GOLDER
MEMBER OF WSP

REPORT

Geotechnical Exploration

Proposed High-Rise Development
683-685 Warden Avenue
Toronto, Ontario

Submitted to:

Choice Properties Limited Partnership

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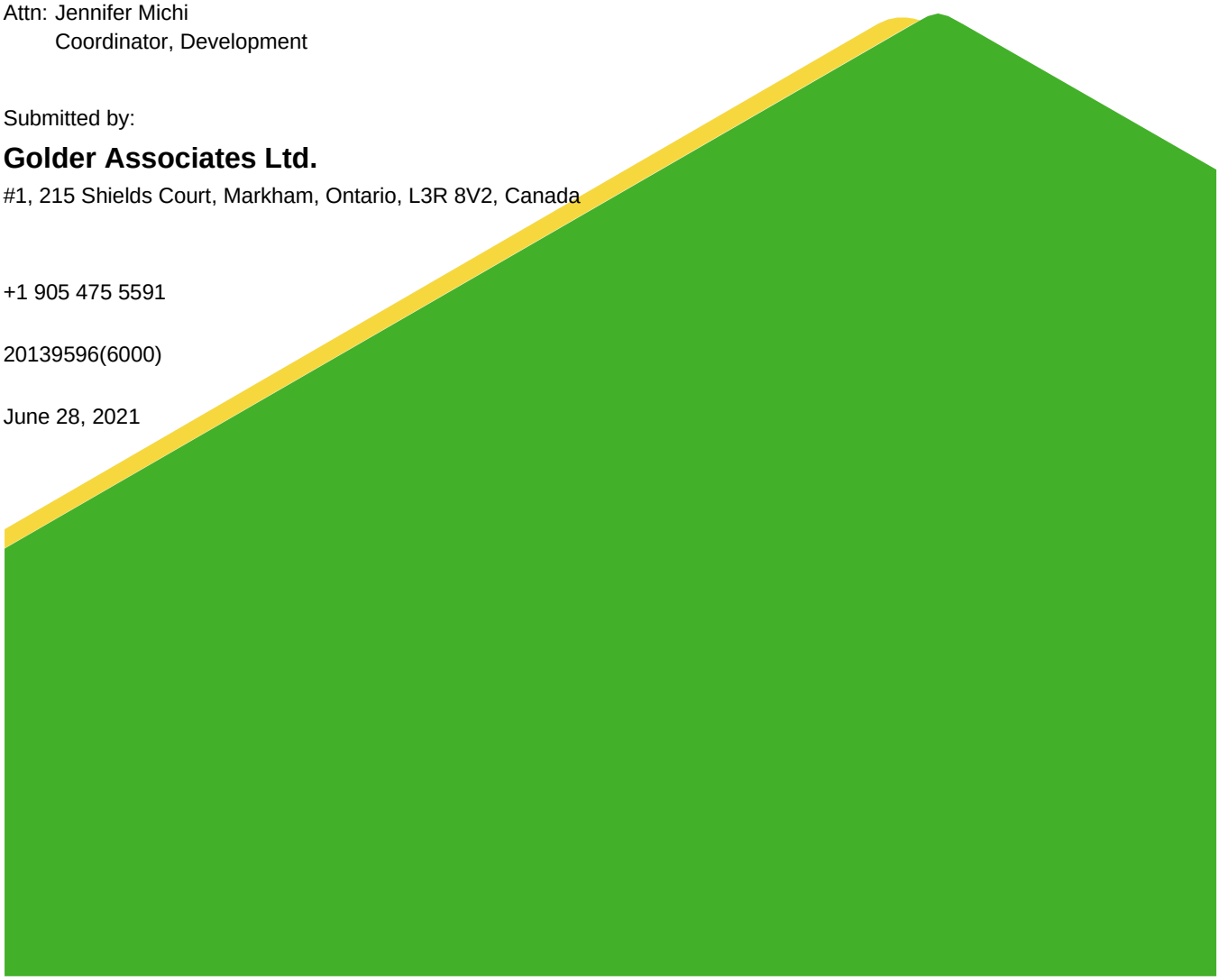

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APPENDICES

1.0 INTRODUCTION

Golder Associates Ltd. (“Golder”) has been retained by Choice Properties Limited Partnership (“Choice” or “Client”) to provide environmental, geotechnical and hydrogeological consulting services in support of the design for the proposed residential development (the “project”) to be located at 683-685 Warden Avenue (the “site”) in Toronto, Ontario, at the location shown on the Key Plan, Figure 1 in ***Appendix B***. The terms of reference for the geotechnical consulting services are included in Golder’s proposal No. CX201455087_R1 dated March 17, 2021. Authorization to proceed with the investigation was received in the form of the signed Authorization to Proceed from Choice on April 1, 2021.

The purpose of the field work and testing was to obtain information on the general subsurface soil and groundwater conditions at the site by means of a limited number of boreholes and laboratory tests. Based on an interpretation of the data available for this site, this report provides engineering comments, recommendations, and parameters for the geotechnical design aspects of the project, including selected construction considerations which could influence design decisions. It should be noted that this report addresses only the geotechnical (physical) aspects of the subsurface conditions at the site. The geo-environmental (chemical) aspects, including the consequences of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources, are beyond the terms of reference for this assignment and are not addressed herein. The updated environmental site assessment, environmental impact study and hydrogeological assessment reports for the proposed development will be submitted separately.

This report provides the results of the geotechnical exploration and testing and should be read in conjunction with the *“Important Information and Limitations of This Report”* in ***Appendix A*** which forms an integral part of this document. The reader’s attention is specifically drawn to this information, as it is essential for the proper use and interpretation of this report. The data, interpretations and recommendations contained in this report pertain to a specific project as described in the report and are not applicable to any other project or site location. If the project is modified in concept, location or elevation, or if the project is not initiated within eighteen months of the date of the report, Golder should be given an opportunity to confirm that the recommendations in this report are still valid.

2.0 SITE AND PROJECT DESCRIPTION

The site is located at municipal addresses 685 Warden Avenue in Toronto, Ontario, as shown on the Borehole Location Plan, Figure 2 in ***Appendix B***. The site is bordered on the north and south by industrial buildings, on the east by a residential complex and to the west by Warden Avenue. The site is currently a vacant lot sloping gently downwards from the northwestern corner to the southeastern corner with approximate change in elevations of 1.2 metres (m). Aerial photographs indicate that the site was previously occupied by a commercial single-storey building which covered the majority of the site with parking along the east, south and west perimeters of the site. The building was reportedly demolished in 2009.

At the time of preparing this report, the preliminary drawings provided by Choice, dated June 28, 2021, indicate that the proposed mixed-use development will consist of the following:

- Towers A and B, located in the east section of the site, which will each be 13-storey buildings connected by a 7-storey podium;
- Towers E and C, located in the northwestern section of the site, which will be 22-storeys and 36-storeys, respectively, connected by an 8-storey podium;

- Towers F and D, located in the southwestern section of the site, which will be 19-storeys and 33-storeys, respectively, connected by an 8-storey podium;
- It is anticipated that there will be a common underground parking structure extending to two levels below finished grade. The finished floor elevation (FFE) of the P2 parking level will range from approximately 139.5 m to 136.7 m, which will be approximately 7 m to 10 m below finished grade Elevation of 146.8 m. Footing bases and elevator shafts are anticipated to be about 1 m to 2 m below the finished basement floor.

Golder previously carried out a preliminary geotechnical investigation at the site in addition to Phase One and Two Environmental Site Assessments.

3.0 INVESTIGATION PROCEDURE

3.1 Previous and Current Drilling Program

The previous geotechnical field investigation for this site was carried out between March 9 and March 12, 2020, during which time seven boreholes (designated as BH20-1 to BH20-7) were advanced at the site. The boreholes for the investigation were drilled using a track-mounted CME 75 Auger and Mud Rotary drill rig supplied and operated by Landshark Drilling of Brantford, Ontario, subcontracted to Golder. An outline of the previous drilling program is presented below in Table 1.

The combined hydrogeological and geotechnical field investigation for this current assignment was carried out from April 28 to May 4, 2021, during which time four boreholes (designated as BH21-1 to BH21-4) were advanced to depths ranging from about 20.3 to 24.8 m below ground surface. The boreholes for the investigation were drilled using a standard track-mounted CME75 drill rig supplied and operated by 3D Drilling Inc. of Whitchurch-Stouffville, Ontario, subcontracted to Golder.

A summary of the previous and current geotechnical drilling programs is presented below in Table 1. The approximate borehole locations are shown on the Borehole Location Plan, Figure 2 in ***Appendix B***. The results of the subsurface investigation are presented on the Record of Borehole sheets in ***Appendix C*** and the results of geotechnical laboratory testing in ***Appendix D***.

Table 1: Drilling Program

Borehole ID	Ground Surface Elevation (m)	Borehole Depth (m)	Finished Elevation (m)	Notes
BH20-1	147.02	15.37	131.65	50-mm diameter monitoring well installed
BH20-2	146.36	15.62	130.74	50-mm diameter monitoring well installed
BH20-3	146.79	15.85	130.94	50-mm diameter monitoring well installed
BH20-4	146.00	15.85	130.15	50-mm diameter monitoring well installed
BH20-5	145.80	15.85	129.95	50-mm diameter monitoring well installed
BH20-6	146.70	7.87	138.83	50-mm diameter monitoring well installed
BH20-7	146.50	8.23	138.27	-

Borehole ID	Ground Surface Elevation (m)	Borehole Depth (m)	Finished Elevation (m)	Notes
BH21-1	146.77	24.84	121.93	50-mm diameter monitoring well installed
BH21-2	146.38	20.27	126.11	Pressuremeter Testing (PMT)
BH21-3	146.38	20.37	126.01	Pressuremeter Testing (PMT)
BH21-4	146.19	21.79	124.40	50-mm diameter monitoring well installed

Standard Penetration Testing (SPT) and sampling were carried out at regular intervals of depth in the geotechnical boreholes using conventional 38-millimetre (mm) internal diameter split spoon sampling equipment driven by an automatic hammer in accordance with the SPT procedures outlined in ASTM International standard D1586: "Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils". The split-spoon samplers used in the investigation limit the maximum particle size that can be sampled and tested to about 40 mm. Therefore, particles or objects that may exist within the soils that are larger than this dimension were not sampled and are not represented in the grain size distributions contained herein. The results of the field tests (i.e., SPT "N"-values) as presented on the Record of Borehole sheets and in subsequent sections of this report are the values measured directly in the field and are unfactored.

The groundwater conditions were noted in the open boreholes during and upon completion of drilling and monitoring wells were installed in six boreholes in the previous investigation and in two boreholes in the current investigation (see Table 1, above) following the completion of drilling to allow for subsequent groundwater measurements and hydrogeological testing. Each monitoring well consisted of a 50-mm diameter PVC riser pipe, with a slotted screen sealed at a selected depth within the borehole. A sand filter pack surrounded the screen, and above the screen the borehole and annulus surrounding the riser pipe were backfilled to the surface with bentonite. The well installation details and groundwater level readings are presented on the Record of Borehole sheets in ***Appendix C***. Boreholes without monitoring wells were backfilled with bentonite and cuttings upon completion in accordance with the requirements of the Revised Regulations of Ontario (R.R.O.) 1990, Regulation 903 (as amended) of the Ontario Water Resources Act.

A total of eight pressuremeter tests (PMT) were completed in BH21-2 and BH21-3. The pre-bored pressuremeter testing was completed using a TEXAM unit. The testing procedure was in conformance with Procedure B, volume-controlled loading, as outlined in ASTM International standard D4719-00: "Standard Test Method for Pre-bored Pressuremeter Testing of Soils". The results of the pressuremeter tests are presented in ***Appendix E***.

The field work for this investigation was observed by members of Golder's technical staff, who located the boreholes in the field, arranged for the clearance of underground utilities, observed the borehole drilling, sampling and in situ testing operations, logged the boreholes as well as examined and took custody of the recovered soil samples. The samples were identified in the field, placed in appropriate containers, labelled and transported to our Whitby geotechnical laboratory for further visual examination by the project engineer and for laboratory testing.

Index and classification tests, consisting of water content determinations and grain size distribution analyses, were carried out on selected soil samples and the results are presented in ***Appendix D*** and also on the Record of Borehole sheets in ***Appendix C***.

The geodetic ground surface elevations at the borehole locations were taken from a survey plan (Plan of Survey with Topography of Part of Lot 32 Concession B, City of Toronto) prepared by Speight, Van Nostrand & Gibson Ltd., Ontario Land Surveyors, dated December 19, 2005. A member of Golder's technical staff was also present on site on March 23, 2020 and May 18, 2021 to measure the elevations at the borehole locations using a laser level based on temporary benchmarks obtained from the topographic plan provided and, as such, the ground surface elevations at the borehole locations should be considered approximate. The borehole locations were referenced to existing prominent site features and plotted on the plan provided in the preparation of Figure 2, Borehole Location Plan. As such, the borehole locations shown on Figure 2 in ***Appendix B*** should also be considered to be approximate.

4.0 SITE GEOLOGY AND STRATIGRAPHY

4.1 Regional Geology

The surficial geology aspects of the general site area were reviewed from the following publications:

- Chapman, L.J., and Putnam, D.F., 2007, *"The Physiography of Southern Ontario"*; 4th Edition, Ontario Geological Survey; and
- Sharpe, D.R., 1980. Quaternary Geology of Toronto and Surrounding Area; Ontario Geological Survey Preliminary Map P. 2204, Geological Series. Scale 1:100,000.

Physiographic mapping in the area according to the above-noted reference indicates that the site lies within the physiographic region of southern Ontario known as the South Slope. The South Slope region slopes gradually downward towards Lake Ontario. The overburden immediately below ground surface within the South Slope generally consists of clayey silt till and silty clay till and at depth consists of alternating deposits of dense lacustrine sands and silts and overconsolidated lacustrine clays and clay tills overlying the bedrock.

The surficial geology mapping indicates that the site lies within a region consisting of stone poor, sandy silt to silty sand and clay-textured till deposits of Paleozoic terrain.

The subsurface conditions encountered during the investigation are generally consistent with the physiographic and surficial geological mapping.

4.2 Background Information

The following reports were previously prepared by Golder for the site:

- Geotechnical report prepared by Golder titled, "Preliminary *Geotechnical Investigation, Proposed Residential Development, 683 to 685 Warden Avenue, Scarborough, Ontario*," dated May 15, 2020, Report No. 20139596(1000);
- Draft Phase One ESA titled, "*Phase One Environmental Site Assessment, 683 and 685 Warden Avenue, Toronto, Ontario*," dated April 2020, Report No. 20139596; and
- Phase Two ESA titled, "*Phase Two Environmental Site Assessment, 683 and 685 Warden Avenue, Toronto, Ontario*," dated April 20, 2020, Report No. 20139596(3000).

The subsurface information from the previous report is incorporated in this report.

4.3 Subsurface Conditions

The detailed subsurface soil and groundwater conditions encountered in the boreholes advanced at the site for this report along with the results of geotechnical laboratory testing are shown on the Record of Borehole sheets in ***Appendix C***. Golder's "*Methods of Soil Classification*", "*Abbreviations and Terms Used on Records of Boreholes and Test Pits*" and "*List of Symbols*" are provided in ***Appendix C*** to assist in the interpretation of the Record of Borehole sheets. The detailed results of geotechnical laboratory testing on selected soil samples are presented in ***Appendix D***.

The Record of Borehole sheets indicate the subsurface conditions at the borehole locations only. The stratigraphic boundaries shown on the borehole records are inferred from non-continuous sampling, observations of drilling progress as well as results of Standard Penetration Tests and, therefore, typically represent transitions between soil types rather than exact planes of geological/stratigraphic change. Subsurface soil conditions will vary between and beyond the borehole locations.

In general, the subsurface conditions encountered in the boreholes consisted of fill overlying compact to very dense non-cohesive till and stiff to hard cohesive till. These glacial tills were underlain by strata of dense to very dense silty sand and silt to sandy silt.

The subsurface soil and groundwater conditions encountered in the boreholes drilled at the site are described in the following sections.

Please note that:

- Depths given in the table describing the subsurface conditions are measured from ground surface;
- The SPT "N"-values given are blows for 0.3 m of penetration unless otherwise indicated; and
- In some boreholes, the presence of cobbles and boulders was inferred within the glacial till deposits due to rock fragments in the split spoon samples or due to bouncing of the split spoon during sampling.

A summary of the encountered soil conditions is presented below in ***Table 2***.

Table 2: Summary of Soil Properties – BH20-1 to BH20-7 and BH21-1 to BH21-4

Stratigraphy	Depth (m)		Elevation (mbgs)		SPT "N"-Values	Consistency / State	Approximate Water Content (%)	Comments
	From	To	From	To				
Topsoil	0	50mm to 80mm	-	-	-	-	-	-
Cohesive FILL	0.0 to 0.7	0.7 to 2.2	146.8 to 145.3	145.8 to 143.6	2 to 13	Very soft to stiff	10 to 27	Not in BH20-1
Non-cohesive FILL	0.0 to 1.5	0.7 to 4.1	147.0 to 145.2	146.8 to 142.6	4 to 50	Loose to very dense (generally compact)	6 to 26	BH20-1, BH20-4, BH20-6 and BH20-7
Non-cohesive TILL	1.5 to 7.1	4.0 to 14.7	145.0 to 139.7	142.9 to 132.1	15 to 50/0.03 m	Compact to very dense (generally very dense)	5 to 17	Not in BH20-6
Cohesive TILL	0.7 to 7.2	2.1 to 10.0	146.1 to 139.3	144.3 to 137.0	6 to 50/0.08 m	Stiff to hard (generally hard)	7 to 18	All Boreholes
Non-cohesive Silt to Sandy Silt Deposits	7.1 to 14.7	15.4* to 24.8*	139.1 to 132.1	131.6* to 121.9*	47 to 50/0.03 m	Dense to very dense (generally very dense)	12 to 26	Not in BH20-6 and BH20-7

mbgs = metres below ground surface

*Borehole termination depth/elevation

Atterberg limits testing results and grain size distribution curves for selected soil samples are shown on Figures D1 to D10 in ***Appendix D***.

4.3.1 Geotechnical Laboratory Testing

The results of Atterberg limits tests on selected soil deposits are presented on Figures D1 to D4 in ***Appendix D.*** A summary of the results is presented below in ***Table 3***.

Table 3: Results of Atterberg Limits Testing

Borehole ID	Sample Number	Liquid Limit %	Plastic Limit %	Plasticity Index %	Soil Classification
BH20-1	8	20	11	9	CL
BH20-4	2	25	15	10	CL
BH20-4	6	14	10	4	ML
BH20-6	6	17	11	6	CL-ML
BH21-3	11	-	-	-	Non-plastic
BH21-3	12	-	-	-	Non-plastic
BH21-4	15	-	-	-	Non-plastic

4.3.2 Pressuremeter Testing

The results of the pressuremeter tests completed in the boreholes are summarized below in ***Table 4*** and are provided in detail in ***Appendix E***.

Table 4: Pressuremeter Results

Borehole	Test No.	Depth (m)	Pressuremeter Modulus E_{PMT} (MPa)	Limit Pressure p^*_L (kPa)	E_{young} (MPa)	Soil Type
BH21-2	1	8.6	99.8	9753	339	Very dense sandy silt to silt
	2	11.8	97.2	7981	271	
	3	14.8	53.4	5577	143	
	4	17.9	85.4	7647	221	
BH21-3	1	10.3	81.4	8020	264	Very dense sandy silt to silt
	2	13.3	83.1	4765	162	
	3	19.5	49.1	5556	130	

4.3.3 Groundwater Conditions

The groundwater conditions encountered in each of the boreholes during drilling and measured in the monitoring wells are shown in detail on the Record of Borehole sheets in ***Appendix C***. Groundwater levels from the monitoring wells installed in 2020 and 2021 and are provided below in ***Tables 5*** *and* ***6***.

Table 5: Groundwater Level Measurements from 2020

BH ID	Depth Below Ground Surface (m)		Elevation (m)	
	March 23, 2020	March 26, 2020	March 23, 2020	March 26, 2020
BH20-1	7.8	7.7	139.2	139.3
BH20-2	7.1	7.1	139.3	139.3
BH20-3	1.8	2.3	145.0	144.5
BH20-4	4.4	4.4	141.6	141.6
BH20-5	5.2	5.9	140.6	139.9
BH20-6	1.7	1.6	145.0	145.1

Table 6: Groundwater Level Measurements from 2021

BH ID	Depth Below Ground Surface (m)	Elevation (m)
	May 12, 2021	May 12, 2021
BH20-1	7.6	139.4
BH20-2	7.2	139.1
BH20-3	3.4	143.4
BH20-4	4.0	142.1
BH20-5	4.6	141.2
BH20-6	1.1	145.6
BH21-1	6.8	140.0
BH21-4	4.0	142.2

It should be noted that the encountered and measured groundwater levels reflect the groundwater conditions in the boreholes at the time of the field work in March 2020 and May 2021. Groundwater levels at the site are anticipated to vary between and beyond the borehole locations and to fluctuate with seasonal variations in precipitation and snowmelt.

5.0 DISCUSSION AND RECOMMENDATIONS

This section of the report provides engineering information on, and recommendations for, the geotechnical design aspects of the project based on our interpretation of the borehole information, the laboratory test data and our understanding of the project requirements. The information in this portion of the report is provided for planning and design purposes for the guidance of the design engineers and architects. Where comments are made on construction, they are provided only in order to highlight aspects of construction which could affect the design of the project. Contractors bidding on or undertaking any work at the site should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction and make their own independent interpretation of the factual data as it affects their proposed construction techniques, schedule, equipment capabilities, costs, sequencing and the like. Golder will not assume any responsibility for construction-related decisions made by contractors on the basis of this report.

At the time of preparing this report, the preliminary drawings provided by the Client, dated June 28, 2021, indicate that the proposed development will consist of six residential towers ranging in heigh from 13 storeys to 36 storeys with a common two-level underground parking structure. The finished floor elevation (FFE) of the P2 parking level will range from Elevations 139.5 m to 136.7 m, which will be approximately 7 m to 10 m the below finished grade Elevation of 146.8 m. Footing bases and elevator shafts are anticipated to be about 1 m to 2 m below the finished basement floor.

5.1 Geotechnical Recommendations

5.1.1 Foundation Design

Consideration may be given to supporting the proposed buildings on conventional spread/strip footings founded in the competent, native and undisturbed deposits at the minimum depths as given below in ***Table 7***. Alternative foundation types such as caissons may be considered if higher bearing capacities than provided below are required.

Table 7: Anticipated Founding Soils for Shallow Foundations

Borehole ID	Minimum Footing Base Depth (m)	Maximum Footing Base Elevation (m)	Anticipated Founding Materials
BH20-1	7.5	139.5	Hard silty clay to clayey silt till Very dense sandy silt to silt
BH20-2	7.5	138.9	Very dense sandy silt till Very dense sandy silt to silt
BH20-3	7.5	139.3	Hard silty clay to clayey silt till or very dense silt Very dense sandy silt to silt
BH20-4	9.0	137.0	Very dense silty sand to sandy silt till Very dense sandy silt to silt
BH20-5	7.5	138.3	Very dense silty sand to sandy silt
BH21-1	7.5	139.3	Very dense silty sand to sandy silt till
BH21-2	8.0	138.4	Very dense sandy silt to silt
BH21-3	9.0	137.4	Very dense sandy silt till or very dense sandy silt to silt
BH21-4	7.5	138.7	Very dense silty sand and gravel Very dense silty sand to sandy silt

All fill, old foundations, other structures and any deleterious materials should be stripped/removed from the proposed development area. The spread/strip footings bearing at the depths/elevations provided above may be designed using the factored geotechnical resistance at Ultimate Limit States (ULS) and the geotechnical reaction at Serviceability Limit States (SLS) for 25 mm total settlement and 19 mm differential settlement provided below in ***Table 8***.

Table 8: Recommended ULS and SLS for Shallow Foundations

Spread or Strip Footing Dimensions	Factored Geotechnical Resistance at ULS (kPa)	Geotechnical Reaction at SLS (for 25 mm of settlement) kPa
0.5 m Strip footing	375	275
1.0 m Strip footing	425	300
1 m x 1 m Spread	625	500
2 m x 2 m Spread	675	
3 m x 3 m Spread	725	625
4 m x 4 m Spread	775	
5 m x 5 m Spread	825	

All exterior footings and footings in unheated areas should be provided with at least 1.2 m of earth cover after final grading or a thermally equivalent thickness of insulation, in order to address the potential for damage due to frost action.

As the actual soil bearing resistances are related to the actual footing sizes and founding depths, the foundation recommendations must be reviewed by Golder once the building details are finalized and, as such, the recommendation provided in ***Table 8*** should be considered preliminary. Additionally, the soil resistance and reaction values presented in the above ***Table 8*** are calculated under the assumption that the founding elevations are at least ***1 m*** below the finished slab elevation. Higher bearing resistances (both at ULS and SLS) could be available for greater footing embedment depths.

If stepped spread footings are constructed at different founding levels, the difference in elevation between individual footings should not be greater than one half the clear distance between the footings (2H:1V or gentler). Should this not be possible, Golder should be consulted to provide field inspection to ensure that the footings exceeding the above requirement are stable and the bearing and lateral support for the upper footing is not compromised. In addition, the lower footings should be constructed first so that if it is necessary to construct the lower footings at a greater depth than anticipated, the elevations of the upper footings can be adjusted accordingly. Stepped strip footings, if required, should be constructed in accordance with the latest edition of the Ontario Building Code (2015 OBC), Section 9.15.3.9.

Our foundation recommendations are subject to a key assumption that no former excavation, former or existing underground utility or structure is within or intercepts the zone of influence of the proposed footings. The zone of influence of the proposed footings can be defined as any line drawn from the underside edge of the footing down and away at a slope of 1 horizontal to 1 vertical. Complete removal of fill and any existing or remaining foundations from previous structures or any underground utilities, if present, or lowering the founding elevation (if appropriate) may be required subject to the inspection by Golder during the time of construction.

The founding materials are susceptible to disturbance by construction activity especially during wet weather and care should be taken to preserve the integrity of the materials as bearing strata. Prior to placing concrete for the

footings, the foundation excavations must be inspected by Golder to confirm that the footings are located in a native, undisturbed and competent bearing stratum which has been cleaned of ponded water and loosened or softened material. If the concrete for the footings on the native soil cannot be placed immediately after excavation and inspection (i.e., within 24 hours of excavation and inspection), it is recommended that a working mat of lean concrete be placed in the excavation to protect the integrity of the bearing stratum. The bearing soil and fresh concrete must be protected from freezing during cold weather construction.

5.1.2 Slab-on-Grade Floor

It is anticipated that the lower floor slab can be designed as a concrete slab-on-grade. The soils at the basement subgrade level will generally consist of hard till, very dense tills and very dense non-cohesive deposits.

The exposed subgrade should be proof rolled in conjunction with an inspection by Golder. Remedial work should be carried out on any softened, disturbed, wet or poorly performing zones as directed by Golder. Any low areas may then be brought up to within at least 200 mm of the underside of the floor slabs, as required, using Ontario Provincial Standard Specification (OPSS) Granular 'B', Type I material or other approved material, placed in maximum 200-mm thick loose lifts and uniformly compacted to at least 98 per cent of the material's Standard Proctor Maximum Dry Density (SPMDD).

The final lift of granular fill beneath floor slabs should consist of a minimum thickness of 200 mm of OPSS Granular 'A' material, uniformly compacted to at least 100 per cent of the material's SPMDD, acting as a moisture barrier. Any filling operations should be inspected and tested by Golder. Additional Granular 'A' material may be needed to provide adequate pipe bedding and cover, depending on the requirements for an under-slab drainage system (see below).

The floor slabs should be structurally separate from the foundation walls and columns. Sawcut control joints should be provided at regular intervals and along column lines to control shrinkage cracking and to allow for differential settlement of the floor slabs.

5.1.3 Permanent Drainage

At the time of the field investigation in March 2020 and May 2021, the highest groundwater levels were measured to be about 2 m to 9 m above the anticipated FFE of the proposed P2 basement level construction. As a result, an exterior perimeter drainage system and underfloor drainage should be installed. If a permanent drainage system is not feasible, the buildings can be constructed with a waterproofed basement that is also resistant to hydrostatic pressure, that is, with a "tanked" basement design.

The extent of drainage measures such as a composite geosynthetic drainage system or equivalent, under slab drainage and sump system should be assessed during the final design stages and Golder can provide geotechnical input as required.

An underfloor drainage system, connected to sumps, should be provided to collect the anticipated seepage volumes and to limit pore water pressure build-up on the underside of the floor slab. The subfloor drainage system may consist of a network of robust sub-drain pipes conveying collected groundwater to a sump or sumps from which the groundwater can be pumped to a municipal storm sewer. The drainage system would consist of interconnected perforated drainpipes (bedded on, and within, free draining granular soils wrapped in geotextile fabric) installed around the perimeter of the building and within the building footprint.

Drainage, such as through the use of a composite geosynthetic drainage system or equivalent, should be provided for the exterior walls. The composite drain must withstand the design horizontal earth pressures used for below-grade wall design and should be connected to the under-slab drainage system or perimeter drainage system. The drainage system collector pipes should drain to a sump for collection and discharge to a storm sewer.

Groundwater samples should be collected and analyzed to characterize the quality of the drainage discharge and treatment incorporated, if required, to comply with applicable sewer discharge criteria.

5.1.4 Temporary Excavation and Support

Excavations for the construction of the foundations will extend through the very soft to stiff or loose to compact fill and into the underlying stiff to hard till, or compact to very dense till and non-cohesive deposits. No unusual problems are anticipated in excavating in the overburden soil using conventional hydraulic excavating equipment. Excavations should not undermine any existing foundations for adjacent structures or existing infrastructure. The soils at this site are glacially derived and as such should be expected to contain cobbles and boulders, which could affect excavations for the buildings and site services. The contractor should be made aware of the potential presence of cobbles and/or boulders within the overburden soils. Further, excavations should not undermine any existing foundations for adjacent structures or existing infrastructure.

It is anticipated that temporary excavations above the groundwater table level will consist of conventional temporary open cuts with side slopes not steeper than 1 horizontal to 1 vertical (1H:1V)) for Type 3 soils (fill) as classified by Ontario Health and Safety Act and Regulations for Construction Projects (OHSA). For Type 3 soils the slope should be from the base of the excavation. Excavations will extend below the measured groundwater elevations and, consequently, adequate dewatering will be required to achieve a Type 3 soil classification. Saturated soils, below the groundwater level would be classified as Type 4 soils and, accordingly, side slope inclinations should not exceed 3H:1V. Where the side slopes consist of more than one soil type, the soil shall be classified as the type with the highest number among the types present.

Depending upon the construction procedures adopted by the contractor, actual groundwater seepage conditions, the success of the contractor's groundwater control methods and weather conditions at the time of construction, some flattening and/or blanketing of the slopes may be required. Care should be taken to direct surface runoff away from the open excavations. Stockpiles of excavated materials should be kept at least the same horizontal distance from the top edge of the excavation as the depth to not negatively impact excavation slope stability, subject to confirmation by a geotechnical engineer in the field during construction. Care should also be taken to avoid overloading of any underground services / structures by stockpiles.

Where space is not available for unsupported open cut excavations, some form of temporary shoring will be needed to support the excavations for the proposed building. In general, there are three basic shoring methods that are commonly used in local practice: steel soldier piles and timber lagging; driven interlocking steel sheet piles; and continuous concrete (secant pile or diaphragm) walls, each with appropriate lateral support (rakers, braces and/or tie-back anchors).

Soldier pile and lagging systems are suitable where the objective is to maintain an essentially vertical excavation wall and the movements above and behind the wall need only be sufficiently limited that relatively flexible features (such as roadways) will not be adversely affected. As a result, steel soldier piles installed in pre-augered sockets, with timber lagging may be feasible at this site where excavations are not located adjacent to settlement sensitive structures.

Due to the hard / very dense soils present at the site, the use of steel sheet piles for shoring is infeasible unless extensive pre-drilling of the sheet pile alignment is implemented.

Where existing buildings or certain buried services lie within the zone of influence of the shoring (such as adjacent to the north, east and south limits of the site) and the shoring deflections need to be strictly limited, secant pile or diaphragm walls would be appropriate due to their stiffer structural characteristics.

Design of the shoring should include an evaluation of base stability, soil squeezing stability and hydraulic uplift stability as defined in the Canadian Foundation Engineering Manual (CFEM, 2006). The shoring system should be designed to account for horizontal/lateral earth loads, surcharge loads, groundwater pressure and the effects of weather as well as the project requirements for controlling ground displacements. Lateral pressures for design of the temporary structures will depend on the temporary structure design and the nature of the lateral support provided. The distribution of lateral pressures on a shoring system depends greatly on the methods used, the stiffness, and the degree of lateral bracing or restraint. As such, the distribution of lateral earth pressures for such a system is best left to the ultimate specialist designer of the shoring who can best account for such conditions. It is a common practice for a specialist contractor to design and install the excavation support system. Golder can provide shoring design services for initial costing or to evaluate the suitability of the specialist contractor's design.

Although the final design of the shoring will be completed by the contractor, the parameters presented below in ***Table 9*** are provided to enable the structural designer to develop a conceptual design and assess the approximate construction costs for the shoring systems.

Table 9: Coefficients of Static Lateral Earth Pressure

Soil Description	Unit Weight	Internal Angle of Friction	Undrained Shear Strength	Coefficient of Earth Pressure[1]		
	(γ, kN/m^3)	(ϕ, degrees)	(kPa)	Active K_a	At Rest K_o	Passive K_p[2]
Very soft to stiff cohesive fill	18	25	10	0.41	0.58	2.46
Loose to compact fill	19	29	-	0.35	0.52	2.88
Stiff to hard cohesive till	19	30	50	0.33	0.50	3.00
Compact to very dense till, dense to very dense non-cohesive deposits	21	34	-	0.28	0.44	3.54

1) The earth pressure coefficients noted above are based on a horizontal surface adjacent to the excavation. If sloped surfaces are present, the coefficient of earth pressure should be adjusted accordingly.
2) The total passive resistance below the base of the excavation (i.e., adjacent to the temporary protection system) may be calculated based on the values of K_p indicated above but reduced by an appropriate factor that considers the allowable wall movement to account for the fact that a large strain would be required for mobilization of the full passive resistance.
3) For longer-term (drained) analyses, cohesion should be assumed to be nil for all soil types.

