

**FOUNDATION INVESTIGATION REPORT
CULVERT REPLACEMENT AT BRADBURN CREEK
SITE NO. 39W-232
HIGHWAY 11
WEST OF HEARST, ONTARIO
G.W.P. No. 5194-13-00**

GEOCRES Number: 42G-53

Report to

URS Canada Inc.

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Foundations\Reports & Memos\Bradburn Creek
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PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents the factual data obtained from a foundation investigation conducted by Thurber Engineering Ltd. (Thurber) at the twin culverts carrying Bradburn Creek under Highway 11, located in the Township of Hanlan, West of Hearst, Ontario.

The purpose of this investigation was to obtain subsurface information at the location of the culvert and, based on the data obtained, to provide a borehole location plan, stratigraphic profiles, records of boreholes, laboratory test results, and a written description of the subsurface conditions.

Thurber was retained by URS Canada Inc. (URS) to carry out this foundation investigation under the MTO Agreement Number 5012-E-0033. The foundation terms of reference indicate that there is no record available of any previous foundation investigation carried out at, or near, the subject culvert.

2 SITE DESCRIPTION

The culvert site is located on Highway 11 in the Township of Hanlan, approximately 15.8 kilometres west of Highway 583 at Hearst, Ontario. The culvert allows Bradburn Creek to flow in a generally north-south orientation under Highway 11.

The existing structure, constructed in 1956, consists of twin timber box culverts each measuring 2.2 m wide by 1.8 m high by 18.5 m long. It is understood that the structure is showing signs of continuing movement and settlement, and there are concerns about its stability. The grade of the existing Highway 11 in the vicinity of the culvert is at approximate Elevation 242.8 m resulting in an embankment height above the culvert in the order of 1.5 to 2 m.

The site is located in a rural area with swamps, creeks and other watercourses nearby. The immediate surroundings of the culvert site are vegetated with grass, low shrubs, bushes and patches of trees. There is no visible bedrock outcrop. Local topography is typically flat with some low rolling hills at a

distance. This site is adjacent to a turnaround point which provides access to a hiking path in the woods.

Based on published geological information, the general area of the project is covered by glacio-lacustrine sediments of clays and silts laid down by the Glacial Lake Barlow-Ojibway. These deposits are mostly varved clays, but massive clays are also present in some areas. Due to the different rates of seasonal deposition during various periods of glaciation, the lower zones of the deposits display much thicker varves than in the upper zones. Below the varved clays are glacial outwash deposits of silts, sands and gravel underlain by Early Precambrian metasedimentary rocks.

3 SITE INVESTIGATION AND FIELD TESTING

This borehole investigation and field testing program was carried out between November 4th and 6th, 2013. The program consisted of drilling and sampling 8 boreholes (identified as BC13-01 through BC13-08) to depths ranging from 6.7 m to 15.8 m (elevations 234.6 to 226.8 m). Of the eight boreholes, two were located in the vicinity of the culvert inlet (BC13-01 and 13-02), two were located in the vicinity of the culvert outlet (BC13-07 and 13-08) and the remaining four boreholes (BC13-03 through 13-06) were located at the highway embankment elevation. The Record of Borehole sheets are included in Appendix A.

The borehole locations were marked in the field and utility clearances were obtained prior to commencement of drilling operations. The coordinates and elevations of the as-drilled boreholes were subsequently provided by Callon Dietz utilizing Digital Terrain Model (DTM), based on borehole location sketches prepared by Thurber. The approximate locations and elevation of the boreholes are shown on the attached Borehole Locations and Soil Strata Drawing included in Appendix C.

A truck mounted drill rig was used to drill and sample the four boreholes advanced from the highway elevation and a track mounted drill rig was used to drill and sample the remaining four boreholes located in the vicinity of the culvert inlet and outlet. Hollow stem augers and NW casing were used to advance the boreholes until the target depth was reached. Soil samples were obtained at select intervals using a 50 mm diameter split spoon sampler in conjunction with Standard Penetration Testing (SPT).

The drilling and sampling operations were supervised on a full time basis by an experienced member of Thurber's technical staff. The recovered soil samples were logged in the field and processed for transportation to Thurber's geotechnical laboratory in Oakville, Ontario for further examinations and testing.

Groundwater conditions in the open boreholes were observed throughout the drilling operations. The details of standpipe piezometer installations and borehole completion are summarized in Table 3-1.

Table 3-1. Borehole Completion and Standpipe Piezometer Installation Details

Borehole Number	Piezometer Tip Position		Borehole Completion and Piezometer Installation Details
	Depth (m)	Elev. (m)	
BC13-01	6.1	234.7	Sand filter from 6.7 to 4.0 m, bentonite holeplug to surface
BC13-02	None Installed		Borehole backfilled with bentonite holeplug to 3.0 m, then sand to surface
BC13-03	None Installed		Borehole backfilled with bentonite holeplug to 50 mm, then sand to surface
BC13-04	None Installed		Borehole backfilled with bentonite holeplug to 100 mm, then sand to surface
BC13-05	None Installed		Borehole backfilled with bentonite holeplug to 100 mm, then sand to surface
BC13-06	None Installed		Borehole backfilled with bentonite holeplug to 50 mm, then sand and gravel to surface
BC13-07	None Installed		Borehole backfilled with sand to 3.9 m, bentonite holeplug to 0.9 m and cuttings to surface
BC13-08	6.1	235.1	Sand filter from 6.7 to 4.3 m, bentonite holeplug to surface

4 LABORATORY TESTING

All recovered soil samples were subjected to Visual Identification (VI) and to natural moisture content determination. Selected soil samples were subjected to grain size distribution analyses (sieve and hydrometer) and plasticity testing (Atterberg Limits). The results of this laboratory testing program are shown on the Record of Borehole sheets in Appendix A and on the figures in Appendix B.

A sample of surface water was submitted to a qualified analytical laboratory, for testing against selected corrosivity parameters.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

5.1 General

Reference is made to the Record of Borehole sheets in Appendix A and the Borehole Locations and Soil Strata Drawings in Appendix C for details of the soil stratigraphy encountered in the boreholes. An overall description of the stratigraphy, based on the conditions encountered in the boreholes, is given in the following paragraphs. However, the factual data presented in the Record of Boreholes governs any interpretation of the site conditions.

In general, the subsurface conditions encountered in the boreholes consist of embankment fill, for boreholes drilled from the highway platform, or a surficial layer of peat or topsoil, for boreholes drilled beyond the toes of the embankment overlying a deposit of silty clay which is underlain by a layer of silt with some sand. These layers are underlain by a deposit of dense

to very dense sandy silt till. More detailed descriptions of the individual stratum encountered within the boreholes are presented below.

5.2 Peat and Topsoil

Peat was encountered at ground surface in Borehole BC13-08 to 1.4 m depth (Elevation 239.7m). This amorphous peat was dark brown in colour, clayey and contains some sand with rootlets and twigs. SPT N-values of 6 and 3 blows per 0.3 m penetration indicated a firm to soft consistency. Measured moisture contents were 17% near the surface and 165% at about 1 m depth. The high value is typically indicative of the organic content.

Peat inclusions of about 0.3 m thick were encountered within the fill at 0.9 to 1 m depth in Boreholes BC13-03 and 13-04. The samples are silty and contained trace clay with wood fibres and trace rootlets. SPT N-values indicates that the peat was in a loose state. Measured moisture contents were in the order of 35% to 40%.

Topsoil of 75 to 100 mm in thickness was encountered surficially in Boreholes BC13-01, 13-02 and 13-07.

The thicknesses of peat and topsoil may vary between and beyond the borehole locations and the limited data is not intended for the purpose of estimating quantities.

5.3 Embankment Fill

Embankment fill was encountered at ground surface in Boreholes BC13-03 through 13-06. The upper portion of the fill (pavement granulars) typically consists of brown to dark brown gravelly sand to sand, some gravel, trace silt and trace clay. Underlying the gravelly sand to sand fill in Borehole BC13-05 and 13-06, and below an interlayer of peat in Boreholes BC13-03 and 13-04, was a layer of brown silt, clayey silt to silty clay fill, trace to some sand and trace gravel. Below the silt fill in Borehole BC13-06 was a localized layer of brown sandy gravel fill with trace silt. Where encountered, the embankment fill extended to depths of 2.3 to 3.0 m (Elevations 240.3 to 239.7 m)

SPT N-values measured in the upper gravelly sand to sand fill typically ranged from 25 to 29 blows per 0.3 m of penetration indicating a compact state. An N-value of 7 blows per 0.3 m of penetration encountered in the underlying sandy gravel fill in Borehole 13-06 indicated a loose state. The moisture contents of the recovered cohesionless fill samples ranged from 5 to 8%.

SPT N-values measured in the silt fill typically ranged from 9 to 11 blows per 0.3 m of penetration indicating loose to compact state. SPT N-values of 5 to 13 blows measured in the clayey silt to silty clay fill indicated a firm to stiff consistency. The moisture contents of the recovered samples of silt, clayey silt to silty clay fill ranged from 12 to 38%.

