end{array} \end{array} \end{array} \end{array} \end{array} \begin{array}{c} \\ \end{array} $					<u>GRAPH</u> NOTES	- <b>T</b> "	· · ·	Numbe to Sens	itivity	Ċ	,	Sualna	ai r'allu	e					
Measure	ement $\underline{\vee}$ $\underline{\Psi}$ $\underline{\Psi}$ $\underline{\Psi}$																			

IPROJECT. GUTCHMOLA MUSTIGATION No Proposed Readentia Staddam Auge     IPET. No.: 2317883       ICUMT Deaded Data Sational Data Bandord, Ontario     Damate:: 52 mm     ORGANIED BY       IPALEDT LOCATION. 23 Browne Data Bandord, Ontario     Damate:: 52 mm     ORGANIED BY       IPAL COLTON. 40000     1997     Data Mar.23 2021     COMPLEDITY       IPAL COLTON. 40000     1997     IPAL     Data Mar.23 2021     COMPLEDITY       IPAL COLTON. 40000     1997     IPAL     IPAL     IPAL       IPAL COLTON. 40000     IPAL     IPAL     IPAL     IPAL       IPAL COLTON. 40000     IPAL     IPAL     IPAL     IPAL       IPAL COLTON. 4000000000     IPAL     IPAL     IPA		יור				LOC	G OF	BOR	EHO	LE E	3H22	-09									2 OF 2
PROJECT LOCATION: 23 Browniee Drive, Bradford, Ontario DATUM: UTN NAD, ZONE BH LOCATION: N 4883030 E 613927 DESCRIPTION	PRO	JECT: GEOTECHNICAL INVESTIGATIO	ON Fo	or Pro	posed	Resid	dential S	Subdivi	sion									REF.	NO.	: 225	517668
Instruction Location Location, Bradient, Market         Datability         Distribution         Distributi	CLIE	NT: Bradford Highlands Joint Venture							Metho	od: So	lid Ster	m Aug	er					ENC	L NO	).:	
BH LOCATION: N 4883030 E 613927           Egyment: Drill Tech Geoprobe 420M           Continued         Proprint Content Chill Tech Geoprobe 420M           DESCRIPTION         Proprint Chill Tech Geoprobe 420M           Continued         Continued         Continued         Proprint Chill Tech Geoprobe 420M           Continue Chill Tech Geoprobe 420M	PRO	JECT LOCATION: 23 Brownlee Drive, B	sradfo	rd, O	ntario				Diam	eter: 1	52 mm	ı						ORIG	SINA	TED	BY PM
SOIL PROFILE     SAMPLES     #<	DATU	JM: UTM NAD , ZONE							Date:	Mar-2	23-202	2 to 1	Mar-23	-2022				COM	PILE	D B)	∕ FJ
Image: construct of the second sec	BH L			-			<u> </u>	. – –						e 420	М					_	
CLAYEY SILT TILL: Brown to grey, trace sand, trace greyel, consistence with to w-PL, very stiff to hard.(Continued)       223         9       SS60/101mm         9       SS60/101mm         222       0         10       SS50/101mm         221       0         10       SS50/127mm         10       SS50/127mm         10       SS50/127mm         10       SS50/127mm         221       0         0       0         10       SS50/127mm         10       SS50/127mm         10       SS50/127mm         10       SS50/127mm         10       SS50/127mm		SOIL PROFILE		S	SAMPL	ES	щ		RESIS	TANCE	PLOT	$\geq$			PLASTI			LIQUID		ΜŢ	REMARKS
CLAYEY SILT TILL: Brown to grey, trace sand, trace greyel, consistence with to w-PL, very stiff to hard.(Continued)       223         9       SS60/101mm         9       SS60/101mm         222       0         10       SS50/101mm         221       0         10       SS50/127mm         10       SS50/127mm         10       SS50/127mm         10       SS50/127mm         221       0         0       0         10       SS50/127mm         10       SS50/127mm         10       SS50/127mm         10       SS50/127mm         10       SS50/127mm	(m)		DT I			ω	VATE VS	-				I	I	00	LINNIT	CON	TENT		T PEN (Pa)	UNIT ")	AND GRAIN SIZE
CLAYEY SILT TILL: Brown to grey, trace sand, trace greyel, consistence with to w-PL, very stiff to hard.(Continued)       223         9       SS60/101mm         9       SS60/101mm         222       0         10       SS50/101mm         221       0         10       SS50/127mm         10       SS50/127mm         10       SS50/127mm         10       SS50/127mm         221       0         0       0         10       SS50/127mm         10       SS50/127mm         10       SS50/127mm         10       SS50/127mm         10       SS50/127mm	ELEV DEPTH	DESCRIPTION	TA PI	н		0.3 m		10IT				1H (kł +	<b>7a)</b> FIELD V/ & Sensiti	ANE			o		OCKE (Cu) (	rural (kn/	
CLAYEY SILT TILL: Brown to grey, trace sand, trace greyel, consistence with to w-PL, very stiff to hard.(Continued)       223         9       SS60/101mm         9       SS60/101mm         222       222         10       SS50/101mm         221       0         10       SS50/127mm         10       SS50/127mm         221       0         10       SS50/127mm         221       0         10       SS50/127mm         10       SS50/127mm         21       0         10       SS50/127mm         21       0         10       SS50/127mm			TRA	IUMB	YPE	۵ z	SROL	ILE (V)				. ×	LAB VA	ANE .				T (%) 30	Ľ	M	
Brown to grey, trace sand, trace yvery stiff to hard. (Continued) 223 223 223 223 223 223 223 22	-			2	-	-		ш	-									1			GR SA SI CL
1       very stiff to hard.(Continued)       223       0       0       0         1       9       \$\$550/101m m       223       0       0       0         1       9       \$\$550/101m m       222       0       0       0         10       \$\$550/101m m       222       0       0       0         10       \$\$560/127m m       221       0       0       0         10.80       END OF BOREHOLE       0       0       0       0         10.80       ED ED ED ED ED ED E	Ł	Brown to grey, trace sand, trace							F												
9     \$\$\$50/101mm       9     \$\$\$\$50/101mm       222     222       10     \$	-	very stiff to hard.(Continued)	D						-												
10.80       END OF BOREHOLE       10       SS50/127m       >       >         10.80       END OF BOREHOLE       10       I       I       I       I         10.80       END OF BOREHOLE       I       I       I       I       I       I         10.80       END OF BOREHOLE       I       I       I       I       I       I       I         10.80       END OF BOREHOLE       I	-		6					223													
10.80       END OF BOREHOLE       10       SS50/127m       >       >         10.80       END OF BOREHOLE       10       I       I       I       I         10.80       END OF BOREHOLE       I       I       I       I       I       I         10.80       END OF BOREHOLE       I       I       I       I       I       I       I         10.80       END OF BOREHOLE       I	-								-												
10.80       END OF BOREHOLE       10       SS50/127m       >       >         10.80       END OF BOREHOLE       10       I       I       I       I         10.80       END OF BOREHOLE       I       I       I       I       I       I         10.80       END OF BOREHOLE       I       I       I       I       I       I       I         10.80       END OF BOREHOLE       I	9		PA						-												
10     SS50/127m     221     0     0       10     SS50/127m     0     0       10.80     END OF BOREHOLE     0     0	-			9	SS5	/101n	m		-							o					
10     SS50/127m     221     0     0       10     SS50/127m     0     0       10.80     END OF BOREHOLE     0     0	-								-												
20.80     221       10.80     END OF BOREHOLE       10.80     END OF	-							222	-												
20.80     221       10.80     END OF BOREHOLE       10.80     END OF	-								-												
220.80     Image: Constraint of the system of	10							1	-												
220.80     Image: Constraint of the system of	-								-												
220.80     Image: Constraint of the system of	Ł							1	-												
220.80     Image: Constraint of the system of	-							221	-												
Notes:       1). A 50mm diameter monitoring well was installed with screens from 7.62 mbgs to 10.67 mbgs.         Water Level Reading:       Date         Date       Depth (m bgs.)				10	SS50	)/127n		221	-							0					
1). A 50mm diameter monitoring well was installed with screens from 7.62 mbgs to 10.67 mbgs. Water Level Reading: Date Depth (m bgs.)	10.80	END OF BOREHOLE																			
Date Depth (m bgs.)		1). A 50mm diameter monitoring well was installed with screens from																			
April 26, 2021 0.9		Date Depth (m bgs.)																			
		April 26, 2021 0.9																			
	622																				
	DHOLAND GPU 5-																				
	03423-00-ERADFOF																				
	0.2.F.JBH L06522																				
	XLL00 200 13.62																				
GROUNDWATER ELEVATIONS GRAPH + 3, X 3: Numbers refer O = 3% Strain at Failure	e dSM									Number	n rofe-		<b>e</b> -20/								



PROJ	ECT: GEOTECHNICAL INVESTIGATIO	DN Fo	r Pro	oposed	d Resid	dential S	Subdivi	sion									REF.	NO.	: 22	517668
	IT: Bradford Highlands Joint Venture								od: So	lid Ste	n Aug	ger					ENC	L NO	).:	
PROJ	ECT LOCATION: 23 Brownlee Drive, B	radfor	d, O	ntario				Diam	eter: 1	52 mm	1						ORIC	SINA <sup>-</sup>	TED	BY PM
DATU	M: UTM NAD , ZONE							Date:	Mar-	26-202	2 to	Mar-26	6-2022				COM	IPILE	D B	r FJ
BH LC	OCATION: N 4883347 E 613849												be 420	М						
	SOIL PROFILE		S	SAMPL	ES			DYNA RESIS	MIC CC	NE PEI PLOT		TION		PLASTI	_ NAT	URAL	LIQUID		F	REMARK
(m)		Ц				ATEF		2	20 4	10 G	0 8	30 1	00	CIIVIIII	CON	TENT	LIMIT	PEN.	) NIT W	AND GRAIN SI
EEV EPTH	DESCRIPTION	STRATA PLOT	NUMBER	ТҮРЕ	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	0 U • Q	NCONF UICK T	RIAXIAL	+ . ×	FIÉLD V & Sensit LAB V/	ANE		TER CO			POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	DISTRIBUT (%)
8.30 0.00	Ground Surface TOPSOIL: (400 mm)	0 <u>11/</u>	z	-	f	00	ш	-	20 4	10 6	3 0	30 1	00		0 2	20 3	30			GR SA SI
		1/ 1/	1	SS	10		238	-								_				
7.90	SILTY CLAY:		'	33			230	-												
	Brown to grey, trace gravel, cohesive w~PL, stiff to hard.							-												
	Conesive w~FL, suit to hard.					-		-												
			2	SS	19			-								φ				
	wet							-												
							237	-										1		
								-												
			3	SS	26			-							o					
								-												
								-												
			4	SS	24		236								0			-		
			-	00	27			-												
								-												
5.46 2.84	SANDY CLAYEY SILT TILL:							-												
	Grey, trace gravel, cobbles fragment, cohesive w <pl, hard.<="" td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,>							-												
			5	SS	15		235	-						(						
	grey						200	-												
								-												
		10						-												
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								-												
							234	-										1		
		6				-		-												
			6	SS5	)/127n	m		-						0						
								-												
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							233	-												
2.80 5.50	SAND:	KR/						-												
	Grey, trace silt, cobbles fragment, wet, dense to very dense.	ŀ.' .						-												
		$\cdot \cdot$						F												
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			7	SS	60		232	-							0			-		
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		<b>!</b>						ŀ										1		
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		•••					201													
		$\left[ \cdot \right]$				-		ŀ												
		$\left \cdot\right $	8	SS	35			F							0			1		
0.32		ŀ ·						[										1		

					LOG	GOF	BOR	EHO	LE B	BH22	-10									2	OF 2
PRO	JECT: GEOTECHNICAL INVESTIGATIO	DN Fo	or Pro	oposed	Resid	lential S	Subdivi	sion									REF.	NO.	: 225	517668	
	NT: Bradford Highlands Joint Venture								d: Sol	id Ster	n Aug	er					ENC	L NO	.:		
PRO	JECT LOCATION: 23 Brownlee Drive, B	radfo	rd, O	ntario				Diame	eter: 1	52 mm							ORIG	SINA	TED	BY PN	Л
DAT	UM: UTM NAD , ZONE							Date:	Mar-2	26-2022	2 to N	Mar-26-	2022				COM	IPILE	DBY	, FJ	
BHL	OCATION: N 4883347 E 613849							Eqipm	nent: D	Drill Teo	ch Ge	eoprobe	e 420N	Λ							
	SOIL PROFILE		s	SAMPL	ES			DYNAM RESIS	/IC CO TANCE	NE PEN PLOT		FION			ΝΑΤΙ	IDAI			_	REM	VBKS
()						GROUND WATER CONDITIONS							0	PLASTIC LIMIT	MOIS	TURE	LIQUID LIMIT	Ľ.	NATURAL UNIT WT (kN/m <sup>3</sup> )	AN	
(m) ELEV		LO.			ЯN	N WA	N	SHEA	R ST	RENG	TH (kF	∟∟⊥ Pa)		WP	v	v	WL	KET F (kPa	AL UN N/m <sup>3</sup> )	GRAIN DISTRIE	
DEPTH	DESCRIPTION	STRATA PLOT	IBER	ш	BLOWS 0.3 m		ELEVATION				+	0 100 Pa) FIELD VAI & Sensitivi	NE	WAT	ER CO		T (%)	POCKET PEN. (Cu) (kPa)	ATUR (k	(%	
	Continued	STR	NUMBER	ТҮРЕ	"z	GRC CON	ELE	• QU 2		RIAXIAL 0 60	~		·-	1(			30		z	GR SA	SI CL
7.98																					
	<b>END OF BOREHOLE</b> Notes: 1). Upon completion of drilling, borehole had caved at 7.01 meter below ground surface (mbgs) and groundwater level was at approximately 4.8 meter below ground surface (mbgs).																				
War out an												<b>8</b> =3%									

wsp

11	sp				LOC	GOF	BOR	ЕНО	LE E	3H22	-11									1	OF 2
PRO	JECT: GEOTECHNICAL INVESTIGATIO	DN Fo	or Pro	oposed	d Resid	dential S	Subdivi	sion									REF.	NO.	: 225	517668	
CLIE	NT: Bradford Highlands Joint Venture							Metho	od: So	lid Ste	m Aug	ger					ENC	L NO	).:		
PRO	JECT LOCATION: 23 Brownlee Drive, B	radfo	rd, O	ntario				Diam	eter: 1	52 mm	ı						ORIC	SINA	TED		1
	JM: UTM NAD , ZONE							Date:	Mar-	29-202	2 to	Mar-29	9-2022	2			COM	IPILE	DBY	′ FJ	
BH L	OCATION: N 4883581 E 613829		1			1		Eqipn	nent: [		ch G		be 420	M				1	<u> </u>		
	SOIL PROFILE	_	S	SAMPL	.ES	с		RESIS	TANCE	DNE PER E PLOT	$\geq$	-		PLASTI LIMIT			LIQUID		μ	REMA	
(m)		OT			0	GROUND WATER CONDITIONS	_		1				00	LIMIT W <sub>P</sub>		TENT	LIMIT W <sub>L</sub>	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	AN GRAIN	
ELEV DEPTH	DESCRIPTION	A PL	Ř		BLOWS 0.3 m	VD V TION	EVATION		AR ST NCONF		TH (k +	Pa) FIELD V & Sensit	ANE			 o		OCKE (Cu) (k	URAL (kN/r	DISTRIB	UTION
DEFIN		STRATA PLOT	NUMBER	ТҮРЕ			EVA	• Q	UICK T	RIAXIAL	. ×	LAB V	ANE		TER CO			а –	NAT	(%	
241.90	Ground Surface TOPSOIL: (450 mm)	5	ž	Ĥ	ŗ	ចីប័	ᆸ	2	20 4	10 6	0	80 1	00	1	0 2	20	30			GR SA	SI CL
- 0.00		1/ 2																			
- 241.45		 	1	SS	6			-							0						
- 0.45 -	SILTY CLAY: Brown, trace gravel, cohesive	X																			
-	w <pl, firm="" stiff.<="" td="" to="" very=""><td></td><td></td><td></td><td></td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,>					-															
- 1			2	SS	11		241														
-			2	33	''			-								1					
-								-													
-								-													
-			3	ss	14										0						
						_	240														
2																					
-								-													
-	 w <pl< td=""><td></td><td>4</td><td>SS</td><td>26</td><td></td><td></td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td>0</td><td></td><td></td><td></td><td></td><td></td><td></td></pl<>		4	SS	26			-							0						
-	W~FL					_		-													
239.08								-													
- 2.82 3	SAND: Brown, some silt, wet, dense to very						239														
-	dense.		5	SS	38										0						
-		· ·				-		-													
-		ŀ						-													
-		ŀ						-													
-		ŀ					238	-													
-		ŀ. ·						-													
E .		ŀ.·																			
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-			6	SS5	)/127n	m		-						0							
-							007	-													
5							237	-													
-								-													
- 236.40		· ·						-													
_ 5.50	SANDY CLAYEY SILT TILL:																				
-	Grey, cohesive w <pl, hard.<="" td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,>																				
- 6		D					236														
-			7	5.950	av(101m)	am		-													
-			<u> </u>	<u> </u>				-													
-		D						-													
-																					
235.05 6.85		172					235														
0.00	Brown, wet, very dense.						200														
7467-1276								ŀ													
-								F													
-								Ì													
- 234.03			8	SS50	/152m	m		ŀ							0						
7.87	END OF BOREHOLE					l						1									
GROUM	Continued Next Page					<u>GRAPH</u> NOTES	+ 3,	× <sup>3</sup> :	Numbe	rs refer itivity	C	<b>8</b> =3%	Strain	at Failur	e						
Measur	1st 2nd 3rd 4th					INUIES		1	U Sens	avity											

	4				LOC	GOF	BOR	EHO	LEE	BH22	-11									2 0	DF 2
PRO	ROJECT: GEOTECHNICAL INVESTIGATION For Proposed Residential Subdiv																REF.	NO.	: 225	517668	
CLIE	NT: Bradford Highlands Joint Venture							Metho	od: Sol	id Ster	n Aug	jer					ENC	L NO	.:		
PRO	JECT LOCATION: 23 Brownlee Drive, B	radfo	rd, O	ntario				Diame	eter: 1	52 mm	n						ORIG	SINA	TED	BY PM	
DATI	JM: UTM NAD , ZONE							Date:	Mar-2	29-202	2 to I	Mar-29-2	2022				COM	IPILE	D B	∕ FJ	
BH L	OCATION: N 4883581 E 613829		-			-	_					eoprobe	e 420N	Λ				-			
	SOIL PROFILE		s	AMPL	ES			DYNA RESIS	MIC CO TANCE	NE PEN PLOT		TION			NATI	IRAI			Т	REMAR	RKS
(m)		⊢				TER		2			~	30 100		PLASTIC LIMIT	MOIS	TURE	Liquid Limit	EN	NATURAL UNIT WT (kN/m <sup>3</sup> )	AND	)
ELEV		PLO	~		S E	⊿W 0 ONS	N			RENG	TH (kf	Pa)		WP	v 	v 	WL	POCKET PEN. (Cu) (kPa)	AL UI	GRAIN S	
DEPTH	DESCRIPTION	ATA	1BEF	ш	BLOWS 0.3 m	DUNE	VATI				+	FIELD VAN & Sensitivit	NE ty	WAT	ER CC	- NTEN	T (%)	00 00 00	IATUR (F	(%)	
	Continued	STR	NUN	ТҮР	ż	GRO	ELE					30 100		10			30		2	GR SA S	SI CL
221:030-03 # BrockeninGLANG.004 F + 1-02	Continued Notes: 1). Upon completion of drilling, borehole had caved at 6.1 meter below ground surface (mbgs) and groundwater level was at approximately 1.5 meter below ground surface (mbgs).	STRATA PLOT	NUMBER	Түре		GROUND WATER CONDITIONS	ELEVATION													GR SA S	51 CL
06 9.05.302.FJBH LC																					
SOLLOG 2																					
<u></u>						GRAPH												L			

