Geotechnical Investigation Report - Thornbury Acres, The Town of The Blue Mountains, Ontario

Revision 1

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Prepared for:
Thornbury Acres Holding Inc.

Cambium Reference: 14266-001

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Table of Contents

List of Appended Figures

List of Tables

List of Appendices

1.0 Introduction

Cambium Inc. (Cambium) was retained by Thornbury Acres Holding Inc. (Client) to complete a geotechnical investigation in support of the proposed Thornbury Acres development located at the southeast quadrant of the intersection of Grey County Road 2 and Grey County Road 40 in The Town of The Blue Mountains, ON (Site).

This report presents and summarizes the methodology and findings of the geotechnical investigation conducted by Cambium at the Site. The report provides geotechnical recommendations for relevant issues pertaining to the proposed development based on the results of the investigation.

It is noted that Cambium was also retained to carry out a hydrogeological assessment, D4 assessment and environmental site assessment (ESA), all of the associated reports have been provided under separate covers.

1.1 Reviewed Documents

The following project documents were received and reviewed during the drafting of this report:

[1] NAK Design Strategies - Toronto – Ontario
150AC. Concept Plan v4B, Drawing No. LU-04B, Project No. 21-087; August 25, 2022.

[2] Zubek, Emo, Patten & Thomsen Limited – Collingwood, Ontario
“Plan Survey of Part of Lot 27 Concession 8, Town of The Blue Mountains, County of Grey”
Survey For: Castlepoint Numa Inc; Job No. 77-69-19; Undated.

1.2 Standards and Guidelines

Applicable standards, guidelines and other normative documents utilized in preparing geotechnical engineering recommendations for this report are provided below.

[3] Canadian Foundation Engineering Manual – 4th Edition; Canadian Geotechnical Society; 2006

[4] The Blue Mountains Engineering Standards – Town of The Blue Mountains; July 2018.

2.0 Site and Project Description

2.1 Site Description

The Site consists of an approximately 61.5 ha (152 acre) land parcel at the southeast quadrant of the intersection of Grey County Road 2 and Grey County Road 40 in The Town of The Blue Mountains, Ontario. The Site is approximately rectangular and is bordered to the north by Grey County Road 40, to the west by Grey County Road 2, and to the south and east by agricultural, forested, and undeveloped properties. At the time of the study, the majority of the site was forested and access paths were created for the purpose of the investigation.

A site location plan is appended as Figure 1 of this report.

2.2 Project Description

It is currently proposed that the property will be subdivided into 37 privately serviced units, approximately 1.3 to 1.6 acres in size. Additionally, the proposed development is to include woodlot and pond areas, agricultural lands, a barn serving as a community event space, a bicycle pavilion, associated internal roadways and parking areas throughout the development, a stormwater management pond and other associated infrastructure.

3.0 Methodology

The geotechnical investigation was conducted at the Site by Cambium on September 22 and 26, 2022.

3.1 Borehole Investigation

A total of seven boreholes, numbered BH101-22 to BH107-22, were advanced into the subsurface at predetermined locations throughout the proposed development. Each of the boreholes were terminated at a depth of 5.2 m below ground surface (mbgs).

Boreholes BH101-22 through BH104-22 were each outfitted with a monitoring well following completion of drilling, to allow for subsequent groundwater level monitoring at the Site.

Borehole drilling and sampling were completed using a track-mounted drill rig operating under the supervision of a Cambium geotechnical analyst. The boreholes were advanced to the sampling depths by means of continuous flight hollow stem augers with 50 mm O.D. split spoon samplers.

Standard Penetration Test (SPT) N values were recorded for the sampled intervals as the number of blows required to drive a split spoon sampler 305 mm into the soil, using a 63.5 kg drop hammer falling 750 mm, as per ASTM D1586 procedures. The SPT N values are used in this report to assess the consistency of cohesive soils and relative density of non-cohesive materials. Soil samples were collected at approximately 0.75 m intervals in the upper 3.0 m and at 1.5 m intervals below that depth.

The encountered soil units were logged in the field using visual and tactile methods, and samples were placed in labelled plastic bags for transport, future reference, laboratory testing, and storage. Borehole logs are provided in Appendix A.

3.2 Test Pit Investigation

A total of twenty test pits, designated as TP101-22 through TP120-22, were advanced throughout the sites to depths from 2.0 to 3.0 mbgs.

The test pits were excavated by means of a hydraulic excavator and operator retained by Cambium, under the supervision of a Cambium geotechnical analyst. Each of the test pits were terminated in competent soils. Dynamic cone penetration tests (DCP) were performed in select test pits using a Wildcat Dynamic Cone Penetrometer (DCP), which consisted of measuring the number of blows required to advance a 35.5 mm diameter cone tip with an area of 10 cm^2 into the subgrade soils a distance of 100 mm using a 15.9 kg hammer dropped 380 mm, were completed within and/or adjacent to select test pits to determine the in-situ relative density or consistency and bearing capacity of the subgrade soils.

Open test pits were checked for groundwater and general stability prior to backfilling. The test pits were backfilled with the excavated material and compacted with the bucket of the excavator and the property was reinstated to as close to pre-existing conditions as practically possible.

Test pit logs are provided in Appendix A. Site soil conditions and geotechnical recommendations are discussed in Section 4.0 and Section 5.0 of this report, respectively.

3.3 Site Survey

The elevations and coordinates for all borehole, test pit, and monitoring well locations were obtained during a subsequent Site survey conducted by Cambium on November 17, 2022. The elevations were surveyed utilizing a benchmark identified on the lot survey [2], consisting of a cut cross on a large rock fence at the northeast corner of the property. The elevation of this benchmark was not identified on the lot survey [2], and as such was assigned an elevation of 100 m Relative Elevation (m Rel. El) by Cambium at the time of the survey.

A Site Plan including the borehole locations is appended as Figure 1 of this report.

3.4 Physical Laboratory Testing

Physical laboratory testing, including twelve grain size analyses (LS-702, 705) were completed on selected soil samples to confirm textural classification and to assess geotechnical parameters. Natural moisture content testing (LS-701) was completed on all retrieved soil

samples. Results of the grain size testing are presented in Appendix B and are discussed in Section 4.0.

4.0 Subsurface Conditions

The stratigraphy encountered in the boreholes are indicated on the attached borehole logs in Appendix A and test pit logs in Appendix B. It is noted that the conditions indicated on the borehole logs and test pit logs are for specific locations only and can vary between and beyond the borehole and test pit locations. The soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. The soil boundaries indicated on the test pit logs are inferred from observations and measurements taken within the test pits. These boundaries are intended to reflect approximate transition zones and should not be interpreted as exact planes of geological change. In addition, the descriptions provided in the borehole logs and test pit 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 excavation, and the drilling process itself (drilling speed, shaking/grinding of the augers, etc.).

In general, the subsurface conditions consist of surficial topsoil underlain by predominantly cohesionless native deposits grading from silt to sandy silt, to silty sand, to sand material. Isolated deposits of cohesive clayey silt material were encountered during the investigation within the southwest quadrant of the site. Due to the site consisting of agricultural fields and forested areas, there is high likelihood of zones of disturbed and/or reworked native soils throughout the property to arbitrary depths. It is imperative to take due care and consideration during stripping and excavating activities to ensure that these zones are identified and appropriately excavated if required based upon the proposed land usage (landscape, park land, residential structures, etc.).

4.1 Regional Geology

Ontario Geological Survey (OGS) mapping indicates that the quaternary geology at the Site is characterized by glaciolacustrine deposits consisting of sand to gravelly sand to gravel, nearshore and beach deposits and stone-poor, sandy silt to silty sand glacial till deposits.

4.2 Topsoil / Organic Soils

A layer of organic topsoil was encountered at the surface of each of the boreholes and test pits advanced at the Site. The encountered organic soil ranged in thickness from 150 mm to 600 mm and was black in colour.

The topsoil was moist at the time of the investigation with natural moisture contents ranging from 26.0% to 29.1% based on laboratory testing. Assessments of organic matter content or other topsoil quality tests were beyond the scope of this study.

4.3 Cohesionless Native Deposits

Cohesionless native deposits grading from silt to sandy silt, to silt and sand, to silty sand, to sand, were encountered beneath the surficial organic topsoil within each of the boreholes advanced across the site, and within each of the test pits advanced throughout the site except TP116-22 and TP120-22. The native deposits were noted as brown to grey in colour.

The native deposits extended to the borehole termination depths of 5.2 mbgs, and test pit termination depths, except as noted above, from 2.0 mbgs to 3.0 mbgs.

SPT N values recorded within the cohesionless native deposits ranged from 4 to 113 blows, indicating very loose to very dense relative density. The very loose and loose native deposits were generally encountered immediately beneath the surficial topsoil and the relative density of the cohesionless native deposits throughout the site was generally compact to dense at depths greater than 0.8 mbgs.

N values inferred from DCPT performed within the test pits ranged from 8 to 63, indicating the cohesionless native deposits were loose to very dense in relative density. Based on the DCPT test results, the deposit was generally compact to dense in relative density.

Natural moisture contents generally ranged between 7% and 20% based on laboratory testing.

Particle size distribution analysis was completed on eleven samples collected from the cohesionless native deposits. The testing results are provided in Appendix B and are summarized in Table 1.

Table 1 Particle Size Distribution Analysis – Cohesionless Native Deposits

Borehole or Test Pit	Depth (mbgs)	Description	% Gravel	% Sand	% Silt	% Clay	% Moisture Content
BH101-22 SS4	2.3 – 2.9	Silt some Clay some Sand trace Gravel	1	16	66	17	12.1
BH102-22 SS3	1.5 – 2.1	Silty Sand trace Clay	0	71	27	2	19.3
BH103-22 SS3	1.5 – 2.1	Silty Sand trace Clay	0	67	30	3	18.0
BH103-22 SS5	3.0 – 3.7	Sand and Silt trace Clay	0	49	47	4	16.1
BH104-22 SS4	2.3 – 2.9	Silty Sand some Gravel some Clay	12	43	34	11	8.3
BH105-22 SS4	2.3 – 2.9	Sand and Silt trace Clay	0	62	35	3	20.5
BH106-22 SS4	2.3 – 2.9	Sandy Silt trace Clay trace Gravel	7	29	55	9	9.3
BH107-22 SS3	1.5 – 2.1	Sandy Silt some Clay some Gravel	12	26	45	17	7.8
TP105-22 GS1	1.1 – 1.4	Silt some Sand trace Clay trace Gravel	2	19	71	8	12.2
TP106-22 GS1	0.6 – 1.1	Silt some Sand trace Clay	0	10	83	7	18.9
TP112-22 GS1	2.7 – 3.0	Sand some Gravel some Silt trace Clay	15	69	14	2	11.8

4.4 Clayey Silt

A layer of cohesive clayey silt material was encountered beneath the surficial topsoil in test pits TP116-22 and TP120-22 and extended to the test pit termination depths of 2.0 mbgs. The clayey silt material was brown to grey in colour and contained some sand, with occasional cobbles and boulders noted within the deposit encountered within TP120-22.

Natural moisture content as determined by laboratory testing was 18% to 19% for the clayey silt material.

Particle size distribution analysis was completed on one sample collected from the native clayey silt deposits. The testing results are provided in Appendix B and are summarized in Table 2.

Table 2 Particle Size Distribution Analysis – Clayey Silt

Borehole or Test Pit	Depth (mbgs)	Description	% Gravel	% Sand	% Silt	% Clay	% Moisture Content
TP116-22 GS1	0.6 – 2.0	Clayey Silt trace Sand	0	2	78	20	19.1

4.5 Bedrock

Bedrock was not encountered within any of the boreholes or test pits advanced by Cambium at the Site. The boreholes and test pits were terminated at depths from 2.0 mbgs and 5.2 mbgs, corresponding to elevations between 103.9 m Rel. El. and 95.7 m Rel. El.

4.6 Groundwater

The soils were predominantly described as being moist to wet throughout the borehole investigation. Wet soils (based on visual and tactile observations during drilling and excavating works) were first encountered within the boreholes and test pits at depths ranging from 0.8 mbgs to 4.6 mbgs.

Groundwater (free water) was observed in borehole BH105-22 at a depth of 3.4 mbgs and groundwater seepage was observed within TP111-22 at a depth of 1.1 mbgs upon completion of the drilling and excavating works. The groundwater level observations in the boreholes and test pits are not representative of the stabilized groundwater conditions and as such, the groundwater table elevation may vary. Caving (sloughing) was noted within borehole BH105-22 at a depth of 3.7 mbgs and test pit TP111-22 at a depth of 1.1 mbgs.

Four monitoring wells were installed in boreholes BH101-22 through BH104-22 to allow for subsequent groundwater level monitoring at the Site. The water level information obtained from the monitoring wells following the borehole investigation is summarized in Table 3.

Table 3 Groundwater Observations in the Monitoring Wells

Date	Borehole	Ground Elevation (m Rel. El.)	Water Level Depth (mbgs)	Water Level Elevation (m Rel. El.)	Bottom of Well Elevation (m Rel. El.)
September 30, 2022	BH101-22	102.28	1.98	100.30	97.08
	BH102-22	101.00	0.92	100.08	95.80
	BH103-22	106.05	0.26	105.79	100.85
	BH104-22	104.46	-	-	99.26
October 25, 2022	BH101-22	102.28	1.95	100.33	97.08
	BH102-22	101.00	1.00	100.00	95.80
	BH103-22	106.05	0.32	105.73	100.85
	BH104-22	104.46	-	-	99.26
November 8, 2022	BH101-22	102.28	2.03	100.25	97.08
	BH102-22	101.00	1.11	99.89	95.80
	BH103-22	106.05	0.59	105.46	100.85
	BH104-22	104.46	-	-	99.26

The groundwater and caving observations made during the borehole and test pit investigation are summarized in Table 4. Only boreholes and test pits which encountered groundwater and caving are included within the table, and those omitted were observed to be open and dry upon completion. It is noted that the test pits were terminated at shallow depths (typically + 2 mbgs) and were open for short periods of time. Due to the fine-grained nature of the native soils (i.e., soil passing the 0.075 mm sieve), it is possible that the stabilized groundwater table may have been within the excavated depths, however, did not have sufficient to stabilize and be observed during the field investigation.

