

**FOUNDATION INVESTIGATION REPORT
CULVERT REPLACEMENT AND EXTENSION
HIGHWAY 26
FROM SIXTH LINE TO PRETTY RIVER PARKWAY
TOWN OF COLLINGWOOD CONNECTING LINK
COLLINGWOOD, ONTARIO
G.W.P. No. 2002-10-00**

GEOCRES Number: 41A-221

Report to

McCormick Rankin Corporation

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November 8, 2011
File: 19-1351-203

H:\19\1351\203 Hwy26 Sixth Line to Pretty River
Pkwy\Reports & Memos\191351203 Hwy 26 Culvert
Extension FIDR FINAL_nov08 11.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 location of a culvert where a new and longer replacement culvert is proposed across Highway 26 which is to be widened from Sixth Line to Pretty River Parkway in the Town of Collingwood.

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

Thurber was retained by McCormick Rankin Corporation (MRC) to carry out this foundation investigation under the MTO Assignment Number 2009-E-0088.

2 SITE DESCRIPTION

The culvert site is located along Highway 26 approximately 40 m west of the intersection with Newport Boulevard. The site is within the Town of Collingwood.

The existing culvert is of the concrete open footing type with an invert slab and has dimensions of 3.00 m wide by 1.9 m high by 15.30 m long. The grade of the existing Highway 26 in the vicinity of the culvert is approximately Elevation 182 m. The embankment fill height at the culvert location is approximately 2.5 m. The general location of the culvert is shown on the key plan on the Borehole Locations and Soil Strata drawing in Appendix C.

The project area is located within the physiographic region known as the Simcoe Lowlands. In the areas bordering Georgian Bay, glacial lacustrine sands and silts overlie shallow limestone bedrock of the Middle Ordovician Age. Drainage in the vicinity of the project area is largely controlled by the



nearby Georgian Bay. Localized drainage is facilitated by creeks, many of which are serviced by culverts located in the flow channel under highway and road embankments.

The land use adjacent to this section of Highway 26 is largely commercial and residential.

3 SITE INVESTIGATION AND FIELD TESTING

The borehole investigation and field testing program was carried out on March 30 and 31, 2011 during which time two boreholes were drilled at this site. One borehole was located on the south shoulder of Highway 26 near the existing culvert outlet and the second one on the shoulder of a gravel road to the south of the existing culvert.

Prior to the start of drilling, the borehole locations were marked/staked in the field and utility clearances were obtained. The drilled borehole locations were subsequently surveyed by McCormick Rankin Corporation (MRC).

A track mounted drill rig was used to drill and sample the boreholes. Hollow stem augers were used to advance the boreholes until practical refusal on the top of bedrock. Soil samples were obtained at selected intervals using a 50 mm diameter split spoon sampler in conjunction with Standard Penetration Testing (SPT). Both boreholes were further advanced by 7.6 to 9.2 m respectively through bedrock using HQ size coring equipment. Groundwater conditions in the open boreholes were observed throughout the drilling operations. A standpipe piezometer was installed in each borehole. The details of piezometer installations and borehole completion are summarized in Table 3.1 below.

Table 3.1
Borehole Completion and Piezometer Installation Details

Borehole Number	Piezometer Installations			Completion Details
	Screen Depth (m)	Screen Elevation (m)	Sand Filter Stratum	
11-01	8.7 – 10.1	172.8 – 171.2	Bedrock	Bentonite to surface
11-02	7.8 – 9.2	172.5 – 171.1	Bedrock	Bentonite to surface

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, stored the rock core samples in wooden boxes, and transported the samples to Thurber's laboratory for further examination and testing.

