Geotechnical Investigation - 1697 Durham Regional Highway 2, Courtice, Ontario

January 26, 2024

Prepared for:
Richard H. Gay Holdings Ltd.

Cambium Reference: 15382-001_R2

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1.0 Introduction

Cambium Inc. (Cambium) was retained by Richard H. Gay Holdings Ltd. (the “Client”) to complete a geotechnical investigation in support of the design of the proposed mixed-use development to be located at 1697 Durham Regional Highway 2 in Courtice, Ontario (the “Site”) as shown on the Site Location Plan, Figure 1 attached. The terms of reference for the geotechnical consulting services were included in Cambium’s proposal No. 15382-P, dated October 18, 2022. Authorization to proceed with the investigation was received from the Client on October 19, 2022.

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 report and are not addressed herein. Hydrogeological and environmental assessment reports will be submitted separately.

This report provides the results of the geotechnical exploration and testing and should be read in conjunction with the *“Standard Limitations”* in Section 9.0 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, Cambium 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 address 1697 & 1701 Durham Regional Highway 2 in Courtice, Ontario as shown on the Site Location Plan, Figure 1, and Borehole Location Plan, Figure 2, attached. At the time of study, the site was vacant, and the building previously located in the north area of the Site had been demolished.

The Site which is about 0.9 hectares (2.3 acres), is bordered on the north by Durham Regional Highway 2, on the west by the proposed Richard H. Gay Avenue, and on the south and east, by detached residential houses and Avondale Drive. The site was previously occupied by a residential building only which was converted to an office for Gay Company. The building was subsequently demolished sometime in 2022.

Based on the topographic plan dated August 16, 2018, drawing No. 18-25-534-00 provided by the Client, the Site is generally flat with elevations ranging from approximately 133 to 134 metres above sea level (masl). Along the south border of the Site, a raise area is present with elevations up to about 135.5 masl.

At the time of preparing this report the information available indicated that the site will be developed with as follows:

- Building 1 – 6-storey building with one basement level for commercial and seniors affordable living. The basement will extend to 3 m below finished grade.
- Building 2 – slab-on-grade 4-storey seniors affordable living building.
- Building 3 – 5-storey building with one basement level for seniors affordable living building. The basement will extend to 3 m below finished grade.
- Foundations are not anticipated to extend more than 1 m below the finished floor elevation (FFE) of the proposed buildings. The elevator shafts will extend 1.5 m below finished grade and will be located adjacent to the building outside the basement footprint.
- The remainder of the site will be utilized for at grade parking and access roads.

3.0 Methodology

3.1 Borehole Investigation

The geotechnical field investigation was conducted from November 17 to 24, 2022, during which time ten boreholes, designated as BH101-22 to BH111-22, were advanced into the subsurface at predetermined locations throughout the Site. A summary of the geotechnical drilling program is presented below in Table 1. The approximate borehole locations are shown on the Borehole Location Plan, Figure 2, attached. The results of the subsurface investigation are presented on the Log of Borehole sheets in Appendix A and the results of geotechnical laboratory testing in Appendix B.

Table 1 Drilling Program

Borehole ID	Ground Surface Elevation (masl)	Borehole Depth (m)	Finished Elevation (masl)	Notes
BH101-21	134.0	17.2	116.8	50-millimetre (mm) diameter monitoring well installed
BH102-22	-	-	-	Was not drilled
BH103-22	133.9	14.2	119.7	50-mm diameter monitoring well installed
BH104-22	133.7	20.3	113.4	50-mm diameter monitoring well installed
BH105-22	135.4	18.7	116.7	50-mm diameter monitoring well installed
BH106-22	133.5	3.5	130.0	50-mm diameter monitoring well installed
BH107-22	133.4	3.5	129.9	
BH108-22 to BH111-22	-	-	-	Environmental only boreholes

Drilling and sampling were completed using a both a truck-mounted and track-mounted drill rigs operating under the supervision of a Cambium technician. The boreholes were advanced to the sampling depths by means of continuous flight solid stem augers and mud rotary drilling 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". 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 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 SPT N values are used in this report to assess consistency of cohesive soils and relative density of non-cohesive soils. Soil samples were collected at approximately 0.75 m intervals up to a depth of 3.0 metres below ground surface (mbgs) and at 1.5 m intervals thereafter.

Groundwater conditions were noted in the open boreholes during and upon completion of drilling and monitoring wells were installed in BH101-22, BH103-22, BH104-22, BH105-22 and BH106-22 following the completion of drilling to allow for subsequent groundwater measurements. The monitoring wells 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. 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.

The field work for this investigation was observed by members of Cambium'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 geotechnical laboratory for further visual examination by the project engineer and for laboratory testing.

Index and classification tests, consisting of water content determinations and gradation analyses, were carried out on selected soil samples and the results are presented in Appendix B and also on the Log of Borehole sheets in Appendix A.

The ground surface elevations at the borehole locations were measured using a Trimble Catalyst GPS unit using a temporary benchmark. The benchmark used was the top of the manhole near the north curb of Avondale Drive and west of the property at 185 Avondale Drive. The elevation the benchmark, at 133.77 metres above seal level (masl), was provided by the Client and all borehole elevations are relative to this elevation.

Site soil and groundwater conditions are described, and geotechnical recommendations are discussed in the following sections of this report.

3.2 Physical Laboratory Testing

Physical laboratory testing, including four particle size distribution analysis (LS-702, 705) and six Atterberg Limits tests, 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 4.0.

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
- The Ontario Geological Survey. 2003. Surficial Geology of Southern Ontario.

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 Iroquois Plain. The Iroquois Plain region covers the border of the lake shore extending from the City of Trenton in the east to the City of St. Catharines in the southwest. The Iroquois Plain refers to an area of lowlands that border the present-day Lake Ontario which was formed within the basin of Glacial Lake Iroquois which was a larger and higher version of Lake Ontario. Lake Iroquois sediments consist both of granular soils (silt and sand) and finer-grained silt and clay soils. The overburden within the Iroquois Plain in the vicinity of the study area is underlain by shale, limestone, dolostone and siltstone bedrock. Surface and groundwater flow is predominantly to the south toward Lake Ontario. The physiographic landforms of the area consist of clay plains.

The surficial geology mapping indicates that the northern section of the Site lies within a region of coarse-textured glaciolacustrine deposits of sand, gravel, minor silt, and clay which are foreshore and basinal deposits.

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

4.2 Subsurface Conditions

The detailed soil profiles encountered in the boreholes are shown on the attached borehole logs in Appendix B. Conditions indicated on the borehole logs are for specific locations only and can vary between and beyond the borehole locations. 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 on 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 (such as drilling speed and shaking/grinding of the augers).

Based on the results of the borehole investigation, subsurface conditions at the Site generally consist of topsoil overlying near surface loose to compact silty sand to sandy silt fill. The fill is underlain by deposits of near surface compact silty sand to sandy silt. Generally soft to firm silty clay to clayey silt was encountered at depths of about 0.7 mbgs to 2.9 mbgs (Elevations 130.6 masl to 133.3 masl) below the near surface silty sand to sandy silt deposits and extended to depths ranging from about 5.6 mbgs to 8.6 mbgs (Elevations 125.1 masl to 128.4 masl). The silty clay to clayey silt deposit was underlain by a deposit of generally loose silt and sand. Four boreholes were extended to penetrate the silt and sand deposit to a deposit of compact to very dense silty sand to sandy silt till which was encountered at depths ranging from about 13.7 mbgs to 15.6 mbgs (Elevations 118.1 masl to 120.2 masl).

Assessments of organic matter content or other topsoil quality tests were beyond the scope of this study.

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; and
- The SPT “N”-values given are blows for 0.3 m of penetration unless otherwise indicated.

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

Table 2 Summary of Soil Properties

Stratigraphy	Depth (mbgs)		Elevation (masl)		SPT "N" Values	Relative Density / Consistency	Approximate Water Content (%)	Notes
	From	To	From	To				
Topsoil	0	175 mm to 280 mm			-	-	-	Encountered at all borehole locations except BH105-22 and BH106-22.
Silty Sand, Sandy Silt to Sand and Gravel Fill	0.0 to 0.3	0.7 to 2.1	133.1 to 135.4	132.3 to 133.3	5 to 20	Loose to compact	8 to 14	Encountered at all boreholes locations.
Silty Sand to Sandy Silt	0.7 to 2.1	2.9	131.9 to 133.3	130.6 to 132.5	7 to 78	Loose to very dense but generally compact	6 to 18	Encountered at all borehole locations underlying the fill.
Silty Clay to Clayey Silt	0.7 to 2.9	5.6 to 8.6	130.6 to 133.3	125.1 to 128.4	WH to 30	Very soft to very stiff but generally soft to firm	11 to 43	Encountered at all boreholes locations underlying the upper silt sand deposits.
Silt and Sand	5.6 to 8.6	13.3 to 15.4	125.1 to 128.4	120.0 to 120.4	1 to 16	Very loose to compact but generally loose	10 to 26	Encountered at all borehole locations.
Silty Sand to Sandy Silt Till	13.7 to 15.6	14.2* to 20.3*	118.1 to 120.2	113.4 to 119.7	11 to 50	Compact to very dense	8 to 13	Boreholes BH101-22, BH103-22, BH104-22 and BH105-22 were extended to this deposit.

**Borehole terminate depth*

The results of the Atterberg Limits test are presented in Table 3 with details provided in Appendix B.

Table 3 Atterberg Limits Analysis –Cohesive Deposits

Borehole	Depth (mbgs)	Soil	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Classification
BH101-22 SS6	4.6 – 5.0	Silty Clay	37.5	18.7	18.8	CL
BH103-22 SS5	3.0 – 3.5	Silty Clay	23.0	13.5	9.5	CL
BH103-22 SS7	6.1 – 6.6	Silty Clay	24.7	13.5	11.2	CL
BH104-22 SS6	4.6 – 5.0	Silty Clay	23.3	13.6	9.7	CL
BH105-22 SS6	4.6 – 5.0	Silty Clay	33.7	15.7	18.0	CL

4.3 Groundwater Conditions

Groundwater level measurements for the current investigation were collected at the Site on November 24, 2022. The groundwater level was measured at each well with an electronic water level tape, which was cleaned between well locations. Table 4, below, summarizes the groundwater level measurements collected to date.

Table 4 Groundwater Level Measurements

Borehole ID	November 24, 2022		January 2024	
	Groundwater Level Depth (mbgs)	Groundwater Elevation masl	Groundwater Level Depth (mbgs)	Groundwater Elevation masl
BH101-22	2.9	131.1	1.2	132.9
BH103-22	2.1	131.8	1.2	132.7
BH104-22	2.9	130.8	1.9	131.8
BH105-22	3.2	132.2	3.0	132.4
BH106-22	2.6	130.9	1.5	132.0
Existing Well 1	2.7	131.4	1.3	132.8
Existing Well 2	2.9	131.2	2.2	131.9
Existing Well 3	2.7	130.0	2.0	131.8

The measured groundwater levels reflect the groundwater conditions in the boreholes at the time of the field work as indicated in the table above. Groundwater levels at the site are anticipated to vary between and beyond the borehole locations and to fluctuate on a seasonal basis and in response to significant precipitation or snowmelt events. Please refer to the hydrogeological report for additional groundwater information.

5.0 Geotechnical Considerations

This section of the report provides engineering information and recommendations for the geotechnical design aspects of the project based on our interpretation of the borehole information, the laboratory test data and on our understanding of the project requirements. The following recommendations are provided to assist designers. It is possible that subsurface conditions beyond the borehole locations may vary from those observed. Recommendations should not be construed as providing instructions to contractors, who should form their own opinions about site conditions. 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 interpretation of the factual data as it affects their proposed construction techniques, schedule, equipment capabilities, costs, sequencing, and the like. If significant variations are found before or during construction, Cambium should be contacted so that we can reassess our findings, if necessary.

Cambium will not assume any responsibility for construction-related decisions made by contractors on the basis of this report.

5.1 Foundation Design

Based on the subsurface conditions, shallow spread or strip footings would be founded above the soft to firm silty clay to clayey silt deposit and loose silt and sand, which will result in a low bearing capacity and as a result would likely not be feasible.

Alternatively, the following foundation options may be considered for the proposed buildings:

1. Option 1 – micropiles or helical piles extending to the compact to very dense glacial till deposits.
2. Option 2 – drilled caissons extending to the compact to very dense glacial till deposits.
3. Option 3 - non-conventional ground improvement/foundation options such as Grouted Rammed Aggregate Piers (RAP) Concrete Modulus Columns (CMC) or ground improvement options including rapid impact compaction.

4. Option 4 – raft foundations may be considered but additional testing and investigation would be required to better characterize the soft to firm silty clay to clayey silt and loose silt and sand deposits.

Option 1 – Micropiles or Helical Piles

Micropiles or helical piles founded in the compact to very dense glacial till deposit underlying the soft to firm silty clay to clayey silt deposit and loose silt and sand may be considered to support the proposed buildings.

The following preliminary ULS bearing capacities may be considered for micropiles with grouted bond lengths of 8 m to 12 m within the compact to very dense glacial till deposits:

i) 270 kN to 400 kN for 100 mm diameter micropiles; or

ii) 380 kN to 570 kN for 150 mm diameter micropiles

Square shaft helical piles with a diameter of 38-mm may be considered with a conservative capacity of 200 kN SLS and 270 kN ULS.

The micropiles and helical piles would usually be designed by the specialist supplier of the micropiles.