Table 4 Groundwater and Caving Observations During Drilling and Test Pitting

Date	Borehole	Elevation (m Rel. El.) [2]	Wet Soils First Encountered (mbgs)[1]	Water Level or Apparent Seepage upon Completion (mbgs) [1]	Elevation of Water upon Completion (m Rel. El) [2]	Caving Depth (mbgs)[1]
September 22 & 26, 2022	BH101-22	102.28	3.5	-	-	-
	BH103-22	106.05	1.5	-	-	-
	BH104-22	104.46	4.6	-	-	-
	BH105-22	102.58	0.8	3.4	-	3.7
September 26 & 27, 2022	TP111-22	105.84	0.8	1.1*	-	1.1
	TP112-22	105.10	0.9	dry	-	open

[1] meters below ground surface
[2] meters Relative Elevation

It should be noted that the encountered and measured groundwater levels reflect the groundwater conditions in the boreholes and test pits at the time of the investigation and the subsequent monitoring event in September 2022, October 2022, and November 2022 respectively. Groundwater levels at the Site are anticipated to vary between and beyond the borehole locations and to fluctuate with seasonal variations in precipitation and snowmelt.

5.0 Geotechnical Considerations

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

5.1 Site Preparation

Existing topsoil and organic material (including significant root bulbs), any loose reworked/disturbed native materials and any deleterious material (i.e., imported fill material, construction debris, fibrous material, asphalt, brick fragments, etc.) encountered should be excavated and removed beneath proposed development areas prior to construction. Additionally, this material should be excavated and removed to a minimum distance of 3 m around any building footprints. Any topsoil and materials with significant quantities of organics and deleterious materials are not appropriate for use as fill.

The exposed subgrade should be proof-rolled and inspected by a qualified geotechnical engineer prior to placement of any engineered fill or foundations. Any loose/soft soils identified at the time of the 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.

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

5.2 Frost Penetration

Based on climate data and design charts, 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 provided with at least 1.4 m of adjacent earth material (where fill is used to raise grades at the Site) or should be appropriately protected. Any services should be located below this depth or be appropriately insulated.

5.3 Excavations

For the purposes of this report, it is assumed that the proposed residential and barn structures may contain basements.

In the areas of the Site where unsupported excavations to the required depths are deemed feasible, the excavations must be carried out in accordance with the latest edition of OHSA and Ontario Regulation 213/91 (as amended). For practical purposes, the overburden soils at the Site above the groundwater table and within continually dewatered depths can be considered Type 3 soils due to the upper portions of the cohesionless native deposits being compact in relative density, as such, excavation side slopes should be no steeper than 1H:1V.

Soils below the groundwater table should be treated as Type 4 soils and therefore excavation unsupported side slopes should be decreased to 3H:1V in these areas.

Excavation slopes should be protected during construction from precipitation, runoff, or snow/ice melt and should be inspected regularly for signs of instability.

If localized instability is noted during excavation or if wet conditions are encountered, the side slopes should be flattened as required to maintain safe working conditions or the excavation sidewalls must be fully supported (shored).

Stockpiles of excavated materials should be kept at least at the same distance as the excavation depth from the top edge of the excavation to prevent slope instability. Care should also be taken to avoid overloading of any existing underground services/structures by stockpiles.

5.4 Groundwater Control and Dewatering

During the groundwater monitoring events conducted in September 2022, October 2022, and November 2022, the groundwater elevation measured in the monitoring wells were recorded between 0.3 and 2.0 mbgs, or at elevations between 99.89 m Rel. El. and 105.79 m Rel. El.

The groundwater level measured at the Site represents a momentary observation, not taken during a high groundwater season (i.e., typically between March to May). Therefore, it could reasonably be expected that the groundwater table will be higher than measured at other times of the year, and it is recommended to conduct excavation and foundation works during drier times of the year to avoid groundwater-related issues and to save costs related to dewatering efforts.

In general, excavation up to the frost penetration depth will most likely encounter groundwater inflow into the excavation due to zones of perched water and/or the prevailing water table in areas across the site, however this seepage should be manageable using filtered sumps and pumps. Depending on the depth, size, and staging of the excavations, a Permit to Take Water (PTTW) or registry with the Environmental Activity and Sector Registry (EASR) of the Ministry of the Environment, Conservation and Parks (MECP) may be required.

Where the excavations for site services such as sewers or watermain 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 filtered sumps and pumps, and/or well points.

Water takings in excess of 50 m^3/day are regulated by the 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 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.

5.5 Foundation Design

It is understood that various structures are to be constructed throughout the site as part of the proposed development. Cambium should be contacted to review the final grading plan and provide any necessary changes to our foundation recommendations.

5.5.1 Conventional Shallow Footings

From a geotechnical perspective, the proposed structures can be supported on standard strip and/or spread footings founded on the cohesionless native soils (silt soils, very loose to compact relative density). Table 5 gives allowable bearing capacities based on geotechnical principles outlined in [3] for shallow foundations bearing on native soils.

The provided values are applicable for strip foundations with a minimum width of 0.5 m and for spread foundations with minimum dimensions of 1 m x 1 m. It is noted that the density of native cohesionless soil is generally consistent with depth, with loose to very loose zones noted in boreholes BH102-22 through BH105-22 above a depth of 0.8 mbgs, as such, footings should be constructed within the elevation ranges provided in Table 5.

Table 5 Bearing Capacities for Shallow Foundations on Native Soils

Borehole	Soil Description	Depth (mbgs)	Elevation (m Rel. El.)	Maximum Geotechnical Reaction SLS (kPa)	Maximum Geotechnical Reaction ULS (kPa)
BH101-22	Silt; very dense to dense	0.8 – 4.6	101.5 – 97.7	150	190
	Sand; dense	4.6 – 5.2	97.7 – 97.1		
BH102-22	Silty Sand; compact to dense	0.8 – 5.2	100.2 – 95.8	150	190
BH103-22	Silty Sand; compact to very dense	0.8 – 3.1	105.2 – 102.9	150	190
	Sand and Silt; very dense	3.1 – 4.6	102.9 – 101.4		
	Sand; dense	4.6 – 5.2	101.4 – 100.8		
BH104-22	Sand; compact to dense	0.8 – 2.3	103.7 – 102.2	150	190
	Silty Sand; compact to dense	2.3 – 4.6	102.2 – 99.9		
	Sand; very dense	4.6 – 5.2	99.9 – 99.3		
BH105-22	Sand and Silt; compact	0.8 – 3.1	101.8 – 99.5	150	190
	Sand; compact	3.1 – 5.2	99.5 – 97.4		
BH106-22	Sandy Silt; dense to very dense	0.8 – 5.2	105.1 – 100.7	150	190
BH107-22	Sandy Silt; very dense	0.8 – 5.2	103.6 – 99.2	150	190
Note: assumes all foundations provided with at least 1.5 m of adjacent earth cover.					

Alternatively, in areas where the proposed founding levels are above the level of competent native soil (due to shallow groundwater conditions), or where sub excavation is required, footings made to bear directly on a pad of engineered fill constructed per the recommendations in Section 5.7.1. From a preliminary perspective, footings placed on approved engineered fill and appropriately protected from frost may be designed for an allowable bearing capacity of 150 kPa at SLS and 185 kPa at ULS. Cambium should be retained to review the final grading plan, as the preliminary engineered fill bearing capacity values will change depending on engineered fill thickness, material and the native subgrade soil the engineered fill pad is constructed on.

Settlement potential at the above-noted SLS loadings is less than 25 mm and differential settlement should be less than 20 mm.

The quality of the subgrade should be inspected by Cambium during construction, prior to constructing the footings, to confirm bearing capacity estimates.

5.5.2 Floor Slabs

To create a stable working surface, to distribute loadings, and for drainage purposes, an allowance should be made to provide at least 200 mm of OPSS.MUNI 1010 Granular A compacted to 98% of Standard Proctor Maximum Dry Density (SPMDD) beneath all floor slabs. It is recommended that all floor slabs are situated at least 500 mm above the seasonal high groundwater elevation.

If any interior areas are not to be continuously heated throughout the winter there is potential for damage to the floor slab due to frost action depending upon the composition of the subgrade soils. The floor slab within any area expected to be exposed to freezing temperatures should be adequately insulated to prevent frost penetration within the subgrade.

Any basement floor slabs should be underlain by a 300 mm thick layer of 19 mm diameter crushed clear stone wrapped in a geotextile (Terrafix 270R or equivalent) and hydraulically connected to perimeter subdrains.

The clear stone material should be nominally compacted to a dense state.

5.6 Subdrainage

The exterior grade around any buildings should be sloped from the walls to direct surface runoff away from the building. To deal with seasonal perched water and/or the water table, perimeter subdrains consisting of geotextile wrapped perforated pipe subdrains set in a trench of clear stone and connected to a sump or other frost-free positive outlet are recommended.

Subsurface walls should be adequately damp proofed above the water table and waterproofed below the water table.

5.7 Backfill and Compaction

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 cohesionless native silt to sandy silt soils to silt and sand soils, and cohesive native clayey silt soils encountered at the Site are generally fine grained and may not be appropriate for use as fill below any proposed grading and/or parking and driving areas, and subsequent materials testing will be required during construction to confirm acceptance.

Some moisture content adjustments of fill material may be required prior to placement and compaction, depending upon seasonal conditions. Geotechnical inspections and testing of engineered fill are required to confirm acceptable quality.

Foundation wall and any buried utility backfill material should consist of free-draining imported granular material. Typically, backfill should be placed in maximum 300 mm thick lifts and should be compacted to a minimum of 98% of SPMDD. Backfill adjacent to the structural elements (i.e., foundation walls) should be compacted to 95% of SPMDD taking care not to damage the adjacent structures. The backfill material in the upper 300 mm below the pavement subgrade elevation should be compacted to 100% of SPMDD in all areas.

5.7.1 Engineered Fill

Where the existing fill is treated as an engineered fill to support structural elements such as foundations and/or floor slabs the following is recommended for the construction of engineered fill:

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

II. The area of the engineered fill should extend horizontally 1 m beyond the outside edge of the foundations then extend downward at an imaginary 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.

III. 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.

IV. Place approved OPSS 1010.MUNI SSM or Granular 'B' Type I material at a moisture content at or near optimum moisture in suitable maximum 200 mm thick lifts, compacted to 100% of SPMDD. 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. Any frost penetration into the fill material must be removed prior to placement of subsequent lifts of fill and reviewed by Cambium.

V. The engineered fill should be placed at least 600 mm above the elevation of the proposed underside of footing.

VI. Due to the potential negative effects of differential settlement between the engineered fill and the native soils, in any block where footings are to be placed partly on engineered fill and partly on native soils, reinforcing steel bars should be included and placed within the footings and the top of the foundation walls. All tie reinforcing steel bars should be included and placed within the top of the foundation walls. All tie reinforcing steel bars should have at least 600 mm of overlap. The actual steel reinforcement design should be confirmed / designed by the project structural engineer.

VII. 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.

5.8 Lateral Earth Pressure

Lateral earth pressure coefficients (K) are shown in Table 6. It is assumed that potential lateral loads will result from cohesion less, frictional materials, such as granular backfill and the encountered near surface native sand.

Table 6 Lateral Earth Pressure Coefficients

Stratum/Parameter	γ / γ ' [kN/m^3]	Φ [°]	c [kN/m^2]	K_o [-]	K_a [-]	K_p [-]
Silty Sand Materials very loose to loose	19 / 10	27.5	0	0.54	0.37	2.72
Silty Sand Materials compact to dense	20 / 11	30.0	0	0.50	0.33	3.00
Silty Sand Materials very dense	21 / 12	32.0	0	0.47	0.31	3.25
Silt (Cohesive) Hard	20.5 / 11.5	27.5	2	0.54	0.37	2.72
Engineered Fill (per recommendations provided above)	20.5 / 11.5	32.5	0	0.46	0.30	3.32

Where: γ = bulk unit weight of soil (kN/m^3)

γ' = submerged (effective) unit weight of soil (kN/m^3)

φ = internal angle of friction (degrees)

c = soil cohesion (kN/m^2)

K_a = Rankine active earth pressure coefficient (dimensionless)

K_o = Rankine at-rest earth pressure coefficient (dimensionless)

K_p = Rankine passive earth pressure coefficient (dimensionless)

The coefficients provided in Table 6 assume that the surface of the granular backfill is horizontal against any proposed retaining wall, and the wall is vertical and smooth. Cambium should be contacted to provide updated lateral earth pressure coefficients should the assumptions differ to those noted.

5.9 Seismic Site Classification

The Ontario Building Code (OBC) specifies that the structures should be designed to withstand forces due to earthquakes. For the purpose of earthquake design, geotechnical information shall be used to determine the “Site Class”.

The parameters for determination of Site Classification for Seismic Site Response are set out in Table 4.1.8.4A of the OBC (2012). The classification is based on the determination of the average shear wave velocity in the top 30 metres of the Site stratigraphy, where shear wave velocity (V_s) measurements have been taken. Alternatively, the classification is estimated based on rational analysis of undrained shear strength (S_u) or penetration resistances (N_{60} values).

Based on the explored soil properties and in accordance with Table 4.1.8.4.A, it is recommended that Site Class “D” (stiff soil) be applied for structural design at the Site.

Peak ground acceleration and spectral acceleration (period of 0.2 seconds) for the Site are calculated to be 0.053g and 0.092g respectively using the 2015 National Building Code Seismic Hazard Calculation. A detailed report of the calculation and its results can be found in Appendix C.

Consideration could be given to carrying out shear wave velocity testing (Multichannel Analysis of Surface Waves, “MASW”) to evaluate whether an improved seismic site class can be obtained. Further details regarding shear wave velocity testing could be provided upon request.

5.10 Site Servicing

Trench excavations should follow general guidelines of Section 5.3 and 5.4.

Bedding and cover material for any services should consist of OPSS 1010 Granular A or B Type II, placed in accordance with the Town of the Blue Mountain standards. The bedding and cover material shall be placed in maximum 150 mm thick lifts and should be compacted to at least 98% of SPMDD. The cover material shall be a minimum of 300 mm over the top of the pipe and compacted to at least 98% of SPMDD.

