Appendix: J

Geotechnical Investigation Report
March 21, 2023

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Geotechnical Investigation and Preliminary Soil Quality Screening New Bridge Crossing Design

Blakeney Road, 0.5 Kilometers West of the Town of Blakeney

GEMTEC Project: 100156.017

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Submitted to:

County of Lanark
99 Christie Lake Road
Perth, Ontario
K7H 3C6

Geotechnical Investigation and Preliminary Soil Quality Screening New Bridge Crossing Design

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1.0 INTRODUCTION

GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) was commissioned by the County of Lanark to carry out a geotechnical investigation in support of the replacement of the Blakeney Bridge along Blakeney Road; about 0.5 kilometers west of the Town of Blakeney, Ontario. The purpose of the investigation was to assess the existing pavement structure, subsurface conditions at the site and provide geotechnical recommendations for the project.

The work program was completed in accordance with GEMTEC proposal No. P100156.017, dated December 12, 2022.

Based on the factual information obtained, engineering guidelines are provided on the geotechnical design aspects for the bridge replacement, including construction considerations that could influence design decisions.

2.0 PROJECT AND SITE DESCRIPTION

The existing bridge, which has reached the end of its service life, consists of three separate spans with lengths of about 28 metres, 28 metres and 14 metres. The bridge decks span a total length of about 110 metres and are single lane in width.

It is understood that the County plans to replace the existing bridge on the same alignment and with abutments at about the same locations. The replacement bridge may be one or two lanes in width.

3.0 METHODOLOGY

3.1 Geotechnical Field Investigation

The geotechnical field investigation included five (5) boreholes, numbered 23-01 to 23-05 inclusive, at the locations shown on the borehole location plan (see Figure 1 in Appendix A). A complete description of the stratigraphy encountered at each borehole location is presented on the Record of Borehole sheets in Appendix B.

The geotechnical investigation was completed between January 23 and January 27, 2023 using a track-mounted drill operating under the supervision of GEMTEC personnel. The boreholes were advanced to bedrock using continuous flight hollow stem augers. Soil samples were obtained at regular intervals in the overburden soils with a 51-millimetre diameter Standard Penetration Test (SPT) split-spoon sampler. The sampling was performed in accordance with ASTM Standard D-1586.

The borehole locations were selected by GEMTEC and positioned relative to existing site features. The ground surface elevations at the locations of the boreholes were determined using GPS equipment.

Soil samples were examined in the field for type, texture and colour to classify each soil layer identified. The samples were sealed in air-tight plastic bags and transferred to GEMTEC's laboratory for further examination and selection of appropriate samples for laboratory testing.

Groundwater conditions within the boreholes were observed during the course of the field investigation and prior to backfilling. One monitoring well was installed in borehole 22-01.

Upon reaching auger refusal on the bedrock surface, the boreholes were advanced into the rock a further 1.5 metres using NQ sized diamond drilling equipment.

Table 3.1 summarizes the borehole numbers and final termination depths.

Table 3.1: Borehole Numbers and Termination Depths

Borehole No.	Depth Below Ground Surface (m)
23-01	4.57
23-02	5.18
23-03	5.97
23-04	4.57
23-05	4.90

3.2 Laboratory Testing Program

A laboratory soil testing program, as summarized in Table 3.2 below, was completed on selected soil samples. The result of the following laboratory tests are presented in Appendix C and/or on the Record of Borehole sheets.

Table 3.2: Laboratory Soil Testing Program

Test	ASTM Standard	Number of Tests
Natural Moisture Content	ASTM D2216	7
Particle Size Analysis (Sieve and Hydrometer)	ASTM D7928	3
Atterberg Limit	ASTM D4318	1
Corrosion Potential	-	1

4.0 SUBSURFACE CONDITIONS

4.1 General

As previously indicated, the subsurface soil conditions identified in the boreholes are presented on the Record of Borehole Sheets in Appendix B, laboratory analyses results are presented on the Laboratory Analyses in Appendix C. The borehole records indicate the subsurface conditions at the specific test locations only. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. The precision with which the subsurface conditions are indicated depends on the method of drilling, the frequency and recovery of samples, the method of sampling, and the uniformity of the subsurface conditions. Subsurface conditions at locations other than the test locations may vary from the conditions encountered in the boreholes. In addition to soil variability, fill or variable physical and chemical composition can be present over portions of the site or an adjacent property.

The soil descriptions in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification and identification of soils and bedrock involves judgement and GEMTEC does not guarantee descriptions as exact, but infers accuracy to the extent that is commonly in current geotechnical practice.

The groundwater conditions described in this report refer only to those observed at the place and time of observation noted in the report. Groundwater conditions may vary seasonally or as a consequence of construction activities in the area.

The following presents an overview of the subsurface conditions encountered in the boreholes advanced during this investigation.

4.2 Subsurface Conditions

4.2.1 Asphaltic Concrete

Asphaltic concrete pavement was encountered at surface at all borehole locations and the ranges in thickness from 80 millimetres to 180 millimetres.

4.2.2 Road Base Material

Underlying the asphaltic concrete surface pavement, road base material consisting of grey crushed sand and gravel, trace silt was encountered. The road base material was found to range in thickness from 220 to 280 millimetres.

The moisture content of one sample of the base material was 2 percent.

Laboratory particle size analysis was performed on one sample of the road base material from borehole 23-02. The results are presented in Appendix C and are summarized below in Table 4.1.

Table 4.1 – Summary of Particle Size Analysis (Road Base Material)

Borehole	Sample Number	Sample Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
23-02	1	0.15 – 0.41	69	25	6	

4.2.3 Road Subbase Material

Subbase material, consisting of dense to very dense, grey crushed sand and gravel, trace silt, was encountered underlying the base material. The subbase material was found to range in thickness from 1.2 to 2.3 metres.

Standard Penetration Test results (N values) recorded in the road subbase material ranged from 11 to greater than 100 blows per 300 millimetres of penetration. The moisture contents of three samples of the subbase material ranged from 1 to 30 percent.

Laboratory particle size analysis was performed on one sample of the subbase material. The results are presented in Appendix C and are summarized below in Table 4.2.

Table 4.2 – Summary of Particle Size Analysis (Road Subbase Material)

Borehole	Sample Number	Sample Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
23-02	2	0.61 – 1.37	62	31	7	

4.2.4 Silty Clay Fill Material

Underlying the road subbase material, a stiff to very stiff, grey to grey-brown silty clay fill material was encountered in all boreholes, with the exception of borehole 23-05. The fill material ranges in thickness from 0.6 to 1.8 metres.

Standard Penetration Test N values in the fill material ranged from 10 to 13 blows per 300 millimetres of penetration indicating a firm consistency. The moisture contents of two samples of the fill material were 12 and 31 percent.

Laboratory Atterberg Limit Testing was performed on one sample of the fill material. The results are presented in Appendix C; are summarized below in Table 4.3; and, indicate the fill is a clay of medium plasticity.