Option 2 – Caissons

Drilled caissons extending into the compact to very dense glacial till deposits will provide adequate support for the buildings. If this option is a feasible option, Cambium can provide bearing capacity resistances during the detailed design stage.

Based on the interpreted stratigraphic conditions as encountered during the geotechnical investigation, the preliminary recommended factored axial geotechnical resistance in compression at ULS and axial geotechnical reaction at SLS for 1-m to 1.5-m diameter caissons are provided in Table 5, below:

Table 5 Geotechnical Resistance for Caissons

Caisson Diameter	Factored Axial Geotechnical Resistance at ULS (kN)	Axial Geotechnical Resistance at SLS (kN)
1.0	650	550
1.2	800	700

Caisson Diameter	Factored Axial Geotechnical Resistance at ULS (kN)	Axial Geotechnical Resistance at SLS (kN)
1.5	1000	850

Option 3 – Ground Improvement

Rammed Aggregate Pier (RAP) soil reinforcing elements are installed by ramming an open-graded aggregate into the ground to form a very stiff, high-density aggregate pier. Ramming takes place with a vertical vibration hammer and crowd pressure with a tamper base that both densifies the aggregate and forces the aggregate laterally into the surrounding native soil. This action increases the lateral stress in the surrounding soil and increases the composite density of the soil mass. RAP can be constructed using the following two methodologies:

Geopier method: This method involves pre-drilling a hole in the soil with an auger and placing crushed rock at the bottom of the hole. The crushed rock is then rammed by a hydraulic hammer and then layers of well graded crushed rock are rammed on top of it (averaging a 12-inch compacted lift thickness). This ramming effect creates a very dense, stiff rock pier that expands the drilled shaft and reinforces the soil.

Impact method: This method includes driving a hollow mandrel into the ground, ¾ inch stone is then delivered through the hollow mandrel. The mandrel is raised and then lowered to compact thin lifts of the aggregate.

The method, spacing/layout and bearing capacity of the piers would be provided by the specialist contractor.

General Comments

All exterior footings, footings in unheated areas or pile caps should be provided with at least 1.3 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.

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 (1H:1V). 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 Cambium during the time of construction.

5.2 Frost Penetration

Based on OPSD3090.101, the maximum frost penetration depth below the surface at the site is estimated at 1.3 mbgs. Exterior footings for the proposed structures should be situated at or below this depth for frost penetration or should be appropriately protected.

It is assumed that the pavement structure thickness will be less than 1.3 m, and as a result grading and drainage are important for good pavement performance and life expectancy. Any services should be located below this depth or be appropriately insulated.

5.3 Slab-on-Grade Floor

The existing fill materials are not suitable to support the slab-on-grade and sub-excavation and replacement with engineered fill will be required during slab-on-grade construction within the footprint of the proposed slab as described in the Engineered Fill section if the elevation of the finished slab is higher than the elevation of the native soil below the fill.

At Building 1, after removal of the existing fill, the subgrade for the slab-on-grade is anticipated to consist of very stiff to hard silty clay or compact silt and an elevation of about 131 m, the subsurface conditions will consist of firm to very soft silty clay. At Buildings 2 and 3, after removal of the existing fill, the subgrade for the slab-on-grade is anticipated to consist of compact sandy silt or silty sand. At Building 3, the subsurface conditions will consist of very soft silty clay at an elevation of about 131 m.

Where soft cohesive deposits are present at the underside of the slab level, some subexcavation and replacement with engineered fill may be required to provide adequate support.

The exposed subgrade should be proof rolled in conjunction with an inspection by Cambium. Remedial work should be carried out on any softened, disturbed, wet or poorly performing zones as directed by Cambium. Any low areas may then be brought up to within at least

200 mm of the underside of the floor slabs, as required, using 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% of SPMDD.

For a poorly performing subgrade, a layer of up to 200 mm thick Granular ‘B’, Type I material would be required below the final lift of Granular ‘A” to stabilize the base and distribute wheel loads. We recommend that the Granular ‘B’, Type I material be placed and compacted in a single lift for it to serve its purpose of strengthening the subgrade.

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% of SPMDD, acting as a moisture barrier. Any filling operations should be inspected and tested by Cambium. 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.

If the basement is designed to be unheated, the subdrain system and granular base soils should not be allowed to freeze, especially around the cold air intake ducts. Cambium would be pleased to provide thermal insulating input during the design stage, if requested.

5.4 Permanent Drainage

At the time of the field investigation and subsequent groundwater level measurement events, in November 2022 and January 2024, the groundwater level measurements ranged from depths of about 1.2 m to 3.0 m below existing ground surface (mbgs) (approximate Elevations 130.0 m to 132.9 m) which are at or above the anticipated FFE of the proposed buildings. As a result, underfloor drainage and an exterior perimeter drainage system are recommended. 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. For Building 2, which will be a slab-on-grade, a underslab drainage may not be required if the slab is above the exterior finished grade.

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 Cambium can provide geotechnical input as required.

An underfloor drainage system, connected to sumps, should be provided to collect seepage 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.

5.5 Engineered Fill

The fill encountered on Site are not considered suitable to provide foundation support for the proposed building foundations, floor slabs, other settlement-sensitive structures, or engineered fill. All topsoil, organics and deleterious material should be removed from below the development areas prior to construction. For site grading, in areas of cut or fill where the proof roll and/or inspection has identified unsuitable subgrade conditions, whether loose, too soft or too wet, the poorly performing material is to be removed and replaced with an approved material and compacted as directed by the Geotechnical Engineer.

Materials for the use of engineered fill must be approved by Cambium prior to placement. When the fill is treated as an engineered fill to support structural elements or pavement, general guidelines for the placement and preparation are presented below:

- Remove any and all existing vegetation, surficial topsoil/organics, organic fills or fills and any loose soils to a competent subgrade for a suitable envelope.

- The subgrade or base of the engineered fill area must be approved by Cambium prior to placement of any new fill, to ensure that suitability of subgrade condition.
- The area of the engineered fill should extend horizontally 1 m beyond the outside edge of the foundations then extend downward at an imaginary 1 horizontal to 1 vertical (1H:1V) slope to the competent approved native soil. The exposed edges of the engineered fill should be sloped at a maximum of 3H:1V to avoid weakening of the engineered fill edges due to slope movement. If fill is required adjacent to sloped banks (i.e., slope steeper than 3H:1V), the fill shall be placed in stepped planes to avoid a plane weakness.
- Cambium suggests the engineered fill should be approved OPSS 1010 SSM or Granular ‘B’ Type I material. Excavated sand and silt material from site may be used as engineered fill provided it does not contain organic matter or have deleterious content and subject to approval by Cambium.
- The engineered fill should be placed at a moisture content at or near optimum moisture in maximum 200 mm thick lifts and compacted to minimum 100% standard Proctor maximum dry density (SPMDD). Any frost penetration into the fill material must be removed prior to placement of subsequent lifts of fill or reviewed by Cambium.
- Full time testing and inspection will be required for all excavation, backfilling, and compaction operations.

5.6 Temporary Excavation and Support

As the depths of the proposed underground services have not been finalized at this time, for the purposes of this report, we have assumed that the service inverts will be up to about 3 m below the existing surface. Once the actual service invert depths are finalized, the following comments and recommendations should be reviewed and revised, as necessary. Excavation for any underground level will extend to depths ranging from about 3 mbgs to 4 mbgs.

Based on the results of this investigation, the founding soils for the services below frost depth and the fill, are likely to consist of very stiff to hard silty clay to clayey silt, compact to very dense silty sand and compact sandy silt.

All excavations should be carried out in accordance with the Occupational Health and Safety Act (OHSA) and Ontario Health and Safety Regulations for Construction Projects (O. Reg 213). Excavation at this site will extend through the loose to compact fill.

It is anticipated that temporary excavations above the groundwater table level will consist of conventional temporary open cuts with side slopes not steeper than 1H:1V for Type 3 soils (loose fill), as provisionally 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. If excavations will extend below the measured groundwater elevations, adequate dewatering will be required to achieve a Type 3 soil classification. Please note that if the excavation extends below the groundwater table without adequate dewatering, the soil at the face of the excavation would be classified as Type 4 and a maximum side slope inclination of 3H:1V would be required for OHSA compliance. 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. Please note that the soil type classifications indicated above are provisional and are subject to change based on field observations of the actual conditions at the time of exposure.

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. Boulders larger than 0.3 m in diameter, if encountered, should be removed from the excavation side slopes for worker safety.

Where side slopes of excavations are required to be steepened to limit the extent of the excavation, then some form of trench support system may be required. It must be emphasized that a trench liner box provides protection for construction personnel but does not provide any lateral support for the adjacent excavation walls, underground services, or existing structures;

trench liner boxes should only be used after consultation with Cambium. It is imperative that any underground services or existing structures adjacent to the excavations be accurately located prior to construction and adequate support provided where required. In addition, steepened excavations should be left open for as short a duration as possible and completely backfilled at the end of each working day.

Conventional hydraulic excavation equipment would be expected to be suitable for excavation in the overburden soils. The subsoils (fill and native materials) are generally susceptible to disturbance due to construction activities, ponded water, potential groundwater seepage and heavy precipitation. Groundwater seepage into the excavations may also occur from perched groundwater or surface water flow, particularly following significant periods of precipitation.

If 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 piles and lagging is 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 adequately dewatered and are not located adjacent to settlement sensitive structures. A soldier pile and lagging system does not provide a groundwater cut-off. Where soldier pile and lagging shoring walls are used, these may require groundwater lowering (i.e., proactive dewatering) to be undertaken prior to the excavation through these materials.

Where existing buildings or certain buried services lie within the zone of influence of the shoring (such as adjacent to the north 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.

Cambium can provide geotechnical parameters as necessary during the final design stages for the shoring.

5.7 Temporary Groundwater Control

Where the excavations for the sewers or watermain and structures are expected to extend below the water table*,* provisions will be required to maintain sufficiently dry excavations to permit safe working conditions. In this context, the groundwater level should be drawn down to at least 1 m below the base of the excavation, prior to the excavations reaching the base level, to reduce the potential for loosening of the excavation base due to seepage pressures. Further, care should be taken to direct surface water away from the open excavations. Excavations extending below the groundwater table through, or in, 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 submitted separately.

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”). Registry 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.

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 hydrogeological assessment will be submitted separately.

5.8 Lateral Earth Pressure for Below Grade Walls

The design of the foundation walls for the proposed building 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.

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

5.9 Backfill For Foundation Elements

Excavated topsoil and organic matter from the Site is not appropriate for use as fill below grading areas. Excavated non-cohesive soils not containing organics or significant deposits of clay may be appropriate for use as fill below grading 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 upon seasonal conditions. All existing vegetation, topsoil, organic and non-organic fills, and any loose soils shall be removed down to a competent base. Backfill areas must be approved by a qualified geotechnical engineer prior to placement of any new fill, to ensure the suitability of subgrade conditions.

The soils at this site containing more than about 15% silt are frost susceptible and should not be used as backfill against exterior or unheated foundation elements or below settlement sensitive structures. To avoid problems with frost adhesion and heaving, these foundation elements should be backfilled with non-frost susceptible sand or sand and gravel conforming to the requirements of OPSS.MUNI 1010 Granular B Type I material.

Backfill adjacent to the structural elements (i.e., foundation walls) should be placed evenly in lifts not exceeding 200 mm loose thickness and should be compacted to 95% of SPMDD taking care not to damage the adjacent structures. Light compaction equipment should be used immediately adjacent to the wall; otherwise compaction stresses on the wall may be greater than that imposed by the backfill material. The backfill material in the upper 0.3 m below the pavement subgrade elevation should be compacted to 100% of SPMDD in all areas. The upper 0.3 metres 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.

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 1.3 m below finished exterior grade at a slope of 3H:1V or flatter, away from the wall.

5.10 Pipe Bedding and Cover

The bedding for the site servicing pipes should be compatible with the type and class of pipe, the surrounding subsoil and anticipated loading conditions and should be designed in accordance with the relevant Municipality of Clarington Design Guidelines and Standard Drawings. The Municipality of Clarington design standards dated 2010, and entitled, *"Design Guidelines and Standard Drawings,"* provides pipe bedding details in drawing C-108. Where granular bedding is deemed to be acceptable, it should consist of at least 150 mm of OPSS Granular A or 19-mm crusher run limestone material. From the springline to 300 mm above the pipe obvert, sand cover may be used. All bedding and cover materials should be placed in maximum 150-mm thick loose lifts and should be uniformly compacted to at least 98% of SPMDD. Clear stone bedding material should not be used in any case for pipe bedding or to stabilize the base since fine particles from the native deposits could potentially migrate into the voids in the clear stone and cause loss of pipe support and settlement.

In some areas where poor subgrade soils are encountered, we recommend increasing the bedding layer thickness, up to 450 mm or more, to provide a flat and stable base for pipe placement. Where unavoidable disturbance to the subgrade surface does occur, it may be necessary to place a sub-bedding layer of compacted OPSS Granular B Type II beneath the Granular A. The requirements for additional bedding thickness should be determined during construction by the geotechnical engineer.

5.11 Trench Backfill

The excavated materials from the site will be variable, primarily consisting of fill, sandy silt to silty sand and silty clay to clayey silt soils. The soils are generally wet of the optimum water content for compaction. The excavated subsoils at suitable water contents (materials no wetter than about 4% above the optimum water content for compaction) may be reused as backfill provided they are free of significant amounts of topsoil, organics or other deleterious material and are placed and compacted as outlined below. All topsoil, if encountered, and organic materials should be wasted or used for landscaping purposes. All oversized cobbles and boulders (i.e., greater than 150 mm in size) should be removed from the backfill.