Four laboratory grain size distribution analyses were performed on samples of the fill. The results of these tests are presented on the corresponding Record of Borehole sheets in Appendix A and the grain size distribution curves are plotted in Figures B1 and B2 of Appendix B. The results are summarized in the following table.

Soil Particles	(%)	(%)
Gravel	26 to 77	0 to 4
Sand	21 to 55	11 to 16
Silt	2 to 19	40
Clay		44 to 45
	Sand/Gravel Fill	Silty Clay Fill

5.4 Silty Clay

A layer of brown silty clay with sand, or trace sand, was encountered below the fill, peat or topsoil in all boreholes. The silty clay ranged from 2.3 to 3.6 m in thickness with an underside depth of 3.7 to 5.6 m (Elevations 237.5 to 236.9 m).

The SPT N-values measured within the silty clay ranged from 1 to 8 blows per 0.3 m of penetration indicating a very soft to firm consistency. An N-Value of 10 blows per 0.3 m of penetration measured within the upper portion of the silty clay in Borehole BC13-06 indicated an occasional stiff zone. Measured moisture contents of the recovered silty clay samples typically ranged from 24% to 67%, with occasional values as high as 97% for a sample containing organics.

Nine laboratory grain size distribution analyses were performed on samples of the silty clay. The results of these tests are presented on the corresponding Record of Borehole sheets in Appendix A and the grain size distribution curves are plotted in Figures B3 and B4 of Appendix B. One set of Atterberg limits tests is plotted on Figure B8. The results are summarized in the following table.

Soil Particles	%
Gravel	0 to 5
Sand	0 to 40
Silt	26 to 70
Clay	28 to 61
Soil Property	%
Liquid Limit	21
Plasticity Index	9

The results of the limits testing indicate that the silty clay is of low plasticity with a group symbol of CL to CL-ML.

5.5 Silt

A layer of silt, some clay, trace sand was encountered below the silty clay in all boreholes. The silt ranged from 1.4 to 2.2 m in thickness with an underside depth of 5.6 to 7.8 m (Elevations 235.6 to 234.8 m)

The SPT N-values measured within the silt ranged from 4 to 19 blows per 0.3 m of penetration indicating a loose to compact state. The moisture contents of the recovered samples of silt ranged from 16 to 25%.

Four laboratory grain size distribution analyses were performed on samples of the silt. The results of these tests are presented on the corresponding Record of Borehole sheets in Appendix A and the grain size distribution curves are plotted in Figure B5 of Appendix B. The results are summarized in the following table.

Soil Particles	(%)
Gravel	0
Sand	0 to 4
Silt	79 to 85
Clay	13 to 17

5.6 Sandy Silt Till

Sandy silt till with some clay to clayey and trace gravel was encountered below the silt layer in all boreholes. The till was brown to grey in colour. The investigated thickness of the sandy silt till ranged from 1.0 to 8.6 m, and all boreholes were terminated in this till at depths of 6.7 to 15.8 m (Elevations 234.1 to 226.8 m).

SPT N-values measured within the sandy silt till ranged from 16 to 79 blows per 0.3 m of penetration to as high as 50 blows for less than 0.3 m penetration, indicating a compact to very dense state. The higher values may be attributed to the presence of cobbles and/or boulders. It is noted that glacial tills inherently contain cobbles and boulders. The moisture contents of the recovered samples of the sandy silt till ranged from 9 to 20%.

Eleven laboratory grain size distribution analyses were performed on the samples of sandy silt till. The results of these tests are presented on the corresponding Record of Borehole sheets in Appendix A and the grain size distribution curves are plotted on Figures B6 and B7 of Appendix B. Results of Atterberg limits tests conducted on three selected samples are plotted on Figure B9 in Appendix B. The results are summarized in the following table.

Soil Particles	(%)
Gravel	0 to 10
Sand	8 to 34
Silt	42 to 65
Clay	10 to 27
Soil Property	%
Liquid Limit	18 to 21
Plasticity Index	6 to 8

Results of the three Atterberg Limits tests indicate that the sandy silt till is of low plasticity with a group symbol of CL-ML.

5.7 Groundwater Conditions

Water levels were observed in the open boreholes during and at the completion of drilling. Standpipe piezometers were installed in Boreholes BC13-01 and 13-08 to permit longer term water level monitoring. The water levels observed in the open boreholes and measured in the piezometers are as follows:

Table 5-1 Groundwater Elevations

Borehole	Date of Reading	Water Level Depth (m)	Water Level Elevation (m)	Comments
BC13-01	Nov. 7, 2013	0.5	240.3	Piezometer
BC13-03	Nov. 5, 2013	0.6	242.0	Open Borehole
BC13-04	Nov. 4, 2013	1.3	241.3	Open Borehole
BC13-06	Nov. 6, 2013	0.6	242.0	Open Borehole
BC13-08	Nov. 7, 2013	0.6	240.6	Piezometer

Where surface water is present, the groundwater level should be assumed to coincide with the local surface or creek water level. Local high water levels, spring snowmelt and periods of significant and/or prolonged precipitation events must be taken into consideration.

6 MISCELLANEOUS

Borehole locations were selected by Thurber. Callon Dietz provided the northing and easting coordinates and ground surface elevations utilizing their DTM based on borehole location sketches provided by Thurber.

Eastern Ontario Diamond Drilling of Hawkesbury, Ontario supplied and operated a truck-mounted and a track-mounted drill rig to carry out the drilling, sampling, in-situ testing operations and standpipe installations.

The drilling and sampling operations in the field were supervised on a full time basis by Mr. Joe Gurzanski and Ms. Eckie Siu of Thurber. Routine laboratory testing was carried out in Thurber's geotechnical laboratory in Oakville, Ontario.

A sample of surface water was submitted to AGAT Laboratories in Mississauga, Ontario for testing against corrosivity parameters.

Overall project management was provided by Mr. Alastair Gorman, P.Eng. Direction of the field and laboratory program was provided by Dr. Sydney Pang, P.Eng. Interpretation of the field data and preparation of this report was completed by Mr. Stephen Peters, P.Eng and Dr. Sydney Pang, P.Eng. The report was reviewed by Mr. Gorman and Dr. P.K. Chatterji, P.Eng, a Designated Principal Contact for MTO Foundations Projects.

THURBER ENGINEERING LTD.

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Project Manager, Senior Foundations Engineer



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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 ⁽¹⁾ '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.

EXPLANATION OF ROCK LOGGING TERMS

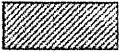




ROCK WEATHERING CLASSIFICATION

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

DISCONTINUITY SPACING

Bedding	Bedding Plane Spacing
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

Rock Strength	Approximate Uniaxial Compressive Strength		Field Estimation of Hardness*
	(MPa)	(psi)	
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.

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			

RECORD OF BOREHOLE No BC13-01

1 OF 1

METRIC

GWP# 5194-13-00 LOCATION Bradburn Creek N 5 509 647.0 E 313 792.6 ORIGINATED BY JG
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2013.11.06 - 2013.11.06 CHECKED BY SKP

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	GR SA SI CL		
240.8	GROUND SURFACE														
0.0 0.1	TOPSOIL: (75mm)														
	Silty CLAY , trace sand, organics Soft to Firm Brown Moist		1	SS	1									97	
			2	SS	3										0 0 39 61
			3	SS	3										
			4	SS	4										0 7 63 30
			5	SS	3										
237.1															
3.7	SILT , some clay, trace sand Compact Brown Moist		6	SS	10										0 4 79 17
			7	SS	14										
235.2															
5.6	Sandy SILT , some clay to clayey, trace gravel Compact to Dense Brown Moist (TILL)		8	SS	30										
234.1															
6.7	END OF BOREHOLE AT 6.7m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.														
	DATE DEPTH (m) ELEV. (m) Nov. 7/13 0.5 240.3														

ONTMT4S 4069.GPJ 2012TEMPLATE(MTO).GDT 1/7/15

RECORD OF BOREHOLE No BC13-02

1 OF 1

METRIC

GWP# 5194-13-00 LOCATION Bradburn Creek N 5 509 643.2 E 313 802.3 ORIGINATED BY JG
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2013.11.06 - 2013.11.06 CHECKED BY SKP

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									
240.6	GROUND SURFACE																
0.0	TOPSOIL: (75mm) Silty CLAY , trace to some sand, trace gravel, organics Soft to Firm Brown Moist																
0.1			1	SS	1		240										
			2	SS	4												
			2	SS	3		239										2 15 50 33
			4	SS	2		238										
			5	SS	3		237										4 12 56 28
236.9	SILT, some clay, trace sand Loose to Compact Brown Moist																
3.7			6	SS	7		236										
			7	SS	13		235										
234.9	Sandy SILT , some clay to clayey, trace gravel Very Dense Brown Moist (TILL)																
5.7			8	SS	48		234									6 25 46 23	
233.9	END OF BOREHOLE AT 6.7m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 3.0m, THEN SAND TO SURFACE.																
6.7																	

