FOUNDATION INVESTIGATION REPORT
CULVERT REPLACEMENT AT WALLY CREEK
SITE NO. 39E-227
HIGHWAY 652
COCHRANE AREA, ONTARIO
G.W.P. No. 5193-13-00

GEOCRES Number: 42H-57

Report to

URS Canada Inc.

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H:\19\4406\9 Highways 11, 583, 652 Culverts 5012-E-0033-Foundations\Reports & Memos\Wally Creek\1944069 Hwy 652 Wally Creek FINAL FIR text 2015-01-08.doc

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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 where replacement is proposed on Highway 652 over Wally Creek, located in the Township of Stimson, in the Cochrane Area, Ontario.

The purpose of this investigation was to obtain subsurface information at the location of the culverts and, based on the data obtained, to provide a borehole location plan, a stratigraphic profile, cross-sections, 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 foundations 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 652, in the Township of Stimson, approximately 28 kilometres east of Highway 11/579. The culvert allows Wally Creek to flow from north to south under Highway 652.

The existing structure, constructed in 1964, consists of twin Structural Steel Plate Pipe (SPP) culvert each with a 2.0 m span and 20.0 m long. It is understood that the structure is in poor condition with deterioration of several elements. The grade of the existing Highway 652 in the vicinity of the culvert is at approximate Elevation 300.1 m resulting in an embankment height above the culvert in the order of 1.7 to 1.8 m.

Naturally low-lying, swampy areas are present near the inlet and outlet of the culvert, with vegetation consisting of tall grass and shrubs with occasional trees. Local topography is of low relief with no visible bedrock outcrops. Areas surrounding the properties are heavily forested. The area in the

immediate vicinity of the culvert is undulating and generally sloping from the highway grade to the creek. There is a parking area located north-east of the existing culvert.

The site is located in a rural area with swamps, creeks and other watercourses nearby. The surrounding areas are covered by forests and low shrubs and bushes with no visible bedrock outcrops. Local topography is generally flat with some low sloping hills. This particular 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 (Superior Province) metasedimentary rocks.

3 SITE INVESTIGATION AND FIELD TESTING

This borehole investigation and field testing program was carried out on October 4, 5, 6 and 9, 2013. The program consisted of drilling and sampling eight boreholes (identified as WC13-01 through 08) to depths ranging from 6.7 to 17.2 m (Elev. 292.0 to 282.7 m) with Dynamic Cone Penetration Tests (DCPT's) continuing below the base of selected boreholes to depths ranging from 22.3 to 25.0 m (Elevations 277.7 to 274.9 m). Of the eight total boreholes, two were located in the vicinity of the culvert inlet (WC13-01 and 02), two were located in the vicinity of the culvert outlet (WC13-07 and 08), and the remaining four boreholes (WC13-03 through 06) were located at the highway embankment level.

The borehole locations were marked in the field and utility clearances were obtained prior to commencement of drilling operations. The coordination and elevation 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 CME75 drill rig was used to drill and sample boreholes WC13-03, 04 and 06 using NW casing drilling techniques. A track mounted drill rig was used to drill and sample boreholes WC13-01, 02 and 05 using hollow stem auger drilling techniques. The remaining two boreholes (WC13-07 and 08), drilled near the culver inlet, were advanced with tri-pod rig using NW casing. DCPT's were conducted below the last samples in Boreholes WC13-04, 05 and 06 until blow count refusal was met.

Soil samples were obtained at select intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT). Field vane testing was carried out to measure in-situ, undrained shear strength of the cohesive soils at selected locations.

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 examination and testing.

Groundwater conditions in the open boreholes were observed throughout the drilling operations. Two standpipe piezometers were installed in Borehole WC13-01 and WC13-08 for monitoring of the groundwater level. The details of piezometer installations and borehole completion are summarized in Table 3-1.

Table 3-1. Borehole Completion and Piezometer Installation Details

Borehole Number	Piezometer Installations			Completion Details
	Screen Depth (m)	Screen Elevation (m)	Sand Filter Stratum	
WC13-01	4.3 – 5.9	294.3 -292.7	Silty Clay	Bentonite hole plug and cuttings
WC13-02	None Installed			Bentonite holeplug and cuttings to surface
WC13-03	None Installed			Sand and Holeplug to 0.1 m and asphalt cold patch at surface
WC13-04	None Installed			Bentonite holeplug to 0.2 m and cuttings to surface
WC13-05	None Installed			Bentonite holeplug to surface.
WC13-06	None Installed			Bentonite holeplug to 0.1 m and a mixture of cuttings and bentonite holeplug to surface.
WC13-07	None Installed			Bentonite holeplug to 5.8 m and cuttings to surface.
WC13-08	4.6 – 6.7	293.6-291.5	Silty Clay	Bentonite to surface

Results of field drilling and sampling are presented on the Record of Borehole sheets in Appendix A.

A member of Thurber's technical staff supervised the drilling and sampling operations on a full time basis. The supervisor logged the boreholes, secured the recovered soil samples in labelled containers, and transported the samples to Thurber's laboratory for further examination and testing.

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 located at the highway level consists of embankment fill overlying a deposit of native silty clay. Boreholes located at the culvert inlet and outlet encountered topsoil overlying a native clay deposit. More detailed descriptions of the individual stratum are presented below.

5.2 Topsoil and Peat

Topsoil, ranging from 50 to 100 mm in thickness, was encountered at the surface in Boreholes WC13-01, 02, 07, and 08. A 1.0 m thick layer of buried peat with pieces of wood was encountered below the sand fill in Borehole WC13-04. The peat was firm in consistency with a moisture content of 491%.

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

5.3 Asphalt

A 20 to 75 mm thick layer of asphalt was encountered at the surface in Boreholes WC13-03 through 06 drilled from the highway level.

5.4 Fill

Embankment fill was encountered below the asphalt in Boreholes WC13-03 through 06. The fill layer typically consists of brown sand with some gravel to gravelly, trace silt underlain by sand, trace to some silt, trace gravel. Where encountered, the embankment fill extended to depth of 1.4 to 3.7 m (Elev. 298.6 to 296.2 m).

SPT N-values measured in the embankment fill typically ranged from 4 to 59 blows per 300 mm of penetration indicating a loose to very dense relative density, to as high as 50 blows per 150 m penetration. The moisture contents of the recovered samples ranged from 2 to 21%.

Three laboratory grain size 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 on Figure B1 of Appendix B. These results are summarized in the following table.

Soil Particles	%
Gravel	1 to 17
Sand	80 to 96
Silt and Clay	3 to 10

5.5 Sand

A layer of sand, trace silt to silty was encountered below the topsoil in Boreholes WC13-01, 07 and 08. The thickness of the sand ranged from 0.7 to 1.5 m with a corresponding underside depth of 0.8 to 1.6 m (Elev. 297.7 to 297.0 m).

SPT N-values measured in the sand ranged from 1 to 4 blows per 300 mm of penetration, indicating very loose relative density. The moisture contents of the recovered soil samples ranged from 13 to 53%.

The gradation of the sand layer is summarized below and in the grain size distribution curves plotted on Figure B4 of Appendix B.

Soil Particles	%
Gravel	3
Sand	94
Silt and Clay	3

5.6 Silty Clay

A layer of silty clay, trace to some sand, trace gravel was encountered below the layers noted above in all boreholes. The investigated thicknesses of the silty clay ranged from 2.4 to 14.0 m with a corresponding underside depth of 7.0 to 17.2 m (Elev. 292.0 to 282.7 m). All borehole sampling was terminated within the silty clay.

SPT N-values measured within the silty clay typically ranged from 0 (static weight of hammer) to 12 blows per 300 mm of penetration, indicating very soft to stiff consistency. A firm crust was noted in the upper 1 to 1.5 m. An N-value of 35 blows per 300 mm of penetration was recorded in Borehole WC13-08, indicating a localized hard zone. The vane tests indicate a range of undrained shear strengths of 18 to 50 kPa. The measured moisture contents of the recovered samples typically ranged from 19% to 67%.

Fourteen grain size analyses were performed on samples of the silty clay. The results are presented on the corresponding Record of Borehole sheets in Appendix A and the grain size distribution curves are plotted on Figures B2, B3 and B4 of Appendix B. These results are summarized in the following table.

Soil Particles	%
Gravel	0 to 4
Sand	0 to 15
Silt	19 to 77
Clay	23 to 80
Soil Property	**%**
Liquid Limit	29 - 65
Plasticity Index	14 - 36

The results of the Atterberg Limits tests performed on 16 samples of the silty clay are plotted in Figure B5 through B7 of Appendix B. The results of the tests are summarized above and indicate that the silty clay ranges from low to high plasticity, but predominately exhibits intermediate plasticity.

