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Tender Addendum 1

File	Tender	Tender No.
225020	**Gross Road Culvert Replacement** **Rosseau, ON**	**T-2025-38**

Date	Owner	Tender Closing
July 23, 2025	**Township of Muskoka Lakes**	**July 31, 2025, 2:00 PM**

Message to Bidder

Instructions to Bidders

- Item 1.9 Tender Correspondence & Questions: the deadline for submitting questions has been revised to **July 28, 2025 at 10:00 AM**. The deadline for posting of addenda is revised to **July 29, 2025 at 4:00 PM**.
- The closing date remains unchanged.

Appendix B: Geotechnical Investigation Report

Attached is Appendix B:

- DRAFT Geotechnical Investigation Report – Gross Road Culvert Replacement, Township of Muskoka Lakes, ON (Cambium Inc., July 18, 2025); and,
- Soil Characterization Report – Gross Road Culvert Replacement, Muskoka Lakes, Ontario (Cambium Inc., July 18, 2025).

Schedule of Items & Prices

Attached is a revised Schedule of Items & Prices with the following changes:

- Item 4.02 Earth Excavation for Structure (Offsite Disposal, Waste, Provisional) quantity is revised to 600 m3;
- Item 4.05 Test Pits (Provisional) is added.

Special Provisions

The following clarification is provided for SP7:

- All earth excavation required to construct a worksite isolation and diversion system is to be included within the lump sum price for this item. It is the Owner's expectation this material will be stockpiled onsite and reused as part of restoration of the isolation and diversion system. Offsite disposal of any material excavated under this item or importing material for restoration will not be compensated under other items of the Contract.

The following clarification is provided for SP12:

- Payment under Item 1.12 is for material meeting Table 2.1 ICC except for SAR and EC.
- Payment under Item 4.02 is intended to cover the incremental cost of offsite disposal of material as waste above and beyond payment under item 1.12.

Attached is SP 31 to be added in Section 12 of the Tender Document.

Terms & Conditions

Except as to and to the extent that they are amended by the foregoing, all terms and conditions of the tender document remain in full force and effect, and time shall be of the essence.

Directions to Bidder

The Bidder shall:

1. sign this Addendum in the space provided below and submit this Addendum to the Owner in the same envelope as the Tender
2. enter this Addendum number in the Tender Form

Signature of Bidder

Date

3 Schedule of Items & Prices

Item	Spec	Description	Unit	Qty	Unit Price	Item Price
1		**SITE PREPERATION AND REMOVALS**				
1.01	SP2	Bonding & Insurance	LS	1		
1.02	SP3	Mobilization & Demobilization	LS	1		
1.03	SP4	Traffic Control (Road Closed)	LS	1		
1.04	SP5	Construction Layout	LS	1		
1.05	SP6	Heavy-Duty Silt Fence Barriers	m	130		
1.06	SP7	Worksite Isolation and Diversion	LS	1		
1.07	SP8	Fish Rescue	LS	1		
1.08	SP9	Dewatering Structure Excavations	LS	1		
1.09	SP10	Clearing, Grubbing and Removal of Ground Cover/Vegetation	LS	1		
1.10	SP11	Removal of Asphalt Pavement, Full Depth	m2	785		
1.11	SP12	Excess Soil Management Plan	LS	1		
1.12	SP12	Earth Excavation for Structure (offsite disposal, meets Table 2.1 ICC)	LS	1		
1.13	SP13	Removal of Culverts (all)	LS	1		
SUBTOTAL SITE PREPERATION AND REMOVALS						
2		**STRUCTURE WORKS**				
2.01	SP14	Culvert Bedding	LS	1		
2.02	SP15	Sheet Pile Cut-off Wall and Caps (Material Supplied by Owner)	ea	2		
2.03	SP16	3600 mm Diameter Polymer Coated Corrugated Steel Pipe Culvert, Round (Material Supplied by Owner)	LS	1		
2.04	SP17	Granular 'A' - Structure Backfill to Springline	t	895		
2.05	SP17	Granular 'B' Type II - Structure Backfill	t	2,680		
2.06	SP18	R-50 Rip-Rap (In Culvert Barrel)	t	160		

2.07	SP19	Reinforced Concrete Distribution Slab	LS	1		
2.08	SP20	Waterproofing (Distribution Slab)	LS	1		
SUBTOTAL STRUCTURE WORKS						
3		**ROAD WORKS**				
3.01	SP21	Granular 'B' Type II - 300 mm Road Subbase	t	400		
3.02	SP21	Granular 'A' - 150 mm Road Base & 50 mm Shoulders	t	300		
3.03	SP22	Hot Mix HL 4 (50 mm, Surface Asphalt)	t	140		
3.04	SP23	Granular Sealing	m2	340		
3.05	SP24	Form and Fill Grooves	m	18.4		
3.06	SP25	Single Rail Steel Beam Guide Rail (Type M)	m	61		
3.07	SP25	Base-Plated Guide Rail Posts (OPSD 912.249)	ea	16		
3.08	SP25	Steel Beam Energy Attenuating Terminal System (Type M, 15 m Length)	ea	4		
3.09	SP26	Widen Embankment for Steek Beam Energy Attenuating Terminal Section	ea	4		
3.10	SP18	R-10 Rip-Rap on Geotextile (on Embankments)	t	150		
3.11	SP27	Site Restoration	LS	1		
SUBTOTAL ROAD WORKS						
4		**PROVISIONAL ITEMS**				
4.01	SP12	Earth Excavation for Structure (Unsuitable Subgrade Material, Offsite Disposal, Meets Table 2.1, Provisional)	m3	300		
4.02	SP12	Earth Excavation for Structure (Offsite Disposal, Waste, Provisional) ADDENDUM 1	m3	600		
4.03	SP14	Additional Culvert Bedding Material (19 mm clear stone wrapped in geotextile, Provisional)	t	10		
4.04	SP28	Biaxial Geogrid and Geotextile (Provisional)	m2	780		
4.05	SP31	Test Pits (Provisional) ADDENDUM 1	ea	3		
SUBTOTAL PROVISIONAL ITEMS						
5		**CONTINGENCY ALLOWANCE**				
5.01	SP29	Contingency Allowance	LS	1	$ 100,000.00	$ 100,000.00

5.02	SP30	Materials Testing Allowance	LS	1	$ 25,000.00	$ 25,000.00
SUBTOTAL CONTINGENCY ALLOWANCE						**$ 125,000.00**
SUMMARY						
Subtotal (Items No.1 to No.5)						

SP31 TEST PITS

The Contractor shall perform the work in accordance with the items detailed below.

SP31.1 Scope of Work

- Immediately upon mobilization, the Contractor shall dig test pits within the existing asphalt road platform at locations selected by the Owner to a maximum depth of 3.0 m.
- The Owner's geotechnical representative will obtain soil samples from the excavated material and undertake RUSH analyses for soil quality data. Upon completion of samples, the Contractor shall backfill all test holes with salvaged material.
- The Owner anticipates results from the testing will be available within one (1) week. The Contractor shall not complete any excavating requiring stockpiling of material outside of the asphalt road platform and within 30 m of the watercourse until the analytical results are provided by the Owner. Excavation may occur up to 3.0 m depth with stockpiles on the road platform at the Contractor's convenience; however, no additional payment will be made for double-handling of material. The Contractor is required to schedule their work to accommodate the testing to be undertaken by the Owner's geotechnical representative. All testing completed by the Owner's geotechnical representative will be expedited to the extent possible.
- Upon receipt of results, the Contractor shall dispose of excavated material at an offsite location. This work will be paid under corresponding tender items as appropriate and as directed by the Contract Administrator.

SP31.2 Specifications

OPSS.MUNI 180, 206, 902

SP31.3 Measurement & Payment

Measurement for payment shall be actual quantity and the unit of measurement is each test pit excavated and backfilled, complete.

Payment for this item shall full compensation for all labour, equipment and material necessary to complete the work. No additional payment will be made due to delays incurred by the Contractor due to waiting for test results unless the response time is beyond the stipulated turnaround time for test results.

Geotechnical Investigation Report – Gross Road Culvert Replacement, Township of Muskoka Lakes, ON

July 22, 2025

Prepared for:
Tatham Engineering

Cambium Reference: 23392-001

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1.0 Introduction

This report presents the findings of a geotechnical investigation conducted by Cambium for the proposed culvert replacement on Gross Road in the Township of Muskoka Lakes, Ontario. The purpose of this report is to provide engineering comments, recommendations, and parameters for the geotechnical design aspects of the project, including construction considerations.

This document details the results of our geotechnical exploration and testing, based on an interpretation of the data available for this Site. It addresses only the geotechnical (physical) aspects of the subsurface conditions and does not cover geo-environmental considerations, which are addressed in a separate Soil Characterization Report issued by Cambium under a separate cover.

This report provides the results of the geotechnical exploration and testing and should be read in conjunction with the "*Standard Limitations*" in Section 9.0 which forms an integral part of this document. The reader's attention is specifically drawn to this information, as it is essential for the proper use and interpretation of this report. The data, interpretations and recommendations contained in this report pertain to a specific project as described in the report and are not applicable to any other project or site location. If the project is modified in concept, location, or elevation, or if the project is not initiated within eighteen months of the date of the report, Cambium should be given an opportunity to confirm that the recommendations in this report are still valid.

1.1 Reviewed Documents

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

[1] Tatham Engineering Limited – Guelph, Ontario
Gross Road Culvert Replacement Draft Plans, Township of Muskoka Lakes, File #: 225020; Drawing #: PP-1, GA-1, SD-1; May 2025.

[2] OSIM Report – RDS-BRDG-C003 Gross Rd Culvert, Provided by Tatham Engineering Limited.

1.2 Standards and Guidelines

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

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

[4] Ontario Building Code; 2024 Building Code Compendium – Volume 1.

[5] Ontario Provincial Standard Specifications (OPSS) and Drawings (OPSD).

2.0 Site and Project Description

The culvert is located on Gross Road between Aspdin Road and Hekkla Road in the Township of Muskoka Lakes (the Site) and is currently closed to traffic in both directions. The existing culvert structure consists of a double corrugated steel pipe culvert. As per the information presented in the OSIM report and following discussion with the Client, it is understood that the roadway failure observed above the culvert, resulting in a sinkhole, has been attributed to the severe deterioration and perforation of the existing culverts at and below the waterline. This deterioration led to the loss of surrounding and overlying backfill material, likely through piping and/or migration through the perforations, which ultimately undermined the roadway pavement and caused the sinkhole. It is further understood from the Client, that the subgrade below the existing culverts did not exhibit signs of failure. Two large stockpiles, one on the west side and one on the east side, blocking the roadway were observed at the time of geotechnical borehole drilling. The average measurement from the top of the existing road to the bottom of the creek on the north side of the road was measured to be ±4.4 m, with the same measurement on the south side recorded as ±4.8 m.

Based on the reviewed drawings [1] and the findings of the 2023 Ontario Structure Inspection Manual (OSIM) report [2], the existing twin 3.6 m diameter, 24.4 m long corrugated steel pipe (CSP) culverts, identified as Structure Name RDS-BRDG-C003, are to be removed and replaced by three (3) new 3.6 m diameter, 24 m long polymer-coated Structural Plate Corrugated Steel Pipe (SPCSP) culverts. The OSIM report characterized the existing culverts as being in generally fair to poor condition, with an overall structure width of 10.2 m, a roadway width of 7.0 m, and approximately 0.6 m of fill on the structure. The report specifically indicated severe corrosion and perforations at and below the waterline along the full length of the existing culverts. Details from the OSIM report noted severe corrosion and wide cracks at both culvert ends. Isolated severe corrosion, perforation, and cracking were also observed below water level on both culverts. The deteriorated state of corrosion suggested the culvert would likely require rehabilitation or replacement within a 1-5 year timeframe. Additionally, the OSIM report recommended the installation of guide rail on the approaches to improve roadside safety. The General Arrangement drawing indicates a 1.2 m clear spacing between the

proposed culverts, a minimum 150 mm thick reinforced concrete distribution slab above the culverts, and a galvanized interlocking sheeting cut-off wall at the inlet/outlet. Erosion protection is indicated as 300 mm thick R-10 riprap underlain by a geotextile. This makes the overall system a composite flexible-rigid structure.

3.0 Methodology

3.1 Borehole Investigation

Two boreholes were advanced at the Site on May 23, 2025, at predetermined locations confirmed with the Client to assess the subsurface conditions. The boreholes advanced were designated as BH101-25 and BH102-25 and were terminated at depths 16.8 m below ground surface (mbgs) and 9.8 mbgs, respectively. A borehole location plan is provided as Figure 2.

Drilling and sampling were completed using a truck-mounted drill rig operating under the supervision of a Cambium technician. The boreholes were advanced to the sampling depths by means of continuous flight solid stem augers using conventional 38-millimetre (mm) internal diameter split spoon sampling equipment driven by an automatic hammer in accordance with the SPT procedures outlined in ASTM International standard D1586: “Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils”. SPT N-values were recorded for the sampled intervals as the number of blows required to drive a split spoon sampler 305 mm into the soil, using a 63.5 kg drop hammer falling 750 mm, as per ASTM D1586 procedures. The split-spoon samplers used in the investigation limit the maximum particle size that can be sampled and tested to about 40 mm. Therefore, particles or objects that may exist within the soils that are larger than this dimension were not sampled and are not represented in the grain size distributions contained herein. The results of the field tests (i.e., SPT N -values) as presented on the Record of Borehole sheets and in subsequent sections of this report are the values measured directly in the field and are unfactored.

The SPT N values are used in this report to assess consistency of cohesive soils and relative density of non-cohesive soils. Soil samples were collected at approximately 0.75 m intervals up to a depth of 3.0 mbgs and at 1.5 m intervals thereafter.

Field vane shear testing was conducted in accordance with ASTM D2573-08 in BH101-25 and BH102-25 to estimate the in-situ shear strength of the soils encountered. The field vane utilized during the investigation was tapered at 45° on both ends, with a height of 155.2 mm and a diameter of 66.0 mm (MTO N vane standard), and the vane was hand torqued.

In addition to the SPT methodology detailed above, dynamic cone penetration testing (DCPT) was performed following the completion of augering and sampling at depths of 16.8 mbgs in BH101-25 and 9.8 mbgs in BH102-25, continuing to final depths of 22.9 mbgs and 21.0 mbgs, respectively. DCPT consists of measuring the number of blows required to advance a 51 mm diameter, 60-degree Apex cone point, screw attached to the tip of A-size rods, into the subsurface using the same energy as in the SPT method. By recording the number of blows required to drive the cone/rod assembly 305 mm into the soil, a qualitative record of in-situ consistency/relative density is obtained.

Groundwater and caving conditions were noted in the open boreholes during and upon completion of drilling. All boreholes were backfilled and sealed in accordance with Ontario Regulation (O.Reg.) 903, as amended, and the property was reinstated to pre-existing conditions.

The field work for this investigation was supervised on a full-time basis by members of Cambium's technical staff, who located the boreholes in the field, arranged for the clearance of underground utilities, observed the borehole drilling, sampling and in situ testing operations, logged the boreholes as well as examined and took custody of the recovered soil samples. The samples were identified in the field, placed in appropriate containers, labelled, and transported to our geotechnical laboratory for further visual examination by the project engineer and for laboratory testing.

The prepared borehole logs are provided in Appendix A. Site soil and groundwater conditions and our geotechnical recommendations are presented in the following sections of this report.

3.2 Site Survey

The borehole coordinates were obtained by Cambium following the investigation using a handheld GPS-enabled device. The coordinates were subsequently utilized to estimate ground surface elevations at the borehole locations based on available light detection and ranging (LiDAR) data available for the project area. The LiDAR-derived data was obtained from the Ontario Digital Terrain Model (DTM) made available by the Ontario Ministry of Natural Resources. It is noted that elevations obtained using LiDAR data are approximate.

3.3 Physical Laboratory Testing

Physical laboratory testing, including four particle size distribution analyses (LS-702,705), were completed on selected soil samples to confirm textural classification and to assess geotechnical parameters. Natural moisture content testing (LS-701) was completed on all retrieved soil samples. The physical laboratory testing results are presented in Appendix B and are discussed in Section 4.0.

3.4 Corrosivity Testing

Corrosivity testing was conducted on selected soil samples from BH101-25 (2.3 - 3 m depth) and BH102-25 (4.6 - 5 m depth). The results of the corrosivity testing are presented in Appendix C. This testing included analysis for pH, Sulphate, Sulphide, Resistivity, and Chloride content.

The pH values ranged from 7.04 to 8.05, indicating neutral to slightly alkaline soil conditions. The sulphate (SO4) content ranged from 5.2 µg/g (0.00052%) to 18 µg/g (0.0018%). Sulphide content was low (<0.01%), and calculated resistivity (2970-7140 ohms.cm) and chloride content (up to 33 µg/g) further indicated low corrosivity for buried metals.

Based on these results, compared to the American Water Works Association (AWWA) C-105 (2005) Standard, the overall corrosivity potential of the soil for buried steel elements is low, indicating that buried steel elements would not require specific additional protection from soil corrosivity. Furthermore, based on CSA A23.1 (Table 3) the measured sulphate concentrations classify the soil environment as Negligible for sulphate attack on concrete.

These recommendations are provided as guidance only; the design engineer should take the results of the laboratory testing, the potential for corrosion, and the ultimate selection of materials into consideration.

4.0 Subsurface Conditions

The stratigraphy encountered in the boreholes is indicated on the attached borehole logs in Appendix A. It is 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. 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 excavating, and the excavation process itself.

Based on the results of the borehole investigation, subsurface conditions at the Site generally consist of the surficial fill layer overlying inferred fill/reworked native soils, followed by native cohesive clayey silt to silty clay soils and non-cohesive silty sand and gravel soils.

4.1 Regional Geology

Ontario Geological Survey (OGS) quaternary geologic mapping indicates that the Site is projected to fall within the bedrock formation and is closely bordered by glaciomarine deposits which consist of silt and clay, minor sand basin and quiet water deposits. This mapping indicates that the material expected to be encountered at the site should be relatively consistent, and the main difference between any materials at site would be the mechanism for which they were deposited.

Physiographic mapping (Chapman, L.J. & Putnam, D.F., 2007) shows the Site within the clay plains formations.

4.2 Pavement Structure

Both boreholes were advanced through a layer of surficial asphalt which had an approximate thickness that ranged from 50 to 100 mm. The asphalt was underlain in both boreholes by a gravelly sand material likely used as the road base layer and a sand material as the road

subbase material. The road base layer extends to a depth of 0.3 mbgs in both boreholes and was noted as brown/grey in colour. The road subbase layer extends to the depths ranging from 0.4 to 0.8 mbgs and was noted as brown/grey in colour. In-situ moisture contents determined by laboratory testing ranged between 2.7% and 3.4% and was noted a moist during field observations. The pavement structure encountered within the Site along Gross Road is summarized in Table 1.

Table 1 Existing Pavement Structure Summary

Borehole ID	Elevation (mASL)	Asphalt Thickness (mm)	Base Thickness (mm)	Subbase Thickness (mm)	Pavement Road Base	Pavement Road Subbase
BH101-25	264.37	50	250	460	Gravelly Sand	Gravelly Sand
BH102-25	264.22	100	150	160	Gravelly Sand	Sand
Average		75	200	310		

Laboratory particle size distribution analysis was completed for two samples of the granular road base materials. The analysis results are summarized in Table 2 with details provided in Appendix B.

Table 2 Particle Size Distribution Analysis – Road Base

Borehole and Sample ID	Depth (mbgs)	Material	% Gravel	% Sand	% Silt & Clay	% Moisture Content
BH101-25 GS1B	0.3 – 0.8	Gravelly Sand trace Silt	11	86	3	2.7
BH102-25 GS1A	0.1 – 0.3	Gravelly Sand trace Silt	30	65	5	3.0

4.3 Inferred Fill Soils

Below the above-described road structure, additional non-cohesive fill soils were discovered in both boreholes advanced at the Site. The transition zone between this material, the road base materials and the underlying undisturbed native materials was delineated in the borehole logs in Appendix A at the location of a distinct change in soil composition/gradation, colour, density

as inferred by SPT N values and/or drilling observations. The inferred fill materials were encountered beneath the pavement structure and extended to the depths ranging from 4.6 to 6.1 mbgs in both boreholes. The inferred fill material was designated as a sand and silty sand material with varying amounts of clay and gravel.