All trench backfill, from the top of the cover material to 1 m below subgrade elevation, should be placed in maximum 450-mm thick loose lifts and uniformly compacted to at least 98% of the material's SPMDD. From 1 m below subgrade to subgrade elevation, the materials should be placed in maximum 300-mm thick loose lifts and uniformly compacted to at least 98% of SPMDD.

In general, silty clay to clayey silt and sandy silt soils are problematic when used for backfilling. Alternatively, if placement water contents at the time of construction are too high, or if there is a shortage of suitable in situ material, then an approved imported sandy material which meets the requirements for OPSS SSM or Granular B, Type I could be used. It should be placed in loose lift thicknesses as indicated above and uniformly compacted to at least 98% of SPMDD. Backfilling operations during cold weather must avoid inclusions of frozen lumps of material, snow and ice.

Normal post-construction settlement of the compacted trench backfill should be anticipated, with the majority of such settlement taking place within about 6 months following the completion of trench backfilling operations. This settlement will be reflected at the ground surface and in pavement construction areas; it may be compensated for, where necessary, by placing additional granular material prior to asphalt paving. However, since it is anticipated that the asphalt binder course will be placed shortly following the completion of trench backfilling operations, any settlement that may be reflected by subsidence of the surface of the binder asphalt should be compensated for by placing an additional thickness of binder asphalt or by padding. In any event, it is recommended that the surface course asphalt should not be placed over the binder course asphalt for at least 12 months. Post-construction settlement of the restored ground surface in off-road trench areas is also expected and should be topped-up and re-landscaped, as required.

It should be noted that in some cases, even though the compaction requirements have been met, the subgrade strength in the trench backfill areas may not be adequate to support heavy construction loading, especially during wet weather or where backfill materials wet of optimum have been placed. In any event, the subgrade should be proof-rolled and inspected by qualified geotechnical personnel prior to placing the Granular B subbase and additional subbase material placed as required, being consistent with the prevailing weather conditions and anticipated use by construction traffic.

5.12 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 5.2 is generally less than 15 blows per 0.3 m of penetration and the undrained shear strength is less than 50 kPa). Based on these results, Site Class E 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.

5.13 Pavement Design

The performance of the pavement is dependent upon proper subgrade preparation. All topsoil and organic materials should be removed down to native material and backfilled with approved engineered fill, compacted to 98% SPMDD. The subgrade should be compacted, proof rolled and inspected by a Geotechnical Engineer. Any areas where rutting or appreciable deflection is noted should be sub-excavated and replaced with suitable fill. The fill should be compacted to 98% SPMDD.

The recommended minimum pavement structure design for the internal access roads has been developed for two traffic loading scenarios, light duty and heavy duty. The heavy-duty design is appropriate for areas where heavy trucks and maintenance vehicles are anticipated to drive while the light duty design is appropriate for areas where no heavy traffic is anticipated. The recommended minimum pavement structure is provided in Table 6.

Table 6 Pavement Structure

Pavement Layer	Compaction Requirements	Light Duty	Heavy Duty
Surface Course Asphalt	OPSS 310	40 mm HL3	40 mm HL3
Binder Course Asphalt	OPSS 310	50 mm HL8	90 mm HL8 (2 lifts)
Granular Base	100% SPMDD	150 mm Granular A	150 mm Granular A
Granular Subbase	98% SPMDD	350 mm Granular B	400 mm Granular B

Please note that the heavy-duty pavement structure meets the minimum requirements for an urban pavement and may be used for the proposed Richard H Gay Avenue.

Material and thickness substitutions must be approved by the Design Engineer. Compaction of the subgrade should be verified by the Engineer prior to placing the granular base. Granular layers should be placed in 150 mm maximum loose lifts and compacted to specified density. The granular materials should conform to OPSS standards, as confirmed by appropriate materials testing.

The final asphalt surface should be sloped at a minimum of 2 percent to shed runoff.

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, Cambium 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 final design additional geotechnical investigations and laboratory testing can be carried out to delineate the glacial till deposit and confirm the engineering properties of the silty clay to clayey silt deposit.

At the time of preparing this report, the design was at the preliminary stage. As a result, Cambium should be retained to review the geotechnical aspects of the final design drawings and specifications prior to tendering and construction to confirm that the intent of this report has been met.

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 Cambium 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 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.

Cambium Inc.

DS

LICENSED PROFESSIONAL ENGINEER
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100126803
PROVINCE OF ONTARIO

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SEB/RA/KL

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9.0 Standard 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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The findings and results presented in reports prepared by Cambium are based on the materials and information provided by the client to Cambium and on the facts, conditions and circumstances encountered by Cambium during the performance of the work requested by the client. In formulating its findings and results into a report, Cambium assumes that the information and materials provided by the client or obtained by Cambium from the client or otherwise are factual, accurate and represent a true depiction of the circumstances that exist. Cambium relies on its client to inform Cambium if there are changes to any such information and materials. Cambium does not review, analyze or attempt to verify the accuracy or completeness of the information or materials provided, or circumstances encountered, other than in accordance with applicable accepted industry practice. Cambium will not be responsible for matters arising from incomplete, incorrect or misleading information or from facts or circumstances that are not fully disclosed to or that are concealed from Cambium during the provision of services, work or reports.

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When preparing reports, Cambium considers applicable legislation, regulations, governmental guidelines and policies to the extent they are within its knowledge, but Cambium is not qualified to advise with respect to legal matters. The presentation of information regarding applicable legislation, regulations, governmental guidelines and policies is for information only and is not intended to and should not be interpreted as constituting a legal opinion concerning the work completed or conditions outlined in a report. All legal matters should be reviewed and considered by an appropriately qualified legal practitioner.

Site Assessments

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.

Only conditions at the site and locations chosen for study by the client are evaluated; no adjacent or other properties are evaluated unless specifically requested by the client. Any physical or other aspects of the site chosen for study by the client, or any other matter not specifically addressed in a report prepared by Cambium, are beyond the scope of the work performed by Cambium and such matters have not been investigated or addressed.

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Potential liability to the client arising out of the report is limited to the amount of Cambium's professional liability insurance coverage. Cambium shall only be liable for direct damages to the extent caused by Cambium's negligence and/or breach of contract. Cambium shall not be liable for consequential damages.

Personal Liability

The client expressly agrees that Cambium employees shall have no personal liability to the client with respect to a claim, whether in contract, tort and/or other cause of action in law. Furthermore, the client agrees that it will bring no proceedings nor take any action in any court of law against Cambium employees in their personal capacity.

Appended Figures

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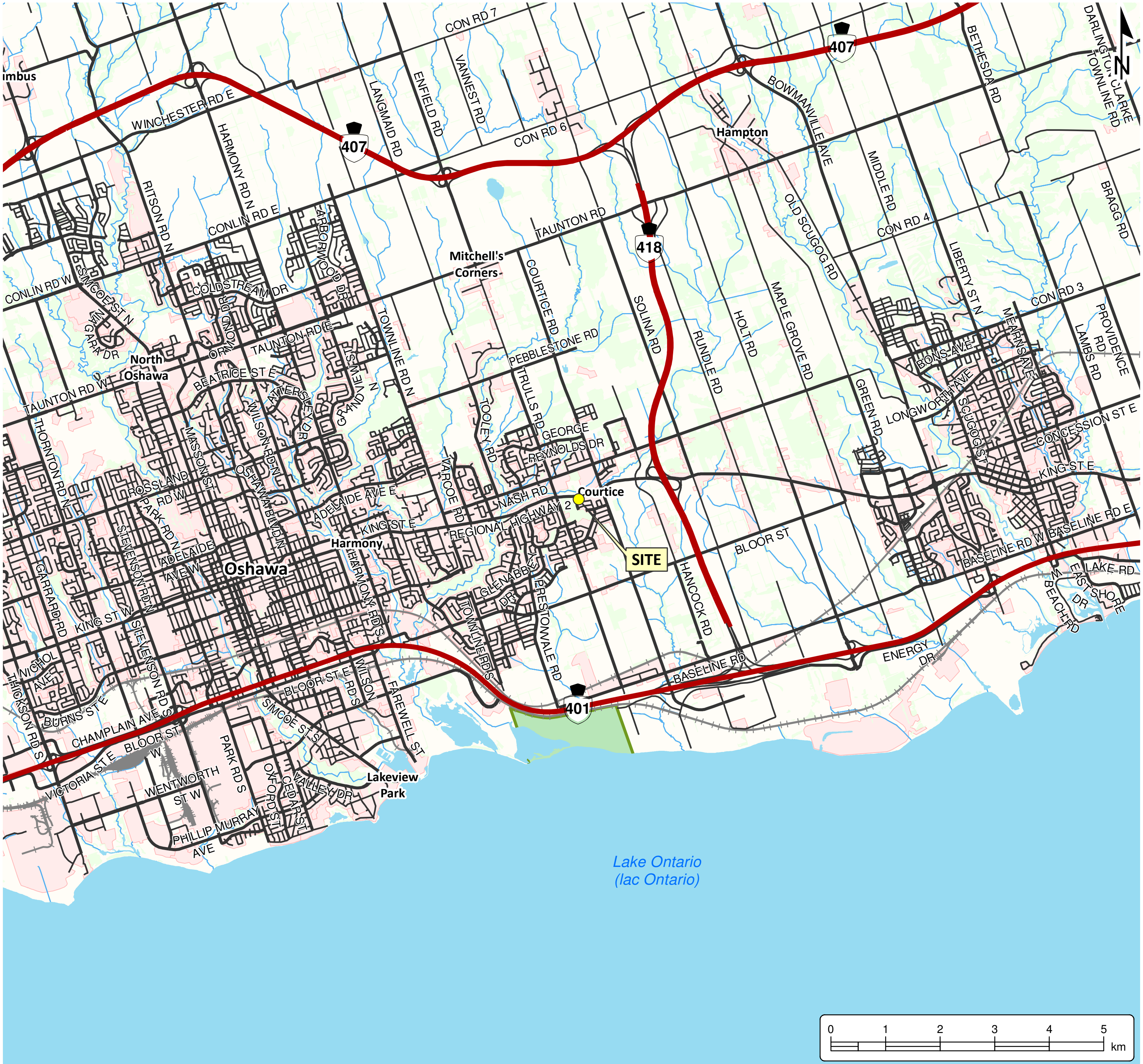

GEOTECHNICAL INVESTIGATION

RICHARD H. GAY HOLDINGS LIMITED
1697 & 1701 Durham Regional Highway 2, Courtice, Ontario

LEGEND

- Highway
- Major Road
- Minor Road
- Railroad
- Watercourse
- Water Area
- Provincial Park
- Wooded Area
- Built Up Area

Notes:
- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors 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.

CAMBIUM
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SITE LOCATION PLAN

Project No.: 15382-003	Date: November 2022 Rev.:
Scale: 1:100,000	Projection: NAD 1983 UTM Zone 17N

Created by:	Checked by:	Figure:
MAT	SN	1

O:\GIS\MXDs\15300-15399\15382-001 Gay Company Ltd - GEO - 1697 Durham Reg Hwy 2\Geotech\2022-11-28 FIG 1 - Site Location Plan.mxd

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GEOTECHNICAL INVESTIGATION
RICHARD H. GAY HOLDINGS LIMITED
1697 & 1701 Durham Regional Highway 2, Courtice, Ontario

LEGEND

- Benchmark
- Borehole
- Monitoring Well
- Proposed Building
- Site (approximate)

Notes:
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BOREHOLE LOCATION PLAN

Project No.: 15382-001	Date: November 2022 Rev.:
Scale: 1:750	Projection: NAD 1983 UTM Zone 17N
Created by: SJV	Checked by: SN / Figure: 2

O:\GIS\MXDs\15300-15399\15382-001 Gay Company Ltd - GEO - 1697 Durham Reg Hwy 2\Geotech\2022-11-28 FIG 2 - Borehole Location Plan.mxd

Appendix A

Borehole Logs

CAMBIUM

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Log of Borehole: BH101-22

Client:	Gay Company Limited	**Project Name:**	GEO - 1697 Durham Reg Hwy 2	**Project No.:**	15382-001
Contractor:	Drilltech Drilling Limited	**Method:**	Track Mounted Solid Stem Auger	**Date Completed:**	November 18 & 23, 2022
Location:	1697 Durham Reg Hwy 2, Courtice	**UTM:**	17T **N:** 4864349 **E:** 677953	**Elevation:**	134.01 mASL

SUBSURFACE PROFILE

Elevation (m)	Depth (m)	Description
134 – 133.83	0 –	**TOPSOIL:** (~175 mm thick)
133.83 – 133.32		**FILL:** (SM) SILTY SAND, trace gravel; brown, trace rubble; non-cohesive, moist, compact
133.32 – 131.88		**(CL-ML) SILTY CLAY - CLAYEY SILT:** trace sand; brown, motted; cohesive; w<PL, very stiff to hard
131.88 – 131.11		**(SM) SILTY SAND:** light brown; non-cohesive, wet, compact
131.11 – 128.45		**(CL) SILTY CLAY:** trace sand; grey; cohesive, w>PL, firm to very soft
128.45 – 127.01		**(ML) SILT:** and SAND trace to some gravel; grey; non-cohesive, wet, loose to compact

SAMPLE

Number	Type	% Recovery	SPT (N)	% Moisture	SPT (N) plot
1A	SS	50	19	22.5%	
1B	SS			9.7%	19
2	SS	50	19	15.2%	19
3	SS	50	30	15%	30
4	SS	50	28	17.7%	28
5	SS	75	8	19.5%	8
6	SS	100	2	38%	2
7	SS	20	7	14.8%	7

% Moisture scale: 25 50 75 — SPT (N) scale: 20 40 60 80

Well Installation

Cap
Bentonite
Riser
Sand Pack
PVC Screen
Cap

Log Notes

50 mm Diameter Monitoring Well with a 1.5 m screen.

