



Englobe

Soils Materials Environment

**Submitted To AECOM Canada Ltd.
189 Wyld Street Suite 103, North Bay, Ontario P1B 1Z2
On Behalf of the Ontario Ministry of Transportation**

**Bridge Rehabilitation – Boshkung Lake Bridge
Highway 118
Stations 15+782.5 to 15+822.5 – Township of Stanhope
Site No. 40-011
GWP 5140-13-00**

FINAL FOUNDATION INVESTIGATION REPORT

Date: October 24, 2016
Ref. No: 15/03/15019-F10

Geocres No. 31E-370

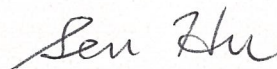
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GWP 5140-13-00

Final Foundation Investigation Report



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Test results mentioned herein are only valid for the sample(s) stated in this report.

Englobe's subcontractors who may have accomplished work either on site or in laboratory are duly qualified as stated in our Quality Manual's procurement procedure. Should you require any further information, please contact your Project Manager."

Client:

AECOM Canada Ltd.

189 Wyld Street, Suite 103

North Bay, Ontario

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Attention: **Mr. Al Rose**

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1 INTRODUCTION

Englobe Corp. (Englobe), formerly LVM-Merlex, a Division of EnGlobe Corp., has been retained by AECOM Canada Ltd., on behalf of the Ministry of Transportation of Ontario (MTO), to carry out a foundation investigation to provide subsurface data for the design of a temporary protection system to be implemented at the existing Boshkung Lake Bridge during the proposed structural rehabilitation and conversion to semi-integral abutments. The bridge is located on Highway 118, some 1.9 km west of the intersection between Highway 118 and Highway 35 in the Township of Stanhope (see Drawing No. 1 in Appendix 1).

The foundation investigation location was specified by the MTO in the Terms of Reference for work under Agreement No. PO 5014-E-0020: GWP 5140-13-00 for Detailed Design. The Terms of Reference for the scope of work are outlined in Englobe's Proposal P-14-168 Rev.1 dated January 21, 2015. The purpose of this investigation was to determine the subsurface conditions in the area of the bridge approaches in order to provide factual subsurface information and design recommendations for the temporary protection system to be implemented during rehabilitation activities. Englobe investigated the foundation area by the drilling of boreholes, carrying out in-situ tests, and performing laboratory testing on selected samples.

2 SITE DESCRIPTION

The Boshkung Lake Bridge is located on Highway 118, between approximately Stations 15+782.5 to 15+822.5, Township of Stanhope (Site No. 40-011). The bridge is a single span steel girder structure of 40 m in length, which we understand was constructed in 1970s. The topography at the site is generally of low to moderate relief. The existing approach embankments for the bridge currently support two undivided lanes of highway, running in a west-east direction. Boshkung Lake flows from the north to the south at the bridge location (left to right). A visual review of the highway to the west and the east of the bridge indicates that, in general, the approaches are in fair to good condition (see Photo Essay in Appendix 4).

The topography at this site is located in a valley area. At the bridge location, the existing highway centreline is at Elevation 313.7 m at the east end and 312.7 m at the west end of the bridge. The highway pavement structure is constructed on the granular fill for the approach embankments, which overlies the natural earth deposits. The existing approach embankments extend out from the existing concrete wing walls in the area of the bridge, and have been built on slope angles of approximately 4H:1V or steeper at the west bank, and staged vertical slope at the east bank.

Infrastructure at the bridge location includes overhead wires to the south of the bridge location, crossing the highway to the east of the bridge. A weather/temperature station is located near

the bridge site and includes sensors within the deck to the west of the bridge approach. Underground services may also be present to the north and/or south of the platform, however, were outside Englobes area of investigation, as such, were not located at the time of investigation.

2.1 SITE PHYSIOGRAPHY AND SURFICIAL GEOLOGY

This project is located in the Geomorphic Sub-province known as the Muskoka Ridges and Pockets. The topography on this section of Highway 118 is generally rolling. Significant deposits of earth overlie the bedrock. Within the project area, the native overburden primarily consists of silt with sand overlying the bedrock.

The bedrock in the area, based on Ontario Geologic Survey (OGS) Map MRD-126, consists of migmatitic rocks and gneisses of undetermined protolith of Precambrian Age.

3 INVESTIGATION PROCEDURES

The fieldwork for this investigation was carried out on May 20th and May 21st, 2015 during which time a total of two (2) sampled boreholes were advanced through the approach slab and the approach embankment at each end of the bridge, with Borehole No. 1 advanced behind the west abutment to the right of centreline (right side), and Borehole No. 2 advanced behind the east abutment to the left of centreline (left side).

The field investigation was carried out using a truck mounted CME drilling rig equipped with hollow stem augers, standard augers, casing equipment, and routine geotechnical sampling equipment. The drill equipment is owned by Chrisdamat Management Ltd. and was operated by an Englobe drill crew. Soil samples were obtained at the borehole locations at regular intervals of depth using the standard 50 mm O.D. split spoon sampler advanced in accordance with the Standard Penetration Test (SPT) procedures (ASTM D-1586). The SPT method involves advancing a 50 mm O.D. split spoon sampler with the force of a 63.5 kg hammer freely dropping 760 mm. The number of blows per 300 mm penetration was recorded as the “N” value. All samples taken during this investigation were stored in labeled airtight containers for transport to the Englobe North Bay laboratory for visual examination and select laboratory testing.

Groundwater conditions in the open boreholes were observed during the advancement of and immediately following completion of the individual boreholes. A single 19 mm diameter standpipe was installed in one open borehole prior to backfilling to allow for further monitoring of the local groundwater level. The remaining open borehole was backfilled upon completion with compacted auger cuttings in the general order from which they were removed, and where necessary, bentonite pellet backfill was added to the boreholes to bring the backfill up to grade in accordance with requirements of Ontario Regulation 903. At the borehole through the

embankment, the upper portion of the hole, where necessary, was backfilled with an asphalt cold patch to seal the existing asphalt surface.

The fieldwork for this investigation was carried out under the full time direction of a senior member of the Englobe engineering staff, who was responsible for locating the boreholes, clearing the borehole locations of underground services, in-situ sampling and testing operations, logging of the boreholes, labeling and preparation of samples for transport to the Englobe North Bay laboratory, plus overall drill supervision. All samples received a visual confirmatory inspection in the laboratory. Laboratory testing of select samples included routine testing for natural moisture content determination and particle size analysis. The results of the laboratory testing are presented on the individual Record of Borehole Sheets (Appendix 2), with a summary of results presented on the laboratory sheets in Appendix 3 (Figures Nos. L-1 to L-3 and Table No. L-4).

The location of the individual boreholes was determined in the field using highway chainage established by Callon Dietz Inc. (Callon Dietz) and offset relative to highway centreline. The MTO co-ordinates, northing and easting, were then established for the boring locations using coordinates from MTM Zone 10, NAD 83 CSRS. Elevations contained in this report are referenced to a geodetic datum. The borehole elevations are based on a survey carried out by Callon Dietz.

