FINAL GEOTECHNICAL INVESTIGATION REPORT

BOLINGBROKE BRIDGE REPLACEMENT

Bolingbroke Bridge

Ainley Group
Consulting Engineers and Planners
1-50 Grant Timmins Drive
Kingston, Ontario
K7M 8N3

File: 19543-1
August 22, 2019

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1.0 INTRODUCTION

Ainley Group was retained by the Corporation of Tay Valley Township to carry out a geotechnical investigation for the replacement of the Bolingbroke Bridge scheduled for construction in 2020. It is understood the proposed works are due to the poor condition of the existing bridge. It is expected that the bridge will be fully replaced with new reinforced concrete abutments and wingwalls constructed in place with a new prefabricated superstructure installed.

The objectives of the geotechnical assignment were:

- To secure soils, cores, and groundwater information/data about the proposed site that could affect the design and performance of the structure, including the effects that the soil, cores, and groundwater may have on construction procedures.
- To prepare a geotechnical report addressing foundation recommendations, backfilling, pavement structure rehabilitation and excavation during construction based on the information obtained during the geotechnical site investigation and laboratory analysis completed.

2.0 SITE DESCRIPTION

The existing structure is a slab on steel girder bridge located on Crow Lake Road, 0.1 km west of Bolingbroke Road in the geographic Township of Tay Valley. Crow Lake Road is a two-lane rural roadway approximately 6 m wide at the location of the structure. The structure accommodates a 5.0 metre wide wearing surface. The site has an AADT of 200, measured in August 2018, 25% of which is estimated to consist of commercial truck traffic.

The original construction date on the structure is 1930. In 1974, a full deck replacement was completed. Wearing surface repairs, expansion joint replacement and minor repairs to selected beams and girders was completed in 2003. In 2009, girder flange repairs, reinforcement of webs and cleaning and painted on girder ends was completed. Re-facing of concrete pier pedestals, repairs to the west abutment and bearing seat and re-coating of external girder ends was completed in 2010. In 2013, emergency repairs to the southwest bearing seat were completed. Full depth deck repairs and stringer replacement at southwest end of bridge was completed in 2015.

Tay River flows from west to east under Crow Lake Road. The existing structure is a single lane, 37.0 m long deck with a width of 5.7 m.

3.0 FIELDWORK / METHODOLOGY

The field program consisted of the advancement of two (2) geotechnical boreholes (BH) to investigate the sub-surface conditions. Prior to commencing the geotechnical investigation program, Ainley Group contacted local utility companies to obtain clearances for all underground services in the immediate area of the proposed field program.

The investigation was completed on July 3, 2019, under the constant supervision of a member of Ainley Group's geotechnical staff. A Site and Borehole Location Plan is attached to this report as **Figure No. 1**.

The boreholes were advanced to depths of 10.5 m (BH1) and 3.53 m (BH2) below ground surface using a truck mounted CME55 drilling rig equipped for soil and bedrock sampling. Groundwater conditions in the boreholes were monitored during the field investigation and representative samples of the subsoil were secured for review and laboratory testing. Rock cores of 3.3 m (BH1) and 1.58 m (BH2) were extracted to verify the bedrock surface at the bottom of the boreholes.

The location and ground surface elevations at each respective borehole location were surveyed using a Sokkia SRX3 Robotic Total Station with real time sub-centimeter accuracy, and referenced to the MTM Geodetic Coordinate system.

4.0 RESULTS OF THE INVESTIGATION

4.1 Subsurface Conditions

Full detail of the subsurface conditions encountered at the borehole locations are presented on the individual borehole logs included in **Appendix A**. It is emphasized however, that the soil types, their sequence, thickness and physical properties may vary between test locations and samples both vertically and horizontally.

Representative samples of the subsoil materials encountered within the boreholes were collected and returned to our office for further visual review by an Engineer having experience with soil classification and identification. A total of four (4) samples were selected and submitted to SNC Lavalin in Kingston, Ontario for gradation analysis and moisture content determination. Copies of the Grain Size Distribution results are included in **Appendix B**.

In general, the soils consist of a layer of asphalt overlying granular material (roadway structure) overlying sand and gravel fill, rock fill, and sand.

The soil characteristics and engineering properties are described in detail as follows:

4.1.1 North Approach (BH1)

4.1.2 Asphalt

The roadway wearing surface consisted of 80 mm of asphalt.

4.1.3 Granular Fill

Fill, consisting of sand and gravel was encountered beneath the asphalt layer. This sand and gravel fill layer was found to be 0.15 m thick and was in a compact state. The material is considered as roadway granular base course.

4.1.4 Asphalt

Beneath the granular base course, a 50 mm layer of buried asphalt was encountered indicating a previous grade raise to the roadway at this location.

4.1.5 Sand and Gravel Fill

A layer of sand and gravel fill was encountered beneath the buried asphalt layer. This sand and gravel fill layer was found to be 0.17 m thick and was in a compact state. This material is considered part of the original roadway granular base structure.

4.1.6 Sand Fill

A layer of sand some gravel and cobbles was encountered beneath the previous fill at a depth of 0.45 m and was found to extend to a depth of 1.50 m below existing grade. This sand some gravel layer was found to be in a compact state with an N-Value of 14 blows per 300 mm and is considered part of the original granular road subbase structure.

4.1.7 Rock Fill

A layer of cobbles and boulders rockfill with a gravelly sand matrix was encountered beneath the sand fill at a depth (elevation) of 1.50 m (162.69 m) below existing grade and extended to a depth (elevation) of 3.9 m (160.29 m). The rock layer was found to be 2.4 m thick and was in a loose state, compact at times.

4.1.8 Sand

A layer of sand, trace of silt, gravel, and cobbles was encountered beneath the rock fill at a depth (elevation) of 3.90 m (160.29 m). The sand layer extended to a depth (elevation) of 6.90 m (157.29 m) and was found to be in a compact state with N-Values between 16 and 50 blows per 300 mm.

