Geotechnical Investigation – Heron Gate Village Subdivision

June 2, 2025

Prepared for:
EFI Engineering

Cambium Reference: 22801-001

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1.0 Introduction

Cambium Inc. (Cambium) was retained by EFI Engineering (Client) to complete a geotechnical investigation in support of the proposed development located at Heron Gate Village, Ottawa, Ontario (Site), as shown on the Site Location Map on the attached Figure 1. The terms of reference for the geotechnical consulting services were included in Cambium's Proposal No. 22801-P, dated February 25, 2025.

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. 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, based on the findings of the subsurface investigation program and subsequent analysis. A limited chemical testing program was also completed to assess the potential for corrosion of buried steel elements and sulphate attack against buried concrete elements at the Site.

This report provides the results of the geotechnical investigation and testing program and should be read in conjunction with the *"Standard Limitations"* in Section 8.0 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 the 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.

1.1 Reviewed Documents

The following project-related documents were provided by the Client and reviewed during the preparation of this report:

[1] Heron Gate Master Plan Document; Unknown Author; Revised March 2021.

1.2 Standards and Guidelines

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

[2] Canadian Foundation Engineering Manual – 5th Edition; Canadian Geotechnical Society; 2023.

[3] Ontario Building Code: 2024 Building Code Compendium – Volume 1, May 29, 2024 – Amalgamating O. Reg. 203/24 with Errata, Supersedes O. Reg. 163/24

2.0 Site and Project Description

2.1 Site Description

The subject site is an approximate 17.2 ha area, between Heron Road to the north and Walkley Road to the south and bounded by Heron-Walkley Park and commercial properties to the west and east, respectively. Development of Block A, shown on Figures 45 and 47 of the Heron Gate Village Master Plan [1], was completed in 2020 and consists of three 6-storey mid-rise buildings; the current investigation scope does not include this area. The Site Location Plan is provided in Figure 1 of this report.

The site is currently developed with multiple low-, mid- and high-rise residential buildings, including at-grade and covered parking areas with associate access lanes, roadways and walking paths. There are also several parks and green spaces within the Site limits.

2.2 Project Description

It is understood that multiple townhomes, mid-rise and high-rise buildings are proposed to be constructed throughout the Site, up to 25 storeys tall [1]. It is also understood that most of the existing buildings are to be demolished, excluding several existing residential towers. Based on the density of units and resulting parking requirements, it is assumed that underground parking garages will be required to accommodate vehicle parking.

It is understood that the current investigation is part of a general feasibility study for the future development. As such, the current investigation, as well as the recommendations contained herein are preliminary; further investigation will be required during future detailed design phases for each building or block of buildings.

3.0 Methodology

3.1 Borehole Investigation

A borehole investigation was conducted at the site from March 25 to 28, 2025 to assess subsurface conditions. A total of 6 boreholes, designated BH101-25 through BH106-25, were advanced in the relative locations shown on the attached Figure 2, to a maximum depth of 9.8 m below ground surface (bgs).

The elevation of each borehole was determined relative to a site benchmark, consisting of the top spindle of a fire hydrant located on the northern corner of the intersection of Sandalwood Drive and Baycrest Drive and assigned a relative elevation of 100 m (mREL). The benchmark location is indicated on Figure 2. The reported relative elevations can be updated to geodetic elevations when topographic survey information becomes available.

Drilling and sampling was completed using a track-mounted drill rig operating under the supervision of a Cambium technician. The boreholes were advanced to the sampling depths by means of continuous hollow stem augers with 50 mm split spoon samplers, and NQ sized diamond drill rock coring equipment. Standard Penetration Test (SPT) N values were recorded for the sampled intervals as the number of blows required to drive a split spoon sampler 305 mm into the soil, using a 63.5 kg drop hammer falling 750 mm, as per ASTM D1586 procedures. The SPT N values are used in this report to assess consistency of cohesive soils and relative density of non-cohesive materials.

Rock core samples were recovered in successive “runs,” each generally approximately 1.5 m long. Rock core sample parameters including total core recovery (TCR), solid core recovery (SCR), and rock quality designation (RQD) were recorded at the time of drilling. These are defined as follows:

$$TCR = \left(\frac{\text{Total length of recovered core pieces}}{\text{Total length of core run}}\right) \times 100\%$$

$$SCR = \left(\frac{\text{Total length of core pieces with full core diameter}}{\text{Total length of core run}}\right) \times 100\%$$

$$RQD = \left(\frac{\text{Total length of core pieces} > 100 \text{ mm long}}{\text{Total length of core run}}\right) \times 100\%$$

Soil samples were collected at regular depth intervals. The encountered soil and bedrock units were logged in the field using visual and tactile methods. Soil samples were placed in watertight plastic bags and rock core samples wrapped in plastic for transport, future reference, laboratory testing, and storage. Open boreholes were checked for groundwater and general stability prior to backfilling. The boreholes were backfilled in accordance with O.Reg. 903, as amended and the Site was restored to pre-investigation conditions.

The borehole and rock core logs are provided in Appendix A. Site soil and groundwater conditions and our geotechnical recommendations are presented in the following sections of this report. Rock core samples were photographed prior to packaging and the photos are provided in Appendix B.

3.2 Soil Laboratory Testing

Laboratory soil testing included Natural Moisture Content Analysis on all soil samples (LS 701), as well as Particle Size Distribution Analyses (LS 702) and Atterberg Limit Analyses (LS 703) on selected samples. Results are presented in Appendix C and are summarized on the borehole logs and described in the subsequent sections of this report.

In addition to the above physical laboratory testing, two samples were submitted to a qualified third-party laboratory to assess corrosion potential of buried steel elements and potential of sulphate attack against buried concrete elements. The Certificate of Analysis is provided in Appendix D.

4.0 Subsurface Conditions

The subsurface soil and groundwater conditions encountered in the boreholes are presented on the borehole logs provided in Appendix A. It should be noted that the conditions indicated on the borehole logs are for specific locations only and can vary between and beyond the borehole locations. 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. Although Cambium attempted to determine the changes in soil layers and their associated thicknesses, the actual thicknesses of the layers may vary from what is noted on the individual borehole logs. In addition, the descriptions provided in the borehole logs are inferred from a variety of factors, including visual observations of the soil samples retrieved, laboratory testing, measurements prior to and after drilling, and the drilling process itself (drilling speed, shaking/grinding of the augers, etc.). It should also be noted that soil samples are taken from a split spoon sampler; therefore, any particles larger than the internal diameter of the split spoons (approximately 35 mm) may not be fully represented in the collected samples.

The subsurface conditions encountered in the boreholes generally consist of asphalt and granular fill overlying gravelly silty sand soils overlying gravely silty sand to silty sand glacial till. The bedrock encountered was generally shale which was weathered at the bedrock surface, generally increasing in quality with depth.

4.1 Pavement Structure

A flexible pavement structure (i.e., asphalt concrete over granular fill) was encountered at ground surface in all borehole locations. The asphalt ranged in thickness from approximately 40 to 100 mm.

The asphalt concrete was underlain by granular fill material at all boreholes and ranged in thickness from approximately 210 to 1420 mm. The material generally consisted of gravel and sand to gravelly silty sand. The granular fill was moist at the time of sampling and brown in

colour. SPT N values obtained during sampling of this material ranged from 8 to 46 blows per 300 mm of penetration, indicating a loose to dense relative density.

The natural moisture content of the granular fill samples ranged from 2.7 to 9.9 percent based on laboratory testing results.

A summary of the pavement structure thicknesses at the borehole locations is provided in Table 1.

Table 1 Summary of Pavement Structure Thickness

Borehole No.	Asphalt Thickness (mm)	Granular Thickness (mm)	Total Thickness (mm)
BH101-25	40	210	250
BH102-25	50	310	360
BH103-25	100	1420	1520
BH104-25	50	250	300
BH105-25	75	680	755
BH106-25	40	260	300

4.2 Reworked Native Soils

Reworked native soils were encountered beneath the granular fill material in all borehole locations. The material extended to depths ranging from approximately 1.5 to 3.1 mbgs and generally consisted of gravelly silty sand with varying amounts of low plasticity fines content, to clayey silt and sand soil.

SPT N values obtained during sampling of this material ranged from 9 to 27 blows per 300 mm of penetration, indicating a loose to compact relative density.

The natural moisture content of the samples of the reworked native soils ranged from 4.1 to 38.7 percent based on laboratory testing results.

Laboratory particle size distribution was completed on four samples of the reworked native soil and the results are summarized in Table 2.

Table 2 Particle Size Distribution Results – Reworked Native Soils

Sample Location	Depth (mbgs)	Soil	% Gravel	% Sand	% Silt	% Clay	% Moisture
BH101-25 SS2	0.8 - 1.4	Gravelly Silty Sand, some Clay	23	42	23	12	11.6
BH102-25 SS1B	0.8 to 1.4	Clayey Silt and Sand, trace Gravel	1	39	42	18	38.7
BH104-25 SS2	0.8 - 1.4	Gravelly Silty Sand, some Clay	13	49	24	14	10.1
BH105-25 SS3	1.5 – 2.1	Silty Sand, some Gravel, Some Clay	11	47	29	13	8.7
BH105-25 SS2	0.8 – 1.4	Silty Sand, some Gravel, Some Clay	10	48	27	15	11.0

Atterberg Limit testing was completed on one selected sample of the reworked native soil and the results are summarized in Table 3.

Table 3 Atterberg Limits Test Results – Reworked Native Soils

Sample	Depth (mbgs)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Moisture (%)	Classification
BH102-25 SS3	1.5 – 2.1	24.4	16.6	7.8	11.8	Low Plasticity Clay

4.3 Glacial Till

Glacial till was encountered beneath the reworked native soil in all borehole locations. The material extended to depths ranging from approximately 3.4 to 8.1 mbgs and generally consisted of gravelly silty sand to silty sand soil with varying amounts of low plasticity fines content.

SPT N values obtained during sampling of this material ranged from 4 to over 50 blows per 300 mm of penetration, indicating a loose to very dense relative density.

The natural moisture content of the samples of the glacial till soils ranged from 4.8 to 12.3 percent based on laboratory testing results.

Laboratory particle size distribution was completed on two selected samples of the glacial till and the results are summarized in Table 4

Table 4 Particle Size Distribution Results – Glacial Till

Sample Location	Depth (mbgs)	Soil	% Gravel	% Sand	% Silt	% Clay	% Moisture
BH103-25 SS4	2.3 - 1.9	Gravelly Silty Sand, some Clay	13	49	30	8	6.9
BH106-25 SS4	2.3 – 2.9	Silty Sand, some Gravel, Some Clay	7	44	33	16	11.0

Atterberg Limit testing was completed on four selected samples of the glacial till and the results are summarized in Table 5.

Table 5 Atterberg Limits Test Results – Glacial Till

Sample	Depth (mbgs)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Moisture (%)	Classification
BH101-24 SS3	1.5 – 2.1	18.7	14.2	4.5	8.1	Low Plasticity Clayey Silt to Silty Clay
BH103-25 SS5	3.0 – 3.7	17.1	13.1	4.0	4.8	Low Plasticity Silt
BH104-25 SS4	2.3 – 2.9	18.6	12.9	5.7	9.2	Low Plasticity Clayey Silt to Silty Clay
BH105-25 SS5	3.0 – 3.7	17.7	13.2	4.5	9.2	Low Plasticity Clayey Silt to Silty Clay

4.4 Bedrock

Bedrock was encountered in all borehole locations, at depths ranging from 3.4 to 8.1 mbgs, below the glacial till soil layers. All boreholes were terminated within the bedrock.

The bedrock appeared to consist predominantly of grey to black shale, which ranged in quality from very poor to excellent, generally increasing in quality with depth. In general, the upper 1.0 to 1.5 m was weathered to highly weathered.

Based on available geological mapping, the local bedrock appears to consist of shale of the Billings Formation. This type of shale is known to degrade upon exposure to oxygen; the bedrock samples were therefore wrapped with plastic to maintain the in-situ moisture content and as-recovered condition as much as possible.

4.5 Groundwater

Groundwater level observations and measurements were carried out at the time of drilling; however, it is noted these measurements may not be indicative of stabilized groundwater conditions due to the introduction of water during rock coring operations. Borehole side wall instability (caving) depth, groundwater depth and standing water depth were recorded in the open boreholes, if observed. A summary of the groundwater and caving observations is provided in Table 6.

Table 6 Summary of Groundwater Level Observations

Borehole	Ground Surface Elevation (mREL)	Groundwater in Borehole upon Completion (mbgs / mREL)	Standing Water in Borehole upon Completion (mbgs / mREL)	Caving Depth (mbgs/ mREL)
BH101-25	98.6	--	--	--
BH102-25	99.1	--	--	
BH103-25	100.2	--	--	--
BH104-25	98.2	3.8 / 94.4	--	--
BH105-25	97.8	6.1 / 91.7	--	--
BH106-25	96.3	96.3 / 92.5	--	--

It should be noted that these represent momentary observations. Groundwater levels at the site may fluctuate seasonally and in response to climatic events.

4.6 Corrosivity Analysis

Two soil samples were submitted to a certified third-party laboratory for chemical corrosivity analysis. The Certificate of Analysis is presented in Appendix D. The samples were analysed for pH, electrical conductivity, resistivity, redox potential, and for chloride, sulphate and sulphide concentrations.

To determine the potential for corrosion, the laboratory results were compared to the ANSI/AWWA corrosivity rating system, as shown in Table 7. Based on the total points scored, the soil is determined to be practically not corrosive based on those parameters listed.

Table 7 Corrosivity Testing Results

Parameter	BH103-25		BH105-25	
	Test Results	ANSI/AWWA Point Rating	Test Results	ANSI/AWWA Point Rating
Resistivity (Ω·cm)	2300	2	3030	0
pH	8.54	3	7.55	0
Redox Potential (mV)	312	0	312	0
Sulphide	Trace	2	Trace	2
Moisture Condition	Fair Drainage, Generally Moist	1	Fair Drainage, Generally Moist	1
Total Points		**8**		**3**

Though not included in the ANSI/AWWA assessment method, it should be noted that the chloride content of the tested samples indicates that the soil is potentially corrosive to buried steel elements. This should be accounted for as required.

The laboratory test results also indicate that the soluble sulphates concentration of the tested samples ranged from 99 to 106 parts per million (ppm). Based on this concentration, there is a

negligible potential for sulphate attack on concrete. Accordingly, normal Type 10 Portland cement can be used in buried concrete elements.

Please note that there may be other overriding factors in the assessment of corrosion potential, such as the application of de-icing salts on any nearby access roads and subsequent leaching into the subsoils and stray currents.

5.0 Geotechnical Design 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 current 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. Due to the preliminary nature of the current investigation, it is expected that additional investigations will be required in the future to provide more detailed information for the construction of each building or development block, depending on the design requirements.

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 based on this report. It is possible that subsurface conditions beyond the borehole locations may vary from those observed. If significant variations are found before or during construction, Cambium should be contacted to reassess findings and recommendations, as needed.

The proposed development includes demolition of the majority of existing buildings, followed by new constructions of high-density residential units including townhomes, mid-rise and high-rise buildings up to 25 storeys tall. Based on the density of units and resulting parking requirements, it is assumed that underground parking garages will be required to accommodate vehicle parking.

5.1 Site Preparation

Existing organic materials, any fill, loose or softened reworked/disturbed native materials, and any deleterious material 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 proposed 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 inspected by a qualified geotechnical engineer prior to placement of any granular fill for foundations. Any loose/soft soils identified at the time of the inspection 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 in this report.

The near surface soils can become 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 Excavation

Temporary excavations must be carried out in accordance with the latest edition of the Occupational Health and Safety Act (OHSA). Within the overburden, the soils at this site would generally be classified as Type 3 in the dry, requiring that excavations be sloped no steeper than 1H:1V to the base of excavation. Excavation side slopes should be protected from exposure to precipitation and associated ground surface runoff and should be inspected regularly for signs of instability. If localized instability is noted during excavations or if wet conditions are encountered, the side slopes should be flattened as required to maintain safe working conditions or excavation sidewalls must be fully supported (shored).

Excavation in bedrock could be accomplished using mechanical methods (such as hoe ramming) for shallow excavation depths. For deeper excavations or where large quantities of bedrock are to be removed, line drilling and blasting may be required. A preconstruction impact assessment should be carried out and the City should be consulted if blasting is considered as an excavation method to ensure minimal disruption to surrounding buildings and the public (Section 5.2.1).

Temporary excavation in sound bedrock may be carried out at near vertical slopes (10H:1V), provided the trench sides are cleared of loose rock prior to workers entering the trench. Bedrock excavation sidewalls adjacent to existing building foundations should be supported to ensure the stability of the existing buildings. Pre and post condition surveys are recommended on structures that could be impacted by the construction activities. Weathered portions of the bedrock should be kept away from the upper edge of the sound bedrock a minimum of at least 1 m to ensure worker safety.

5.2.1 Vibration Monitoring

The anticipated excavations within bedrock will generate some vibrations that will be perceptible to nearby residents. The vibrations are expected to be greatest during bedrock excavation by mechanical methods or blasting. Preconstruction surveys are recommended for all adjacent structures; any structures in the area that may be particularly sensitive to vibrations should be identified and appropriate specifications developed for the excavation plan by a contractor specializing in vibration monitoring.

5.2.2 Bedrock Protection

Shale bedrock of the Billings Formation is known to undergo rapid weathering and fracturing upon exposure to oxygen. This process begins as soon as bedrock is exposed, and can cause sound bedrock to become weathered within a matter of days. Therefore, it is crucial to plan accordingly, and any exposed bedrock surfaces in excavations must be covered within 24 hours using a concrete mud mat or similar moisture-containing material. Sidewalls of

excavations within bedrock should be similarly protected using rolled on or sprayed on waterproofing material for this purpose.