5.7 Groundwater Conditions

Water levels were observed in the open boreholes during and upon completion of drilling. Standpipe piezometers were installed in Boreholes WC13-01 and 08 to permit longer term monitoring. The water levels observed in the open boreholes and measured in the piezometer are as follows:

Table 5-1 Groundwater Elevations

Borehole	Date of Reading	Water Level Depth (m)	Water Level Elevation (m)	Comments
13-01	November 1, 2013	0.2	298.4	Piezometer
	November 7, 2013	0.2	298.4	Piezometer
13-08	November 1, 2013	0.2	298.0	Piezometer
	November 7, 2013	0.2	298.0	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 also be taken into consideration.

6 MISCELLANEOUS

Borehole locations were selected by Thurber. Callon Dietz provided northing and easting coordinates and ground surface elevation for the as-drilled locations utilizing DTM, based on borehole location sketches provided by Thurber.

Downing Drilling of Hawkesbury, Ontario supplied and operated a truck-mounted drill rig, a track-mounted drill rig, and a tri-pod drill 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. Stephane Loranger and Ms. Kathrine Young of Thurber. Routine laboratory testing was carried out by Thurber's geotechnical laboratory in Oakville, Ontario.

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

THURBER ENGINEERING LTD.

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Appendix A

Record of Borehole Sheets

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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.

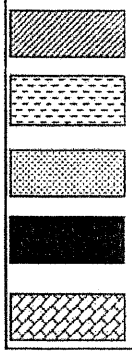
(2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of 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			

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RECORD OF BOREHOLE No WC13-01 1 OF 1 METRIC

GWP# 5114-09-01 LOCATION Wally Creek Culvert N 5 435 099.2 E 329 317.4 ORIGINATED BY KMY

HWY 652 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2013.10.05 - 2013.10.05 CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
298.6											
0.0	**TOPSOIL:** (100 mm), trace sand, trace rootlets		1	SS	4						3 94 3 (SI+CL)
0.1	**SAND**, trace to some silt, trace gravel Loose to Very Loose Light Brown Moist to Wet		2	SS	1		298				Split spoon wet
297.0			3	SS	1		297				
1.6	Silty **CLAY**, trace to some sand, trace organics Firm to Soft Grey Moist		4	SS	7		296	1.2			
			5	SS	3		295	2.8			0 13 45 42
			6	SS	1		294				
291.6							293				
7.0	END OF BOREHOLE AT 7.0 m. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Nov. 1/13 0.2 298.4 Nov. 7/13 0.2 298.4						292	1.7			

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \cdot 10 \cdot 5}$ (%) STRAIN AT FAILURE

ONTMT4S 4069.GPJ 2012TEMPLATE(MTO).GDT 12/23/13

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RECORD OF BOREHOLE No WC13-02 1 OF 1 METRIC

GWP# 5114-09-01 LOCATION Wally Creek Culvert N 5 435 092.6 E 329 336.0 ORIGINATED BY KMY

HWY 652 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2013.10.05 - 2013.10.05 CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
299.0											
0.0	**TOPSOIL**, trace sand, trace rootlets										
0.0	Silty **CLAY**, trace to some sand, trace gravel Stiff to to Firm Grey Moist		1	SS	8		299				
			2	SS	4		298				
			3	SS	4		297				
			4	SS	12						4 5 33 58
							296				
			5	SS	3		295				
			6	SS	1		294				
			7	SS	1		293				0 12 40 48
292.0											
7.0	END OF BOREHOLE AT 7.0 m. BOREHOLE BACKFILLED WITH CUTTINGS AND BENTONITE HOLEPLUG TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE
10

ONTMT4S 4069.GPJ 2012TEMPLATE(MTO).GDT 12/23/13

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RECORD OF BOREHOLE No WC13-03 1 OF 2 METRIC

GWP# 5114-09-01 LOCATION Wally Creek Culvert N 5 435 090.6 E 329 317.9 ORIGINATED BY SLL

HWY 652 BOREHOLE TYPE NW Casing COMPILED BY AN

DATUM Geodetic DATE 2013.10.05 - 2013.10.05 CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
299.9											
0.0	**ASPHALT:** (25 mm)										
	SAND, some gravel to gravelly Very Dense Brown Moist (FILL)		1	SS	50/ 0.150						
299.3 0.6											
	SAND, trace silt, trace gravel, occasional cobbles Very Dense to Loose Brown Moist (FILL)		2	SS	59	▽	299				4 86 10 (SI+CL)
			3	SS	15		298				
			4	SS	5						Split spoon wet
			5	SS	4		297				
296.2											
3.7	Silty **CLAY**, trace to some sand Firm to soft Grey Moist		6	SS	7		296				0 1 40 59
			7	SS	4		295	4.0			
			8	SS	2		294				
			9	SS	2		293	3.0			
							292	2.0			
			10	SS	WH		291				
							290				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \cdot 10 \cdot 5}$ (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No WC13-03 2 OF 2 METRIC

GWP# 5114-09-01 LOCATION Wally Creek Culvert N 5 435 090.6 E 329 317.9 ORIGINATED BY SLL

HWY 652 BOREHOLE TYPE NW Casing COMPILED BY AN

DATUM Geodetic DATE 2013.10.05 - 2013.10.05 CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100) ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, trace to some sand Firm to soft Grey Wet							3.0			
288.8			11	SS	12		289				
11.1	Sandy										
288.2											
11.7							288				
			12	SS	PH						
							287				
			13	SS	WH		286				0 6 24 70
								5.0			
							285				
			14	SS	WH						
283.6							284	5.0			
16.3	END OF BOREHOLE AT 15.8 m. BOREHOLE OPEN TO 1.7 m AND WATER LEVEL AT 1.5 m. BOREHOLE BACKFILLED WITH SAND TO 0.1 m, THEN ASPHALT TO SURFACE.										

+ ^{3}, × ^{3}: Numbers refer to Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

ONTMT4S 4069.GPJ 2012TEMPLATE(MTO).GDT 12/23/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No WC13-04 1 OF 3 METRIC

GWP# 5114-09-01 LOCATION Wally Creek Culvert N 5 435 085.2 E 329 344.0 ORIGINATED BY SLL

HWY 652 BOREHOLE TYPE NW Casing COMPILED BY AN

DATUM Geodetic DATE 2013.10.05 - 2013.10.05 CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
300.0											
0.0	**ASPHALT:** (20mm)						300				
	SAND, some gravel to gravelly, trace silt, with asphalt fragments		1	SS	50/ 0.150						
299.5 / 0.5	Very Dense Brown Moist (FILL)		2	SS	24		299				
	SAND, trace silt, trace gravel Compact										
298.6 / 1.4	Brown Moist (FILL)		3	SS	8	▽			491		
	PEAT, with wood pieces and roots Firm Black						298				
297.6 / 2.4	Wet		4	SS	8						
	Silty **CLAY**, trace to some sand Firm to Soft Brown Moist						297				
			5	SS	7						
			6	SS	2		296				0 0 41 59
	With silt pockets		7	SS	1		295	4.0			
			8	SS	WH		294				
							293	3.0			
			9	SS	WH		292				0 15 33 52
								3.0			
			10	SS	1		291				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \cdot 5}$ (%) STRAIN AT FAILURE

ONTMT4S 4069.GPJ 2012TEMPLATE(MTO).GDT 12/23/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No WC13-04 2 OF 3 METRIC

GWP# 5114-09-01 LOCATION Wally Creek Culvert N 5 435 085.2 E 329 344.0 ORIGINATED BY SLL

HWY 652 BOREHOLE TYPE NW Casing COMPILED BY AN

DATUM Geodetic DATE 2013.10.05 - 2013.10.05 CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100): ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, trace to some sand Firm to Soft Brown Moist						290	2.0			
			11	SS	WH		289		○		
								3.0			
							288				
			12	SS	WH				○		0 7 31 62
							287	4.0			
			13	SS	WH		286		○		
								6.0			
284.2			14	SS	WH		285		○		
15.8	End of sampling at 15.8 m and start DCPT						284	3.0			
							283				
							282				
							281				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \cdot 10 \cdot 5}$ (%) STRAIN AT FAILURE

ONTMT4S 4069.GPJ 2012TEMPLATE(MTO).GDT 12/23/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No WC13-04 3 OF 3 METRIC