4 SUBSURFACE CONDITIONS

Details of the subsurface conditions revealed by the investigation program are presented on the enclosed Records of Borehole Logs (Appendix 2) and on Drawing No. 2 (Appendix 3). Please note that stratigraphic delineations presented on the borehole logs and soil strata plot are the results of non-continuous sampling, response to drilling progress, the results of SPT, plus field observations. Typically such boundaries represent transitions from one zone to another and are not an exact demarcation of specific geological unit. Additional consideration should be given to the fact that subsurface conditions may vary markedly between adjacent boreholes and beyond any specific boring location, and are shown on the drawings for illustration purposes only.

4.1 BOSHKUNG LAKE BRIDGE, TOWNSHIP OF STANHOPE

A plan and profile illustrating the borehole locations and stratigraphic sequences is shown on Drawing No. 2, Appendix 3. During the course of the exploration program, two (2) sampled boreholes were put down at this site, with Borehole No. 1 advanced behind the west abutment to the right of centreline (right side), and Borehole No. 2 advanced behind the east abutment to the left of centreline (left side).

At the time of the subsurface investigation, the ground surface elevations at Borehole Nos. 1 and 2 were recorded at Elevations 312.7 m and 313.7 m, respectively.

4.1.1 Pavement Structure

At the surface at Borehole Nos. 1 and 2, a pavement structure consisting of 102 mm thick asphalt concrete overlying a 254 mm thick concrete approach slab was measured.

4.1.2 Sand Fill

Underlying the concrete approach slab at Borehole Nos. 1 and 2, a layer of brown sand fill, gravelly to trace gravel, trace silt, trace clay was penetrated. The natural moisture contents measured on samples of this deposit recovered from Borehole Nos. 1 and 2 were in the order of 3% to 12%, with the exception of a 23% natural moisture content measured on the one sample recovered near the bottom of the fill in Borehole No. 1. Gradation analyses were carried out on four (4) samples of this deposit recovered from Borehole Nos. 1 and 2, the results of which indicated 0% to 30% gravel size particles, 60% to 92% sand size particles, and 4% to 10 % silt and clay size particles (Figure No. L-1, Appendix 3). Results of grain size distribution testing carried out on four samples recovered from Borehole Nos. 1 and 2 indicate that the sand fill generally meets requirements of Granular "B" Type II stated in OPSS.PROV 1010. Based on SPT 'N' values of 4 to 73 blows per 300 mm penetration and 41 blows per 152 mm penetration, the relative density of this deposit was described as loose to very dense. This deposit was encountered to depths of 7.8 m and 3.4 m below grade at Borehole Nos. 1 and 2, respectively (Elevation 304.9 m and 310.3 m, respectively).

4.1.3 Silt

Underlying the sand fill deposit at Borehole No. 1, a deposit of grey silt, with sand, trace clay was penetrated. The natural moisture contents measured on samples of this deposit were in the order of 26 to 34%. An hydrometer analysis was carried out on one (1) sample of this deposit, the results of which indicated 0% gravel size particles, 25% sand size particles, 75% silt size particles, and 0% clay size particles (Figure No. L-2, Appendix 3). Based on observation of the spilt spoon sampler advanced 300 mm using the static weight of hammers for the SPT testing in the deposit, the relative density of this deposit was described as very loose. Borehole No. 1 was terminated in this deposit at a depth of 9.8 m below grade (Elevation 302.9 m).

4.1.4 Bedrock

Underlying the sand fill deposit at Borehole No.1, the bedrock was proven by diamond core drilling. The bedrock was described as pink granite with black gneiss. Based on RQD values of 50 to 65%, the bedrock was described as fair to good quality. Sampling in the bedrock was terminated at a depth of 6.4 m below grade at Borehole No. 1 (Elevation 307.3 m). It should be noted that, where encountered, the underlying bedrock surfaces in this area can be very erratic in nature, varying substantially in elevation over short horizontal distances.

4.1.5 Previous Investigations

A previous foundation investigation (Project No. 3782), was carried out at this location in 1967 by the William Trow Associates Limited. The results of this previous investigation as shown on a Drawing No. 1 indicated the subsurface soils nearby the bridge approach consisted of sand overlying the gneiss bedrock encountered at elevations ranging from 304.5 m to 299.3 m (see Enclosure No. 5, Appendix 5).

4.2 GROUNDWATER DATA

The lake water level was measured at Elevation 307.5 m on May 21, 2015 during the foundation investigation period. Measurements of the groundwater table and cave-in levels were undertaken, where possible, in the open boreholes during the advance of the individual borings and upon completion. A standpipe was installed in Borehole No. 1 to obtain the water level post borehole completion. These levels are recorded on the individual Record of Borehole Log Sheets (Appendix 2) and shown on the Borehole Locations and Soil Strata Drawing No. 2 in Appendix 3.

At the time of this investigation, the water level was measured at Elevation 307.5 m on May 21st, 2015 at Borehole No. 1. The water level reading at Elevation 310.1 m measured at Borehole No. 2 had probably not yet stabilized since it was taken upon completion of borehole on May 20th, 2015.

The groundwater and lake water levels should be expected to fluctuate seasonally/yearly.