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



4 LABORATORY TESTING

All recovered soil samples were subjected to Visual Identification (VI) and to natural water content determination. Selected soil samples were subjected to grain size distribution analyses (sieve and hydrometer). All rock cores were logged including the determination of Total Core Recovery (TCR) and Rock Quality Designation (RQD). Point load testing was carried out on selected rock cores for unconfined compressive strength correlation. 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.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

5.1 General

Reference is made to the Record of Borehole sheets in Appendix A for details of the soil stratigraphy encountered in the boreholes. Stratigraphic profiles for the culvert replacement and extension area is presented on the Borehole Locations and Soil Strata Drawing in Appendix D for illustrative purposes. An overall description of the stratigraphy 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 on the highway shoulder consist of granular fill overlying bedrock. The Boreholes located south of the highway consisted of thin layers of sandy silt and sand overlying bedrock. More detailed descriptions of the individual stratum are presented below.

5.2 Fill

Embankment fill was encountered in Borehole 11-01. This fill consists of brown sand and gravel. The fill extended to a depth of 2.5 m (Elevation 178.9 m).

SPT N-values measured in the sand and gravel fill ranged from 6 to 25 blows per 0.3 m penetration indicating a loose to compact state. A high blow count of 100 blows for 0.1 m penetration was measured just above bedrock. The moisture contents of the recovered fill samples ranged between 6% and 9%. Grain size analyses conducted on samples of the fill are presented on Figures B1 in Appendix B. These results are summarized in the following table.

Soil Particles	%
Gravel	35 to 41
Sand	43 to 53
Silt and Clay	12 to 16



5.3 Silt and Sand

A thin layer of sandy silt mixed with organics and underlain by a thin layer of sand was encountered in Borehole 11-02 immediately above the bedrock. The combined thickness of these layers is 0.2 m.

5.4 Bedrock

The soils described above were found to be underlain by limestone bedrock which was proven by coring in both boreholes. The limestone is slightly weathered to fresh and grey to dark grey in colour. Bedrock was found at a depth of 2.5 m (Elevation 178.9 m) in Borehole 11-01 and at a depth of 0.2 m (Elevation 180.1 m) in Borehole 11-02.

The measured Total Core Recovery (TCR) was 100% in both boreholes except in run number one of Borehole 11-02 where 50% was measured. The Rock Quality Designation (RQD) values were recorded at 84 to 100% indicating a typically good to excellent rock quality, except for the first run of Borehole 11-02 where the value of 20% indicated very poor quality.

The estimated Unconfined Compressive Strength (UCS) of the cores ranged from 22 to 87 MPa indicating a medium strong to strong rock. These estimated rock strength values are based on point load tests that were conducted on selected rock cores recovered from the boreholes.

5.5 Groundwater Conditions

Free water was not observed in the boreholes upon completion of drilling. Standpipe piezometers were installed in both boreholes. Measured water levels in these piezometers are presented below.

Borehole (screen location)	Date of Reading	Water Level Depth (m)	Water Level Elevation (m)
11-01	April 7, 2011	2.7	178.7
	July 5, 2011	4.4	177.0
11-02	April 7, 2011	0.5	179.8
	July 5, 2011	2.3	178.0

6 MISCELLANEOUS

Thurber staked and/or marked the borehole locations in the field and obtained utility clearances prior to drilling. The MRC surveyed the as-drilled locations, and provided the northing and easting coordinates and ground surface elevations.

Walker Drilling of Utopia, Ontario supplied and operated a track-mounted D50 Turbo drill rig to carry out the drilling, sampling and in-situ testing operations.



The drilling and sampling operations in the field were supervised on a full time basis by Ms. Eckie Siu of Thurber. Laboratory testing was carried out by Thurber in its laboratory.

Overall project management and direction of the field program was provided by Mr. Matthew Boucher, P.Eng.(AB). Interpretation of the field data and preparation of this report was completed by Mr Matthew Boucher, P.Eng.(AB). The report was reviewed by Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.





Sydney Pang, P.Eng.,
Associate, Senior Geotechnical Engineer



P. K. Chatterji, P.Eng.,
Review Principal, Designated MTO Contact



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}

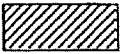
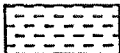



Shear Strength Determination by Pocket Penetrometer

- (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.

