

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

**Culvert Replacement  
Highway 60  
Station 20+566 - Twp. of Chaffey  
GWP 5333-11-00**

## **FINAL PRELIMINARY FOUNDATION INVESTIGATION REPORT**

Date: May 14, 2015  
Ref. N<sup>o</sup>: 14/07/14083-F3

**Geocres No. 31E-346**



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## Final Preliminary Foundation Investigation Report

Prepared by:

  
**Alexander Tepylo, P.Eng.**

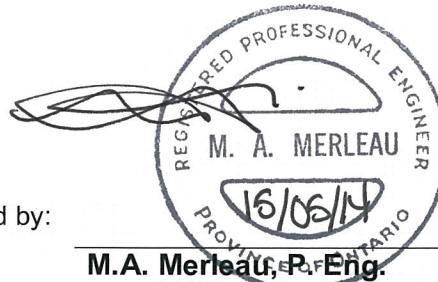
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Test results mentioned herein are only valid for the sample(s) stated in this report.

LVM inc.'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.

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Attention: **Mr. Al Rose**

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## 1 INTRODUCTION

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 preliminary foundation investigation at an existing centerline culvert site for preparation of a Design-Build Contract. The site is located at Station 20+566 in the Township of Chaffey on Highway 60, some 10.5 km east of Highway 11.

The foundation investigation location was specified by the MTO in the Terms of Reference for work under Agreement No. 5013-E-0032. The terms of reference for the scope of work are outlined in LVM-Merlex's Proposal P-13-051, dated May, 2014. The purpose of this investigation was to determine the subsurface conditions in the area of the existing culvert. LVM-Merlex investigated the foundation area by the drilling of boreholes, carrying out in-situ tests, and performing laboratory testing on select samples.

## 2 SITE DESCRIPTION

A Corrugated Steel Pipe (CSP) culvert is located on Highway 60 at Station 20+566 in the Township of Chaffey. The topography in the area of this site is generally rolling. The existing highway embankment currently supports two undivided lanes of highway, running in an east-west direction. The existing highway, at the culvert location, is constructed on a granular and rock fill embankment some 4.8 m in height (at centreline), with centerline elevation of 330.4 m at the culvert location. The existing embankment slopes, in the area of the culvert, have been generally established between angles of approximately 1.8H:1V to 1.9H:1V. The culvert at this location is a 910 mm diameter Corrugated Steel Pipe (CSP) culvert, some 30 m in length. Flow through the culvert is from north to south (left to right).

The culvert at this location appears to have failed and rock fill pieces were observed in the culvert up from the outlet end (see Photo 4, Photo Essay, Appendix 4).

Infrastructure at the culvert location consists of overhead wires to the left (north) side of the highway embankment.

### 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 60 is generally rolling. Significant layers of earth overlay the bedrock. Organic materials were also observed. Within the project area native overburden consists primarily of sands overlying bedrock.

Bedrock in the area consists of migmatitic rocks and gneisses of undetermined protolith.

### 3 INVESTIGATION PROCEDURES

The fieldwork for this investigation was carried out during the period of August 13<sup>th</sup> to September 16<sup>th</sup>, 2014 during which time three (3) sampled boreholes were advanced. One (1) borehole was advanced through the embankment at the location of the culvert, and a single borehole was advanced at each of the inlet (north) and outlet (south) ends of the culverts.

The field investigation was carried out using a truck and bombardier mounted CME drilling rig equipped with hollow stem augers, standard augers, casing equipment and routine geotechnical sampling equipment. 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. When cohesive deposits were encountered, the in-situ strength was measured using an “N” size field vane, vane collar, and calibrated torque meter. All samples taken during this investigation were stored in labeled airtight containers for transport to our 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 selected open boreholes prior to backfilling to allow for further monitoring of the shallow groundwater levels. All open boreholes were backfilled upon completion with compacted auger cuttings in the general order they were removed, and where necessary, bentonite pellet backfill was added to the boreholes to bring them up to grade in accordance with requirements of Ontario Regulation 903. At the borehole(s) 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 under the full time direction of a senior member of the LVM-Merlex 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 our North Bay laboratory, plus overall drill supervision. All samples received a visual confirmatory inspection in our 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-2 and Table No. L-3).

