Geotechnical Exploration - Batteaux Road – 57 Batteaux Road, Nottawa, Township of Clearview

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Prepared for:
Georgian Communities

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CAMBIUM INC.

866.217.7900

cambium-inc.com

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1.0 Introduction

Cambium Inc. (Cambium) has been retained by Georgian Communities (the “Client”/ “Georgian”) to provide geotechnical consulting services in support of the design of the proposed residential development to be located at 57 Batteaux Road (the “Site”) in Nottawa, Township of Clearview, Ontario. The location of the project is 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. 14768-P, dated March 14, 2022. Authorization to proceed with the investigation was received in the form of the signed proposal from the Client on March 15, 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 assignment and are not addressed herein.

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 southeast of Batteaux Road and County Road 124 at 57 Batteaux Road in Nottawa, Township of Clearview, Ontario, as shown on the Borehole Location Plan, Figure 2 attached. The site is bordered on the north and south sides by residential houses, on the west by agriculture lands and on the east by an elementary school. The site has access to County Road 124 via one of the residential properties in the northwest corner of the site.

The 3.4-hectare site is currently used for agricultural purposes with the northwest corner occupied by a single storey residential building. Regional topographic information of the site generally indicates that the site is flat with elevations ranging from about 214 metres above sea level (masl) to 215 masl.

At the time of preparing this report, the conceptual information available for the proposed development indicated that the site will be occupied by 47 single detached residential lots and associated access roads.

3.0 Methodology

The geotechnical field investigation for this current assignment was carried out on April 8 and 11, 2022, during which time five boreholes (designated as BH121-22 to BH125-22) were advanced at the site. The boreholes for the investigation were drilled using a standard track-mounted drill rig supplied and operated by Walker Drilling of Utopia, Ontario, subcontracted to Cambium.

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 (mbgs*)	Finished Elevation (m)	Notes
BH121-22	215	6.7	208.3	
BH122-22	215	6.7	208.3	50-mm monitoring well
BH123-22	215	5.2	209.8	
BH124-22	215.1	6.7	208.4	50-mm monitoring well
BH125-22	215.5	6.7	208.8	50-mm monitoring well
*Metres below ground surface *Elevation is relative to temporary benchmark				

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

The 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 up to a depth of 3.0 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 three boreholes in this investigation (see Table 1, above) following the completion of drilling to allow for subsequent groundwater measurements and hydrogeological testing. 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. The well installation details, and groundwater level readings are presented on the Record of Borehole sheets in Appendix A. Boreholes without monitoring wells were backfilled with bentonite and cuttings upon completion in accordance with the requirements of the Revised Regulations of Ontario (R.R.O.) 1990, Regulation 903 (as amended) of the Ontario Water Resources Act.

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 Peterborough geotechnical laboratory for further visual examination by the project engineer and for laboratory testing.

Index and classification tests, consisting of water content determinations, gradation analyses and Atterberg Limits testing, 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 interpolated from a topographic survey provided by the Client. As such, the elevations given on the Log of Borehole sheets and referred to herein should be considered to be approximate. The borehole locations were referenced to existing prominent site features and plotted on the plan provided in the preparation of Figure 2, Borehole Location Plan. As such, the borehole locations shown on Figure 2 attached should also be considered to be approximate.

4.0 Site Geology and Stratigraphy

4.1 Regional Geology

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

- Chapman, L.J., and Putnam, D.F., 2007, “The Physiography of Southern Ontario”; 4th Edition, Ontario Geological Survey; and
- 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 Simcoe Lowlands. The Simcoe Lowlands occupy an area of about 2,850 square kilometres and consist of the lowlands bordering the Georgian Bay and Lake Simcoe. The site is within the are of the Simcoe Lowlands called the Nottawasaga Basin and the lowlands surrounding Lake Simcoe is referred to as the Lake Simcoe Basin. These two basins are connected at Barrie by a flat-floored valley and by similar valleys among the upland plateaux farther north. Both the lowlands and transverse valleys were flooded by Lake Algonquin and are bordered by shorecliffs, beaches and bouldery terraces. Thus, they are floored by sand, silt, and clay.

The surficial geology mapping indicates that 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 A. 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 disturbed native material (likely from agricultural activities). The near surface disturbed soil is underlain by non-cohesive deposits of silty sandy, sandy silt to silt. A localized deposit of silty clay was encountered in BH121-22 underlying the non-cohesive deposits. The measured SPT “N”values indicate the near surface disturbed material is underlain by compact to very dense non-cohesive deposits.

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;

- The SPT “N” values given are blows for 0.3 m of penetration unless otherwise indicated; and
- In some boreholes, the presence of cobbles and boulders was inferred within the glacial till deposits due to rock fragments in the split spoon samples or due to bouncing of the split spoon during sampling.

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

Table 2 Summary of Soil Properties for Northwestern Area of Site

Stratigraphy	Depth (mbgs)		Elevation (masl)		SPT "N" Values	Relative Density / Consistency	Approximate Water Content (%)	Notes
	From	To	From	To				
Topsoil	0	150mm to 200mm	-	-	-	-	-	-
Non-cohesive Fill / Disturbed Native	0.2	0.6 to 1.5	214.8 to 215.3	213.6 to 214.3	1 to 12	Very loose to compact but generally very loose to loose	11 to 31	
Sand to Silty Sand	0.6 to 2.2	2.0 to 5.6	213.6 to 214.3	209.4 to 212.1	11 to 50/0.2m of penetration	Compact to very dense but generally compact	16 to 21	
Sandy Silt to Silt	2.0 to 5.6	5.2* to 6.7*	209.4 to 212.1	208.3 to 209.7	14 to 50/0.2m of penetration	Compact to very dense but generally compact	12 to 21	Except for an upper deposit of sandy silt in BH122-22
Silty Clay to Clayey Silt	5.6	6.7*	209.4	208.3	15	Very stiff	25	BH121-22 only
Mbgs = metres below ground surface *Borehole termination depth								

Please note:

The sandy silt to silt deposits were generally encountered underlying the sand to silty sand deposits, however, in BH122-22, a deposit of sandy silt was encountered underlying the disturbed silty sand between the depths of 0.7 mbgs and 2.2 mbgs.

The gradation curves of selected samples are included in Appendix B.

4.3 Groundwater Conditions

Groundwater level measurements for the current investigation were collected at the Site on May 5 and June 8, 2022. Groundwater level was measured at each well with an electronic water level tape, which was cleaned between well locations. Table 3, below, summarizes the groundwater level measurements collected to date.

Table 3 Groundwater Level Measurements

Borehole ID	Measurement Date	Water Level	
		Depth (mbgs)	Elevation (m)
BH122-22	May 5, 2022	0.17	214.9
	June 8, 2022	0.60	214.4
BH124-22	May 5, 2022	0.54	214.6
	June 8, 2022	0.90	214.2
BH125-22	May 5, 2022	1.14	214.4
	June 8, 2022	1.32	214.2

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.

5.0 Geotechnical Design 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 General Considerations

At the time of preparing this report, final grading plans and details of the proposed site services were not available. In addition, it was not known if the proposed residential houses will have a basement level. The groundwater conditions at the site varied from about 0.2 m to 1.3 m below the existing ground surface. Based on these conditions, the following should be considered:

Conventional spread or strip footings are feasible, but the bearing capacity depends on the founding depth and location on site. Once grading plans are available, recommendations can be provided for the founding depths and where higher bearing capacity, if required, is available.

If a basement level is being proposed for the buildings, foundation and under slab drainage would have to be considered or alternatively, the buildings can be designed as fully waterproof/ tanked basements.

5.2 Topsoil Stripping and Reuse

The following geotechnical comments are provided regarding organic and topsoil stripping and reuse at the site:

Surficial vegetation and topsoil should be stripped from the proposed development area.

Consideration may be given to selective stripping operations, consisting of road allowances, and building footprints (including driveways).

Outside of road allowances and building footprints, topsoil, if encountered, may be buried and/or reused as general lot fill to raise grades. The primary factor controlling methane generation is the organic carbon content of the topsoil. The loss on ignition (LOI) test provides an indication of the organic carbon content of the sample. If topsoil is to be reused as general lot fill to raise grades, then LOI testing should be carried out and further recommendations provided by the geotechnical engineer in regard to the reuse of topsoil and the potential for methane generation. Stripping of organically stained layers would not be required in any site area from a geotechnical perspective. However, from a construction viewpoint, it may not be practical (or possible) for the contractor to distinguish between this zone and the overlying topsoil, if encountered, especially if cuts of less than 150 mm are required.