Based on SPT N values recorded during sampling, the inferred fill was predominantly noted as having a very loose to dense relative density, with blow counts ranging from 2 to 48. Samples obtained in these layers were generally noted as moist to wet, with wet soils first being encountered at a depth of 2.3 mbgs in both boreholes. Natural moisture contents ranged between 2.4% and 22.6% based on laboratory testing.

4.4 Cohesive Native Soils

Underlying the inferred fill/reworked native soils, a layer of cohesive native materials was encountered at the depths ranging from 4.6 to 6.1 mbgs extending down to the depths of 9.8 to 13.4 mbgs in both boreholes advanced at the Site. These soils consisted of a sandy clay and silt composition with varying amounts of gravel and were noted as grey in colour.

SPT N values in the cohesive materials ranged from 1 to 3 blows, indicative of a very soft to soft consistency. Samples obtained in these layers were generally wetter than the plastic limit, with the natural moisture contents ranging from 11.9% to 31.2% based on laboratory testing.

Laboratory particle size distribution analyses were completed for two samples of the native cohesive soils in order to assess the soil composition. The analysis results are summarized in Table 3 with details provided in Appendix B.

Table 3 Particle Size Distribution Analysis – Cohesive Soils

Borehole and Sample ID	Depth (mbgs)	Soil	% Gravel	% Sand	% Silt	% Clay	% Moisture Content
BH102-25 SS7	6.1 – 6.7	Clayey Sandy Silt trace Gravel	1	13	60	26	36.6

Three field vane shear tests were conducted within the cohesive native soil formation in both boreholes at various depths. The results of the field vane shear test are presented in Table 4,

strength values were derived using the formulas provided in ASTM D2573-08 and the actual dimensions and properties of the employed field vane.

Table 4 Field Vane Shear Test – Cohesive Soils

Borehole ID	Depth (mbgs)	Max. Torque Natural (ft-lbs)	Max. Torque Remoulded (ft-lbs)	Peak Shear Strength, S_u (kPa)	Remolded Shear Strength, S_{ur} (kPa)	Notes
BH101-25	7.6	30	15	46.9	23.5	Hand-torqued
BH101-25	12.2	30	15	46.9	23.5	
BH102-25	7.6	25	20	39.1	31.3	

4.5 Non-Cohesive Native Soils

Below the cohesive soils describe above, a layer of non-cohesive native soils were encountered at a depth of 13.4 mbgs extending down to the augering/sampling termination depth of 15.9 mbgs in BH101-25. This layer consisted of a sandy silt mixture, containing some amounts of clay. The non-cohesive materials were grey in colour, with an SPT N value of 4, indicating a loose relative density.

Natural moisture contents determined by laboratory testing on samples obtained from the cohesive materials ranged between 24.1% and 24.5%.

DCPT was conducted from the termination of augering/sampling at 9.7 and 16.8 mbgs to a final depth of 22.9 and 21 mbgs in BH101-25 and BH102-25, respectively. Below the depths of 18.6 mbgs (BH102-15) and 21.3 mbgs (BH101-25), the values increased to a range between 23 to 52 blows being attained per 300 mm of penetration of the DCPT cone. It is noted that DCPT results should be interpreted with caution and as qualitative information, given that no direct samples can be obtained using the DCPT methodology and that frictional resistance, increasing with the depth tested by DCPT, can be expected to progressively influence the recorded blow counts required for 300 mm penetration of the DCPT cone. DCPT blow counts should not be construed as equivalent to SPT N values for design purposes.

4.6 Bedrock

Bedrock was not confirmed in any of the boreholes advanced by Cambium at the Site. The investigation works, including borehole and DCPT advancement were terminated at the depths of 21.0 and 22.9 mbgs in both boreholes, corresponding to elevations of 241.47 mASL and 243.22 mASL.

4.7 Groundwater

Wet soils were first encountered at depths of 2.3 mbgs in both boreholes, corresponding to elevations of 261.92 and 262.07 mASL.

Standing water was observed in both boreholes at depths of 2.7 mbgs and 3 mbgs corresponding to elevations of 261.67 and 261.22 mASL. Caving/sloughing of the borehole sidewalls was not observed in either borehole upon completion of drilling.

The water level observations detailed above are momentary observations made during drilling and therefore do not reflect stabilized groundwater conditions at the borehole locations. Particularly given the cohesive nature of some of the soils encountered, it is possible that the stabilized groundwater level may be higher than observed during the current investigation. Furthermore, groundwater levels at the site should be anticipated to vary between and beyond the borehole locations and to fluctuate on a seasonal basis and in response to significant precipitation or snowmelt events and changes in the level of the water surface in the river.

5.0 Geotechnical Considerations

This section presents engineering recommendations for the geotechnical aspects of the project, including the proposed SPCSP culvert replacement. These recommendations are based on our interpretation of borehole data, laboratory test results, and our understanding of the project requirements and subsurface conditions encountered.

The guidance provided is intended to support the design of flexible culvert installations and associated earthworks, considering the composite nature of the structure (flexible SPCSP pipes with a rigid distribution slab and cut-off walls). While these recommendations are offered to assist designers, subsurface conditions may vary beyond the borehole locations.

Contractors should independently assess the site conditions and the factual data from this investigation to determine the suitability of the information for their construction methods, safety planning, equipment, scheduling, and cost estimation. This report is not intended to serve as construction instructions. Cambium should be contacted if significant variations are encountered before or during construction so that findings can be reassessed if necessary.

Cambium assumes no responsibility for construction-related decisions made by contractors based solely on this report.

5.1 Design Soil Parameters

The following unfactored geotechnical design parameters are recommended for calculations related to culvert embedment, earthworks, and the design of the rigid cut-off wall:

Table 5 Design Soil Parameters

Soil Stratum	Unit Weight, γ (kN/m^3)	Effective Friction Angle, ϕ′ (degrees)	Undrained Shear Strength, Su (kPa)	SPT N-value Range	At-rest earth pressure coefficient, Ko	Active earth pressure coefficient, Ka	Passive earth pressure coefficient, Kp
Silty Sand Fill (Very Loose to Dense)	18.0 (Loose) to 20.0 (Dense)	28 (Loose) to 32 (Dense)	-	2-48	0.53-0.47	0.36-0.31	2.77-3.25

Soil Stratum	Unit Weight, γ (kN/m^3)	Effective Friction Angle, ϕ′ (degrees)	Undrained Shear Strength, Su (kPa)	SPT N-value Range	At-rest earth pressure coefficient, Ko	Active earth pressure coefficient, Ka	Passive earth pressure coefficient, Kp
Cohesive Native (Very Soft to Soft Sandy Silt/Clay)	18.0	20 (Drained)	35 (FVST Su Avg)	1-3	0.67	0.49	2.04
Non-Cohesive Native (Loose Sandy Silt)	20.0	28	-	4	0.53	0.36	2.77
Engineered Granular Fill (OPSS 1010 Granular B Type I)	21.0	32	-	-	0.47	0.31	3.25
Engineered Granular Fill (OPSS 1010 Granular B Type II or Granular A)	21.5	36	-	-	0.41	0.26	3.85

- *For cohesive soils, the undrained shear strength (Su) is critical for short-term stability and is derived from Field Vane Shear Tests. A factored drained friction angle (ϕ') may be used for long-term conditions.*
- *Lateral earth pressure coefficients (Ko,Ka,Kp) are provided primarily for the design of rigid retaining elements such as the sheet pile cut-off wall. They are not direct design inputs for the flexible SPCSP culvert barrel itself.*
- *For the "Silty Sand Fill (Very Loose to Dense)" stratum, due to its inherent variability, conservative (lower bound) strength parameters corresponding to the looser end of the encountered range should generally be adopted for design calculations where this material is load-bearing or impacts stability.*

5.2 Flexible Culvert Soil-Structure Interaction

Unlike rigid structures, flexible SPCSP culverts derive their structural strength primarily from the uniform support provided by the surrounding compacted soil envelope. The pipe itself is designed to deform under load, transferring the applied stresses to the engineered backfill

material surrounding it. This 'pipe-soil interaction' is critical for the culvert's long-term performance, resisting buckling and excessive deflection.

While the overall culvert system incorporates rigid elements such as a concrete distribution slab and a sheet pile cut-off wall, this section specifically addresses the geotechnical behavior and support requirements for the flexible SPCSP culvert pipes themselves.

Therefore, the geotechnical design recommendations for a flexible SPCSP culvert focus on:

- Proper Subgrade Preparation: To provide a stable and uniform base for bedding.
- Quality Granular Bedding: To create a firm, well-drained foundation directly beneath the pipe.
- Controlled Pipe Zone Embedment: The granular backfill immediately around the pipe must be a consistent, high-quality granular material (such as OPSS 1010 Granular B Type I or Type II). This material should be placed in maximum 200 mm loose lifts and compacted to 98% of its Standard Proctor Maximum Dry Density (SPMDD). This ensures the flexible pipe is adequately supported and can carry the imposed loads without excessive deformation. This zone acts as a structural element with the pipe.

This approach ensures the culvert performs as intended without requiring calculations for rigid wall lateral earth pressures, which are not applicable to the behavior of flexible pipe structures. Detailed specifications for subgrade, bedding, and pipe zone embedment are provided in Section 5.3.

5.3 Culvert Bedding and Pipe Zone Embedment Recommendations

The successful performance of a flexible SPCSP culvert is highly dependent on proper subgrade preparation, granular bedding, and compacted pipe zone embedment backfill. The overall system also includes a rigid distribution slab above the culverts.

It is understood that the existing road section failure is due to culvert's mechanical deterioration and subsequent material loss through piping, highlighting the critical need for proper subgrade preparation, embedment and control of groundwater.

5.3.1 Subgrade Preparation

Based on the average creek bottom depths (±4.4 m to ± 4.8m below road) and the presence of very soft to soft cohesive native soils (N = 1 – 3 blows) starting from 4.6 to 6.1 mbgs, significant subgrade preparation will be required.

All unsuitable materials must be removed from below the proposed culvert invert elevation. This includes:

- All topsoil, organic matter, and deleterious materials.
- Any very loose, highly variable, or otherwise unsuitable portions of the inferred fill soils that are not capable of providing adequate bearing support. Where inferred fill soils are encountered and confirmed through geotechnical inspection and testing to be dense and consistent, they may potentially serve as a bearing stratum for specific foundations, subject to the limitations outlined in Section 5.3.2 – provided notes below Table 6
- Any very soft or soft cohesive native soils (N = 1 – 3) that fall within or immediately below the culvert's proposed invert level. Given the very low strength and high compressibility, these soils are not considered suitable for direct bearing. Excavation should extend to a competent stratum or to a depth that allows for the placement of an engineered fill pad of sufficient thickness to distribute culvert loads to deeper, firmer strata.

The exposed subgrade should be inspected by qualified geotechnical personnel. Any soft or loose areas that cannot be uniformly compacted by proof-rolling (if applicable) should be further excavated. All excavations resulting from the removal of unsuitable materials must be backfilled with approved materials meeting the requirements for OPSS 1010 Granular B Type I or Type II. This granular fill should be placed in maximum 300 mm loose lifts and uniformly compacted to 100% of SPMDD. Any large cobbles or boulders encountered at the culvert subgrade should be removed and replaced with engineered fill.

5.3.2 Subgrade Bearing Capacity

Provided that the culvert's granular bedding is constructed on properly prepared subgrade (either competent native soils or engineered fill as specified), the following preliminary bearing capacities are provided for the subgrade underlying the granular bedding.

The final depth of excavation will be dictated by the proposed culvert invert elevation and the requirement to remove all unsuitable materials (including the very soft to soft cohesive native soils, if encountered at or near the invert). The appropriate bearing capacity for design should be selected from the table below, corresponding to the competent soil stratum encountered at the actual base of the culvert excavation.

Table 6 Preliminary Bearing Capacities for Culvert Subgrade

Borehole / Material	Soil Description	Depth (mbgs)	Approx. Elevation (mASL)	Maximum Geotechnical Reaction SLS (kPa)	Maximum Geotechnical Reaction ULS (kPa)
Engineered Fill	OPSS 1010 Granular B (Compacted to 100% SPMDD)	N/A	N/A	150	225*
BH101-25 / BH102-25	Inferred Fill (Dense Silty Sand)	0.8 - 4.6	263.5 - 259.7	100	150
BH101-25 / BH102-25	Cohesive Native (Very Soft to Soft Clayey Silt)	4.6 - 9.8	259.7 - 254.5	Not Recommended for Direct Bearing	Not Recommended for Direct Bearing
BH101-25	Non-Cohesive Native (Loose Sandy Silt)	13.4 - 15.9	251.0 - 248.5	Not Recommended for Direct Bearing	Not Recommended for Direct Bearing
Deeper / Compacted Strata	Deeper Cohesive (Very Stiff/Hard) OR Deeper Non-Cohesive (Compact/Very Dense)	Below 18.6 - 21.3	Below 245-243	250-400 (Based on DCPT N>23)	300-500 (Based on DCPT N>23)

** The recommended bearing capacities for the Engineered Fill (e.g., OPSS 1010 Granular B) and the inferred fill are conditional upon the dimensions of any rigid elements of the culvert system bearing on this stratum (e.g., the concrete distribution slab, or other concrete components). This condition is applied to prevent significant impact on the underlying very soft to soft clayey silt stratum (starting at approx. 4.6 m below ground surface i.e., elevation 259.7 mASL), which is highly compressible. The "zone of significant stress increase" refers to the area below a*

*bearing element where stress levels are materially influenced by the applied load, typically extending to 1.5 to 2.0 times the bearing element's width below its base. To ensure this zone remains within the stronger **engineered fill** and does not excessively impact the underlying very soft clay, for example, for a rigid element placed at an illustrative shallow depth of 1.0 m below finished grade (bearing on engineered granular backfill), its bearing width should generally not exceed approximately 2.4 m.*

Soils indicated as "Not Recommended for Direct Bearing" (i.e., very soft to soft cohesive native soils and loose non-cohesive native soils) are highly compressible and possess insufficient strength for direct foundation support. If encountered at the culvert's bearing level, these materials would require over-excavation and replacement with engineered granular fill or consideration of deep foundation solutions.

SLS and ULS values for the Inferred Fill are conservative given their observed variable density (very loose to dense) and potentially inconsistent nature. It is noted that Cambium will need to assess the existing fill during construction to confirm acceptance, if not accepted the fill will need to be removed and replaced with Engineered Fill per the recommendations below.

Bearing capacities for "Deeper / Compacted Strata" are estimated qualitatively based on increasing Dynamic Cone Penetration Test (DCPT) N-values recorded at depth. Final design for foundations bearing on these strata would require more specific geotechnical testing and characterization (e.g., CPT, coring (if bedrock is encountered), etc.).

5.3.3 Settlement Considerations

The existing culvert, constructed over 50 years ago, has likely allowed sufficient time for the underlying compressible soils (starting from 4.6 mbgs, elevation 259.7 mASL) to consolidate under the previously applied loads.

The proposed design includes the installation of a third culvert, which is expected to reduce the overall load to the underlying compressible soils compared to the existing two-culvert configuration. As such, the anticipated design loads are expected to be equal to or less than the current loading conditions. However, if it is determined by the design team that the proposed configuration will impose greater loads than the existing system, Cambium should be consulted to evaluate the risks related to settlement and assess the various solutions to mitigate the risk (i.e., increasing culvert diameter, a detailed settlement analysis, potential ground improvement options, etc.).

5.3.4 Granular Bedding and Pipe Zone Backfill

The material directly supporting the SPCSP culvert pipe (the bedding) and the material immediately surrounding it (the pipe zone backfill or embedment) are critical for its structural performance.

- **Bedding Material:** Geotechnical best practice for the structural bedding of flexible SPCSP culverts requires a material that provides uniform, stiff, and highly compactable support to minimize deflection and ensure long-term performance. Therefore, for the culvert bedding, Cambium strongly recommends the use of a well-graded granular material such as OPSS 1010 Granular B Type II. This material should be placed in approximately 300 mm thick lifts, shaped to receive the bottom of the pipe, and compacted to 98% of SPMDD.
- **Pipe Zone Backfill:** The pipe zone backfill (from the top of the bedding up to the underside of the 150 mm rigid distribution slab) should consist of a well-graded granular material such as OPSS 1010 Granular A or Granular B. This material should be placed carefully around the pipe in maximum 200 mm loose lifts, ensuring uniform support in the haunch areas. Each lift must be compacted to 98% of SPMDD. To avoid deflection or damage to the flexible SPCSP, heavy compaction equipment should not be used within 600 mm of the culvert pipe. Only hand-operated compaction equipment should be employed in this immediate vicinity. The granular backfill should be placed simultaneously on alternating sides of culverts to prevent differential pressures and ensure uniform embedment. Based on the design drawing, there will be granular ‘A’ backfill to culvert springline,

5.4 Earthworks and General Backfill

5.4.1 Excavation Stability

All excavations must comply with OHSA and Ontario Regulation 213/91. Given the depth of excavation required (likely 4.4 m to 4.8 m to creek bottom, plus potential deeper sub-excavation for unsuitable soils) and the presence of very loose to dense fill soils and very soft to soft cohesive native soils (N = 1 – 3), maintaining safe and stable excavation slopes will be challenging.

Temporary open cut side slopes are anticipated to be stable at inclinations no steeper than 1 horizontal to 1 vertical (1H:1V) for Type 3 soils. However, the very soft to soft cohesive native soils may behave as Type 4 soils or worse when saturated or disturbed, potentially requiring slopes of 3H:1V or flatter, or immediate support. If excavations extend below the groundwater

table (around 2.3 mbgs) without effective dewatering, soils will likely be Type 4, necessitating very flat slopes or shoring. The most conservative classification should be used if multiple soil types are present.

Given the depth of excavation, variable soil conditions, and the existing road failure, shoring (e.g., interlocking sheet piles, soldier piles) is highly likely to be required to maintain safe working conditions and control ground movements. Stockpiles should be kept away from excavation crests. Excavation slopes need regular inspection and protection from weather.

5.4.2 Dewatering Requirements

Groundwater was observed at approximately 2.3 to 3 mbgs. Given the significant excavation depths and the presence of very soft to soft cohesive native soils, extensive dewatering will be required to maintain dry and stable working conditions. The groundwater level should be lowered to at least 1 meter below the base of the excavation.

Positive dewatering methods such as perimeter trenching with sumps and pumps, well points, or eductors are highly probable. All dewatering activities must comply with applicable environmental regulations, including obtaining necessary permits from the MECP (e.g., through registration on the Environmental Activity and Sector Registry (EASR) for construction dewatering that meets specific criteria, or a Permit To Take Water (PTTW) for larger water takings). The water table may be hydraulically connected to Rosseau River, necessitating careful management.

Temporary cofferdams or diversion methods will be necessary for Rosseau River to bypass the work area during culvert replacement. Detailed design of these water management solutions should be performed by a qualified hydraulic/geotechnical engineer.

5.4.3 General Trench Backfill and Compaction

For the general backfill of the culvert trench (outside the pipe zone backfill envelope), OPSS 1010 Granular B Type I should be used as structure backfill, as indicated on the drawings [1]. This material should be placed in maximum 200 mm loose lifts and compacted to 95% of its Standard Proctor Maximum Dry Density (SPMDD) up to 1.0 m below final subgrade. The

upper 1.0 m of backfill material should be compacted to 98% of SPMDD. No frozen material, snow, or ice should be incorporated into the backfill.