4.1.9 Weathered Bedrock

A layer of weathered bedrock was encountered beneath the sand layer at a depth (elevation) of 6.9 m (157.29 m). The weathered layer of bedrock was 300 mm thick.

4.1.10 Bedrock

A layer of bedrock was encountered beneath the weathered bedrock layer at a depth (elevation) of 7.2 m (156.99 m) below existing site grades. Two rock core samples were extracted to a depth (elevation) of 10.5 m (153.69 m) below existing site grades where the borehole was terminated. The first rock core sample (RC1) found a poor quality, fine grained white granite bedrock with extensive horizontal fractures and few vertical fractures. The recovery was 94% and the RQD was determined to be 26%.

The second rock core sample (RC2) found a good quality, fine grained white granite bedrock with few horizontal fractures. The recovery was 97% with an RQD of 77%.

4.2.1 South Approach (BH2)

4.2.2 Asphalt

The roadway wearing surface consists of 90 mm of asphalt.

4.2.3 Roadway Base and Subbase

Fill, consisting of gravel and sand was encountered beneath the asphalt layer. This layer was found to be 0.12 m thick and was in a compact state. The material is considered as roadway granular base course.

Beneath the base course, a 0.14 m layer of silty sand, some clay trace of gravel, was encountered. The material extended to a depth of 0.35 m below existing site grades and was found to be in a loose state. This material is considered as roadway granular subbase course and roadway fill.

Grain size distribution testing results on one (1) sample of the granular base fill material indicate the material can be classified as gravel and sand. Results indicate the material meets OPSS 1010 specifications for Granular A with 51.8% (35% to 55% allowable) of the material passing the 4.75 mm sieve and 10% (2% to 10% allowable) of the material passing the 75 µm sieve. The Moisture Content was determined to be 1.8% at the time of the field investigation.

Grain size distribution testing results on one (1) sample of the granular subbase fill material indicate the material can be classified as silty sand, some clay trace of gravel. Results indicate the material does not meet OPSS 1010 specifications for Granular B, Type I with 98% (20% to 100% allowable) of the material passing the 4.75 mm sieve and 47% (0% to 8% allowable) of the material passing the 75 µm sieve. The Moisture Content was found to be 9.6% at the time of the field investigation.

4.2.4 Rock Fill

A layer of cobbles and boulders rockfill with a gravelly sand matrix was encountered beneath the granular fill at a depth (elevation) of 0.35 m (165.90 m) and extended to a depth (elevation) of 1.8 m (164.45 m). This layer was found to be 1.45 m thick and was in a loose, compact at times state.

Grain size distribution testing results on one (1) sample of the rock fill material indicate the material can be classified as sand with gravel and silt and cobbles and boulders. Results indicates 76.6% of the material passing the 4.75 mm sieve and 22.5% passing the 75 µm sieve. The Moisture Content was determined to be 6.0% at the time of the field investigation.

4.2.5 Sand

A layer of sand, trace of silt, gravel, and cobbles was encountered beneath the rock layer at a depth (elevation) of 1.80 m (164.45 m) and extended to a depth (elevation) of 1.95 m (164.30 m) where bedrock was encountered. This sand layer was found to be 0.15 m thick and was in a compact state.

4.2.6 Bedrock

Bedrock was encountered beneath the sand layer at a depth (elevation) of 1.95 m (164.30 m) below existing site grades. One rock core sample (RC1) was extracted and found a very poor quality, fine grained white granite bedrock with extensive horizontal fractures and frequent vertical fractures. The recovery was 97% and the RQD was determined to be 0%.

The bedrock was cored to a depth of 1.5 m below top of bedrock.

4.3 Groundwater

Groundwater was not encountered during the borehole investigation at both boreholes.

5.0 DISCUSSION AND RECOMMENDATIONS

It is expected that the bridge will be fully replaced with new reinforced concrete abutments and wingwalls constructed in place with a new prefabricated superstructure installed.

Based on the subsoil and groundwater conditions encountered at the borehole locations and considering them to be representative of the subsoil and groundwater conditions across the subject site, the following recommendations and comments are offered to advance the design and construction of the proposed structure.

Should the assumptions of this report be inconsistent with the final site design it is recommended that the geotechnical engineer be consulted with to ensure all recommendations are consistent with the proposed design and modifications are not warranted.

5.1 Foundations

Due to the variable depth to bedrock on either side of the structure, it is recommended that the structure found on spread footings bearing directly on bedrock at the south abutment and on piles driven to bedrock at the north abutment.

At the south approach, the structure may found on spread footings designed to bear on bedrock encountered at a depth (elevation) of 1.95 m (164.30 m) using a bearing capacity of 500 kPa (ULS). ULS will govern as settlement of the footing set on clean, sound bedrock will be negligible.

At the north abutment, it is recommended to consider steel H-piles or closed end steel tube piles (concrete filled) driven to the underlying bedrock encountered at a depth (elevation) of 7.20 m (156.99 m). The following summarizes the anticipated load capacities of selected H-piles:

Table 1 – Pile Capacities and Lateral Resistance

Pile Size	**Factored Capacity (ULS)**	**Factored Lateral Resistance (ULS)**	**Factored Lateral Resistance (SLS)**
HP310x110	1500 kN	55 kN	43 kN
HP310x79	1100 kN	55 kN	43 kN
254 mm dia. steel tube	1210 kN	45 kN	36 kN
222.3 mm dia. steel tube	850 kN	40 kN	32 kN

The above geotechnical capacities should be verified for structural capacity by the structural designer. It is cautioned that due to the presence of rock fill, difficulties may be experienced during the pile driving operation. Piling contractors should review the borehole logs and verify piling suitability based on experience under similar conditions. Full time inspection during the piling operation is recommended.