ONTMT4S 4069.GPJ 2012TEMPLATE(MTO).GDT 1/7/15

RECORD OF BOREHOLE No BC13-03

1 OF 2

METRIC

GWP# 5194-13-00 LOCATION Bradburn Creek N 5 509 642.4 E 313 787.7 ORIGINATED BY ES
 HWY 11 BOREHOLE TYPE NW/NQ Casing COMPILED BY AN
 DATUM Geodetic DATE 2013.11.05 - 2013.11.05 CHECKED BY SKP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					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							
								20 40 60 80 100							
242.6	GROUND SURFACE														
0.0	Gravelly SAND , trace silt, trace clay Compact Brown Moist (FILL)		1	SS	25		242								26 55 19 (SI+CL)
241.7															
0.9	PEAT , trace clay, trace rootlets, wood fibres Loose		2	SS	7										
241.4	Dark Brown Moist														
1.2	SILT , some clay, trace sand, trace gravel Compact to Loose Brown (FILL) Occasional wood fibres		3	SS	11			241							
			4	SS	9			240							
239.7															
3.0	Silty CLAY , trace sand, occasional wood fibres Firm to Soft Grey Moist		5	SS	8			239							0 0 45 55
			6	SS	2										
			7	SS	2			238							
237.0															
5.6	SILT , some clay, trace sand Compact Grey Wet		8	SS	11		237								
							236								
235.6															
7.0	Sandy SILT , some clay to clayey, trace gravel Dense to Very Dense Grey Moist (TILL)		9	SS	44		235							2 24 51 23	
							234								
			10	SS	68		233								

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15 10 5 10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No BC13-03

2 OF 2

METRIC

GWP# 5194-13-00 LOCATION Bradburn Creek N 5 509 642.4 E 313 787.7 ORIGINATED BY ES
 HWY 11 BOREHOLE TYPE NW/NQ Casing COMPILED BY AN
 DATUM Geodetic DATE 2013.11.05 - 2013.11.05 CHECKED BY SKP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					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						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
								WATER CONTENT (%)						
							20 40 60 80 100							
		</												

RECORD OF BOREHOLE No BC13-04

1 OF 2

METRIC

GWP# 5194-13-00 LOCATION Bradburn Creek N 5 509 636.9 E 313 809.4 ORIGINATED BY ES
HWY 11 BOREHOLE TYPE NW/NQ Coring COMPILED BY AN
DATUM Geodetic DATE 2013.11.04 - 2013.11.04 CHECKED BY SKP

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			SHEAR STRENGTH kPa									
242.6	GROUND SURFACE							20 40 60 80 100									
0.0	SAND , some gravel to gravelly, trace silt, trace clay Compact Dark Brown to Brown Moist (FILL)		1	SS	27		242										
241.7																	
1.0	PEAT , silty, trace clay, trace rootlets		2	SS	8												
241.4	Loose Dark Brown Moist																
1.3	Silty CLAY , some sand, trace gravel Firm to Stiff Brown Moist (FILL) Occasional inferred cobbles		3	SS	9			241									
			4	SS	13			240									
239.7																	
3.0	Silty CLAY , trace sand Soft to Firm Grey Moist		5	SS	3			239									
			6	SS	6												
			1	TW	PH			238									
237.0							237										
5.6	SILT , some clay, trace sand Compact Grey Moist		7	SS	19		236										
235.5																	
7.2	Sandy SILT , some clay to clayey, trace gravel Very Dense Grey Moist (TILL)		8	SS	56/ 0.150		235										
							234										
			9	SS	50/ 0.075		233										

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No BC13-04

2 OF 2

METRIC

GWP# 5194-13-00 LOCATION Bradburn Creek N 5 509 636.9 E 313 809.4 ORIGINATED BY ES
HWY 11 BOREHOLE TYPE NW/NQ Coring COMPILED BY AN
DATUM Geodetic DATE 2013.11.04 - 2013.11.04 CHECKED BY SKP

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			SHEAR STRENGTH kPa										
	Continued From Previous Page							20 40 60 80 100										
	Sandy SILT , some clay to clayey, trace gravel Very Dense Grey Moist (TILL)		10	SS	75		232											
							231											
			11	SS	79		230											
229.4 13.3							229											
	Compact		12	SS	16		228											
227.9 14.8							227											
	Trace Sand, Very Dense		13	SS	74													
226.8 15.8	END OF BOREHOLE AT 15.8m. FREE WATER AT 1.3m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND SAND TO 0.1m, SAND AND GRAVEL TO SURFACE.																	

RECORD OF BOREHOLE No BC13-05

1 OF 2

METRIC

GWP# 5194-13-00 LOCATION Bradburn Creek N 5 509 633.2 E 313 774.5 ORIGINATED BY ES
 HWY 11 BOREHOLE TYPE NW/NQ Coring COMPILED BY AN
 DATUM Geodetic DATE 2013.11.05 - CHECKED BY SKP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					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						
								20 40 60 80 100						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
						WATER CONTENT (%) 20 40 60								
242.6	GROUND SURFACE													
0.0	SAND , some gravel to gravelly, trace silt Compact Dark Brown Moist (FILL)		1	SS	28		242							
241.6														
1.0	Silty CLAY , some sand, trace gravel, trace organics Firm Brown Moist (FILL) Trace rootlets		2	SS	12		241						4 11 40 45	
			3	SS	5									
240.3														
2.3	Silty CLAY , trace sand, trace rootlets Firm Brown Moist		4	SS	6		240							
			5	SS	7		239							
	Occasional wood fibres		6	SS	6		238						0 9 47 44	
			7	SS	4									
237.0							237							
5.6	SILT , some clay, trace sand Compact Grey Moist		8	SS	15		236						0 2 85 13	
235.4														
7.2	Sandy SILT , some clay to clayey, trace gravel Dense to Very Dense Grey Moist (TILL)		9	SS	31		235						10 20 46 24	
							234							
	Occasional cobbles		10	SS	61/ 0.150		233							

Continued Next Page

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

RECORD OF BOREHOLE No BC13-05

2 OF 2

METRIC

GWP# 5194-13-00 LOCATION Bradburn Creek N 5 509 633.2 E 313 774.5 ORIGINATED BY ES
HWY 11 BOREHOLE TYPE NW/NQ Coring COMPILED BY AN
DATUM Geodetic DATE 2013.11.05 - CHECKED BY SKP

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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)				
							20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				W _p W W _L 20 40 60					
	Continued From Previous Page															
	Sandy SILT, some clay to clayey, trace gravel Compact to Dense Grey Moist (TILL)		11	SS	34		232									
							231									
			12	SS	17		230									
							229									
			13	SS	17		228									
							227									
226.8			14	SS	25											
15.8	END OF BOREHOLE AT 15.8m.															

ONTMT4S 4069.GPJ 2012TEMPLATE(MTO).GDT 1/7/15

RECORD OF BOREHOLE No BC13-06

1 OF 2

METRIC

GWP# 5194-13-00 LOCATION Bradburn Creek N 5 509 626.3 E 313 800.0 ORIGINATED BY ES
 HWY 11 BOREHOLE TYPE NW/NQ Casing COMPILED BY AN
 DATUM Geodetic DATE 2013.11.06 - 2013.11.06 CHECKED BY SKP

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)		
242.6	GROUND SURFACE							20	40	60	80	100					GR SA SI CL		
0.0	Gravelly SAND , trace silt Compact Dark Brown to Brown Moist (FILL)		1	SS	29		242							○					
241.7															○				
0.9	Clayey SILT , occasional cobbles Compact Brown Moist (FILL)		2	SS	11											○			
241.2																			
1.4	Sandy GRAVEL , trace silt, occasional cobbles Loose Brown Moist (FILL)		3	SS	7											○			77 21 2 (SI+CL)
240.3																			
2.3	Silty CLAY , trace sand, trace gravel, trace organics, occasional cobble Firm to Stiff Brown Moist		4	SS	10				240							○			
				5	SS		5										○		
			6	SS	7										○		0 0 57 43		
			7	SS	8										○				
237.0																			
5.6	SILT , some clay, trace sand Compact Brown Wet		8	SS	16										○				
234.8																			
7.8	Sandy SILT , with sand, trace gravel Very Dense Grey Moist (TILL)		9	SS	58										○				

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15 10 5 10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No BC13-06

2 OF 2

METRIC

GWP# 5194-13-00 LOCATION Bradburn Creek N 5 509 626.3 E 313 800.0 ORIGINATED BY ES
HWY 11 BOREHOLE TYPE NW/NQ Casing COMPILED BY AN
DATUM Geodetic DATE 2013.11.06 - 2013.11.06 CHECKED BY SKP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100			PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	
								SHEAR STRENGTH kPa							WATER CONTENT (%)			
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE										
	Continued From Previous Page																	
	Sandy SILT , some clay to clayey, trace gravel Very Dense Grey Moist (TILL)		11	SS	61		232					○						
							231											
			12	SS	51		230					○						
229.4																		
13.3	Compact		13	SS	25		229					⊕				1 28 48 23		
							228											
227.8																		
14.8	Very Dense		14	SS	52/ 0.150		227					○						
226.9																		
15.7	END OF BOREHOLE AT 15.7m. FREE WATER AT 0.6m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 0.05m, SAND AND GRAVEL TO SURFACE.																	