5.11 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 at least 98% of 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 at least 98% of SPMDD.

The recommended minimum pavement structure design has been provided in Table 7 based upon review of the site soil and groundwater conditions and review of the Town of the Blue Mountains engineering standards.

Table 7 Pavement Structure

Pavement Layer	Compaction Requirements	Local Rural and Urban
Surface Course Asphalt	OPSS 310	40 mm HL3
Binder Course Asphalt	OPSS 310	40 mm HL8
Granular Base	98% of SPMDD	150 mm Granular A
Granular Subbase	98% of SPMDD	450 mm Granular B

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.

Subdrains are recommended beneath the pavement structure, connecting to the storm sewer or an alternative frost-free outlet as outlined above, to extend the lifespan of the structure.

The final asphalt surface should be sloped at a minimum of 2% to shed runoff. Abutting pavements should be sawcut to provide clean vertical joints with new pavement areas.

6.0 Report Limitations

6.1 Design Review and Inspections

Cambium should be contacted to review and approve design drawings, prior to tendering or commencing construction, to ensure that all pertinent geotechnical-related factors have been addressed. It is important that onsite geotechnical supervision be provided at this site for excavation and backfill procedures, deleterious soil removal, subgrade inspections and compaction testing.

6.2 Changes in Site and Project Scope

This geotechnical engineering report is intended for planning and design purposes only.

Subsurface conditions can be altered by the passage of sufficient time, natural occurrences, and human intervention. In particular, consideration should be given to contractual responsibilities as they relate to control of groundwater seepage, disturbance of soils, and frost protection.

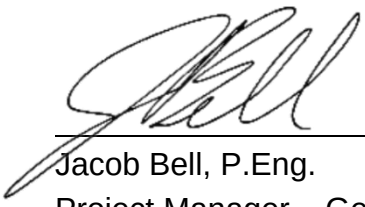
The design parameters provided, and the engineering advice offered in this report are intended for use by the owner and its retained design consultants. If there are changes to the project scope and development features, these interpretations made of the subsurface information, for geotechnical design parameters, advice, and comments relating to constructability issues and quality control may not be complete for the project. Cambium should be retained to conduct further review to interpret the implications of such changes with respect to this report.

7.0 Closing

We trust that the information contained in this report meets your current requirements. If you have questions or comments regarding this document, please do not hesitate to contact the undersigned at (705) 719-0700.

Respectfully submitted,

CAMBIUM INC.



Jacob Bell, P.Eng.
Project Manager – Geotechnical

Rob Gethin, P.Eng.
Group Manager – Geotechnical

RLG/JB

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8.0 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.

Facts, conditions, information, and circumstances may vary with time and locations and Cambium's work is based on a review of such matters as they existed at the particular time and location indicated in its reports. No assurance is made by Cambium that the facts, conditions, information, circumstances, or any underlying assumptions made by Cambium in connection with the work performed will not change after the work is completed and a report is submitted. If any such changes occur or additional information is obtained, Cambium should be advised and requested to consider if the changes or additional information affect its findings or results.

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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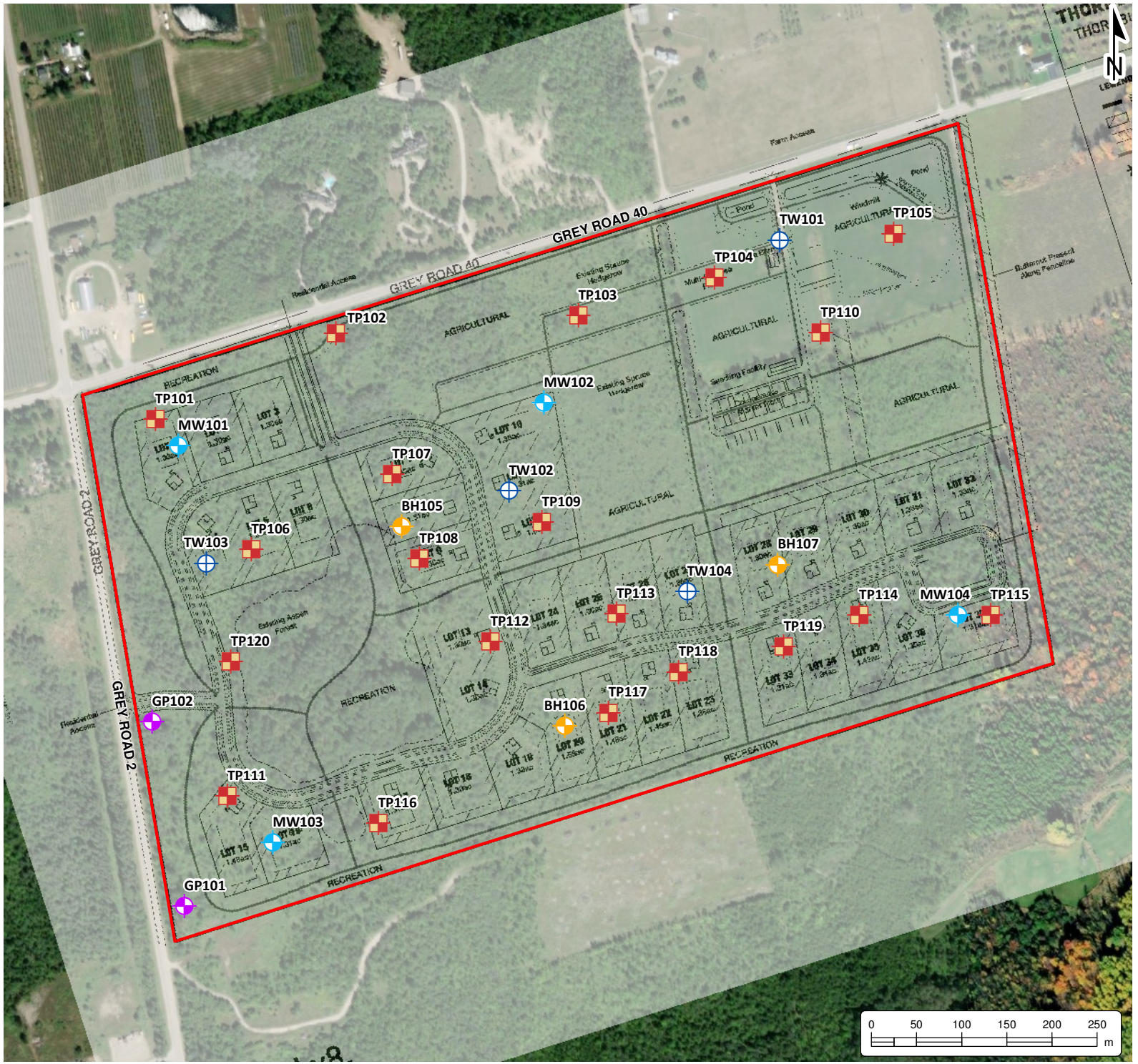
Limitation of Liability

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 INVESTIGATION

TATHAM ENGINEERING LTD.
Thornbury Acres
Grey Road 40 &Grey Road 2
Thornbury, Ontario

LEGEND

- Borehole
- Monitoring Well
- Gas Probe
- Test Well
- Test Pit
- Site (approximate)

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 PLAN

Project No.: 14266-001		Date: October 2022	Rev.:
Scale: 1:6,000		Projection: NAD 1983 UTM Zone 17N	
Created by: TLC	Checked by: CM	Figure: 1	

O:\GIS\MXDs\1:4200-14299\14266-001 Tatham Engineering Ltd - Geo, HydroG & D4 - Thornbury Acres\2022-10-27 FIG 2 - Site Plan.mxd

Appendix A

Borehole and Test Pit Logs

Peterborough
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T: 866-217-7900
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Log of Borehole: BH101-22

Client: Thornbury Acres Holding Inc. **Project Name:** Thornbury Acres **Project No.:** 14266-001

Contractor: Walker Drilling **Method:** Hollow Stem Augers **Date Completed:** September 22, 2022

Location: Grey County Road 40 & Road 2, Blue Mountains, ON **UTM:** 17T, 4931343 m N, 545208 m E **Elevation:** 102.28 m Rel. El.

Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	Well Installation	Remarks
102 / 0		TOPSOIL: (~ 150 mm thick)	1A				Monument	50 mm diameter monitoring well with a 3.0 m screen. Groundwater level measured in monitoring well at a depth of about 2.0 mbgs on September 30th, 2022 and 2.0 mbgs on October 25, 2022
		SAND: (SP) trace silt, brown; non-cohesive, moist, compact	1B	SS	50	10	Cap	
							Holeplug	
							PVC Standpipe	
101 / 1		SILT: (ML) some clay, some sand, trace gravel; brown; non-cohesive, moist, very dense to dense	2	SS	60	68		
			3	SS	60	100		
100 / 2								
		- becomes grey at 2.6 mbgs	4	SS	75	46	Sand	GSA SS4: 1% Gravel 16% Sand 66% Silt 17% Clay
99 / 3			5	SS	65	48	PVC Screen	
		- becomes wet at 3.5 mbgs						
98 / 4								
		SAND: (SP) trace gravel, grey; non-cohesive, wet, dense	6	SS	100	47		
97 / 5							Cap	
		Borehole terminated at 5.2 mbgs due to target depth achieved						
6								

% Moisture: 25 50 75

SPT (N) / DCPT: 10 20 30 40

Logged By: C. Malliaros **Input By:** Waleed El-Taweel

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Kingston
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Log of Borehole: BH102-22

Client: Thornbury Acres Holding Inc. **Project Name:** Thornbury Acres **Project No.:** 14266-001

Contractor: Walker Drilling **Method:** Hollow Stem Augers **Date Completed:** September 22, 2022

Location: Grey County Road 40 & Road 2, Blue Mountains, ON **UTM:** 17T, 4931457 m N, 545604 m E **Elevation:** 101.00 m Rel. El.

Elevation (m)	Depth	Description	Number	Type	% Recovery	SPT (N) / DCPT	Well Installation	Remarks
100	0	TOPSOIL: (~ 150 mm thick)	1A				Monument	50 mm diameter monitoring well with a 3.0 m screen. Groundwater level measured in monitoring well at a depth of about 0.9 mbgs on September 30th, 2022 and 1.0 mbgs on October 25, 2022
		SANDY SILT: (ML) some clay, trace gravel, brown; non-cohesive, moist, loose	1B	SS	50	5	Cap	
							Holeplug	
							PVC Standpipe	
99	1	SILTY SAND: (SM) trace clay; brown; non-cohesive, moist, compact to dense	2	SS	40	10		
		- decreased gravel content	3	SS	100	17		GSA SS3: 0% Gravel 71% Sand 27% Silt 2% Clay
98	2	- becomes grey at 2 mbgs	4	SS	75	23		
							Sand	
97	3		5	SS	80	33	PVC Screen	
96	4		6	SS	70	35		
							Cap	
95	5	Borehole terminated at 5.2 mbgs due to target depth achieved						
	6							

% Moisture: 25 50 75

SPT (N) / DCPT: 10 20 30 40

Logged By: C. Malliaros **Input By:** Waleed El-Taweel

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Log of Borehole: BH103-22

Client: Thornbury Acres Holding Inc. **Project Name:** Thornbury Acres **Project No.:** 14266-001

Contractor: Walker Drilling **Method:** Hollow Stem Augers **Date Completed:** September 22, 2022

Location: Grey County Road 40 & Road 2, Blue Mountains, ON **UTM:** 17T, 4930900 m N, 545369 m E **Elevation:** 106.05 m Rel. El.

Elevation (m) / Depth	Description	Number	Type	% Recovery	SPT (N) / DCPT	Well Installation	Remarks
106 / 0	TOPSOIL: (~ 150 mm thick)	1A				Monument, Cap	50 mm diameter monitoring well with a 3.0 m screen. Groundwater level measured in monitoring well at a depth of about 0.2 mbgs on September 30th, 2022 and 0.3 mbgs on October 25, 2022
	SANDY SILT: (ML) some clay, brown; non-cohesive, moist, loose	1B	SS	50	7	Holeplug, PVC Standpipe	
105 / 1	SILTY SAND: (SM) trace clay; brown; non-cohesive, moist to wet, compact to dense	2	SS	70	16		
	- becomes wet at 1.5 mbgs	3	SS	80	37		GSA SS3: 0% Gravel, 67% Sand, 30% Silt, 3% Clay
104 / 2		4	SS	80	50	Sand, PVC Screen	
103 / 3	SAND AND SILT: (ML) trace clay; grey; non-cohesive, wet, very dense	5	SS	70	50		GSA SS5: 0% Gravel, 49% Sand, 47% Silt, 4% Clay
102 / 4							
	SAND: (SP) some silt, grey; non-cohesive, wet, compact	6	SS	80	28	Cap	
101 / 5	Borehole terminated at 5.2 mbgs due to target depth achieved						Borehole was open and dry upon completion of drilling
100 / 6							

% Moisture: 25 50 75

SPT (N) / DCPT: 10 20 30 40

Logged By: Waleed El-Taweel **Input By:** Waleed El-Taweel

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Log of Borehole: BH104-22

Client:	Thornbury Acres Holding Inc.	**Project Name:**	Thornbury Acres	**Project No.:**	14266-001
Contractor:	Walker Drilling	**Method:**	Hollow Stem Augers	**Date Completed:**	September 26, 2022
Location:	Grey County Road 40 & Road 2, Blue Mountains, ON	**UTM:**	17T, 4931238 m N, 546082 m E	**Elevation:**	104.46 m Rel. El.

Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
0 / 104		TOPSOIL: (~ 450 mm thick)	1	SS	30	8			Monument, Cap, Holeplug, PVC Standpipe	50 mm diameter monitoring well with a 3.0 m screen. Monitoring well was measured as dry on September 30th, 2022 and on October 25, 2022
1 / 103		SAND: (SP) some silt, trace gravel, brown; non-cohesive, moist, compact to dense	2	SS	70	17				
			3	SS	80	32				
2 / 102		SILTY SAND: (SM) some gravel, some clay; brown; non-cohesive, moist, compact to dense	4	SS	70	23			Sand, PVC Screen	GSA SS4: 12% Gravel 43% Sand 34% Silt 11% Clay
3 / 101		- trace clay, dense	5	SS	80	47				
4 / 100		SAND: (SP) trace silt, brown; non-cohesive, moist to wet, very dense	6	SS	70	82			Cap	
5 / 99		Borehole terminated at 5.2 mbgs due to target depth achieved								
6										

Logged By: Waleed El-Taweel **Input By:** Waleed El-Taweel

Peterborough
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Kingston
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Log of Borehole: BH105-22

Client:	Thornbury Acres Holding Inc.	**Project Name:**	Thornbury Acres	**Project No.:**	14266-001
Contractor:	Walker Drilling	**Method:**	Hollow Stem Augers	**Date Completed:**	September 26, 2022
Location:	Grey County Road 40 & Road 2, Blue Mountains, ON	**UTM:**	17T, 4931345 m N, 545446 m E	**Elevation:**	102.58 m Rel. El.

Elevation (m) / Depth	Lithology	Description	Number	Type	% Recovery	SPT (N) / DCPT	% Moisture (25 50 75)	SPT (N) / DCPT (10 20 30 40)	Well Installation	Remarks
102 / 0		TOPSOIL: (~ 100 mm thick)	1A							
		SAND AND SILT: (ML) trace clay, brown; non-cohesive, moist, loose to compact	1B	SS	55	4				
		- becomes wet at 0.8 mbgs	2	SS	70	13				
101 / 1			3	SS	65	16				
		- trace gravel, decreased clay content	4	SS	100	18				GSA SS4: 0% Gravel 62% Sand 35% Silt 3% Clay
100 / 2		SAND: (SP) trace gravel, brown; non-cohesive, wet, compact	5	SS	100	24				
99 / 3										
98 / 4			6	SS	100	28				Borehole caved to a depth of about 3.7 mbgs and groundwater level measured in borehole at a depth of about 3.4 mbgs upon completion of drilling
97 / 5		Borehole terminated at 5.2 mbgs due to target depth achieved								
6										

Logged By: C. Malliaros **Input By:** Waleed El-Taweel

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Kingston
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Log of Borehole: BH106-22

Client:	Thornbury Acres Holding Inc.	**Project Name:**	Thornbury Acres	**Project No.:**	14266-001
Contractor:	Walker Drilling	**Method:**	Hollow Stem Augers	**Date Completed:**	September 26, 2022
Location:	Grey County Road 40 & Road 2, Blue Mountains, ON	**UTM:**	17T, 4931124 m N, 545686 m E	**Elevation:**	105.92 m Rel. El.

Elevation (m)	Depth	Description	Number	Type	% Recovery	SPT (N) / DCPT	Well Installation	Remarks
	0	TOPSOIL: (~ 450 mm thick)	1	SS	40	12		
105	1	SANDY SILT: (ML) trace clay, trace gravel, brown; non-cohesive, moist, dense to very dense	2	SS	80	42		
			3	SS	65	42		
104	2	- becomes grey at 2.3 mbgs	4	SS	50	100		GSA SS4: 7% Gravel 29% Sand 55% Silt 9% Clay
103	3		5	SS	60	80		
102	4	- decreased gravel content	6	SS	70	113		
101	5							
100	6	Borehole terminated at 5.2 mbgs due to target depth achieved						Borehole was open and dry upon completion of drilling

% Moisture: 25 50 75

SPT (N) / DCPT: 10 20 30 40

Logged By: Waleed El-Taweel **Input By:** Waleed El-Taweel

Peterborough
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Log of Borehole: BH107-22

Client: Thornbury Acres Holding Inc. **Project Name:** Thornbury Acres **Project No.:** 14266-001

Contractor: Walker Drilling **Method:** Hollow Stem Augers **Date Completed:** September 26, 2022

Location: Grey County Road 40 & Road 2, Blue Mountains, ON **UTM:** 17T, 4931237 m N, 545923 m E **Elevation:** 104.41 m Rel. El.

Elevation (m) / Depth	Description	Number	Type	% Recovery	SPT (N) / DCPT	Well Installation	Remarks
0 / 104	TOPSOIL: (~ 175 mm thick)						
	SAND: (SP) trace gravel, trace silt, brown; non-cohesive, moist, compact	1	SS	40	13		
1 / 103	SANDY SILT: (ML) some clay, some gravel; brown; non-cohesive, moist, very dense	2	SS	80	61		
2 / 102	- trace clay	3	SS	80	84		GSA SS3: 12% Gravel 26% Sand 45% Silt 17% Clay
3 / 101	- becomes grey at 2.3 mbgs	4	SS	80	56		
4 / 100	- trace gravel	5	SS	80	62		
5 / 99		6	SS	70	83		
6	Borehole terminated at 5.2 mbgs due to target depth achieved						Borehole was open and dry upon completion of drilling

% Moisture: 25 50 75

SPT (N) / DCPT: 10 20 30 40

Logged By: Waleed El-Taweel **Input By:** Waleed El-Taweel

TEST PIT LOGS

Geotechnical Investigation : Thornbury Acres

Technician: NH

Cambium Reference No. 14266-001

Completed: September 26, 2022

Test Pit ID	Depth (mbgs[1])	Soil Sample	Moisture Content (%)	Material Description	Depth (m)	Inferred 'N' Value
TP101-22	0.0 - 0.15			TOPSOIL: (~ 150mm thick)		
	0.15 - 1.20	GS1	11.6	(SM) - SANDY SILT, some clay; dark brown; non-cohesive, moist		
	1.20 - 2.00	GS2	17.3	(SP) - SAND; light brown; non-cohesive, moist		
				No sloughing, seepage or groundwater observed in open test pit upon completion		
4931403 m N						
545234 m E				Test pit terminated at 2.6 mbgs		
TP102-22	0.0 - 0.15			TOPSOIL: (~ 150mm thick)		
	0.15 - 0.90			(SP) - SAND, some silt, trace gravel; brown; non-cohesive, moist		
	0.90 - 2.30	GS1 & GS2	19.0 & 16.7	(SP) - SAND, trace silt; light brown; non-cohesive, moist		
				No sloughing, seepage or groundwater observed in open test pit upon completion		
4931567 m N						
545365 m E				Test pit terminated at 2.30 mbgs		
TP103-22	0.0 - 0.30			TOPSOIL: (~ 300mm thick)	0.15 - 0.25	12
	0.30 - 1.80	GS1	8.6	(SP) - SAND, trace gravel, trace silt; brown; non-cohesive, moist, compact to very dense	0.25 - 0.35	17
	1.80 - 3.10	GS2	8.5	(ML) sandy SILT some clay; brown; non-cohesive, moist, very dense	0.35 - 0.45	21
				- becomes grey at 2.60 mbgs	0.45 - 0.55	24
					0.55 - 0.65	29
					0.65 - 0.75	31
					0.75 - 0.85	39
					0.85 - 0.95	41
					0.95 - 1.05	38
					1.05 - 1.15	41
					1.15 - 1.25	38
					1.25 - 1.35	38
					1.35 - 1.45	46
					1.45 - 1.55	51
					1.55 - 1.65	52
				No sloughing, seepage or groundwater observed in open test pit upon completion	1.65 - 1.75	57
4931569 m N					1.75 - 1.85	60
545683 m E				Test pit terminated at 3.10 mbgs	1.85 - 1.95	60
TP104-22	0.0 - 0.60			TOPSOIL: (~ 600mm thick)		
	0.60 - 2.20	GS1	13.0	(SP) - SAND, some silt, trace gracel; brown; non-cohesive, dry to moist		
				-becomes grey at 2.20 mbgs		
				No sloughing, seepage or groundwater observed in open test pit upon completion		
4931570 m N						
545842 m E				Test pit terminated at 2.20 mbgs		

[1]: metres below ground surface

[2]: Dynamic Penetration Test

TEST PIT LOGS

Geotechnical Investigation : Thornbury Acres

Technician: NH

Cambium Reference No. 14266-001

Completed: September 26, 2022

Test Pit ID	Depth (mbgs[1])	Soil Sample	Moisture Content (%)	Material Description	Depth (m)	Inferred 'N' Value
TP105-22	0.0 - 0.30			TOPSOIL: (~ 300mm thick)		
	0.30 - 1.10			(SP) - SAND, some silt, trace gravel, trace clay; brown; non-cohesive, moist		
	1.10 - 2.10	GS1 & GS2	12.2 &12.3	(ML) - SILT, some sand, trace clay, trace gravel; brown; non-cohesive, moist		
				-becomes grey at 1.83 mbgs		
				No sloughing, seepage or groundwater observed in open test pit upon completion		
				GS1 lab results - 2% gravel, 19% sand, 71% silt, 8% clay, T-Time = 25 min/cm		
4931571 m N						
546001 m E				Test pit terminated at 2.10 mbgs		
TP106-22	0.0 - 0.15			TOPSOIL: (~ 150mm thick)	0.15 - 0.25	15
	0.15 - 2.90	GS1	18.9	(ML) - SILT, some sand, trace clay; brown; non-cohesive, moist, compact to very dense	0.35 - 0.45	20
					0.45 - 0.55	24
				No sloughing, seepage or groundwater observed in open test pit upon completion	0.55 - 0.65	25
				GS1 lab results - 10% sand, 83% silt, 7% clay, T-Time = 20 min/cm	0.65 - 0.75	31
					0.75 - 0.85	35
					0.85 - 0.95	40
					0.95 - 1.05	43
					1.05 - 1.15	48
					1.15 - 1.25	52
					1.25 - 1.35	54
					1.35 1.45	55
4931233 m N					1.45 1.55	55
545288 m E				Test pit terminated at 2.90 mbgs	1.55 - 1.65	55
TP107-22	0.0 - 0.15			TOPSOIL: (~ 150mm thick)		
	0.15 - 1.50	GS1	-	(SP) - SAND, some silt, trace gravel; brown; non-cohesive, dry		
	1.50 - 2.40			(SM) - SILTY SAND, trace gravel, brown; non-cohesive, moist		
				No sloughing, seepage or groundwater observed in open test pit upon completion		
4931345 m N						
545446 m E				Test pit terminated at 2.40 mbgs		
TP108-22	0.0 - 0.30			TOPSOIL: (~ 300mm thick)		
	0.30 - 2.30	GS1	9.9	(SP) - SAND, some silt, trace gravel; non-cohesive, moist		
				No sloughing, seepage or groundwater observed in open test pit upon completion		
4931234 m N						
545527 m E				Test pit terminated at 2.30 mbgs		

[1]: metres below ground surface

[2]: Dynamic Penetration Test

TEST PIT LOGS

Geotechnical Investigation : Thornbury Acres

Technician: NH

Cambium Reference No. 14266-001

Completed: September 26, 2022

Test Pit ID	Depth (mbgs[1])	Soil Sample	Moisture Content (%)	Material Description	Depth (m)	Inferred 'N' Value
TP109-22	0.0 - 0.15			TOPSOIL: (~ 150mm thick)	0.15 - 0.25	8
	0.15 - 0.75	GS1	12.4	(SP) - SAND, some silt, trace gravel; brown; non-cohesive, moist, compact	0.25 - 0.35	10
	0.75 - 1.70	GS2	16.5	(ML) - SANDY SILT, some clay, trace gravel; brown; non-cohesive, moist, dense to very dense	0.35 - 0.45	15
	1.60 - 2.00	GS3	17.2	(ML) - SANDY SILT, some clay, trace gravel; brown; non-cohesive, moist, very dense	0.45 - 0.55	16
					0.55 - 0.65	24
					0.65 - 0.75	26
					0.75 - 0.85	32
					0.85 - 0.95	35
					0.95 - 1.05	36
					1.05 - 1.15	41
					1.15 - 1.25	38
					1.25 - 1.35	43
					1.35 - 1.45	47
					1.45 - 1.55	51
				No sloughing, seepage or groundwater observed in open test pit upon completion	1.55 - 1.65	55
4931347 m N					1.65 - 1.75	55
545685 m E				Test pit terminated at 2.00 mbgs	1.75 - 1.85	55
TP110-22	0.0 - 0.30			TOPSOIL: (~ 300mm thick)		
	0.30 - 1.80	GS1	13.7	(SP) - SAND, some silt, trace gravel; brown; non-cohesive, moist		
	1.80 - 2.10	GS2	10.0	(ML) - SANDY SILT, some clay, trace gravel; grey; non-cohesive, moist		
				No sloughing, seepage or groundwater observed in open test pit upon completion		
4931459 m N						
545922 m E				Test pit terminated at 2.10 mbgs		
TP111-22	0.0 - 0.15			TOPSOIL: (~ 150mm thick)	0.15 - 0.25	16
	0.15 - 0.75			(SM) - SILTY SAND, trace clay, trace gravel; brown; non-cohesive, moist, compact to dense	0.25 - 0.35	19
	0.75 - 1.10			(GM/SP) - SAND and GRAVEL, brown; non-cohesive, wet, dense to very dense	0.35 - 0.45	11
	1.10 - 2.90	GS1	15.5	(SP) - SAND, coarse medium grained, some silt, trace gravel, trace clay; brown; non-cohesive, saturated, very dense	0.45 - 0.55	15
					0.55 - 0.65	30
					0.65 - 0.75	32
					0.75 - 0.85	38
					0.85 - 0.95	36
					0.95 - 1.05	53
4931011 m N				Sloughing, seepage and groundwater at 1.07 mbgs	1.05 - 1.15	63
545290 m E				Test pit terminated at 2.90 mbgs	1.15 - 1.25	55

