

**FOUNDATION INVESTIGATION REPORT
HURONTARIO STREET SOUTH TO HIGHWAY 401 EAST RAMP
HWY 401 WIDENING, HWY 410 TO CREDIT RIVER
MISSISSAUGA, ONTARIO
G.W.P. 2107-05-00, WP 2107-05-02, SITE 24-757**

Geocres Number: 30M12-266

Report to

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February 25, 2008
File: 19-1423-11

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PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This report presents the factual findings obtained from a foundation investigation conducted at the site of a proposed grade separation structure to carry the proposed Hurontario Street South to Highway 401 East Ramp (ramp) over a new Hurontario Street South Access Road (access road) of the Highway 401-Hurontario Street interchange in Mississauga, Ontario. The proposed structure and associated RSS walls will be located on the south side of Highway 401 and the east side of Hurontario Street.

The purpose of the investigation was to explore the subsurface conditions at the site and, based on the data obtained, provide a borehole location plan, borehole logs, stratigraphic profile and cross-sections and a written description of the subsurface conditions. A model of the subsurface conditions was developed to describe the geotechnical conditions influencing design and construction of the foundations and approach embankments for the structure, as well for the associated retaining walls.

Thurber carried out the investigation as a sub-consultant to MMM Group Limited (MMM) under the Ministry of Transportation Ontario (MTO) Agreement Number 2005-A-000347.

2 SITE DESCRIPTION

The site is located at the southeast quadrant of Highway 401 and Hurontario Street interchange in Mississauga, Ontario.

The lands at the northwest quadrant of Highway 401 and Hurontario Street are generally vacant, undeveloped and/or agricultural. Vegetation is moderate consisting mainly of tall grass and shrubs. To the east of Hurontario Street and south of Highway 401, lands have been developed for commercial and industrial uses. The topography is typically flat.

The general site area is located within the physiographic region known as Peel Plain, characterized by a level to undulating cohesive glacial till plain underlain by reddish brown shale with limestone layers of the Queenston Formation.

3 SITE INVESTIGATION AND FIELD TESTING

The site investigation and field testing for this project were carried out from September 12 to 24, 2007 and consisted of drilling and sampling seventeen boreholes (numbered RSE-01 to RSE-17) at the site. Boreholes were drilled at locations of the structure abutments, approaches and retaining walls along the alignment of the proposed Hurontario Street South Access Road and Hurontario Street South- Highway 401 East Ramp (ramp).

Eleven boreholes were terminated upon auger refusal in shale bedrock at depths of 3.8 m to 7.7 m (elevations 187.6 m to 185.0 m). Six boreholes were further advanced into shale bedrock by coring to depths of 7.2 m to 10.8 m (elevations 183.5 m to 181.6m), with a minimum 3.0 m of rock cores recovered in each borehole.

The approximate borehole locations are shown on the Borehole Locations and Soil Strata Drawing in Appendix C. The coordinates and elevations of the boreholes are given on these drawings and on the individual Record of Borehole Sheets in Appendix A.

Prior to commencement of drilling, utility clearances were obtained for all borehole locations.

Solid stem augers were used to advance the boreholes in the overburden and into the shale. Samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT). NQ rock coring equipment was used to recover core samples of the underlying bedrock in selected boreholes.

A member of Thurber's engineering staff supervised the drilling and sampling operations on a full time basis. The supervisor logged the boreholes, visually examined the recovered samples, and transported them to Thurber's laboratory for further examination and testing.

All rock cores were logged, and the Total Core Recovery (TCR), Rock Quality Designation (RQD) and the Fracture Indices (FI) were determined.

Groundwater conditions in the open boreholes were observed throughout the drilling operations. Five standpipe piezometers consisting of 19 mm PVC pipes with slotted screens were installed in selected boreholes to permit monitoring of groundwater levels. Details of the piezometer installations and other borehole completion details are as shown in Table 3.1.