5.4.4 Engineered Fill Specifications

If engineered fill is required to provide a stable subgrade for the culvert due to unsuitable native soils (e.g., replacement of very soft/soft cohesive soils), the following apply:

- 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.
- The engineered fill should extend at least 1 m horizontally beyond the culvert's bedding footprint and then transition downwards at a 1H:1V slope to a competent native stratum. The exposed edges of the engineered fill should be sloped at a maximum of 3H:1V to avoid weakening of the engineered fill edges due to slope movement. If fill is required adjacent to sloped banks (i.e., slope steeper than 3H:1V), the fill shall be placed in stepped planes to avoid a plane weakness.
- The subgrade beneath the engineered fill must be approved by geotechnical personnel.
- OPSS 1010 Granular B Type I or Type II should be placed in maximum 200 mm loose lifts, at ±2% of optimum moisture, compacted to 100% of SPMDD. 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.
- Full-time geotechnical inspection and testing are required for engineered fill.
- The final surface of the engineered fill should be protected as necessary from construction traffic, ponded water and freezing, and should be sloped to provide positive drainage for surface water during and following the construction period. During periods of freezing weather, additional soil cover should be placed above final subgrade to provide frost protection.

5.4.5 Hard Excavation (Potential Very Dense Material or Large Boulders)

If isolated occurrences of very dense or hard strata (such as cemented soil lenses, very dense till pockets, or unconfirmed bedrock protrusions), or large isolated boulders, are encountered at the required culvert subgrade elevation in a manner that creates a hard point or prevents uniform, compressible bearing for the flexible culvert, they must be entirely removed and the resulting void replaced with engineered fill. This is critical to ensure the flexible culvert relies on uniform bearing and to prevent damaging differential support. The procedure should be as follows:

1. **Boulder/Hard Material Removal and Over-Excavation:** The hard material must be completely removed. The excavation should then extend to a minimum depth of 300 mm below the deepest extent of the removed hard material, or 300 mm below the planned elevation for the bottom of the culvert bedding (whichever results in deeper excavation to accommodate the cushion).
2. **Create a Granular Cushion:** This newly created 300 mm (minimum) deep space must be filled with compacted granular material (e.g., OPSS 1010 Granular B, compacted to 95% of its SPMDD) to bring the level back up to the planned culvert bedding elevation. This creates a uniform, compressible foundation cushion.

Hard excavation methods, such as hoe-ramming, may be required and must be performed in a manner that does not compromise the stability of adjacent trench walls.

5.4.6 Frost Protection

Based on OPSD 3090.101, the design frost penetration depth for the Township of Muskoka Lakes (Zone 2) is estimated at 1.8 m. Fill within this frost zone should either match the frost susceptibility of the adjacent native soils exposed in the trench walls or consist of non-frost susceptible granular materials (e.g., OPSS granulars).

5.5 Erosion Control

Exposed slopes, especially near Rosseau River, are highly susceptible to erosion. This risk is particularly elevated if the underlying soft cohesive soils (likely present below excavation depths) become exposed due to scour or construction activities, or if uncontrolled groundwater flow leads to internal erosion and piping of backfill, as observed with the existing culverts. We recommend protecting Rosseau River banks and all disturbed areas with robust erosion control measures.

Exposed slopes, especially near Rosseau River, are highly susceptible to erosion. This risk is particularly elevated if the underlying soft cohesive soils (likely present below excavation depths) become exposed due to scour or construction activities. We recommend protecting river / creek banks and all disturbed areas with robust erosion control measures.

As per the drawing [1], inlet and outlet protection for the culvert should include “300 THICK R-10 RIP RAP ON GEOTEXTILE”. This riprap should be placed in accordance with OPSS 511 (Rip-Rap, Rock Protection and Granular Sheeting) and relevant OPSD (e.g., OPSD 810.010 - Rip-Rap Treatment for Sewer and Culvert Outlets). The riprap must be underlain by a geofabric filter layer (e.g., conforming to OPSS 1860 Class II requirements for separation/filtration fabric) or a suitable granular filter layer to prevent migration of underlying finer soils and potential undermining. The precise extent and sizing of riprap should be confirmed by a qualified hydraulic engineer based on design flow velocities.

For general embankment stabilization beyond the riprap, the embankment slopes should be covered with topsoil and vegetated (seeded/sodded) as soon as possible after completion of construction. Seeding and sodding should comply with OPSS 803 (Construction Specification for Seed and Cover) and OPSS 804 (Construction Specification for Sodding).

Temporary erosion and sediment control measures required during construction must be implemented in accordance with OPSS 805 (Construction Specification for Temporary Erosion and Sediment Control Measures) to prevent soil erosion and sediment transport into Rosseau River and adjacent areas.

5.6 Sheet Pile Cut-Off Wall Design Parameters

The proposed L150x100x10 galvanized interlocking sheeting cut-off wall shown on the drawings [1] is a rigid retaining structure requiring specific design consideration for lateral earth pressures. The design of this wall should be performed in accordance with applicable codes and standards, such as the Canadian Highway Bridge Design Code (CHBDC), or other relevant municipal/provincial guidelines for retaining structures.

Based on the corrosivity testing (Section 3.4), the soil's corrosivity potential for buried steel elements is low. This indicates that the galvanized coating on the sheet piling should perform well against soil-induced corrosion, supporting its long-term durability in this specific environment.

The following geotechnical parameters and considerations should be used for its design:

- For portions retaining fill (e.g., Engineered Granular Fill / General Trench Backfill): Use parameters for OPSS 1010 Granular B or A (from Table 5).
- For portions retaining native soils (e.g., Inferred Fill, Cohesive Native Soils, Non-Cohesive Native Soils): Use parameters for the respective soil strata (from Table 5), considering the specific soil type at the depth of interest.
- Design for "At-Rest" (Ko) conditions: If the wall is relatively rigid and does not permit significant lateral movement.
- Design for "Active" (Ka) conditions: If the wall is allowed to deflect sufficiently to mobilize active pressures (e.g., for cantilever or anchored walls with some movement).
- Design against "Passive" (Kp) conditions: For embedment depth calculations, where the soil resists wall movement.

Appropriate geotechnical resistance factors (for Limit States Design) or factors of safety (for Allowable Stress Design) must be applied to the design parameters in accordance with the selected design code.

Hydrostatic pressures from groundwater must be included in the design of the cut-off wall unless effective drainage measures (e.g., weep holes, gravel drains) are incorporated and maintained to prevent water buildup behind the wall.

The design should include comprehensive checks for the overall stability of the sheet pile wall, including:

- **External Stability:** Overturning, sliding, and bearing capacity of the base (if applicable).
- **Internal Stability:** Structural capacity of the sheet pile sections and connections.
- **Global Stability:** Overall slope stability of the retained ground mass including the wall.

5.7 Concrete Distribution Slab Durability Considerations

The proposed 150 mm minimum thick reinforced concrete distribution slab is a critical structural component that will be buried within the soil environment. For long-term durability (e.g., 75+ year design life), the concrete mix design, to be finalized by the structural engineer, should adhere to general good practice for buried concrete elements. As detailed in Section 3.4 (Corrosivity Testing), laboratory analysis indicates a negligible potential for aggressive chemical attack (e.g., sulphate attack) from the surrounding soil (classified as Negligible (S-1) in accordance with CSA A23.1). Therefore, specific provisions solely for aggressive chemical attack are not deemed necessary based on current testing.

Corrosivity testing (Section 3.4) was performed on soil samples relevant to the distribution of burial depth of slab. The results indicate:

- pH values are neutral to slightly alkaline (7.04 to 8.05).
- Sulphate (SO4) content is very low, ranging up to 18 µg/g (0.0018%).
- Sulphide content is low, and resistivity and chloride levels are favorable.

Based on these results, the soil environment is classified as Negligible (S-1) for sulphate attack on concrete in accordance with CSA A23.1 (Table 4). Therefore, the use of General Use (GU) cement is considered appropriate for the concrete mix design to resist sulphate attack.

The corrosivity testing also indicates a low potential for soil-induced corrosion of the reinforcing steel within the slab.

Beyond these specific chemical considerations, the overall quality of the concrete itself is paramount for durability in a buried environment. General durability measures, such as specifying an appropriate water-cementitious materials ratio, adequate air entrainment, sufficient compressive strength, and proper concrete cover to reinforcing steel (all in accordance with CSA A23.1 and CSA A23.2), should be followed to ensure the long-term performance and durability of the concrete in this buried environment.

5.8 Pavement Support Recommendations

For the reconstructed roadway over the culvert, the pavement structure will be directly supported by the compacted culvert backfill and the 150 mm thick reinforced concrete distribution slab [1]. This slab acts as a rigid load distributor over the flexible SPCSP culverts.

Below the distribution slab, the culvert pipe zone backfill (OPSS 1010 Granular A, 98% of SPMDD) provides support to the pipes. Above the slab, granular base and subbase layers, conforming to OPSS 1010 Granular A and Granular B respectively, should be placed over the prepared subgrade and compacted to 100% of SPMDD in maximum 200 mm loose lifts.

It is understood that the design grades for the road will not vary significantly from the present grades. Provided that the structure is backfilled as outlined previously, final restoration of the roadway pavement, as detailed on the drawings [1], is anticipated to consist of the following typical layers:

Granular Base: 150 mm of well compacted OPSS 1010 Granular A

Granular Subbase: 300 mm of well compacted OPSS 1010 Granular B

Asphalt Pavement (Over Distribution Slab): 50 mm of HL4 (Binder Course) and 40 mm of HL4 (Surface Course)

Asphalt Pavement (For Full-Depth Reconstruction and Resurfacing Areas): 50 mm of HL4

Proper subgrade preparation, drainage, and compaction of all granular layers are essential for long-term pavement performance. Some pavement distress adjacent to the construction should be expected and the actual limits of the pavement restoration should be established in the field at the time of construction.

5.9 Site Classification for Seismic Site Response

The site classification for seismic site response has been determined in accordance with Table 4.1.8.4.-A of the Ontario Building Code [3]. Based on the presence of very soft to soft cohesive native soils (N = 1 – 3) at depth, the site classification for seismic site response along the alignment may be taken as Site Class E (very soft clay/silt) or Site Class D (stiff clay/silt or dense sand/gravel) depending on the actual shear wave velocity profile, which was not measured. The DCPT results, particularly in their initial ranges at depths below the SPT intervals, generally support the presence of these soft conditions.

Given the observed soft consistency of the native cohesive soils, a cautious approach leaning towards **Site Class E** is prudent due to its implications for potential seismic ground motion amplification. Unless site-specific shear wave velocity measurements are conducted, the more conservative classification should be adopted for design.

6.0 Construction Review and Inspections

Ongoing geotechnical review and inspection are vital throughout all stages of construction due to the complex soil conditions and composite nature of the culvert system. A sufficient degree of subgrade inspections, in-situ density tests, and materials testing should be carried out to confirm that the conditions exposed are consistent with those encountered in the boreholes and to monitor conformance to the pertinent project specifications. This includes, but is not limited to:

- Subgrade inspection and approval, particularly after removal of very soft/soft cohesive soils and prior to placing any fill or concrete.
- Monitoring of excavation stability, especially in deep cuts and soft cohesive soils, and observation of shoring installation (if required).
- Monitoring dewatering effectiveness and water management around the creek.
- Full-time inspection and density testing during engineered fill placement.
- Regular in-situ density testing of all backfill and granular layers, ensuring proper compaction in the pipe zone (around the SPCSP pipes) and under the concrete distribution slab.
- Testing of concrete for the distribution slab (both plastic material in the field and set cylinder samples in a CSA certified laboratory).
- Review of sheet pile installation for the cut-off wall.

The soils at this site are sensitive to disturbance from water, construction traffic, and frost. All bearing surfaces must be approved by qualified geotechnical personnel prior to filling or concreting to confirm that strata having adequate bearing capacity have been reached and that the bearing surfaces have been properly prepared.

7.0 Limitations

The recommendations presented in this report are based on the subsurface conditions encountered at the borehole locations. Subsurface conditions are inherently variable and may differ between and beyond the borehole locations. This report was prepared specifically for the proposed culvert replacement at the Gross Road Site in the Township of Muskoka Lakes, Ontario, and is not applicable for any other project or site. This report is limited to geotechnical engineering aspects exclusively and does not include environmental assessment.

8.0 Closing

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

Respectfully submitted,

Cambium Inc.

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RG/PV/cm

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9.0 Standard Limitations

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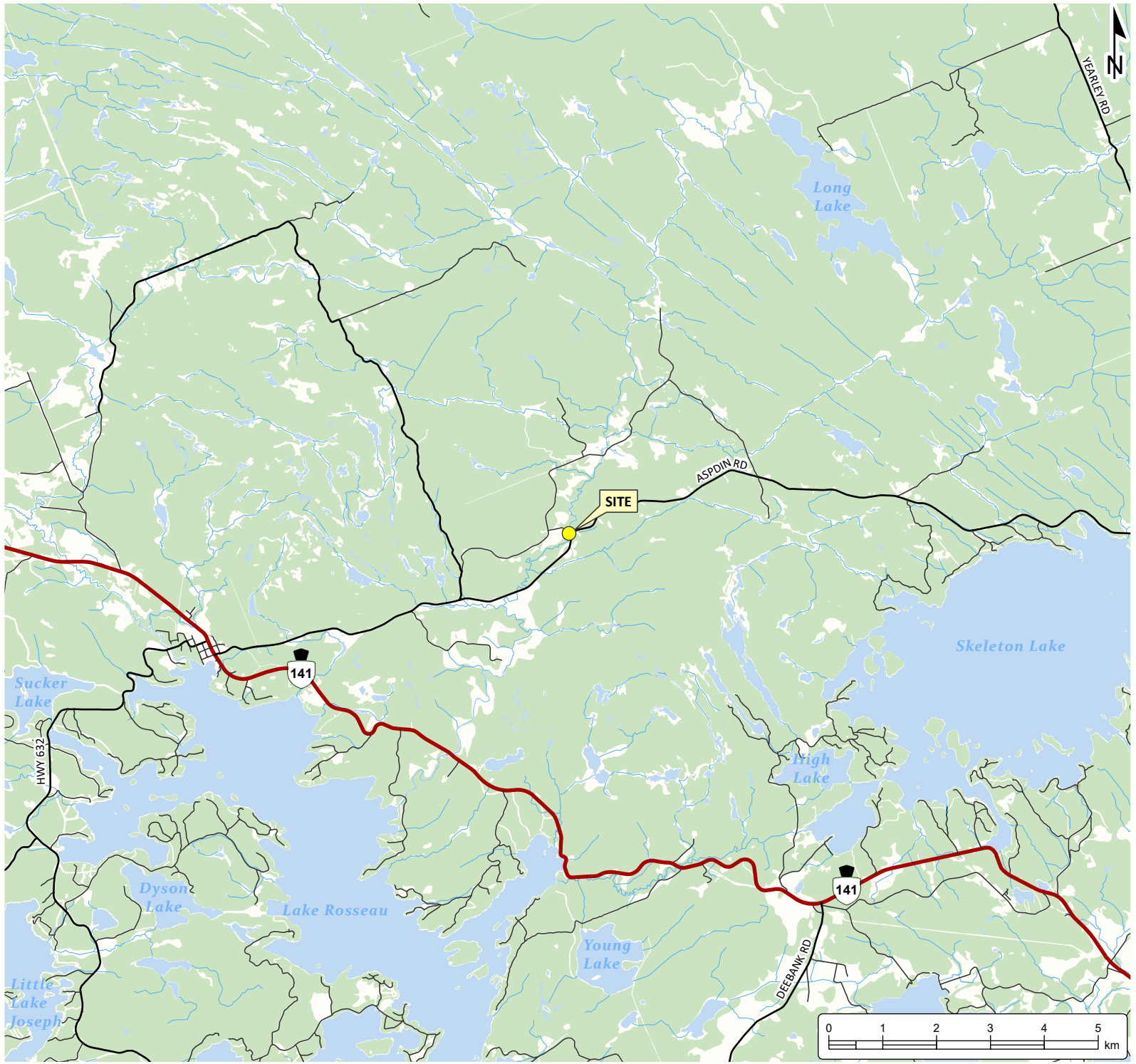
Appended Figures



GEOTECHNICAL INVESTIGATION

TATHAM ENGINEERING
Gross Road
Township of Muskoka Lakes, Ontario

LEGEND

- Highway
- Major Road
- Minor Road
- Railway
- Watercourse
- Federal Protected Areas
- Water Area
- First Nations Reserve
- Provincial Park
- Wooded Area
- Built Up Area

Notes:
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SITE LOCATION PLAN

Project No.:	Date:
23392-001	June 2025
Scale: 1:100,000	Projection: NAD 1983 UTM Zone 17N
Created by: LD	Checked by: CM
Figure: 1	

O:\GIS\MXDs\23300-23399\23392-001 Tatham-Collingwood -MSP- Gross Rd Culvert\2025-05-28 Geotechnical 23392-001.aprx

GEOTECHNICAL INVESTIGATION

TATHAM ENGINEERING
Gross Road
Township of Muskoka Lakes, Ontario

LEGEND

Borehole

Notes:
- Aerial imagery from the South Central Ontario Orthophotography Project (SCOOP) 2018 - Web Map Service.
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- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
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BOREHOLE LOCATION PLAN

Project No.:	Date:
23392-001	June 2025
Scale: 1:500	Projection: NAD 1983 UTM Zone 17N
Created by: LD	Checked by: CM
Figure: 2	

O:\GIS\MXDs\23300-23399\23392-001 Tatham-Collingwood -MSP- Gross Rd Culvert\2025-05-28 Geotechnical 23392-001.aprx

Appendix A

Borehole Logs

CAMBIUM

Client: Tatham Engineering Limited (Collingwood)
Contractor: Drill Tech Drilling Ltd.
Project No.: 23392-001
Location: Gross Road, Township of Muskoka Lakes ON

Project Name: Gross Road Culvert Replacement
Method: Truck Mounted Solid Stem Auger
Elevation: 264.37 mASL
UTM: 17 T **N:** 5014605.27 **E:** 613309.93

Log of Borehole: BH101-25
Page: 1 of 4
Date Completed: May 23, 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
264.4	0	**ASPHALT:** ~ 50 mm thick	264.32 / 0.05	1A	GB			3.4%			
263.9	0.5	**FILL:** gravelly SAND: brown/grey, moist, trace silt [ROAD BASE]	264.07 / 0.30	1B	GB			2.7%			
263.4	1	**FILL:** gravelly SAND: brown/grey, moist, trace silt [ROAD SUBBASE]	263.61 / 0.76	2	SS	60	35	2.9%	35		
262.9	1.5	**FILL:** SAND: brown/grey, moist, dense, some gravel, trace silt									
262.4	2	- compact		3	SS	75	28	2.4%	28		
261.9	2.5	- wet		4	SS	50	13	4.1%	13		
261.4	3		261.32 / 3.05								
260.9	3.5	**FILL:** SAND and SILT: grey, wet, very loose, trace clay, some gravel, trace organics		5	SS	33	2	19.1%	2		
260.4	4										
259.9	4.5	- loose		6	SS	92	8	22.6%	8		
259.4	5										
258.9	5.5										
258.4	6		258.27 / 6.10								
257.9	6.5	**(CH) sandy CLAY and SILT:** grey, w>PL, very soft		7	SS	100	2	46%	2		
257.4	7										
256.9			256.87 / 7.50								

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
GB1B	11	86	3	
SS6	9	44	41	6

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

CAMBIUM

Client: Tatham Engineering Limited (Collingwood)
Contractor: Drill Tech Drilling Ltd.
Project No.: 23392-001
Location: Gross Road, Township of Muskoka Lakes ON

Project Name: Gross Road Culvert Replacement
Method: Truck Mounted Solid Stem Auger
Elevation: 264.37 mASL
UTM: 17 T **N:** 5014605.27 **E:** 613309.93