[1]: metres below ground surface

[2]: Dynamic Penetration Test

TEST PIT LOGS

Geotechnical Investigation : Thornbury Acres

Technician: NH

Cambium Reference No. 14266-001

Completed: September 26, 2022

Test Pit ID	Depth (mbgs[1])	Soil Sample	Moisture Content (%)	Material Description	Depth (m)	Inferred 'N' Value
TP112-22	0.0 - 0.15			TOPSOIL: (~ 150mm thick)		
	0.15 - 0.90			(ML) - SANDY SILT, trace gravel; brown; cohesive, moist		
	0.90 - 3.10	GS1 & GS2	11.8 & 8.6	(SP) - SAND, some gravel, some silt, trace clay; brown; non-cohesive, wet		
				Oxidized layer from 1.8 to 2.4 mbgs, mottled grey at 1.5 mbgs to termination depth		
				No sloughing, seepage or groundwater observed in open test pit upon completion		
4931123 m N				GS1 lab results - 15% gravel, 69% sand, 14% silt, 2% clay, T-Time = 8 min/cm		
545527 m E				Test pit terminated at 3.1 mbgs		
TP113-22	0.0 - 0.15			TOPSOIL: (~ 150mm thick)		
	0.15 - 2.00	GS1	9.6	(SP) - SAND, some silt, some gravel, some cobbles; brown; non-cohesive, dry		
				No sloughing, seepage or groundwater observed in open test pit upon completion		
4931236 m N						
545685 m E				Test pit terminated at 2.00 mbgs		
TP114-22	0.0 - 0.15			TOPSOIL: (~ 150mm thick)		
	0.15 - 2.00	GS1	15.2	(ML) - SANDY SILT, trace clay, trace gravel; brown; non-cohesive, moist		
				-becomes grey at 2.00 mbgs		
				No sloughing, seepage or groundwater observed in open test pit upon completion		
4931170 m N						
545022 m E				Test pit terminated at 2.00 mbgs		
TP115-22	0.0 - 0.15			TOPSOIL: (~ 150mm thick)		
	0.15 - 2.10	GS1	12.3	(SM) - SILTY SAND, trace gravel; brown; non-cohesive, dry		
				No sloughing, seepage or groundwater observed in open test pit upon completion		
4931147 m N						
545168 m E				Test pit terminated at 2.10 mbgs		
TP116-22	0.0 - 0.15			TOPSOIL: (~ 150mm thick)		
	0.15 - 0.60			(ML) - clayey SILT, trace sand; brown; cohesive, W~PL		
	0.60 - 2.00	GS1	19.1	(ML) - clayey SILT, trace sand; brown; cohesive, W~PL		
				-becomes grey at 1.5 mbgs		
				No sloughing, seepage or groundwater observed in open test pit upon completion		
				GS1 lab results - 2% sand, 78% silt, 20% clay, T-Time = 35 min/cm		
4931012 m N						
545449 m E				Test pit terminated at 2.00 mbgs		

[1]: metres below ground surface

[2]: Dynamic Penetration Test

TEST PIT LOGS

Geotechnical Investigation : Thornbury Acres

Technician: NH

Cambium Reference No. 14266-001

Completed: September 26, 2022

Test Pit ID	Depth (mbgs[1])	Soil Sample	Moisture Content (%)	Material Description	Depth (m)	Inferred 'N' Value
TP117-22	0.0 - 0.15			TOPSOIL: (~ 150mm thick)		
	0.15 - 2.10	GS1	10.5	(ML) - SILT, some gravel, some boulders, some cobbles, some clay; brown; non-cohesive, moist		
				No sloughing, seepage or groundwater observed in open test pit upon completion		
				2		
4931013 m N						
545687 m E				Test pit terminated at 2.10 mbgs		
TP118-22	0.0 - 0.30			TOPSOIL: (~ 300mm thick)	0.15 - 0.25	11
	0.30 - 2.30	GS1	11.7	(SM) - SILTY SAND, some gravel, some boulders and cobbles; brown; non-cohesive, dry, compact to very dense	0.25 - 0.35	13
					0.35 - 0.45	24
				No sloughing, seepage or groundwater observed in open test pit upon completion	0.45 - 0.55	21
					0.55 - 0.65	40
					0.65 - 0.75	35
					0.75 - 0.85	41
					0.85 - 0.95	52
					0.95 - 1.05	49
					1.05 - 1.15	49
					1.15 - 1.25	48
4931125 m N					1.25 - 1.35	55
545766 m E				Test pit terminated at 2.30 mbgs	1.35 - 1.45	55
TP119-22	0.0 - 0.15			TOPSOIL: (~ 150mm thick)		
	0.15 - 0.60	GS1	9.0	(SP) - SAND, some silt, trace gravel; brown; non-cohesive, dry		
	0.60 - 2	GS2	10.4	(SP-ML) - SAND and SILT, some gravel, trace clay; brown; non-cohesive, moist		
				No sloughing, seepage or groundwater observed in open test pit upon completion		
4931238 m N						
545083 m E				Test pit terminated at 2.00 mbgs		
TP120-22	0.0 - 0.15			TOPSOIL: (~ 150mm thick)		
	0.15 - 2.00	GS1	18.3	(ML) - CLAYEY SILT, cobbles and boulders; brown; cohesive, moist		
				becomes grey at 1.8 mbgs		
				No sloughing, seepage or groundwater observed in open test pit upon completion		
4931142 m N						
545280 m E				Test pit terminated at 2.00 mbgs		

[1]: metres below ground surface

[2]: Dynamic Penetration Test

Appendix B

Physical Laboratory Testing Results

Grain Size Distribution Chart

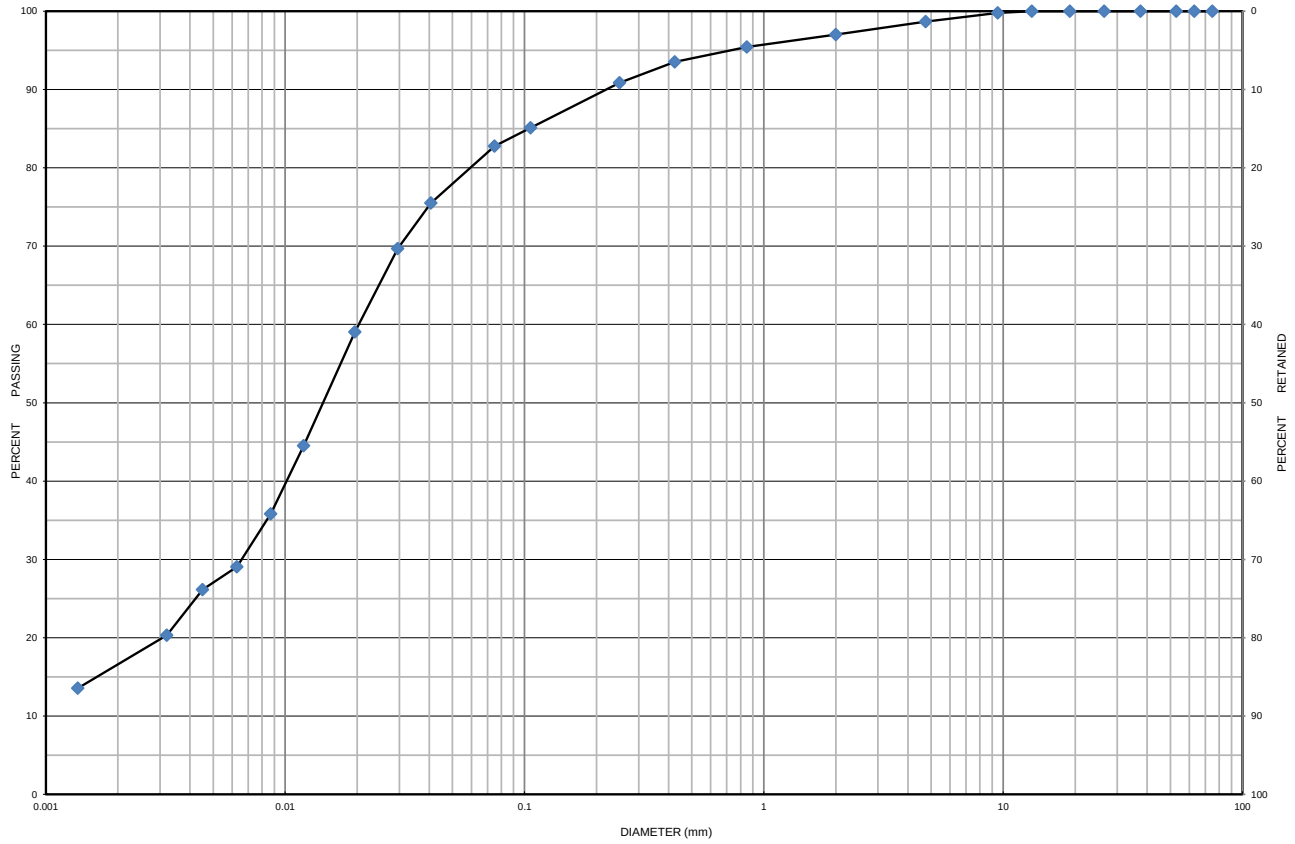
Project Number: *14266-001* **Client:** *Thornbury Acres Holdings*

Project Name: *Thornbury Acres - Geotechnical Investigation*

Sample Date: *September 27, 2022* **Sampled By:** *Chris Malliaros - Cambium Inc.*

Location: *BH 101-22 SS 4* **Depth:** *2.3 m to 2.9 m* **Lab Sample No:** *S-22-1475*

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 4	2.3 m to 2.9 m	1	16	66	17	12.1

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silt some Clay some Sand trace Gravel	ML	0.0210	0.0066	-	-	-

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Grain Size Distribution Chart

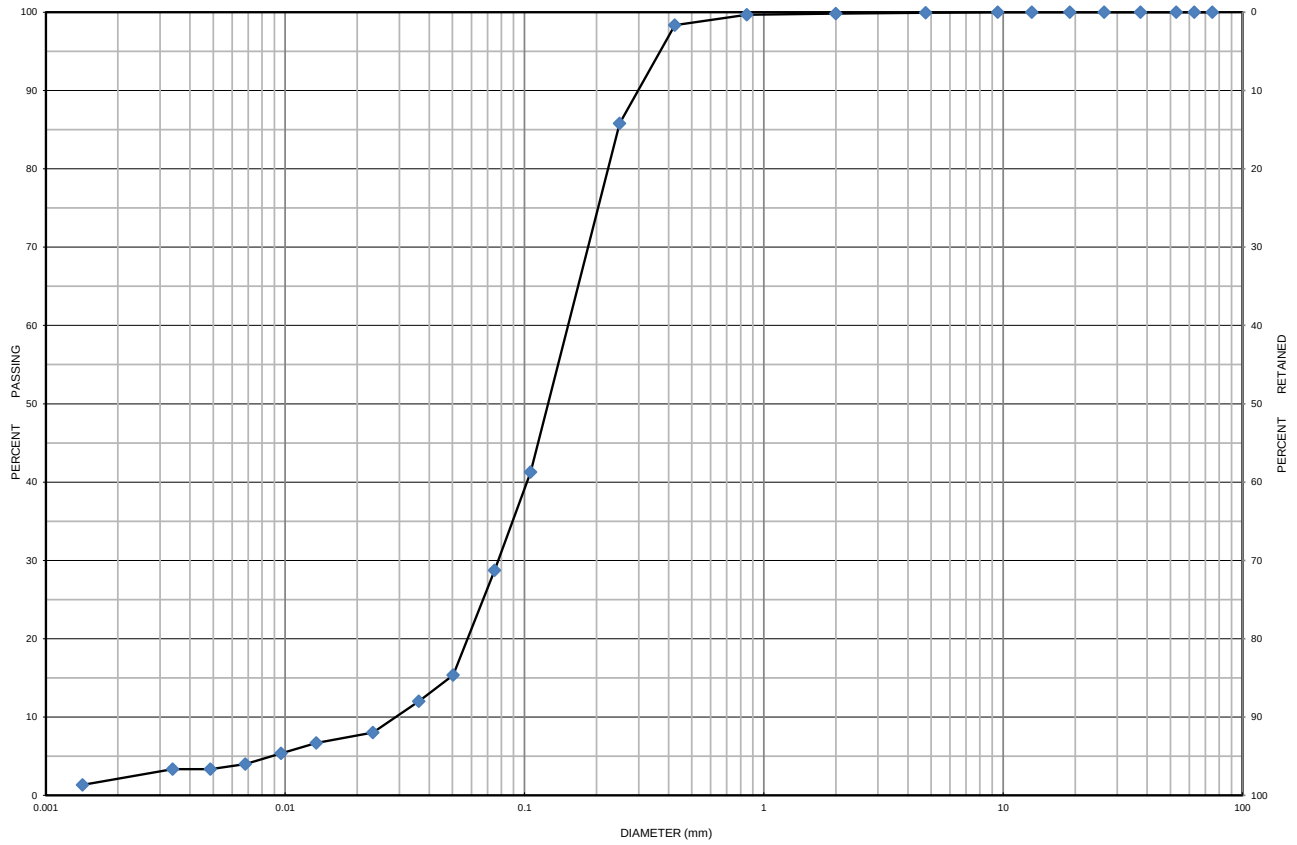
Project Number: *14266-001* **Client:** *Thornbury Acres Holdings*

Project Name: *Thornbury Acres - Geotechnical Investigation*

Sample Date: *September 27, 2022* **Sampled By:** *Chris Malliaros - Cambium Inc.*

Location: *BH 102-22 SS 3* **Depth:** *1.5 m to 2.1 m* **Lab Sample No:** *S-22-1476*

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



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

Borehole No.	Sample No.	Depth	Gravel	Sand	Silt	Clay	Moisture
BH 102-22	SS 3	1.5 m to 2.1 m	0	71	27	2	19.3

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silty Sand trace Clay	SM	0.160	0.078	0.029	5.52	1.31

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Grain Size Distribution Chart