The location of the individual boreholes were determined in the field using highway chainage (established by others) and offset relative to highway centerline. The MTO co-ordinates, northing and easting, were then established for the boring locations. Elevations contained in

this report are referenced to a geodetic datum. The borehole elevations are based on a survey carried out by others.

## **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 delineation 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 CULVERT STATION 20+566, TWP OF CHAFFEY**

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, three (3) sampled boreholes were put down at this site, with Borehole No. 1 advanced at the culvert outlet, Borehole No. 2 advanced at the culvert inlet, and Borehole No. 3 advanced through the embankment. At the time of the subsurface investigation, the ground surface elevations at Boreholes Nos. 1 to 3 were recorded at elevations 319.9, 328.5, and 330.2 m, respectively.

#### **4.1.1 Pavement Structure**

Borehole No. 3 was advanced through the embankment where a pavement structure consisting of 100 mm asphalt and 300 mm crushed gravel was penetrated.

#### **4.1.2 Embankment Fill**

Underlying the pavement structure at Borehole Nos. 3, a layer of fill consisting of brown sand some to with gravel some silt, mixed with rock fill, was penetrated. The natural moisture content measured on samples of this deposit was in the order of 3 to 7%. Gradation analyses were carried out on two (2) samples of this deposit, the results of which indicated 19 to 22% gravel size particles, 62 to 67% sand size particles, and 15 to 17% silt and clay size particles (Figure No. L-1, Appendix 3). Based on SPT 'N' values of 4 to 34 blows per 300 mm penetration, the compactness of this deposit was described as loose to dense. This deposit was encountered to a depth of 2.9 m below grade at Borehole No. 3 (elevation 327.3 m).

#### **4.1.3 Organic Soils**

Underlying the embankment fill at Borehole No. 3, and at surface at Borehole Nos. 1 and 2, a layer of silty organic soils, some to with sand was penetrated. Cobble size rock pieces were encountered in this layer at Borehole No. 1. The natural moisture content measured on samples of this layer was in the order of 30 to 54%. This organic soil layer was encountered to depths of 0.8, 0.6 and 3.7 m below ground surface at Borehole Nos. 1 to 3, respectively (elevations 319.1, 327.9, and 326.5 m, respectively).

#### 4.1.4 Sands

Underlying the organic soils at Borehole Nos. 2 and 3, a deposit of grey sand with silt some gravel silt was penetrated. Cobble and boulder size rock pieces were encountered at depth ranging from 4.6 to 6.5 below ground surface in this deposit at Borehole No. 3. The natural moisture content measured on samples of this deposit was in the order of 13 to 23%. A gradation analysis was carried out on one (1) sample of this deposit, the results of which indicated 11% gravel size particles, 62% sand size particles, and 27% silt and clay size particles (Figure No. L-2, Appendix 3). Based on SPT 'N' values of 40 to 58 blows per 300 mm penetration, this deposit was described as dense to very dense. This deposit was encountered to depths of 2.0 and 6.5 m below grade at Borehole Nos. 2 and 3, respectively (elevations 326.5 and 323.8 m, respectively).

#### 4.1.5 Bedrock

Underlying the above described organic soils at Borehole No. 1 and sands at Borehole Nos. 2 and 3, bedrock was proven by diamond core drilling. The bedrock was described as pink to grey gneiss bedrock. Based on RQD values of 59 to 98% the bedrock was described as fair to excellent quality. Sampling in the bedrock was terminated at depths of 4.5, 5.0, and 9.5 m below grade at Borehole Nos. 1 to 3, respectively (elevations 315.4, 323.5, and 320.7 m, respectively). It should be noted that, when encountered, the underlying bedrock surfaces in this area can be very erratic in nature, varying substantially in elevation over short horizontal distances.

### 4.2 GROUNDWATER DATA

At the time of this investigation (September 16, 2014), a slight flow was observed through the culvert.