GWP# 5114-09-01 LOCATION Wally Creek Culvert N 5 435 085.2 E 329 344.0 ORIGINATED BY SLL

HWY 652 BOREHOLE TYPE NW Casing COMPILED BY AN

DATUM Geodetic DATE 2013.10.05 - 2013.10.05 CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page						280				
							279				
277.7							278				
22.3	END OF BOREHOLE AND DCPT AT 22.3 m ON PROBABLE BEDROCK. BOREHOLE OPEN TO 1.9 m AND WATER LEVEL AT 1.7 m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 0.2 m AND CUTTINGS TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

20
15 5
10
(%) STRAIN AT FAILURE

ONTMT4S 4069.GPJ 2012TEMPLATE(MTO).GDT 12/23/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No WC13-05 1 OF 3 METRIC

GWP# 5114-09-01 LOCATION Wally Creek Culvert N 5 435 083.5 E 329 307.3 ORIGINATED BY KMY

HWY 652 BOREHOLE TYPE Casing COMPILED BY AN

DATUM Geodetic DATE 2013.10.09 - 2013.10.09 CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
299.9											
0.0	**ASPHALT:** (75 mm)		1	AS							
0.1	**SAND**, some gravel to gravelly, trace silt Very Dense Light Brown (FILL)		1	SS	52						
299.1											
0.8	**SAND**, some gravel, trace to some silt Compact to Loose LIght Brown (FILL)		2	SS	25		299				
			3	SS	9		298				17 80 3 (SI+CL)
			4	SS	12						Split spoon wet
296.7	Frequent wood fragments						297				
3.2	Silty **CLAY**, trace to some sand, with rootlets Firm to Soft Grey Moist		5	SS	3						
			6	SS	12		296				0 4 23 73
			7	SS	1		295				
			8	SS	8		294				0 0 77 23
			9	SS	WH		293				
							292				
							291				
							290				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \cdot 10 \cdot 5}$ (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No WC13-05 2 OF 3 METRIC

GWP# 5114-09-01 LOCATION Wally Creek Culvert N 5 435 083.5 E 329 307.3 ORIGINATED BY KMY

HWY 652 BOREHOLE TYPE Casing COMPILED BY AN

DATUM Geodetic DATE 2013.10.09 - 2013.10.09 CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY**, trace to some sand, with rootlets Firm to Soft Grey Moist		10	SS	WH		289				
			11	SS	WH		288				
			12	SS	WH		287				0 1 19 80
			13	SS	WH		286				
			14	SS	WH		285				
282.7							284				
17.2	End of sampling and start DCPT at 17.2 m						283				
							282				
							281				
							280				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \cdot 5}$ (%) STRAIN AT FAILURE

ONTMT4S 4069.GPJ 2012TEMPLATE(MTO).GDT 12/23/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No WC13-05 3 OF 3 METRIC

GWP# 5114-09-01 LOCATION Wally Creek Culvert N 5 435 083.5 E 329 307.3 ORIGINATED BY KMY

HWY 652 BOREHOLE TYPE Casing COMPILED BY AN

DATUM Geodetic DATE 2013.10.09 - 2013.10.09 CHECKED BY SKP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	w_P w w_L WATER CONTENT (%) 20 40 60	γ kN/m^3	GR SA SI CL
	Continued From Previous Page										
							279				
							278				
							277				
							276				
274.9							275				
25.0	END OF BOREHOLE AND DCPT AT 25.0 m. BOREHOLE BACKFILLED WITH HOLEPLUG TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

20
15 5
10
(%) STRAIN AT FAILURE

ONTMT4S 4069.GPJ 2012TEMPLATE(MTO).GDT 12/23/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No WC13-06 1 OF 3 METRIC

GWP# 5114-09-01 LOCATION Wally Creek Culvert N 5 435 079.2 E 329 330.5 ORIGINATED BY KMY

HWY 652 BOREHOLE TYPE NW Casing COMPILED BY AN

DATUM Geodetic DATE 2013.10.06 - 2013.10.06 CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
300.0								20 40 60 80 100	20 40 60		
0.0	**ASPHALT:** (20 mm)						300				
	SAND, some gravel to gravelly, trace silt Very Dense Brown		1	SS	48						
299.2							299				
0.8	Moist (FILL)		2	SS	32						
	SAND, trace silt, trace gravel Compact to Loose Brown Moist (FILL)		3	SS	15	▽	298				
			4	SS	7						Split spoon wet
			5	SS	7		297				1 96 3 (SI+CL)
296.3											
3.7	Silty **CLAY**, trace to some sand Firm Grey Wet		6	SS	7		296				
			7	SS	4						
							295	6.0			
			8	SS	3		294				0 4 50 46
							293	5.0			
			9	SS	2		292				
								3.0			
			10	WH	0		291				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE

ONTMT4S 4069.GPJ 2012TEMPLATE(MTO).GDT 12/23/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No WC13-06 2 OF 3 METRIC

GWP# 5114-09-01 LOCATION Wally Creek Culvert N 5 435 079.2 E 329 330.5 ORIGINATED BY KMY

HWY 652 BOREHOLE TYPE NW Casing COMPILED BY AN

DATUM Geodetic DATE 2013.10.06 - 2013.10.06 CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Silty **CLAY** Very Soft Grey Wet						290	4.0			
			11	WH	0		289				0 14 23 63
								4.0			
							288				
			12	WH	0						
							287	6.0			
			13	WH	0		286				
								3.0			
							285				
284.2			14	WH	0						
15.8	End of sampling and start DCPT at 15.8 m						284	4.0			
							283				
							282				
							281				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE

ONTMT4S 4069.GPJ 2012TEMPLATE(MTO).GDT 12/23/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No WC13-06 3 OF 3 METRIC

GWP# 5114-09-01 LOCATION Wally Creek Culvert N 5 435 079.2 E 329 330.5 ORIGINATED BY KMY

HWY 652 BOREHOLE TYPE NW Casing COMPILED BY AN

DATUM Geodetic DATE 2013.10.06 - 2013.10.06 CHECKED BY SKP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
	Continued From Previous Page						280				
							279				
							278				
							277				
275.6							276				
24.4	END OF DCPT AND BOREHOLE AT 24.4 m. BOREHOLE OPEN TO 2.5 m AND FREE WATER AT 2.0 m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 0.1 m AND CUTTINGS AND BENTONITE HOLEPLUG TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \cdot 10 \cdot 5}$ (%) STRAIN AT FAILURE

ONTMT4S 4069.GPJ 2012TEMPLATE(MTO).GDT 12/23/13

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No WC13-07 1 OF 1 METRIC

GWP# 5114-09-01 LOCATION Wally Creek Culvert N 5 435 075.6 E 329 315.9 ORIGINATED BY KMY

HWY 652 BOREHOLE TYPE NW Casing COMPILED BY AN

DATUM Geodetic DATE 2013.10.06 - 2013.10.06 CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
298.5											
0.0	**ROOTMAT** (75 mm)										
0.1	**SAND**, trace silt, some rootlets Very Loose Light Brown Wet		1	SS	2		298				Split spoon wet
297.7											
0.8	Silty **CLAY**, trace to some sand Firm to Soft Grey Moist		2	SS	3						
			3	SS	12		297				0 0 39 61
							296				
			4	SS	4						
							295	1.8			
			5	SS	4		294				
								1.5			
							293				
			6	SS	2						0 11 37 52
							292	1.1			
291.4											
7.1	END OF BOREHOLE AT 7.0 m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 5.8 m AND CUTTINGS TO SURFACE.										

+ 3, × 3: Numbers refer to Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

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Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No WC13-08 1 OF 1 METRIC

GWP# 5114-09-01 LOCATION Wally Creek Culvert N 5 435 072.1 E 329 332.4 ORIGINATED BY KMY

HWY 652 BOREHOLE TYPE NW Casing COMPILED BY AN

DATUM Geodetic DATE 2013.10.04 - 2013.10.04 CHECKED BY SKP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
298.2											
0.0	**ROOTMAT**										
0.0	Silty **SAND**, trace gravel, trace clay Very Loose Brown Wet		1	SS	3		298				
297.4											
0.8	Silty **CLAY**, trace to some sand, trace gravel Stiff to Soft Grey Wet		2	SS	9		297				Split spoon wet
			3	SS	35						0 0 37 63
			4	SS	11		296				
			5	SS	16		295				
			6	SS	3		294				0 13 37 50
			7	SS	0		293				
			8	SS	2		292				
291.5											
6.7	END OF BOREHOLE AT 6.7 m. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen.										