UNIFIED SOILS CLASSIFICATION

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

EXPLANATION OF ROCK LOGGING TERMS

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

<u>DISCONTINUITY SPACING</u>		<u>STRENGTH CLASSIFICATION</u>		
Bedding	Bedding Plane Spacing	Rock Strength	Approximate Uniaxial Compressive Strength (MPa)	Field Estimation of Hardness*
Very thickly bedded	Greater than 2m	Extremely Strong	Greater than 250	Specimen can only be chipped with a geological hammer
Thickly bedded	0.6 to 2m			
Medium bedded	0.2 to 0.6m	Very Strong	100-250	Requires many blows of geological hammer to break
Thinly bedded	60mm to 0.2m			
Very thinly bedded	20 to 60mm	Strong	50-100	Requires more than one blow of geological hammer to break
Laminated	6 to 20mm			
Thinly Laminated	Less than 6mm	Medium Strong	25.0 to 50.0	Breaks under single blow of geological hammer.
		Weak	5.0 to 25.0	Can be peeled by a pocket knife with difficulty
		Very Weak	1.0 to 5.0	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
		Extremely Weak (Rock)	0.25 to 1.0	Indented by thumbnail

<u>TERMS</u>	
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 percentage of total core run length.
Uniaxial Compressive Strength (UCS)	Axial stress required to break the specimen
Fracture Index: (FI)	Frequency of natural fractures per 0.3m of core run.

RECORD OF BOREHOLE No 11-01

1 OF 1

METRIC

G.W.P. 2002-10-00 LOCATION N 4 928 877.6 E 250 160.5 ORIGINATED BY ES
 HWY 26 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.03.30 - 2011.03.30 CHECKED BY MAB

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 (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
181.4								20	40	60	80	100					
0.0	SAND and GRAVEL , some silt Compact to Loose Brown Moist (FILL)		1	SS	20		181										35 53 12 (SI+CL)
			2	SS	6		180										
	Occasional cobbles		3	SS	25												41 43 16 (SI+CL)
178.9			4	SS	100/		179										
2.5	END OF SAMPLING AT 2.5m AND START CORING. FOR ROCK DETAILS PLEASE REFER TO BH11-01R. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Apr.07/11 2.7 178.7 Jul.05/11 4.4 177.0				0.100												

ONTMT4S 1203.GPJ 7/8/11

RECORD OF BOREHOLE 11-01R

PROJECT : Culvert Replacement and Extension
 LOCATION : Hwy 26 Sixth Line to Pretty River Pkwy
 STARTED : March 30, 2011
 COMPLETED : March 30, 2011

Project No. 2002-10-00

INCLINATION: Vertical AZIMUTH: Vertical

SHEET 1 OF 1
 DATUM Geodetic

DEPTH SCALE (metres)	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.		RUN No.	PENETRATION RATE (mm/min)	COLOUR FLUSH % RETURN	FR-FRACTURE CL-CLEAVAGE SH-SHEAR VN-VEIN	F-FAULT J-JOINT P-POLISHED S-SLICKENSIDED	SM-SMOOTH R-ROUGH ST-STEPPED PL-PLANAR	FL-FLEXURED UE-UNEVEN W-WAVY C-CURVED	Unconfined Compressive Strength (MPa)	FIELD/LABORATORY TESTING RESULTS ● Point Load Test Diametral ▲ Point Load Test Axial ■ Laboratory UCS Test	
				DEPTH	DEPTH										
				(m)	(m)										
				178.90 2.54											
4	RUN	LIMESTONE (BEDROCK), slightly weathered to fresh, grey to dark grey, moderately strong to strong Sub-horizontal fractures (25mm to 75mm) at 2.8m, 2.9m		1	0.098	100									
	RUN	125mm sub-vertical fracture at 3.3m													
		Sub-horizontal fractures (between 25mm to 75mm) at 3.6m, 3.7m, 4.1m, 4.5m, 4.7m													
		25mm soft zone at 4.1m													
	RUN	Sub-horizontal fractures (between 25mm to 75mm) at 5.2m, 5.6m		3	0.095	100									
6	RUN	Sub-horizontal fractures (between 25mm to 75mm) at 6.5m, 6.6m, 7.1m, 7.2m													
	RUN	Sub-horizontal fractures (between 25mm to 75mm) at 7.9m, 9.1m	4	0.101	100										
8	RUN	Sub-horizontal fractures (between 25mm to 75mm) at 9.4m, 9.5m, 9.6m, 9.8m													
	RUN	END OF BOREHOLE AT 10.1m.	6	0.108	100										
10															
12															



