

Geotechnical Investigation Report - 5329 Old Brock Road, Pickering, Ontario



2019-07-09

Prepared for:
1972229 Ontario Ltd.

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Table of Contents

1.0	INTRODUCTION	1
2.0	METHODOLOGY	2
2.1	Borehole Investigation	2
2.2	Physical Laboratory Testing	3
3.0	SUBSURFACE CONDITIONS	4
3.1	Silty Sand	4
3.2	Sandy Silt Till.....	5
3.3	Bedrock	5
3.4	Groundwater.....	5
4.0	GEOTECHNICAL CONSIDERATIONS	7
4.1	General Site Preparation	7
4.2	Frost Penetration	7
4.3	Excavations	8
4.4	Dewatering	8
4.5	Backfill and Compaction	9
4.6	Foundation Design	9
4.7	Floor Slabs	10
4.8	Buried Utilities	10
4.9	Design Review and Inspections	11
5.0	CLOSING	12



List of Embedded Tables

Table 1	Particle Size Distribution Analysis – Silty Sand.....	4
Table 2	Particle Size Distribution Analysis – Sandy Silt.....	5
Table 3	Groundwater Levels Observed in Boreholes	6

List of Appended Figures

Figure 1	Site Plan
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List of Appendices

Appendix A	Borehole Logs
Appendix B	Physical Laboratory Testing Results



1.0 INTRODUCTION

Cambium Inc. (Cambium) was retained by 1972229 Ontario Ltd. (Client) to complete a geotechnical investigation in support of the design and construction of a metal fabricated storage barn and a trailer office located at 5329 Old Brock Road in Pickering, Ontario (Site).

The Site is located approximately 100 m north of the CP rail line within Hamlet of Claremont, Pickering. The purpose of this geotechnical investigation was to obtain information about the subsurface conditions by means of a number of boreholes and based on the findings provide recommendations pertaining to the geotechnical design of the proposed structure and facilities. This report presents the methodology and findings of the geotechnical investigation at the Site and addresses requirements and constraints for the design and construction of the proposed structure and facilities.



2.0 METHODOLOGY

2.1 Borehole Investigation

Cambium completed a geotechnical investigation at the Site on June 20, 2019. A total of Four (4) boreholes, designated as BH (MW)101-19 through BH (MW)104-19, were advanced into the subsurface at predetermined locations throughout the Site. One (1) borehole (BH (MW)102-19) was terminated at depths of 6.5 m below ground surface (mgs). The other Three (3) boreholes were terminated at 5.0 mbgs. The location of the boreholes was obtained from a handheld GPS unit while the elevation of the boreholes was surveyed relative to BM (culvert at the entrance of the property as benchmark). The elevation of the top of culvert at inlet side is having a geodetic elevation of 270.53 masl according to the survey plan provided by the client. A Site Plan, including borehole locations and benchmark is appended as Figure 1 of this report.

Drilling and sampling was completed using a track-mounted drill rig operating under the supervision of a Cambium technician. The boreholes were advanced to the sampling depths by means of continuous flight solid or hollow stem augers with 50 mm O.D. split spoon samplers. Standard Penetration Test (SPT) N values were recorded for the sampled intervals as the number of blows required to drive a split spoon sampler 305 mm into the soil, using a 63.5 kg drop hammer falling 750 mm, as per ASTM D1586 procedures. The SPT N values are used in this report to assess consistency of cohesive soils and relative density of non-cohesive materials. Soil samples were collected at approximately 0.75 m intervals in the upper 3.0 m depth and in 1.5 m intervals below 3.0 m depth. The encountered soil units were logged in the field using visual and tactile methods, and samples were placed in labelled plastic bags for transport, future reference, possible laboratory testing, and storage.

Open boreholes were checked for groundwater and general stability prior to backfilling. Borehole BH101-19, BH102-19 and BH104-19 were outfitted as monitoring wells in order to understand the groundwater conditions at the site. All other boreholes were backfilled and sealed in accordance with Ontario Regulation (O.Reg.) 903, as amended, and the property was reinstated to pre-existing conditions.