Where low organic content topsoil is used as general lot fill, its thickness should be limited to about 1.5 m. The topsoil fill should be placed in maximum 300-mm thick loose lifts and uniformly compacted to at least 95% of standard Proctor maximum dry density (SPMDD). To have any success in placing topsoil as lot grading fill, it must be placed at or very close to its optimum water content to achieve workability and adequate compaction, in order to reduce post-construction settlements and/or lateral movements (e.g. of fences, etc.).

5.3 Site Preparation

We understand that, while final design grades are not yet available, some minor cut and fill site grading operations will be required to establish final grade levels throughout the site. Fill (mainly surficial soils disturbed by agricultural activity) soil and materials containing organics were encountered at all of the borehole locations; topsoil and fill materials are not considered suitable to provide foundation support for the proposed building foundations, floor slabs, other settlement-sensitive structures, or engineered fill materials that may be subsequently used to support these structures. To reduce the potential for differential settlements, all existing topsoil (where present) and fill materials within the proposed building footprints and paved areas, should be completely sub-excavated and replaced with approved engineered fill materials, as required (subject to inspection in the field during construction by Cambium, as discussed later). Any topsoil and materials with significant quantities of organics and deleterious materials (i.e., construction debris, etc.) are not appropriate for use as fill.

The exposed subgrades should be proof-rolled and inspected by a qualified geotechnical engineer prior to placement of any granular fill. Any loose/soft soils identified at the time of proof-rolling that are unable to uniformly be compacted should be sub-excavated and removed. The excavations created through the removal of these materials should be backfilled with approved engineered fill consistent with the recommendations provided below.

Complete removal of any existing septic systems, wells, old foundations, etc. would also be required as part of the Site redevelopment. 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 45° angles to the horizontal.

Proposed building foundations, floor slabs, pavements or other settlement-sensitive structures may be supported on approved native undisturbed compact soils that are free of organics and other deleterious materials or on approved engineered fill materials.

The near surface silty sand to sandy silt soils can become unstable if they are wet or saturated. Such conditions are common in the spring and late fall. Under these conditions, temporary use of granular fill, and possible reinforcing geotextiles may be required to prevent severe rutting on construction access routes.

5.4 Engineered Fill

Engineered fill may be required to support structural elements such as foundations and / or floor slabs depending on the extent of existing fill removal or removal of the existing structures on site. The following is recommended for the construction of engineered fill:

Prior to placing engineered fill on site, all of the topsoil and disturbed native, or deleterious materials within the limits of the engineered fill must first be removed to the competent subgrade.

The area of the engineered fill should extend horizontally 1 m beyond the outside edge of the foundations then extend downward at a 1H:1V slope to the competent approved native soil.

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(s) should then be proof-rolled in conjunction with an inspection by Cambium to confirm that the exposed soils are native, undisturbed, and competent, and have been adequately cleaned of ponded water and all disturbed, loosened, softened, organic and other deleterious material. Some of the localized near-surface loose/soft soils will also likely need to be removed prior to placement of engineered fill as directed by Cambium during proof-rolling.

Materials for reuse as engineered fill must be approved by Cambium prior to placement. In this regard, approved disturbed native or the native soil which are near their optimum water contents and do not contain topsoil or organics or any other deleterious materials can be reused on Site as engineered fill. The fill materials disturbed by agricultural activity may contain organic inclusions and as such must be assessed by Cambium for their suitability for reuse as engineered fill. Should the fill contain significant organics, these materials should be wasted or reused for landscaping purposes. The materials for use as engineered fill must be maintained within about 2 percent of optimum water content for compaction. Based on the measured natural water contents, most of the native sandy soils are generally moist to wet and may require drying during engineered fill construction. Their actual water content will need to be assessed in comparison to the laboratory optimum water contents for compaction at the time of construction.

If native soils from the site are not used as engineered fill, imported material for engineered fill should consist of clean, non-organic soils, free of chemical contamination or deleterious material. Imported materials to be used for engineered fill must be approved by Cambium at the source(s), prior to hauling to the Site. In this regard, imported sandy materials which meet the requirements for Ontario Provincial Standard Specification (OPSS) 1010.MUNI SSM or

Granular ‘B’ Type I material at a moisture content at or near optimum moisture would be suitable for use as engineered fill. In any event, the approved materials for engineered fill should be placed in maximum 300-mm thick loose lifts and uniformly compacted to 100% of SPMDD throughout. Any frost penetration into the fill material must be removed prior to placement of subsequent lifts of fill and reviewed by Cambium.

Full time testing and inspection of the engineered fill will be required for it to be used as a founding material, as outlined in Section 4.2.2.2 of the Ontario Building Code.

To account for varying founding soils, the footings and foundation walls should be suitably reinforced to mitigate potential settlement cracking.

The final surface of the engineered fill should be protected as necessary from construction traffic, ponded water and freezing, and should be sloped to provide positive drainage for surface water during and following the construction period. During periods of freezing weather, additional soil cover should be placed above final subgrade to provide frost protection.

5.5 Frost Penetration

Based on OPSD3090.101, the maximum frost penetration depth below the surface at the site is estimated at 1.4 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 1.4 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.

5.6 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 4 m below the existing surface after grading. Once the actual service invert depths are finalized, the following comments and recommendations should be reviewed and revised, as necessary.

Based on the results of this investigation, the founding soils for the services below frost depth are likely to consist of compact to very dense non-cohesive deposits. The compact to very dense non-cohesive deposits are generally considered to be suitable for supporting the pipes, provided the integrity of the base can be maintained during construction.

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 very loose to compact disturbed native soils and into the underlying compact to very dense native deposits.

It is anticipated that temporary excavations above the groundwater table level will consist of conventional temporary open cuts with side slopes not steeper than 3 horizontal to 1 vertical (3H:1V) for Type 4 soils (very loose disturbed native) and 1H:1V for Type 3 soils (loose to compact disturbed native), 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.

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.

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 is being carried out by others.

5.8 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 Township of Clearview Engineering Standards. The Township of Clearview guideline dated October 2025, and entitled, *"Township of Clearview Design Engineering Standards"* references OPSD 802.010, 802.030 and 802.031 for pipe bedding. 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 100% 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.

5.9 Trench Backfill

The excavated materials from the site will be variable, primarily consisting of sand to silty sand and sandy 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. The Township's engineering standards recommends Granular "B" (Type I) for backfill of road crossings.

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.

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.

5.9.1 Trench Cut-Offs

Where the invert levels of the services are located below the measured groundwater levels, consideration should be given to installation of low hydraulic conductivity water-stops or cut-offs (trench plugs) at strategic locations in accordance with OPSD 802.095. This should be done, as appropriate, to reduce the potential for preferential groundwater flow through the granular bedding. For this site, trench cut-offs would be less effective where the pipeline is installed in the non-cohesive deposits unless the trench plugs can be extended and keyed into underlying low hydraulic conductivity cohesive soils. The need and frequency of trench plugs must be evaluated in the field during construction. The spacing is largely dependent on the grades established at the ground surface and in the trench base; however, spacings on the order of 50 to 100 m are common. As such, it should be included in the contract as a provisional item.

5.10 Foundation Design

The recommendations given below should be reviewed once the grading plans and founding depths are available. Based on the results of this investigation, residential houses with or without basements may be founded on conventional shallow spread and/or continuous strip footings bearing in the competent, native, undisturbed soils or on approved engineered fill as described below in Table 4.

Table 4 Anticipated Founding Soils for Shallow Foundations

Borehole ID	Minimum Footing* Base Depth (m)	Maximum Footing Base Elevation (m)	Anticipated Founding Materials
BH121-22	1.0	214	Compact silty sand
BH122-22	1.0	214	Compact sandy silt
BH123-22	1.0	214	Compact silty sand to sand
BH124-22	1.5	213.6	Compact silty sand
BH125-22	1.5	214	Compact silty sand to sandy silt
*Footings to be at this minimum recommended depth or frost depth relative to final grades, whichever is greater.			

The spread/strip footings bearing at the depths/elevations provided above may be designed using the factored geotechnical resistance at Ultimate Limit States (ULS) and the geotechnical reaction at Serviceability Limit States (SLS), for 25 mm of total settlement and 19 mm of differential settlement, provided below in Table 5.