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. 2 to obtain post borehole completion water levels. These levels are recorded on the individual Record of Borehole Log Sheets (Appendix B).

The water levels were measured at elevations 319.7 and 328.5 m at Borehole Nos. 1 and 2, respectively. Groundwater was not encountered within the depth of cave (elevation 328.9 m) at Borehole No. 3.

The groundwater and river water levels will fluctuate seasonally/yearly.



## Appendix 1 Key Plan

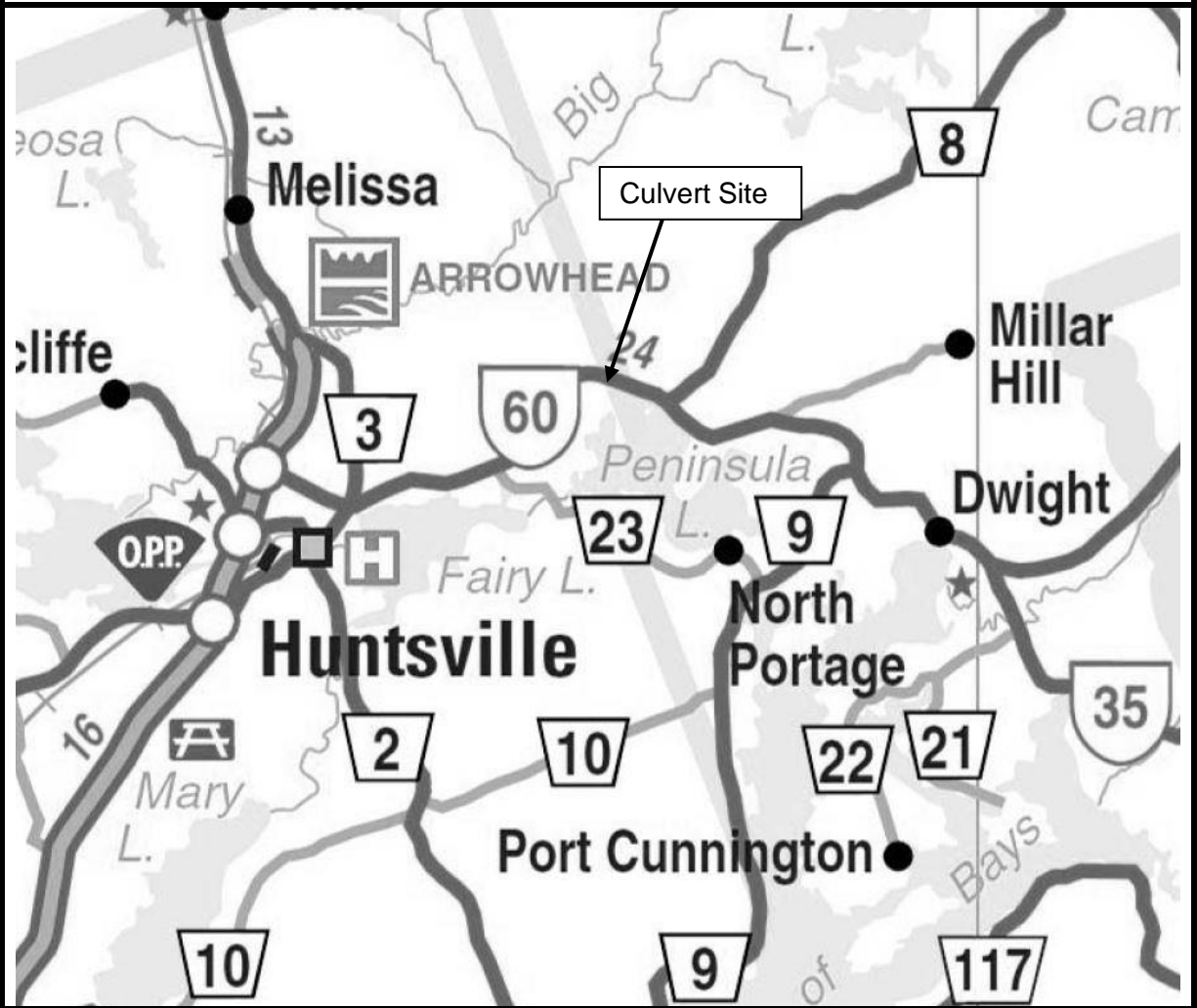
Drawing No. 1

Key Plan

KEY PLAN

Drawing No. 1

NOT TO SCALE



FINAL  
FOUNDATION INVESTIGATION REPORT  
GWP 5333-11-00  
Highway 60  
Culvert 20+566, Twp of Chaffey



