



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

**Highway 560
Seven Mile Creek Culvert – Site No. 47-314/C
Twp. Of Mickle
GWP 5242-11-00**

FINAL FOUNDATION INVESTIGATION AND DESIGN REPORT

Date: May 21, 2014
Ref. N^o: 13/05/13073-F5

Geocres No. 41P-59

LVM | MERLEX

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Final Foundation Investigation and Design Report

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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.

189 Wyld Street, Suite 103

North Bay, Ontario

P1B 1Z2

Attention: **Mr. Al Rose**

REVISION AND PUBLICATION REGISTER		
Revision N°	Date	Modification And/Or Publication Details
00	2014-04-03	DRAFT FIDR Issued
01	2014-05-21	Final Report Issued

REPORT DISTRIBUTION	
2 hard copies	AECOM
5 hard copies and 1 electronic copy	MTO Project Manager
1 hard copy and 1 electronic copy	MTO Pavements and Foundations Section, Foundations Group
1 hard copy	File

1 INTRODUCTION

LVM | MERLEX has been retained by AECOM Canada Ltd., on behalf of the Ministry of Transportation of Ontario (MTO), to carry out a foundation investigation at the site of an existing centerline culvert. The site is located in the Township of Mickle on Highway 560, some 10.7 km west of the west junction of Highway 65 and 560.

The foundation investigation location was specified by the MTO in the Terms of Reference for work under Agreement No. 5012-E-0025. The terms of reference for the scope of work are outlined in LVM | MERLEX's Proposal P-13-022, dated February, 2013. The purpose of this investigation was to determine the subsurface conditions in the area of the culvert ends in order to provide design recommendations for construction of a dewatering system for use during culvert rehabilitation. It is understood that the culvert rehabilitation will consist of lining the lower section of the cell. 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

The site of this foundation investigation is located on Highway 560 some 10.7 km west of the west junction of Highway 65 and 560, in the Township of Mickle. For the purposes of this project, the intersection of the highway and culvert centerlines has been given a local site chainage of station 10+000, Township of Mickle. The local topography at the site is a low wetland to the left and right (north and south) of the embankment. The existing highway embankment currently supports two undivided lanes of highway, running in a west to east direction. The existing highway, at the culvert location, is constructed on an embankment some 3.6 m in height, with centerline elevation of 301.8 m at the culvert location. The culvert at this location has been described, in the RFP, as a 5.0 m diameter Corrugated Steel Pipe (CSP) culvert. However, based on inspection reports and survey data, the culvert at this site is a 4.37 x 2.87 m Structural Plate Corrugated Steel Pipe Arch (SPCSPA) culvert some 17 m in length.

Infrastructure at the culvert location consists of overhead wires on the right (north) side of the highway.

2.1 SITE PHYSIOGRAPHY AND SURFICIAL GEOLOGY

This project is located in the Geomorphic Sub-province known as the Eastern Sandy Uplands. The topography on this section of Highway 560 is generally flat. Significant layers of earth overlay the bedrock. Organic terrain was also observed. Within the project area native overburden consists primarily of a layer of organic soils overlying sands within the depths investigated.

Bedrock in the area, as indicated on OGS Map 2506, is of the Late to Middle Precambrian period, Huronian Supergroup, consisting of conglomerate, sandstone, siltstone, and argillite.

3 INVESTIGATION PROCEDURES

The field work for this investigation was carried out February 12th and 13th, 2014 during which time four (4) sampled boreholes were advanced. Two (2) boreholes were advanced at both the inlet and outlet ends of the culvert.

The field investigation was carried out using a Bombardier mounted CME drilling rig equipped with hollow stem augers, standard augers, 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 mounted in a trip (automatic) hammer. 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 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. 19 mm diameter standpipes were installed in select open boreholes prior to backfilling to allow 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 Ontario Regulation 903.

The field work 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 and L-2).

The location of the individual boreholes were determined in the field using temporary highway chainage (established by others) and offset relative to highway centerline. The centreline of this culver was assigned Station 10+000. 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, established by others.