Log of Borehole: BH101-25
Page: 2 of 4
Date Completed: May 23, 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
256.9	7.5		**(CH) sandy CLAY and SILT:** grey, w>PL, very soft								Field vane test at 7.6 mbgs. Hand-torqued. Peak shear strength: 46.9 kPa. Remolded shear strength: 23.5 kPa.
256.4	8			8	GB			41.8%			
255.9	8.5										
255.4	9										
254.9	9.5		- decrease in sand	9	SS	50	2		2		
254.4	10										
253.9	10.5										
253.4	11			10	SS	50	1	35.5%	1		
252.9	11.5										
252.4	12										
251.9	12.5			11	GB			44%			Field vane test at 12.2 mbgs. Hand-torqued. Peak shear strength: 46.9 kPa. Remolded shear strength: 23.5 kPa.
251.4	13										
250.9	13.5										
250.65	13.72		**(ML) sandy SILT:** grey, wet, loose, some clay								
250.4	14			12	SS	50	4	24.5%	4		
249.9	14.5										
249.37	15.00										
249.4											

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
GB1B	11	86	3	
SS6	9	44	41	6

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

CAMBIUM

Client: Tatham Engineering Limited (Collingwood)
Contractor: Drill Tech Drilling Ltd.
Project No.: 23392-001
Location: Gross Road, Township of Muskoka Lakes ON

Project Name: Gross Road Culvert Replacement
Method: Truck Mounted Solid Stem Auger
Elevation: 264.37 mASL
UTM: 17 T **N:** 5014605.27 **E:** 613309.93

Log of Borehole: BH101-25
Page: 3 of 4
Date Completed: May 23, 2025

SUBSURFACE PROFILE			SAMPLE							
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
249.4 — 15										
248.9 — 15.5		**(ML) sandy SILT:** grey, wet, loose, some clay	13	SS	50	4	24.1%	4		Augering and Split Spoon Sampling terminated at 15.2 mbgs in sandy silt. Borehole caving not observed. Wet soils first encountered at 2.3 mbgs. Standing water observed at 2.7 mbgs.
		248.52 / 15.85								
248.4 — 16										
247.9 — 16.5										
247.4 — 17			14	DCPT		7		7		Dynamic Cone Penetration Testing commenced at 16.8 mbgs and terminated at 22.9 mbgs.
			15	DCPT		15		15		
246.9 — 17.5			16	DCPT		19		19		
			17	DCPT		22		22		
246.4 — 18			18	DCPT		24		24		
			19	DCPT		20		20		
245.9 — 18.5			20	DCPT		23		23		
			21	DCPT		20		20		
245.4 — 19			22	DCPT		26		26		
			23	DCPT		22		22		
244.9 — 19.5			24	DCPT		22		22		
			25	DCPT		16		16		
244.4 — 20			26	DCPT		16		16		
			27	DCPT		18		18		
243.9 — 20.5			28	DCPT		19		19		
			29	DCPT		23		23		
243.4 — 21			30	DCPT		25		25		
			31	DCPT		52		52		
242.9 — 21.5										
242.4 — 22										
241.9										

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
GB1B	11	86	3	
SS6	9	44	41	6

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

CAMBIUM

Client: Tatham Engineering Limited (Collingwood)
Contractor: Drill Tech Drilling Ltd.
Project No.: 23392-001
Location: Gross Road, Township of Muskoka Lakes ON

Project Name: Gross Road Culvert Replacement
Method: Truck Mounted Solid Stem Auger
Elevation: 264.37 mASL
UTM: 17 T **N:** 5014605.27 **E:** 613309.93

Log of Borehole: BH101-25
Page: 4 of 4
Date Completed: May 23, 2025

SUBSURFACE PROFILE				SAMPLE							
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
241.9 / 22.5			32	DCPT		33		33		
241.4 / 23			33	DCPT		39		39		
240.9 / 23.5										
240.4 / 24										
239.9 / 24.5										
239.4 / 25										
238.9 / 25.5										
238.4 / 26										
237.9 / 26.5										
237.4 / 27										
236.9 / 27.5										
236.4 / 28										
235.9 / 28.5										
235.4 / 29										
234.9 / 29.5										
234.4										

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
GB1B	11	86	3	
SS6	9	44	41	6

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

CAMBIUM

Client: Tatham Engineering Limited (Collingwood)
Contractor: Drilltech Drilling Ltd.
Project No.: 23392-001
Location: Gross Road, Township of Muskoka Lakes ON

Project Name: Gross Road Culvert Replacement
Method: Truck Mounted Solid Stem Auger
Elevation: 264.22 mASL
UTM: 17 T **N:** 5014612.03 **E:** 613290.03

Log of Borehole: BH102-25
Page: 1 of 3
Date Completed: May 23, 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
264.2	0	**ASPHALT:** ~ 102 mm thick	264.12	1A	GB			3%			
			0.10	1B	GB			3%			
		FILL: gravelly SAND: brown/grey, moist, trace silt [ROAD BASE]	263.97								
263.7	0.5		0.25								
		FILL: SAND: brown/grey, moist, some gravel, some silt [ROAD SUBBASE]	263.81								
263.2	1		0.41	2	SS	75	48	4.6%	48		
		FILL: SAND: brown/grey, moist, dense, some gravel, some silt									
262.7	1.5										
		- compact		3	SS	83	25	4.9%	25		
262.2	2										
			261.93								
261.7	2.5	**FILL:** SILTY SAND: grey, wet, loose, trace clay, trace gravel	2.29	4	SS	100	7	20.9%	7		
261.2	3										
		- compact		5	SS	100	13	16.6%	13		
260.7	3.5										
260.2	4										
259.7	4.5		259.65								
		(CL) SILTY CLAY: grey, w>PL, soft, some sand, trace gravel	4.57	6	SS	100	3	47.9%	3		
259.2	5										
258.7	5.5										
258.2	6		258.12								
		(ML) sandy CLAYEY SILT: grey, w>PL, very soft, trace gravel	6.10	7	SS	100	1	36.6%	1		
257.7	6.5										
257.2	7										
			256.72								
256.7			7.50								

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
GS1A	30	65	5	
SS7	1	13	60	26

Logged By: AM
Input By: AM

Client: Tatham Engineering Limited (Collingwood)
Contractor: Drilltech Drilling Ltd.
Project No.: 23392-001
Location: Gross Road, Township of Muskoka Lakes ON

Project Name: Gross Road Culvert Replacement
Method: Truck Mounted Solid Stem Auger
Elevation: 264.22 mASL
UTM: 17 T **N:** 5014612.03 **E:** 613290.03

Log of Borehole: BH102-25
Page: 2 of 3
Date Completed: May 23, 2025

Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) / % Moisture (25 50 75)	Shear Strength Cu, kPa (20 40 60 80) / SPT (N) (20 40 60 80)	Well Installation	Log Notes
256.7	7.5		**(ML) sandy CLAYEY SILT:** grey, w>PL, very soft, trace gravel								Field vane test at 7.6 mbgs. Hand-torqued. Peak shear strength: 39.1 kPa. Remolded shear strength: 31.3 kPa.
256.2	8			8	GB			43.3%			
255.7	8.5										
255.2	9										
254.7	9.5			9	SS	83	2	60.8%	2		Augering and Split Spoon Sampling terminated at 9.7 mbgs in sandy clay and silt. Borehole caving not observed. Wet soils first encountered at 2.3 mbgs. Standing water observed at 3.0mbgs.
			254.47 / 9.75								Dynamic Cone Penetration Testing commenced at 9.7 mbgs and terminated at 21.0 mbgs.
254.2	10			10	DCPT		1		1		
				11	DCPT		3		3		
253.7	10.5			12	DCPT		2		2		
				13	DCPT		2		2		
253.2	11			14	DCPT		3		3		
				15	DCPT		3		3		
252.7	11.5			16	DCPT		3		3		
				17	DCPT		3		3		
252.2	12			18	DCPT		4		4		
				19	DCPT		4		4		
251.7	12.5			20	DCPT		5		5		
				21	DCPT		9		9		
251.2	13			22	DCPT		8		8		
				23	DCPT		15		15		
250.7	13.5			24	DCPT		10		10		
				25	DCPT		10		10		
250.2	14			26	DCPT		10		10		
249.7	14.5										
249.2											

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
GS1A	30	65	5	
SS7	1	13	60	26

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

CAMBIUM

Client: Tatham Engineering Limited (Collingwood)
Contractor: Drilltech Drilling Ltd.
Project No.: 23392-001
Location: Gross Road, Township of Muskoka Lakes ON

Project Name: Gross Road Culvert Replacement
Method: Truck Mounted Solid Stem Auger
Elevation: 264.22 mASL
UTM: 17 T **N:** 5014612.03 **E:** 613290.03

Log of Borehole: BH102-25
Page: 3 of 3
Date Completed: May 23, 2025

SUBSURFACE PROFILE			SAMPLE								
Elevation (m) / Depth	Lithology	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
249.2 / 15			27	DCPT		11		11		
248.7 / 15.5			28	DCPT		23		23		
			29	DCPT		19		19		
248.2 / 16			30	DCPT		24		24		
			31	DCPT		22		22		
247.7 / 16.5			32	DCPT		26		26		
			33	DCPT		19		19		
247.2 / 17			34	DCPT		20		20		
			35	DCPT		18		18		
246.7 / 17.5			36	DCPT		25		25		
			37	DCPT		22		22		
246.2 / 18			38	DCPT		20		20		
			39	DCPT		27		27		
245.7 / 18.5			40	DCPT		25		25		
			41	DCPT		25		25		
245.2 / 19			42	DCPT		31		31		
			43	DCPT		26		26		
244.7 / 19.5			44	DCPT		37		37		
			45	DCPT		42		42		
244.2 / 20			46	DCPT		50		50		
243.7 / 20.5										
243.2 / 21										
242.7 / 21.5										
242.2 / 22										
241.7										

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
GS1A	30	65		5
SS7	1	13	60	26

Logged By: AM
Input By: AM

Appendix B

Soil Laboratory Testing Results

Grain Size Distribution Chart

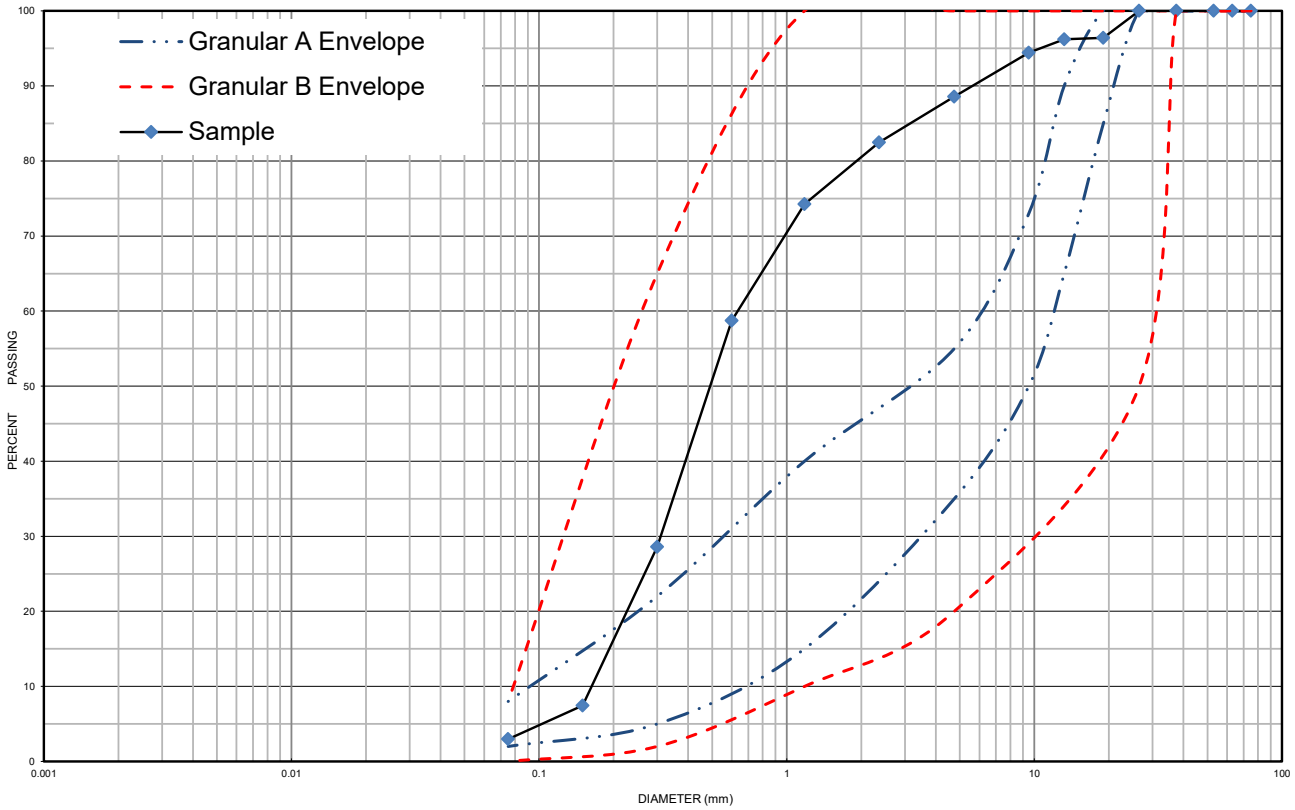
Project Number: *23392-001* **Client:** *Tatham Engineering Limited - Collingwood*

Project Name: *Gross Road Culvert Replacement*

Sample Date: *May 23, 2025* **Sampled By:** *Abigail Mackle - Cambium Inc.*

Location: *BH 101-25 GS 1B* **Depth:** *0.3 m to 0.8 m* **Lab Sample No:** *S-25-0827*

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	GS 1B	0.3 m to 0.8 m	11	86	3		2.7

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Gravelly Sand trace Silt	SP	0.620	0.310	0.165	3.76	0.94

Additional information available upon request

Issued By: _____ *Date Issued:* *June 5, 2025*

(Senior Project Manager)

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Grain Size Distribution Chart

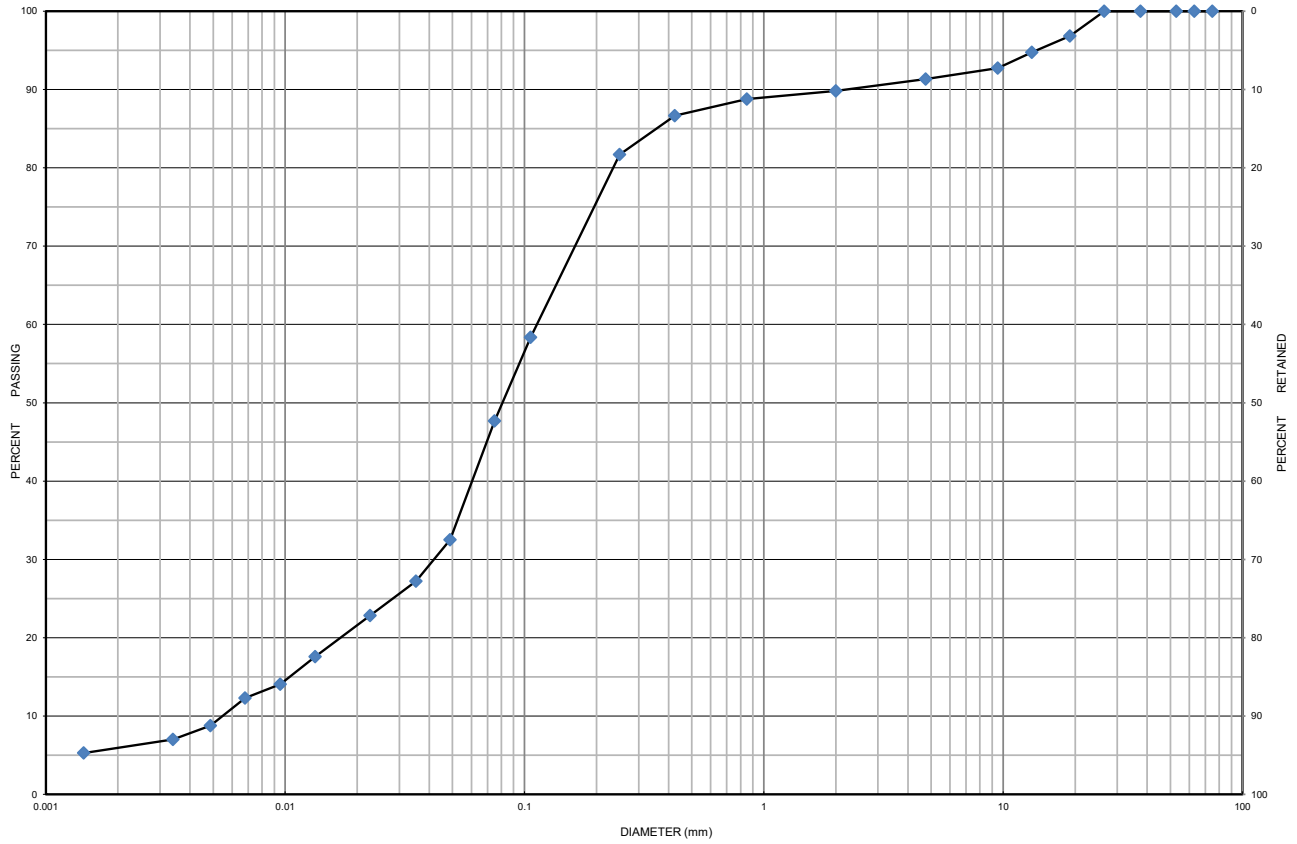
Project Number: *23392-001* **Client:** *Tatham Engineering Limited - Collingwood*

Project Name: *Gross Road Culvert Replacement*

Sample Date: *May 23, 2025* **Sampled By:** *Abigail Mackle - Cambium Inc.*

Location: *BH 101-25 SS 6* **Depth:** *4.6 m to 5.2 m* **Lab Sample No:** *S-25-0829*

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 6	4.6 m to 5.2 m	9	44	41	6	22.6

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Sand and Silt some Gravel trace Clay	SM	0.1200	0.0420	0.0054	22.22	2.72

Additional information available upon request

Issued By: _____ *Date Issued:* *June 5, 2025*

(Senior Project Manager)

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Grain Size Distribution Chart

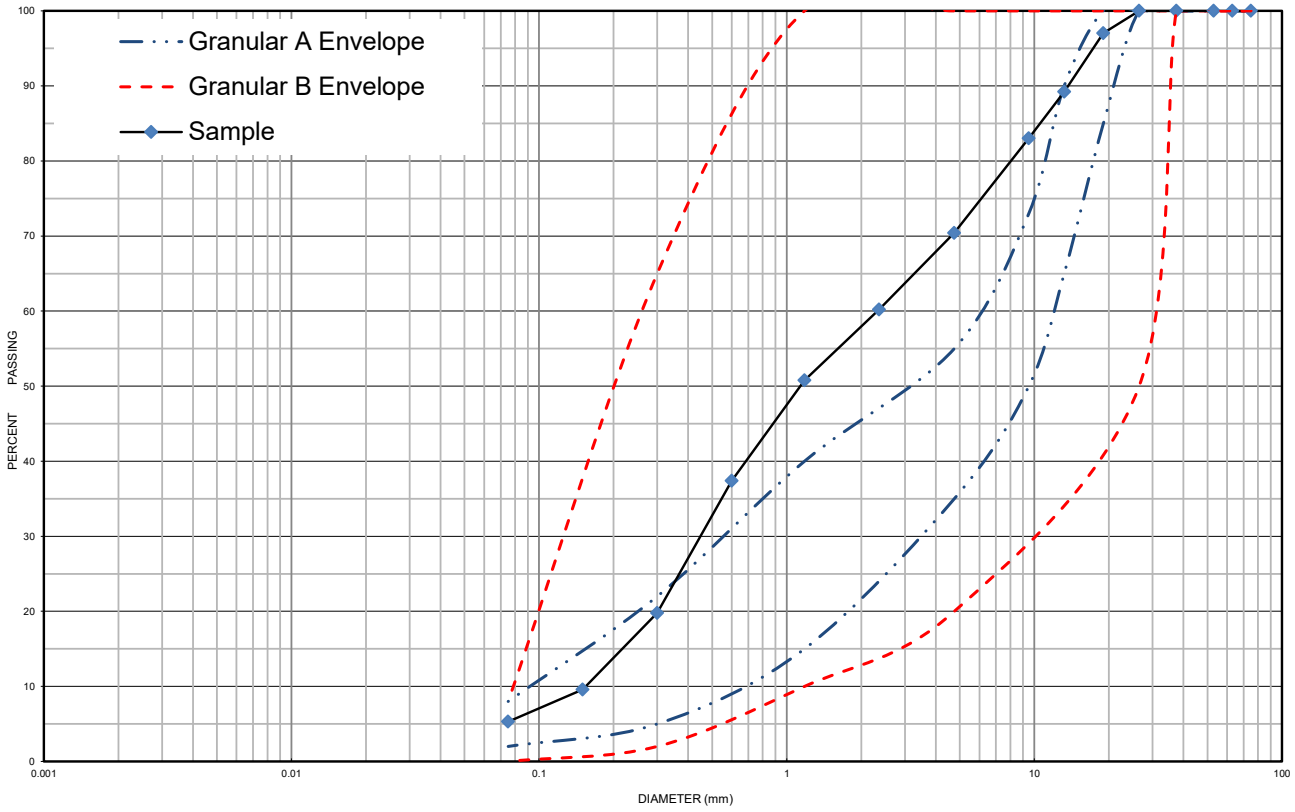
Project Number: *23392-001* **Client:** *Tatham Engineering Limited - Collingwood*