 $\begin{array}{c} \underline{\text{GROUNDWATER ELEVATIONS}} \\ \text{Measurement} \quad \underbrace{\stackrel{1 \text{st}}{\underline{\checkmark}} \quad \underbrace{\stackrel{2 \text{nd}}{\underline{\checkmark}} \quad \underbrace{\stackrel{3 \text{rd}}{\underline{\checkmark}} \quad \underbrace{\stackrel{4 \text{th}}{\underline{\checkmark}}} \\ \underline{} \end{array}$ 



					LOC	٦UF	BOK	EHC		SH22	-12									1	OF 2
PRO	JECT: GEOTECHNICAL INVESTIGATIO	DN Fo	or Pr	opose	d Resi	dential \$	Subdivi	sion									REF.	NO.	: 22	517668	3
CLIEI	NT: Bradford Highlands Joint Venture							Meth	od: So	lid Ster	n Aug	ger					ENC	L NC	0.:		
PRO.	JECT LOCATION: 23 Brownlee Drive, B	radfo	rd, C	Intario				Diam	eter: 1	52 mm	I						ORIC	GINA	TED	51	PM
	JM: UTM NAD , ZONE							Date	: Mar-2	28-202	2 to	Mar-28	8-2022	2			CON	IPILE	D B	γ F	J
BH LO	OCATION: N 4883516 E 613608		1			i				Drill Te			be 420	M				-	1		
	SOIL PROFILE		5	SAMPI	LES	~		RESI	STANCE	NE PEN PLOT				PLAST		URAL	LIQUID		₽	RE	MARKS
(m)		5				GROUND WATER CONDITIONS			20 4	10 6	0 8	80 1	00	LINNIT	CON	ITENT	LIMIT	a) PEN.	NATURAL UNIT WT (KN/m <sup>3</sup> )		AND JN SIZE
ELEV	DESCRIPTION	A PLO	ъ		BLOWS 0.3 m	N OL	NOL			RENG	TH (k	Pa)		W <sub>P</sub>		w o	WL	E K	(kN/m	DISTR	
DEPTH		STRATA PLOT	NUMBER	щ	<u> </u>		ELEVATION		NCONF	'INED RIAXIAL	+ ×	FIELD V & Sensit		WA	TER CO	ONTEN	T (%)	9 O O	NATU		(%)
213.20	Ground Surface	1	INN	ТҮРЕ	ž	GR	ELE			40 6			00		10 2	20	30				A SI C
0.00	TOPSOIL: (600 mm)	<u>×1 /y</u>						-													
-		1/ 2/	1	SS	5		213	-								0					
-		<u>\\</u>																			
212.59 0.61			-			-		-													
-	Brown, cohesive w~PL, firm to stiff.					1		-													
1		1	2	SS	7			-									0				
-		Ĥ				1	212														
			1																		
-			1—			-		-													
-	wet spon	12	3	SS	11			-							0						
				33	''																
2		K	╞			1		-													
-		R.	1				211		-					-							
-		Ĥ				1															
-		H.	4	SS	17										0					2 48	3 36 1
-		12	1			4		-													
-		1	1																		
-		K	}—			-															
-			5	SS	25		210								0			1			
-		1	Ĭ					-													
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-		K	1					-													
209.20																					
_ 4.00	SAND AND SILT TILL: Brown, some clay, trace gravel,							-													
-	moist, compact to very dense.						209	-													
-																					
		ø				1		_													
-			6	SS	36			-							•						
5		p	-			1		-													
-							208	-													
-		0						-													
-								-													
-																					
6																					
-			7	SS5	0/152n	m	207								<u>م</u>						
-		0						-													
7701-0																					
								-													
- 7								-													
								F						1							
-							206	L -	1				1	1				1			
								Ł						1							
-			<u> </u>		-	-		F						1							
- 205.33			8	SS5	<b>0</b> /101n	m		F						1	<b>\</b>						
7.87	END OF BOREHOLE	overat file												1							
GROUN	Continued Next Page					<u>GRAPH</u> <u>NOTES</u>	+ 3.	× <sup>3</sup> :	Number to Sens	rs refer	C	8=3%	' Strain	at Failu	re						
<u></u>	$\begin{array}{c} \begin{array}{c} \text{NDWATER ELEVATIONS} \\ \text{ement}  \underbrace{\overset{1\text{st}}{\underline{\nabla}}} & \underbrace{\overset{2\text{nd}}{\underline{\nabla}}} & \underbrace{\overset{3\text{rd}}{\underline{\nabla}}} & \underbrace{\overset{4\text{th}}{\underline{\nabla}}} \end{array}$					NUTES			to Sens	nivity											
weasur																					

	4				LOG	GOF	BOR	EHO	LE E	3H22	2-12									2	OF 2
PRO	JECT: GEOTECHNICAL INVESTIGATI	ON Fo	or Pro	posed	Resid	lential S	Subdivi	ision									REF.	NO.	: 225	517668	
CLIEI	NT: Bradford Highlands Joint Venture				Meth	od: So	lid Ste	m Aug	er					ENC	L NO	.:					
PRO	JECT LOCATION: 23 Brownlee Drive, B	radfo	rd, O	ntario				Diam	eter: 1	52 mn	n						ORIC	SINA <sup>-</sup>	TED	BY P	М
DATU	JM: UTM NAD , ZONE							Date	Mar-	28-202	2 to	Mar-28	8-2022				CON	IPILE	D B)	ν F.	J
BH L	OCATION: N 4883516 E 613608						-					eoprob	be 420	М							
	SOIL PROFILE		s	AMPL	ES	~		RESIS	MIC CC STANCE	DNE PEI E PLOT		TION			NATI	URAL			Ļ	REM	ARKS
(m)		OT			M	GROUND WATER CONDITIONS			1	1	1	1	00	PLASTI LIMIT W <sub>P</sub>	MOIS CON	TURE TENT N	LIQUID LIMIT WL	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )		ND N SIZE
ELEV DEPTH	DESCRIPTION	APL	R		BLOWS 0.3 m		VOIL		AR ST NCONF		iTH (kl +	Pa) FIELD V/ & Sensiti	ANE		(	 o		Cu) (K	URAL (kN/r	DISTRI	BUTION
		STRATA PLOT	NUMBER	ТҮРЕ		IDNC	ELEVATION	• Q	UICK T	RIAXIAL	- ×	LAB VA	ANE .		TER CC		• •	g -	NAT		%)
	Continued	S	ž	F	ż	ចប័			20 4	40 6	50 E	30 10	00	1	0 2	20	30			GR SA	SI CL
12 (325 64 AVORDIN LLANDOV L 112 2	Notes: 1). Upon completion of drilling, groundwater level was at approximately 1.5 meter below ground surface (mbgs).																				
2.FJBH L008.2																					
20 20 20																					
P 501L L00 20																					
48M						GRAPH	L	× 3.				<b>8</b> =3%									

Discution Ion         End by the second sufficiency         Discution Ion         Concort Read of the second sufficiency         Discution Ion         Discution Ion <t< th=""><th></th><th>יור</th><th></th><th></th><th></th><th>LOC</th><th>g of</th><th>BOR</th><th>EHC</th><th>DLE E</th><th>3H22</th><th>2-13</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th>1</th><th>OF 2</th></t<>		יור				LOC	g of	BOR	EHC	DLE E	3H22	2-13									1	OF 2
PROJECT LOCATION: 28 BOARD ED Ne, Backtor, Onton DATUM UTANIO, 2004 BOARD ET ATTACH SOLE PROFILE SOLE PROFILE	PROJ	ECT: GEOTECHNICAL INVESTIGATIO	ON Fo	or Pr	opose	d Resi	dential \$	Subdivi	sion									REF.	. NO.	: 22	517668	
DATUM LITMAND, ZONE         Date: More:35222         Deck: More:35222         COMPLEDIN         C	CLIEN	IT: Bradford Highlands Joint Venture							Meth	od: So	lid Ste	m Aug	ger					ENC	L NO	).:		
Eigenet: Unit Tube: Generate-out Tube: Generat	PROJ	ECT LOCATION: 23 Brownlee Drive, B	radfo	rd, C	ntario				Diam	neter: 1	52 mm	n						ORIC	gina <sup>.</sup>	TED	BY PI	М
SOL PROFILE         SAMPLES         Baseline         Baseline         Description         Baseline	DATU	M: UTM NAD , ZONE							Date	: Mar-	28-202	2 to	Mar-28	8-2022	2			COM	1PILE	DB	γ F.	J
Image: Marcon         DESCRIPTION         Bar Marcon         Bar	BH LC	DCATION: N 4883307 E 613701												be 420	M						-	
The result         DESCRIPTION         Control		SOIL PROFILE		5	SAMPL	ES	~		RESI	STANCE	E PLOT		-		PLAST		URAL			5	REM	ARKS
0.00       TOPSOL: (510 mm)       1       55       5       0	(m)		5			0	ATEF S			20 4	40 6	60	80 1	00	LIMIT			LIMIT	PEN.	UNIT V		
0.00       TOPSOL: (510 mm)       1       55       5       0	ELEV	DESCRIPTION	APL	н		.3 m		NOIT				iTH (k	Pa) FIELD V	/ANE	•••p		о Э————		CKE Cu) (K	(kN/m	DISTRI	BUTION
0.00       TOPSOL: (510 mm)       1       55       5       0	DEPTH		RAT	IMBE	Щ		UDOS	EVA	• 0	UICK T	RIAXIAL	- ×	LAB V	ANE	WA	TER CO			PG C	NATI	(9	%)
11 00       1 05       5       0<		Ground Surface		ž	È	Ž	68	Ē		20 4	40 6	50 i	80 1	00	1	10 2	20 3	30			GR SA	SI CI
11 00     10	_ 0.00	<b>TOPSOIL:</b> (510 mm)							F													
11.125       25.00       MADY CLAYEY SLT:       2       5       23         2       5       5       19       2       241       0       0         3       3       5       19       240       0       0       0         4       5       58       37       230       0       0       0         5       58       37       230       0       0       0       0         4.00       CLAYEY SILT TILL:       230       0       0       0       0       0         8000, frace and, tace gravel, cohesive w-PL, wey still to hard.       0       237       0       0       0       0       0         3300       CLAYEY SILT TILL:       0 <td></td> <td></td> <td>F</td> <td>1</td> <td>SS</td> <td>5</td> <td></td> <td></td> <td>-</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>0</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>			F	1	SS	5			-							0						
Brown, finde gravel, cohesive     2     SS     23       2     SS     1     240       3     SS     19       4     SS     27       5     SS     37       4     SS     27       5     SS     37       6     SS     32       7     SS     31       6     SS     32       7     SS     31       9     33.00     Contract strenge treavel, cohesive wrPL, very stiff to hard.       7     SS     31       9     0     0       13.00     To Sat Extrempt treavel, cohesive wrPL, very stiff to hard.	241.09 0.51	SANDY CLAYEY SILT	111					044	-													
37400       CLAPEY BUT TILL:         5 SS 37       238         5 SS 37       0         5 SS 37       0         6 SS 32       0         7 No       0         6 SS 32       0         7 SS 31       238         238       0         239       0         231       0         1       0	- 0.01	Brown, trace gravel, cohesive						241	-										1			
37.00     CLAYEY SLITTILL:       Boow, the sand, frage gravel, coheadow w-PL, wery aff to hard.       6     SS       13.00       To NOT Sample recovery       0        0	-	w~PL, firm to very stiff.							-													
37.60       CLAVEY SILT TILL:         44       55       27         5       58       37         5       58       37         6       58       32         6       58       32         7       7       7         8.00       7       7         9       0       0         9       0       0         10       1       1         10       1       1         10       1       1         10       1       1         10       10       10       10         10       10       10       10       10         10       10       10       10       10       10         10       10       10       10       10       10       10         10       10       10       10       10       10       10       10         10       10       10       10       10       10       10       10         10       10       10       10       10       10       10       10       10         10       10 <td< td=""><td>-</td><td></td><td></td><td>2</td><td>SS</td><td>23</td><td></td><td></td><td>Ŀ</td><td></td><td></td><td></td><td></td><td></td><td></td><td>0</td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	-			2	SS	23			Ŀ							0						
37.60       CLAVEY SILT TILL:         44       55       27         5       58       37         5       58       37         6       58       32         6       58       32         7       7       7         8.00       7       7         9       0       0         9       0       0         10       1       1         10       1       1         10       1       1         10       1       1         10       10       10       10         10       10       10       10       10         10       10       10       10       10       10         10       10       10       10       10       10       10         10       10       10       10       10       10       10       10         10       10       10       10       10       10       10       10         10       10       10       10       10       10       10       10       10         10       10 <td< td=""><td>-  </td><td></td><td></td><td>]</td><td></td><td></td><td>-</td><td></td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	-			]			-		-													
37.60       CLAVEY SILT TILL:         44       55       27         5       58       37         5       58       37         6       58       32         6       58       32         7       7       7         8.00       7       7         9       0       0         9       0       0         10       1       1         10       1       1         10       1       1         10       1       1         10       10       10       10         10       10       10       10       10         10       10       10       10       10       10         10       10       10       10       10       10       10         10       10       10       10       10       10       10       10         10       10       10       10       10       10       10       10         10       10       10       10       10       10       10       10       10         10       10 <td< td=""><td>-  </td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	-								-													
37.80         CLAYEY SILT TILL:           4.00         CLAYEY SILT TILL:           Brown, trace small, trace gravel, ochesive w <pl, hard.<="" stiff="" td="" to="" very="">         6           6         SS           7         SS           7         SS           7         SS           7         SS           8.00         Contestive W<pl, hard.<="" stiff="" td="" to="" very=""></pl,></pl,>	-							240	-										-			
37.60     CLAYEY SILT TILL:       5     SS       4.00     CLAYEY SILT TILL:       Brown, trace sand, trace gravel, ochesive w <pl, hard.<="" stiff="" td="" to="" very="">       6     SS       7     SS       7     SS       7     SS       7     SS       8     SS0/130cm       236     0       7     SS       8     SS0/130cm       234     0       9     0       10     0       11     0       12     0       13.00     rever sample recovery       14     14       15     SS       16     SS       17     SS       18     19       19     10       10     10       10     10       10     10       10     10       11     10       12     10       10     10       11     10       12     10       13.00     reverse sample recovery       14     10       15     10       16     10       17     10       10       10     10    &lt;</pl,>	-			3	SS	19			-							<b>\$</b>	1				4 28	38 3 <sup>.</sup>
37.60     CLAYEY SILT TILL:       5     SS       4.00     CLAYEY SILT TILL:       Brown, trace sand, trace gravel, ochesive w <pl, hard.<="" stiff="" td="" to="" very="">       6     SS       7     SS       7     SS       7     SS       7     SS       8     SS0/130cm       236     0       7     SS       8     SS0/130cm       234     0       9     0       10     0       11     0       12     0       13.00     rever sample recovery       14     14       15     SS       16     SS       17     SS       18     19       19     10       10     10       10     10       10     10       10     10       11     10       12     10       10     10       11     10       12     10       13.00     reverse sample recovery       14     10       15     10       16     10       17     10       10       10     10    &lt;</pl,>	2			1			_															
37.60     CLAYEY SILT TILL:       5     SS       4.00     CLAYEY SILT TILL:       Brown, trace sand, trace gravel, ochesive w <pl, hard.<="" stiff="" td="" to="" very="">       6     SS       7     SS       7     SS       7     SS       7     SS       8     SS0/130cm       236     0       7     SS       8     SS0/130cm       234     0       9     0       10     0       11     0       12     0       13.00     rever sample recovery       14     14       15     SS       16     SS       17     SS       18     19       19     10       10     10       10     10       10     10       10     10       11     10       12     10       10     10       11     10       12     10       13.00     reverse sample recovery       14     10       15     10       16     10       17     10       10       10     10    &lt;</pl,>	-			1					F													
37.60     CLAYEY SILT TILL:       5     SS       4.00     CLAYEY SILT TILL:       Brown, trace sand, trace gravel, ochesive w <pl, hard.<="" stiff="" td="" to="" very="">       6     SS       7     SS       7     SS       7     SS       7     SS       8     SS0/130cm       236     0       7     SS       8     SS0/130cm       234     0       9     0       10     0       11     0       12     0       13.00     rever sample recovery       14     14       15     SS       16     SS       17     SS       18     19       19     10       10     10       10     10       10     10       10     10       11     10       12     10       10     10       11     10       12     10       13.00     reverse sample recovery       14     10       15     10       16     10       17     10       10       10     10    &lt;</pl,>	-			_			-		-													
37.60     CLAYEY SILT TILL:       5     SS       4.00     CLAYEY SILT TILL:       Brown, trace sand, trace gravel, ochesive w <pl, hard.<="" stiff="" td="" to="" very="">       6     SS       7     SS       7     SS       7     SS       7     SS       8     SS0/130cm       236     0       7     SS       8     SS0/130cm       234     0       9     0       10     0       11     0       12     0       13.00     rever sample recovery       14     14       15     SS       16     SS       17     SS       18     19       19     10       10     10       10     10       10     10       10     10       11     10       12     10       10     10       11     10       12     10       13.00     reverse sample recovery       14     10       15     10       16     10       17     10       10       10     10    &lt;</pl,>	-			4	ss	27			-							•						
37.60	-			1		2.		239	_										1			
37.60	-								ŀ													
37.60	3			1					-													
37.60	-								-													
37.60	-			5	SS	37			Ŀ						°							
37.60	-			<u> </u>			-	220	-													
4.00 CLAYEY SILT TILL: Brown, Trace start, t	-							230	-													
4.00 CLAYEY SILT TILL: Brown, Trace start, t	237 60								-													
cohesive w <pl, hard.<="" stiff="" td="" to="" very=""></pl,>									Ļ													
33.90 7.70 ND OF BOREHOLE Continued Next Page		Brown, trace sand, trace gravel, cohesive w <pl, hard.<="" stiff="" td="" to="" very=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,>																				
33.90     No Soli sample recovery     8     SSO(130mm)     234       Continued Next Page     8     SSO(130mm)     234	-		10																			
33.90     No soil sample recovery     35.90     No soil sample recovery     234       Continued Next Page     No soil sample recovery     No soil sample recovery     No soil sample recovery	-			╞			-	237											-			
33.90	-			6	ss	32			-						6	×						
33.90	5		lá						-													
33.90				,					F													
33.90	-								-													
33.90	-								-													
33.90         no soil sample recovery         8         SSS0/130mm         234         1	-							236	-													
33.90         no soil sample recovery         8         SSS0/130mm         234         1																						
33.90         no soil sample recovery         8         SSS0/130mm         234         1	6								ŀ													
33.90         no soil sample recovery         8         SSS0/130mm         234         1	-								F													
33.90	-		191	7	SS	31			-						· ·	¢						
33.90	-						-	235														
7.70 No Soil sample recovery 12.71 8 SS0/139mm Continued Next Page			11	, ,																		
7.70 No Soil sample recovery 12.71 8 SS0/139mm Continued Next Page	7		Ø				1		ŀ						1							
7.70 No Soil sample recovery 12.71 8 SS0/139mm Continued Next Page	-						1		F						1							
7.70 No Soil sample recovery 12.71 8 SS0/139mm Continued Next Page	-						1		ļ						1							
7.70 No Soil sample recovery 12.71 8 SS0/139mm Continued Next Page			K				1		ŀ						1							
7.70 NO SOII SAMPLE RECOVERY END OF BOREHOLE	233.90				595	0/13Qn	m	234														
Continued Next Page							T															
Continued Next Page <u>GROUNDWATER ELEVATIONS</u> <u>At</u> <u>and</u> <u></u>																						
Aeasurement V V V	<u>GRO</u> UN	DWATER ELEVATIONS					GRAPH	+ 3	׳:	Numbe	rs refer	C	S <sup>8=3%</sup>	Strain	at Failu	re						
	Measure	ement $\stackrel{1 \text{st}}{\nabla}$ $\stackrel{2 \text{nd}}{\Psi}$ $\stackrel{3 \text{rd}}{\Psi}$ $\stackrel{4 \text{th}}{\Psi}$					10120			10 0018	nuvity											