WATER LEVEL READINGS:

DATE	DEPTH (m)	ELEV. (m)
Nov. 1/13	0.2	298.0
Nov. 7/13	0.2	298.0

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S 4069.GPJ 2012TEMPLATE(MTO).GDT 12/23/13

Appendix B

Laboratory Test Results

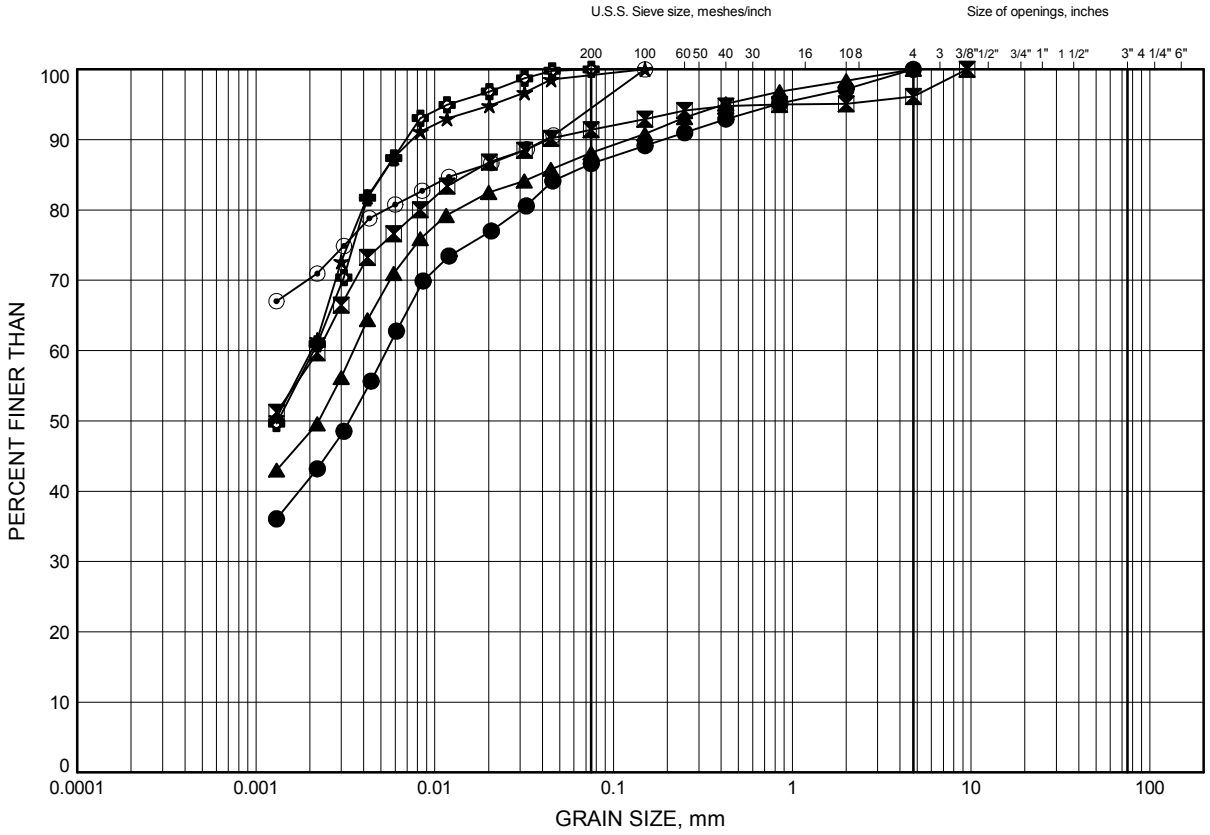
THURBER

Hwys 11, 583, 652 Culverts - Foundations

GRAIN SIZE DISTRIBUTION

FIGURE B1

SILTY CLAY, Trace to Some Sand



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	WC13-01	4.11	294.49
⊠	WC13-02	2.59	296.41
▲	WC13-02	6.40	292.60
★	WC13-03	4.11	295.79
⊙	WC13-03	14.02	285.88
✿	WC13-04	4.11	295.89

Date December 2013

GWP# 5114-09-01

THURBER

Prep'd AN

Chkd. LPG

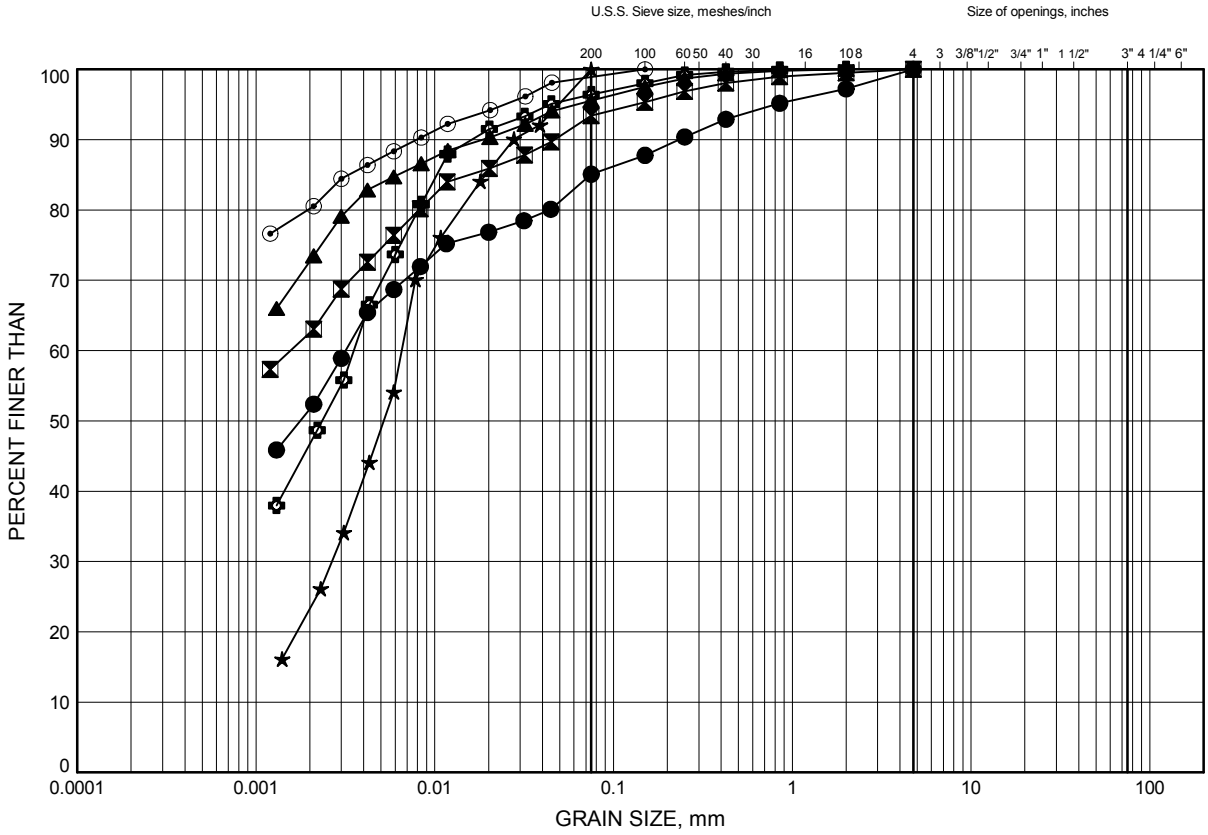
GRAIN SIZE DISTRIBUTION - THURBER 4069.GPJ 12/23/13

Hwys 11, 583, 652 Culverts - Foundations

GRAIN SIZE DISTRIBUTION

FIGURE B2

SILTY CLAY, Trace to Some Sand



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	WC13-04	7.92	292.08
⊠	WC13-04	12.50	287.50
▲	WC13-05	4.11	295.79
★	WC13-05	6.86	293.04
⊙	WC13-05	13.26	286.64
✿	WC13-06	6.40	293.60

