

**FOUNDATION INVESTIGATION REPORT  
NISBET CREEK CULVERT REPLACEMENT  
HIGHWAY 522 (MTO SITE 41H-61)  
AGREEMENT NO.: 5005-E-0062  
ASSIGNMENT NO. 2**

**September 1, 2006  
TG06131**

**Prepared For:  
Ministry of Transportation  
447 McKeown Avenue  
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**FOUNDATION INVESTIGATION AND DESIGN REPORT  
NISBET CREEK CULVERT REPLACEMENT  
HIGHWAY 522 (MTO SITE 41H-61)**

**PART 1: FACTUAL INFORMATION**

**1.0 INTRODUCTION**

DST Consulting Engineers Inc. (DST) has been retained by the Ministry of Transportation, Geotechnical Section, Northeastern Region to conduct a foundation investigation for the proposed culvert replacement at Nisbet Creek on Highway 522. This work was carried out under Agreement No. 5005-E-0062 - Geotechnical Retainer - West, Assignment No. 2.

This report addresses the field investigation, laboratory test program factual report on conditions (Part 1) and recommendations for the design and construction for the proposed culvert replacement (Part 2).

**2.0 SITE DESCRIPTION**

The Nisbet Creek culvert is located on Highway 522 approximately 1.5 km east of the junction of Highways 522 and 69, Mowat Township, Concession 14, Lot 32.

The existing Nisbet Creek culvert is a 3.0 m diameter structural plate culvert that is in poor condition due to corrosion. A vertical concrete cut-off wall is visible at the inlet. In March 2006, the road surface started to develop depression due to losses of soils. The culvert is to be replaced with a precast concrete box culvert 3.5 m in width by 2.0 m high placed at the same elevation and alignment.

The embankment height at the culvert is in the order of 7 m. The side slopes from the edge of shoulder to the top of culvert are approximately 2.5 to 3 horizontal to 1 vertical. The side slopes are covered with large boulders. There is an existing cut-off wall located at the culvert inlet. There is exposed bedrock on the north side of Highway 522 on the east side of Nisbet Creek about 20 m from

the culvert. The surrounding local area is heavily treed.

A wooden snowmobile bridge founded on timber cribs is located on the south side of Highway 522 over Nisbet Creek within 10 m of the culvert outlet.

Pictures of the inlet and outlet areas of the culvert and snowmobile bridge are shown below. The photos were taken May 23, 2006.



Looking North at Snowmobile Bridge and Culvert Outlet



Looking Southeast at Culvert Inlet



Looking West at Culvert Inlet

### **3.0 INVESTIGATION PROCEDURES AND LABORATORY TESTING**

Site work was carried out between June 14 to June 20, 2006 utilizing a CME 750 drill rig mounted on an all terrain chassis with large floatation tires, equipped for geotechnical drilling and operated by DST. Eight boreholes were put down to depths ranging between 2.7 and 11.3 m.

Borehole locations and a stratigraphic profile and section are shown on the Borehole Location Plan, Drawing No. 1. Boreholes 1 and 2 are located at pavement edge of the roadway adjacent the existing culvert. Boreholes 3 to 6 were put down through the roadway bed. Boreholes 7 and 8 are in the area of the inlet and outlet of the culvert. Due to accessibility to the sloping terrain at the culvert inlet, Borehole 7 could not be advanced at the inlet without disturbing the creek bed and was located at the top of the slope at Station 11+495 Lt 15 m which is approximately 16 m west of the inlet.

Note that Boreholes 3, 4 and 5 were advanced for supplementary information. Soil descriptions are estimated on auger cuttings only, and as such may vary significantly from actual conditions.

Boreholes 1, 2, 7 and 8 were advanced with hollow stem augers to auger refusal. At Boreholes 1 and 8, the bedrock was confirmed by diamond drilling techniques utilizing a NQ core barrel. The refusal material at Boreholes 2 and 7 was not confirmed and could be bedrock or boulders.

The remaining boreholes were advanced with solid stem augers to a depth of 10 m or auger refusal. Auger refusal occurred at Boreholes 3 and 5 at depths of 2.7 m and 7.3 m respectively. No wells were installed. Boreholes were backfilled with the auger cuttings.

The borehole locations are related to MTO Station numbering system. The ground surface elevations at the borehole locations were surveyed by DST personnel and referenced to a mark on the bedrock

outcrop to the north of Highway 522 (Station 11+514.9 Lt 40.5 m). The elevation of the benchmark was taken as 182.280 m, as indicated on MTO's Horizontal and Vertical Control Drawing, Plate No. 748-522/29-0.

The fieldwork was supervised on a full-time basis by DST personnel who located the boreholes in the field, supervised the drilling, sampling and in-situ testing, and logged the boreholes. The soil samples were identified in the field, placed in labelled containers and transported to DST's laboratory in Thunder Bay for further analysis. It should be noted that no soil samples were retained from boreholes 3, 4, or 5. Soil descriptions for these samples were determined in the field during drilling.

Classification and index tests were subsequently performed in the laboratory on samples collected from the boreholes to aid in the selection of engineering properties. Laboratory tests included natural moisture contents, gradation analyses and plastic and liquid limits. Laboratory test results are presented on the Boreholes Logs and Enclosures 9 to 10.

## **4.0 DESCRIPTION OF SUBSURFACE CONDITIONS**

### **4.1 Stratigraphy Overview**

The generalized stratigraphy near the inlet, based on Borehole 7, consists of topsoil overlying sand that in turn is underlain with clay. Auger refusal occurred at Elevation 176.2 m, 7.9 m from existing grade. Note that Borehole 7 is located approximately 16 m west of the inlet and may not be truly representative of the soils below the culvert at the inlet. Therefore, subsurface conditions at the inlet location are unknown for design and construction. Foundation design for the new culvert inlet must be based on interpolation of subsurface conditions. As noted in Appendix A, Limitations of Report, contractors bidding on this project or undertaking the construction must make their own interpretation of the factual information presented and draw their own conclusion as to how the subsurface conditions may affect their work.

The generalized stratigraphy at the outlet based on Borehole 8 consists of topsoil overlying sand fill that in turn is underlain with clay. Beneath the clay a sand stratum occurs, overlying the bedrock at Elevation 179.9 m, 4.0 m below ground surface.

The highway embankment at the culvert locations (Boreholes 1 and 2) generally consists of a sand fill over sand down to bedrock. Bedrock was proven at Borehole 1 at an elevation of 179.1 m, 8.3 m below roadway surface. Auger refusal occurred in Borehole 2 at an elevation of 178.9, 8.4 m below roadway surface. The sand below the culvert is most likely a fill, placed during the installation of the existing culvert.

West of the culvert (Boreholes 3, 4 and 6), below the pavement structure, the sand is underlain with clay. At Borehole 3 auger refusal occurred at elevation 184.5 m, 2.7 m below existing grade. Boreholes 4 and 6 were advanced to a depth of 10.0 m below existing grade.

To the east of the culvert (Borehole 5) sand was encountered below the pavement structures, and extends to a depth of 7.3 m (EI 180.3) where auger refusal occurred.

#### **4.2 Topsoil**

Topsoil was noted at surface at Boreholes 7 and 8 up to 300 mm in thickness.

#### **4.2 Asphalt/Sand and Gravel**

At Boreholes 1 to 6, asphalt was at surface varying in thickness from 25 mm to 50 mm. Beneath the asphalt a crushed sand and gravel base material is present varying in thickness from 110 mm to 255 mm.

#### **4.3 Sand**

A sand is present beneath the topsoil and sand and gravel road base noted above. The upper portion of this layer is most likely a fill in all embankment boreholes.

Adjacent to the culvert the fill extends to the bedrock in Borehole 1 and to 6.7 m in Borehole 2, as evident by traces of wood encountered at the base of the layer. The sand noted below 6.7 m in Borehole 2 could also be fill. At Borehole 8 the sand to a depth of 3.0 m is a fill. Cobbles were encountered within this deposit.

SPT values between 6 and 23 blows per 0.3 m were measured in the sand at Borehole 1 indicating a loose to compact condition. At Boreholes 7 and 8, the SPT values were less than 10 blows per 0.3 m indicating a very loose to loose condition. Gradation analyses conducted on samples from Boreholes 1, 2, 7 and 8 indicate a gravel content up to 6%, sand content between 82% and 88% and a fines content between 6% and 15%. Grainsize distributions for the sand are reported on the Record of Borehole sheets and are plotted in Enclosure 9. The sand has some frost susceptibility.

#### **4.4 Clay**

Clay was encountered in 4 of the 8 boreholes, Boreholes 4, 6, 7 and 8. The clay layer varies in thickness from 4.4 m to 0.7 m in Boreholes 7 and 8 respectively. At Boreholes 4 and 6 the boreholes were terminated in the clay layer. The elevation of the top of this stratum varies between 179.4 m to 180.9 m. Plastic and liquid limits completed on samples from Borehole 7 at 4.6 m and 6.1 m are shown on Enclosure 13. The clay has a liquid limit between 26 and 47 with a plasticity index between 8 and 24, indicating a low to medium plasticity. The natural water content is above the liquid limit indicating a sensitive and weak material. An in-situ field vane test (MTO vane) taken in Borehole 7 at 5.5 m indicates an undrained shear strength of 33 kPa.

#### **4.5 Bedrock**

Bedrock was proven in Boreholes 1 and 8 by diamond drilling techniques using NQ2 size core barrel. The bedrock was encountered at Elevations 179.1 m and 179.9 m in Boreholes 1 and 8 respectively. Auger refusal occurred at Elevation 176.2 m in Borehole 7 and Elevation 178.9 m in Borehole 2. This most likely represents the bedrock surface.

The rock quality designation (RQD) is an indirect measure of the number of fractures and the amount of jointing in the rock mass. The RQD is expressed as a percentage of the ratio of summed core lengths (greater than 100 mm) to the total length cored.

The RQD index is used to provide a classification for the rock quality according to the following limits.

<b>RQD %</b>	<b>ROCK QUALITY</b>
0 - 25	Very Poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

The RQD's for rock cores are indicated on the Record of Borehole sheets, Enclosures 1 and 8 for each core run. The RQD varied between 43% and 100% indicating the bedrock quality ranges from poor to excellent.

#### **4.6 Groundwater**

Upon completion of drilling, the following water depths were observed in the boreholes.

<b>Borehole No</b>	<b>Depth Below Grade (m)</b>	<b>Elevation (m)</b>
1	Dry	N/A
2	6.1	181.2
3	Dry	N/A
4	6.1	180.8
5	7.0	180.6
6	6.0	180.6
7	3.8	180.3
8	2.3	181.6

These levels, observed before backfilling and also documented on Borehole Logs and Drawing 1, are not intended to represent information with respect to the water table or groundwater flow. The creek level at the time of investigation was at 180.6 m at the culvert inlet.

## **5.0 LIMITATIONS OF REPORT**

A description of limitations which are inherent in carrying out site investigation studies is given in Appendix 'A', and this forms an integral part of this report.

For DST CONSULTING ENGINEERS INC.

Prepared by:

Reviewed by:

R.F. Crowley, P. Eng.  
Sr. Project Engineer

Mike Fabius, P. Eng.  
Principal

RFC:dm

**APPENDIX 'A'**  
**LIMITATIONS OF REPORT**

# **LIMITATIONS OF REPORT**

## **GEOTECHNICAL STUDIES**

The data, conclusions and recommendations which are presented in this report, and the quality thereof, are based on a scope of work authorized by the Client. Note that no scope of work, no matter how exhaustive, can identify all conditions below ground. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the specific locations tested, and conditions may become apparent during construction which were not detected and could not be anticipated at the time of the site investigation. Conditions can also change with time. It is recommended practice that DST Consulting Engineers be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the testholes. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the testhole locations and should not be used for other purposes, such as grading, excavation, planning, development, etc.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.

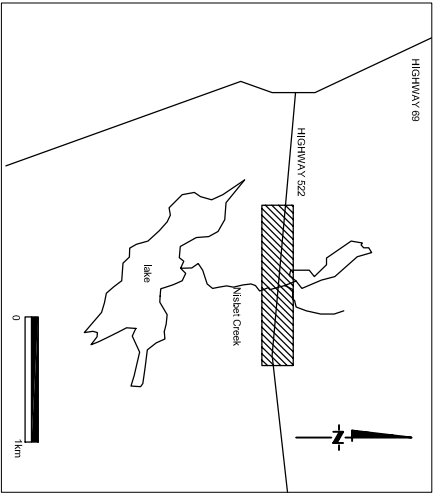
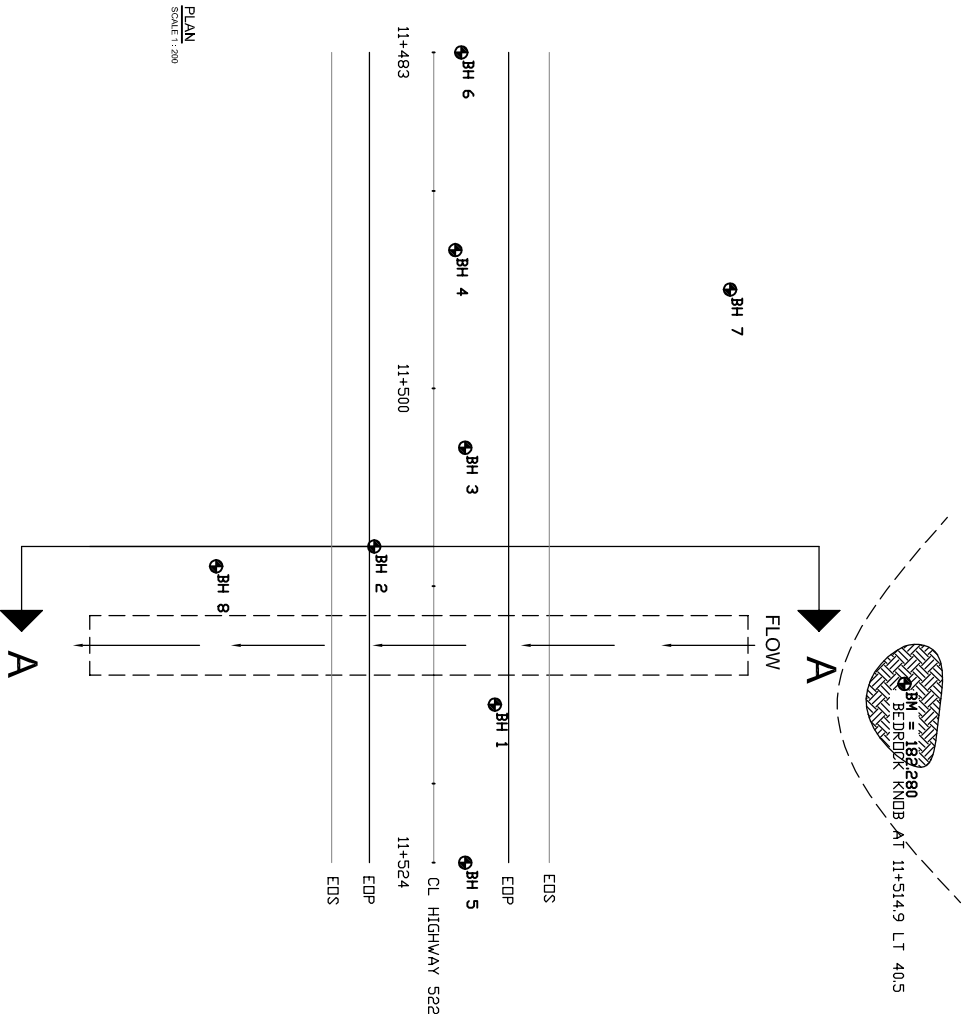
Unless otherwise noted, the information contained herein in no way reflects on environmental aspects of either the site or the subsurface conditions.

The comments given in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of testholes may not be sufficient to determine all the factors that may affect construction methods and costs, e.g. the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusion as to how the subsurface conditions may affect their work.

Any results from an analytical laboratory or other subcontractor reported herein have been carried out by others, and DST Consulting Engineers Inc. cannot warranty their accuracy. Similarly, DST cannot warranty the accuracy of information supplied by the client.

**DST CONSULTING ENGINEERS INC.**

# **DRAWING**



CONT No 5005-E-0062	
MTO GEOCRES No. 41H-61	SHEET 1



LEGEND

	BOREHOLE		CLAY
	END OF HOLE		FILL
	NO FURTHER PROGRESS		BEDROCK
	NFP		SAND
	WATER LEVEL ELEVATION		

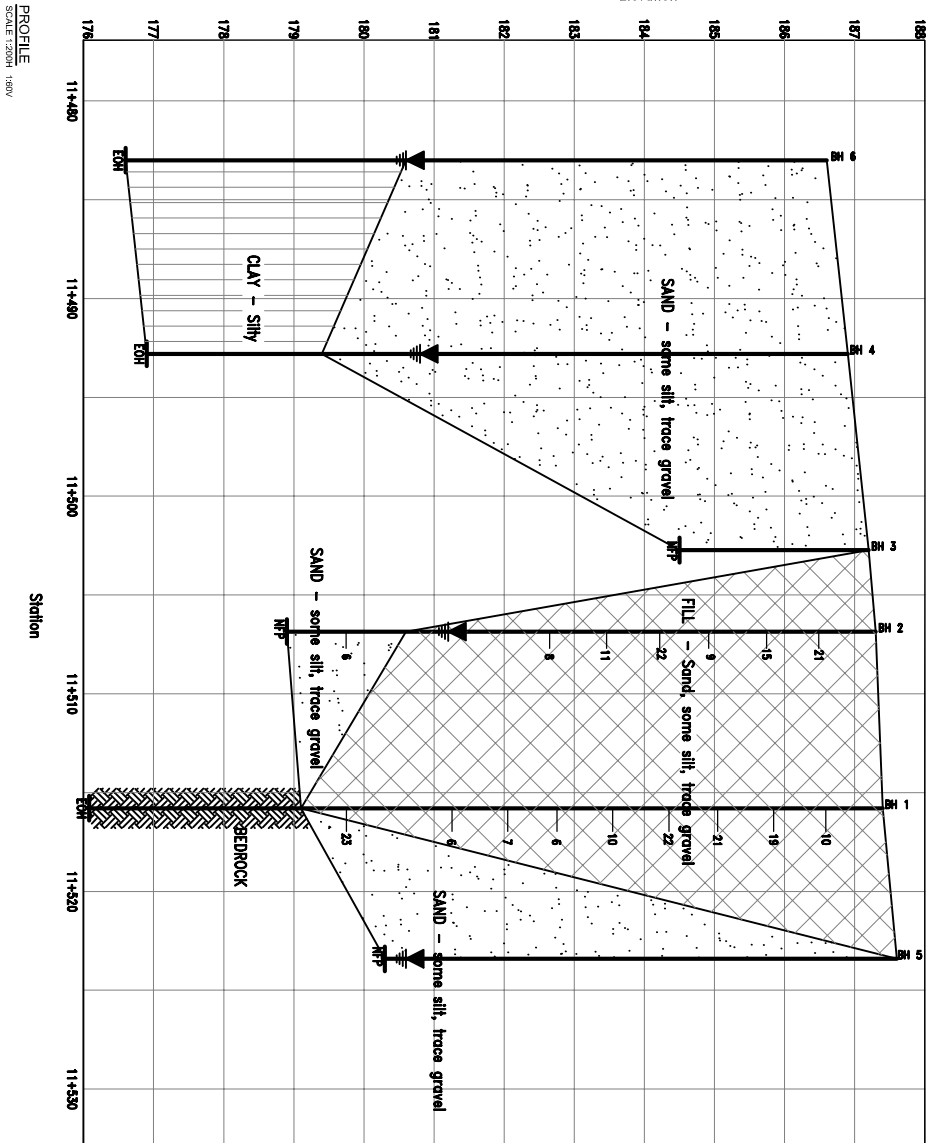
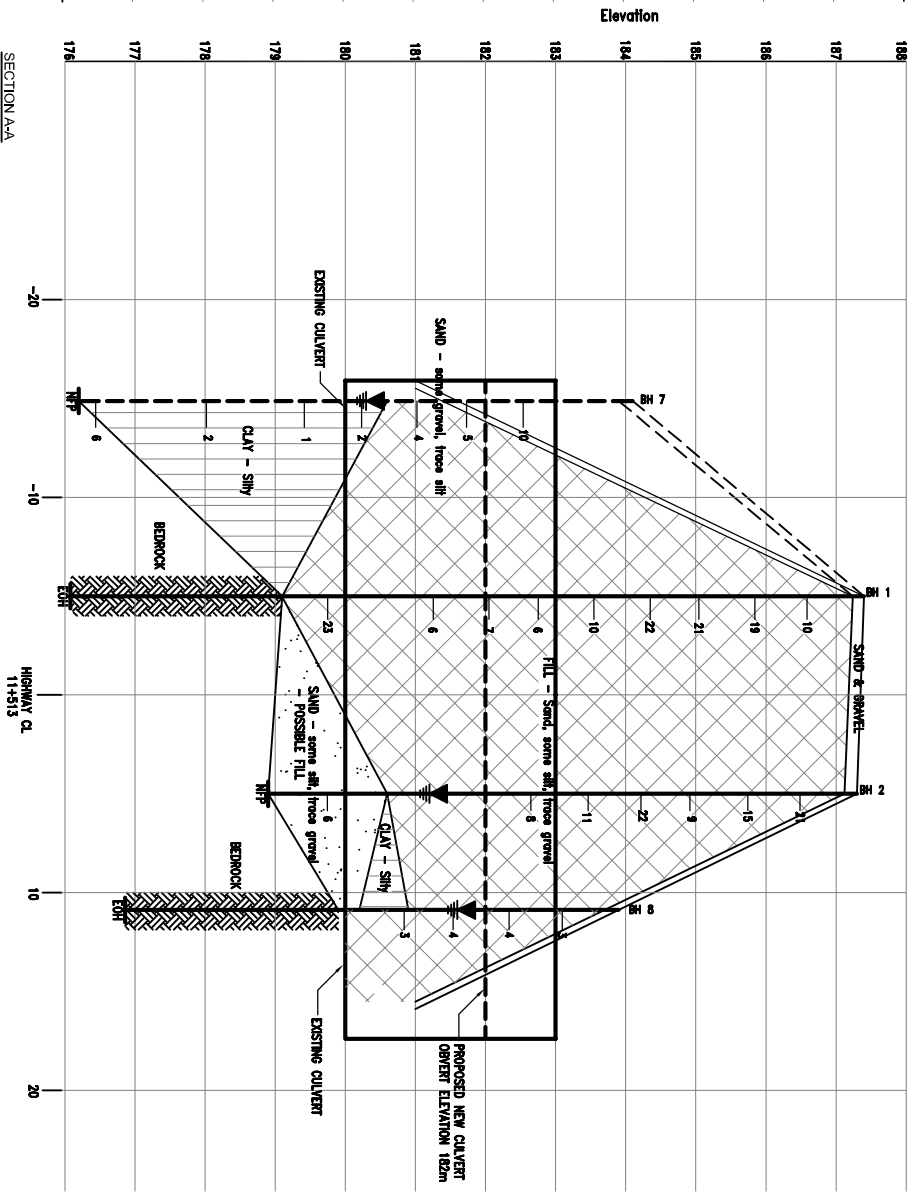
BH No.	Elevation	Station	Offset
1	187.4	11+516	3.1 LT
2	187.3	11+508	3.0 RT
3	187.2	11+503	1.6 LT
4	186.9	11+493	1.1 LT
5	187.6	11+524	1.6 LT
6	186.6	11+483	1.4 LT
7	184.1	11+495	15.0 LT
8	183.9	11+509	11.0 RT

NOTE:  
The boundaries between soil strata have been established only at borehole locations. Between boreholes, the boundaries are assumed by interpolation and may not represent actual conditions.

This drawing is for subsurface information only. Surface details and features are for conceptual illustration. The 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.

HWY No 522	CHECKED	DATE JULY 2006	DIST ?
SUBMID	CHECKED	APPRVD R.C.	SITE
DRAWN S.R.	CHECKED		DWG 1

SECTION A-A  
SCALE 1:200H 1:20V  
NOTE: BH 7 is offset 16m from culvert.



# **ENCLOSURES**

# RECORD OF BOREHOLE No 1

1 OF 1

METRIC

W.P. #5005-E-0062 LOCATION 11+516 Lt 3.1m ORIGINATED BY P.R.  
 DIST Sudbury HWY 522 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.R.  
 DATUM Geodetic DATE 2006.06.15 CHECKED BY R.C.

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 (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED □ QUICK TRIAXIAL	✕ FIELD VANE ★ LAB VANE	20						40	60
187.4			1	AS											GR SA SI CL		
186.9	ASPHALT - 50mm														Cave 5.6m, dry on completion		
186.2	SAND & GRAVEL		2	AS													
	FILL - sand, some silt, trace gravel, brown, compact		3	SS	10										3 83 (15)		
			4	SS	19												
			5	SS	21												
			6	SS	22										0 86 (14)		
			7	SS	10												
			8	SS	6												
	----- - some gravel, loose		9	SS	7										5 82 (12)		
			10	SS	6												
	----- - trace wood		11	SS	23												
179.1	BEDROCK														RC1 REC 100% RQD 70%		
8.3			1	RC													
			2	RC											RC2 REC 100% RQD 57%		
			3	RC											RC3 REC 90% RQD 43%		
176.1	End of Borehole @ 11.32m																
11.3																	

×<sup>3</sup>, ★<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ENCLOSURE 1

ONL\_MOT\_TG06131 LOGS.GPJ DST\_MIN.GDT 01/09/06

# RECORD OF BOREHOLE No 2

1 OF 1

METRIC

W.P. #5005-E-0062 LOCATION 11+508 Rt 3.0m ORIGINATED BY P.R.  
 DIST Sudbury HWY 522 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.R.  
 DATUM Geodetic DATE 2006.06.16 CHECKED BY R.C.

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	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)		
								20	40	60	80						100	20	40
187.3																			
180.0	ASPHALT - 30mm		1	AS												Water Level 6.1m, cave 6.1m on completion 1 84 (15)			
180.2	SAND & GRAVEL		2	AS															
	FILL - sand, some silt, trace gravel, brown, loose to compact		3	SS	21														
	----- - trace clay, red		4	SS	15														
			5	SS	9														
	----- - occasional cobbles		6	SS	22														
			7	SS	11														
	----- - Silty, trace wood		8	SS	8														
	----- - trace wood, grey		9	SS															
180.6																			
6.7	SAND - some silt, trace gravel, grey, loose															1 84 (15)			
			10	SS	6														
	----- - occasional cobbles																		
178.9	End of Borehole @ 8.4m Auger Refusal																		
8.4																			

×<sup>3</sup>, ★<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ENCLOSURE 2

ONL MOT TG06131 LOGS.GPJ DST\_MIN.GDT 01/09/06

# RECORD OF BOREHOLE No 3

1 OF 1

METRIC

W.P. #5005-E-0062 LOCATION 11+503 Lt 1.6m ORIGINATED BY P.R.  
 DIST Sudbury HWY 522 BOREHOLE TYPE Solid Stem Auger COMPILED BY S.R.  
 DATUM Geodetic DATE 2006.06.16 CHECKED BY R.C.

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					WATER CONTENT (%)				
							20	40	60	80	100	20	40	60			
187.2	ASPHALT - 25mm																
180.0	SAND & GRAVEL																
180.0	SAND - some silt, trace gravel, occasional cobbles, brown																
184.5	End of Borehole @ 2.7m Auger Refusal																

$\times^3, \star^3$ : Numbers refer to Sensitivity  $\bigcirc$  3% STRAIN AT FAILURE

ENCLOSURE 3



## METRIC

[illegible]

**ENCLOSURE 5**

# RECORD OF BOREHOLE No 6

1 OF 1

METRIC

W.P. #5005-E-0062 LOCATION 11+483 Lt 1.4m ORIGINATED BY P.R.  
 DIST Sudbury HWY 522 BOREHOLE TYPE Solid Stem Auger COMPILED BY S.R.  
 DATUM Geodetic DATE 2006.06.18 CHECKED BY R.C.

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	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED	× FIELD VANE							□ QUICK TRIAXIAL	★ LAB VANE	
186.6								20 40 60 80 100										
186.6	ASPHALT - 35mm		1	AS											Water Level 6.0m, cave 6.0m on completion			
186.3	SAND & GRAVEL																	
0.3	SAND - some silt, trace gravel, occasional cobbles, brown																	
			2	AS														
			3	AS														
180.6	CLAY - Silty, grey																	
6.0																		


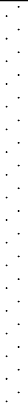

$\times^3, \star^3$ : Numbers refer to Sensitivity  $\bigcirc$  3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No 7

1 OF 1

METRIC

W.P. #5005-E-0062 LOCATION 11+495 Lt 15m ORIGINATED BY P.R.  
 DIST Sudbury HWY 522 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.R.  
 DATUM Geodetic DATE 2006.06.18 CHECKED BY R.C.

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										WATER CONTENT (%)		
								○ UNCONFINED	✕ FIELD VANE	□ QUICK TRIAXIAL	★ LAB VANE									
184.1							20	40	60	80	100									
183.9	TOPSOIL - 200mm		1	AS																
0.2	SAND -some gravel, trace silt, occasional cobbles and boulders, brown, loose																			
			2	SS																
			3	SS	10															
			4	SS	5															
			5	SS	4															
180.6	CLAY - Silty, grey/red, very soft to firm																			
3.5			6	SS	2															
			7	SS	1															
			8	SS	2															
			9	SS	6															
176.2	End of Borehole @ 7.9m Auger Refusal																			
7.9																				

$\times^3, \star^3$ : Numbers refer to Sensitivity  $\circ$  3% STRAIN AT FAILURE

ENCLOSURE 7

ONL MOT TG06131 LOGS.GPJ DST\_MIN.GDT 01/09/06

# RECORD OF BOREHOLE No 8

1 OF 1

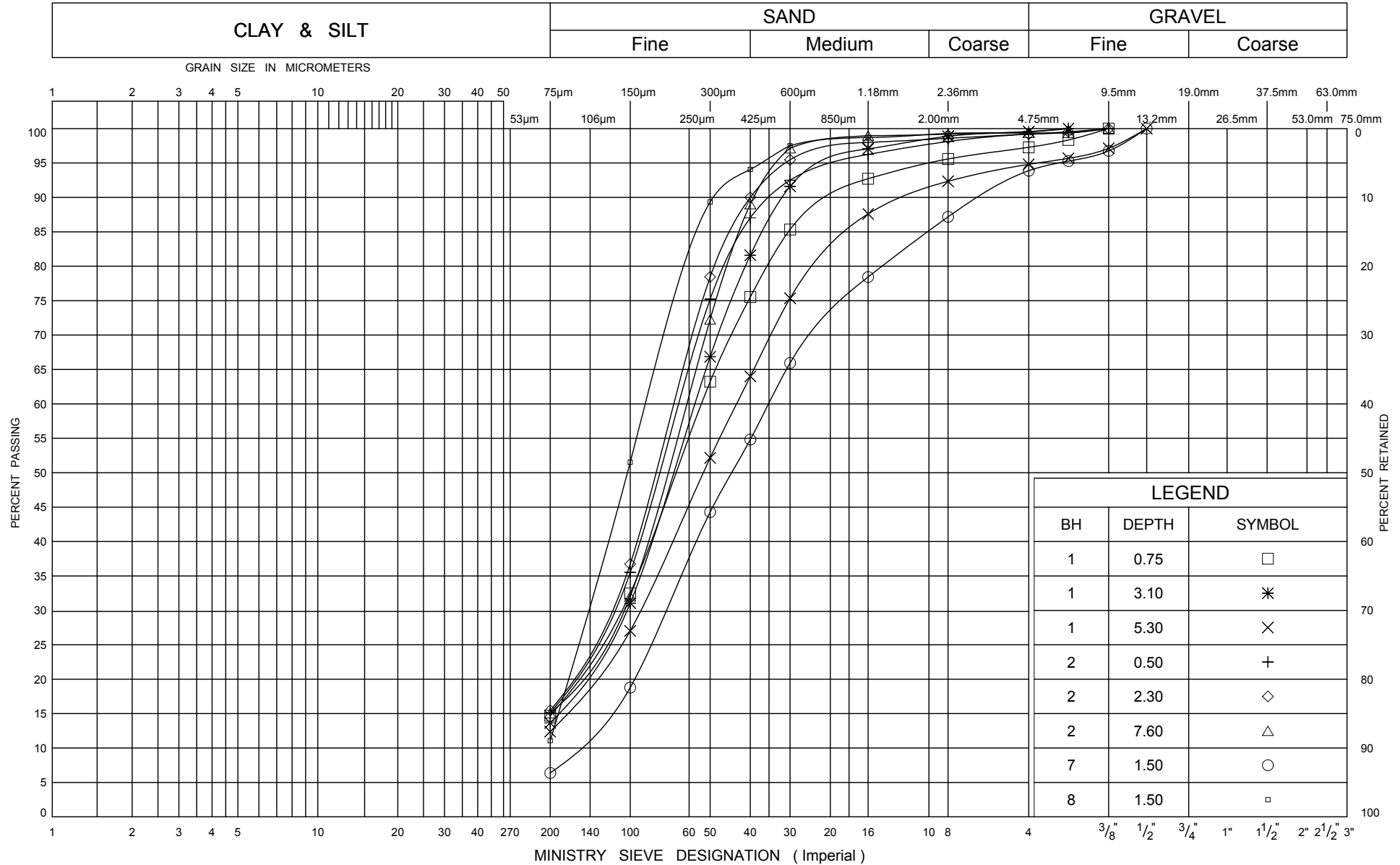
METRIC

W.P. #5005-E-0062 LOCATION 11+509 Rt 11.0m ORIGINATED BY P.R.  
 DIST Sudbury HWY 522 BOREHOLE TYPE Hollow Stem Auger COMPILED BY S.R.  
 DATUM Geodetic DATE 2006.06.17 CHECKED BY R.C.

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 (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								20	40	60	80	100						20	40	60
183.9																	GR SA SI CL			
183.9	TOPSOIL - 200mm																			
0.2	FILL - sand, some silt, trace gravel, brown, very loose		1	AS																
			2	SS	3															
			3	SS	4												0 88 (11)			
	----- - trace wood		4	SS	4															
180.9																				
3.0	CLAY - Silty, grey, soft		5	SS	3															
180.2																				
3.7	SAND - Silty, grey		6	SS																
179.9																				
4.0	BEDROCK		1	RC													RC1 REC 87% RQD 57%			
			2	RC													RC2 REC 100% RQD 100%			
			3	RC													RC3 REC 100% RQD 100%			
176.9																				
7.0	End of Borehole @ 7.04m																			

✕<sup>3</sup>, ★<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

## UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of  
Transportation

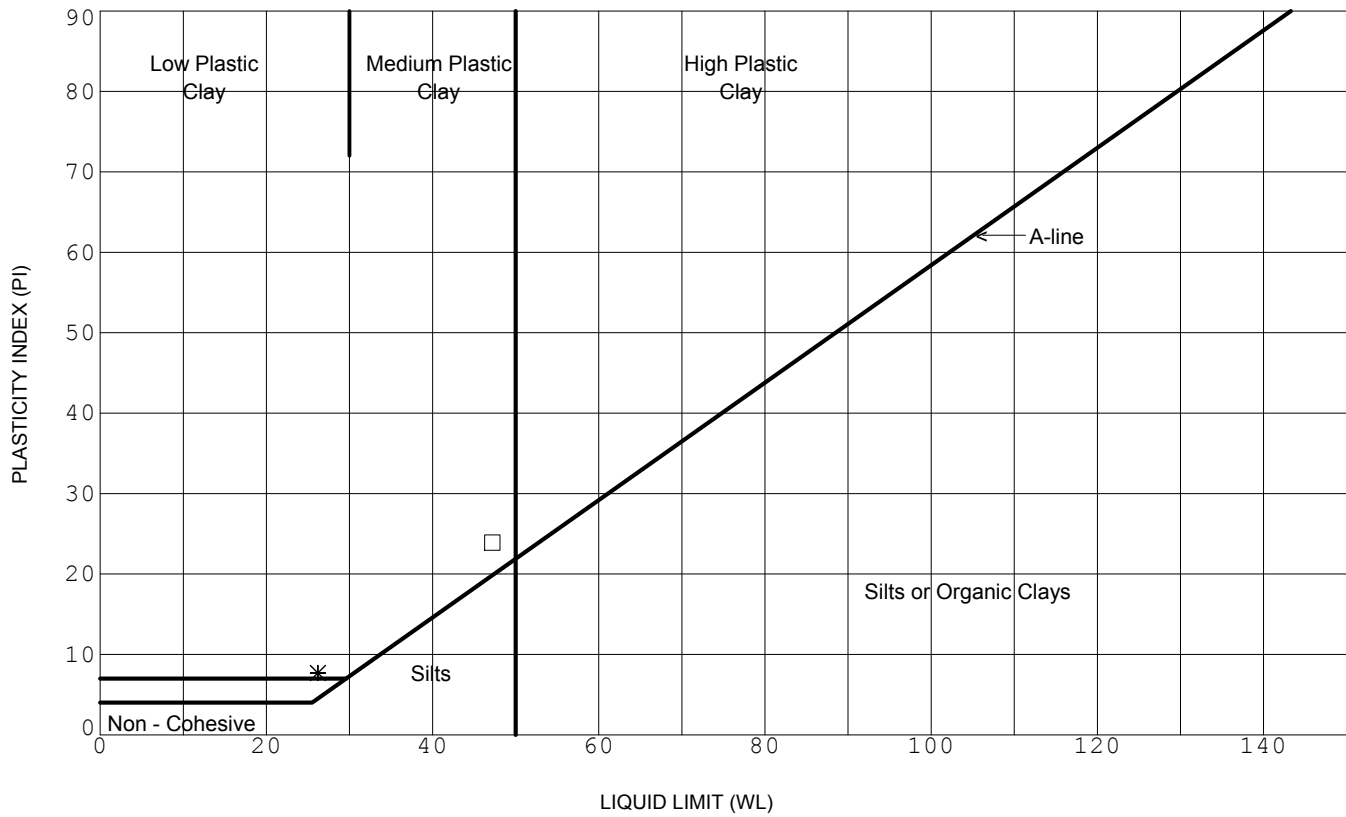
## GRAIN SIZE DISTRIBUTION NISBET CREEK CULVERT

ENCLOSURE 9

W P #5005-E-0062

522

# ATTERBERG LIMIT TEST RESULTS



LEGEND:

□ BOREHOLE 7 DEPTH 4.60  
\* BOREHOLE 7 DEPTH 6.10

W <sub>L</sub>	W <sub>P</sub>	PI	W
47	23	24	57
26	19	8	41

September 2006

Reference No.:

## NISBET CREEK CULVERT -

DST CONSULTING ENGINEERS INC.

Enclosure 10