Borehole logs are provided in Appendix A. Site soil and groundwater conditions are described and geotechnical recommendations are discussed in the following sections of this report.

2.2 Physical Laboratory Testing

Physical laboratory testing, including Three (3) particle size distribution analyses (LS-702,705), was completed on selected soil samples to confirm textural classification and to assess geotechnical parameters. Moisture content testing was completed on all soil samples. Testing results are presented in Appendix B and are discussed in Section 3.0.



3.0 SUBSURFACE CONDITIONS

The detailed soil profiles encountered in the boreholes are indicated on the attached borehole logs in Appendix A. It should be noted that the conditions indicated on the borehole logs are for specific locations only, and can vary between and beyond the borehole locations. It should be also noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones and should not be interpreted as exact planes of geological change. In addition, the descriptions provided in the borehole logs are inferred from a variety of factors, including: visual observations of the soil samples retrieved, laboratory testing, measurements prior to and after drilling, and the drilling process itself (speed of drilling, shaking/grinding of the augers, etc.).

Based on the results of the borehole investigation, subsurface conditions at the Site generally consist of silty sand overlying deposits of sandy silt till materials. Bedrock was not encountered during the investigation.

3.1 Silty Sand

A layer of silty sand was found in all boreholes, the thickness of the silty sand deposit was between 0.6 m to 1.2 m. Standard Penetration Test (SPT) "N"-values measured within the silty sand ranged from 2 blows to over 25 blows per 0.3 m of penetration, and as such, the compactness of the silty sand deposit ranges from very loose to compact. The natural water content of the silty sand deposit ranges from 9.3% to 21.8%.

A laboratory particle size distribution analysis was completed for one (1) sample of the silty sand material, taken from a depth of between 0.8 mbgs and 1.2 mbgs. The analysis results are summarized in Table 1 and provided in Appendix B.

Table 1 Particle Size Distribution Analysis – Silty Sand

Borehole	Depth (mbgs)	Soil	% Gravel	% Sand	% Silt	% Clay	% Moisture Content
BH104-19-SS2	0.8 – 1.2	Silty Sand, some Gravel, some Clay	13	52	22	12	16.8



3.2 Sandy Silt Till

Beneath the silty sand, a layer of sandy silt was encountered at all boreholes at a depth of 0.6 to 1.2 mbgs and extended to the depth of borehole termination between 5.0 mbgs to 6.5 mbgs. The texture of this light brown native till was predominantly sandy silt with trace gravel and some clay.

This soil was encountered in a damp to moist in-situ condition with moisture contents varying from 12.2% to 22.6% and loose to compact relative density based on SPT N values between 8 and 22 per 0.3 m of penetration.

Laboratory particle size distribution analyses were completed for two (2) samples of the native sandy silt material, taken from a depth of between 1.5 mbgs to 2.7 mbgs. The analysis results are summarized in Table 2 and provided in Appendix B.

Table 2 Particle Size Distribution Analysis – Sandy Silt

Borehole	Depth (mbgs)	Soil	% Gravel	% Sand	% Silt	% Clay	% Moisture Content
BH102-19-SS3	1.5 – 2.0	Sandy Silt some Clay trace Gravel	6	32	46	16	11.8
BH101-19-SS4	2.3 – 2.7	Sandy Silt some Clay trace Gravel	5	29	54	12	12.7

3.3 Bedrock

No bedrock was encountered during the course of this investigation.

3.4 Groundwater

All boreholes were found to have some groundwater seepage upon completion excluding. The water elevations were measured on completion of drilling and prior to backfill. During drilling, short-term groundwater table was found at depths of 1.0 m to 3.4 m below the existing grade as listed on Table 3 below. The stabilized groundwater levels observed in the monitoring wells on June 24, 2019 were at depth ranging from 0.70 mbgs to 0.84 mbgs, corresponding to Elevations from 269.3 m to 269.9 m, as listed on Table 3. It should be noted that the groundwater levels at the site may fluctuate seasonally and in response to climatic events.