The piles should be installed as per OPSS 903 utilizing driving shoes in accordance with OPSS 3000.100 and points when seated onto bedrock. Piling equipment used to drive the piles should be capable of developing 30 kJ to 50 kJ per blow to set the piles. The load carrying capacity of the piles should be verified using a dynamic pile driving formula or other approved methods during construction.

5.2 Abutment Backfill

Backfill to abutments should consist of OPSS 1010 Granular B, Type I with a maximum aggregate size of 100 mm. The backfill should be placed in suitable lifts to achieve compaction of 95% SPMDD up to the roadway subgrade level. The backfill should be extended back of the abutment for a minimum of 2 m and installation of a subdrain for drainage should be provided.

The following parameters may be used to determine lateral earth pressures using Granular B, Type I backfill:

Unit Weight – dry (kN/m^3)	21.2
Angle of Internal Friction	32
Coefficient of Earth Pressure at Rest (K_O)	0.50
Coefficient of Active Earth Pressure (K_A)	0.41
Coefficient of Passive Earth Pressure (K_P)	3.3

5.3 Groundwater Control/Subsurface Drainage

It is recommended that construction occur during the dryer summer months, if possible. Dewatering of the construction area, if required, should be completed in accordance with OPSS 517 and OPSS 518. It is noted that groundwater levels may vary with seasonal variation in weather.

5.4 Excavations

All excavations should be carried out in accordance with the provisions in the Occupational Health and Safety Act. At the time of the field investigation the sub-soil materials encountered across the site can be classified as Type 3.

5.5 Roadway Reinstatement

The section of disturbed roadway should be removed full depth to allow placement of the following pavement structure:

50 mm	HL3 Surface Course
150 mm	Granular ‘A’
300 mm	Granular ‘B’, Type I

The asphalt cement should consist of PG58-34 with an asphalt cement content of 5.0% for the Surface Course. All granular material shall conform to OPSS 1010 and shall be placed in suitable lifts to achieve 100% of their SPMDD.

5.6 Site Inspections

It is recommended that all foundation and subgrade materials be inspected by qualified geotechnical personnel prior to the placement of any bedding materials or concrete footings, to ensure that the materials and founding elevations are consistent with the recommendations of this report. It is also recommended that the placement and compaction of all granular fill soils be monitored and tested by qualified geotechnical personnel to ensure that the appropriate materials and compaction densities are achieved.

6.0 CLOSURE

The Limitations of Report attached, form an integral part of this report. We trust this report provides sufficient information for your present requirements in accordance with our Terms of Reference. We trust this report is to your satisfaction. Should you have any questions concerning the above, please feel free to contact our office.

Sincerely,
AINLEY GRAHAM & ASSOCIATES LIMITED

Bill McLatchie, P.Eng.
Senior Geotechnical Engineer

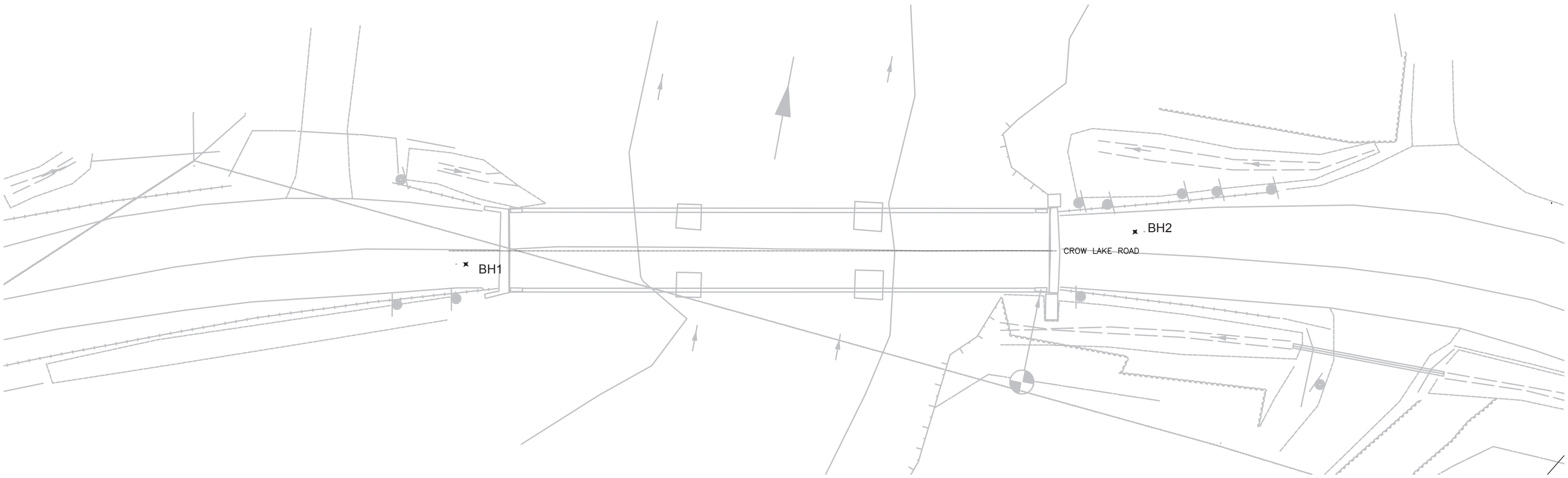
Limitations of Report

The conclusions and recommendations given in this report are based on information determined at the borehole locations. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the Soils Engineer be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the boreholes.

The comments made in this report are intended only for the guidance of the designer. The number of test pits may not be sufficient to determine all factors that may affect construction methods and costs. The contractors bidding on this project or undertaking the construction should therefore make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work.