Table 5 Preliminary Recommended ULS and SLS for Spread/Strip Footing Foundations

Spread or Strip Footing Dimensions	Factored Geotechnical Resistance at ULS (kPa)	Geotechnical Reaction at SLS (for 25 mm of settlement) kPa
0.5 m Strip footing	200	150
1.0 m Strip footing		
1 m x 1 m Spread	250	200
2 m x 2 m Spread		

Footings in engineered fill may be designed using a factored geotechnical resistance at ULS of 200 kPa and a geotechnical reaction at SLS of 150 kPa. These bearing resistances are for strip footings 0.45 m to 1.0 m wide and spread footings varying from 1 m x 1 m to 2 m to 2 m in size.

The ULS resistance and SLS reaction values should be confirmed/refined during final design based on the actual final grades and bearing elevations.

In general, for any houses placed wholly or in part on engineered fill, it is recommended that the foundations be provided with nominal reinforcement, consisting of reinforcing steel (two 15M bars) at the top and bottom of the foundation walls. However, once the final thicknesses and extent of engineered fill are known, the need for and design of any reinforcement can be determined on a lot-by-lot basis by the builder's structural engineer, in consultation with Cambium.

The perimeter house basement walls should be backfilled with a free draining, non-frost susceptible granular material carefully placed and compacted in lifts and should be designed using the methodology presented in subsection 5.12. Alternatively, where site excavated material is to be reused for backfill, an approved geo-composite drainage system should be used directly against the wall.

All foundation excavations at the site should be carried out in accordance with the current OHSA requirements (see excavation side slope comments and geometry requirements in Section 5.6).

All fill, old foundations, other structures organics, and any deleterious materials should be stripped/removed from the proposed development area.

As the actual soil bearing resistances are related to the actual footing sizes and founding depths, the foundation recommendations must be reviewed by Cambium once the building details are finalized and, as such, the recommendation provided above should be considered preliminary.

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

Our foundation recommendations are subject to a key assumption that no former excavation, former or existing underground utility or structure is located 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 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.

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

All exterior footings and footings in unheated areas should be provided with at least 1.4 m of earth cover after final grading or a thermally equivalent thickness of insulation to address the potential for damage due to frost action.

5.11 Slab-on-Grade Floor

It is anticipated that the floor slab can be designed as a concrete slab-on-grade. The soils at the anticipated slab-on-grade level after removal of the topsoil or disturbed native will generally consist of compact non-cohesive deposits.

The existing disturbed native material is 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.

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.

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.

5.12 Backfill and Lateral Earth Pressure for Basement Walls

Excavated topsoil 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 1.4 m below finished exterior grade at a slope of 3H:1V or flatter, away from the wall.

The design of the foundation walls for the permanent basement level 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:

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

where:

p = lateral earth pressure acting depth z, kilopascals

$K = K_O$ = at rest earth pressure coefficient, use 0.5 for the foundation wall

γ = unit weight of retained soil/backfill, a value of 21 KN/m³ may be assumed h = depth to point of interest in soil, metres

q = equivalent value of surcharge on the ground surface, kilopascals.

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 road should also be included in the design as indicated.

5.13 Site Classification for Seismic Site Response

Seismic hazard is defined in the 2024 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 Fa and Fv, 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 5.10) is generally less than 50 blows per 0.3 m of penetration. Based on these results, Site Class D 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.

5.14 Pavement Design

To develop an appropriate pavement design strategy, we have reviewed the Township of Clearview Engineering Standards dated October 2025. The design manual states that the minimum pavement element thicknesses for local roads should be as follows:

- 40 mm - HL3 surface course asphalt
- 60 mm – HL8 base course asphalt
- 150 mm – Granular “A”
- 350 mm – Granular “B” (min) or as per geotechnical recommendations

In general, the above minimum design criteria may be used for the proposed development. However, Cambium has recommended the following pavement structures for two traffic loading scenarios: light duty and heavy duty. The heavy-duty design is appropriate for areas where heavy traffic is anticipated while the light duty design is appropriate for areas where light traffic is anticipated. As traffic information was not available, it is anticipated that the light duty pavement will be used by lightly loaded passenger cars and the heavy-duty access roads and driveways will be designed to support fire trucks and waste collection equipment but will not be subject to regular heavy vehicle loading such as daily deliveries. Repair and maintenance work (i.e., crack infilling, asphalt sealing, etc.) will need to be carried out on an as-needed basis to limit pavement degradation and extend the service life of the pavement.

Table 6 Recommended Minimum Pavement Structure

Pavement Layer	Light Duty	Heavy Duty
Surface Course Asphalt[1]	40 mm HL3 or HL4	40 mm HL3 or HL4
Binder Course Asphalt[1]	60 mm HL8	70 mm HL8
Granular Base[2]	150 mm OPSS 1010 Granular A	150 mm OPSS 1010 Granular A
Granular Subbase[2]	350 mm OPSS 1010 Granular B Type 1	450 mm OPSS 1010 Granular B Type 1
Notes: *1 Asphaltic Material shall be in accordance with OPSS 1150 (November 2018)* *2 Granular Materials shall be in accordance with OPSS.MUNI 1010 (September 2017)*		

Material and thickness substitutions must be approved by the Design Engineer.

5.14.1 Compaction Requirements

The table below provides the minimum compaction requirements for different pavement layers.

Table 7 Minimum Compaction Requirements

Material	Required Compaction
	(% of Marshal Maximum Relative Density or Standard Proctor Density)
HL3 Surface Course	Minimum 92% to 96.5%
HL8 Binder Course	Minimum 92% to 96.5%
Granular A Base	Minimum 100%
Granular B Type I Subbase	Minimum 100%
Subgrade	Minimum 98% - Prepared and Approved Subgrade

Granular and stone materials are to be spread and compacted in layers with a maximum depth of 150 mm. Compaction of the granular materials and subgrade soils should be carried out at a moisture content that is between optimum moisture content and 2% of the optimum.

Compaction of the granular base and subbase materials should be carried out at a moisture content that is within ±1% of the optimum moisture content.

The subgrade or engineered fill must be compacted to a minimum 98% of SPMDD at a moisture content of ±2% of optimum.

Asphalt and granular materials; and placement requirements should be in accordance with OPSS 310 and OPSS 314, as amended by the applicable Municipal standards.

5.14.2 Drainage

Adequate surface and subsurface drainage are critical if the pavement is to provide satisfactory service over the design life. The drainage system could consist of a system of catchbasins connected to subdrains draining to a permanent storm water outlet. In this regard, the asphalt surface should be graded to drain towards the catchbasins, and the subgrade should be carefully proof-rolled to a smooth surface and sloped towards the catchbasins to prevent ponding or entrapment of water in the subbase which would lead to weakened sections.

Subdrains shall be installed under all curbs. The subdrains should consist of 150-mm diameter wrapped perforated pipes, placed inside 300-mm by 300-mm trenches, and surrounded by clean free draining sand, such as concrete sand. The drain inverts should be at approximately 300 mm below the bottom of the granular subbase and should be sloped to drain towards the catchbasins.

5.14.3 Performance graded Asphalt Cement (PGAC)

It is recommended that PG 58-28 asphalt cement be used for the HL 3 and HL 8 asphalt on this project.

5.14.4 Tack Coat

Tack coat should be applied between all lifts of the hot mix asphalt and at all but joints and milled surfaces. Tack coat should satisfy the requirements listed in OPSS.PROV 308.

5.14.5 General Notes

Topsoil, organic matter, or any other deleterious materials within the footprint of the proposed roadway should be removed. Prior to placing granular subbase material, subgrade should be proof-rolled and inspected by a qualified geotechnical engineer from Cambium. All the remedial work (i.e., sub-excavation and replacement) should be carried out on any disturbed, softened or poorly performing areas, as directed by the geotechnical engineer. The subgrade should be graded at a minimum 3% crossfall towards subdrains.

The subgrade should be proof-rolled and inspected by a qualified geotechnical engineer prior to placing the subbase and additional material placed as required to address the subgrade soil conditions and the anticipated construction traffic. Remedial work (i.e., further sub-excavation and replacement) should be carried out on any disturbed, softened or poorly performing areas, as directed by the geotechnical engineer.