Table 3 Groundwater Levels Observed in Boreholes

Borehole	Date of Drilling	Date of Observation	Depth of Groundwater (mbgs)	Notes
MW101-19	June 20, 2019	June 20, 2019 June 24, 2019	2.4 0.84	During drilling Monitoring Well
MW102-19	June 20, 2019	June 20, 2019 June 24, 2019	3.4 0.70	During drilling Monitoring Well
BH103-19	June 20, 2019	June 20, 2019	1.8	During drilling
MW104-19	June 20, 2019	June 20, 2019 June 24, 2019	1.0 0.84	During drilling Monitoring Well



4.0 GEOTECHNICAL CONSIDERATIONS

The following recommendations are based on the borehole information and are intended to assist designers. Recommendations should not be construed as providing instructions to contractors, who should form their own opinions about site conditions. It is possible that subsurface conditions beyond the borehole locations may vary from those observed. If significant variations are found before or during construction, Cambium should be contacted so that we can reassess our findings, if necessary.

4.1 General Site Preparation

Although no boreholes were advanced in vegetated area during this investigation. The existing site vegetation, surficial topsoil/organics materials and other near surface soils containing significant amounts of organic matter are not considered to be suitable for the subgrade support of building foundations, floor slabs, or other settlement sensitive structures or engineered fill materials that support these structures. The non-organic granular fill material however can be excavated and stockpiled on Site for reuse as backfill for trenches and site grading.

Based on the recommended excavation depths for the foundation area, the subgrade material is expected to consist of loose to compact sandy silt material. The native subgrade at the base of the trenches should be inspected by a Geotechnical Engineer and proof rolled prior to backfilling.

In areas of cut or minor fill where the proof roll and/ or inspection has identified unsuitable subgrade conditions, whether too soft or too wet, material is to be removed and replaced with an approved OPSS 1010 SSM or Granular 'B' Type I compacted material, under guidance of Cambium Staff.

4.2 Frost Penetration

Based on the Ontario Provincial Standard Drawing (OPSD) 3090.101, the typical frost penetration depth for the proposed structure is expected to be approximately 1.4 mbgs.



Footings for the proposed structure should be situated at or below this depth for frost penetration or should be protected. If construction is carried out during the winter months, all footing locations where excavated soils become exposed to potential frost penetration should be poured within the day to prevent potential future settlements. If the footings cannot be poured within the same day the soils are excavated, the surface should be covered with thermal insulation equivalent to 1.4 m of soil cover to prevent potential freezing of the frost susceptible soils at the Site.

It is assumed that any pavement structure thickness will be less than 1.4 m; therefore, grading and drainage are important for good pavement performance and life expectancy. Any utilities should be located below this depth or be appropriately insulated.

4.3 Excavations

Temporary excavations must be carried out in accordance with the latest edition of the Occupational Health and Safety Act (OHSA). As per the OHSA, excavations less than 1.2 m deep can have unsupported vertical walls. Areas of compact to dense soils encountered above the groundwater table may be generally be classified as Type 3 soils in accordance with OHSA, with unsupported side slopes no steeper than 1H:1V to the bottom of the excavation.

Excavation side slopes should be protected from exposure to precipitation and associated ground surface runoff and should be inspected regularly for signs of instability. If localized instability is noted during excavations or if wet conditions are encountered, the side slopes should be flattened as required to maintain safe working conditions or excavation sidewalls must be fully supported (shored).

4.4 Dewatering

As discussed in previous section, groundwater was observed on monitoring well at a depth between 0.7 mbgs and 0.84 mbgs. It should be noted that the groundwater table is influenced by seasonal fluctuations and major precipitation events.

It is understood the proposed development will not involved large or deep excavations. Overall, minor groundwater seepage may be anticipated during typical excavations and any



groundwater seepage that is encountered should be controllable with filtered sumps and pumps. Registration on the Environmental Activity and Sector Registry (EASR) or a Permit to Take Water (PTTW) is likely not required from the Ministry of the Environment Conservation and Parks (MOECP) as pumping rates should not exceed 50,000 L/day or 400,000 L/day respectively. Large open excavations or excavations extending significantly below the groundwater table will experience a larger volume of groundwater seepage and may require more advanced dewatering efforts.