Groundwater level measured in monitoring well at a depth of about 2.9mbgs (Elevation 131.1masl).

Atterberg Limits SS6: LL: 37.5% PL: 18.7% PI: 18.8%

Mud rotary drilling with 90 mm tri-cone from a depth of about 4.5mbgs

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS10	5	41	42	12
SS14	15	37	39	9

1m = 26 units

Logged By: EC **Input By:** CM

CAMBIUM
Peterborough
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Oshawa
Kingston
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Log of Borehole: BH101-22

Client: Gay Company Limited
Project Name: GEO - 1697 Durham Reg Hwy 2
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UTM: 17T **N:** 4864349 **E:** 677953
Elevation: 134.01 mASL

Elevation (m)	Depth (m)	Description	Sample Number	Type	% Recovery	SPT (N)	% Moisture	SPT (N) (plot)	Well Installation	Log Notes
127	7	**(ML) SILT:** and SAND trace to some gravel; grey; non-cohesive, wet, loose to compact								
126.2	7.85		8	SS	80	6	26.4%	6		
124.7	9.35		9	SS	50	16	10.1%	16		
123.2	10.85		10	SS	45	13	16.7%	13		
121.7	12.35		11	SS	50	6	21.3%	6		
120.14			12	SS	100	24	10%	24		
120.01		**(ML) sandy SILT:** to (SM) SILTY SAND, trace gravel; grey (TILL); non-cohesive, wet, compact								

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS10	5	41	42	12
SS14	15	37	39	9

1m = 26 units

Logged By: EC **Input By:** CM

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Client:	Gay Company Limited	**Project Name:**	GEO - 1697 Durham Reg Hwy 2	**Project No.:**	15382-001
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SUBSURFACE PROFILE			SAMPLE							
Elevation (m) Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	SPT (N) (20 40 60 80)	Well Installation	Log Notes
120 / 14 – 116.79 / 17.2		**(ML) sandy SILT:** to (SM) SILTY SAND, trace gravel; grey (TILL); non-cohesive, wet, compact	12	SS	100	24	10%	24		
			13	SS	85	24	10.4%	24		
			14	SS	55	19	10.9%	19		
116.79		Borehole Terminated @ 17.2m in competent soil								

Elevation / Depth scale: 120 / 14, 119.5 / 14.5, 119 / 15, 118.5 / 15.5, 118 / 16, 117.5 / 16.5, 117 / 17, 116.5 / 17.5, 116 / 18, 115.5 / 18.5, 115 / 19, 114.5 / 19.5, 114 / 20, 113.5 / 20.5

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS10	5	41	42	12
SS14	15	37	39	9

1m = 26 units

Logged By: EC **Input By:** CM

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Log of Borehole: BH103-22

Client: Gay Company Limited
Project Name: GEO - 1697 Durham Reg Hwy 2
Project No.: 15382-001
Contractor: Drilltech Drilling Limited
Method: Track Mounted Solid Stem Auger
Date Completed: November 17, 2022
Location:
UTM: 17T **N:** 4864356 **E:** 678002
Elevation: 133.85 mASL

SUBSURFACE PROFILE

Elevation (m)	Depth (m)	Description
133.85 – 133.67	0 – 0.18	**TOPSOIL:** (~175 mm thick)
133.67 – 132.48	0.18 – 1.37	**FILL:** (ML) sandy SILT, dark brown, trace rubble; non-cohesive, moist, loose to compact
132.48 – 131.72	1.37 – 2.13	**(ML) sandy SILT:** brown; mottled; non-cohesive, moist, compact
131.72 – 130.95	2.13 – 2.9	**(SM) SILTY SAND:** grey; non-cohesive, wet, very dense
130.95 – 126.85	2.9 – 7.0	**(CL) SILTY CLAY:** trace sand; grey; cohesive, w>PL, stiff to very soft

SAMPLE

Number	Type	% Recovery	SPT (N)	% Moisture
1A	SS			39.3%
1B	SS	75	5	13.6%
2	SS	30	11	11.8%
3	SS	90	26	12%
4	SS	50	72	17.1%
5	SS	80	15	18.1%
6	SS	100	6	21.7%
7	SS	100	1	29.9%

Well Installation: Cap; Bentonite Plug; Riser; Sand Pack; PVC Screen; Cap

Log Notes

50 mm Diameter Monitoring Well with a 1.5 m screen.

Groundwater level measured in monitoring well at a depth of about 2.1mbgs (Elevation 131.8masl).

Atterberg's Limits SS5: LL: 23% PL: 13.5% PI: 9.5%

Atterberg Limits SS7: LL: 24.7% PL: 13.5% PI: 11.2%

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS6	0	3	60	37

1m = 26 units

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Log of Borehole: BH103-22

Client:	Gay Company Limited	**Project Name:**	GEO - 1697 Durham Reg Hwy 2	**Project No.:**	15382-001
Contractor:	Drilltech Drilling Limited	**Method:**	Track Mounted Solid Stem Auger	**Date Completed:**	November 17, 2022
Location:		**UTM:**	17T **N:** 4864356 **E:** 678002	**Elevation:**	133.85 mASL

SUBSURFACE PROFILE / SAMPLE

Elevation (m) / Depth scale: 126.8 – 7; 126.4 – 7.5; 125.8 – 8; 125.4 – 8.5; 124.8 – 9; 124.4 – 9.5; 123.8 – 10; 123.4 – 10.5; 122.8 – 11; 122.4 – 11.5; 121.8 – 12; 121.4 – 12.5; 120.8 – 13; 120.4 – 13.5

% Moisture scale: 25 50 75 — SPT (N) scale: 20 40 60 80

Description	Bottom Elevation (m)
(CL) SILTY CLAY: trace sand; grey; cohesive, w>PL, stiff to very soft	125.24
(ML) SILT: and (SP) SAND; trace gravel; grey; non-cohesive, wet, very loose	120.13
(ML) sandy SILT: trace gravel; grey (TILL); non-cohesive, moist, compact to dense	119.85

Number	Type	% Recovery	SPT (N)	% Moisture	SPT (N) plot
8	SS	100	1	11.2%	1
9	SS	100	1	10.2%	1
10	SS	55	30		30

Well Installation | Log Notes

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS6	0	3	60	37

1m = 26 units

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Log of Borehole: BH103-22

Client: Gay Company Limited
Project Name: GEO - 1697 Durham Reg Hwy 2
Project No.: 15382-001
Contractor: Drilltech Drilling Limited
Method: Track Mounted Solid Stem Auger
Date Completed: November 17, 2022
Location:
UTM: 17T **N:** 4864356 **E:** 678002
Elevation: 133.85 mASL

SUBSURFACE PROFILE			SAMPLE							
Elevation (m) Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture (25 50 75)	SPT (N) (20 40 60 80)	Well Installation	Log Notes
119.8 — 14		**(ML) sandy SILT:** trace gravel; grey (TILL); non-cohesive, moist, compact to dense — 119.68	10	SS	55	30		30		
119.4 — 14.5		Borehole Terminated @ 14.2m in competent soil								
118.8 — 15										
118.4 — 15.5										
117.8 — 16										
117.4 — 16.5										
116.8 — 17										
116.4 — 17.5										
115.8 — 18										
115.4 — 18.5										
114.8 — 19										
114.4 — 19.5										
113.8 — 20										
113.4 — 20.5										

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS6	0	3	60	37

1m = 26 units

Logged By: EC **Input By:** CM

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Log of Borehole: BH104-22

Client: Gay Company Limited **Project Name:** GEO - 1697 Durham Reg Hwy 2 **Project No.:** 15382-001

Contractor: Drilltech Drilling Limited **Method:** Track Mounted Solid Stem Auger **Date Completed:** November 18, 21, 22, 2022

Location: **UTM:** 17T **N:** 4864339 **E:** 678045 **Elevation:** 133.72 mASL

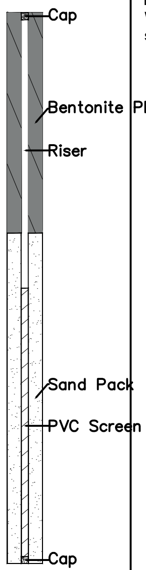
SUBSURFACE PROFILE / SAMPLE

Elevation (m)	Depth (m)	Description	Number	Type	% Recovery	SPT (N)	% Moisture	Log Notes
133.7	0	**TOPSOIL:** (~175 mm thick) — 133.54	1A	SS			19.6%	50 mm Diameter Monitoring Well with a 1.5 m screen.
		FILL: (SM) SILTY SAND, trace gravel; brown, trace organic matter; non-cohesive, moist, loose to compact — 132.35	1B	SS	30	9	8%	
132.7	1		2	SS	90	12	10.3%	
132.2	1.5	**(ML) sandy SILT:** brown; mottled; non-cohesive, moist, compact — 131.59	3	SS	100	20	12%	
131.2	2.5	**(SM) SILTY SAND:** brown; non-cohesive, wet, very dense — 130.82	4	SS	70	78	16.8%	
130.7	3	**(CL) SILTY CLAY:** trace sand; grey; cohesive, w>PL, stiff to very soft	5	SS	85	15	17.3%	
129.0	4.75		6	SS	100	1	33.1%	Atterberg's Limits LL: 23.3%, PL: 13.6%, PI: 9.7%
127.5	6.25	— 126.72	7	SS	100	1	33.8%	

Elevation / Depth scale: 133.7 – 0; 133.2 – 0.5; 132.7 – 1; 132.2 – 1.5; 131.7 – 2; 131.2 – 2.5; 130.7 – 3; 130.2 – 3.5; 129.7 – 4; 129.2 – 4.5; 128.7 – 5; 128.2 – 5.5; 127.7 – 6; 127.2 – 6.5

% Moisture scale: 25 50 75; SPT (N) scale: 20 40 60 80

Well Installation



GRAINSIZE DISTRIBUTION | SAMPLE | GRAVEL | SAND | SILT | CLAY

1m = 26 units

Logged By: EC **Input By:** CM

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Log of Borehole: BH104-22

Client: Gay Company Limited
Project Name: GEO - 1697 Durham Reg Hwy 2
Project No.: 15382-001
Contractor: Drilltech Drilling Limited
Method: Track Mounted Solid Stem Auger
Date Completed: November 18, 21, 22, 2022
Location:
UTM: 17T **N:** 4864339 **E:** 678045
Elevation: 133.72 mASL

Elevation	Depth (m)	Description	Number	Type	% Recovery	SPT (N)	% Moisture	SPT (N)	Well Installation	Log Notes
126.7	7	**(CL) SILTY CLAY:** trace sand; grey; cohesive, w>PL, stiff to very soft — 126.63								
126.2	7.5	**(CL) sandy SILTY CLAY:** trace gravel; grey; cohesive, w>PL, firm								
			8	SS	100	6	11.9%	6		
125.7	8									
125.2	8.5	125.11								
		(ML) SILT and (SP) SAND: trace to some gravel; grey; non-cohesive, wet, loose								
124.7	9									
			9	SS	100	1	10%	1		
124.2	9.5									
123.7	10									
123.2	10.5									
			10	SS	100	4	11.2%	4		
122.7	11									
122.2	11.5									
121.7	12									
			11	SS	10	2	10.1%	2		
121.2	12.5									
120.7	13									
		120.38								
120.2	13.5	**(SP) SAND and GRAVEL:** Coarse, grey; non-cohesive, wet, compact								
		119.72								

% Moisture scale: 25 50 75; SPT (N) scale: 20 40 60 80

GRAINSIZE DISTRIBUTION: SAMPLE | GRAVEL | SAND | SILT | CLAY

1m = 26 units

Logged By: EC **Input By:** CM

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Client: Gay Company Limited | **Project Name:** GEO - 1697 Durham Reg Hwy 2 | **Project No.:** 15382-001
Contractor: Drilltech Drilling Limited | **Method:** Track Mounted Solid Stem Auger | **Date Completed:** November 18, 21, 22, 2022
Location: | **UTM:** 17T **N:** 4864339 **E:** 678045 | **Elevation:** 133.72 mASL

Elevation (m)	Depth (m)	Description	Number	Type	% Recovery	SPT (N)	% Moisture	SPT (N)	Well Installation	Log Notes
119.7	14	**(SP) SAND and GRAVEL:** Coarse, grey; non-cohesive, wet, compact								
118.7	15									Mud rotary drilling with 90 mm tri-cone from a depth of about 15mbgs
118.2	15.5	118.12	12A	SS	100	11	9.3%	11		
		(ML) sandy SILT: to (SM) SILTY SAND, trace to some gravel; grey (TILL); non-cohesive, moist, compact to dense	12B	SS			8.6%			
116.7	17		13	SS	40	11	8.8%	11		
115.2	18.5		14	SS	45	12	7.9%	12		
113.7	20	113.45	15	SS	50	47	8.1%	47		
113.2	20.5	Borehole Terminated @ 20.3m in competent soil								