Where the new pavement abuts the existing pavement (e.g., at tie-ins to existing pavement), proper longitudinal lap joints should be constructed to key the new asphalt surface course into the existing pavement. The existing asphalt should be sawcut to provide a vertical face prior to keying-in the new asphalt surface course. Any undermined or broken edges resulting from the construction activities should be removed by the sawcut. All laps, but joints and milled surfaces should be appropriately tack coated.

It should be noted that in some cases, even though the compaction requirements have been met, the subgrade strength may not be adequate to support heavy construction loading especially during wet weather or where subgrade soils are wet of optimum. In this regard, the design subbase thickness may not be sufficient for a construction haul road and additional granular materials (in the order of 150 mm to 300 mm) may be required as determined during construction by the geotechnical engineer.

The thickness of the subbase layer could be increased at the discretion of the Engineer, to accommodate site conditions at the time of construction, including soft or weak subgrade soil replacement.

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 Inspections and Testing

At the time of writing this report, the final grading plans and founding elevations of the proposed structures and facilities on site were not available. Once these details are available, the recommendations in this report should be updated especially for the recommendations related to excavations and foundations. 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.

It would be prudent to carry out a "public digging" (i.e., test pitting) during the tender stage, to allow prospective bidders to assess the subsurface conditions and determine the type and location of groundwater control required, consistent with their equipment capabilities and the actual groundwater conditions at that time. The locations of the test pits should be determined in consultation with Cambium.

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 work program and report are governed by the attached Qualifications and Limitations. If you have questions or comments regarding the contents of this report or require additional information, please do not hesitate to contact this office.

Respectfully submitted,

Cambium Inc.

Signed by:
C. Malliaros
E70D3B9336AE4BD...

Chris Malliaros, P.Eng.
Project Coordinator - Geotechnical

DocuSigned by:
34555F00ED064E9...

Zhaochang Luo, M.Eng., P.Eng.
Group Manager - Geotechnical

Signed by:

LICENSED PROFESSIONAL ENGINEER
Z.LUO
100230770
PROVINCE OF ONTARIO
2026-02-05

RG/js/bw

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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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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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Limitation of Liability

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

GEOTECHNICAL EXPLORATION

GEORGIAN COMMUNITIES
Nottawa Lands Development 57
Batteaux Road
Nottawa, Ontario

LEGEND

- 🟥 Highway
- ▬ Major Road
- ― Minor Road
- ― 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

194 Sophia Street
Peterborough, Ontario, K9H 1E5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

SITE LOCATION MAP

Project No.: 14768-001	Date: May 2022 Rev.:
Scale: 1:150,000	Projection: NAD 1983 UTM Zone 17N

Created by: TLC	Checked by: RG	Figure: 1

O:\GIS\MXDs\14700-14799\14768-001 Georgian Communities - Geo - Nottawa Lands\2022-04-24 FIG 1 - Site Location Plan - Batteaux.mxd

GEOTECHNICAL EXPLORATION

GEORGIAN COMMUNITIES
Nottawa Lands Development 57
Batteaux Road
Nottawa, Ontario

LEGEND

- ⊕ Borehole
- ⊕ Monitoring Well
- ▭ Site (approximate)

Notes:
- Site is approximate and was obtained from the Simcoe County online GIS.
- 2019 imagery was obtained from the Simcoe County online GIS.
- 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

194 Sophia Street
Peterborough, Ontario, K9H 1E5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

BOREHOLE LOCATION PLAN

Project No.: 14768-001
Date: May 2022
Rev.:
Scale: 1:2,000
Projection: NAD 1983 UTM Zone 17N
Created by: TLC
Checked by: RG
Figure: 2

O:\GIS\MXDs\14700-14799\14768-001 Georgian Communities - Geo - Nottawa Lands\2022-04-24 FIG 2- Borehole Location Plan - Batteaux.mxd

Appendix A

Log of Boreholes

CAMBIUM

Client: Georgian Communities
Contractor: Walker Drilling Ltd.
Project No.: 14768-001
Location: Nottawa, ON

Project Name: GEO - Nottawa Lands
Method: Track Mounted Hollow Stem Auger
Elevation: 215.01 mASL
UTM: 17T **N:** 4923240.00 **E:** 563728.00

Log of Borehole: BH121-22
Page: 1 of 1
Date Completed: April 8, 2022

SUBSURFACE PROFILE

Elevation (m)	Depth	Description	Elevation	Depth
215	0	**TOPSOIL:** ~ 150 mm thick	214.86	0.15
		(SM) SILTY SAND: brown, disturbed native; non-cohesive, moist, very loose	214.25	0.76
		(SM) SILTY SAND: to SAND: fine to medium; brown to grey; non-cohesive, wet, compact - grey	210.90	4.11
		(ML) sandy SILT: grey; non-cohesive, wet, compact	209.37	5.64
		(CL) SILTY CLAY: trace sand; grey; cohesive, w > PL, stiff to very stiff	208.30	6.71
		Borehole terminated @ 6.7 mbgs due to target depth achieved.		

Elevation scale: 215, 214.5, 214, 213.5, 213, 212.5, 212, 211.5, 211, 210.5, 210, 209.5, 209, 208.5, 208, 207.5
Depth scale: 0, 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7

SAMPLE

Atterberg Limits (%) LL ○ PL ○ PI ○ 25 50 75 / % Moisture 25 50 75
Shear Strength Cu, kPa nat V. + rem V. ⊕ 20 40 60 80 / SPT (N) 20 40 60 80

Number	Type	% Recovery	SPT (N)	% Moisture	SPT (N)
1A	SS	50	2	29.8%	
1B	SS			13.1%	2
2	SS	85	18	17.6%	18
3	SS	100	15	19.8%	15
4	SS	85	12		12
5	SS	90	15	16.2%	15
6	SS	80	21	15.9%	21
7	SS	100	15	24.9%	15

Well Installation

Log Notes

Borehole terminated in silty clay. Borehole caving observed at 0.9 mbgs. Wet soils first encountered at 0.8 mbgs. Standing water observed at 0.8 mbgs.

GRAINSIZE DISTRIBUTION SAMPLE | GRAVEL | SAND | SILT | CLAY

Logged By: CM **Input By:** AM

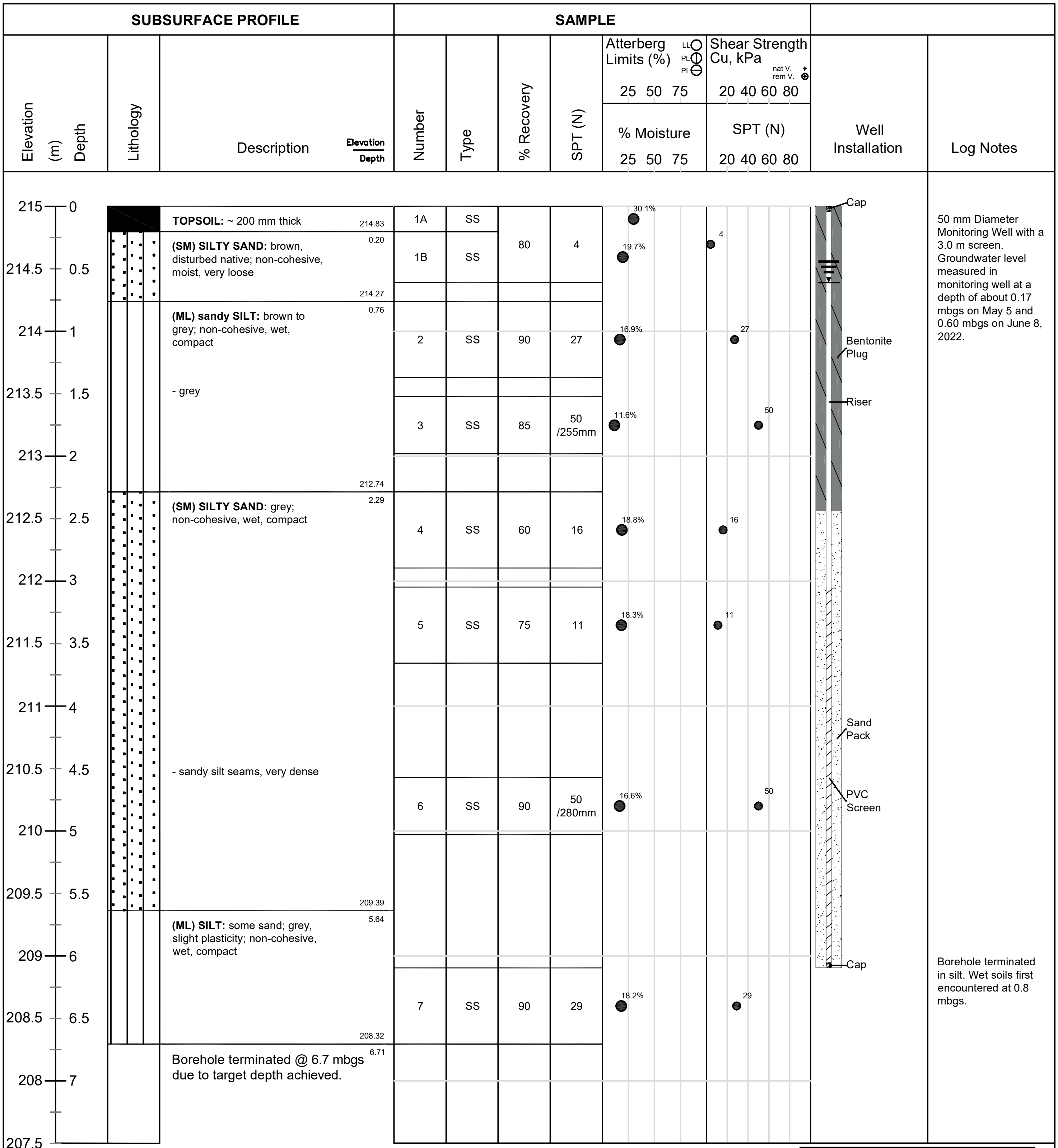
Peterborough, Barrie, Whitby, Kingston, Ottawa