	יור				LOG	GOF	BOR	EHOLE	ΕBł	122-1	13								2 (	OF 2
PRO	JECT: GEOTECHNICAL INVESTIGAT	ION Fo	or Pro	posed	d Resid	lential S	Subdivi	sion								REF.	NO.	: 225	517668	
CLIE	NT: Bradford Highlands Joint Venture							Method:	Solic	l Stem	Auge	er				ENC	L NO	.:		
PRO	JECT LOCATION: 23 Brownlee Drive, I	Bradfo	rd, O	ntario				Diamete	r: 152	2 mm						ORIC	SINA	TED	BY PM	
DATI	JM: UTM NAD , ZONE							Date: M	ar-28	-2022	to N	/lar-28-20	22			COM	IPILE	DΒY	, FJ	
BH L	OCATION: N 4883307 E 613701											eoprobe 4	20M				1	-		
	SOIL PROFILE		s	ampl	ES	с		DYNAMIC RESISTAI	NCE F			ION	PLAST			LIQUID		μ	REMA	
(m)		ь			(0)	GROUND WATER CONDITIONS	_	20	40	60	80		LIMIT WP	IC NAT MOIS CON	TURE ITENT W	LIQUID LIMIT WL	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	ANI GRAIN	
ELEV DEPTH	DESCRIPTION	APL	Я		BLOWS 0.3 m	ND N TION	TION	SHEAR O UNCO			H (kP	Pa) FIELD VANE & Sensitivity			 o		Cu) (k	URAL (kN/n	DISTRIB	UTION
DEFIN		STRATA PLOT	NUMBER	түре	" "		ELEVATION	QUIC	K TRI	AXIAL	×Ι	LAB VANE		TER CO			а –		(%)	
	Continued Notes:	<u>v</u>	ž	Ļ	2	σŏ	Ξ	20	40	60	8	0 100		10 2	20 :	30			GR SA	SI CL
	Continued           Notes:         1). Upon completion of drilling, borehole had caved at approximately 7.3 meter below ground surface (mbgs).																		<u>GR SA</u>	<u>si cl</u>
L	1					GRAPH		3. Nur				<b>8</b> =3% or		1		I				



11	sp				LOC	g of	BOR	ehoi	E E	8H22-	-14									1	OF 2
PROJ	ECT: GEOTECHNICAL INVESTIGATIO	ON Fo	or Pro	opose	d Resi	dential \$	Subdivi	sion									REF	. NO.	: 22	517668	
CLIEN	NT: Bradford Highlands Joint Venture							Metho	d: Sol	id Sten	n Aug	jer					ENC	L NO	<b>)</b> .:		
PROJ	IECT LOCATION: 23 Brownlee Drive, B	Iradfo	rd, O	ntario				Diame	ter: 1	52 mm							ORIO	gina <sup>.</sup>	TED	BY PM	1
DATU	IM: UTM NAD , ZONE							Date:	Mar-2	25-2022	2 to	Mar-2	5-2022	2			CON	1PILE	D B	∕ FJ	
BH LO	DCATION: N 4883207 E 613647					1		Eqipm	ent: D	Drill Tec	h G	eoprol	be 420	M							
	SOIL PROFILE		s	SAMPL	ES	~		RESIS	IC CO ANCE	NE PEN PLOT		HON .		PLAST	NAT	URAL	LIQUID	,	Þ	REMA	RKS
(m)		5				GROUND WATER CONDITIONS		20	) 4	0 60	3 0	30 1	00	PLAST LIMIT			LIMIT	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	AN GRAIN	
ELEV	DESCRIPTION	STRATA PLOT	ш		BLOWS 0.3 m	NOI NOI	ELEVATION			RENG	ΓΗ (kl	Pa)	ANF	W <sub>P</sub>		w o	WL	C, (F)	(kN/m	DISTRIB	
DEPTH		RAT,	NUMBER	ТҮРЕ			EVA <sup>-</sup>	O UN		RIAXIAL	+ ×	FIELD V & Sensit LAB V	tivity ANE	WA	TER CO	ONTEN	IT (%)	P C C	NATL	(%	)
	Ground Surface		Z	∠	ž	5 9	Ц	20	) 4	0 60	3 (	30 1	00	1	0 2	20	30			GR SA	SI CI
_ 0.00	TOPSOIL: (510 mm)	<u>× 1/</u>						-													
-		<u>// · · ·</u> · · · ·	1	SS	5			-													
2 <u>42.29</u> 0.51	SILTY CLAY:							-													
- 0.51	Brown, trace rootlets, trace sand,					1		-													
-	cohesive w~PL, firm to stiff.		2	SS	4	1	242	-													
<u>1</u>			<u> </u>		· ·	4		-													
-			1					-													
-			1					-													
-								-													
-			3	SS	13		241	-							0						
2								-													
-			1					-													
-						-		-													
-		12	4	SS	24			-							0						
-								-													
-							240	-													
			1			-		-													
-			5	SS	80			-							þ						
-					-			-													
-								-													
-			1				239	-										-			
238.80			1					-													
4.00	CLAYEY SILT TILL: Brown to grey, trace sand, trace							-													
-	Brown to grey, trace sand, trace gravel, cohesive w <pl, stiff="" to<br="" very="">hard.</pl,>							-													
-	nara.							-													
-		Ø	6	SS5	0/152n	m		-						0							
-			1			-	238	-													
5								-													
-								-													
-			1					-													
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-							237	-													
6								-													
-			1		-	-		-													
-			7	SS	46			-						0							
-			<u> </u>			1		-													
-		H.	1																		
-		B	1				236	-									1	1			
7			1																		
-		10						E													
-		H						F													
-			1																		
-		Đ	8	SS	52		235	<u> </u>						<b>—</b> 。							
234.82			Ĺ					ŀ													
<u>GROUN</u> Measure	Continued Next Page <u>IDWATER ELEVATIONS</u> ement $\stackrel{1st}{\underbrace{2nd}}$ $\stackrel{2nd}{\underbrace{3rd}}$ $\underbrace{4^{th}}{\underbrace{4^{th}}}$					<u>GRAPH</u> NOTES	+ 3,	× <sup>3</sup> : <sup>N</sup> to	lumber Sensi	s refer tivity	С	<b>8</b> =3%	' Strain	at Failu	re						

	212				LOG	GOF	BOR	EHO	LE E	3H22	-14									2 OF	2
PRO	JECT: GEOTECHNICAL INVESTIGATIO	ON Fo	or Pro	posed	Resid	lential S	Subdivi	sion									REF.	. NO.	: 225	517668	
CLIEI	NT: Bradford Highlands Joint Venture							Metho	od: Sol	lid Ster	m Aug	ler					ENC	L NO	).:		
PRO	IECT LOCATION: 23 Brownlee Drive, B	radfo	rd, O	ntario				Diam	eter: 1	52 mm	ı						ORIC	GINA <sup>-</sup>	TED	вү РМ	
DATU	JM: UTM NAD , ZONE							Date:	Mar-2	25-202	2 to I	Mar-25	-2022				CON	1PILE	D B	∕ FJ	
BH L	OCATION: N 4883207 E 613647											eoprob	e 420	М							
	SOIL PROFILE		s	AMPL	ES			DYNA RESIS	MIC CO	NE PEN PLOT		TION				URAL			⊢	REMARKS	5
(m)		Ŀ				GROUND WATER CONDITIONS						30 10	00	PLASTI LIMIT	C MOIS	TURE	Liquid Limit	EN.	NATURAL UNIT WT (kN/m <sup>3</sup> )	AND	
ELEV	DECODIDITION	PLO	~		BLOWS 0.3 m	4W C	NO			RENG	TH (ki	Pa)		Wp		N 0	WL	POCKET PEN. (Cu) (kPa)	AL UI	GRAIN SIZE	
DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	ш			ELEVATION			'INED RIAXIAL	+	FIELD VA & Sensitiv	ANE vity	WAT	TER CC	ONTEN	T (%)	80		(%)	
	Continued	STR	NUN	ТҮРЕ	z	GRO CON	ELE					30 10		1			30		2	GR SA SI	CL
7.98	END OF BOREHOLE																				
7.98	END OF BOREHOLE Notes: 1) Upon completion of drilling, groundwater was at approximately 0.9 meter below ground surface (mbgs).																				
M8* 544 LVJ 210 - 444																					
						GRAPH		√3. I						t Eailun							

11	sp				LOC	g of	BOR	EHC	DLE E	3H22	2-15									1 OF
PRO	JECT: GEOTECHNICAL INVESTIGATIO	DN Fo	or Pro	opose	d Resi	dential \$	Subdivi	sion									REF.	NO.	: 225	517668
CLIE	NT: Bradford Highlands Joint Venture							Meth	od: So	lid Ste	m Au	ger					ENC	L NO	).:	
PRO	JECT LOCATION: 23 Brownlee Drive, B	radfo	rd, O	Intario				Diam	neter: 1	52 mn	n						ORIC	SINA	TED	вү РМ
DATI	JM: UTM NAD , ZONE							Date	: Mar-	23-202	22 to	Mar-2	3-2022	2			COM	IPILE	D B)	∕ FJ
BH L	OCATION: N 4883102 E 613793		_									Geoprol	be 420	M						
	SOIL PROFILE		5	SAMPI	ES			DYNA RESIS	MIC CO	DNE PEI E PLOT		ATION >			NAT	URAL			Т	REMARK
(m)		⊢				GROUND WATER CONDITIONS					<u>5</u> 0		100	LIMIT	IC NAT MOIS CON	STURE	LIQUID LIMIT	Ľ.	NATURAL UNIT WT (kN/m <sup>3</sup> )	AND
ELEV		PLO			SN E	d W Ø	N	SHE	AR ST	RENG	STH (I	(Pa)		W <sub>P</sub>		w 0	WL	POCKET PEN. (Cu) (kPa)	AL UI	GRAIN SIZ DISTRIBUTI
DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	ш	BLOWS 0.3 m		ELEVATION				+	FIELD V & Sensit	/ANE tivity	WA	TER C		T (%)	00 00 00	ATUR (	(%)
235 60	Ground Surface	STR	NUN	ТҮРЕ	z	GRC	Ē		UICK T		∟ × 50	LAB V. 80 1	ANE 100				30		2	GR SA SI
0.00		<u>x1 1y</u>						-												
		4 2	1	SS	4											0				
235.19	SILTY CLAY:	1. Vi	, '	00	1			ŀ												
. 0.41	Brown, cohesive w <pl, soft="" td="" to="" very<=""><td>12</td><td>1</td><td></td><td></td><td>4</td><td>235</td><td>-</td><td></td><td></td><td></td><td>_</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,>	12	1			4	235	-				_								
	stiff		_			4		È .												
1	grey, w~PL		2	SS	10			ŀ								0				
-		12				-		F												
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		12				1	234	-												
			3	SS	16			ļ.								¢				
2		K				-		E												
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			└──			4		ļ.												
		K.	4	SS	50			Ł							0					
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3			1																	
		R.				1		-												
			5	SS	51			ļ.						0						
-		HX.																		
		K.					232													
								Ē.												
231.60		KX.	1					È												
4.00	CLAYEY SILT TILL: Grey, trace gravel, trace sand,							F												
	cobble fragments, cohesive w <pl,< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,<>							-												
	very stiff to hard.							-												
		6				1	231													
			6	SS	24			F							0					
5		1a				1		ļ.												
		M						╞												
								F												
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6								ļ.												
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			7	SS	83			-							o					
-						1		F												
		10					229					-								
			1					ŀ						1						
228.60	SILTY SAND:	Į¶ĮĮ́Į́						F						1						
1.00	Grey, moist to wet, very dense.	臣						F												
			1					ŀ						1						
-		臣						Ē						1						
		臣	$\vdash$		-	1	228	-		-	+			1		+		1		
		말	8	ss	78			ŀ						1	0					
8	Continued Next Page		Ĺ	_				[										1		
<u>GROUI</u>	DWATER ELEVATIONS					<u>GRAPH</u> <u>NOTES</u>	+ 3,	׳:	Numbe to Sens	rs refer		O <sup>₿=3%</sup>	Strain	at Failu	re					
Measur	1st 2nd 3rd 4th								.0 0018											

					LOG	GOF	BOR	EHO	LE E	3H22	-15									2 OF 2
PRO	JECT: GEOTECHNICAL INVESTIGATIO	DN Fo	or Pro	oposed	Resid	lential S	Subdivi	sion									REF.	NO.	: 225	517668
CLIE	NT: Bradford Highlands Joint Venture							Metho	od: So	lid Ste	m Aug	er					ENC	L NO	.:	
PRO	JECT LOCATION: 23 Brownlee Drive, B	radfo	rd, O	ntario				Diam	eter: 1	52 mm	ı						ORIC	GINA <sup>-</sup>	TED	BY PM
DATU	JM: UTM NAD , ZONE							Date:	Mar-2	23-202	2 to I	Mar-23	-2022				COM	IPILE	D B	∕ FJ
BH L	OCATION: N 4883102 E 613793											eoprob	e 420	М						
	SOIL PROFILE		s	SAMPL	ES			DYNA RESIS	MIC CC	NE PEI PLOT		TION			- NATI	URAL			т	REMARKS
(m)		⊢				GROUND WATER CONDITIONS						30 10	00	PLASTI LIMIT	C MOIS	TURE	Liquid Limit	ż "	NATURAL UNIT WT (kN/m <sup>3</sup> )	AND
ELEV	DECODIDE ON	PLO	~		S E	⊿W C	N	SHE	AR ST	RENG	TH (ki	Pa)		W <sub>P</sub>	\	N 0	WL	POCKET PEN. (Cu) (kPa)	RAL UI	GRAIN SIZE DISTRIBUTION
DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	ш	BLOWS 0.3 m		EVATION			'INED RIAXIAL	+	FIELD VA & Sensitiv LAB VA	ANE vity	WAT	TER CC		T (%)	0 Q Q	IATUF (	(%)
	Continued	STR	NUN	ТҮРЕ	"z	GRG	ELE					30 10		1			30		-	GR SA SI CL
227 50 8.10			-																	
	Notes: 1). Upon completion of drilling, borehole had caved at 5.2 meters below ground surface (mbgs).																			
AND POLICY ON THE						GRAPH		× 3.				\$ \$=3%								

"	sp				LOC	g of	BOR	EHOL	EE	BH22-	-16									1	OF :
PRO	IECT: GEOTECHNICAL INVESTIGATIO	DN Fo	or Pro	oposed	d Resid	dential S	Subdivi	sion									REF.	NO.	: 225	517668	
CLIEI	NT: Bradford Highlands Joint Venture							Method	I: Sol	id Ster	n Aug	ger					ENC	L NO	).:		
	IECT LOCATION: 23 Brownlee Drive, Br	radfo	rd, O	ntario				Diamet	er: 1	52 mm							ORIC				l
DATU	JM: UTM NAD , ZONE							Date:	Mar-2	23-2022	2 to	Mar-23	3-2022	2			CON	IPILE	DBY	′ FJ	
BH L	DCATION: N 4882952 E 613636							Eqipme	ent: D		ch G	Beoprot	be 420	M				-			
	SOIL PROFILE		S	SAMPL	.ES	~		DYNAM RESIST	ANCE	PLOT		-		PLASTI LIMIT			LIQUID		Ł	REMA	
(m)		OT			6	GROUND WATER CONDITIONS	_	20		0 60			00	LIMIT W <sub>P</sub>		TENT	LIMIT W <sub>L</sub>	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	ANI GRAIN	
ELEV DEPTH	DESCRIPTION	A PL	н		BLOWS 0.3 m	VD V	EVATION	SHEAF			TH (k	Pa) FIELD V & Sensit	ANE	<del>-</del>		o		Cu) (K	URAL (kN/n	DISTRIB	IOITU
		STRATA PLOT	NUMBER	ТҮРЕ			EVA	• QUI	CK TF	RIAXIAL	Х	LAB V	ANE		TER CO			а -	NAT	(%	
238.90 0.00 238.70	Ground Surface TOPSOIL: (200 mm)	S <u>× ½</u>	ž	F	".	00	Ш	- 20	4	0 60	0 8	80 1	00	1	0 2	20	30			GR SA	SI C
0.20	SAND: Brown, trace gravel, moist, loose.		1	SS	8			- -						0							
38.29 0.61	SILTY CLAY:		<u> </u>					-													
0.01	Brown, trace gravel, cohesive			~~~	45	-		-								0					
<u>1</u>	w <pl, hard.<="" stiff="" td="" to="" very=""><td></td><td>2</td><td>SS</td><td>15</td><td>_</td><td>238</td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>0</td><td></td><td>1</td><td></td><td></td><td></td></pl,>		2	SS	15	_	238	-								0		1			
								-													
								-													
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	wet spon		3	SS	32										0						
2			<u> </u>				237	_										1			
			1					-													
			4	<u> </u>	)/127n	-								0							
			4	330		-		-						ľ							
								-													
							236	-													
3						-		-													
			5	SS50	)/152n	m								°							
_			1					-													
							005	-													
4.00	SANDY CLAYEY SILT TILL:						235	-										1			
1.00	Brown to grey, trace gravel, cobble							-													
	fragment, cohesive w <pl, hard.<="" td=""><td>IA</td><td></td><td></td><td></td><td></td><td></td><td>-  </td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,>	IA						-													
-			6	<u> </u>	)/127m	m		-						0							
				330	//12/11			-						ľ							
5		A					234	-													
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6							233	-										-			
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231.18			8	5.950	)/139n	m		-							<b>b</b>			1			
7.72	END OF BOREHOLE	KI 1/4/												Ì				1			
	Continued Next Page	1	I	I	I	GRAPH	. 3		Imbor	srefer		8=20/		1	1	L		1			
	IDWATER ELEVATIONS ement $\stackrel{1st}{\underline{\checkmark}}$ $\stackrel{2nd}{\underline{\checkmark}}$ $\stackrel{3rd}{\underline{\checkmark}}$ $\stackrel{4th}{\underline{\checkmark}}$					<u>GRAPH</u> NOTES	+ °,	× <sup>3</sup> : Ni to	Sensi	tivity	C	~5% - ر	Strain	at Failur	e						
Neasur	ement 💟 🗶 🖳 🔽																				