Care should also be taken not to over-dewater the site, as excessive removal of water could cause inadvertent exposure of bedrock to air.

5.3 Dewatering

Groundwater observations made during the investigation are shown in Table 6. These measurements may not be indicative of stabilized groundwater conditions due to the introduction of water during rock coring operations. Further assessment of dewatering requirements is recommended during future investigations and detailed design phases for the site development.

Although soil and bedrock permeability measurements were not included as part of this investigation, it is expected that dewatering of open excavations will be possible by pumping from filtered sumps and/or perimeter ditch drains.

Dewatering requirements will be governed by the time of the year the construction is performed. It is often best practice to carry out excavations outside of those times that water levels are expected to be highest (e.g., spring). It is generally the responsibility of the contractor to propose a suitable dewatering plan based on the time of construction and seasonal groundwater levels. However, as noted in Section 5.2.2, care must be taken to not over-dewater the site and risk potential exposure and weathering of the bedrock.

5.4 Frost Penetration

Based on OPSD 3090.101, the typical frost penetration depth is expected to be approximately 1.8 mbgs. Exterior footings should be situated at or below this depth for frost protection, or should be provided with a thermal equivalent combination of soil cover and insulation.

The bedrock at the site is considered potentially susceptible to frost action / heaving. Any exposed bedrock surfaces should be protected from freezing using insulated tarpaulins or other similar means.

Additional frost protection recommendations for buried utilities are provided in Section 5.12.1.

5.5 Foundation Design

Based on the existing development plans, it is assumed that conventional footings will be placed on either the existing silty sand soils or bedrock surface, depending on the building loads.

Assuming underground parking will be included as part of the building design for mid-rise and high-rise buildings, it is anticipated that footings will be placed directly on the bedrock surface or extended to bedrock using concrete. Footings placed directly on sound unweathered bedrock may be designed using a preliminary factored bearing resistance of **1,500 kPa** at Ultimate Limit States (ULS). The geotechnical reaction at Serviceability Limit States (SLS) generally does not apply for footings placed on bedrock, as settlement is expected to be negligible. Footings placed on bedrock must be cleared of any loose or fractured rock for the above to apply. Consideration could be given to completing pilot holes in the rock to identify any near-surface fractures or planes of weakness to verify the design bearing capacity values.

Footings placed on the dense glacial till deposit, or on the upper weathered portion of bedrock can be designed using a bearing resistance value of **225 kPa at SLS**, and a factored bearing resistance of **350 kPa at ULS**, incorporating a geotechnical resistance factor of 0.5.

Footings placed on compact native or reworked glacial till may be designed using a bearing resistance value of **100 kPa at SLS** and a factored bearing resistance value of **150 kPa at ULS**, incorporating a geotechnical resistance factor of 0.5.

The above bearing resistance values at SLS assume acceptable total and differential settlements of 25 mm and 20 mm, respectively.

It should be noted that the above bearing resistance values are preliminary and are subject to change as more information from future investigations becomes available. Further testing, such as unconfined compressive strength (UCS) testing of rock core samples, is recommended to confirm the preliminary values given above.

5.5.1 Uplift Resistance

Rock anchors should be installed in any footings placed on bedrock surface to provide uplift resistance. Pilot holes should be completely flushed to ensure adequate removal of rock flour, and grout should be installed surrounding the rock anchors with a tremie tube to ensure grout reaches the bottom of the pilot holes.

Typically, the bonded length of anchors should not exceed 50% of the total anchor length; this will provide resistance to the rock anchor within the upper portion of the rock mass. The contractor should develop a pull testing plan for rock anchors to confirm capacity. Pull tests should be carried out under supervision of the geotechnical engineer.

Additional information regarding rock anchor design can be provided during detailed design phases.

5.6 Seismic Site Classification

The site class for seismic site response can be taken as **Site Class C** for footings placed on the overburden soil or bedrock. A higher seismic site class (e.g., Class A or B) may be possible, however this would need to be confirmed by site-specific geophysical testing, such as Multichannel Analysis of Surface Waves (MASW). The Site soils are not considered susceptible to seismic liquefaction. Reference should be made to Table 4.1.8.4.A of the OBC [3] for further information.

Cambium completed an assessment using the 2020 NBCC Seismic Hazard Tool. Seismic hazard values were interpolated for an earthquake event having 2% probability of occurring in 50 years based on Site Classes A, B and C. A summary of the seismic hazard values is provided in Table 8 below.

Table 8 NBCC 2020 Seismic Hazard Values – 2%/50 Years Probability

Site Class	$S_a(0.2)$	$S_a(0.5)$	$S_a(1.0)$	$S_a(2.0)$	$S_a(5.0)$	$S_a(10.0)$	PGA	PGV
C (X_C)	0.671	0.398	0.212	0.0973	0.0257	0.00846	0.360	0.272
B (X_B)	0.578	0.259	0.126	0.0564	0.0147	0.00521	0.317	0.176
A (X_A)	0.405	0.206	0.105	0.0487	0.0133	0.00496	0.330	0.153

5.7 Floor Slabs

The non-organic, compact to dense native soils are considered competent to support floor slab loads. To create a stable working surface and to distribute loadings, all slabs-on-grade should be constructed on a minimum of 200 mm of OPSS 1010 Granular A compacted to 98 percent of the material's standard Proctor maximum dry density (SPMDD).

For basement floor slabs, consideration should be given to using a 200 mm thick layer of 19 mm diameter clear crushed stone connected to perimeter drains below the floor slab to assist with drainage. The clear stone should conform to OPSS 1004 and be wrapped with a suitable non-woven geotextile to prevent clogging with fine grained soil particles.

5.8 Perimeter and Underfloor Drainage

Perforated pipe subdrains wrapped in a suitable non-woven geotextile should be provided for all basement perimeter footings. The subdrains should be set in a trench of clear stone and connected with positive drainage to storm sewers or an alternative frost-free outlet. The subdrain trenches should also be lined with a non-woven geotextile to prevent clogging.

Subfloor drains should also be installed below basement floor slabs, which connect to the perimeter foundation drains to provide positive drainage.

5.9 Basement Walls

Fluctuations in the groundwater table should be expected over time, and therefore basement walls should be provided with appropriate waterproofing. This should consist of exterior sealing treatment and application of a waterproofing membrane, such as Delta Drain 6000 or an

approved equivalent, applied from the bottom of the foundation upward to minimum 300 mm above the anticipated high water table. The membrane should connect to the perimeter foundation drainage pipe and be installed according to the manufacturer's instructions.

For basement walls constructed below the bedrock, blindside waterproofing should be implemented. In this regard, foundation waterproofing should be applied directly to the vertical or near-vertical bedrock face, and perimeter foundation drainage pipes placed prior to pouring of concrete for the basement walls. This will ensure groundwater within the bedrock is properly conducted to the perimeter drains and does not allow water pressure buildup against the basement walls.

5.10 Lateral Earth Pressures

Lateral earth pressure coefficients (K) and soil mechanical parameters for the encountered stratigraphy are shown in Table 9 below and may be used for the preliminary design of temporary and permanent structures at the Site.

Table 9 Lateral Earth Pressure Coefficients

Soil	Bulk Unit Weight γ (kN/m^3)	Internal Friction Angle φ (°)	Earth Pressure Coefficients (Rankine)		
			Active K_a (-)	Passive K_p (-)	At-rest K_0 (-)
Native Non-Cohesive Soils *loose*	18.0	28	0.36	2.77	0.53
Native Non-Cohesive Soils *compact*	19.0	30	0.33	3.00	0.50
Granular A, Granular B Type I/II *(placed and compacted according to recommendations provided in this report)*	21	32	0.31	3.21	0.47

It should be noted that the lateral earth pressure acting on basement walls (as applicable) will be higher if the basement walls are within the influence zone of footings supporting adjacent portions of the building founded at higher elevations (i.e., with no basement level). Cambium should be contacted to provide updated earth pressure coefficients for these areas as design progresses and final footing dimensions and elevations become known.

The coefficients provided in Table 9 assume that the surface of the granular backfill is horizontal against any proposed retaining wall, and the wall is vertical and smooth. It is noted that use of the active earth pressure coefficient for design purposes assumes that any proposed retaining structures will be free to deform/experience sufficient displacement throughout their lifespan.

5.11 Backfill and Compaction

Foundation wall backfill should consist free-draining imported granular material. Excavated site soils such as existing fill, or native silty sand, sand and silt or clay soils are not anticipated to be appropriate for backfill against foundation elements without significant treatment (separation of fine materials, moisture treatment, etc.). Backfill material should therefore consist of engineered fill conforming to OPSS 1010 Granular A or Granular B Type I or II.

Engineered fill used for backfill against foundation elements must be free of frozen, loose, contaminated, organic or otherwise deleterious materials, placed in maximum 200 mm thick loose lifts and compacted to minimum 98% of the material's SPMDD at a water content within ±2% of optimum. Placement of engineered fill should be verified by onsite compaction testing during construction.

If engineered fill is placed over dissimilar material such as silty or clayey soil, it may be necessary to separate the engineered fill from the finer-grained soils and prevent long-term fine particle migration into the engineered fill. A non-woven geotextile, such as Terrafix 270R or an approved equivalent, should be used for this purpose. The exposed subgrades below engineered fill should be verified onsite by geotechnical personnel prior to backfilling to ensure subgrade suitability and that appropriate treatments are applied as needed.

Additional recommendations for backfilling of buried utilities are provided in Section 5.12.

5.11.1 Engineered Fill Placement

Based on the laboratory testing results of the existing Site soils, it is anticipated that they will not be suitable for reuse as engineered fill for backfill, without removal of excessively fine and coarse particles and moisture treatment prior to reuse.

The following is recommended for the construction of engineered fill that will support structural elements such as footings or floor slabs:

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 of 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 suitability of the 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 tested and approved 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 building where footings are to be placed on differing bearing surfaces (e.g., partly on engineered fill and partly on native soils, or partly on bedrock and partly on engineered fill), 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.

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, appropriate frost protection should be provided as discussed in Section 5.14.

5.12 Buried Utilities

Cambium should be retained to review site servicing plan to confirm the following recommendations.

5.12.1 Frost Protection for Underground Services

It is recommended to place water services at a minimum depth of 300 mm below the frost penetration depth, with the top of the pipe located at 2.1 mbgs or lower as dictated by municipal service requirements. If a minimum of 2.1 m of soil cover cannot be provided, then the pipe should be insulated with a rigid polystyrene insulation (DOW Styrofoam HI40, or equivalent) or a pre-insulated pipe should be installed.

5.12.2 Subgrade Preparation

Excavation and dewatering recommendations are provided in Section 5.12.3 below. The subgrades are expected to consist predominantly of compact to dense silty and sandy soils. To

limit migration of fine particles into pipe bedding, non-woven geotextile such as Terrafix 270R or an approved equivalent should be used as a separator between subgrade and pipe bedding materials. The geotextile should be placed immediately following excavation, followed as soon as possible by pipe bedding.

Care should be taken to limit construction traffic directly on the soil subgrade.

5.12.3 Excavation and Dewatering

Excavation and dewatering for trenches should adhere to the recommendations provided in Sections 5.2 and 5.3, respectively.

5.12.4 Pipe Bedding and Cover Materials

Bedding and cover material for any services should conform to Ontario Provincial Standard Drawings (OPSD) 802.010 and 802.013 (flexible pipes) and OPSD 802.031 to 802.033 (rigid pipes). The pipe bedding should consist of 200 mm of OPSS.MUNI 1010 Granular A wrapped by a geotextile (Terrafix 270R or an approved equivalent). Bedding thickness should be increased to 400 mm in areas with bedrock subgrade. The bedding and cover material shall be placed in maximum 200 mm thick lifts and should be compacted to at least 95 percent SPMDD. The cover material shall extend a minimum of 300 mm above the top of the pipe and be compacted to a minimum of 95 percent of SPMDD, taking care not to damage the utility pipes during compaction. It should be noted that excessive vibrations from compaction equipment could soften the subgrade, so low vibration methods should be used wherever possible. The use of clear stone as pipe bedding and cover material should not be permitted.

5.12.5 Pipe Backfill

Above the pipe cover material, the pipe can be backfilled by using imported granular fill material such as OPSS.MUNI 1010 Granular B Type I. An alternative select subgrade material (SSM) may be used as well, provided that the material is approved by Cambium prior to use. The re-using of excavated organic free native soils may be possible with proper moisture treatment and removal of excessive fine and coarse particles. In any case, backfill should be

free of organic, frozen or otherwise deleterious materials, and should match as closely as reasonably possible the composition of the materials in the trench walls to limit differential movement. The soils should be placed in maximum 300 mm thick lifts compacted to 95 percent of SPMDD.

5.13 Pavement Design

The performance of pavement is dependent upon provision of a properly prepared and well-drained subgrade. All topsoil and organic materials should be removed down to native material and backfilled with approved engineered fill or native material, compacted to minimum 95 percent SPMDD. The subgrade should be proof rolled and inspected by a geotechnical engineer. Any areas where rutting or appreciable deflection is noted should be subexcavated and replaced with suitable fill. The fill should be compacted to at least 95 percent of SPMDD.

The recommended minimum pavement structure design has been developed for two traffic loading scenarios; light duty and heavy duty. The heavy-duty design is appropriate for areas where truck/bus/emergency vehicle traffic is anticipated, while the light duty design is appropriate for areas where no heavy vehicles are anticipated. The recommended minimum pavement structure is provided in Table 10.

Table 10 Recommended Minimum Pavement Structure

Pavement Layer	Light Duty	Heavy Duty
Surface Course Asphalt	50 mm HL3 or SP12.5	40 mm HL3 or SP12.5
Binder Course Asphalt	--	50 mm HL8 or SP19.0
Granular Base	150 mm OPSS 1010 Granular A	150 mm OPSS 1010 Granular A
Granular Subbase	300 mm OPSS 1010 Granular B	450 mm OPSS 1010 Granular B

Material and thickness substitutions must be approved by the Design 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.

In areas where additional subgrade support is required and/or sub-excavation is not feasible, consideration should be given to placing a non-woven geotextile and geogrid subgrade reinforcement prior to placing the pavement structure. The non-woven geotextile should consist of Terrafix 270R, followed by a geogrid consisting of Terrafix TBX11, or approved equivalents. The geosynthetics should be provided with minimum 300 mm overlap between adjacent sheets and installed according to the manufacturer's instructions.

To maintain a relatively dry subgrade condition and prevent subgrade softening, subdrains are recommended to be installed. These should consist of 150 mm diameter perforated, corrugated plastic pipe, surrounded by 150 mm of 19 mm clear crushed stone with pipe inverts placed 300 mm below the top of subgrade. The subdrains should connect to a positive outlet such as a catch basin or storm sewer.

Transitions between differing pavement structures should be provided with minimum slopes of 10H:1V to limit differential movement due to frost heave.

Compaction of the subgrade should be verified by the Engineer prior to placing the granular fill. Pavement granular materials should be placed in 150 mm maximum loose lifts and compacted to at least 100 percent of SPMDD. The granular materials specified should conform to OPSS standards, as confirmed by appropriate materials testing.

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

If Superpave mixes are used, Performance Graded Asphalt Cement (PGAC) 58-34 and Traffic Category C should be used in the design.

5.14 Winter Construction

If work is planned during freezing temperatures, excavations and subgrade soils should be exposed for as short a time as practicable to maintain adequate performance of the founding soils and subgrades. Excavations for site services should be carried out only in lengths which allow all construction operations, including backfilling, to be fully completed in one working day. The materials on the sides of the excavations should not be allowed to freeze.

Stockpiles of materials should be stored and replaced without being disturbed by frost or contaminated by snow or ice. For excavations below foundations, soils should be protected immediately from frozen conditions using heaters, insulated tarps, straw, or other appropriate methods. Provisions should be arranged to prevent freezing or frost build up within soils or rock situated below the level of any existing structures or services. Frozen soil or shale may heave and settle upon thawing, resulting in damages to structures or services.

6.0 Limitations and Use of Report

This geotechnical engineering report intended for planning and design purposes only. This investigation has been carried out using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by engineering practitioners. The discussion and recommendations that have been presented are based on factual data obtained from this investigation.

The current feasibility study is preliminary in nature and has been completed with the understanding that additional information will be collected in the future for use during detailed design phases.

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

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 and recommendations provided 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, the 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

Please note that this work program and report are governed by the attached Qualifications and Limitations. If you have questions or comments regarding this document, please do not hesitate to contact the undersigned at (705) 742-7900.

Respectfully submitted,

Cambium Inc.