4.5 Backfill and Compaction

Excavated non-organic fill and native sand and silt soils from the site may be appropriate for use as fill below grading and parking areas, provided that the actual or adjusted moisture content at the time of construction is within a range that permits compaction to required densities. Some moisture content adjustments may be required depending on seasonal conditions. Geotechnical inspections and testing of engineered fill are required to confirm acceptable quality.

Engineered fill for foundations should consist of free-draining granular material meeting the specifications of OPSS 1010 Granular B or an approved equivalent, and should be placed in maximum 200 mm thick lifts compacted to a minimum of 100 percent standard Proctor maximum dry density (SPMDD) as confirmed by nuclear densometer testing. Foundation wall backfill should consist of imported free-draining granular material meeting the specifications for OPSS Granular B, or an approved equivalent, compacted to 98 percent SPMDD, taking care to keep heavy compaction equipment from damaging the walls.

The backfill material, if any, in the upper 300 mm below the pavement subgrade elevation should be compacted to 100 percent SPMDD in all areas.

4.6 Foundation Design

If the Site is prepared as outlined in Section 4.1, the native sandy silt soil is competent to support the building on conventional strip and spread footings at a minimum depth of 1.4 mbgs. Assuming any new exterior footings will be placed a minimum of 1.4 m below final



adjacent grade for frost protection, these footings can be founded on compact native sandy silt material at depth. Conventional spread and strip footings foundations for lightly structures on the competent native soils may be designed using a factored geotechnical resistance at Ultimate Limit States (ULS) of 125 kPa and a geotechnical resistance at Serviceability Limit States (SLS) of 75 kPa (assuming 25 mm total and 19 mm differential of settlement).

If a higher allowable bearing capacity than that outlined above is required, it may be achievable at a greater depth.

The quality of the subgrade should be inspected by Cambium during construction, prior to constructing the footings and placing engineered fill, to confirm bearing capacity estimates. Engineered fill should be placed and compacted as discussed in Section 4.5.

4.7 Floor Slabs

The floor slabs for the proposed structures may be constructed using conventional concrete poured slab techniques, following removal of soft soils otherwise deleterious soils and preparation of the subgrade as outlined in Section 4.1. To create a stable working surface, to distribute loadings, and for drainage purposes, the floor slabs should be constructed on a minimum of 200 mm of OPSS 1010 Granular A compacted to 98% of SPMDD.

4.8 Buried Utilities

Trench excavations should generally consider Type 3 soil conditions which require side slopes no steeper than 1H:1V to the bottom of the excavation. Where very loose or very soft to soft soils are encountered during excavations, trench slopes should generally consider Type 4 soil conditions which require side slopes no steeper than 3H:1V to the bottom of the excavation. The bedding and cover material for any buried utilities should consist of OPSS 1010 Granular A or B Type II, placed in accordance with pertinent Ontario Provincial Standard Drawings (OPSD 802.013). The bedding and cover material shall be placed in maximum 200 mm thick lifts and should be compacted to at least 98% of SPMDD. The cover material shall be a minimum of 300 mm over the top of the pipe and compacted to 98% of SPMDD, taking care not to damage the utility pipes during compaction.



If wet or saturated conditions exist within any utility excavation, consideration should be given to using 19 mm diameter crushed clear stone wrapped in a geotextile filter fabric as pipe bedding.

4.9 Design Review and Inspections

Cambium should be contacted to review and approve design drawings, prior to tendering or commencing construction, to ensure that all pertinent geotechnical-related factors have been addressed.

Cambium should be retained to complete testing and inspections during construction operations to examine and approve subgrade conditions, placement and compaction of fill materials, granular base courses, and asphaltic concrete.



5.0 CLOSING

Please note that this report is governed by the attached qualifications and limitations. If you have questions or comments regarding this document, please do not hesitate to contact the undersigned at 905-725-6280.

Cambium Inc.