Table 4.3 – Summary of Atterberg Limit testing (Silty Clay Fill Material)

Borehole	Sample Number	Sample Depth (m)	LL (%)	PL(%)	PI (%)
23-03	4	2.29 – 2.90	48	21	27

4.2.5 Silty Clay

A thin (0.5 metre in thickness) deposit of silty clay was encountered underlying the fill in borehole 23-02. The upper portion of the deposit contained wood fragments and possible organics.

4.2.6 Glacial Till

Glacial till was encountered below the fill in boreholes 23-01, 23-04 and 23-05. The glacial till ranges from about 0.3 to 0.7 metres in thickness.

The glacial till can be generally described as grey-brown sandy silt and silty sand containing varying amounts of gravel, traces of clay and cobbles and boulders.

Laboratory particle size analysis was performed on one sample of the glacial till. The results are presented in Appendix C and summarized below in Table 4.4.

Table 4.4 – Summary of Particle Size Analysis (Glacial Till / Silt Material)

Borehole	Sample Number	Sample Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
23-05	4	2.29 – 2.90	63	35	2	

4.2.7 Bedrock

Bedrock was encountered underlying the overburden at all borehole locations at depths ranging from 2.6 metres to 3.2 metres below pavement surface.

The RQD values for the recovered core ranged, with one exception, from 75 to 100, indicating good to excellent quality rock. The exception was the initial short run of core (i.e., about 0.4 metres in length) in the rock at borehole 23-04 which had an RQD value of 0%. A limited thickness of fractured or weathered rock may also exist at the rock surface at borehole 23-02.

Laboratory compressive strength testing was conducted on one sample of rock core each from boreholes 23-03 and 23-05. The results are presented in Appendix C and summarized below in Table 4.5.

Table 4.5: Summary of Compressive Strength Testing

Borehole No.	Depth (m)	Failure Load (kN)	Corrected Strength (MPa)
23-03	4.95 – 5.28	184	103
23-05	4.34 – 4.64	157	89

The results of the compressive strength testing indicate a strong to very strong rock.

4.3 Groundwater Conditions

The groundwater level within the monitoring well installed in borehole 23-01 was measured on January 25, 2023. At that time, the groundwater level was measured at a depth of about 2.5 metres below the existing ground surface (i.e., elevation 96.0 metres).

The elevation of the surface water in the Mississippi River was also measured on January 25, 2023. At that time, the surface water was measured at an elevation of 96.4 metres.

The groundwater levels may be higher during wet periods of the year such as the early spring or following periods of precipitation. Furthermore, it is expected that the groundwater conditions will be influenced by the surface water levels in the Mississippi River.

4.4 Corrosion Potential of Soil and Groundwater

To evaluate the corrosion potential of the existing soils on subsurface structures one (1) soil sample was obtained and analysed for pH, resistivity, chloride and sulphate.

Table 4.6 summarizes the results obtained for the soil sample tested. The laboratory certificate of analyses are presented in Appendix D.

Table 4.6: Corrosion Potential Testing

Borehole No.	Sample No.	pH	Resistivity (Ohm cm)	Chloride (ug/g)	Sulphate (ug/g)
23-03	5	7.48	1610	139	130

5.0 DISCUSSION AND RECOMMENDATIONS

5.1 General

The information in the following sections is provided for the guidance of the design engineers and is intended for the design of this project only. Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data as it affects their construction techniques, schedule, safety and equipment capabilities.

5.2 Consequence and Site Understanding Classification

In accordance with Section 6.5 of the 2019 Canadian Highway Bridge Design Code (CSA S6:19) and its Commentary (CSA S6.1:19), the structure and its foundation system is classified as having a “typical consequence level” associated with exceeding limits states design. In addition, given the level of foundation investigation completed to date at this location in comparison to the degree of site understanding in Section 6.5 of the 2014 CHBDC, the level of confidence for design is considered to be “typical degree of site and prediction model understanding.” Accordingly, the appropriate corresponding ULS and SLS consequence factor, ψ, from Table 6.1 and geotechnical resistance factors, ϕ_{gu} and ϕ_{gs}, from Table 6.2 of the CHBDC (2019) have been used for design.

5.3 Shallow Foundations

5.3.1 Geotechnical Resistance

The bridge foundations may be supported on the bedrock. For bridge foundations on rock, a bearing resistance at Ultimate Limit States (ULS) of 5 MPa may be used for design. SLS resistance need not be considered since the bearing pressure that would result in foundation movements of 25 mm would exceed the ULS resistance.

Due to the low RQD value and highly fractured/weathered condition of some of the upper portions of the bedrock (i.e., at boreholes 23-02 and 23-04), some excavation of the upper ~0.5 metres of bedrock may be necessary in localized areas but only loose rock that is readily excavatable should be removed. A geotechnical engineer should observe the founding rock surface to confirm if removal is necessary at the time of construction.

Where the surface of the bedrock is below the design founding elevation, the foundations may be supported on mass concrete placed on properly cleaned and prepared bedrock. The mass concrete should extend beyond the edge of footings a distance equal to the depth of the mass concrete.

5.3.2 Resistance to Lateral Loads / Sliding Resistance

Resistance to lateral forces / sliding resistance between the foundations and the subgrade should be calculated in accordance with Section 6.10.4 of the CHBDC (2014). For the interface between

cast in place footings and the surface of the bedrock, a coefficient of friction, tan δ, (unfactored) of 0.7 may be used in the design.

Based on the previous borehole information, the rock service elevation at the foundation locations is fairly consistent with variations of no more than 1/2 metre. However, experience with this type of Precambrian rock suggests that the rock surface elevation may vary more than indicated and over the short foundation lengths there may be sloping bedrock. The design and construction documents should allow for dowels or additional excavation to create steps in the rock to allow for sloping bedrock at the time of construction.

5.3.3 Frost Protection

All footings should be provided with a minimum of 1.8 metres of earth cover for frost protection.

5.4 Seismic Design

5.4.1 Site Seismicity, Importance Category

CHBDC states that the seismic hazard values associated with the design earthquakes should be those established for the National Building Code of Canada (NBCC) by the Geological Survey of Canada (GSC). The GSC has developed a new set of seismic hazard maps (referred to as the 5th generation seismic hazard maps) that were made available for public use in December 2015.

It is understood that the importance category for this bridge shall be “other” in accordance with Section 4.4.2 of the CHBDC.

5.4.2 Seismic Site Classification

Subsurface ground conditions for seismic site characterization were established based on the results of the current field investigation and laboratory testing. Considering the expected founding on bedrock, a Site Class B is considered applicable for design of this bridge.

5.4.3 Seismic Performance Category

In accordance with Section 4.4.3.1. of the CHBDC, the peak ground acceleration (PGA) values and design spectral acceleration values for Site Class B at this site are shown in Table 5.1.

Based on the above values and Table 4.10 of the CHBDC, the seismic performance category for this bridge would be 2 for a bridge with a fundamental period less than 0.5s and 1 for a bridge with a fundamental period greater than 0.5 s.

From Table 4.11 in the CHNBDC, no seismic analysis is required for a bridge with a seismic performance category of 1 and a regular bridge of type “other” and a seismic performance category of 2 would require Force Based Design (FBD) as defined in the CHBDC.