Date December 2013

GWP# 5114-09-01

THURBER

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Chkd. LPG

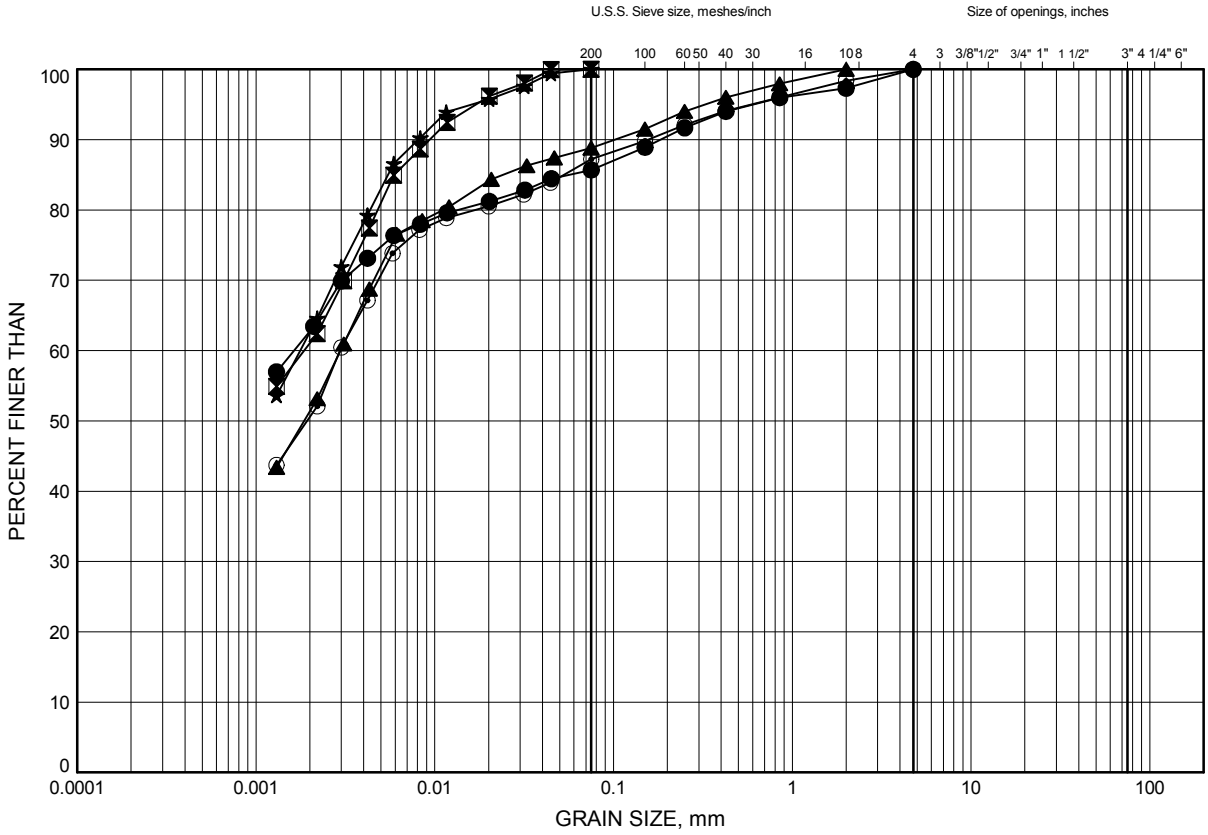
GRAIN SIZE DISTRIBUTION - THURBER 4069.GPJ 12/23/13

Hwys 11, 583, 652 Culverts - Foundations

GRAIN SIZE DISTRIBUTION

FIGURE B3

SILTY CLAY, Trace to Some Sand



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	WC13-06	10.97	289.03
⊠	WC13-07	1.83	296.67
▲	WC13-07	6.40	292.10
★	WC13-08	1.83	296.37
⊙	WC13-08	4.11	294.09

Date December 2013

GWP# 5114-09-01

THURBER

Prep'd AN

Chkd. LPG

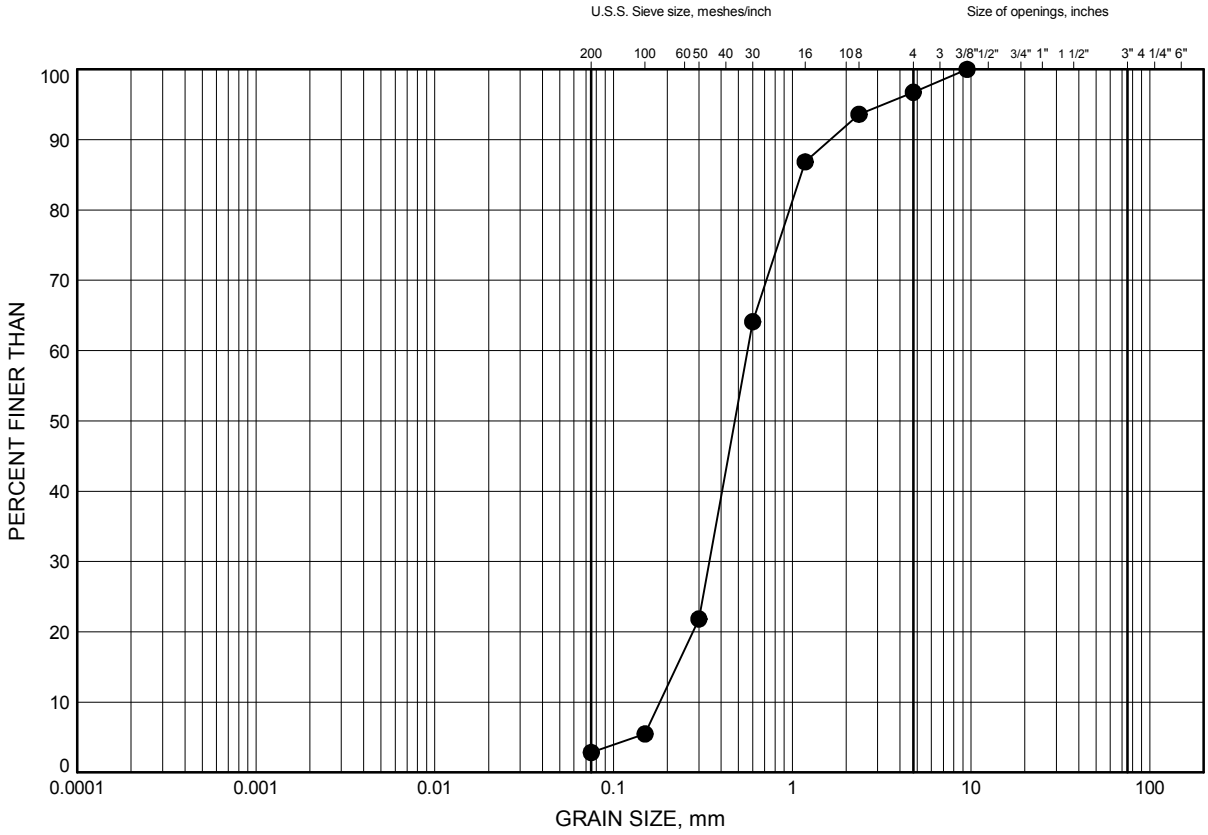
GRAIN SIZE DISTRIBUTION - THURBER 4069.GPJ 12/23/13