Reference No: 14/07/13083-F3

May 2015

## Appendix 2   Subsurface Data

Enclosure No. 1	List of Abbreviations and Symbols
Enclosure Nos. 2 to 4	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
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) *Cohesive Soils:*

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 14/07/14083-F3 DATUM Geodetic LOCATION N 5025121.6 E 334582.8 - Chaffey Twp., Station 20+566 ORIGINATED BY JL  
 PROJECT GWP 5333-11-00, Highway 60 BOREHOLE TYPE Track Mounted CME 45 - Hollow Stem Augers COMPILED BY SH  
 CLIENT AECOM DATE (Started) 13 August 2014 TIME 14 August 2014 (Completed) 1:00:00 PM CHECKED BY MAM

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
319.9	Ground Surface		1	SS	10/0mm												
0.0	ORGANIC SOILS - silty some sand cobble size rock pieces		2	SS	20/0mm												
319.1	BEDROCK - grey/ pink gneiss		3	RC	Rec = 100% RQD = 59%												
0.8	fair to good quality		4	RC	Rec = 100% RQD = 88%												
			5	RC	Rec = 100% RQD = 88%												
315.4	End of Borehole																
4.5																	

WATER LEVEL RECORDS		
Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 14/8/14 10:45:00 AM	0.25	3.76
2)	-	-
3)	-	-

COMMENTS

+ 3, × 3 : Numbers on right refer to Sensitivity  
 Numbers on left refer to values greater than 120 kPa  
 ○ 3% STRAIN AT FAILURE

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

LVM-Merlex, a Division of EnGlobe Corp.

120 Progress Court, North Bay, On P1A 0C2 Phone: (705)476-2550 Fax: (705)476-8882 Email: northbay@lvm.ca

MEL-GEO 14083 - BOREHOLE LOGS - F3.GPJ MEL-GEO.GDT 15/5/15

## METRIC

## RECORD OF BOREHOLE NO. 2



REFERENCE 14/07/14083-F3 DATUM Geodetic LOCATION N 5025157.0 E 334596.8 - Chaffey Twp., Station 20+567 ORIGINATED BY JL  
 PROJECT GWP 5333-11-00, Highway 60 BOREHOLE TYPE Track Mounted CME 45 - Hollow Stem Augers COMPILED BY SH  
 CLIENT AECOM DATE (Started) 21 August 2014 TIME   
 DATE (Completed) 21 August 2014 (Completed) 1:30:00 PM CHECKED BY MAM

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80	100	W <sub>p</sub>	W		
328.5	Ground Surface															
0.0	ORGANIC SOILS - silty, with sand		1	SS	12											
327.9																
0.6	SAND - with silt some gravel brown (very dense)		2	SS	50/76mm											
			3	SS	58											
326.5																
2.0	BEDROCK - grey gneiss good to excellent quality		4	RC	Rec= 98% RQD= 98%											
			5	RC	Rec= 100% RQD= 87%											
323.5																
5.0	End of Borehole															
COMMENTS						+ 3, x 3 : Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa ○ 3% STRAIN AT FAILURE										
						WATER LEVEL RECORDS Date (dd/mm/yy)/Time      Water Depth (m)      Cave In (m) 1) 21/8/14 1:40:00 PM      0      3.96 2)      -      - 3)      -      -										