Depth scale: 119.7 – 14; 119.2 – 14.5; 118.7 – 15; 118.2 – 15.5; 117.7 – 16; 117.2 – 16.5; 116.7 – 17; 116.2 – 17.5; 115.7 – 18; 115.2 – 18.5; 114.7 – 19; 114.2 – 19.5; 113.7 – 20; 113.2 – 20.5

% Moisture scale: 25 50 75; SPT (N) scale: 20 40 60 80

GRAINSIZE DISTRIBUTION | SAMPLE | GRAVEL | SAND | SILT | CLAY |

1m = 26 units

Logged By: EC **Input By:** CM

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Log of Borehole: BH105-22

Client: Gay Company Limited | **Project Name:** GEO - 1697 Durham Reg Hwy 2 | **Project No.:** 15382-001

Contractor: Drilltech Drilling Limited | **Method:** Track Mounted Solid Stem Auger | **Date Completed:** November 18, 23, 24, 2022

Location: | **UTM:** 17T **N:** 4864264 **E:** 677965 | **Elevation:** 135.41 mASL

Elevation (m)	Depth (m)	Lithology	Description	Number	Type	% Recovery	SPT (N)	% Moisture	SPT (N)	Well Installation	Log Notes
135.4	0	FILL	**FILL:** (ML) sandy SILT, trace gravel; dark brown, trace organic matter, non-cohesive, moist, compact to loose	1	SS	40	20	10.2%	20	Cap; Bentonite Plug; Riser	50 mm Diameter Monitoring Well with a 1.5 m screen. Groundwater level measured in monitoring well at a depth of about 3.2mbgs (Elevation 132.2masl
				2	SS	50	8	10.1%	8		
				3	SS	95	8	11.5%	8	Sand Pack; PVC Screen	
133.28	2.13	SM	**(SM) SILTY SAND:** brown; non-cohesive, moist, compact	4	SS	75	22	5.8%	22		
132.51	2.9	ML	**(ML) CLAYEY SILT:** trace sand; brown; cohesive, w<PL, very stiff	5	SS	60	20	15.8%	20	Cap	
131.9	3.5	CL	**(CL) SILTY CLAY:** grey; cohesive, w>PL, very soft to soft								Atterberg Limits SS6: LL: 33.7% PL: 15.7% PI: 18%
											Mud rotary drilling with 90 mm tri-cone from a depth of about 4.5mbgs
				6	SS	30	0	37.8%			Shear Vane 1: at a depth of about 5.3mbgs: Natural 17kPa; Remolded 17kPa
											Shear Vane 2: at a depth of about 6.9mbgs: Natural 14kPa; Remolded 14kPa
				7	SS	100	2	43.4%	2		
128.41											

Depth scale: 135.4 – 0; 134.9 – 0.5; 134.4 – 1; 133.9 – 1.5; 133.4 – 2; 132.9 – 2.5; 132.4 – 3; 131.9 – 3.5; 131.4 – 4; 130.9 – 4.5; 130.4 – 5; 129.9 – 5.5; 129.4 – 6; 128.9 – 6.5

% Moisture scale: 25 50 75; SPT (N) scale: 20 40 60 80

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS9	13	38	41	8

1m = 26 units

Logged By: EC **Input By:** CM

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Log of Borehole: BH105-22

Client: Gay Company Limited
Project Name: GEO - 1697 Durham Reg Hwy 2
Project No.: 15382-001
Contractor: Drilltech Drilling Limited
Method: Track Mounted Solid Stem Auger
Date Completed: November 18, 23, 24, 2022
Location:
UTM: 17T **N:** 4864264 **E:** 677965
Elevation: 135.41 mASL

Elevation (m)	Depth (m)	Description	Number	Type	% Recovery	SPT (N)	% Moisture	SPT (N)	Well Installation	Log Notes
128.4	7	**(CL) SILTY CLAY:** grey; cohesive, w>PL, very soft to soft (128.32)								
127.9	7.5	**(ML) SILT and (SP) SAND:** some gravel to gravelly; grey; non-cohesive, wet, very loose to loose								
			8	SS	100	5	10.7%	5		
127.4	8									
126.9	8.5									
126.4	9									
125.9	9.5									
125.4	10									
124.9	10.5									
			9	SS	85	3	12%	3		
124.4	11									
123.9	11.5									
123.4	12									
122.9	12.5									
122.4	13									
121.9	13.5									
		(121.41)	10	SS	100	9	9.9%	9		

% Moisture scale: 25 50 75; SPT (N) scale: 20 40 60 80

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS9	13	38	41	8

1m = 26 units

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Log of Borehole: BH105-22

Client: Gay Company Limited **Project Name:** GEO - 1697 Durham Reg Hwy 2 **Project No.:** 15382-001

Contractor: Drilltech Drilling Limited **Method:** Track Mounted Solid Stem Auger **Date Completed:** November 18, 23, 24, 2022

Location: **UTM:** 17T **N:** 4864264 **E:** 677965 **Elevation:** 135.41 mASL

Elevation (m)	Depth (m)	Description	Number	Type	% Recovery	SPT (N)	% Moisture	SPT (N)	Well Installation	Log Notes
121.4	14	**(ML) SILT and SAND:** some gravel to gravelly; grey; non-cohesive, wet, very loose to loose	10	SS	100	9	9.9%	9		
120.02		**(ML) sandy SILT:** to (SM) SILTY SAND; grey (TILL); non-cohesive, wet, compact to very dense	11	SS	25	26	12.5%	26		
			12	SS	80	50	9.2%	50		
			13	SS	45	49	8.8%	49		
116.66		Borehole Terminated @ 18.7m in competent soil								

Elevation scale: 121.4, 120.9, 120.4, 119.9, 119.4, 118.9, 118.4, 117.9, 117.4, 116.9, 116.4, 115.9, 115.4, 114.9
Depth scale: 14, 14.5, 15, 15.5, 16, 16.5, 17, 17.5, 18, 18.5, 19, 19.5, 20, 20.5
% Moisture axis: 25 50 75
SPT (N) axis: 20 40 60 80

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS9	13	38	41	8

1m = 26 units

Logged By: EC **Input By:** CM

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Log of Borehole: BH106-22
Page 1 of 1

Client: Gay Company Limited | **Project Name:** GEO - 1697 Durham Reg Hwy 2 | **Project No.:** 15382-001
Contractor: Drilltech Drilling Limited | **Method:** Track Mounted Solid Stem Auger | **Date Completed:** November 18, 2022
Location: | **UTM:** 17T **N:** 4864289 **E:** 677993 | **Elevation:** 133.51 mASL

Elevation (m)	Depth (m)	Description	Number	Type	% Recovery	SPT (N)	% Moisture	Well Installation	Log Notes
133.5	0	**FILL:** (SP/GP) SAND and GRAVEL, brown; non-cohesive, moist, compact (to 133.38)	1A	SS			%	Cap	50 mm Diameter Monitoring Well with a 1.5 m screen.
		FILL: (SM) SILTY SAND, brown; non-cohesive, moist, compact (to 132.82)	1B	SS	50	20	8.4%	Bentonite Plug; Riser	
		(ML) sandy SILT: brown, mottled; non-cohesive, moist, compact (to 131.38)	2	SS	75	16	10.3%		Groundwater level measured in monitoring well at a depth of about 2.6mbgs (Elevation 130.9masl).
			3	SS	75	19	10.7%	Sand Pack	
		(SM) SILTY SAND: brown; non-cohesive, moist, very dense (to 130.61)	4	SS	90	70	%	PVC Screen	
		(CL) SILTY CLAY: trace sand, grey; cohesive, w>PL, stiff (to 130)	5	SS	60	9	18.9%	Cap	
130	3.5	Borehole Terminated @ 3.5m							

GRAINSIZE DISTRIBUTION: SAMPLE | GRAVEL | SAND | SILT | CLAY

1m = 26 units

Logged By: EC **Input By:** CM

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Log of Borehole: BH107-22

Client: Gay Company Limited
Project Name: GEO - 1697 Durham Reg Hwy 2
Project No.: 15382-001
Contractor: Drilltech Drilling Limited
Method: Track Mounted Solid Stem Auger
Date Completed: November 17, 2022
Location:
UTM: 17T **N:** 4864315 **E:** 677963
Elevation: 133.41 mASL

Elevation (m)	Depth (m)	Description	Number	Type	% Recovery	SPT (N)	% Moisture	SPT (N) plot	Well Installation	Log Notes
133.4	0	**TOPSOIL:** (~ 280 mm thick) — 133.13	1A	SS	75	7	20.5%	7		Borehole dry and open upon completion of drilling
132.9	0.5	**FILL:** (ML) sandy SILT; brown; non-cohesive, moist, loose — 132.72	1B	SS			12.2%			
132.4	1	**(CL-ML) SILTY CLAY - CLAYEY SILT:** brown, mottled; cohesive, w<PL, stiff to very stiff	2	SS	100	13	16.2%	13		
131.9	1.5		3	SS	100	17	16.8%	17		
131.4	2	— 131.28								
130.9	2.5	**(SM) SILTY SAND:** grey; non-cohesive, wet, dense — 130.51	4	SS	60	36	16.9%	36		
130.4	3	**(CL) SILTY CLAY:** grey; cohesive, w>PL, soft — 129.9	5	SS	100	3	21.4%	3		
129.9	3.5	Borehole Terminated @ 3.5m								
129.4	4									
128.9	4.5									
128.4	5									
127.9	5.5									
127.4	6									
126.9	6.5									

% Moisture scale: 25 50 75; SPT (N) scale: 20 40 60 80

GRAINSIZE DISTRIBUTION: SAMPLE | GRAVEL | SAND | SILT | CLAY

1m = 26 units

Logged By: EC **Input By:** CM

Appendix B

Physical Laboratory Testing Results

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Plasticity Chart

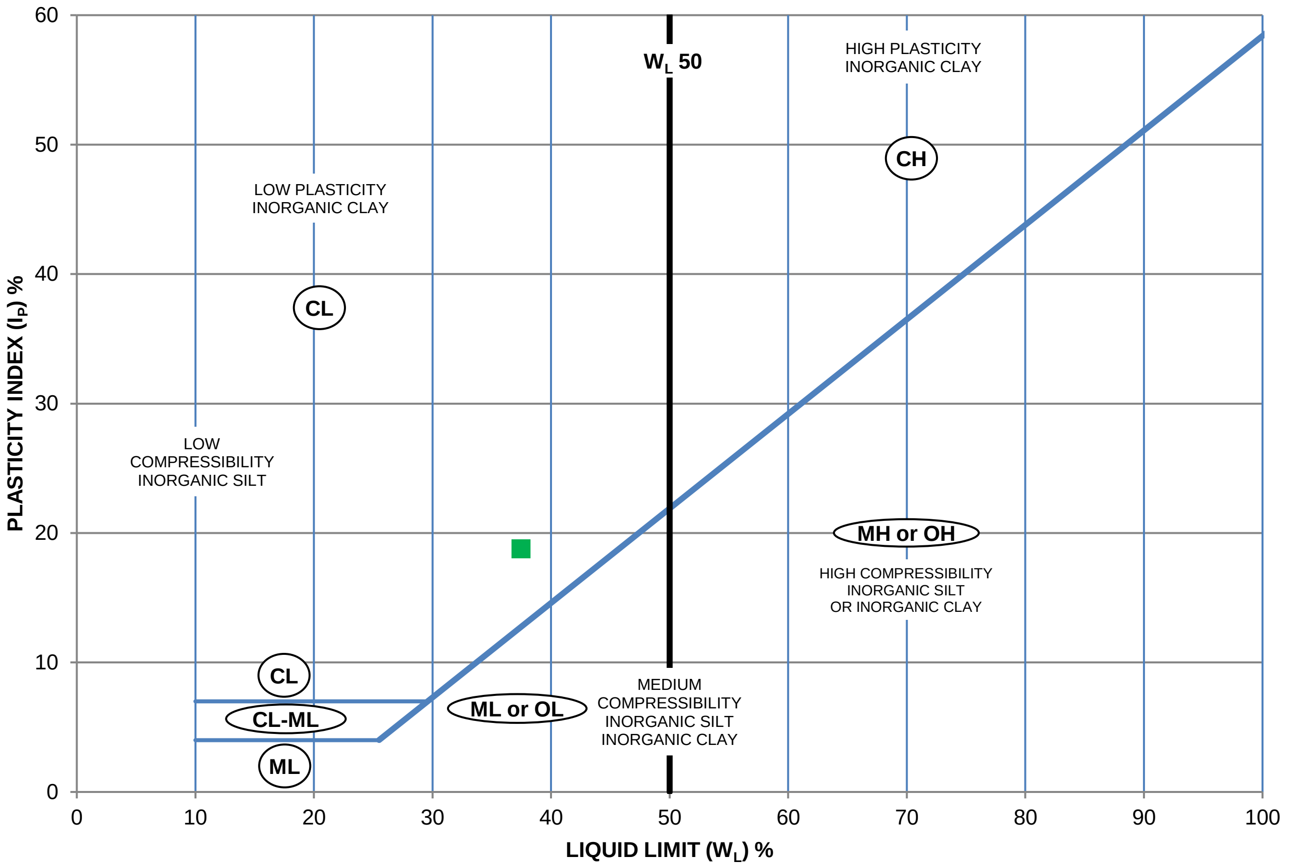
Project Number: *15382-001* **Client:** *Gay Company Limited*