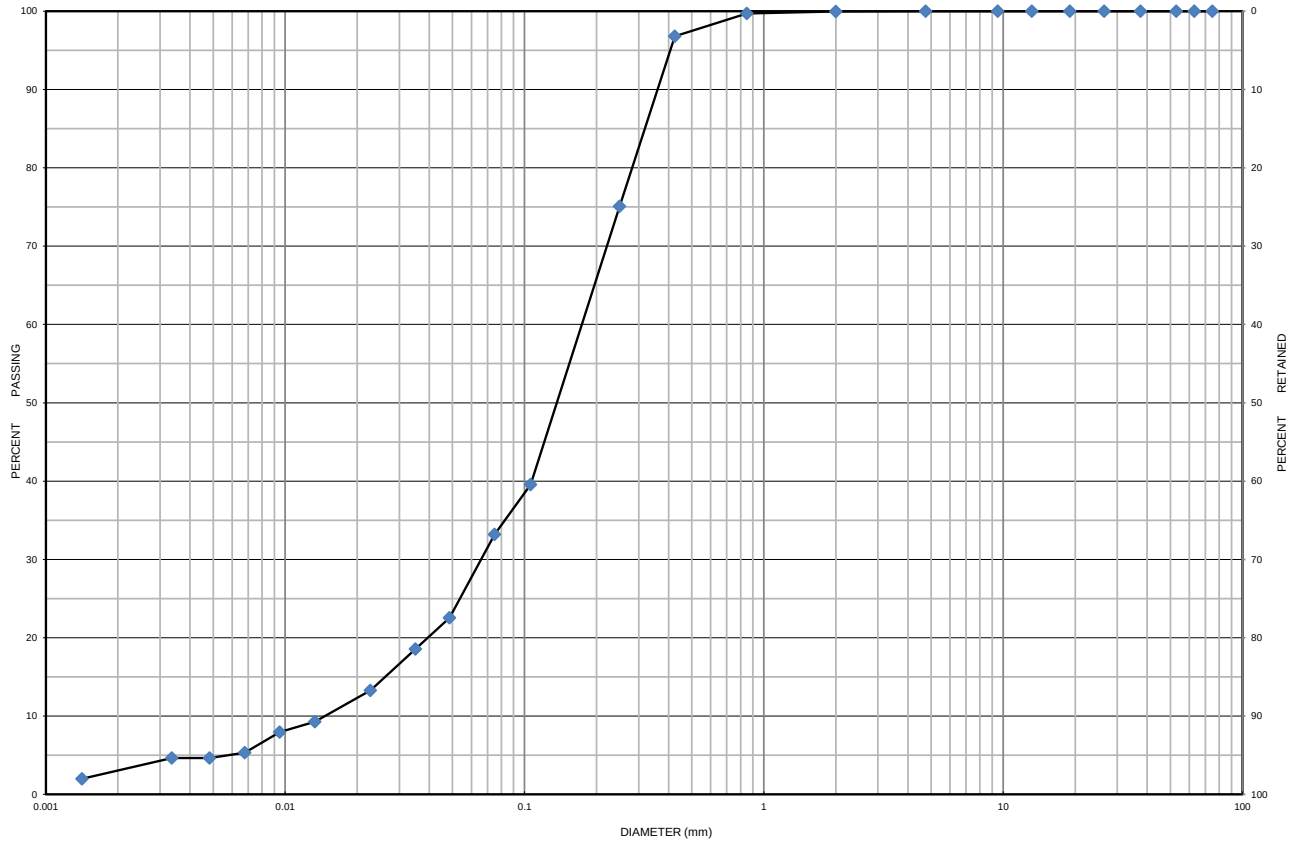
Project Number: *14266-001* **Client:** *Thornbury Acres Holdings*

Project Name: *Thornbury Acres - Geotechnical Investigation*

Sample Date: *September 27, 2022* **Sampled By:** *Chris Malliaros - Cambium Inc.*

Location: *BH 103-22 SS 3* **Depth:** *1.5 m to 2.1 m* **Lab Sample No:** *S-22-1477*

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 3	1.5 m to 2.1 m	0	67	30	3	18.0

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silty Sand trace Clay	SM	0.170	0.066	0.016	10.63	1.60

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Grain Size Distribution Chart

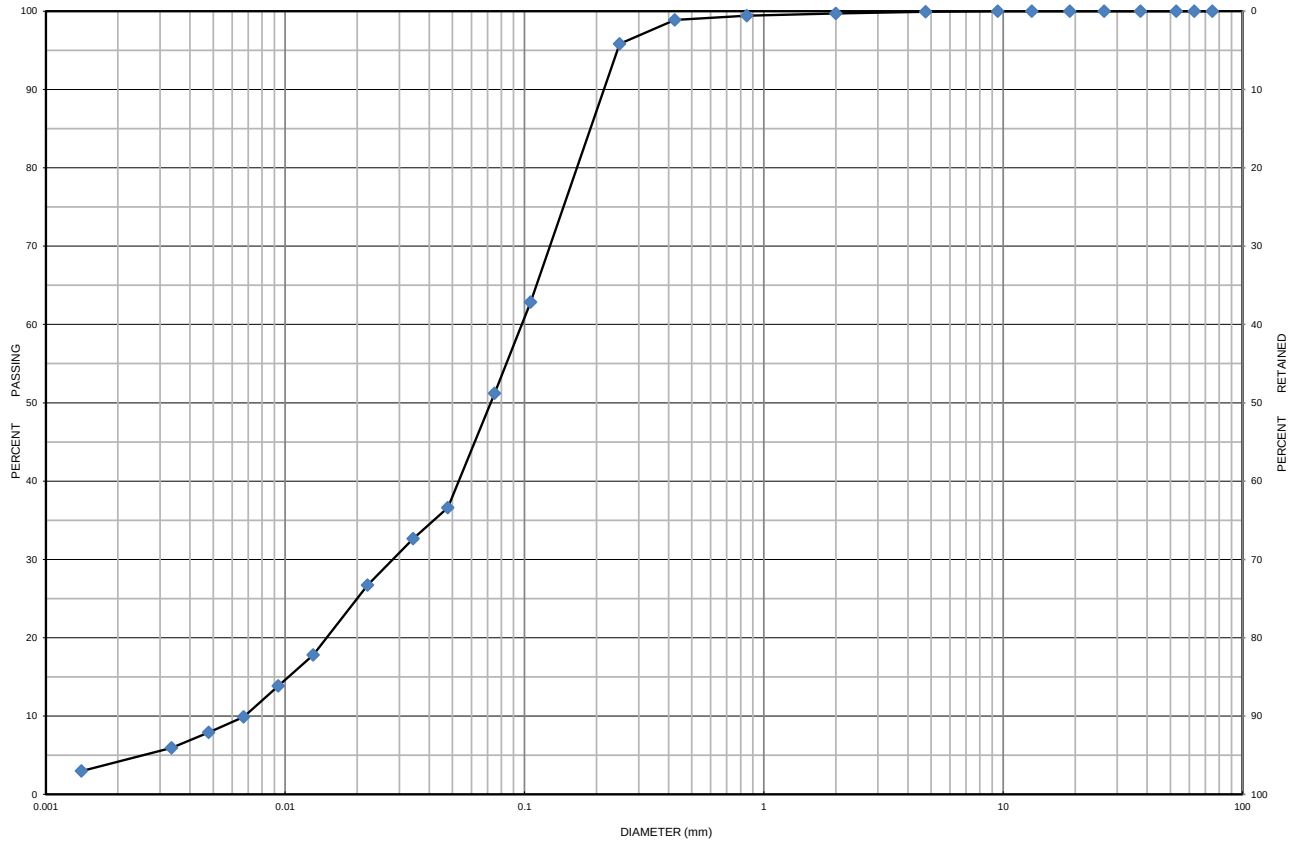
Project Number: *14266-001* **Client:** *Thornbury Acres Holdings*

Project Name: *Thornbury Acres - Geotechnical Investigation*

Sample Date: *September 27, 2022* **Sampled By:** *Chris Malliaros - Cambium Inc.*

Location: *BH 103-22 SS 5* **Depth:** *3 m to 3.7 m* **Lab Sample No:** *S-22-1478*

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 5	3 m to 3.7 m	0	49	47	4	16.1

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sand and Silt trace Clay	ML	0.0990	0.0280	0.0069	14.35	1.15

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Grain Size Distribution Chart

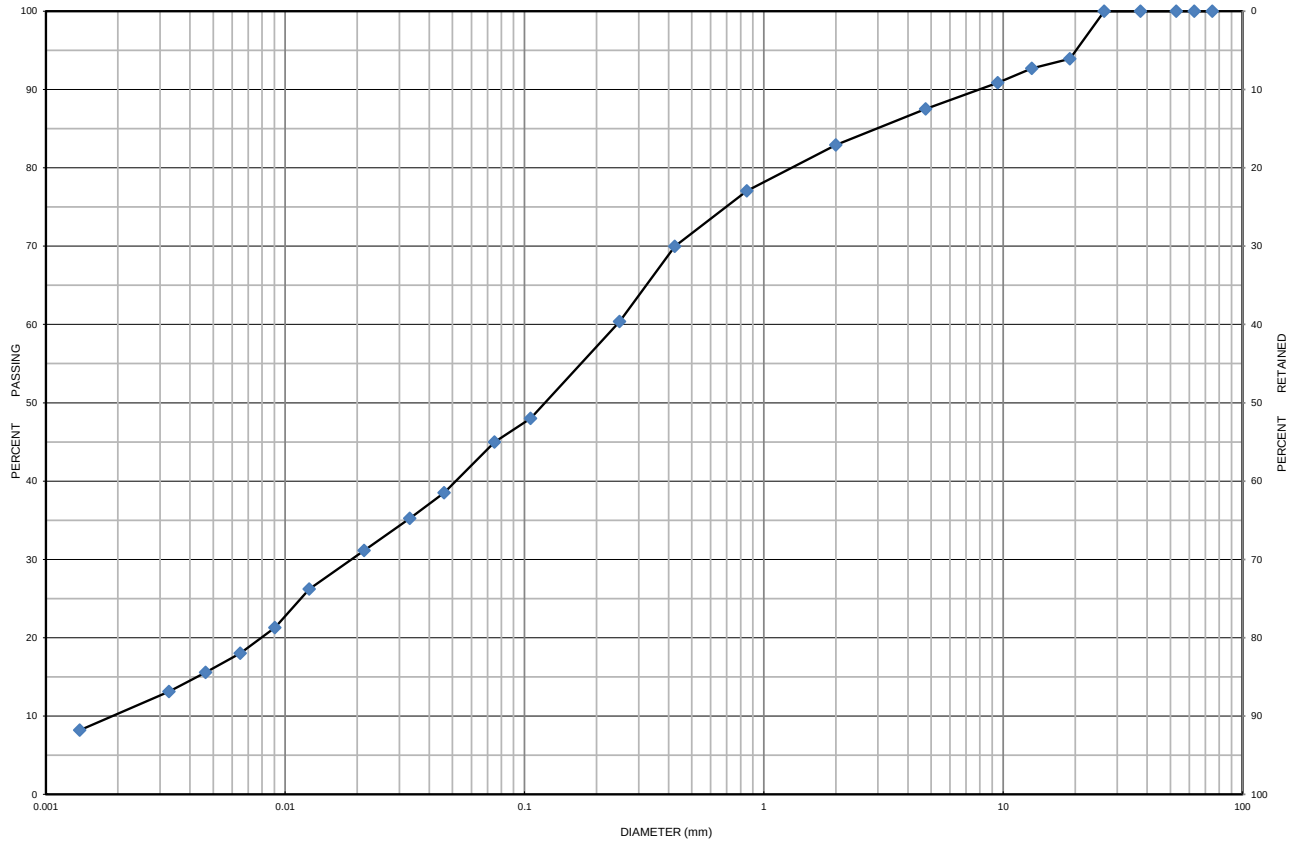
Project Number: *14266-001* **Client:** *Thornbury Acres Holdings*

Project Name: *Thornbury Acres - Geotechnical Investigation*

Sample Date: *September 27, 2022* **Sampled By:** *Chris Malliaros - Cambium Inc.*

Location: *BH 104-22 SS 4* **Depth:** *2.3 m to 2.9 m* **Lab Sample No:** *S-22-1479*

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 104-22	SS 4	2.3 m to 2.9 m	12	43	34	11	8.3

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silty Sand some Gravel some Clay	SM	0.2500	0.0190	0.0019	131.58	0.76

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Grain Size Distribution Chart

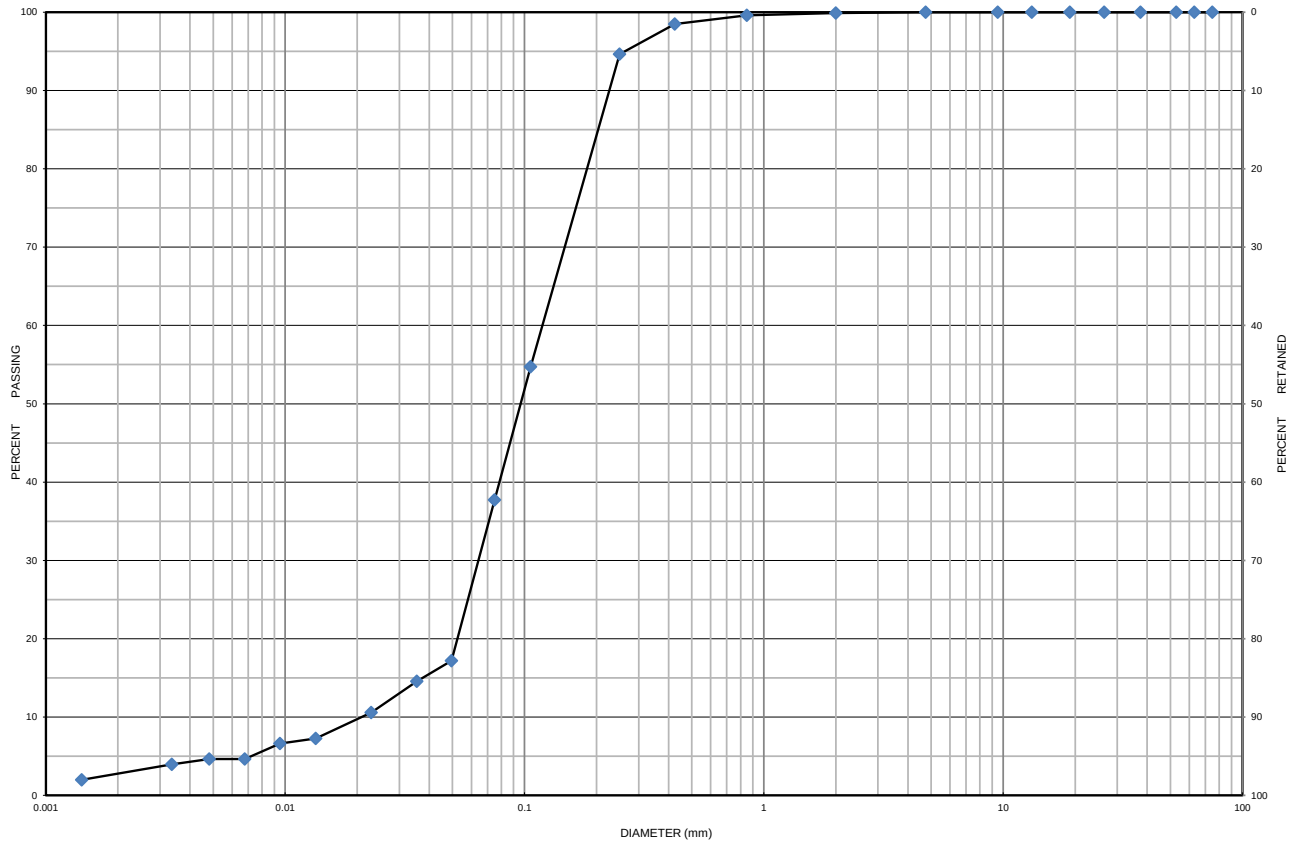
Project Number: *14266-001* **Client:** *Thornbury Acres Holdings*