4 SUBSURFACE CONDITIONS

Details of the subsurface conditions revealed by the investigation program are presented on the enclosed Record 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 10+000, TWP OF MICKLE

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, four (4) sampled boreholes were put down at this site, with Borehole Nos. 1 and 4 advanced at the culvert outlet (right/south) and Borehole Nos. 2 and 3 advanced at the culvert inlet (left/north). At the time of the subsurface investigation, the ground surface elevations at Boreholes Nos. 1 to 4 were recorded at 299.2, 299.0, 299.3, and 299.3 m, respectively.

4.1.1 Organic Soils

At ground surface, at Borehole Nos. 1, 2, and 3, a layer of organic soils was encountered. This layer was described as black silty to sandy organic soils with fine fibres. Trace gravel was encountered in this deposit. Cobbles were encountered in this deposit at Borehole Nos. 1 and 3, and a boulder was encountered in this deposit at a depth of 0.9 m below grade at Borehole No. 2. The natural moisture content measured on samples of this organic soil deposit was in the order of 25 to 144%. The layer of organic soils was encountered to depths of 1.5, 1.1, and 1.1 m below grade at Borehole Nos. 1, 2, and 3, respectively (elevations 297.7, 297.9, and 298.2 m, respectively).

4.1.2 Sand

Underlying the layer of organic soils at Borehole Nos. 1, 2, and 3, and at surface at Borehole No. 4, a stratum of grey sand, with varying silt content, trace to with gravel, was penetrated. Occasional cobbles/boulders were encountered in this deposit. Trace organic soil was encountered in this deposit at Borehole No. 4. The natural moisture content measured on samples of this deposit was in the order of 9 to 38%. The elevated moisture contents in this deposit are likely due to the presence of organic soils. Gradation analyses were carried out on two (2) samples of this deposit, the results of which indicated 0 to 4% gravel size particles, 88 to 97% sand size particles, and 3 to 8% silt and clay size particles (Figure No. L-1, Appendix 3). Hydrometer analyses were carried out on five (5) samples of this deposit, the results of which indicated 1 to 24% gravel size particles, 50 to 73% sand size particles, 18 to 44% silt size particles, and 2 to 3% clay size particles (Figure No. L-1, Appendix 3). Atterberg Limits testing was attempted on samples of this deposit, however, the results indicated this material is non-plastic. Based on SPT 'N' values of 6 to 78 blows per 300 mm penetration, the compactness of this deposit was described as loose to very dense, generally compact. Sampling was

terminated in this deposit at depths of 6.1, 5.9, 6.2, and 5.8 m below grade at Borehole Nos. 1 to 4, respectively (elevations 293.1, 293.1, 293.1, and 293.5 m, respectively).

4.2 GROUNDWATER DATA

At the time of this investigation, the water level (ice level) at the culvert location was measured at elevation 299.4 m.

Measurements of the groundwater 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. 4 to obtain post completion water levels. These levels are recorded on the individual Record of Borehole Log Sheets (Appendix 2). The water levels in Borehole Nos. 2, 3, and 4, were measured at elevations 298.7 to 299.3 m.

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

5 DISCUSSION AND RECOMMENDATIONS

5.1 GENERAL

The culvert at this location is a 4.37 x 2.87 m Structural Plate Corrugated Steel Pipe Arch (SPCSPA) culvert, some 17 m in length. Flow through the culvert is from left to right (i.e. north to south) (see Photo Essay, Appendix 1). The subsurface conditions at this site generally consist of a layer of organic soils overlying a compact sand deposit at the culvert ends.

It is understood that, presently, it is proposed to rehabilitate the culvert by cell lining the lower half of pipe.

In order to carry out this work geotechnical information for a dewatering system is required.

5.2 DEWATERING

The culvert must be maintained in a dewatered condition during culvert rehabilitation. The groundwater level, at the time of this investigation, was recorded at approximately elevations 298.7 to 299.3 m in February 2014. A slight flow was observed through the culvert at the time of the investigation. The water level in the creek was at elevation 299.4 m, measured in February, 2014, some 1.3 m above the culvert invert. Dewatering, in accordance with OPSS 517 and 518, will be required during rehabilitation activities.