Table 5.1: Seismic Hazard Values for Site Class B

Seismic Hazard Values	2% Exceedance in 50 years (2,475 Return Period)
PGA (g)	0.191
Sa (0.2) (g)	0.263
Sa (0.5) (g)	0.124
Sa (1.0) (g)	0.062
Sa (2.0) (g)	0.030
Sa (5.0) (g)	0.008
Sa (10.0) (g)	0.003

5.5 Lateral Earth Pressures for Design

The lateral earth pressures acting on the abutment stem walls and any associated wingwalls/retaining walls will depend on the type and method of placement of the backfill material, the nature of the soils behind the backfill, the magnitude of surcharge including construction loadings, the freedom of lateral movement of the structure, and the drainage conditions behind the walls.

The following recommendations are made concerning the design of the abutment walls and associated retaining walls. These design recommendations and parameters assume level backfill and ground surface behind the walls. Where there is sloping ground behind the walls, the coefficient of lateral earth pressure must be adjusted to account for the slope.

- Select, free draining granular fill meeting the specifications of OPSS.MUNI 1010 (Aggregates) Granular ‘A’ or Granular ‘B’ Type II, but with less than 5 % passing the No. 200 sieve, should be used as backfill behind the walls.
- Longitudinal drains and weep holes should be installed to provide positive drainage of the granular backfill. Compaction (including type of equipment, target densities, etc.) should be carried out in accordance with OPSS.MUNI 501 (Compacting).

- Other aspects of the granular backfill requirements with respect to sub-drains and frost taper should be in accordance with OPSD 3121.150 (Walls, Retaining, Backfill, Minimum Granular Requirement).
- A minimum compaction surcharge of 12 kPa should be included in the lateral earth pressures for the structural design of the wall stem, in accordance with Section 6.12.3 and Figure 6.8 of the 2019 CHBDC. Other surcharge loadings should be accounted for in the design as required.
- The lateral earth pressures are based on the proposed embankment fill material and the parameters provided in Table 5.2.

Table 5.2: Coefficients of Static Lateral Earth Pressure

Fill Type	Soil Unit Weight (kN/m^3)	Coefficients of Static Lateral Earth Pressure	
		At-Rest, Ko	Active, Ka
Granular 'A'	21	0.43	0.27
Granular 'B' Type II	22	0.43	0.27

Where the wall support does not allow lateral yielding, at-rest earth pressures should be assumed for the geotechnical design. Where the wall support allows lateral yielding of the stem, active earth pressures should be used in the geotechnical design of the wall structure(s). The movement required to allow active pressures to develop within the backfill, and thereby assume an unrestrained structure for design, should be calculated in accordance with Section C6.12.1 and Table C6.12 of the 2019 CHBDC.

5.6 Excavation

For foundations on rock, excavation for the proposed bridge foundation will be carried out through fill material, native silty clay and glacial till. The bedrock surface is indicated to be at elevations ranging from 95.2 to 96.0 metres and the measured groundwater level was at about elevation 96.0 metres or about 0.8 metres above the lowest bedrock surface. Depending on the water levels at the time of construction, excavations may therefore extend below the groundwater level (see Section 5.7 below).

The sides of the excavation should be sloped in accordance with the requirements in Ontario Regulation 213/19 under the Occupational Health and Safety Act. According to the Act, the overburden soil above the groundwater level can be classified as Type 3. The soils below the groundwater level would be classified as Type 4 soils and the excavations below the groundwater level will need to be sloped at 3 horizontal to 1 vertical, or flatter, unless the groundwater level is lowered in advance of excavation. If groundwater lowering or shallow excavation slopes are not feasible, then the excavations will need to be supported.

5.7 Groundwater and Surface Water Management

The dewatering effort required for construction will depend on the soil conditions, excavation depth and excavation dimensions. Given the proximity of the proposed construction to the river, the groundwater level in the area Is similar to the water level in the river based on the field measurement in the monitoring well installed in BH 23-01. Ideally, construction should be carried out during a dry period of the year (i.e., late summer) when the water levels are likely to low.

Cofferdams may be challenging to construct and seal since fractured bedrock, where encountered, may allow for significant inflows into excavations.

The construction, repair, alteration, extension, or replacement of bridge structures using active or passive in stream diversion measures are exempt from EASR permit requirements; however, appropriate discharge and sediment control measures must be implemented. This exemption to the requirements for an EASR or Permit to Take Water should be confirmed during design.

It is suggested that an excavation and groundwater management plan be submitted for review and approval as part of the contract.

5.8 Corrosion Potential of Soil and Recommendations

To evaluate the corrosion potential of the existing soils on concrete structures and buried steel, on soil sample was obtained and analysed for pH, resistivity, chloride and sulphate. The results are summarized in Table 4.2 with the laboratory certificates provided in Appendix D.

The measured sulphate concentrations in the sample of soil collected was 130 micrograms per gram. According to the Canadian Standards Association “Concrete Materials and Methods of Concrete Construction” (CSA A23.1-12 Table 3), the concentrations of sulphate in the soil recovered is less that the minimum concentration for ‘Moderate’ sulphate exposure (1000 to 2000 ppm). As such, the sulphate content of the subsurface soils should not affect the selection of the CSA A23.1 Class of Exposure. Other factors, (structurally reinforced or non-structurally reinforced, freeze-thaw environment, chloride exposure) should be considered in selecting the Class of Exposure and associated mixture proportioning and performance requirements.

It should be noted that the corrosivity of the soil could vary throughout the year due to the application of sodium chloride for de-icing purposes.

The resistivity results of the soil sample tested was found to be 1610 Ohms centimetre which indicates that the soil has a slightly aggressive degree of corrosiveness. The manufacturer of any buried steel elements that will be in contact with the soil should be consulted to determine the durability of the product used.

5.9 Pavement Design and Recommendations

5.9.1 General Considerations

The existing subgrade materials have been identified as having low frost susceptibility. As such, our recommended rehabilitation treatment is limited to the upper pavement structure only.

Given the short sections of flexible pavement at this location, full depth removal of the existing asphaltic concrete will address all existing distresses, prevent reflective cracking, permit the correction of profile and cross section, and provide a stable platform for new pavement materials.

5.9.2 Performance Graded Asphalt Cement

The standard base grade of Performance Graded Asphalt Cement (PGAC) for the County of Lanark is PG 58-34. The use of PG 64-34 asphalt cement should be considered given the slow moving nature of traffic over the bridge. If more than 15 percent of RAP is included with the new HMA, it is recommended that the low temperature grade of virgin asphalt cement be increased to PG 58-40.

The PGAC material should conform to OPSS 1101.

5.9.3 Preferred Rehabilitation Treatment

The preferred rehabilitation treatment will involve full depth removal of the existing asphaltic concrete by cold milling or other mechanical means. The remaining granular base material should be graded and compacted, with new OPSS Granular A provided as required, to meet design grades.

The prepared granular base should then be subjected to heavy proof rolling under the supervision of geotechnical personnel. Any noticeably soft areas should be subexcavated and replaced with suitable earth borrow that is compatible with the native soils and/or OPSS Granular A or B Type II depending upon the depth of removal. All new granular materials should be placed and compacted in maximum lifts of 200 millimetres and compacted to 98 percent of the standard Proctor maximum dry density as per ASTM D698.