Project Name: *GEO - 1697 Durham Reg Hwy 2*

Sampled By: *Emily Couperthwaite - Cambium Inc.* **Sample Date:** *November 17 - 24, 2022*

Hole No.: *BH 101-22 SS 6* **Depth:** *4.6 m to 5 m* **Lab Sample No:** *S-22-1723*

Low Plasticity	High Plasticity



Symbol	Borehole	Sample	Depth	Description
■	BH 101-22	SS 6	4.6 m to 5 m	Low Compressibility

Liquid Limit (%)	Plastic Limit	Plasticity Index (%)
37.5	***18.7***	***18.8***

Additional information available upon request

Issued By: [signature] *Date Issued:* *December 1, 2022*

(Senior Project Manager)

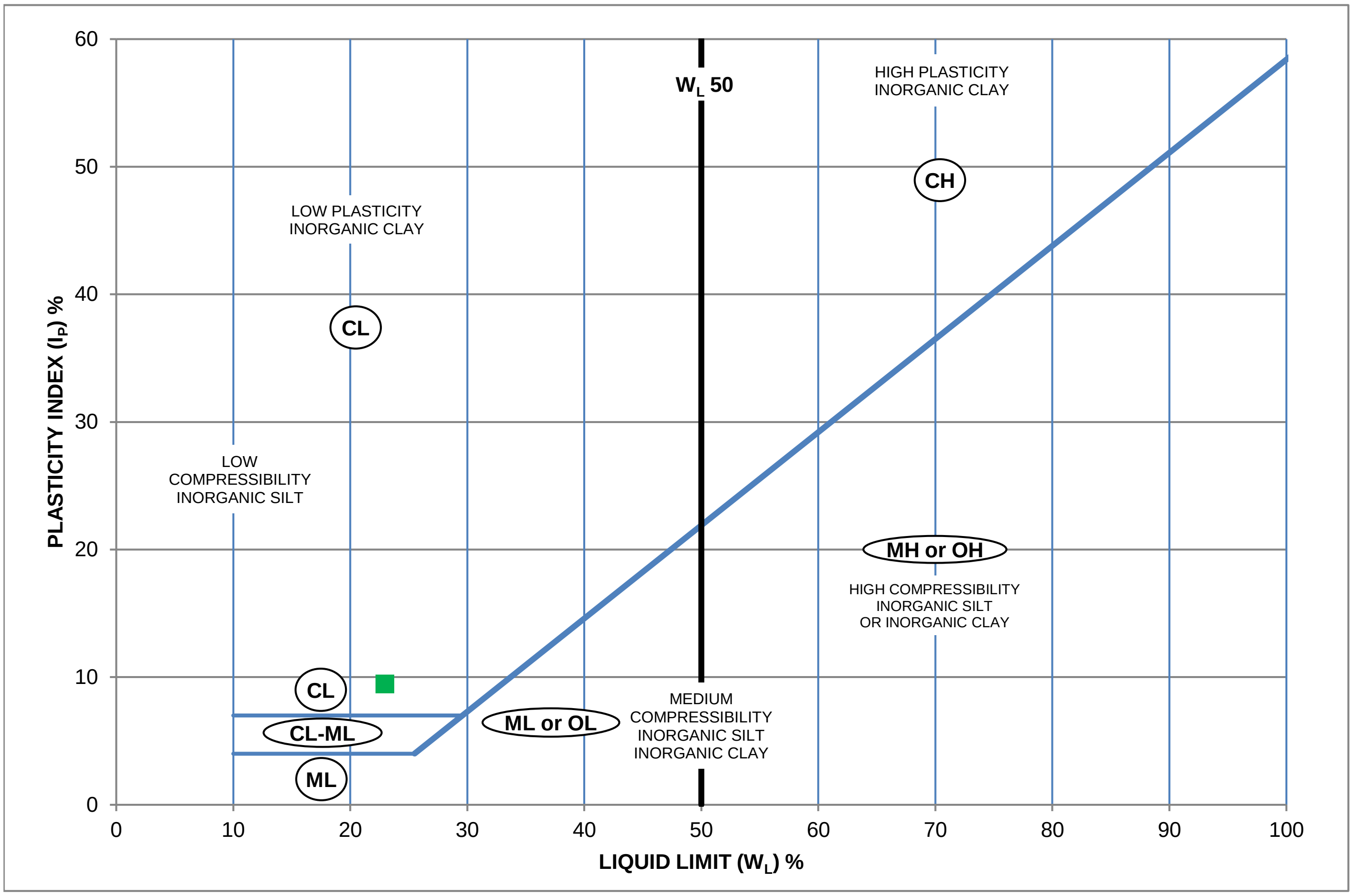
CAMBIUM

Plasticity Chart

Project Number:	*15382-001*	**Client:**	*Gay Company Limited*
Project Name:	*GEO - 1697 Durham Reg Hwy 2*		
Sampled By:	*Emily Couperthwaite - Cambium Inc.*	**Sample Date:**	*November 17 - 24, 2022*

Hole No.: *BH 103-22 SS 5* **Depth:** *3 m to 3.5 m* **Lab Sample No:** *S-22-1724*

Low Plasticity	High Plasticity



Symbol	Borehole	Sample	Depth	Description
■	BH 103-22	SS 5	3 m to 3.5 m	Low Compressibility

Liquid Limit (%)	Plastic Limit	Plasticity Index (%)
23.0	***13.5***	***9.5***

Additional information available upon request

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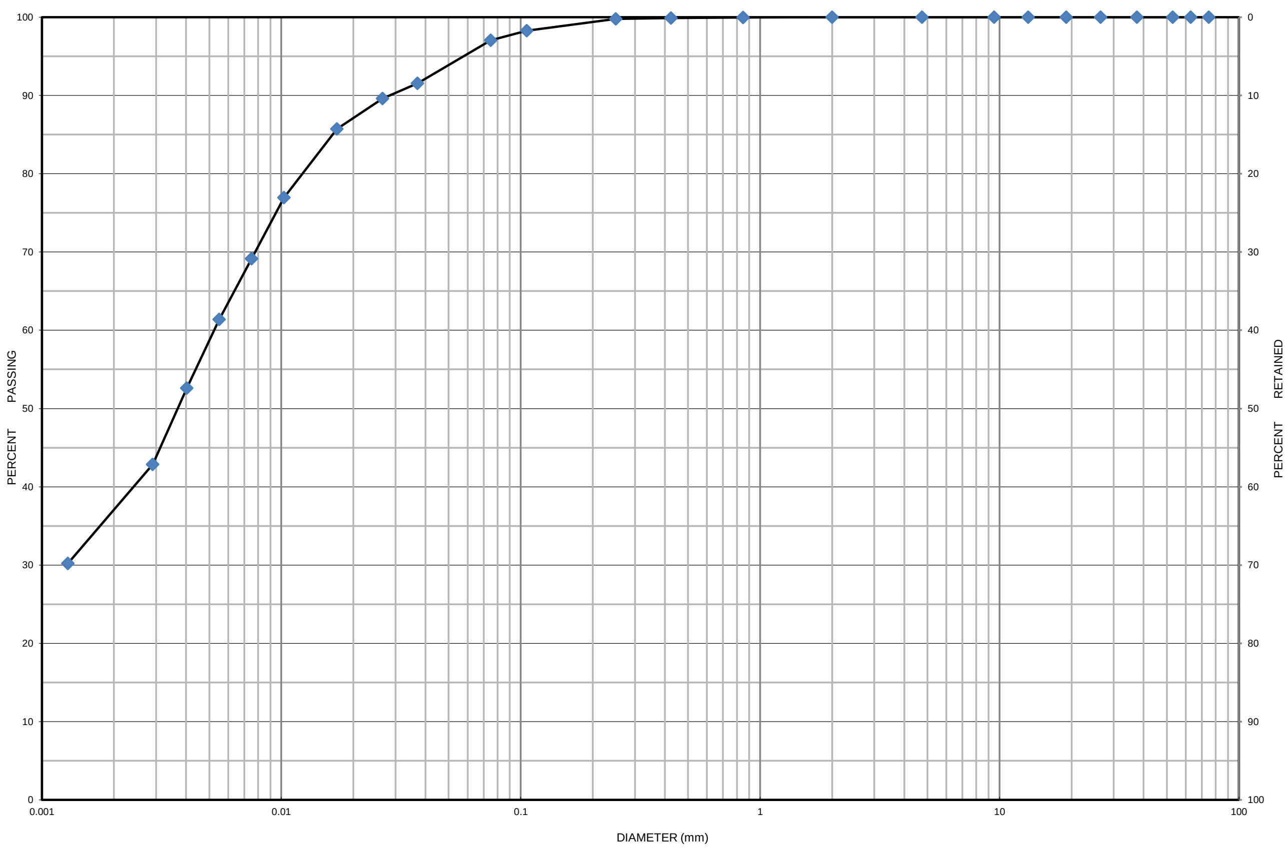
Grain Size Distribution Chart

Project Number:	*15382-001*	**Client:**	*Gay Company Limited*		
Project Name:	*GEO - 1697 Durham Reg Hwy 2*				
Sample Date:	*November 17 - 24, 2022*	**Sampled By:**	*Emily Couperthwaite - Cambium Inc.*		
Location:	*BH 103-22 SS 6*	**Depth:**	*4.6 m to 5 m*	**Lab Sample No:**	*S-22-1725*

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 103-22	SS 6	4.6 m to 5 m	0	3	60	37	21.7

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
SILTY CLAY	CL	0.0053	-	-	-	-

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Plasticity Chart

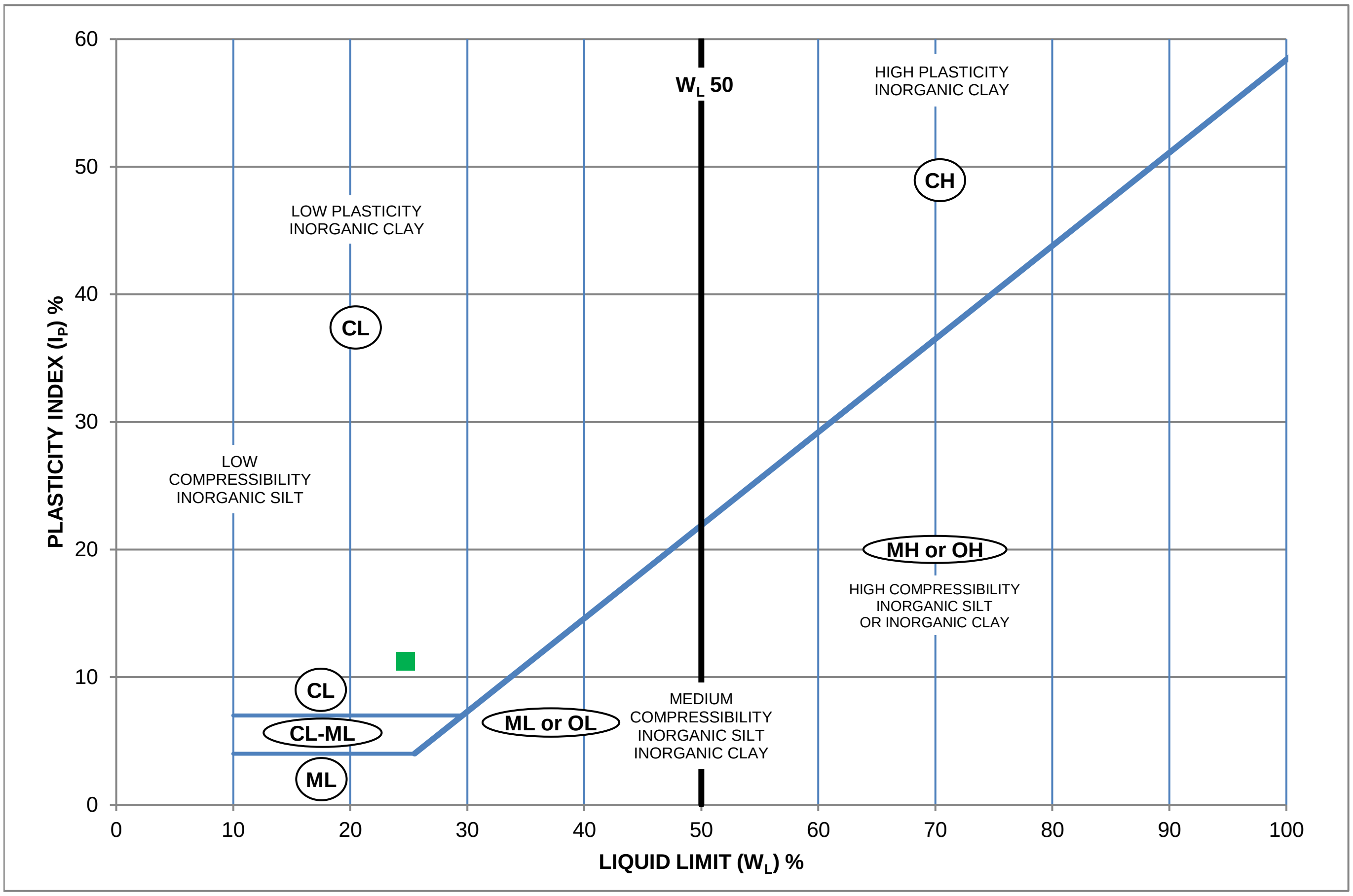
Project Number: *15382-001* **Client:** *Gay Company Limited*

