

**FINAL**  
**FOUNDATION INVESTIGATION REPORT**  
**MCCONNELL CREEK CULVERT REPLACEMENT**  
**HIGHWAY 527**  
**DISTRICT OF THUNDER BAY, ONTARIO**

**G.W.P. 6527-14-00, SITE No. 48C-356/C**

**Geocres Number: 52H-24**

**Report to**

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November 11, 2014  
File: 19-1605-121

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## **1 INTRODUCTION**

This report presents the factual findings obtained from a foundation investigation conducted at the proposed location of the replacement culvert to carry Highway 527 over McConnell Creek, approximately 0.6 km south of Kabitotikiwa River in the District of Thunder Bay, Ontario.

The purpose of this investigation was to explore the subsurface conditions at the site and, based on the data obtained, to provide a borehole location plan, records of boreholes, stratigraphic profile, laboratory test results and a written description of the subsurface conditions. A model of the subsurface conditions was developed from the data obtained in the course of the investigation.

Thurber carried out the investigation as a sub-consultant to Hatch Mott MacDonald (HMM), under the Ministry of Transportation Ontario (MTO) Agreement Number 6013-E-0027, Work Item 1.

## **2 SITE DESCRIPTION**

The existing McConnell Creek crossing is located on Highway 527, approximately 125 km north of Thunder Bay and 1 km south of Kabitotikiwa River. At the existing Highway 527 crossing McConnell Creek flows meandering, in general from the east to west direction. The existing culvert consists of a 3000 mm diameter and 30 m long polymer coated CSP, which was installed after the washout of the original 3500 mm x 2200 mm x 28 m CSP culvert. Two 1500 m diameter overflow culverts exist to the south of the main culvert.

The highway embankment is approximately 6 m in height at the culvert location. A layer of rock fill to form erosion protection was placed on both slopes of the highway embankment at the replaced culvert location.

The surrounding lands are densely treed with grass and shrubs in close proximity to the highway. Photographs in Appendix C show the existing McConnell Creek culverts and the general nature of the site.

The site lies within the physiographic region known as the Wabigoon Subprovince of the Superior Province of the Canadian Shield. The site is underlain by mafic dikes and related intrusive rocks of Keweenawan age. The bedrock is overlain by fluvial and glaciolacustrine deposits of sand, gravelly sand, gravel and near shore and beach deposits.

### **3 SITE INVESTIGATION AND FIELD TESTING**

The site investigation and field testing for this project was carried out between August 19 and 23, 2014. The investigation comprised drilling and sampling of six boreholes denoted as Boreholes 14-01 to 14-06. The approximate borehole locations are shown on the attached Borehole Locations and Soil Strata Drawing in Appendix D.

The borehole locations were marked in the field and utility clearances were obtained prior to drilling.

Boreholes 14-02 to 14-05 were advanced to depths between 9.8 and 36.6 m (Elev. 269.2 to 242.4 m), with drilling carried out using a track mounted CME 750 drill rig. Hollow stem augers were used to advance these boreholes to depths of 9.1 m to 15.2 m, and wash boring techniques and NQ casing were employed below these depths in Boreholes 14-03 to 14-05. Boreholes 14-01 and 14-06 were drilled using portable drilling equipment (tripod) to 9.8 m depth (Elev. 267.4 m and 266.8 m, respectively). Wash boring technique was used to advance those two boreholes. Soil samples were obtained at selected intervals in the boreholes using a split spoon sampler in conjunction with Standard Penetration Testing (SPT). Dynamic Cone Penetration Testing (DCPT) was conducted below the sampled depth in Boreholes 14-1, 14-3, 14-5 and 14-6 to depths ranging from 20.1 m to 37.2 m (Elev. 257.1 m to 241.8 m).

The drilling and sampling operations were supervised on a full time basis by a member of Thurber's technical staff. The supervisor logged the boreholes and processed the recovered soil samples for transport to Thurber's laboratory for further examination and testing.

Groundwater conditions were observed in the open boreholes upon completion of the drilling operations. A standpipe piezometer was installed in Borehole 14-03 to measure groundwater levels. The piezometer was subsequently decommissioned in general accordance with MOE Regulation 903 following completion of the final water level reading. The piezometer installation and borehole completion details are summarized in Table 3.1.

**Table 3.1 – Borehole Completion and Piezometer Installation Details**

<b>Borehole</b>	<b>Piezometer Tip Depth/ Elev. (m)</b>	<b>Completion and Installation Details</b>
14-01	None installed	Borehole caved to 6.2 m. Borehole backfilled with bentonite holeplug to 0.5 m, then cuttings to surface.
14-02	None installed	Borehole caved to 5 m. Borehole backfilled with bentonite holeplug mixed with cuttings to 1.8 m, then cuttings to surface.
14-03	9.6/269.4	19 mm diameter Schedule 40 PCV pipe with 1.52 m slotted screen. Piezometer installed with bentonite holeplug from 7.3 m to 1.8 m, then cuttings to surface.
14-04	None installed	Borehole caved to 7.2 m. Borehole backfilled with bentonite holeplug mixed with cuttings to surface.
14-05	None installed	Borehole caved to 10.2 m. Borehole backfilled with bentonite holeplug mixed with cuttings to 1.5 m, then cuttings to surface.
14-06	None installed	Borehole backfilled with bentonite holeplug mixed with cuttings to 0.5 m, then cuttings to surface.

#### **4 LABORATORY TESTING**

The recovered soil samples were subjected to Visual Identification (VI) and to natural moisture content determination. Selected samples were also subjected to gradation analysis (hydrometer and sieve) and Atterberg Limits testing, where appropriate. The results of these tests are summarized on the Record of Borehole sheets included in Appendix A and are presented on the figures included in Appendix B.

#### **5 DESCRIPTION OF SUBSURFACE CONDITIONS**

Reference is made to the Record of Borehole sheets included in Appendix A. Details of the encountered soil stratigraphy are presented in these sheets and on the “Borehole Locations and Soil Strata” drawings included in Appendix F. An overall description of the stratigraphy is given in the following paragraphs. However, the factual data presented in the Record of Borehole sheets governs any interpretation of the site conditions.

In general, the subsurface stratigraphy encountered at the culvert site consisted of existing embankment fill, overlying deep cohesionless deposit ranging from sand to silt extending to the depths investigated. More detailed descriptions of the individual strata are presented below.

### **5.1 Topsoil**

Approximately 100 mm of topsoil was encountered in Boreholes 14-01 and 14-06 drilled at the toe of the highway embankment. The topsoil thickness may vary between and beyond the borehole locations.

### **5.2 Embankment Fill**

Boreholes 14-02 to 14-05 were drilled from the shoulder of Highway 527 through the existing embankment fill. The embankment fill extended to depths of 4.0 m to 6.9 m (Elev. 275.0 m to 272.1 m). The encountered fill consisted of sandy gravel to sand, some gravel with trace of silt. Occasional cobbles (possible rock fill) were encountered in the boreholes.

A layer of erosion protection consisting of rock fill was present on both side slopes of the embankment. Some of the inferred cobbles during drilling in the embankment fill could originate from the material placed as erosion protection on the embankment slopes.

SPT N-values ranged from 3 to 44 blows per 0.3 m penetration, indicating a very loose to dense relative density. In general, the fill was loose to compact with the higher N values indicative of the presence of cobbles or rock fill in the fill materials. Moisture contents ranged from 3 to 7%.

The results of grain size distribution analyses conducted on samples of the fill are presented on the Record of Borehole sheets in Appendix A and on Figure B1 in Appendix B. The results are summarized below.

Gravel %	26 to 68
Sand %	25 to 66
Silt and Clay %	7 to 9.

### **5.3 Peat and Sand**

A layer of organic materials, believed to represent incompletely removed peat during embankment construction, was encountered below the embankment fill in Borehole 14-03 at 5.6 m depth. The material consisted of peat with wood fragments and a significant amount of sand. The peat and sand layer was 1.4 m thick and extended to Elev. 272.0 m. One SPT N-value of 2 blows per 0.3 m penetration was recorded in this deposit indicating a very loose relative density. A moisture content of 36% was measured on one sample of this deposit.