Traffic data was not provided for Blakeney Road in this area. Based on the performance of the existing pavement structure, the following new Hot Mix Asphalt (HMA) layers could be placed following preparation of the granular base:

- 50 millimetres of Superpave 12.5 FC1 Traffic Level C surface course; placed over
- 70 millimetres of Superpave 19 Traffic Level C base course

The anticipated service life of the full depth asphaltic concrete removal and replacement alternative would be approximately 20 years.

5.9.4 Modifications to Preferred Rehabilitation Treatment

The preferred rehabilitation treatment has been recommended based on our understanding of the project objectives, the results of our investigation, noted assumptions, and engineering experience. The following modification to the preferred rehabilitation treatment is provided for consideration in the event that additional/modified project details become available.

As a lower cost alternative, the existing asphaltic concrete could be partially removed to a depth of 50 millimetres by cold milling and replaced with a 50-millimetre layer of Superpave 12.5 FC1 Traffic Level C surface course. Any distresses remaining in the asphaltic concrete after milling would be expected to manifest through the new HMA within 2 years. The anticipated service life of the partial depth removal and replacement alternative would be approximately 10 to 12 years.

6.0 ADDITIONAL CONSIDERATIONS

6.1 Effects of Construction Induced Vibration

Some of the construction operations (such as excavation, granular material compaction, etc.) will cause ground vibration on and off of the site. The vibrations will attenuate with distance from the source, but may be felt at nearby structures. Assuming that any excavation is carried out in accordance with the guidelines in this report, the magnitude of the vibrations will be much less than that required to cause damage to the nearby structures or utilities in good condition.

6.2 Monitoring Well Abandonment

The monitoring well installed as part of this investigation should be decommissioned by a licensed well technician. The well abandonment could be carried out in advance or during construction.

6.3 Design Review

The details for the proposed construction were not available to us at the time of preparation of this report. It is recommended that the final design drawings be reviewed by the geotechnical engineer to ensure that the guidelines provided in this report have been interpreted as intended.

The engagement of the services of the geotechnical consultant during construction is recommended to confirm that the subsurface conditions throughout the proposed excavations do not materially differ from those given in the report and that the construction activities do not adversely affect the intent of the design. The subgrade surfaces for the proposed bridge rehabilitation should be inspected by experienced geotechnical personnel to ensure that suitable materials have been reached and properly prepared. The placing and compaction of earth fill and imported granular materials should be inspected to ensure that the materials used conform to the grading and compaction specifications.

7.0 CLOSURE

We trust that this report provides sufficient information for your purposes. If you have any questions concerning this report, please do not hesitate to contact the undersigned.

Respectfully,

Tim Meighen, B.A.Sc.
Geotechnical Scientist

William (Bill) Cavers, P.Eng.
Senior Geotechnical Engineer

ABBREVIATIONS AND TERMINOLOGY USED ON RECORDS OF BOREHOLES AND TEST PITS

SAMPLE TYPES	
AS	Auger sample
CA	Casing sample
CS	Chunk sample
BS	Borros piston sample
GS	Grab sample
MS	Manual sample
RC	Rock core
SS	Split spoon sampler
ST	Slotted tube
TO	Thin-walled open shelby tube
TP	Thin-walled piston shelby tube
WS	Wash sample

SOIL TESTS	
w	Water content
PL, w_p	Plastic limit
LL, w_L	Liquid limit
C	Consolidation (oedometer) test
D_R	Relative density
DS	Direct shear test
G_S	Specific gravity
M	Sieve analysis for particle size
MH	Combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	Organic content test
UC	Unconfined compression test
γ	Unit weight

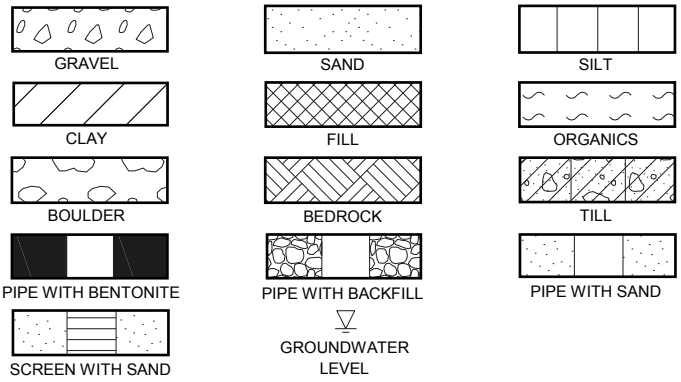
PENETRATION RESISTANCE

Standard Penetration Resistance, N
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 millimetres (30 in.) required to drive a 50 mm split spoon sampler for a distance of 300 mm (12 in.). For split spoon samples where less than 300 mm of penetration was achieved, the number of blows is reported over the sampler penetration in mm.

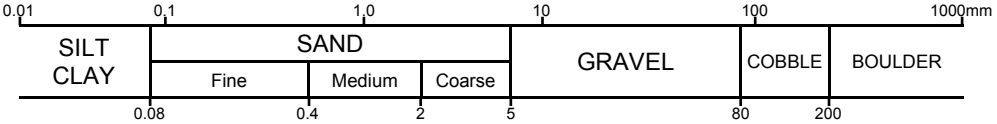
Dynamic Penetration Resistance
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive a 50 mm (2 in.) diameter 60° cone attached to 'A' size drill rods for a distance of 300 mm (12 in.).

WH	Sampler advanced by static weight of hammer and drill rods
WR	Sampler advanced by static weight of drill rods
PH	Sampler advanced by hydraulic pressure from drill rig
PM	Sampler advanced by manual pressure

COHESIONLESS SOIL Compactness		COHESIVE SOIL Consistency	
SPT N-Values	**Description**	**Cu, kPa**	**Description**
0-4	Very Loose	0-12	Very Soft
4-10	Loose	12-25	Soft
10-30	Compact	25-50	Firm
30-50	Dense	50-100	Stiff
>50	Very Dense	100-200	Very Stiff
		>200	Hard

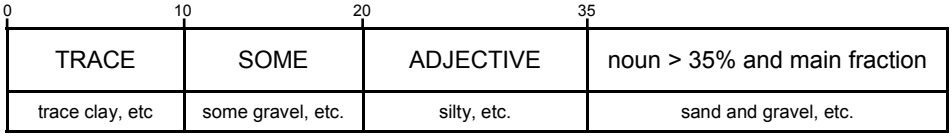


GRAIN SIZE



DESCRIPTIVE TERMINOLOGY

(Based on the CANFEM 4th Edition)



LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

WEATHERING STATE	
Fresh	No visible sign of rock material weathering
Faintly weathered	Weathering limited to the surface of major discontinuities
Slightly weathered	Penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material
Moderately weathered	Weathering extends throughout the rock mass but the rock material is not friable
Completely weathered	Rock is wholly decomposed and in a friable condition but the rock and structure are preserved

CORE CONDITION
Total Core Recovery (TCR) The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run
Solid Core Recovery (SCR) The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.
Rock Quality Designation (RQD) The percentage of solid drill core, greater than 100 mm length, as measured along the centerline axis of the core, relative to the length of the total core run. RQD varies from 0% for completed broken core to 100% for core in solid segments.