CAMBIUM

Client: Georgian Communities
Contractor: Walker Drilling Ltd.
Project No.: 14768-001
Location: Nottawa, ON

Project Name: GEO - Nottawa Lands
Method: Track Mounted Hollow Stem Auger
Elevation: 215.03 mASL
UTM: 17T **N:** 4923252.00 **E:** 563660.00

Log of Borehole: BH122-22
Page: 1 of 1
Date Completed: April 8, 2022



Description	Elevation / Depth
TOPSOIL: ~ 200 mm thick	214.83 0.20
(SM) SILTY SAND: brown, disturbed native; non-cohesive, moist, very loose	214.27 0.76
(ML) sandy SILT: brown to grey; non-cohesive, wet, compact - grey	212.74 2.29
(SM) SILTY SAND: grey; non-cohesive, wet, compact - sandy silt seams, very dense	209.39 5.64
(ML) SILT: some sand; grey, slight plasticity; non-cohesive, wet, compact	208.32 6.71
Borehole terminated @ 6.7 mbgs due to target depth achieved.	

Number	Type	% Recovery	SPT (N)	% Moisture
1A	SS	80	4	30.1%
1B	SS			19.7%
2	SS	90	27	16.9%
3	SS	85	50 /255mm	11.6%
4	SS	60	16	18.8%
5	SS	75	11	18.3%
6	SS	90	50 /280mm	16.6%
7	SS	90	29	18.2%

Log Notes

50 mm Diameter Monitoring Well with a 3.0 m screen. Groundwater level measured in monitoring well at a depth of about 0.17 mbgs on May 5 and 0.60 mbgs on June 8, 2022.

Borehole terminated in silt. Wet soils first encountered at 0.8 mbgs.

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS5	3	83	12	2

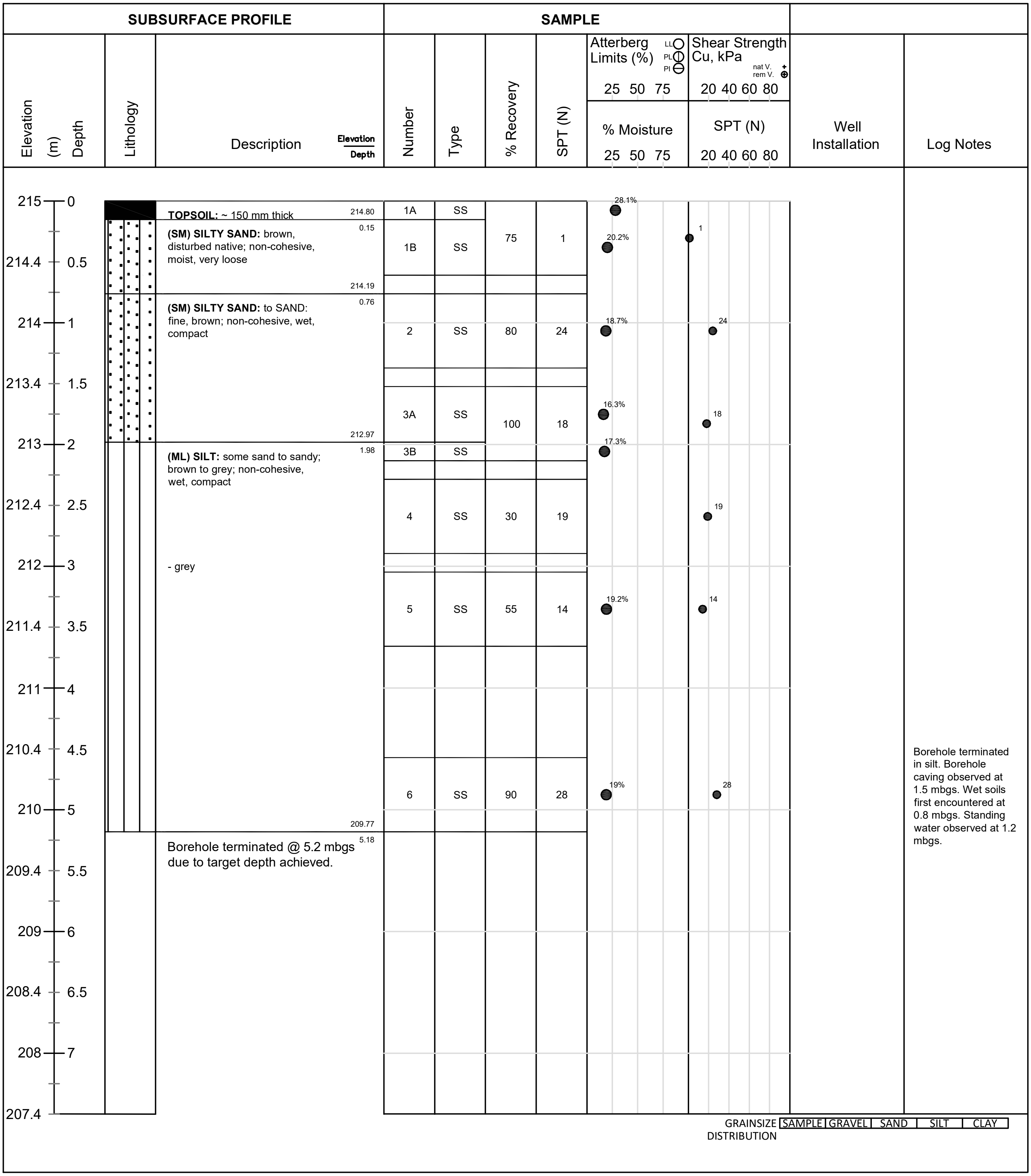
Logged By: CM **Input By:** AM

CAMBIUM

Client: Georgian Communities
Contractor: Walker Drilling Ltd.
Project No.: 14768-001
Location: Nottawa, ON

Project Name: GEO - Nottawa Lands
Method: Track Mounted Hollow Stem Auger
Elevation: 214.95 mASL
UTM: 17T **N:** 4923336.00 **E:** 563646.00

Log of Borehole: BH123-22
Page: 1 of 1
Date Completed: April 8, 2022



Description	Elevation / Depth
TOPSOIL: ~ 150 mm thick	214.80 / 0.15
(SM) SILTY SAND: brown, disturbed native; non-cohesive, moist, very loose	214.19 / 0.76
(SM) SILTY SAND: to SAND: fine, brown; non-cohesive, wet, compact	212.97 / 1.98
(ML) SILT: some sand to sandy; brown to grey; non-cohesive, wet, compact - grey	209.77 / 5.18
Borehole terminated @ 5.2 mbgs due to target depth achieved.	