Appendix 1 Key Plan

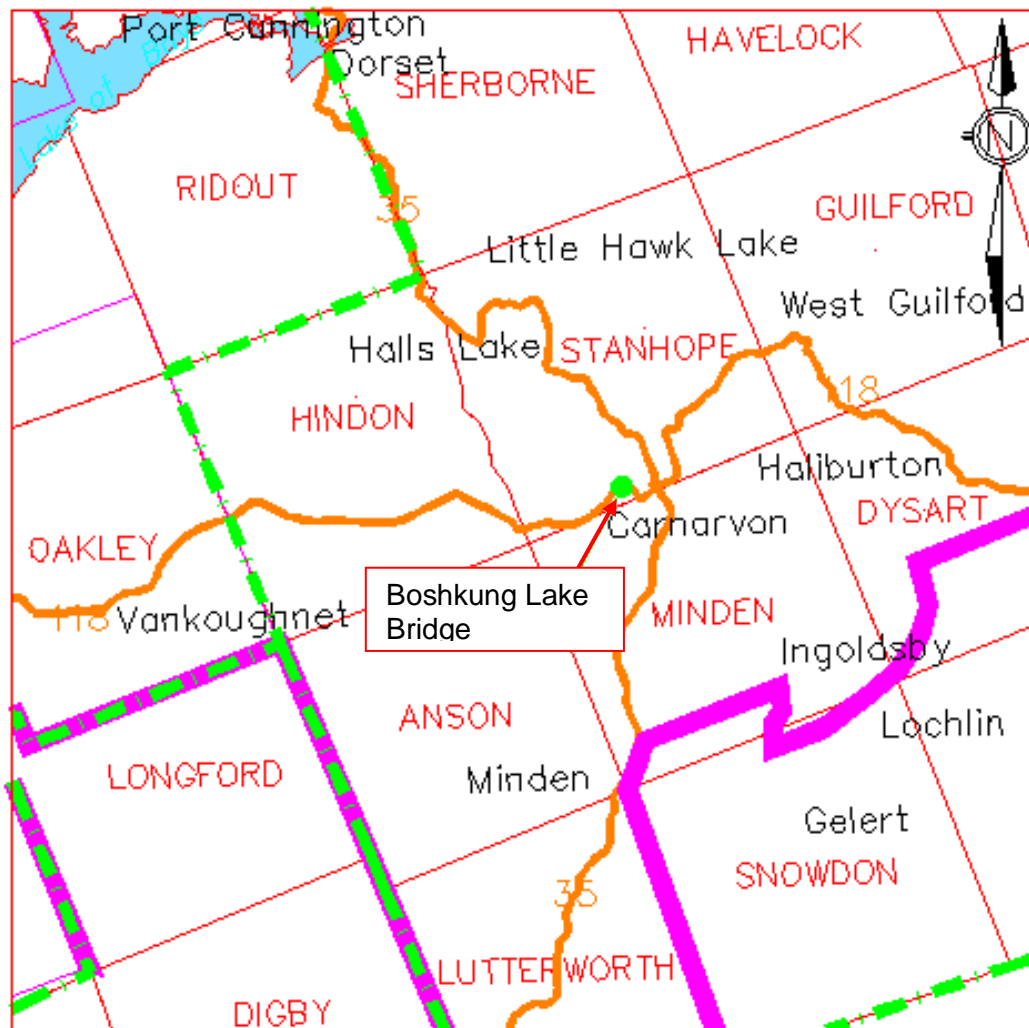
Drawing No. 1

Key Plan

MACRO KEY PLAN

Drawing No.1

NOT TO SCALE



**FINAL FOUNDATION
INVESTIGATION REPORT
GWP 5140-13-00
Highway 118**

Boshkung Lake Bridge

Site No. 40-011

Township of Stanhope



Reference No: 15/03/15019-F10

September 2016

Appendix 2 Subsurface Data

Enclosure No. 1	List of Abbreviations and Symbols
Enclosure Nos. 2 and 3	Record of Borehole Sheet

LIST OF ABBREVIATIONS & DESCRIPTION OF TERMS

The abbreviations and terms, used to describe retrieved samples and commonly employed on the borehole logs, on the figures and in the report are as follows:

1. ABBREVIATIONS

AS	Auger Sample
CS	Chunk Sample
DS	Denison type sample
FS	Foil Sample
NFP	No Further Progress
PH	Sampler advanced by hydraulic pressure
PM	Sampler advanced by manual pressure
RC	Rock core with size & percentage of recovery
SS	Split Spoon
ST	Slotted Tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash Sample
WH	Sampler advanced by static weight of hammer and/or rods
Rec	% recovery from individual run of rock core
RQD	Rock quality designation (%)

2. PENETRATION RESISTANCE/"N"

Dynamic Cone Penetration Test (DCPT):

A continuous profile showing the number of blows for each 300 mm of penetration of a 50 mm diameter 60° cone attached to AW rod driven by a 63 kg hammer falling 760 mm.

Plotted as —●—●—●—●—

Standard Penetration Test (SPT) or "N" Values

The number of blows of a 63 kg hammer falling 760 mm required to advance a 50 mm O.D. drive open sampler 300 mm.

3. SOIL DESCRIPTION

a) *Cohesionless Soils:*

"N" (blows/0.3 m)	Relative Density
0 to 4	very loose
4 to 10	loose
10 to 30	compact
30 to 50	dense
over 50	very dense

b) *Cohesive Soils:*

Undrained Shear Strength (kPa)	Consistency
Less than 12	very soft
12 to 25	soft
25 to 50	firm
50 to 100	stiff
100 to 200	very stiff
over 200	hard

3. SOIL DESCRIPTION (Cont'd)

c) *Bedrock:*

RQD (%)	Classification
Less than 25	Very poor quality
25 to 50	Poor quality
50 to 75	Fair quality
75 to 90	Good quality
90 to 100	Excellent quality

d) *Method of Determination of Undrained Shear Strength of Cohesive Soils:*

- + 3.2 - Field Vane test in borehole.
The number denotes the sensitivity to remoulding.
- D - Laboratory Vane Test
- " - Compression test in laboratory

For a saturated cohesive soil the undrained shear strength is taken as one-half of the undrained compressive strength.

e) *Soil Moisture:*

Moisture	Described as
Dry	Below optimum moisture content
Moist	Near optimum moisture content
Wet	Above optimum moisture content

4. TERMINOLOGY

Terminology used for describing soil strata is based on the proportion of individual particle sizes present in the samples (please note that, with the exception of those samples subject to a grain-size analysis, all samples were classified visually and the accuracy of visual examination is not sufficient to determine exact grain sizing):

Trace, or occasional	Less than 10%
Some	10 to 20%
With	20 to 30%
Adjective (i.e. silty or sandy)	30 to 40%
And (i.e. sand and gravel)	40 to 60%

Terminology for cobbles and boulders is based on auger response and field observations:

Occasional	Obstructions encountered in borehole, however advance is not impeded
Numerous	Obstructions are essentially continuous over drilled length

SAMPLE DESCRIPTION NOTES:

1. **FILL:** The term fill is used to designate all man-made deposits of natural soil and/or waste materials. The reader is cautioned that fill materials can be very heterogeneous in nature and variable in depth, density and degree of compaction. Fill materials can be expected to contain organics, waste materials, construction materials, shot rock, rip-rap, and/or larger obstructions such as boulders, concrete foundations, slabs, abandoned tanks, etc.; none of which may have been encountered in the borehole. The description of the material penetrated in the borehole therefore may not be applicable as a general description of the fill material on the site as boreholes cannot accurately define the nature of fill material. During the boring and sampling process, retrieved samples may have certain characteristics that identify them as 'fill'. Fill materials (or possible fill materials) will be designated on the Borehole Logs. If fill material is identified on the site, it is highly recommended that testpits be put down to delineate the nature of the fill material. However, even through the use of testpits defining the true nature and composition of the fill material cannot be guaranteed. Fill deposits often contain pockets or seams of organics, organically contaminated soils or other deleterious material that can cause settlement or result in the production of methane gas. It should be noted that the origins and history of fill material is frequently very vague or non-existent. Often fill material may be contaminated beyond environmental guidelines and the material will have to be disposed of at a designated site (i.e. registered landfill). Unless requested or stated otherwise in this report, fill material on this site has not been tested for contaminants however, environmental testing of the fill material can be carried out at your request. Detection of underground storage tanks cannot be determined with conventional geotechnical procedures.
2. **TILL:** The term till indicates a material that is an unstratified, glacial deposit, heterogeneous in nature and, as such, may consist of mixtures and pockets of clay, silt, sand, gravel, cobbles and/or boulders. These heterogeneous deposits originate from a geological process associated with glaciation. It must be noted that due to the highly heterogeneous nature of till deposits, the description of the deposit on the borehole log may only be applicable to a very limited area and therefore, caution must be exercised when dealing with a till deposit. When excavating in till, contractors may encounter cobbles/boulders or possibly bedrock even if they are not indicated on the borehole logs. It must be appreciated that conventional geotechnical sampling equipment does not identify the nature or size of any obstruction.
3. **BEDROCK:** Auger refusal may be due to the presence of bedrock, but possibly could also be due to the presence of very dense underlying deposits, boulders or other large obstructions. Auger refusal is defined as the point at which an auger can no longer be practically advanced. It must be appreciated that conventional geotechnical sampling equipment does not differentiate between nature and size of obstructions that prevent further penetration of the boring below grade. Bedrock indicated on the borehole logs will be labeled 'possibly' or 'probable' etc. based on the response of the boring and sampling equipment, surrounding topography, etc. Bedrock can be proven at individual borehole locations, at your request, by diamond core drilling operations or, possibly, by testpits. It must also be appreciated that bedrock surfaces can be, and most times are, very erratic in nature (i.e. sheer drops, isolated rock knobs, etc.) and caution must be used when interpreting subsurface conditions between boreholes. A bedrock profile can be more accurately estimated, at the clients' request, through a series of closely positioned unsampled auger probes combined with core drilling.
4. **GROUNDWATER:** Although the groundwater table may have been encountered during this investigation and the elevation noted in the report and/or on the record of boreholes, it must be appreciated that the elevation of the groundwater table will fluctuate based upon seasonal conditions, localized changes, erratic changes in the underlying soil profile between boreholes, underlying soil layers with highly variable permeabilities, etc. These conditions may affect the design and type and nature of dewatering procedures. Cave-in levels recorded in borings give a general indication of the groundwater level in cohesionless soils however, it must be noted that cave-in levels may also be due to the relative density of the deposit, drilling operations etc.

METRIC

RECORD OF BOREHOLE NO. 1



REFERENCE 15/04/15019 DATUM Geodetic LOCATION N 4989843.9 E366366.9 - Stanhope Twp., Station 15+780 ORIGINATED BY JL
 PROJECT GWP 5140-13-00, Highway 118 - F10 BOREHOLE TYPE Truck Mounted CME 45 - Hollow Stem Augers COMPILED BY SH
 CLIENT AECOM DATE (Started) 21 May 2015 TIME (Completed) 9:35:00 AM CHECKED BY MAM
 DATE (Completed) 21 May 2015

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION (see Enclosure No. 1)	STRATA PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
312.7	Ground Surface												
0.0	102 mm Asphalt												
312.3	254 mm Concrete												
0.4	Sand FILL- sand, gravelly to trace gravel, trace silt, trace clay brown, moist (very dense/loose)		1	SS	73								30 60 (10)
			2	SS	17								
			3	SS	16								
			4	SS	5								
			5	SS	11								13 83 (4)
			6	SS	6								
			7	SS	4								
			8	SS	7								0 92 (8)
304.9	SILT - with sand, trace clay moist Grey, wet (very loose)		9	SS	WH								
7.8													
			10	SS	WH								0 25 75 0 (NP)
302.9	End of Sampling End of Borehole												
9.8													

COMMENTS		WATER LEVEL RECORDS	
The stratification lines represent approximate boundaries. The transition may be gradual. + 3, × 3 : Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa ○ 3% STRAIN AT FAILURE	Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
	1) 21/5/15 9:40:00 AM	5.2	▽ - 5.2
	2) -	-	▽ -
	3) -	-	▽ -

MEL-GEO 15019 - BOREHOLE LOGS - F10.GPJ MEL-GEO.GDT 20/6/16

METRIC

RECORD OF BOREHOLE NO. 2



REFERENCE 15/04/15019 DATUM Geodetic LOCATION N 4989877.0 E366397.9 - Stanhopen Twp., Station 18+825 ORIGINATED BY JL
 PROJECT GWP 5140-13-00, Highway 118 - F10 BOREHOLE TYPE Truck Mounted CME 45 - Hollow Stem Augers COMPILED BY SH
 CLIENT AECOM DATE (Started) 20 May 2015 TIME
 DATE (Completed) 20 May 2015 (Completed) 11:10:00 AM CHECKED BY MAM

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION (see Enclosure No. 1)	STRATA PLOT	NUMBER	TYPE	"N" VALUES			20	40	60					
313.7	Ground Surface														
0.0	102 mm Asphalt														
313.3	254 mm Concrete														
0.4	Sand FILL- sand, some to trace gravel, trace silt, trace clay brown, moist (compact/very dense)		1	SS	20										
			2	SS	13										
			3	SS	17										
			4	SS	5										
			5	SS	41/152 mm										
310.3	Auger Refusal Start Rock Coring														
3.4	Bedrock - pink granite/thin black gneiss Fair quality		6	RC	Rec.=98% RQD=50%										
			7	RC	Rec.=100% RQD=65%										
307.3	End of Sampling End of Borehole														
6.4															

COMMENTS		WATER LEVEL RECORDS		
		Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
		1) 20/5/15 4:15:00 PM	3.6	4.6
		2)	-	-
		3)	-	-

The stratification lines represent approximate boundaries. The transition may be gradual.

MEL-GEO 15019 - BOREHOLE LOGS - F10.GPJ MEL-GEO.GDT 20/6/16

Appendix 3 Borehole Plan and Lab Data

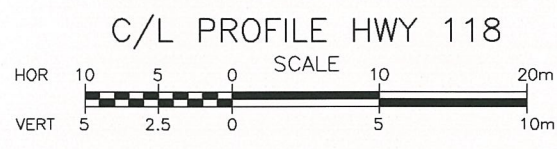
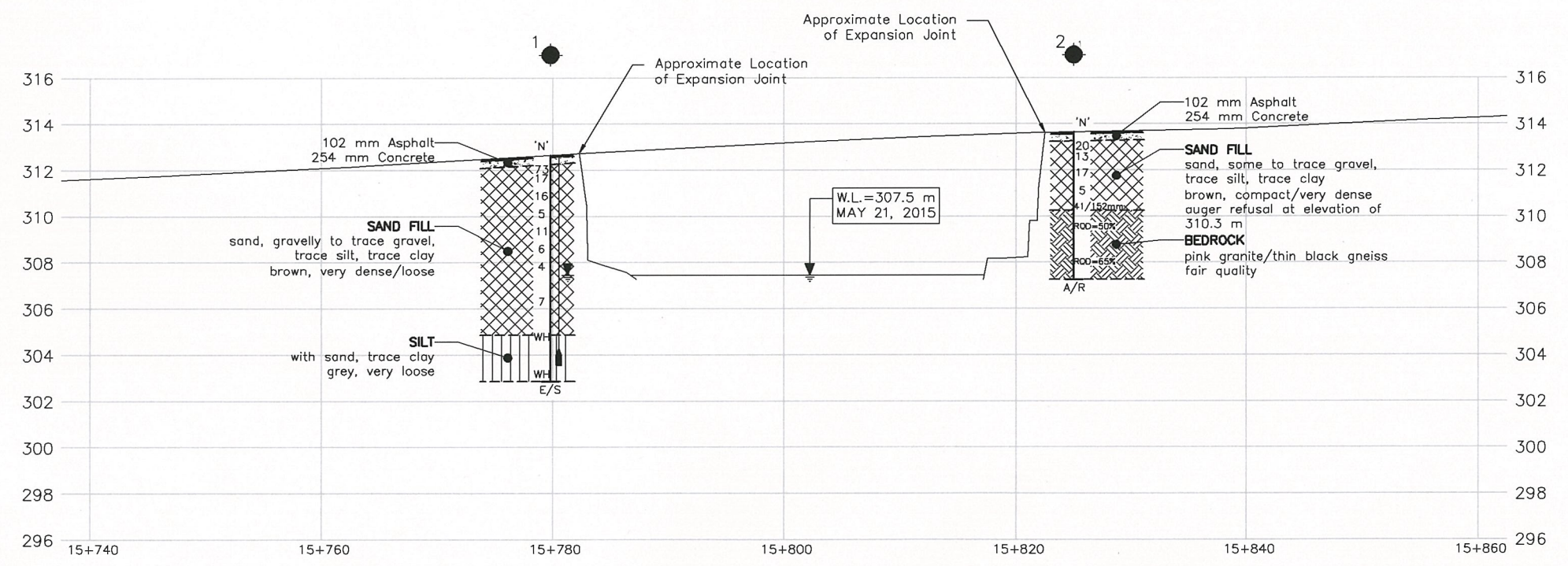
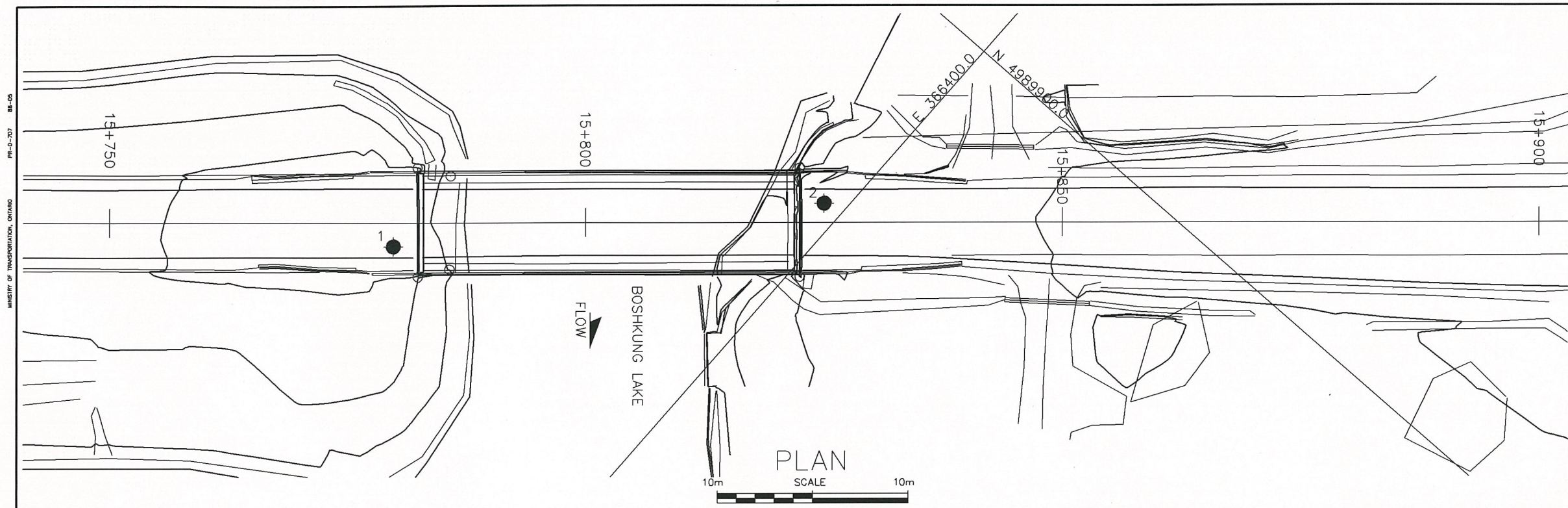
Drawing No. 2: Borehole Locations and Soil Stratigraphy

Figure Nos. L-1 and L-2: Grain Size Distribution Curves

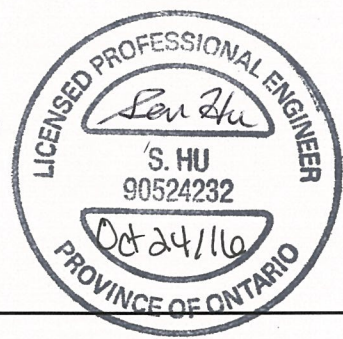
Table No. L-3: Lab Test Summary Sheet

PR-0-207 88-05
MINISTRY OF TRANSPORTATION, ONTARIO


CAD FILE LOCATION AND NAME: C:\2015\15019 - PAV & IDN, Hwy 35 & 118 5014-E-0020 (4ECOM)\FOUNDATION Drawings\15019 F10 - Boshkung Lake Bridge.dwg
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DATE PLOTTED: 9/20/2016 1:28:54 PM BY: RYAN GRASSER

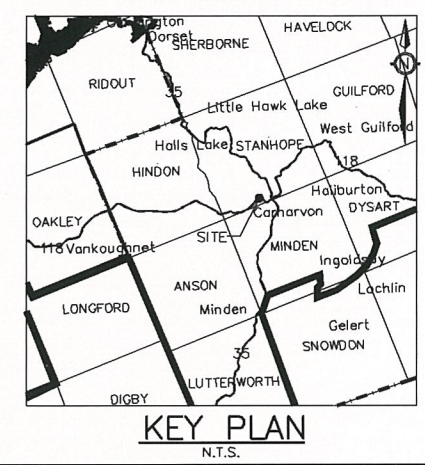








This drawing is for subsurface information only. Surface details and features are for conceptual illustration. The proposed structure location is shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contract Documents.



2016-10-27

DISTRICT CONT. No. GWP No. 5140-13-00	 DRAWING 2
HWY 118 BOSHKUNG LAKE BRIDGE SITE NO. 40-011	
BOREHOLE LOCATIONS AND SOIL STRATIGRAPHY	



LEGEND				
	Borehole			
	Blows/0.3 m (Std Pen Test, 475 J/blow)			
	Water Level at Time of Investigation			
	Auger Refusal at Elevation			
	End of Sampling			
	Piezometer			

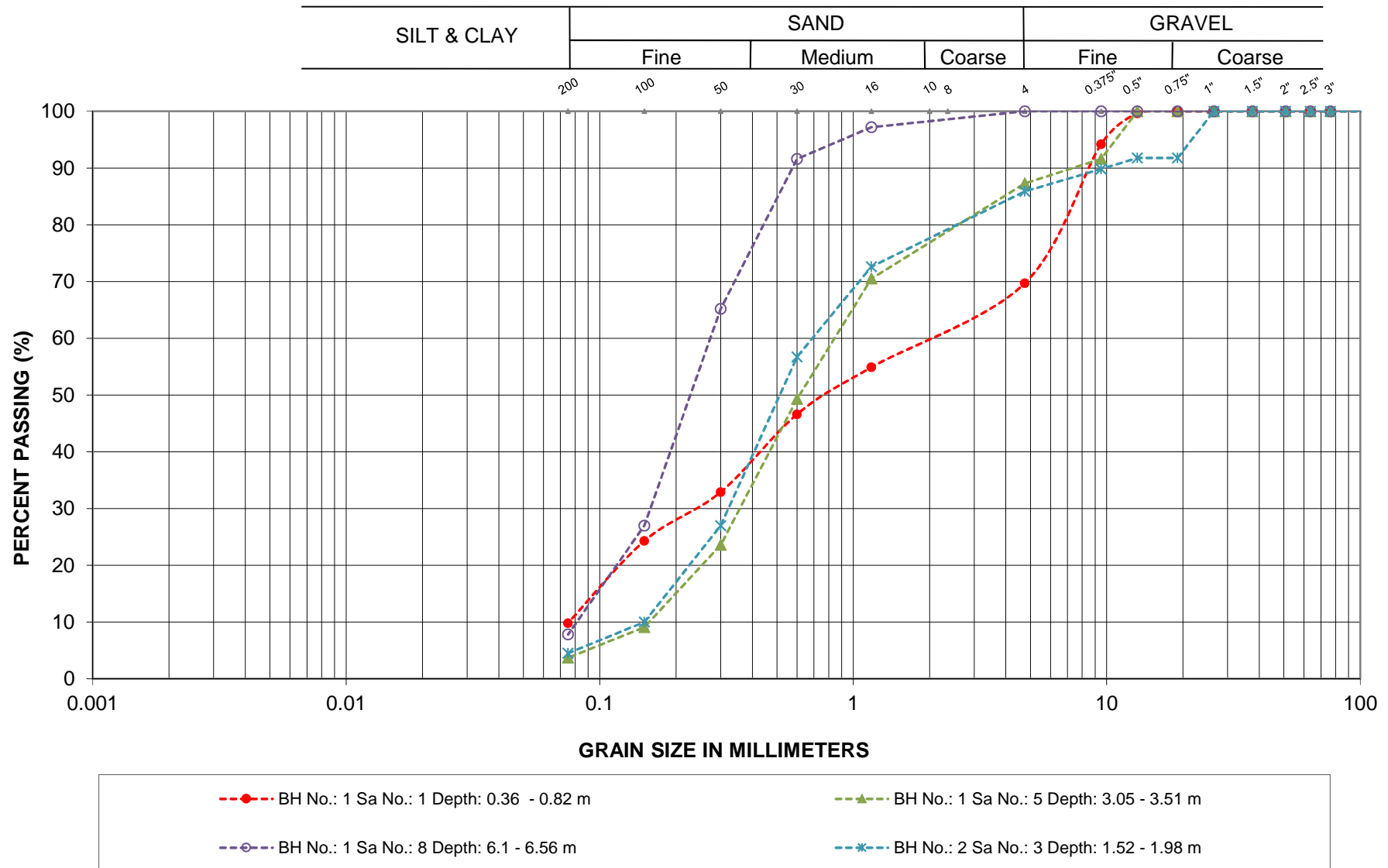
BOREHOLE No.	ELEVATION	O/S	NORTHING	EASTING
1	312.7	2.5m Rt	4989843.9	366366.9
2	313.7	2.0m Lt	4989877.0	366397.9

NOTES:
The boundaries between soil strata have been established at the borehole locations only. The boundaries illustrated and stratigraphy between boreholes on this drawing are assumed based on borehole data and may vary. They are intended for design only.

Base plan and alignment provided in digital format by Callon Dietz on February 26, 2016
Coordinates based on MTM Zone 10 NAD83 CSRS

GEOCRES No. 31E-370

REVISIONS		DESCRIPTION		DATE SEP/16	
JUN/16	DM	DRAFT			
SEP/16	DM	FINAL			
DESIGN	CHK	CODE	LOAD		
DRAWN	DM	CHK SH	SITE 40-011	STRUCT	SCHEME
				TDWG	2

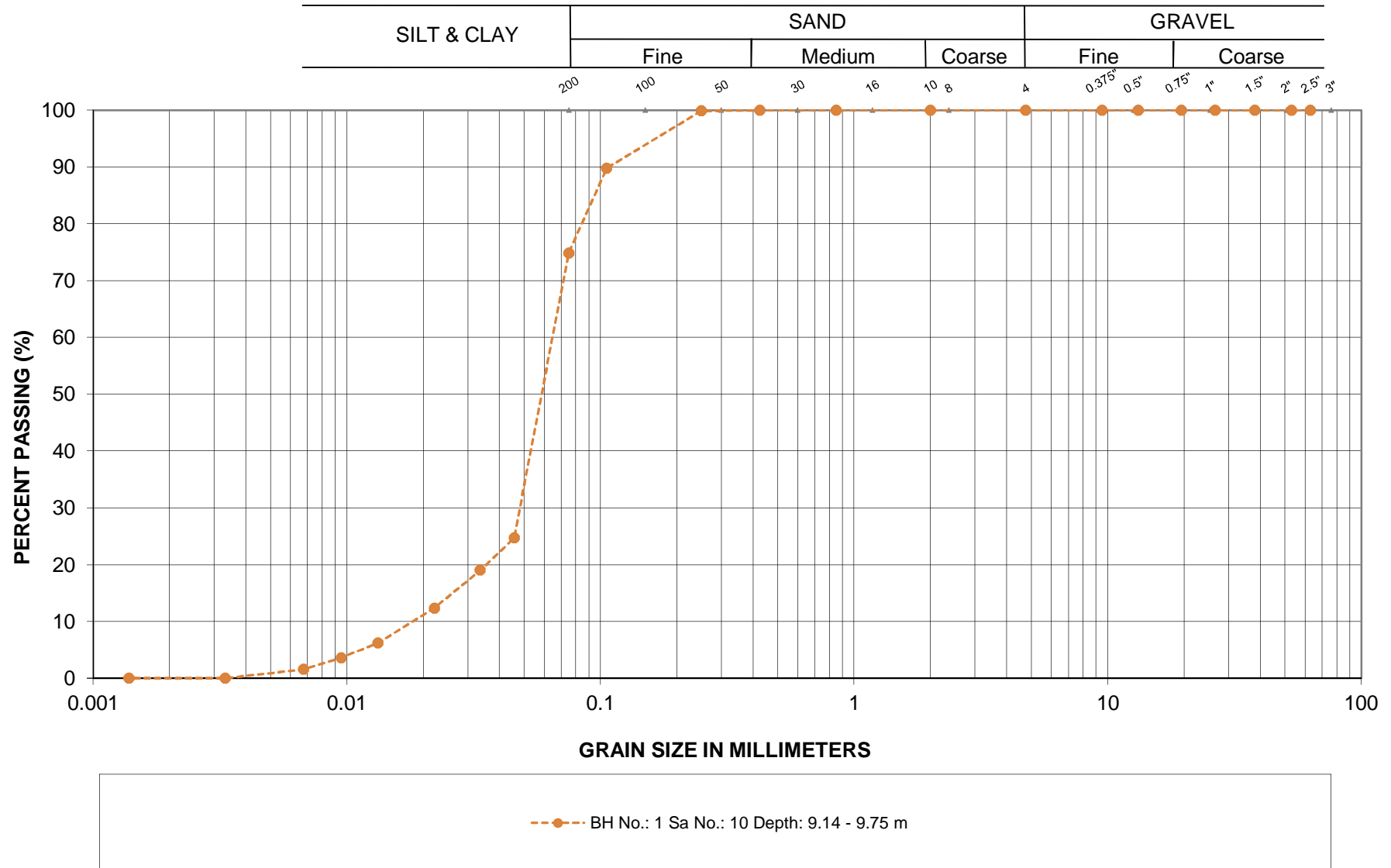
GRAIN SIZE ANALYSIS

LOCATION: Boshkung Lake Bridge
 Hwy 118, Station 15+782.5 to 15+822.5
 TWP of Stanhope

Sand FILL
 Englobe Corp.