Zhaochang Luo, M.Eng., P.Eng.
Project Manager – Geotechnical

Stuart Baird, M.Eng., P.Eng.
General Manager - Geotechnical

ZL/seb

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Qualifications and Limitations

Limited Warranty

In performing work on behalf of a client, Cambium relies on its client to provide instructions on the scope of its retainer and, on that basis; Cambium determines the precise nature of the work to be performed. Cambium undertakes all work in accordance with applicable accepted industry practices and standards. Unless required under local laws, other than as expressly stated herein, no other warranties or conditions, either expressed or implied, are made regarding the services, work or reports provided.

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A site assessment is created using data and information collected during the investigation of a site and based on conditions encountered at the time and particular locations at which fieldwork is conducted. The information, sample results and data collected represent the conditions only at the specific times at which and at those specific locations from which the information, samples and data were obtained and the information, sample results and data may vary at other locations and times. To the



extent that Cambium's work or report considers any locations or times other than those from which information, sample results and data was specifically received, the work or report is based on a reasonable extrapolation from such information, sample results and data but the actual conditions encountered may vary from those extrapolations.

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Appended Figures

**GEOTECHNICAL
INVESTIGATION -
5329 OLD BROCK ROAD**
GRANT MORRIS ASSOCIATES LTD.
5329 Old Brock Road,
Pickering, Ontario

LEGEND

-  Borehole
-  Benchmark
-  Monitoring Well
-  Subject Property

Notes:
 - Base mapping features were obtained from Google Earth 2018 imagery, retrieved June 2019.
 - Distances on this plan are in metres and can be converted to feet by multiplying by 3.28084.
 - The user assumes every effort to ensure this map is free from error but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

Benchmarks:
 BM1 - The top edge of a culvert located at the northern end of the driveway, adjacent to Old Brock Road.



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BOREHOLE LOCATION PLAN

Project No.:	8964-001	Date:	June 2019
Scale:	1:750	Projection:	NAD 1983 UTM Zone 17N
Created by:	MAT	Checked by:	ZL
		Figure:	1





Appendix A
Borehole Logs



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Log of Borehole:

MW101-19

Page 1 of 1

Client: 1972229 Ontario Ltd.
Contractor: Drilltech
Location: 5329 Old Brock Road, Pickering

Project Name: Geo-Environmental Studies
Method: Solid Stem Auger
UTM: 17T 649875 m E 4871967 m N

Project No.: 8964-001
Date Completed: June 20, 2019
Elevation: 270.730 masl

SUBSURFACE PROFILE			SAMPLE													
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture			SPT (N) / DCPT	Well Installation	Remarks			
								25	50	75	10	20	30	40		
271	0	SILTY SAND: Brown silty sand, some gravel, trace clay, compact		1	SS	70	9									
270	-1			2	SS	100	16									
269	-2	SANDY SILT: Light brown sandy silt till, trace gravel, some clay, compact		3	SS	100	21									
268	-3			4	SS	100	17									
267	-4	SANDY SILT: -become grey		5	SS	75	22									
266	-5			6	SS	85	13									
		Borehole terminated at 5.0 mbgs in sandy silt till														

PVC Riser
 Bentonite Plug
 Sand Pack
 PVC Screen
 Cap

: GSA SS4:
 5% Gravel
 29% Sand
 54% Silt
 12% Clay

Water level at 2.4 mbgs upon completion

Logged By: P.Ahuja

Input By: Z. Luo



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Log of Borehole:

MW102-19

Page 1 of 1

Client: 1972229 Ontario Ltd.
Contractor: Drilltech
Location: 5329 Old Brock Road, Pickering

Project Name: Geo-Environmental Studies
Method: Solid Stem Auger
UTM: 17T 649896 m E 4871971 m N

Project No.: 8964-001
Date Completed: June 20, 2019
Elevation: 270.630 masl

SUBSURFACE PROFILE				SAMPLE											
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture			SPT (N) / DCPT	Well Installation	Remarks		
								25	50	75				10	20
270	0	SILTY SAND: Brown silty sand, some gravel, trace clay, compact		1	SS	75	14					PVC Riser Bentonite Plug			
269	1	SANDY SILT: Light brown sandy silt till, trace gravel, some clay, compact		2	SS	60	8					Sand Pack PVC Screen	: GSA SS3: 6% Gravel 32% Sand 46% Silt 16% Clay		
268	2					3	SS	100	13						
						4	SS	100	12						
267	3	SANDY SILT: -become grey		5	-	0	10					Water level at 3.4 mbgs upon completion			
266	4					6	SS	90	9						
265	5											Cap			
264	6			7	SS	75	14								
	7		Borehole terminated at 6.5 mbgs in sandy silt till												