Number	Type	% Recovery	SPT (N)	% Moisture	SPT (N) plot
1A	SS	75	1	28.1%	1
1B	SS			20.2%	
2	SS	80	24	18.7%	24
3A	SS	100	18	16.3%	18
3B	SS			17.3%	
4	SS	30	19		19
5	SS	55	14	19.2%	14
6	SS	90	28	19%	28

Log Notes

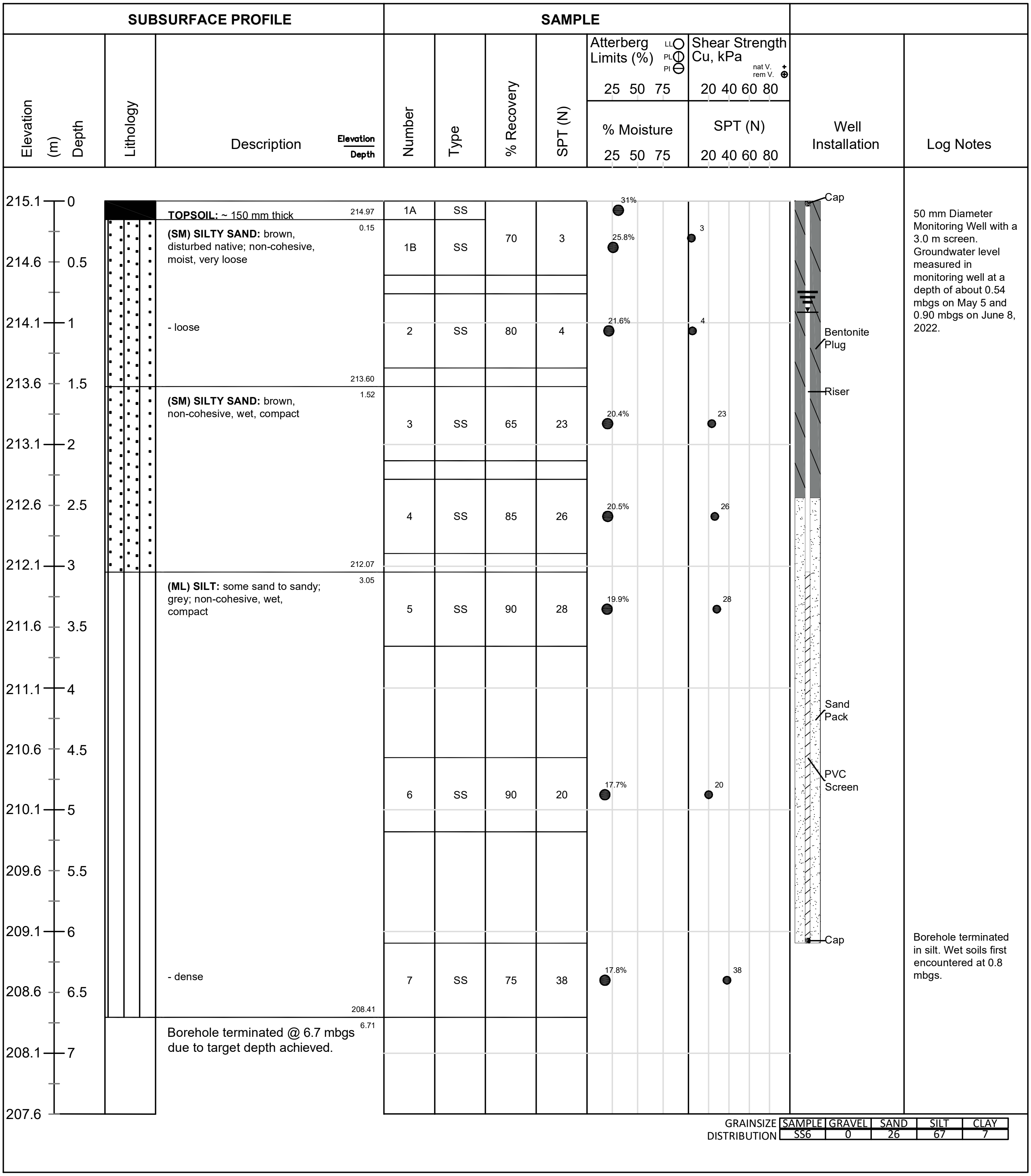
Borehole terminated in silt. Borehole caving observed at 1.5 mbgs. Wet soils first encountered at 0.8 mbgs. Standing water observed at 1.2 mbgs.

Logged By: CM **Input By:** AM

Client: Georgian Communities
Contractor: Walker Drilling Ltd.
Project No.: 14768-001
Location: Nottawa, ON

Project Name: GEO - Nottawa Lands
Method: Track Mounted Hollow Stem Auger
Elevation: 215.12 mASL
UTM: 17T **N:** 4923340.00 **E:** 563739.00

Log of Borehole: BH124-22
Page: 1 of 1
Date Completed: April 11, 2022



Elevation	Depth	Description
214.97	0.15	**TOPSOIL:** ~ 150 mm thick
213.60	1.52	**(SM) SILTY SAND:** brown, disturbed native; non-cohesive, moist, very loose - loose
212.07	3.05	**(SM) SILTY SAND:** brown, non-cohesive, wet, compact
208.41	6.71	**(ML) SILT:** some sand to sandy; grey; non-cohesive, wet, compact - dense

Borehole terminated @ 6.7 mbgs due to target depth achieved.

Number	Type	% Recovery	SPT (N)	% Moisture
1A	SS	70	3	31%
1B	SS			25.8%
2	SS	80	4	21.6%
3	SS	65	23	20.4%
4	SS	85	26	20.5%
5	SS	90	28	19.9%
6	SS	90	20	17.7%
7	SS	75	38	17.8%

Log Notes:

50 mm Diameter Monitoring Well with a 3.0 m screen. Groundwater level measured in monitoring well at a depth of about 0.54 mbgs on May 5 and 0.90 mbgs on June 8, 2022.

Borehole terminated in silt. Wet soils first encountered at 0.8 mbgs.

GRAINSIZE DISTRIBUTION	SAMPLE	GRAVEL	SAND	SILT	CLAY
	SS6	0	26	67	7

Logged By: CM **Input By:** AM

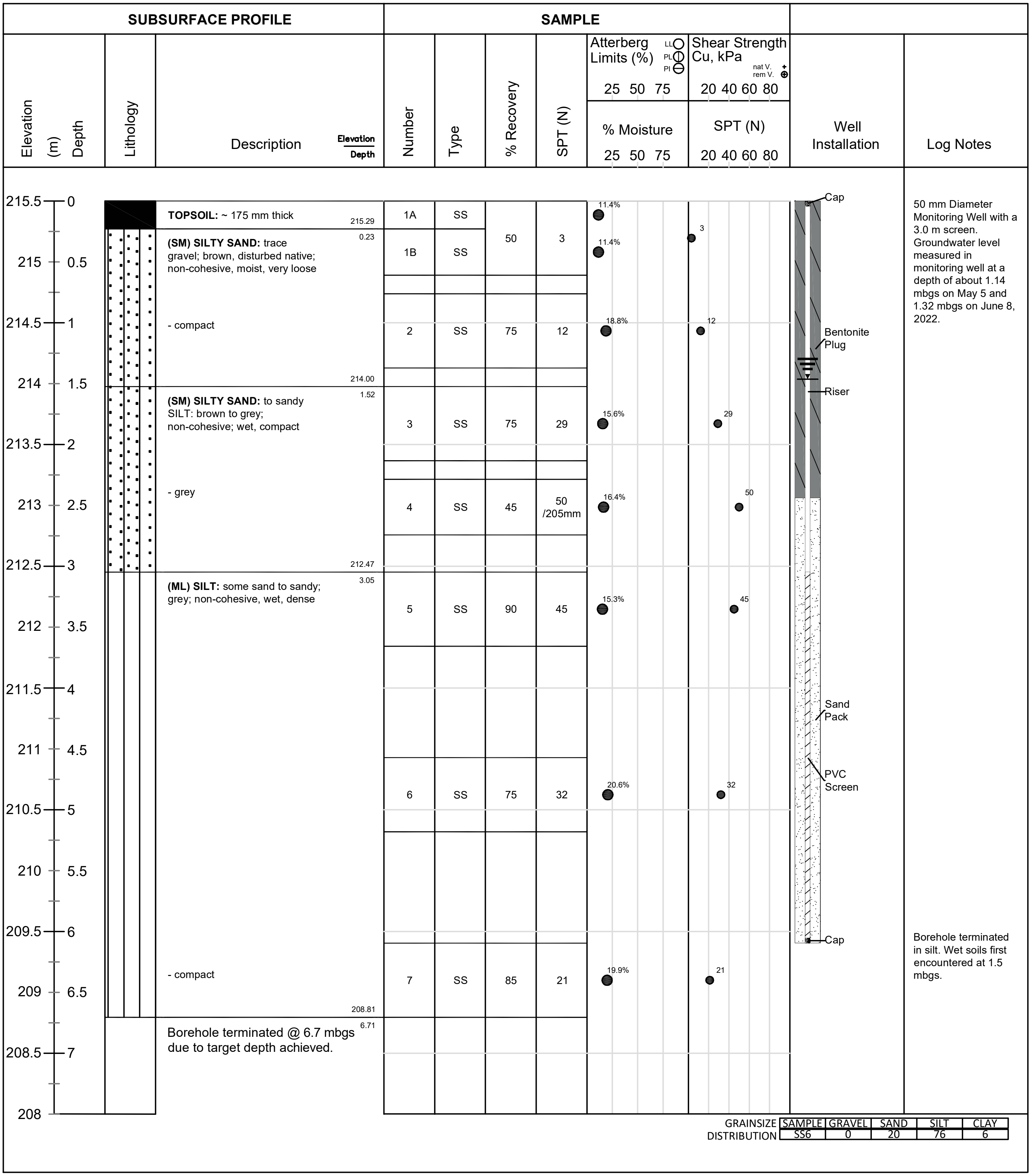
Peterborough, Barrie, Whitby, Kingston, Ottawa