Project Name: *GEO - 1697 Durham Reg Hwy 2*

Sampled By: *Emily Couperthwaite - Cambium Inc.* **Sample Date:** *November 17 - 24, 2022*

Hole No.: *BH 103-22 SS 7* **Depth:** *6.1 m to 6.6 m* **Lab Sample No:** *S-22-1726*

Low Plasticity	High Plasticity



Symbol	Borehole	Sample	Depth	Description
■	BH 103-22	SS 7	6.1 m to 6.6 m	Low Compressibility

Liquid Limit (%)	Plastic Limit	Plasticity Index (%)
24.7	***13.5***	***11.2***

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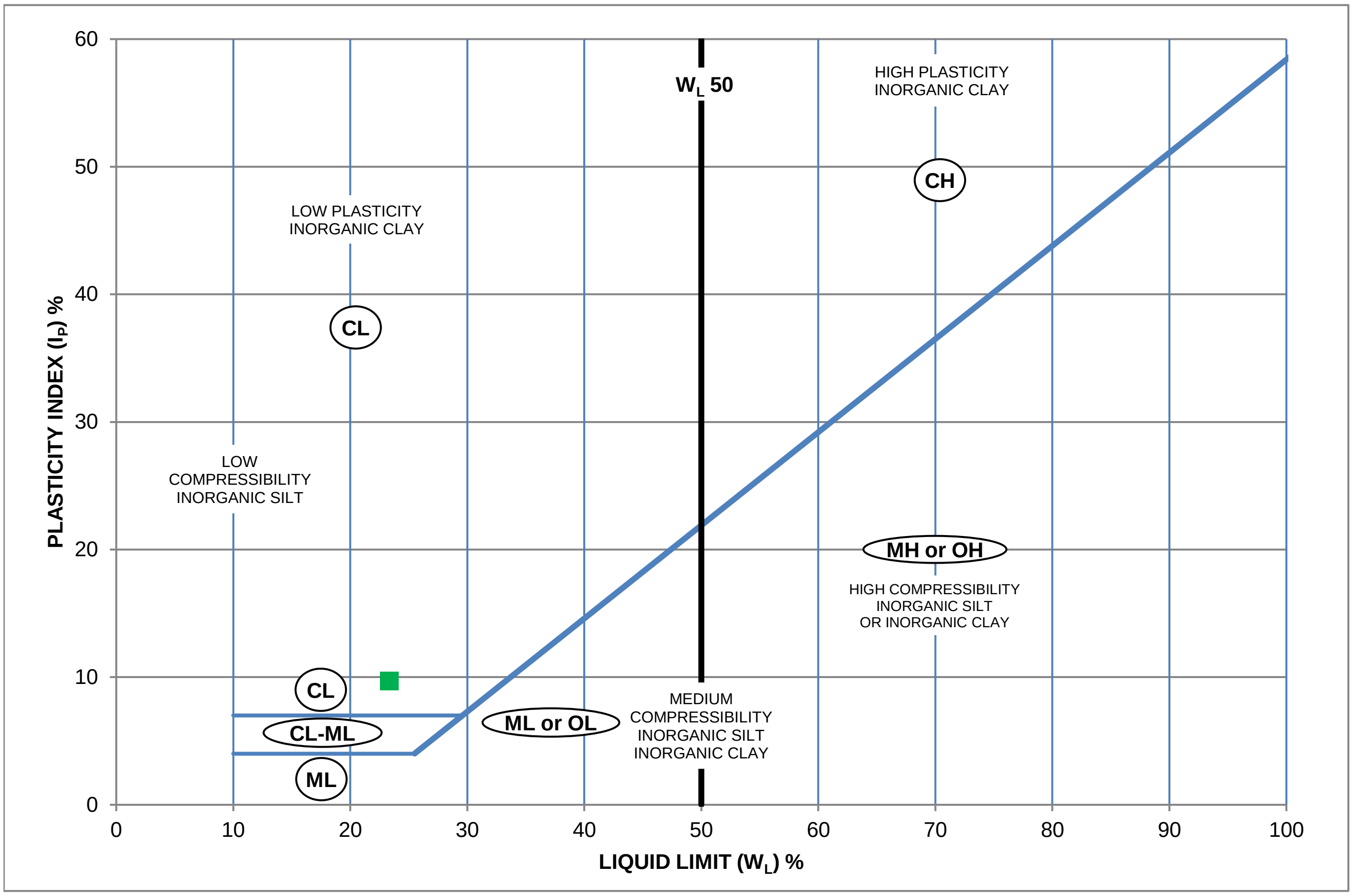
Plasticity Chart

Project Number:	*15382-001*	**Client:**	*Gay Company Limited*
Project Name:	*GEO - 1697 Durham Reg Hwy 2*		
Sampled By:	*Emily Couperthwaite - Cambium Inc.*	**Sample Date:**	*November 17 - 24, 2022*

Hole No.: *BH 104-22* *SS 6* **Depth:** *4.6 m to 5 m* **Lab Sample No:** *S-22-1727*



Symbol	Borehole	Sample	Depth	Description
■	BH 104-22	SS 6	4.6 m to 5 m	Low Compressibility

Liquid Limit (%)	Plastic Limit	Plasticity Index (%)
23.3	***13.6***	***9.7***

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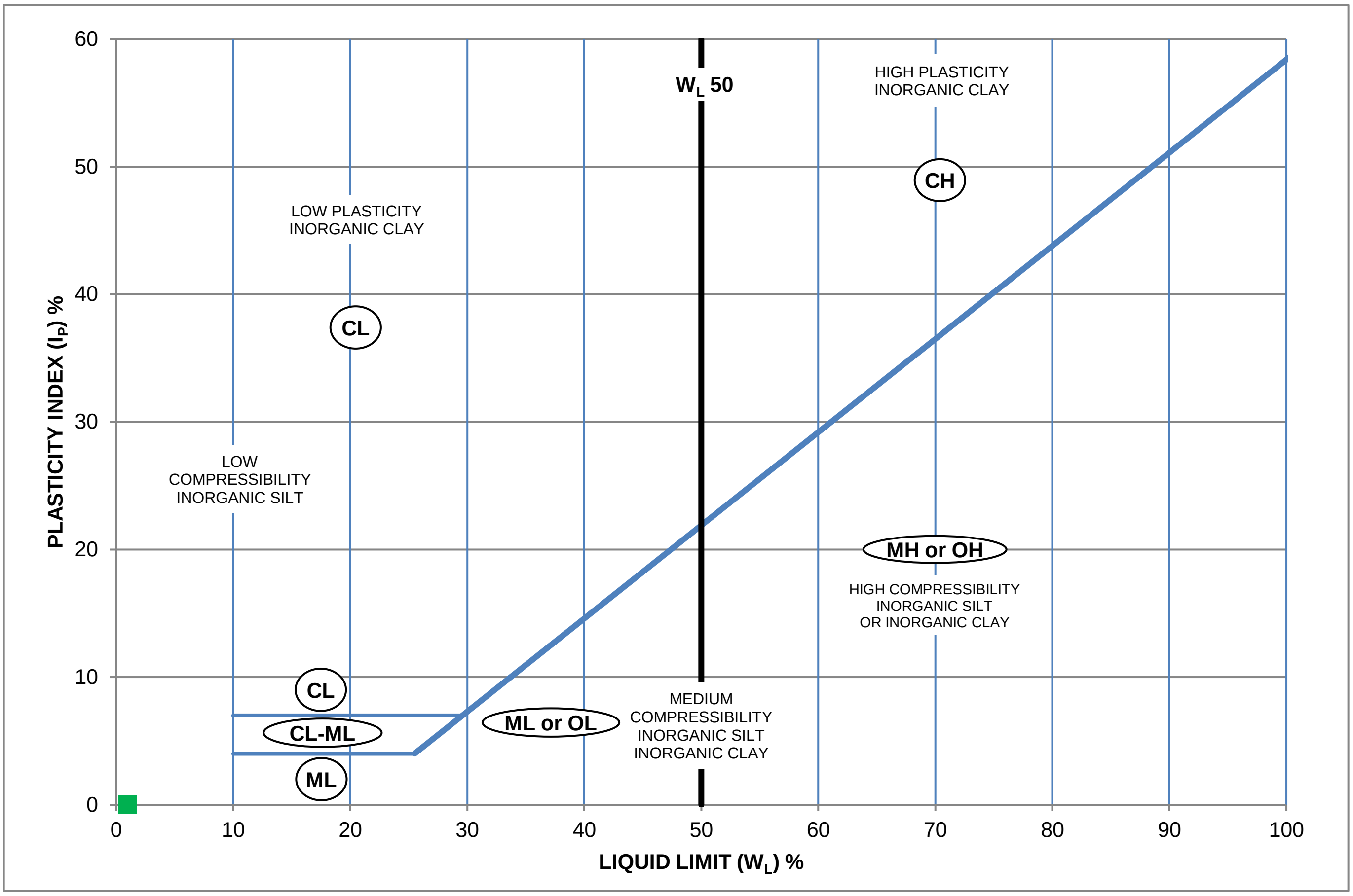
Plasticity Chart

Project Number: *15382-001* **Client:** *Gay Company Limited*
Project Name: *GEO - 1697 Durham Reg Hwy 2*
Sampled By: *Emily Couperthwaite - Cambium Inc.* **Sample Date:** *November 17 - 24, 2022*

Hole No.: *BH 104-22 SS 9* **Depth:** *9.1 m to 9.6 m* **Lab Sample No:** *S-22-1728*

Low Plasticity	High Plasticity



Symbol	Borehole	Sample	Depth	Description
■	BH 104-22	SS 9	9.1 m to 9.6 m	-

Liquid Limit (%)	Plastic Limit	Plasticity Index (%)
Unable to complete	***Unable to complete***	***Unable to complete***

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Plasticity Chart

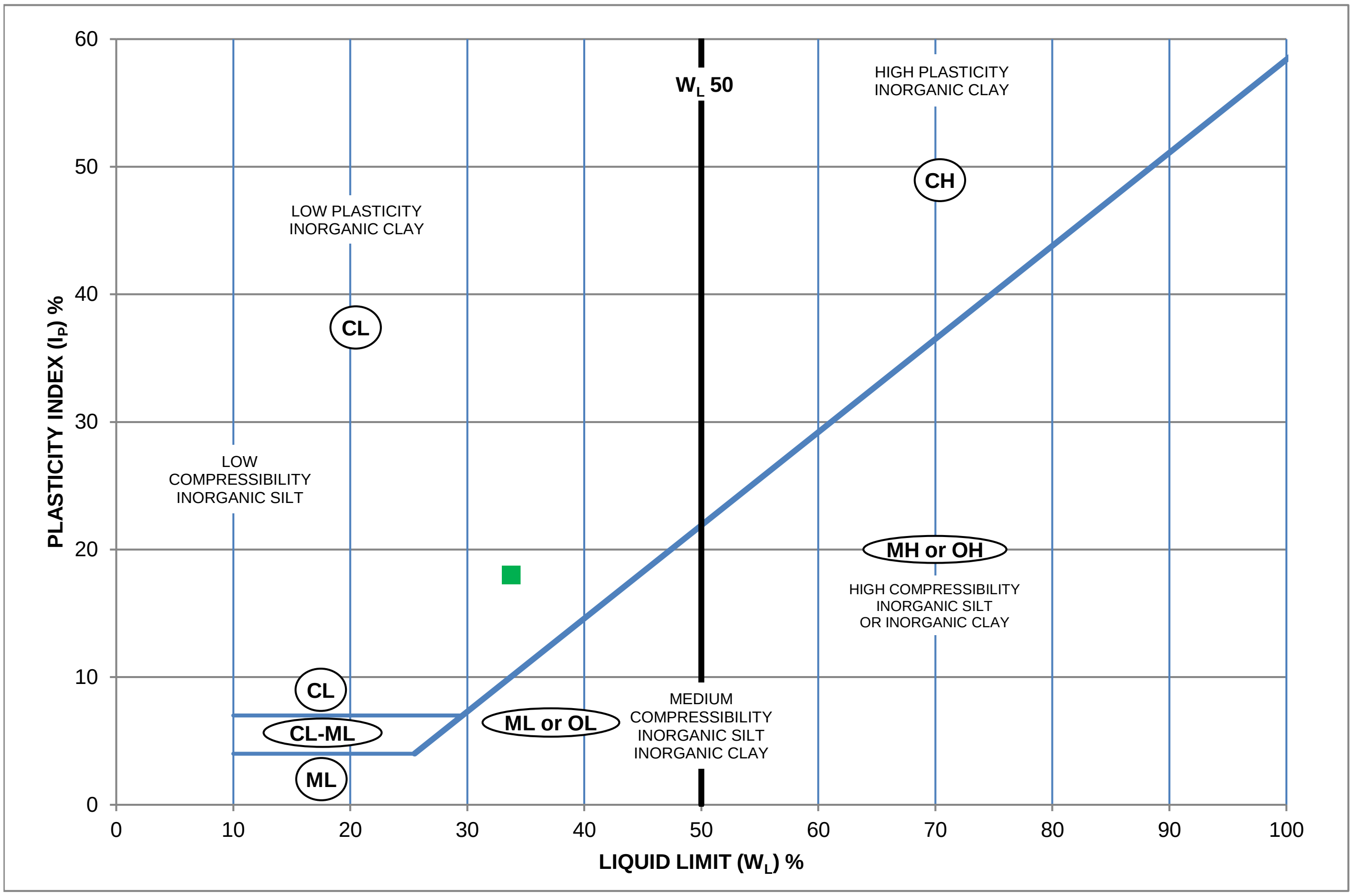
Project Number: *15382-001* **Client:** *Gay Company Limited*