In order to dewater the culvert location a cofferdam will be required at the inlet and outlet. A complete cofferdam at the inlet and outlet with bypass pumping is the suggested method of controlling the creek flow. A bypass pipe could be suspended from the roof of the existing culvert, considering the culvert size, or alternately installed through the existing embankment. The former bypass approach is favoured to prevent impacting the existing pavement structure during construction. Consideration could also be given to constructing a cofferdam along the center of the culvert, in consideration of the 4.4 m width of the arch. This would allow work in the dry on one side and permit bypass flow along the other side. Since the existing culvert is a closed SPCSPA, a gravity type cofferdam (i.e. sand bag or other sufficiently narrow gravity cofferdam system) could be used along the center of the culvert to control flow to one side. Considering the corrugated cross section of the existing culvert, a seal (i.e. bentonite seal) would likely be required between the gravity cofferdam base and existing culvert, for the dam to effectively contain water. A sheet pile wall, that conforms to the culvert corrugations, fixed to the interior of the existing culvert, could also be considered.

A temporary gravity type cofferdam is the recommended method of controlling the creek flow at this culvert location. A gravity type cofferdam could be constructed of earth fill with a low permeable core, sand bag/metre bag, or aquadam (water filled bladder) type dam. Depending upon the base width of the cofferdam, seepage may develop below the temporary sand bag wall. This may require pumping from filtered sump holes within the dewatered area.

A sheet pile type cofferdam could also be considered for use during culvert replacement. However, it should be noted that cobbles and boulders were encountered in the existing organic soils and native sand deposits. As such, advancing a sheet pile cofferdam may be problematic during construction. Therefore, a sheet pile type cofferdam may not be appropriate at this site. For information purposes, to resist the 1.3 m hydrostatic pressure, a circular sheet pile wall will attain structural stability from its geometry and depth of penetration of the sheets, therefore may require minimal interior bracing. To minimize seepage below the cofferdam, the sheets should extend to a minimum depth below the inside base equal to the depth of water above the base. It is likely that the depth of sheet penetration will be controlled by structural considerations and not seepage.

It should be noted that deposits of organic soils of significant thickness (1.3 to 1.5 m) were encountered at the borehole locations, with exception of BH No. 4, advanced adjacent to the existing channel. The design of the cofferdam system must account for the presence of organic soils in and around the channel.

A conceptual cofferdam sketch has been included in Appendix 5.

6 STATEMENT OF LIMITATIONS

The design recommendations given in this geotechnical report are applicable only to the project described in the text and only if constructed substantially in accordance with details of alignment and elevations stated in the report. Since all details of the design may not be known, in our analysis certain assumptions had to be made. The actual conditions may however, vary from those assumed, in which case changes and modifications may be required to our geotechnical recommendations. We recommend, therefore, that we be retained and provided the opportunity during the design stage to review the design drawings, site survey information, proposed elevations, etc. to verify that they are consistent with our recommendations or the assumptions made in our analysis. It is further recommended that we be retained to review the final design drawings and specifications relative to the geotechnical recommendations.

If, during construction, conditions in the field vary from those assumed at the design stage, an engineer from this office must be notified immediately.

Proper subgrade preparation, groundwater control, compaction, etc. are all critical aspects of the bearing capacity of native soils. It must be noted that different aspects of the geotechnical design are based on the assumption that LVM | MERLEX will be retained during site preparation and construction of the proposed works to ensure that both the geotechnical site characteristics and the construction operations/techniques are consistent with our recommendations. Should LVM | MERLEX not be involved during the full construction phase, our liability is strictly limited to the factual information contained herein only.

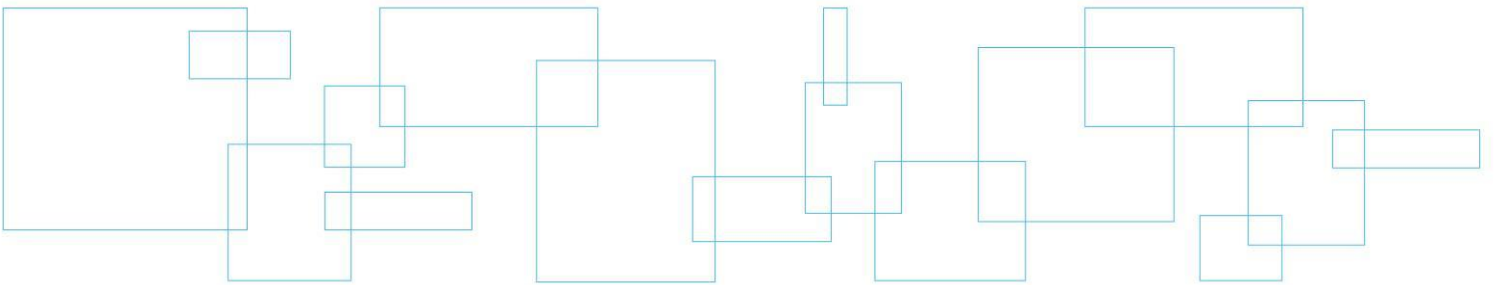
The comments in this report are intended solely for the guidance of the design engineer and address the geotechnical conditions only. The number of boreholes required to determine the localized conditions between boreholes directly affecting construction costs, equipment, scheduling, etc. would in fact be greater than what has been carried out for design purposes. Therefore, contractors bidding on this project or undertaking this work should make their own interpretations of the factual borehole results and carry out further work as they deem necessary to assess the scope of the project.

Section 5 of this reported is intended for the use of the client and the design team only and is not intended to be included in the tender documents. Inclusion of the factual information (Sections 1 to 5 inclusive) in the tender documents is furnished merely for the general information of bidders and is not in any way warranted or guaranteed by or on behalf of the owner or the owner's consultants and its subconsultants or the consultants' or subconsultants' employees, and neither the owner nor its consultants or its employees shall be liable for any representations negligent or otherwise contained in the documents.

Appendix 1 Key Plan

Drawing No. 1

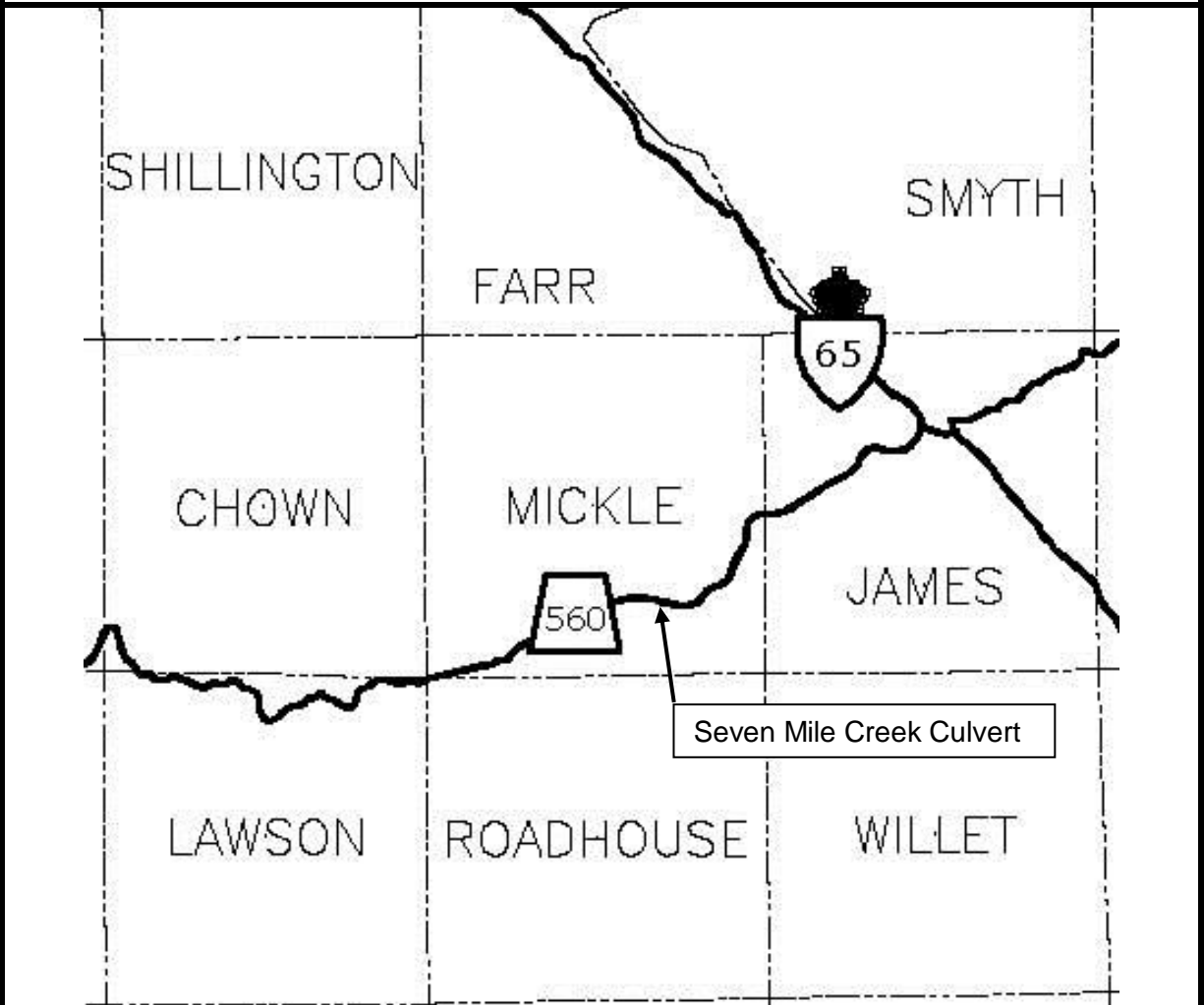
Key Plan



KEY PLAN

Drawing No. 1

NOT TO SCALE



DRAFT
FOUNDATION INVESTIGATION
AND DESIGN REPORT
GWP 5242-11-00
Highway 560
Seven Mile Creek Culvert

LVM | MERLEX

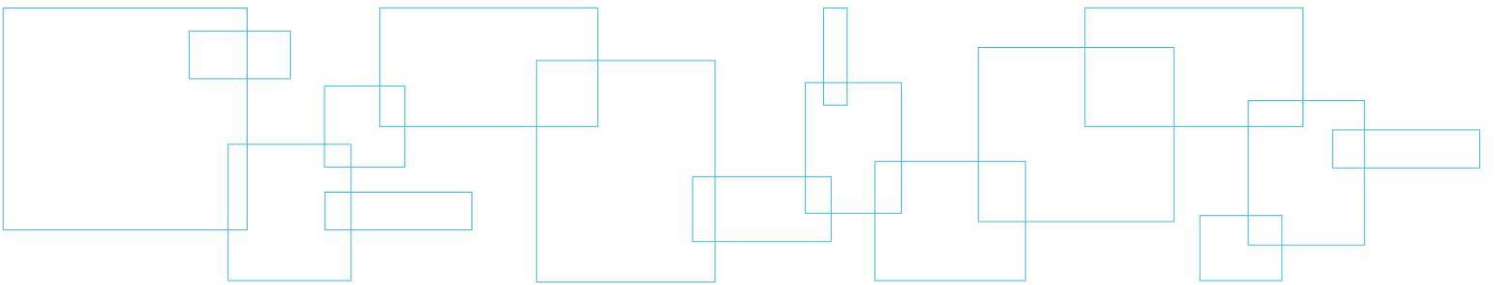
Reference No: 13/05/13073-F5

May 2014

Appendix 2 Subsurface Data

Enclosure No. 1
Enclosure Nos. 2 to 5

List of Abbreviations and Symbols
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. 01**

REFERENCE 13/05/13073-F5 DATUM Geodetic LOCATION N 5283259.1 E 346463.0 - Mickle Township - Station 10+005 ORIGINATED BY JL