BEDDING THICKNESS	
Description	**Thickness**
Thinly laminated	< 6 mm
Laminated	6 - 20 mm
Very thinly bedded	20 - 60 mm
Thinly bedded	60 - 200 mm
Medium bedded	200 - 600 mm
Thickly bedded	600 - 2000 mm
Very thickly bedded	2000 - 6000 mm

DISCONTINUITY SPACING	
Description	**Spacing**
Very close	20 - 60 mm
Close	60 - 200 mm
Moderate	200 - 600 mm
Wide	600 -2000 mm
Very wide	2000 - 6000 mm

ROCK QUALITY	
RQD	**Overall Quality**
0 - 25	Very poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

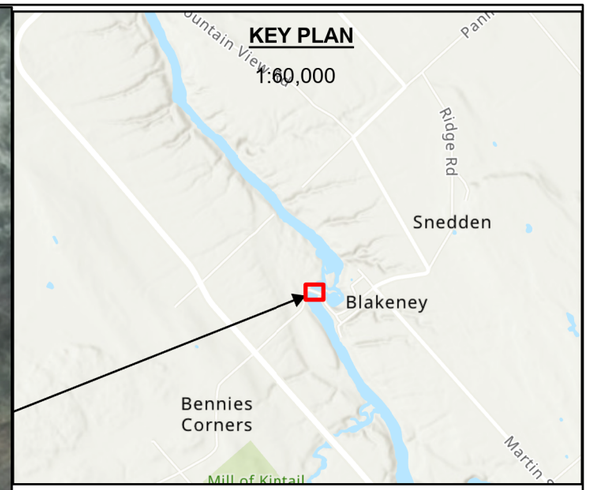
ROCK COMPRESSIVE STRENGTH	
Comp. Strength, MPa	**Description**
1 - 5	Very weak
5 - 25	Weak
25 - 50	Moderate
50 - 100	Strong
100 - 250	Very strong

APPENDIX A

Site Plan

KEY PLAN

1:60,000



LEGEND

- **BH #** ← **BOREHOLE ID**
- **XX.XX** ← **GROUND SURFACE ELEVATION, IN METRES GEODETIC DATUM**
- **BOREHOLE LOCATION** (current investigation by GEMTEC)

Service Layer Credits: World Imagery: Maxar, Microsoft
MVC DRAPE 2019 Imagery: Terms of Use
World Topographic Map: City of Ottawa, Province of Ontario, Esri Canada, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc,

Scale
1:600

0 5 10 20 30 40 50 Meters

GEMTEC
Consulting Engineers and Scientists
32 Steacie Drive,
Ottawa, ON K2K 2A9
T: (613) 836-1422
www.gemtec.ca
ottawa@gemtec.ca

Client:	Project:
County of Lanark	100156.017

Location: **Blakeney Road, 0.5 Kilometers West of the Town of Blakeney**

Drwn By:	Chkd By:	Title
E.P.	T.M.	**Borehole Location Plan Geotechnical Investigation, New Bridge Crossing Design**

Date: February 2023

Rev. 0

Figure 1

APPENDIX B

Record of Borehole Sheets

RECORD OF BOREHOLE 23-01

CLIENT: County of Lanark
PROJECT: Bew Bridge Crossing Design - Blakeney Road
JOB#: 100156.017
LOCATION: See Figure 1 for Survey Location

Northing: 5013398.4 Easting: 401907.3

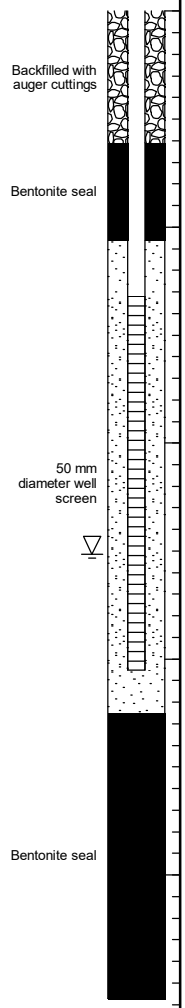
SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 23 2023

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface		98.54				
		ASPHALTIC CONCRETE		0.18				
		Grey, crushed sand and gravel, trace silt (BASE)		98.08	1	SS	305	61
		Very dense, grey, crushed sand and gravel, trace silt (SUBBASE)		0.46				
1					2	SS	455	67
2					3	SS	305	13
		Grey silty clay (FILL MATERIAL)		96.51 2.03				
					4	SS	305	5
		Wood fragments, possible organics		95.88				
		Grey SILT and grey brown, SILTY SAND, with gravel (GLACIAL TILL)		95.60				
3	Diamond Rotary Core Advance NQ (70mm OD)	Fresh, GRANITE BEDROCK			5	RC	1500	NQ
				93.97				
4		End of Borehole		4.57				
5								
6								
7								

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, %: W_P, W, W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING: TCR = 98%; SCR = 85%; RQD = 98%

PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
23/01/25	2.3 ▽	96.0

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Consulting Engineers and Scientists

LOGGED: TM
CHECKED: BC

GEO - BOREHOLE LOG 100156017_BLAKNEY_BH_LOGS_2023-02-01.GPJ GEMTEC 2018.GDT 2/17/23

RECORD OF BOREHOLE 23-02

CLIENT: County of Lanark
PROJECT: Bew Bridge Crossing Design - Blakeney Road
JOB#: 100156.017
LOCATION: See Figure 1 for Survey Location

Northing: 5013388.7 Easting: 401934.7

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 23 2023

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		98.66					
		ASPHALTIC CONCRETE		0.15					
		Grey, crushed sand and gravel, trace silt (BASE)		98.25	1	SS	330	114	
		Very dense, grey, crushed sand and gravel, trace silt (SUBBASE)		0.41					
1					2	SS	455	83	
2					3	SS	150	34	
		Grey brown, silty clay (FILL MATERIAL)		96.58 2.08					
					4	SS	510	15	
		Grey brown, SILTY CLAY with wood fragments, possible organics		95.95 2.71					
3		Grey brown, SILTY CLAY, some gravel							
				95.46	5	SS	230	50+	
		Potentially highly weathered and fractured BEDROCK		3.20 95.16					
4	Diamond Rotary Core Advance NQ (70mm OD)	Fresh, GRANITE BEDROCK		3.50	6	RC	1100	NQ	TCR = 100%; SCR = 81%; RQD = 100%
5					7	RC	600	NQ	TCR = 100%; SCR = 100%; RQD = 100%
				93.48					
		End of Borehole		5.18					
6									
7									

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, %: W_P, W, W_L
10 20 30 40 50 60 70 80 90

PIEZOMETER OR STANDPIPE INSTALLATION
Asphalt cold patch
Backfilled with auger cuttings
Bentonite seal