### **5.4 Sand to Sand and Silt**

A layer ranging in composition from sand with trace silt to silty sand with trace gravel and trace clay was encountered beneath the fill in boreholes advanced through the highway embankment and beneath topsoil in Borehole 14-06 drilled at the embankment toe.

Interlayers of sand and silt and sandy silt were present in this deposit and various depths. The increased content of silt was noted in Borehole 14-01 located in the northwest quadrant of the site, and the upper deposit extending to approximately 7.3 m depth was classified as sand and silt. Fragments of roots were observed in soil samples recovered from the upper zone of that deposit.

Boreholes 14-01, 14-02 and 14-06 were terminated within the sand/sand and silt deposit at depths of 9.8 m (Elev. 266.8 to 269.2 m). Where fully penetrated in Boreholes 14-03 to 14-05, the deposit varied in thickness from 14.3 m to 17.3 m, with the base at 21.3 m depth (Elev. 257.7 m).

SPT N-values ranged from 1 to 27 blows per 0.3 m penetration, indicating a very loose to compact relative density. The lowest N-values were recorded in the upper zone of the deposit in proximity to the groundwater level. In general, the sand/sand and silt deposit could be considered as loose to compact. Dynamic Cone Penetration Testing carried out below the base of Boreholes 14-01 and 14-06 and extended to depths of 20.1 m and 20.3 m (Elev. 257.1 m and 256.3 m), in general, confirmed the relative density. Moisture contents varied between 9 and 45%, typically being 15% to 25%.

The results of the grain size distribution testing are presented on the corresponding Record of Borehole sheets included in Appendix A. The grain size distribution curves for the samples of this deposit are presented on Figures B2 to B4 enclosed in Appendix B. A summary is provided below:

Gravel %	0 to 5
Sand %	52 to 96
Silt and Clay %	4 to 48.

### **5.5 Silt to Sandy Silt**

A deposit of silt with some sand to sandy silt with trace clay underlies the sand deposit in Boreholes 14-03 to 14-05. The silt to sandy silt was encountered to depths investigated in the boreholes ranging from 29.6 m (Elev. 249.4 m) to 36.6 m (Elev. 242.4 m). Interlayers/seams of clayey silt were encountered in the lower zone of the deposit in Boreholes 14-03 and 14-04, below approximately Elev. 250 m and between Elev. 253 m to 255 m in Borehole 14-05.

SPT N-values recorded in the silt to sandy silt deposit ranged from 6 to 26 blows per 0.3 m penetration, indicating a loose to compact relative density with a majority of values indicating compact density.

Dynamic Cone Penetration Testing (DCPT) carried out from the base of Boreholes 14-03 and 14-05 were advanced to 36.9 m and 37.2 m depth (approximately Elev. 242 m)

confirming compact relative density of the deposit. The gradual increase in N values indicated by DCPT was probably related to build-up of friction at the tip of the dynamic cone.

Moisture contents varied between 19 and 42%. The results of grain size distribution testing are presented on the corresponding Record of Borehole sheets included in Appendix A. The grain size distribution curves for the tested samples are plotted on Figures B5 to B7 in Appendix B, and the summary is presented below:

Gravel %	0
Sand %	2 to 27
Silt %	63 to 90
Clay%	5 to 19.

### 5.6 Water Levels

Groundwater levels in the boreholes were observed during drilling operations and a standpipe piezometer was installed in one borehole (Borehole 14-03) to monitor the groundwater level after completion of drilling. A summary of the recorded groundwater levels is provided below.

**Table 5.1 - Groundwater Level Measurements**

Borehole	Date	Groundwater Level (m)		Comment
		Depth	Elevation	
14-01	August 22, 2014	3.8	273.4	Borehole open to 6.2 m depth
14-02	August 21, 2014	4.9	274.1	Borehole open to 5.0 m depth
14-03	August 21, 2014	5.1	273.9	In piezometer
	August 22, 2014	5.3	273.7	
	August 23, 2014	5.4	273.6	
14-04	August 19, 2014	3.8	275.2	Borehole open to 7.2 m depth
14-05	August 21, 2014	5.4	273.6	Borehole open to 10.2 m depth
14-06	August 23, 2014	N/A	N/A	N/A

The recorded groundwater levels are considered short-term readings and seasonal fluctuations of the groundwater level are to be expected. Higher water levels may occur,

particularly after spring snowmelt as well as periods of prolonged and/or significant precipitation.

The groundwater level is also expected to be influenced by the water level in the McConnell Creek, which at the time of the field investigation was estimated to be at Elev. 273.6 m.

## 6 MISCELLANEOUS

Borehole locations were selected and established in the field by Thurber Engineering Ltd. The coordinates and the ground surface elevations for the boreholes were established based on topographic survey information provided by HMM.

Thurber obtained utility clearances for the borehole locations prior to drilling.

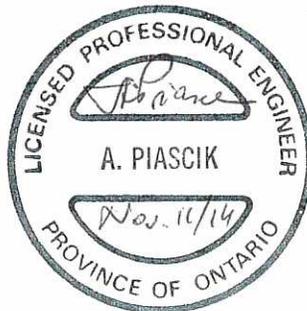
TBT of Thunder Bay, Ontario supplied a truck mounted CME-750 drill rig and tri-pod, and conducted the drilling, sampling and in-situ testing operations. The drilling operations were supervised by Mr. Stephane Loranger of Thurber.

Overall supervision of the field program was conducted by Mr. Mark Farrant, P.Eng. Interpretation of the data and preparation of the report were carried out by Ms. A. Piascik, P.Eng.

The report was reviewed by Mr. Murray R. Anderson, P.Eng. and Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

### Thurber Engineering Ltd

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**Appendix A**

**Record of Borehole Sheets**

# SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

## 1. TEXTURAL CLASSIFICATION OF SOILS

CLASSIFICATION	PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	Greater than 200mm	same
Cobbles	75 to 200mm	same
Gravel	4.75 to 75mm	5 to 75mm
Sand	0.075 to 4.75mm	Not visible particles to 5mm
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to the naked eye
Clay	Less than 0.002mm	Plastic particles, not visible to the naked eye

## 2. COARSE GRAIN SOIL DESCRIPTION (50% greater than 0.075mm)

TERMINOLOGY	PROPORTION
Trace or Occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

## 3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)	APPROXIMATE SPT <sup>(1)</sup> 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction

- 1) Laboratory Triaxial Testing
- 2) Field Insitu Vane Testing
- 3) Laboratory Vane Testing
- 4) SPT value
- 5) Pocket Penetrometer

## 4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	SPT "N" VALUE
Very Loose	Less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

## 5. LEGEND FOR RECORDS OF BOREHOLES

SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE	SS Split Spoon Sample	WS Wash Sample	AS Auger (Grab) Sample
	TW Thin Wall Shelby Tube Sample	TP Thin Wall Piston Sample	
	PH Sampler Advanced by Hydraulic Pressure	PM Sampler Advanced by Manual Pressure	
	WH Sampler Advanced by Self Static Weight	RC Rock Core	SC Soil Core

$$\text{Sensitivity} = \frac{\text{Undisturbed Shear Strength}}{\text{Remoulded Shear Strength}}$$

 Water Level  
 $C_{pen}$  Shear Strength Determination by Pocket Penetrometer

- (1) SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.
- (2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

UNIFIED SOILS CLASSIFICATION

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS $W_L < 50\%$	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. ( $W_L < 30\%$ ).
		CI	Inorganic clays of medium plasticity, silty clays. ( $30\% < W_L < 50\%$ ).
		OL	Organic silts and organic silty-clays of low plasticity.
	SILTS AND CLAYS $W_L > 50\%$	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS	Pt	Peat and other highly organic soils.	
CLAY SHALE			
SANDSTONE			
SILTSTONE			
CLAYSTONE			
COAL			

## EXPLANATION OF ROCK LOGGING TERMS

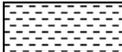
### ROCK WEATHERING CLASSIFICATION

<b>Fresh (FR)</b>	No visible signs of weathering.
<b>Fresh Jointed (FJ)</b>	Weathering limited to the surface of major discontinuities.
<b>Slightly Weathered (SW)</b>	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock material.
<b>Moderately Weathered (MW)</b>	Weathering extends throughout the rock mass, but the rock material is not friable.
<b>Highly Weathered (HW)</b>	Weathering extends throughout the rock mass and the rock is partly friable.
<b>Completely Weathered (CW)</b>	Rock is wholly decomposed and in a friable condition, but the rock texture and structure are preserved.