Project Name: *GEO - 1697 Durham Reg Hwy 2*

Sampled By: *Emily Couperthwaite - Cambium Inc.* **Sample Date:** *November 17 - 24, 2022*

Hole No.: *BH 105-22 SS 6* **Depth:** *4.6 m to 5 m* **Lab Sample No:** *S-22-1729*

Low Plasticity	High Plasticity



Symbol	Borehole	Sample	Depth	Description
■	BH 105-22	SS 6	4.6 m to 5 m	Low Compressibility

Liquid Limit (%)	Plastic Limit	Plasticity Index (%)
33.7	***15.7***	***18.0***

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Grain Size Distribution Chart

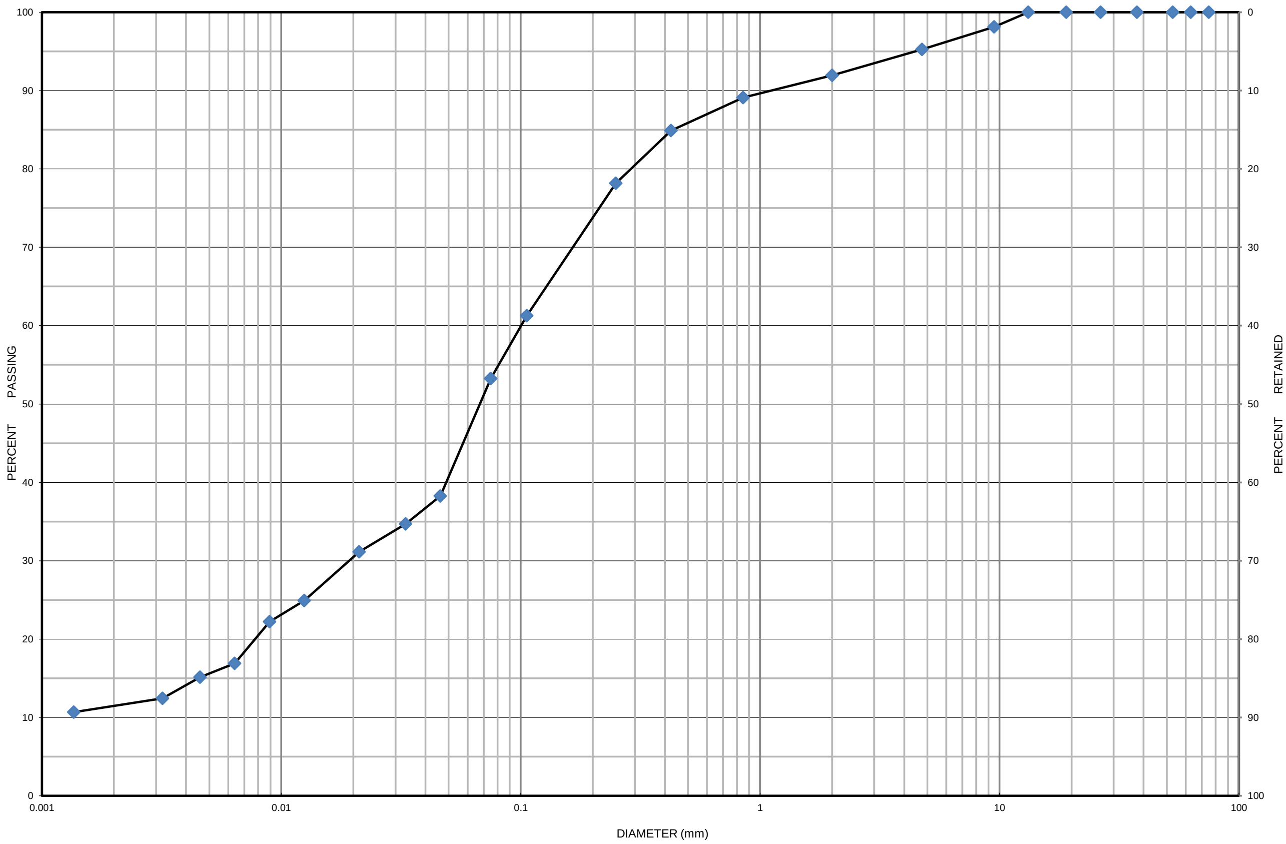
Project Number: *15382-001* **Client:** *Gay Company Limited*

Project Name: *GEO - 1697 Durham Reg Hwy 2*

Sample Date: *November 17 - 24, 2022* **Sampled By:** *Emily Couperthwaite - Cambium Inc.*

Location: *BH 101-22 SS 10* **Depth:** *10.7 m to 11.1 m* **Lab Sample No:** *S-22-130*

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 101-22	SS 10	10.7 m to 11.1 m	5	42	41	12	16.7

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
SILT and SAND	ML/SP	0.110	0.019	-	-	-

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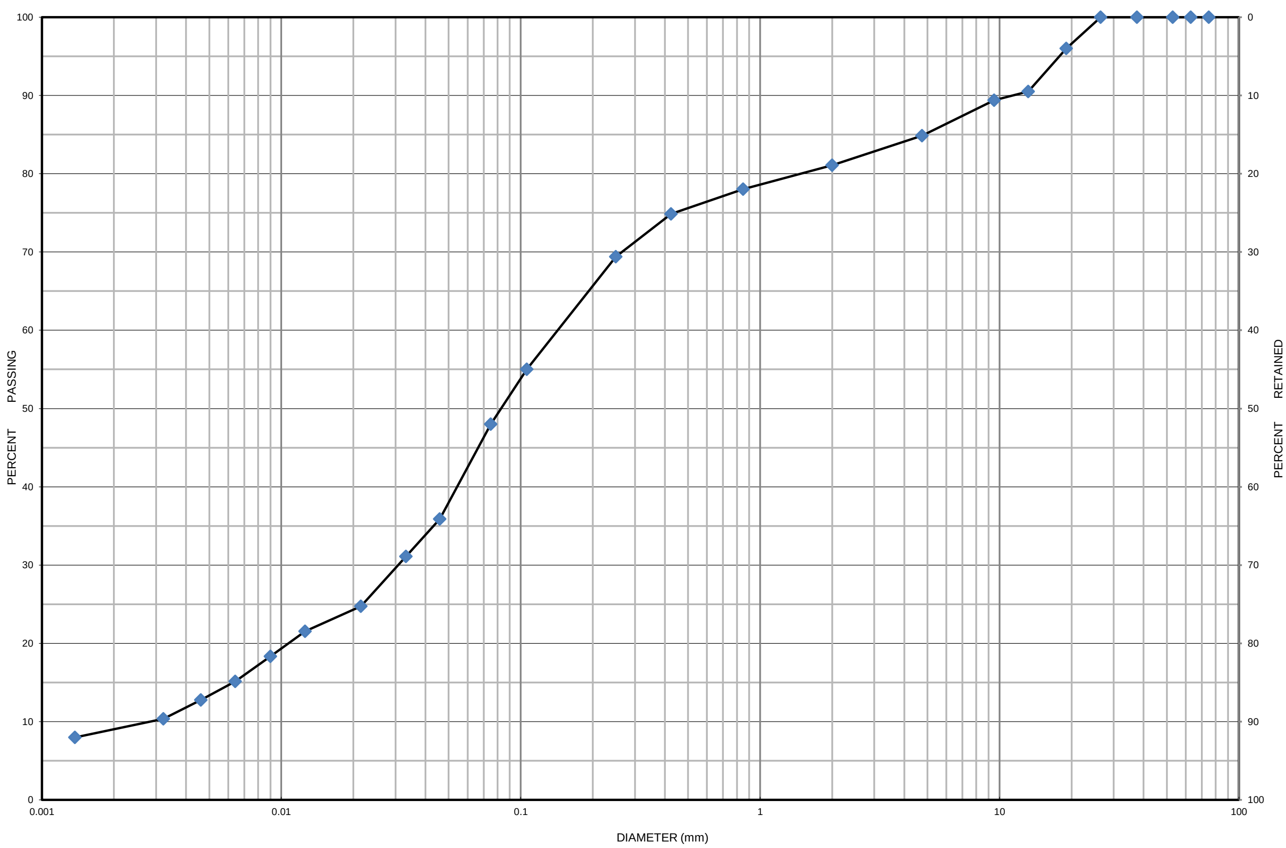
Grain Size Distribution Chart

Project Number:	*15382-001*	**Client:**	*Gay Company Limited*		
Project Name:	*GEO - 1697 Durham Reg Hwy 2*				
Sample Date:	*November 17 - 24, 2022*	**Sampled By:**	*Emily Couperthwaite - Cambium Inc.*		
Location:	*BH 101-22 SS 14*	**Depth:**	*16.8 m to 17.2 m*	**Lab Sample No:**	*S-22-131*

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 101-22	SS 14	16.8 m to 17.2 m	15	37	40	8	10.9

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sandy SILT to SILTY SAND TILL	ML/SM	0.1500	0.0310	0.0026	57.69	2.46

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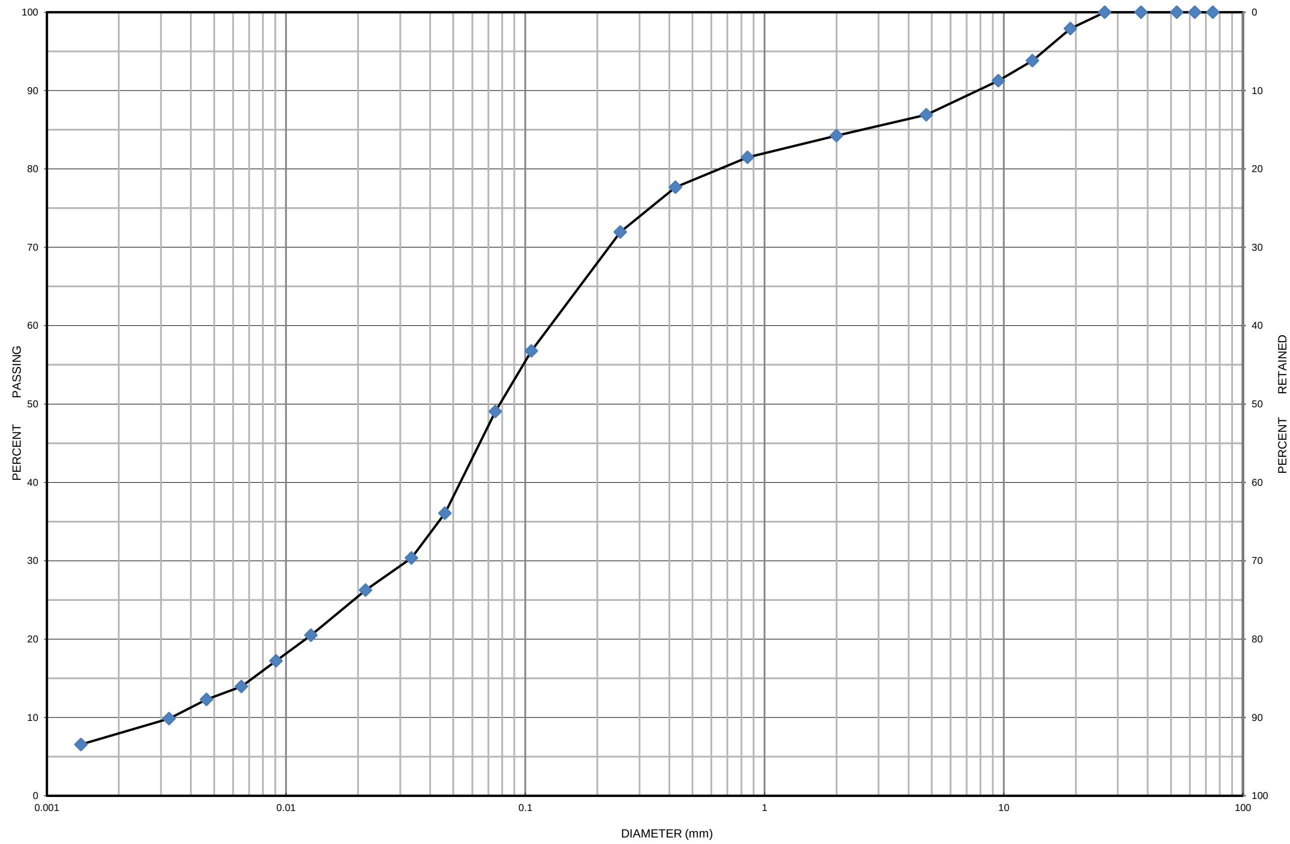
Grain Size Distribution Chart

Project Number:	*15382-001*	**Client:**	*Gay Company Limited*		
Project Name:	*GEO - 1697 Durham Reg Hwy 2*				
Sample Date:	*November 17 - 24, 2022*	**Sampled By:**	*Emily Couperthwaite - Cambium Inc.*		
Location:	*BH 105-22 SS 9*	**Depth:**	*10.7 m to 11.1 m*	**Lab Sample No:**	*S-22-132*

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 105-22	SS 9	10.7 m to 11.1 m	13	38	41	8	12.0

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
SILT and SAND	ML/SP	0.1400	0.0320	0.0033	42.42	2.22

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