GEMTEC
Consulting Engineers and Scientists

LOGGED: TM
CHECKED: BC

GEO - BOREHOLE LOG 100156017_BLAKNEY_BH_LOGS_2023-02-01.GPJ GEMTEC 2018.GDT 2/17/23

RECORD OF BOREHOLE 23-03

CLIENT: County of Lanark
PROJECT: Bew Bridge Crossing Design - Blakeney Road
JOB#: 100156.017
LOCATION: See Figure 1 for Survey Location

Northing: 5013381.5 Easting: 401953.6

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 25 2023

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface		98.51					
		ASPHALTIC CONCRETE							
		Grey, crushed sand and gravel, trace silt (BASE)		0.15					
		Very dense grey, crushed sand and gravel, trace silt (SUBBASE)		0.31	1	SS	355	92	
1					2	SS	430	92	
		Firm, grey silty clay, possible organics (FILL MATERIAL)		96.99 1.52	3	SS	255	10	
2					4	SS	430	13	
3					5	SS	305	6	
		Grey CLAYEY SILT with gravel, and possible organics		95.19					
	Diamond Rotary Core Advance NQ (70mm OD)	Fresh, GRANITE BEDROCK			6	RC	985	NQ	TCR = 96%; SCR = 95%; RQD = 96%
4									
5					7	RC	1400	NQ	TCR = 100%; SCR = 85%; RQD = 92%
6		End of Borehole		92.54 5.97					
7									

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P W W_L
10 20 30 40 50 60 70 80 90

PIEZOMETER OR STANDPIPE INSTALLATION

GEMTEC
Consulting Engineers and Scientists

LOGGED: TM
CHECKED: BC

GEO - BOREHOLE LOG 100156017_BLAKNEY_BH_LOGS_2023-02-01.GPJ GEMTEC 2018.GDT 2/17/23

RECORD OF BOREHOLE 23-04

CLIENT: County of Lanark
PROJECT: Bew Bridge Crossing Design - Blakeney Road
JOB#: 100156.017
LOCATION: See Figure 1 for Survey Location

Northing: 5013371.3 Easting: 401982.2

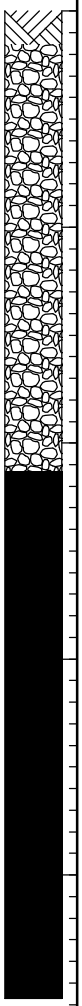
SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 27 2023

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		98.60					
		ASPHALTIC CONCRETE		0.08					
		Grey, crushed sand and gravel, trace silt (BASE)		98.27					
		Very dense grey, crushed sand and gravel, trace silt (SUBBASE)		0.33	1	SS	355	139	
1					2	SS	455	100	
		Grey silty clay (FILL MATERIAL)		97.28 1.32					
					3	SS	150	11	
2		Grey brown silty sand and gravel, with possible boulders and cobbles (GLACIAL TILL)		96.70 1.90					
	Diamond Rotary Core Advance NQ (70mm OD)	Fresh, GRANITE BEDROCK		96.04 2.56	4	RC	510	NQ	TCR = 95%; SCR = 50%; RQD = 0%
3									
4					5	RC	1470	NQ	TCR = 100%; SCR = 97%; RQD = 96%
		End of Borehole		94.03 4.57					
5									
6									
7									

SAMPLES

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

PIEZOMETER OR STANDPIPE INSTALLATION



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LOGGED: TM
CHECKED: BC

GEO - BOREHOLE LOG 100156017_BLAKNEY_BH_LOGS_2023-02-01.GPJ GEMTEC 2018.GDT 2/17/23

RECORD OF BOREHOLE 23-05

CLIENT: County of Lanark
PROJECT: Bew Bridge Crossing Design - Blakeney Road
JOB#: 100156.017
LOCATION: See Figure 1 for Survey Location

Northing: 5013365.3 Easting: 401997.6

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Jan 24 2023

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger Hollow Stem Auger (210mm OD)	Ground Surface		98.58						Asphalt cold patch
		ASPHALTIC CONCRETE		0.08						
		Grey, crushed sand and gravel, trace silt (BASE)		98.25						Filter sand
		Dense to very dense grey, crushed sand and gravel, trace silt (SUBBASE)		0.33	1	SS	355	139		
1					2	SS	455	100		
2					3	SS	150	11		Backfilled with auger cuttings
		Grey brown silty sand and gravel, with possible boulders and cobbles (GLACIAL TILL)		95.97 2.61	4	SS	280	24		
3				95.44	5	SS	50	50+		
	Diamond Rotary Core Advance NQ (70mm OD)	Fresh, GRANITE BEDROCK		3.14	6	RC	1000	NQ	TCR = 100%; SCR = 56%; RQD = 75%	Bentonite seal
4					7	RC	630	NQ	TCR = 100%; SCR = 82%; RQD = 100%	
		End of Borehole		93.68 4.90						
5										
6										
7										

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, %: W_P, W, W_L
10 20 30 40 50 60 70 80 90