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

MEL-GEO 14083 - BOREHOLE LOGS - F3.GPJ MEL-GEO.GDT 15/5/15

**METRIC****RECORD OF BOREHOLE NO. 3**

REFERENCE 14/07/14083-F3 DATUM Geodetic LOCATION N 5025149.3 E 334594.0 - Chaffey Twp., Station 20+567 ORIGINATED BY JL  
 PROJECT GWP 5333-11-00, Highway 60 BOREHOLE TYPE Truck Mounted CME 45 - Hollow Stem Augers COMPILED BY SH  
 CLIENT AECOM DATE (Started) 16 September 2014 TIME 16 September 2014 (Completed) 2:00:00 PM CHECKED BY MAM

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)												
ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)											
							20	40	60	80	100	20	40	60													
330.2	Ground Surface																										
0.0	100 mm Asphalt 300 mm Crushed Gravel  FILL - sand some to with gravel some silt mixed with rock fill  brown  (loose/dense)		1	SS	34										19 67 (15)												
			2	SS	15																						
			3	SS	12																						
			4	SS	4										22 62 (17)												
327.3	ORGANIC SOILS - silty  black		5	SS	2																						
326.5																											
3.7	SAND - with silt some gravel to gravelly  brown  (dense/very dense)		6	SS	40																						
			7	SS	50/25 mm																						
			8	RC	Rec=40% Rec(BDR)=0%																						
323.8																											
6.5	BEDROCK - grey gneiss  good to excellent quality		9	RC	Rec=100% ROD=91%																						
			10	RC	Rec=100% ROD=84%																						
320.7																											
9.5	End of Borehole																										
COMMENTS							+ 3, × 3 : Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa			WATER LEVEL RECORDS																	
							○ 3% STRAIN AT FAILURE			<table border="1"> <thead> <tr> <th>Date (dd/mm/yy)/Time</th> <th>Water Depth (m)</th> <th>Cave In (m)</th> </tr> </thead> <tbody> <tr> <td>1) 16/9/14 9:40:00 AM</td> <td>Dry</td> <td>2.16</td> </tr> <tr> <td>2) 16/9/14 2:00:00 PM</td> <td>Dry</td> <td>1.32</td> </tr> <tr> <td>3)</td> <td>-</td> <td>-</td> </tr> </tbody> </table>						Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)	1) 16/9/14 9:40:00 AM	Dry	2.16	2) 16/9/14 2:00:00 PM	Dry	1.32	3)	-	-
Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)																									
1) 16/9/14 9:40:00 AM	Dry	2.16																									
2) 16/9/14 2:00:00 PM	Dry	1.32																									
3)	-	-																									