DS

2025-06-02

Signed by:

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Senior Project Manager – Geotechnical

DocuSigned by:

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Stuart Baird, M.Eng., P.Eng.
Director of Technical Operations, Services

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8.0 Standard Limitations

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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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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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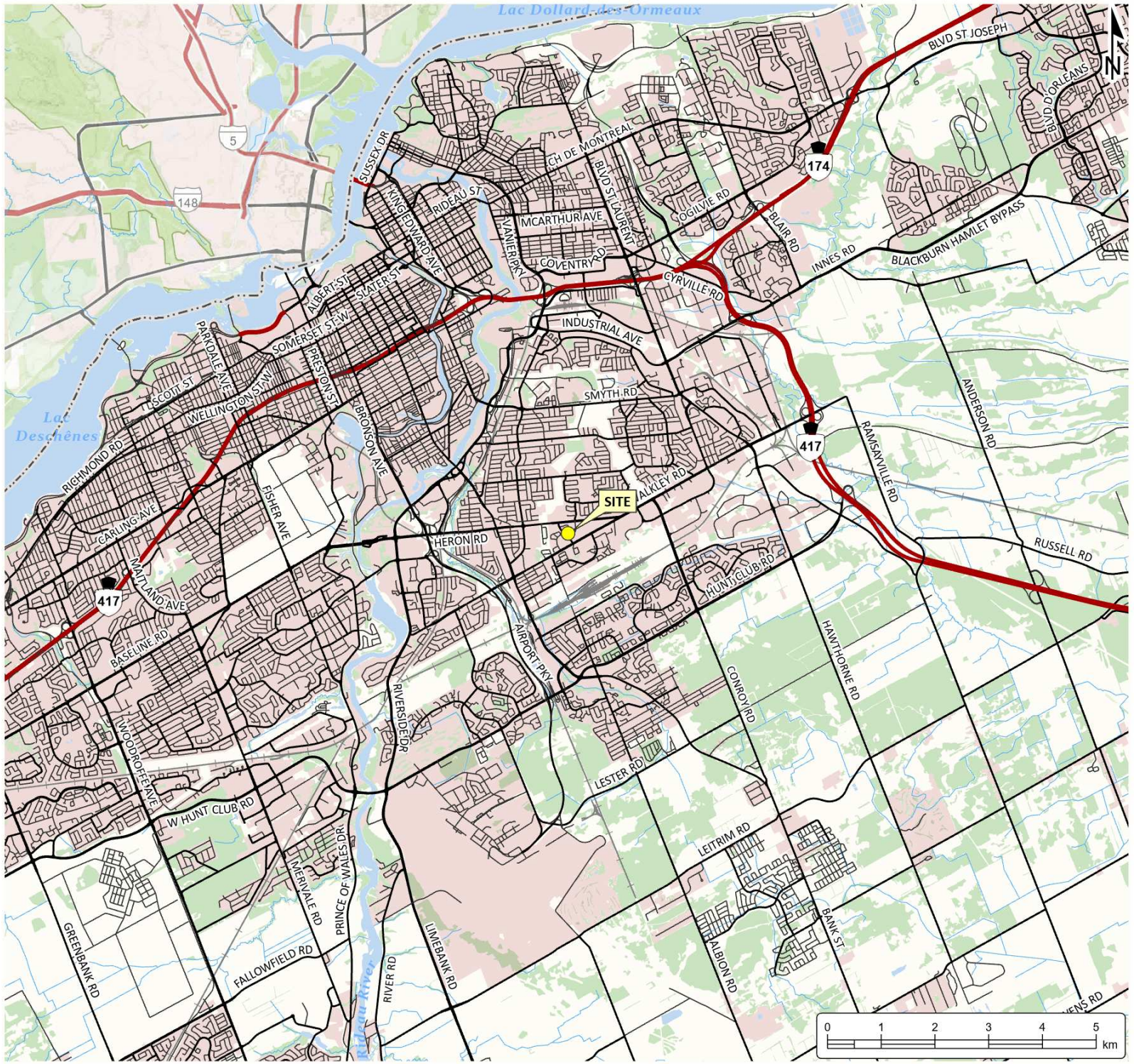
Appended Figures



GEOTECHNICAL INVESTIGATION

HAZELVIEW PROPERTIES
Heron Gate Village Subdivision
Ottawa, Ontario

LEGEND

- Highway
- Major Road
- Minor Road
- Railway
- Watercourse
- Provincial Border
- Water Area
- Wooded Area
- Built Up Area

Notes:
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SITE LOCATION PLAN

Project No.:	22801-001	Date:	April 2025
		Rev.:	
Scale:	1:100,000	Projection:	NAD 1983 UTM Zone 18N
Created by:	NLB	Checked by:	NC
Figure:	1		

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GEOTECHNICAL INVESTIGATION

HAZELVIEW PROPERTIES
Heron Gate Village Subdivision
Ottawa, Ontario

LEGEND

- Benchmark
- Borehole
- Block
- Construction Completed In 2020
- Future Parkland

Notes:
- Survey conducted by Cambium on March 27 & 28, 2025.
- Benchmark BM1 is the top nut of fire hydrant located on at the corner of Baycrest drive and Sandalwood Drive.
- Benchmark BM2 is the top nut of fire hydrant located on Cedarwood Drive.
- Imagery from Maxar (GE01) image captured on May 7, 2023 as shown in the 2023-08-10 version of the World Imagery map.
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BOREHOLE LOCATION PLAN

Project No.: 22801-001		Date: April 2025 Rev.:	
Scale: 1:3,500		Projection: NAD 1983 UTM Zone 18N	
Created by: NLB	Checked by: NC	Figure:	2

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Appendix A

Borehole and Rock Core Logs

CAMBIUM

Client: EFI Engineering
Contractor: Downing Drilling Ltd.
Project No.: 22801-001
Location: Heron Rd, Ottawa ON

Project Name: Heron Gate Village Subdivision
Method: Track Mounted Hollow Stem Auger
Elevation: 98.56 mREL
UTM: 18 T **N:** 5025165 **E:** 448907

Log of Borehole: BH101-25
Page: 1 of 2
Date Completed: March 28, 2025

Elevation (m)	Depth	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI / % Moisture (25 50 75)	Shear Strength Cu, kPa (nat V. rem V.) / SPT (N) (20 40 60 80)	Well Installation	Log Notes
98.6	0	**ASPHALT:** 40 mm	98.52 / 0.04								
		(SP) SAND and GRAVEL: some silt; brown; moist, compact [GRANULAR FILL]	98.31 / 0.25	1A	SS			6.2%			
98.1	0.5	**(SM) gravelly SILTY SAND:** with low plasticity fines; brown, with occasional cobbles; non-cohesive, moist, compact [POSSIBLE REWORKED NATIVE]		1B	SS	75	10	11.5%	10		
97.6	1			2	SS	42	9	11.6%	9		
97.1	1.5		97.04 / 1.52								
		(SM) gravelly SILTY SAND: with low plasticity fines; grey, with occasional cobbles; non-cohesive, moist, compact [GLACIAL TILL]		3	SS	58	14	8.1%	14		
96.6	2										
				4A	SS	100	50 / 125 mm	10.1%			
96.1	2.5			4B	SS			8.5%	50		
95.6	3										
			95.13	5	SS	80	50 / 75 mm	5.4%	50		
95.1	3.5	**Shale:** [WEATHERED BEDROCK] See bedrock core logs.	3.43								Borehole caving not observed. Groundwater not encountered. Standing water not observed. Coring initiated at 3.4 mbgs.
94.6	4										
94.1	4.5	**Shale:** See bedrock core logs.	4.72								
93.6	5										
93.1	5.5										
92.6	6										
92.1	6.5										
		Borehole terminated @ 6.8 mbgs due to target depth achieved.									Coring terminated at 6.8 mbgs.
91.6	7										
91.1											

GRAINSIZE DISTRIBUTION	SAMPLE	GRAVEL	SAND	SILT	CLAY
	SS2	23	42	23	12

Logged By: RR **Input By:** RR

CAMBIUM

Client: EFI Engineering
Contractor: Downing Drilling Ltd.
Project No.: 22801-001
Location: Heron Rd, Ottawa ON

Project Name: Heron Gate Village Subdivision
Method: Track Mounted NQ Diamond Core Drill
Ground Elevation: 98.56 m Rel.
UTM: 18 T **N:** 5025165 **E:** 448907

Log of Borehole: BH101-25
Page: 2 of 2
Date Completed: March 28, 2025

SUBSURFACE PROFILE

Elevation (m)	Depth	Lithology	Description	Elevation / Depth	Core Run	UCS (MPa) 10 50 100 250	Natural Fractures	Lab Notes	Log Notes
95	3.6		**Shale:** [WEATHERED BEDROCK]				10		
							10		
94.5	4.1				Run 1 TCR = **100%** SCR = **44%** RQD = **6%**		10		
94	4.6						10		
				93.71 4.85			3		
93.5	5.1		**Shale:** grey to black, very weak to weak field strength, fine grained, laminated bedding, intensly fractured to moderately fractured, very poor to fair quality [UPPER ORDOVICIAN]				4		
93	5.6						2		
					Run 2 TCR = **100%** SCR = **95%** RQD = **54%**		3		
92.5	6.1						2		
							1		
92	6.6			91.80 6.76			1		
			Rock core terminated @ 6.8m due to due to target depth achieved.						
91.5	7.1								
91	7.6								

Logged By: RR
Input By: RR

CAMBIUM

Client: EFI Engineering
Contractor: Downing Drilling Ltd.
Project No.: 22801-001
Location: Heron Rd, Ottawa ON

Project Name: Heron Gate Village Subdivision
Method: Track Mounted Hollow Stem Auger
Elevation: 99.11 mREL
UTM: 18 T **N:** 5025076 **E:** 449007

Log of Borehole: BH102-25
Page: 1 of 3
Date Completed: March 26, 2025

Elevation (m)	Depth	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI / % Moisture (25 50 75)	Shear Strength Cu, kPa (nat V. rem V.) / SPT (N) (20 40 60 80)	Well Installation	Log Notes
99.1	0	**ASPHALT:** 50 mm	99.06								
		(SP) SAND and GRAVEL: some silt; brown; moist, compact [GRANULAR FILL]	0.05 / 98.75	1A	SS	100	14	7.7%			
98.6	0.5			1B	SS			38.7%	14		
		(ML) CLAYEY SILT and SAND: trace gravel; black; non-cohesive, moist, compact	0.36 / 98.35								
98.1	1	**(SM) gravelly SILTY SAND:** with low plasticity fines; brown; non-cohesive, moist, compact [POSSIBLE REWORKED NATIVE]	0.76	2	SS	92	12	18.5%	12		
97.6	1.5										
				3	SS	83	22	11.8%	22		
97.1	2										
			96.82 / 2.29								
96.6	2.5	**(SM) gravelly SILTY SAND:** with low plasticity fines; grey, with occasional cobbles; non-cohesive, moist, very dense [GLACIAL TILL]		4	SS	22	50	10.3%	50		
96.1	3										
		becomes compact		5	SS	54	11	8.9%	11		
95.6	3.5										
95.1	4			6	SS	50	10	8.7%	10		
94.6	4.5										
				7	SS	79	16	8.9%	16		
94.1	5										
93.6	5.5										
93.1	6		92.99								
		Shale: [WEATHERED BEDROCK] See bedrock core logs.	6.12								
92.6	6.5										
		Shale: See bedrock core logs.	6.71								
92.1	7										
91.6											

Borehole caving not observed. Groundwater not encountered. Standing water not observed.

Coring initiated at 6.1 mbgs.

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS1B	1	39	42	18

Logged By: RR **Input By:** RR

CAMBIUM

Client: EFI Engineering
Contractor: Downing Drilling Ltd.
Project No.: 22801-001
Location: Heron Rd, Ottawa ON

Project Name: Heron Gate Village Subdivision
Method: Track Mounted Hollow Stem Auger
Elevation: 99.11 mREL
UTM: 18 T **N:** 5025076 **E:** 449007

Log of Borehole: BH102-25
Page: 2 of 3
Date Completed: March 26, 2025

Elevation (m)	Depth	Lithology	Description (Elevation / Depth)	Number	Type	% Recovery	SPT (N)	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	Well Installation	Log Notes
91.6	7.5		**Shale:** See bedrock core logs. 7.50								Coring terminated 7.7 mbgs.
91.1	8		Borehole terminated @ 7.7 mbgs due to target depth achieved.								
90.6	8.5										
90.1	9										
89.6	9.5										
89.1	10										
88.6	10.5										
88.1	11										
87.6	11.5										
87.1	12										
86.6	12.5										
86.1	13										
85.6	13.5										
85.1	14										
84.6	14.5										
84.1											

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS1B	1	39	42	18

Logged By: RR **Input By:** RR

CAMBIUM

Client: EFI Engineering
Contractor: Downing Drilling Ltd.
Project No.: 22801-001
Location: Heron Rd, Ottawa ON

Project Name: Heron Gate Village Subdivision
Method: Track Mounted NQ Diamond Core Drill
Ground Elevation: 99.11 m Rel.
UTM: 18 T **N:** 5025076 **E:** 449007

Log of Borehole: BH102-25
Page: 3 of 3
Date Completed: March 26, 2025

SUBSURFACE PROFILE

Elevation (m)	Depth	Lithology	Description	Elevation / Depth	Core Run	UCS (MPa) 10 50 100 250	Natural Fractures	Lab Notes	Log Notes
93	6.1		**Shale:** [WEATHERED BEDROCK]				10		
							10		
92.5	6.6			92.40 / 6.71					
			Shale: grey to black, very weak to weak field strength, fine grained, laminated bedding, intensly fractured to moderately fractured, very poor to fair quality [UPPER ORDOVICIAN]		Run 1 TCR = **82%** SCR = **60%** RQD = **28%**		4		
92	7.1						3		
							3		
91.5	7.6			91.41					
			Rock core terminated @ 7.7m due to due to target depth achieved.	7.70					
91	8.1								
90.5	8.6								
90	9.1								
89.5	9.6								
89	10.1								

Logged By: RR
Input By: RR

CAMBIUM

Client: EFI Engineering
Contractor: Downing Drilling Ltd.
Project No.: 22801-001
Location: Heron Rd, Ottawa ON

Project Name: Heron Gate Village Subdivision
Method: Track Mounted Hollow Stem Auger
Elevation: 100.17 mREL
UTM: 18 T **N:** 5025076 **E:** 449007

Log of Borehole: BH103-25
Page: 1 of 2
Date Completed: March 26, 2025

Elevation (m)	Depth	Description	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) / % Moisture	Shear Strength Cu, kPa / SPT (N)	Well Installation	Log Notes
100.2	0	**ASPHALT:** 100 mm (100.07)								
		(SM) gravelly SILTY SAND: brown, occasional cobbles; non-cohesive, moist, compact [GRANULAR FILL] (0.10)	1	SS	79	20	4.1%	20		
99.7	0.5		2	SS	46	46	4.1%	46		
99.2	1									
98.7	1.5	(98.65) 1.52 **(SM) gravelly SILTY SAND:** with low plasticity fines; brown; non-cohesive, moist, compact [POSSIBLE REWORKED NATIVE]	3	SS	79	23	7.6%	23		
98.2	2	(97.88) 2.29 **(SM) gravelly SILTY SAND:** with low plasticity fines; grey, with occasional cobbles; non-cohesive, moist, very dense [GLACIAL TILL]	4	SS	38	60	6.9%	60		
97.7	2.5									
97.2	3	becomes compact, increase in fines content	5	SS	54	14	4.8%	14		
96.7	3.5									
96.2	4		6	SS	42	22	7.1%	22		
95.7	4.5									
95.2	5	becomes very dense (95.06) 5.11	7	SS	71	61	7.5%	61		
		Shale: See bedrock core logs.								Borehole caving not observed. Groundwater not encountered. Standing water not observed. Coring initiated at 5.1 mbgs.
94.7	5.5									
94.2	6									
93.7	6.5									Coring terminated at 6.7 mbgs.
93.2	7	Borehole terminated @ 6.7 mbgs due to target depth achieved.								
92.7										

Atterberg Limits (%) / % Moisture: 25 50 75
Shear Strength Cu, kPa (nat V., rem V.) / SPT (N): 20 40 60 80

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS4	13	49	30	8

Logged By: RR **Input By:** RR

CAMBIUM

Client: EFI Engineering
Contractor: Downing Drilling Ltd.
Project No.: 22801-001
Location: Heron Rd, Ottawa ON

Project Name: Heron Gate Village Subdivision
Method: Track Mounted NQ Diamond Core Drill
Ground Elevation: 100.17 m Rel.
UTM: 18 T **N:** 5025076 **E:** 449007

Log of Borehole: BH103-25
Page: 2 of 2
Date Completed: March 26, 2025

SUBSURFACE PROFILE

Elevation (m)	Depth	Lithology	Description	Elevation / Depth	Core Run	UCS (MPa) 10 50 100 250	Natural Fractures	Lab Notes	Log Notes
95.1	5.1		**Shale:** grey to black, very weak to weak field strength, fine grained, laminated bedding, intensly fractured to moderately fractured, very poor quality [UPPER ORDOVICIAN]				5		
							5		
94.6	5.6				Run 1 TCR = **94%** SCR = **84%** RQD = **21%**		5		
94.1	6.1						5		
							5		
93.6	6.6			93.46					
			Rock core terminated @ 6.7m due to due to target depth achieved.	6.71					
93.1	7.1								
92.6	7.6								
92.1	8.1								
91.6	8.6								
91.1	9.1								

Logged By: RR
Input By: RR

CAMBIUM

Client: EFI Engineering
Contractor: Downing Drilling Ltd.
Project No.: 22801-001
Location: Heron Rd, Ottawa ON

Project Name: Heron Gate Village Subdivision
Method: Track Mounted Hollow Stem Auger
Elevation: 98.15 mREL
UTM: 18 T **N:** 5024878 **E:** 448833

Log of Borehole: BH104-25
Page: 1 of 1
Date Completed: March 27, 2025

Elevation (m)	Depth	Description	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) / % Moisture	Shear Strength Cu, kPa / SPT (N)	Well Installation	Log Notes
98.2	0	**ASPHALT:** 50 mm (98.10 / 0.05)								
		(SM) SILTY SAND and GRAVEL: brown; moist, compact [GRANULAR FILL] (97.85 / 0.30)	1A	SS	50	12	2.7%	12		
97.6	0.5		1B	SS			15.7%			
		(SM) gravelly SILTY SAND: with low plasticity fines; brown; non-cohesive, moist, compact [POSSIBLE REWORKED NATIVE]								
97.2	1		2	SS	50	16	10.1%	16		
96.6	1.5									
			3	SS	45	10	9%	10		
96.2	2	(95.86 / 2.29)								
95.6	2.5	**(SM) gravelly SILTY SAND:** with low plasticity fines; grey, with occasional cobbles; non-cohesive, moist, loose [GLACIAL TILL]	4	SS	58	8	9.2%	8		
95.2	3									
		becomes compact	5	SS	8	13	9.5%	13		
94.6	3.5									
94.2	4	becomes wet, increase in gravel content	6	SS	83	16	10%	16		
93.6	4.5	(93.58 / 4.57)				50				Borehole caving not observed. Groundwater encountered at 3.8 mbgs. Standing water not observed.
		Shale: [WEATHERED BEDROCK] See bedrock core logs.	7	SS	25	/ 125 mm	7.4%	50		Coring initiated at 4.7 mbgs.
93.2	5									
		Shale: See bedrock core logs. (5.33)								
92.6	5.5									
92.2	6									
91.6	6.5									
91.2	7	Borehole terminated @ 6.9 mbgs due to target depth achieved.								Coring terminated at 6.9 mbgs.
90.6										