Project Name: *Gross Road Culvert Replacement*

Sample Date: *May 23, 2025* **Sampled By:** *Abigail Mackle - Cambium Inc.*

Location: *BH 102-25 GS 1A* **Depth:** *0.1 m to 0.3 m* **Lab Sample No:** *S-25-0826*

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	GS 1A	0.1 m to 0.3 m	30	65	5		3.0

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Gravelly Sand trace Silt	SW	2.400	0.440	0.165	14.55	0.49

Additional information available upon request

Issued By: _____ *Date Issued:* *June 5, 2025*

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Grain Size Distribution Chart

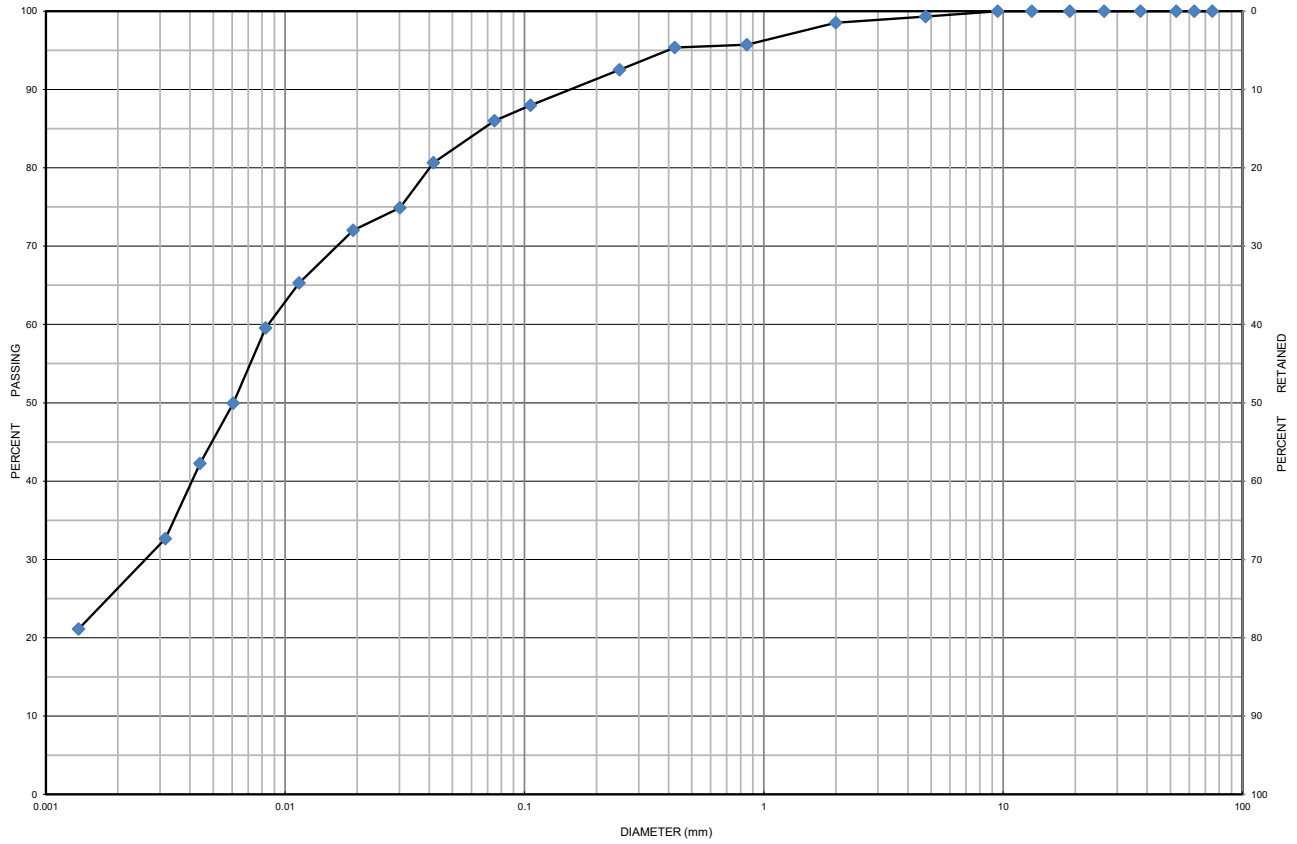
Project Number: *23392-001* **Client:** *Tatham Engineering Limited - Collingwood*

Project Name: *Gross Road Culvert Replacement*

Sample Date: *May 23, 2025* **Sampled By:** *Abigail Mackle - Cambium Inc.*

Location: *BH 102-25 SS 7* **Depth:** *6.1 m to 6.7 m* **Lab Sample No:** *S-25-0828*

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 7	6.1 m to 6.7 m	1	13	60	26	36.6

Description	Classification	D_{60}	D_{30}	D_{10}	C_u	C_c
Clayey Sandy Silt trace Gravel	ML	0.0088	0.0026	-	-	-

Additional information available upon request

Issued By: _____ *Date Issued:* *June 5, 2025*

(Senior Project Manager)

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Moisture Content

Project Number: 23392-001
Project Name: Gross Road Culvert Replacement
Client: Tatham Engineering Limited - Collingwood
Date Taken: 2025-05-23

Lab Number: S-25-0825
Date Tested: 2025-05-30
Tested By: I. Meldrum

Borehole Number	Sample Number	Sample Depth (m)	Water Weight (g)	Water Content (%)	Additional Observations
101	01A	0.05-0.30	8.7	3.4	
101	01B	0.25-0.76	43.9	2.7	NR
101	02	0.76-1.40	6.4	2.9	
101	03	1.52-2.13	5.3	2.4	
101	04	2.29-2.90	11.5	4.1	
101	05	3.05-3.66	48.2	19.1	NR
101	06	4.57-5.18	208.9	22.6	NR
101	07	6.10-6.71	82.9	46.0	
101	08	7.62-8.23	96.2	41.8	
101	10	10.67-11.28	58.9	35.5	
101	11	12.19-12.80	70.4	44.0	
101	12	13.72-14.33	40.8	24.5	
101	13	15.24-15.85	51.0	24.1	
102	01A	0.10-0.25	45.6	3.0	NR
102	01B	0.25-0.30	7.3	3.0	
102	02	0.76-1.37	11.5	4.6	
102	03	1.52-2.13	11.2	4.9	
102	04	2.29-2.90	52.9	20.9	
102	05	3.05-3.66	47.0	16.6	
102	06	4.57-5.18	74.5	47.9	
102	07	6.10-6.71	74.2	36.6	NR
102	08	7.62-8.23	99.0	43.3	
102	09	9.14-9.75	106.0	60.8	

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

Appendix C

Corrosivity Laboratory Testing Results

FINAL REPORT

CA40339-MAY25 R1

23392-001

Prepared for

Cambium Inc.

FINAL REPORT

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	Cambium Inc.	Project Specialist	Brad Moore Hon. B.Sc
		Laboratory	SGS Canada Inc.
Address	135 Bayfield St, Suite 102 Barrie, ON L4M 3B3. Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Chris Malliaros	Telephone	705-652-2143
Telephone	705-719-0700	Facsimile	705-652-6365
Facsimile	705-742-7907	Email	brad.moore@sgs.com
Email	Chris.Malliaros@cambium-inc.com; file@cambium-inc.com; ES	SGS Reference	CA40339-MAY25
Project	23392-001	Received	05/30/2025
Order Number		Approved	06/06/2025
Samples	Soil (2)	Report Number	CA40339-MAY25 R1
		Date Reported	06/06/2025

COMMENTS

Temperature of Sample upon Receipt: 4 degrees C
Cooling Agent Present:yes
Custody Seal Present:yes

Chain of Custody Number:044907

Corrosivity Index is based on the American Water Works Corrosivity Scale according to AWWA C-105. An index greater than 10 indicates the soil matrix may be corrosive to cast iron alloys.

SIGNATORIES

Brad Moore Hon. B.Sc

TABLE OF CONTENTS

FINAL REPORT

CA40339-MAY25 R1

Client: Cambium Inc.
Project: 23392-001
Project Manager: Chris Malliaros
Samplers: Abby Mackie

MATRIX: SOIL

Sample Number	5	6
Sample Name	BH101-25_2.3-2.9	BH102-25_4.6-5.2
Sample Matrix	Soil	Soil
Sample Date	23/05/2025	23/05/2025

Parameter	Units	RL		Result	Result
Corrosivity Index					
Corrosivity Index	none	1		2	2
pH	pH Units	0.05		8.05	7.04
Soil Redox Potential	mV	no		282	225
Sulphide (Na2CO3)	%	0.01		< 0.01	< 0.01
Resistivity (calculated)	ohms.cm	-9999		2970	7140
General Chemistry					
Conductivity	uS/cm	2		337	140
Metals and Inorganics					
Sulphate	µg/g	0.4		5.2	18
Other (ORP)					
Chloride	µg/g	0.4		9.1	33

FINAL REPORT

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENV]IC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chloride	DIO0012-JUN25	µg/g	0.4	<0.4	12	35	98	80	120	96	75	125
Sulphate	DIO0012-JUN25	µg/g	0.4	<0.4	4	35	101	80	120	99	75	125

Carbon/Sulphur

Method: ASTM E1915-07A | Internal ref.: ME-CA-[ENV]ARD-LAK-AN-020

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Sulphide (Na2CO3)	ECS0007-JUN25	%	0.01	< 0.01								

Conductivity

Method: SM 2510 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0076-JUN25	uS/cm	2	< 2	0	20	100	90	110	NA		

FINAL REPORT

QC SUMMARY

pH

Method: SM 4500 I Internal ref.: ME-CA-[ENV]EWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0076-JUN25	pH Units	0.05	NA	0		100			NA		

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Results relate only to the sample tested.
Data reported represent the sample as submitted to SGS. Solid samples expressed on a dry weight basis.
"Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.
Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the "Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act and Excess Soil Quality" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated.

SGS Canada Inc. statement of conformity decision rule does not consider uncertainty when analytical results are compared to a specified standard or regulation.

This report supersedes all previous versions.

-- End of Analytical Report --

Request for Laboratory Services and CHAIN OF CUSTODY

No: 044907

Industries & Environment - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

Page _____ of _____

Laboratory Information Section - Lab use only

Received By: Ari Coodyman
Received Date: 05/30/25 (mm/dd/yy)
Received Time: 15:15 (hr : min)
Received By (signature):
Custody Seal Present: Yes ☑ No ☐
Custody Seal Intact: Yes ☑ No ☐
Cooling Agent Present: Yes ☑ No ☐ Type: ice
Temperature Upon Receipt (°C) 4x2
CA ~~40349~~ 40339, MAY 25
LAB LIMS #: ~~40349~~ 40339, 25

REPORT INFORMATION

Company: Cambium
Contact: Chris Malliaros
Address: 135 Bayfield St, Barrie, ON
Phone:
Fax:
Email: chris.malliaros@cambium-inc.com

INVOICE INFORMATION

☑ (same as Report Information)
Company: Cambium Inc.
Contact:
Address: P.O. Box 325, Peterborough, ON K9J 6Z3
Phone:
Email: accounting@cambium-inc.com

Quotation #:
P.O. #:
Project #: 23392-001
Site Location/ID: Gross Rd, Muskoka Lakes, ON

TURNAROUND TIME (TAT) REQUIRED

☐ Client Regular TAT ☒ Regular TAT (5-7days)

TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date:

*NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

☐ O.Reg 153/04 ☐ O.Reg 406/19

☐ Table 1 ☐ Res/Park Soil Texture:
☐ Table 2 ☐ Ind/Com ☐ Coarse
☐ Table 3 ☐ Agri/Other ☐ Medium/Fine
☐ Table _____ Appx. _____
Soil Volume ☐ <350m3 ☐ >350m3

Other Regulations:
☐ Reg 347/558 (3 Day min TAT)
☐ PWQO ☐ MMER
☐ CCME ☒ Other: soil corrosivity
☐ MISA
☐ ODWS Not Reportable *See note

Sewer By-Law:
☐ Sanitary
☐ Storm
Municipality:

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX
1	BH101-25_2.3-2.9	May 23/25		1	S
2	BH102-25_4.6-5.2	"		1	↓
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

	Field Filtered (Y/N)	Metals & Inorganics (Incl CrVI, CN,Hg pH,(B(HWS),EC,SAR-soil) (Cl, Na-water)	Full Metals Suite (ICP metals plus B(HWS-soil only) Hg, CrVI	ICP Metals only Sb,As,Ba,Be,B,Cd, Cr,Co,Cu,Pb,Mo,Ni,Se,Ag,Tl,U,V,Zn	PAHs only	SVOCs all incl PAHs, ABNs, CPs	PCBs ☐ Aroclor ☐ Total	F1-F4 + BTEX	F1-F4 only no BTEX	VOCs all incl BTEX	BTEX only	Pesticides Organochlorine or specify other	Other (please specify) (Corrosivity Package (FULL)				Sewer Use: Specify pkg:	Water Characterization Pkg General ☐ Extended ☐	SPLP Specify tests	TCLP Specify tests	COMMENTS:
1													X								
2													X								
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					
11																					
12																					

Observations/Comments/Special Instructions

Sampled By (NAME): Abby Mackie
Signature:
Date: ____/____/____ (mm/dd/yy)

Relinquished by (NAME): Chris Malliaros
Signature: C. Malliaros
Date: 05/30/2025 (mm/dd/yy)

Pink Copy - Client
Yellow & White Copy - SGS

Revision #: 1.8
Date of Issue: 06 SEP 2024

Soil Characterization Report - Gross Road Culvert Replacement, Muskoka Lakes, Ontario

July 18, 2025

Prepared for:
Tatham Engineering

Cambium Reference: 23392-001

CAMBIUM INC.

866.217.7900

cambium-inc.com

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1.0 Introduction

Tatham Engineering (Client) retained Cambium Inc. (Cambium) to characterize excess in-situ soil at Gross Road Culvert, located on a segment of Gross Road, from approximately 80 m west of the intersection of Gross Road and Aspdin Road to approximately 100 m west of the intersection of Gross Road and Aspdin Road, Muskoka Lakes, Ontario ('Project Area') (Figure 1). The soil characterization was completed in support of road resurfacing and a culvert replacement at the Project Area and will be used to support the reuse or disposal of excess soil under Ontario Regulation (O.Reg.) 406/19 and the associated document "Rules for Soil Management and Excess Soil Quality Standards" (Soil Rules). It is estimated that up to 600 m^3 of excess soil will be generated from the Project Area.

The excess soil characterization involved soil sampling and analysis to assess environmental quality, including the presence of contaminants and their respective concentration relative to regulatory standards.

The methodology for the excess soil characterization was based on the requirements of O.Reg. 406/19 and the associated Soil Rules.

The scope of work falls under O.Reg. 406/19 Section 8 (1.1), with the following applicable: the Site is not and has never been, in whole or part, an enhanced investigation project area; the purpose of the project is not to remediate contaminated land; and the location is not within an area of settlement within the meaning of the *Planning Act*. Therefore, this location is exempt from section 8; however, due diligence soil sampling was conducted.

1.1 Project Area Information

The Project Area is a portion of Gross Road from approximately 85 m west of the intersection of Gross Road and Aspdin Road to approximately 100 m west of the intersection of Gross Road and Aspdin Road. Project Area information and property owner information are summarized below. The Project Area location is shown on Figure 1. The Project Area is in a primarily agricultural area.

1.2 Project Personnel Information

Property Owner
The Township of Muskoka Lakes 1 Bailey St., P.O. Box 129, Port Carling, ON, P0B 1J0

Project Leader	Contact Information
Tatham Engineering 115 Sandford Fleming Drive, Unit 200 Collingwood, Ontario L9Y 5A6	Matt Scott Senior Vice President Phone: +1 800 265 9662 Email: Matt.Brooks@rjburnside.com

Qualified Person	Contact Information
John Kaasalainen, P.Eng., QP_{ESA} Cambium Inc. 135 Bayfield Street, Suite 102 Barrie, Ontario	John Kaasalainen, P.Eng. Senior Project Manager Phone: 705-719-0700 Email: john.kaasalainen@cambium-inc.com

1.3 Background

No Assessment of Past Uses or Phase One Environmental Site Assessment was available for review; therefore, based on a cursory review of the Site and surrounding properties, the contaminants of potential concern (COPCs) for the Project Area include:

- Benzene, toluene, ethylbenzene, xylenes (BTEX)
- Petroleum hydrocarbons fractions F1 to F4 (PHCs)
- Metals and hydride-forming metals (antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, selenium, silver, thallium, uranium, vanadium and zinc)
- Electrical conductivity (EC), sodium adsorption ratio (SAR)

2.0 Investigation Method

The methodology for the excess soil characterization was based on the requirements of O.Reg. 406/19.

Cambium personnel conducted the soil sampling on May 23, 2025. Cambium oversaw the advancement of two boreholes by Strong Soil Search Inc., throughout the subject volume source, concurrently with a Geotechnical Investigation. BH101-25 was advanced to a depth of 16.0 m below ground surface (bgs), and BH102-25 was advanced to a depth of 10.0 mbgs. The proposed depth of excavation that will generate excess soil is 6.0 mbgs.

Samples were collected consistent with accepted industry practices and regulatory guidance. During the soil investigation program, soil samples were collected in 0.61 m sections. Each sample was handled solely by a field technician using dedicated nitrile gloves to reduce potential for cross-contamination. Gloves were replaced after collection of each sample. Samples to be submitted for analysis of BTEX and/or PHC F1 were collected using a pre-calibrated syringe sampler and methanol preserved vials.

Olfactory and visual observations of the soil samples were documented immediately upon extraction for soil characteristics and potential indicators of environmental contamination. The samples, which were placed in plastic sample bags and sealed, were used to determine if volatile and/or organic contaminants were present in the sample headspace. An RKI Eagle 2 portable gas detector was used to screen the soil samples and concentrations of combustible soil vapour (CSV) and organic vapour (OV). The RKI was calibrated to hexane and isobutylene standards. After agitating the sample, the peak concentration was recorded by inserting the RKI probe into the sample bag.

Soil samples were selected for laboratory analysis based on the soil screening results, visual and olfactory observation, and location of the sample with respect to an environmental concern. The borehole location plan is provided in Figure 2. The soil sampling program is included in Embedded Table 1 below.

Embedded Table 1 Soil Sampling Program

Borehole ID	Depth (m)	COPC analyzed	Selected for mSPLP Leachate Metals Analysis
BH101	2.7-3.2	Metals, hydride-forming metals, BTEX, PHCs, EC and SAR	☑
	5.2-5.7	Metals, hydride-forming metals, BTEX, PHCs, EC and SAR, pH	☑
BH102	1.5-2.1	Metals, hydride-forming metals, BTEX, PHCs, EC and SAR, pH	☑

Three samples were submitted for leachate analysis by modified Synthetic Precipitation Leaching Procedure (mSPLP). The mSPLP samples were submitted from the sampling locations where 90% (or higher) of the highest contaminant concentrations were identified.