5.1.5 Lateral Earth Pressure for Below Grade Walls

The design of the foundation walls for the proposed buildings should take into account the horizontal soil loads, hydrostatic pressure, as well as surcharge loads that may occur during or after construction. The permanent below-grade wall is considered to be a rigid structure and should be designed to resist at-rest lateral earth pressures calculated as follows:

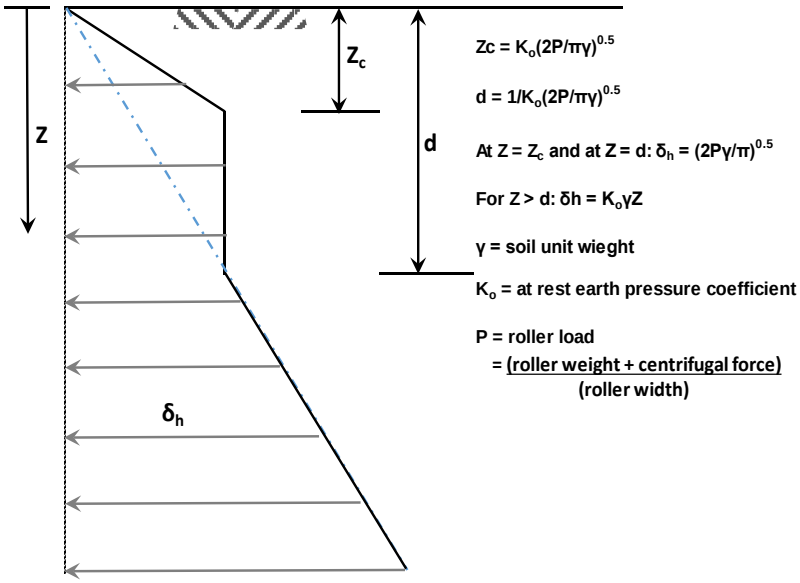
$$p = K(\gamma h + q)$$

where:

p	=	lateral earth pressure acting depth z, kPa
$K = K_o$	=	at rest earth pressure coefficient, use 0.5 for the foundation wall
γ	=	unit weight of retained soil/backfill, a value of 21 kN/m^3 may be assumed
h	=	depth to point of interest in soil, m
q	=	equivalent value of surcharge on the ground surface, kPa

The above expression assumes that the perimeter drainage system prevents the build-up of any hydrostatic pressure behind the wall. Should hydrostatic pressures be considered to build-up behind the walls (such as in the case of a fully waterproofed or “tanked” basement), they must be included in calculating the lateral earth pressures and other measures to address possible buoyancy and waterproofing may need to be considered. The lateral earth pressures acting on the below-grade walls will depend on the type and method of placement of the backfill materials, the nature of the soils behind the wall, the magnitude of surcharge including construction loadings from equipment or materials, the freedom of lateral movement of the structure, and the drainage conditions behind the walls. Surcharge pressures from any adjacent foundations and/or roads should also be included in the design as indicated.

To account for lateral pressures induced by the compaction effort adjacent to foundation walls, small walk-behind compaction equipment should be used within the zone of influence of the wall, as defined by a line extending upwards and outwards from the base of the wall at an inclination of 1 horizontal to 2.0 vertical, and the design lateral earth pressure distribution should consist of a combined trapezoidal/triangular distribution as depicted below. Typical roller loads are provided for reference.



Typical Roller Loads

Roller Type	Weight (kN)	Cent. Force (kN)	Width (mm)	P (kN/m)
1-drum walk-behind	2.3	8.3	560	18.9
2-drum walk-behind	1.6	10.1	560	20.9
2-drum walk-behind	12.1	8.8	760	27.5
2-drum walk-behind	9.2	19.8	750	38.7

To avoid detrimental impacts from frost adhesion and heaving, the excavated areas behind foundation walls for the basement levels or any below grade foundation elements should be backfilled with non-frost susceptible granular material conforming to the requirements for OPSS.MUNI 1010 Granular "B" Type I material. In areas where pavement or other hard surfacing will abut the building, differential frost heaving could occur between the granular fill immediately adjacent to the building and the more frost susceptible native materials which exist beyond the wall backfill. To reduce the severity of this differential heaving, the backfill adjacent to the wall should be placed to form a frost taper. The frost taper should be brought up to pavement subgrade level from 1.2 m below finished exterior grade at a slope of 3 horizontal to 1 vertical, or flatter, away from the wall. The backfill materials should be placed evenly in lifts not exceeding 200 mm in loose thickness. The layers should be uniformly compacted to at least 95 per cent of the material's SPMDD. Light compaction equipment should be used within 2 m of the wall; otherwise, compaction stresses on the wall may be greater than that imposed by the backfill material. The upper 0.3 m of backfill should consist of clayey material (where appropriate) to provide a relatively low-permeability cap and the exterior grade should also be shaped to slope away from the building.

The lateral earth pressure equation outlined above is given in an unfactored format and will need to be factored for Limit States Design purposes.

5.1.6 Site Classification for Seismic Site Response

Seismic hazard is defined in the 2012 Ontario Building Code (OBC) by uniform hazard spectra (UHS) at spectral coordinates of 0.2 second, 0.5 second, 1.0 second and 2.0 seconds and a probability of exceedance of 2% in 50 years. The OBC method uses a site classification system defined by the average soil/bedrock properties (e.g., shear wave velocity, Standard Penetration Test (SPT) resistance, undrained soil shear strength, etc.) in the 30 m of the soil profile extending below the foundation level. There are 6 site classes from A to F, decreasing in ground stiffness from A, hard rock, to E, soft soil; with site class F used to denote problematic soils (e.g., sites

underlain by thick peat deposits and/or liquefiable/collapsible soils). The site class is then used to obtain acceleration and velocity-based site coefficients F_a and F_v, respectively, used to modify the UHS to account for the effects of site-specific soil conditions in design.

The results of the borehole investigation indicate the average SPT "N"-value below the recommended founding depths (as discussed in ***Section 5.1.1***) is generally greater than 50 blows per 0.3 m of penetration. Based on these results, **Site Class C** may be used for design. The site classification may be improved by site-specific testing such as multi-channel analysis of surface waves (MASW) testing.

5.2 Temporary Groundwater Control

As noted in Section 2.0, the estimated FFE for the lowest parking level will be approximately 9 m below the finished grade. The measured groundwater level ranges from depths of about 1.1 m to 7.8 m (approximate Elevations 139.1 m to 145.6 m).

Care should be taken to direct surface water away from the open excavations. Any excavations extending into the saturated non-cohesive deposits will require the use of positive dewatering in the form of perimeter trenching with sumps and pumps, and/or well points, and/or eductors. Additional details are provided in the hydrogeological report.

Water takings in excess of 50 m^3/day are regulated by the Ministry of the Environment, Conservation and Parks (MECP). Certain takings of groundwater and storm water for construction site dewatering purposes with a combined total less than 400 m^3/day qualify for self-registration on the MECP's Environmental Activity and Sector Registry ("EASR"). Registration on the EASR replaces the need to obtain a PTTW and a Section 53 approval. A Category 3 PTTW is required where the proposed water taking is greater than 400 m^3/day. It is anticipated that excavations extending to the anticipate founding elevations will require only nuisance dewatering and that the required extraction rates will not trigger a requirement for an EASR registration or a PTTW.

The dewatering system is the Contractor's responsibility and the rate and volume required for dewatering is dependent on the construction methods and staging chosen by the contractor. Further, the contractor will be responsible for obtaining any required discharge approvals. The report on the hydrogeological assessment being carried out by Golder will be submitted separately.

5.3 Corrosivity

Six composite samples (from BH20-1, BH20-5 and BH21-1 to BH21-4) were submitted for corrosivity testing and the laboratory certificate of analysis for the corrosivity parameters is provided in ***Appendix F***. The corrosivity results were compared to the American Water Works Association (AWWA) C-105 (2005) Standard, "Polyethylene Encasement for Ductile-Iron Pipe Systems". Based on the results, the corrosivity potential is considered to be low in the areas of the boreholes tested. Buried steel elements installed at the site will therefore not need protection from corrosion in the general vicinity of the boreholes. The analytical results at the locations tested indicate that the potential for sulphate attack is negligible and that concrete made with Type GU Portland cement should be acceptable for below grade concrete elements. These recommendations are based on a limited number of sample locations and are provided as guidance only; the civil engineer should take the results of the laboratory testing, the potential for corrosion and the ultimate selection of materials into consideration.

6.0 MONITORING WELL DECOMMISSIONING

As previously indicated, monitoring wells were installed in the boreholes to permit monitoring of groundwater levels. Ontario Regulation (O.Reg.) 903 as amended, of the Ontario Water Resources Act, requires that wells be properly abandoned / decommissioned by qualified and licensed personnel. It is recommended that the decommissioning of the wells be carried out as part of the construction activities at the site so that additional water level measurements can be taken leading up to, and immediately prior to, construction and/or so that the wells can be potentially used to evaluate the effectiveness of the dewatering system during construction. If requested, Golder could provide assistance to the owner in arranging for the decommissioning of the wells by a MECP-licensed water well drilling contractor.

7.0 ADDITIONAL CONSIDERATIONS

During construction, a sufficient degree of foundation inspections, subgrade inspections, and an adequate number of in situ density tests and materials testing should be carried out to confirm that the conditions exposed are consistent with those encountered in the boreholes, and to monitor conformance to the pertinent project specifications. Concrete testing should be carried out on both the plastic material in the field and of set cylinder samples in a CSA certified laboratory.

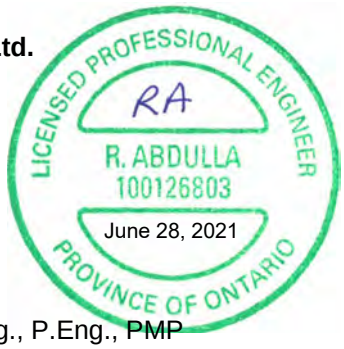
The soils at this site are sensitive to disturbance from ponded water, construction traffic and frost. All bearing surfaces must be inspected by Golder prior to filling or concreting to ensure that strata having adequate bearing capacity have been reached and that the bearing surfaces have been properly prepared.

8.0 CLOSURE

We trust that this report provides sufficient geotechnical engineering information to facilitate the preliminary design of this project. If you have any questions regarding the contents of this report or require additional information, please do not hesitate to contact this office.

Signature Page

Golder Associates Ltd.



Rafael Abdulla, M.Eng., P.Eng., PMP
Geotechnical Engineer

Mark A. Swallow, M.A.Sc., P.E., P.Eng.
Principal and Senior Practice Leader

RA/MAS/lh

https://golderassociates.sharepoint.com/sites/123368/project files/6 deliverables/6000 - geo 2021/20139596(6000) georeport_685wardenave 2021'06'28-rev0.docx

APPENDIX A

Important Information and Limitations of This Report

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder cannot be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Ground Water Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

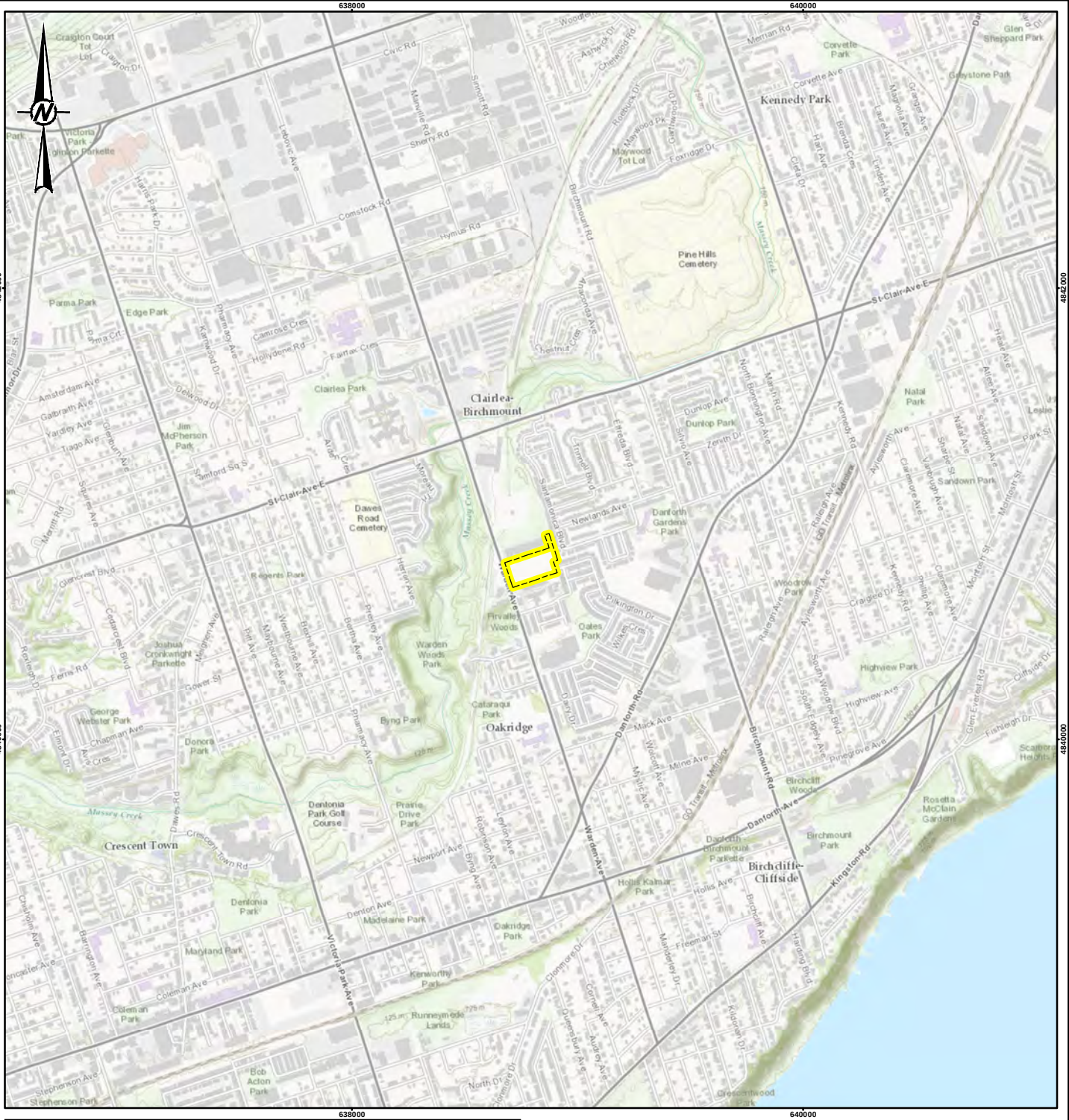
Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.

APPENDIX B

Figure 1 – Key Plan

Figure 2 – Borehole Location Plan



LEGEND

SITE BOUNDARY

0 500 1,000

1:25,000 METRES

REFERENCE(S)

BASE MAP SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
CHOICE PROPERTIES REIT

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2020-04-21
DESIGNED	JT
PREPARED	JT
REVIEWED	RA
APPROVED	MAS

PROJECT
GEOTECHNICAL AND HYDROGEOLOGICAL INVESTIGATIONS
PROPOSED HIGH-RISE DEVELOPMENT
683-685 WARDEN AVENUE, TORONTO, ON

TITLE
KEY PLAN

PROJECT NO.	CONTROL	REV.	FIGURE
20139596	0004	A	1

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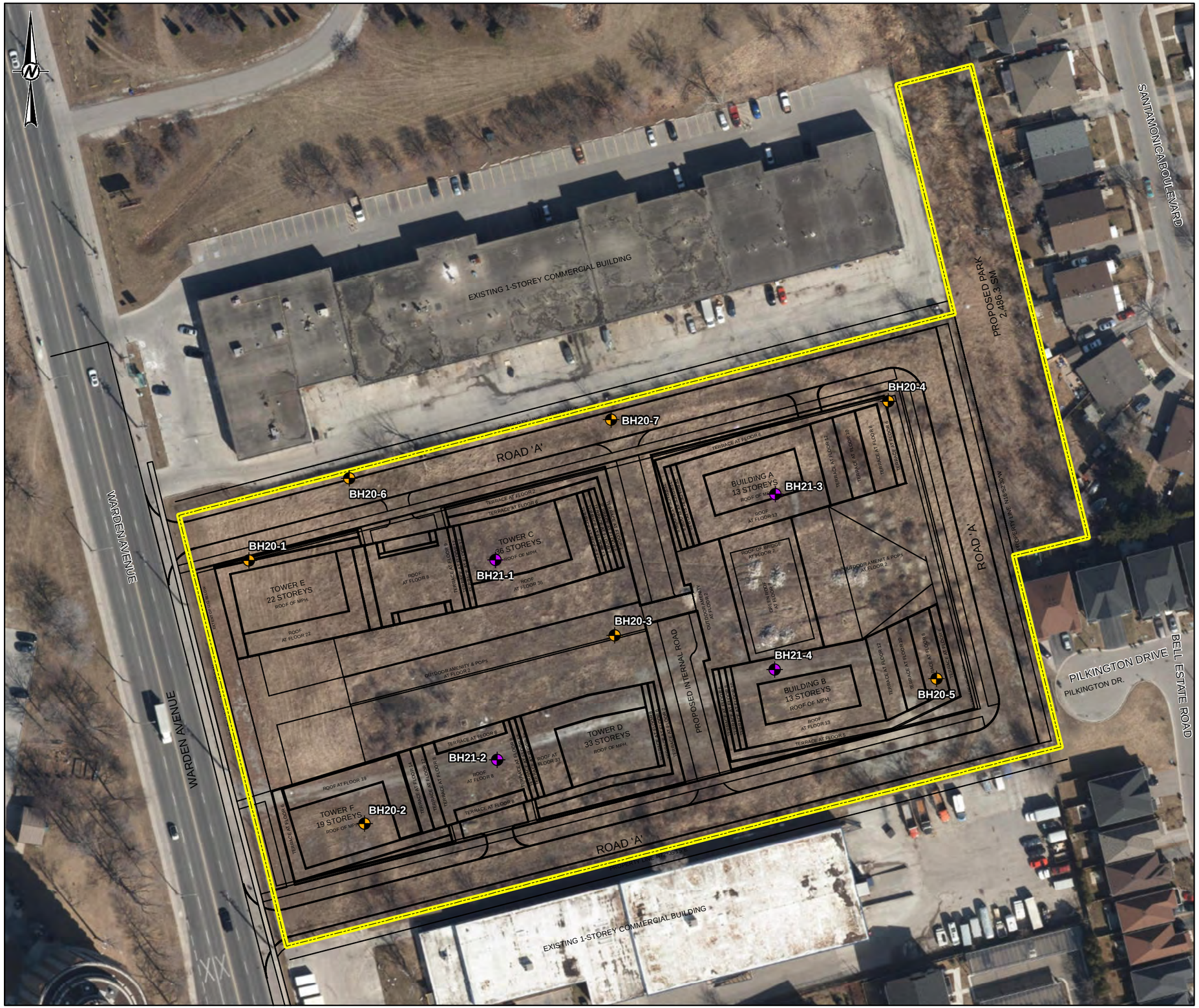

LEGEND

- BOREHOLE LOCATION (2020)
- BOREHOLE LOCATION (2021)
- SITE BOUNDARY

0 40 80

1:1,000 METRES

REFERENCE(S)

1. IMAGERY SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY
2. BASE PLAN PROVIDED BY TURNER FLEISCHER, ENTITLED "SITE PLAN/ROOF PLAN". DRAWING NO. RZ00, DATED 2021-05-03.
3. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
CHOICE PROPERTIES REIT

PROJECT
GEOTECHNICAL AND HYDROGEOLOGICAL INVESTIGATIONS
PROPOSED HIGH-RISE DEVELOPMENT
683-685 WARDEN AVENUE, TORONTO, ON

TITLE
BOREHOLE LOCATION PLAN

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2020-03-25
DESIGNED	RA
PREPARED	MK/JT
REVIEWED	RA
APPROVED	MAS

PROJECT NO.	CONTROL	REV.	FIGURE
20139596	0004	A	2

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APPENDIX C

Method of Soil Classification

Symbols and Terms used on Records of Boreholes and Test Pits

List of Symbols

Record of Borehole Sheets

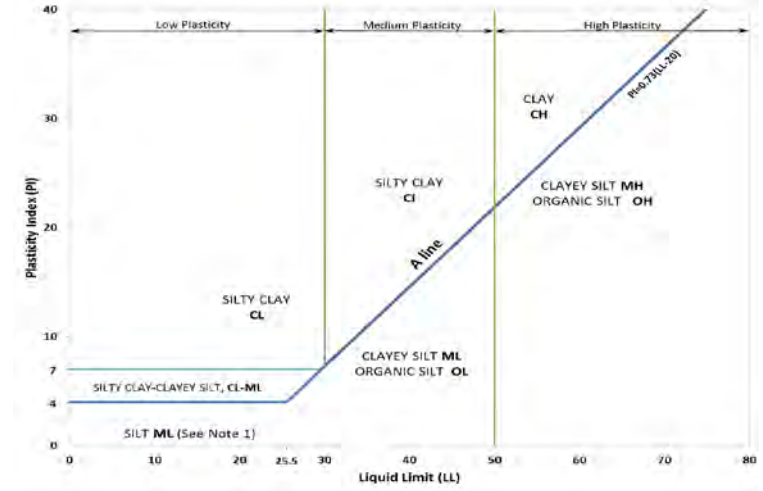
Boreholes BH20-1 to BH20-7 & BH21-1 to BH21-4

METHOD OF SOIL CLASSIFICATION

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$	$Cc = \frac{(D_{30})^2}{D_{10} x D_{60}}$	Organic Content	USCS Group Symbol	Group Name
INORGANIC (Organic Content ≤30% by mass)	COARSE-GRAINED SOILS (>50% by mass is larger than 0.075 mm)	GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm)	Gravels with ≤12% fines (by mass)	Poorly Graded	<4	≤1 or ≥3	≤30%	GP	GRAVEL
				Well Graded	≥4	1 to 3		GW	GRAVEL
			Gravels with >12% fines (by mass)	Below A Line	n/a			GM	SILTY GRAVEL
				Above A Line	n/a			GC	CLAYEY GRAVEL
		SANDS (≥50% by mass of coarse fraction is smaller than 4.75 mm)	Sands with ≤12% fines (by mass)	Poorly Graded	<6	≤1 or ≥3		SP	SAND
				Well Graded	≥6	1 to 3		SW	SAND
			Sands with >12% fines (by mass)	Below A Line	n/a			SM	SILTY SAND
				Above A Line	n/a			SC	CLAYEY SAND

Organic or Inorganic	Soil Group	Type of Soil	Laboratory Tests	Field Indicators					Organic Content	USCS Group Symbol	Primary Name
				Dilatancy	Dry Strength	Shine Test	Thread Diameter	Toughness (of 3 mm thread)			
INORGANIC (Organic Content ≤30% by mass)	FINE-GRAINED SOILS (≥50% by mass is smaller than 0.075 mm)	SILTS (Non-Plastic or PI and LL plot below A-Line on Plasticity Chart below)	Liquid Limit <50	Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT
				Slow	None to Low	Dull	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT
				Slow to very slow	Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT
			Liquid Limit ≥50	Slow to very slow	Low to medium	Slight	3mm to 6 mm	Low to medium	<5%	MH	CLAYEY SILT
				None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	OH	ORGANIC SILT
		CLAYS (PI and LL plot above A-Line on Plasticity Chart below)	Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0% to 30% (see Note 2)	CL	SILTY CLAY
			Liquid Limit 30 to 50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium		CI	SILTY CLAY
			Liquid Limit ≥50	None	High	Shiny	<1 mm	High		CH	CLAY
HIGHLY ORGANIC SOILS (Organic Content >30% by mass)		Peat and mineral soil mixtures							30% to 75%	PT	SILTY PEAT, SANDY PEAT
		Predominantly peat, may contain some mineral soil, fibrous or amorphous peat							75% to 100%		PEAT



Note 1 – Fine grained materials with PI and LL that plot in this area are named (ML) SILT with slight plasticity. Fine-grained materials which are non-plastic (i.e. a PL cannot be measured) are named SILT.
Note 2 – For soils with <5% organic content, include the descriptor "trace organics" for soils with between 5% and 30% organic content include the prefix "organic" before the Primary name.

Dual Symbol — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC and CL-ML.
For non-cohesive soils, the dual symbols must be used when the soil has between 5% and 12% fines (i.e. to identify transitional material between "clean" and "dirty" sand or gravel.
For cohesive soils, the dual symbol must be used when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart (see Plasticity Chart at left).

Borderline Symbol — A borderline symbol is two symbols separated by a slash, for example, CL/CI, GM/SM, CL/ML.
A borderline symbol should be used to indicate that the soil has been identified as having properties that are on the transition between similar materials. In addition, a borderline symbol may be used to indicate a range of similar soil types within a stratum.

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>300	>12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	<0.075	< (200)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
>35	Use 'and' to combine major constituents (*i.e.,* SAND and GRAVEL)
> 12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable
> 5 to 12	some
≤ 5	trace

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.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); N_d:

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

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DD	Diamond Drilling
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
GS	Grab Sample
MC	Modified California Samples
MS	Modified Shelby (for frozen soil)
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
TO	Thin-walled, open – note size (Shelby tube)
TP	Thin-walled, piston – note size (Shelby tube)
WS	Wash sample

SOIL TESTS

w	water content
PL , w_p	plastic limit
LL , w_L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
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
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1. Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

NON-COHESIVE (COHESIONLESS) SOILS

Compactness[2]

Term	SPT 'N' (blows/0.3m)[1]
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

1. SPT 'N' in accordance with ASTM D1586, uncorrected for the effects of overburden pressure.
2. Definition of compactness terms are based on SPT 'N' ranges as provided in Terzaghi, Peck and Mesri (1996). Many factors affect the recorded SPT 'N' value, including hammer efficiency (which may be greater than 60% in automatic trip hammers), overburden pressure, groundwater conditions, and grainsize. As such, the recorded SPT 'N' value(s) should be considered only an approximate guide to the soil compactness. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

COHESIVE SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT 'N'[1,2] (blows/0.3m)
Very Soft	<12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.
2. SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations.

Water Content

Term	Description
w < PL	Material is estimated to be drier than the Plastic Limit.
w ~ PL	Material is estimated to be close to the Plastic Limit.
w > PL	Material is estimated to be wetter than the Plastic Limit.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
ln x	natural logarithm of x
$\log_{10}$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
υ	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is ρ. Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

(a) Index Properties (continued)

w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index = $(w_l - w_p)$
NP	non-plastic
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_α	secondary compression index
m_v	coefficient of volume change
c_v	coefficient of consolidation (vertical direction)
c_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = tan δ
c′	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p′	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes: 1 $\tau = c' + \sigma' \tan \phi'$

2 shear strength = (compressive strength)/2

PROJECT: 20139596

LOCATION: See Figure 4

RECORD OF BOREHOLE: BH20-1

SHEET 1 OF 2

BORING DATE: March 10, 2020

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ⊕ (ND = Not Detected; 100 200 300 400) / HEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM] □ (ND = Not Detected; 100 200 300 400)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		147.02						
0	CME 75 TRACK MOUNTED 90 mm Mud Rotary Drilling	FILL - (ML) sandy SILT, trace to some gravel; brown, trace rootlets; non-cohesive, moist, very loose to compact		0.00	1	SS	4			50 mm Diameter Monitoring Well
1					2	SS	9			
					3	SS	14			
2				144.81						
		(ML) sandy SILT, trace gravel; brown (TILL), oxidization staining; non-cohesive, moist, compact to dense		2.21	4	SS	33	ND		
3										
					5	SS	24	ND		
4				142.91						
		(CL) SILTY CLAY, some sand, trace gravel; grey (TILL); cohesive w~PL, stiff to very stiff		4.11	6	SS	14	ND		PHC, VOC, PAH / Bentonite Seal
5										
6					7	SS	21	ND		
7				139.86						
		(CL-ML) SILTY CLAY to CLAYEY SILT, some sand, trace gravel; grey (TILL); cohesive, w~PL, hard		7.16	8	SS	50/0.08	ND		▽ March 23, 2020
8										
9					9	SS	50/0.13	ND		
				137.04						
10		*CONTINUED NEXT PAGE*								

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: RP

CHECKED: AD

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PROJECT: 20139596

RECORD OF BOREHOLE: BH20-1

SHEET 2 OF 2

LOCATION: See Figure 4

BORING DATE: March 10, 2020

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ⊕ ND = Not Detected (100 200 300 400) / HEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM] □ ND = Not Detected (100 200 300 400)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---								
10	CME 75 TRACK MOUNTED 90 mm Mud Rotary Drilling	(ML) sandy SILT; grey; non-cohesive, slight plasticity, moist to wet, very dense		9.98	10	SS	50/0.13	ND		Bentonite Seal
11										
12					11	SS	50/0.10	ND		
13										
14					12	SS	50/0.25	ND		Silica Sand Filter
15				131.65	13	SS	50/0.13	ND	MH	
		END OF BOREHOLE		15.37						
16		NOTES:								
		1. Borehole open upon completion of drilling.								
		2. Groundwater level measured in monitoring well as follows:								
17		Date / Depth(m) / Elev. (m): 23/03/2020 7.79 139.2; 26/03/2020 7.71 139.3; 12/05/2021 7.63 139.4								
18										
19										
20										

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: RP

CHECKED: AD

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PROJECT: 20139596

RECORD OF BOREHOLE: BH20-2

SHEET 1 OF 2

LOCATION: See Figure 4

BORING DATE: March 11, 2020

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ⊕ (ND = Not Detected; 100 200 300 400) / HEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM] □ (ND = Not Detected; 100 200 300 400)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		146.36						
0	CME 75 TRACK MOUNTED 90 mm Mud Rotary Drilling	FILL - (CL) sandy SILTY CLAY, trace gravel; brown, trace rootlets and organic material; cohesive, w~PL, firm		0.00	1	SS	7	ND		METALS ORP
1					2	SS	8	ND		
				144.91						
		(ML) sandy SILT, trave gravel; brown (TILL), oxidation staining; non-cohesive, moist, compact		1.45	3	SS	22	ND		
2					4	SS	27	ND		PHC, VOC, PAH
				143.39						
3		(CL) SILTY CLAY, some sand, trace gravel; brown (TILL), oxidation staining; cohesive, w~PL, very stiff		2.97	5	SS	21	ND		
4										
					6	SS	21	ND		
5										
				140.72						
		(ML) sandy SILT, trace gravel; brown (TILL); non-cohesive, moist to wet, dense to very dense		5.64						
6										
					7	SS	35	ND		
7										
					8	SS	52/ 0.13	ND		
8										
				137.83						
		(ML) SILT to sandy SILT; brown to grey; non-cohesive, moist to wet, very dense		8.53						
9					9	SS	50/ 0.08	ND		
10		*CONTINUED NEXT PAGE*								

Bentonite Seal

Silica Sand Filter

May 12, 2021

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: RP

CHECKED: AD

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PROJECT: 20139596

RECORD OF BOREHOLE: BH20-2

SHEET 2 OF 2

LOCATION: See Figure 4

BORING DATE: March 11, 2020

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ⊕ ND = Not Detected (100 200 300 400) / HEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM] □ ND = Not Detected (100 200 300 400)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	CME 75 TRACK MOUNTED 90 mm Mud Rotary Drilling	- Becomes grey at a depth of about 10.0 m (ML) SILT to sandy SILT; brown to grey; non-cohesive, moist to wet, very dense			10	SS	50/0.08	ND		MH	
11											
12					11	SS	50/0.13	ND			
13											
14					12	SS	80	ND			
15											
				130.74	13	SS	93/0.23	ND			
		END OF BOREHOLE		15.62							
16		NOTES: 1. Borehole open upon completion of drilling. 2. Groundwater level measured in monitoring well as follows: Date / Depth(m) / Elev. (m) 23/03/2020 / 7.06 / 139.3 26/03/2020 / 7.10 / 139.3 12/05/2021 / 7.24 / 139.1									
17											
18											
19											
20											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: RP

CHECKED: AD

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PROJECT: 20139596

RECORD OF BOREHOLE: BH20-3

SHEET 1 OF 2

LOCATION: See Figure 4

BORING DATE: March 11, 2020

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ⊕ (ND = Not Detected; 100 200 300 400) / HEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM] □ (ND = Not Detected; 100 200 300 400)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		146.79						
	CME 75 TRACK MOUNTED 90 mm Mud Rotary Drilling	FILL - (CL) sandy SILTY CLAY, trave gravel; brown, trace rootlets and organic matter; cohesive, w~PL, soft to firm		0.00	1	SS	5	ND		50 mm Diameter Monitoring Well
1					2	SS	5	ND		METALS, ORP
					3	SS	4	ND		
2				144.58						Bentonite Seal
		(SM/ML) SILTY SAND to sandy SILT, trace to some gravel; brown (TILL), oxidation staining; non-cohesive, moist, compact to very dense		2.21	4	SS	25	ND		MH
3					5	SS	41	ND		▽ May 12, 2021
4										
5					6	SS	67	ND		
				141.15						
		(CL-ML) SILTY CLAY to CLAYEY SILT, travel gravel; grey (TILL); cohesive, w~pL to w<pL, hard		5.64						
6					7	SS	47	ND		Silica Sand Filter / PHC, VOC, PAH
7										
					8	SS	73/0.23	ND		
8				138.23						
		(ML) SILT, trace sand; grey; non-cohesive, slight plasticity, moist to wet, very dense to dense		8.56						Bentonite Seal
9					9	SS	50/0.1	ND		
10		*CONTINUED NEXT PAGE*								

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: RP

CHECKED: AD

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PROJECT: 20139596

RECORD OF BOREHOLE: BH20-3

SHEET 2 OF 2

LOCATION: See Figure 4

BORING DATE: March 11, 2020

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ⊕ ND = Not Detected (100 200 300 400) / HEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM] □ ND = Not Detected (100 200 300 400)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	CME 75 TRACK MOUNTED 90 mm Mud Rotary Drilling	(ML) SILT, trace sand; grey; non-cohesive, slight plasticity, moist to wet, very dense to dense			10	SS	50/0.08	ND	W		
11					11	SS	50/0.05	ND	W		Bentonite Seal
12											
13					12	SS	50/0.13	ND	W		
14											
15					13	SS	47	ND	W		
				130.94							
16		END OF BOREHOLE		15.85							
17		NOTES: 1. Borehole open upon completion of drilling. 2. Groundwater level measured in monitoring well as follows: Date / Depth(m) / Elev. (m) 23/03/2020 / 1.84 / 145.0 26/03/2020 / 2.29 / 144.5 12/05/2021 / 3.42 / 143.4									
18											
19											
20											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: RP

CHECKED: AD

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PROJECT: 20139596

RECORD OF BOREHOLE: BH20-4

SHEET 1 OF 2

LOCATION: See Figure 4

BORING DATE: Mar 09, 2020

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ⊕ (ND = Not Detected; 100 200 300 400) / HEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM] □ (ND = Not Detected; 100 200 300 400)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		146.03						
0	CME 75 TRACK MOUNTED 90 mm Mud Rotary Drilling	FILL - (SP/GP) SAND and GRAVEL, some fines; brown; non-cohesive, moist, loose		0.00	1	SS	5	ND		METALS, ORP — 50 mm Diameter Monitoring Well
				145.34						
1		FILL - (CL) sandy SILTY CLAY, trace gravel; brown and grey, trace organic matter; cohesive, w~pL, firm		0.69	2	SS	7	ND		
					3	SS	6	ND		
2				143.82						
		(ML) sandy CLAYEY SILT, trace gravel; brown to grey (TILL); cohesive, w~pL to w<pL, very stiff		2.21	4	SS	20	ND		
3					5	SS	28	ND		
4		- Becomes grey at a depth of about 4.1 m								March 23, 2020
					6	SS	22	ND		PHC, VOC, PAH — Bentonite Seal
5				140.39						
		(SM/ML) SILTY SAND to sandy SILT, trace to some gravel; grey (TILL); non-cohesive, moist, dense to very dense		5.64						
6					7	SS	33	ND		
7										
8					8	SS	43	ND		
9					9	SS	50/0.13	ND		
10				136.05						
		CONTINUED NEXT PAGE								

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: RP

CHECKED: AD

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PROJECT: 20139596

RECORD OF BOREHOLE: BH20-4

SHEET 2 OF 2

LOCATION: See Figure 4

BORING DATE: Mar 09, 2020

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ⊕ (ND = Not Detected; 100 200 300 400) / HEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM] □ (ND = Not Detected; 100 200 300 400)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---								
10	CME 75 TRACK MOUNTED 90 mm Mud Rotary Drilling	(ML) SILT to sandy SILT, trace gravel; grey; non-cohesive, slight plasticity, wet, very dense		9.98						
					10	SS	50/0.05	ND		Bentonite Seal
11										
12					11	SS	50/0.05	ND		
13										
					12	SS	50/0.10			Silica Sand Filter
14										
15										
					13	SS	53	ND		
16				130.18						
		END OF BOREHOLE		15.85						
17		NOTES:								
		1. Borehole open upon completion of drilling.								
18		2. Groundwater level measured in monitoring well as follows:								
		Date / Depth(m) / Elev. (m): 23/03/2020 / 4.44 / 141.6; 26/03/2020 / 4.40 / 141.6; 12/05/2021 / 3.95 / 142.1								
19										
20										