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

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS2	13	49	24	14

Logged By: RR
Input By: RR

CAMBIUM

Client: EFI Engineering
Contractor: Downing Drilling Ltd.
Project No.: 22801-001
Location: Heron Rd, Ottawa ON

Project Name: Heron Gate Village Subdivision
Method: Track Mounted NQ Diamond Core Drill
Ground Elevation: 98.15 m Rel.
UTM: 18 T **N:** 5024878 **E:** 448833

Log of Borehole: BH104-25
Page: 2 of 2
Date Completed: March 27, 2025

SUBSURFACE PROFILE

Elevation (m)	Depth	Lithology	Description	Elevation / Depth	Core Run	UCS (MPa) 10 50 100 250	Natural Fractures	Lab Notes	Log Notes
93.5	4.7		**Shale:** [WEATHERED BEDROCK]				10		
93	5.2						10		
				92.82 / 5.33	Run 1 TCR = **82%** SCR = **57%** RQD = **0%**		10		
92.5	5.7		**Shale:** grey to black, very weak to weak field strength, fine grained, laminated bedding, intensly fractured to moderately fractured, very poor to poor quality [UPPER ORDOVICIAN]				3		
							6		
92	6.2				Run 2 TCR = **96%** SCR = **89%** RQD = **35%**		3		
91.5	6.7						5		
				91.27 / 6.88					
91	7.2		Rock core terminated @ 6.9m due to due to target depth achieved.						
90.5	7.7								
90	8.2								
89.5	8.7								

Logged By: RR
Input By: RR

CAMBIUM

Client: EFI Engineering
Contractor: Downing Drilling Ltd.
Project No.: 22801-001
Location: Heron Rd, Ottawa ON

Project Name: Heron Gate Village Subdivision
Method: Track Mounted Hollow Stem Auger
Elevation: 97.80 mREL
UTM: 18 T **N:** 5024896 **E:** 449029

Log of Borehole: BH105-25
Page: 1 of 3
Date Completed: March 27, 2025

Elevation (m)	Depth	Description	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) LL PL PI / % Moisture	Shear Strength Cu, kPa (nat V., rem V.) / SPT (N)	Well Installation	Log Notes
97.8	0	**ASPHALT:** 75 mm (97.72)								
		(SM) gravelly SILTY SAND: brown; moist, dense [GRANULAR FILL] (0.08 – 97.04)	1	SS	25	30	9.9%	30		
97.3	0.5									
		(SM) SILTY SAND: some gravel, with low plasticity fines; brown; non-cohesive, moist, compact [POSSIBLE REWORKED NATIVE] (0.76)	2	SS	75	28	13.4%	28		
96.8	1									
96.3	1.5		3	SS	58	27	8.7%	27		
95.8	2									
95.3	2.5	colour change to grey	4	SS	71	23	8.2%	23		
94.8	3	(94.75)								
		(SM) SILTY SAND: some gravel, with low plasticity fines; grey, with occasional cobbles; non-cohesive, moist, compact [GLACIAL TILL] (3.05)	5	SS	71	23	9.3%	23		
94.3	3.5									
93.8	4									
93.3	4.5	becomes loose, decrease in gravel	6	SS	29	9	9.4%	9		
92.8	5									Coring initiated at 8.1 mbgs.
92.3	5.5									
91.8	6									
		becomes wet	7	SS	58	25	11.5%	25		
91.3	6.5									
90.8	7									
90.3		(90.30) 7.50								

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS3	11	47	29	13

Logged By: RR **Input By:** RR

CAMBIUM

Client: EFI Engineering
Contractor: Downing Drilling Ltd.
Project No.: 22801-001
Location: Heron Rd, Ottawa ON

Project Name: Heron Gate Village Subdivision
Method: Track Mounted Hollow Stem Auger
Elevation: 97.80 mREL
UTM: 18 T **N:** 5024896 **E:** 449029

Log of Borehole: BH105-25
Page: 2 of 3
Date Completed: March 27, 2025

Elevation (m)	Depth	Lithology	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	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	Well Installation	Log Notes
90.3	7.5		**(SM) SILTY SAND:** some gravel, with low plasticity fines; grey, with occasional cobbles; non-cohesive, moist, compact [GLACIAL TILL]	89.67	8	SS	90	79	9%	79		Borehole caving not observed. Groundwater encountered at 6.1 mbgs. Standing water not observed.
89.8	8		**Shale:** See bedrock core logs.	8.13								
89.3	8.5											
88.8	9											
88.3	9.5											
87.8	10		Borehole terminated @ 9.8 mbgs due to target depth achieved.									Coring terminated at 9.8 mbgs.
87.3	10.5											
86.8	11											
86.3	11.5											
85.8	12											
85.3	12.5											
84.8	13											
84.3	13.5											
83.8	14											
83.3	14.5											
82.8												

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS3	11	47	29	13

Logged By: RR
Input By: RR

CAMBIUM

Client: EFI Engineering
Contractor: Downing Drilling Ltd.
Project No.: 22801-001
Location: Heron Rd, Ottawa ON

Project Name: Heron Gate Village Subdivision
Method: Track Mounted NQ Diamond Core Drill
Ground Elevation: 97.80 m Rel.
UTM: 18 T **N:** 5024896 **E:** 449029

Log of Borehole: BH105-25
Page: 3 of 3
Date Completed: March 27, 2025

SUBSURFACE PROFILE

Elevation (m)	Depth	Lithology	Description	Elevation / Depth	Core Run	UCS (MPa) 10 50 100 250	Natural Fractures	Lab Notes	Log Notes
89.7	8.1		**Shale:** grey to black, very weak to weak field strength, fine grained, laminated bedding, intensly fractured to moderately fractured, very poor quality [UPPER ORDOVICIAN]				8		
							4		
89.2	8.6				Run 1 TCR = **98%** SCR = **83%** RQD = **23%**		6		
88.7	9.1						5		
							2		
88.2	9.6			88.02					
			Rock core terminated @ 9.8m due to due to target depth achieved.	9.78					
87.7	10.1								
87.2	10.6								
86.7	11.1								
86.2	11.6								
85.7	12.1								

Logged By: RR
Input By: RR

CAMBIUM

Client: EFI Engineering
Contractor: Downing Drilling Ltd.
Project No.: 22801-001
Location: Heron Rd, Ottawa ON

Project Name: Heron Gate Village Subdivision
Method: Track Mounted Hollow Stem Auger
Elevation: 96.32 mREL
UTM: 18 T **N:** 5025071 **E:** 44921

Log of Borehole: BH106-25
Page: 1 of 3
Date Completed: March 28, 2025

Elevation (m)	Depth	Description	Elevation / Depth	Number	Type	% Recovery	SPT (N)	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	Well Installation	Log Notes
96.3	0	**ASPHALT:** 40 mm	96.28								
		(SP) SAND: some gravel, some silt; brown; moist, loose [GRANULAR FILL]	0.04 / 96.02	1A	SS	13	8	9%	8		
95.8	0.5			1B	SS			11.1%			
		(SM) SILTY SAND: some gravel, with low plasticity fines; brown; non-cohesive, moist, compact [POSSIBLE REWORKED NATIVE]	0.30								
95.3	1			2	SS	71	23	11%	23		
94.8	1.5										
		some clay		3	SS	100	20	10.8%	20		
94.3	2		94.03								
		(SM) gravelly SILTY SAND: some gravel, with low plasticity fines; grey to black, with occasional cobbles; non-cohesive, moist, compact [GLACIAL TILL]	2.29	4	SS	29	10	11%	10		
93.8	2.5										
93.3	3	becomes loose		5	SS	29	4	11.7%	4		
92.8	3.5										
92.3	4	becomes wet and dense		6	SS	63	34	10.1%	34		
91.8	4.5										
91.3	5			7	SS	25	46	5.8%	46		
							50				
90.8	5.5		90.83	8	SS	100	/ 150 mm	12.3%	50		Borehole caving not observed. Groundwater encountered 3.8 mbgs. Standing water not observed. Coring initiated at 6.1 mbgs.
		Shale: [WEATHERED BEDROCK] See bedrock core logs.	5.49								
90.3	6										
		Shale: See bedrock core logs.	6.10								
89.8	6.5										
89.3	7										
88.8											

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS2	10	48	27	15
SS4	7	44	33	16

Logged By: RR **Input By:** RR

CAMBIUM

Client: EFI Engineering
Contractor: Downing Drilling Ltd.
Project No.: 22801-001
Location: Heron Rd, Ottawa ON

Project Name: Heron Gate Village Subdivision
Method: Track Mounted Hollow Stem Auger
Elevation: 96.32 mREL
UTM: 18 T **N:** 5025071 **E:** 44921

Log of Borehole: BH106-25
Page: 2 of 3
Date Completed: March 28, 2025

Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	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	Well Installation	Log Notes
88.8	7.5		**Shale:** See bedrock core logs. 7.50								
88.3	8										
87.8	8.5										
87.3	9										Coring terminated at 9.2 mbgs.
86.8	9.5		Borehole terminated @ 9.2 mbgs due to target depth achieved.								
86.3	10										
85.8	10.5										
85.3	11										
84.8	11.5										
84.3	12										
83.8	12.5										
83.3	13										
82.8	13.5										
82.3	14										
81.8	14.5										
81.3											

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
SS2	10	48	27	15
SS4	7	44	33	16

Logged By: RR **Input By:** RR

CAMBIUM

Client: EFI Engineering
Contractor: Downing Drilling Ltd.
Project No.: 22801-001
Location: Heron Rd, Ottawa ON

Project Name: Heron Gate Village Subdivision
Method: Track Mounted NQ Diamond Core Drill
Ground Elevation: 96.32 m Rel.
UTM: 18 T **N:** 5025071 **E:** 449251

Log of Borehole: BH106-25
Page: 3 of 3
Date Completed: March 27, 2025

SUBSURFACE PROFILE

Elevation (m)	Depth	Lithology	Description	Elevation / Depth	Core Run	UCS (MPa) 10 50 100 250	Natural Fractures	Lab Notes	Log Notes
90.2	6.1		**Shale:** grey to black, very weak to weak field strength, fine grained, laminated bedding, intensly fractured to moderately fractured, very poor to excellent quality [UPPER ORDOVICIAN]				4		
							2		
89.7	6.6				Run 1 TCR = **72%** SCR = **42%** RQD = **17%**		10		
89.2	7.1						10		
							10		
88.7	7.6						2		
							1		
88.2	8.1				Run 2 TCR = **98%** SCR = **98%** RQD = **84%**		1		
87.7	8.6						1		
							1		
87.2	9.1			87.15					
			Rock core terminated @ 9.2m due to due to target depth achieved.	9.17					
86.7	9.6								
86.2	10.1								

Logged By: RR
Input By: RR

Appendix B

Rock Core Photos

BH101-25
Cored length of 3.43 to 6.76 mbgs
Core Box 1 of 2

CLIENT
EFI Engineering

PROJECT
Geotechnical Investigation – Heron Gate Village Subdivision

YYYY-MM-DD	2025-03-28
PREPARED	RR
DESIGN	
REVIEW	NC
APPROVED	

TITLE
BOREHOLE 101-25
ROCK CORE PHOTOGRAPHS

PROJECT No.	PHASE	Rev.	FIGURE
22801	001		B1-1

BH101-25
Cored length of 3.43 to 6.76 mbgs
Core Box 2 of 2

CLIENT	EFI Engineering
PROJECT	Geotechnical Investigation – Heron Gate Village Subdivision

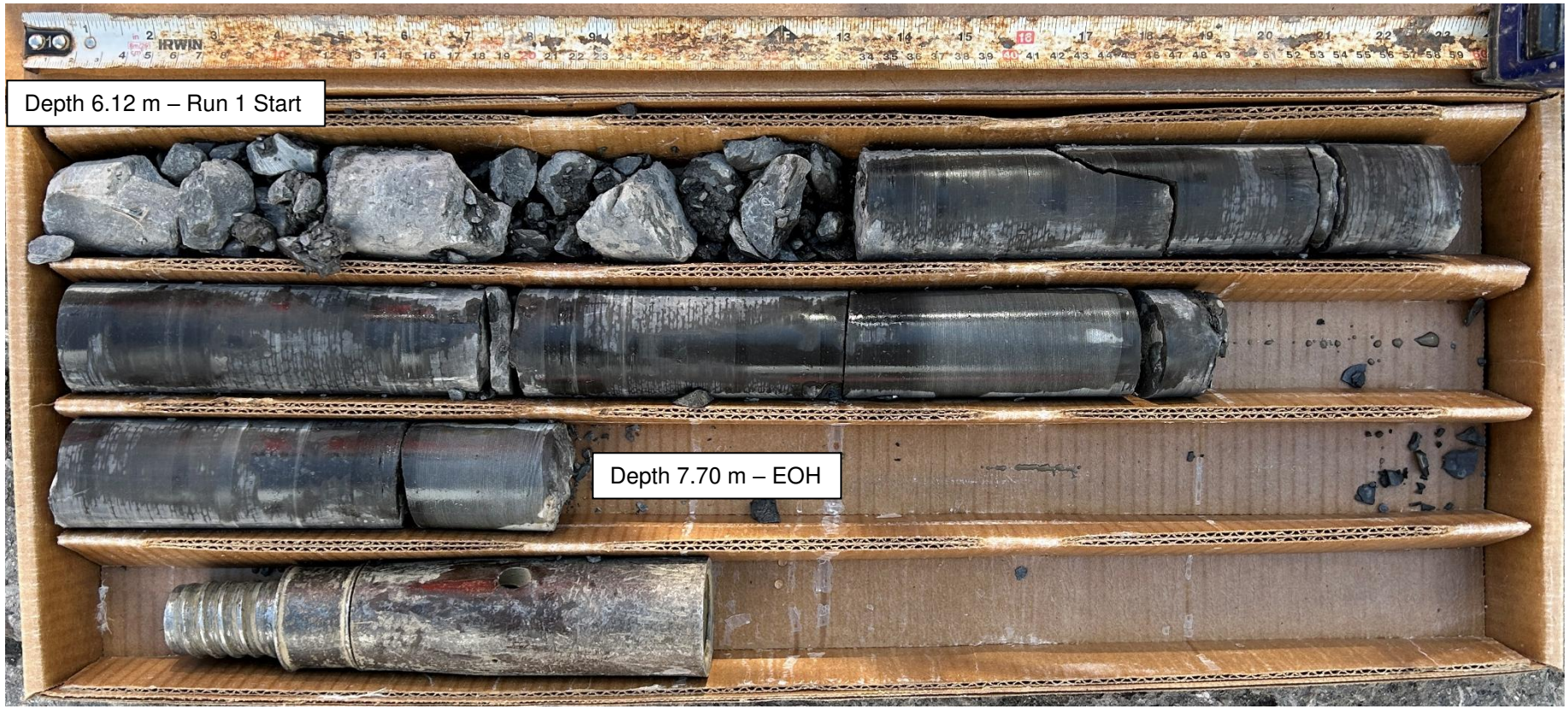
CAMBIUM

YYYY-MM-DD	2025-03-28
PREPARED	RR
DESIGN	
REVIEW	NC
APPROVED	

TITLE
BOREHOLE 101-25
ROCK CORE PHOTOGRAPHS

PROJECT No.	PHASE	Rev.	FIGURE
22801	001		B1-2

BH102-25
Cored length of 6.12 to 7.70 mbgs
Core Box 1 of 1



CLIENT	EFI Engineering
PROJECT	Geotechnical Investigation – Heron Gate Village Subdivision

CAMBIUM

YYYY-MM-DD	2025-03-26
PREPARED	RR
DESIGN	
REVIEW	NC
APPROVED	

TITLE
BOREHOLE 102-25
ROCK CORE PHOTOGRAPHS

PROJECT No.	PHASE	Rev.	FIGURE
22801	001		B2

BH103-25
Cored length of 5.11 to 6.71 mbgs
Core Box 1 of 1

CLIENT	EFI Engineering
PROJECT	Geotechnical Investigation – Heron Gate Village Subdivision