This report has been prepared for design purposes, for the sole use of the Tay Valley Township. Any uses, which a Third Party makes of this report, or any reliance or decisions to be made based on it, are the responsibilities of said Third Parties. Ainley Group accepts no responsibility for damages if any, suffered by any Third Party as a result of decisions made or actions based on this report.

Figure 1
Site and Borehole Location Plan



REV.#	REVISIONS	DATE	INITIAL

Not Valid Unless Signed And Dated

SCALE:

DESIGN:

DRAWN:

CHECKED:

DATE:

Ainley Group
CONSULTING
ENGINEERS
PLANNERS

BOLINGBROKE BRIDGE REPLACEMENT

BOREHOLE LOCATIONS

CONTRACT No. | DWG

K:\Projects\19543 - Bolingbroke Bridge\19543-1\Drawings\19543-1 Bolingbroke Bridge - GA.dwg 2019-07-23 3:06 PM Liza Guilbeau

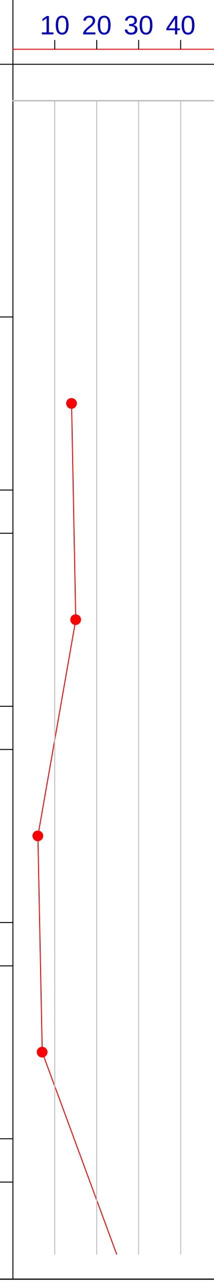
Appendix A
Borehole Logs

Ainley Group
1-50 Grant Timmins Drive
Kingston, Ontario
K7M 8N2

Log of Borehole: BH1

Project No.: 2019-PW-006
Project: Bolingbroke Bridge
Client: Tay Valley Township
Location: West Approach
Ground Elevation (masl): 164.19
Water Elevation (masl): NA
Depth to Water (m): NA

SUBSURFACE PROFILE			SAMPLE						
Depth (ft / m)	Elevation	Description	Number	Type	Recovery	SPT	SPT Graph (10 20 30 40)	Groundwater	Symbol Log
0 / 0	0.00	Ground Surface							
	0.23	***Asphalt*** 80 mm							
	0.45	***Fill*** Sand and gravel, compact, white.							
2		***Asphalt*** 50 mm							
		Fill Sand and gravel, compact, brown.							
4	1.50	***Fill*** Sand, some gravel and cobbles, compact, brown.	JC001		38	14			
6 / 2		***Rock Fill*** Sand some gravel and cobbles and boulders, loose, compact at times, brown.	JC002		17	15			
8			JC003		21	6			
10			JC004		29	7			
12	3.90		JC005			26			



Drilled By: G.E.T Drilling
Drill Method: Truck Mounted CME 55
Drill Date: July 3, 2019
Project Engineer: Bill McLatchie, P.Eng
Project Technician: Joshua Charlton, C.Tech.

Ainley Group
1-50 Grant Timmins Drive
Kingston, Ontario
K7M 8N2

Log of Borehole: BH1

Project No.: 2019-PW-006

Project: Bolingbroke Bridge

Client: Tay Valley Township

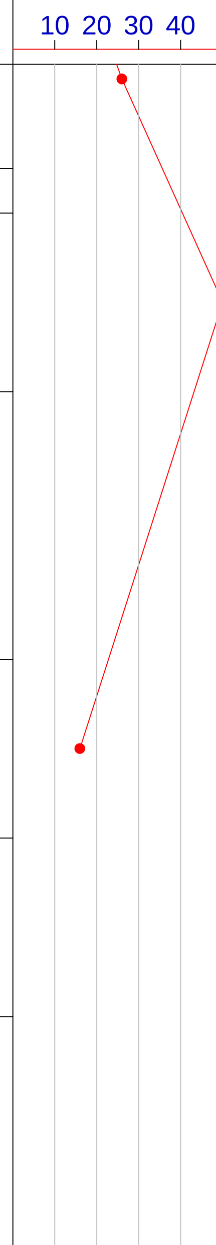
Location: West Approach

Ground Elevation (masl): 164.19

Water Elevation (masl): NA

Depth to Water (m): NA

SUBSURFACE PROFILE			SAMPLE						
Depth	Elevation	Description	Number	Type	Recovery	SPT	SPT Graph (10 20 30 40)	Groundwater	Symbol Log
		Sand Sand, trace of silt, gravel and cobbles, compact, brown.	JC005		71	26			
15			JC006		33	50			
17									
19									
6			JC007		17	16			
21									
	6.90								
23	7.20	***Weathered Bedrock***							
25									



Drilled By: G.E.T Drilling

Drill Method: Truck Mounted CME 55

Drill Date: July 3, 2019

Project Engineer: Bill McLatchie, P.Eng

Project Technician: Joshua Charlton, C.Tech.

Ainley Group
1-50 Grant Timmins Drive
Kingston, Ontario
K7M 8N2

Log of Borehole: BH1

Project No.: 2019-PW-006 | **Ground Elevation (masl):** 164.19
Project: Bolingbroke Bridge | **Water Elevation (masl):** NA
Client: Tay Valley Township | **Depth to Water (m):** NA
Location: West Approach

SUBSURFACE PROFILE			SAMPLE						
Depth	Elevation	Description	Number	Type	Recovery	SPT	SPT Graph (10 20 30 40)	Groundwater	Symbol Log
28 / 30 / 32 / 34 (ft); 10 (m)	10.50	***Bedrock*** Poor quality, fine grained, white granite bedrock with extensive horizontal fractures and few vertical fractures becoming good quality with depth with few horizontal fractures. RC1 Rec = 94% RQD = 26% RC2 Rec = 97% RQD = 77%	RC1		-	-			
			RC2		-	-			
36 / 38		***End of Borehole at 10.50 m below existing site grades within bedrock.*** Note: Groundwater infiltration was not encountered during the borehole investigation.							