LOG OF BOREHOLE BH22-16 2 C													OF 2								
PRO	JECT: GEOTECHNICAL INVESTIGAT	ION Fo	or Pro	posed	d Resid	dential S	Subdivi	sion									REF.	NO.	: 225	517668	
CLIE	NT: Bradford Highlands Joint Venture							Metho	d: Sol	lid Ster	n Aug	er					ENC	L NC	).:		
PRO	JECT LOCATION: 23 Brownlee Drive, B	Bradfo	rd, O	ntario				Diame	ter: 1	52 mm	ı						ORIC	SINA	TED	BY PN	1
DATI	JM: UTM NAD , ZONE							Date:	Mar-2	23-202	2 to I	Mar-23-2	2022				CON	IPILE	D B)	r FJ	
BH L	OCATION: N 4882952 E 613636											eoprobe	420M								
	SOIL PROFILE		s	AMPL	ES	~		DYNAN RESIST	IIC CO ANCE	NE PEN PLOT		TION			ΝΑΤΙ	JRAL			F	REMA	RKS
(m)		H				ATEF		20	) 4	0 6	0 8	80 100			NATU MOIS CONT	TURE FENT	LIQUID LIMIT	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	AN	
ELEV	DESCRIPTION	PLO	2		BLOWS 0.3 m	NOI	NOI	SHEA			TH (kF	Pa)		W <sub>P</sub>	v c	v >	WL	e, KFT	KAL U	GRAIN DISTRIB	
DEPTH		STRATA PLOT	NUMBER	Щ		NUO	ELEVATION	○ UN ● QU		INED RIAXIAL	+ ×	FIELD VAN & Sensitivity LAB VAN	y IE	WATE	ER CO	NTEN	T (%)	9 O	NATU	(%	b)
	Continued	STF	NN	TYF	ż	R C	ELE	20	) 4	0 6		0 100		10	2	0 3	30			GR SA	SI CL
	Continued Notes: 1). Upon completion of drilling, groundwater level was at approximately 1.5 meters below ground surface (mbgs).	STR		Түрд		GROUND WATER CONDITIONS											• •			<u>GR SA</u>	SI CL
The second									_					_							
			-	-	-	-		-			-	<b>8</b> =3%						•	-		

 $\begin{array}{c} \underline{\text{GROUNDWATER ELEVATIONS}} \\ \text{Measurement} \quad \stackrel{1\text{st}}{\underline{\nabla}} \quad \stackrel{2\text{nd}}{\underline{\Psi}} \quad \stackrel{3\text{rd}}{\underline{\Psi}} \quad \stackrel{4\text{th}}{\underline{\Psi}} \end{array}$ 



11	sp				LOC	GOF	BOR	EHC	DLE E	3H22	2-17									1	1 OF 2
PRO	JECT: GEOTECHNICAL INVESTIGATIO	DN Fo	or Pro	opose	d Resi	dential S	Subdivi	sion									REF.	NO.	: 225	517668	3
CLIEI	NT: Bradford Highlands Joint Venture							Meth	od: So	lid Ste	m Au	ger					ENC	L NO	.:		
PRO.	IECT LOCATION: 23 Brownlee Drive, Br	radfo	rd, O	ntario				Diam	neter: 1	52 mn	n						ORIC	GINA	TED		РМ
DATU	JM: UTM NAD , ZONE							Date	: Mar-	25-202	2 to	Mar-2	5-2022				CON	IPILE	DΒ	γ F	J
BH LO	DCATION: N 4882531 E 613929					·		Eqip	ment: I	Drill Te	ch (	Geoprol	be 420	M				_			
	SOIL PROFILE		5	SAMPL	ES	~		RESI	AMIC CO STANCE	E PLOT		-		PLAST			LIQUID		¥1	RE	MARKS
(m)		ы				GROUND WATER CONDITIONS			20 4	40 <del>(</del>	50 I	80 1	00	PLAST LIMIT		NTENT W	LIMIT	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )		AND AN SIZE
ELEV	DESCRIPTION	A PL(	Ř		BLOWS 0.3 m		NOI		AR ST		ith (k	(Pa) FIELD V & Sensit	'ANE	W <sub>P</sub>		-0	WL	CKET Cu) (k	JRAL ( (KN/m	DISTF	RIBUTION
DEPTH		STRATA PLOT	NUMBER	ТҮРЕ			ELEVATION				- ×	& Sensit LAB V	ivity ANE	WA	TER C	ONTEN	IT (%)	d E	NATI		(%)
	Ground Surface	ST .	Z	₽	ż	<u></u> В С	Ц		20 4	40 6	50 	80 1	00	1	10	20	30			GR S/	A SI CI
0.00	· · · · ·	<u> </u>																			
219.60 0.30		TT.	1	SS	3			Ŀ								0					
-	Brown to grey, trace sand, trace rootlets, cohesive w <pl, soft="" td="" to="" very<=""><td></td><td>1</td><td></td><td></td><td></td><td></td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,>		1					-													
-	stiff.					1		-													
-			2	SS	6		219									•					
_ <u>1</u> -	wet					-		-													
-																					
-			1					-													
-			3	SS	16	1		-									_			0 1	33 67
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-	grey		5	SS	11			-								•					
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-		12						-													
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2 <u>415.90</u> 4.00							216	-										1			
	Grey, trace gravel, cohesive w <pl,< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,<>							-													
-	hard.	H						-													
-			<b> </b>			4															
-			6	SS	16										0						
-		H		33			215														
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87-01-57.492								F													
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2011/00			8	SS	60		212	-							•						
211.88	Continued Next Page	KA:L	1		<u> </u>			L					I	L	I			1			
GROUN	$\begin{array}{c} \begin{array}{c} & \\ \text{NDWATER ELEVATIONS} \\ \\ \text{ement} & ^{\text{1st}} & ^{\text{2nd}} & ^{\text{3rd}} \\ \\ ^{\text{ymatrix}} & ^{\text{ymatrix}} & ^{\text{ymatrix}} \\ \end{array} \end{array}$					<u>GRAPH</u> <u>NOTES</u>	+ 3,	×3:	Numbe to Sens	is refer	(	⊃ <sup>€=3%</sup>	Strain	at Failu	re						
Measur	ement 💟 🍸 🏆 🖤																				

LOG OF BOREHOLE BH22-17 2 OF													OF 2							
PRO	JECT: GEOTECHNICAL INVESTIGATIO	ON Fo	or Pro	posed	Resid	lential S	Subdivi	sion								REF.	NO.	: 225	517668	
CLIE	NT: Bradford Highlands Joint Venture							Metho	od: Sol	lid Ster	n Aug	er				ENC	L NO	.:		
PRO	IECT LOCATION: 23 Brownlee Drive, B	radfo	rd, O	ntario				Diam	eter: 1	52 mm	ı					ORIC	GINA	TED	BY P	М
DATU	JM: UTM NAD , ZONE							Date:	Mar-2	25-202	2 to I	Mar-25-2	022			CON	1PILE	D B	/ F	J
BH L	DCATION: N 4882531 E 613929											eoprobe	420M							
	SOIL PROFILE		s	AMPL	ES	~		RESIS	TANCE	NE PEN PLOT		TION	PLA	ASTIC NA	TURAL		,	₽ F	REM	IARKS
(m)		5				GROUND WATER CONDITIONS		2	0 4	0 6	08	30 100	LIN	ASTIC NA IIT CO	NTENT W	LIQUID LIMIT	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )		ND N SIZE
ELEV	DESCRIPTION	APL	н		BLOWS 0.3 m		NOIT		AR STI		TH (kF	Pa) FIELD VANE & Sensitivity	W	P	-0	WL	OCKET Cu) (kl	(kN/m	DISTR	IBUTION
DEPTH		STRATA PLOT	NUMBER	түре	= =	NDN	ELEVATION	• Q	JICK TR	RIAXIAL	×	LAB VANE	E	WATER C			9 0	NATI	(	%)
0.00	Continued	ST	й	Ļ	ŗ	50	Ш	2	0 4	0 6	8 0	80 100		10	20	30			GR SA	SI CL
8.02	END OF BOREHOLE																			
	Notes: 1). Upon completion of drilling, borehole had caved at 7.3 meter below ground surface (mbgs) and borehole was dry.																			
LL03 200 13 05 302 F.JBH (05522) 12823 40 44401 4400																				
WSb SCI																				
							. 3					<b>8</b> =3% -								

 $\begin{array}{c} \underline{\text{GROUNDWATER ELEVATIONS}} \\ \text{Measurement} \quad \stackrel{1\text{st}}{\underline{\nabla}} \quad \stackrel{2\text{nd}}{\underline{\Psi}} \quad \stackrel{3\text{rd}}{\underline{\Psi}} \quad \stackrel{4\text{th}}{\underline{\Psi}} \end{array}$ 



	יור				LOC	GOF	BOR	EHO	LE E	3H22	-18									1	OF 2
PROJ	ECT: GEOTECHNICAL INVESTIGATI	ON Fo	or Pro	posed	d Resid	dential S	Subdivi	sion									REF.	NO.	: 225	517668	
CLIEN	NT: Bradford Highlands Joint Venture							Metho	od: So	lid Ste	m Aug	ler					ENC	L NO	.:		
PROJ	ECT LOCATION: 23 Brownlee Drive, E	Bradfo	rd, O	ntario				Diam	eter: 1	52 mm	۱						ORIC	GINA	TED	BY P	М
DATU	IM: UTM NAD , ZONE							Date:	Mar-2	24-202	2 to	Mar-24	-2022	2			COM	IPILE	D B	γ F.	J
BH LO	DCATION: N 4882455 E 613650											eoprot	be 420	M							
	SOIL PROFILE		s	AMPL	ES			DYNA RESIS	MIC CC	DNE PEI E PLOT		TION			- NAT	URAL			⊢	REM	ARKS
(m)		_⊢				GROUND WATER CONDITIONS							00	PLASTI LIMIT	C MOIS	TURE	LIQUID LIMIT	ËN.	NATURAL UNIT WT (kN/m <sup>3</sup> )	A	ND
ELEV		PLO	~		BLOWS 0.3 m	o W⊿ ONS	N	SHE	AR ST	RENG	TH (kl	Pa)	1	W <sub>P</sub>		w 0	WL	POCKET PEN. (Cu) (kPa)	AL UI		N SIZE BUTION
DEPTH	DESCRIPTION	ATA	BER		0.3	DND	ELEVATION		NCONF		+	FIELD V. & Sensiti	ANE vity	W/A	TER CO		т (%)	DOC DOC	ATUR (k		%)
232 40	Ground Surface	STRATA PLOT	NUMBER	ТҮРЕ	ż	GRC	ELE			RIAXIAL 10 6		LAB VA 30 1	NNE DO				30		z	GR SA	SI CL
_ 0.00	TOPSOIL: (610 mm)	<u>x1 1/</u>						-												-	-
		1/ 1/	1	SS	4											0					
-		11	'	00	4		232	_													
231.79								-													
0.61	SILTY CLAY: Brown cohesive w <pl, stiff.<="" td=""><td></td><td> </td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,>																				
1			2	SS	12			-							0						
-		12						-													
-		12																			
-							231											1			
E			1					ŀ													
-			3	SS	22			-							0						
2		11						-													
-						-		-													
-		1.	4	SS	22		230	-							•			1			
-																					
229.60 2.80	CLAYEY SILTY SAND TILL:	-						-													
3	Brown, trace sand, trace gravel, cohesive w <pl, hard.<="" stiff="" td="" to="" very=""><td></td><td></td><td></td><td></td><td></td><td></td><td>F</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,>							F													
-	conesive ward, very sum to hard.							1													
-			5	SS	30		229							0	н					3 42	35 21
-							220	-													
-								-													
								Ľ.													
4		Ø																			
-								-													
-		19					228														
-		161																			
			6	SS50	0/127n	m								0							
-								_													
-								-													
226.90		Í					227														
5.50	SILTY SAND: Brown trace gravel moist very	×						-													
	Brown, trace gravel, moist, very dense.	· × ·						-													
6								-													
-		× .	7	9950	0/101m	m		-						0							
-		×	-	530	0/10111			-													
-							226	-													
		^						-													
-		× .						-													
7		 × .						F													
-								ŀ													
-		× .					225	ŀ													
-		× :					220	-													
-		 × .				1		ļ													
-			8	SS50	0/101m	m		L							•						
8	Continued Next Page	×				L						I									
<u>GROUN</u>	IDWATER ELEVATIONS					<u>GRAPH</u> NOTES	+ <sup>3</sup> ,	׳:	Numbe to Sens	rs refer itivity	С	<b>8</b> =3%	Strain	at Failur	e						
Measure	ement $\underbrace{\stackrel{1  \text{st}}{\underline{\nabla}}}_{\text{memory}} \underbrace{\stackrel{2  \text{nd}}{\underline{\nabla}}}_{\text{memory}} \underbrace{\stackrel{3  \text{rd}}{\underline{\nabla}}}_{\text{memory}} \underbrace{\stackrel{4  \text{th}}{\underline{\nabla}}}_{\text{memory}}$					_															

LOG OF BOREHOLE BH22-18 2													2 OF 2							
PRO	IECT: GEOTECHNICAL INVESTIGATIO									REF.	NO.	: 225	517668							
CLIEI	NT: Bradford Highlands Joint Venture							Metho	od: Sol	id Ste	m Aug	er					ENC	L NO	.:	
PRO.	IECT LOCATION: 23 Brownlee Drive, B	radfo	rd, O	ntario				Diam	eter: 1	52 mm	ı						ORIC	SINA <sup>-</sup>	TED	BY PM
DATU	IM: UTM NAD , ZONE							Date:	Mar-2	24-202	2 to I	Mar-24	-2022				COM	IPILE	DBY	∕ FJ
BH LO	DCATION: N 4882455 E 613650											eoprob	e 420	М						
	SOIL PROFILE		s	AMPL	ES	~		DYNA RESIS	MIC CO	NE PEI PLOT		TION			NAT	URAL			F	REMARKS
(m)		1				GROUND WATER CONDITIONS		2	20 4	0 6	8 0	30 10	00	PLASTI LIMIT	CON	TURE	LIQUID LIMIT	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m <sup>3</sup> )	AND GRAIN SIZE
ELEV	DESCRIPTION	A PLO	~		BLOWS 0.3 m	D W,	NOI		AR STI		TH (kF	Pa)		W <sub>P</sub>	\ (	<i>N</i> 0	WL	CKET (kF	RAL L (kN/m	DISTRIBUTION
DEPTH		STRATA PLOT	NUMBER	ТҮРЕ		NUO	EVATION		NCONF UICK TF		. ×	FIELD VA & Sensiti		WAT	TER CO	ONTEN	Г (%)	0 <sup>0</sup> 0	NATU	(%)
	Continued		R	Ł	ż	GR CO	ELI	2	20 4	0 6	8 0	30 10	00	1	0 2	20 3	30			GR SA SI CL
22 <u>4 30</u> 8.10	END OF BOREHOLE	×																		
8.10	END OF BOREHOLE Notes: 1). Upon completion of drilling, groundwater level was at approximately 0.7 meter below ground surface (mbgs).																			
War sout too 200 11.																				
						GRAPH	-	√3. I				8=3%								



### 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, Nd:

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,  $60^{\circ}$  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 (4 <sup>th</sup> 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)

Very loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

### Soil Tests

w Water content	
-----------------	--

- w<sub>p</sub> Plastic limit
- w<sub>I</sub> Liquid limit
- C Consolidation (oedometer) test
- CID Consolidated isotropically drained triaxial test
- CIU consolidated isotropically undrained triaxial test with porewater pressure measurement

SPT "N" Value

- D<sub>R</sub> 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

## RECORD OF BOREHOLE: BH1

DATUM: Geodetic

BORING DATE: March 11, 2016

SALE	THOD		SOIL PROFILE	F		SAN	MPLES	DYNAMI RESISTA	ANCE, B	LOWS	0.3m	$\mathbf{X}$		AULIC C k, cm/s				ING	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE BLOWS/0.3m	20 SHEAR S Cu, kPa		GTH r r	∟ at V. + em V. ⊕		w w				WI	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
		_	GROUND SURFACE	S	249.32			20	40	6	8 0	0	1	0 2	20 :	30	40		
• 0 -			TOPSOIL (ML) CLAYEY SILT, trace gravel, trace to some sand; mottled brown; cohesive, w>PL to w~PL, stiff to very stiff		0.00	1A	DO 8							0					
· 1 · 2	0	_	(CL) SILTY CLAY and SAND, trace to some gravel; brown to greyish-brown, (TILL); cohesive, w <pl stiff="" to="" to<br="" w~pl,="">hard</pl>		247.95 1.37		DO 15							на	0			мн	
	Buggy Mount I	4" U/D Solid Stem Au	Sand seam in sample 4			4	DO 45						С						
3			Sand and gravel seam at 3.3 mbgs			5	DO 15. mr						0						
• 4			Coarse sand seam at 4.2 mbgs			6	DO 91						0						
- 5-			End of Borehole NOTE:		244.32 5.00		DO 89	-					(	Þ					
6			<ol> <li>Groundwater measured at a depth of 4.3 m below existing grade in open borehole upon completion of drilling March 11, 2016.</li> </ol>																
7																			
8																			
9																			
10																			
DEF 1 : 5		ISC	CALE						Â		- olde socia	er							OGGED: CL IECKED: NL

SHEET 1 OF 1

# RECORD OF BOREHOLE: BH10

SHEET 1 OF 1 DATUM: Geodetic

BORING DATE: March 15, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm
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ы М	ПОР	SOIL PROFILE			SA	MPLES		AMIC PE STANCE	NETRAT	ION 5/0.3m	$\overline{)}$		k, cm/s	ONDUCT		T	AL	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	SHE/ Cu, k		INGTH	nat V. + rem V. ∉		w w	ATER C			WI	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
	_	GROUND SURFACE	S	237.49				20	40	<u>60</u>	30	1		20 3	30 4	40		
- 0 -		TOPSOIL (CL/ML) SILTY CLAY to CLAYEY SILT, trace sand, light brown; cohesive, w>PL to w~PL, stiff		0.00 237.29 0.20		DO 8								0				
- 2	-90 Auger				3	DO 1	ı							0				
- 3	Buggy Mount D-90 4" O/D Solid Stern Auger			234.39	4	DO 1								0				
- 4		(CL) SILTY CLAY and SAND to sandy CLAY, trace to some gravel; greyish-brown, (TILL); cohesive, w~PL, very stiff to hard		3.10	5	DO 1	5						рı				мн	
- 5		End of Borehole NOTE: 1. Groundwater measured at a depth of		<u>232.77</u> 4.72	6	50 DO 15 m	// 2 11					0					мн	
6		4.5 m below existing grade in open borehole upon completion of drilling March 15, 2016.																
7																		
8																		
9																		
10 DEF 1 : 5	PTH S	CALE								Golde	er							DGGED: CL ECKED: NL

## RECORD OF BOREHOLE: BH11 BORING DATE: March 16, 2016

SHEET 1 OF 1 DATUM: Geodetic

;	Ę	SOIL PROFILE			SA	MPLE	s	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAU k	ILIC CONDUCTIVITY,	<u>ں</u> آ	
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	түре	BLOWS/0.3m	20 40 60 80 SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - O	Wp H		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	а 	GROUND SURFACE TOPSOIL		233.55 0.00	1		12	20 40 60 80	10	20 30 40		Casing
1		(ML/CL) CLAYEY SILT to SILTY CLAY, trace gravel, trace to some sand; brown to mottled brown to brownish-grey to grey; cohesive, w>PL to w~PL, stiff to very stiff		<u>233.14</u> 0.41	2	DO	13			0		
2					3	DO	24			0		Hole Plug
					4	DO	17			0		
3	Buggy Mount D-90 8" O/D Hollow Stem Auger				5	DO	19			0		Silica Sand
4	Buggy 8" O/D Hollc				6	DO	23			Feed	мн	⊻ 8-Dec-2016
5					7	DO	26			0		8-Dec-2016
6		(CL) SILTY CLAY and SAND, trace gravel; grey, (TILL); cohesive, w~PL, hard		227.99 5.56								10 Slot PVC Screen
					8	DO 1	50/ 152 nm		0			
7		End of Borehole NOTE:		226.23 7.32	9	DO	68		0			
8		<ol> <li>Borehole dry upon completion of drilling March 16, 2016.</li> <li>Groundwater measured at a depth of 3.3 m below existing grade on September 23, 2016.</li> <li>Groundwater measured at a depth od 4.4 m below existing grade on December 8, 2016.</li> </ol>										
9												
10												
DEF	PTH S	CALE				·		Golder			L.	OGGED: CL

# RECORD OF BOREHOLE: BH12

SHEET 1 OF 1 DATUM: Geodetic

BORING DATE: March 15, 2016

ц Л	DOH-		SOIL PROFILE		1	SAI	MPLE		DYNAMIC PENETRATIC RESISTANCE, BLOWS	0.3m			C CONDU m/s	CTIVITY,	R <sup>R</sup> AL	PIEZOMETER
UEPTH SCALE METRES	BORING METHOD		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/U.3m	SHEAR STRENGTH r Cu, kPa r	0 80 µat V. + Q em V. ⊕ U	- •	Wp 🛏		10 <sup>-4</sup> 10 <sup>-3</sup> NT PERCENT W W	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
		-	GROUND SURFACE	Ω.	228.74			-	20 40 6	0 80		10	20	30 40	+	
0-			TOPSOIL (CL) SILTY CLAY, trace to some sand, trace to some gravel, cobble fragments; greyish-brown, oxidation staining, (TILL); cohesive, w~PL to w>PL, very stiff to		0.00 <u>228.23</u> 0.51	1	DO	6					0			
1			hard		227.04	3A		16					S			
2	Buggy Mount D-90	Solid Stem Auger	(CL) SILTY CLAY and SAND, trace to some gravel; greyish-brown, (TILL); cohesive, w~PL, hard		1.70	3B	DO 11	46 60/ 27				°⊢ ∘	1		мн	
3	ñ.	8" O/D S				5	DO 1: m	i0/ 27 1m				0				
4			End of Borehole		223.94 4.80	6	DO 7	60/ 76 1111-				0				
6			NOTE: 1. Groundwater measured at a depth of 2.8 m below existing grade in open borehole upon completion of drilling March 15, 2016.													
7																
8																
9																
10																
DEF 1 : 5		H SC	CALE							older sociate	es					OGGED: CL IECKED: NL

## RECORD OF BOREHOLE: BH13

SHEET 1 OF 1 DATUM: Geodetic

BORING DATE: March 21, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 76	)mm
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c         c         DePTH SCALE           c         c         c         DePTH SCALE           c         c         c         o         METHS SCALE           c         c         c         c         method           c         c         c         c         method	4 1/4" O/D Hollow Stem Auger	DESCRIPTION  GROUND SURFACE  TOPSOIL  (CL) sandy CLAY, trace gravel, trace to some sand; brown to greyish-brown, (TILL); cohesive, w~PL to w <pl, (sm="" (till);="" and="" dense<="" gravel;="" greyish-brown,="" moist="" non-cohesive,="" sand="" silty="" sp-gw)="" stiff="" th="" to="" very="" wet,=""><th>STRATA CONTINUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU</th><th>ELEV. DEPTH (m) 228.16 0.00 2227.47 0.69</th><th>МЛN 1</th><th></th><th></th><th>20 HEAR : iu, kPa 20</th><th>STREN</th><th>IGTH r r</th><th>⊥ nat V. + em V. ⊕</th><th></th><th></th><th>ATER CO</th><th></th><th>PERCE</th><th>ADDITIONAL LAB. TESTING</th><th>PIEZOMETER OR STANDPIPE INSTALLATION</th></pl,>	STRATA CONTINUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUUU	ELEV. DEPTH (m) 228.16 0.00 2227.47 0.69	МЛN 1			20 HEAR : iu, kPa 20	STREN	IGTH r r	⊥ nat V. + em V. ⊕			ATER CO		PERCE	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
- 0 - 1 LX 52 d - 2	4 1/4" O/D Hollow Stem Auger	TOPSOIL (CL) sandy CLAY, trace gravel, trace to some sand; brown to greyish-brown, (TILL); cohesive, w~PL to w <pl, stiff="" to<br="">very stiff (SM/SP-GW) SILTY SAND to SAND and</pl,>		0.00	1	DO	в		4	<u> </u>			1	) 2	<u> </u>	0 4		
1 52.8 D.25.81	4 1/4" O/D Hollow Stem Auger	(CL) sandy CLAY, trace gravel, trace to some sand; brown to greyish-brown, (TILL); cohesive, w~PL to w <pl, stiff="" to<br="">very stiff (SM/SP-GW) SILTY SAND to SAND and</pl,>		0.00	1													
- 5 D-26.RT	4 1/4" O/D Hollow Stem Auger	(SM/SP-GW) SILTY SAND to SAND and			$\vdash$	DO	в											
	4 1/4" O/D HC	(SM/SP-GW) SILTY SAND to SAND and GRAVEL; greyish-brown, (TILL); non-cohesive, moist to wet, dense		1										ŀО	-1		мн	
3			4 7 4 7 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	226.03 2.13		DO 2 DO 4							G	)				
		(CL) SILTY CLAY and SAND, some gravel; greyish-brown, (TILL); cohesive, w~PL, hard End of Borehole Refusal on Boulder		225.26 2.90 224.83 3.33	5	DO 12 m	0/ 27 im						0					
- 4	- I	NOTE: 1. Groundwater measured at a depth of 2.1 m below existing grade in open borehole upon completion of drilling March 21, 2016.																
6																		
8																		
9																		
10												er ates						

### RECORD OF BOREHOLE: BH14 BORING DATE: March 21, 2016

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

H L			SOIL PROFILE			SA	MPLI	-	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	NG NG	PIEZOMETER
DEPTH SCALE METRES	BOPING METHOD		DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	ТҮРЕ	BLOWS/0.3m	20 40 60 80 SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - ○	10 <sup>6</sup> 10 <sup>5</sup> 10 <sup>4</sup> 10 <sup>3</sup> <sup>⊥</sup> WATER CONTENT PERCENT Wp	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
_	a			STF	(m)	-		BL	20 40 60 80	10 20 30 40		
- 0	$\vdash$	$ \dashv$	GROUND SURFACE Mixed SILTY CLAY and TOPSOIL	822	220.48 0.00							Casing -
					219.79	1	DO	7				Silica Sand Silica Sand
• 1			(CL) SILTY CLAY, trace sand; mottled brown to greyish-brown to brown, oxidation; cohesive, w>PL to w <pl, stiff<br="">to hard</pl,>		0.69	2	DO	14		0		
						3	DO	21		0		Hole Plug
2												
		ger				4	DO	37		φ		
3	ь	Stern Au										Silica Sand
- 4	D-25 RT	4 1/4" O/D Hollow Stem Auger				5	DO	33		φ		Angan Angan
5						6	DO	17			МН	10 Slot PVC Screen
6					213.93	7	DO	22		0		
7			End of Borehole NOTES: 1. Groundwater measured at a depth of 1.6 m below existing grade in open borehole upon completion of drilling March 21, 2016. 2. Groundwater measured at a depth of		6.55							
8			0.7 m below existing grade September 12, 2016. 3. Grounwater measuted at a depth of 0.2 m below existing grade on December 8, 2016.									
9												
· 10												
DE 1:		H S	CALE	1					Golder			DGGED: CL ECKED: NL

## PROJECT: 1543120

### RECORD OF BOREHOLE: BH15

LOCATION: See Figure 2

#### BORING DATE: March 22, 2016

SHEET 1 OF 1

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

SALE	THOD		SOIL PROFILE	F		-	AMPL	-	DYNAMIC RESISTAN			· · ·				TIVITY,		ING AL	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD		DESCRIPTION	STRATA PLOT	ELEV.	_1 =	TYPE	BLOWS/0.3m	20 SHEAR ST Cu, kPa	40 RENGTI	60 H nat V rem '	80 7. + Q- ● 7. ⊕ U- C	3			r Perci	10 <sup>-3</sup>	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
	E C	_		STF	(m)			В	20	40	60	80		10	2		40		
• 0			GROUND SURFACE TOPSOIL	ESS	224.5 0.0	4		$\vdash$		_			_						
						1A	DO	4											
		╞	(CL) SILTY CLAY and SAND, some		224.0 0.4														
			(CL) SILTY CLAY and SAND, some gravel; brown to mottled brown-grey, (TILL); cohesive, w~PL, very stiff to hard				1												
1			(),,	₹. •		2	DO	25						þ					
				₹ A A			-												
				¢ A A															
				¢:4 A		3	DO	50						0					
2		rger				_													
		tem A						50/											
	D-25 RT	ollow S				4	DO	50/ 127 mm						d					
		4 1/4" O/D Hollow Stem Auger																	
3		4 1/4"																	
						5	DO	65						$\circ \vdash$				мн	
						$\vdash$	-												
4																			
						6	DO	82					0	р					
5		+	End of Borehole		219.5 5.0														
			NOTE:																
			1. Groundwater measured at a depth of 1.5 m below existing grade in open borehole upon completion of drilling																
			borehole upon completion of drilling March 22, 2016.																
6																			
_																			
7																			
8																			
-																			
9																			
10																			
DF	РТ	1.50	CALE							Â								10	DGGED: CL
1:										A	Go	lder ciates							ECKED: NL

#### RECORD OF BOREHOLE: **BH16**

BORING DATE: March 21, 2016

DATUM: Geodetic

ц Т			SOIL PROFILE			SA	MPL		DYNAMIC PENETRA RESISTANCE, BLO	NS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	T  <sub>₹</sub> 9	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD			STRATA PLOT	ELEV.	3ER	щ	BLOWS/0.3m	20 40	60 80		ADDITIONAL LAB. TESTING	OR STANDPIPE
ΞΨ	JNIAC		DESCRIPTION	RATA	DEPTH	NUMBER	ТҮРЕ	OWS.	SHEAR STRENGTH Cu, kPa	rem V. $\oplus$ U - C			INSTALLATION
_	a	ă		STI	(m)	1		BL	20 40	60 80		40	ļ
0		$ \square$	GROUND SURFACE TOPSOIL	222	231.66							├	Casing
					0.00		DO	10					Silica Sand
			(ML/CL) CLAYEY SILT to SILTY CLAY, trace sand; mottled greyish-brown to grey; cohesive, w>PL to w <pl, stiff="" td="" to<=""><td></td><td>230.97 0.69</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl,>		230.97 0.69								
1			trace sand; motited grey(sh-prown to grey; cohesive, w>PL to w <pl, stiff="" to<br="">very stiff</pl,>			2	DO	11			0		
													Hole Plug
2						3	DO	21			0		
						4	DO	27			0		
3		em Auger											त <u>,</u> यर
	D-25 RT	4 1/4" O/D Hollow Stem Auger				5	DO	21			0		Silica Sand
		4 1/4" O/											
4													8-Dec-2016
						6	DO	20			0		10 SLot PVC Screen
5													
6							DO	21			0		
			End of Borehole NOTES:	- 81 A	225.11 6.55								
7			1. Groundwater measured at a depth of 1.5 m below existing grade in open borehole upon completion of drilling March 21, 2016. 2. Groundwater measured at a depth of										
8			2. Groundwater measured at a depth of 2.8 m below existing grade September 12, 2016. 3. Grounwater measured at a depth of 4.0 m below existing grade December 8, 2016.										
9													
10													
	PTI	H S	CALE	1	I	L	I			Golder		<u> </u>	LOGGED: CL

### RECORD OF BOREHOLE: BH17

SHEET 1 OF 1 DATUM: Geodetic

BORING DATE: March 23, 2016

ш			SOIL PROFILE			SA	MPLE		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	_ NG	PIEZOMETER
DEPTH SCALE METRES	RORING METHOD		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	20 40 60 80 SHEAR STRENGTH nat V. + Q - ( Cu, kPa rem V. ⊕ U - ( 20 40 60 80	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
- 0			GROUND SURFACE		235.02							
- 1			TOPSOIL (CL/ML) SILTY CLAY to CLAYEY SILT, trace sand, trace gravel; mottled brown to grey, oxidation; cohesive, w~PL to w>PL, firm to very stiff		0.00 234.51 0.51	1B	DO DO	7		0		
· 2	D-25 RT	4 1/4" O/D Hollow Stem Auger	Coarse sand seams at 1.8 and 1.9 mbgs				DO :			0		
- 3		4 1/4" O/D				5	DO :	20		0		
- 4		-	(ML) sandy SILT, trace gravel; grey; non-cohesive, wet, very dense		230.98	6	DO 1	50/ 102		0	МН	
5			End of Borehole NOTE: 1. Groundwater measured at a depth of 1.1 m below existing grade in open borehole upon completion of drilling March 23, 2016.		4.83							
6												
7												
8												
9												
DEF		H SC	CALE	1					Golder			DGGED: CL IECKED: NL

### RECORD OF BOREHOLE: BH18

SHEET 1 OF 1 DATUM: Geodetic

BORING DATE: March 23, 2016

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

ц Г	0	머머	SOIL PROFILE	L	1	SA	MPL	_	DYNAMIC PENETRA RESISTANCE, BLO	TION VS/0.3m	کر	HYDRAULIC CONDUCTIVITY, k, cm/s	T   =		ER
DEP IN SUALE METRES		BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	түре	BLOWS/0.3m	20 40 I I SHEAR STRENGTH Cu, kPa	rem V. 🕀 l	Q - ● U - O			PIEZOMETI OR STANDPIP INSTALLATI	Έ
	6	<u> </u>	GROUND SURFACE	S.	236.95	$\vdash$	-	<u>ш</u>	20 40	60 80		10 20 30	40		
0			TOPSOIL		0.00									Casing	
					236.52		DO	11						Silica Sand	
			(ML) CLAYEY SILT, trace sand, trace gravel; brownish-grey; cohesive, w~PL to w>PL, very stiff		0.43	1B									
1			to w/rL, very sun			2	DO	23				0			
						Ľ		20						Hole Plug	7
														8-Dec-2016	
		4 1/4" O/D Hollow Stem Auger			1	3	DO	29				φ			
2	RT	w Sterr	Coarse sand seam at 1.9 mbgs		]										
	D-25 RT	0 Hollo	(CL) sandy CLAY, trace to some gravel;		234.75									Silica Sand	
		1/4" O/I	mottled brown to grey, (TILL); cohesive, w~PL, hard			4	DO	80				0			
		4			e e										
3					e e	$\vdash$								10 Slot PVC Screen	
						5	DO	80				0			
4															123
					232.68		DO	54				ρ			
			End of Borehole on Refusal NOTES:		4.27										
			1 Groundwater measured at a depth of												
5			0.9 m below existing grade in open borehole upon completion of drilling March 23, 2016.												
			<ul><li>March 23, 2016.</li><li>2. Groundwater measured at a depth of 1.7 m below existing grade September</li></ul>												
			12, 2016. 3. Groundwater measured at a depth of												
			1.3 m below existing grade on December 8, 2016.												
6															
7															
8															
9															
э															
10															
DE	PT	TH S	CALE						Â	Colda	•			LOGGED: CL	
1:	50	)								Golder	tes			CHECKED: NL	

### RECORD OF BOREHOLE: BH19

DATUM: Geodetic

BORING DATE: March 23, 2016

SALE			SOIL PROFILE	<b>⊢</b>	1	SA	MPLE		DYNAMIC PER RESISTANCE			),		k, cm/s		Ţ	ING	PIEZOMETER
DEPTH SCALE METRES	DODING METHOD	םסעואס שו	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	SHEAR STRE Cu, kPa	40 NGTH 40	nat V. + rem V. ∉	30 - Q - ● 9 U - ○ 30	W. Wr		I PERCI	10 <sup>-3</sup> ENT I WI 40	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
		+	GROUND SURFACE		241.21					+0	60 8					+0		
• 0			TOPSOIL		0.00 240.93	1A												
· 1			(CL) sandy SILTY CLAY, trace to some gravel; mottled brown grey to greyish brown, (TILL); cohesive, w <pl to="" w="">PL, firm to very stiff</pl>		0.28	1B 2	DO	6 22						0				
2	RT	tem Auger	(SM) SILTY SAND, trace to some		239.08 2.13	3	DO	21						<b>D</b> I			МН	
3	D-25 RT	4" O/D Solid Stem	gravel; grevish brown, (TILL); non-cohesive, moist, very dense	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2			DO						0					
				\$ \$ \$ \$ \$ \$ \$ \$ \$ \$		5	DO	93/ 279 mm					0					
4			End of Borehole NOTE:	A A A A A A A A A A A A A A A A A A A	236.51 4.70	6	DO	50/ 127 mm					0					
6			1. Groundwater measured at a depth of 1.6 m below existing grade in open borehole upon completion of drilling March 23, 2016.															
7																		
8																		
9																		
10																		
DEF 1 : 5		HSC	CALE						G	<b>B</b> A	Golde ssoci	er ates						OGGED: CL IECKED: NL

# BORING DATE: March 14, 2016

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

л ЧГЕ		E E	SOIL PROFILE		i	SA	MPLE		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	NG	PIEZOMETER
DEPTH SCALE METRES		0 MET		PLO1	ELEV.	BER	щ	/0.3m	20 40 60 80		TESTI	OR STANDPIPE
DEP- ME		BORING METHOD	DESCRIPTION	STRATA PLOT	DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - O		ADDITIONAL LAB. TESTING	INSTALLATION
		ă		STI	(m)			В	20 40 60 80	10 20 30 40		
• 0	_		GROUND SURFACE TOPSOIL	222	245.66 0.00			_				Casing
			FILL-(CL) SILTY CLAY, trace sand, trace to some gravel; brown; cohesive, w~PL, firm		0.15 245.15	1	DO	5		0	Metals, inorganic	Silica Sand
- 1			(CL) SILTY CLAY and SAND, trace to some gravel, cobble fragments; greyish-brown, (TILL); cohesive, w~PL, very stiff to hard		0.51							
·						2	DO	28				Hole Plug
						3	DO	35		0		, A
2		uger										Silica Sand
	Mount CME	O/D Hollow Stem Auge				4	DO	75		0	MH, VOC, PHC, pH	
3	Truck	8" O/D H				5	DO	90		0		
												8-Dec-2016
4						6	DO :	95/ 279 mm		0		
						7		50/ 51 mm		0		
- 5								50/ 102				
			End of Borehole		240.22 5.44	8	DO	102 mm.		0	VOC, PHC	
- 6			NOTE: 1. Groundwater measured at a depth of 3.2 m below existing grade in open borehole upon completion of drilling March 14, 2016. 2. Groundwater measured at a depth of 3.4 m below existing grade in monitoring well on December 8, 2016.									
7												
8												
9												
10												
DE	EP1	TH S	CALE	1	1			1	Golder		L	I OGGED: CL

# BORING DATE: March 11, 2016

SHEET 1 OF 1 DATUM: Geodetic

щ	ЦОР	SOIL PROFILE			SAM	PLES	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	<u>र</u> ा	HYDRAULIC CONDUCTIVITY, k, cm/s	وب	PIEZOMETER
METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	BLOWS/0.3m	20 40 60 80 SHEAR STRENGTH nat V. + Q Cu, kPa rem V. ⊕ U 20 40 60 80	a-●	10 <sup>-6</sup> 10 <sup>-5</sup> 10 <sup>-4</sup> 10 <sup>-3</sup> WATER CONTENT PERCENT Wp	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
0				245.36						Motolo	
Ū		FILL-(SW/GP) SAND and GRAVEL, some silt, asphalt fragments; brown; non-cohesive, moist, compact FILL-(CL) SILTY CLAY, some sand, some gravel; brown; cohesive, w>PL, stiff		0.08	B D	D 14				Metals, inorganio	Casing Silica Sand
1		(CL) SILTY CLAY and SAND, some gravel; brown to greyish-brown, (TILL); cohesive, w~PL, very stiff to hard			2 D	O 49			0	VOC, PHC	Hole Plug
2				_	3 D	5 67			0		Silica Sand
3	Buggy Mount D-90 O/D Hollow Stem Auger			-	4 D	D 81			0	VOC, PHC	이 사망가 가지 않는다. 이 사망가 가지 않는다. 이 사망가 가지 않는다. 이 사망가 가지 않는다.
	Bug 8" O/D H				5 D	80/			0		2 8-Dec-2016 10 Slot PVC Screen
4						229 mm			0		
5					7 D	95/ 279 mm			0		
6		End of Borehole		239.44 5.92	8 D	0 75			Φ		
7		NOTES: 1. Groundwater measured at a depth of 2.8 m below existing grade in open borehole upon completion of drilling March 14, 2016. 2. Groundwater measured at a depth of 3.3 m below existing grade September 12, 2016. 3. Groundwater measured at a depth of 3.4 m below existing grade December 8, 2016.									
8											
9											
10											
DE	PTH S	SCALE					Golder			L	OGGED: CL

# BORING DATE: March 14, 2016

DATUM: Geodetic

ų I	Ę		SOIL PROFILE	1		SA	MPLE	S	DYNAMIC PENETRATION Y RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	Ę,	PIEZOMETER
METRES	BORING METHOD		DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	ТҮРЕ	BLOWS/0.3m	20 40 60 80 SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - O	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
	ă	,	GROUND SURFACE	ST	(m)		$\square$	Ħ	20 40 60 80			
0 -			FILL-(ML) CLAYEY SILT, some sand, some gravel; brown; cohesive, w>PL, stiff		245.21 0.00 244.52	1	DO	10		0	Metals, inorganic	Casing Silica Sand
1			(CL) SILTY CLAY and SAND, trace to some gravel, cobble fragments; greyish-brown, (TILL); cohesive, w~PL, hard		0.69	2	DO	30		0		Hole Plug
2						3	DO	34		0		Silica Sand
	Truck Mount CME 55	O/D Hollow Stem Auger				4	DO	47		0	VOC, PHC	
3	Truck Mc	8" O/D Hollo				5	DO	49		•		
4						-6	DO	50/ 25 mm				10 Slot PVC Screen
5						7	DO	91		0	VOC, PHC	মন্,মন, মন, মন্
			End of Borehole		239.57 5.64	8	DO	50/ 152 mm		o		[ <u>객</u>
6			NOTE: 1. Groundwater measured at a depth of 4.4 m below existing grade in open borehole upon completion of drilling March 14, 2016. 2. Monitoring well unable to be located									
7			due to golf course landscaping.									
8												
9												
10												
DEI	PTH	-1 S(	CALE	<u> </u>	1				Golder		L	DGGED: CL

# BORING DATE: March 15, 2016

SHEET 1 OF 1 DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 64kg; DROP, 760mm

л н			SOIL PROFILE		1	SA	MPLE		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	N.	ULIC CONDUCTIVITY, k, cm/s	NG A	PIEZOMETER
DEP IN SUALE METRES	BORING METHOD		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	20 40 60 80 SHEAR STRENGTH nat V. + C Cu, kPa rem V. ⊕ U 20 40 60 80			ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
0			GROUND SURFACE	.,	248.16								
0			TOPSOIL		0.00								Casing Silica Sand
					247.65	1	DO	3			0		
			FILL-(ML) CLAYEY SILT and SAND; light brown; cohesive, w <pl to="" w="">PL,</pl>		0.51								
1			firm		×	2	DO	6					
					*								Hole Plug
					Ś	3	DO	6			e l	мн	
2													
			(CL) SILTY CLAY and SAND, some gravel; greyish-brown, (TILL); cohesive,		246.03 2.13								
			w~PL to w>PL, hard			4	DO	46		d			
	55	Auger	Coarse sand seam at 2.6 mbgs										Silica Sand
3	Truck Mount CME 55	O/D Hollow Stem Auger											
	k Mour	Hollow				5	DO	56			н	мн	8-Dec-2016
		8" O/D I				-	$\left  \right $						
		~											
4													
						<u> </u>							10 Slot PVC Screen
						6	DO	53					
5						<u> </u>							
ļ													
6						7	DO	50/ 76					
	$\vdash$	+	End of Borehole	PUDE	241.84 6.32	ŀ		mm			-		
			NOTES:										
7			1. Groundwater measured at a depth of 3.4 m below existing grade in open										
·			borehole upon completion of drilling March 15, 2016.										
			2. Groundwater measured at a depth of 2.9 m below existing grade September										
			<ul><li>12, 2016.</li><li>3. Groundwater measured at a depth of 3.2 m below existing grade December 8,</li></ul>										
8			3.2 m below existing grade December 8, 2016.										
9													
10													
DE	PTł	H SC	CALE						Golder				OGGED: CL
1:	50									es		CH	ECKED: NL

# BORING DATE: March 15, 2016

DATUM: Geodetic

0	BORING METHOD 4" O/D Solid Stem Auger	DESCRIPTION GROUND SURFACE TOPSOIL (CL) SILTY CLAY, trace sand; brown to mottled light brown; cohesive, w <pl to<br="">w-PL, stiff to very stiff</pl>	STRATA PLOT	ELEV. DEPTH (m) 242.51 0.00 242.00 0.51	1 NUMBER		PLOWS/0.3m	20 40 6 SHEAR STRENGTH n Cu, kPa 20 40 6	at V. + em V. ⊕	Q - ● U - O	10 W/ Wp 10		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0 -		TOPSOIL (CL) SILTY CLAY, trace sand; brown to mottled light brown; cohesive, w <pl th="" to<=""><th></th><th>242.51 0.00 242.00</th><th></th><th></th><th></th><th>20 40 6</th><th>0 80</th><th>)</th><th>1(</th><th></th><th></th><th></th></pl>		242.51 0.00 242.00				20 40 6	0 80	)	1(			
1	Auger	TOPSOIL (CL) SILTY CLAY, trace sand; brown to mottled light brown; cohesive, w <pl th="" to<=""><th></th><th>0.00 242.00</th><th>1</th><th>DO</th><th>4</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></pl>		0.00 242.00	1	DO	4							
	Auger	mottled light brown; cohesive, w <pl td="" to<=""><td></td><td></td><td>1</td><td>DO</td><td>⊿  </td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></pl>			1	DO	⊿							
	D-90 I Auger	mottled light brown; cohesive, w <pl td="" to<=""><td></td><td></td><td></td><td></td><td>7</td><td></td><td></td><td></td><td></td><td>φ</td><td></td><td></td></pl>					7					φ		
	D-90 I Auger	w~PL, stiff to very stiff												
2	D-su Auger			1	2	DO	12					He I	мн	
2	- au Auger		XXX											
2	n-su Auger													
2	N-30				3	DO	21					0		
	5121	(CL) SILTY CLAY and SAND, trace to		240.38 2.13										
1	Sterr	some gravel, cobble fragments; greyish-brown to grey, (TILL); cohesive,			4	DO	49				0			
A NOOT	/D Solic	w~PL, hard									Ŭ			
3	4						75/							
					5	DO	279 mm				0			
4														
					6	DO	42				0			
					7	DO	36				0			
5		End of Borehole	GK BK	237.48 5.03		$\vdash$								
		NOTE:												
		<ol> <li>Groundwater measured at a depth of</li> <li>7 m below existing grade in open borehole upon completion of drilling</li> </ol>												
6		March 15, 2016.												
7														
8														
9														
10														
DEP	TH S	CALE											LC	OGGED: CL

# BORING DATE: March 15, 2016

SHEET 1 OF 1 DATUM: Geodetic

ц Ц	LOH		SOIL PROFILE	1.	,	SAM	PLES	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	<u>او ہ</u>	PIEZOMETER
METRES	BORING METHOD		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	BLOWS/0.3m	20 40 60 80 SHEAR STRENGTH nat V. + Q - € Cu, kPa rem V. ⊕ U - C	10 <sup>6</sup> 10 <sup>5</sup> 10 <sup>4</sup> 10 <sup>3</sup> WATER CONTENT PERCENT         Wp         WW         WI	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
	á	$\rightarrow$	GROUND SURFACE	ST	(,	-	B	20 40 60 80	10 20 30 40	+	
0			TOPSOIL		241.08 0.00	+				+	
					240.62	1 [	8 0		φ		
		F	FILL-(ML) CLAYEY SILT, trace sand;		0.46						
			light brown; cohesive, w>PL, stiff		1	_					
1						2 0	0 11		0		
					1 [						
					+ +	_					
						3 C	0 11		0		
2		ъ			238.95	_					
	t D-90	Stem Auger	(CL) SILTY CLAY and SAND, trace to some gravel, cobble fragments; greyish-brown, (TILL); cohesive, w~PL,		2.13	_					
	/ Moun	olid Ste	greyish-brown, (TILL); cohesive, w~PL, hard			4 C	0 40		0	MH, NP	
	Buggy Mount D-90	4" O/D So				-					
3		4					50/				
						5 C	O 127 mm		0		
4											
						6 C	0 32		φ		
5		+	End of Borehole		236.05 5.03	_	_				
			NOTE:								
			1. Groundwater measured at a depth of								
			4.2 m below existing grade in open borehole upon completion of drilling								
6			March 15, 2016.								
7											
8											
9											
10											
	ΡТ	- 50	CALE					Golder		1.00	GGED: CL

### RECORD OF BOREHOLE: BH8 BORING DATE: March 10, 2016

SHEET 1 OF 1 DATUM: Geodetic

ц.	Ģ		SOIL PROFILE	1		SA	MPLE	s	DYNAMIC PENETRATION	HYDRAULIC CONDUCTIVITY, k, cm/s	Ę,	PIEZOMETER
DEPTH SCALE METRES	RORING METHOD		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	BLOWS/0.3m	20 40 60 80 SHEAR STRENGTH nat V. + Q - ● Cu, kPa rem V. ⊕ U - O 20 40 60 80	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
. 0			GROUND SURFACE		236.62							
Ū			FILL-(CL) SILTY CLAY, trace sand, mixed organics; brown to light brown; cohesive, w <pl, firm="" stiff<="" td="" to=""><td></td><td>0.00</td><td></td><td>DO</td><td>7</td><td></td><td>0</td><td></td><td>Casing</td></pl,>		0.00		DO	7		0		Casing
1			(CL) sandy CLAY, trace to some gravel; mottled brown to brown to brownish-grey to grey, (TILL); cohesive, w>PL to w~PL, stiff to hard		0.69	2	DO	10		p		Silica Sand
2	Buggy Mount D-90	8" O/D Hollow Stem Auger		A A A A A A A A A A A A A A A A A A A		3	DO	20		0		
	Buggy	8" O/D Hol				4	DO	64/ 254 mm		о <b>—</b> ч	MH, BTEX, PHC	10 Slot PVC Screen
3						5	DO	88		0		
4			End of Borehole	K K K K	<u>232.51</u> 4.11	6	DO	50/ 152 mm		0	BTEX, PHC	<u>त्र स</u> ्थः स्व स
5			NOTES: 1. Groundwater measured at a depth of 2.2 m below existing grade in open borehole upon completion of drilling March 10, 2016. 2. Groundwater measured at a depth of 1.5 m below existing grade September 12, 2016. 3. Monitoring well unable to be accessed due to damaged well cover.									
6			-									
7												
8												
9												
10												
DEI	PTł	H S	CALE						Golder		L	OGGED: CL

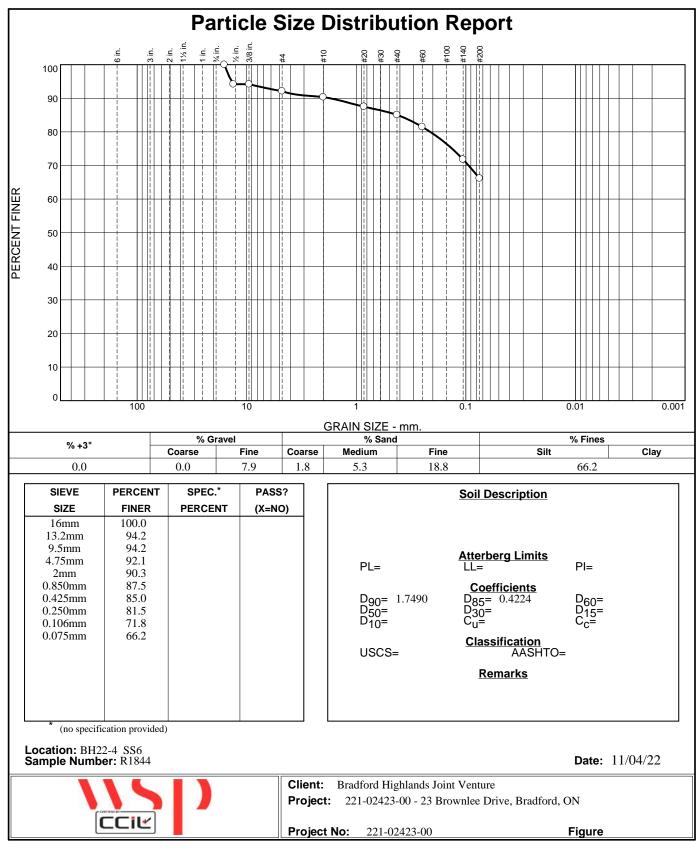
# BORING DATE: March 11, 2016

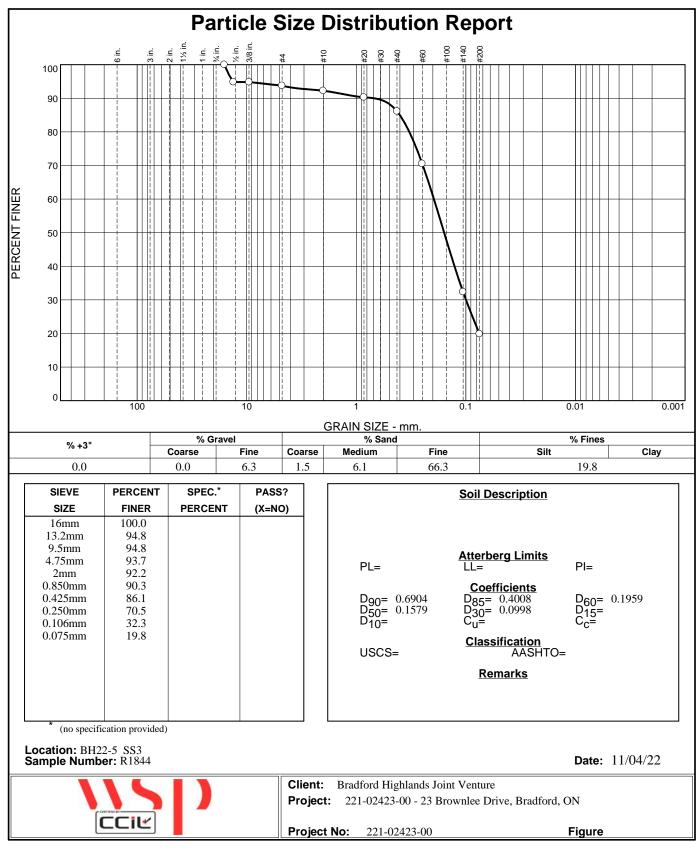
DATUM: Geodetic

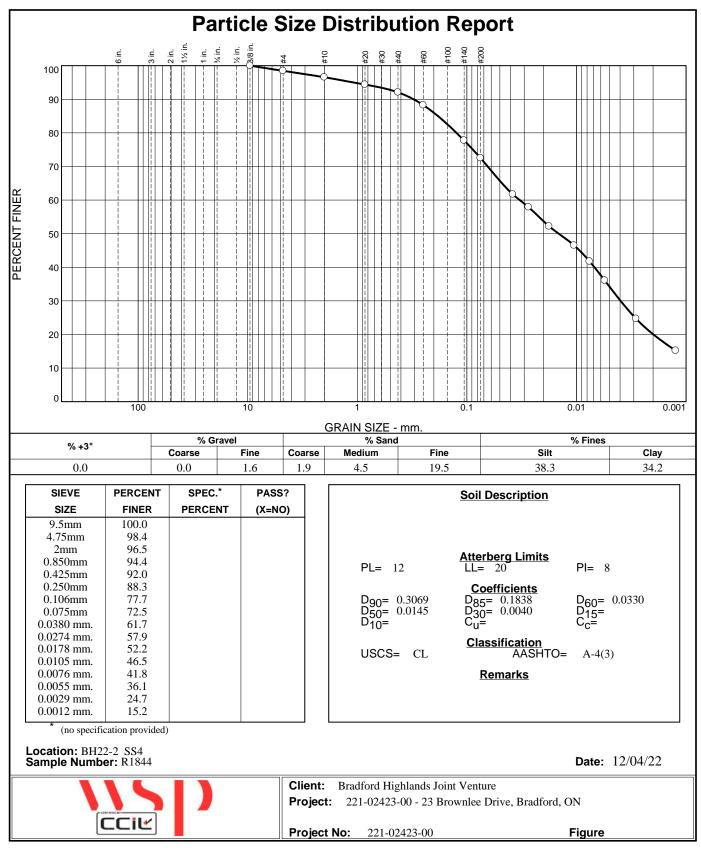
Щ	Б	SOIL PROFILE			SA	MPLE	s [	DYNAMIC PENE RESISTANCE, E	TRATIO	DN /0.3m	$\mathbf{r}$	HYDRA	AULIC CONDUCTIVITY, k, cm/s	T	-19	PIEZOMETER
DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)		TYPE	BLOWS/0.3m	20 41 SHEAR STREN Cu, kPa 20 41	GTH r r	∟ iat V. + em V. ⊕	Q - • U - O			10 <sup>-3</sup> ⊥ ENT I WI 40	ADDITIONAL LAB. TESTING	OR STANDPIPE INSTALLATION
- 0				236.24												
		FILL-(SP/GP) SAND and GRAVEL, some silt; grey; non-cohesive, moist, compact		235.73		DO 1	12					0			DTEV	Casing
1		(CL) SILTY CLAY, trace sand; brown; cohesive, w>PL, stiff to very stiff to hard		0.51		DO 1									BTEX, PHC, pł	
					2		14						0			Hole Plug
2					3	DO 2	21						ю		мн	
					4	DO 3	37						0		BTFX.	Silica Sand
3	ount D-90 Stern Auger	(CL) SILTY CLAY and SAND, trace to		233.26 2.98											PHC, pł	
	Buggy Mount D-90 8" O/D Hollow Stem Auç	some gravel; greyish-brown to grey, (TILL); cohesive, w>PL, very stiff to hard			5	DO 3	35					0				
4	8"0				6	DO 6	60					0				
																10 Slot PVC Screen
5					7	DO 2	28					0			МН	
					8	DO 4	46					0				
6				229.69	9	DO 2	29					0				
7		End of Borehole NOTE: 1. Groundwater measured at a depth of 4.9 m below existing grade in open borehole upon completion of drilling March 11, 2016.		6.55												
8		<ol> <li>Monitoring well unable to be located due to golf course landscaping.</li> </ol>														
9																
10																
DE	PTH S	SCALE	-					á		- Folde socia	er		I I		L	DGGED: CL

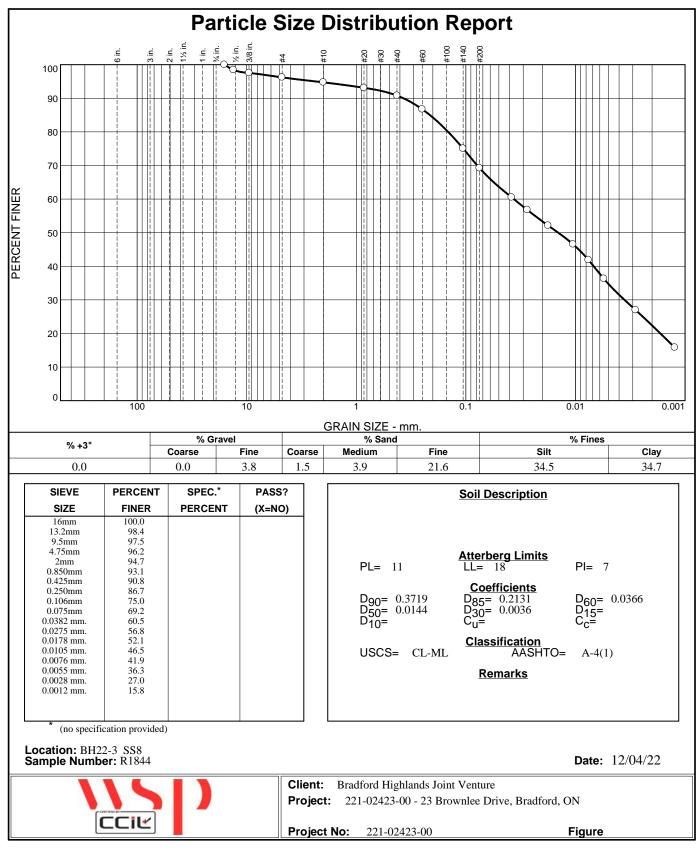


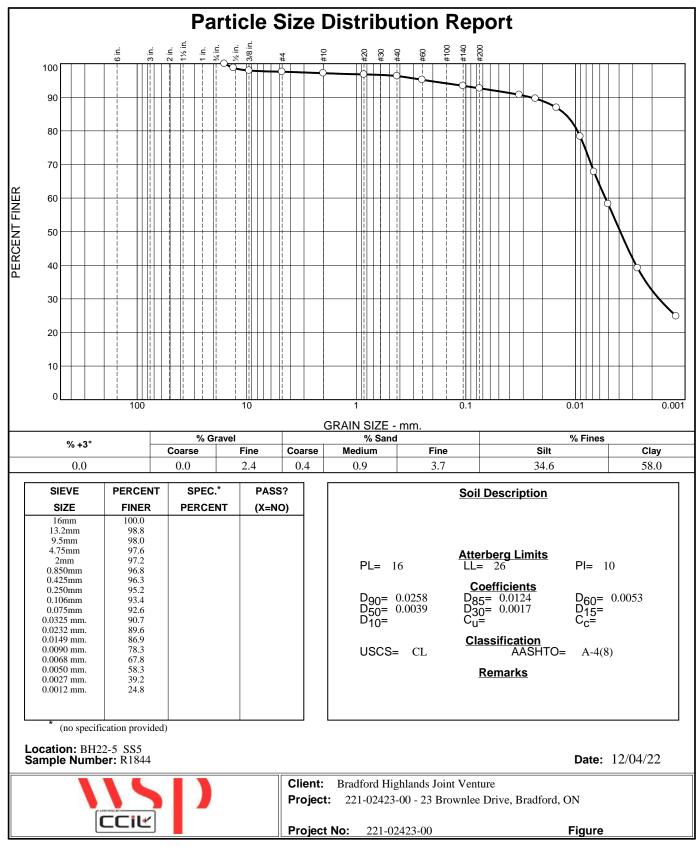


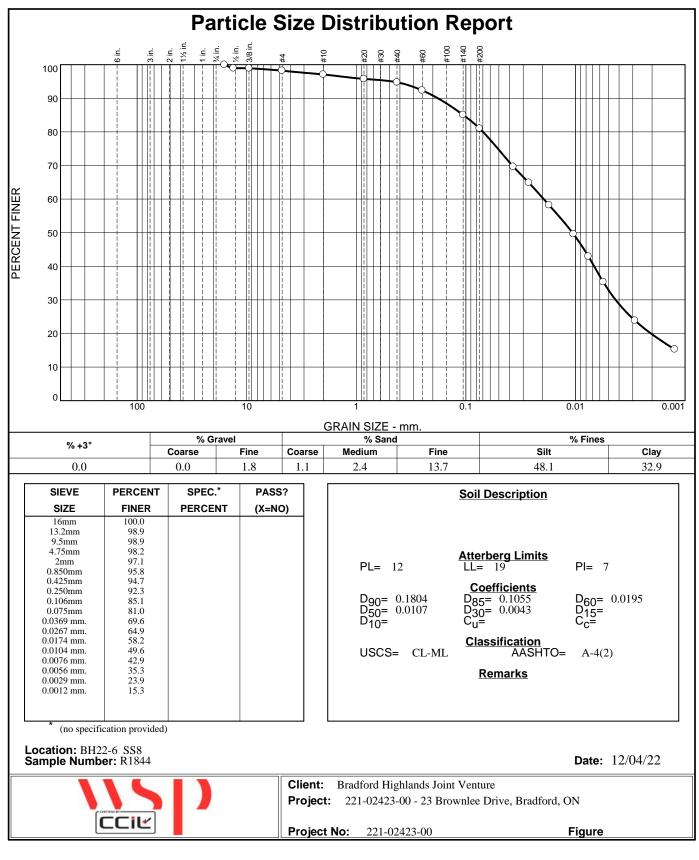


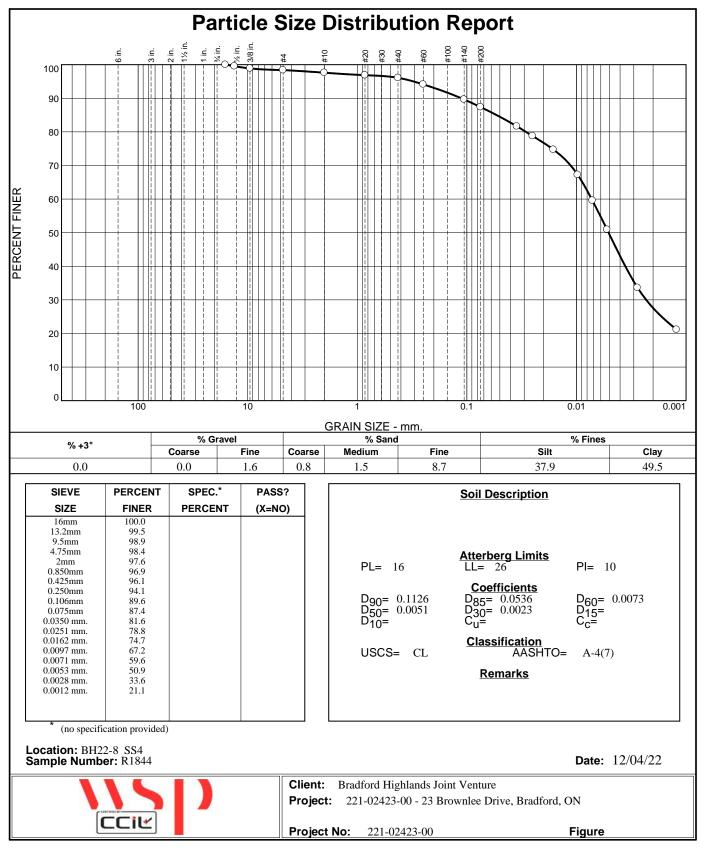


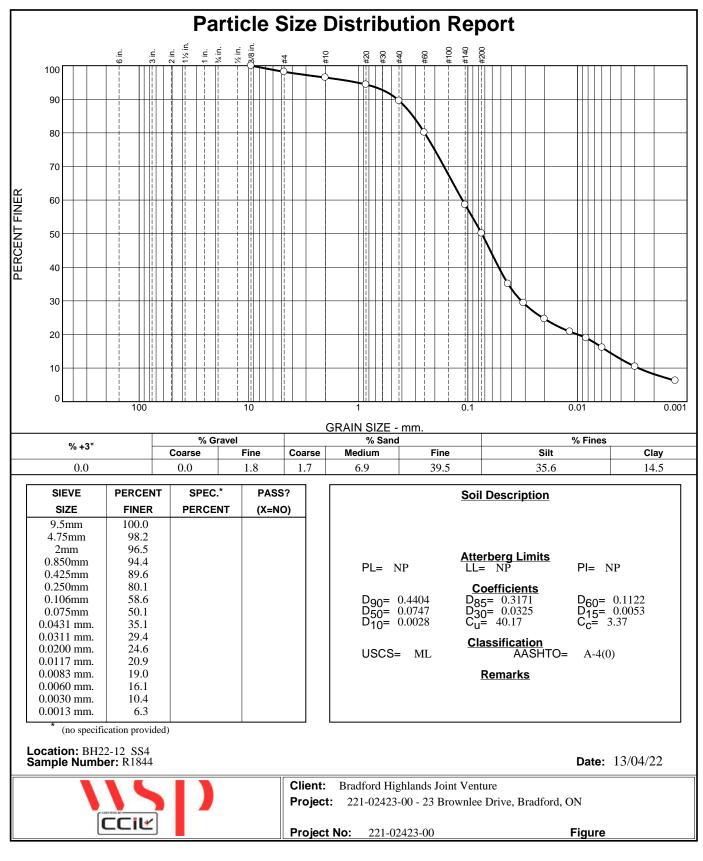


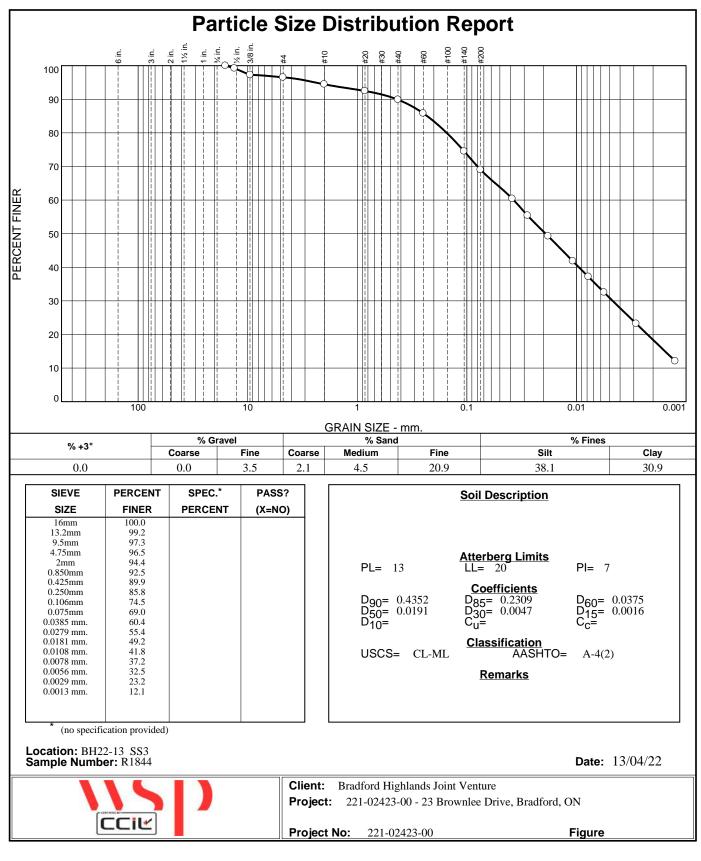


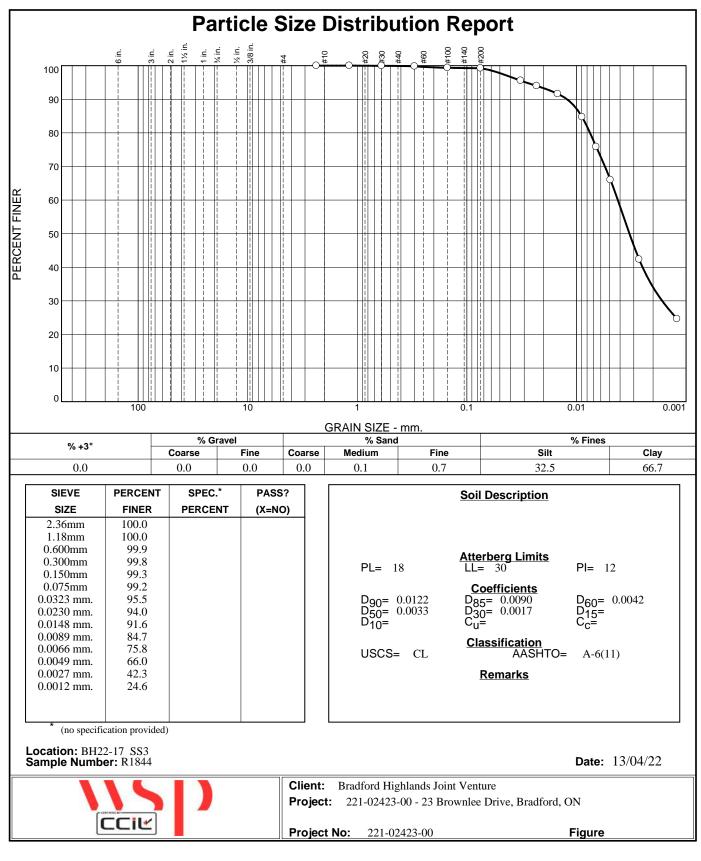


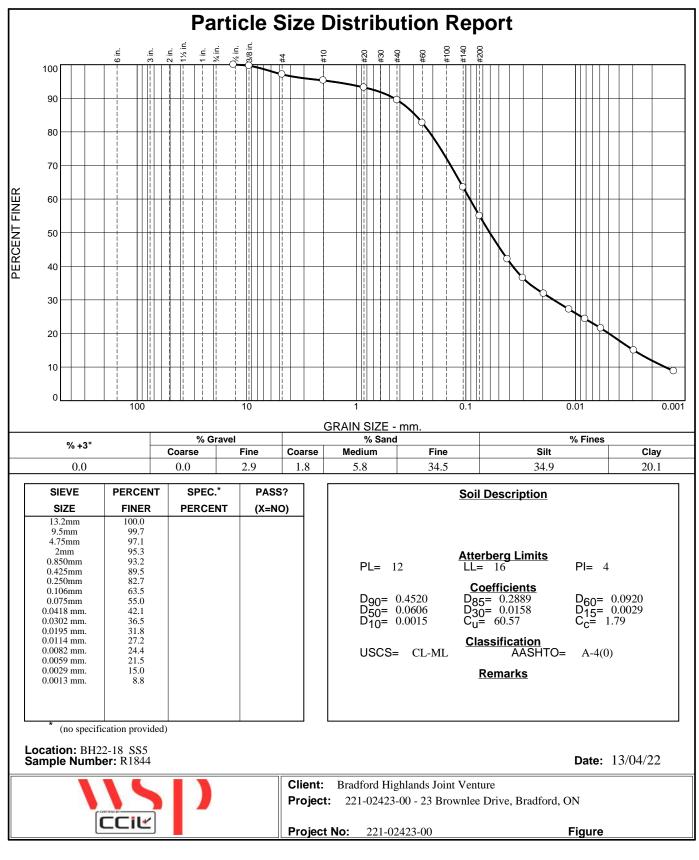


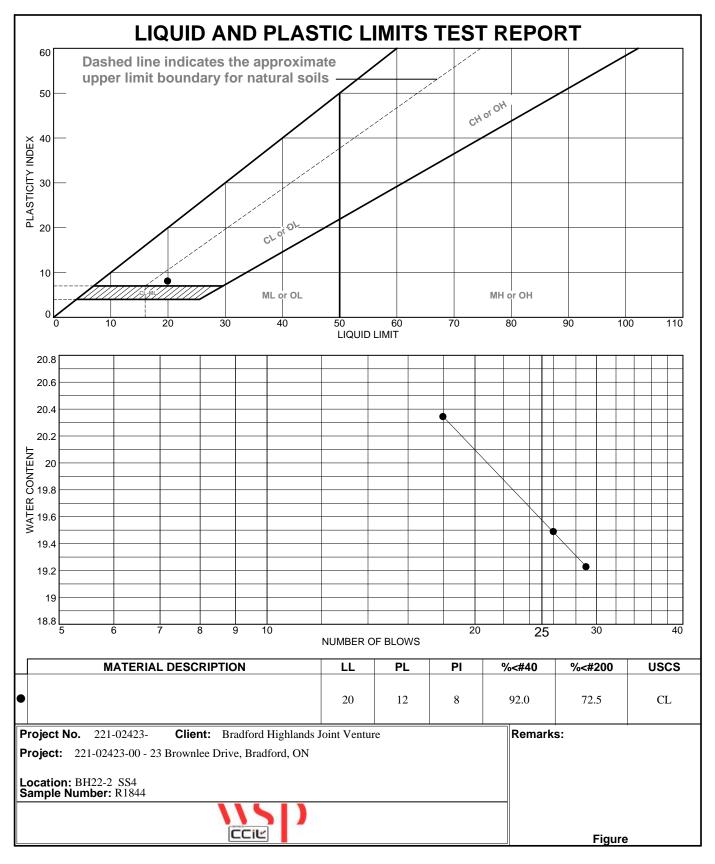


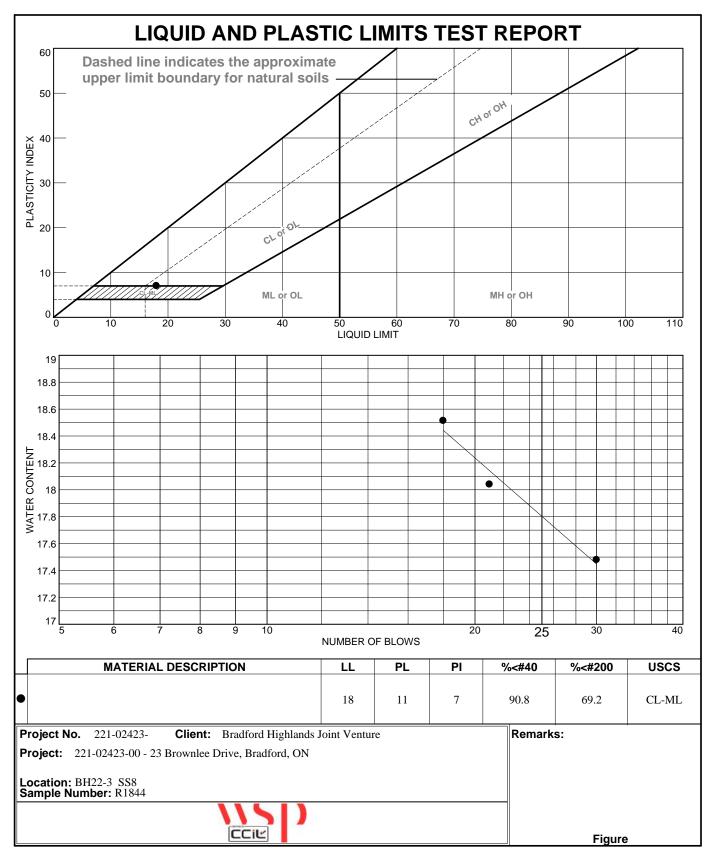


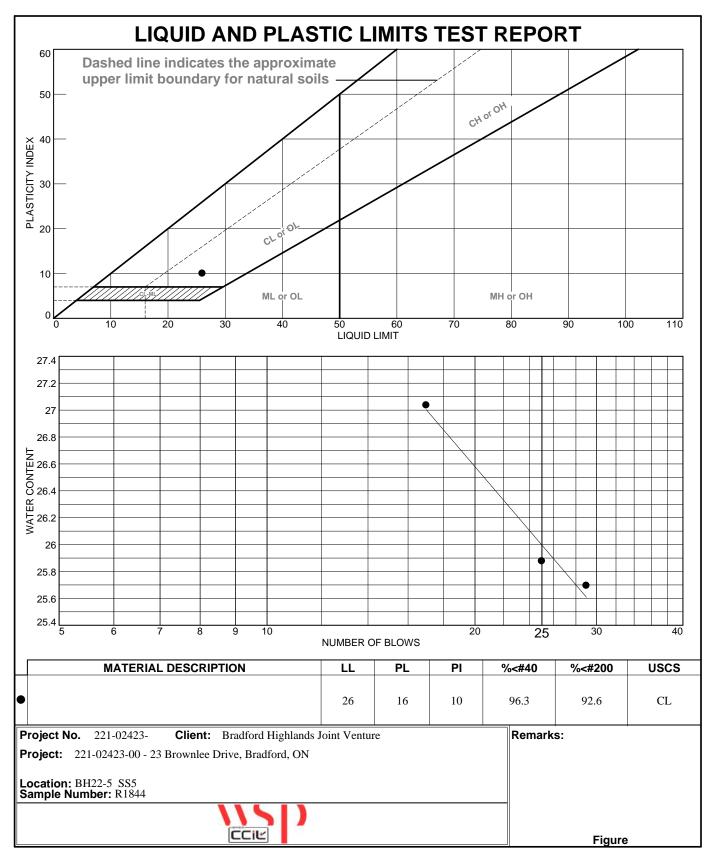


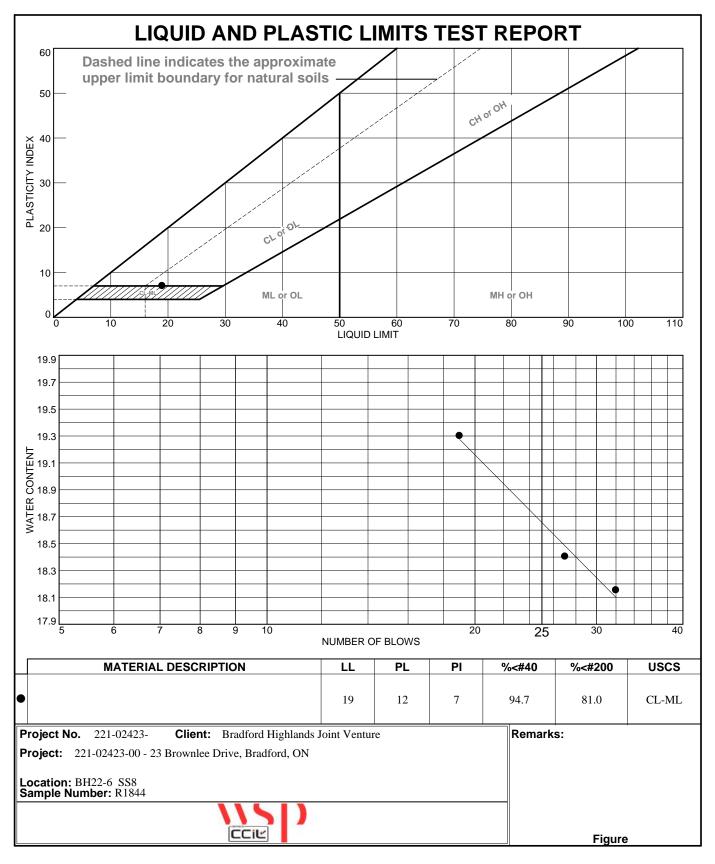


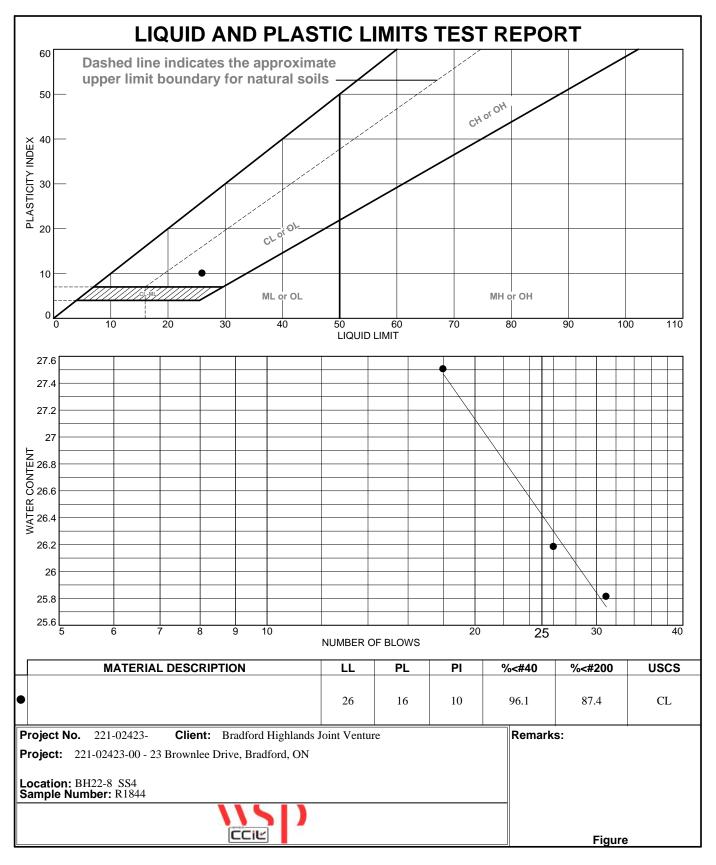


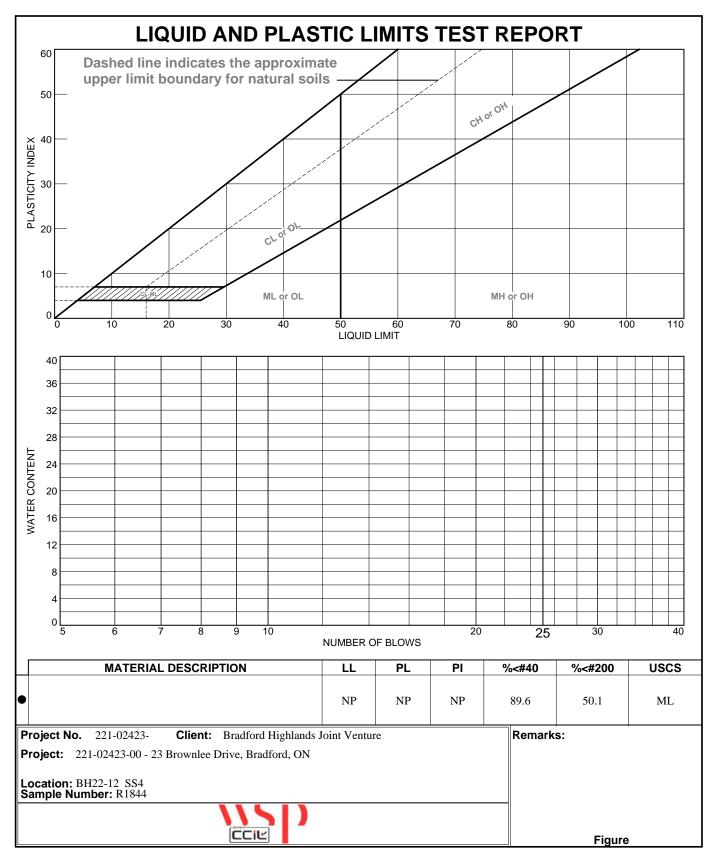


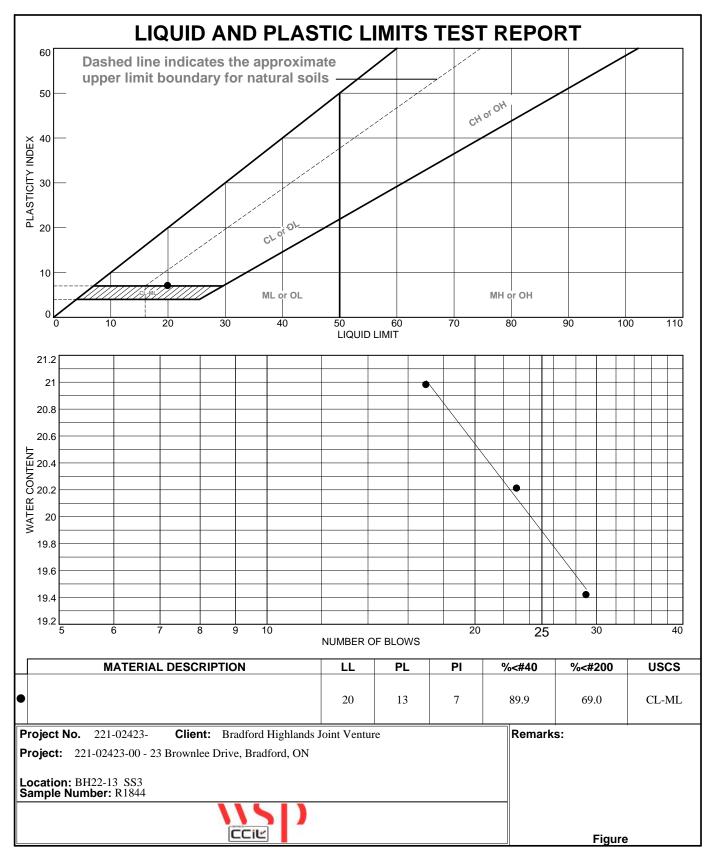


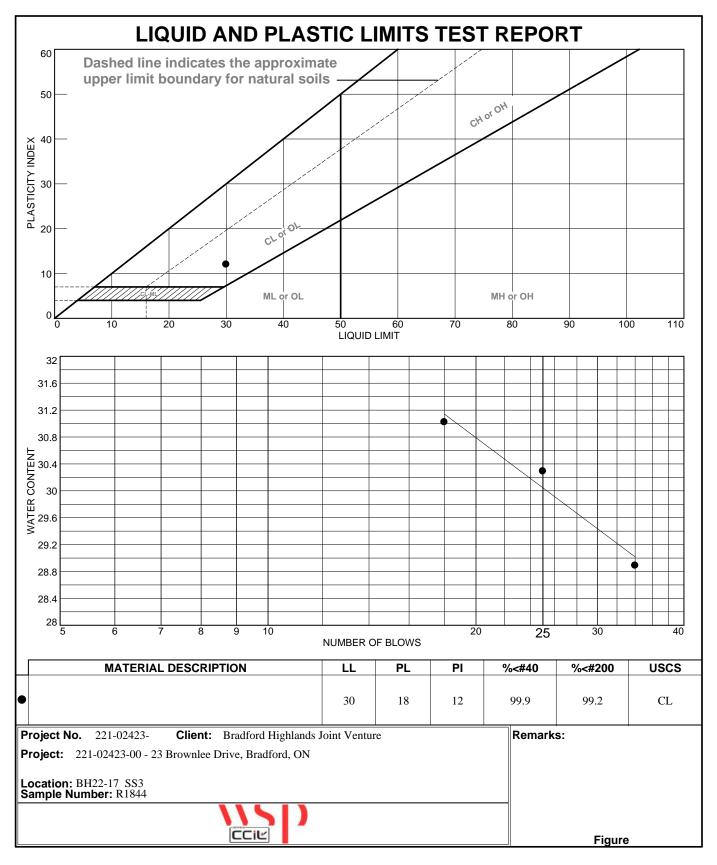


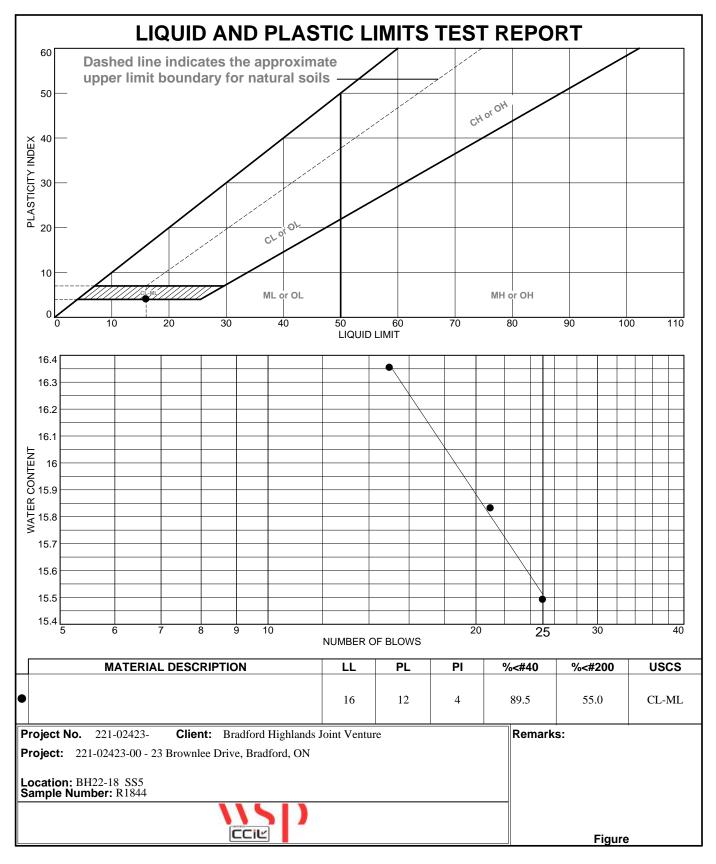


















### GENERAL REQUIREMENTS FOR ENGINEERED FILL

Compacted imported soil that meets specific engineering requirements and is free of organics and debris and that has been continually monitored on a full-time basis by a qualified geotechnical representative is classified as engineered fill. Engineered fill that meets these requirements and is bearing on suitable native subsoil can be used for the support of foundations.

Imported soil used as engineered fill can be removed from other portions of a site or can be brought in from other sites. In general, most of Ontario soils are too wet to achieve the 100% Standard Proctor Maximum Dry Density (SPMDD) and will require drying and careful site management if they are to be considered for engineered fill. Imported non-cohesive granular soil is preferred for all engineered fill. For engineered fill, we recommend use of OPSS Granular 'B' sand and gravel fill material.

Adverse weather conditions such as rain make the placement of engineered fill to the required degree of density difficult or impossible; engineered fill cannot be placed during freezing conditions, i.e. normally not between December 15 and April 1 of each year.

The location of the foundations on the engineered fill pad is critical and certification by a qualified surveyor that the foundations are within the stipulated boundaries is mandatory. Since layout stakes are often damaged or removed during fill placement, offset stakes must be installed and maintained by the surveyors during the course of fill placement so that the contractor and engineering staff are continually aware of where the engineered fill limits lie. Excavations within the engineered fill pad must be backfilled with the same conditions and quality control as the original pad.

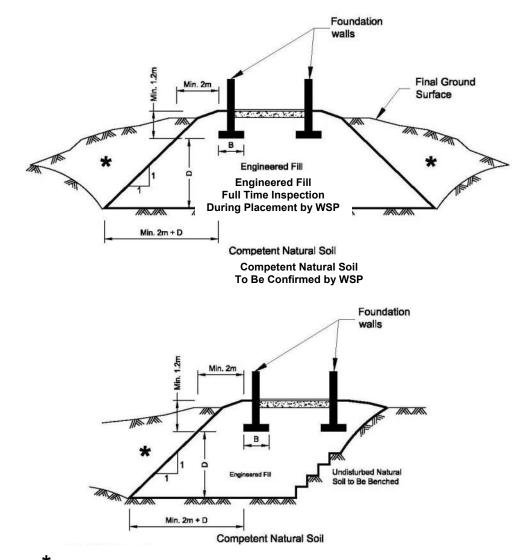
To perform satisfactorily, engineered fill requires the cooperation of the designers, engineers, contractors and all parties must be aware of the requirements. The minimum requirements are as follows, however, the geotechnical report must be reviewed for specific information and requirements.

- 1. Prior to site work involving engineered fill, a site meeting to discuss all aspects must be convened. The surveyor, contractor, design engineer and geotechnical engineer must attend the meeting. At this meeting, the limits of the engineered fill will be defined. The contractor must make known where all fill material will be obtained from and samples must be provided to the geotechnical engineer for review, and approval before filling begins.
- 2. Detailed drawings indicating the lower boundaries as well as the upper boundaries of the engineered fill must be available at the site meeting and be approved by the geotechnical engineer.
- 3. The building footprint and base of the pad, including basements, garages, etc. must be defined by offset stakes that remain in place until the footings and service connections are all constructed. Confirmation that the footings are within the pad, service lines are in place, and that the grade conforms to drawings, must be obtained by the owner in writing from the surveyor and WSP Canada Inc. Without this confirmation no responsibility for the performance of the structure can be accepted by WSP Canada Inc. Survey drawing of the pre and post fill location and elevations will also be required.
- 4. The area must be stripped of all topsoil and fill materials. Subgrade must be proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a WSP Canada Inc. engineer prior to placement of fill.



- 5. The approved engineered fill material must be compacted to 100% Standard Proctor Maximum Dry Density throughout. Engineered fill should not be placed during the winter months. Engineered fill compacted to 100% SPMDD will settle under its own weight approximately 0.5% of the fill height and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur and should be evaluated prior to placing the fill.
- 6. Full-time geotechnical inspection by WSP Canada Inc. during placement of engineered fill is required. Work cannot commence or continue without the presence of the WSP Canada Inc. representative.
- 7. The fill must be placed such that the specified geometry is achieved. Refer to the attached sketches for minimum requirements. Take careful note that the projection of the compacted pad beyond the footing at footing level is a minimum of 2 m. The base of the compacted pad extends 2 m plus the depth of excavation beyond the edge of the footing.
- 8. A bearing capacity of 150 kPa at SLS (225 kPa at ULS) can be used provided that all conditions outlined above are adhered to. A minimum footing width of 500 mm (20 inches) is suggested and footings must be provided with nominal steel reinforcement.
- 9. All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.
- 10. After completion of the engineered fill pad a second contractor may be selected to install footings. The prepared footing bases must be evaluated by engineering staff from WSP Canada Inc. prior to footing concrete placements. All excavations must be backfilled under full time supervision by WSP Canada Inc. to the same degree as the engineered fill pad. Surface water cannot be allowed to pond in excavations or to be trapped in clear stone backfill. Clear stone backfill can only be used with the approval of WSP Canada Inc.
- 11. After completion of compaction, the surface of the engineered fill pad must be protected from disturbance from traffic, rain and frost. During the course of fill placement, the engineered fill must be smooth-graded, proof-rolled and sloped/crowned at the end of each day, prior to weekends and any stoppage in work in order to promote rapid runoff of rainwater and to avoid any ponding surface water. Any stockpiles of fill intended for use as engineered fill must also be smooth-bladed to promote runoff and/or protected from excessive moisture take up.
- 12. If there is a delay in construction, the engineered fill pad must be inspected and accepted by the geotechnical engineer. The location of the structure must be reconfirmed that it remains within the pad.
- 13. The geometry of the engineered fill as illustrated in these General Requirements is general in nature. Each project will have its own unique requirements. For example, if perimeter sidewalks are to be constructed around the building, then the projection of the engineered fill beyond the foundation wall may need to be greater.





14. These guidelines are to be read in conjunction with WSP Canada Inc. report attached.

\* Backfill in this area to be as per WSP report.