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

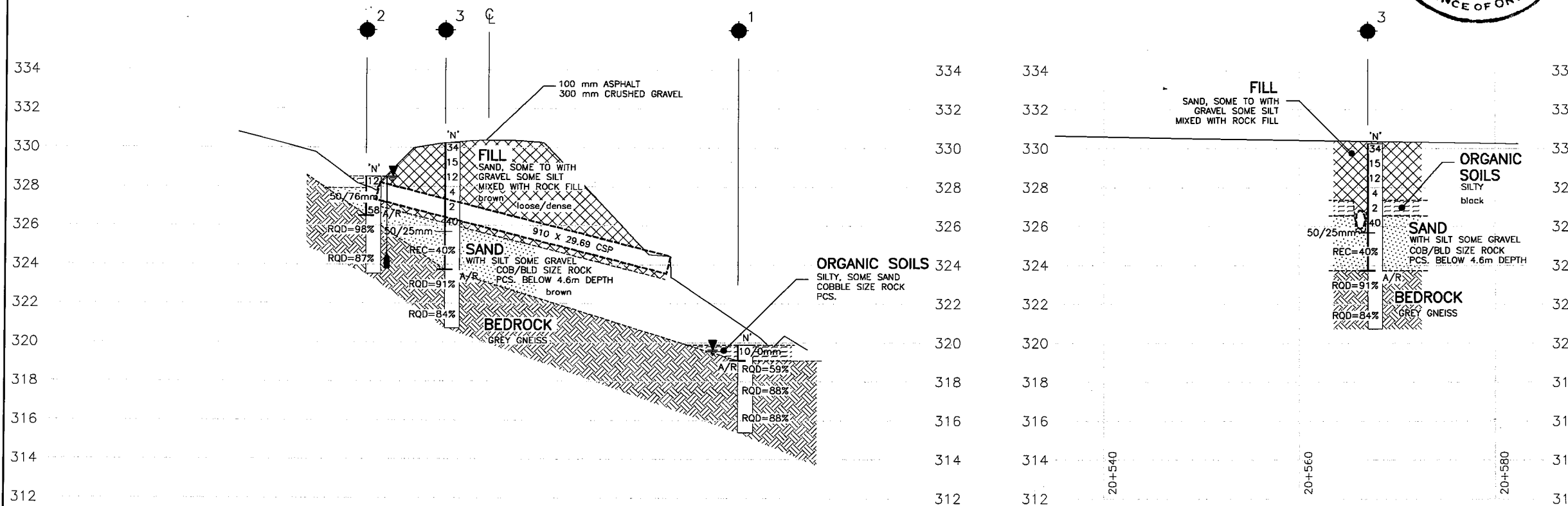
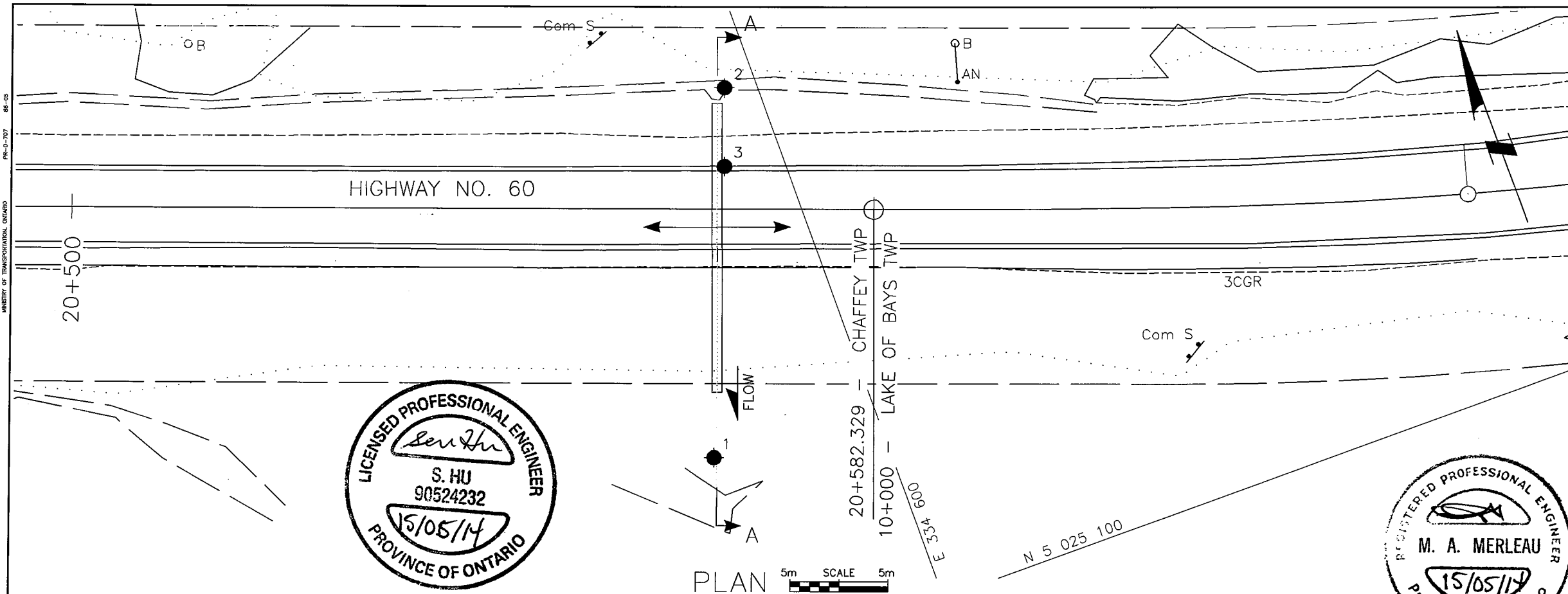
MEL-GEO 14083 - BOREHOLE LOGS - F3.GPJ MEL-GEO.GDT 15/5/15