Drilled By: G.E.T Drilling
Drill Method: Truck Mounted CME 55
Drill Date: July 3, 2019

Project Engineer: Bill McLatchie, P.Eng
Project Technician: Joshua Charlton, C.Tech.

Ainley Group
1-50 Grant Timmins Drive
Kingston, Ontario
K7M 8N2

Log of Borehole: BH2

Project No.: 2019-PW-006
Project: Bolingbroke Bridge
Client: Tay Valley Township
Location: East Approach

Ground Elevation (masl): 166.25
Water Elevation (masl): NA
Depth to Water (m): NA

SUBSURFACE PROFILE			SAMPLE						
Depth (ft / m)	Elevation	Description	Number	Type	Recovery	SPT	SPT Graph (10 20 30 40)	Groundwater	Symbol Log
0 / 0	0.00	Ground Surface							
	0.09	***Asphalt*** 90 mm							
	0.21	***Fill*** Gravel and sand, compact, white. % Passing JC008 4.75 mm = 51.8 75 um = 10 Moisture Content = 1.8%	JC008		-	-			
	0.35	***Fill*** Silty sand, some clay traces of gravel, loose, brown. % Passing JC009 4.75 mm = 98 75 um = 47 5 um = 20 2 um = 15 Moisture Content = 9.6%	JC009		-	-			
2		***Rock Fill*** Sand with gravel and silt and cobbles and boulders, loose, compact at times, brown. % Passing JC010 4.75 mm = 76.6 75 um = 22.5 Moisture Content = 6.0%	JC010		17	16			
4			JC011		50	10			
6	1.80	***Sand*** Sand, trace of silt, gravel and cobbles, compact, brown.							
8 / 2	1.95								

Drilled By: G.E.T Drilling
Drill Method: Truck Mounted CME 55
Drill Date: July 3, 2019
Project Engineer: Bill McLatchie, P.Eng
Project Technician: Joshua Charlton, C.Tech.
Sheet: 1 of 2

Ainley Group
1-50 Grant Timmins Drive
Kingston, Ontario
K7M 8N2

Log of Borehole: BH2

Project No.: 2019-PW-006	***Ground Elevation (masl):*** 166.25
Project: Bolingbroke Bridge	***Water Elevation (masl):*** NA
Client: Tay Valley Township	***Depth to Water (m):*** NA
Location: East Approach	

SUBSURFACE PROFILE			SAMPLE						
Depth	Elevation	Description	Number	Type	Recovery	SPT	SPT Graph (10 20 30 40)	Groundwater	Symbol Log
10	3.53	***Bedrock*** Very poor quality, fine grained, white granite bedrock with extensive horizontal fractures with frequent vertical fractures. RC3 Rec = 97% RQD = 0%	RC3		-	-			
12 14 5 16		***End of Borehole at 3.53 m below existing site grades within bedrock.*** Note: Groundwater infiltration was not encountered during the borehole investigation.							

Drilled By: G.E.T Drilling

Drill Method: Truck Mounted CME 55

Drill Date: July 3, 2019

Project Engineer: Bill McLatchie, P.Eng

Project Technician: Joshua Charlton, C.Tech.

Appendix B
Grain Size Distribution Results

SNC·LAVALIN

Lab # 19126 Client Ainley

Project Name: 19543-1 Bolingbroke Bridge Date: July 3,2019

SAMPLE INFORMATION	SAMPLE	MASS OF SAMPLE WET & TARE (g)	MASS OF SAMPLE DRY & TARE (g)	MASS OF WATER (g)	MASS OF DRY SOIL (g)	MASS OF TARE (g)	MOISTURE CONTENT (%)
JC006	A	569.6	521	48.6	384.5	136.5	12.6
JC008	B	845.2	832.7	12.5	706.6	126.1	1.8
JC009	C	612.8	566	46.8	485.6	80.4	9.6
JC010	D	592.4	563.5	28.9	485	78.5	6.0

SNC-Lavalin GEM Ontario Inc.
1164 Clyde Court
Kingston, Ontario K7P 2E4
(613) 389-178   (613) 389-4204

Grain Size Analysis Test Report

Project No.: 18-1690-06 **Project Description:** Lab Testing **Date:** Jul 12, 2019
Project Location: **Contract No.:**

SAMPLE DATA

Material: Soil
Date Sampled: Jul 03, 2019
Time Sampled:
Sample Type: Borehole
Sample Location: Bolingbroke Bridge ID:JC006 BH#1 4.5-5.1M
Lot: **Sublot:**
Source: Ainley
Sampled By: Client

LAB DATA

Lab No.: **19126-A** **Date Tested:** Jul 03, 2019
Specification: OPSS, SSM

Grain Size Analysis

Sieve Sizes (mm)	Percent Passing	
	Sample	Specification
150.0		100 - 100
100.0		-
75.0		-
53.0		-
50.0		-
37.5		-
26.5	100	50 - 100
25.0		-
19.0		-
16.0		-
13.2		-
9.5		-
6.7		-
4.75	82.8	20 - 100
2.36		-
2.00		-
1.18	64.5	10 - 100
0.600		-
0.425		-
0.300	39.5	5 - 95
0.150	26.4	2 - 65
0.075	19.1	0 - 25