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: RP

CHECKED: AD

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PROJECT: 20139596

RECORD OF BOREHOLE: BH20-5

SHEET 1 OF 2

LOCATION: See Figure 4

BORING DATE: Mar 12, 2020

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ⊕ (ND = Not Detected; 100 200 300 400) / HEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM] □ (ND = Not Detected; 100 200 300 400)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		145.80						
0	CME 75 TRACK MOUNTED 90 mm Mud Rotary Drilling	FILL - (CL) sandy SILTY CLAY, trace to some gravel; brown and grey, trace organic matter; cohesive, w>pL, soft to firm		0.00	1	SS	4	ND		50 mm Diameter Monitoring Well
1					2	SS	6	ND		METALS, ORP
2					3	SS	5	ND		PHC, VOC, PAH
				143.59						
		(ML) sandy SILT, trace gravel; brown (TILL), oxidation staining; non-cohesive, moist, compact		2.21	4	SS	15	ND		
3					5	SS	25	ND		
4				141.69						
		(CL-ML) SILTY CLAY TO CLAYEY SILT, some sand, trace gravel; grey (TILL); cohesive, w<pL, hard		4.11	6	SS	32	ND		Bentonite
				140.16						
5		(ML) sandy SILT, trace gravel; grey (TILL); non-cohesive, moist, dense		5.64						▽ March 26, 2020
6					7	SS	31	ND		
7				138.64						
		(SM/ML) SILTY SAND to sandy SILT; trace gravel; grey; non-cohesive, slight plasticity, wet, very dense		7.16	8	SS	80/0.28	ND		
8										
9					9	SS	83/0.2	ND		MH
10		*CONTINUED NEXT PAGE*								

DEPTH SCALE 1 : 50

GOLDER MEMBER OF WSP

LOGGED: RP

CHECKED: AD

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PROJECT: 20139596

RECORD OF BOREHOLE: BH20-5

SHEET 2 OF 2

LOCATION: See Figure 4

BORING DATE: Mar 12, 2020

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ⊕ (ND = Not Detected; 100 200 300 400) / HEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM] □ (ND = Not Detected; 100 200 300 400)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---								
10	CME 75 TRACK MOUNTED 90 mm Mud Rotary Drilling	(SM/ML) SILTY SAND to sandy SILT; trace gravel; grey; non-cohesive, slight plasticity, wet, very dense			10	SS	50/0.05	ND		Bentonite
11										
12					11	SS	50/0.08	ND		Sand
13										
14					12	SS	73	ND		Screen and Sand
15										
					13	SS	84	ND		
16		END OF BOREHOLE		129.95 / 15.85						
17		NOTES: 1. Borehole open upon completion of drilling. 2. Groundwater level measured in monitoring well as follows: Date / Depth(m) / Elev. (m) 23/03/2020 / 5.23 / 140.6 26/03/2020 / 5.93 / 139.9 12/05/2021 / 4.58 / 141.2								
18										
19										
20										

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: RP

CHECKED: AD

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PROJECT: 20139596

RECORD OF BOREHOLE: BH20-6

SHEET 1 OF 1

LOCATION: See Figure 4

BORING DATE: March 9, 2020

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ⊕ *ND = Not Detected* (100 200 300 400) / HEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM] □ *ND = Not Detected* (100 200 300 400)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT Wp — W — Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		146.76						
0	CME 75 TRACK MOUNTED 140 mm Hollow Stem Augers	FILL - (CL) SILTY CLAY, some sand, some gravel; brown; cohesive, w>pL, very soft to stiff		0.00	1	SS	2	ND		50 mm Diameter Monitoring Well
1					2	SS	8	ND		
				145.31						
		FILL - (SP/GP) SAND and GRAVEL, some fines; brown; non-cohesive, moist, compact to very dense		1.45	3	SS	22	ND		March 23, 2020
2									PHC, VOC, PAH	Bentonite Seal
					4	SS	50	ND		
3					5	SS	26	ND		
4				142.65						
		(CL-ML) sandy SILTY CLAY to CLAYEY SILT, trace gravel; grey (TILL); cohesive, w~pL, very stiff to hard		4.11	6	SS	18	ND		
5										
6					7	SS	28	ND		Silica Sand Filter
7										
				138.89	8	SS	50/0.1			
8		END OF BOREHOLE		7.87						
9		NOTES: 1. Borehole open upon completion of drilling. 2. Groundwater level measured in monitoring well as follows: Date / Depth(m) / Elev. (m) 23/03/2020 / 1.71 / 145.0 26/03/2020 / 1.57 / 145.1 12/05/2021 / 1.09 / 145.6								
10										

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: RP

CHECKED: AD

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PROJECT: 20139596

RECORD OF BOREHOLE: BH20-7

SHEET 1 OF 1

LOCATION: See Figure 4

BORING DATE: March 9, 2020

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ⊕ ND = Not Detected (100 200 300 400) / HEADSPACE ORGANIC VAPOUR CONCENTRATIONS [PPM] □ ND = Not Detected (100 200 300 400)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		146.55							
0	CME 75 TRACK MOUNTED 140 mm Hollow Stem Augers	TOPSOIL		0.00							
		FILL - (CL) SILTY CLAY, some sand, trace gravel; brown, trace rootlets; cohesive, w>pL, firm		0.10	1	SS	7			METALS, ORP	
				145.86							
1		FILL - (SP/GP) SAND and GRAVEL, some fines; brown; non-cohesive, moist, compact		0.69	2	SS	14				
				145.10							
		(SM/ML) SILTY SAND to sandy SILT, trace gravel; brown to grey (TILL); non-cohesive, moist, compact to very dense		1.45	3	SS	18	ND		PHC, VOC, PAH	
2					4	SS	39	ND			
3		- Becomes grey at a depth of 3.4 m			5	SS	71/0.28	ND			
4					6A	SS	84				
					6B						
5											
6					7	SS	44			MH	
7				139.39							
		(CL-ML) SILTY CLAY to CLAYEY SILT, some gravel; grey (TILL); cohesive, w<pL, hard		7.16	8	SS	38				
8				138.32							
		END OF BOREHOLE		8.23							
		NOTE:									
		1. Borehole open upon completion of drilling.									
9											
10											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: RP

CHECKED: AD

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PROJECT: 20139596 (6000)

LOCATION: See Figure 2

RECORD OF BOREHOLE: BH21-1

SHEET 1 OF 3

BORING DATE: April 30/May 3, 2021

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		146.77							
0	200 mm O.D. Hollow Stem	TOPSOIL (~80 mm thick)		0.00							
		FILL - (CL) SILTY CLAY, trace sand, trace gravel; brown; cohesive, w~PL, firm		0.08	1	SS	5				Concrete; 50 mm Diameter Monitoring Well
				146.08							
1		(CL/CL-ML) SILTY CLAY to CLAYEY SILT, some sand to sandy, trace gravel; brown to grey (TILL); cohesive, w<PL to w~PL, firm to hard		0.69	2	SS	6				
					3	SS	13				
2					4	SS	27				
3					5	SS	50/0.08				
4	CME75 Track Rig										
		- Becomes grey at a depth of about 4.6 m			6	SS	25				Bentonite
5											
6	120 mm Tricone Mud Rotary				7	SS	28				
											▽ May 12, 2021
7		(ML/SM) sandy SILT to SILTY SAND, trace gravel; grey (TILL); non-cohesive, moist to wet, very dense		139.68 7.09							
					8	SS	51				
8											
9					9	SS	50/0.03			MH	
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AD

CHECKED: RA

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PROJECT: 20139596 (6000)

LOCATION: See Figure 2

RECORD OF BOREHOLE: BH21-1

BORING DATE: April 30/May 3, 2021

SHEET 2 OF 3

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	CME75 Track Rig 120 mm Tricone Mud Rotary	(ML/SM) sandy SILT to SILTY SAND, trace gravel; grey (TILL); non-cohesive, moist to wet, very dense			10	SS	50/0.1				
11											
12					11	SS	50/0.13				
13											
14					12	SS	50/0.13				
15		(ML) SILT to sandy SILT, grey; non-cohesive, wet, very dense		132.06 14.71	13	SS	50/0.1				Bentonite
16											
17					14	SS	93				
18		(ML) SILT, trace sand, grey; non-cohesive, wet, very dense		129.02 17.75	15	SS	92				
19											
20		*CONTINUED NEXT PAGE*			16	SS	86				

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AD

CHECKED: RA

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PROJECT: 20139596 (6000)

RECORD OF BOREHOLE: BH21-1

SHEET 3 OF 3

LOCATION: See Figure 2

BORING DATE: April 30/May 3, 2021

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
20	CME75 Track Rig 120 mm Tricone Mud Rotary	(ML) SILT, trace sand, grey; non-cohesive, wet, very dense			16	SS	86				Bentonite
21					17	SS	86				Sand
22											
23					18	SS	65				Silica Sand Filter and Screen
24											
				121.93	19	SS	74				
25		END OF BOREHOLE NOTE: 1. Groundwater level measured in monitoring well as follows: Date 12/05/2021 Depth(m) 6.76 Elev. (m) 140.01		24.84							
26											
27											
28											
29											
30											

DEPTH SCALE
1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AD
CHECKED: RA

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PROJECT: 20139596 (6000)

LOCATION: See Figure 2

RECORD OF BOREHOLE: BH21-2

SHEET 1 OF 3

BORING DATE: April 28/29, 2021

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3})	WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		146.38									
	CME75 Track Rig	TOPSOIL (~50 mm thick)		0.00									
	200 mm O.D. Hollow Stem	FILL - (CL) SILTY CLAY, trace sand; trace gravel; brown to dark brown (REWORKED NATIVE); red brick fragments; cohesive, w~PL, stiff to firm		0.05	1	SS	13						
1					2	SS	5						
		(CL/CL-ML) SILTY CLAY to CLAYEY SILT, trace to some sand; trace gravel; brown (TILL); cohesive, w<PL, stiff to hard		145.01 1.37	3	SS	11						
2					4	SS	31						
		(ML) sandy SILT, trace gravel; brown (TILL); non-cohesive, moist, dense		143.48 2.90	5	SS	40						
3													
		(CL-ML) SILTY CLAY to CLAYEY SILT, some sand, trace to some gravel; grey (TILL); cohesive, w<PL, very stiff to hard		142.34 4.04	6	SS	27						
4													
5					7	SS	48						
6	120 mm Tricone Mud Rotary												
		(ML) sandy SILT to SILT, grey; non-cohesive, wet, very dense		138.53 7.85	PMT 1								
7													
8					8	SS	50/ 0.13					MH	
9													
10		*CONTINUED NEXT PAGE*											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AD

CHECKED: RA

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PROJECT: 20139596 (6000)

RECORD OF BOREHOLE: BH21-2

SHEET 2 OF 3

LOCATION: See Figure 2

BORING DATE: April 28/29, 2021

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10	CME75 Track Rig 120 mm Tricone Mud Rotary	*--- CONTINUED FROM PREVIOUS PAGE ---* (ML) sandy SILT to SILT, grey; non-cohesive, wet, very dense			PMT 2						
11					9	SS	50/ 0.1			MH	
12											
13					PMT 3						
14					10	SS	50/ 0.08				
15											
16					PMT 4						
17					11	SS	83				
18											
19					12	SS	60				
20		*CONTINUED NEXT PAGE*									

DEPTH SCALE
1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AD
CHECKED: RA

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PROJECT: 20139596 (6000)

LOCATION: See Figure 2

RECORD OF BOREHOLE: BH21-2

SHEET 3 OF 3

BORING DATE: April 28/29, 2021

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
20		*--- CONTINUED FROM PREVIOUS PAGE ---*									
		(ML) sandy SILT to SILT, grey; non-cohesive, wet, very dense		126.11	12	SS	60		○		
		END OF BOREHOLE		20.27							
		NOTE:									
21		1. Borehole grouted on completion of drilling.									
22											
23											
24											
25											
26											
27											
28											
29											
30											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AD

CHECKED: RA

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PROJECT: 20139596 (6000)

LOCATION: See Figure 2

RECORD OF BOREHOLE: BH21-3

SHEET 1 OF 3

BORING DATE: April 29/30, 2021

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		146.38							
0	200 mm O.D. Hollow Stem	TOPSOIL (~50 mm thick)		0.00							
		FILL - (CL) SILTY CLAY, some sand; trace gravel; trace rootlets; brown (REWORKED NATIVE); cohesive, w>PL, firm		0.05	1	SS	4				
1					2	SS	5				
		(CL) sandy SILTY CLAY, trace gravel; brown, oxidation stains (TILL); cohesive, w<PL, firm		145.01 1.37	3	SS	7				
2		(ML) sandy SILT, trace gravel; brown to grey (TILL); oxidation stains to 4.6 m; non-cohesive, moist, very dense		144.25 2.13	4	SS	54				
3	CME75 Track Rig				5	SS	78/ 0.28				
4											
5	120 mm Tricone Mud Rotary	- Becomes grey at a depth of about 4.6 m			6	SS	50/ 0.1				
6					7	SS	52				
7											
8					8	SS	33				
				137.54							
9		(ML) SILT to sandy SILT, grey; non-cohesive, wet, very dense		8.84							
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AD

CHECKED: RA

GTA-BHS 001 S:\CLIENTS\CHOICE_PROPERTIES\SCARBOROUGH_WARDEN_AVE_683_685\02_DATA\GINT\20139596.GPJ GAL-MIS.GDT 5/25/21 MLK Mar. 2020

PROJECT: 20139596 (6000)

RECORD OF BOREHOLE: BH21-3

SHEET 2 OF 3

LOCATION: See Figure 2

BORING DATE: April 29/30, 2021

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	CME75 Track Rig 120 mm Tricone Mud Rotary	(ML) SILT to sandy SILT, grey; non-cohesive, wet, very dense			PMT 1						
11					9	SS	50/ 0.1		W	MH	
12											
13					PMT 2						
14					10	SS	50/ 0.13		W		
15											
16					PMT 3						
17					11	SS	94		W		
18											
19					PMT 4						
20					12	SS	52				
		CONTINUED NEXT PAGE									

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AD

CHECKED: RA

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PROJECT: 20139596 (6000)

LOCATION: See Figure 2

RECORD OF BOREHOLE: BH21-3

BORING DATE: April 29/30, 2021

SHEET 3 OF 3

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp ○W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
20		(ML) SILT to sandy SILT, grey; non-cohesive, wet, very dense		126.01	12	SS	52		○		
		END OF BOREHOLE		20.37							
		NOTE:									
21		1. Borehole grouted on completion of drilling.									
22											
23											
24											
25											
26											
27											
28											
29											
30											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AD

CHECKED: RA

GTA-BHS 001 S:\CLIENTS\CHOICE_PROPERTIES\SCARBOROUGH_WARDEN_AVE_683_685\02_DATA\GINT\20139596.GPJ GAL-MIS.GDT 5/25/21 MLK Mar. 2020

PROJECT: 20139596 (6000)

LOCATION: See Figure 2

RECORD OF BOREHOLE: BH21-4

BORING DATE: May 3/4, 2021

SHEET 1 OF 3

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		146.19							
0	200 mm O.D. Hollow Stem	TOPSOIL (~50 mm thick)		0.00							
		FILL - (CL) SILTY CLAY, some gravel; brown; cohesive, w~PL, stiff		0.05	1	SS	9				Concrete 50 mm Diameter Monitoring Well
				145.50							
1		(CL) SILTY CLAY, some sand, trace gravel; brown, oxidation stains (TILL); cohesive, w<PL, stiff to very stiff		0.69	2	SS	11				
					3	SS	23				
2				144.06							
		(ML) sandy SILT, trace to some gravel; brown, oxidation stains (TILL); non-cohesive, moist, very dense to dense		2.13	4	SS	62				
3					5	SS	47				
4				142.15							▽ May 12, 2021
		(CL) sandy SILTY CLAY, trace gravel; grey (TILL); cohesive, w~PL, very stiff to hard		4.04	6	SS	28				
5	CME75 Track Rig										Bentonite
6	120 mm Tricone Mud Rotary				7	SS	52				
7				139.10							
		(SM/GP) SILTY SAND and GRAVEL; grey; wet, very dense		7.09	8	SS	99/ 0.28				
8											
				137.58							
		(SM/ML) SILTY SAND to sandy SILT, grey; non-cohesive, wet, very dense		8.61							
9					9	SS	50/ 0.1				
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AM

CHECKED: RA

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PROJECT: 20139596 (6000)

LOCATION: See Figure 2

RECORD OF BOREHOLE: BH21-4

SHEET 2 OF 3

BORING DATE: May 3/4, 2021

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	CME75 Track Rig 120 mm Tricone Mud Rotary	(SM/ML) SILTY SAND to sandy SILT, grey; non-cohesive, wet, very dense			10	SS	50/0.03		○		Sand
11				134.61							
		(ML) sandy SILT, grey; non-cohesive, wet, very dense		11.58							
12					11	SS	50/0.1		○		Silica Sand Filter and Screen
13											
14					12	SS	82		○		Sand
				131.48							
15		(ML) SILT, trace to some sand; grey; non-cohesive, wet, very dense to dense		14.71	13	SS	66		○		
16											
17					14	SS	68		○		Bentonite
18											
19					15	SS	47		○		
20					16	SS	54				
		CONTINUED NEXT PAGE									

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AM

CHECKED: RA

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PROJECT: 20139596 (6000)

LOCATION: See Figure 2

RECORD OF BOREHOLE: BH21-4

BORING DATE: May 3/4, 2021

SHEET 3 OF 3

DATUM: Geodetic

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

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
20	CME75 Track Rig 120 mm Tricone Mud Rotary	(ML) SILT, trace to some sand; grey; non-cohesive, wet, very dense to dense			16	SS	54		W		
21					17	SS	50		W		
				124.40							
22		END OF BOREHOLE		21.79							
		NOTE:									
		1. Groundwater level measured in monitoring well as follows:									
		Date Depth(m) Elev. (m) 12/05/2021 3.96 142.23									
23											
24											
25											
26											
27											
28											
29											
30											

DEPTH SCALE

1 : 50

GOLDER
MEMBER OF WSP

LOGGED: AM

CHECKED: RA

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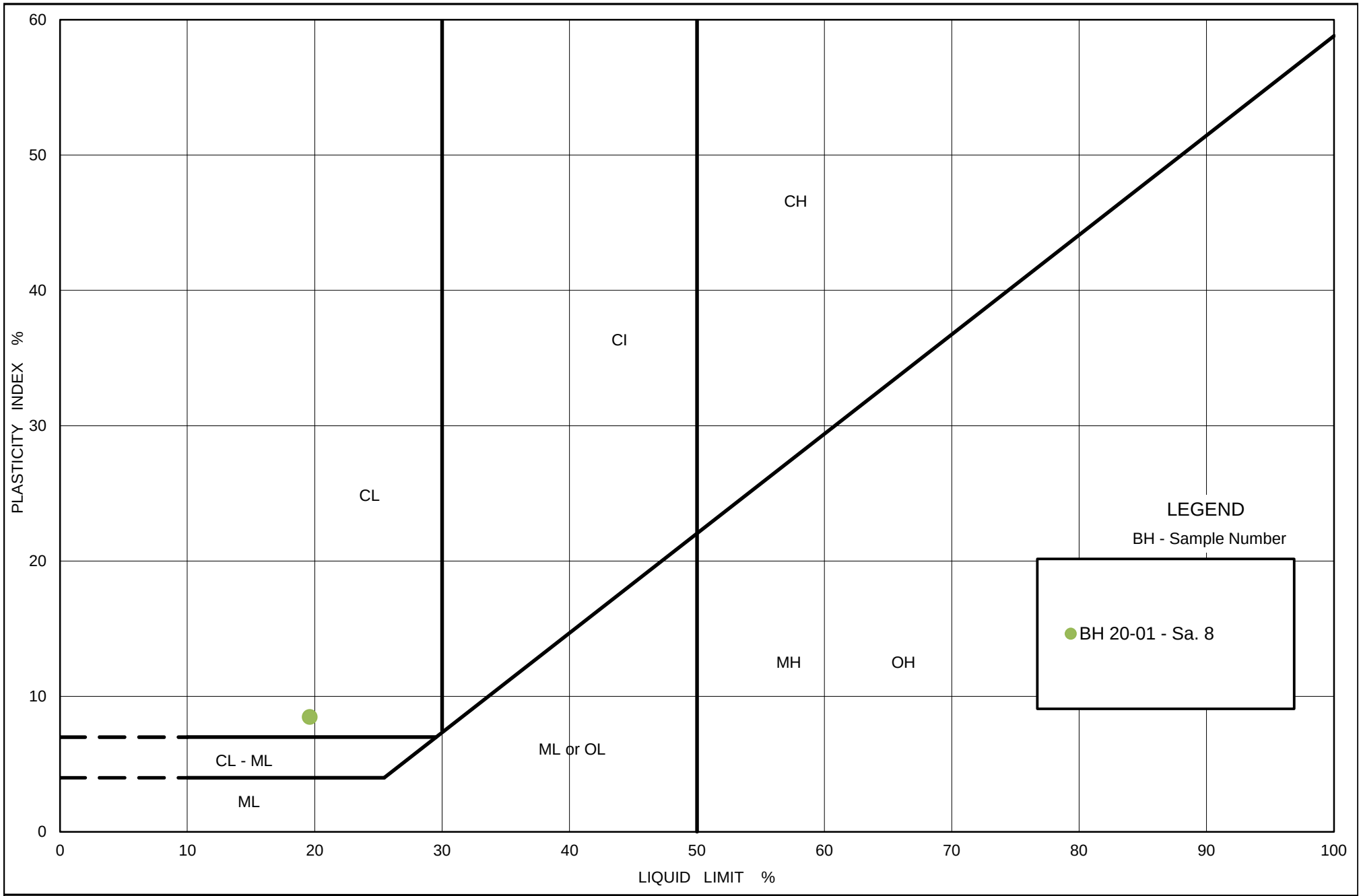
APPENDIX D

Results of Geotechnical Laboratory Testing

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX OF SOILS (ASTM D4318)



GOLDER

PLASTICITY CHART

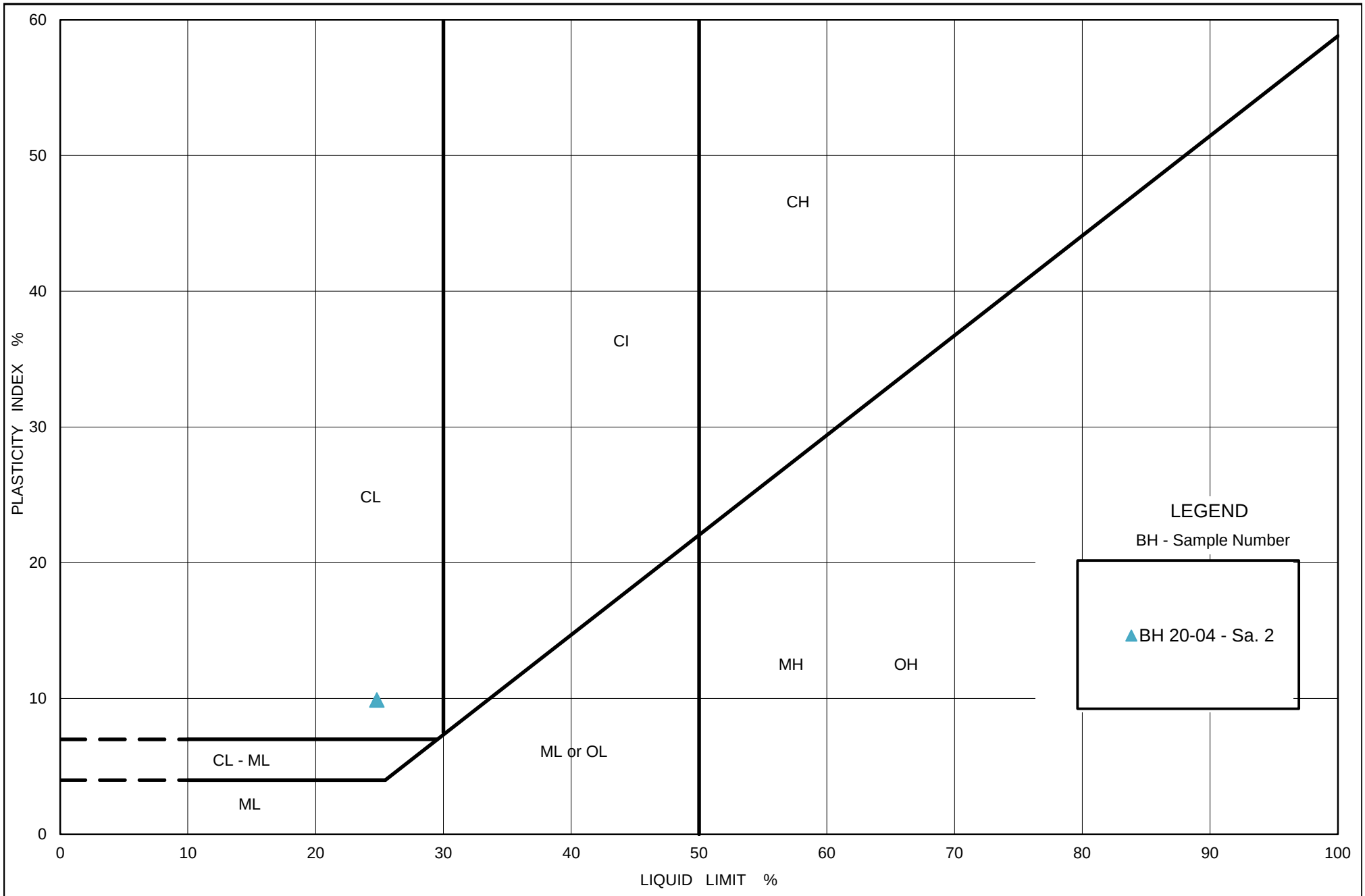
(CL) SILTY CLAY (TILL)

Figure No.: D1

Project No.: 20139596

Checked By:

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX OF SOILS (ASTM D4318)



GOLDER

PLASTICITY CHART

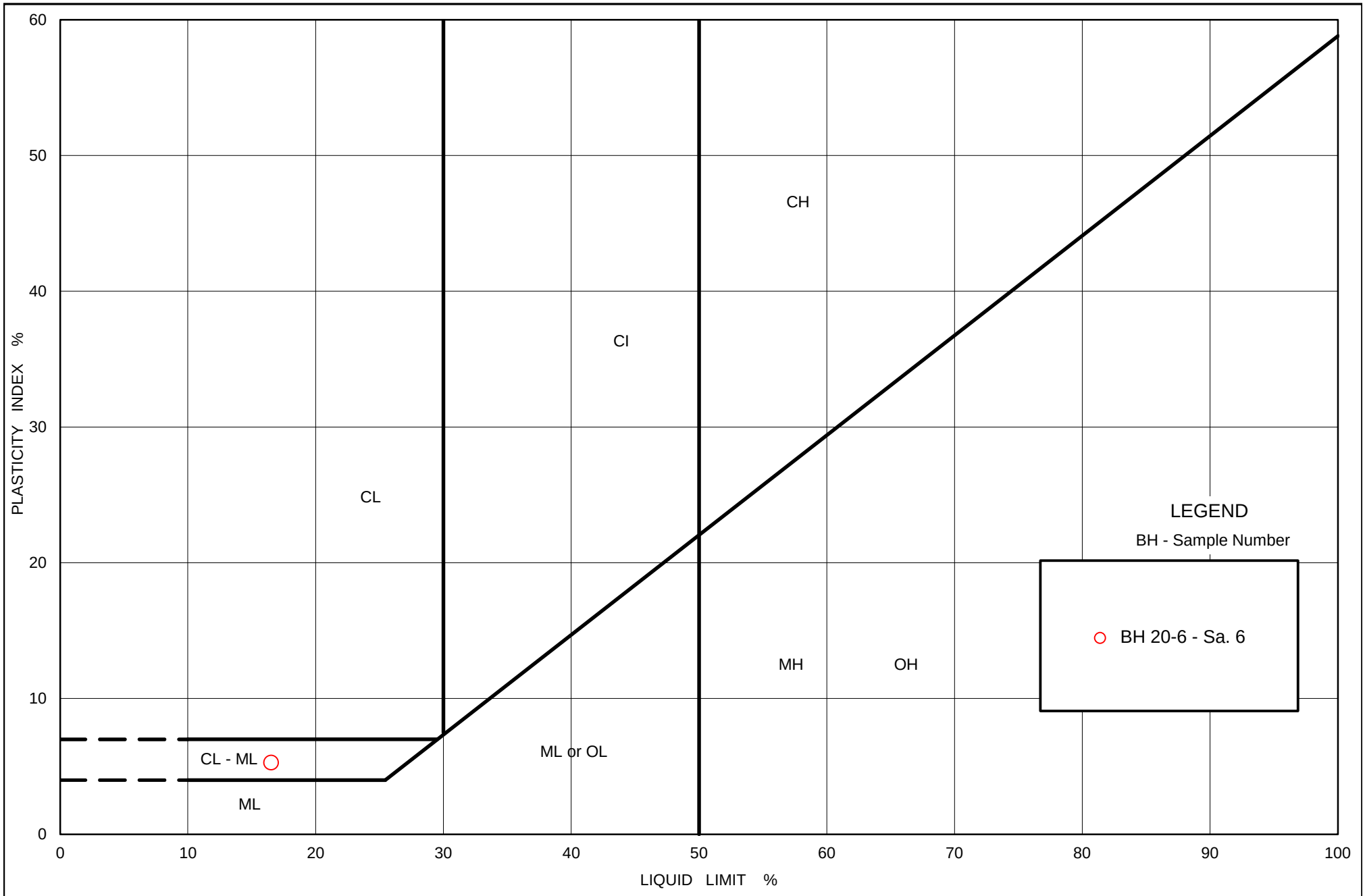
(CL) SILTY CLAY (FILL)

Figure No.: D2

Project No.: 20139596

Checked By:

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX OF SOILS (ASTM D4318)



GOLDER

PLASTICITY CHART

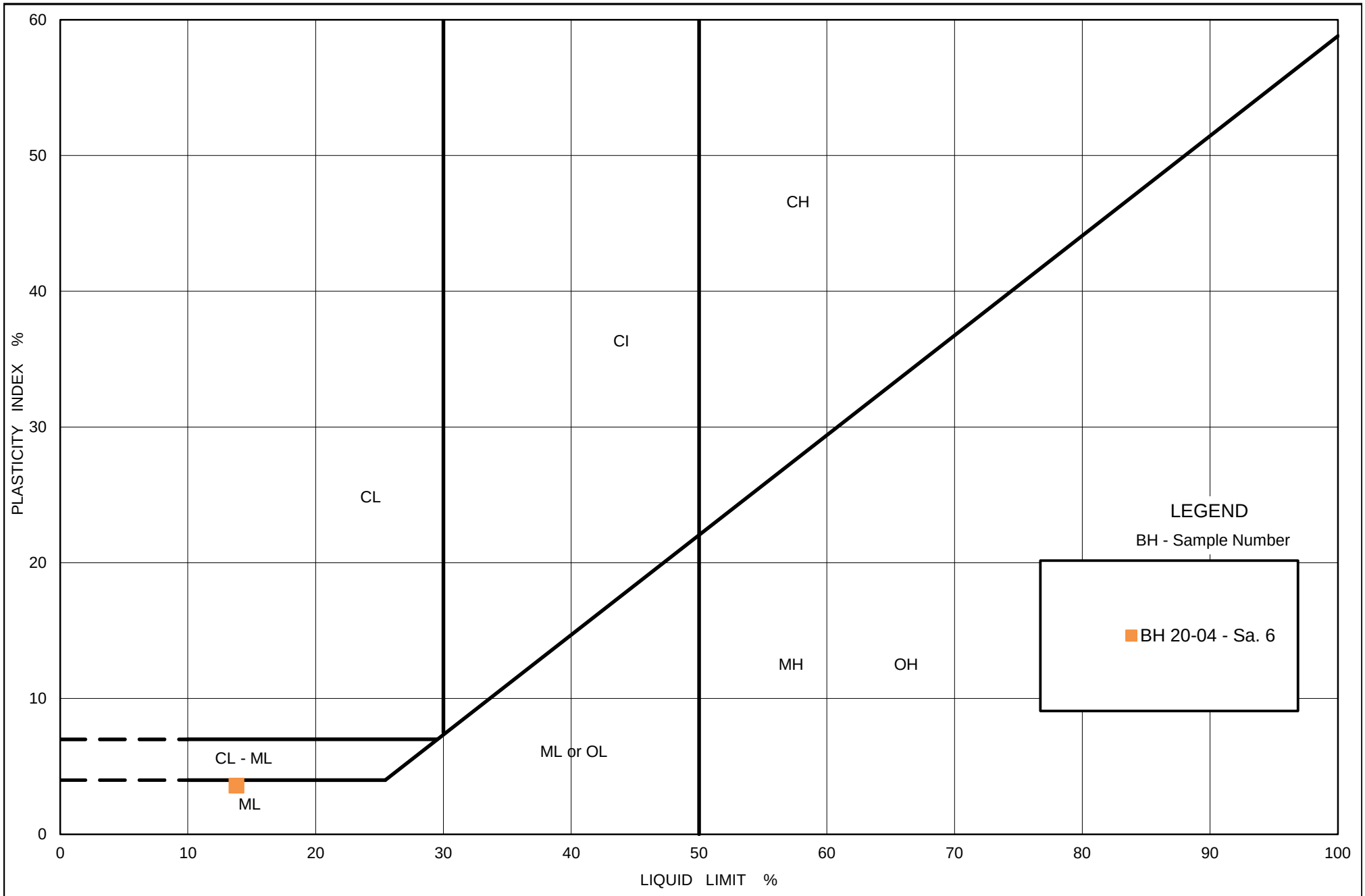
(CL-ML) SILTY CLAY to CLAYEY SILT (TILL)

Figure No.: D3

Project No.: 20139596

Checked By:

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX OF SOILS (ASTM D4318)



GOLDER

PLASTICITY CHART

(ML) CLAYEY SILT (TILL)