### DISCONTINUITY SPACING

<b>Bedding</b>	<b>Bedding Plane Spacing</b>
Very thickly bedded	Greater than 2m
Thickly bedded	0.6 to 2m
Medium bedded	0.2 to 0.6m
Thinly bedded	60mm to 0.2m
Very thinly bedded	20 to 60mm
Laminated	6 to 20mm
Thinly Laminated	Less than 6mm

### SYMBOLS

	CLAYSTONE
	SILTSTONE
	SANDSTONE
	COAL
	BEDROCK

### STRENGTH CLASSIFICATION

<b>Rock Strength</b>	<b>Approximate Uniaxial Compressive Strength</b>		<b>Field Estimation of Hardness*</b>
	<b>(MPa)</b>	<b>(psi)</b>	
Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail

### TERMS

Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length
Solid Core Recovery:(SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run
Rock Quality Designation:(RQD)	Total length of sound core recovered in pieces 0.1m in length or larger as a % of total core run length.
Uniaxial Compressive Strength (UCS)	Axial stress required to break the specimen
Fracture Index:(FI)	Frequency of natural fractures per 0.3m of core run.

### RECORD OF BOREHOLE No 14-01

1 OF 3

METRIC

WP# 6527-14-00 LOCATION McConnel Creek Culvert N 5 494 648.5 E 363 812.5 ORIGINATED BY SLL  
 HWY 527 BOREHOLE TYPE Tripod/Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2014.08.22 - 2014.08.22 CHECKED BY MEF

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 kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							
277.2	GROUND SURFACE														
0.0	TOPSOIL, with roots and rootlets														
0.1	SAND and SILT, trace clay, with roots and rootlets Compact Brown Moist		1	SS	12									0 52 43 5	
275.7			2	SS	13										
1.5	Sandy SILT Loose Brown Moist		3	SS	9										
275.0			4	SS	4									0 52 43 5	
2.2	SAND and SILT, trace gravel Loose Brown Moist to Wet		5	SS	2										
			6	SS	3										
	Grey		7	SS	4										
	Some gravel at 6.7m		8	SS	9									3 76 18 3	
269.9	SAND, some silt, trace clay, trace gravel Loose to Compact Grey Saturated		9	SS	14										
267.4	End of sampling and start DCPT														

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+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15 10 5 0  
 (%) STRAIN AT FAILURE

### RECORD OF BOREHOLE No 14-01

2 OF 3

**METRIC**

WP# 6527-14-00 LOCATION McConnel Creek Culvert N 5 494 648.5 E 363 812.5 ORIGINATED BY SLL  
 HWY 527 BOREHOLE TYPE Tripod/Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2014.08.22 - 2014.08.22 CHECKED BY MEF

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 $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	20 40 60 80 100			20 40 60	20 40 60						
	Continued From Previous Page															
267																
266																
265																
264																
263																
262																
261																
260																
259																
258																

ONTMT4S 5121.GPJ 2012TEMPLATE(MTO).GDT 10/28/14

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+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15 10 5  
 (%) STRAIN AT FAILURE

**RECORD OF BOREHOLE No 14-01**

3 OF 3

**METRIC**

WP# 6527-14-00 LOCATION McConnel Creek Culvert N 5 494 648.5 E 363 812.5 ORIGINATED BY SLL  
 HWY 527 BOREHOLE TYPE Tripod/Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2014.08.22 - 2014.08.22 CHECKED BY MEF

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
257.1 20.1	Continued From Previous Page  END OF DCPT AT 20.1m. BOREHOLE CAVED TO 6.2m AND WATER LEVEL AT 3.8m ON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 0.5m, THEN CUTTINGS TO SURFACE.														

ONTMT4S 5121.GPJ 2012TEMPLATE(MTO).GDT 10/28/14

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15 10 5 0  
 (%) STRAIN AT FAILURE

### RECORD OF BOREHOLE No 14-02

1 OF 2

**METRIC**

WP# 6527-14-00 LOCATION McConnel Creek Culvert N 5 494 638.0 E 363 817.7 ORIGINATED BY SLL  
 HWY 527 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2014.08.21 - 2014.08.21 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							
						WATER CONTENT (%)							
						PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT					
						W <sub>p</sub>	W	W <sub>L</sub>					
279.0	GROUND SURFACE												
0.0	Sandy GRAVEL, trace silt and clay Brown Moist (FILL)		1	GS								59 32 9 (SI+CL)	
278.4													
0.6	SAND and GRAVEL, trace silt, occasional cobble size rockfill Compact Brown Moist (FILL)		2	SS	16								
			3	SS	20								
			4	SS	12								
			5	SS	11								
	Gravelly sand Wood and asphalt fragments Wet		6	SS	15							26 66 8 (SI+CL)	
272.1													
6.9	SAND, some silt, trace clay Loose Brown Wet												
			7	SS	6								
			8	SS	10							0 80 17 3	
269.2													
9.8	END OF BOREHOLE AT 9.8m.												

ONTMT4S 5121.GPJ 2012TEMPLATE(MTO).GDT 10/28/14

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

**RECORD OF BOREHOLE No 14-02**

2 OF 2

**METRIC**

WP# 6527-14-00 LOCATION McConnel Creek Culvert N 5 494 638.0 E 363 817.7 ORIGINATED BY SLL  
 HWY 527 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN  
 DATUM Geodetic DATE 2014.08.21 - 2014.08.21 CHECKED BY MEF

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
							20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>			
	Continued From Previous Page BOREHOLE OPEN TO 5.0m AND WATER LEVEL AT 4.9m ON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG MIXED WITH CUTTINGS TO 1.8m, THEN CUTTINGS TO SURFACE.																

ONTMT4S 5121.GPJ 2012TEMPLATE(MTO).GDT 10/28/14

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15 10 5 0  
 (%) STRAIN AT FAILURE



### RECORD OF BOREHOLE No 14-03

2 OF 4

METRIC

WP# 6527-14-00 LOCATION McConnel Creek Culvert N 5 494 634.3 E 363 825.5 ORIGINATED BY SLL  
 HWY 527 BOREHOLE TYPE Hollow Stem Augers/NW Casing/Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2014.08.20 - 2014.08.20 CHECKED BY MEF

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 kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
	Continued From Previous Page														
	SAND, trace gravel, some silt Compact Grey Wet		10	SS	13		268								
			11	SS	18		267								
			12	SS	15		266								
			13	SS	16		265							3 84 13 (SI+CL)	
			14	SS	18		264								
			15	SS	20		263								
							262								
							261								
							260							5 84 11 (SI+CL)	
							259								

ONTMT4S 5121.GPJ 2012TEMPLATE(MTO).GDT 10/28/14

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

### RECORD OF BOREHOLE No 14-03

3 OF 4

METRIC

WP# 6527-14-00 LOCATION McConnel Creek Culvert N 5 494 634.3 E 363 825.5 ORIGINATED BY SLL  
 HWY 527 BOREHOLE TYPE Hollow Stem Augers/NW Casing/Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2014.08.20 - 2014.08.20 CHECKED BY MEF

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 kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60					
	Continued From Previous Page														
257.7	<b>SAND</b> , trace gravel, some silt Compact Grey Wet		16	SS	19										
21.3	<b>SILT</b> , some sand to sandy, trace clay Compact Grey Wet														
			17	SS	26									0 24 71 5	
	Trace sand														
			18	SS	17										
249.4	Clayey silt seam 50mm thick at 29.4m depth		19	SS	20									0 2 81 17	
29.6	End of sampling and start DCPT														

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15 10 5  
 (%) STRAIN AT FAILURE