Bentonite

173.36

Filter Sand

172.75

Slotted Screen

171.22

GROUNDWATER ELEVATIONS



SHALLOW/SINGLE INSTALLATION

WATER LEVEL (date) 07/05/2011



DEEP/DUAL INSTALLATION

WATER LEVEL (date)

LOGGED : ES

CHECKED : MAB



RECORD OF BOREHOLE No 11-02

1 OF 1

METRIC

G.W.P. 2002-10-00 LOCATION N 4 928 861.3 E 250 155.3 ORIGINATED BY ES
HWY 26 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.03.31 - 2011.03.31 CHECKED BY MAB

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									
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%)						
						20	40	60	80	100	20	40	60				
180.3																	
0.0																	
0.1																	
0.2	Sandy SILT, some clay, trace gravel, mixed with organics Very Dense Brown Damp SAND, some gravel, occasional limestone fragments Very Dense Brown Damp END OF SAMPLING AT 0.2m AND START CORING. FOR CORE LOG PLEASE REFER TO BH10-02R. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Apr.07/11 0.5 179.8 Jul.05/11 2.3 178.0		1	SS	100/ 0.050												

RECORD OF BOREHOLE 11-02R

PROJECT : Culvert Replacement and Extension
 LOCATION : Hwy 26 Sixth Line to Pretty River Pkwy
 STARTED : March 31, 2011
 COMPLETED : March 31, 2011

Project No. 2002-10-00

INCLINATION: Vertical AZIMUTH: Vertical

SHEET 1 OF 1
 DATUM Geodetic

DEPTH SCALE (metres)	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE (mm/min)	COLOUR % RETURN	FR-FRACTURE CL-CLEAVAGE SH-SHEAR VN-VEIN	F-FAULT J-JOINT P-POLISHED S-SLICKENSIDED	SM-SMOOTH R-ROUGH ST-STEPPED PL-PLANAR	FL-FLEXURED UE-UNEVEN W-WAVY C-CURVED	HYDRAULIC CONDUCTIVITY k, cm/sec	Unconfined 50 Compressive Strength (MPa)	FIELD/LABORATORY TESTING RESULTS ● Point Load Test Diametral ▲ Point Load Test Axial ■ Laboratory UCS Test
								TOTAL CORE %	SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 3 m	DIP wrt Core Axis	TYPE AND SURFACE DESCRIPTION	
				180.10 0.20										
	RUN	LIMESTONE (BEDROCK), slightly weathered to fresh, grey to dark grey, moderately strong to strong Silt or sand seams 75mm broken zone at 1.0m and 1.1m 150mm sub-vertical fracture at 1.2m 25mm sub-vertical fractures at 4.7m Sub-horizontal fractures (between 25mm to 75mm) at 1.7m, 2.0m, 3.0m			1	0.089	100							
2	RUN				2	0.101	100							
4	RUN				3	0.101	100							
6	RUN	25mm sub-horizontal fractures at 4.6m			4	0.101	100							
8	RUN				5	0.095	100							
	RUN				6	0.101	100							
10		END OF BOREHOLE AT 9.3m.		170.93 9.37										

Bentonite

Filter Sand

Slotted
Screen

173.27

172.46

171.14

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION

WATER LEVEL (date) 07/05/2011

▽ DEEP/DUAL INSTALLATION

WATER LEVEL (date)