Hwys 11, 583, 652 Culverts - Foundations

GRAIN SIZE DISTRIBUTION

FIGURE B4

SAND



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	WC13-01	0.13	298.47

Date December 2013

GWP# 5114-09-01

THURBER

Prep'd AN

Chkd. LPG

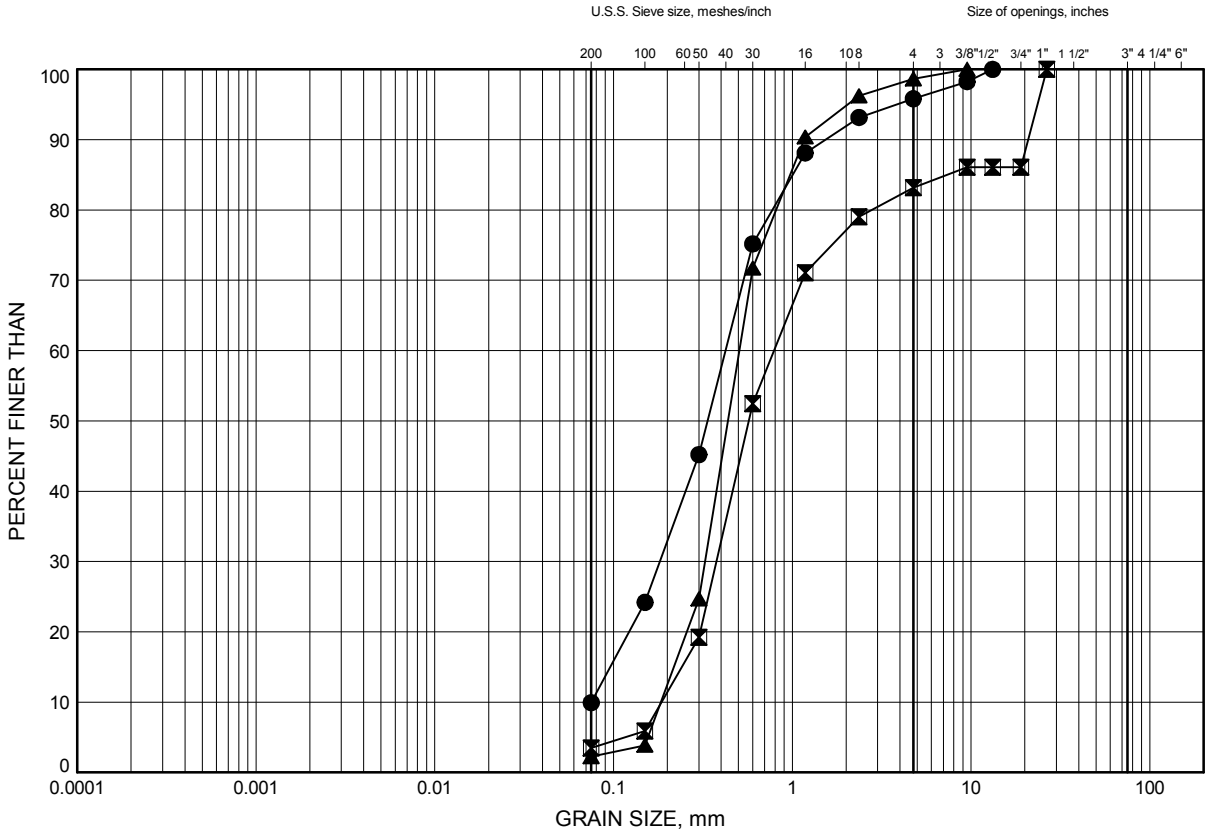
GRAIN SIZE DISTRIBUTION - THURBER 4069.GPJ 12/23/13

Hwys 11, 583, 652 Culverts - Foundations

GRAIN SIZE DISTRIBUTION

FIGURE B5

SAND FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	WC13-03	1.07	298.83
⊠	WC13-05	1.83	298.07
▲	WC13-06	3.35	296.65

Date December 2013

GWP# 5114-09-01

THURBER

Prep'd AN

Chkd. LPG

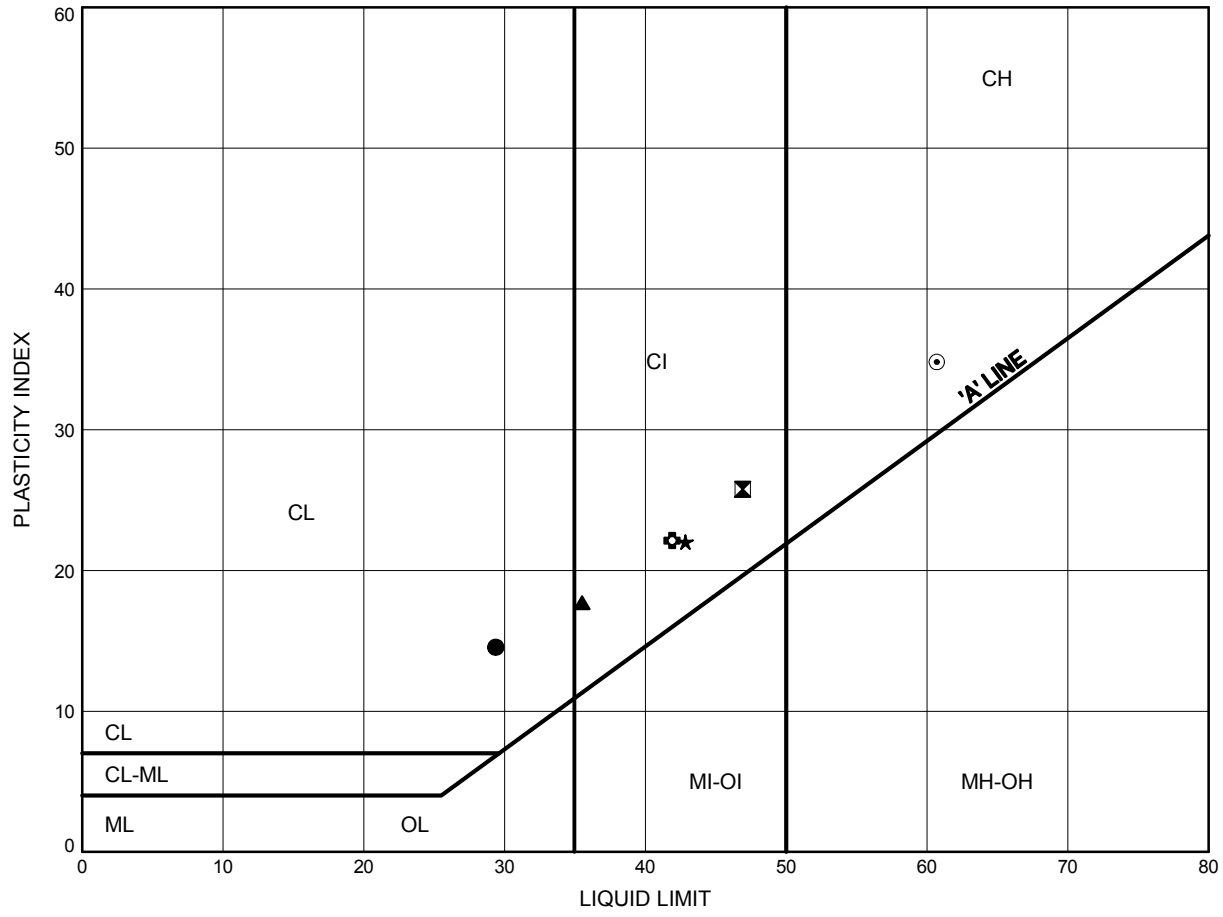
GRAIN SIZE DISTRIBUTION - THURBER 4069.GPJ 12/23/13

Hwys 11, 583, 652 Culverts - Foundations

ATTERBERG LIMITS TEST RESULTS

FIGURE B6

SILTY CLAY, Trace to Some Sand



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	WC13-01	4.11	294.49
⊠	WC13-02	2.59	296.41
▲	WC13-02	6.40	292.60
★	WC13-03	4.11	295.79
⊙	WC13-03	14.02	285.88
✿	WC13-04	4.11	295.89