Figure No.: D4

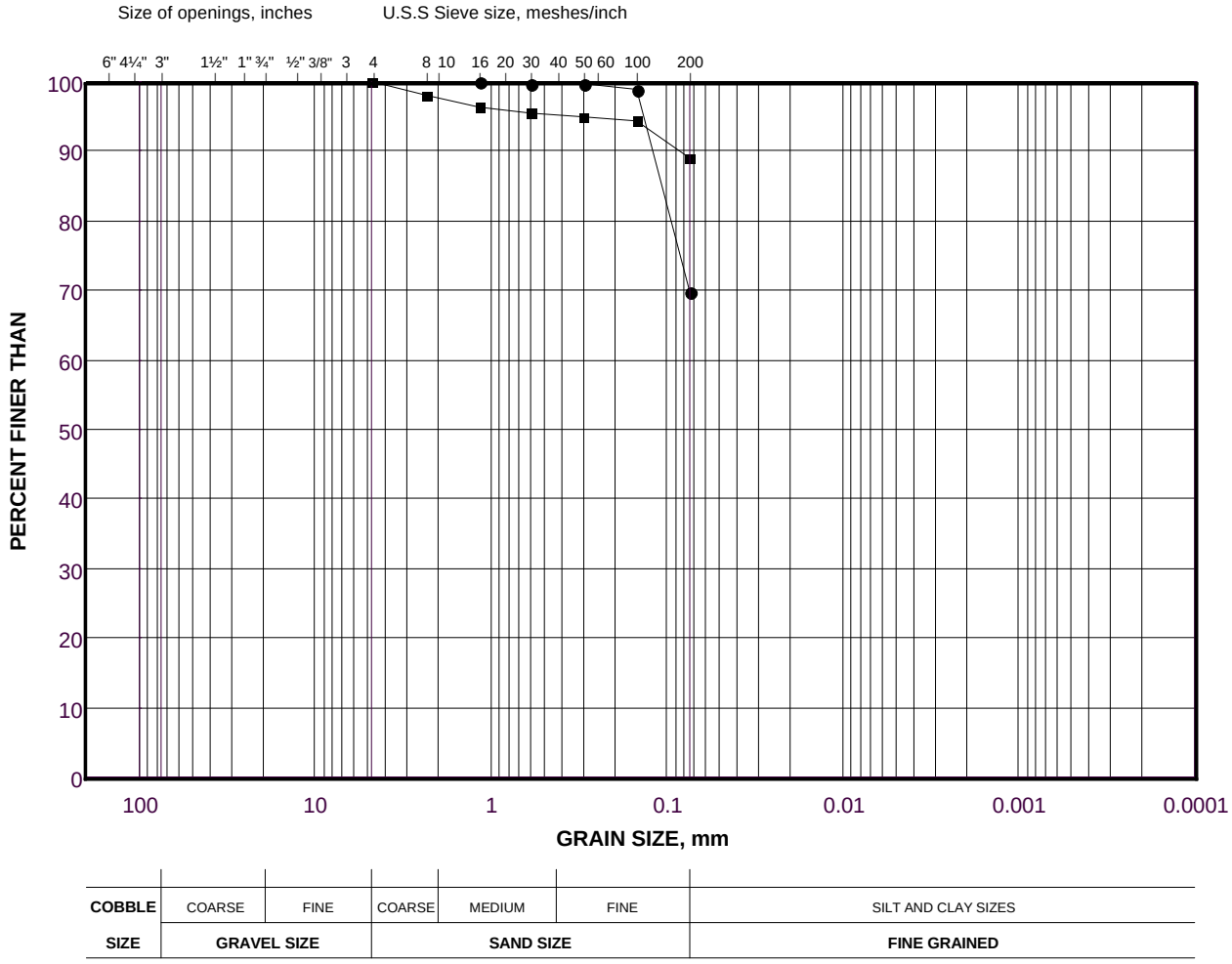
Project No.: 20139596

Checked By:

GRAIN SIZE DISTRIBUTION

(ML) SANDY SILT

FIGURE D5



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	20-02	10	10.67 - 10.87
■	20-01	13	15.24 - 15.37

Project Number: 20139596

Checked By: _____

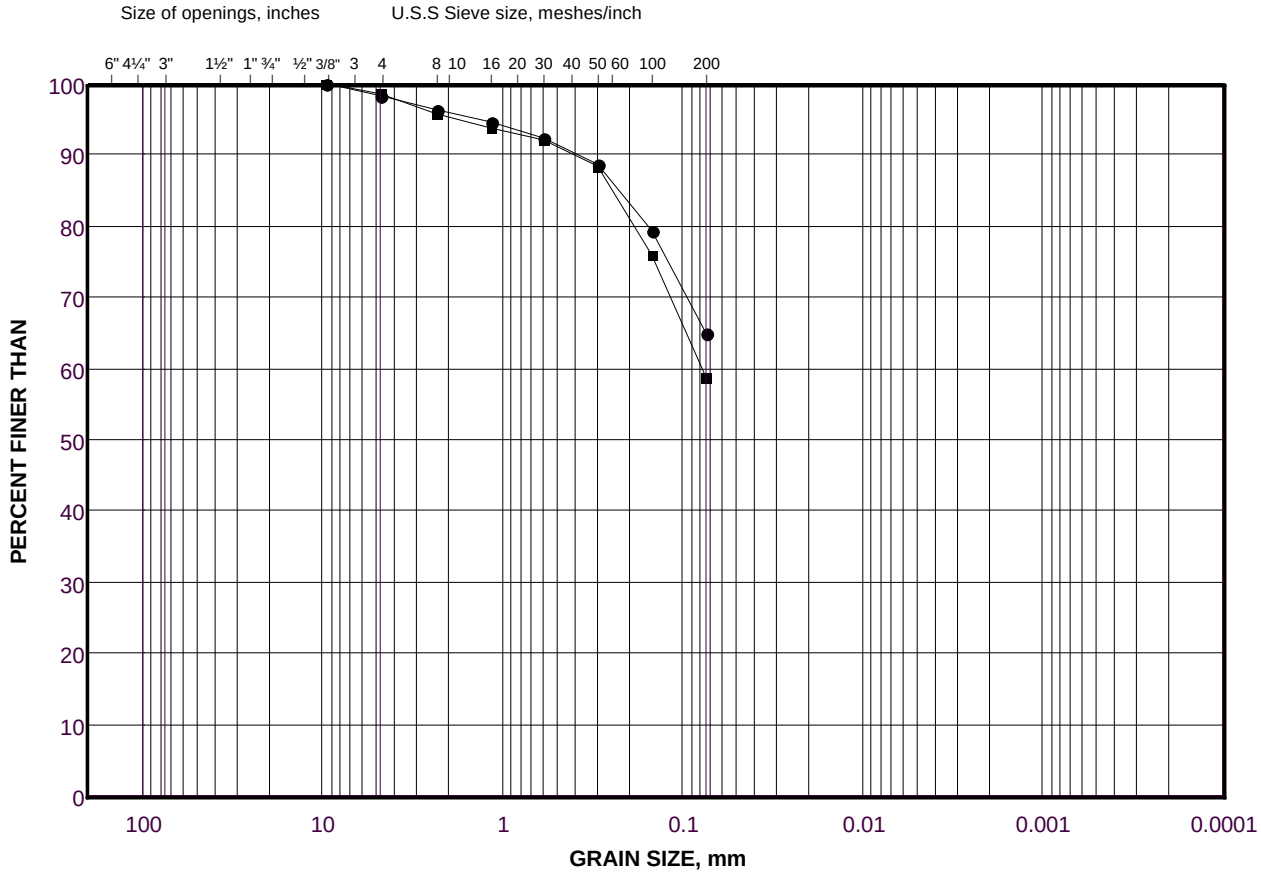
Golder Associates

Date: 01-Apr-20

GRAIN SIZE DISTRIBUTION

(SM/ML) SILTY SAND to Sandy SILT (TILL)

FIGURE D6



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	20-3	4	2.29 - 2.90
■	20-7	7	6.10 - 6.71

Project Number: 20139596

Checked By: _____

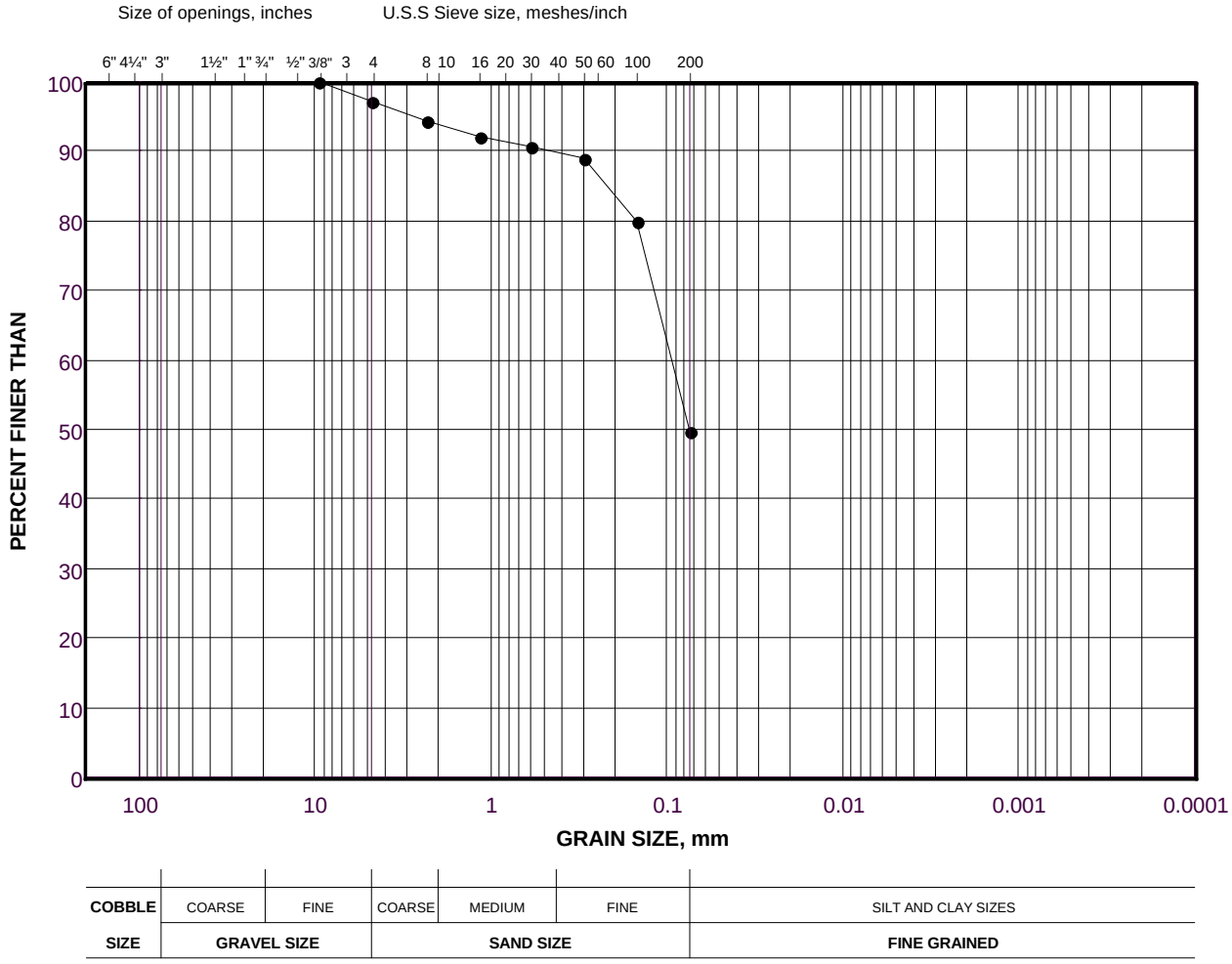
Golder Associates

Date: 01-Apr-20

GRAIN SIZE DISTRIBUTION

(SM-ML) SILTY SAND to Sandy SILT

FIGURE D7



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	20-05	9	9.14 - 9.53

Project Number: 20139596

Checked By: _____

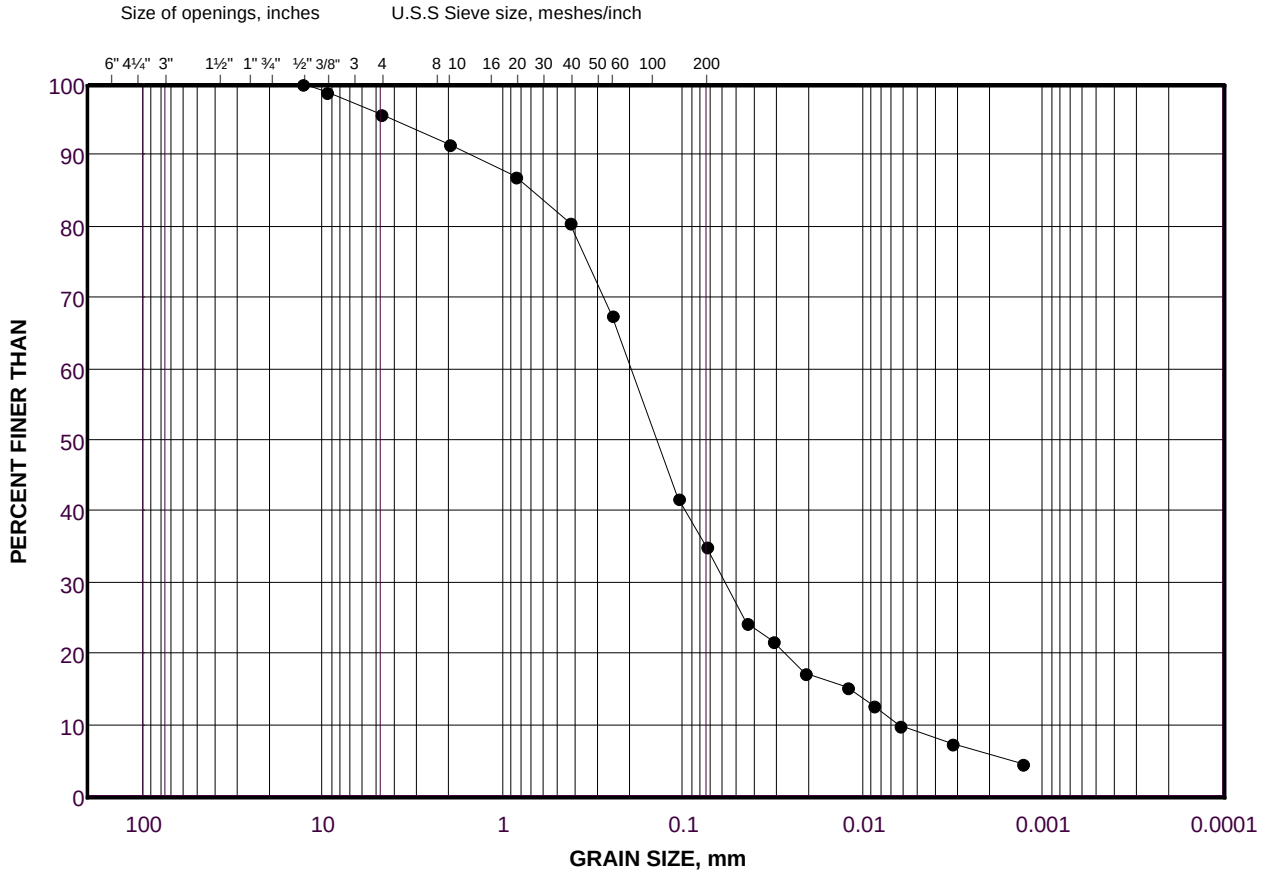
Golder Associates

Date: 01-Apr-20

GRAIN SIZE DISTRIBUTION

(SM/ML) SILTY SAND to sandy SILT

FIGURE D8



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	BH 21-1	9	9.1 - 9.3

Project Number: 20139596 (6000)

Checked By: RA

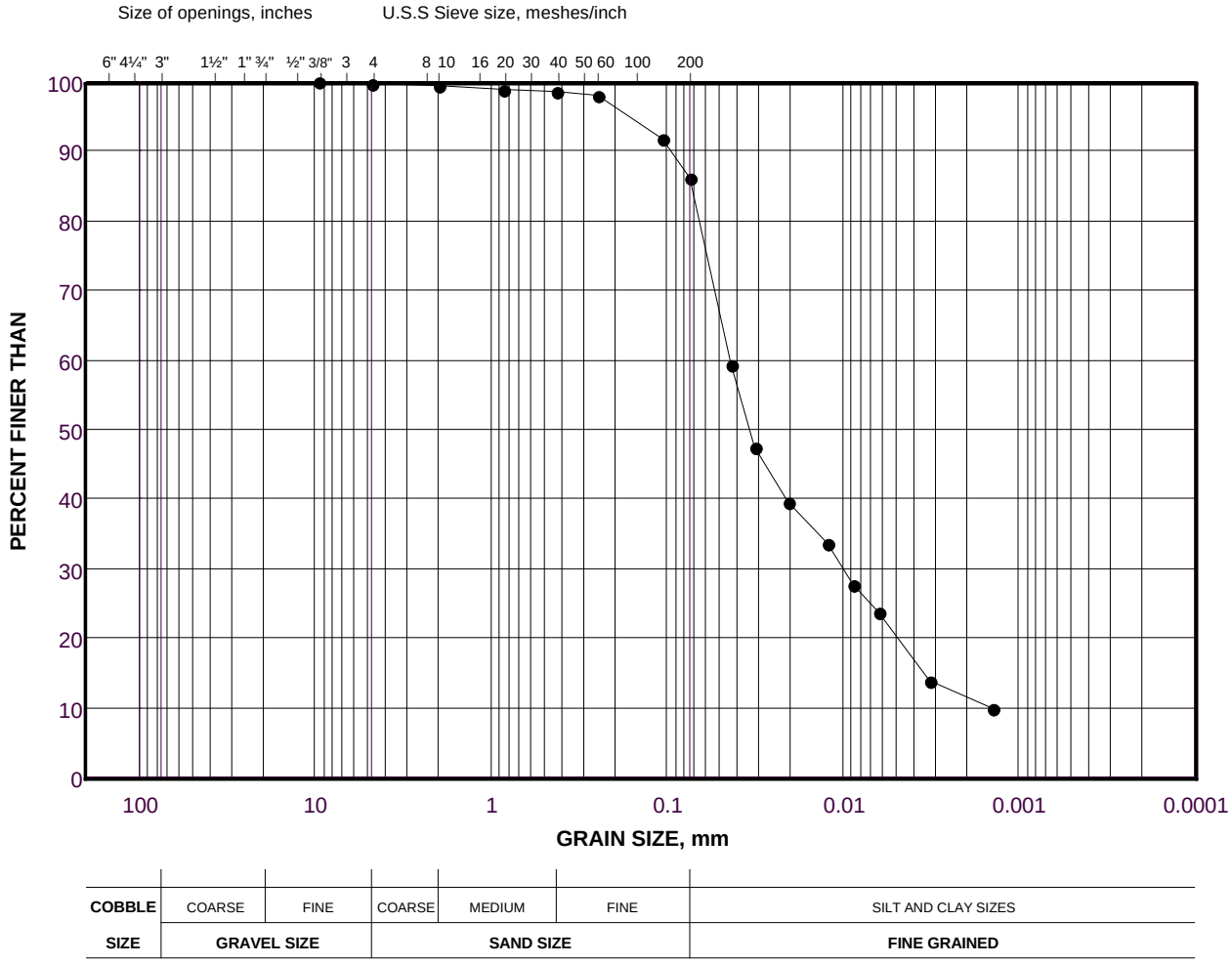
Golder Associates

Date: 25-May-21

GRAIN SIZE DISTRIBUTION

(ML) sandy SILT

FIGURE D9



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	BH 21-2	8	9.1 - 9.3

Project Number: 20139596 (6000)

Checked By: RA

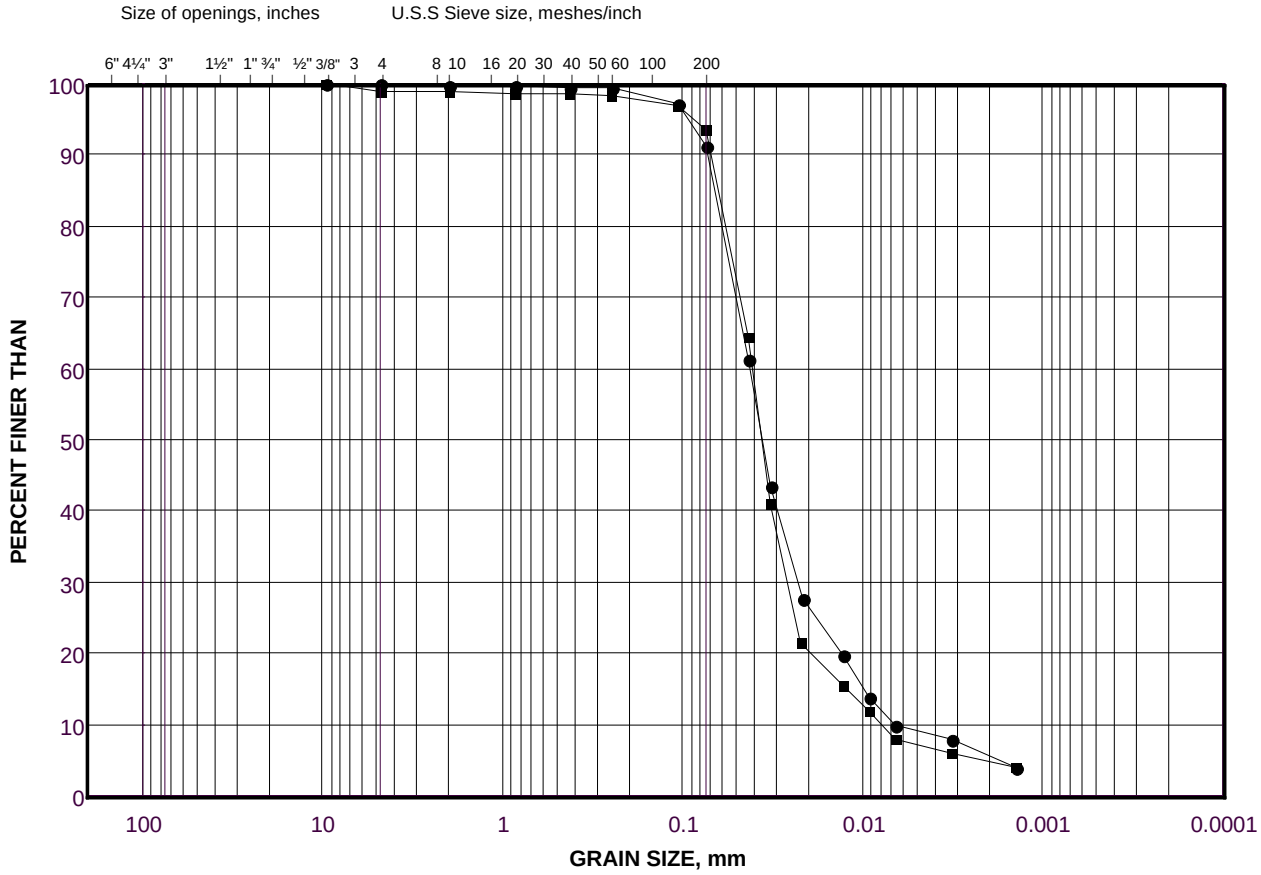
Golder Associates

Date: 25-May-21

GRAIN SIZE DISTRIBUTION

(ML) SILT

FIGURE D10



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	BH 21-3	9	10.7 - 11.0
■	BH 21-2	9	12.2 - 12.3

Project Number: 20139596 (6000)

Checked By: RA

Golder Associates

Date: 25-May-21

APPENDIX E

Results of PMT Testing

In-Situ Pressuremeter Testing
685 Warden Avenue, Scarborough
Boring Nos. BH21-2 and BH21-3
May 26th, 2021

Project No. IDG 210628

Prepared for:
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L3R 8V2

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20 Ravenscliffe Avenue
Hamilton, Ontario
L8P 3M4
Phone: (905) 541 9937
Fax: (877) 624 0140

Table of Contents

1. Introduction

In-Depth Geotechnical Inc. was retained by Golder associates Ltd. to conduct Pressuremeter testing in relation to their Geotechnical Investigation for the 685 Warden Avenue Project, in Scarborough, Ontario.

This report presents the results of pressuremeter testing (PMT) carried out at two borehole locations with the purpose of evaluating specific parameters related to a) shear strength; and b) deformation properties of the encountered soils.

This report includes data obtained by use of a pre-bored pressuremeter system. Inferred characteristics of the data are also presented including initial contact pressure, limit pressure, secant deformation modulus values during loading, unloading and reloading cycles, and yield pressure if and when justified by the data. Multiple methods are available for interpretation of this data to estimate engineering properties of soils but such methods are not discussed or included in this report except for the characteristics of the data plots as described above.

2. Field Testing Procedures

Pressuremeter testing was performed at two boreholes, on the above-mentioned site.

Details of tested boring are:

Borehole	Number of Tests	Ground Elevation (masl)	Water Elevation (masl)	Maximum Depth (m)
BH21-2-PMT	4	146.77	140.01	21.0
BH21-3-PMT	3	146.38	142.37	20.0

Field work was completed on April 28, 29, and 30, 2021. Drilling procedures were undertaken by 3D Drilling Contractor. The boreholes were advanced using mud rotary drilling technique with a truck-mounted CME 75 drilling rig. These borings were drilled for PMT testing as well as SPT testing and sampling.

HW casing was installed to a depth of about 3.0 m below the ground surface to prevent soil collapse on the upper part of the boring (collar).

The test sections of the boring were drilled with a tricone bit or a drag bit. The bit was advanced using continuous circulation of drilling mud to flush soil cuttings, producing a controlled diameter hole for the pressuremeter probe. A positive water head was kept inside the surface casing throughout drilling and in-situ testing procedures. In general, the drilling fluid remained at the top of casing.

Pre-boring pressuremeter testing was completed using a TEXAM unit. The testing procedure was in general accordance with Procedure B, volume-controlled loading, as outlined in the ASTM D 4719-00 Standard Test Method for Pre-bored Pressuremeter Testing of Soils. The testing equipment was calibrated for pressure and volume losses as indicated in the above-mentioned standard. The Records of Calibration for the PMT probes utilized in this job are attached on Appendix Three. The control unit was de-aired prior to every test. Also, checks were completed to ensure that the probe, tubing, and control unit assembly were fully saturated, and that the probe membrane was leakage-free at high pressures. Two readings were taken for each volume step, namely for time delays of 15, and 30 seconds.

As per Golder instructions, test procedures also included completion of up to three unload-reload cycles per test, wherever possible.

It is noted that a test was completed on BH 21-03, at the 16.41 m below surface, but the hole size was too big and the results from this test are not considered to be representative of soil conditions. The results from this test have been omitted in this report.

3. Pressuremeter Test Results

3.1 PMT test parameters

Pressuremeter test data is presented in Appendix One, and the summary of test results are illustrated in Table Nos. 1a and 1b, below.

Based on pressuremeter test data, we have included subsoil profiles for the tested borings, plotting the distributions of the interpreted PMT parameters. These profiles are shown in the following pages.

3.2 PMT-Inferred soil parameters

A general guideline to interpret and infer soil properties based on available PMT test data is attached to Appendix Two This guideline suggests accepted current procedures to estimate or infer shear strength, deformation properties, and other related soil parameters. These inferred properties are summarized in Table No. 2, below.

It is recognized that the values of in-situ total horizontal stresses, σ_{h0}, presented in this report correspond to best possible estimates. These estimates were obtained using the *corrected pressure* versus *1/Volume* method, and are used in this report to infer values of the at-rest stress ratio k_0. The following subsurface soil conditions were assumed to apply:

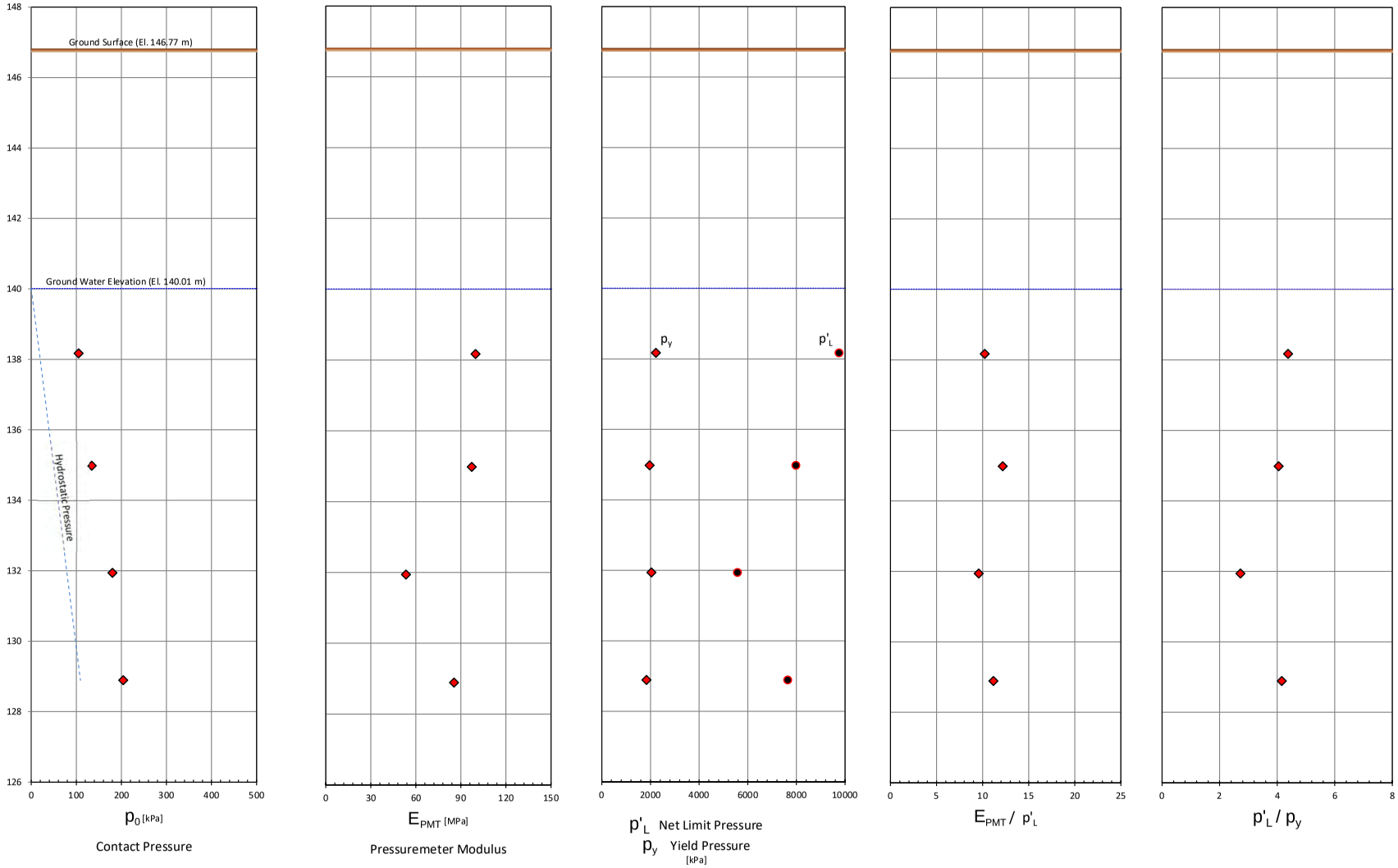
- Ground Surface and Ground Water elevations: as indicated on the Table Nos. 2a and 2b, below
- Average wet and saturated unit weights: γ_{wet} = 20 kN/m^3 and γ_{sat} = 21 kN/m^3
- Total horizontal stresses taken as direct values of p_0 (PMT test results).

It is considered that stresses within the soil mass are defined by geostatic conditions, that is to say:

1. No surcharges are applied on the surface (structural loads from existing buildings nearby are negligible),
2. Static groundwater conditions (no seepage occurs),
3. Surface topography is horizontal (no slopes or excavations), and
4. Total vertical stresses are defined by the *wet* (unsaturated soils) and *saturated* (submerged soils) unit weights, γ_{wet} and γ_{sat}, respectively.

Using the *Pressiorama* and the associated *Pressiorama Cyclique Charts* inferred values of Young's Moduli (E_Y), Classification Index (I_c), and drained friction angle (ϕ') are also shown in Table Nos. 2a and 2b.