Project Name: *Thornbury Acres - Geotechnical Investigation*

Sample Date: *September 27, 2022* **Sampled By:** *Chris Malliaros - Cambium Inc.*

Location: *BH 105-22 SS 4* **Depth:** *2.3 m to 2.9 m* **Lab Sample No:** *S-22-1480*

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 4	2.3 m to 2.9 m	0	62	35	3	20.5

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sand and Silt trace Clay	SM	0.125	0.064	0.021	5.95	1.56

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Grain Size Distribution Chart

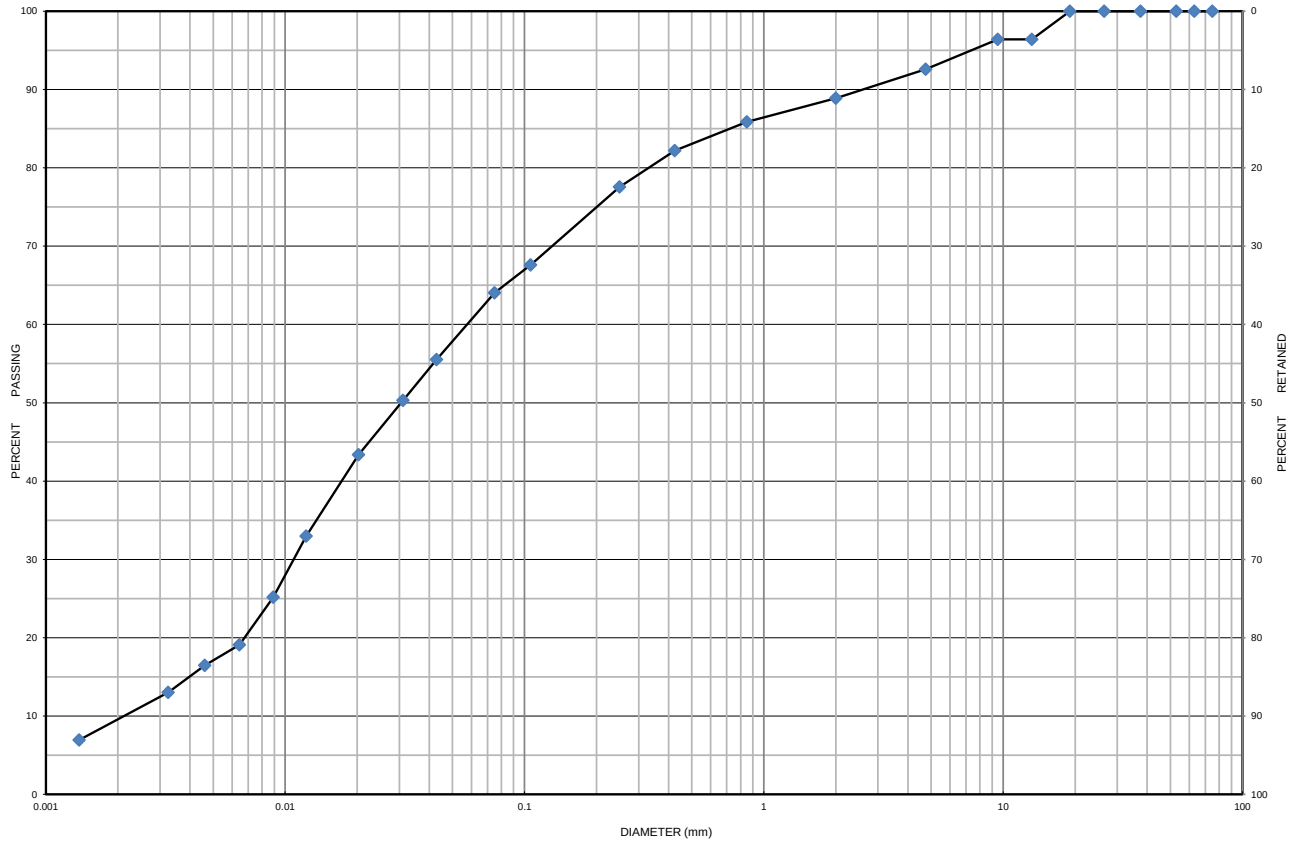
Project Number: *14266-001* **Client:** *Thornbury Acres Holdings*

Project Name: *Thornbury Acres - Geotechnical Investigation*

Sample Date: *September 27, 2022* **Sampled By:** *Chris Malliaros - Cambium Inc.*

Location: *BH 106-22 SS 4* **Depth:** *2.3 m to 2.9 m* **Lab Sample No:** *S-22-1481*

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 106-22	SS 4	2.3 m to 2.9 m	7	29	55	9	9.3

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sandy Silt trace Clay trace Gravel	ML	0.0590	0.0120	0.0022	26.82	1.11

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Grain Size Distribution Chart

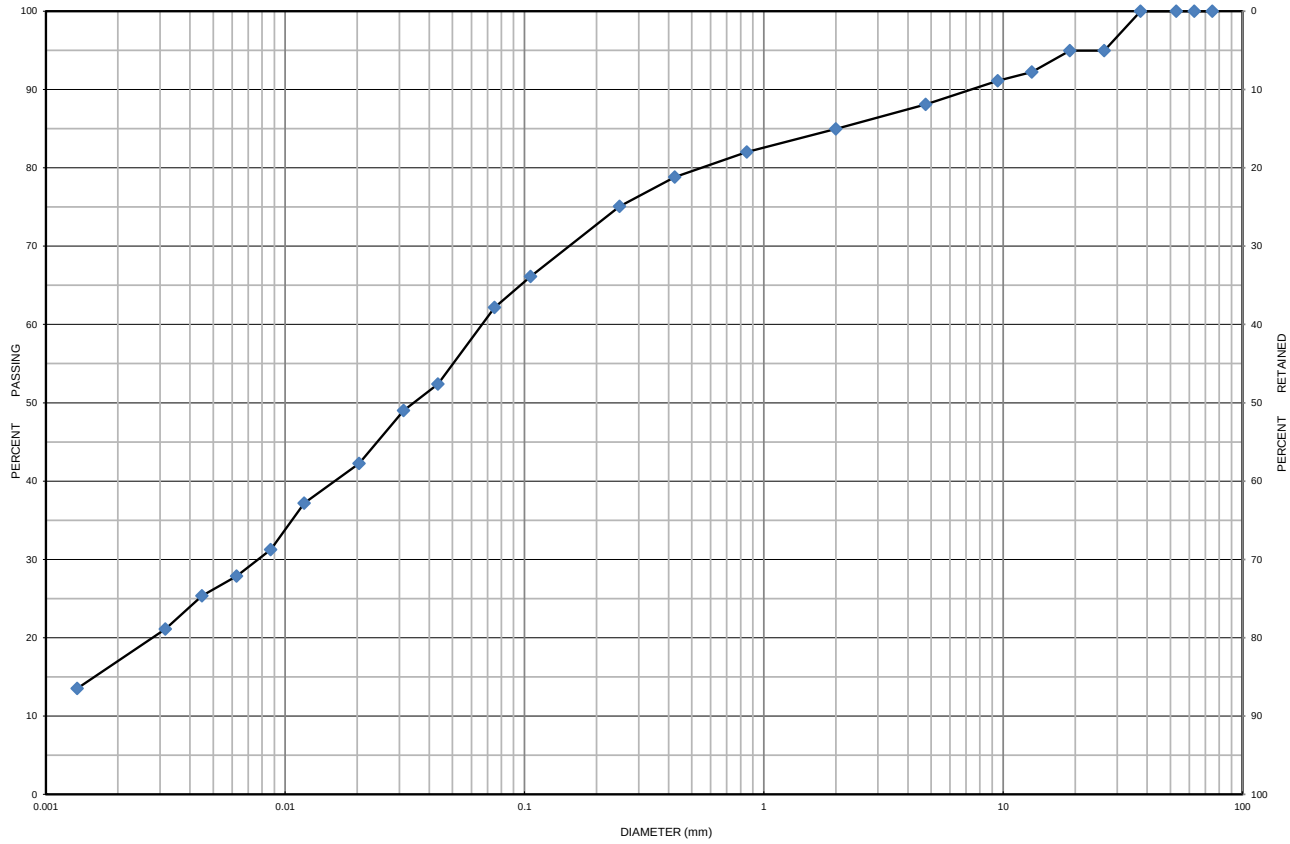
Project Number: *14266-001* **Client:** *Thornbury Acres Holdings*

Project Name: *Thornbury Acres - Geotechnical Investigation*

Sample Date: *September 27, 2022* **Sampled By:** *Chris Malliaros - Cambium Inc.*

Location: *BH 107-22 SS 3* **Depth:** *1.5 m to 2.1 m* **Lab Sample No:** *S-22-1482*

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 107-22	SS 3	1.5 m to 2.1 m	12	26	45	17	7.8

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sandy Silt some Clay some Gravel	ML	0.066	0.008	-	-	-

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Grain Size Distribution Chart

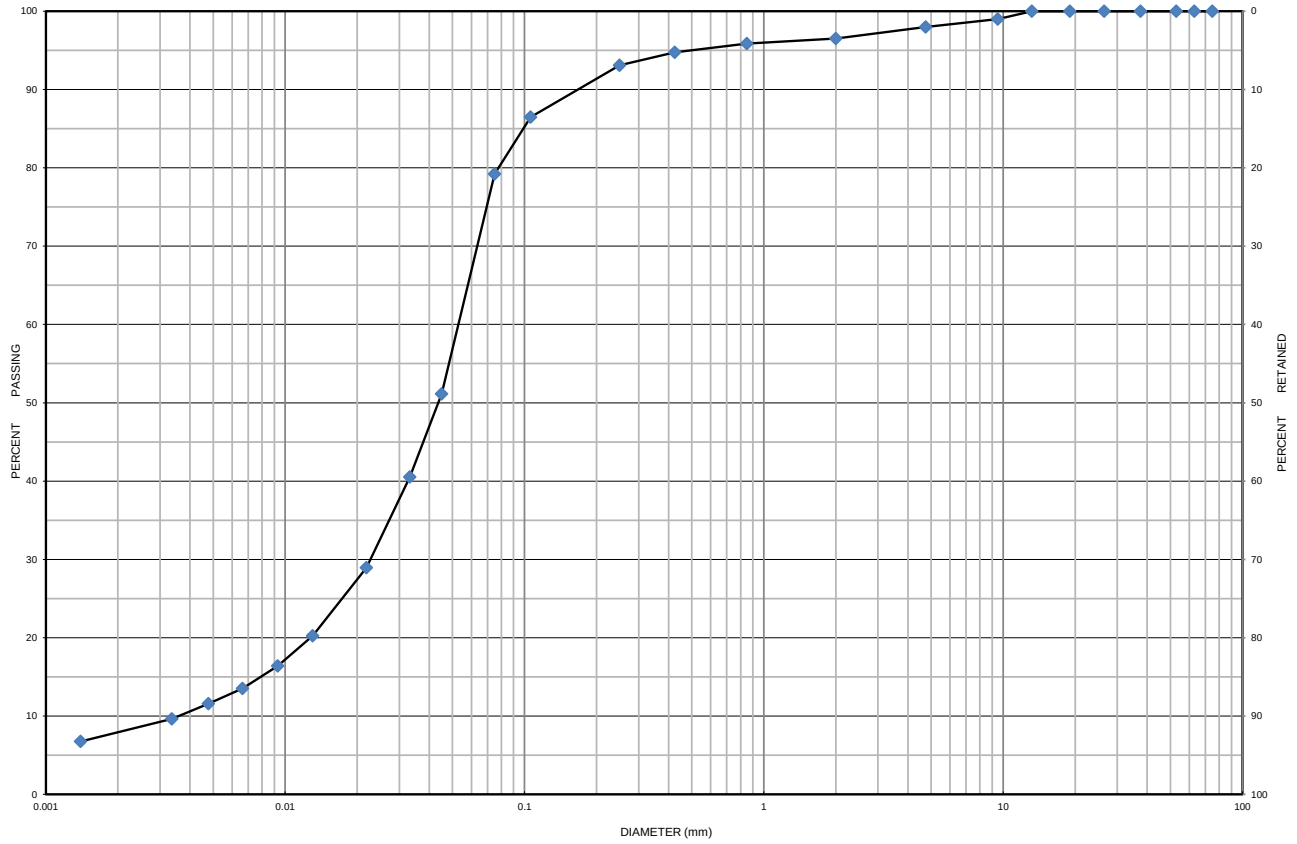
Project Number: *14266-001* **Client:** *Thornbury Acres Holdings*

Project Name: *Thornbury Acres - Geotechnical Investigation*

Sample Date: *September 27, 2022* **Sampled By:** *Chris Malliaros - Cambium Inc.*

Location: *TP 105-22 GS 1* **Depth:** *1.1 m to 1.4 m* **Lab Sample No:** *S-22-1483*