Date December 2013

GWP# 5114-09-01

THURBER

Prep'd AN

Chkd. LPG

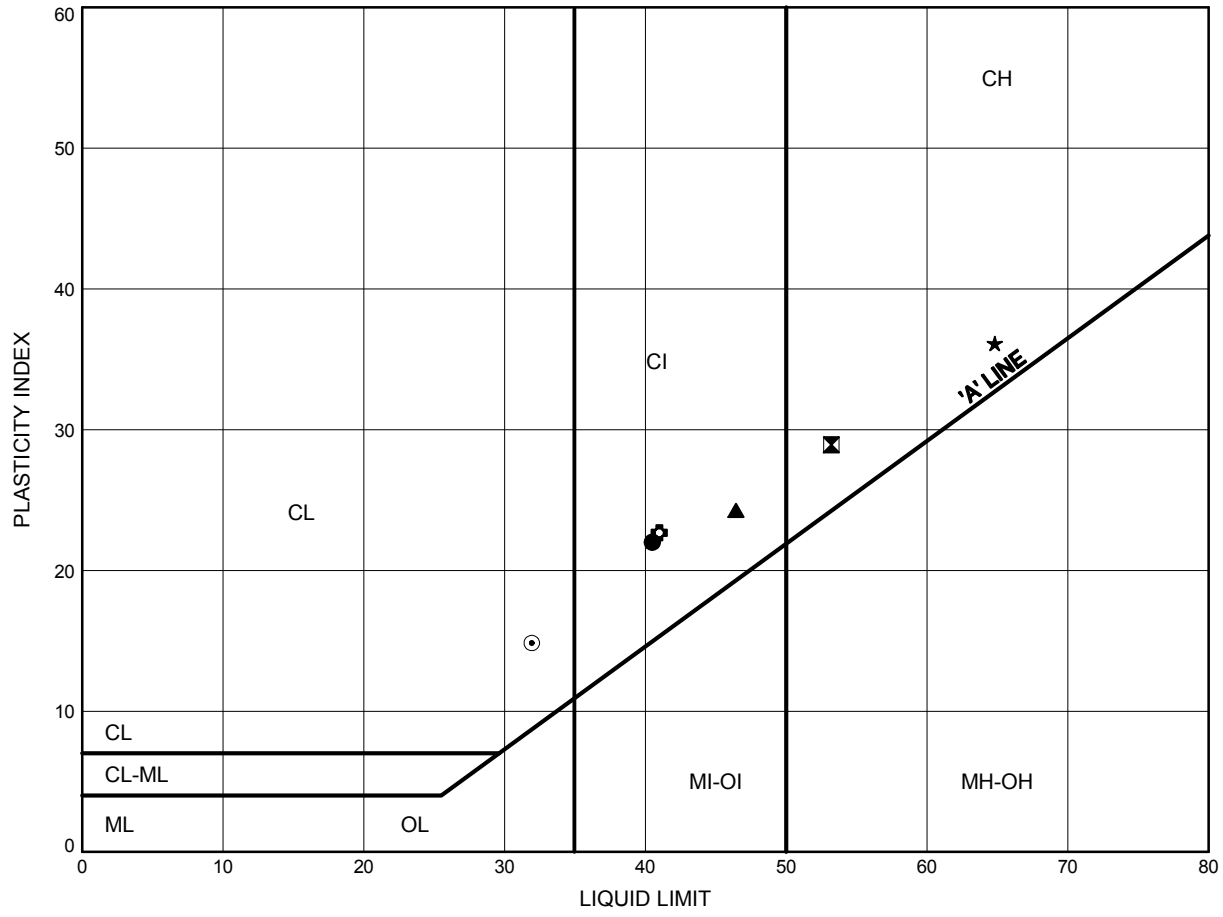
THURBALT 4069.GPJ 12/23/13

Hwys 11, 583, 652 Culverts - Foundations

ATTERBERG LIMITS TEST RESULTS

FIGURE B7

SILTY CLAY, Trace to Some Sand



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	WC13-04	7.92	292.08
⊠	WC13-04	12.50	287.50
▲	WC13-05	4.11	295.79
★	WC13-05	13.26	286.64
⊙	WC13-06	6.40	293.60
✿	WC13-06	10.97	289.03

Date December 2013

GWP# 5114-09-01

THURBER

Prep'd AN

Chkd. LPG

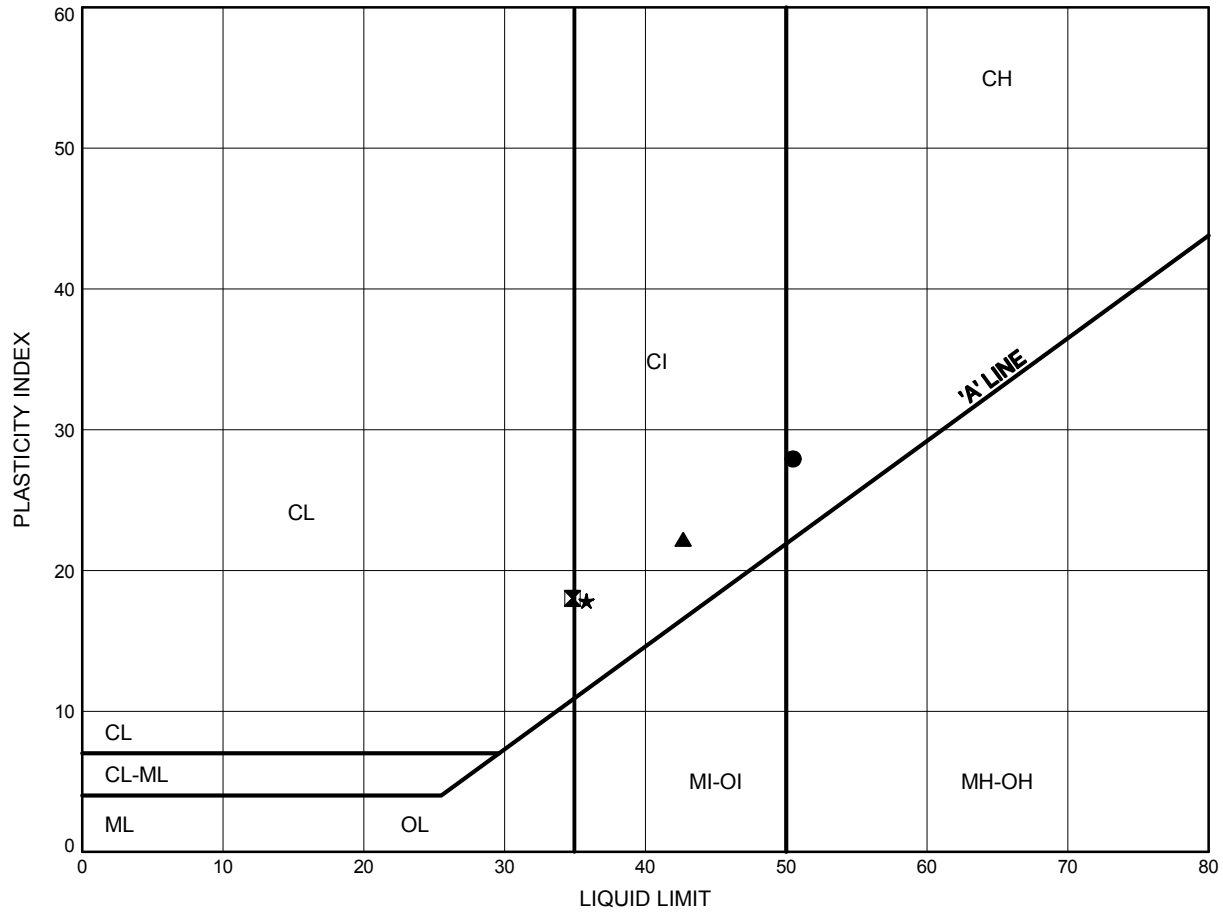
THURBALT 4069.GPJ 12/23/13

Hwys 11, 583, 652 Culverts - Foundations

ATTERBERG LIMITS TEST RESULTS

FIGURE B8

SILTY CLAY, Trace to Some Sand



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	WC13-07	1.83	296.67
⊠	WC13-07	6.40	292.10
▲	WC13-08	1.83	296.37
★	WC13-08	4.11	294.09