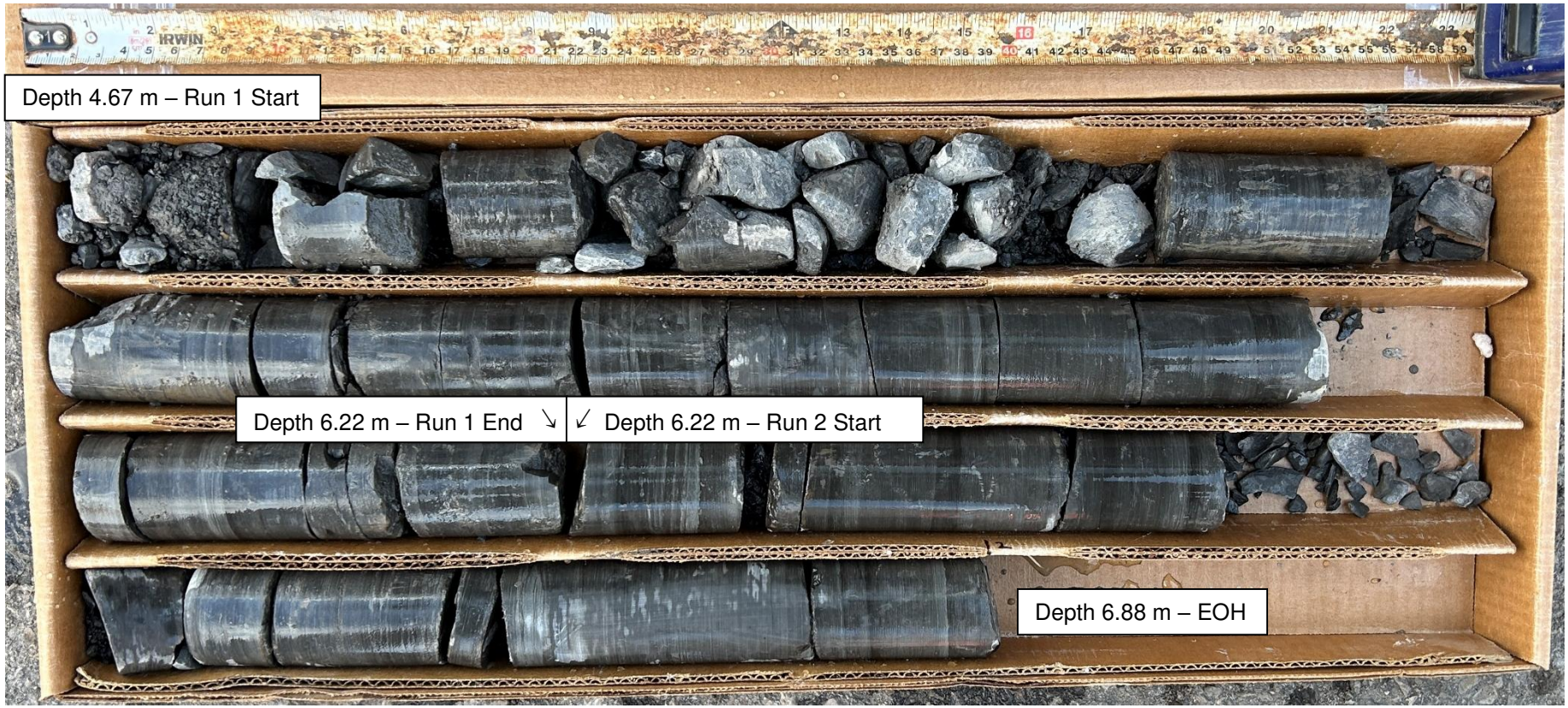
CAMBIUM

YYYY-MM-DD	2025-03-26
PREPARED	RR
DESIGN	
REVIEW	NC
APPROVED	

TITLE
BOREHOLE 103-25
ROCK CORE PHOTOGRAPHS

PROJECT No.	PHASE	Rev.	FIGURE
22801	001		B3

BH104-25
Cored length of 4.67 to 6.88 mbgs
Core Box 1 of 1



CLIENT	EFI Engineering
PROJECT	Geotechnical Investigation – Heron Gate Village Subdivision

CAMBIUM

YYYY-MM-DD	2025-03-27
PREPARED	RR
DESIGN	
REVIEW	NC
APPROVED	

TITLE
BOREHOLE 104-25
ROCK CORE PHOTOGRAPHS

PROJECT No.	PHASE	Rev.	FIGURE
22801	001		B4

BH105-25
Cored length of 8.13 to 9.78 mbgs
Core Box 1 of 1

CLIENT	EFI Engineering
PROJECT	Geotechnical Investigation – Heron Gate Village Subdivision

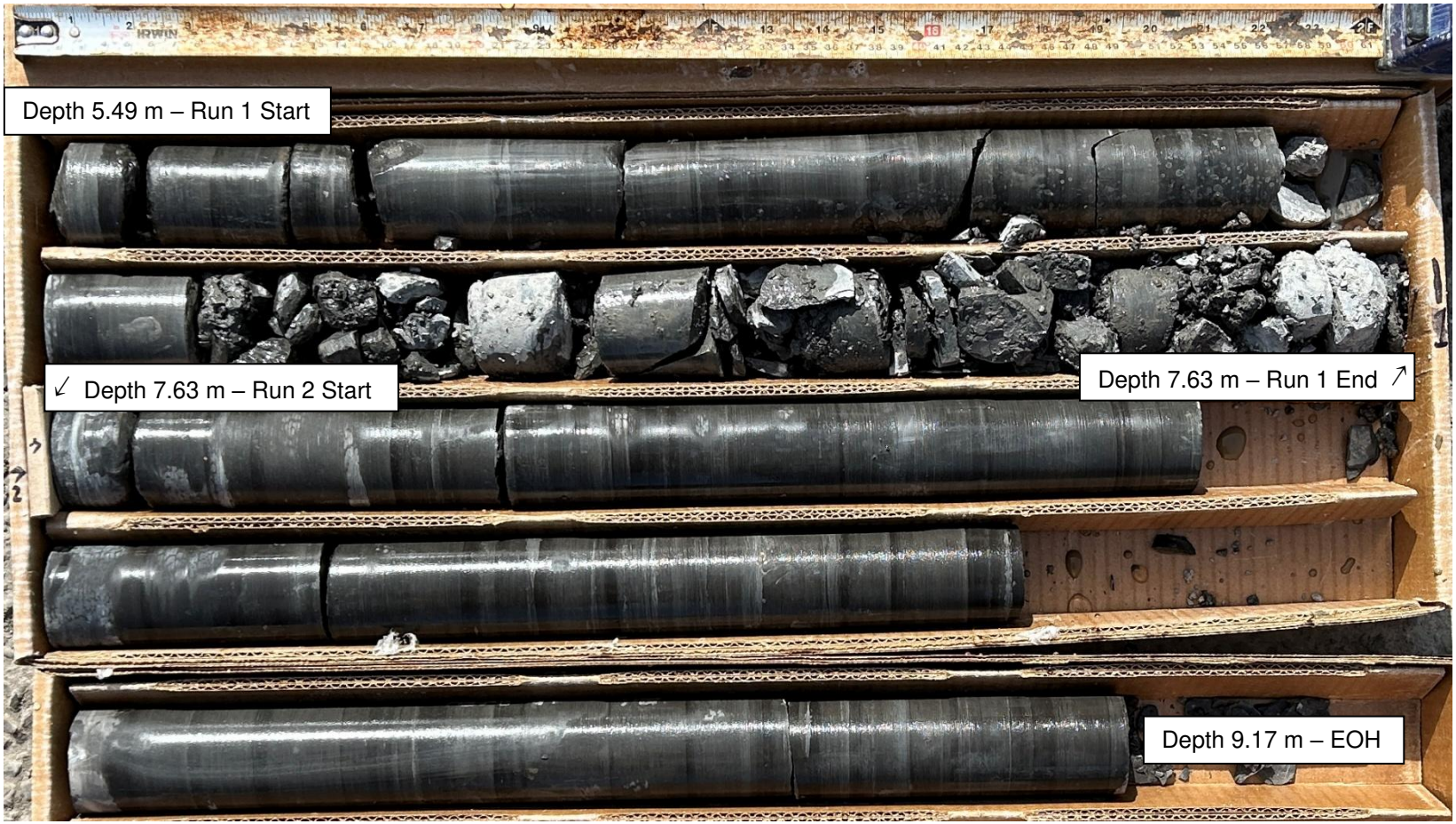
CAMBIUM

YYYY-MM-DD	2025-03-27
PREPARED	RR
DESIGN	
REVIEW	NC
APPROVED	

TITLE
BOREHOLE 105-25
ROCK CORE PHOTOGRAPHS

PROJECT No.	PHASE	Rev.	FIGURE
22801	001		B5

BH106-25
Cored length of 5.49 to 9.17 mbgs
Core Box 1 and 2 of 2



CLIENT	EFI Engineering
PROJECT	Geotechnical Investigation – Heron Gate Village Subdivision

CAMBIUM

YYYY-MM-DD	2025-03-27
PREPARED	RR
DESIGN	
REVIEW	NC
APPROVED	

TITLE
BOREHOLE 106-25
ROCK CORE PHOTOGRAPHS

PROJECT No.	PHASE	Rev.	FIGURE
22801	001		B6

Appendix C

Soil Laboratory Testing Results

Moisture Content

Project Number: 22801-001
Project Name: Heron Gate Village Subdivision
Client: EFI Engineering
Date Taken: 2025-03-26

Lab Number: S-25-0553
Date Tested: 2025-04-01
Tested By: Jackie O'Brien & Isaac Meldrum

Borehole Number	Sample Number	Sample Depth (m)	Water Weight (g)	Water Content (%)	Additional Observations
101	1A	0.040-0.250	13.9	6.2	NR
101	1B	0.250-0.759	26.9	11.5	
101	2	0.759-1.369	54.7	11.6	NR
101	3	1.521-2.131	70.7	8.1	NR
101	4A	2.289-2.591	24.7	10.1	NR
101	4B	2.441-2.740	17.7	8.5	
101	5	3.051-3.481	11.8	5.4	NR
102	1A	0.049-0.360	20.6	7.7	NR
102	1B	0.360-0.759	70.8	38.7	NR
102	2	0.759-1.369	46.0	18.5	
102	3	1.521-2.131	107.4	11.8	NR
102	4	2.289-2.899	23.8	10.3	
102	5	3.051-3.661	22.6	8.9	
102	6	3.810-4.420	25.9	8.7	
102	7	4.569-5.179	23.5	8.9	
103	1	0.101-0.759	11.5	4.1	
103	2	0.759-1.369	8.8	4.1	
103	3	1.521-2.131	21.6	7.6	
103	4	2.289-2.899	20.8	6.9	NR
103	5	3.051-3.661	19.9	4.8	NR
103	6	3.810-4.420	14.1	7.1	
103	7	4.569-5.179	14.0	7.5	
104	1A	0.049-0.299	8.4	2.7	NR
104	1B	0.299-0.610	15.8	15.7	NR
104	2	0.759-1.369	38.0	10.1	NR
104	3	1.521-2.131	17.4	9.0	
104	4	2.289-2.899	55.9	9.2	NR

1 – Contains organics
2 – Contains rubble
3 – Hydrocarbon Odour
4 – Unknown Chemical Odour
5 – Saturated – free water visible
6 – Very moist – near optimum moisture content
7 – Moist – below optimum moisture
8 – Dry – dry texture – powdery
9 – Very small – caution may not be representative
10 – Hold sample for gradation analysis

Moisture Content

Project Number: 22801-001
Project Name: Heron Gate Village Subdivision
Client: EFI Engineering
Date Taken: 2025-03-26

Lab Number: S-25-0553
Date Tested: 2025-04-01
Tested By: Jackie O'Brien & Isaac Meldrum

Borehole Number	Sample Number	Sample Depth (m)	Water Weight (g)	Water Content (%)	Additional Observations
104	5	3.051-3.661	19.1	9.5	NR
104	6	3.810-4.420	35.7	10.0	
104	7	4.569-4.670	2.1	7.4	NR,9
105	1	0.079-0.759	33.5	9.9	NR
105	2	0.759-1.369	45.8	13.4	
105	3	1.521-2.131	35.2	8.7	NR
105	4	2.289-2.899	25.1	8.2	
105	5	3.051-3.661	53.4	9.3	NR
105	6	4.569-5.179	19.7	9.4	
105	7	6.099-6.709	42.8	11.5	
105	8	7.620-8.129	21.4	9.0	
106	1A	0.040-0.299	22.1	9.0	
106	1B	0.299-0.759	23.3	11.1	
106	2	0.759-1.369	75.8	11.0	NR
106	3	1.521-2.131	30.6	10.8	
106	4	2.289-2.899	26.3	11.0	NR
106	5	3.051-3.661	31.2	11.7	NR
106	6	3.810-4.420	34.7	10.1	
106	7	4.569-5.179	11.9	5.8	NR
106	8	5.331-5.489	38.1	12.3	NR

1 – Contains organics
2 – Contains rubble
3 – Hydrocarbon Odour
4 – Unknown Chemical Odour
5 – Saturated – free water visible
6 – Very moist – near optimum moisture content
7 – Moist – below optimum moisture
8 – Dry – dry texture – powdery
9 – Very small – caution may not be representative
10 – Hold sample for gradation analysis

Grain Size Distribution Chart

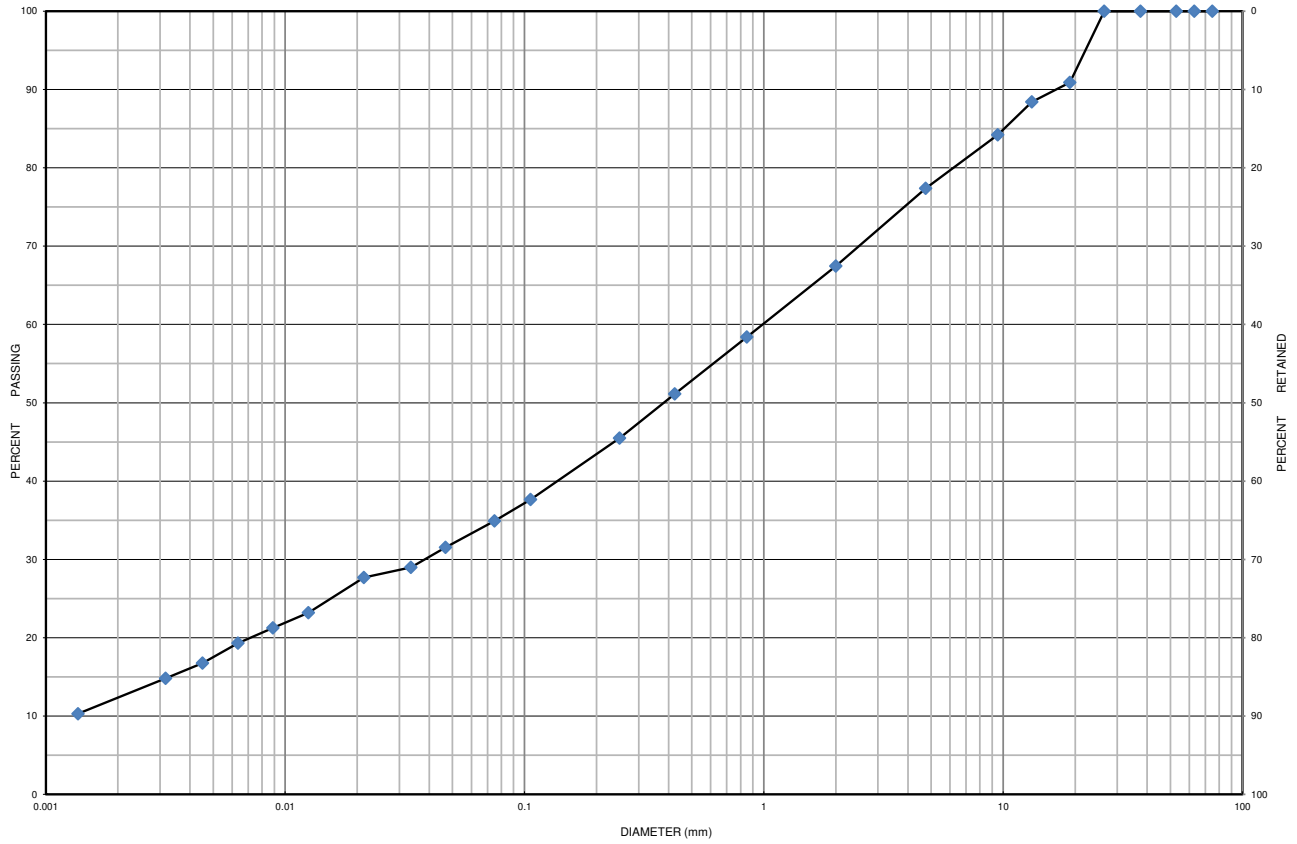
Project Number: *22801-001* **Client:** *EFI Engineering*

Project Name: *Heron Gate Village Subdivision*

Sample Date: *March 26-28, 2025* **Sampled By:** *Rory Ryan - Cambium Inc.*

Location: *BH 101-25 SS 2* **Depth:** *0.8 m to 1.4 m* **Lab Sample No:** *S-25-0554*

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 101-25	SS 2	0.8 m to 1.4 m	23	42	23	12	11.6

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Gravelly Silty Clayey Sand	SM	1.000	0.039	-	-	-

Additional information available upon request

Issued By: _____ *Date Issued:* *April 7, 2025*

(Senior Project Manager)

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Grain Size Distribution Chart