PROJECT GWP 5839-05-00, Hwy 560 - Seven Mile Creek Culvert BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Canada Inc. DATE (Started) 2014 February 12 TIME (Completed) 2:45:00 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 γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
299.2	Ground Surface																
0.0	ORGANIC SOILS - silty to sandy organic soils with fine fibres		1	AS													
	black		2	SS	28												
	cobbles encountered between 0.5 and 1.1 m depth																
297.7			3	SS	7												
1.5	SAND - trace silt to silty trace to with gravel																
	grey		4	SS	8												
	(loose)																
			5	SS	9												
	cobbles encountered between 3.5 and 4.1 m depth		6	SS	50/50mm												
	(compact)		7	SS	29												
293.1			8	SS	22												
6.1	End of Borehole																
COMMENTS							$+3, \times 3$: Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa ○ 3% STRAIN AT FAILURE					WATER LEVEL RECORDS Date (yy/mm/dd)/Time Water Depth (m) Cave In (m) 1) - ▽ - 2) - ▽ - 3) - ▼ -					

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



METRIC

RECORD OF BOREHOLE NO. 02



REFERENCE 13/05/13073-F5 DATUM Geodetic LOCATION N 5283284.5 E 346470.4 - Mickle Township - Station 10+008 ORIGINATED BY JL

PROJECT GWP 5839-05-00, Hwy 560 - Seven Mile Creek Culvert BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Canada Inc. DATE (Started) 2014 February 12 TIME 5:30:00 PM CHECKED BY MAM

DATE (Completed) 2014 February 12

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	w_p	w	w_L		
299.0	Ground Surface																
0.0	ORGANIC SOILS - silty to sandy organic soils with fine fibres black		1	SS	2												
297.9	boulder encountered at 0.9 m depth																
1.1	SAND - trace to with silt trace some gravel grey		2	SS	14												
	cobbles/boulders encountered between 1.1 and 5.9 m depth (compact/dense)		3	SS	37												
			4	SS	26												
			5	SS	17												
			6	SS	50/75 mm												
			7	SS	31												
293.1	End of Borehole																
5.9																	

COMMENTS		WATER LEVEL RECORDS	
+ 3, X 3 : Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa O 3% STRAIN AT FAILURE		Date (yy/mm/dd)/Time	Water Depth (m)
		1) 13/2/12 4:10:00 PM	0
		2)	-
		3)	-

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

MEL-GEO 13073-F5 - BOREHOLE LOGS - SEVEN MILE; GPJ MEL-GEO.GDT 14/5/21

REFERENCE	13/05/13073-F5	DATUM	Geodetic	LOCATION	N 5283287.9 E 346457.8 - Mickle Township - Station 9+995	ORIGINATED BY	JL
PROJECT	GWP 5839-05-00, Hwy 560 - Seven Mile Creek Culvert	BOREHOLE TYPE	Track Mounted CME 45B - Hollow Stem Augers	COMPILED BY	AT		
CLIENT	AECOM Canada Inc.	DATE (Started)	2014 February 13	TIME (Completed)	11:45:00 AM	CHECKED BY	MAM
		DATE (Completed)	2014 February 13				

MEL-GEO 13073-F5 - BOREHOLE LOGS - SEVEN MILE.GPJ MEL-GEO.GDT 14/5/21

METRIC**RECORD OF BOREHOLE NO. 04**

REFERENCE 13/05/13073-F5 DATUM Geodetic LOCATION N 5283261.3 E 346453.2 - Mickle Township - Station 9+995 ORIGINATED BY JL

PROJECT GWP 5839-05-00, Hwy 560 - Seven Mile Creek Culvert BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM Canada Inc. DATE (Started) 2014 February 13 TIME 6:15:00 PM CHECKED BY MAM

DATE (Completed) 2014 February 13

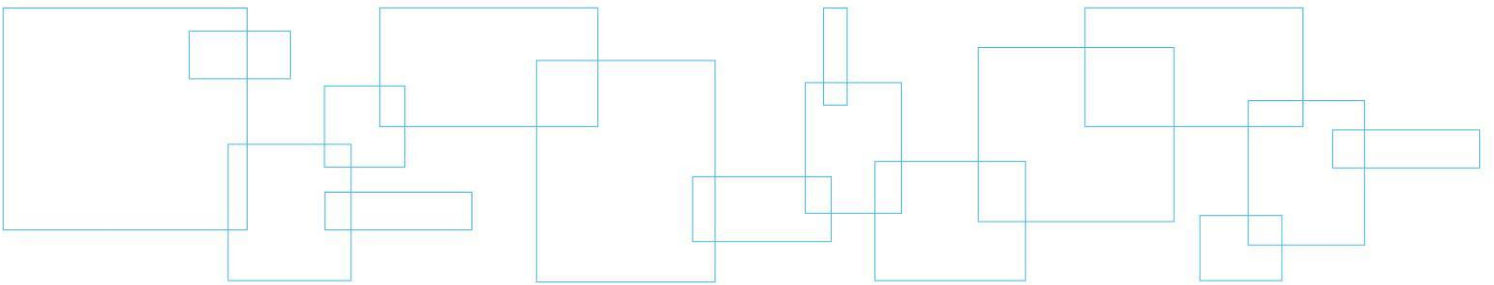
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
299.3	Ground Surface																
0.0	SAND - trace to with silt trace gravel trace organic soil brown grey (loose/compact)		1	SS	15												
			2	SS	16												
			3	SS	6												
			4	SS	12												
			5	SS	7												
			6	SS	15												
			7	SS	27												
293.5	End of Borehole																
5.8																	
COMMENTS							+ 3, X 3 : Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa O 3% STRAIN AT FAILURE					WATER LEVEL RECORDS Date (yy/mm/dd)/Time Water Depth (m) Cave In (m) 1) 13/2/13 2:35:00 PM 0 ∇ - ∇ 2) - ∇ - ∇ 3) - ∇ - ∇					