RECORD OF BOREHOLE No BC13-07

1 OF 1

METRIC

GWP# 5194-13-00 LOCATION Bradburn Creek N 5 509 626.0 E 313 784.4 ORIGINATED BY JG
 HWY 11 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2013.11.06 - 2013.11.06 CHECKED BY SKP

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			SHEAR STRENGTH kPa								
								20 40 60 80 100								
241.3	GROUND SURFACE															
0.0	TOPSOIL: (100mm) Silty CLAY , with sand, trace gravel Firm Brown Moist Trace sand, some organics Soft to Firm															
0.1																
													</			


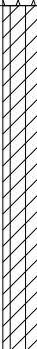


+³, ×³: Numbers refer to Sensitivity 20 15 10 5 0 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No BC13-08

1 OF 1

METRIC

GWP# 5194-13-00 LOCATION Bradburn Creek N 5 509 622.2 E 313 794.1 ORIGINATED BY JG
 HWY 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2013.11.04 - 2013.11.04 CHECKED BY SKP

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 w _P	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L
241.2	GROUND SURFACE																
0.0	PEAT (amorphous), silty clay, trace sand, some organics Firm to Soft Dark Brown Moist to Wet		1	SS	6												
			2	SS	3												
239.7																	
1.4	Silty CLAY , trace sand, trace gravel, trace organics Firm Brown Moist		3	SS	4												
			4	SS	6												
			5	SS	4												
237.4																	
3.7	SILT , some clay, trace sand Loose Brown Moist		6	SS	4												
			7	SS	7												
235.5																	
5.6	Sandy SILT , some clay to clayey, trace gravel Very Dense Brown Moist (TILL)		8	SS	59												
234.5																	
6.7	END OF BOREHOLE AT 6.7m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. DATE DEPTH (m) ELEV. (m) Nov. 7/13 0.6 240.6																

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

Appendix B

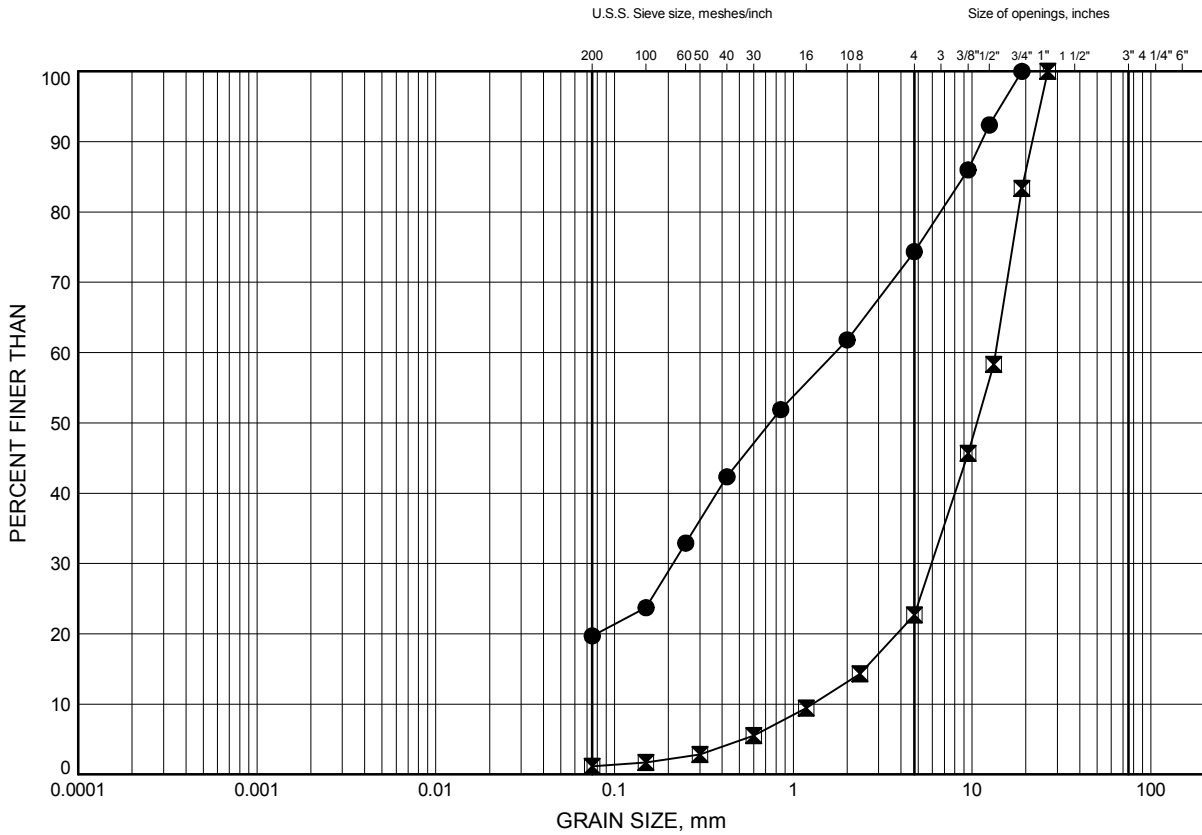
Laboratory Test Results

Hwys 11, 583, 652 Culverts - Foundations

GRAIN SIZE DISTRIBUTION

FIGURE B1

GRAVELLY 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)
●	BC13-03	0.30	242.33
⊠	BC13-06	1.83	240.79

Date January 2015
GWP# 5194-13-00



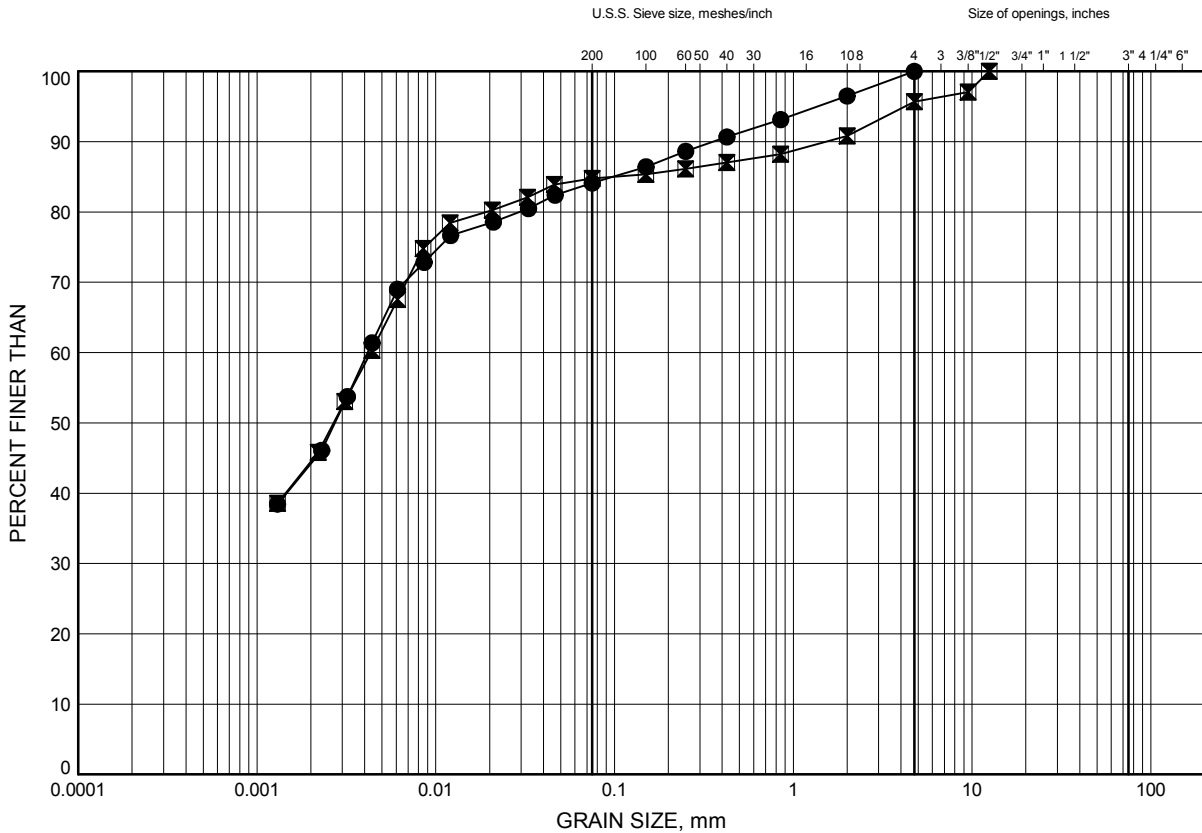
Prep'd AN
Chkd. SKP

Hwys 11, 583, 652 Culverts - Foundations

GRAIN SIZE DISTRIBUTION

FIGURE B2

SILTY CLAY FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BC13-04	1.31	241.34
⊠	BC13-05	1.07	241.54

Date January 2015
GWP# 5194-13-00

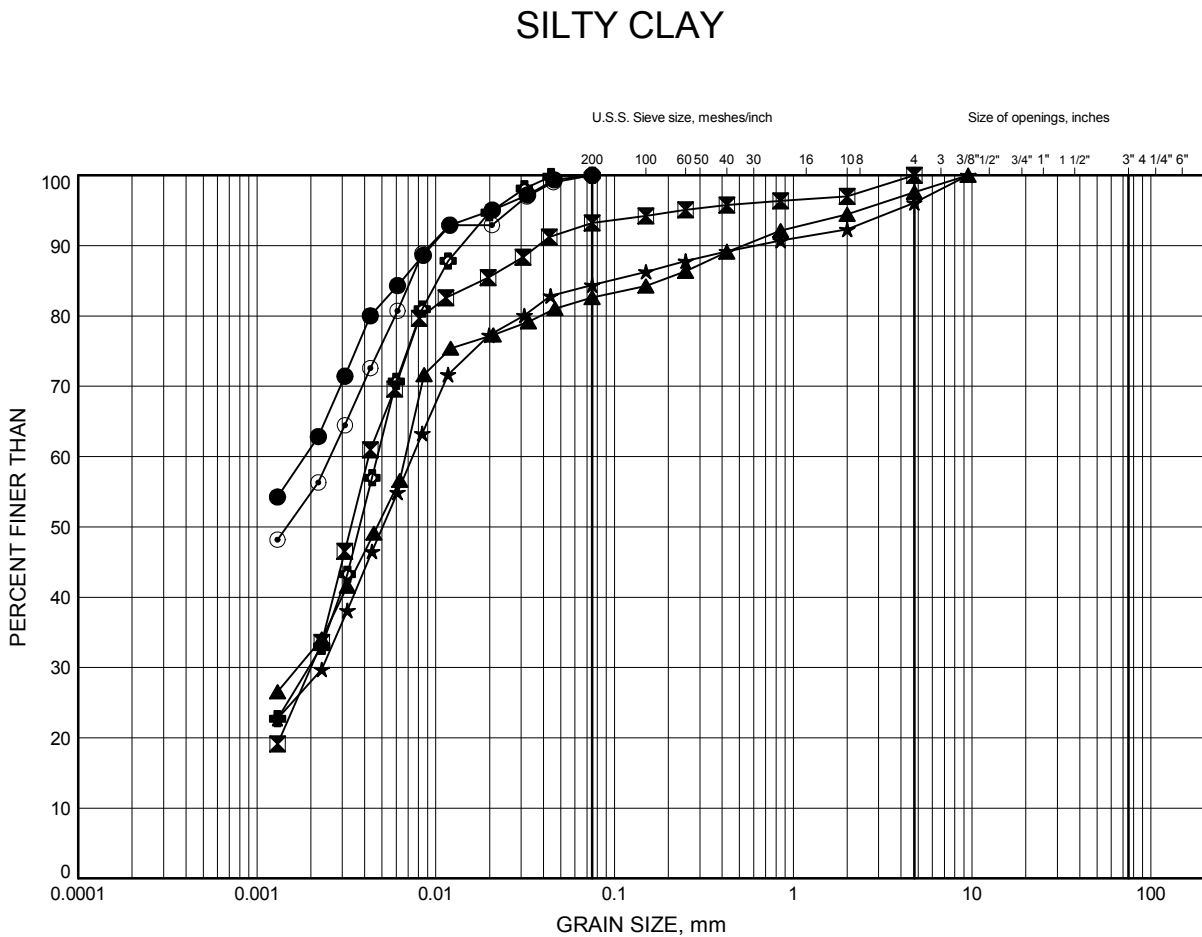


Prep'd AN
Chkd. SKP

Hwys 11, 583, 652 Culverts - Foundations

GRAIN SIZE DISTRIBUTION

FIGURE B3



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BC13-01	1.07	239.77
⊠	BC13-01	2.59	238.25
▲	BC13-02	1.83	238.77
★	BC13-02	3.35	237.25
⊙	BC13-03	3.35	239.28
⊕	BC13-04	4.11	238.53

Date January 2015

GWP# 5194-13-00



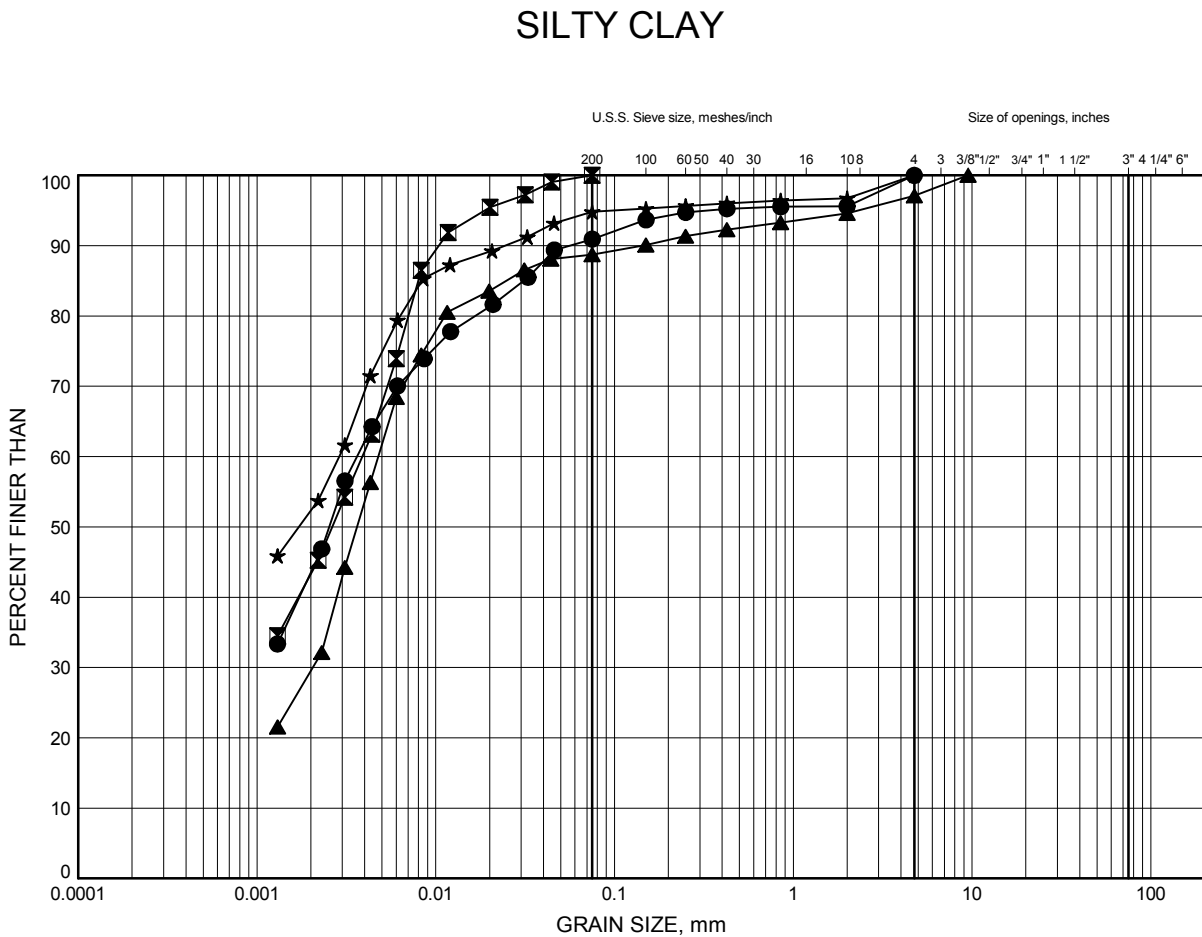
Prep'd AN

Chkd. SKP

Hwys 11, 583, 652 Culverts - Foundations

GRAIN SIZE DISTRIBUTION

FIGURE B4



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BC13-05	4.11	238.49
⊠	BC13-06	4.11	238.50
▲	BC13-07	2.59	238.67
★	BC13-08	1.83	239.33

Date January 2015

GWP# 5194-13-00



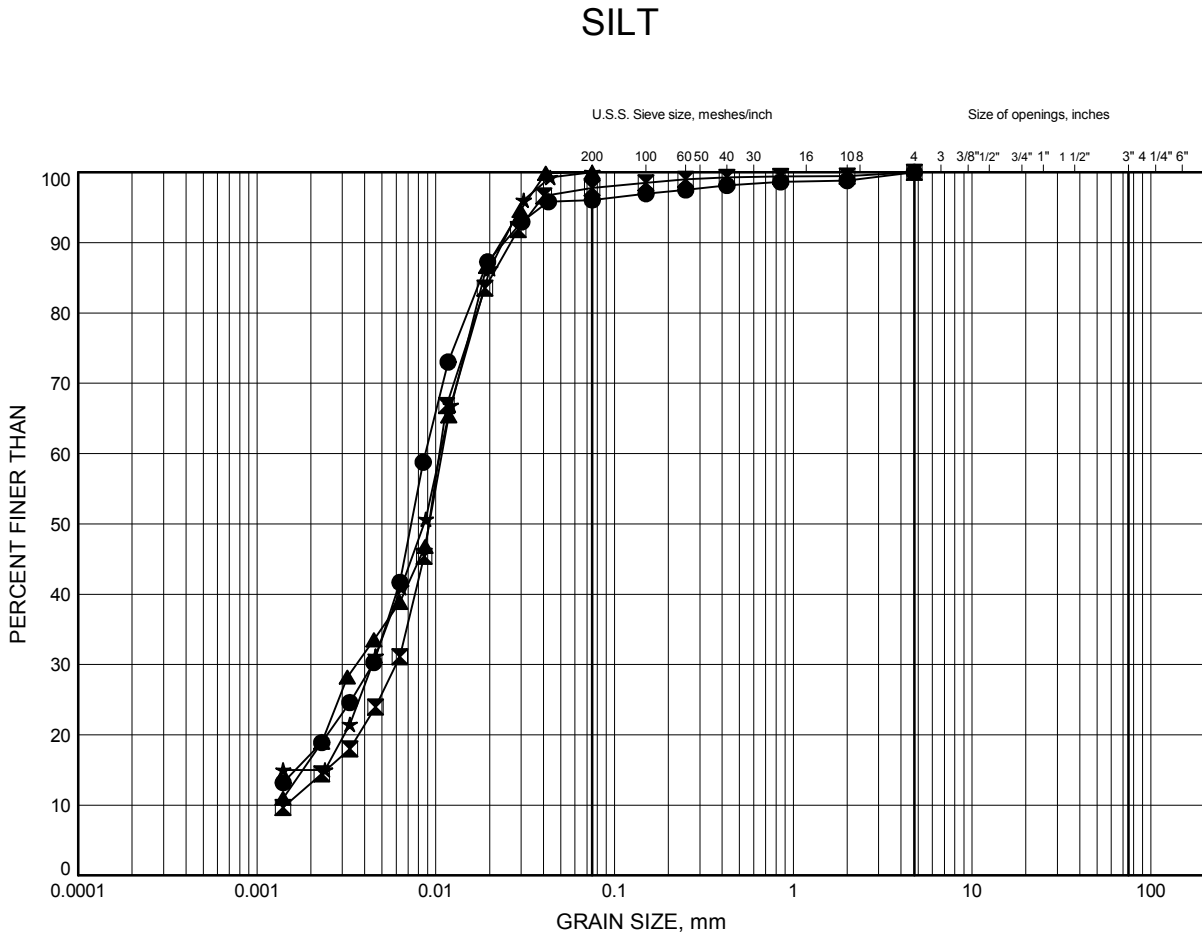
Prep'd AN

Chkd. SKP

Hwys 11, 583, 652 Culverts - Foundations

GRAIN SIZE DISTRIBUTION

FIGURE B5



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BC13-01	4.11	236.73
⊠	BC13-05	6.40	236.20
▲	BC13-07	4.88	236.38
★	BC13-08	4.11	237.04

Date January 2015
GWP# 5194-13-00



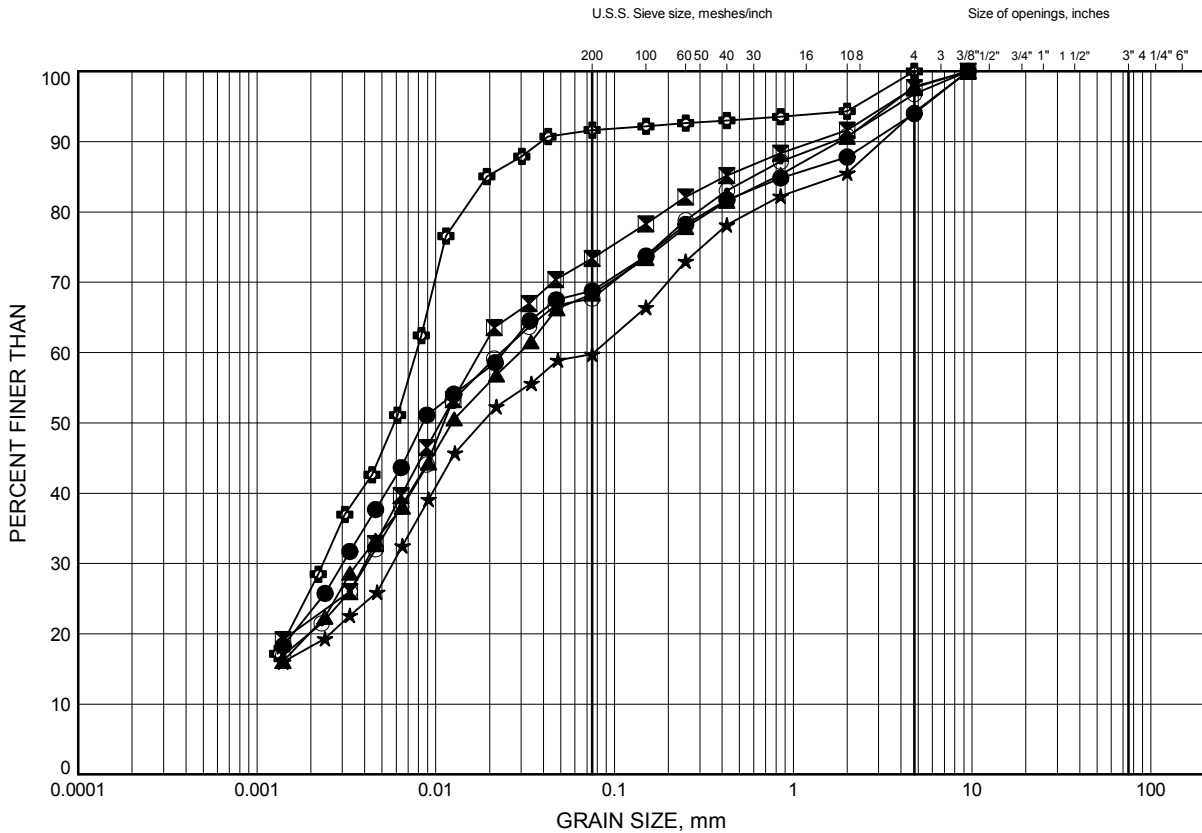
Prep'd AN
Chkd. SKP

Hwys 11, 583, 652 Culverts - Foundations

GRAIN SIZE DISTRIBUTION

FIGURE B6

SANDY SILT TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BC13-02	6.40	234.20
⊠	BC13-03	7.92	234.71
▲	BC13-03	12.50	230.14
★	BC13-04	9.33	233.31
⊙	BC13-04	14.02	228.62
⊕	BC13-04	15.54	227.10

Date January 2015

GWP# 5194-13-00



Prep'd AN

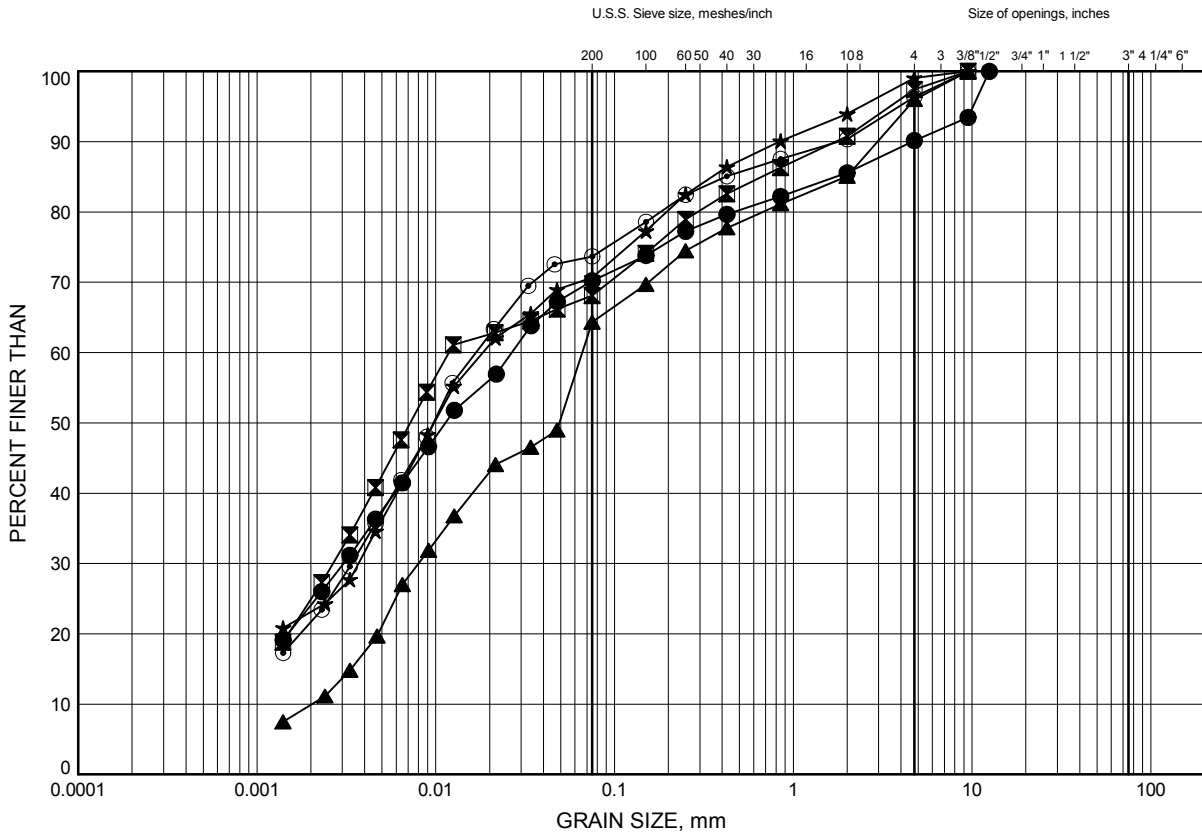
Chkd. SKP

Hwys 11, 583, 652 Culverts - Foundations

GRAIN SIZE DISTRIBUTION

FIGURE B7

SANDY SILT TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BC13-05	7.92	234.68
⊠	BC13-05	14.02	228.58
▲	BC13-06	9.37	233.25
★	BC13-06	14.02	228.60
⊙	BC13-08	6.40	234.76