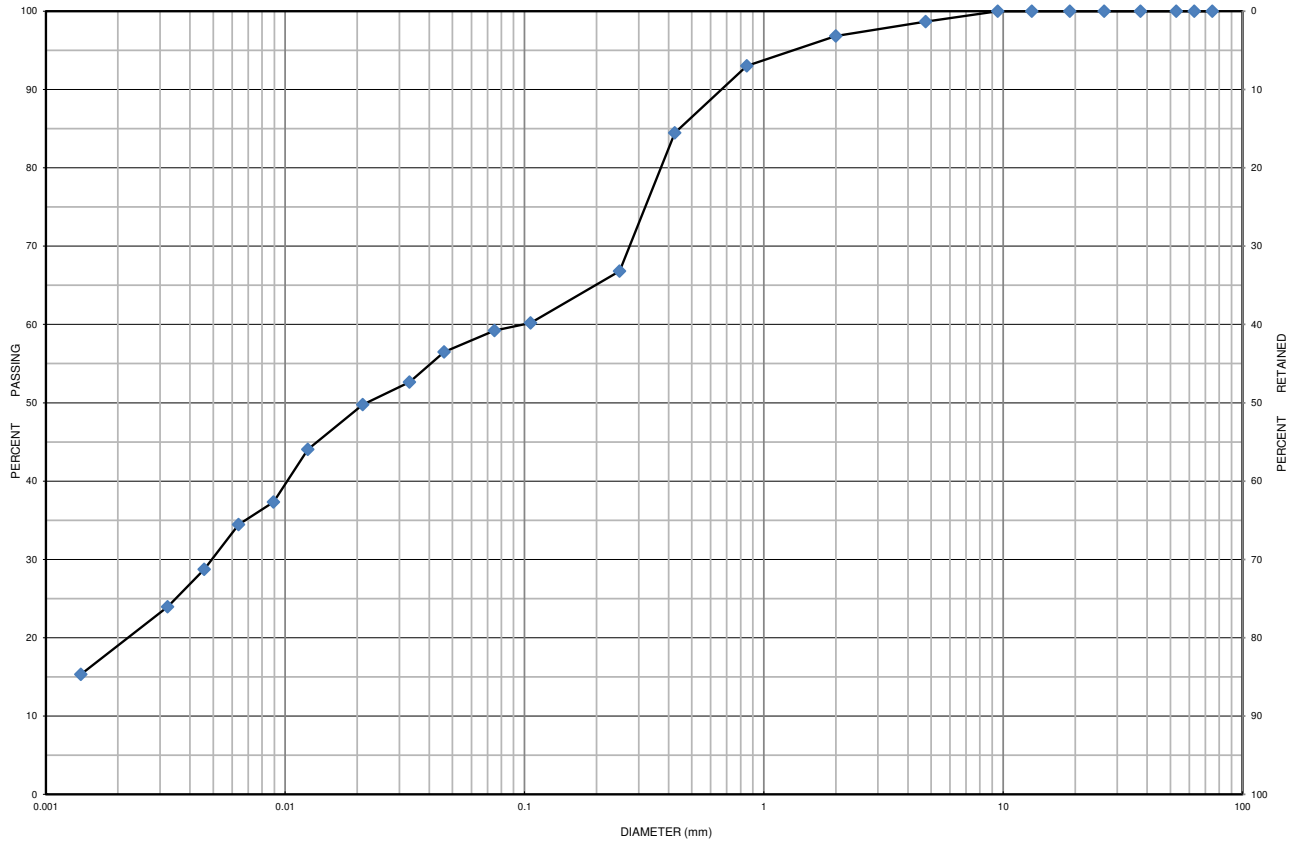
Project Number: *22801-001* **Client:** *EFI Engineering*

Project Name: *Heron Gate Village Subdivision*

Sample Date: *March 26-28, 2025* **Sampled By:** *Rory Ryan - Cambium Inc.*

Location: *BH 102-25 SS 1B* **Depth:** *0.4 m to 0.8 m* **Lab Sample No:** *S-25-0556*

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 102-25	SS 1B	0.4 m to 0.8 m	1	39	42	18	38.7

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Clayey Silt and Sand trace Gravel	ML	0.100	0.005	-	-	-

Additional information available upon request

Issued By: _____ *Date Issued:* *April 7, 2025*

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Grain Size Distribution Chart

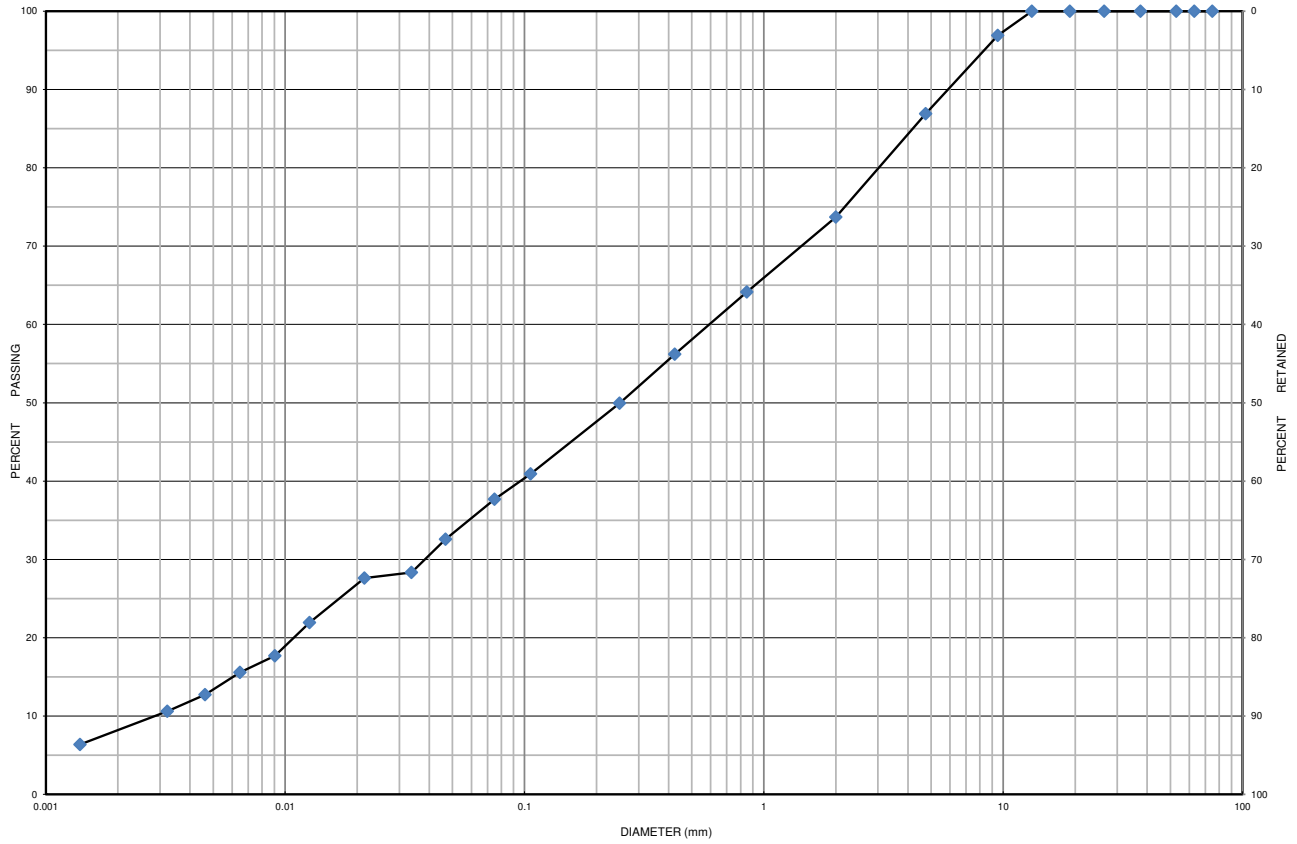
Project Number: *22801-001* **Client:** *EFI Engineering*

Project Name: *Heron Gate Village Subdivision*

Sample Date: *March 26-28, 2025* **Sampled By:** *Rory Ryan - Cambium Inc.*

Location: *BH 103-25 SS 4* **Depth:** *2.3 m to 2.9 m* **Lab Sample No:** *S-25-0558*

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 103-25	SS 4	2.3 m to 2.9 m	13	49	30	8	6.9

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silty Gravelly Sand some Clay	SM	0.6000	0.0390	0.0028	214.29	0.91

Additional information available upon request

Issued By: _____ *Date Issued:* *April 7, 2025*

(Senior Project Manager)

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Grain Size Distribution Chart

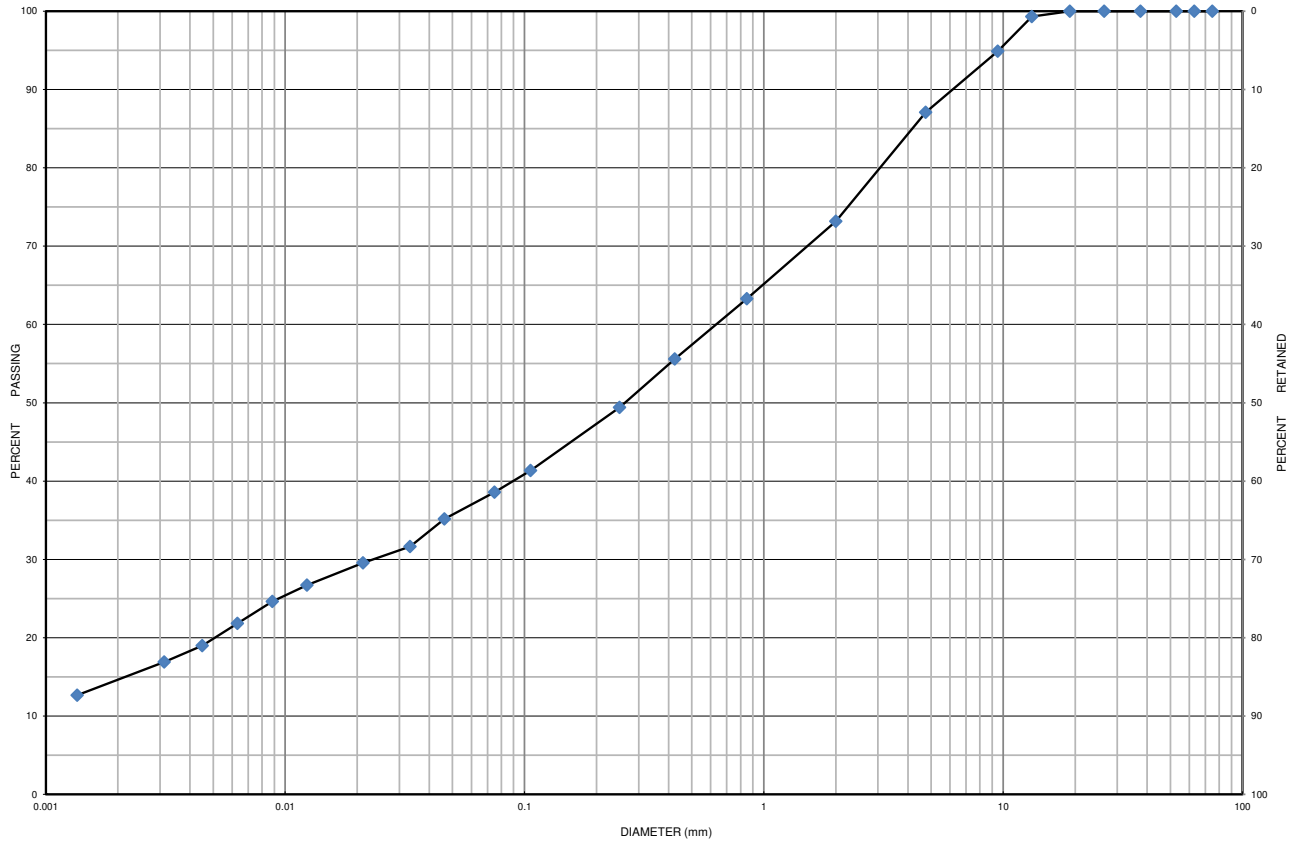
Project Number: *22801-001* **Client:** *EFI Engineering*

Project Name: *Heron Gate Village Subdivision*

Sample Date: *March 26-28, 2025* **Sampled By:** *Rory Ryan - Cambium Inc.*

Location: *BH 104-25 SS 2* **Depth:** *0.8 m to 1.4 m* **Lab Sample No:** *S-25-0560*

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 104-25	SS 2	0.8 m to 1.4 m	13	49	24	14	10.1

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silty Clayey Gravelly Sand	SM	0.630	0.024	-	-	-

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Grain Size Distribution Chart

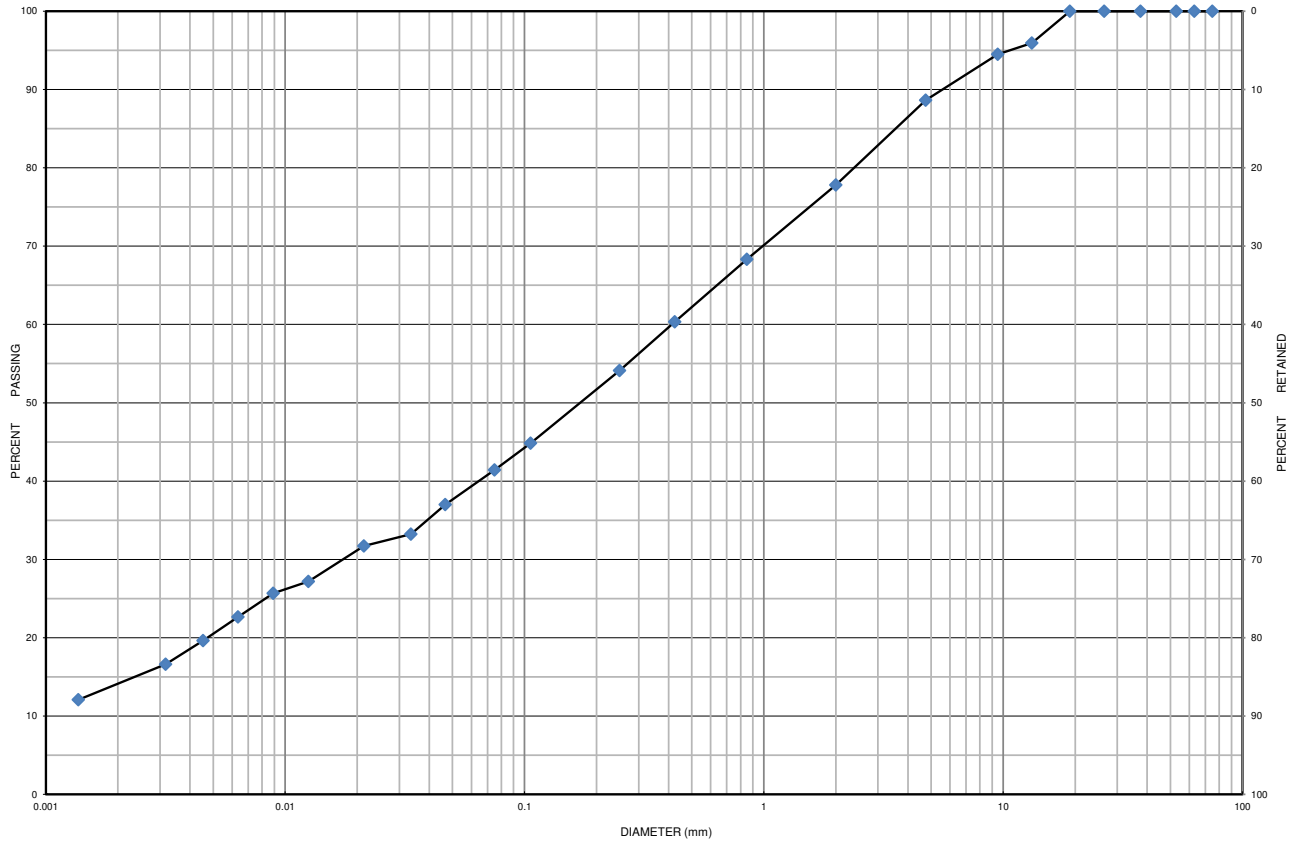
Project Number: *22801-001* **Client:** *EFI Engineering*

Project Name: *Heron Gate Village Subdivision*

Sample Date: *March 26-28, 2025* **Sampled By:** *Rory Ryan - Cambium Inc.*

Location: *BH 105-25 SS 3* **Depth:** *1.5 m to 2.1 m* **Lab Sample No:** *S-25-0562*

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 105-25	SS 3	1.5 m to 2.1 m	11	47	29	13	8.7

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silty Clayey Sand some Gravel	SM	0.410	0.018	-	-	-

Additional information available upon request

Issued By: _____ *Date Issued:* *April 8, 2025*

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Grain Size Distribution Chart

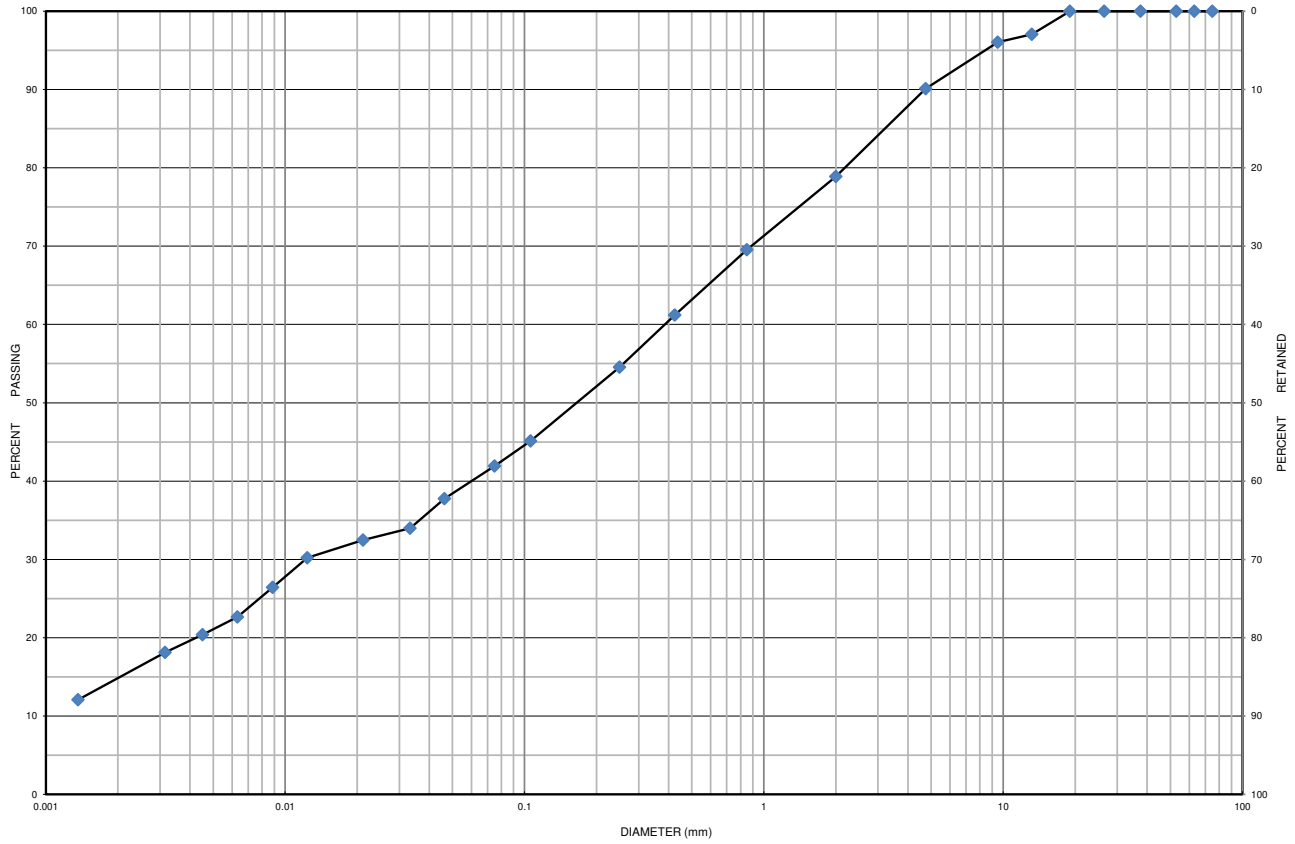
Project Number: *22801-001* **Client:** *EFI Engineering*