ONTMT4S\_5121.GPJ 2012TEMPLATE(MTO).GDT 10/28/14

### RECORD OF BOREHOLE No 14-03

4 OF 4

**METRIC**

WP# 6527-14-00 LOCATION McConnel Creek Culvert N 5 494 634.3 E 363 825.5 ORIGINATED BY SLL  
 HWY 527 BOREHOLE TYPE Hollow Stem Augers/NW Casing/Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2014.08.20 - 2014.08.20 CHECKED BY MEF

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 kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
242.1	Continued From Previous Page														
36.9	END OF DCPT AT 36.9m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.  WATER LEVEL READINGS: DATE    DEPTH (m)    ELEV. (m) Aug 21/14    5.1            273.9 Aug 22/14    5.3            273.7 Aug 23/14    5.2            273.8														

ONTMT4S 5121.GPJ 2012TEMPLATE(MTO).GDT 10/28/14



### RECORD OF BOREHOLE No 14-04

2 OF 4

METRIC

WP# 6527-14-00 LOCATION McConnel Creek Culvert N 5 494 628.9 E 363 813.4 ORIGINATED BY SLL  
 HWY 527 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY AN  
 DATUM Geodetic DATE 2014.08.19 - 2014.08.19 CHECKED BY MEF

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 $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
	Continued From Previous Page													
	<b>SAND</b> , trace to some silt, trace clay Loose to Compact Grey Wet													
		9	SS	6		268							0 85 12 3	
						267								
		10	SS	18		266								
						265								
		11	SS	27		264								
						263								
		12	SS	13		262							0 90 10 (SI+CL)	
						261								
		13	SS	18		260								
						259								
		14	SS	21										

ONTMT4S 5121.GPJ 2012TEMPLATE(MTO).GDT 10/28/14

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity 20  
15 10 5 (%) STRAIN AT FAILURE



**RECORD OF BOREHOLE No 14-04**

4 OF 4

**METRIC**

WP# 6527-14-00 LOCATION McConnell Creek Culvert N 5 494 628.9 E 363 813.4 ORIGINATED BY SLL  
 HWY 527 BOREHOLE TYPE Hollow Stem Augers/NW Casing COMPILED BY AN  
 DATUM Geodetic DATE 2014.08.19 - 2014.08.19 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
	Continued From Previous Page						20 40 60 80 100							
							20 40 60 80 100							
248	SILT, some sand, with clayey silt seams (varved like) Firm Grey Moist													
247			19	SS	6									
246														
245	Sandy, some clay Compact													
244			20	SS	21								0 25 63 12	
243														
242.4	END OF BOREHOLE AT 36.6m. BOREHOLE CAVED TO 7.2m AND WATER LEVEL AT 3.8m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG MIXED WITH CUTTINGS TO SURFACE.													
36.6														

ONTMT4S 5121.GPJ 2012TEMPLATE(MTO).GDT 10/28/14



### RECORD OF BOREHOLE No 14-05

2 OF 4

METRIC

WP# 6527-14-00 LOCATION McConnel Creek Culvert N 5 494 625.5 E 363 821.2 ORIGINATED BY SL  
 HWY 527 BOREHOLE TYPE Hollow Stem Augers/NW Casing/Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2014.08.21 - 2014.08.21 CHECKED BY MEF

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 kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							
268.8	Continued From Previous Page														
10.2	<b>SAND</b> and <b>SILT</b> , trace clay Compact Brown Wet  Sand layer (500mm) at 11.2m		10	SS	19		268								
							267								
			11	SS	25		266							0 58 38 4	
265.7							265								
13.3	<b>SAND</b> , some silt, trace clay and gravel Compact Grey Wet		12	SS	15		264								
							263								
			13	SS	15		262							2 84 14 (SI+CL)	
							261								
			14	SS	14		260								
							259								
			15	SS	15										

ONTMT4S 5121.GPJ 2012TEMPLATE(MTO).GDT 10/28/14

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

### RECORD OF BOREHOLE No 14-05

3 OF 4

**METRIC**

WP# 6527-14-00 LOCATION McConnel Creek Culvert N 5 494 625.5 E 363 821.2 ORIGINATED BY SLL  
 HWY 527 BOREHOLE TYPE Hollow Stem Augers/NW Casing/Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2014.08.21 - 2014.08.21 CHECKED BY MEF

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 $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)						
	Continued From Previous Page		16	SS	18										
257.7	<b>SAND</b> , some silt, trace clay Compact Grey Saturated						258								
21.3	<b>SILT</b> , some sand, trace clay Compact Brown Wet						257								
	Grey		17	SS	22		256							0 20 74 6	
	Clayey silt seam (50mm) at 24.4m						255								
	Trace sand						254								
	Clayey silt seam (50mm) at 25.9m		18	SS	6		253								
							252								
							251								
							250								
249.4			19	SS	22									0 3 90 7	
29.6	End of sampling and start DCPT						240								

ONTMT4S 5121.GPJ 2012TEMPLATE(MTO).GDT 10/28/14

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity 20  
15 5 10 (%) STRAIN AT FAILURE

**RECORD OF BOREHOLE No 14-05**

4 OF 4

**METRIC**

WP# 6527-14-00 LOCATION McConnel Creek Culvert N 5 494 625.5 E 363 821.2 ORIGINATED BY SLL  
 HWY 527 BOREHOLE TYPE Hollow Stem Augers/NW Casing/Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2014.08.21 - 2014.08.21 CHECKED BY MEF

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 kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE			WATER CONTENT (%) 20 40 60							
	Continued From Previous Page															
241.8 37.2	END OF DCPT AT 37.2m. BOREHOLE CAVED TO 10.2m AND WATER LEVEL AT 5.4m ON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG MIXED WITH CUTTINGS TO 1.5m, THEN CUTTINGS TO SURFACE.															

ONTMT4S 5121.GPJ 2012TEMPLATE(MTO).GDT 10/28/14

### RECORD OF BOREHOLE No 14-06

1 OF 3

METRIC

WP# 6527-14-00 LOCATION McConnel Creek Culvert N 5 494 613.8 E 363 822.9 ORIGINATED BY SLL  
 HWY 527 BOREHOLE TYPE NW Casing/Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2014.08.23 - 2014.08.23 CHECKED BY MEF

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 kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							
276.6	GROUND SURFACE														
0.0	TOPSOIL, with roots and rootlets														
0.1	SAND, some silt to silty, trace clay, trace roots and rootlets Loose to Very Loose Brown Moist		1	SS	4									0 73 24 3	
			2	SS	9										
							275								
	Grey		3	SS	3										
			4	SS	6		274							0 84 13 3	
			5	SS	5		273								
							272								
			6	SS	7		271								
							270							0 80 18 2	
	Compact		7	SS	17		269								
			8	SS	13		268								
							267							0 96 4 (SI+CL)	
266.8	Trace silt		9	SS	16										
9.8	End of sampling and start DCPT														

ONTMT4S 5121.GPJ 2012TEMPLATE(MTO).GDT 10/28/14

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 (%) STRAIN AT FAILURE

### RECORD OF BOREHOLE No 14-06

2 OF 3

**METRIC**

WP# 6527-14-00 LOCATION McConnel Creek Culvert N 5 494 613.8 E 363 822.9 ORIGINATED BY SLL  
 HWY 527 BOREHOLE TYPE NW Casing/Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2014.08.23 - 2014.08.23 CHECKED BY MEF

SOIL PROFILE			SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	20 40 60 80 100			20 40 60	W <sub>p</sub> W W <sub>L</sub>						
	Continued From Previous Page															
266																
265																
264																
263																
262																
261																
260																
259																
258																
257																

ONTMT4S 5121.GPJ 2012TEMPLATE(MTO).GDT 10/28/14

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity 20  
15  
10 (%) STRAIN AT FAILURE

**RECORD OF BOREHOLE No 14-06**

3 OF 3

**METRIC**

WP# 6527-14-00 LOCATION McConnel Creek Culvert N 5 494 613.8 E 363 822.9 ORIGINATED BY SLL  
 HWY 527 BOREHOLE TYPE NW Casing/Dynamic Cone Penetration Test COMPILED BY AN  
 DATUM Geodetic DATE 2014.08.23 - 2014.08.23 CHECKED BY MEF

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
	Continued From Previous Page							20 40 60 80 100							
256.3 20.3	END OF DCPT AT 20.3m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG MIXED WITH CUTTINGS TO 0.5m, THEN CUTTINGS TO SURFACE.														

ONTMT4S 5121.GPJ 2012TEMPLATE(MTO).GDT 10/28/14

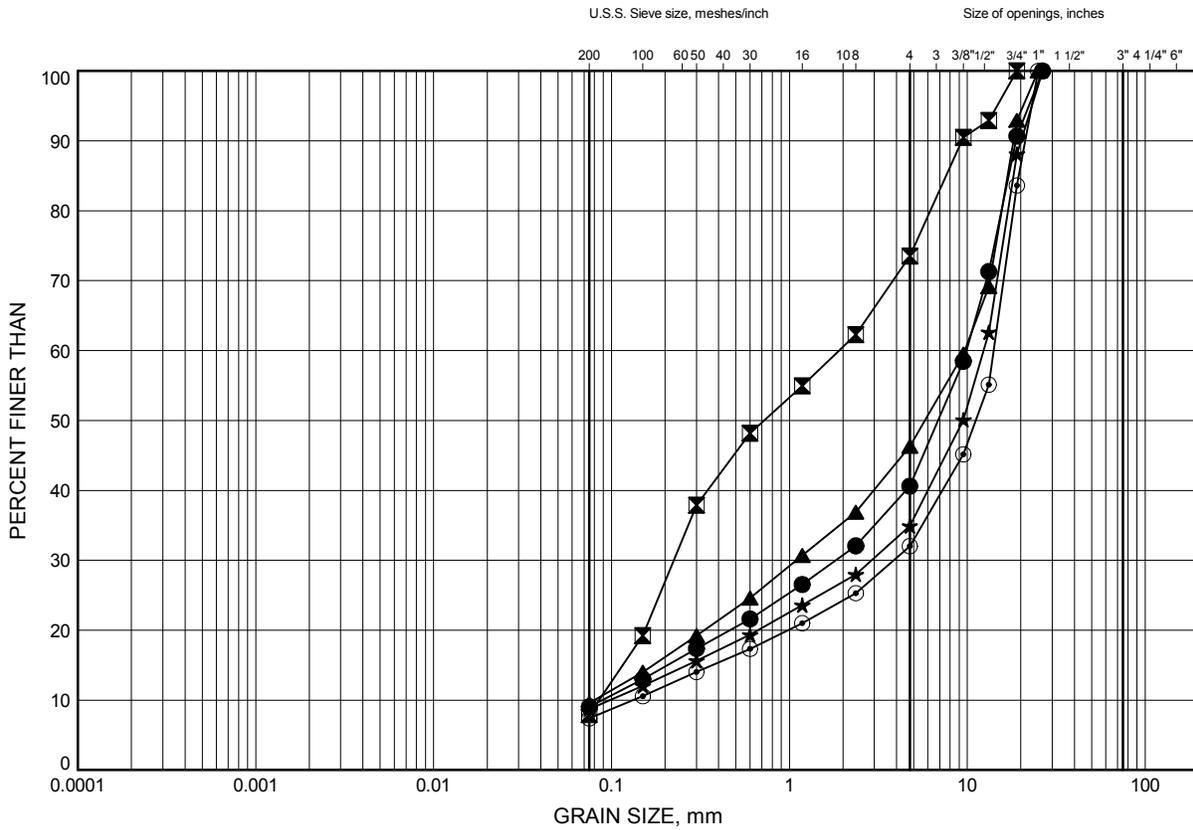
**Appendix B**

**Laboratory Test Results**

McConnel Creek Culvert  
**GRAIN SIZE DISTRIBUTION**

FIGURE B1

**SAND TO SANDY GRAVEL FILL**



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	14-02	0.15	278.84
☒	14-02	6.40	272.60
▲	14-03	0.15	278.84
★	14-04	0.15	278.84
⊙	14-05	0.15	278.84

GRAIN SIZE DISTRIBUTION - THURBER 5121.GPJ 10/28/14

Date .. October 2014 ..  
 WP# .. 6527-14-00 ..

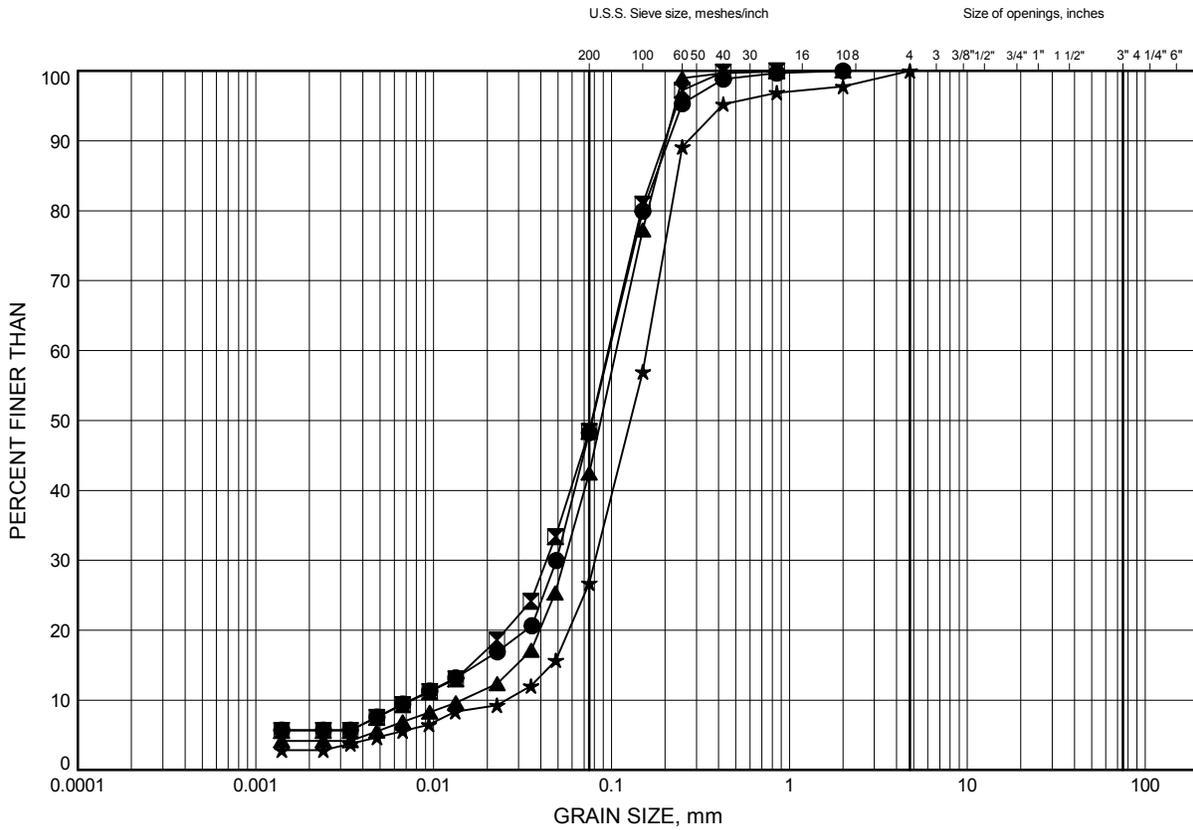


Prep'd .. AN ..  
 Chkd. .. AMP ..

McConnel Creek Culvert  
**GRAIN SIZE DISTRIBUTION**

FIGURE B2

**SAND & SILT TO SILTY SAND**



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	14-01	1.07	276.13
⊠	14-01	2.59	274.61
▲	14-05	12.50	266.50
★	14-06	0.38	276.22

GRAIN SIZE DISTRIBUTION - THURBER 5121.GPJ 10/29/14

Date .. October 2014 ..  
 WP# .. 6527-14-00 ..

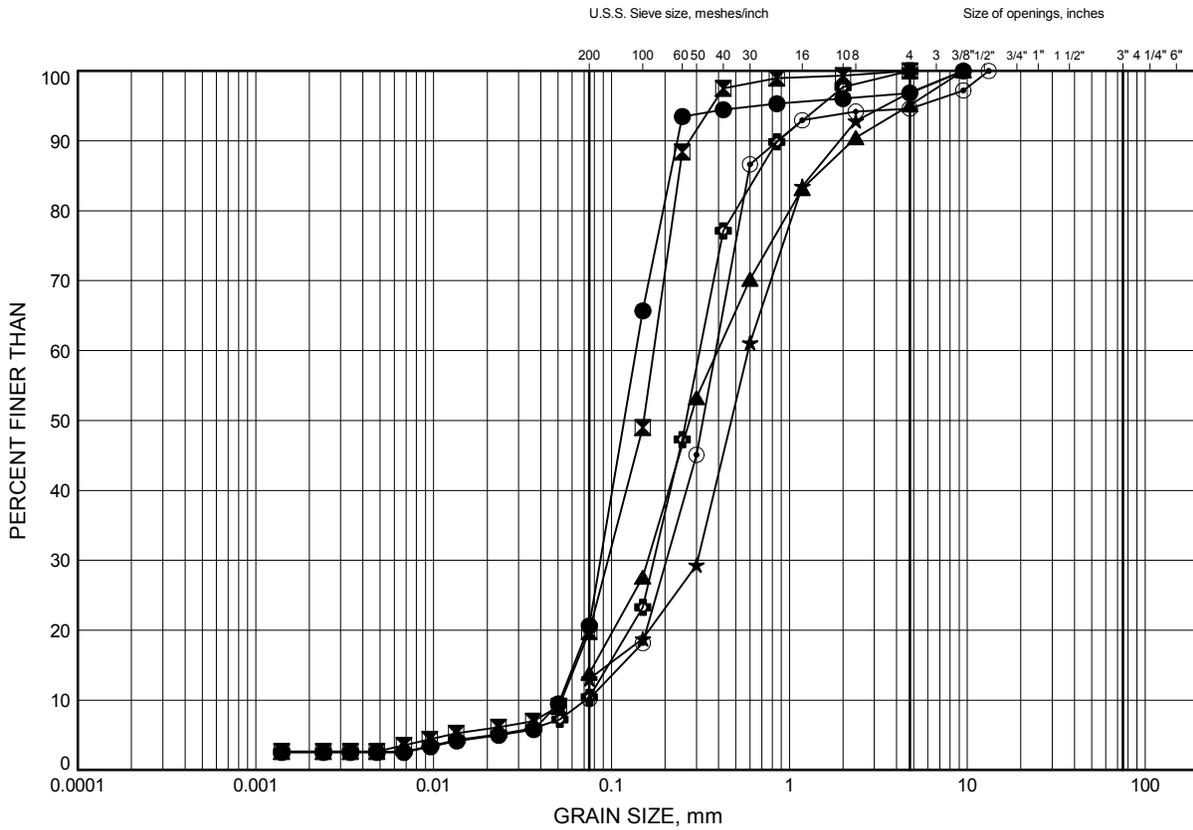


Prep'd .. AN ..  
 Chkd. .. AMP ..

McConnel Creek Culvert  
**GRAIN SIZE DISTRIBUTION**

FIGURE B3

**SAND**



**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	14-01	7.92	269.27
⊠	14-02	9.45	269.55
▲	14-03	9.45	269.55
★	14-03	14.02	264.98
⊙	14-03	18.59	260.40
⊕	14-04	6.40	272.60

Date .. October 2014 ..  
 WP# .. 6527-14-00 ..

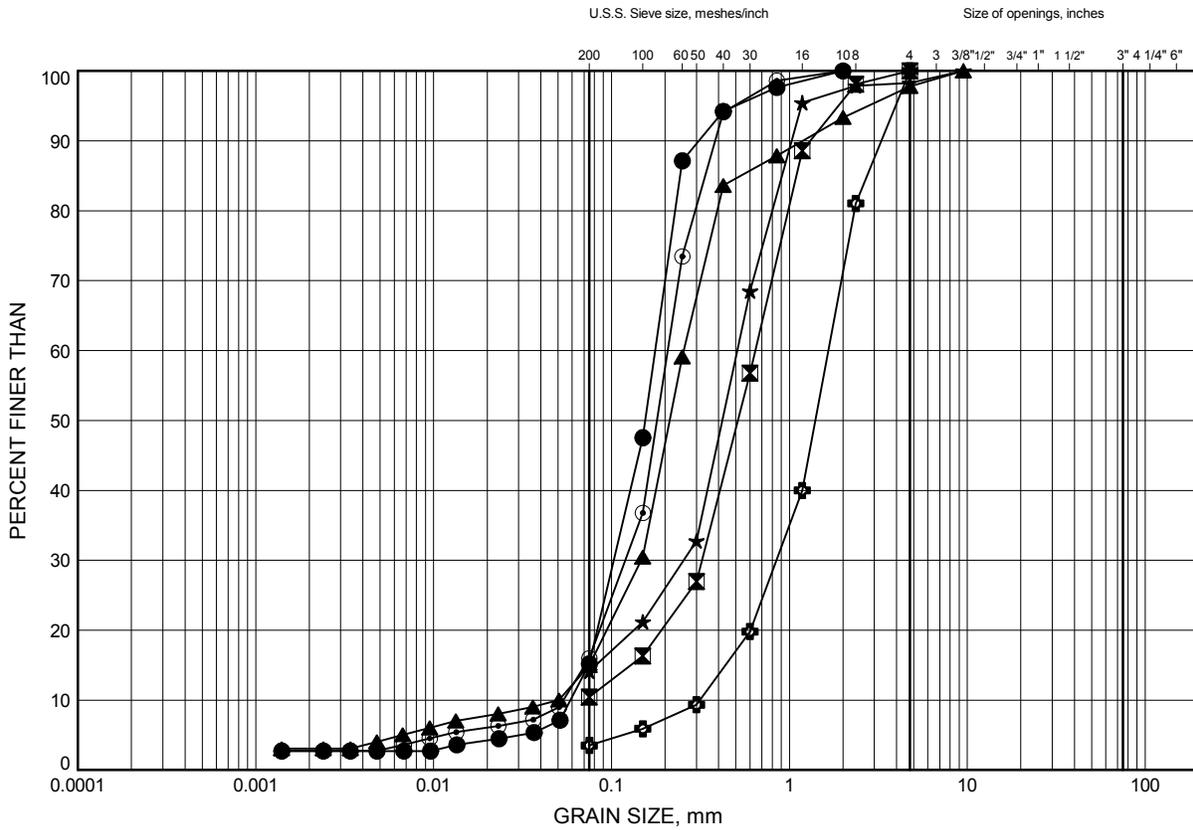


Prep'd .. AN ..  
 Chkd. .. AMP ..

McConnel Creek Culvert  
**GRAIN SIZE DISTRIBUTION**

FIGURE B4

**SAND**



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	14-04	10.97	268.02
⊠	14-04	15.54	263.45
▲	14-05	7.92	271.07
★	14-05	17.07	261.93
⊙	14-06	2.59	274.01
⊕	14-06	9.42	267.17

Date .. October 2014 ..  
 WP# .. 6527-14-00 ..