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LOGGED: TM
CHECKED: BC

GEO - BOREHOLE LOG 100156017_BLAKNEY_BH_LOGS_2023-02-01.GPJ GEMTEC 2018.GDT 2/17/23

APPENDIX C

Laboratory Analyses

GEMTEC
Consulting Engineers and Scientists

Client: County of Lanark Public Works Building

Project: Geotechnical Investigation and Design for new Bridge crossing

Project #: 100156017

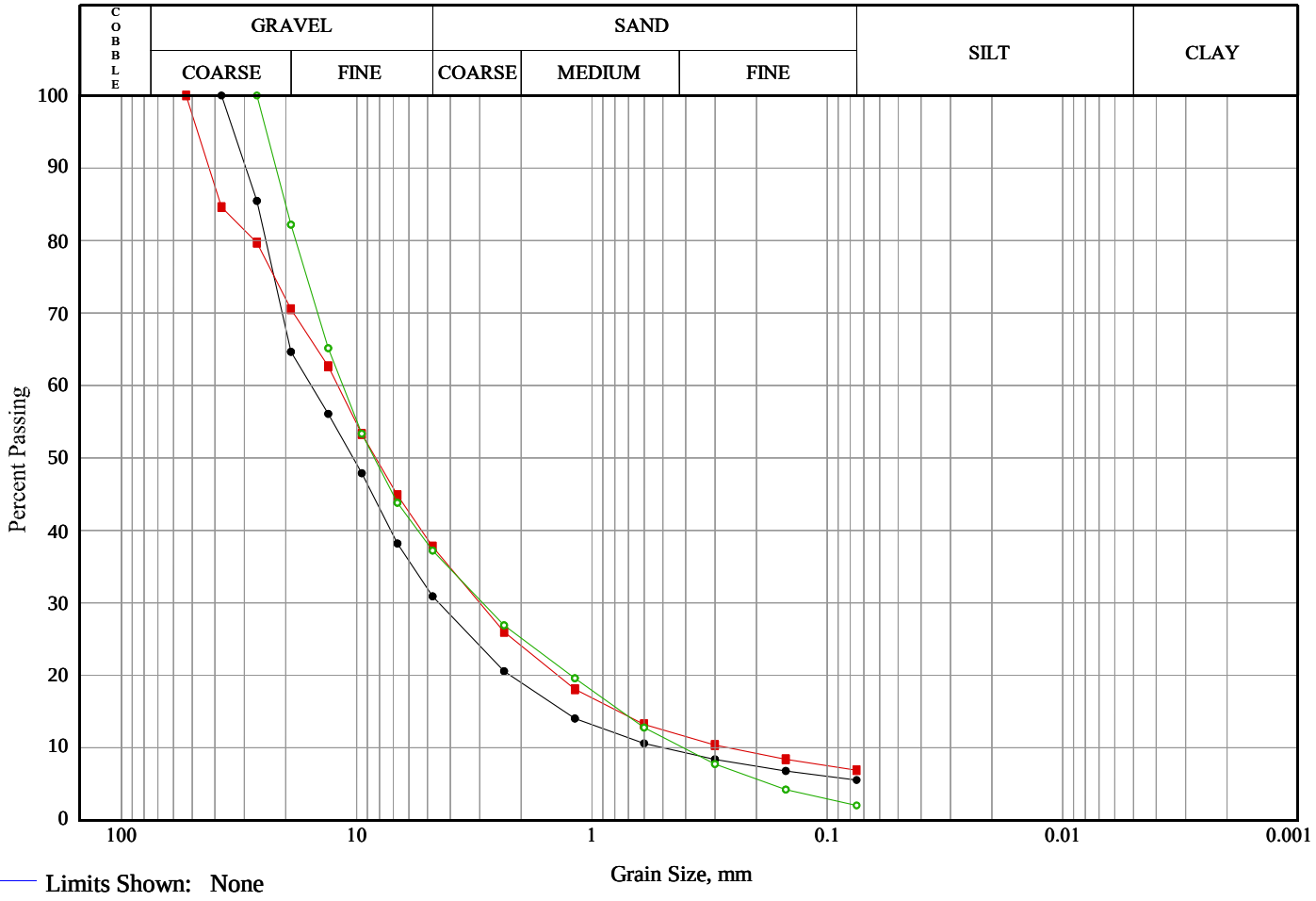
Moisture Content and Density

Borehole / Testpit	Depth	Sample	Description	Date/Time Sampled	Moisture Content, %	Sample Volume, mm^3	Wet Density, kg/m^3	Dry Density, kg/m^3
23-01	0.76-1.37	2		23/02/09 8:46:00 AM	1.45			
23-02	2.29-2.90	4		23/02/09 8:46:54 AM	30.81			
23-02	3.05-3.51	5		23/02/09 8:46:54 AM	12.63			
23-04	0.15-0.61	1		23/02/09 8:46:54 AM	1.80			
23-04	0.76-1.37	2A		23/02/09 8:46:54 AM	12.08			
23-04	0.76-1.37	2B		23/02/09 8:46:54 AM	2.35			
23-05	1.52-2.13	3		23/02/09 8:46:54 AM	30.14			

GEMTEC
Consulting Engineers and Scientists

Client:	County of Lanark Public Works Building
Project:	Geotechnical Investigation and Design for new Bridge cr
Project #:	100156017

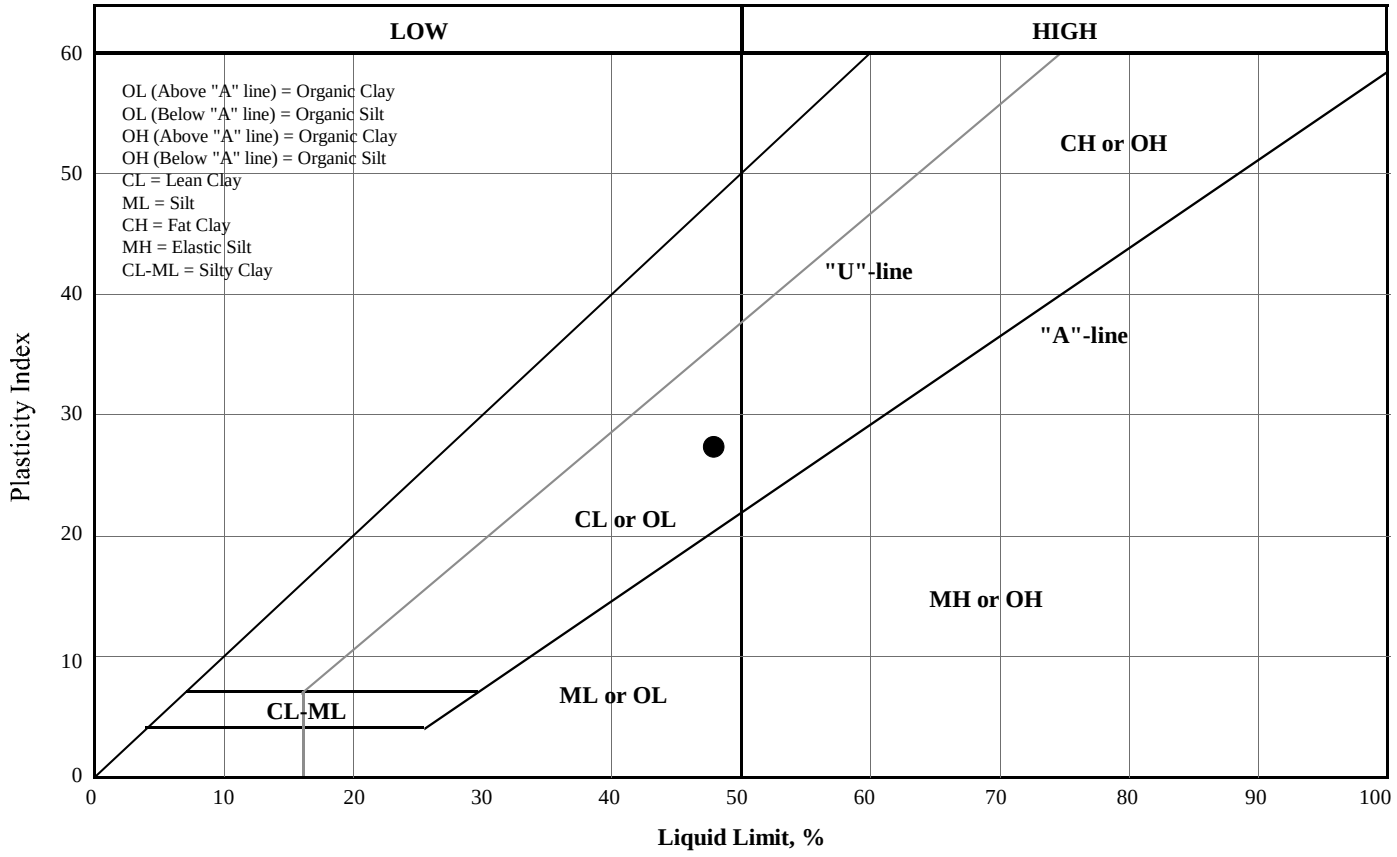
Soils Grading Chart



Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
●		23-02	1	0.15-0.61	69.1	25.3	5.5	
■		23-02	2	0.61-1.37	62.3	30.9	6.9	
○		23-05	4	2.29-2.90	62.8	35.2	2.0	