Date December 2013

GWP# 5114-09-01

THURBER

Prep'd AN

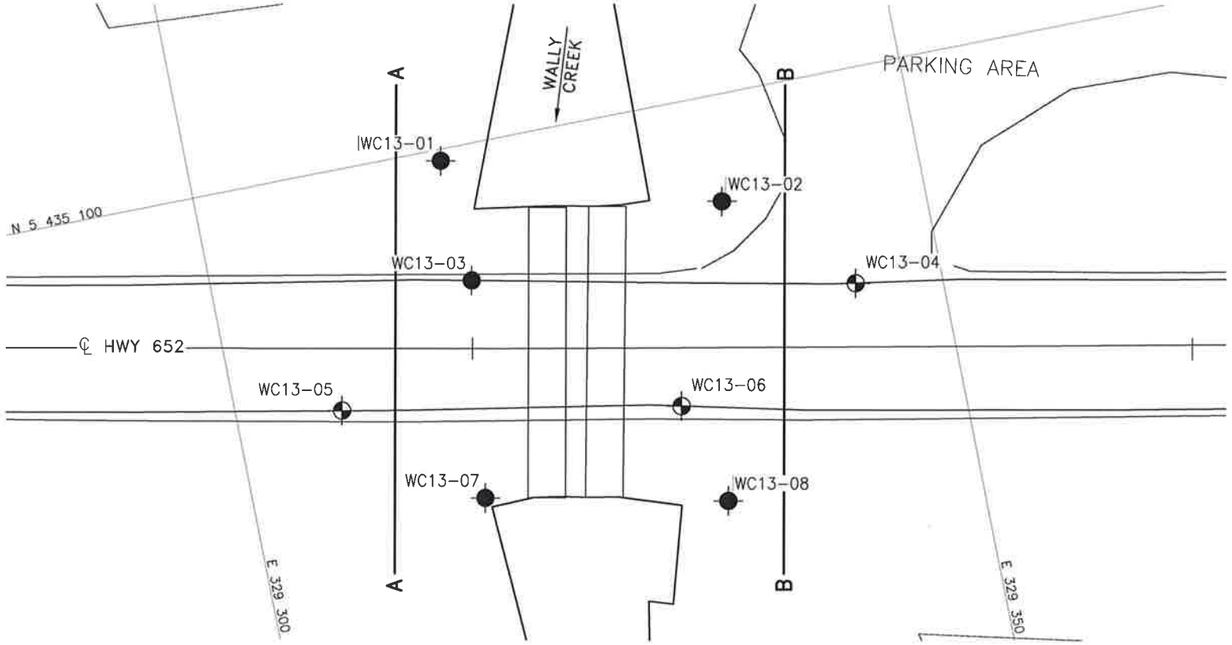
Chkd. LPG

THURBALT 4069.GPJ 12/23/13

Appendix C

Borehole Locations and Soil Strata Drawings

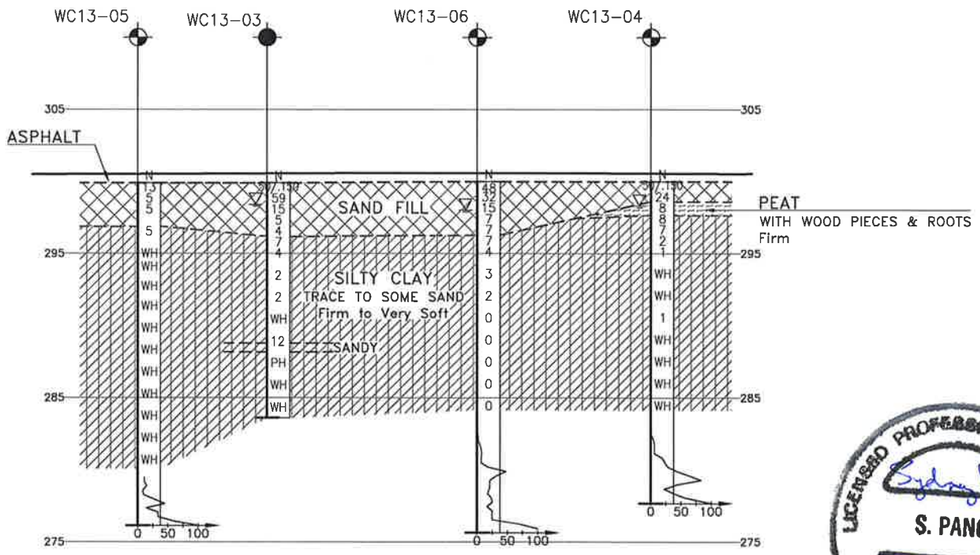
THURBER



PLAN

8 0 8 16m

SCALE 1:400



PROFILE ALONG ℄ HWY 652

8 0 8 16m

SCALE 1:400

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No

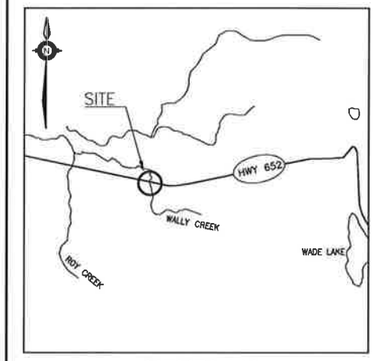
GWP No 5193-13-00

HIGHWAY 652
WALLY CREEK
CULVERT REPLACEMENT I
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

URS

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)
WH	Weight Hammer
PH	Pressure, Hydraulic
▽	Water Level
▼	Head Artesian Water
	Piezometer
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
WC13-01	298.6	5 435 099.2	329 317.4
WC13-02	299.0	5 435 092.6	329 336.0
WC13-03	299.9	5 435 090.6	329 317.9
WC13-04	300.0	5 435 085.2	329 344.0
WC13-05	299.9	5 435 083.5	329 307.3
WC13-06	300.0	5 435 079.2	329 330.5
WC13-07	298.5	5 435 075.6	329 315.9
WC13-08	298.2	5 435 072.1	329 332.4

-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. 42H-57

LICENSED PROFESSIONAL ENGINEER S. PANG Jan. 8/15 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER P.K. CHATTERJI Jan 8/15 PROVINCE OF ONTARIO

REVISIONS		
DATE	BY	DESCRIPTION

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MINISTRY OF TRANSPORTATION, ONTARIO

MINISTRY OF TRANSPORTATION, ONTARIO

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

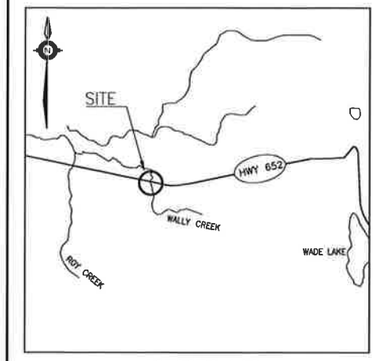
CONT No
GWP No 5193-13-00

HIGHWAY 652
WALLY CREEK
CULVERT REPLACEMENT II
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

URS

THURBER ENGINEERING LTD.



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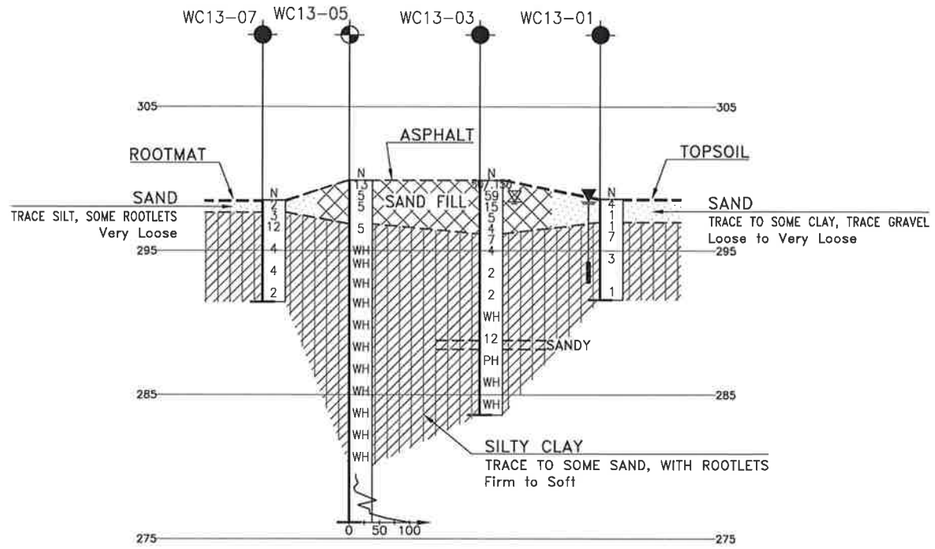
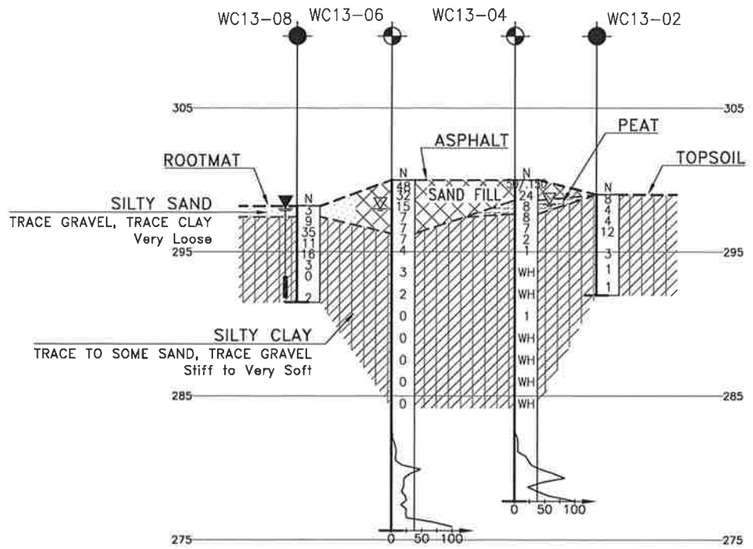


SECTION ALONG A-A



SECTION ALONG B-B

8 0 8 16m
SCALE 1:400

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
▽	Water Level
▼	Head Artesian Water
	Piezometer
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
WC13-01	298.6	5 435 099.2	329 317.4
WC13-02	299.0	5 435 092.6	329 336.0
WC13-03	299.9	5 435 090.6	329 317.9
WC13-04	300.0	5 435 085.2	329 344.0
WC13-05	299.9	5 435 083.5	329 307.3
WC13-06	300.0	5 435 079.2	329 330.5
WC13-07	298.5	5 435 075.6	329 315.9
WC13-08	298.2	5 435 072.1	329 332.4

-NOTES-

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Jan. 8/15
PROVINCE OF ONTARIO

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P.K. CHATTERJI
Jan 8/15
PROVINCE OF ONTARIO

REVISIONS		
DATE	BY	DESCRIPTION

DESIGN SKP	CHK SKP	CODE	LOAD	DATE	DEC 2014
DRAWN AN/MFA	CHK AEG	SITE 39E-227C	STRUCT	DWG	3

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