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
TP 105-22	GS 1	1.1 m to 1.4 m	2	19	71	8	12.2

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silt some Sand trace Clay trace Gravel	ML	0.0530	0.0230	0.0035	15.14	2.85

Additional information available upon request

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Grain Size Distribution Chart

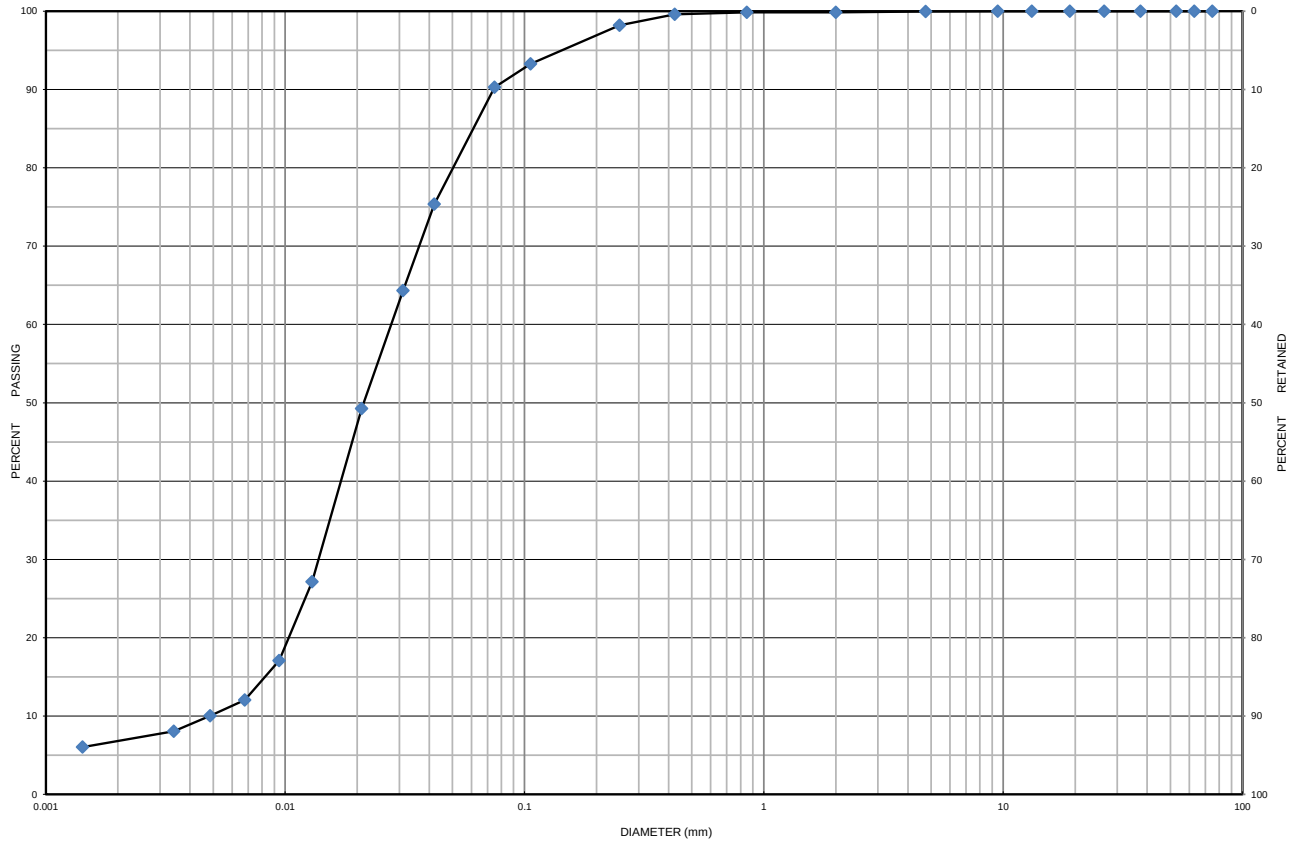
Project Number: *14266-001* **Client:** *Thornbury Acres Holdings*

Project Name: *Thornbury Acres - Geotechnical Investigation*

Sample Date: *September 27, 2022* **Sampled By:** *Chris Malliaros - Cambium Inc.*

Location: *TP 106-22 GS 1* **Depth:** *0.6 m to 1.1 m* **Lab Sample No:** *S-22-1484*

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
TP 106-22	GS 1	0.6 m to 1.1 m	0	10	83	7	18.9

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silt some Sand trace Clay	ML	0.0270	0.0140	0.0049	5.51	1.48

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Grain Size Distribution Chart

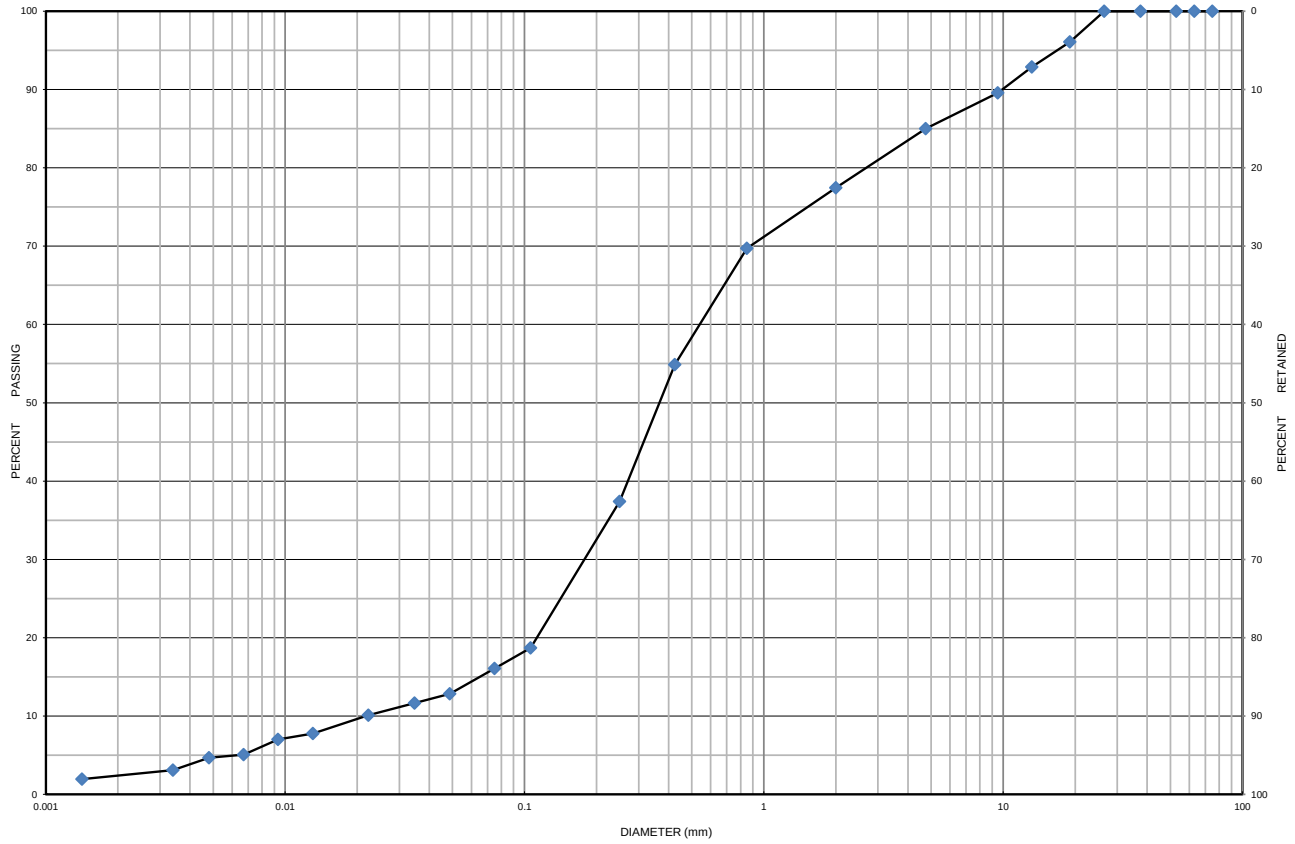
Project Number: *14266-001* **Client:** *Thornbury Acres Holdings*

Project Name: *Thornbury Acres - Geotechnical Investigation*

Sample Date: *September 27, 2022* **Sampled By:** *Chris Malliaros - Cambium Inc.*

Location: *TP 112-22 GS 1* **Depth:** *2.7 m to 3 m* **Lab Sample No:** *S-22-1485*

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
TP 112-22	GS 1	2.7 m to 3 m	15	69	14	2	11.8

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sand some Gravel some Silt trace Clay	SM	0.540	0.175	0.021	25.71	2.70

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Grain Size Distribution Chart

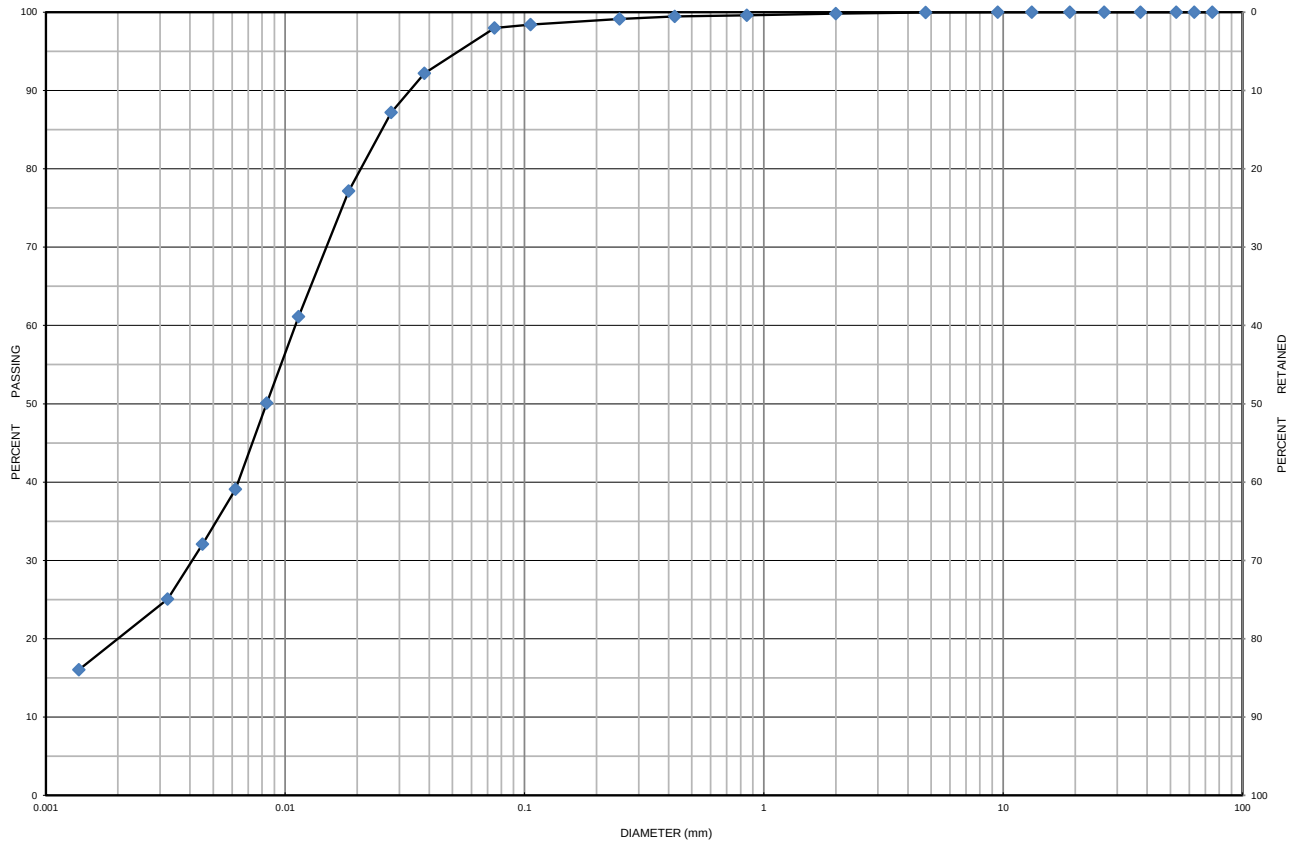
Project Number: *14266-001* **Client:** *Thornbury Acres Holdings*

Project Name: *Thornbury Acres - Geotechnical Investigation*

Sample Date: *September 27, 2022* **Sampled By:** *Chris Malliaros - Cambium Inc.*

Location: *TP 116-22 GS 1* **Depth:** *1.5 m to 2 m* **Lab Sample No:** *S-22-1486*

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
TP 116-22	GS 1	1.5 m to 2 m	0	2	78	20	19.1

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Clayey Silt trace Sand	ML	0.012	0.002	-	-	-

Additional information available upon request

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Appendix C

2015 National Building Code Seismic Hazard Values

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Site: 44.534N 80.425W **User File Reference:** Thornbury Acres 2022-12-02 18:15 UT

Requested by: Cambium Inc.

Probability of exceedance per annum	0.000404	0.001	0.0021	0.01
Probability of exceedance in 50 years	2 %	5 %	10 %	40 %
Sa (0.05)	0.064	0.040	0.026	0.009
Sa (0.1)	0.091	0.059	0.039	0.014
Sa (0.2)	0.092	0.061	0.042	0.016
Sa (0.3)	0.081	0.055	0.038	0.015
Sa (0.5)	0.068	0.046	0.032	0.012
Sa (1.0)	0.043	0.029	0.019	0.006
Sa (2.0)	0.022	0.015	0.009	0.002
Sa (5.0)	0.005	0.003	0.002	0.001
Sa (10.0)	0.002	0.002	0.001	0.000
PGA (g)	0.053	0.034	0.023	0.008
PGV (m/s)	0.056	0.036	0.023	0.007

Notes: Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are highlighted in yellow. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. **These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.**

References

National Building Code of Canada 2015 NRCC no. 56190; Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

Structural Commentaries (User's Guide - NBC 2015: Part 4 of Division B)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites www.EarthquakesCanada.ca and www.nationalcodes.ca for more information