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
●	Sandy gravel , trace silt	N/A	0.50	1.31	4.48	10.35	15.61	26.31	---
■	Sandy gravel , trace silt	N/A	0.27	0.77	3.00	8.30	12.03	37.85	---
○	Gravel and sand , trace silt	GW	0.41	0.75	2.92	8.41	11.44	20.03	---

GEMTEC Consulting Engineers and Scientists	Client: County of Lanark Public Works Building	Plasticity Chart (D4318)
	Project: Geotechnical Investigation and Design for new Bridge cr	
	Project #: 100156017	



Symbol	Borehole /Test Pit	Sample Number	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Non-Plastic	Moisture Content, %
●	23-03	4	2.29-2.90	47.9	20.5	27.4	☐	--

Note: More information available upon request

GEMTEC Consulting Engineers and Scientists Limited
32 Steacie Drive
Ottawa, ON
K2K 2A9
Tel.: 613-836-1422
Fax.:613-836-9731

COMPRESSIVE STRENGTH of ROCK CORE

CLIENT: Lanark County **PROJECT No.:** 100156.017

Project: Blakeney **REPORT NO:** 1

Date Received: 31-Jan-23 **Date Tested:** 06-Feb-23

Lab no.						
Cylinder ID	23-03	23-05				
Depth (m)	4.95-5.28	4.34-4.64				
Cut length (mm)						
Ground length (mm)	99.66	94.05				
Diameter (mm)	47.90	47.35				
Ground Mass (kg)	4.60	4.38				
Length:Diameter ratio	2.08	1.99				
Correction factor	1.01	1.00				
Failure load (kN)	183.61	156.53				
Uncorrected Strength (MPa)	101.90	88.90				
Corrected Strength (MPa)	**102.90**	**88.90**				

Remarks

More information may be provided upon request

Checked by: Krystle Smith, Laboratory Manager

Reviewed by: Steve Goodman, Ph.D., P.Eng.

APPENDIX D

Laboratory Certificate

PARACEL LABORATORIES LTD.

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Ottawa, ON, K1G 4J8
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

GEMTEC Consulting Engineers and Scientists Limited

32 Steacie Drive
Kanata, ON K2K 2A9
Attn: Tim Meighen

Client PO:
Project: 100156.017
Custody:

Report Date: 6-Feb-2023
Order Date: 31-Jan-2023

Order #: 2305158

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

Paracel ID	Client ID
2305158-01	BH23-03 SA5, 10' - 11'9" Bot 10"

Approved By:

Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis

Report Date: 06-Feb-2023

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 31-Jan-2023

Client PO:

Project Description: 100156.017

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC, water extraction	6-Feb-23	6-Feb-23
Conductivity	MOE E3138 - probe @25 °C, water ext	3-Feb-23	3-Feb-23
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	2-Feb-23	3-Feb-23
Resistivity	EPA 120.1 - probe, water extraction	3-Feb-23	3-Feb-23
Solids, %	CWS Tier 1 - Gravimetric	2-Feb-23	2-Feb-23

Certificate of Analysis

Report Date: 06-Feb-2023

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 31-Jan-2023

Client PO:

Project Description: 100156.017

	Client ID:	BH23-03 SA5, 10' - 11'9" Bot 10"	-	-	-
	Sample Date:	25-Jan-23 12:43	-	-	-
	Sample ID:	2305158-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	72.4	-	-	-
General Inorganics					
Conductivity	5 uS/cm	623	-	-	-
pH	0.05 pH Units	7.48	-	-	-
Resistivity	0.10 Ohm.m	16.1	-	-	-
Anions					
Chloride	10 ug/g dry	139	-	-	-
Sulphate	10 ug/g dry	130	-	-	-

Certificate of Analysis

Report Date: 06-Feb-2023

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 31-Jan-2023

Client PO:

Project Description: 100156.017

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	10	ug/g						
Sulphate	ND	10	ug/g						
General Inorganics									
Conductivity	ND	5	uS/cm						
Resistivity	ND	0.10	Ohm.m						

Certificate of Analysis

Report Date: 06-Feb-2023

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 31-Jan-2023

Client PO:

Project Description: 100156.017

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	136	10	ug/g	139			2.2	35	
Sulphate	128	10	ug/g	130			1.6	35	
General Inorganics									
Conductivity	286	5	uS/cm	279			2.2	5	
pH	7.51	0.05	pH Units	7.49			0.3	2.3	
Resistivity	35.0	0.10	Ohm.m	35.8			2.2	20	
Physical Characteristics									
% Solids	71.4	0.1	% by Wt.	72.4			1.3	25	

Certificate of Analysis

Report Date: 06-Feb-2023

Client: GEMTEC Consulting Engineers and Scientists Limited

Order Date: 31-Jan-2023

Client PO:

Project Description: 100156.017

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	234	10	ug/g	139	94.3	82-118			
Sulphate	225	10	ug/g	130	94.4	80-120			

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 when the units are denoted with 'dry'.
Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

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TRU
RES
REL.....

Paracel ID: 2305158

Office
319 St. Laurent Blvd.
a, Ontario K1G 4J8
00-749-1947
acel@paracellabs.com

Chain of Custody
(Lab Use Only)

Page 1 of 1

Client Name: GEMTEC	Project Reference: 100156.017
Contact Name: Tim Meighen	Quote #
Address: 32 Steacie Dr, Kanata ON	PO #
Telephone: 613 836-1422	Email Address: timothy.meighen@gemtec.ca

Turnaround Time:
☐ 1 Day ☐ 3 Day
☐ 2 Day ☒ Regular
Date Required: _____

Criteria: ☐ O. Reg. 153/04 (As Amended) Table _ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: _____ ☐ Other: _____

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

Required Analyses

Paracel Order Number: 2305158

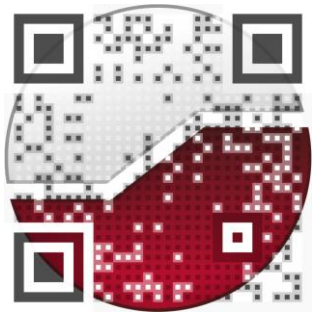
	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	chloride	pH/SO4	Elec. conductivity	Elec. Resistivity			
1	BH23-03 SA5, 10'-11'9" But 10"			1	Jan 25, 2023	12:43pm	☐	☐	☐	☐	☐	☐	☐	☒	☒	☒	☒	☐	☐	☐
2							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Comments:

Method of Delivery: Hand Walked

Relinquished By (Sign):	Received by Driver/Depot: 2:40 pm	Received at Lab: Sandra Demarins	Verified By: Sandra Demarins
Relinquished By (Print): Joey Murphy	Date/Time: Jan 31/23	Date/Time: Jan 31, 4:40	Date/Time: Jan 31, 4:45
Date/Time: Jan 31, 2023 12:47pm	Temperature: 5.8 °C	Temperature: 4.6 °C	pH Verified [ ] By:

experience • knowledge • integrity



civil	civil
geotechnical	géotechnique
environmental	environnement
structural	structures
field services	surveillance de chantier
materials testing	service de laboratoire des matériaux

expérience • connaissance • intégrité