The soil samples were submitted to Paracel, an accredited analytical laboratory.

2.1 Quality Assurance and Quality Control Results

Quality control duplicate samples were analyzed as part of a Quality Assurance/Quality Control (QA/QC) program. A blind duplicate soil sample was submitted for analysis from BH101-25 at 2.7 to 3.2 mbgs.

Where analytical parameters were detected in both the parent and the duplicate samples at concentrations greater than five times the laboratory reported detection limit (RDL), relative percent difference (RPD) was calculated to assess the precision of the results. RPD between was calculated as follows:

$$RPD(\%) = \frac{|x_1 - x_2|}{x_m} \times 100\%$$

Where: x_1 = parent sample result

x_2 = duplicate sample result

x_m = arithmetic mean of parent and duplicate sample results

RPD is generally more sensitive at low parameter concentrations; as such, RPD is not calculated when the parameter concentration of the parent and/or duplicate sample is less than five times the laboratory RDL.

The calculated RPD results were compared to the performance criteria for each parameter group as outlined in the *Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act and Excess Soil Quality* (MECP, 2021).

All calculated RPDs met the performance criteria. Accordingly, the sample results were considered acceptable and suitable for use in evaluating soil quality at the Project Area.

3.0 Results

The excess soil generally consisted of sand fill extending to 4.5 mbgs to 6.0 mbgs, underlain by finer grained silty clay to clay and silt.

No odours, staining, deleterious material, or elevated vapours were noted in the soil samples. Groundwater was encountered at approximately 2.3 mbgs within the fill material.

Soil analysis results were compared to the volume independent Table 1, Table 2.1, and Table 3.1 excess soil quality standards (ESQS) from Appendix 1 of the Soil Rules for all property uses – agricultural and other (AO); residential, parkland, institutional (RPI), and industrial, commercial, community (ICC).

The following is a summary of the excess soil quality standards that are met based on the analysis (Embedded Table 2). The full set of analysis is presented in Table 1.

Embedded Table 2 Excess Soil Quality Standards Met

Sample ID	Sample Depth (mbgs)	Table 1 (AO)	Table 1 (RPIICC)	Table 2.1 (AO)	Table 2.1 (RPI)	Table 2.1 (ICC)	Table 3.1 (RPI)	Table 3.1 (ICC)
BH101-25	2.7-3.2	✗ (leachate cobalt)	✗ (leachate cobalt)	✗ (leachate cobalt)	✗ (leachate cobalt)	✗ (leachate cobalt)	✓	✓
BH101-25	5.2-5.7	✗ (leachate copper)	✗ (leachate copper)	✗ (leachate copper)	✗ (leachate copper)	✗ (leachate copper)	✗ (leachate copper)	✗ (leachate copper)
BH102-25	1.5-2.1	✓*	✓	✓	✓	✓	✓	✓

✗ exceeds standard ✓ meets standard ✓ exceeds for SAR and/or EC only*

The leachate results met the O.Reg. 406/19 Appendix 2 *Generic Leachate Screening Levels for Excess Soil* for Table 1, Table 2.1, and Table 3.1, except for soil from BH101-25, where soil exceeded Table 2.1 (ICC) leachate screening levels for cobalt and Table 3.1 (ICC) leachate screening levels for copper.

The bulk soil results compared to various ESQS are provided in Table 1, and the mSPLP leachate results compared to the leachate screening levels are provided in Table 2. The

original laboratory Certificates of Analysis for bulk soil and leachate analyses are included in Appendix B, with bulk soil results compared to Table 1 AO standards.

3.1 Salt-Impacted Excess Soil

Salt-related contaminants, SAR and/or EC, were present in some samples at levels exceeding the standards. As noted in the Soil Rules, excess soil quality standards are deemed to be met for those chemicals in soil resulting solely from the use of a substance for the safety of vehicular or pedestrian traffic applied under conditions of snow or ice or both (e.g., SAR and EC), if the salt-impacted excess soil is placed in accordance with subsection 1(3) of Section D in Part I Appendix C.

4.0 Discussion and Recommendations

Cambium collected three bulk samples and one QA/QC duplicates from two boreholes to characterize soil to depths of 6.0 mbgs in support of up to 600 m^3 of excess soil generation within the Project Area. Bulk soil samples were analyzed for metals, hydride-forming metals, BTEX, PHCs, EC, and SAR. An additional three soil samples were analyzed for leachate by mSPLP.

The following exceedances were identified:

- BH101-25 (2.7-3.2) – EC and SAR
- BH102-25 (1.5-2.1) – EC and SAR
- BH101-25 (2.7-3.2) – mSPLP Leachate (Cobalt)
- BH101-25 (5.2-5.7) – mSPLP Leachate (Copper)

The leachate results exceeded the O.Reg. 406/19 Appendix 2 *Generic Leachate Screening Levels for Excess Soil* for Table 1, Table 2.1, and Table 3.1.

Excess soil with concentrations meeting various ESQS and leachate screening levels can be reused off-site at an appropriate reuse/receiving site accepting such materials. Excess soil to be reused off-site must be placed in accordance with the salt-impacted excess soil rules and subject to applicable municipal fill bylaws. Excess soil exceeding Table 3.1 ICC ESQS requires disposal at a licensed waste disposal facility (landfill may require O.Reg. 347 TCLP analysis).

The following options are available for the soil tested at BH101-25 and BH102-25:

- Disposal at a licensed waste disposal facility (landfill may require O.Reg. 347 TCLP analysis) or a Class 1 Soil Management Site.
- Alternatively, additional delineation drilling and associated excess soil sampling may be completed in an attempt to refine the areas of soil with the potential for reuse and to further define the limits of soil that is subject to disposal at a licensed waste disposal facility or Class 1 Soil Management Site.

Recommendations provided herein are based solely on the analysis of samples obtained and do not represent acceptance or suitability of this material on behalf of an intended receiving site. Should conditions encountered during excavation vary from those described in this report, Cambium should be notified to evaluate the need for further work.

5.0 Closing

We trust that this report meets your requirements. Should you have any questions or concerns regarding any aspect of this report, or should you require any further assistance, please do not hesitate to contact our office.

Best regards,

Cambium Inc.

Signed by:
FDDEF86C438548E...

Rowan Galashan, B.A.Sc. Hons.
Project Technician

DS

Signed by:
756936F0E7C5436...

John Kaasalainen, P.Eng., QP$_{ESA}$
Senior Project Manager

2025-07-22

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6.0 References

MECP. (2021). *Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act.* Ministry of the Environment, Conservation and Parks. February 19, 2021.

MECP. (2021). *Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act and the Excess Soil Quality.* Laboratory Services Branch, Ministry of the Environment, Conservation, and Parks.

7.0 Standard Limitations

Limited Warranty

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

Reliance on Materials and Information

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

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

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

Site Assessments

A site assessment is created using data and information collected during the investigation of a site and based on conditions encountered at the time and particular locations at which fieldwork is conducted. The information, sample results and data collected represent the conditions only at the specific times at which and at those specific locations from which the information, samples and data were obtained and the information, sample results and data may vary at other locations and times. To the extent that Cambium's work or report considers any locations or times other than those from which information, sample results and data was specifically received, the work or report is based on a reasonable extrapolation from such information, sample results and data but the actual conditions encountered may vary from those extrapolations.

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

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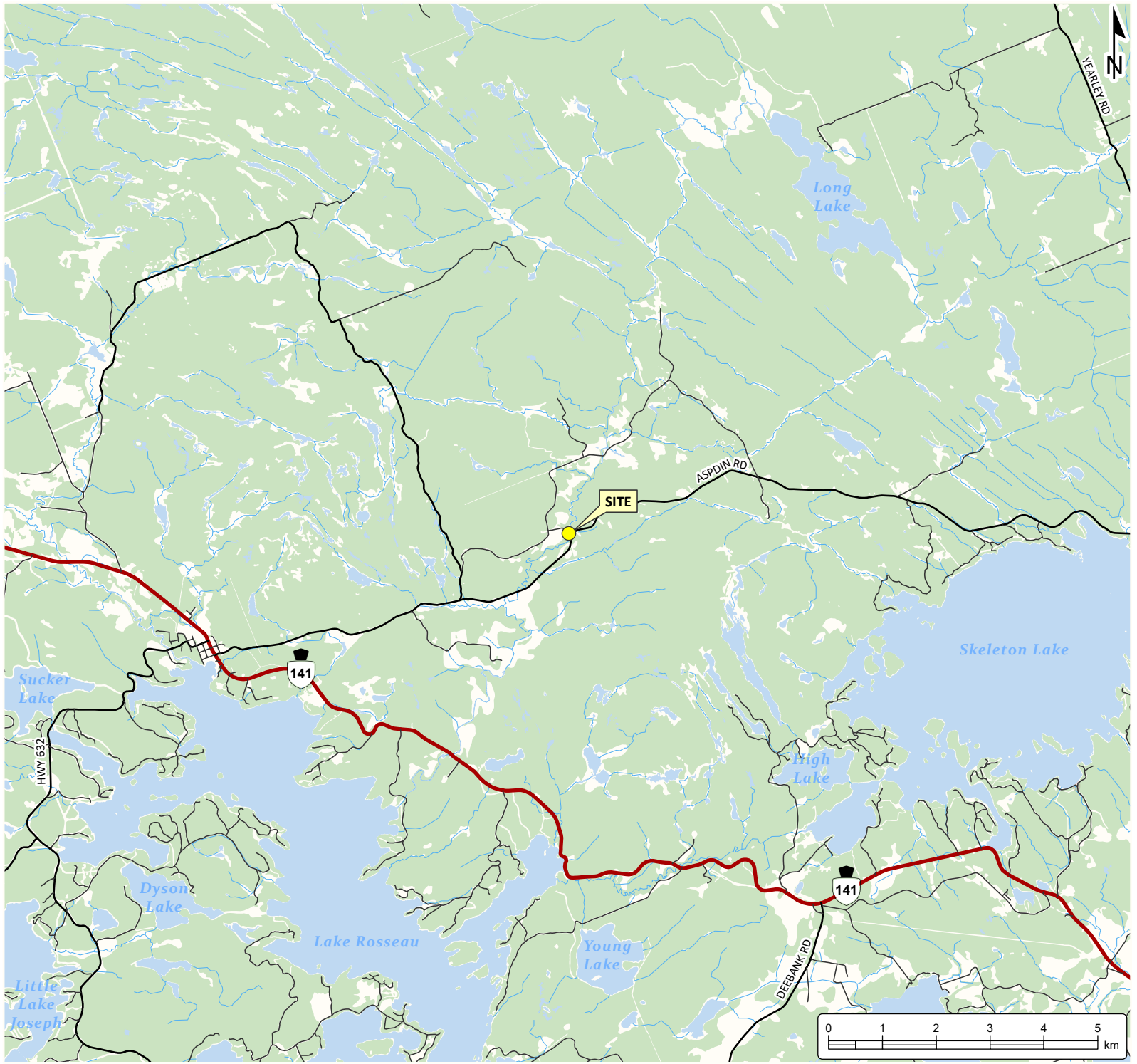
Appended Figures



SOIL CHARACTERIZATION REPORT

TATHAM ENGINEERING
Gross Road
Muskoka Lakes, Ontario

LEGEND

- Highway
- Major Road
- Minor Road
- Watercourse
- Water Area
- Wooded Area

Notes:
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PROJECT AREA LOCATION PLAN

Project No.: 23392-001	Date: July 2025
Scale: 1:100,000	Projection: NAD 1983 UTM Zone 17N
Created by: MAT	Checked by: MC
Figure: 1	

O:\GIS\MXDs\23300-23399\23392-001 Tatham-Collingwood -MSP- Gross Rd Culvert\2025-07-09 SCR.aprx

SOIL CHARACTERIZATION REPORT

TATHAM ENGINEERING
Gross Road
Muskoka Lakes, Ontario

LEGEND

- Borehole
- Meets Table 1, ICC
- Exceeds Table 3.1, ICC
- Dispose at Licensed Waste Disposal Facility
- Project Area (approximate)

Notes:
- Aerial imagery from the South Central Ontario Orthophotography Project (SCOOP) 2018 - Web Map Service.
- This document contains information licensed under the Open Government License - Ontario.
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

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SAMPLE LOCATION PLAN AND PROPOSED EXCAVATION AREA

Project No.:	Date:
23392-001	July 2025
Scale: 1:400	Projection: NAD 1983 UTM Zone 17N
Created by: MAT	Checked by: MC
Figure: 2	

O:\GIS\MXDs\23300-23399\23392-001 Tatham-Collingwood -MSP- Gross Rd Culvert\2025-07-09 SCR.aprx

Appended Tables

CAMBIUM

Table 1 - Soil Quality

Sample Location	Units	RDL	Table 1 AO	Table 1 RPIICC	Table 2.1 AO	Table 2.1 RPI	Table 2.1 ICC	Table 3.1 RPI	Table 3.1 ICC	BH101			BH102
Sample ID										BH101-25_2.7-3.2	QA/QC 1	BH101-25_5.2-5.7	BH102-25_1.5-2.1
Sample Date (dd-mmm-yy)										23-May-25	23-May-25	23-May-25	23-May-25
Sample Depth (mbgs)										2.7-3.2	2.7-3.2	5.2-5.7	1.5-2.1
General Inorganics													
SAR	N/A	0.01	1	2.4	5	5	12	5	12	**1.82**	**1.76**	0.72	**1.07**
Conductivity	mS/cm	0.005	0.47	0.57	0.7	0.7	1.4	0.7	1.4	0.057	0.067	0.151	0.052
pH	N/A	0.05	NV	NV	NV	NV	NV	NV	NV	N/A	N/A	6.99	5.87
Metals													
Antimony	µg/g	1	1	1.3	7.5	7.5	40	7.5	40	< 1.0	< 1.0	< 1.0	< 1.0
Arsenic	µg/g	1	11	18	11	18	18	18	18	1.5	1.7	2.4	1.6
Barium	µg/g	1	210	220	390	390	670	390	670	42.9	40.7	113	48.1
Beryllium	µg/g	0.5	2.5	2.5	4	4	8	4	8	< 0.5	< 0.5	< 0.5	< 0.5
Boron	µg/g	5	36	36	120	120	120	120	120	< 5.0	< 5.0	< 5.0	< 5.0
Cadmium	µg/g	0.5	1	1.2	1	1.2	1.9	1.2	1.9	< 0.5	< 0.5	< 0.5	< 0.5
Chromium	µg/g	5	67	70	160	160	160	160	160	12.6	13	26	14.5
Cobalt	µg/g	1	19	21	22	22	80	22	80	4.3	4.4	7	4.5
Copper	µg/g	5	62	92	140	140	230	140	230	13.3	16.2	12.3	17.2
Lead	µg/g	1	45	120	45	120	120	120	120	1.8	2	2.7	2.1
Molybdenum	µg/g	1	2	2	6.9	6.9	40	6.9	40	< 1.0	< 1.0	< 1.0	< 1.0
Nickel	µg/g	5	37	82	100	100	270	100	270	7.5	7.6	13.6	7.2
Selenium	µg/g	1	1.2	1.5	2.4	2.4	5.5	2.4	5.5	< 1.0	< 1.0	< 1.0	< 1.0
Silver	µg/g	0.3	0.5	0.5	20	20	40	20	40	< 0.3	< 0.3	< 0.3	< 0.3
Thallium	µg/g	1	1	1	1	1	3.3	1	3.3	< 1.0	< 1.0	< 1.0	< 1.0
Uranium	µg/g	1	1.9	2.5	23	23	33	23	33	1.1	1.1	< 1.0	< 1.0
Vanadium	µg/g	10	86	86	86	86	86	86	86	25.8	29.4	36.6	27.1
Zinc	µg/g	20	290	290	340	340	340	340	340	25.3	25.7	38.9	27.5
Volatiles													
Benzene	µg/g	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.034	< 0.02	< 0.02	< 0.02	< 0.02
Ethylbenzene	µg/g	0.05	0.05	0.05	0.05	0.05	0.05	1.9	1.9	< 0.05	< 0.05	< 0.05	< 0.05
Toluene	µg/g	0.05	0.2	0.2	0.2	0.2	0.2	0.99	7.8	< 0.05	< 0.05	< 0.05	< 0.05
m/p-Xylene	µg/g	0.05	NV	NV	NV	NV	NV	NV	NV	< 0.05	< 0.05	< 0.05	< 0.05
o-Xylene	µg/g	0.05	NV	NV	NV	NV	NV	NV	NV	< 0.05	< 0.05	< 0.05	< 0.05
Xylenes, total	µg/g	0.05	0.05	0.05	0.091	0.091	0.091	0.9	3	< 0.05	< 0.05	< 0.05	< 0.05
Hydrocarbons													
F1 PHCs (C6-C10)	µg/g	7	17	25	17	25	25	25	25	< 7	< 7	< 7	< 7
F2 PHCs (C10-C16)	µg/g	4	10	10	10	10	26	10	26	< 4	< 4	< 4	< 4
F3 PHCs (C16-C34)	µg/g	8	240	240	240	240	240	300	1700	22	22	17	13
F4 PHCs (C34-C50)	µg/g	6	120	120	2800	2800	3300	2800	3300	47	49	49	35

Notes:
Table 1 Standards - Full Depth Background Site Condition Standards - Agricultural or Other Property Use
Table 1 Standards - Full Depth Background Site Condition Standards - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Table 2.1 Standards - Full Depth Excess Soil Quality Standards in a Potable Ground Water Condition- Agricultural or Other Property Use
Table 2.1 Standards - Full Depth Excess Soil Quality Standards in a Potable Ground Water Condition- Residential/Parkland/Institutional Property Use
Table 2.1 Standards - Full Depth Excess Soil Quality Standards in a Potable Ground Water Condition- Industrial/Commercial/Community Property Use
Table 3.1 Standards - Full Depth Excess Soil Quality Standards in a Non-Potable Ground Water Condition- Residential/Parkland/Institutional Property Use
Table 3.1 Standards - Full Depth Excess Soil Quality Standards in a Non-Potable Ground Water Condition- Industrial/Commercial/Community Property Use
Bold and shaded grey - value exceeds Table 1 AO
Bold and shaded yellow - value exceeds Table 1 RPIICC
Bold and shaded orange - value exceeds Table 2.1 AO
Bold and shaded red - value exceeds Table 2.1 RPI
Bold and shaded green - value exceeds Table 2.1 ICC
Bold and shaded blue - value exceeds Table 3.1 RPI
Bold and shaded purple - value exceeds Table 3.1 ICC
Bold and underline - RDL exceeds standard
N/A - not applicable
NC - The duplicate RPD was not calculated. One or both samples < 5x RDL.