FIGURE L-1

GRAIN SIZE ANALYSIS



LOCATION: Boshkung Lake Bridge
Hwy 118, Station 15+782.5 to 15+822.5
TWP of Stanhope

SILT
Englobe Corp.

FIGURE L-2

Laboratory Tests - Summary Sheet



Borehole No.	Sample No.	Depth	Grain Size Analysis				NMC	Atterberg Limits			SPT 'N'	USCS	Unit Weight (kN/m3)	Remarks
			Gravel Size (%)	Sand Size (%)	Silt Size (%)	Clay Size (%)		LL (%)	PL (%)	IP (%)				
1	1	0.6	30	60	10		4.1				73			
	2	1.0					3.5				17			
	3	1.8					5.2				16			
	4	2.5					4.4				5			
	5	3.3	13	83	4		3.3				11			
	6	4.0					4.4				6			
	7	4.8					12.1				4			
	8	6.3	0	92	8		23.0				7			
	9	7.9					34.4				WH			
	10	9.4	0	25	75	0	25.6				WH			Non-plasticity
2	1	0.6					3.2				20			
	2	1.1					3.5				13			
	3	1.8	14	81	5		3.0				17			
	4	2.5					3.5				5			
	5	3.2					4.3				41/152 mm			

Appendix 4 Photo Essay

Enclosure No. 4:

Photo Essay

Bridge East side– Looking West

Photo: 1



Bridge East side– Pavement Cracks at East of Borehole No.2

Photo: 2



Project: Hwy 118 – Boshkung Lake Bridge, Station 15+782.5 to 15+822.5, Township of Stanhope

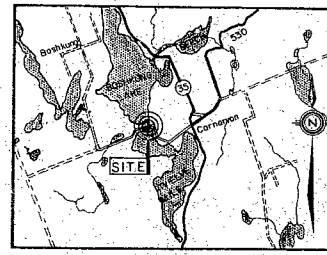
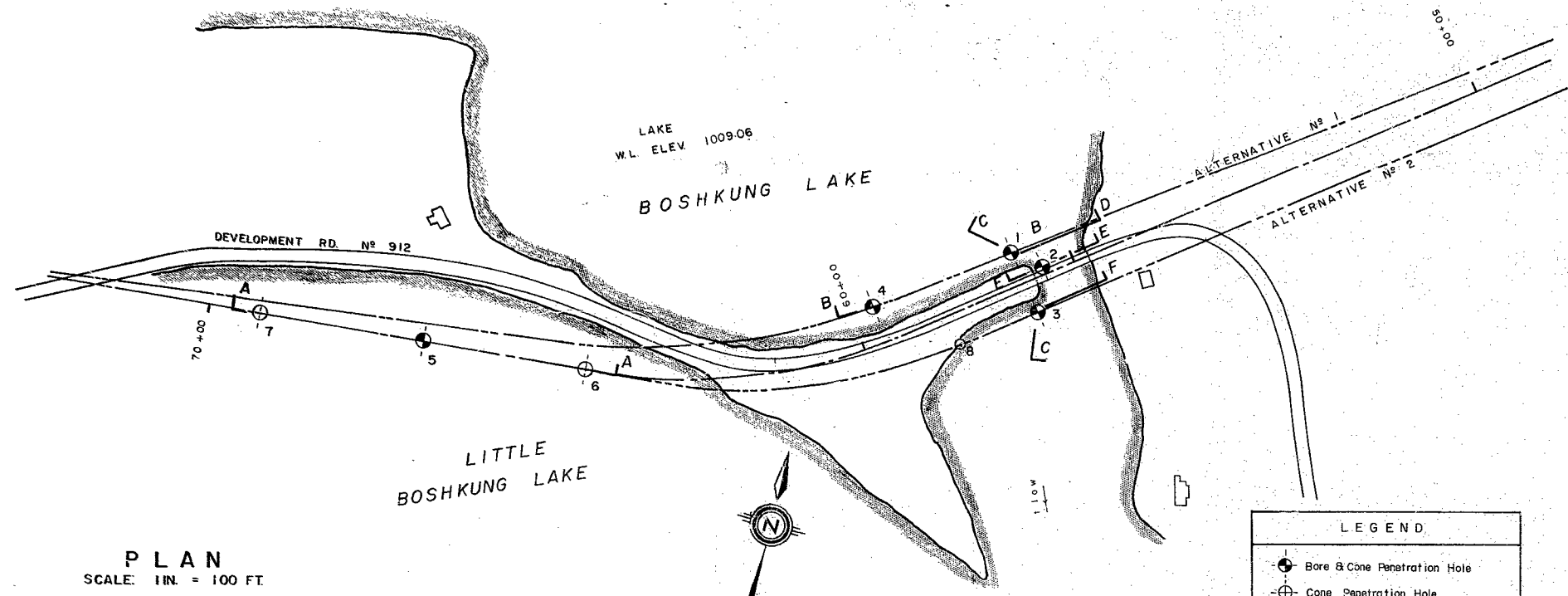
Photos Provided By: Englobe