TABLE No. 1a Summary of Pressuremeter Test Results														Boring No. BH 21-2-PMT			
Test No.	Surface Elevation (m): 146.77		Contact Pressure	PMT Modulus	Unload - Reload Cycles								Yield Pressure	Net Limit Pressure		
					$E_{Unload\ 1}$	$E_{Reload\ 1}$	Stresses			Strains $\Delta R/R_0$						
	Depth	Elevation	p_0	E_{PMT}			Point 1	Point 2	Point 3	Point 1	Point 2	Point 3	p_y	p^*_L	E_{PMT} / p^*_L	p^*_L / p_y
	[m]	[m]	[kPa]	[MPa]	[MPa]	[MPa]	[kPa]	[kPa]	[kPa]	[%]	[%]	[%]	[kPa]	[kPa]		
1	8.60	138.2	105	99.8	807.9	443.6	2782.0	1004.6	2943.6	10.0	9.7	10.5	2226	9753	10.2	4.4
					1602.1	727.9	4400.6	2124.2	4553.2	12.5	12.2	12.9				
2	11.79	135.0	134	97.2	766.1	272.1	2495.9	720.9	2356.8	7.3	7.0	7.8	1969	7981	12.2	4.1
					1325.0	445.9	4408.9	2247.5	4401.0	10.6	10.4	11.1				
3	14.83	131.9	180	53.4	196.3	107.9	1276.6	596.2	1279.2	14.9	14.4	15.3	2045	5577	9.6	2.7
					300.7	121.9	2291.4	1389.7	2193.2	18.2	17.7	18.6				
4	17.88	128.9	204	85.4	479.8	286.6	2271.0	1010.4	2380.3	16.5	16.0	16.9	1838	7647	11.2	4.2



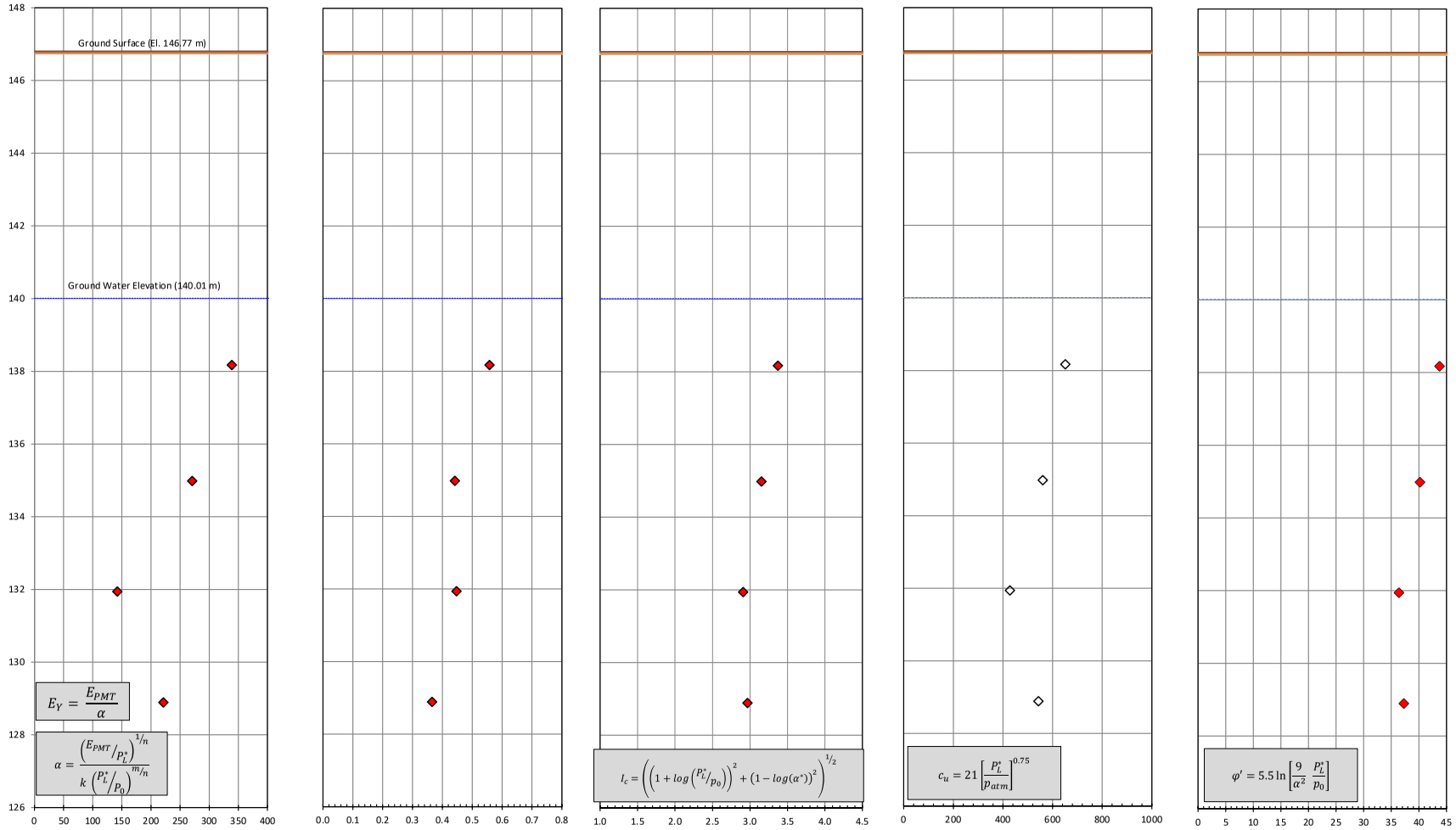
685 Warden Avenue, Scarborough	**Boring No. BH 21-2-PMT**	In-Depth Geotechnical Inc.
Pressuremeter Test Results		
Date: May 26, 2021	Project No.: IDG 210628	

Table No. 2a PMT-Inferred Parameters Boring No. BH 21-2-PMT

PMT Test No.	z depth [m]	z_w water [m]	Hydrostatic Pressure [kPa]	Total Stresses Vertical [kPa]	Total Stresses Horizontal [kPa]	Effective Stresses Vertical [kPa]	Effective Stresses Horizontal [kPa]	**Stress Ratio** k_0	**Young's Modulus** α Menard's Parameter	**Young's Modulus** E_Y [MPa]	**Shear Strength** Undrained Cohesive Behavior c_u [kPa]	**Shear Strength** Drained Cohesionless Behavior ϕ' [degrees]	**Classification Index** I_c
1	8.60	1.84	18	174	105	156	87	**0.56**	0.29	339	652	44	3.37
2	11.79	5.03	49	241	134	192	85	**0.44**	0.36	271	561	40	3.15
3	14.83	8.07	79	305	180	226	101	**0.45**	0.37	143	429	36	2.91
4	17.88	11.12	109	369	204	260	95	**0.37**	0.39	221	543	37	2.97

Notes

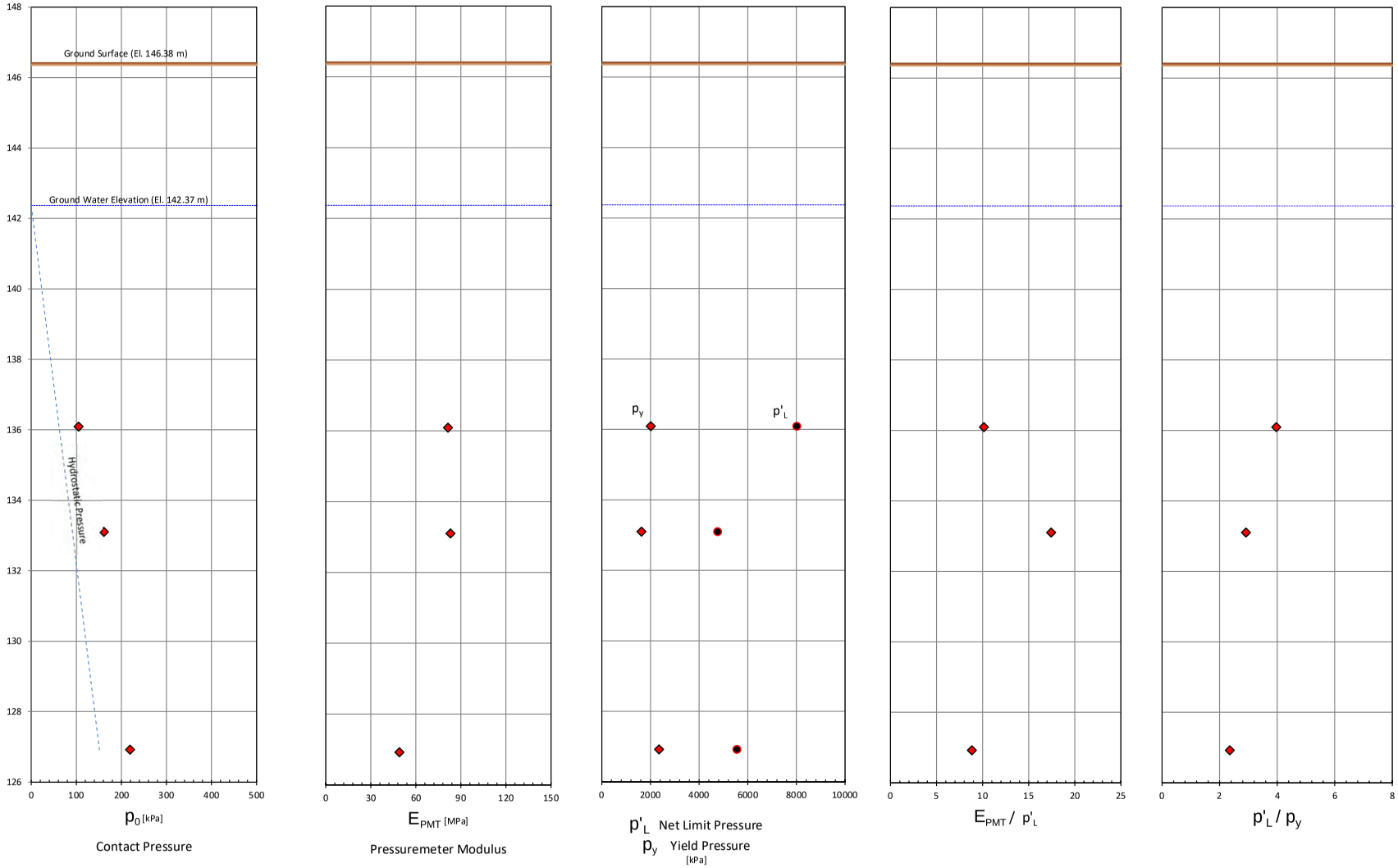
1. Ground surface elevation (m) 146.77 Water elevation (m) 140.01 Water depth (m) 6.76
2. Wet unit weight of soil 20.0 [kN/m^3] Saturated unit weight of soil 21.0 [kN/m^3]
3. Observations on Shear Strength Parameters (SSP):
   SSP are considered either for Undrained Conditions (Short Term) or Drained Conditions (Long Term). These two conditions are mutually exclusive.
   Undrained Conditions imply cohesion is c_u , and $\phi = 0$. ***Drained Conditions*** imply negligible cohesion or $c' = 0$, and $\phi = \phi'$
   Based on the Classification Index I_C (Soil Behavior Type), the suggested values of the SSP are highlighted in green (Thick box border)
4. The Classification Index parameter, I_C, is indicative of the soil type of behavior. It does not exactly relate to the Soil Classification types as those obtained via Grain-Size Distribution analyses. I_C varies from 1.0 to 4.5, from soft clays (cohesive) to dense coarse sands (frictional), correspondingly.



685 Warden Avenue, Scarborough	**Boring No. BH 21-2-PMT**	
PMT - Inferred Soil Parameters		
Date: May 26, 2021	Project No.: IDG 210628	

In-Depth Geotechnical Inc.

TABLE No. 1b Summary of Pressuremeter Test Results														Boring No. BH 21-3-PMT			
Test No.	Surface Elevation (m): 146.38		Contact Pressure	PMT Modulus	Unload - Reload Cycles								Yield Pressure	Net Limit Pressure		
					$E_{Unload\ 1}$	$E_{Reload\ 1}$	Stresses			Strains $\Delta R/R_0$						
	Depth	Elevation	p_0	E_{PMT}			Point 1	Point 2	Point 3	Point 1	Point 2	Point 3	p_y	p^*_L	E_{PMT} / p^*_L	p^*_L / p_y
	[m]	[m]	[kPa]	[MPa]	[MPa]	[MPa]	[kPa]	[kPa]	[kPa]	[%]	[%]	[%]	[kPa]	[kPa]		
1	10.29	136.1	105	81.4	602.9	330.0	2473.4	966.0	2572.0	11.9	11.6	12.4	2019	8020	10.1	4.0
2	13.28	133.1	161	83.1	420.0	238.0	2033.8	816.4	2095.4	12.0	11.6	12.5	1634	4765	17.4	2.9
					709.6	256.5	2798.4	1195.0	2734.5	14.6	14.2	15.0				
3	19.46	126.9	219	49.1	179.1	119.6	510.8	312.8	532.1	22.7	22.2	23.1	2360	5556	8.8	2.4
					416.0	214.1	324.0	510.8	347.3	20.3	22.7	22.2				

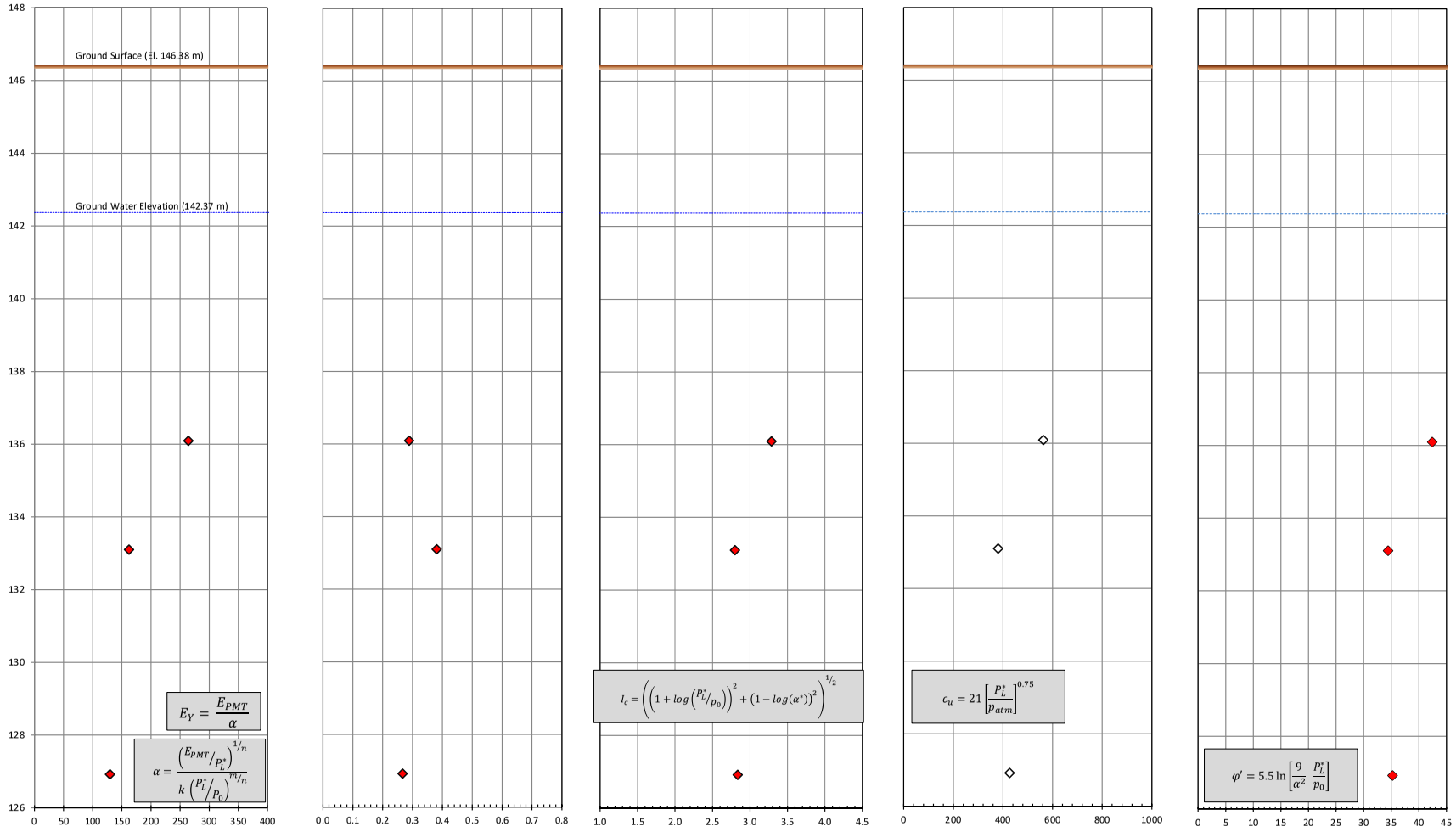


685 Warden Avenue, Scarborough	**Boring No. BH 21-3-PMT**	In-Depth Geotechnical Inc.
Pressuremeter Test Results		
Date: May 26, 2021	Project No.: IDG 210628	

Table No. 2b	PMT-Inferred Parameters							Boring No. BH 21-3-PMT					
PMT Test No.	z depth [m]	z_w water [m]	Hydrostatic Pressure [kPa]	Total Stresses Vertical [kPa]	Total Stresses Horizontal [kPa]	Effective Stresses Vertical [kPa]	Effective Stresses Horizontal [kPa]	**Stress Ratio k_0**	**Young's Modulus** α Menard's Parameter	E_Y [MPa]	**Shear Strength** Undrained Cohesive Behavior c_u [kPa]	Drained Cohesionless Behavior ϕ' [degrees]	**Classification Index I_c**
1	10.29	6.28	62	212	105	150	43	**0.29**	0.31	264	563	42	3.29
2	13.28	9.27	91	275	161	184	70	**0.38**	0.51	162	381	34	2.80
3	19.46	15.45	152	405	219	253	67	**0.27**	0.38	130	427	35	2.84

Notes

1. Ground surface elevation (m) 146.38 Water elevation (m) 142.37 Water depth (m) 4.01
2. Wet unit weight of soil 20.0 [kN/m^3] Saturated unit weight of soil 21.0 [kN/m^3]
3. Observations on Shear Strength Parameters (SSP):
   SSP are considered either for Undrained Conditions (Short Term) or Drained Conditions (Long Term). These two conditions are mutually exclusive.
   Undrained Conditions imply cohesion is c_u , and $\phi = 0$. ***Drained Conditions*** imply negligible cohesion or $c'=0$, and $\phi = \phi'$
   Based on the Classification Index I_C (Soil Behavior Type), the suggested values of the SSP are highlighted in green (Thick box border)
4. The Classification Index parameter, I_C, is indicative of the soil type of behavior. It does not exactly relate to the Soil Classification types as those obtained via Grain-Size Distribution analyses. I_C varies from 1.0 to 4.5, from soft clays (cohesive) to dense coarse sands (frictional), correspondingly.



685 Warden Avenue, Scarborough	**Boring No. BH 21-3-PMT**	
PMT - Inferred Soil Parameters		
Date: May 26, 2021	Project No.: IDG 210628	

In-Depth Geotechnical Inc.

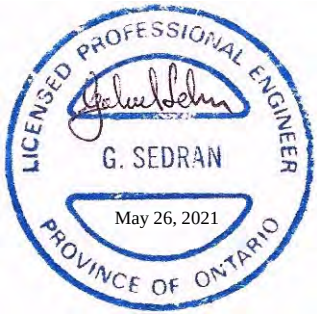
4. Closure

The subsoils data presented in this report is based on in-situ PMT testing and interpretation procedures. It should be noted that soil conditions may vary within the site and interpreted data may not be entirely representative of conditions at locations away from the tested borings. Therefore, care should be exercised when extrapolating or inferring subsoil conditions away from the borehole location.

We trust that the present report fulfills your requirements. Should you have any question, please feel free to contact the undersigned.

Sincerely,

In-Depth Geotechnical Inc.



Gabriel Sedran, P.Eng., Ph.D.
President

Appendix One

Pressuremeter Results - Data

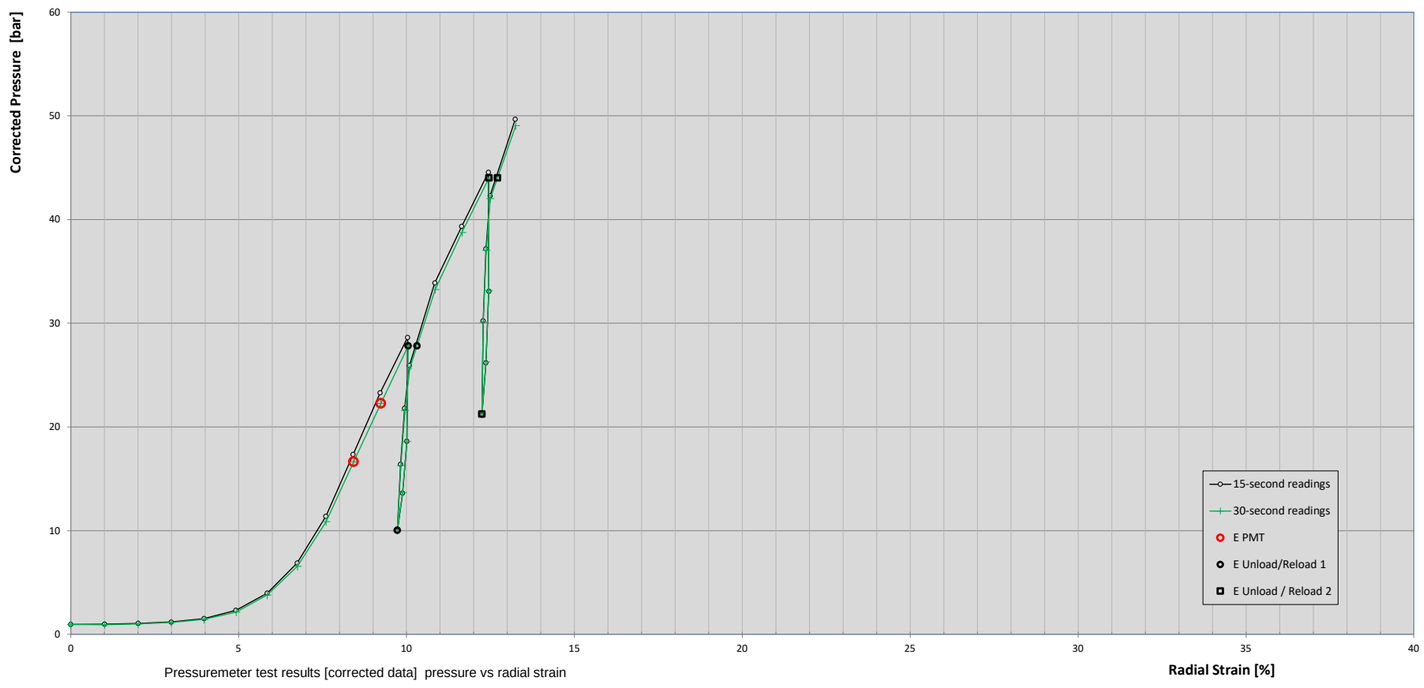
Field Test Data (uncorrected)		
Volume	Pressure [bar]	
[cm³]	15 sec	30 sec
2	0.20	0.20
40	0.26	0.22
80	0.37	0.32
120	0.53	0.49
160	0.89	0.82
200	1.71	1.54
240	3.38	3.20
280	6.30	5.97
320	10.82	10.31
360	16.80	16.09
400	22.74	21.72
440	28.10	27.29
430	18.08	18.05
420	13.09	13.14
410	9.44	9.51
420	15.87	15.73
430	21.26	21.04
440	25.38	25.10
480	33.35	32.72
520	38.82	38.25
560	44.05	43.50
550	32.58	32.64
540	25.68	25.77
530	20.60	20.73
540	29.71	29.63
550	36.65	36.51
560	41.77	41.50
600	49.16	48.56

Corrected Test data						
15-second readings			30-second readings			
Pressure [bar]	Volume [cm³]	$\Delta r/r_0$ [%]	Pressure [bar]	Volume [cm³]	$\Delta r/r_0$ [%]
0.96	2	0.00	0.96	2	0.00
0.98	39.8	1.01	0.94	39.8	1.01
1.06	79.7	2.00	1.01	79.7	2.01
1.19	119.5	2.99	1.15	119.6	2.99
1.52	159.2	3.97	1.45	159.3	3.97
2.32	198.5	4.92	2.15	198.6	4.93
3.97	236.9	5.85	3.79	237.1	5.85
6.88	274.3	6.74	6.55	274.6	6.75
11.38	310.2	7.59	10.87	310.7	7.60
17.35	344.8	8.41	16.64	345.4	8.42
23.28	379.4	9.22	22.26	380.3	9.24
28.63	414.6	10.03	27.82	415.3	10.05
18.61	413.6	10.01	18.58	413.7	10.01
13.62	408.2	9.88	13.67	408.1	9.88
9.98	401.5	9.73	10.05	401.4	9.73
16.40	405.6	9.82	16.26	405.8	9.83
21.79	410.8	9.94	21.57	411.0	9.95
25.91	417.0	10.09	25.63	417.3	10.09
33.87	449.8	10.84	33.24	450.4	10.86
39.33	484.9	11.64	38.76	485.4	11.65
44.56	520.1	12.44	44.01	520.6	12.45
33.09	520.5	12.45	33.15	520.5	12.45
26.19	516.8	12.37	26.28	516.7	12.36
21.11	511.4	12.24	21.24	511.2	12.24
30.22	513.1	12.28	30.14	513.2	12.29
37.16	516.8	12.37	37.02	516.9	12.37
42.28	522.2	12.49	42.01	522.4	12.49
49.66	555.5	13.24	49.06	556.0	13.25

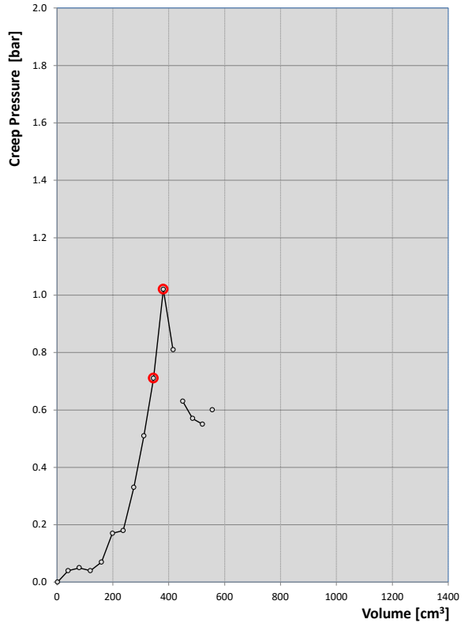
Creep	
Volume [cm³]	$\Delta p_{30\text{-}15}$ [bar]
2	0.00
39.8	0.04
79.7	0.05
119.6	0.04
159.3	0.07
198.6	0.17
237.1	0.18
274.6	0.33
310.7	0.51
345.4	0.71
380.3	1.02
415.3	0.81
450.4	0.63
485.4	0.57
520.6	0.55
556.0	0.60

Auxiliary Data	
30 sec	
Pressure [bar]	1 / V
0.96	0.54977
0.94	0.02513
1.01	0.01255
1.15	0.00836
1.45	0.00628
2.15	0.00504
3.79	0.00422
6.55	0.00364
10.87	0.00322
16.64	0.00289
22.26	0.00263
27.82	0.00241
18.58	0.00242
13.67	0.00245
10.05	0.00249
16.26	0.00246
21.57	0.00243
25.63	0.00240
33.24	0.00222
38.76	0.00206
44.01	0.00192
33.15	0.00192
26.28	0.00194
21.24	0.00196
30.14	0.00195
37.02	0.00193
42.01	0.00191
49.06	0.00180

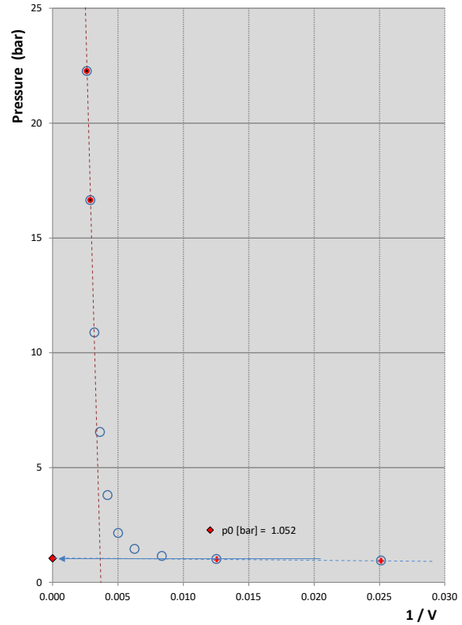
Interpreted PMT Test Results					
[30-second readings]			volume [cm³]	radial strain [%]	strain range [%]
p_0	1.05	[bar]	79.7	2.0	
p_L	98.59	[bar]			
p^*_L	97.53	[bar]			
p_Y	22.26	[bar]	380	9.2	
E_{PMT}	998	[bar]	345	8.4	{8.4 - 9.2 %}
E_{PMT} / p^*_L	10.2				
$E_{Unload\ 1}$	8079	[bar]	401	9.7	
$E_{Reload\ 1}$	4436	[bar]			
$E_{Unload\ 2}$	16021	[bar]	511	12.2	
$E_{Reload\ 2}$	7279	[bar]			



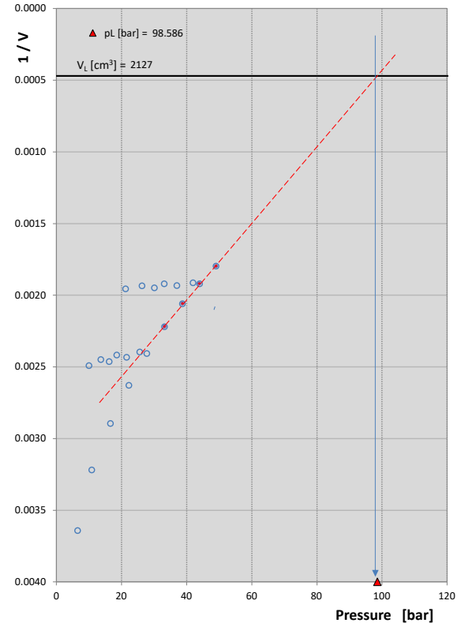
Pressuremeter test results [corrected data] pressure vs radial strain



Pressure difference from 15 to 30 sec. readings $\Delta p_{[15\text{-}30\ sec]}$



Determination of total contact pressure p_0



Determination of Limit Pressure p_L

Pressuremeter Equipment: TEXAM Model	Probe Designation : NX Probe (76 mm OD)	Drilling Method: Mud Rotary Drilling	
Volume-controlled test as per ASTM D4719 Method B	Probe No.: A 438	Drilling Bit: Tricone Bit	
Volume increments: 40 cm³	Calibration Record No.: 1	Time elapsed from hole drilling to testing ~ 5 minutes	
Maximum Volume: 1400 cm³	Tubing Length: 160 [ft]	Engineer: Gabriel Sedran, P.Eng., Ph.D.	
Maximum Pressure: 100 bar	Probe Lenght: 0.46 [m]	Operator: Fabiano Sambati	
	Probe Initial Volume: 1968 cm³		

Test Date:	April 28, 2021	**Project:**	**685 Warden Avenue, Scarborough**
Test Depth [m]:	8.56 (center of the probe)	Client:	Golder Associates
Drilling Company:	3D Drilling	In-Depth Geotechnical Project No.:	IDG 210628

PMT TEST No.: 1

Borehole No.: BH 21-2

Field Test Data (uncorrected)		
Volume	Pressure [bar]	
[cm³]	15 sec	30 sec
2	0.20	0.20
40	0.32	0.30
80	1.03	0.82
120	2.20	1.95
160	4.71	4.40
200	8.55	8.15
240	13.65	13.04
280	19.53	18.80
320	24.99	24.08
310	13.98	13.58
300	9.37	9.26
290	6.35	6.32
300	11.04	10.69
310	14.90	14.40
320	18.29	17.66
360	28.80	27.73
400	34.22	33.17
440	39.27	38.34
480	44.15	43.25
470	32.72	32.71
460	26.60	26.67
450	21.54	21.63
460	29.87	29.71
470	36.51	36.30
480	41.31	41.01
520	46.39	45.34
560	50.53	49.44

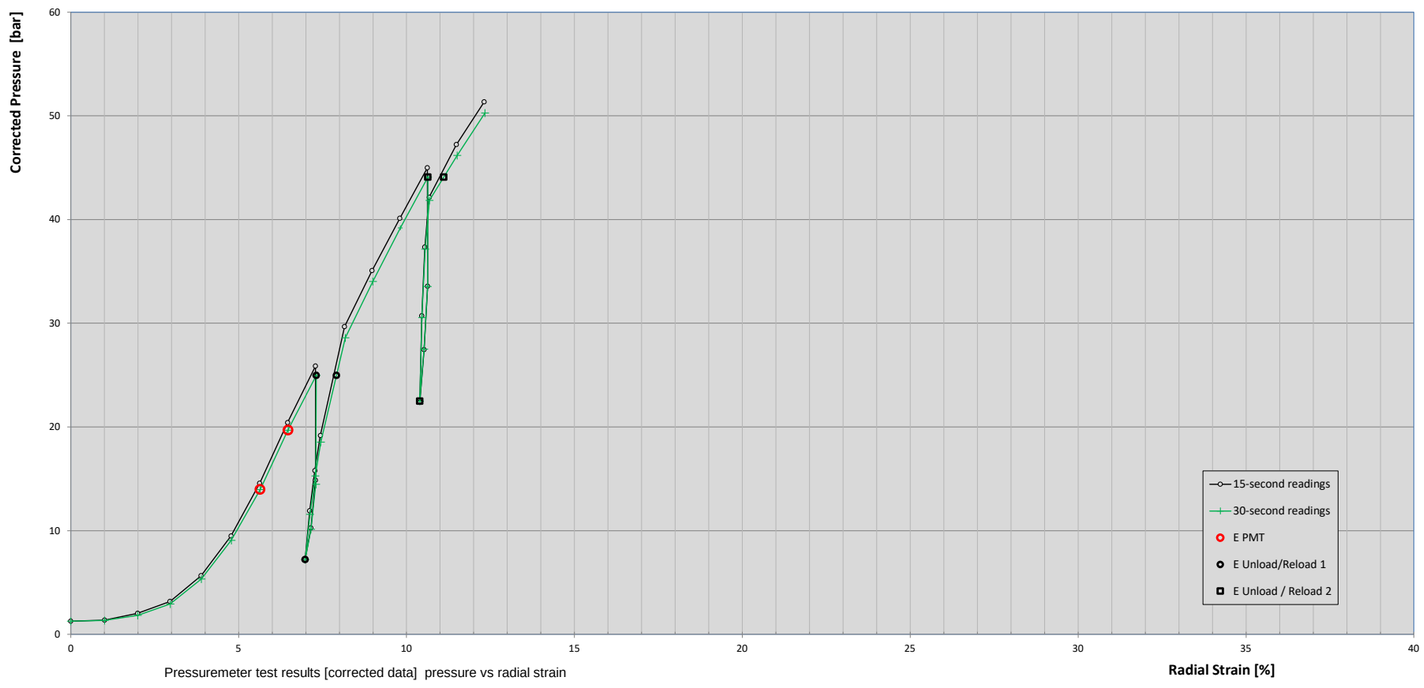
Corrected Test data						
15-second readings			30-second readings		
Pressure	Volume	$\Delta r/r_0$	Pressure	Volume	$\Delta r/r_0$
[bar]	[cm³]	[%]	[bar]	[cm³]	[%]
1.27	2	0.00	1.27	2	0.00
1.36	39.7	1.00	1.34	39.7	1.00
2.03	79.1	1.99	1.82	79.3	1.99
3.17	118.0	2.95	2.92	118.2	2.96
5.66	155.7	3.88	5.35	156.0	3.89
9.47	192.3	4.77	9.07	192.6	4.78
14.56	227.6	5.63	13.95	228.2	5.64
20.42	262.3	6.46	19.69	263.0	6.47
25.87	297.4	7.29	24.96	298.2	7.31
14.86	297.3	7.29	14.46	297.7	7.30
10.25	291.5	7.15	10.14	291.6	7.15
7.24	284.3	6.98	7.21	284.3	6.98
11.92	290.0	7.12	11.57	290.3	7.12
15.78	296.5	7.27	15.28	297.0	7.28
19.17	303.4	7.43	18.54	304.0	7.45
29.67	333.9	8.15	28.60	334.9	8.18
35.07	369.0	8.97	34.02	370.0	9.00
40.12	404.5	9.80	39.19	405.3	9.82
44.99	440.0	10.62	44.09	440.8	10.64
33.56	440.4	10.63	33.55	440.4	10.63
27.44	435.9	10.52	27.51	435.9	10.52
22.38	430.5	10.40	22.47	430.4	10.40
30.71	433.0	10.46	30.55	433.1	10.46
37.35	436.9	10.55	37.14	437.1	10.55
42.15	442.6	10.68	41.85	442.9	10.68
47.22	478.0	11.49	46.17	479.0	11.51
51.35	514.3	12.31	50.26	515.2	12.33

Creep		
Volume	$\Delta p_{30\text{-}15}$	
[cm³]	[bar]	
2	0.00	
39.7	0.02	
79.3	0.21	
118.2	0.25	
156.0	0.31	
192.6	0.40	
228.2	0.61	
263.0	0.73	
298.2	0.91	
334.9	1.07	
370.0	1.05	
405.3	0.93	
440.8	0.90	
479.0	1.05	
515.2	1.09	

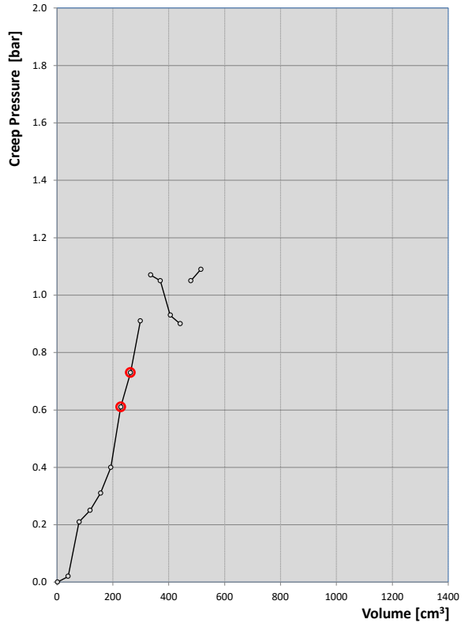
Auxiliary Data	
30 sec	
Pressure	1 / V
[bar]	
1.27	0.54977
1.34	0.02517
1.82	0.01262
2.92	0.00846
5.35	0.00641
9.07	0.00519
13.95	0.00438
19.69	0.00380
24.96	0.00335
14.46	0.00336
10.14	0.00343
7.21	0.00352
11.57	0.00344
15.28	0.00337
18.54	0.00329
28.60	0.00299
34.02	0.00270
39.19	0.00247
44.09	0.00227
33.55	0.00227
27.51	0.00229
22.47	0.00232
30.55	0.00231
37.14	0.00229
41.85	0.00226
46.17	0.00209
50.26	0.00194

Interpreted PMT Test Results

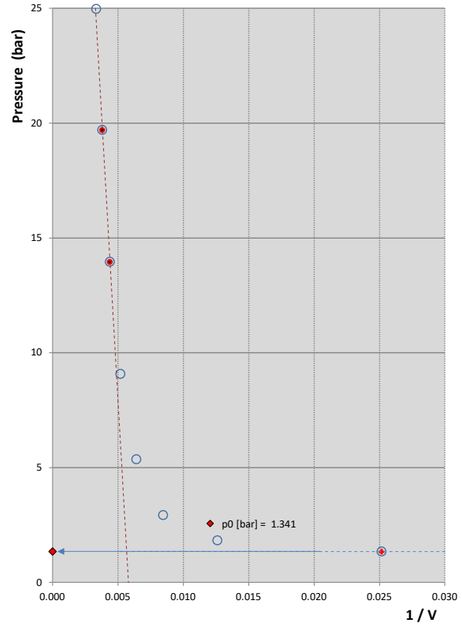
[30-second readings]			volume [cm³]	radial strain [%]	strain range [%]
p_0	1.34	[bar]	39.7	1.0	
p_L	81.15	[bar]			
p^*_L	79.81	[bar]			
p_V	19.69	[bar]	263	6.5	
E_{PMT}	972	[bar]	228	5.6	{5.6 - 6.5 %}
E_{PMT} / p^*_L	12.2				
$E_{Unload\ 1}$	7661	[bar]	284	7.0	
$E_{Reload\ 1}$	2721	[bar]			
$E_{Unload\ 2}$	13250	[bar]	430	10.4	
$E_{Reload\ 2}$	4459	[bar]			