Table 2 - Soil Leachate Quality

Sample Location	Units	Table 1 AO	Table 1 RPIICC	Table 2.1 AO	Table 2.1 RPI	Table 2.1 ICC	Table 3.1 RPI	Table 3.1 ICC	BH101		BH102
Sample ID									BH101-25_2.7-3.2	BH101-25_5.2-5.7	BH102-25_1.5-2.1
Sample Date (dd-mmm-yy)									23-May-25	23-May-25	23-May-25
Sample Depth (mbgs)									2.7-3.2	5.2-5.7	1.5-2.1
mSPLP Leachate Metals											
Antimony	µg/L	6	-	6	6	6	-	-	< 0.5	< 0.5	< 0.5
Arsenic	µg/L	-	-	-	-	-	-	-	2.7	8	1.8
Barium	µg/L	-	-	1000	1000	1000	4600	4600	61.4	279	83.7
Beryllium	µg/L	-	-	4	4	4	11	11	< 0.5	< 0.5	< 0.5
Boron (total)	µg/L	-	-	5000	5000	5000	-	-	14.4	63.8	< 10.0
Cadmium	µg/L	-	-	0.5	-	0.5	-	0.5	< 0.2	< 0.2	< 0.2
Chromium Total	µg/L	-	-	50	50	50	130	130	31.4	7.2	18.2
Cobalt	µg/L	-	-	3.8	3.8	3.8	10	10	**4.8**	3.5	2.6
Copper	µg/L	-	-	14	14	14	14	14	12.9	**32.9**	9.8
Lead	µg/L	-	-	-	-	-	-	-	3.2	9.5	2
Molybdenum	µg/L	23	23	23	23	23	-	1500	1.2	2.1	2.8
Nickel	µg/L	-	-	78	78	78	78	78	13.7	5.5	8.2
Selenium	µg/L	-	-	10	10	10	10	10	< 1.0	< 1.0	< 1.0
Silver	µg/L	0.3	0.3	0.3	0.3	0.3	0.3	0.3	< 0.2	< 0.2	< 0.2
Thallium	µg/L	-	2	2	2	2	-	80	< 0.5	< 0.5	< 0.5
Uranium	µg/L	-	-	20	20	20	66	66	1.4	2.3	0.4
Vanadium	µg/L	-	-	-	-	-	-	-	24.4	28.8	7.5
Zinc	µg/L	-	-	180	180	180	180	180	16.5	22	13.4

Notes:
Table 1 Standards - Leachate Screening Levels for Excess Soil Reuse - Agricultural or Other Property Use
Table 1 Standards - Leachate Screening Levels for Excess Soil Reuse - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Table 2.1 Standards - Leachate Screening Levels for Excess Soil Reuse - Agricultural or Other Property Use
Table 2.1 Standards - Leachate Screening Levels for Excess Soil Reuse - Residential/Parkland/Institutional Property Use
Table 2.1 Standards - Leachate Screening Levels for Excess Soil Reuse - Industrial/Commercial/Community Property Use
Table 3.1 Standards - Full Depth Excess Soil Quality Standards in a Non-Potable Ground Water Condition- Residential/Parkland/Institutional Property Use
Table 3.1 Standards - Full Depth Excess Soil Quality Standards in a Non-Potable Ground Water Condition- Industrial/Commercial/Community Property Use
Bold and shaded grey - value exceeds Table 1 AO
Bold and shaded yellow - value exceeds Table 1 RPIICC
Bold and shaded orange - value exceeds Table 2.1 AO
Bold and shaded red - value exceeds Table 2.1 RPI
Bold and shaded green - value exceeds Table 2.1 ICC
Bold and shaded blue - value exceeds Table 3.1 RPI
Bold and shaded purple - value exceeds Table 3.1 ICC
Bold and underline - RDL exceeds standard
N/A - not applicable
NC - The duplicate RPD was not calculated. One or both samples < 5x RDL.
NV - no value

Appendix A

Borehole Logs

CAMBIUM

Client: Tatham Engineering Limited (Collingwood)
Contractor: Drill Tech Drilling Ltd.
Project No.: 23392-001
Location: Gross Road, Township of Muskoka Lakes ON

Project Name: Gross Road Culvert Replacement
Method: Truck Mounted Solid Stem Auger
Elevation: 264.37 mASL
UTM: 17 T **N:** 5014605.27 **E:** 613309.93

Log of Borehole: BH101-25
Page: 1 of 4
Date Completed: May 23, 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
264.4 / 0	**ASPHALT:** ~ 50 mm thick	264.32 / 0.05	1A	GB			3.4%			
263.9 / 0.5	**FILL:** gravelly SAND: brown/grey, moist, trace silt [ROAD BASE]	264.07 / 0.30	1B	GB			2.7%			
	FILL: gravelly SAND: brown/grey, moist, trace silt [ROAD SUBBASE]	263.61 / 0.76								
263.4 / 1	**FILL:** SAND: brown/grey, moist, dense, some gravel, trace silt		2	SS	60	35	2.9%	35		
262.9 / 1.5	- compact		3	SS	75	28	2.4%	28		
262.4 / 2										
261.9 / 2.5	- wet		4	SS	50	13	4.1%	13		
261.4 / 3		261.32 / 3.05								
260.9 / 3.5	**FILL:** SAND and SILT: grey, wet, very loose, trace clay, some gravel, trace organics		5	SS	33	2	19.1%	2		
260.4 / 4										
259.9 / 4.5	- loose		6	SS	92	8	22.6%	8		
259.4 / 5										
258.9 / 5.5										
258.4 / 6		258.27 / 6.10								
257.9 / 6.5	**(CH) sandy CLAY and SILT:** grey, w>PL, very soft		7	SS	100	2	46%	2		
257.4 / 7										
256.9		256.87 / 7.50								

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
GB1B	11	86	3	
SS6	9	44	41	6

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

CAMBIUM

Client: Tatham Engineering Limited (Collingwood)
Contractor: Drill Tech Drilling Ltd.
Project No.: 23392-001
Location: Gross Road, Township of Muskoka Lakes ON

Project Name: Gross Road Culvert Replacement
Method: Truck Mounted Solid Stem Auger
Elevation: 264.37 mASL
UTM: 17 T **N:** 5014605.27 **E:** 613309.93

Log of Borehole: BH101-25
Page: 2 of 4
Date Completed: May 23, 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
256.9	7.5		**(CH) sandy CLAY and SILT:** grey, w>PL, very soft								Field vane test at 7.6 mbgs. Hand-torqued. Peak shear strength: 46.9 kPa. Remolded shear strength: 23.5 kPa.
256.4	8			8	GB			41.8%			
255.9	8.5										
255.4	9										
254.9	9.5		- decrease in sand	9	SS	50	2		2		
254.4	10										
253.9	10.5										
253.4	11			10	SS	50	1	35.5%	1		
252.9	11.5										
252.4	12										
251.9	12.5			11	GB			44%			Field vane test at 12.2 mbgs. Hand-torqued. Peak shear strength: 46.9 kPa. Remolded shear strength: 23.5 kPa.
251.4	13										
250.9	13.5										
250.65	13.72		**(ML) sandy SILT:** grey, wet, loose, some clay								
250.4	14			12	SS	50	4	24.5%	4		
249.9	14.5										
249.37	15.00										
249.4											

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
GB1B	11	86	3	
SS6	9	44	41	6

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

CAMBIUM

Client: Tatham Engineering Limited (Collingwood)
Contractor: Drill Tech Drilling Ltd.
Project No.: 23392-001
Location: Gross Road, Township of Muskoka Lakes ON

Project Name: Gross Road Culvert Replacement
Method: Truck Mounted Solid Stem Auger
Elevation: 264.37 mASL
UTM: 17 T **N:** 5014605.27 **E:** 613309.93

Log of Borehole: BH101-25
Page: 3 of 4
Date Completed: May 23, 2025

SUBSURFACE PROFILE			SAMPLE							
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
249.4 / 15										
248.9 / 15.5		**(ML) sandy SILT:** grey, wet, loose, some clay	13	SS	50	4	24.1%	4		Augering and Split Spoon Sampling terminated at 15.2 mbgs in sandy silt. Borehole caving not observed. Wet soils first encountered at 2.3 mbgs. Standing water observed at 2.7 mbgs.
		248.52 / 15.85								
248.4 / 16										
247.9 / 16.5										
247.4 / 17			14	DCPT		7		7		Dynamic Cone Penetration Testing commenced at 16.8 mbgs and terminated at 22.9 mbgs.
			15	DCPT		15		15		
246.9 / 17.5			16	DCPT		19		19		
			17	DCPT		22		22		
246.4 / 18			18	DCPT		24		24		
			19	DCPT		20		20		
245.9 / 18.5			20	DCPT		23		23		
			21	DCPT		20		20		
245.4 / 19			22	DCPT		26		26		
			23	DCPT		22		22		
244.9 / 19.5			24	DCPT		22		22		
244.4 / 20			25	DCPT		16		16		
			26	DCPT		16		16		
243.9 / 20.5			27	DCPT		18		18		
			28	DCPT		19		19		
243.4 / 21			29	DCPT		23		23		
			30	DCPT		25		25		
242.9 / 21.5			31	DCPT		52		52		
242.4 / 22										
241.9										

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
GB1B	11	86	3	
SS6	9	44	41	6

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

CAMBIUM

Client: Tatham Engineering Limited (Collingwood)
Contractor: Drill Tech Drilling Ltd.
Project No.: 23392-001
Location: Gross Road, Township of Muskoka Lakes ON

Project Name: Gross Road Culvert Replacement
Method: Truck Mounted Solid Stem Auger
Elevation: 264.37 mASL
UTM: 17 T **N:** 5014605.27 **E:** 613309.93

Log of Borehole: BH101-25
Page: 4 of 4
Date Completed: May 23, 2025

SUBSURFACE PROFILE			SAMPLE							
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
241.9 / 22.5			32	DCPT		33		33		
241.4 / 23			33	DCPT		39		39		
240.9 / 23.5										
240.4 / 24										
239.9 / 24.5										
239.4 / 25										
238.9 / 25.5										
238.4 / 26										
237.9 / 26.5										
237.4 / 27										
236.9 / 27.5										
236.4 / 28										
235.9 / 28.5										
235.4 / 29										
234.9 / 29.5										
234.4										

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
GB1B	11	86	3	
SS6	9	44	41	6

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

CAMBIUM

Client: Tatham Engineering Limited (Collingwood)
Contractor: Drilltech Drilling Ltd.
Project No.: 23392-001
Location: Gross Road, Township of Muskoka Lakes ON

Project Name: Gross Road Culvert Replacement
Method: Truck Mounted Solid Stem Auger
Elevation: 264.22 mASL
UTM: 17 T **N:** 5014612.03 **E:** 613290.03

Log of Borehole: BH102-25
Page: 1 of 3
Date Completed: May 23, 2025

Elevation (m)	Depth	Description	Elevation / Depth	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
								25 50 75	25 50 75	20 40 60 80	20 40 60 80		
264.2	0	**ASPHALT:** ~ 102 mm thick	264.12 / 0.10	1A	GB				3%				
				1B	GB				3%				
263.7	0.5	**FILL:** gravelly SAND: brown/grey, moist, trace silt [ROAD BASE]	263.97 / 0.25										
		FILL: SAND: brown/grey, moist, some gravel, some silt [ROAD SUBBASE]	263.81 / 0.41										
263.2	1	**FILL:** SAND: brown/grey, moist, dense, some gravel, some silt		2	SS	75	48		4.6%		48		
262.7	1.5												
		- compact		3	SS	83	25		4.9%		25		
262.2	2												
			261.93 / 2.29										
261.7	2.5	**FILL:** SILTY SAND: grey, wet, loose, trace clay, trace gravel		4	SS	100	7		20.9%		7		
261.2	3												
		- compact		5	SS	100	13		16.6%		13		
260.7	3.5												
260.2	4												
259.7	4.5		259.65 / 4.57										
		(CL) SILTY CLAY: grey, w>PL, soft, some sand, trace gravel		6	SS	100	3		47.9%		3		
259.2	5												
258.7	5.5												
258.2	6		258.12 / 6.10										
		(ML) sandy CLAYEY SILT: grey, w>PL, very soft, trace gravel		7	SS	100	1		36.6%		1		
257.7	6.5												
257.2	7												
256.7			256.72 / 7.50										

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
GS1A	30	65		5
SS7	1	13	60	26

Logged By: AM
Input By: AM

CAMBIUM

Client: Tatham Engineering Limited (Collingwood)
Contractor: Drilltech Drilling Ltd.
Project No.: 23392-001
Location: Gross Road, Township of Muskoka Lakes ON

Project Name: Gross Road Culvert Replacement
Method: Truck Mounted Solid Stem Auger
Elevation: 264.22 mASL
UTM: 17 T **N:** 5014612.03 **E:** 613290.03

Log of Borehole: BH102-25
Page: 2 of 3
Date Completed: May 23, 2025

Elevation (m)	Depth	Lithology	Description	Number	Type	% Recovery	SPT (N)	Atterberg Limits (%) / % Moisture (25 50 75)	Shear Strength Cu, kPa (20 40 60 80) / SPT (N) (20 40 60 80)	Well Installation	Log Notes
256.7	7.5		**(ML) sandy CLAYEY SILT:** grey, w>PL, very soft, trace gravel								Field vane test at 7.6 mbgs. Hand-torqued. Peak shear strength: 39.1 kPa. Remolded shear strength: 31.3 kPa.
256.2	8			8	GB			43.3%			
255.7	8.5										
255.2	9										
254.7	9.5			9	SS	83	2	60.8%	2		Augering and Split Spoon Sampling terminated at 9.7 mbgs in sandy clay and silt. Borehole caving not observed. Wet soils first encountered at 2.3 mbgs. Standing water observed at 3.0mbgs.
			254.47 / 9.75								Dynamic Cone Penetration Testing commenced at 9.7 mbgs and terminated at 21.0 mbgs.
254.2	10			10	DCPT		1		1		
				11	DCPT		3		3		
253.7	10.5			12	DCPT		2		2		
				13	DCPT		2		2		
253.2	11			14	DCPT		3		3		
				15	DCPT		3		3		
252.7	11.5			16	DCPT		3		3		
				17	DCPT		3		3		
252.2	12			18	DCPT		4		4		
				19	DCPT		4		4		
251.7	12.5			20	DCPT		5		5		
				21	DCPT		9		9		
251.2	13			22	DCPT		8		8		
				23	DCPT		15		15		
250.7	13.5			24	DCPT		10		10		
				25	DCPT		10		10		
250.2	14			26	DCPT		10		10		
249.7	14.5										
249.2											

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
GS1A	30	65	5	
SS7	1	13	60	26

Logged By: AM
Input By: AM

CAMBIUM

Client: Tatham Engineering Limited (Collingwood)
Contractor: Drilltech Drilling Ltd.
Project No.: 23392-001
Location: Gross Road, Township of Muskoka Lakes ON

Project Name: Gross Road Culvert Replacement
Method: Truck Mounted Solid Stem Auger
Elevation: 264.22 mASL
UTM: 17 T **N:** 5014612.03 **E:** 613290.03

Log of Borehole: BH102-25
Page: 3 of 3
Date Completed: May 23, 2025

SUBSURFACE PROFILE			SAMPLE							
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
249.2 / 15			27	DCPT		11		11		
248.7 / 15.5			28	DCPT		23		23		
			29	DCPT		19		19		
248.2 / 16			30	DCPT		24		24		
			31	DCPT		22		22		
247.7 / 16.5			32	DCPT		26		26		
			33	DCPT		19		19		
247.2 / 17			34	DCPT		20		20		
			35	DCPT		18		18		
246.7 / 17.5			36	DCPT		25		25		
			37	DCPT		22		22		
246.2 / 18			38	DCPT		20		20		
			39	DCPT		27		27		
245.7 / 18.5			40	DCPT		25		25		
			41	DCPT		25		25		
245.2 / 19			42	DCPT		31		31		
			43	DCPT		26		26		
244.7 / 19.5			44	DCPT		37		37		
			45	DCPT		42		42		
244.2 / 20			46	DCPT		50		50		
243.7 / 20.5										
243.2 / 21										
242.7 / 21.5										
242.2 / 22										
241.7										

GRAINSIZE DISTRIBUTION

SAMPLE	GRAVEL	SAND	SILT	CLAY
GS1A	30	65		5
SS7	1	13	60	26

Logged By: AM
Input By: AM

Appendix B

Laboratory Certificates of Analysis

PARACEL LABORATORIES LTD.

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Certificate of Analysis

Cambium Inc. (Barrie)
135 Bayfield St., Suite 102
Barrie, ON L4M 3B3
Attn: Matt Cunningham

Client PO:
Project: 23392-001
Custody: 147093

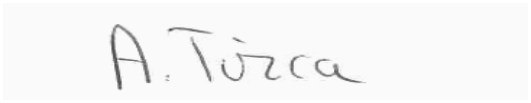
Report Date: 3-Jun-2025
Order Date: 28-May-2025

Order #: 2522337

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

Paracel ID	Client ID
2522337-01	BH101-25_2.7-3.2
2522337-02	BH101-25_5.2-5.7
2522337-03	BH102-25_1.5-2.1
2522337-04	QA/QC

Approved By:



Adriana Tirca, B.Eng (Chem)
Supervisor

PARACEL LABORATORIES LTD.

Order #: 2522337

Certificate of Analysis

Report Date: 03-Jun-2025

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

Order Date: 28-May-2025

Client PO:

Project Description: 23392-001

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
BTEX by P&T GC-MS	EPA 8260 - P&T GC-MS	30-May-25	30-May-25
Conductivity	MOE E3138 - probe @25 °C, water ext	30-May-25	30-May-25
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	30-May-25	30-May-25
PHC F1	CWS Tier 1 - P&T GC-FID	30-May-25	30-May-25
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	30-May-25	30-May-25
REG 153: Metals by ICP/MS, soil	EPA 6020 - Digestion - ICP-MS	30-May-25	30-May-25
REG 406: Metals, leachate	mSPLP EPA 6020 - Digestion - ICP-MS	30-May-25	2-Jun-25
SAR	Calculated	30-May-25	2-Jun-25
Solids, %	CWS Tier 1 - Gravimetric	29-May-25	30-May-25

PARACEL LABORATORIES LTD.

Order #: 2522337

Certificate of Analysis

Report Date: 03-Jun-2025

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

Order Date: 28-May-2025

Client PO:

Project Description: 23392-001

Summary of Criteria Exceedances

(If this page is blank then there are no exceedances)

Only those criteria that a sample exceeds will be highlighted in red

Regulatory Comparison:

Paracel Laboratories has provided regulatory guidelines on this report for informational purposes only and makes no representations or warranties that the data is accurate or reflects the current regulatory values. The user is advised to consult with the appropriate official regulations to evaluate compliance. Sample results that are highlighted have exceeded the selected regulatory limit. Calculated uncertainty estimations have not been applied for determining regulatory exceedances.

Sample	Analyte	MDL / Units	Result	Reg 406/19 -T1 Agr	-
BH101-25_2.7-3.2	SAR	0.01 N/A	1.82	1 N/A	-
BH102-25_1.5-2.1	SAR	0.01 N/A	1.07	1 N/A	-
QA/QC	SAR	0.01 N/A	1.76	1 N/A	-

PARACEL LABORATORIES LTD.

Order #: 2522337

Certificate of Analysis

Report Date: 03-Jun-2025

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

Order Date: 28-May-2025

Client PO:

Project Description: 23392-001

	Client ID:	BH101-25_2.7-3.2	BH101-25_5.2-5.7	BH102-25_1.5-2.1	QA/QC	Criteria:	
	Sample Date:	23-May-25 00:00	23-May-25 00:00	23-May-25 00:00	23-May-25 00:00	Reg 406/19 -T1 Agr	-
	Sample ID:	2522337-01	2522337-02	2522337-03	2522337-04		
	Matrix:	Soil	Soil	Soil	Soil		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	93.3	74.4	92.9	94.9	-	-
mSPLP Leachate Metals							
Antimony	0.5 ug/L	<0.5	<0.5	<0.5	-	-	-
Arsenic	1.0 ug/L	2.7	8.0	1.8	-	-	-
Barium	1.0 ug/L	61.4	279	83.7	-	-	-
Beryllium	0.5 ug/L	<0.5	<0.5	<0.5	-	-	-
Boron	10.0 ug/L	14.4	63.8	<10.0	-	-	-
Cadmium	0.2 ug/L	<0.2	<0.2	<0.2	-	-	-
Chromium	1.0 ug/L	31.4	7.2	18.2	-	-	-
Cobalt	0.5 ug/L	4.8	3.5	2.6	-	-	-
Copper	0.5 ug/L	12.9	32.9	9.8	-	-	-
Lead	0.2 ug/L	3.2	9.5	2.0	-	-	-
Molybdenum	0.5 ug/L	1.2	2.1	2.8	-	-	-
Nickel	1.0 ug/L	13.7	5.5	8.2	-	-	-
Selenium	1.0 ug/L	<1.0	<1.0	<1.0	-	-	-
Silver	0.2 ug/L	<0.2	<0.2	<0.2	-	-	-
Thallium	0.5 ug/L	<0.5	<0.5	<0.5	-	-	-
Uranium	0.2 ug/L	1.4	2.3	0.4	-	-	-
Vanadium	0.5 ug/L	24.4	28.8	7.5	-	-	-
Zinc	5.0 ug/L	16.5	22.0	13.4	-	-	-
General Inorganics							
SAR	0.01 N/A	1.82	0.72	1.07	1.76	1 N/A	-
Conductivity	0.005 mS/cm	0.057	0.151	0.052	0.067	0.47 mS/cm	-
pH	0.05 pH Units	-	6.99	5.87	-	5.00 - 9.00 pH Units	-
Metals							

PARACEL LABORATORIES LTD.