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

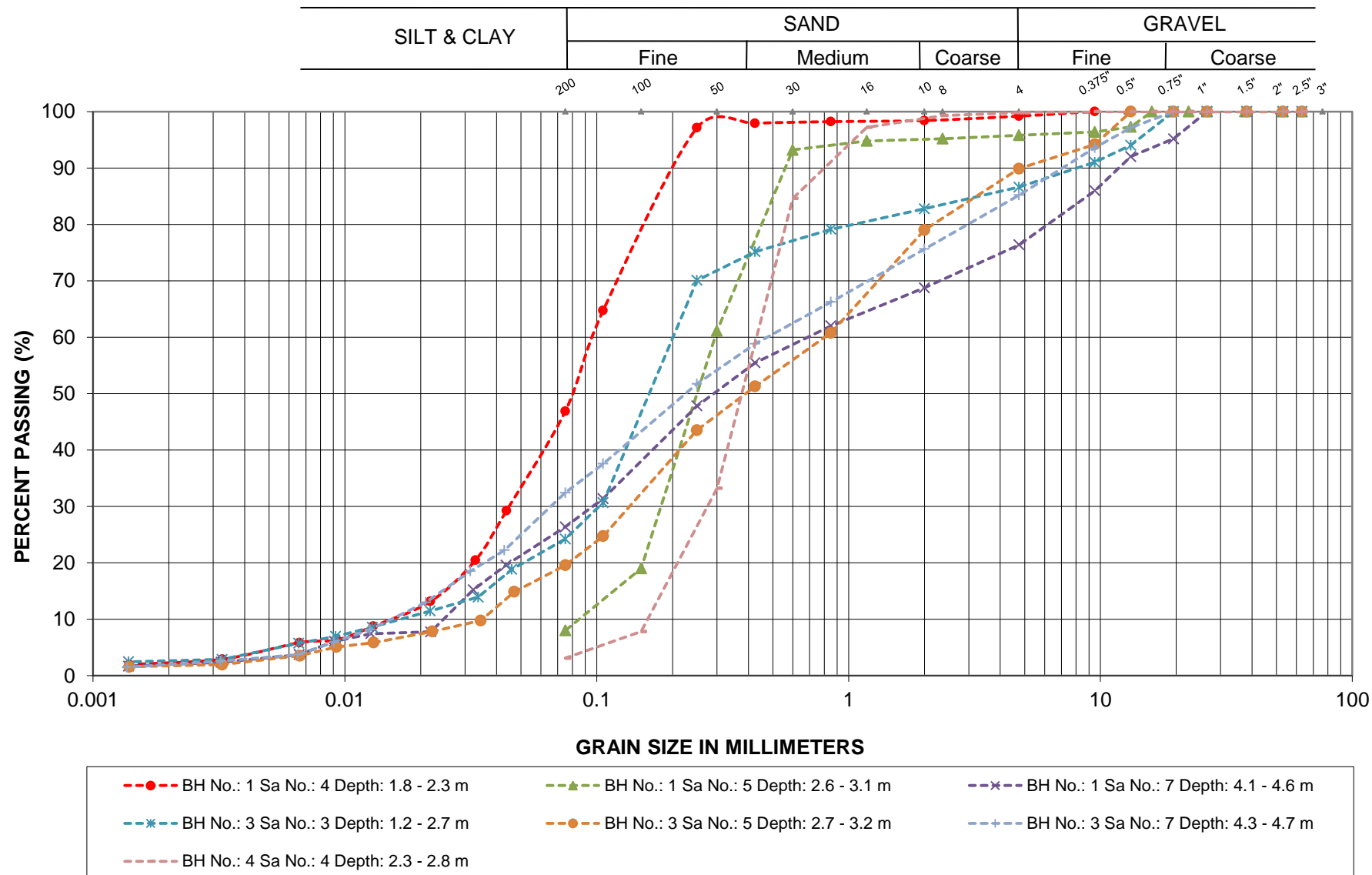


Appendix 3 Borehole Plan and Lab Data

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



GRAIN SIZE ANALYSIS



G.W.P.: 5242-11-00

LOCATION: Hwy 560, Seven Mile Creek

SANDS

LVM | MERLEX

FIGURE L-1

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					57.1							
	2	0.3					24.7				28			
	3	1.1					48.2				7			
	4	1.8					28.2				8			
	5	2.6					20.6				9			
	6	3.4					17.7				50/50mm			
	7	4.1					9.3				29			
	8	5.6					12.6				22			
2	1	0.2					72.2				2			
	2	0.9					9.1				14			
	3	1.7					9.0				37			
	4	2.4					15.3				26			
	5	3.2					15.5				17			
	6	4.0					16.9				50/75 mm			
	7	5.5					12.1				31			
3	1	0.0					144.0				10			
	2	0.5					30.6				3			
	3	1.2					14.7				78			
	4	2.0					10.7				61			
	5	2.7					14.2				24			
	6	3.51					9.6				26			
	7	4.27					10.1				31			
	8	5.8					13.2				50/125 mm			

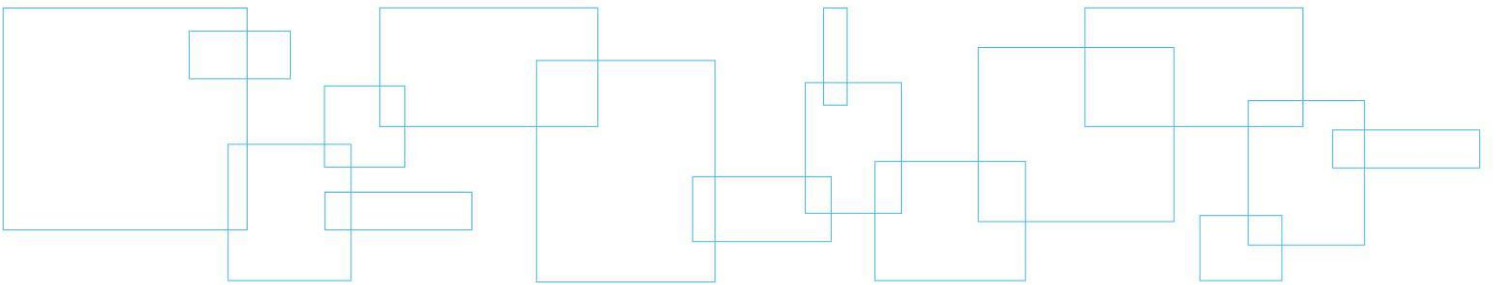
Laboratory Tests - Summary Sheet

[illegible]

Appendix 4 Photo Essay

Enclosure No. 6:

Photo Essay



Culvert Inlet – Looking North

Photo: 1



Culvert Outlet – Looking South

Photo: 2



Project: Hwy 560 – Seven Mile Creek Culvert

Photos Provided By: LVM

Date: July 2013

Appendix 5 Design Data

Sketch No. 1: Conceptual Cofferdam Sketch