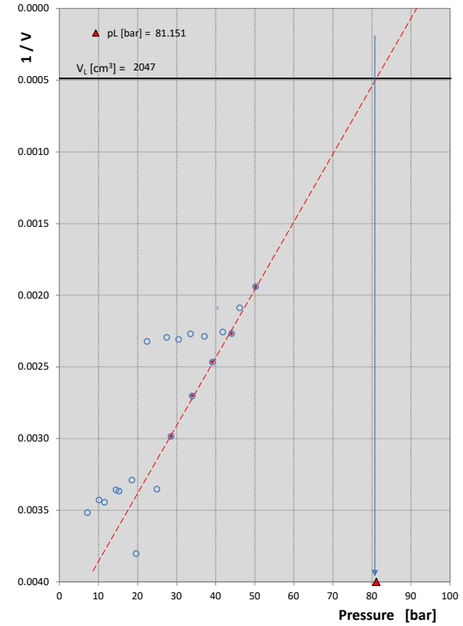
Pressuremeter test results [corrected data] pressure vs radial strain



Pressure difference from 15 to 30 sec. readings $\Delta p_{[15\text{-}30\ sec]}$



Determination of total contact pressure p_0



Determination of Limit Pressure p_L

Pressuremeter Equipment: TEXAM Model	Probe Designation : NX Probe (76 mm OD)	Drilling Method: Mud Rotary Drilling	Test Date: April 28, 2021
Volume-controlled test as per ASTM D4719 Method B	Probe No.: A 438	Drilling Bit: Tricone Bit	
Volume increments: 40 cm³	Calibration Record No.: 1	Time elapsed from hole drilling to testing ~ 5 minutes	Test Depth [m]: 11.79 (center of the probe)
Maximum Volume: 1400 cm³	Tubing Length: 160 [ft]	Engineer: Gabriel Sedran, P.Eng., Ph.D.	
Maximum Pressure: 100 bar	Probe Lenght: 0.46 [m]	Operator: Fabiano Sambati	Drilling Company: 3D Drilling
	Probe Initial Volume: 1968 cm³		

Project:	**685 Warden Avenue, Scarborough**
Client:	Golder Associates
In-Depth Geotechnical Project No.:	IDG 210628

PMT TEST No.:	**2**
Borehole No.:	**BH 21-2**

Field Test Data (uncorrected)		
Volume	Pressure [bar]	
[cm³]	15 sec	30 sec
2	0.40	0.40
40	0.46	0.44
80	0.49	0.49
120	0.53	0.51
160	0.58	0.56
200	0.63	0.61
240	0.74	0.72
280	1.10	1.08
320	1.42	1.38
360	1.88	1.83
400	2.36	2.29
440	3.03	2.90
480	3.88	3.67
520	5.01	4.78
560	7.40	6.80
600	10.10	9.09
640	12.72	11.66
630	7.36	7.34
620	5.77	5.81
610	4.78	4.85
620	7.15	7.02
630	8.80	8.52
640	10.17	9.75
680	14.73	13.63
720	17.70	16.56
760	20.38	19.36
800	22.89	21.83
790	16.32	16.26
780	14.16	14.15
770	12.81	12.81
780	15.82	15.63
790	17.89	17.56
800	19.73	19.26
840	23.34	22.44
880	25.86	24.87
920	28.03	26.97
960	30.06	28.94

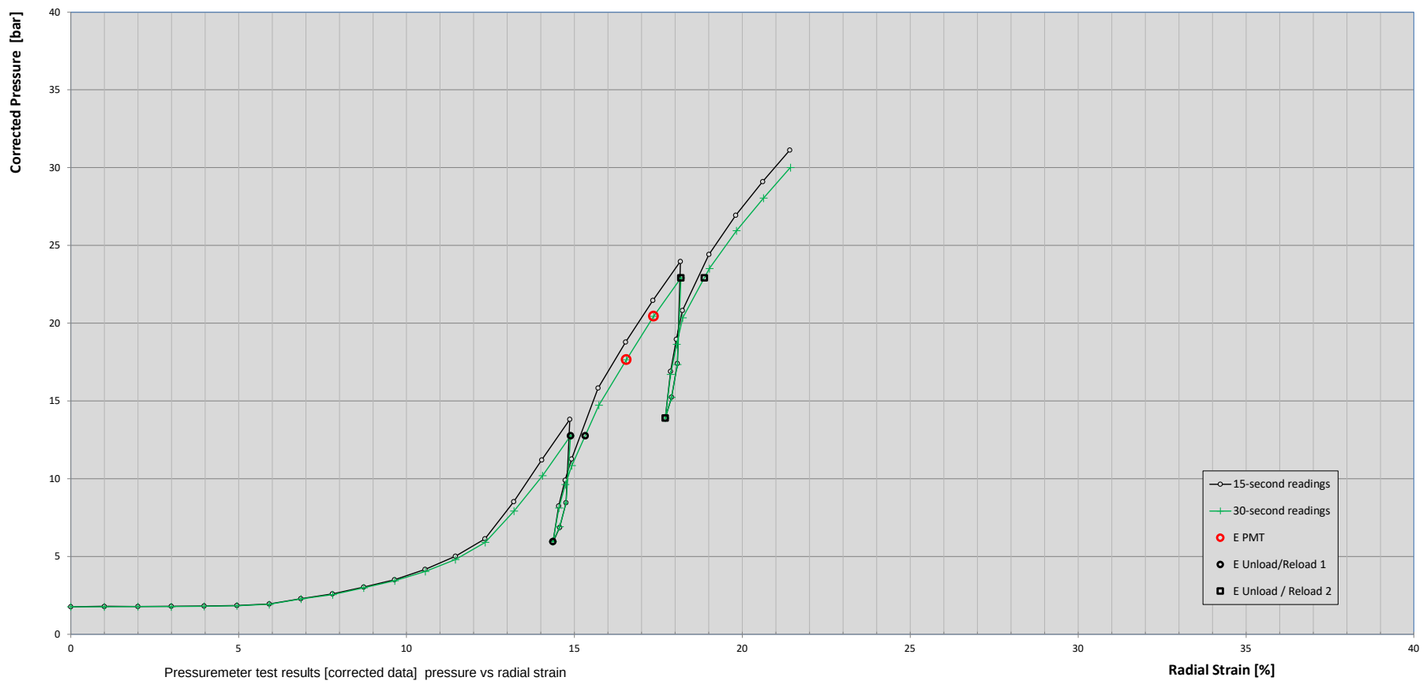
Corrected Test data						
15-second readings			30-second readings		
Pressure [bar]	Volume [cm³]	$\Delta r/r_0$ [%]	Pressure [bar]	Volume [cm³]	$\Delta r/r_0$ [%]
1.77	2	0.00	1.77	2	0.00
1.80	39.6	1.00	1.78	39.6	1.00
1.79	79.6	2.00	1.79	79.6	2.00
1.80	119.5	2.99	1.78	119.5	2.99
1.83	159.5	3.97	1.81	159.5	3.97
1.85	199.4	4.95	1.83	199.4	4.95
1.95	239.3	5.91	1.93	239.3	5.91
2.29	279.0	6.85	2.27	279.0	6.86
2.60	318.7	7.79	2.56	318.8	7.80
3.05	358.3	8.72	3.00	358.3	8.72
3.51	397.9	9.64	3.44	397.9	9.65
4.18	437.3	10.55	4.05	437.4	10.56
5.02	476.5	11.45	4.81	476.7	11.46
6.14	515.5	12.34	5.91	515.7	12.34
8.52	553.3	13.19	7.92	553.8	13.20
11.21	590.9	14.03	10.20	591.8	14.05
13.83	628.5	14.87	12.77	629.4	14.89
8.47	623.3	14.75	8.45	623.4	14.75
6.88	614.8	14.56	6.92	614.7	14.56
5.89	605.7	14.36	5.96	605.6	14.36
8.26	613.5	14.53	8.13	613.6	14.54
9.91	622.0	14.72	9.63	622.3	14.73
11.28	630.8	14.92	10.86	631.2	14.92
15.83	666.7	15.71	14.73	667.7	15.73
18.79	704.0	16.52	17.65	705.0	16.55
21.47	741.6	17.34	20.45	742.5	17.36
23.97	779.3	18.15	22.91	780.2	18.17
17.40	775.2	18.07	17.34	775.3	18.07
15.25	767.2	17.89	15.24	767.2	17.89
13.90	758.4	17.70	13.90	758.4	17.70
16.91	765.7	17.86	16.72	765.9	17.86
18.97	773.8	18.04	18.64	774.1	18.04
20.81	782.1	18.22	20.34	782.6	18.22
24.42	818.9	19.00	23.52	819.7	19.02
26.94	856.6	19.81	25.95	857.5	19.82
29.10	894.6	20.61	28.04	895.6	20.63
31.13	932.8	21.41	30.01	933.8	21.43

Creep	
Volume	$\Delta p_{30\text{-}15}$
[cm³]	[bar]
2	0.00
39.6	0.02
79.6	0.00
119.5	0.02
159.5	0.02
199.4	0.02
239.3	0.02
279.0	0.02
318.8	0.04
358.3	0.05
397.9	0.07
437.4	0.13
476.7	0.21
515.7	0.23
553.8	0.60
591.8	1.01
629.4	1.06
667.7	1.10
705.0	1.14
742.5	1.02
780.2	1.06
819.7	0.90
857.5	0.99
895.6	1.06
933.8	1.12

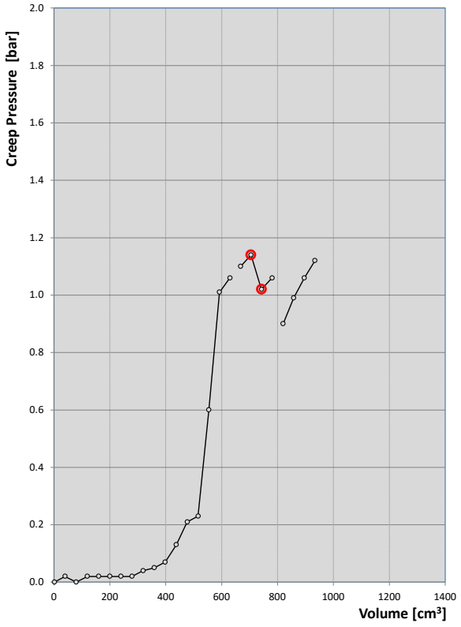
Auxiliary Data	
30 sec	
Pressure [bar]	1 / V
1.77	0.61054
1.78	0.02525
1.79	0.01257
1.78	0.00837
1.81	0.00627
1.83	0.00501
1.93	0.00418
2.27	0.00358
2.56	0.00314
3.00	0.00279
3.44	0.00251
4.05	0.00229
4.81	0.00210
5.91	0.00194
7.92	0.00181
10.20	0.00169
12.77	0.00159
8.45	0.00160
6.92	0.00163
5.96	0.00165
8.13	0.00163
9.63	0.00161
10.86	0.00158
14.73	0.00150
17.65	0.00142
20.45	0.00135
22.91	0.00128
17.34	0.00129
15.24	0.00130
13.90	0.00132
16.72	0.00131
18.64	0.00129
20.34	0.00128
23.52	0.00122
25.95	0.00117
28.04	0.00112
30.01	0.00107

Interpreted PMT Test Results

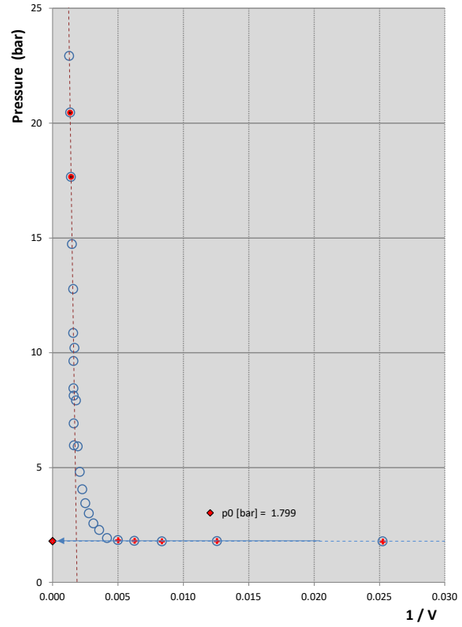
[30-second readings]			volume [cm³]	radial strain [%]	strain range [%]
p_0	1.80	[bar]	159.5	4.0	
p_L	57.57	[bar]			
p^*_L	55.77	[bar]			
p_Y	20.45	[bar]	742	17.4	
E_{PMT}	534	[bar]	705	16.5	{16.5 - 17.4 %}
E_{PMT} / p^*_L	9.6				
$E_{Unload\ 1}$	1963	[bar]	606	14.4	
$E_{Reload\ 1}$	1079	[bar]			
$E_{Unload\ 2}$	3007	[bar]	758	17.7	
$E_{Reload\ 2}$	1219	[bar]			



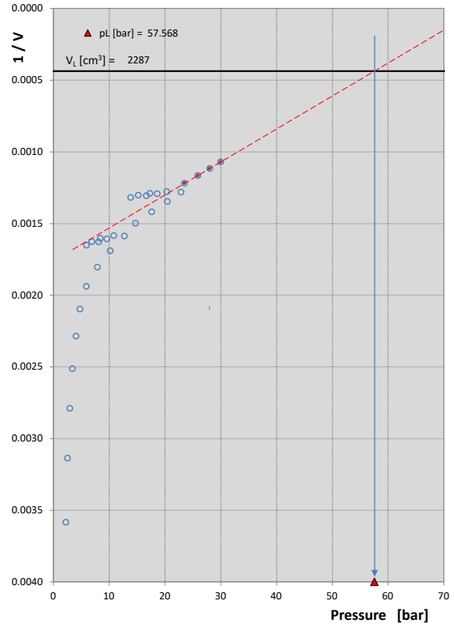
Pressuremeter test results [corrected data] pressure vs radial strain



Pressure difference from 15 to 30 sec. readings $\Delta p_{[15\text{-}30\ sec]}$



Determination of total contact pressure p_0



Determination of Limit Pressure p_L

Pressuremeter Equipment: TEXAM Model		Probe Designation : NX Probe (76 mm OD)		Drilling Method: Mud Rotary Drilling	Test Date: April 28, 2021	**Project:** 685 Warden Avenue, Scarborough	**PMT TEST No.:** 3
Volume-controlled test as per ASTM D4719 Method B		Probe No.: A 438		Drilling Bit: Tricone Bit			
Volume increments: 40 cm³		Calibration Record No.: 1		Time elapsed from hole drilling to testing ~ 5 minutes	Test Depth [m]: 14.83 (center of the probe)	Client: Golder Associates	**Borehole No.:** BH 21-2
Maximum Volume: 1400 cm³		Tubing Length: 160 [ft]		Engineer: Gabriel Sedran, P.Eng., Ph.D.			
Maximum Pressure: 100 bar		Probe Lenght: 0.46 [m]		Operator: Fabiano Sambati	Drilling Company: 3D Drilling	In-Depth Geotechnical Project No.: IDG 210628	
		Probe Initial Volume: 1968 cm³					

Field Test Data (uncorrected)		
Volume	Pressure [bar]	
[cm³]	15 sec	30 sec
2	0.34	0.34
40	0.42	0.40
80	0.44	0.43
120	0.48	0.46
160	0.51	0.49
200	0.54	0.52
240	0.59	0.55
280	0.66	0.64
320	0.80	0.75
360	0.98	0.94
400	1.24	1.20
440	1.67	1.61
480	2.48	2.38
520	3.82	3.68
560	5.90	5.65
600	9.06	8.66
640	13.08	12.55
680	17.60	16.98
720	22.04	21.32
710	14.04	14.06
700	10.83	10.89
690	8.62	8.71
700	13.80	13.05
710	16.78	16.55
720	19.76	19.45
760	26.00	25.38
800	29.84	29.20
840	33.10	32.43
880	35.95	35.31
920	38.57	37.88
960	40.93	40.23

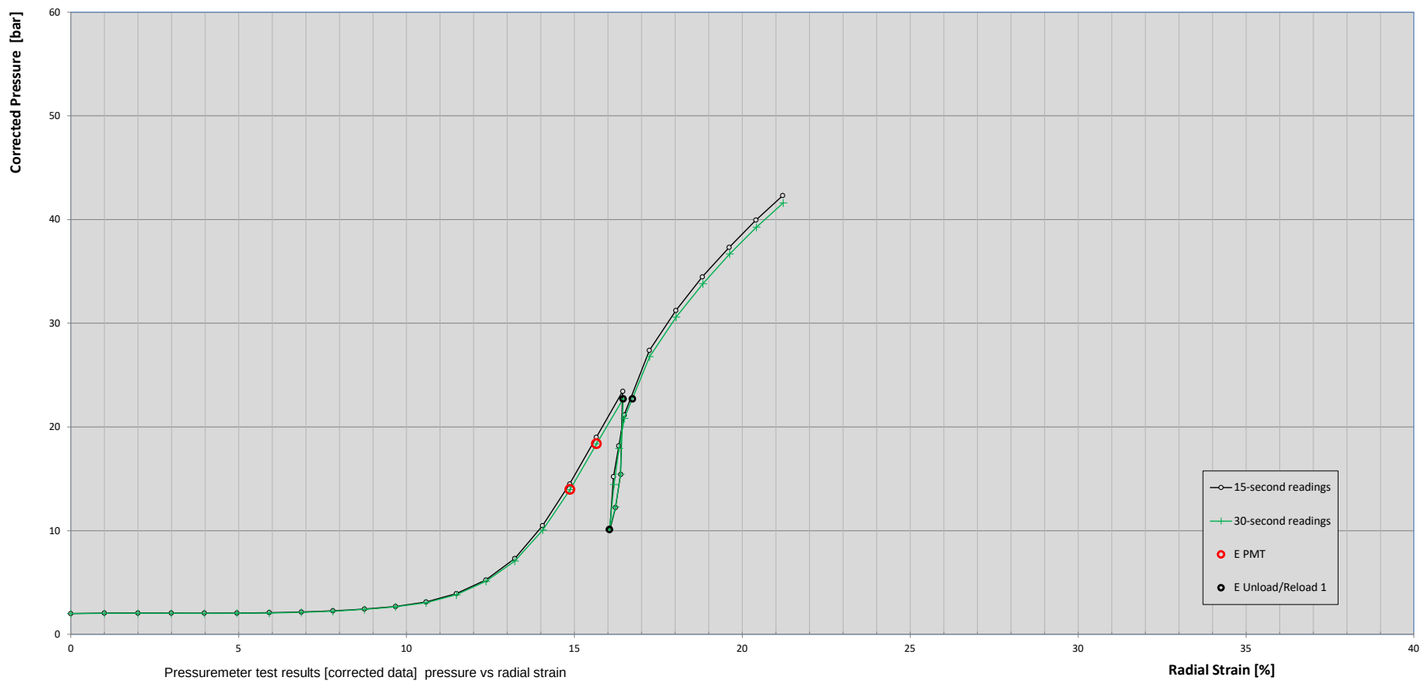
Corrected Test data						
15-second readings			30-second readings		
Pressure	Volume	$\Delta r/r_0$	Pressure	Volume	$\Delta r/r_0$
[bar]	[cm³]	[%]	[bar]	[cm³]	[%]
2.01	2	0.00	2.01	2	0.00
2.06	39.6	1.00	2.04	39.6	1.00
2.04	79.6	2.00	2.03	79.6	2.00
2.05	119.6	2.99	2.03	119.6	2.99
2.06	159.5	3.97	2.04	159.6	3.98
2.06	199.5	4.95	2.04	199.5	4.95
2.10	239.5	5.91	2.06	239.5	5.91
2.15	279.4	6.86	2.13	279.4	6.86
2.28	319.3	7.81	2.23	319.3	7.81
2.44	359.1	8.74	2.40	359.1	8.74
2.69	398.9	9.67	2.65	398.9	9.67
3.11	438.5	10.58	3.05	438.5	10.58
3.92	477.8	11.48	3.82	477.8	11.48
5.25	516.5	12.36	5.11	516.7	12.36
7.32	554.7	13.22	7.07	554.9	13.23
10.47	591.8	14.05	10.07	592.2	14.06
14.48	628.2	14.86	13.95	628.6	14.87
19.00	664.1	15.65	18.38	664.6	15.66
23.43	700.0	16.44	22.71	700.7	16.45
15.43	697.3	16.38	15.45	697.3	16.38
12.22	690.2	16.22	12.28	690.1	16.22
10.01	682.2	16.05	10.10	682.1	16.05
15.19	687.5	16.16	14.44	688.2	16.18
18.17	694.8	16.32	17.94	695.0	16.33
21.15	702.1	16.48	20.84	702.4	16.49
27.39	736.5	17.23	26.77	737.0	17.24
31.22	773.0	18.02	30.58	773.6	18.03
34.48	810.0	18.81	33.81	810.6	18.83
37.32	847.5	19.61	36.68	848.0	19.62
39.94	885.1	20.41	39.25	885.7	20.42
42.30	922.9	21.20	41.60	923.6	21.22

Creep		
Volume	$\Delta p_{30\text{-}15}$	
[cm³]	[bar]	
2	0.00	
39.6	0.02	
79.6	0.01	
119.6	0.02	
159.6	0.02	
199.5	0.02	
239.5	0.04	
279.4	0.02	
319.3	0.05	
359.1	0.04	
398.9	0.04	
438.5	0.06	
477.8	0.10	
516.7	0.14	
554.9	0.25	
592.2	0.40	
628.6	0.53	
664.6	0.62	
700.7	0.72	
737.0	0.62	
773.6	0.64	
810.6	0.67	
848.0	0.64	
885.7	0.69	
923.6	0.70	

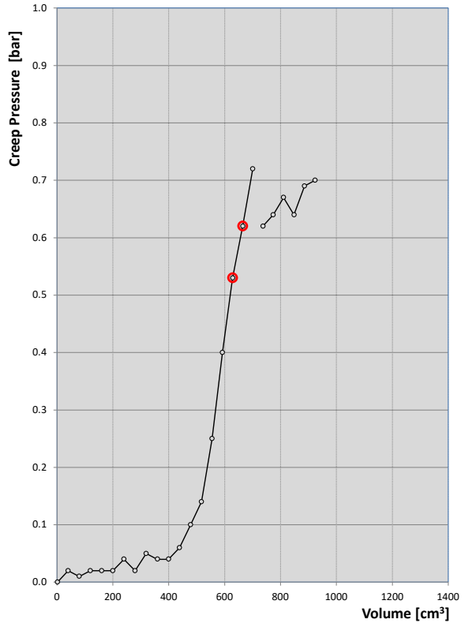
Auxiliary Data	
30 sec	
Pressure	1 / V
[bar]	
2.01	0.59094
2.04	0.02523
2.03	0.01256
2.03	0.00836
2.04	0.00627
2.04	0.00501
2.06	0.00418
2.13	0.00358
2.23	0.00313
2.40	0.00278
2.65	0.00251
3.05	0.00228
3.82	0.00209
5.11	0.00194
7.07	0.00180
10.07	0.00169
13.95	0.00159
18.38	0.00150
22.71	0.00143
15.45	0.00143
12.28	0.00145
10.10	0.00147
14.44	0.00145
17.94	0.00144
20.84	0.00142
26.77	0.00136
30.58	0.00129
33.81	0.00123
36.68	0.00118
39.25	0.00113
41.60	0.00108

Interpreted PMT Test Results

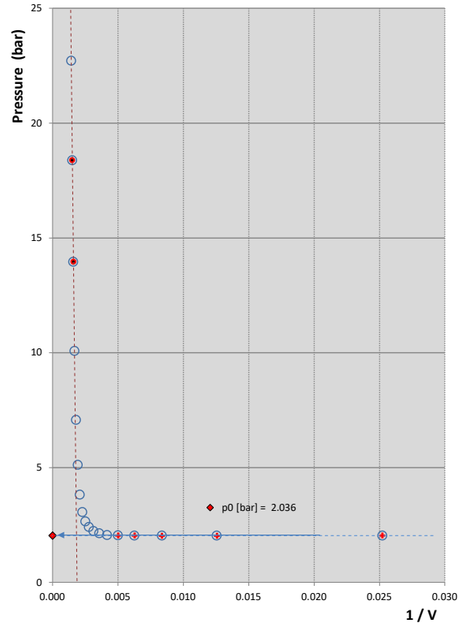
[30-second readings]			volume [cm³]	radial strain [%]	strain range [%]
p_0	2.04	[bar]	199.5	4.9	
p_L	78.50	[bar]			
p^*_L	76.47	[bar]			
p_Y	18.38	[bar]	665	15.7	
E_{PMT}	854	[bar]	629	14.9	{14.9 - 15.7 %}
E_{PMT} / p^*_L	11.2				
$E_{Unload\ 1}$	4798	[bar]	682	16.0	
$E_{Reload\ 1}$	2866	[bar]			



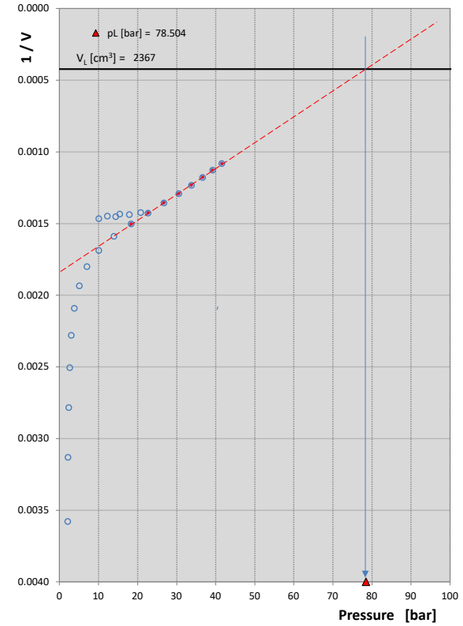
Pressuremeter test results [corrected data] pressure vs radial strain



Pressure difference from 15 to 30 sec. readings $\Delta p_{[15\text{-}30\ sec]}$



Determination of total contact pressure p_0



Determination of Limit Pressure p_L

Pressuremeter Equipment: TEXAM Model		Probe Designation : NX Probe (76 mm OD)		Drilling Method: Mud Rotary Drilling	Test Date: April 29, 2021	**Project:** 685 Warden Avenue, Scarborough	**PMT TEST No.:** 4
Volume-controlled test as per ASTM D4719 Method B		Probe No.: A 438		Drilling Bit: Tricone Bit			
Volume increments: 40 cm³		Calibration Record No.: 1		Time elapsed from hole drilling to testing ~ 5 minutes	Test Depth [m]: 17.88 (center of the probe)	Client: Golder Associates	**Borehole No.:** BH 21-2
Maximum Volume: 1400 cm³		Tubing Length: 160 [ft]		Engineer: Gabriel Sedran, P.Eng., Ph.D.			
Maximum Pressure: 100 bar		Probe Lenght: 0.46 [m]		Operator: Fabiano Sambati	Drilling Company: 3D Drilling	In-Depth Geotechnical Project No.: IDG 210628	
		Probe Initial Volume: 1968 cm³					

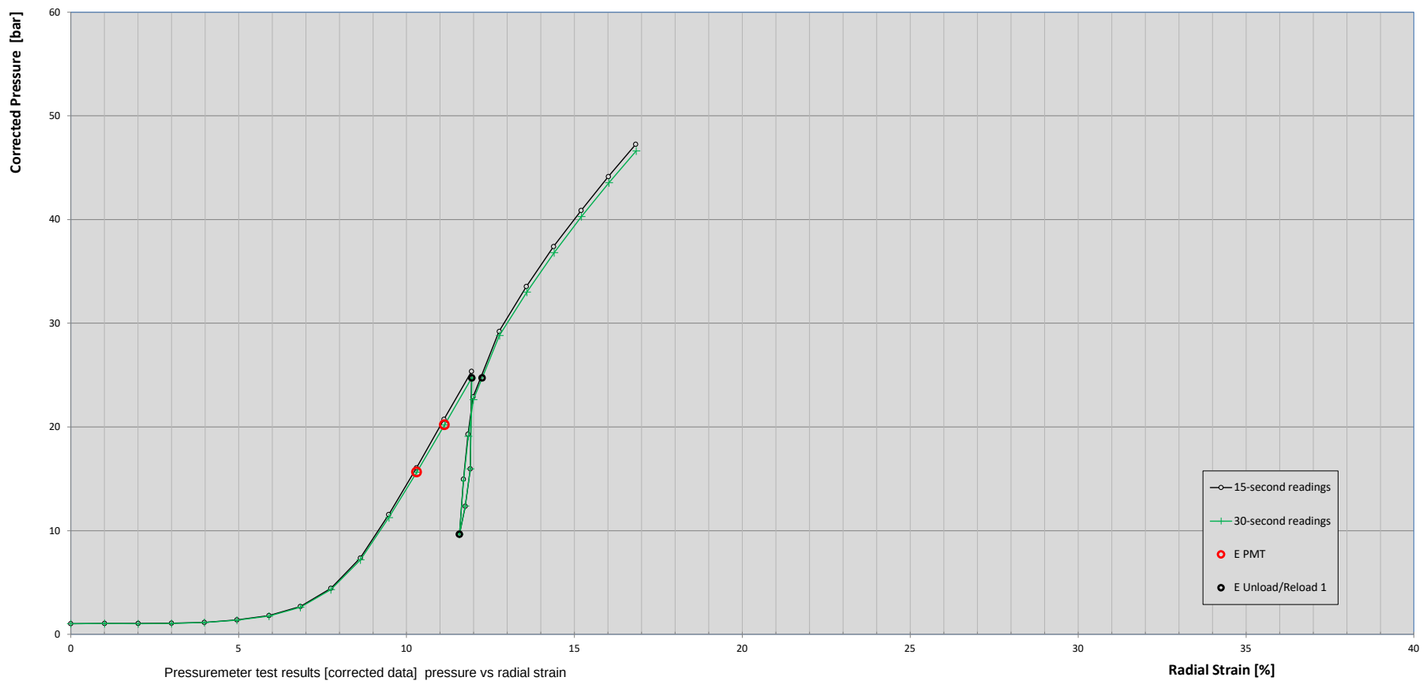
Field Test Data (uncorrected)		
Volume	Pressure [bar]	
[cm³]	15 sec	30 sec
2	0.11	0.11
40	0.16	0.15
80	0.20	0.18
120	0.25	0.23
160	0.36	0.34
200	0.61	0.58
240	1.05	1.00
280	1.95	1.87
320	3.70	3.59
360	6.64	6.48
400	10.85	10.55
440	15.36	14.94
480	20.05	19.50
520	24.68	24.05
510	15.27	15.28
500	11.66	11.69
490	8.93	8.97
500	14.26	14.13
510	18.62	18.42
520	22.21	21.94
560	28.54	28.14
600	32.87	32.33
640	36.74	36.14
680	40.22	39.64
720	43.50	42.90
760	46.60	45.97

Corrected Test data						
15-second readings			30-second readings		
Pressure	Volume	$\Delta r/r_0$	Pressure	Volume	$\Delta r/r_0$
[bar]	[cm³]	[%]	[bar]	[cm³]	[%]
1.04	2	0.00	1.04	2	0.00
1.05	39.9	1.01	1.04	39.9	1.01
1.06	79.8	2.01	1.04	79.8	2.01
1.08	119.8	3.00	1.06	119.8	3.00
1.16	159.7	3.98	1.14	159.7	3.98
1.39	199.4	4.95	1.36	199.5	4.95
1.81	239.0	5.90	1.76	239.1	5.90
2.70	278.2	6.84	2.62	278.3	6.84
4.43	316.7	7.75	4.32	316.8	7.75
7.36	354.0	8.62	7.20	354.1	8.63
11.56	390.2	9.47	11.26	390.4	9.47
16.06	426.1	10.30	15.64	426.5	10.31
20.74	461.8	11.12	20.19	462.3	11.13
25.36	497.7	11.93	24.73	498.2	11.95
15.96	496.2	11.90	15.97	496.2	11.90
12.35	489.4	11.75	12.38	489.4	11.75
9.62	481.9	11.58	9.66	481.9	11.57
14.95	487.1	11.69	14.82	487.2	11.70
19.31	493.1	11.83	19.11	493.3	11.84
22.89	499.9	11.98	22.62	500.1	11.99
29.22	534.2	12.76	28.82	534.5	12.77
33.54	570.2	13.57	33.00	570.7	13.58
37.40	606.7	14.38	36.80	607.3	14.40
40.87	643.6	15.20	40.29	644.1	15.21
44.15	680.6	16.01	43.55	681.2	16.02
47.24	717.8	16.82	46.61	718.4	16.84

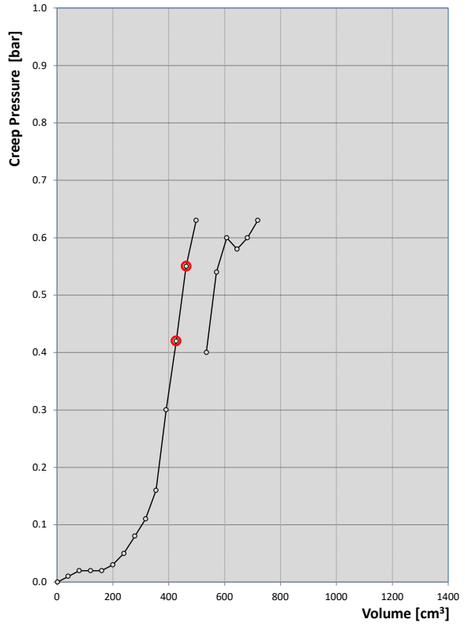
Creep	
Volume	$\Delta p_{30\text{-}15}$
[cm³]	[bar]
2	0.00
39.9	0.01
79.8	0.02
119.8	0.02
159.7	0.02
199.5	0.03
239.1	0.05
278.3	0.08
316.8	0.11
354.1	0.16
390.4	0.30
426.5	0.42
462.3	0.55
498.2	0.63
534.5	0.40
570.7	0.54
607.3	0.60
644.1	0.58
681.2	0.60
718.4	0.63

Auxiliary Data	
30 sec	
Pressure	1 / V
[bar]	
1.04	0.52620
1.04	0.02509
1.04	0.01253
1.06	0.00835
1.14	0.00626
1.36	0.00501
1.76	0.00418
2.62	0.00359
4.32	0.00316
7.20	0.00282
11.26	0.00256
15.64	0.00234
20.19	0.00216
24.73	0.00201
15.97	0.00202
12.38	0.00204
9.66	0.00208
14.82	0.00205
19.11	0.00203
22.62	0.00200
28.82	0.00187
33.00	0.00175
36.80	0.00165
40.29	0.00155
43.55	0.00147
46.61	0.00139

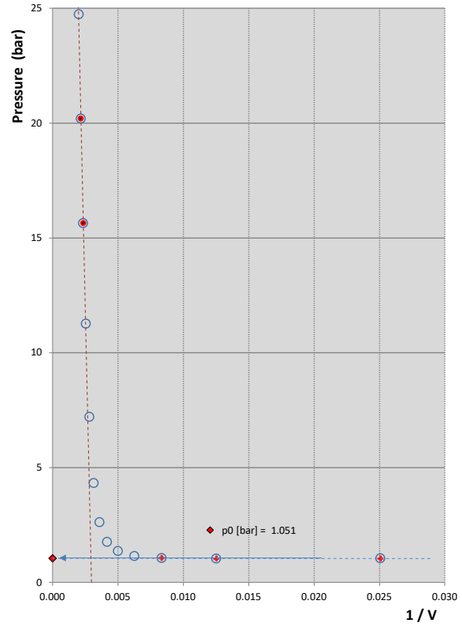
Interpreted PMT Test Results					
[30-second readings]			volume	radial strain	strain range
			[cm³]	[%]	[%]
p_0	1.05	[bar]	119.8	3.0	
p_L	81.25	[bar]			
p^*_L	80.20	[bar]			
p_Y	20.19	[bar]	462	11.1	
E_{PMT}	814	[bar]	426	10.3	{10.3 - 11.1 %}
E_{PMT} / p^*_L	10.2				
$E_{Unload\ 1}$	6028	[bar]	482	11.6	
$E_{Reload\ 1}$	3300	[bar]			



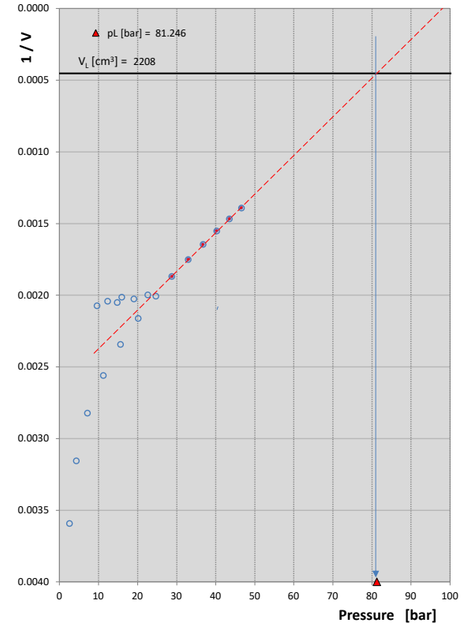
Pressuremeter test results [corrected data] pressure vs radial strain



Pressure difference from 15 to 30 sec. readings $\Delta p_{[15\text{-}30\ sec]}$



Determination of total contact pressure p_0



Determination of Limit Pressure p_L

Pressuremeter Equipment: TEXAM Model	Probe Designation : NX Probe (76 mm OD)	Drilling Method: Mud Rotary Drilling	
Volume-controlled test as per ASTM D4719 Method B	Probe No.: A 438	Drilling Bit: Tricone Bit	
Volume increments: 40 cm³	Calibration Record No.: 1	Time elapsed from hole drilling to testing ~ 5 minutes	
Maximum Volume: 1400 cm³	Tubing Length: 160 [ft]	Engineer: Gabriel Sedran, P.Eng., Ph.D.	
Maximum Pressure: 100 bar	Probe Lenght: 0.46 [m]	Operator: Fabiano Sambati	
	Probe Initial Volume: 1968 cm³		

Test Date:	April 29, 2021	**Project:**	**685 Warden Avenue, Scarborough**
Test Depth [m]:	10.29 (center of the probe)	Client:	Golder Associates
Drilling Company:	3D Drilling	In-Depth Geotechnical Project No.:	IDG 210628

PMT TEST No.: 1

Borehole No.: BH 21-3

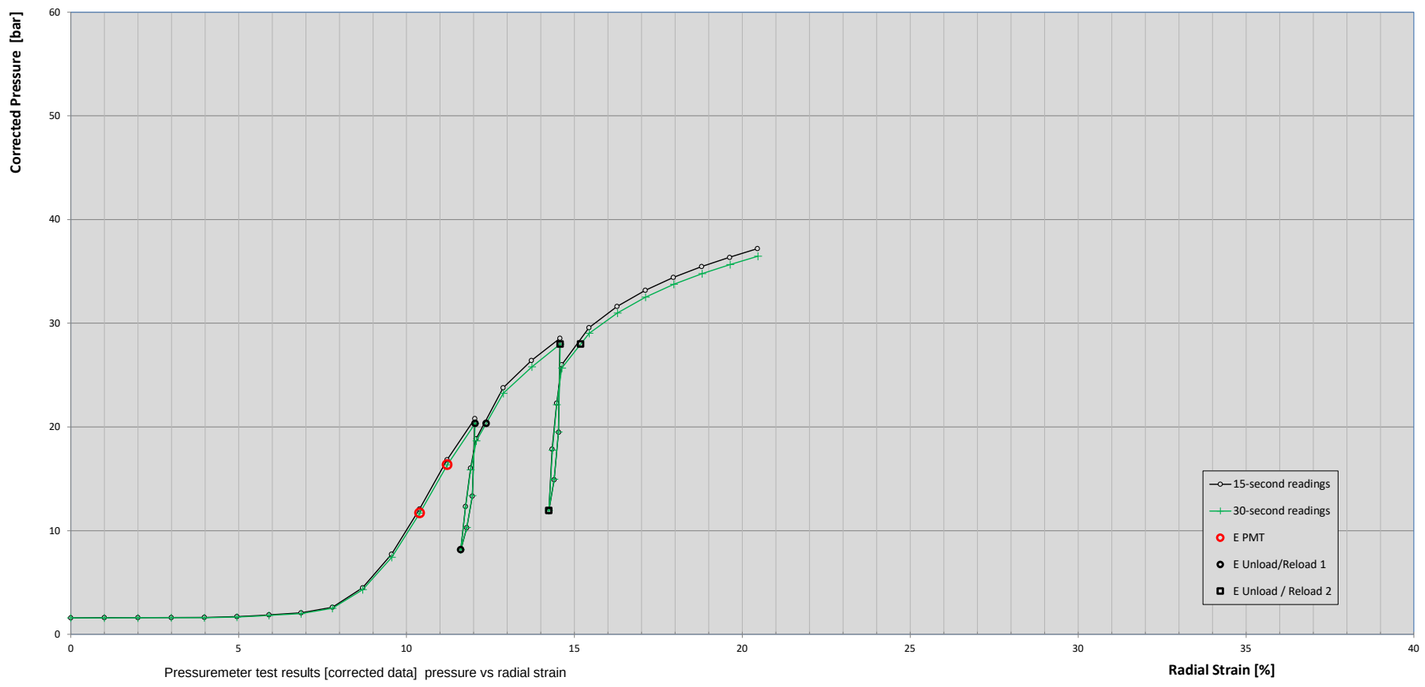
Field Test Data (uncorrected)		
Volume	Pressure [bar]	
[cm³]	15 sec	30 sec
2	0.36	0.36
40	0.43	0.41
80	0.47	0.45
120	0.50	0.49
160	0.53	0.52
200	0.63	0.60
240	0.82	0.78
280	1.04	0.97
320	1.59	1.50
360	3.48	3.30
400	6.73	6.43
440	11.10	10.71
480	15.85	15.35
520	19.83	19.36
510	12.35	12.39
500	9.29	9.32
490	7.13	7.18
500	11.35	11.24
510	15.05	14.88
520	17.87	17.68
560	22.80	22.28
600	25.44	24.84
640	27.60	27.03
630	18.53	18.56
620	13.96	14.01
610	10.92	10.99
620	16.91	16.80
630	21.33	21.20
640	25.03	24.71
680	28.63	28.08
720	30.67	30.04
760	32.23	31.58
800	33.48	32.82
840	34.53	33.85
880	35.43	34.73
920	36.27	35.55

Corrected Test data						
15-second readings			30-second readings		
Pressure [bar]	Volume [cm³]	$\Delta r/r_0$ [%]	Pressure [bar]	Volume [cm³]	$\Delta r/r_0$ [%]
1.58	2	0.00	1.58	2	0.00
1.62	39.6	1.00	1.60	39.6	1.00
1.62	79.6	2.00	1.60	79.6	2.00
1.62	119.5	2.99	1.61	119.6	2.99
1.63	159.5	3.97	1.62	159.5	3.97
1.70	199.4	4.95	1.67	199.5	4.95
1.88	239.3	5.91	1.84	239.3	5.91
2.08	279.1	6.86	2.01	279.1	6.86
2.62	318.6	7.79	2.53	318.6	7.79
4.49	356.8	8.69	4.31	357.0	8.69
7.73	393.9	9.55	7.43	394.2	9.56
12.09	430.0	10.39	11.70	430.3	10.39
16.84	465.7	11.20	16.34	466.1	11.21
20.81	502.0	12.03	20.34	502.5	12.04
13.33	498.8	11.96	13.37	498.8	11.96
10.27	491.6	11.80	10.30	491.6	11.80
8.11	483.5	11.61	8.16	483.5	11.61
12.33	489.7	11.75	12.22	489.8	11.76
16.03	496.4	11.90	15.86	496.5	11.91
18.85	503.8	12.07	18.66	504.0	12.08
23.77	539.4	12.88	23.25	539.8	12.89
26.40	577.0	13.72	25.80	577.5	13.73
28.55	615.0	14.57	27.98	615.5	14.58
19.49	613.2	14.53	19.52	613.2	14.53
14.92	607.4	14.40	14.97	607.3	14.40
11.88	600.1	14.24	11.95	600.1	14.23
17.87	604.7	14.34	17.76	604.8	14.34
22.29	610.7	14.47	22.16	610.8	14.47
25.98	617.3	14.62	25.66	617.6	14.62
29.58	654.1	15.43	29.03	654.6	15.44
31.61	692.2	16.27	30.98	692.8	16.28
33.17	730.8	17.11	32.52	731.4	17.12
34.41	769.7	17.95	33.75	770.3	17.96
35.46	808.7	18.79	34.78	809.4	18.80
36.35	847.9	19.62	35.65	848.6	19.63
37.19	887.2	20.45	36.47	887.8	20.47

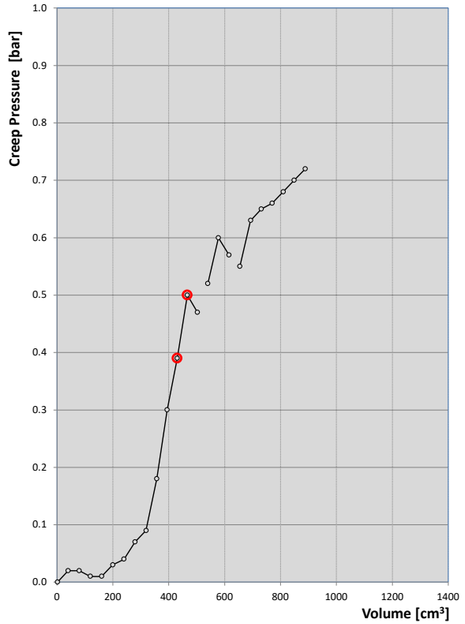
Creep		
Volume	$\Delta p_{30\text{-}15}$	
[cm³]	[bar]	
2	0.00	
39.6	0.02	
79.6	0.02	
119.6	0.01	
159.5	0.01	
199.5	0.03	
239.3	0.04	
279.1	0.07	
318.6	0.09	
357.0	0.18	
394.2	0.30	
430.3	0.39	
466.1	0.50	
502.5	0.47	
539.8	0.52	
577.5	0.60	
615.5	0.57	
654.6	0.55	
692.8	0.63	
731.4	0.65	
770.3	0.66	
809.4	0.68	
848.6	0.70	
887.8	0.72	

Auxiliary Data	
30 sec	
Pressure [bar]	1 / V
1.58	0.59733
1.60	0.02523
1.60	0.01256
1.61	0.00836
1.62	0.00627
1.67	0.00501
1.84	0.00418
2.01	0.00358
2.53	0.00314
4.31	0.00280
7.43	0.00254
11.70	0.00232
16.34	0.00215
20.34	0.00199
13.37	0.00200
10.30	0.00203
8.16	0.00207
12.22	0.00204
15.86	0.00201
18.66	0.00198
23.25	0.00185
25.80	0.00173
27.98	0.00162
19.52	0.00163
14.97	0.00165
11.95	0.00167
17.76	0.00165
22.16	0.00164
25.66	0.00162
29.03	0.00153
30.98	0.00144
32.52	0.00137
33.75	0.00130
34.78	0.00124
35.65	0.00118
36.47	0.00113

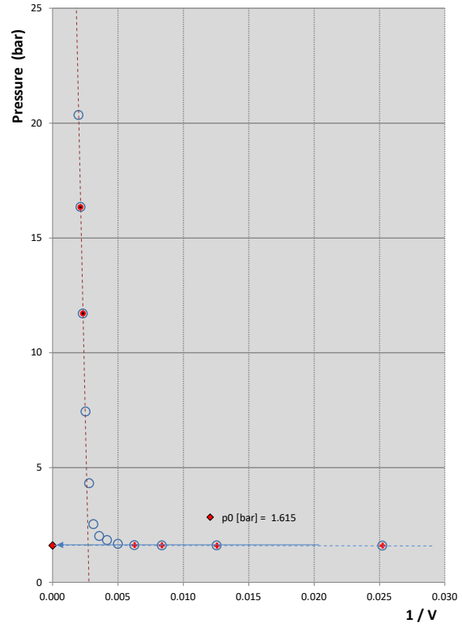
Interpreted PMT Test Results					
[30-second readings]			volume	radial strain	strain range
			[cm³]	[%]	[%]
p_0	1.61	[bar]	159.5	4.0	
p_L	49.27	[bar]			
p^*_L	47.65	[bar]			
p_Y	16.34	[bar]	466	11.2	
E_{PMT}	831	[bar]	430	10.4	{10.4 - 11.2 %}
E_{PMT} / p^*_L	17.4				
$E_{Unload\ 1}$	4200	[bar]	484	11.6	
$E_{Reload\ 1}$	2380	[bar]			
$E_{Unload\ 2}$	7096	[bar]	600	14.2	
$E_{Reload\ 2}$	2565	[bar]			



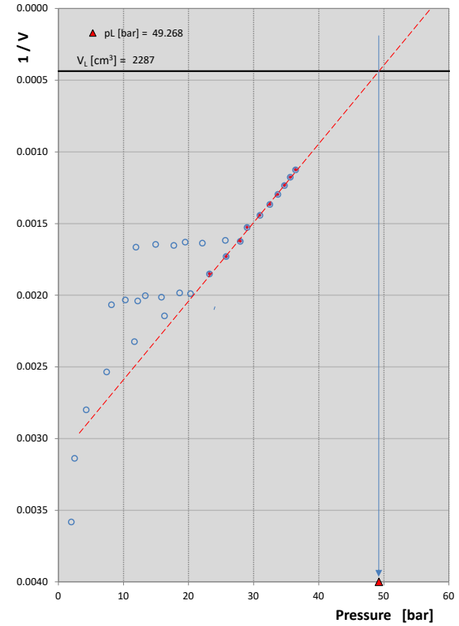
Pressuremeter test results [corrected data] pressure vs radial strain



Pressure difference from 15 to 30 sec. readings $\Delta p_{[15\text{-}30\ sec]}$



Determination of total contact pressure p_0



Determination of Limit Pressure p_L

Pressuremeter Equipment: TEXAM Model			Probe Designation : NX Probe (76 mm OD)		Drilling Method: Mud Rotary Drilling	Test Date: April 29, 2021	Project: 685 Warden Avenue, Scarborough
Volume-controlled test as per ASTM D4719 Method B			Probe No.: A 438		Drilling Bit: Tricone Bit		PMT TEST No.: 2
Volume increments:	40	cm³	Calibration Record No.: 1		Time elapsed from hole drilling to testing ~ 5 minutes	Test Depth [m]: 13.28 (center of the probe)	Client: Golder Associates
Maximum Volume:	1400	cm³	Tubing Length: 160	[ft]	Engineer: Gabriel Sedran, P.Eng., Ph.D.		Borehole No.: BH 21-3
Maximum Pressure:	100	bar	Probe Lenght: 0.46	[m]	Operator: Fabiano Sambati	Drilling Company: 3D Drilling	In-Depth Geotechnical Project No.: IDG 210628
			Probe Initial Volume: 1968	cm³			

Field Test Data (uncorrected)		
Volume	Pressure [bar]	
[cm³]	15 sec	30 sec
2	0.34	0.34
40	0.42	0.40
80	0.45	0.43
120	0.49	0.47
160	0.54	0.51
200	0.64	0.60
240	0.75	0.72
280	0.94	0.88
320	1.27	1.23
360	1.92	1.82
400	3.08	2.95
440	4.87	4.65
480	7.04	6.73
520	9.75	9.25
560	12.26	11.64
550	7.84	7.85
540	6.25	6.29
530	5.08	5.15
540	7.54	7.40
550	9.29	9.08
560	10.82	10.57
600	14.64	14.11
640	17.48	16.85
680	20.10	19.43
720	22.75	22.06
710	15.20	15.21
700	12.30	12.34
690	10.48	10.54
700	14.82	14.68
710	17.70	17.51
720	20.24	19.93
760	25.13	24.51
800	27.65	27.00
840	29.84	29.18
880	31.76	31.08
920	33.54	32.84
960	35.15	34.43
1000	36.69	35.93

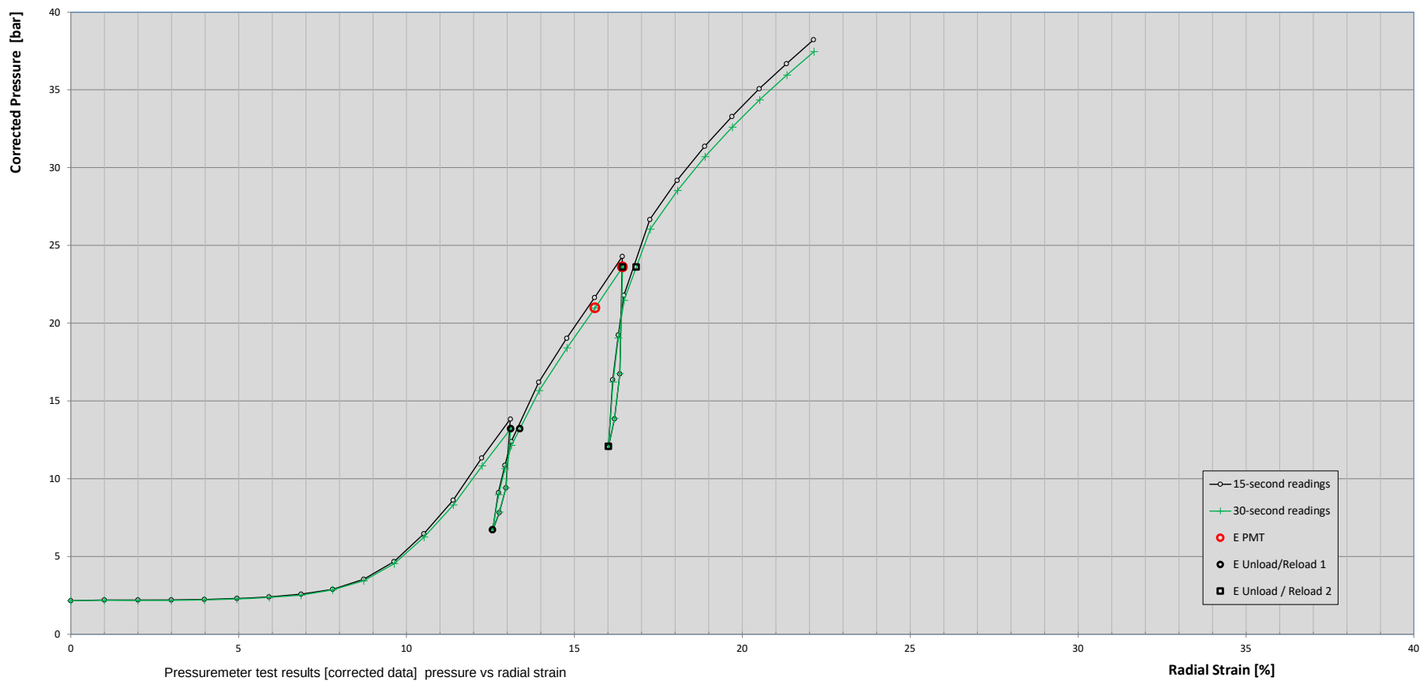
Corrected Test data						
15-second readings			30-second readings			
Pressure [bar]	Volume [cm³]	$\Delta r/r_0$ [%]	Pressure [bar]	Volume [cm³]	$\Delta r/r_0$ [%]
2.16	2	0.00	2.16	2	0.00
2.21	39.6	1.00	2.19	39.6	1.00
2.20	79.6	2.00	2.18	79.6	2.00
2.21	119.6	2.99	2.19	119.6	2.99
2.24	159.5	3.97	2.21	159.5	3.97
2.32	199.4	4.95	2.28	199.5	4.95
2.41	239.3	5.91	2.38	239.3	5.91
2.58	279.1	6.86	2.52	279.2	6.86
2.90	318.9	7.80	2.86	318.9	7.80
3.54	358.3	8.72	3.44	358.4	8.73
4.69	397.2	9.63	4.56	397.3	9.63
6.47	435.6	10.52	6.25	435.8	10.52
8.63	473.6	11.39	8.32	473.9	11.39
11.33	511.2	12.24	10.83	511.6	12.25
13.83	548.9	13.09	13.21	549.5	13.10
9.42	542.9	12.96	9.43	542.9	12.96
7.83	534.3	12.76	7.87	534.3	12.76
6.66	525.4	12.56	6.73	525.3	12.56
9.12	533.2	12.74	8.98	533.3	12.74
10.87	541.6	12.93	10.66	541.8	12.93
12.39	550.2	13.12	12.14	550.4	13.13
16.21	586.7	13.94	15.68	587.2	13.95
19.04	624.2	14.77	18.41	624.7	14.78
21.65	661.8	15.60	20.98	662.4	15.61
24.29	699.4	16.42	23.60	700.0	16.44
16.75	696.2	16.35	16.76	696.2	16.35
13.85	688.9	16.19	13.89	688.8	16.19
12.03	680.5	16.01	12.09	680.5	16.01
16.37	686.6	16.14	16.23	686.7	16.15
19.25	694.0	16.30	19.06	694.1	16.31
21.78	701.7	16.47	21.47	702.0	16.48
26.67	737.3	17.25	26.05	737.8	17.26
29.19	775.0	18.06	28.54	775.6	18.07
31.37	813.0	18.88	30.71	813.6	18.89
33.29	851.2	19.69	32.61	851.9	19.70
35.07	889.6	20.50	34.37	890.3	20.52
36.68	928.2	21.31	35.96	928.8	21.33
38.22	966.8	22.12	37.46	967.5	22.13

Creep	
Volume [cm³]	$\Delta p_{30\text{-}15}$ [bar]
2	0.00
39.6	0.02
79.6	0.02
119.6	0.02
159.5	0.03
199.5	0.04
239.3	0.03
279.2	0.06
318.9	0.04
358.4	0.10
397.3	0.13
435.8	0.22
473.9	0.31
511.6	0.50
549.5	0.62
587.2	0.53
624.7	0.63
662.4	0.67
700.0	0.69
737.8	0.62
775.6	0.65
813.6	0.66
851.9	0.68
890.3	0.70
928.8	0.72
967.5	0.76

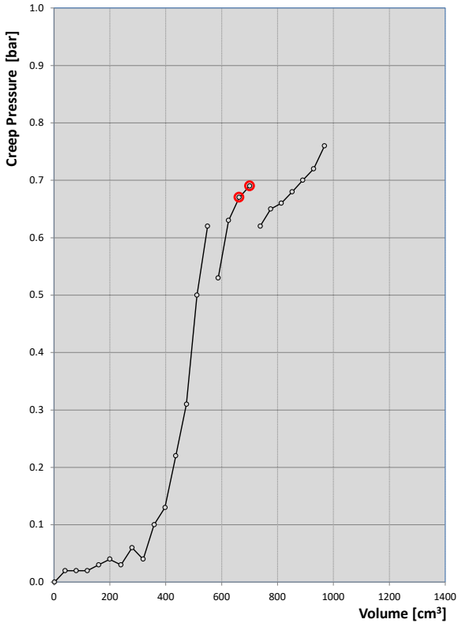
Auxiliary Data	
30 sec	
Pressure [bar]	1 / V
2.16	0.59094
2.19	0.02523
2.18	0.01256
2.19	0.00836
2.21	0.00627
2.28	0.00501
2.38	0.00418
2.52	0.00358
2.86	0.00314
3.44	0.00279
4.56	0.00252
6.25	0.00229
8.32	0.00211
10.83	0.00195
13.21	0.00182
9.43	0.00184
7.87	0.00187
6.73	0.00190
8.98	0.00188
10.66	0.00185
12.14	0.00182
15.68	0.00170
18.41	0.00160
20.98	0.00151
23.60	0.00143
16.76	0.00144
13.89	0.00145
12.09	0.00147
16.23	0.00146
19.06	0.00144
21.47	0.00142
26.05	0.00136
28.54	0.00129
30.71	0.00123
32.61	0.00117
34.37	0.00112
35.96	0.00108
37.46	0.00103

Interpreted PMT Test Results

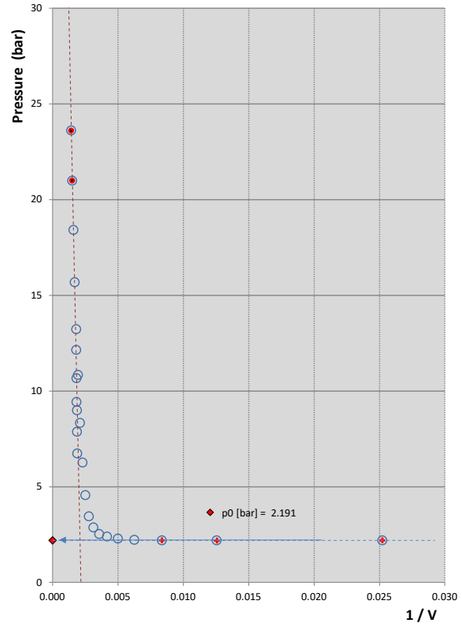
[30-second readings]			volume [cm³]	radial strain [%]	strain range [%]
p_0	2.19	[bar]	119.6	3.0	
p_L	57.75	[bar]			
p^*_L	55.56	[bar]			
p_Y	23.60	[bar]	700	16.4	
E_{PMT}	491	[bar]	662	15.6	{15.6 - 16.4 %}
E_{PMT} / p^*_L	8.8				
$E_{Unload\ 1}$	1791	[bar]	525	12.6	
$E_{Reload\ 1}$	1196	[bar]			
$E_{Unload\ 2}$	4160	[bar]	680	16.0	
$E_{Reload\ 2}$	2141	[bar]			



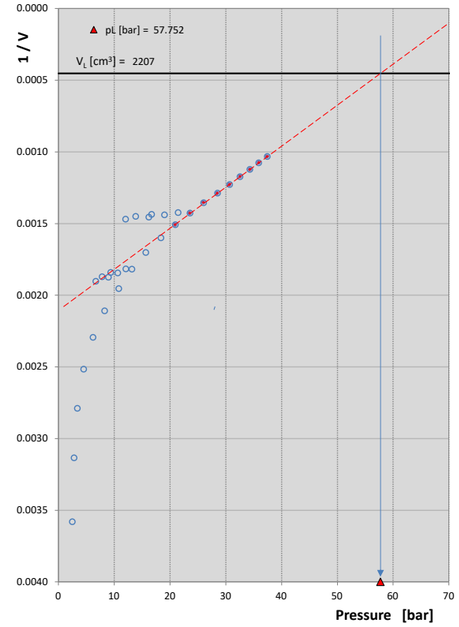
Pressuremeter test results [corrected data] pressure vs radial strain



Pressure difference from 15 to 30 sec. readings $\Delta p_{[15\text{-}30\ sec]}$



Determination of total contact pressure p_0



Determination of Limit Pressure p_L

Pressuremeter Equipment: TEXAM Model		Probe Designation : NX Probe (76 mm OD)		Drilling Method: Mud Rotary Drilling	Test Date: April 30, 2021	**Project:**	**685 Warden Avenue, Scarborough**	**PMT TEST No.:**	**3**
Volume-controlled test as per ASTM D4719 Method B		Probe No.: A 438		Drilling Bit: Tricone Bit					
Volume increments:	40 cm³	Calibration Record No.: 1		Time elapsed from hole drilling to testing ~ 5 minutes	Test Depth [m]: 19.46 (center of the probe)	Client:	Golder Associates		
Maximum Volume:	1400 cm³	Tubing Length: 160 [ft]		Engineer: Gabriel Sedran, P.Eng., Ph.D.				**Borehole No.:**	**BH 21-3**
Maximum Pressure:	100 bar	Probe Lenght: 0.46 [m]		Operator: Fabiano Sambati	Drilling Company: 3D Drilling	In-Depth Geotechnical Project No.:	IDG 210628		
		Probe Initial Volume: 1968 cm³							

Appendix Two

Pressuremeter Data Interpretation

Interpretation of Pressuremeter Test Results

Prebored pressuremeter test results are expressed in terms of applied pressure versus radial strain. Both pressure and strain measurements must be corrected for pressure and volume loses using the corresponding probe and system calibration curves.

The typical pressure versus radial strain curve features up to four distinctive portions which characterize the stress-strain behaviour of the soil, namely:

a) The linear pseudo-elastic stress-strain portion of the deformation curve;
b) The departure from linear elastic conditions starting at the yield pressure p_y;
c) The unload-reload portion of the test (usually two cycles are performed); and
d) The development of soil failure, which is represented by the net limit pressure p^*_L.

Based on these test features the following soil parameters are determined or estimated:

1. **Contact Pressure p_o**:

When using the prebored TEXAM unit, the initial contact pressure is taken as the pressure at the intersection of the two lines representing the pseudo elastic and the initial expansion portions of the pressure vs. 1/V plot, as shown in the PMT data sheets, in Appendix One.

2. **Pressuremeter modulus E_{PMT}**:

The pressuremeter modulus is represented by the slope of the pressure versus radial strain curve along its linear portion, and may be calculated as follows:

$$E_{PMT} = (1+\upsilon)(p_2 - p_1)\frac{\left(1+\left(\frac{\Delta R}{R_o}\right)_2\right)^2 + \left(1+\left(\frac{\Delta R}{R_o}\right)_1\right)^2}{\left(1+\left(\frac{\Delta R}{R_o}\right)_2\right)^2 - \left(1+\left(\frac{\Delta R}{R_o}\right)_1\right)^2}$$

where the sub-indices 1 and 2 indicate the beginning and the end of the linear portion of the curve, respectively. These two points are shown in pressuremeter curves with two red oversized circles. For the self-boring probe, the linear portion of the stress-strain response occurs between the very first data point (zero volume increase) and the subsequent two or three data points.

In this determination a value of the Poisson's ratio, typically $\nu = 0.33$ for most soils, must be assumed. For saturated clays a value of $\nu = 0.45$ is suggested.

3. **Yield Pressure** p_y:

The yield pressure indicates the end of the linear pseudo-elastic deformations and the onset of plasticity. This yield pressure is useful in indicating beyond which pressure significant creep deformations may occur.

4. **Unload-Reload Moduli** E_{Unload} and E_{Reload}

The unload and reload moduli are represented by the slope of the unload-reload loop, and they may be used to determine elastic soil deformations upon unloading or reloading conditions such as those typically encountered during excavations.

5. **Net Limit Pressure** p^*_L:

The net limit pressure is a measure of the strength of the soil (either under undrained conditions for cohesive soils, or drained conditions for non-cohesive soils). This parameter is defined as the pressure reached when the soil cavity has been extended to twice its original soil cavity volume V_c (minus the initial total contact pressure p_o).

The limit pressure is not always attained during testing. In such cases, the value of p_L is inferred by plotting pressure versus 1/V for the plastic phase of the deformations. This method of inferring p_L, known as the "upside down curve" method, is described in "*The Pressuremeter and Foundation Engineering*" textbook, by F. Baguelin, J.F. Jezequel, and D.H. Shields, published in 1978 by Trans Tech Publications, Section: Methods of extrapolating pressuremeter curves to p_L. See also ASTM D4719-00, Section 10.6.

It should be noted that radial strains are calculated from the volume of fluid (typically tap water) injected into the probe. In this regard, the radial strains shown in the results are related to the probe expansion, not the cavity's expansion. The cavity initial volume, V_c, is calculate by adding the probe initial volume, V_0, to the volume of water injected into the probe at the initial contact pressure p_0.

6. Some Additional PMT-based Parameters

In addition, two useful ratios, (E_{PMT} / p^*_L) and (p^*_L / p_y), may be used as a general guideline for soil identification, as follows:

for sands $\quad 7 < E_{PMT} / p^*_L < 12$

for clays $\quad 12 < E_{PMT} / p^*_L$

Many PMT tests completed in the glacial tills present in the geology of the Golden Shoe area (Ontario) registered much higher values than those listed above. In many cases, values for E_{PMT} / p^*_L in excess of 30 have been recorded.

The E_{PMT} / p^*_L value is known as the *mechanical ratio*, and it indicates whether a soil mass behaves in a ductile (high value) or brittle (low value) manner after yield stresses have been reached. This ration It is the PMT equivalent of the soil mechanic's Rigidity Index, e.g., G/σ_{max}.

Inferred Soil Parameters

7. Young's Modulus E_Y

The Pressuremeter modulus E_{PMT} corresponds to large strains, namely for radial strains in the 2 to 5 % range, and it is therefore considered to be a relatively low value of the elastic modulus. In practice, the Young's modulus E can be inferred from Pressuremeter testing using the empirical Menard α factor:

$E_Y = E_{PMT} / \alpha$

Typical values of the Menard α factor are suggested in the following Table:

Soil type	Peat		Clay		Silt		Sand		Sand and gravel	
	E/p_L^*	α	E/p_L^*	α	E/p_L^*	α	E/p_L^*	α	E/p_L^*	α
Over consolidated		1	> 16	1	> 14	2/3	> 12	1/2	> 10	1/3
Normally consolidated	For all values	1	9-16	2/3	8-14	1/2	7-12	1/3	6-10	1/4
Weathered and/or remoulded		1	7-9	1/2		1/2		1/3		1/4
Rock	Extremely fractured				Other				Slightly fractured or extremely weathered	
	α = 1/3				α = 1/2				α = 2/3	

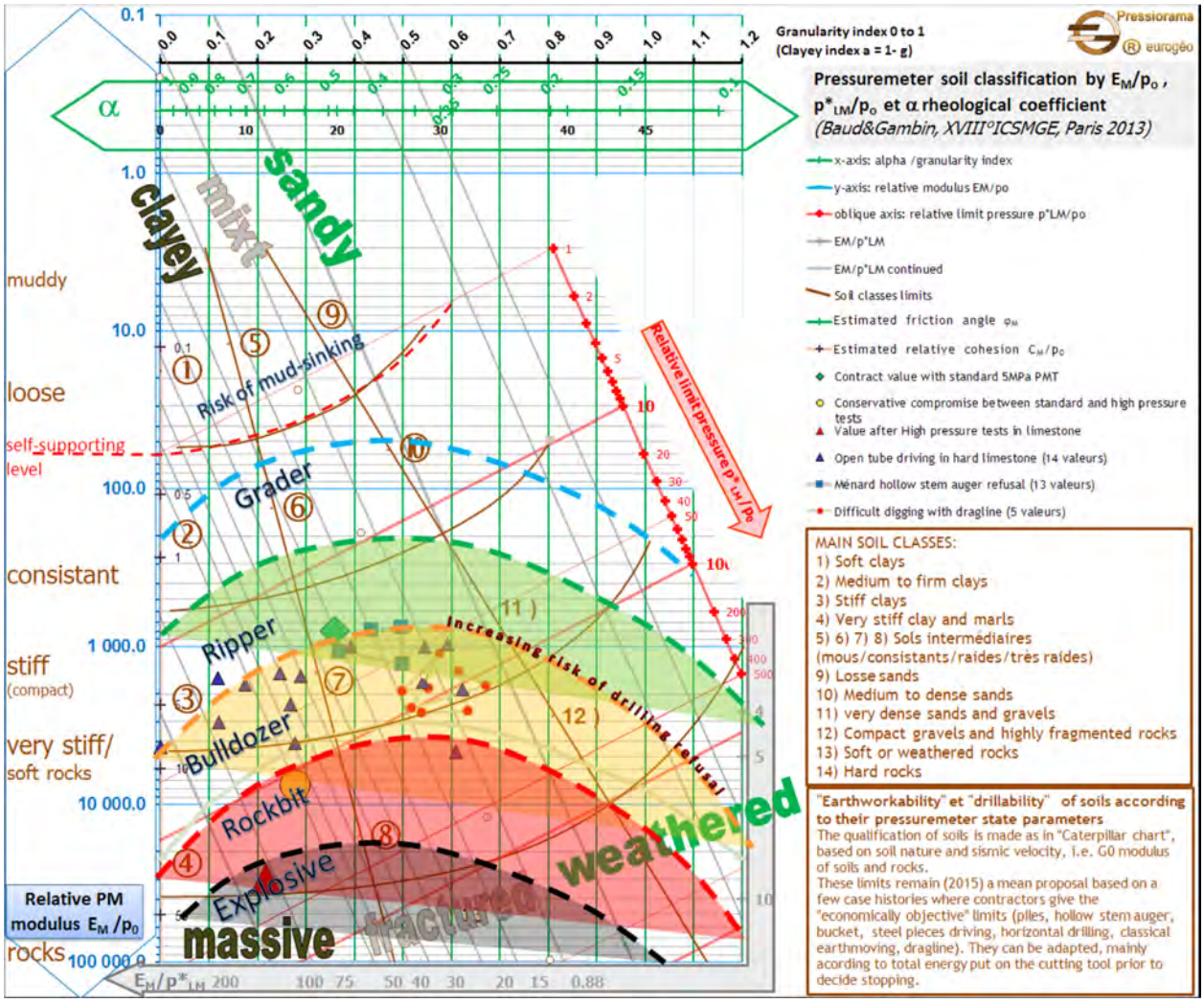
(from 'The Pressuremeter', J.L. Briaud. Balkema, 1992)

Alternatively, better-defined values of the Menard α parameter can be obtained using the following expression, as introduced by J.P. Baud

$$\alpha = \frac{\left(E_{PMT}/P_L^*\right)^{1/n}}{k_E \left(\frac{P_L^*}{p_0}\right)^{m/n}}$$

With $n = 2$; $m = 0.5$; and $k_E = 3.5$.