## **Appendix 3      Borehole Plan and Lab Data**

Drawing No. 2:              Borehole Location and Soil Strata  
Figure Nos. L-1 to L-2:      Grain Size Distribution Curves  
Figure No. L-3:              Lab Test Summary Sheet

CAD FILE LOCATION AND NAME: \\2014\14083 - PAV & FDN, Hwy 60, Huntsville (ACEDON\FOUNDATIONS\Drawings\F2 and F3\F3\Working - Do Not Move or Delete Files\14083-F3 - FINAL - Drawing Plg, Culvert at 20+566.dwg  
MODIFIED: 4/9/2015 9:30:30 AM BY: GRASSER  
DATE PLOTTED: 5/6/2015 1:53:03 PM BY: RYAN GRASSER



DISTRICT  
CONT. No.  
GWP No. 5333-11-00

HWY 60  
CULVERT AT STATION 20+566  
CHAFFEY TOWNSHIP

BOREHOLE LOCATIONS  
AND SOIL STRATA

DRAWING  
2

LVM  
Mertex

METRIC

LEGEND

Borehole

Borehole w/ Dynamic Cone Penetration Test

Blows/0.3 m (Std Pen Test, 475 J/blow)

Blows/0.3 m (60° Cone, 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	319.9	25.5m Rt	5025121.6	334582.8
2	328.5	12.5m Lt	5025157.0	334596.8
3	330.2	4.4m Lt	5025149.3	334594.0

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 exp. on October 23, 2014.

GEOCRES No. 31E-346

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.

DRAWING NOT TO BE SCALED  
50mm ON ORIGINAL DRAWING

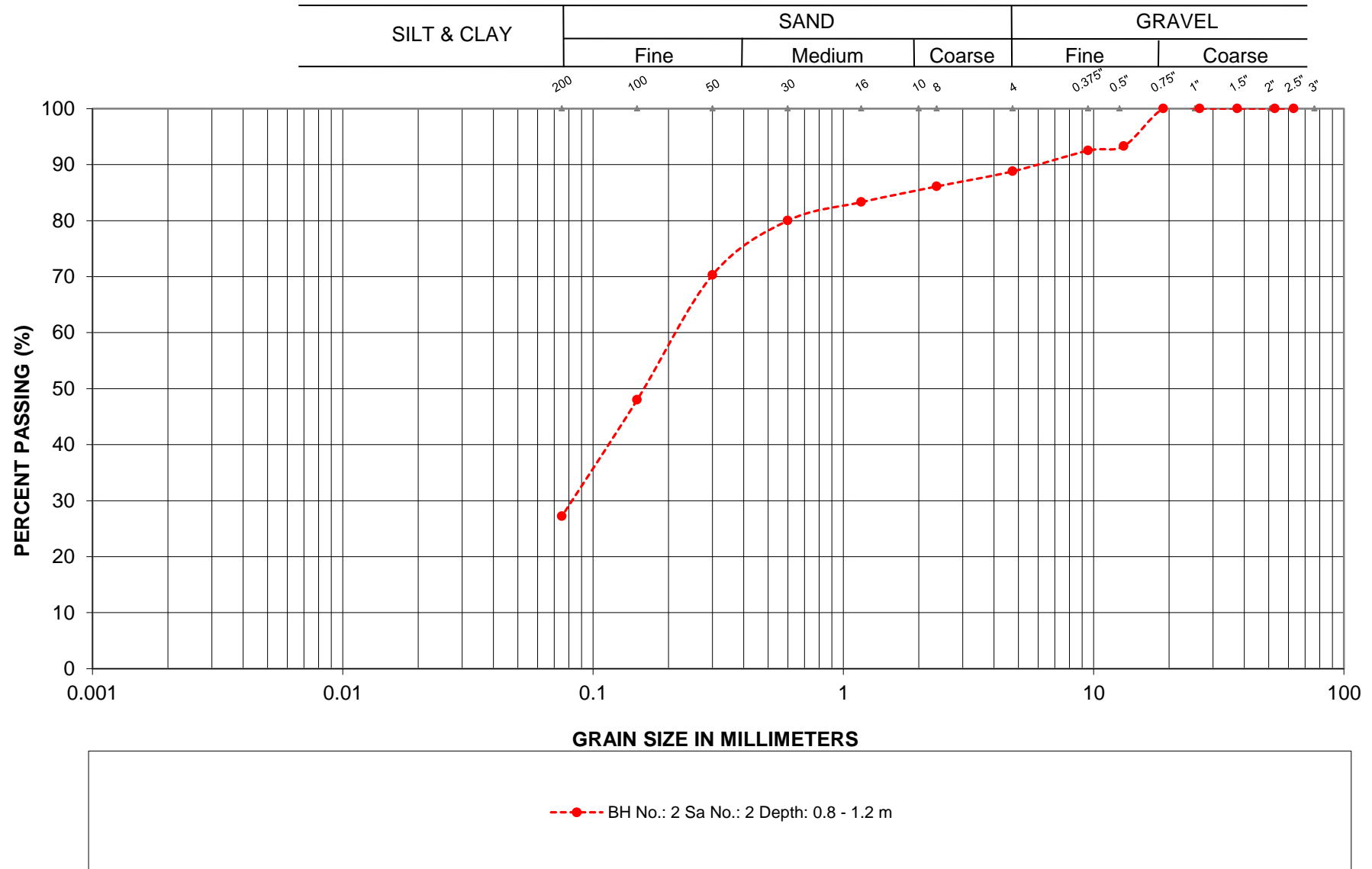
REVISIONS		DATE		DESCRIPTION	
FEB/15	RG	DRAFT			
APR/15	RG	FINAL			
DESIGN	CHK	CODE	LOAD	DATE APR/15	
DRAWN	RG	CHK	AT	STRUCT	SCHEME
				DWG	2