Project Name: *Heron Gate Village Subdivision*

Sample Date: *March 26-28, 2025* **Sampled By:** *Rory Ryan - Cambium Inc.*

Location: *BH 106-25 SS 2* **Depth:** *0.8 m to 1.4 m* **Lab Sample No:** *S-25-0565*

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 106-25	SS 2	0.8 m to 1.4 m	10	48	27	15	11.0

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silty Clayey Sand some Gravel	SM	0.395	0.014	-	-	-

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Grain Size Distribution Chart

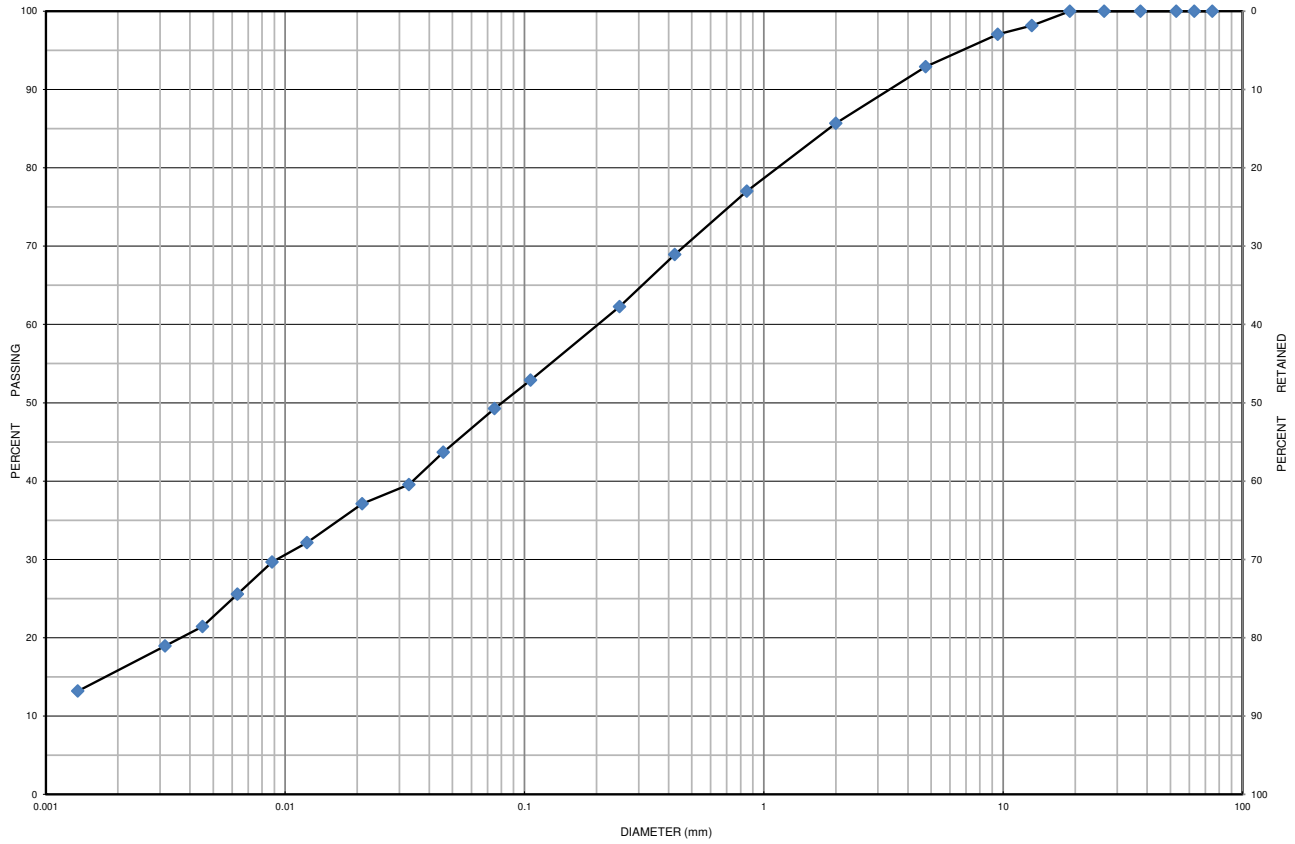
Project Number: *22801-001* **Client:** *EFI Engineering*

Project Name: *Heron Gate Village Subdivision*

Sample Date: *March 26-28, 2025* **Sampled By:** *Rory Ryan - Cambium Inc.*

Location: *BH 106-25 SS 4* **Depth:** *2.3 m to 2.9 m* **Lab Sample No:** *S-25-0564*

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 106-25	SS 4	2.3 m to 2.9 m	7	44	33	16	11.0

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Silty Clayey Sand some Gravel	SM	0.2000	0.0093	-	-	-

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Issued By: _____ *Date Issued:* *April 8, 2025*

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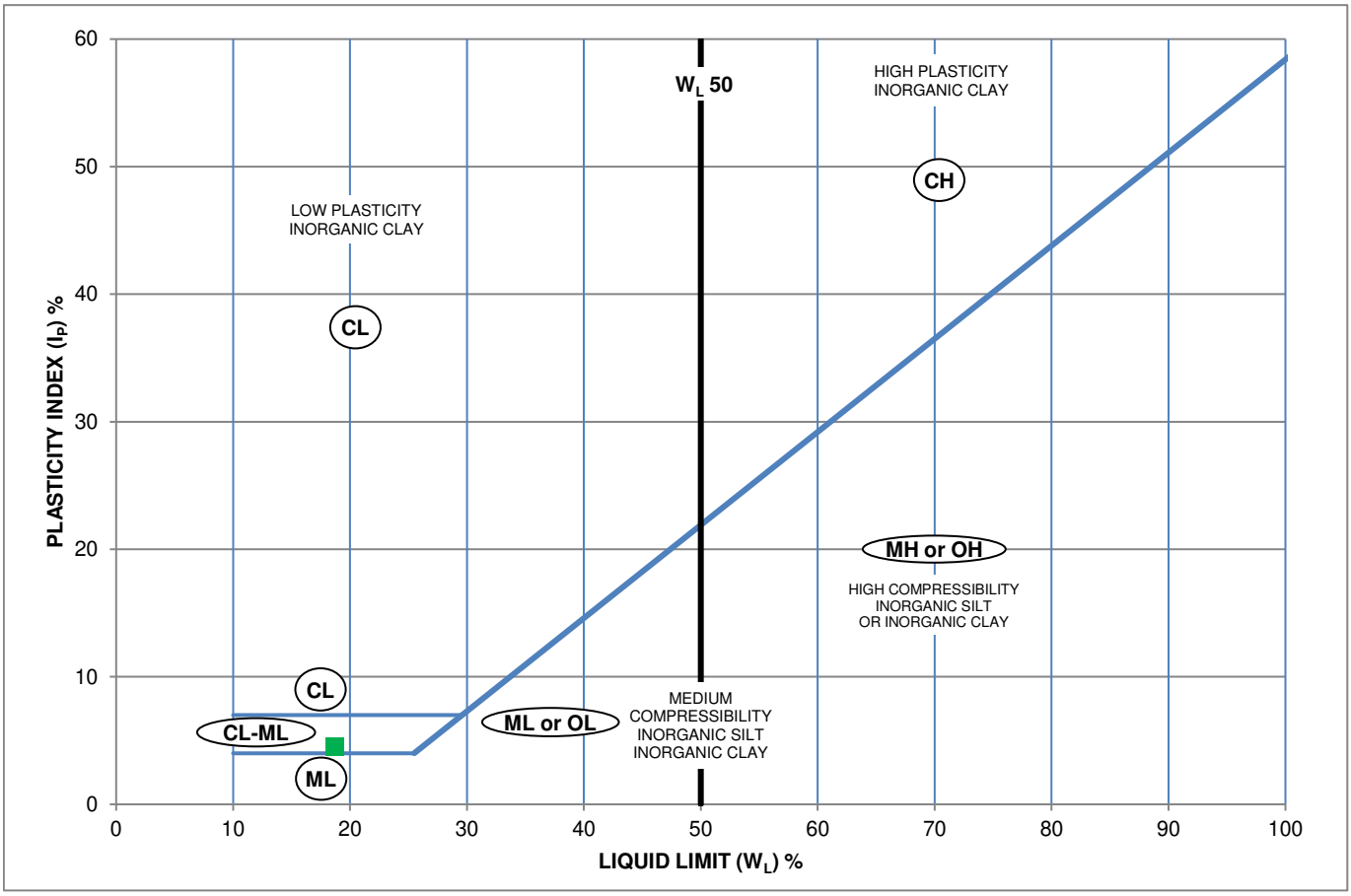
Plasticity Chart

Project Number: *22801-001* **Client:** *EFI Engineering*

Project Name: *Heron Gate Village Subdivision*

Sampled By: *Rory Ryan - Cambium Inc.* **Sample Date:** *March 26-28, 2025*

Hole No.: *BH 101-25 SS 3* **Depth:** *1.5 m to 2.1 m* **Lab Sample No:** *S-25-0555*



Symbol	Borehole	Sample	Depth	Description
■	BH 101-25	SS 3	1.5 m to 2.1 m	CL-ML

Liquid Limit (%)	Plastic Limit	Plasticity Index (%)
18.7	***14.2***	***4.5***

Additional information available upon request

Issued By: _____ *Date Issued:* *April 7, 2025*

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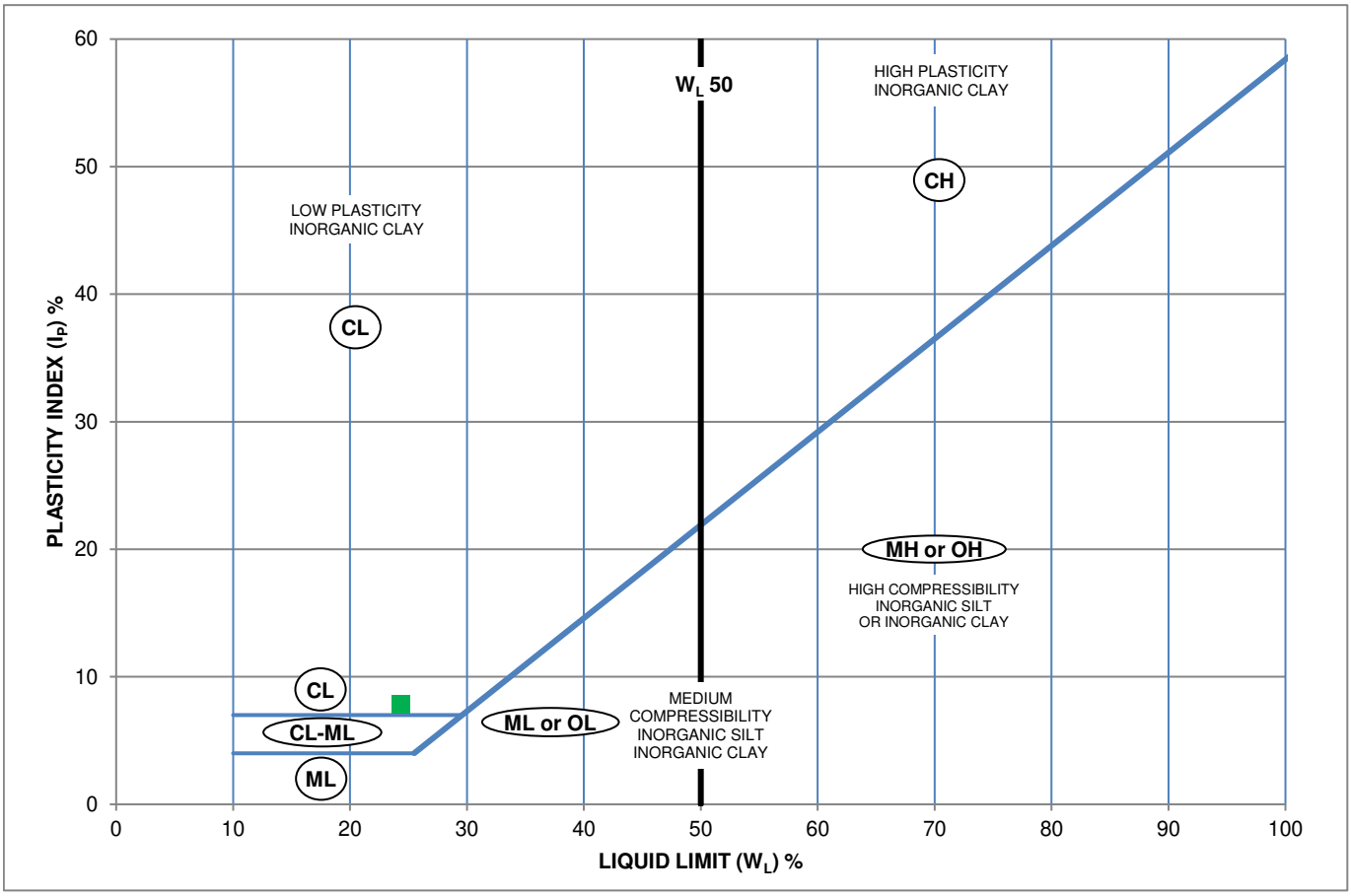
Plasticity Chart

Project Number: *22801-001* **Client:** *EFI Engineering*

Project Name: *Heron Gate Village Subdivision*

Sampled By: *Rory Ryan - Cambium Inc.* **Sample Date:** *March 26-28, 2025*

Hole No.: *BH 102-25 SS 3* **Depth:** *1.5 m to 2.1 m* **Lab Sample No:** *S-25-0557*



Symbol	Borehole	Sample	Depth	Description
■	BH 102-25	SS 3	1.5 m to 2.1 m	Low Plasticity Clay

Liquid Limit (%)	Plastic Limit	Plasticity Index (%)
24.4	***16.6***	***7.8***

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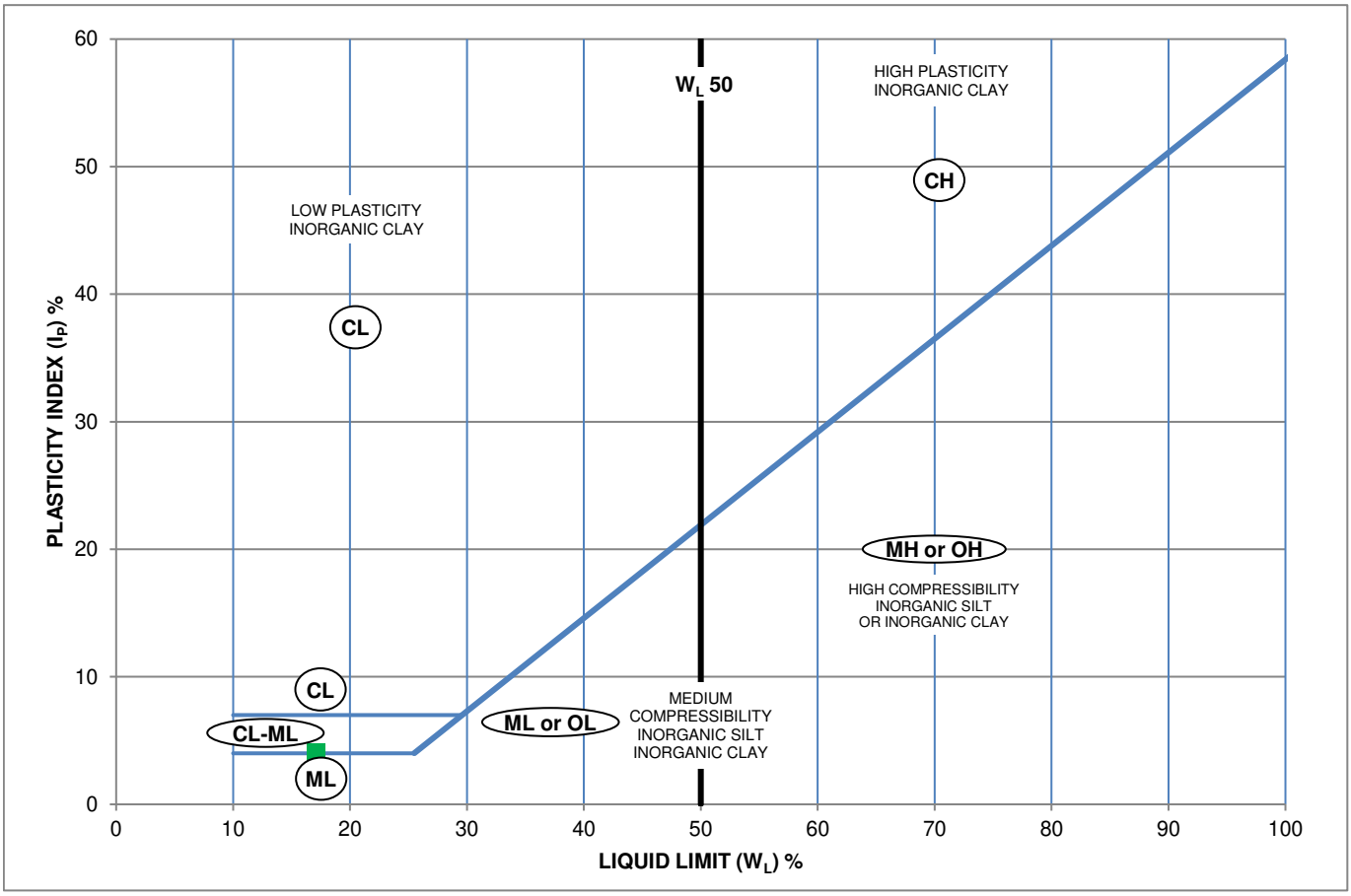
Plasticity Chart