Date: May, 2015

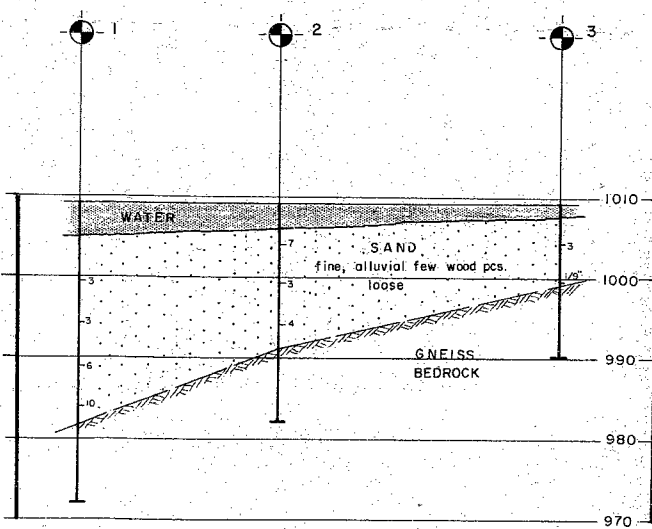
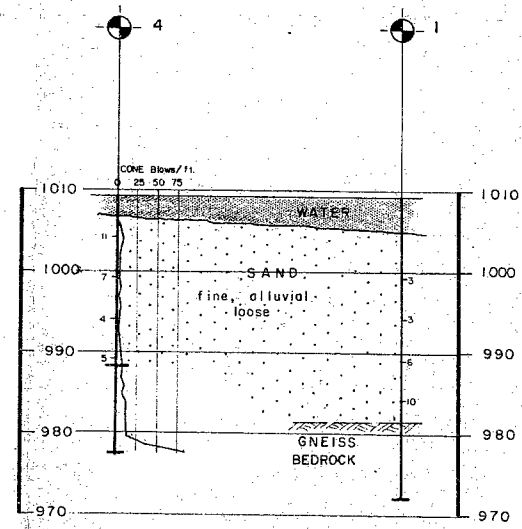
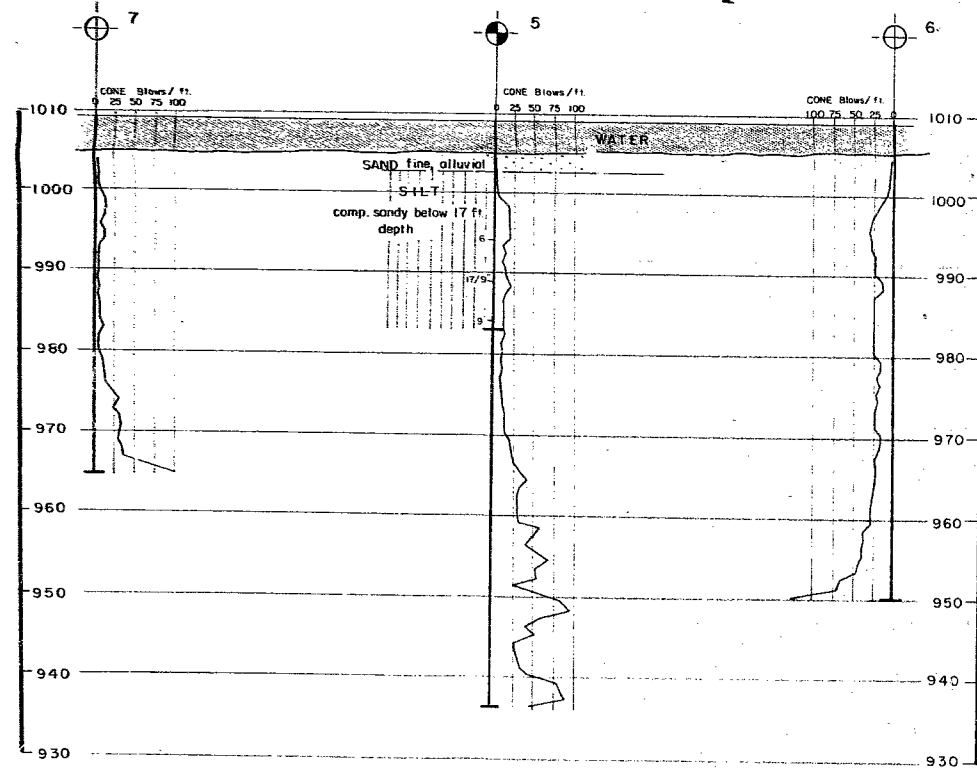
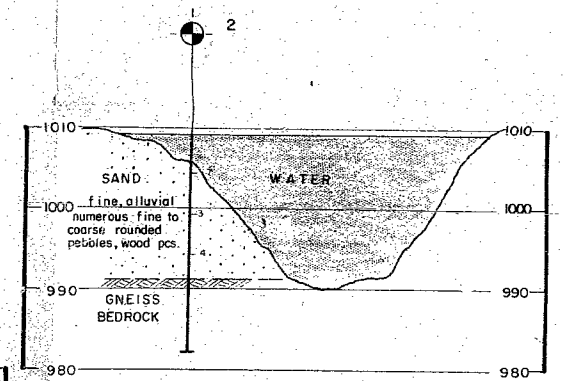
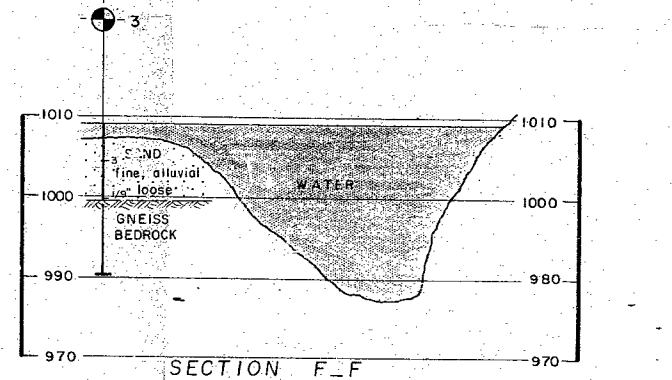
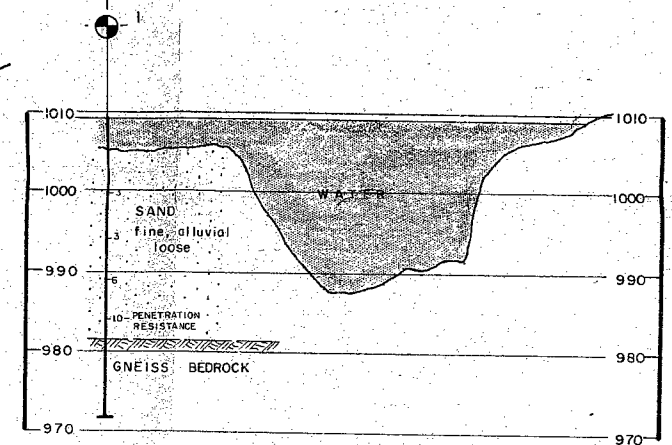
Appendix 5 Historical Data

Enclosure No. 5:

Historical Drawing



LEGEND			
⊕	Bore & Cone Penetration Hole		
⊙	Cone Penetration Hole		
○	Probe		
No.	ELEVATION	STATION	OFFSET
1	1009.1	57+39	50' Rt.
2	1009.1	57+17	15' Lt.
3	1009.1	57+39	50' Lt.
4	1009.1	59+60	50' Rt.
5	1009.1	66+70	
6	1009.1	64+26	
7	1009.1	69+22	



SCALE: HOR. 1 IN. = 20 FT.
VERT. 1 IN. = 10 FT.

NOTE:
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

William Trow & Associates Ltd.
FOUNDATION INVESTIGATION

PROPOSED BRIDGE REPLACEMENT

BOSHKUNG NARROWS BRIDGE

TWP. MINDEN ONTARIO

PROJ. 3782 DATE AUG. 1967 DWG. No. 1

SCALE: HOR. 1 IN. = 50 FT.
VERT. 1 IN. = 10 FT.

SCALE: HOR. 1 IN. = 20 FT.
VERT. 1 IN. = 10 FT.