* Indicates Out of Specification

PARTICLE ANALYSIS

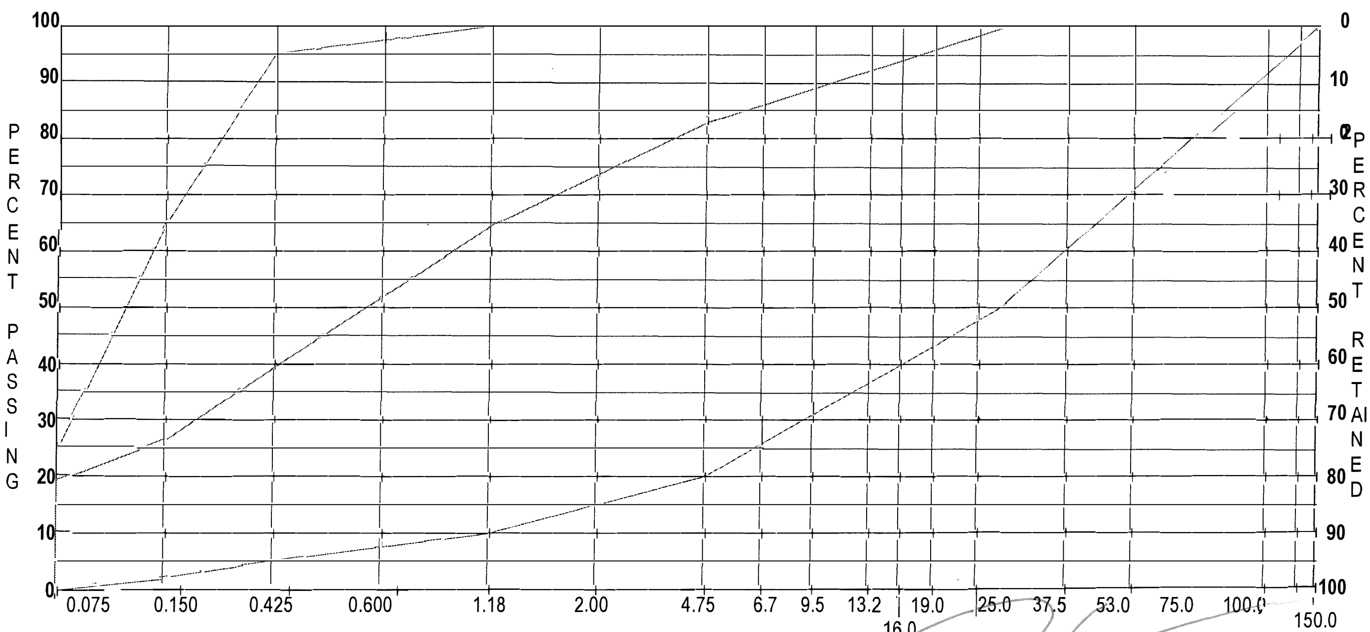
TEST	Sample	Specification
Percent Crushed:		
% Asphalt Coated:		
% Flat and Elongated		

WASH PASS 0.075mm

TEST	Sample	Specs
Wash Pass 0.075 mm:		
FINENESS MODULUS	1.87	

Comments: Moisture Content is 12.6%

Sample: .... **Specs:** ....



Project Manager: Mark McClelland, C.E.T

SNC • LAVALIN

SNC-Lavalin GEM Ontario Inc.
1164 Clyde Court
Kingston, Ontario K7P 2E4
(613) 389-178 (613) 389-4204

Grain Size Analysis Test Report

Project No.: 18-1690-06 **Project Description:** Lab Testing **Date:** Jul 12, 2019

Project Location: **Contract No.:**

SAMPLE DATA

Material: Granular
Date Sampled: Jul 03, 2019
Time Sampled:
Sample Type: Borehole
Sample Location: Bolingbroke Bridge ID:JC008 BH#2 0.9-0.21M
Lot: **Sublot:**
Source: Ainley
Sampled By: Client

LAB DATA

Lab No.: **19126-B** **Date Tested:** Jul 03, 2019

Specification: OPSS, Granular A

PARTICLE ANALYSIS

TEST	Sample	Specification
Percent Crushed:		60
% Asphalt Coated:		30
% Flat and Elongated		

WASH PASS 0.075mm

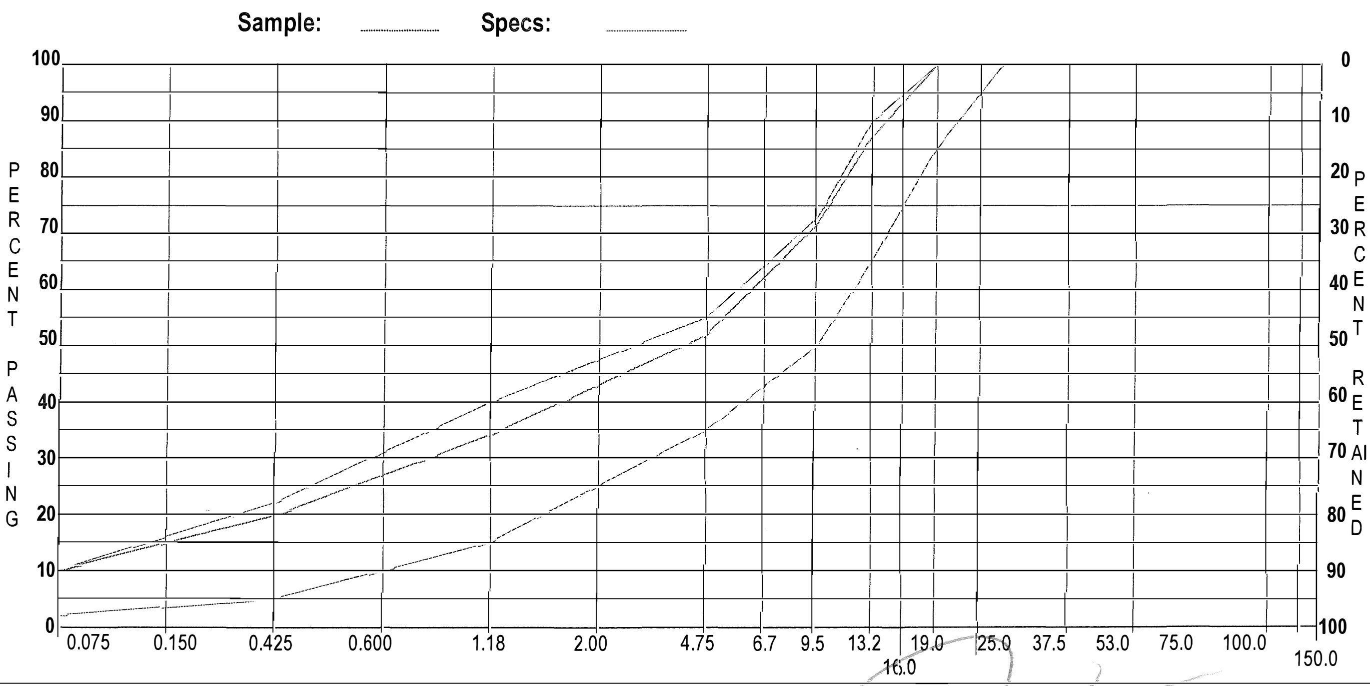
TEST	Sample	Specs
Wash Pass 0.075 mm:		
FINENESS MODULUS	**2.23**	

Comments: Moisture Content is 1.8%

Grain Size Analysis

Sieve Sizes (mm)	Percent Passing Sample	Percent Passing Specification
150.0		-
100.0		-
75.0		-
53.0		-
50.0		-
37.5		-
26.5	**100**	100 - 100
25.0		-
19.0	**100**	85 - 100
16.0		-
13.2	**87.4**	65 - 90
9.5	**71.9**	50 - 73
6.7		-
4.75	**51.8**	35 - 55
2.36		-
2.00		-
1.18	**34.1**	15 - 40
0.600		-
0.425		-
0.300	**19.7**	5 - 22
0.150		-
0.075	**10**	2 - 10

* Indicates Out of Specification

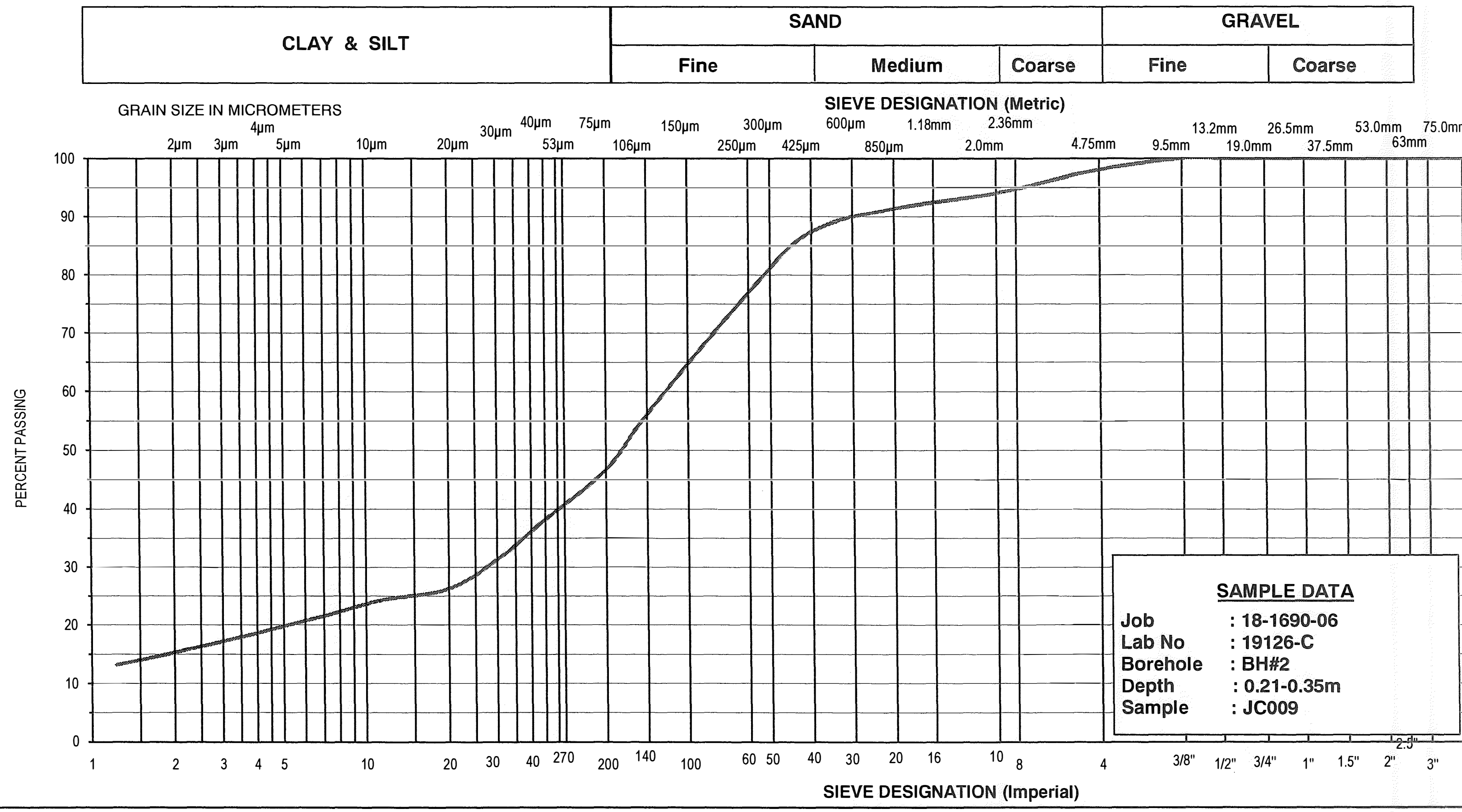


Project Manager: Mark McClelland, C.E.T

Infrastructure

SNC-LAVALIN

UNIFIED SOIL CLASSIFICATION SYSTEM



% +3"	% Gravel		% Sand			% Fines	
	Course	Fine	Course	Medium	Fine	Silt	Clay
	0	2	4	7	41	32	15

SNC-LAVALIN 1164 Clyde Court Kingston, Ontario K7P 2E4	**GRAIN SIZE DISTRIBUTION**	**Client: Ainley**	
		Project: 18-1690-06	
	SILTY SAND	**Location: 19543-1 Bolingbroke Bridge**	
	Some Clay,Trace Gravel	**Date: July 3,2019**	**Moisture Content is 9.6 %**

SNC·LAVALIN

SNC-Lavalin GEM Ontario Inc.
1164 Clyde Court
Kingston, Ontario K7P 2E4
(613) 389-178 (613) 389-4204

Grain Size Analysis Test Report

Project No.: 18-1690-06 **Project Description:** Lab Testing **Date:** Jul 12, 2019

Project Location: **Contract No.:**

SAMPLE DATA

Material: Subsoil
Date Sampled: Jul 03, 2019
Time Sampled:
Sample Type: Borehole
Sample Location: Bolingbroke Bridge ID:JC010 BH#2 0.75-1.05M
Lot: **Sublot:**
Source: Ainley
Sampled By: Client

LAB DATA

Lab No.: **19126-D** **Date Tested:** Jul 12, 2019

Specification: OPSS, SSM

Grain Size Analysis

Sieve Sizes (mm)	Percent Passing	
	Sample	Specification
150.0	**100**	100 - 100
100.0		-
75.0		-
53.0		-
50.0		-
37.5		-
26.5	**100**	50 - 100
25.0		-
19.0		-
16.0		-
13.2		-
9.5		-
6.7		-
4.75	**76.6**	20 - 100
2.36		-
2.00		-
1.18	**58.9**	10 - 100
0.600		-
0.425		-
0.300	**42.1**	5 - 95
0.150	**30.3**	2 - 65
0.075	**22.5**	0 - 25

* Indicates Out of Specification

PARTICLE ANALYSIS

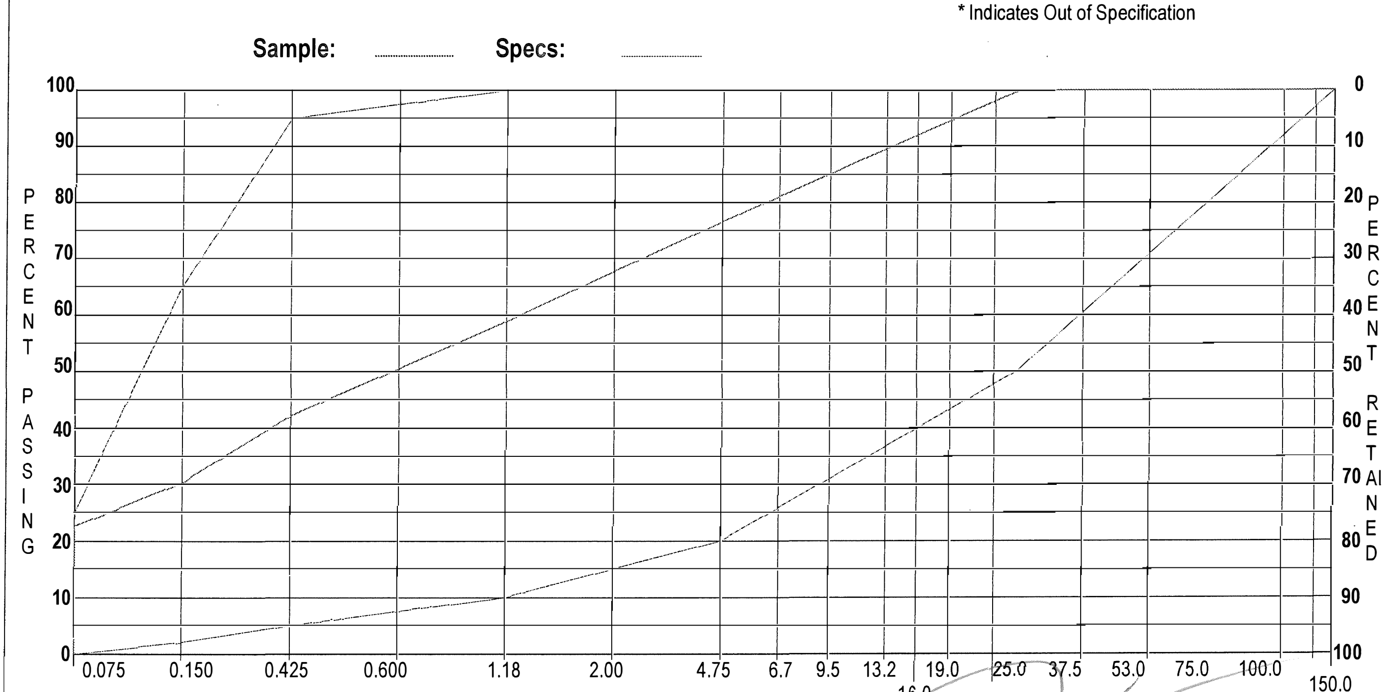
TEST	Sample	Specification
Percent Crushed:		
% Asphalt Coated:		
% Flat and Elongated		

WASH PASS 0.075mm

TEST	Sample	Specs
Wash Pass 0.075 mm:		

FINENESS MODULUS	**1.92**

Comments: Moisture Content is 6.0%



Project Manager: Mark McClelland, C.E.T