CAMBIUM

Client: Georgian Communities
Contractor: Walker Drilling Ltd.
Project No.: 14768-001
Location: Nottawa, ON

Project Name: GEO - Nottawa Lands
Method: Track Mounted Hollow Stem Auger
Elevation: 215.52 mASL
UTM: 17T **N:** 4923431.00 **E:** 563632.00

Log of Borehole: BH125-22
Page: 1 of 1
Date Completed: April 11, 2022



Description	Elevation	Depth
TOPSOIL: ~ 175 mm thick	215.29	0.23
(SM) SILTY SAND: trace gravel; brown, disturbed native; non-cohesive, moist, very loose - compact	214.00	1.52
(SM) SILTY SAND: to sandy SILT: brown to grey; non-cohesive; wet, compact - grey	212.47	3.05
(ML) SILT: some sand to sandy; grey; non-cohesive, wet, dense - compact	208.81	6.71
Borehole terminated @ 6.7 mbgs due to target depth achieved.		

Number	Type	% Recovery	SPT (N)	% Moisture	SPT (N)
1A	SS	50	3	11.4%	
1B	SS			11.4%	3
2	SS	75	12	18.8%	12
3	SS	75	29	15.6%	29
4	SS	45	50 /205mm	16.4%	50
5	SS	90	45	15.3%	45
6	SS	75	32	20.6%	32
7	SS	85	21	19.9%	21

Log Notes

50 mm Diameter Monitoring Well with a 3.0 m screen. Groundwater level measured in monitoring well at a depth of about 1.14 mbgs on May 5 and 1.32 mbgs on June 8, 2022.

Borehole terminated in silt. Wet soils first encountered at 1.5 mbgs.

GRAINSIZE DISTRIBUTION	SAMPLE	GRAVEL	SAND	SILT	CLAY
	SS6	0	20	76	6

Logged By: CM **Input By:** AM

Appendix B

Physical Laboratory Testing Results

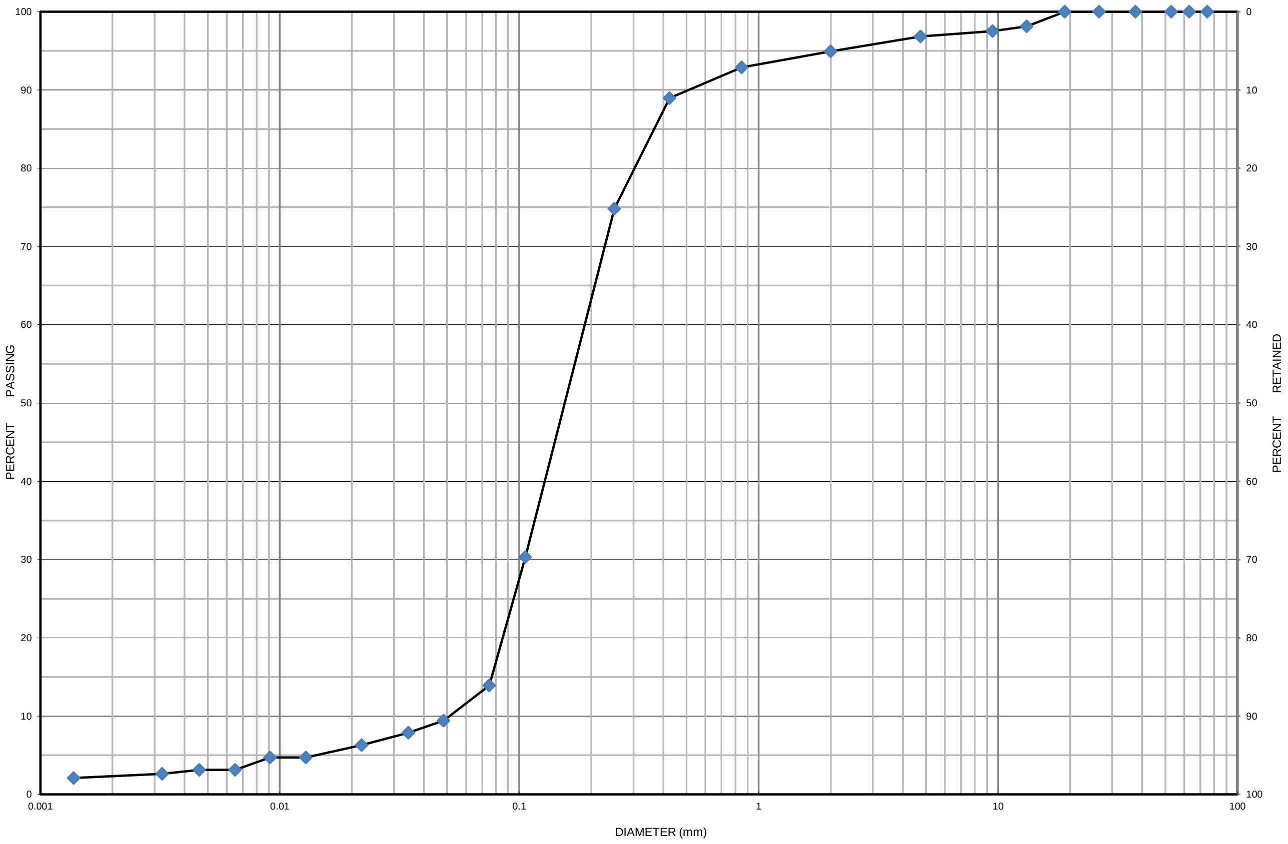
CAMBIUM

CERTIFIED BY CCIL Canadian Council of Independent Laboratories For specific tests as listed on www.ccil.com

Grain Size Distribution Chart

Project Number:	*14768-001*	**Client:**	*Georgian Communities*		
Project Name:	*Geo - Nottawa Lands*				
Sample Date:	*March 2022*	**Sampled By:**	*Chris Malliaros - Cambium Inc.*		
Location:	*BH 122-22 SS 5*	**Depth:**	*3 m to 3.7 m*	**Lab Sample No:**	*S-22-0663*

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 122-22	SS 5	3 m to 3.7 m	3	83	12	2	18.3

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silty Sand trace gravel	SM	0.190	0.110	0.051	3.73	1.25

Additional information available upon request

Issued By: ______________________ *Date Issued:* *May 12, 2022*

(Senior Project Manager)

Grain Size Distribution Chart

Project Number: *14768-001* **Client:** *Georgian Communities*

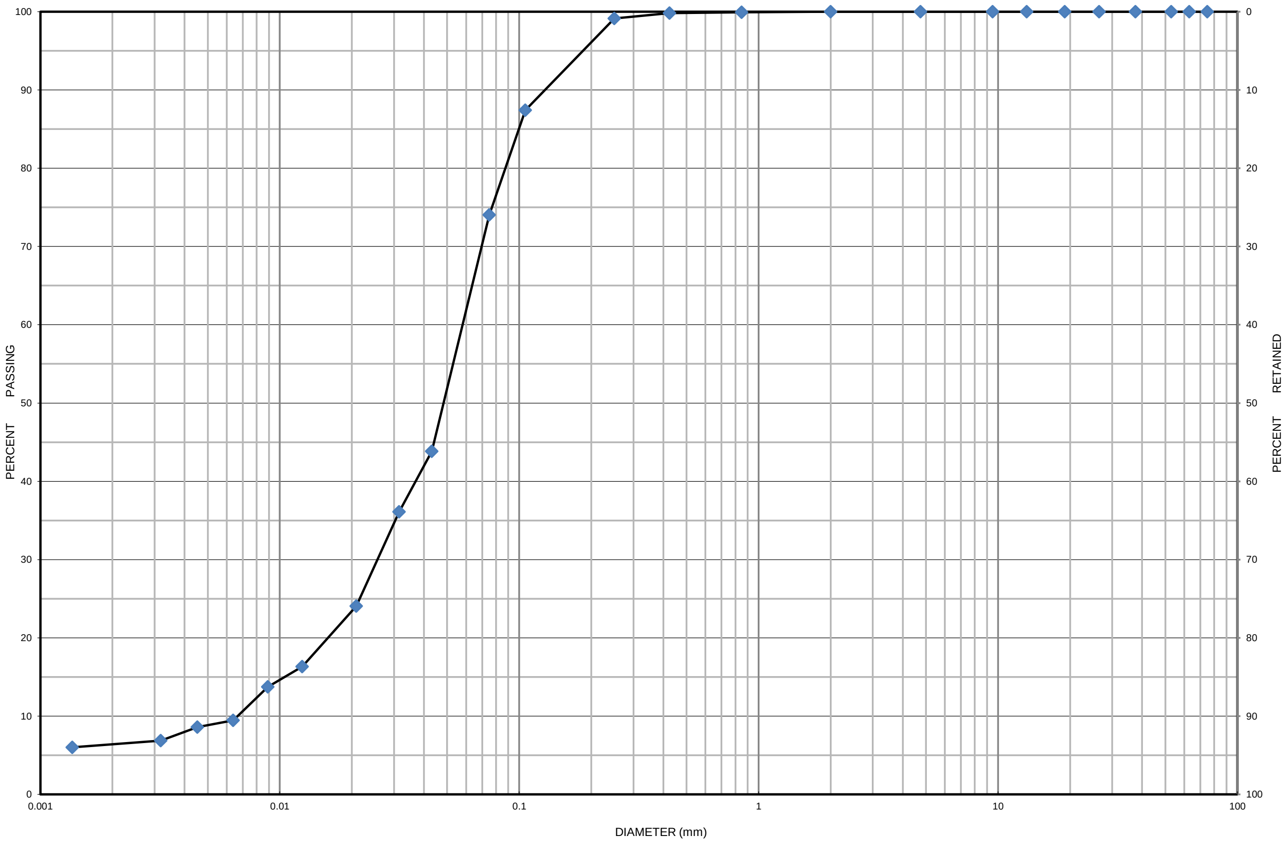
Project Name: *Geo - Nottawa Lands*

Sample Date: *March 2022* **Sampled By:** *Chris Malliaros - Cambium Inc.*

Location: *BH 124-22 SS 6* **Depth:** *4.6 m to 5.2 m* **Lab Sample No:** *S-22-0664*

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	SAND			GRAVEL			BOULDERS
		FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 124-22	SS 6	4.6 m to 5.2 m	0	26	67	7	17.7

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sandy Silt	ML	0.0590	0.0260	0.0067	8.81	1.71

Additional information available upon request

Issued By: (Senior Project Manager) *Date Issued:* *May 12, 2022*

Cambium Inc. (Laboratory)
866.217.7900 | cambium-inc.com
194 Sophia St. | Peterborough | ON | K9H 1E5

Grain Size Distribution Chart

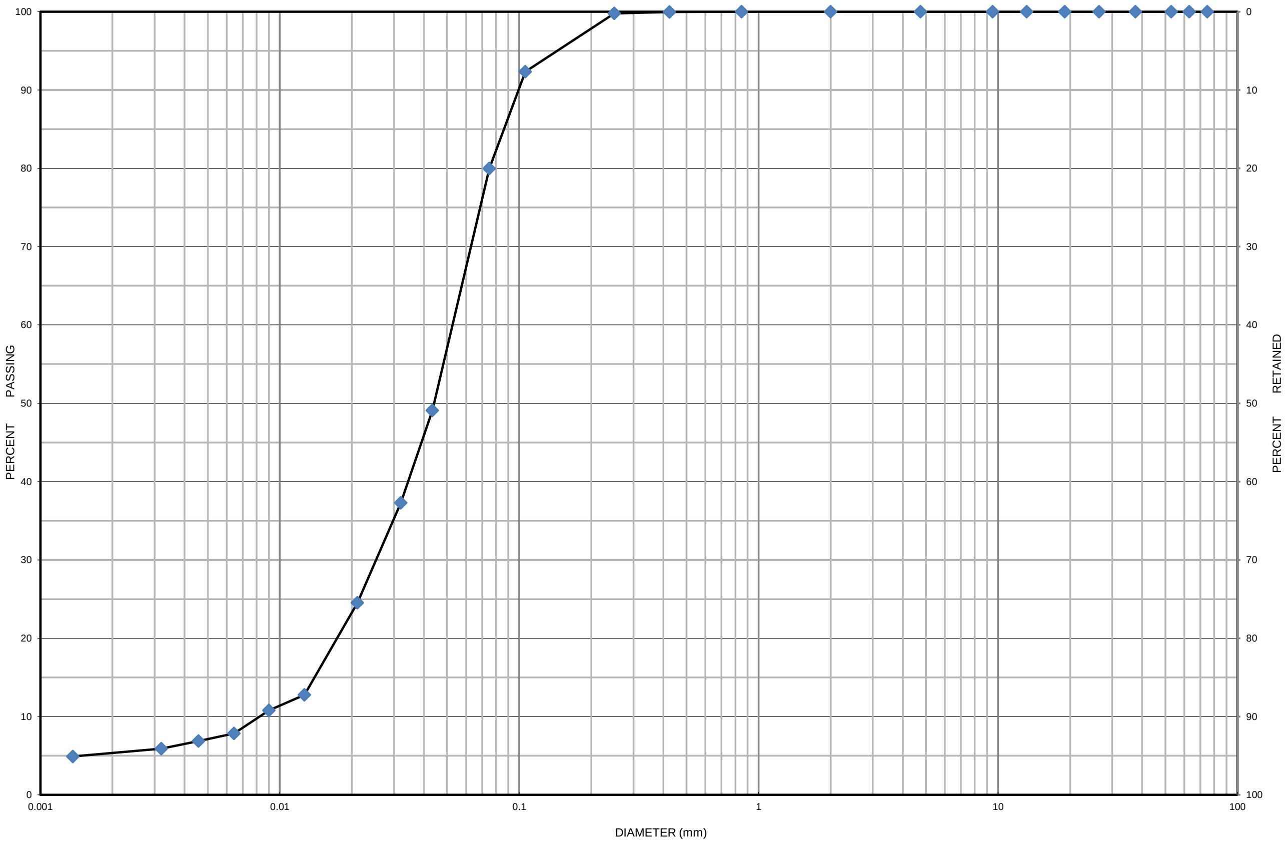
Project Number: *14768-001* **Client:** *Georgian Communities*

Project Name: *Geo - Nottawa Lands*

Sample Date: *March 2022* **Sampled By:** *Chris Malliaros - Cambium Inc.*

Location: *BH 125-22 SS 6* **Depth:** *4.6 m to 5.2 m* **Lab Sample No:** *S-22-0665*

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 125-22	SS 6	4.6 m to 5.2 m	0	20	74	6	20.6

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sandy Silt	ML	0.0530	0.0260	0.0083	6.39	1.54

Additional information available upon request

Issued By: (Senior Project Manager)

Date Issued: *May 12, 2022*