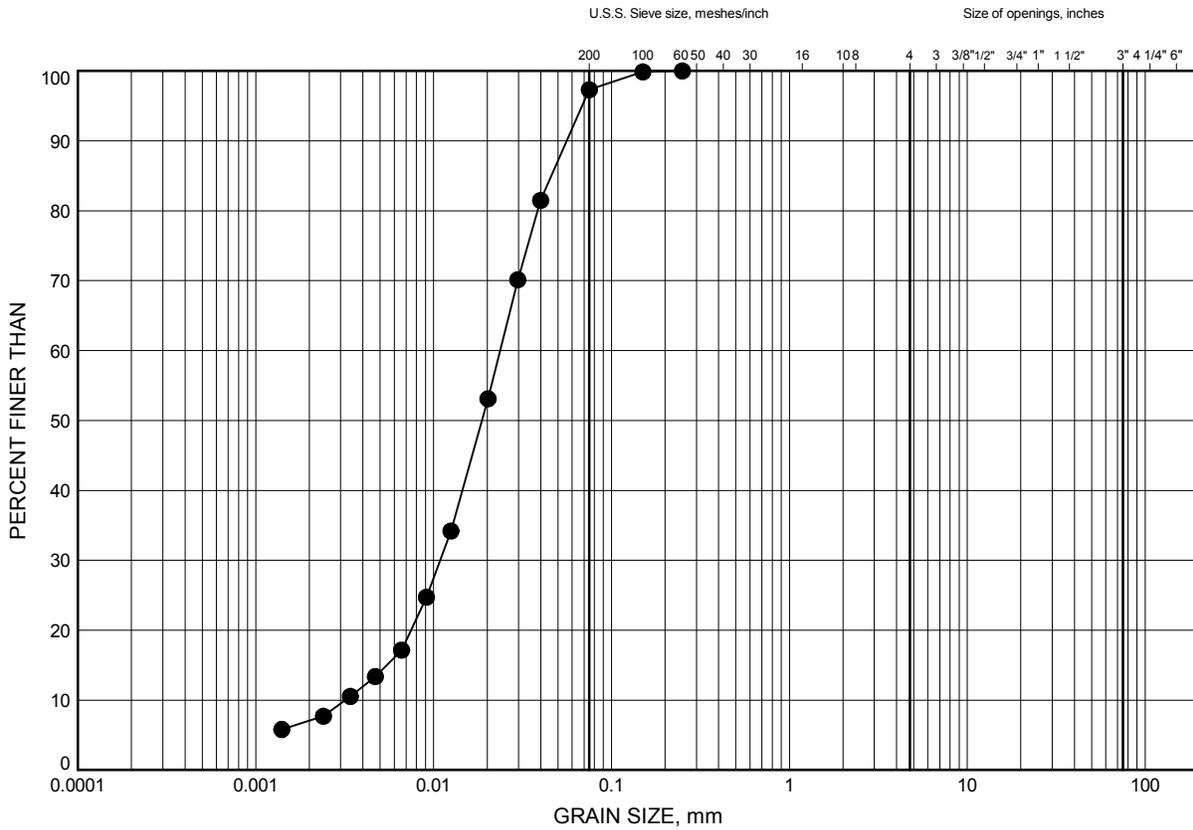


Prep'd .. AN ..  
 Chkd. .. AMP ..

McConnel Creek Culvert  
**GRAIN SIZE DISTRIBUTION**

FIGURE B5

**SILT**



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	14-05	29.26	249.74

Date .. October 2014 ..  
 WP# .. 6527-14-00 ..

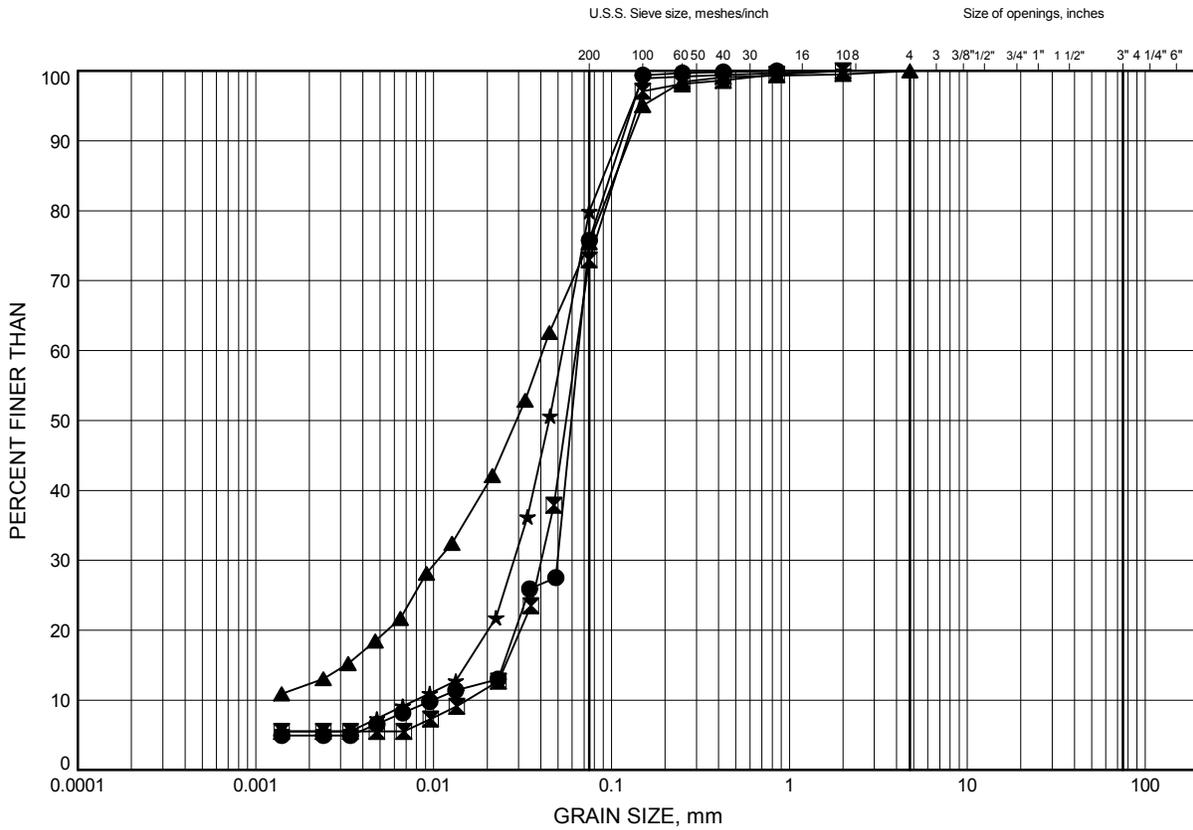


Prep'd .. AN ..  
 Chkd. .. AMP ..

McConnel Creek Culvert  
**GRAIN SIZE DISTRIBUTION**

FIGURE B6

**SANDY SILT**



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

**LEGEND**

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	14-03	23.16	255.83
⊠	14-04	23.16	255.83
▲	14-04	35.36	243.64
★	14-05	23.16	255.83

GRAIN SIZE DISTRIBUTION - THURBER 5121.GPJ 10/28/14

Date .. October 2014 ..  
 WP# .. 6527-14-00 ..



Prep'd .. AN ..  
 Chkd. .. AMP ..