Date January 2015

GWP# 5194-13-00



Prep'd AN

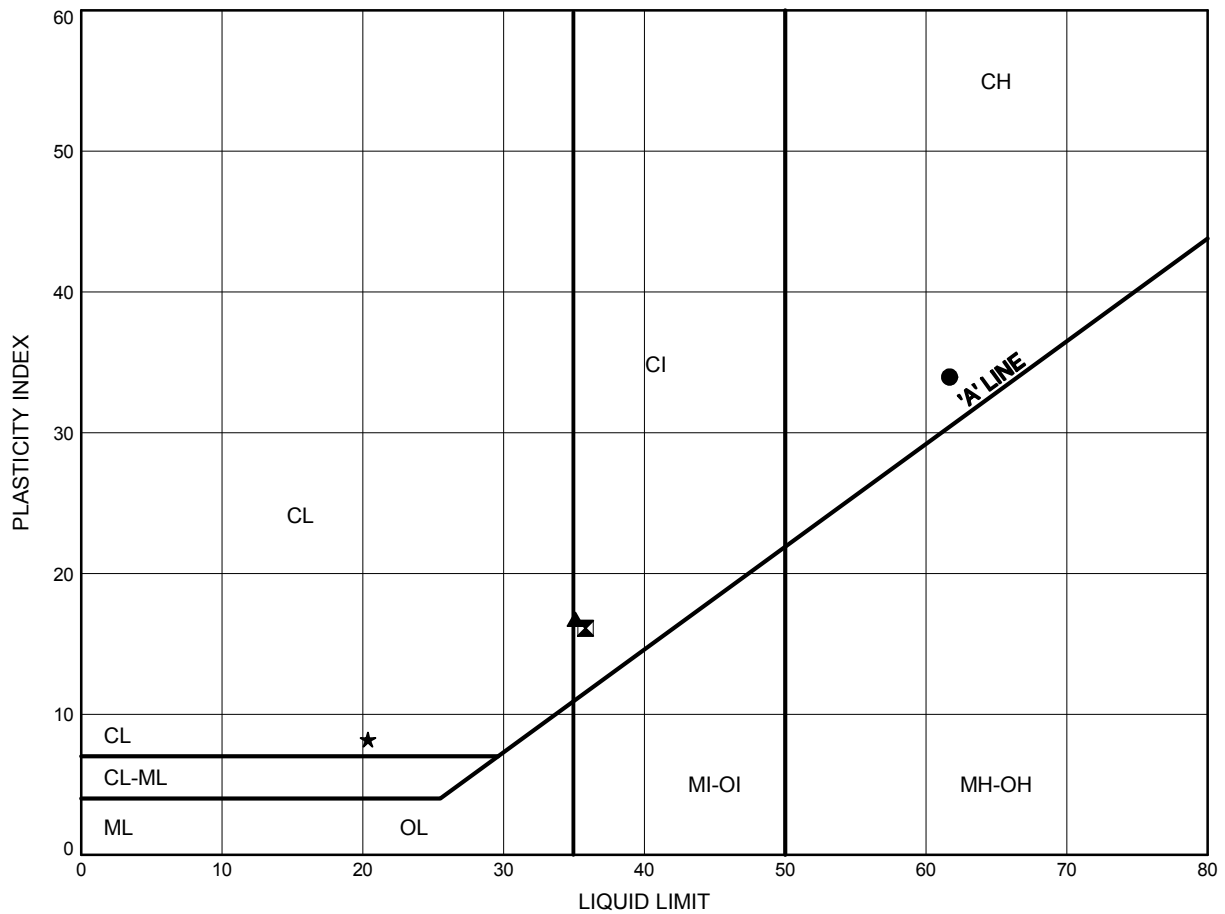
Chkd. SKP

Hwys 11, 583, 652 Culverts - Foundations

ATTERBERG LIMITS TEST RESULTS

FIGURE B8

SILTY CLAY



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BC13-01	1.07	239.77
⊠	BC13-02	1.83	238.77
▲	BC13-05	4.11	238.49
★	BC13-05	7.92	234.68

Date January 2015

GWP# 5194-13-00



Prep'd AN

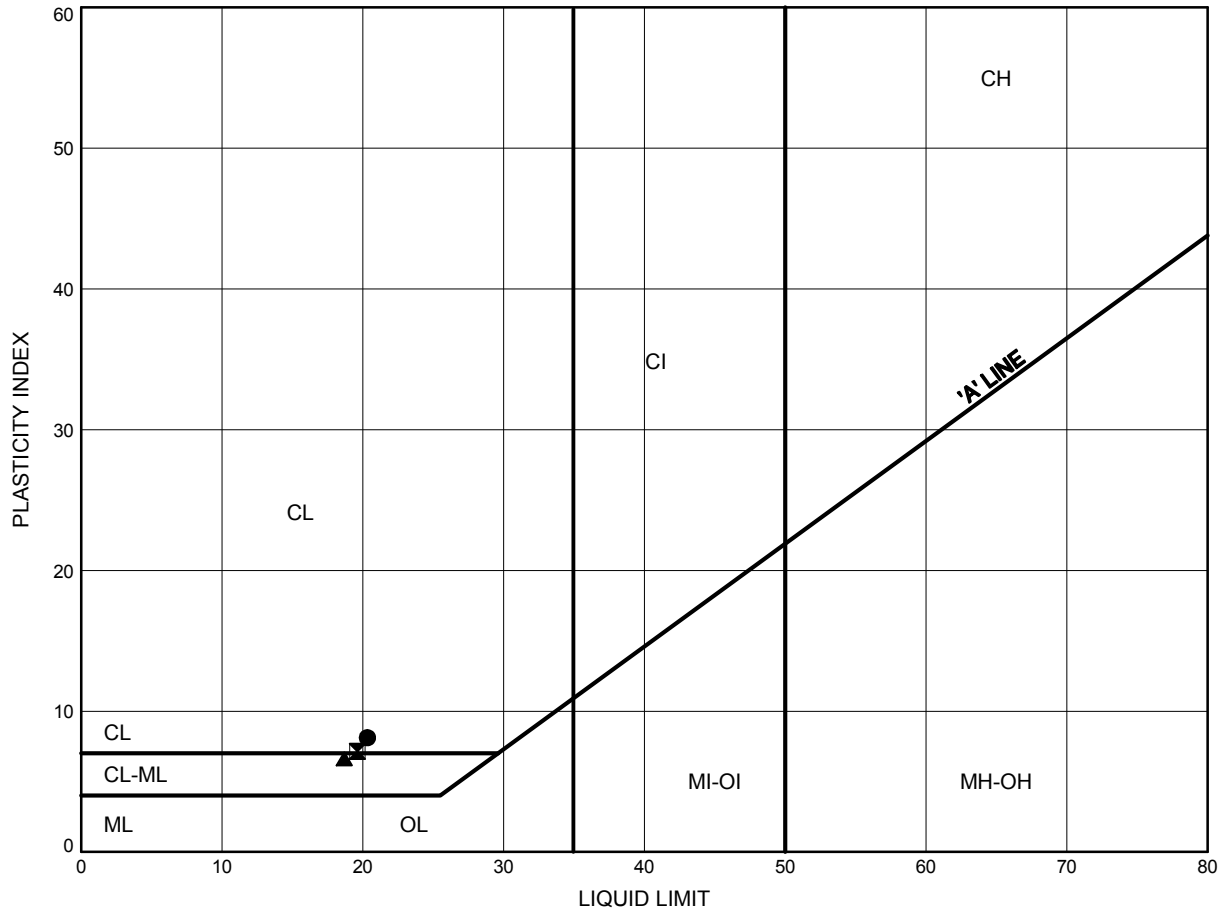
Chkd. SKP

Hwys 11, 583, 652 Culverts - Foundations

ATTERBERG LIMITS TEST RESULTS

FIGURE B9

SANDY SILT TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BC13-03	7.92	234.71
⊠	BC13-04	14.02	228.62
▲	BC13-06	14.02	228.60