**GRAIN SIZE ANALYSIS**

LOCATION: Hwy 60 CSP, Station 20+566  
Chaffey TWP, Ontario

EMBANKMENT FILL

# GRAIN SIZE ANALYSIS



LOCATION: Hwy 60 CSP, Station 20+566  
Chaffey TWP, Ontario

SAND

## 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	0.0					54.5				10/0mm			
	2	0.8									20/0mm			
	3	0.8												Rec=100%, RQD=59%
	4	1.7												Rec=100%, RQD=88%
	5	3.1												Rec=100%, RQD=88%
2	1	0.0					36.7				12			
	2	0.8	11	62	27		16.9				50/76mm			
	3	1.5					13.0				58			
	4	2.0												Rec=98%, RQD=98%
	5	3.5												Rec=100%, RQD=87%
3	1	0.0	19	67	15		5.0				34			
	2	0.8					3.5				15			
	3	1.5					3.0				12			
	4	2.3	22	62	17		8.0				4			
	5	3.1					30.1				2			
	6	3.8					22.8				40			
	7	4.6									50/25 mm			
	8	5.0												Rec=40%, Rec(BDR)=0%
	9	6.5												Rec=100%, RQD=91%
	10	8.0												Rec=100%, RQD=84%

## **Appendix 4    Photo Essay**

Enclosure No. 5:

Photo Essay

Existing Embankment – Looking East

Photo: 1



Rock fill in embankment – South side

Photo: 2



Project: Hwy 60 – Culvert at Station 20+566, Chaffey Township

Photos Provided By: LVM

Date: June 2014



Culvert outlet – Looking South

Photo: 3



Culvert Outlet – Looking north

Photo: 4



Project: Hwy 60 – Culvert at Station 20+566, Chaffey Township

Photos Provided By: LVM

Date: June 2014



Looking through culvert – Looking north

Photo: 5



Culvert Inlet – Looking South

Photo: 6



Project: Hwy 60 – Culvert at Station 20+566, Chaffey Township

Photos Provided By: LVM

Date: June/August 2014