## **Appendix C**

### **Site Photographs**



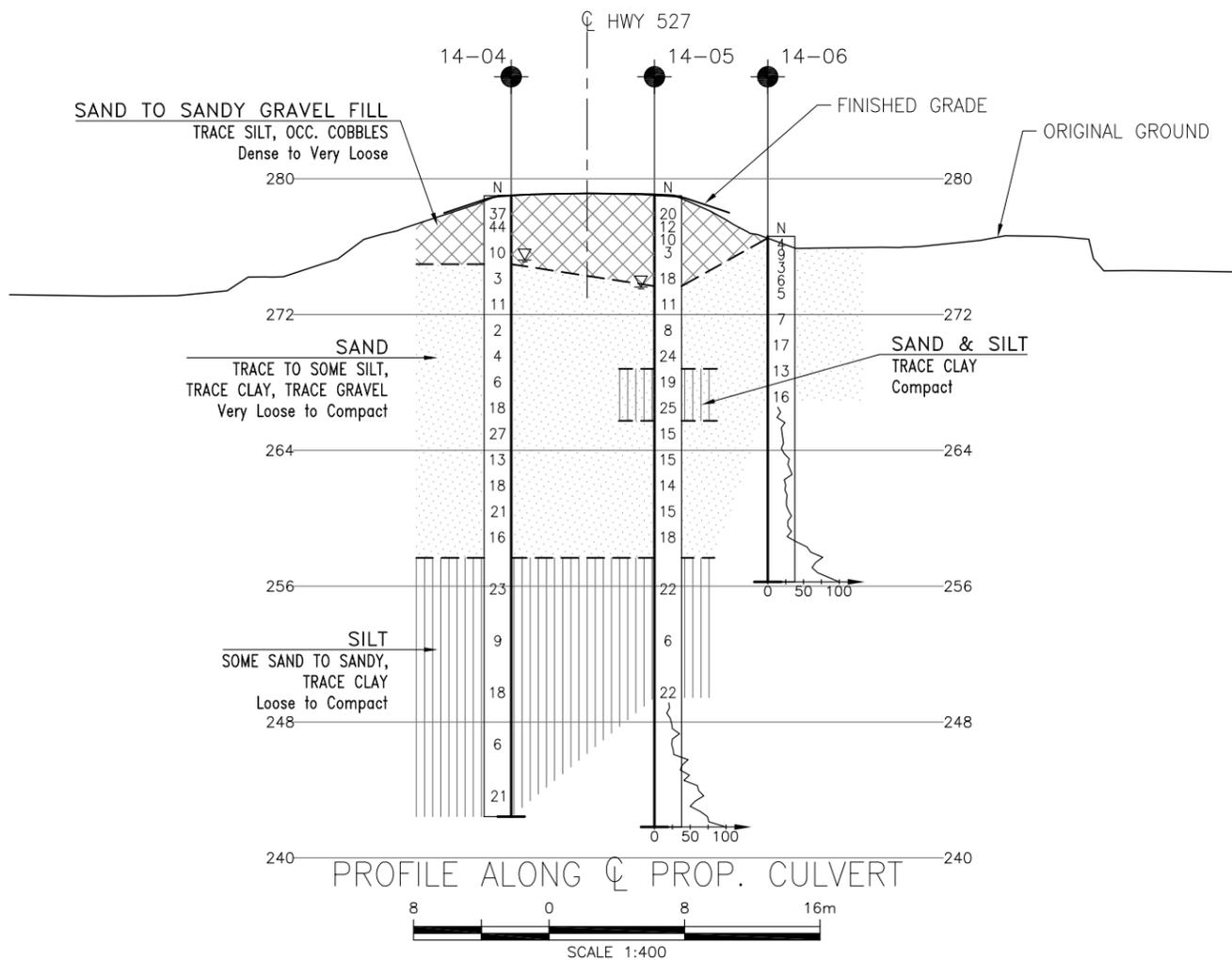
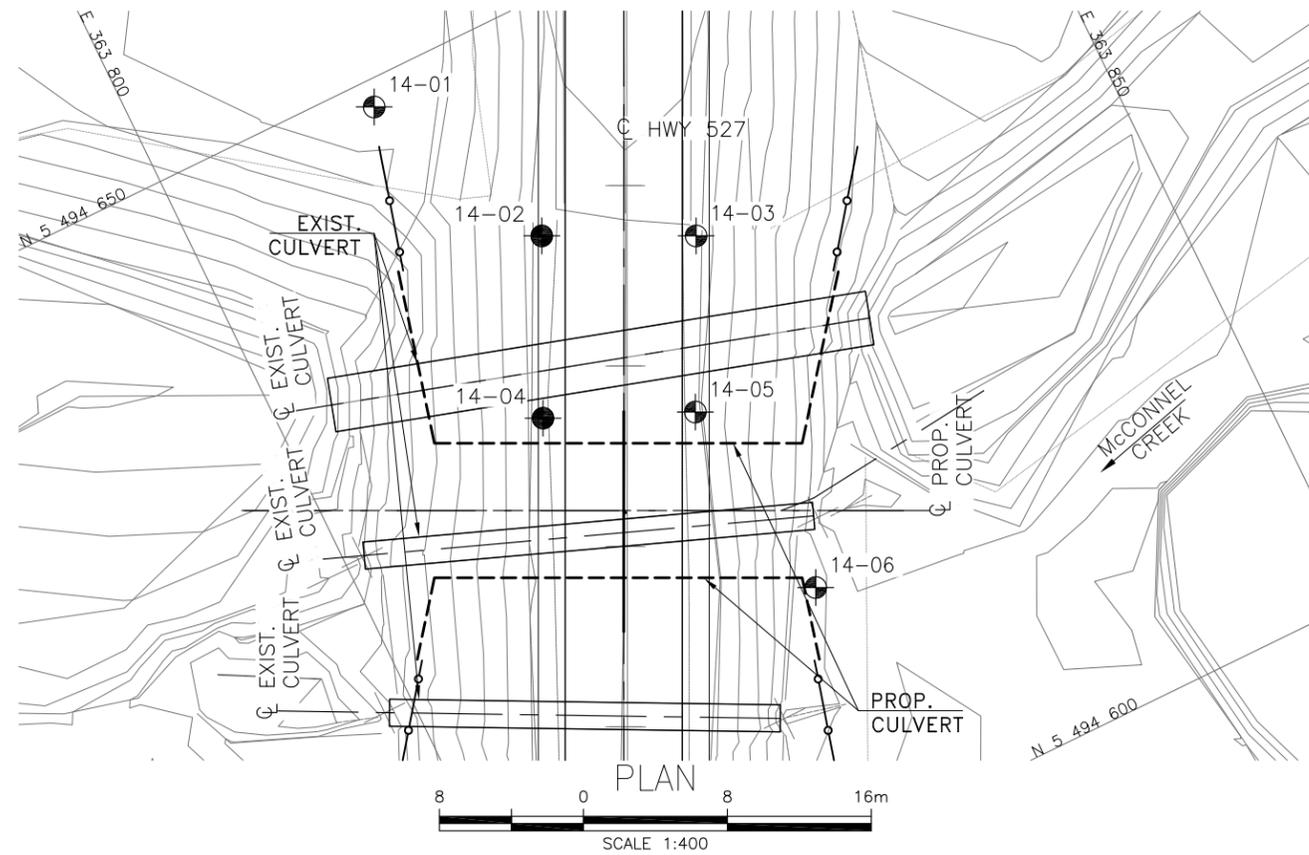
**Photograph 1 – McConnell Creek Culvert – looking east at culvert inlet**



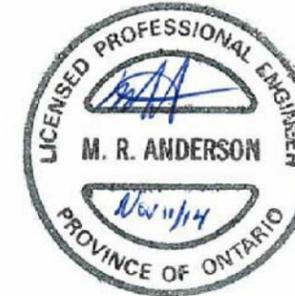
**Photograph 2 – McConnell Creek Culvert – looking west at culvert outlet**

**Appendix D**

**Borehole Locations and Soil Strata Drawing**



METRIC  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

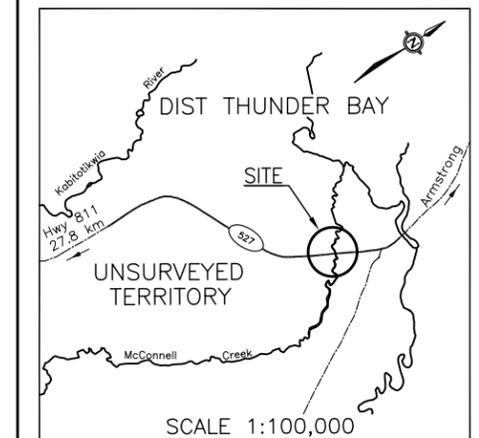


CONT No  
WP No 6527-14-00



HIGHWAY 527  
McCONNELL CREEK CULVERT  
STRUCTURAL REPLACEMENT  
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET



KEYPLAN

LEGEND

●	Borehole
⊕	Borehole and Cone
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
∇	Water Level
⊥	Head Artesian Water
⊥	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
14-01	277.2	5 494 648.5	363 812.5
14-02	279.0	5 494 638.0	363 817.7
14-03	279.0	5 494 634.3	363 825.5
14-04	279.0	5 494 628.9	363 813.4
14-05	279.0	5 494 625.5	363 821.2
14-06	276.6	5 494 613.8	363 822.9

-NOTES-

- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOGRES No. 52H-24

REVISIONS	DATE	BY	DESCRIPTION

DESIGN	MEF	CHK	MEF	CODE	LOAD	DATE	NOV 2014
DRAWN	AN	CHK		SITE 48C-356/6/STRUCT	DWG	1	