This expression is based on empirical correlations and may also be visualized in the Pressiorama Chart illustrated in the next page:



Baud J.P., and Gambin M. 2013. *"Détermination du coefficient rhéologique α de Ménard dans le diagramme Pressiorama"*. Proceedings of the 18th International Conference on Soil Mechanics and Geotechnical Engineering. Paris, 2013, Parallel Session ISP 6, International Symposium on the Pressuremeter.

8. Undrained Shear Strength for Cohesive Soil Materials

The undrained shear strength of cohesive soils, c_u or S_u, may be estimated as:

$$\frac{S_u}{p_a} = 0.21\left(\frac{p_L^*}{p_a}\right)^{0.75}$$

where p_a represents a reference pressure (i.e., atmospheric pressure = 100 kPa), after J.L. Briaud ('The Pressuremeter', Balkema, 1992).

9. Drained Friction Angle for Cohesionless Soil Materials

The drained friction angle of cohesionless soils (for $c' = 0$) may be estimated using the empirical correlations illustrated in the graph shown below. This approach is outlined by Baguelin et.al., in *"The Pressuremeter and Foundation Engineering"* (F. Baguelin; J.F. Jézéquel; and D.H. Shields. TransTech Publications. 1978), and it requires some knowledge on the state or conditions of the cohesionless material. This approach only provides a likely range of friction angles for recorded values of the limit pressure.

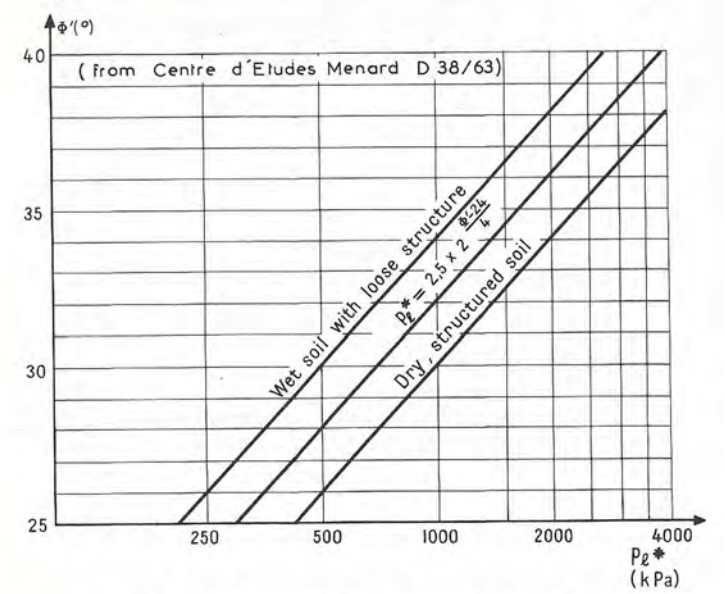


Fig. 6-86: MÉNARD's graph to determine Φ' from p_1^*.

Also alternatively, values of the drained friction angle ϕ' can be inferred using the modified Pressiorama Chart (*Pressiorama Cyclique, in French*) as introduced by Baud.

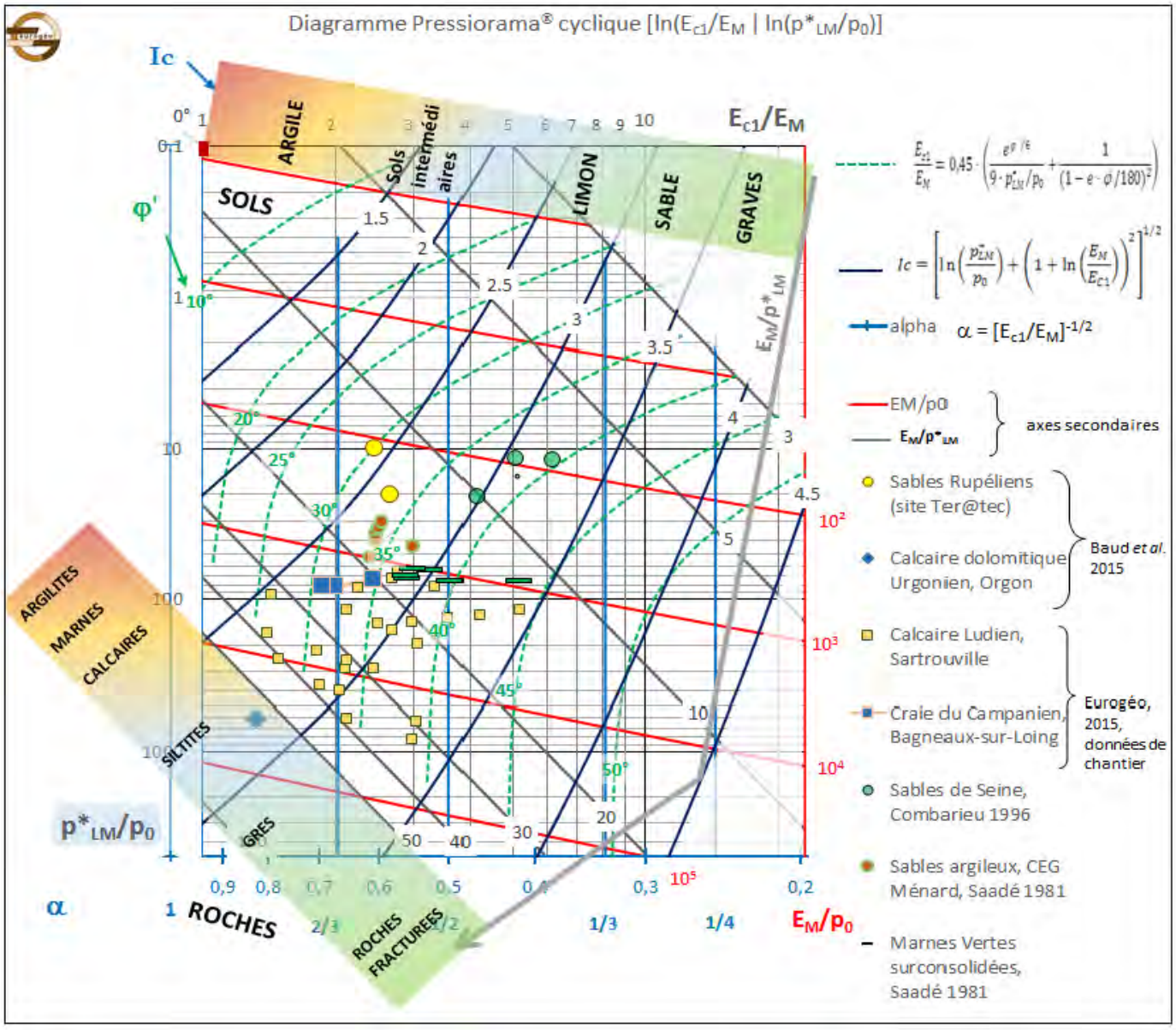


Figure 3. Diagramme Pressiorama® cyclique [ln(Ec1/EM | ln(p*LM/p0].

The values of ϕ' plotted in the modified Pressiorama Chart are calculated with the following expression:

$$\phi' = 5.5\, ln\left(\frac{9}{\alpha^2}\ \frac{P_L^*}{p_0}\right)$$

with values of α calculated/inferred from the modified Pressiorama Chart.

Where this expression provides values of effective friction angle greater than a 45°, a maximum value of 45° should be assumed.

This expression was presented by J.P. Baud, in his publication *"Apport de L'Essai Cyclique a la Classification Pressiométrique des Sols et des Roches"*, Journées Nationales de Geotechnique et de Géologie de l'Ingénieur, Nancy, 2016.

Shear strength parameters suggested in Table No. 3, are based on the guidelines provided by the *Pressiorama* and *Cyclique Pressiorama* charts. It should be noted that these guidelines are subject to changes, or improvements, as the correlations between pressuremeter parameters E_M, p'_L, and p_0 are being adjusted by ever increasing amount of field data. As such, care should be used when using these suggested parameters.

10. Soil Classification Index

Based on PMT testing procedures, soil behavior may be characterized as cohesive or frictional (cohesionless). Using the modified Pressiorama Chart, a Soil Classification Index, namely I_c, can be inferred with the following expression:

$$I_c = \left[\left(1 + log\left(P_L^*/p_0\right)\right)^2 + \left(1 - log(\alpha)\right)^2\right]^{½}$$

A minimum value of 1 would correspond to a cohesive soil, near its state of liquefaction. Whereas, a value of 4.5 would correspond to coarse gravel materials. A value of I_c = 2.7 would apply to a material which behaves mechanically as part frictional (drained for long-term loading conditions) and part cohesive (undrained for the short-term loading conditions). In general, Soil Type Behaviors corresponding to values of the Classification Index I_C are listed as:

1.0 to 1.5	Clays
1.5 to 2.5	Clay-Silt mixes
2.5 to 3.0	Silts
3.0 to 3.5	Sands
3.5 to 4.0	Gravels, and
4.0 to 4.5	Weathered Rocks

Appendix Three

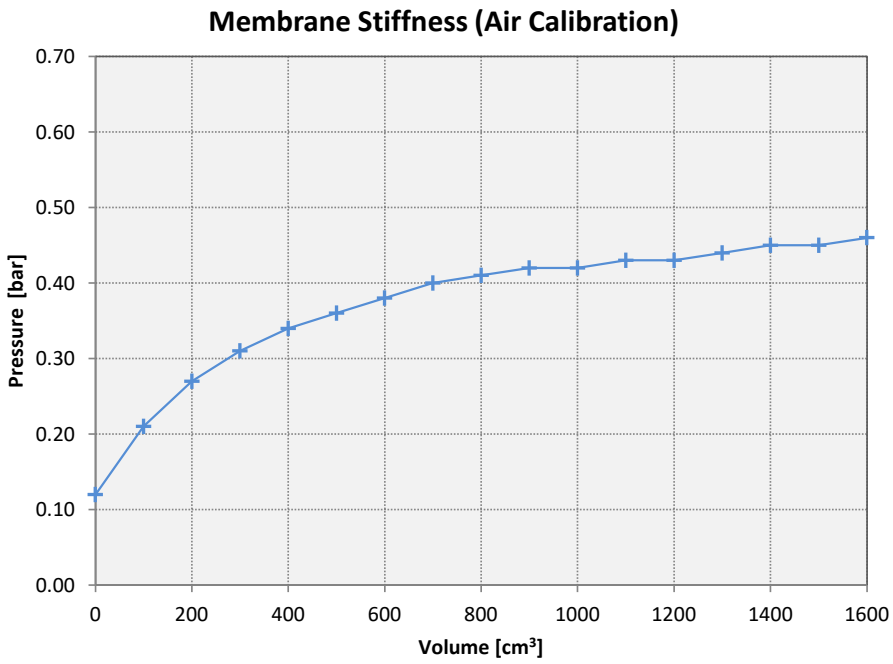
Calibration Data

Calibration Date:	January 21, 2021
Probe Designation:	A 438
Calibration Record No.:	1
Length of Tubing:	160 feet
Calibrated by:	S.H.

In-Depth Geotechnical Inc.

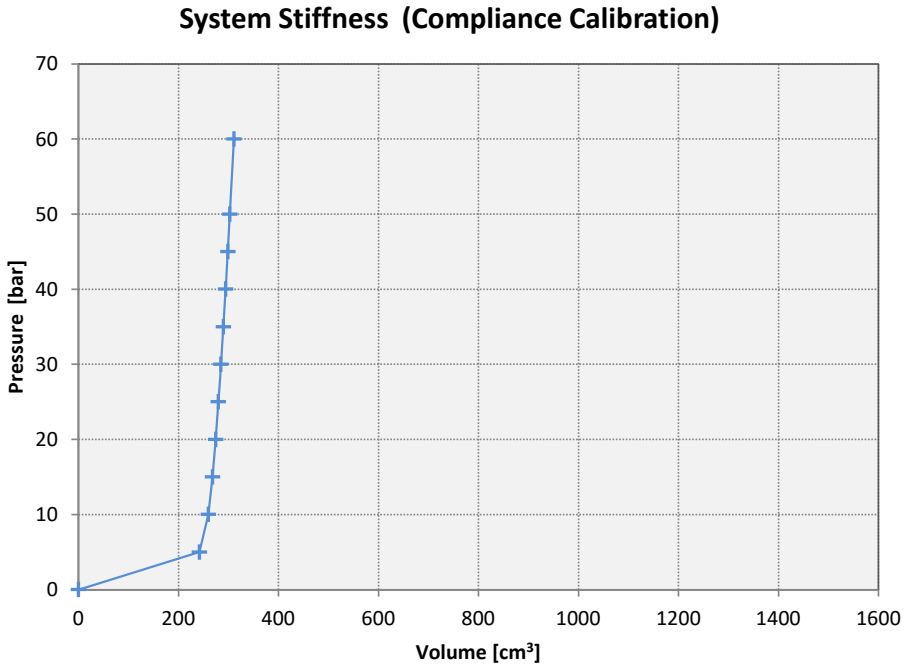
Membrane stiffness calibration

Pressure [bar]	Volume cm³
0.12	0
0.21	100
0.27	200
0.31	300
0.34	400
0.36	500
0.38	600
0.40	700
0.41	800
0.42	900
0.42	1000
0.43	1100
0.43	1200
0.44	1300
0.45	1400
0.45	1500
0.46	1600



Volume calibration

Pressure [bar]	Volume cm³
0	0.0
5	242.1
10	259.8
15	268.4
20	274.8
25	280.0
30	285.0
35	289.7
40	294.3
45	298.7
50	302.9
60	311.0
Reload Cal. Data	
25	284.1
50	303.4



APPENDIX F

Results of Chemical Laboratory Testing

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GOLDER ASSOCIATES LTD
#1, 215 SHIELDS COURT
MARKHAM, ON L3R 8V2
(905) 475-5591
ATTENTION TO: Alexander Dziedzic
PROJECT: 20139596(1000)
AGAT WORK ORDER: 20T589715
SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Lab Manager
DATE REPORTED: Apr 09, 2020
PAGES (INCLUDING COVER): 5
VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days following analysis, unless expressly agreed otherwise in writing. Please contact your Client Project Manager if you require additional sample storage time.*
- *AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.*
- *This report shall not be reproduced or distributed, in whole or in part, without the prior written consent of AGAT Laboratories.*
- *The test results reported herewith relate only to the samples as received by the laboratory.*
- *Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the information contained in this document.*
- *All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.*

AGAT Laboratories

5835 COOPERS AVENUE
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CANADA L4Z 1Y2
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http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 20T589715

PROJECT: 20139596(1000)

CLIENT NAME: GOLDER ASSOCIATES LTD

ATTENTION TO: Alexander Dziedzic

SAMPLING SITE:

SAMPLED BY:

Corrosivity Package

DATE RECEIVED: 2020-04-01

DATE REPORTED: 2020-04-09

Parameter	Unit	G / S	RDL	BH20-1 Sa 10,11,12 Soil 2020-03-30 1061500	BH20-5 Sa 9,10,11 Soil 2020-03-30 1061504
Chloride (2:1)	µg/g		2	13	49
Sulphate (2:1)	µg/g		2	62	62
pH (2:1)	pH Units		NA	8.32	8.31
Electrical Conductivity (2:1)	mS/cm		0.005	0.190	0.247
Resistivity (2:1) (Calculated)	ohm.cm		1	5260	4050
Redox Potential 1	mV		NA	232	236
Redox Potential 2	mV		NA	236	236
Redox Potential 3	mV		NA	248	239

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

1061500-1061504 EC, pH, Chloride and Sulphate were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil). Resistivity is a calculated parameter.
Redox potential measured on as received sample. Due to the potential for rapid change in sample equilibrium chemistry with exposure to oxidative/reduction conditions laboratory results may differ from field measured results.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
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CANADA L4Z 1Y2
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Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD

AGAT WORK ORDER: 20T589715

PROJECT: 20139596(1000)

ATTENTION TO: Alexander Dziedzic

SAMPLING SITE:

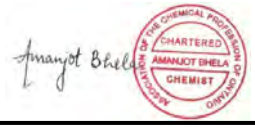
SAMPLED BY:

Soil Analysis

RPT Date: Apr 09, 2020			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Corrosivity Package															
Chloride (2:1)	1066100		9	9	NA	< 2	94%	70%	130%	103%	80%	120%	102%	70%	130%
Sulphate (2:1)	1066100		7	7	NA	< 2	101%	70%	130%	106%	80%	120%	107%	70%	130%
pH (2:1)	1060545		7.70	7.70	0.0%	NA	101%	90%	110%	NA			NA		
Electrical Conductivity (2:1)	1062244		0.253	0.254	0.4%	< 0.005	112%	80%	120%	NA			NA		
Redox Potential 1	1						100%	90%	110%						

Comments: NA signifies Not Applicable.
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.
If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.

Certified By:



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Method Summary

CLIENT NAME: GOLDER ASSOCIATES LTD

AGAT WORK ORDER: 20T589715

PROJECT: 20139596(1000)

ATTENTION TO: Alexander Dziedzic

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Chloride (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Electrical Conductivity (2:1)	INOR-93-6036	modified from MSA PART 3, CH 14 and SM 2510 B	EC METER
Resistivity (2:1) (Calculated)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Redox Potential 1	INOR-93-6066	modified G200-09, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 2	INOR-93-6066	modified G200-09, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 3	INOR-93-6066	modified G200-09, SM 2580 B	REDOX POTENTIAL ELECTRODE

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 20T589715

Cooler Quantity: Room

Arrival Temperatures: 4.8 | 4.6 | 4.5 / 3.7 | 3.5 | 3.4

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes:

Report Information:

Company: GOLDER
Contact: Alexander Dziedzic
Address: #1, 215 Shields Court
Markham, ON
Phone: L3R 8V2 Fax:

Reports to be sent to:
1. Email: alexander_dziedzic@golder.com
2. Email: rafael_abdulla@golder.com

Regulatory Requirements:

☑ No Regulatory Requirement

(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One) ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One) ☐ Coarse ☐ Fine

☐ Sewer Use
☐ Sanitary ☐ Storm
Region (Indicate One) ☐ MISA

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
(Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☐ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 20139596 (1000)
Site Location: 683 Warden Avenue
Sampled By: Alex Dziedzic
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company: GOLDER
Contact: alexanderDziedzic
Address: #1, 215 Shields Court, Markham, ON
Email: leanh_huynh@golder.com

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Y/N	Field Filtered - Metals, Hg, CrVI	O. Reg 153: Metals and Inorganics (☐ All Metals ☐ 153 Metals (excl. Hydrides) ☐ Hydride Metals ☐ 153 Metals (Incl. Hydrides))	ORPs: ☐ B-HWS ☐ Cl⁻ ☐ CN ☐ Cr^{6+} ☐ EC ☐ FOC ☐ Hg ☐ pH ☐ SAR	Full Metals Scan	Regulation/Custom Metals	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3+NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	PHCs F1 - F4	ABNs	PAHs	PCBs: ☐ Total ☐ Aroclors	Organochlorine Pesticides	TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Sewer Use	Corrosivity
BH20-1 Sa 10, 11, 12	Mar30	12:00	1	S																	✓
BH20-5 Sa 9, 10, 11	Mar30	12:00	1	S																	✓

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Alexander Dziedzic	Apr 1, 20	12:00		4/1/20	9:45
	4/1/20				

Page ____ of ____

N°: T 067865

AGAT Laboratories

5623 McADAM ROAD
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FAX (905)501-0589
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CLIENT NAME: GOLDER ASSOCIATES LTD
#1, 215 SHIELDS COURT
MARKHAM, ON L3R 8V2
(905) 475-5591

ATTENTION TO: Alexander Dziedzic

PROJECT: 20T589715

AGAT WORK ORDER: 20T590318

SOLID ANALYSIS REVIEWED BY: Sherin Moussa, Senior Technician

DATE REPORTED: Apr 06, 2020

PAGES (INCLUDING COVER): 5

Should you require any information regarding this analysis please contact your client services representative at (905) 501-9998

*NOTES

All samples are stored at no charge for 90 days. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

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TEL (905)501-9998
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http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 20T590318

PROJECT: 20T589715

CLIENT NAME: GOLDER ASSOCIATES LTD

ATTENTION TO: Alexander Dziedzic

(201-042) Sulfide

DATE SAMPLED: Apr 02, 2020 | DATE RECEIVED: Apr 03, 2020 | DATE REPORTED: Apr 06, 2020 | SAMPLE TYPE: Other

Analyte:	Sulfide
Unit:	%
Sample ID (AGAT ID) RDL:	0.05
BH20-1 Sa 10,11,12 (1065513)	0.06
BH20-5 Sa 9,10,11 (1065514)	0.06

Comments: RDL - Reported Detection Limit

Analysis performed at AGAT 5623 McAdam Rd., Mississauga, ON (unless marked by *)

Certified By: Sherin Moussa

AGAT Laboratories

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MISSISSAUGA, ONTARIO
CANADA L4Z 1N9
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FAX (905)501-0589
http://www.agatlabs.com

Quality Assurance - Replicate

AGAT WORK ORDER: 20T590318

PROJECT: 20T589715

CLIENT NAME: GOLDER ASSOCIATES LTD

ATTENTION TO: Alexander Dziedzic

(201-042) Sulfide

	REPLICATE #1				REPLICATE #2											
Parameter	Sample ID	Original	Replicate	RPD	Sample ID	Original	Replicate	RPD								
S	1065513	0.061	0.063	3.2%	1065514	0.059	0.058	1.7%								
Sulfate	1065513	< 0.01	< 0.01	0.0%	1065514	< 0.01	< 0.01	0.0%								
Sulfide	1065513	0.06	0.06	0.0%	1065514	0.06	0.06	0.0%								

AGAT Laboratories

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FAX (905)501-0589
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Quality Assurance - Certified Reference materials

AGAT WORK ORDER: 20T590318

PROJECT: 20T589715

CLIENT NAME: GOLDER ASSOCIATES LTD

ATTENTION TO: Alexander Dziedzic

(201-042) Sulfide

	CRM #1				CRM #2											
Parameter	Expect	Actual	Recovery	Limits	Expect	Actual	Recovery	Limits								
S	0.80	0.794	99%	90% - 110%	0.80	0.823	102%	90% - 110%								
Sulfate	0.01	0.01	100%	90% - 110%	0.01	0.01	100%	90% - 110%								
Sulfide	0.80	0.784	98%	90% - 110%	0.80	0.813	101%	90% - 110%								

5623 McADAM ROAD
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Method Summary

CLIENT NAME: GOLDER ASSOCIATES LTD

AGAT WORK ORDER: 20T590318

PROJECT: 20T589715

ATTENTION TO: Alexander Dziedzic

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Solid Analysis			
Sulfide	MIN-200-12037		LECO

AGAT Laboratories

5835 COOPERS AVENUE
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CANADA L4Z 1Y2
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CLIENT NAME: GOLDER ASSOCIATES LTD
#1, 215 SHIELDS COURT
MARKHAM, ON L3R 8V2
(905) 475-5591

ATTENTION TO: Rafael Abdulla

PROJECT: 20139596(1000)

AGAT WORK ORDER: 21T745922

SOIL ANALYSIS REVIEWED BY: Nivine Basily, Inorganics Report Writer

DATE REPORTED: May 19, 2021

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*Notes

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 21T745922

PROJECT: 20139596(1000)

CLIENT NAME: GOLDER ASSOCIATES LTD

ATTENTION TO: Rafael Abdulla

SAMPLING SITE:685 Warden

SAMPLED BY:RA

Corrosivity Package

DATE RECEIVED: 2021-05-12

DATE REPORTED: 2021-05-19

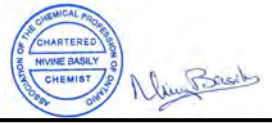
SAMPLE DESCRIPTION:				BH21-1 SA4-6	BH21-2 SA4-6	BH21-3 SA4-7	BH21-4 SA4-6
SAMPLE TYPE:				Soil	Soil	Soil	Soil
DATE SAMPLED:				2021-05-11	2021-05-11	2021-05-11	2021-05-11
Parameter	Unit	G / S	RDL	2459376	2459377	2459378	2459379
Chloride (2:1)	µg/g		2	13	63	7	116
Sulphate (2:1)	µg/g		2	52	63	62	66
pH (2:1)	pH Units		NA	7.99	8.09	8.16	8.13
Electrical Conductivity (2:1)	mS/cm		0.005	0.195	0.284	0.189	0.380
Resistivity (2:1) (Calculated)	ohm.cm		1	5130	3520	5290	2630
Redox Potential 1	mV		NA	451	418	394	422
Redox Potential 2	mV		NA	443	430	401	411
Redox Potential 3	mV		NA	420	435	408	412

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

2459376-2459379 EC, pH, Chloride and Sulphate were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil). Resistivity is a calculated parameter.
Redox potential measured on as received sample. Due to the potential for rapid change in sample equilibrium chemistry with exposure to oxidative/reduction conditions laboratory results may differ from field measured results.
Redox potential measurement in soil is quite variable and non reproducible due in part, to the general heterogeneity of a given soil. It is also related to the introduction of increased oxygen into the sample after extraction. The interpretation of soil redox potential should be considered in terms of its general range rather than as an absolute measurement.

Analysis perfomed at AGAT Toronto (unless marked by *)

Certified By:



AGAT Laboratories
5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD
AGAT WORK ORDER: 21T745922
PROJECT: 20139596(1000)
ATTENTION TO: Rafael Abdulla
SAMPLING SITE:685 Warden
SAMPLED BY:RA

Soil Analysis

RPT Date: May 19, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Corrosivity Package															
Chloride (2:1)	2450778		3	3	NA	< 2	96%	70%	130%	106%	80%	120%	104%	70%	130%
Sulphate (2:1)	2450778		<2	<2	NA	< 2	96%	70%	130%	103%	80%	120%	100%	70%	130%
pH (2:1)	2398611		8.46	8.62	1.9%	NA	100%	80%	120%						
Electrical Conductivity (2:1)	2459376	2459376	0.195	0.197	1.0%	< 0.005	98%	80%	120%						
Redox Potential 1	1						100%	90%	110%						

Comments: NA signifies Not Applicable.
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.

Duplicate NA: results are under 5X the RDL and will not be calculated.

Certified By:

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Method Summary

CLIENT NAME: GOLDER ASSOCIATES LTD

AGAT WORK ORDER: 21T745922

PROJECT: 20139596(1000)

ATTENTION TO: Rafael Abdulla

SAMPLING SITE:685 Warden

SAMPLED BY:RA

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Chloride (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	modified from EPA 9045D and MCKEAGUE 3.11	PH METER
Electrical Conductivity (2:1)	INOR-93-6036	modified from MSA PART 3, CH 14 and SM 2510 B	EC METER
Resistivity (2:1) (Calculated)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Redox Potential 1	INOR-93-6066	G200-20, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 2	INOR-93-6066	G200-20, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 3	INOR-93-6066	G200-20, SM 2580 B	REDOX POTENTIAL ELECTRODE

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 21T745922

Cooler Quantity: BAG

Arrival Temperatures: 4.8 | 4.5 | 4.9 | 4.7
ice | 2.9 | 2.9 | 2.7

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes:

Report Information:

Company: Golder Markham
Contact: Rafael Abdulla
Address: Unit #1 215 Shields Court
Markham ON L3R 8V2
Phone: 647-637-7480 Fax:
Reports to be sent to:
1. Email: rabdulla@golder.com
2. Email:

Regulatory Requirements:

(Please check all applicable boxes)

☐ Regulation 153/04
Table ____ *Indicate One*
☐ Ind/Com
☐ Res/Park
☐ Agriculture
Soil Texture *(Check One)*
☐ Coarse
☐ Fine

☐ Excess Soils R406
Table ____ *Indicate One*

☐ Regulation 558

☐ CCME

☐ Sewer Use
☐ Sanitary ☐ Storm
____ *Region*

☐ Prov. Water Quality Objectives (PWQO)

☐ Other
____ *Indicate One*

Turnaround Time (TAT) Required:

Regular TAT (Most Analysis) ☐ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

For 'Same Day' analysis, please contact your AGAT CPM

Project Information:

Project: 20139596 (1000)
Site Location: 685 Warden
Sampled By: RA
AGAT ID #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Is this submission for a **Record of Site Condition?** ☐ Yes ☐ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☐ No

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC (Y/N)	O. Reg 153: Metals & Inorganics	O. Reg 153: Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	O. Reg 153: BTEX, F1-F4 PHCs	O. Reg 153: Analyze F4G if required ☐ Yes ☐ No	O. Reg 153: PAHs	O. Reg 153: Total PCBs ☐ Aroclor	O. Reg 153: VOC	O. Reg 558: Landfill Disposal Characterization TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	O. Reg 406: Excess Soils SPLP Rainwater Leach	O. Reg 406: Excess Soils SPLP: ☐ Metals ☐ VOCs ☐ SVOCs	O. Reg 406: Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Salt - EC/SAR	Corrosivity	Potentially Hazardous or High Concentration (Y/N)
BH21-1 Sa 4-6	May 11	AM/PM	1	S															✓	
BH21-2 Sa 4-6	May 11	AM/PM	1	S															✓	
BH21-3 Sa 4-7	May 11	AM/PM	1	S															✓	
BH21-4 Sa 4-6	May 11	AM/PM	1	S															✓	
		AM/PM																		
		AM/PM																		
		AM/PM																		
		AM/PM																		
		AM/PM																		
		AM/PM																		
		AM/PM																		
		AM/PM																		

Samples Relinquished By (Print Name and Sign): Rafael Abdulla RAbdulla	Date 12/5/21	Time	Samples Received By (Print Name and Sign):	Date 5/12/21	Time 9:03
Samples Relinquished By (Print Name and Sign):	Date 5/12/21	Time 2pm	Samples Received By (Print Name and Sign):	Date	Time
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time

Page ____ of ____

N°: T 115487

5623 McADAM ROAD
MISSISSAUGA, ONTARIO
CANADA L4Z 1N9
TEL (905)501-9998
FAX (905)501-0589
http://www.agatlabs.com

CLIENT NAME: GOLDER ASSOCIATES LTD
#1, 215 SHIELDS COURT
MARKHAM, ON L3R 8V2
(905) 475-5591

ATTENTION TO: Rafael Abdulla

PROJECT: 21T745922

AGAT WORK ORDER: 21T747253

SOLID ANALYSIS REVIEWED BY: Sherin Moussa, Senior Technician

DATE REPORTED: May 21, 2021

PAGES (INCLUDING COVER): 5

Should you require any information regarding this analysis please contact your client services representative at (905) 501-9998

*NOTES

All samples are stored at no charge for 90 days. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 21T747253

PROJECT: 21T745922

CLIENT NAME: GOLDER ASSOCIATES LTD

ATTENTION TO: Rafael Abdulla

(201-042) Sulfide

DATE SAMPLED: May 13, 2021 | DATE RECEIVED: May 14, 2021 | DATE REPORTED: May 21, 2021 | SAMPLE TYPE: Other

Analyte:	Sulfide
Unit:	%
Sample ID (AGAT ID) RDL:	0.05
BH21-1 SA4-6-2459376 (2468649)	0.13
BH21-1 SA4-6-2459376-DUP (2468650)	0.13
BH21-2 SA4-6-2459377 (2468651)	0.14
BH21-3 SA4-7-2459378 (2468652)	0.13
BH21-4 SA4-6-2459379 (2468653)	0.21

Comments: RDL - Reported Detection Limit

Analysis performed at AGAT 5623 McAdam Rd., Mississauga, ON (unless marked by *)

Certified By: Sherin Moussa

AGAT Laboratories

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Quality Assurance - Replicate

AGAT WORK ORDER: 21T747253

PROJECT: 21T745922

CLIENT NAME: GOLDER ASSOCIATES LTD

ATTENTION TO: Rafael Abdulla

(201-042) Sulfide

	REPLICATE #1				REPLICATE #2											
Parameter	Sample ID	Original	Replicate	RPD	Sample ID	Original	Replicate	RPD								
S	2468649	0.129	0.126	2.4%	2468653	0.207	0.209	1.0%								
Sulfate	2468649	< 0.01	< 0.01	0.0%	2468653	< 0.01	< 0.01	0.0%								
Sulfide	2468649	0.13	0.13	0.0%	2468653	0.21	0.21	0.0%								

AGAT Laboratories

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Quality Assurance - Certified Reference materials

AGAT WORK ORDER: 21T747253

PROJECT: 21T745922

CLIENT NAME: GOLDER ASSOCIATES LTD

ATTENTION TO: Rafael Abdulla

(201-042) Sulfide

	CRM #1				CRM #2											
Parameter	Expect	Actual	Recovery	Limits	Expect	Actual	Recovery	Limits								
S	0.80	0.81	101%	90% - 110%	0.80	0.81	101%	90% - 110%								
Sulfate	0.01	0.01	100%	90% - 110%	0.01	0.01	100%	90% - 110%								
Sulfide	0.80	0.80	100%	90% - 110%	0.80	0.80	100%	90% - 110%								

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Method Summary

CLIENT NAME: GOLDER ASSOCIATES LTD

AGAT WORK ORDER: 21T747253

PROJECT: 21T745922

ATTENTION TO: Rafael Abdulla

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Solid Analysis			
Sulfide	MIN-200-12037		LECO

golder.com