Project Number: *22801-001* **Client:** *EFI Engineering*

Project Name: *Heron Gate Village Subdivision*

Sampled By: *Rory Ryan - Cambium Inc.* **Sample Date:** *March 27, 2025*

Hole No.: *BH 103-25 SS 5* **Depth:** *3 m to 3.7 m* **Lab Sample No:** *S-25-0559*



Symbol	Borehole	Sample	Depth	Description
■	BH 103-25	SS 5	3 m to 3.7 m	ML

Liquid Limit (%)	Plastic Limit	Plasticity Index (%)
17.1	***13.1***	***4.0***

Additional information available upon request

Issued By: _____ *Date Issued:* *April 8, 2025*

(Senior Project Manager)

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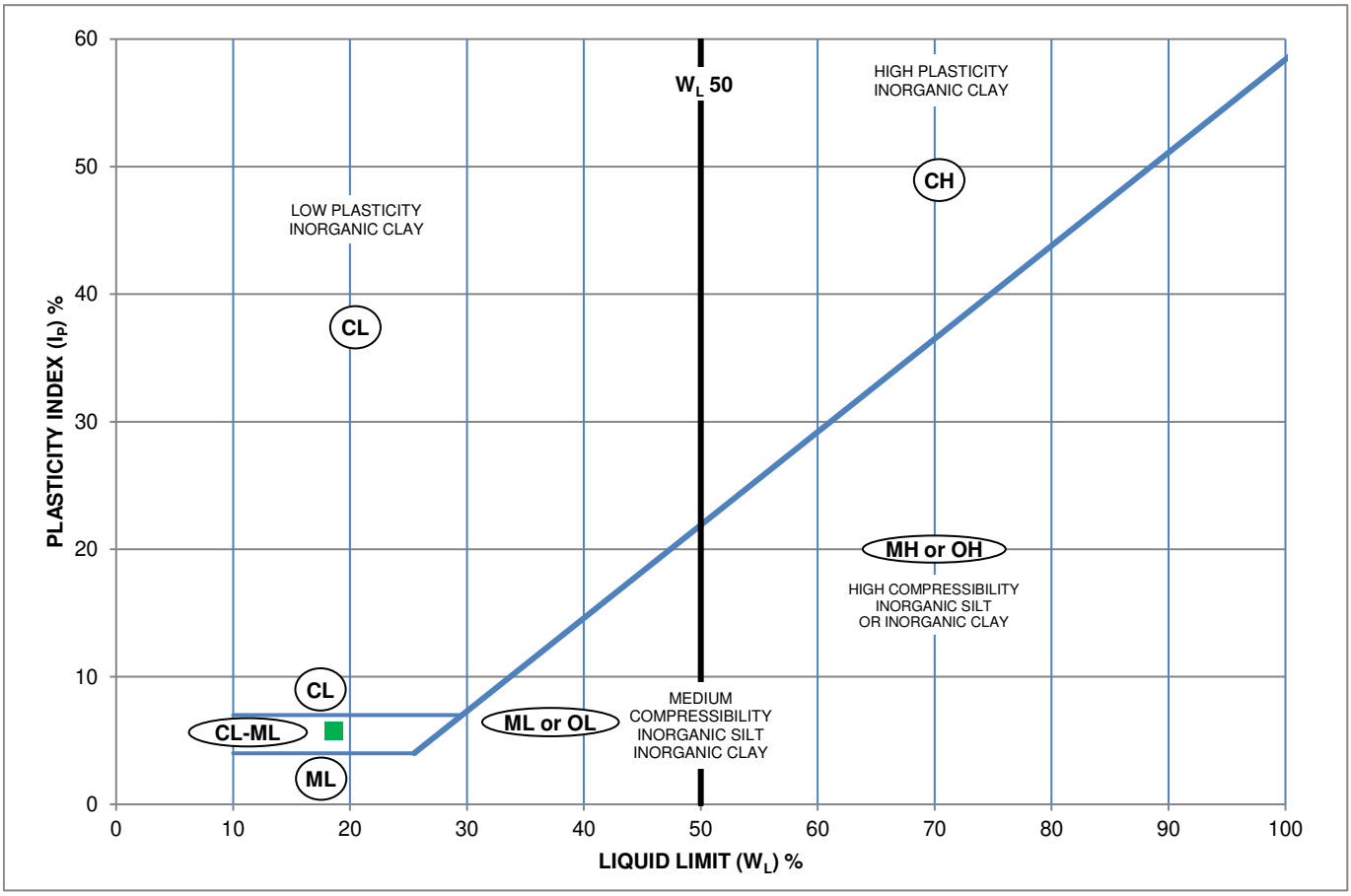
Plasticity Chart

Project Number: *22801-001* **Client:** *EFI Engineering*

Project Name: *Heron Gate Village Subdivision*

Sampled By: *Rory Ryan - Cambium Inc.* **Sample Date:** *March 26-28, 2025*

Hole No.: *BH 104-25 SS 4* **Depth:** *2.3 m to 2.9 m* **Lab Sample No:** *S-25-0561*



Symbol	Borehole	Sample	Depth	Description
■	BH 104-25	SS 4	2.3 m to 2.9 m	CL-ML

Liquid Limit (%)	Plastic Limit	Plasticity Index (%)
18.6	***12.9***	***5.7***

Additional information available upon request

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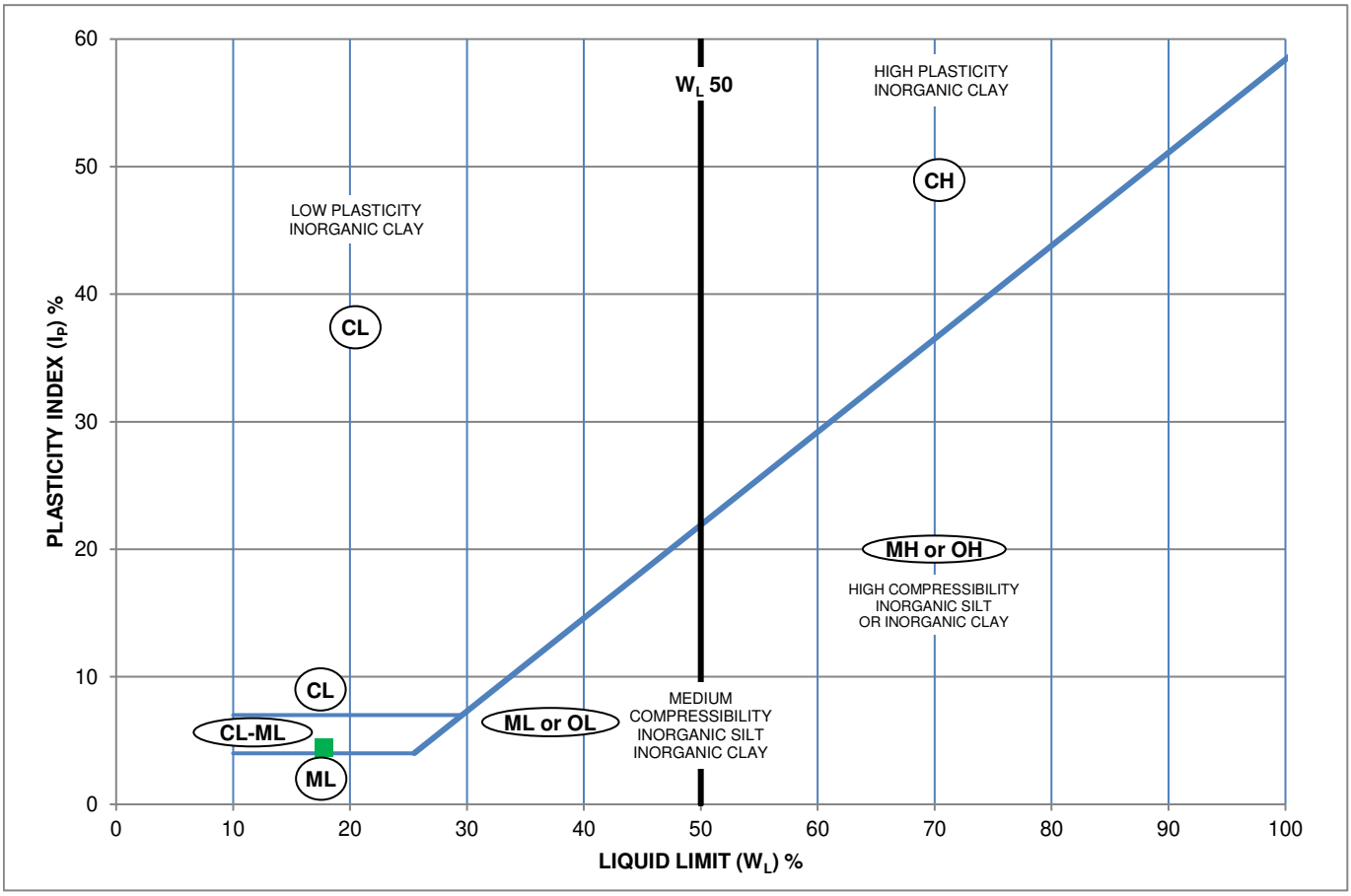
Plasticity Chart

Project Number: *22801-001* **Client:** *EFI Engineering*

Project Name: *Heron Gate Village Subdivision*

Sampled By: *Rory Ryan - Cambium Inc.* **Sample Date:** *March 26-28, 2025*

Hole No.: *BH 105-25 SS 5* **Depth:** *3 m to 3.7 m* **Lab Sample No:** *S-25-0563*



Symbol	Borehole	Sample	Depth	Description
■	BH 105-25	SS 5	3 m to 3.7 m	CL-ML

Liquid Limit (%)	Plastic Limit	Plasticity Index (%)
17.7	***13.2***	***4.5***

Additional information available upon request

Issued By: _____ *Date Issued:* *April 7, 2025*

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Appendix D

Corrosivity Testing Certificate of Analysis

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Certificate of Analysis

Cambium Inc. (Ottawa)
102-343 Preston Street
Ottawa, ON K7K 7G3
Attn: Nathan Christie

Client PO:
Project: 22801-001
Custody: 76606

Report Date: 15-Apr-2025
Order Date: 28-Mar-2025

Order #: 2513400

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2513400-01	BH105-25_0.76-1.5
2513400-02	BH103-25_1.5-2.7

Approved By:

Mark Foto, M.Sc.
Laboratory Director

PARACEL LABORATORIES LTD.

Order #: 2513400

Certificate of Analysis

Report Date: 15-Apr-2025

Client: **Cambium Inc. (Ottawa)**

Order Date: 28-Mar-2025

Client PO:

Project Description: 22801-001

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC, water extraction	31-Mar-25	31-Mar-25
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	28-Mar-25	28-Mar-25
Redox potential, soil	Subcontract - SM 2580 pH/ion meter Extraction	4-Apr-25	7-Apr-25
Resistivity	EPA 120.1 - probe, water extraction	31-Mar-25	31-Mar-25
Solids, %	CWS Tier 1 - Gravimetric	28-Mar-25	28-Mar-25
Sulphide, solid	ASTM E1918-1	4-Apr-25	4-Apr-25

PARACEL LABORATORIES LTD.

Order #: 2513400

Certificate of Analysis

Report Date: 15-Apr-2025

Client: **Cambium Inc. (Ottawa)**

Order Date: 28-Mar-2025

Client PO:

Project Description: 22801-001

	Client ID:	BH105-25_0.76-1.5	BH103-25_1.5-2.7	-	-		
	Sample Date:	27-Mar-25 09:30	27-Mar-25 14:00	-	-	-	-
	Sample ID:	2513400-01	2513400-02	-	-		
	Matrix:	Soil	Soil	-	-		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	89.2	92.9	-	-	-	-
General Inorganics							
pH	0.05 pH Units	7.55	8.54	-	-	-	-
Resistivity	0.1 Ohm.m	30.3	23.0	-	-	-	-
Anions							
Chloride	10 ug/g	24	102	-	-	-	-
Sulphate	10 ug/g	106	99	-	-	-	-
Subcontract							
Sulphide	0.02 %	0.87 [3]	0.03 [3]	-	-	-	-
REDOX Potential	6 mV	312 [1] [2]	312 [1] [2]	-	-	-	-

PARACEL LABORATORIES LTD.

Order #: 2513400

Certificate of Analysis

Report Date: 15-Apr-2025

Client: **Cambium Inc. (Ottawa)**

Order Date: 28-Mar-2025

Client PO:

Project Description: 22801-001

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions								
Chloride	ND	10	ug/g					
Sulphate	ND	10	ug/g					
General Inorganics								
Resistivity	ND	0.1	Ohm.m					

PARACEL LABORATORIES LTD.

Order #: 2513400

Certificate of Analysis

Report Date: 15-Apr-2025

Client: **Cambium Inc. (Ottawa)**

Order Date: 28-Mar-2025

Client PO:

Project Description: 22801-001

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	10	ug/g	ND			NC	35	
Sulphate	38.5	10	ug/g	39.9			3.5	35	
General Inorganics									
pH	7.28	0.05	pH Units	7.32			0.5	2.3	
Resistivity	51.7	0.1	Ohm.m	50.6			2.1	20	
Physical Characteristics									
% Solids	88.5	0.1	% by Wt.	88.5			0.1	25	

PARACEL LABORATORIES LTD.

Order #: 2513400

Certificate of Analysis

Report Date: 15-Apr-2025

Client: **Cambium Inc. (Ottawa)**

Order Date: 28-Mar-2025

Client PO:

Project Description: 22801-001

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	107	10	ug/g	ND	107	82-118			
Sulphate	138	10	ug/g	39.9	97.7	80-120			

PARACEL LABORATORIES LTD.

Order #: 2513400

Certificate of Analysis

Report Date: 15-Apr-2025

Client: **Cambium Inc. (Ottawa)**

Order Date: 28-Mar-2025

Client PO:

Project Description: 22801-001

Qualifier Notes:

Sample Qualifiers :

1: Holding time had been exceeded upon receipt of the sample at the laboratory or prior to the analysis being requested.

Applies to Samples: BH105-25_0.76-1.5, BH103-25_1.5-2.7

2: Subcontracted analysis - Testmark.

Applies to Samples: BH105-25_0.76-1.5, BH103-25_1.5-2.7

3: Subcontracted analysis - SGS

Applies to Samples: BH105-25_0.76-1.5, BH103-25_1.5-2.7

Sample Data Revisions:

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

NC: Not Calculated

Soil results are reported on a dry weight basis unlesss otherwise noted.

Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

PARAC LABORATORIE.

Paracel ID: 2513400

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K1G 4J8
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cellabs.com

Paracel Order Number (Lab Use Only): 2513400

Chain Of Custody (Lab Use Only) № 76606

Client Name: Cambium Inc	Project Ref: 22801-001
Contact Name: Nathan Christie	Quote #: /
Address: 343 Preston St, Ottawa, ON 11th floor	PO #: /
Telephone: 613-808-4182	E-mail: nathan.christie@cambium-inc.com; james.sullivan@cambium-inc.com

Page 1 of 1

Turnaround Time

☐ 1 day ☐ 3 day
☐ 2 day ☑ Regular
Date Required:

☐ REG 153/04 ☐ REG 406/19

☐ Table 1 ☐ Agri/Other ☐ Med/Fine
☐ Table 2 ☐ Res/Park ☐ Coarse
☐ Table 3 ☐ Ind/Comm
☐ Table ___
For RSC: ☐ Yes ☐ No

Other Regulation

☐ REG 558 ☐ PWQO
☐ CCME ☐ MISA
☐ SU - Sani ☐ SU - Storm
Mun:
☐ Other:

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Field Filtered	Sample Taken: Date	Sample Taken: Time	Required Analysis: Corrosivity	Redox Pot.	Sulphides
1	BH05-25_0.76-1.5	S		3		Mar.27/25	9:30 AM	X	X	X
2	BH03-25_1.5-2.7	S		3		Mar 11	2:00 PM	X	X	X
3										
4										
5										
6										
7										
8										
9										
10										

Comments:

Method of Delivery: Drop Box

Relinquished By (Sign):	Received at Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Rory Ryan	Date/Time:	Date/Time: Mar. 28 8:00	Date/Time: Mar 27 8:16
Date/Time: Mar. 27, 2025 5:20 PM	Temperature: °C	Temperature: 9.7 °C	pH Verified: ☐ By: