

**FOUNDATION INVESTIGATION REPORT
LITTLE REST CREEK CULVERT REPLACEMENT
HIGHWAY 17, DISTRICT OF THUNDER BAY, ONTARIO
SITE 48W-309/C
G.W.P. 6941-10-00**

Geocres Number: 52B-15

Report to

GENIVAR

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PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents the factual findings obtained from a foundation investigation conducted at the location of a proposed culvert replacement at Little Rest Creek east of Savanne, Ontario. The existing culvert carries Little Rest Creek under Highway 17 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 Genivar, under the Ministry of Transportation Ontario (MTO) Agreement Number 6010-E-0012.

2 SITE DESCRIPTION

The Little Rest Creek culvert is located on Highway 17, approximately 1.4 km east of the Town of Savanne, Ontario. The site is approximately 53.4 km north of the intersection of Highway 17 and Highway 11.

The existing highway is a two-lane paved road and crosses the creek on approach embankments about 3.0 m to 4.0 m high.

Currently twin CSP culverts carry Little Rest Creek under Highway 17. The existing culverts are both 2.4 m in diameter and are approximately 24.4 m long.

Lands surrounding the culvert site consist primarily of forested areas with open swamps.

Photographs in Appendix C show the general nature of the surrounding land.

The site lies within the Superior Province of the Canadian Shield, characterized by low, rounded hills of Pre-Cambrian bedrock mantled by varying thicknesses of overburden. At this site, the overburden primarily consists of glaciolacustrine clay and silty sand.

3 SITE INVESTIGATION AND FIELD TESTING

The site investigation and field testing for this project were carried out on September 17 and 26, 2011 and consisted of drilling and sampling a total of three boreholes (identified as LRC-01 to LRC-03) in the area of the existing culvert. One borehole was drilled near each end of the culvert and one borehole was drilled through the Highway 17 embankment from the north shoulder of the highway. Borehole advancement within the overburden soils extended to depths of 6.2 m to 11.6 m (elevations 448.0 to 451.0).

A dynamic cone penetration test (DCPT) was conducted from the base of Borehole LRC-03 and was terminated at 8.4 m depth (elevation 449.1).

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.

For Borehole LRC-02, located on the highway, drilling was carried out using a truck mounted CME 75 drill rig. Hollow-stem augers were used to advance the borehole. For Boreholes LRC-01 and LRC-03, located near the toes of the highway embankment, drilling was carried out using portable drilling equipment mounted on a tripod. Wash boring techniques were used to advance Boreholes LRC-01 and LRC-03. Overburden samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT). In situ vane shear testing was carried out to assess the undrained shear strength of soft to firm cohesive deposits.

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. Two standpipe piezometers, consisting of 19 mm diameter PVC pipe with a slotted screen and enclosed in filter sand, were installed in Boreholes LRC-01 and LRC-03 to permit longer term groundwater level monitoring. The boreholes were abandoned in general accordance with O.Reg. 903 upon completion. The completion details of the boreholes and locations of the piezometers and boreholes are shown in Table 3.1.

Table 3.1 – Borehole Abandonment Details

Borehole	Piezometer Tip Depth/ Elevation (m)	Abandonment Details
LRC-01	6.2 / 451.0	Piezometer with 1.5 m slotted screen installed with sand filter to 4.3 m and bentonite holeplug from 4.3 m to surface.
LRC-02	None installed	Backfilled with bentonite holeplug from 11.6 m to 0.3 m, then sand and gravel to surface.
LRC-03	7.0 / 450.5	Piezometer with 1.5 m slotted screen installed with sand filter to 4.9 m and bentonite holeplug from 4.9 m to surface.

An attempt was made to decommission the piezometers in October 2012. However, the water in the piezometers installed in Boreholes LRC-01 and LRC-02 was frozen and it was not possible to decommission them. These piezometers will be decommissioned in the Spring of 2013.

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 (sieve and hydrometer) 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” drawing included in Appendix D. 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 terms, the site was found to be underlain by surficial topsoil at the toe of the highway embankment and the borehole drilled through the highway embankment encountered sand fill with gravel. Layers of native silty clay and silty sand were encountered below the topsoil and the embankment fill. Auger refusal on boulders or probable bedrock was encountered below the native silty sand.

More detailed descriptions of the individual strata are presented below.

5.1 Topsoil/Organics

Topsoil and organics were encountered at the surface in Boreholes LRC-01 and LRC-03, which were drilled at the toe of the highway embankment, near the north and south ends of

the existing culvert, respectively. The topsoil was dark brown to brown in colour and contained organics, some clay and occasional roots. The topsoil was 0.6 m thick in Borehole LRC-01 and 1.2 m thick in Borehole LRC-03.

The elevations of the base of the topsoil layer in the boreholes are 456.6 and 456.3.

The topsoil thickness may vary between and beyond the borehole locations.

5.2 Gravelly Sand Fill

Gravelly sand fill was encountered from the surface in Borehole LRC-02, which was drilled through the existing Highway 17 westbound shoulder. The sand fill was brown in colour and contained some gravel to being gravelly with trace silt and clay. The thickness of the sand fill was 4.0 m.

The depth to the base of the fill was 4.0 m (elevation 455.6).

Standard Penetration Tests performed in the sand fill layer gave SPT N-values ranging from 13 to 39 blows for 0.3 m penetration, indicating a compact to dense relative density. The density of the fill decreased with depth.

The moisture content of samples of the sand fill ranged from 3% to 13%.

One sample of the sand fill underwent gradation analysis testing, the results of which are presented below. These results are also summarized on the Record of Borehole sheets in Appendix A and the grain size distribution curve for this sample is plotted on Figure B1 of Appendix B.

Soil Particles	Percentage (%)
Gravel	26
Sand	66
Silt and Clay	8

5.3 Silty Clay

A layer of silty clay was encountered below the topsoil in Boreholes LRC-01 and LRC-03 and below the sand fill in Borehole LRC-02. The silty clay was grey to reddish brown in colour and contained trace sand and gravel and occasional roots. The thickness of the silty clay layer ranged from 3.5 m to 4.3 m.

The depth to the base of the silty clay layer ranged from 4.9 m to 7.5 m (elevations 452.3 to 452.0).

SPT N-values recorded in the silty clay layer ranged from 2 to 7 blows for 0.3 m penetration, indicating a soft to firm consistency. Shear Vane Tests were also performed

where low N-values were recorded. The shear strength of the silty clay ranged from 24 to 44 kPa.

The moisture content of samples of the silty clay ranged from 23% to 99%, typically greater than 40%.

Three samples of the silty clay were selected for grain size analysis testing and two samples were selected for Atterberg Limits testing. The results of these tests are presented on the Record of Borehole sheets included in Appendix A. The grain size distribution curves for these samples are plotted on Figure B2, Appendix B and the results of the Atterberg Limits tests are plotted on Figure B4, Appendix B. The results of the laboratory tests are summarized as follows:

Soil Particles	Percentage (%)
Gravel	0
Sand	0
Silt	27 to 68
Clay	32 to 72

Index Property	Percentage (%)
Liquid Limit	51 to 58
Plastic Limit	20 to 21
Plasticity Index	31 to 37

Results of the Atterberg Limits tests indicate that the silty clay is of high plasticity with a group symbol of CH.

5.4 Silty Sand

Silty sand was encountered below the silty clay in all three boreholes drilled at this site. The silty sand was grey in colour and contained trace to some gravel and trace silt and clay. Occasional cobbles and boulders were encountered within the silty sand in Borehole LRC-02 at a depth of 10.1 m. Bedrock fragments were encountered in Borehole LRC-01 near 6.0 m depth.

The thickness of the silty sand layer penetrated in the three boreholes ranged from 1.3 m to 4.1 m, however all the boreholes were terminated upon refusal below the silty sand layer.

SPT N-values recorded in the silty sand typically ranged from 19 to 74 blows for 0.3 m penetration, indicating a compact to very dense relative density. An SPT N-value of 8 blows for 0.3 m penetration was recorded in Borehole LRC-02 at a depth of 8.0 m,

indicating a loose relative density. One SPT-N value of 50 blows without penetration was recorded in Borehole LRC-02 near elevation 449.0.

The moisture content of samples of the silty sand ranged from 8% to 13%.

Four samples of the silty sand underwent laboratory gradation analysis, the results of which are summarized below. These results are also presented on the Record of Borehole sheets included in Appendix A and the grain size distribution curves for these samples are plotted on Figure B3, Appendix B.

Soil Particles	Percentage (%)
Gravel	8 to 17
Sand	50 to 62
Silt	25 to 32
Clay	2 to 6

5.5 Refusal

Auger refusal on probable boulders or bedrock was encountered below the silty sand at depths and elevations shown in Table 5.1.

Table 5.1 – Depths and Elevations to Auger Refusal

Location relative to existing culvert	Borehole	Depth (m)	Elevation (m)
North end	LRC-01	6.2	451.0
Middle	LRC-02	11.6	448.0
South end	LRC-03/DCPT	8.4	449.1

5.6 Water Levels

Water levels were observed in the open boreholes upon completion of the drilling operations.

Artesian conditions were encountered during drilling operations within the silty sand layer below 4.9 m and 5.5 m depth (elevations 452.3 and 452.0) in Boreholes LRC-01 and LRC-03. A standpipe piezometer was installed in Boreholes LRC-01 and LRC-03 to monitor water levels after completion of drilling.

The water levels measured in the open boreholes and piezometers are summarized in Table 5.2.

Table 5.2 – Water Level Measurements

Borehole	Date	Water Level (m)		Comment
		Depth	Elevation	
LRC-01	Sept. 26, 2011	1.8	455.4	Open borehole
	Dec. 1, 2011	0.4*	457.6	Piezometer
	Oct. 28, 2012	0.4* (frozen)	457.6	Piezometer
LRC-02	Sept. 17, 2011	3.3	456.3	Open borehole
LRC-03	Sept. 26, 2011	1.2	456.3	Open borehole
	Dec. 1, 2011	0.6*	458.1	Piezometer
	Oct. 28, 2012	1.1* (frozen)	458.6	Piezometer

*Indicates water level above ground surface, artesian conditions.

The piezometric readings reveal that the groundwater level is 0.4 m to 1.1 m above the original ground surface (elevations 457.6 to 458.6), indicating artesian conditions at this site.

The above values are short-term readings and seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after the spring snowmelt or after periods of heavy rainfall.

General arrangement (GA) drawing indicates that the Little Rest Creek water level was measured at Elevation 456.8 m on June 28, 2011.

6 MISCELLANEOUS

Borehole locations were selected and marked in the field by Thurber Engineering Ltd. Upon completion of drilling, the borehole elevations and coordinates were established from a drawing provided by Genivar.

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

Eastern Ontario Diamond Drilling Ltd. from Hawkesbury, Ontario supplied a truck mounted CME 75 drill rig and conducted the drilling, sampling and in-situ testing operations for Borehole LRC-02. OGS Drilling Inc. of Almonte, Ontario supplied a portable tripod mounted drilling set up and conducted the drilling, sampling and in-situ testing operations for Borehole LRC-01 and LRC-03.

The field program was supervised by Mr. George Azzopardi and Mr. Mubashar Tahir of Thurber.

Routine laboratory testing was carried out by Thurber Engineering Ltd.

Overall supervision of the field program was conducted by Mr. Mark Farrant, P.Eng. Interpretation of the data and preparation of this report were carried out by Ms. Lindsey Blaine, E.I.T. and Ms. R. Palomeque Reyna, P.Eng.

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

Thurber Engineering Ltd

Lindsey Blaine, E.I.T.
Project Manager

L. Blaine
Dec. 4/12

Rocío Palomeque Reyna, P.Eng.
Geotechnical Engineer



P. K. Chatterji, P.Eng.
Review Principal



Appendix A

Record of Borehole Sheets

RECORD OF BOREHOLE No LRC-01

1 OF 1

METRIC

W.P. 6941-10-00 LOCATION N 5 425 733.8 E 702 906.8 Little Rest Creek Culvert ORIGINATED BY MAT
HWY 17 BOREHOLE TYPE Wash Boring COMPILED BY AN
DATUM Geodetic DATE 2011.09.26 - 2011.09.26 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
457.2													
0.0	TOPSOIL, organics Very Loose Dark Brown Moist to Wet (600mm)		1	SS	1		457						
456.6													
0.6	Silty CLAY, occasional roots Soft to Firm Grey		2	SS	2		456						
			3	SS	5		456						
			4	SS	7		455						0 0 66 32
			5	SS	3		454						
	Trace sand and gravel		6	SS	7		453						
452.3													
4.9	Silty SAND, trace to some gravel, trace clay Dense Grey Moist to Wet		7	SS	43		452						8 62 25 5
			8	SS	34								
	Occasional bedrock fragments												
451.0			9	SS	59								
6.2	END OF BOREHOLE AT 6.2m UPON REFUSAL ON PROBABLE BEDROCK OR BOULDER. WATER LEVEL OBSERVED AT 1.8m DURING DRILLING. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Sep.26/11 1.8 455.4 Dec.01/11 0.4* 457.6 Oct.28/12 0.4* (Frozen) 457.6 * Above Ground Surface (Artesian Condition)				0.150								

+ 3, x 3

Numbers refer to
Sensitivity

20
15 5
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No LRC-02

1 OF 2

METRIC

W.P. 6941-10-00 LOCATION N 5 425 727.4 E 702 896.6 Little Rest Creek Culvert ORIGINATED BY GA
HWY 17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.09.17 - 2011.09.17 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _p W W _L	20 40 60	GR SA SI CL			
459.6 0.0	SAND, some gravel to gravelly, trace silt and clay Dense to Compact Brown Moist (FILL)		1	SS	39									26 66 8 (SI+CL)	
			2	SS	25										
			3	SS	18										
			4	SS	13										
			5	SS	15										
455.6 4.0	Silty CLAY Firm Grey to Reddish Brown Wet		6	SS	6										0 0 27 72
			7	SS	5										
452.1 7.5	Silty SAND, trace to some gravel, trace clay Loose to Compact Grey Wet		8	SS	8										17 50 30 3
			9	SS	30										

Continued Next Page

+³ . X³: Numbers refer to Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No LRC-02

2 OF 2

METRIC

W.P. 6941-10-00 LOCATION N 5 425 727.4 E 702 896.6 Little Rest Creek Culvert ORIGINATED BY GA
HWY 17 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.09.17 - 2011.09.17 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
	Continued From Previous Page														
448.0	Silty SAND, trace to some gravel, occasional cobbles and boulders Very Dense Grey Wet		10	SS	56/ 0.00		449								
11.6	END OF BOREHOLE AT 11.6m UPON AUGER REFUSAL ON PROBABLE BOULDERS. WATER LEVEL OBSERVED AT 3.3m. BOREHOLE BACKFILLED WITH HOLEPLUG FROM 11.6m TO 0.3m. THEN SAND & GRAVEL TO SURFACE.														

RECORD OF BOREHOLE No LRC-03

1 OF 2

METRIC

W.P. 6941-10-00 LOCATION N 5 425 709.5 E 702 894.2 Little Rest Creek Culvert ORIGINATED BY MAT
HWY 17 BOREHOLE TYPE Wash Boring COMPILED BY AN
DATUM Geodetic DATE 2011.09.26 - 2011.09.26 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT		
457.5 0.0	TOPSOIL, organics, some clay, occasional roots Very Loose Brown Moist		1	SS	0								
456.3 1.2	Silty CLAY Firm to Soft Grey		2	SS	4								
			3	SS	5								
			4	SS	6								
			5	SS	5								
			6	SS	3								
			7	SS	4								
452.0 5.5	Silty SAND, trace to some gravel, trace clay Compact to Very Dense Grey Wet		8	SS	19								
			9	SS	51								
			10	SS	74								
			11	SS	29								
449.6 7.9	End of sampling and start DCPT at 7.9m												
449.1 8.4	END OF BOREHOLE AT 8.4m UPON REFUSAL ON PROBABLE BEDROCK. WATER LEVEL OBSERVED AT 1.2m DURING DRILLING. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.												

Continued Next Page

+ 3, x 3 : Numbers refer to
Sensitivity 20 15 10 5 10 (%) STRAIN AT FAILURE

ONTMT4S 0840.GPJ 11/5/12

2 OF 2

METRIC

DATUM Geodetic DATE 2011.09.26 - 2011.09.26 CHECKED BY RPR

[illegible]

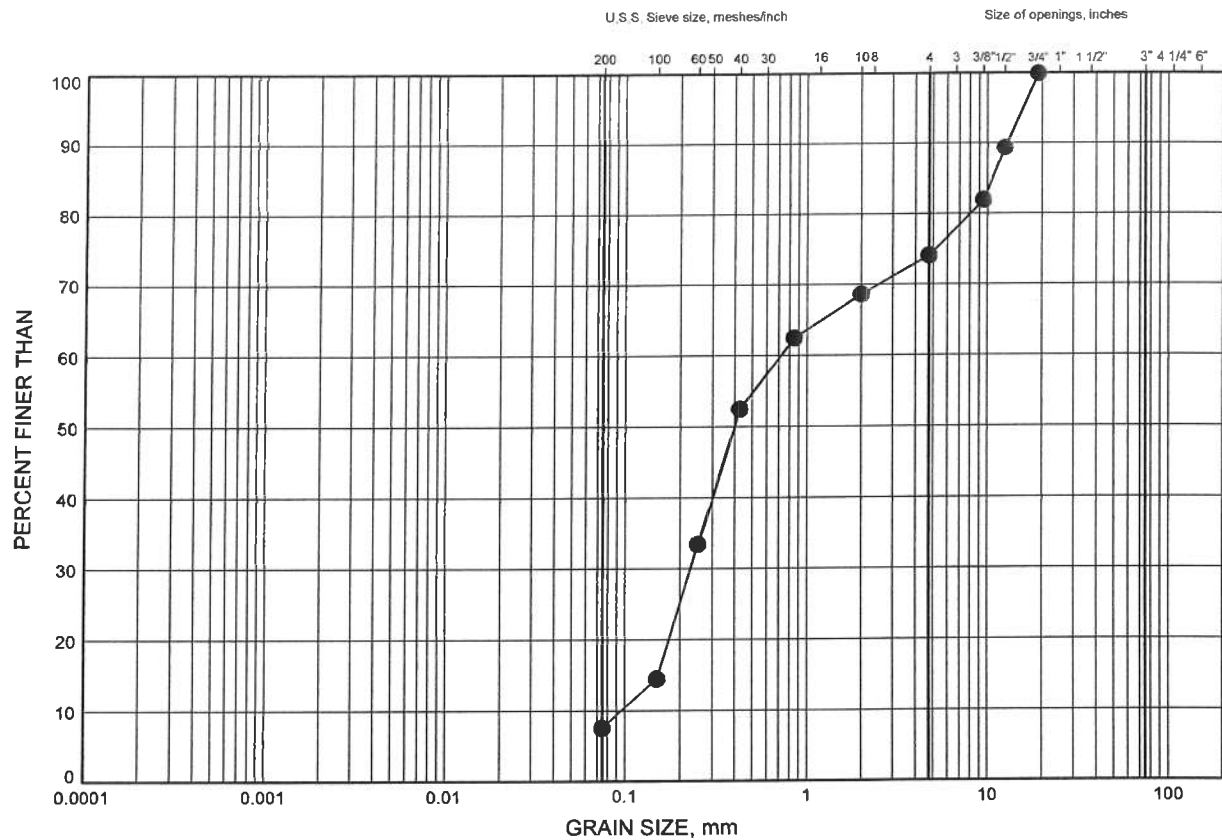
+ 3, × 3: Numbers refer to Sensitivity

Appendix B
Laboratory Test Results

Little Rest Creek Culvert GRAIN SIZE DISTRIBUTION

FIGURE B1

GRAVELLY SAND FILL



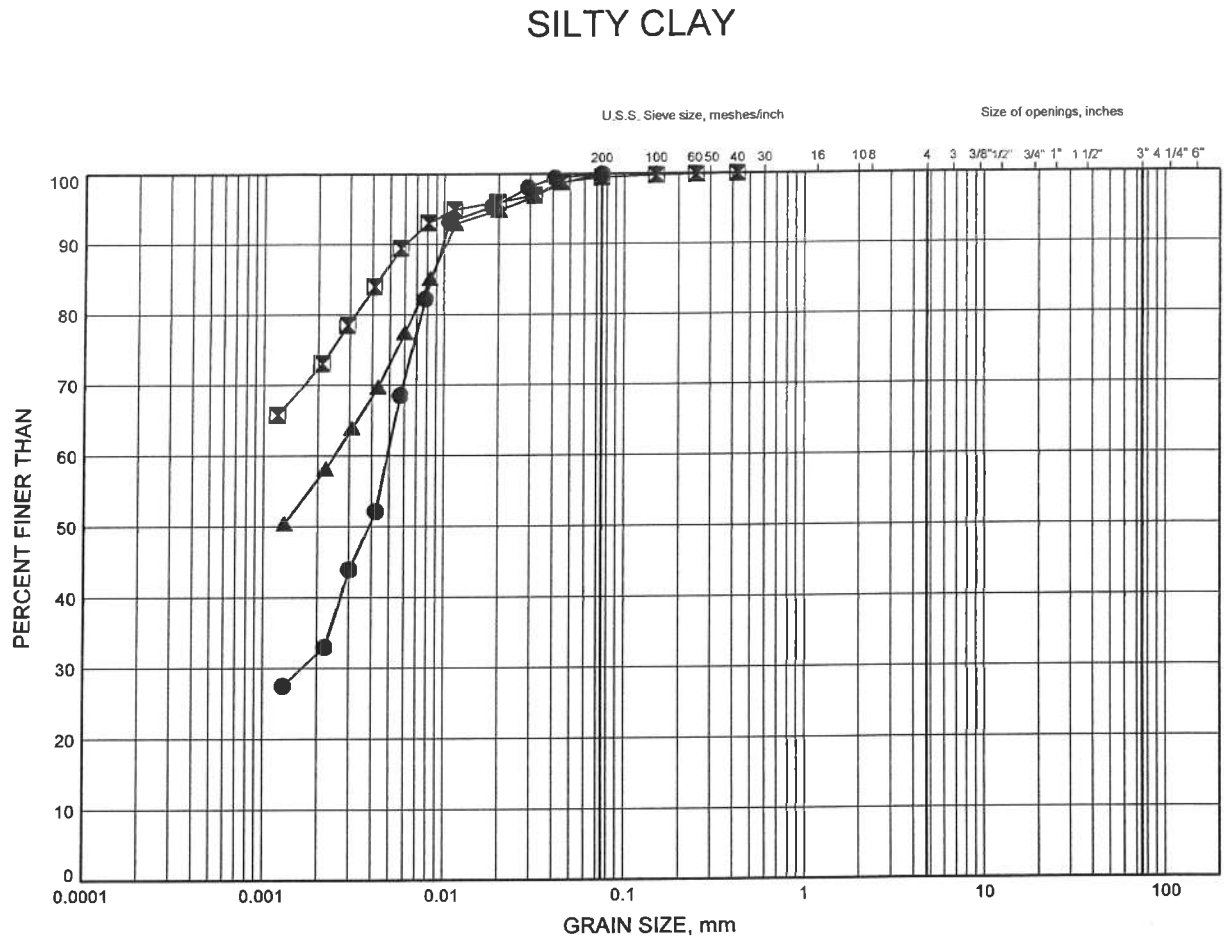
SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	LRC-02	1.07	458.53

Little Rest Creek Culvert GRAIN SIZE DISTRIBUTION

FIGURE B2



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

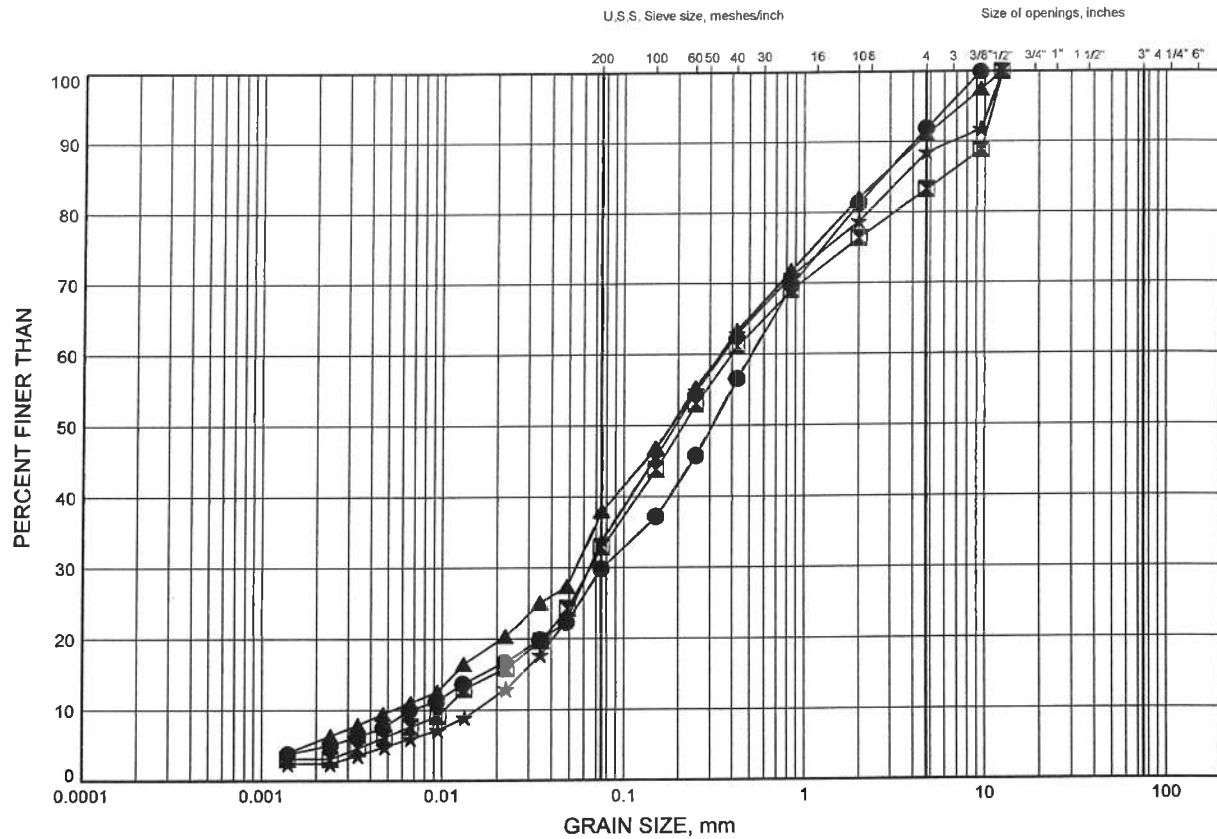
LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	LRC-01	2.13	455.07
⊠	LRC-02	6.40	453.20
▲	LRC-03	3.96	453.54

Little Rest Creek Culvert GRAIN SIZE DISTRIBUTION

FIGURE B3

SILTY SAND



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

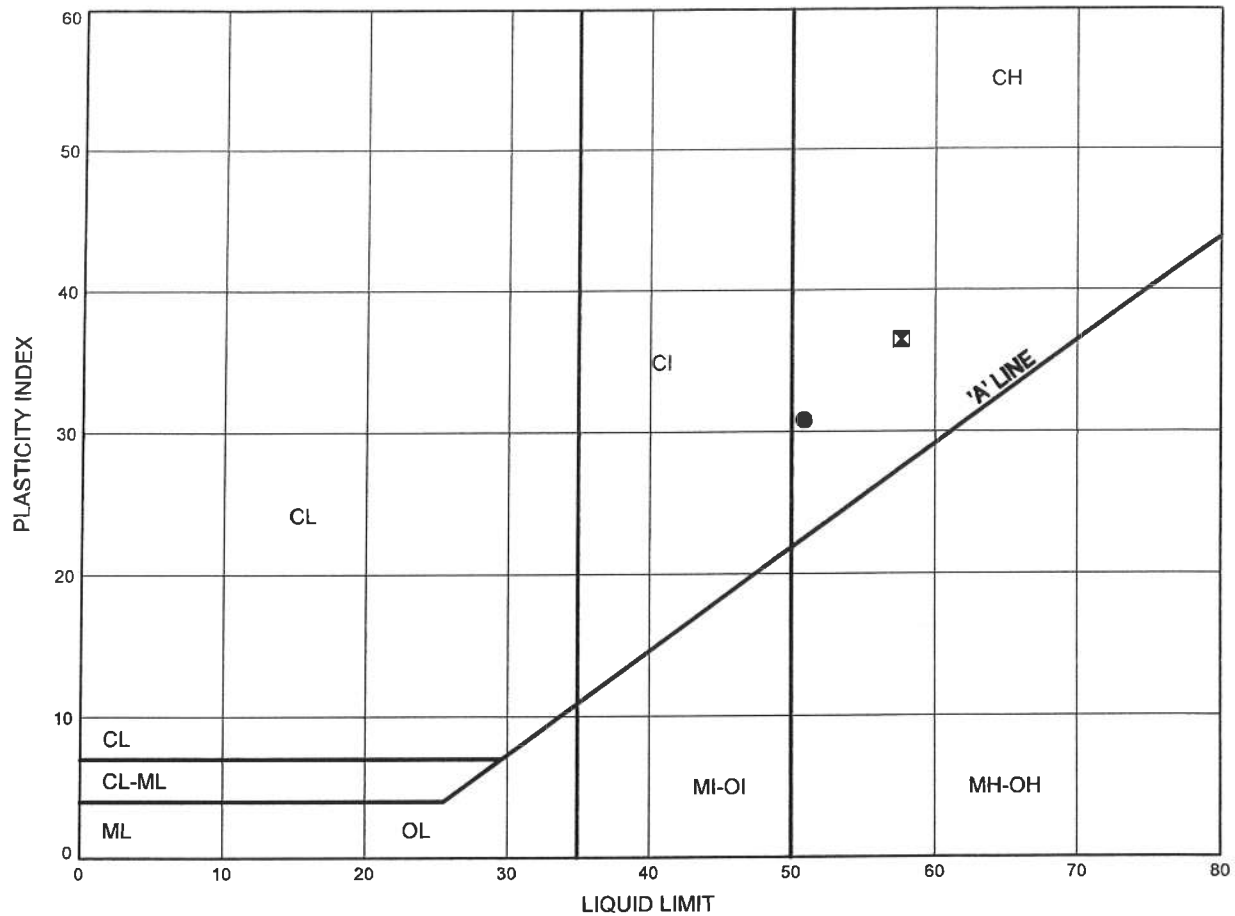
LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	LRC-01	5.18	452.02
■	LRC-02	9.45	450.15
▲	LRC-03	5.79	451.71
★	LRC-03	7.01	450.49

Little Rest Creek Culvert
ATTERBERG LIMITS TEST RESULTS

FIGURE B4

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	LRC-02	6.40	453.20
⊠	LRC-03	3.96	453.54

Date March 2012
 Project 6941-10-00



Prep'd AN
 Chkd. LRB

Appendix C
Site Photographs



Photograph 1 – Highway 17 and Little Rest Creek culverts



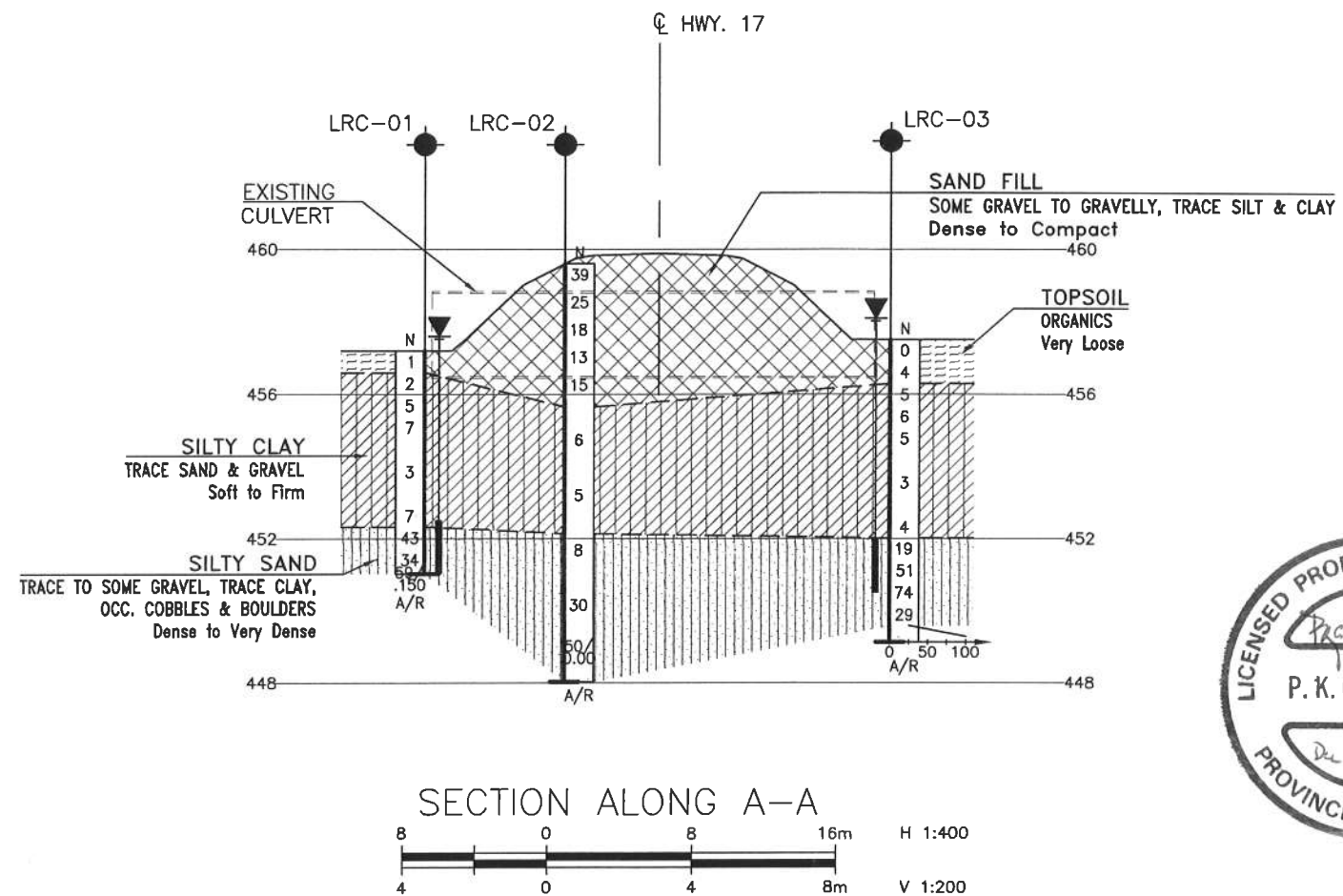
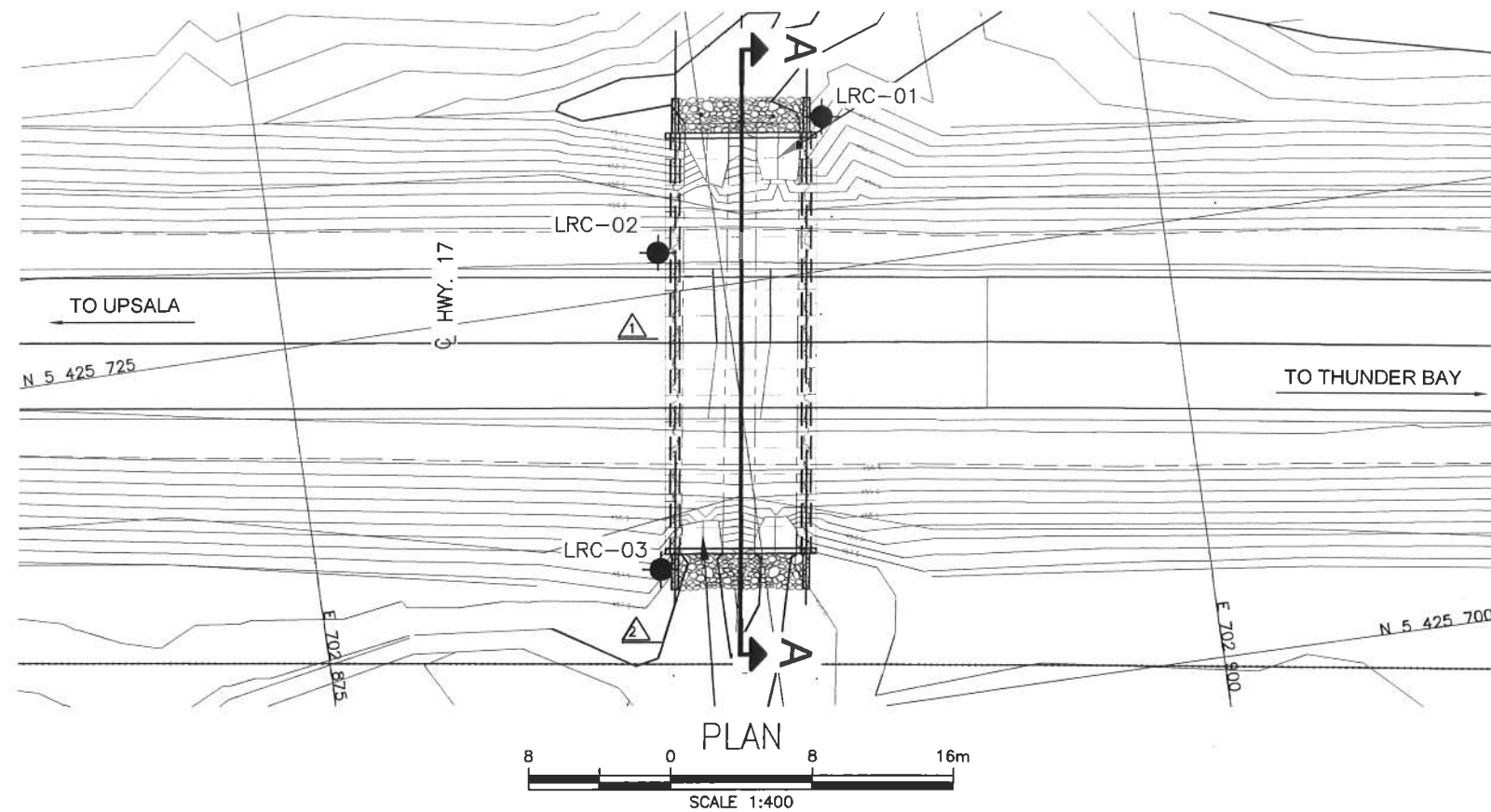
Photograph 2 – North end of Little Rest Creek culverts, looking north



Photograph 3 – South end of Little Rest Creek culverts, looking towards Highway 17

Appendix D

Drawing Borehole Locations and Soil Strata



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

CONT No
GWP No
WP No 6941-10-00



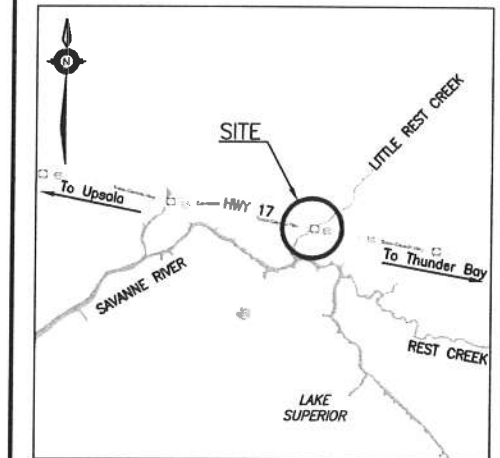
LITTLE REST CREEK
CULVERT REPLACEMENT
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

GENIVAR



THURBER ENGINEERING LTD.



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
LRC-01	457.2	5 425 733.8	702 906.8
LRC-02	459.6	5 425 727.4	702 896.6
LRC-03	457.5	5 425 709.5	702 894.2

-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.

GEOCREs No. 52B-15



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	LRB	CHK	LRB
DRAWN	MFA	CHK	SITE
			STRUCT
			DWG 1
			DATE OCT. 2012