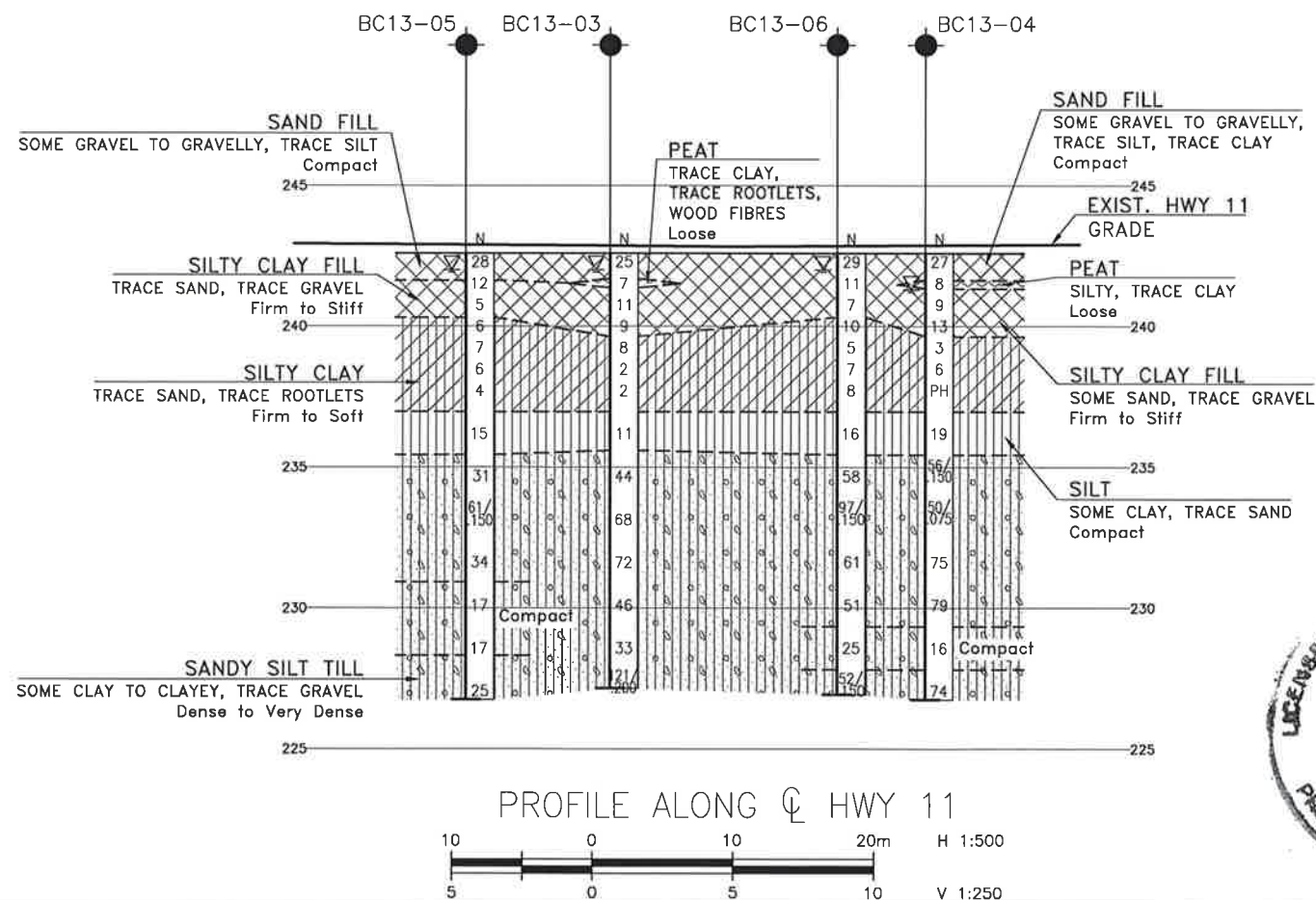
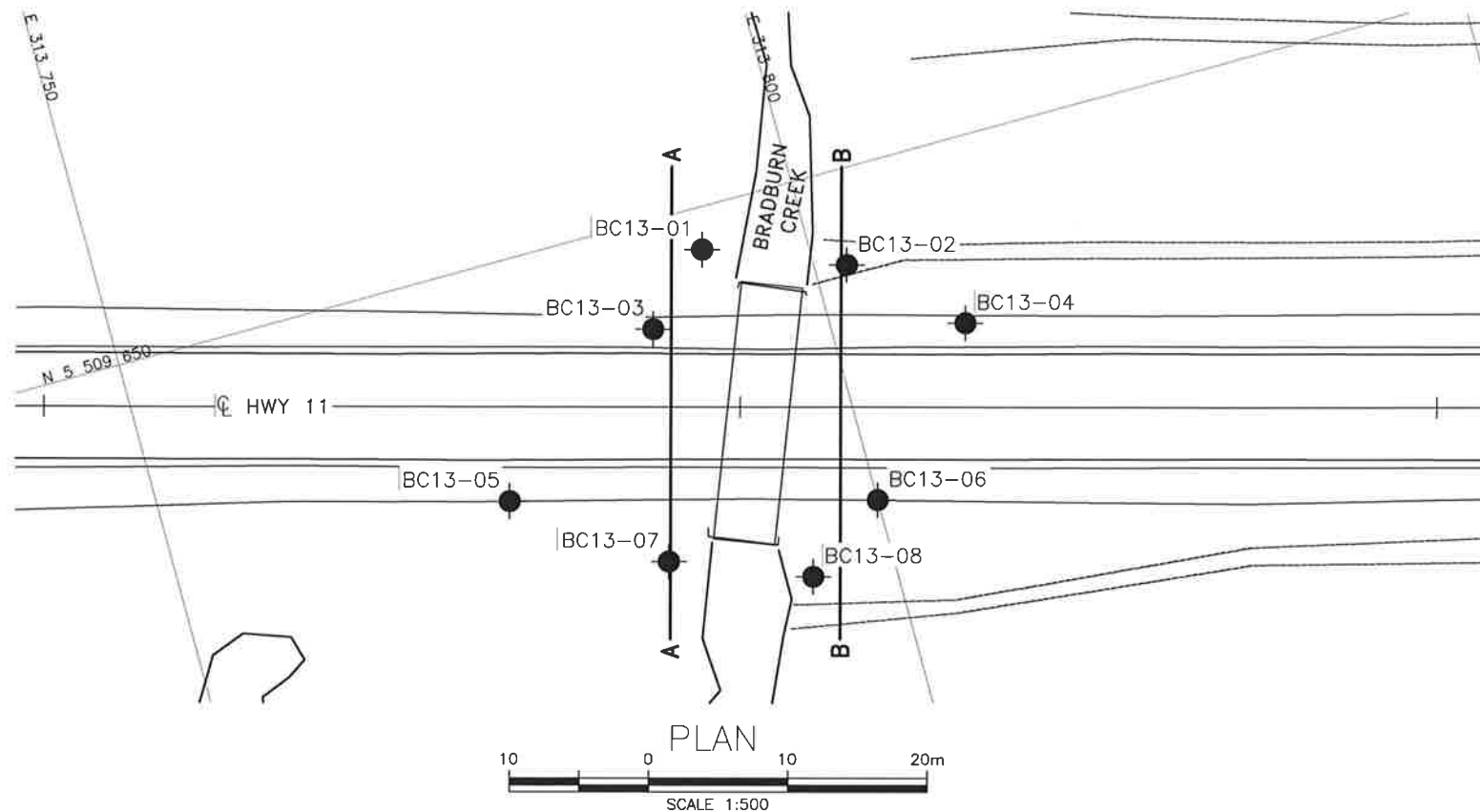
Date January 2015
GWP# 5194-13-00



Prep'd AN
Chkd. SKP

Appendix C

Borehole Locations and Soil Strata Drawings



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

CONT No
GWP No 5194-13-00



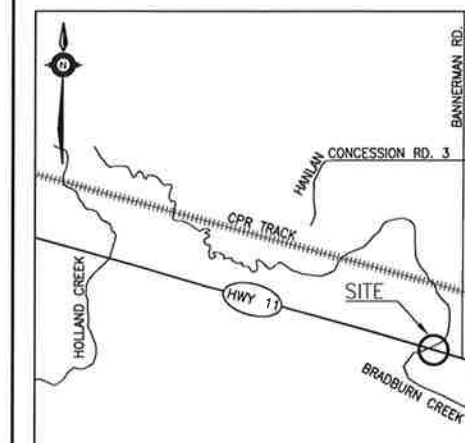
HIGHWAY 11
BRADBURN CREEK
CULVERT REPLACEMENT I
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

URS



THURBER ENGINEERING LTD.



LEGEND

- Borehole
- ⊕ Borehole and Cone
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60' Cone, 475J/blow)
- WH Weight Hammer
- PH Pressure, Hydraulic
- W Water Level
- HA Head Artesian Water
- PZ Piezometer
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
BC13-01	240.8	5 509 647.0	313 792.6
BC13-02	240.6	5 509 643.2	313 802.3
BC13-03	242.6	5 509 642.4	313 787.7
BC13-04	242.6	5 509 636.9	313 809.4
BC13-05	242.6	5 509 633.2	313 774.5
BC13-06	242.6	5 509 626.3	313 800.0
BC13-07	241.3	5 509 626.0	313 784.4
BC13-08	241.2	5 509 622.2	313 794.1

-NOTES-

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

GEOCREs No. 42G-53



DATE	BY	DESCRIPTION
DESIGN	SKP	CHK SKP
DRAWN	AN	CHK AEG
		SITE 39W-232C
		STRUCT
		DWG 2