Order #: 2522337

Certificate of Analysis

Report Date: 03-Jun-2025

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

Order Date: 28-May-2025

Client PO:

Project Description: 23392-001

	Client ID:	BH101-25_2.7-3.2	BH101-25_5.2-5.7	BH102-25_1.5-2.1	QA/QC	Criteria:	
	Sample Date:	23-May-25 00:00	23-May-25 00:00	23-May-25 00:00	23-May-25 00:00	Reg 406/19 -T1 Agr	-
	Sample ID:	2522337-01	2522337-02	2522337-03	2522337-04		
	Matrix:	Soil	Soil	Soil	Soil		
	MDL/Units						
Metals							
Antimony	1.0 ug/g	<1.0	<1.0	<1.0	<1.0	1 ug/g	-
Arsenic	1.0 ug/g	1.5	2.4	1.6	1.7	11 ug/g	-
Barium	1.0 ug/g	42.9	113	48.1	40.7	210 ug/g	-
Beryllium	0.5 ug/g	<0.5	<0.5	<0.5	<0.5	2.5 ug/g	-
Boron	5.0 ug/g	<5.0	<5.0	<5.0	<5.0	36 ug/g	-
Cadmium	0.5 ug/g	<0.5	<0.5	<0.5	<0.5	1 ug/g	-
Chromium	5.0 ug/g	12.6	26.0	14.5	13.0	67 ug/g	-
Cobalt	1.0 ug/g	4.3	7.0	4.5	4.4	19 ug/g	-
Copper	5.0 ug/g	13.3	12.3	17.2	16.2	62 ug/g	-
Lead	1.0 ug/g	1.8	2.7	2.1	2.0	45 ug/g	-
Molybdenum	1.0 ug/g	<1.0	<1.0	<1.0	<1.0	2 ug/g	-
Nickel	5.0 ug/g	7.5	13.6	7.2	7.6	37 ug/g	-
Selenium	1.0 ug/g	<1.0	<1.0	<1.0	<1.0	1.2 ug/g	-
Silver	0.3 ug/g	<0.3	<0.3	<0.3	<0.3	0.5 ug/g	-
Thallium	1.0 ug/g	<1.0	<1.0	<1.0	<1.0	1 ug/g	-
Uranium	1.0 ug/g	1.1	<1.0	<1.0	1.1	1.9 ug/g	-
Vanadium	10.0 ug/g	25.8	36.6	27.1	29.4	86 ug/g	-
Zinc	20.0 ug/g	25.3	38.9	27.5	25.7	290 ug/g	-
Volatiles							
Benzene	0.02 ug/g	<0.02	<0.02	<0.02	<0.02	0.02 ug/g	-
Ethylbenzene	0.05 ug/g	<0.05	<0.05	<0.05	<0.05	0.05 ug/g	-
Toluene	0.05 ug/g	<0.05	<0.05	<0.05	<0.05	0.2 ug/g	-
m,p-Xylenes	0.05 ug/g	<0.05	<0.05	<0.05	<0.05	-	-
o-Xylene	0.05 ug/g	<0.05	<0.05	<0.05	<0.05	-	-
Xylenes, total	0.05 ug/g	<0.05	<0.05	<0.05	<0.05	0.05 ug/g	-

PARACEL LABORATORIES LTD.

Order #: 2522337

Certificate of Analysis

Report Date: 03-Jun-2025

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

Order Date: 28-May-2025

Client PO:

Project Description: 23392-001

	Client ID:	BH101-25_2.7-3.2	BH101-25_5.2-5.7	BH102-25_1.5-2.1	QA/QC	Criteria:	
	Sample Date:	23-May-25 00:00	23-May-25 00:00	23-May-25 00:00	23-May-25 00:00	Reg 406/19 -T1 Agr	-
	Sample ID:	2522337-01	2522337-02	2522337-03	2522337-04		
	Matrix:	Soil	Soil	Soil	Soil		
	MDL/Units						
Volatiles							
Toluene-d8	Surrogate	126%	139%	126%	124%	-	-
Hydrocarbons							
F1 PHCs (C6-C10)	7 ug/g	<7	<7	<7	<7	17 ug/g	-
F2 PHCs (C10-C16)	4 ug/g	<4	<4	<4	<4	10 ug/g	-
F3 PHCs (C16-C34)	8 ug/g	22	17	13	22	240 ug/g	-
F4 PHCs (C34-C50)	6 ug/g	47	49	35	49	120 ug/g	-

PARACEL LABORATORIES LTD.

Order #: 2522337

Certificate of Analysis

Report Date: 03-Jun-2025

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

Order Date: 28-May-2025

Client PO:

Project Description: 23392-001

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics								
Conductivity	ND	0.005	mS/cm					
Hydrocarbons								
F1 PHCs (C6-C10)	ND	7	ug/g					
F2 PHCs (C10-C16)	ND	4	ug/g					
F3 PHCs (C16-C34)	ND	8	ug/g					
F4 PHCs (C34-C50)	ND	6	ug/g					
Metals								
Antimony	ND	1.0	ug/g					
Arsenic	ND	1.0	ug/g					
Barium	ND	1.0	ug/g					
Beryllium	ND	0.5	ug/g					
Boron	ND	5.0	ug/g					
Cadmium	ND	0.5	ug/g					
Chromium	ND	5.0	ug/g					
Cobalt	ND	1.0	ug/g					
Copper	ND	5.0	ug/g					
Lead	ND	1.0	ug/g					
Molybdenum	ND	1.0	ug/g					
Nickel	ND	5.0	ug/g					
Selenium	ND	1.0	ug/g					
Silver	ND	0.3	ug/g					
Thallium	ND	1.0	ug/g					
Uranium	ND	1.0	ug/g					
Vanadium	ND	10.0	ug/g					
Zinc	ND	20.0	ug/g					
mSPLP Leachate Metals								
Antimony	ND	0.5	ug/L					
Arsenic	ND	1.0	ug/L					
Barium	ND	1.0	ug/L					
Beryllium	ND	0.5	ug/L					
Boron	ND	10.0	ug/L					
Cadmium	ND	0.2	ug/L					

PARACEL LABORATORIES LTD.

Order #: 2522337

Certificate of Analysis

Report Date: 03-Jun-2025

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

Order Date: 28-May-2025

Client PO:

Project Description: 23392-001

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Chromium	ND	1.0	ug/L					
Cobalt	ND	0.5	ug/L					
Copper	ND	0.5	ug/L					
Lead	ND	0.2	ug/L					
Molybdenum	ND	0.5	ug/L					
Nickel	ND	1.0	ug/L					
Selenium	ND	1.0	ug/L					
Silver	ND	0.2	ug/L					
Thallium	ND	0.5	ug/L					
Uranium	ND	0.2	ug/L					
Vanadium	ND	0.5	ug/L					
Zinc	ND	5.0	ug/L					
Volatiles								
Benzene	ND	0.02	ug/g					
Ethylbenzene	ND	0.05	ug/g					
Toluene	ND	0.05	ug/g					
m,p-Xylenes	ND	0.05	ug/g					
o-Xylene	ND	0.05	ug/g					
Xylenes, total	ND	0.05	ug/g					
Surrogate: Toluene-d8	*9.99*		*%*	*125*	*50-140*			

PARACEL LABORATORIES LTD.

Order #: 2522337

Certificate of Analysis

Report Date: 03-Jun-2025

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

Order Date: 28-May-2025

Client PO:

Project Description: 23392-001

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
General Inorganics									
SAR	0.65	0.01	N/A	0.64			1.5	30	
Conductivity	0.334	0.005	mS/cm	0.337			1.1	5	
pH	7.04	0.05	pH Units	6.99			0.7	2.3	
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g	ND			NC	40	
F2 PHCs (C10-C16)	ND	4	ug/g	ND			NC	30	
F3 PHCs (C16-C34)	12	8	ug/g	14			16.0	30	
F4 PHCs (C34-C50)	ND	6	ug/g	11			NC	30	
Metals									
Antimony	1.2	1.0	ug/g	ND			NC	30	
Arsenic	2.1	1.0	ug/g	2.5			15.5	30	
Barium	9.9	1.0	ug/g	13.4			29.9	30	
Beryllium	ND	0.5	ug/g	ND			NC	30	
Boron	ND	5.0	ug/g	ND			NC	30	
Cadmium	ND	0.5	ug/g	ND			NC	30	
Chromium	7.1	5.0	ug/g	9.5			28.9	30	
Cobalt	2.4	1.0	ug/g	2.8			16.6	30	
Copper	12.4	5.0	ug/g	14.5			16.2	30	
Lead	6.7	1.0	ug/g	8.6			24.6	30	
Molybdenum	ND	1.0	ug/g	ND			NC	30	
Nickel	ND	5.0	ug/g	6.6			NC	30	
Selenium	ND	1.0	ug/g	ND			NC	30	
Silver	ND	0.3	ug/g	ND			NC	30	
Thallium	ND	1.0	ug/g	ND			NC	30	
Uranium	ND	1.0	ug/g	ND			NC	30	
Vanadium	15.1	10.0	ug/g	17.9			17.0	30	
Zinc	46.5	20.0	ug/g	58.1			22.1	30	
mSPLP Leachate Metals									
Antimony	ND	0.5	ug/L	ND			NC	50	
Arsenic	1.41	1.0	ug/L	1.37			2.9	50	

PARACEL LABORATORIES LTD.

Order #: 2522337

Certificate of Analysis

Report Date: 03-Jun-2025

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

Order Date: 28-May-2025

Client PO:

Project Description: 23392-001

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Barium	46.8	1.0	ug/L	42.9			8.6	50	
Beryllium	ND	0.5	ug/L	ND			NC	50	
Boron	17.3	10.0	ug/L	17.0			1.9	50	
Cadmium	ND	0.2	ug/L	ND			NC	50	
Chromium	10.0	1.0	ug/L	9.15			9.2	50	
Cobalt	1.42	0.5	ug/L	1.34			5.9	50	
Copper	5.22	0.5	ug/L	4.81			8.1	50	
Lead	2.18	0.2	ug/L	2.14			1.9	50	
Molybdenum	1.58	0.5	ug/L	1.57			0.1	50	
Nickel	4.63	1.0	ug/L	4.26			8.3	50	
Selenium	ND	1.0	ug/L	ND			NC	50	
Silver	ND	0.2	ug/L	ND			NC	50	
Thallium	ND	0.5	ug/L	ND			NC	50	
Uranium	0.30	0.2	ug/L	0.28			6.2	50	
Vanadium	7.89	0.5	ug/L	7.10			10.6	50	
Zinc	11.9	5.0	ug/L	11.8			0.5	50	
Physical Characteristics									
% Solids	89.5	0.1	% by Wt.	88.9			0.7	25	
Volatiles									
Benzene	ND	0.02	ug/g	ND			NC	50	
Ethylbenzene	ND	0.05	ug/g	ND			NC	50	
Toluene	ND	0.05	ug/g	ND			NC	50	
m,p-Xylenes	ND	0.05	ug/g	ND			NC	50	
o-Xylene	ND	0.05	ug/g	ND			NC	50	
Surrogate: Toluene-d8	*10.7*		*%*		*124*	*50-140*			

PARACEL LABORATORIES LTD.

Order #: 2522337

Certificate of Analysis

Report Date: 03-Jun-2025

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

Order Date: 28-May-2025

Client PO:

Project Description: 23392-001

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	162	7	ug/g	ND	94.5	85-115			
F2 PHCs (C10-C16)	95	4	ug/g	ND	103	60-140			
F3 PHCs (C16-C34)	263	8	ug/g	14	110	60-140			
F4 PHCs (C34-C50)	152	6	ug/g	11	98.8	60-140			
Metals									
Antimony	45.6	1.0	ug/g	ND	91.0	70-130			
Arsenic	45.4	1.0	ug/g	1.0	88.8	70-130			
Barium	54.3	1.0	ug/g	5.4	97.8	70-130			
Beryllium	49.8	0.5	ug/g	ND	99.5	70-130			
Boron	48.2	5.0	ug/g	ND	92.7	70-130			
Cadmium	48.6	0.5	ug/g	ND	97.2	70-130			
Chromium	56.5	5.0	ug/g	ND	105	70-130			
Cobalt	49.9	1.0	ug/g	1.1	97.5	70-130			
Copper	51.5	5.0	ug/g	5.8	91.3	70-130			
Lead	47.3	1.0	ug/g	3.5	87.7	70-130			
Molybdenum	49.2	1.0	ug/g	ND	98.3	70-130			
Nickel	50.9	5.0	ug/g	ND	96.5	70-130			
Selenium	49.2	1.0	ug/g	ND	98.4	70-130			
Silver	42.3	0.3	ug/g	ND	84.5	70-130			
Thallium	47.1	1.0	ug/g	ND	94.2	70-130			
Uranium	46.1	1.0	ug/g	ND	91.8	70-130			
Vanadium	55.4	10.0	ug/g	ND	96.4	70-130			
Zinc	61.1	20.0	ug/g	23.2	75.7	70-130			
mSPLP Leachate Metals									
Antimony	44.8	0.5	ug/L	ND	89.5	60-130			
Arsenic	49.5	1.0	ug/L	1.37	96.2	70-130			
Barium	96.3	1.0	ug/L	42.9	107	70-130			
Beryllium	48.7	0.5	ug/L	ND	97.2	70-130			
Boron	66.6	10.0	ug/L	17.0	99.2	70-130			
Cadmium	47.5	0.2	ug/L	ND	95.0	70-130			

PARACEL LABORATORIES LTD.

Order #: 2522337

Certificate of Analysis

Report Date: 03-Jun-2025

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

Order Date: 28-May-2025

Client PO:

Project Description: 23392-001

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Chromium	60.7	1.0	ug/L	9.15	103	70-130			
Cobalt	50.8	0.5	ug/L	1.34	99.0	70-130			
Copper	51.4	0.5	ug/L	4.81	93.3	70-130			
Lead	49.9	0.2	ug/L	2.14	95.5	70-130			
Molybdenum	51.1	0.5	ug/L	1.57	99.1	70-130			
Nickel	50.1	1.0	ug/L	4.26	91.7	70-130			
Selenium	50.8	1.0	ug/L	ND	102	70-130			
Silver	44.4	0.2	ug/L	ND	88.7	70-130			
Thallium	46.1	0.5	ug/L	ND	92.0	70-130			
Uranium	46.9	0.2	ug/L	0.28	93.2	70-130			
Vanadium	59.5	0.5	ug/L	7.10	105	70-130			
Zinc	60.8	5.0	ug/L	11.8	97.9	70-130			
Volatiles									
Benzene	3.19	0.02	ug/g	ND	79.8	60-130			
Ethylbenzene	4.50	0.05	ug/g	ND	112	60-130			
Toluene	4.36	0.05	ug/g	ND	109	60-130			
m,p-Xylenes	8.97	0.05	ug/g	ND	112	60-130			
o-Xylene	4.44	0.05	ug/g	ND	111	60-130			
Surrogate: Toluene-d8	*9.80*		*%*		*122*	*50-140*			

PARACEL LABORATORIES LTD.

Order #: 2522337

Certificate of Analysis

Report Date: 03-Jun-2025

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

Order Date: 28-May-2025

Client PO:

Project Description: 23392-001

Qualifier Notes:

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.

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.

- F1 range corrected for BTEX.

- F2 to F3 ranges corrected for appropriate PAHs where available.

- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.

- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

- When reported, data for F4G has been processed using a silica gel cleanup.

PARACEL LABORATORIES LTD

Paracel ID: 2522337

Paracel Order Number (Lab Use Only)	Chain of Custody (Lab Use Only)
2522337	№ 147093

Client Name: Cambium	Project Ref: 23392-001	Page 1 of 1
Contact Name: Matt Cunningham	Quote #	Turnaround Time
Address: 185 Bayfield St. #102 Barrie ON L4M 3B3	PO #	☐ 1 Day ☐ 3 Day ☐ 2 day ~~☐ Regular~~
Telephone: 705 559 1797	E-mail: matt.cunningham@cambium-inc.com	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: PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	metals and hydride forming metals	EC & SAR	mSPLP leachate metals	pH
1	BH101-25-2.7-3.2	S	-	3	N/A	May 23/25	-	X							X	X	X	
2	BH101-25-5.2-5.7	↓	-	3	↓	↓	-	X							X	X	X	X
3	BH102-25-1.5-2.1		-	3			-	X							X	X	X	X
4	QA/QC		-	2			-	X							X	X		
5																		
6																		
7																		
8																		
9																		
10																		

Comments:

Method of Delivery: RABBEX

Relinquished By (Sign):	Received at Depot:	Received at Lab: JM	Verified By: JM
Relinquished By (Print): Erin McLeod	Date/Time: 28-MAY-25 12:45	Date/Time: May 29/25 1325	Date/Time: May 29/25 1454
Date/Time: May 28 2025 12pm	Temperature 6.7 °C	Temperature 14.2 °C	pH Verified: ☐ By:

Appendix C

Salt-Impacted Excess Soil Reuse Rules

Salt-Impacted Excess Soil Reuse Rules

1. For the purposes of deemed compliance with excess soil quality standards as set out in paragraph 1 of subsection 1 (10.1) of Section A in Part II, salt-impacted excess soil shall be placed in accordance with the following:
    a. Salt-impacted excess soil may be placed in any area of the reuse site where it is anticipated a substance will be applied for the safety of vehicular or pedestrian traffic under conditions of snow or ice.
    b. Salt-impacted excess soil may be placed at any reuse site used for an industrial or commercial property use.
    c. In respect of a reuse site used for a community, parkland, institutional, or residential use,
        i. salt-impacted excess soil may be placed at a depth of at least 1.5 metres below the soil surface, or
        ii. if subparagraph i does not apply, it must be finally placed in accordance with a landscape plan described in subsection 5(8) of the regulation that meets the requirements set out in paragraph 3.
    d. In respect of a reuse site used for an agricultural or other property use,
        i. salt-impacted excess soil may be finally placed at a depth of at least 1.5 metres below the soil surface, or
        ii. if subparagraph i does not apply, in areas that will not be vegetated and only to achieve a grade necessary to construct a planned building, including a barn or greenhouse, or install a driveway or parking area.
2. Despite paragraph 1, in all cases, salt-impacted excess soil shall not be finally placed at any of the following areas of a reuse site:
    a. within 30 metres of a waterbody;
    b. within 100 metres of a potable water well or, with respect to an approved lot that may require a potable water well, within 100 metres of the planned water well location or if the location of the well is unknown, the centre of the lot; or
    c. an area that will be used for growing crops or pasturing livestock unless the salt-impacted excess soil is placed 1.5 metres or greater below the soil surface.
3. A landscape plan for the purposes of subsection 5(8) of the regulation and subclause 1.c)(ii) shall:
    A. Identify the areas within the reuse site in which salt-impacted excess soil can be finally placed, which shall include only the following:
        a. An area that will be unvegetated and that is not an area of the reuse site described in paragraph 2.
        b. An area that is not an area described in paragraph 2 and that will be vegetated with vegetation that,
            i. may tolerate elevated levels of chemicals associated with salt-impacted excess soil, or
            ii. requires less than 1.5 metres of soil that meets applicable excess soil quality standards to grow successfully.
    B. Identify, for each area mentioned in subparagraph A.b):
        a. The types of vegetation that may be planted in that area,
        b. The acceptable levels of salt-related contaminants that may be tolerated by the vegetation mentioned in subparagraph A.b)i, if applicable, and
        c. The depth of soil that must meet the applicable excess soil quality standards in order for the vegetation mentioned in subparagraph A.b)ii to grow successfully, if applicable.
    C. Be signed by a person with qualifications as set out in subsection 5(10) of the regulation.