Logged By: P.Ahuja

Input By: Z. Luo



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Log of Borehole:

BH103-19

Page 1 of 1

Client: 1972229 Ontario Ltd.
Contractor: Drilltech
Location: 5329 Old Brock Road, Pickering

Project Name: Geo-Environmental Studies
Method: Solid Stem Auger
UTM: 17T 649876 m E 4871956 m N

Project No.: 8964-001
Date Completed: June 20, 2019
Elevation: 270.523 masl

SUBSURFACE PROFILE				SAMPLE							Well Installation	Remarks					
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture					SPT (N) / DCPT				
								25	50	75	10	20	30	40			
270	0		SILTY SAND: Brown silty sand, some gravel, trace clay, compact	1	SS	100	25										
269	1		SANDY SILT: Light brown sandy silt till, trace gravel, some clay, loose to compact	2	SS	100	4										
268	2			3	SS	90	7										
267	3			4	SS	90	9										
266	4			SANDY SILT: -become grey	5	SS	80	17									
265	5		6		SS	80	16										
			Borehole terminated at 5.0 mbgs in sandy silt till													Water level at 1.8 mbgs upon completion	

Logged By: P.Ahuja

Input By: Z. Luo



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Log of Borehole:

MW104-19

Page 1 of 1

Client: 1972229 Ontario Ltd.
Contractor: Drilltech
Location: 5329 Old Brock Road, Pickering

Project Name: Geo-Environmental Studies
Method: Solid Stem Auger
UTM: 17T 649895 m E 4871955 m N

Project No.: 8964-001
Date Completed: June 20, 2019
Elevation: 270.555 masl

SUBSURFACE PROFILE				SAMPLE					Well Installation	Remarks				
Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture			SPT (N) / DCPT			
								25	50	75	10	20	30	40
270	0	Silty Sand: Brown sand and silt, some gravel, trace clay, compact		1	SS	60	10							
	1			2	SS	75	2							
269		SANDY SILT: Light brown sandy silt till, trace gravel, some clay, very loose to compact		3	SS	90	6							
268	2			4	SS	75	6							
267		SANDY SILT: -become grey		5	SS	100	9							
266	4			6	SS	100	12							
	5	Borehole terminated at 5.0 mbgs in sandy silt till												

: GSA SS4:
 13% Gravel
 52% Sand
 22% Silt
 12% Clay

Water level at 1.0 mbgs upon completion

Logged By: P. Ahuja

Input By: Z. Luo



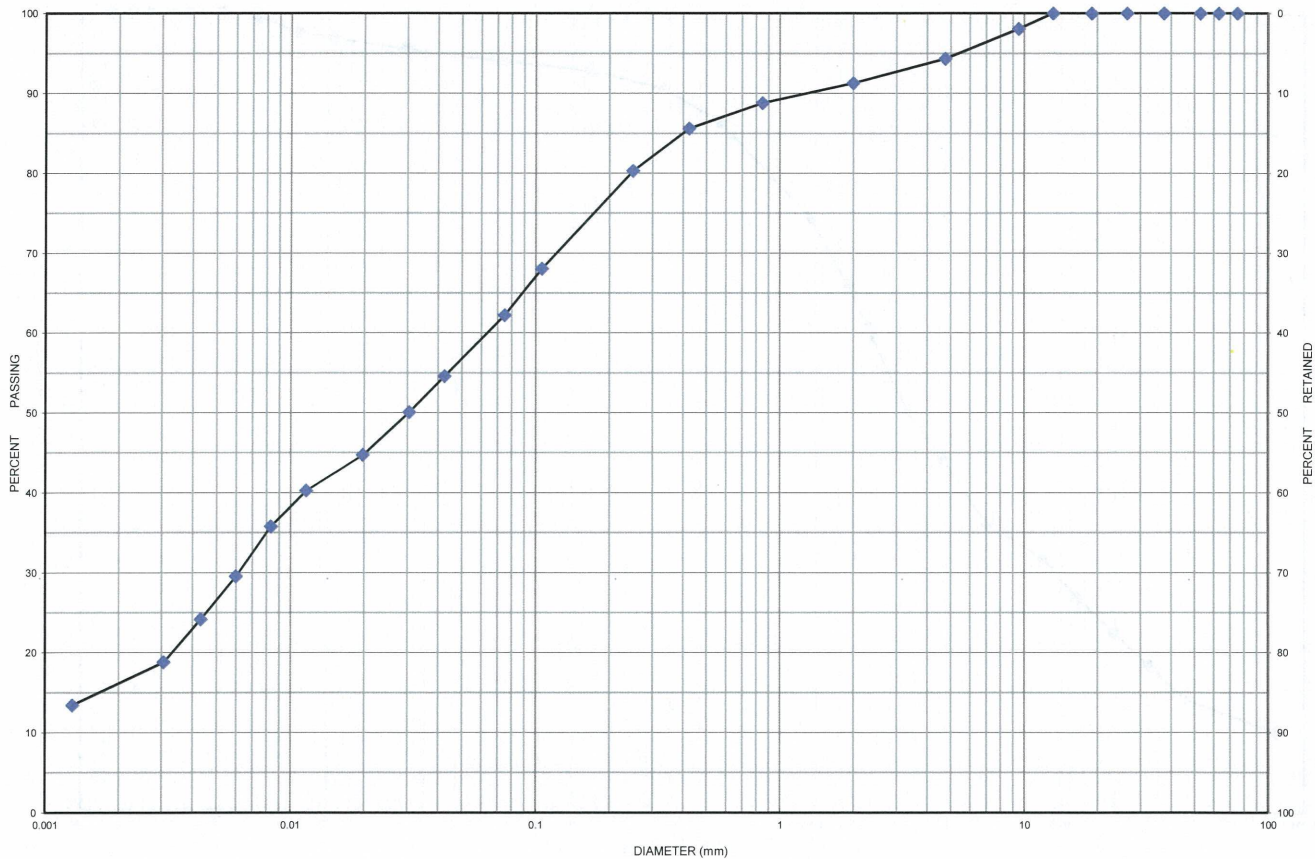
Appendix B
Physical Laboratory Testing Results



Grain Size Distribution Chart

Project Number: 8964-001 **Client:** 1972229 Ontario Ltd.
Project Name: Geo-Environmental Studies - 5329 Old Brock Road
Sample Date: June 24, 2019 **Sampled By:** Prateek Ahuja - Cambium Inc.
Location: BH 102-19 SS 3 **Depth:** 1.5 m to 2 m **Lab Sample No:** S-19-0461

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 102-19	SS 3	1.5 m to 2 m	6	32	62		11.8
Description		Classification	D ₆₀	D ₃₀	D ₁₀	C _u	C _c
Sandy Silt some Clay trace Gravel		ML	0.064	0.0063	-	-	-

Issued By: *John Baird*
 (Senior Project Manager)

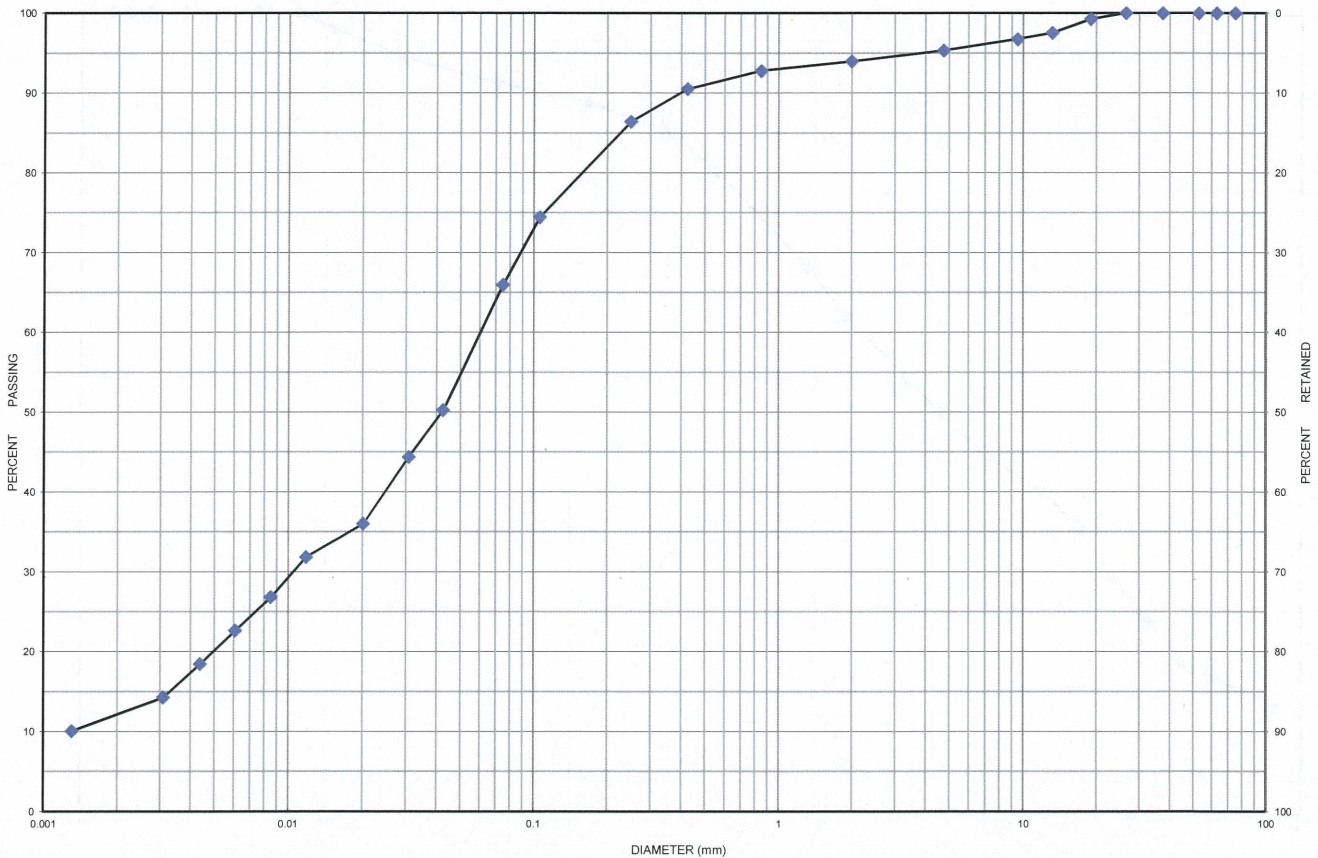
Date Issued: July 8, 2019



Grain Size Distribution Chart

Project Number: 8964-001 **Client:** 1972229 Ontario Ltd.
Project Name: Geo-Environmental Studies - 5329 Old Brock Road
Sample Date: June 24, 2019 **Sampled By:** Prateek Ahuja - Cambium Inc.
Location: BH 101-19 SS 4 **Depth:** 2.3 m to 2.7 m **Lab Sample No:** S-19-0460

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT (<0.075 mm)	SAND (<4.75 mm to 0.075 mm)			GRAVEL (>4.75 mm)	
	FINE	MEDIUM	COARSE	FINE	COARSE



MIT SOIL CLASSIFICATION SYSTEM								
CLAY	SILT	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	BOULDERS
		SAND			GRAVEL			

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 101-19	SS 4	2.3 m to 2.7 m	5	29	66		12.7
Description		Classification	D ₆₀	D ₃₀	D ₁₀	C _u	C _c
Sandy Silt some Clay trace Gravel		ML	0.062	0.011	0.0013	47.69	1.50

Issued By: *Shant Bains* Date Issued: July 8, 2019
 (Senior Project Manager)