LOGGED : ES

CHECKED : MAB



Appendix B

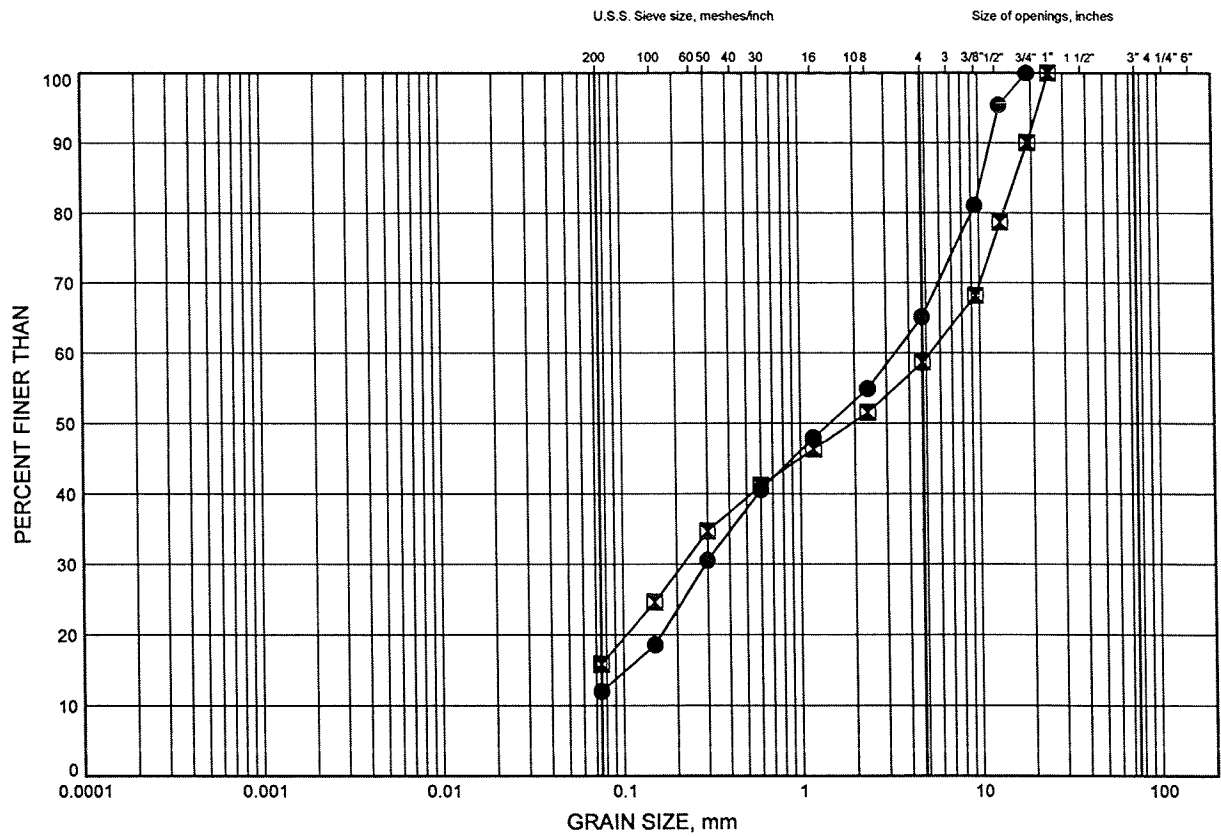
Laboratory Test Results



Hwy 26 Sixth Line to Pretty River Pkwy
GRAIN SIZE DISTRIBUTION

FIGURE C1

SAND and GRAVEL FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	11-01	0.30	181.11
⊠	11-01	1.83	179.58

GRAIN SIZE DISTRIBUTION - THURBER 1203.GPJ 4/23/11

W.P.# 19-1351-203
 Prepared By EA
 Checked By MTB



Appendix C

Borehole Locations and Soil Strata Drawings



DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

HIGHWAY 26 WIDENING
CULVERT REPLACEMENT &
EXTENSION, COLLINGWOOD
BOREHOLE LOCATIONS AND SOIL STRATA

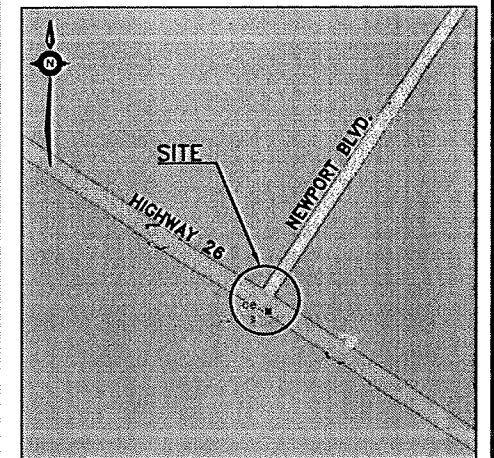
SHEET



McCORMICK RANKIN
CORPORATION








THURBER ENGINEERING LTD.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS



KEYPLAN

LEGEND

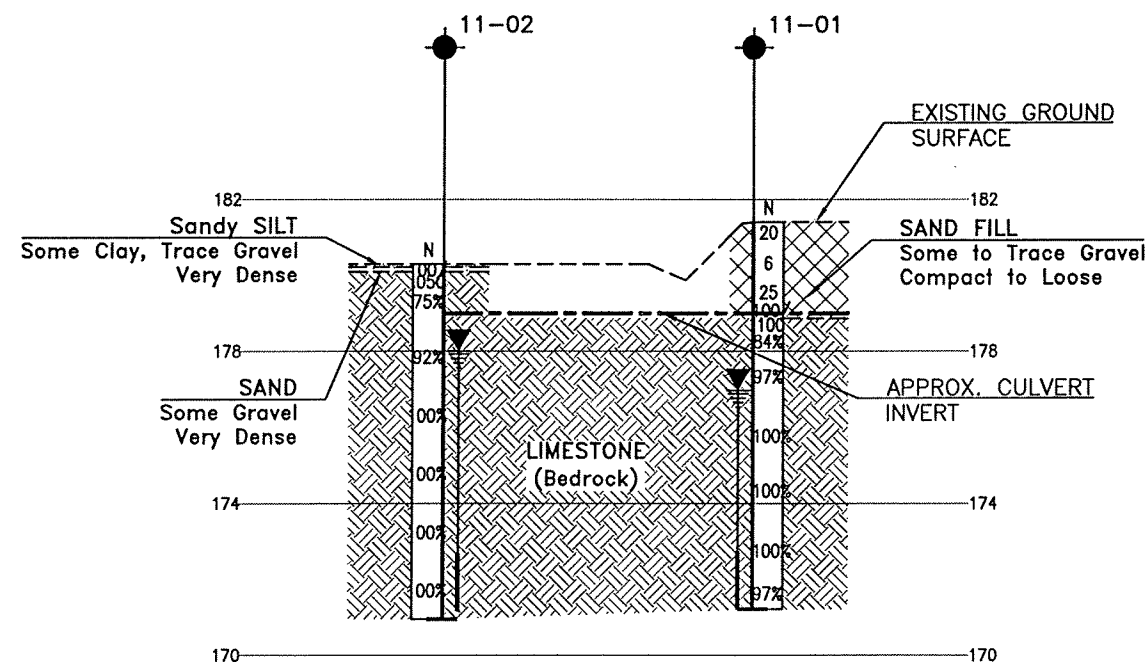
	Borehole
	Borehole and Cone
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
11-01	181.4	4 928 877.6	250 160.5
11-02	180.3	4 928 861.3	250 155.3

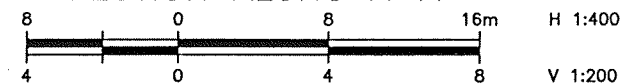
-NOTES-

- 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. 41A-221



SECTION ALONG A-A



REVISIONS									
	DATE	BY	DESCRIPTION						
DESIGN	MB	CHK	SKP	LOAD			DATE	NOV. 2011	
DRAWN	AN	CHK	PKC	SITE	STRUCT	DWG			