Table 3.1 – Borehole Completion Details

Foundation Unit	Borehole	Piezometer Tip Depth/ Elevation (m)	Completion Details
West Abutment			
South	RSE-01	None installed	Bentonite grout to surface.
	RSE-02	7.2/183.5	Sand from 7.2 m to 5.2 m, bentonite grout to surface.
Centre	RSE-03	None installed	Bentonite grout to surface.
	RSE-04	None installed	Bentonite grout for full depth.
North	RSE-05	None installed	Bentonite grout to surface.
	RSE-06	6.4/186.0	Sand from 6.4 m to 4.6 m, bentonite grout to surface.
East Abutment			
South	RSE10	4.6/185.0	Sand from 4.6 m to 2.7, bentonite grout to surface.
	RSE11	None installed	Bentonite grout to surface.
Centre	RSE12	None installed	Bentonite grout to surface.
	RSE13	None installed	Bentonite grout to surface.
North	RSE14	10.8/181.6	Sand from 10.8 m to 8.8 m, bentonite grout to surface.
	RSE15	None installed	Bentonite grout to surface.
West Approach	RSE16	None installed	Bentonite grout to surface.
East Approach	RSE17	None installed	Bentonite grout to surface.
Retaining Wall			
Southeast	RSE-09	None installed	Bentonite grout to surface.
Northwest	RSE-07	None installed	Backfilled with bentonite grout to 0.3 m, cuttings to surface.
	RSE-08	7.7/185.0	Sand from 7.7 m to 5.8 m, bentonite grout to 0.3 m, sand and gravel to surface. Flushmount installed.

4 LABORATORY TESTING

All recovered soil and rock samples were subjected to Visual Identification (VI) and geological logging. At least 25% of the recovered samples of soil were also subjected to grain size distribution analyses (sieve and hydrometer) and Atterberg Limits testing where appropriate. Moisture content determinations were carried out on all soil samples. The results of this testing program are shown on the Record of Borehole sheets in Appendix A and on the figures contained in Appendix B.

Core samples of the shale bedrock were carefully protected to prevent drying during transport to the laboratory. Point load tests were carried out on selected samples of intact shale, siltstone and

limestone interbeds upon arrival at the laboratory to assist in evaluation of the compressive strength of the bedrock. Results of point load tests on the selected rock core samples are shown in Table 1 immediately following the text and on the Record of Borehole sheets in Appendix A.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

Reference is made to the Records of Borehole sheets in Appendix A. Details of the encountered soil and rock stratigraphy are presented in this appendix and on the Borehole Locations and Soil Strata Drawing in Appendix C. An overall description of the stratigraphy is given in the following paragraphs. However, the factual data presented in the Record of Borehole Sheets governs any interpretation of the site conditions.

In general terms, the soil stratigraphy encountered at this site consists of topsoil overlying fill which is underlain by native silty clay, silty clay/clayey silt till deposits and occasional sand layers. Weathered shale bedrock was contacted below the till deposits. More detailed descriptions of the individual strata are presented below.

5.1 Topsoil

Topsoil was identified at ground surface in most of the boreholes, except in Boreholes RSE-07 to RSE-09 and RSE-13. The topsoil thickness generally ranged from 50 mm to 100 mm. The topsoil thickness may vary between and beyond the borehole locations and the data is not intended for the purpose of estimating quantities.

5.2 Fill

Fill was encountered below the topsoil in all the boreholes. The fill generally consists of brown to grey silty clay and/or clayey silt with trace to some sand, trace of gravel and occasional rootlets. Sand and silt fill was revealed surficially along the proposed retaining walls (Boreholes RSE-07 to RSE-09). In Borehole RSE-14, located at the east abutment, a 600 mm-thick layer of reddish brown shale fill was contacted below the topsoil.

Based on recorded SPT N-values ranging from 8 to 86 blows for 0.3 m of penetration, the silty clay/clayey silt fill is described as stiff to hard. SPT N-values greater than 50 blows per 0.15 m penetration were observed within the clayey fill at 0.75 m depth in Borehole RSE-16. SPT values measured in the cohesionless fill were 18 and 39 blows per 0.3 m penetration indicating compact to dense conditions. The natural moisture content of the fill samples ranged from 3% to 18%.

The results of laboratory tests carried out on five samples were as follows:

Soil Particles	(%)
Gravel	0 to 1
Sand	24 to 40
Silt	38 to 50
Clay	19 to 29

Index Property	(%)
Liquid Limit	23 to 38
Plastic Limit	13 to 18
Plasticity Index	9 to 19

The above results show that the silty clay/clayey silt fill is of low to medium plasticity with a group symbol of CL to CI.

Grain size distribution curves for the samples tested are presented on the Record of Borehole sheets and on Figure B1 of Appendix B. Atterberg Limit test results are presented on Figure B7 of Appendix B.

The depth to the base of the clay fill layer ranged from 1.4 m to 4.6 m (from Elevations 191.3 to 187.9 m).

5.3 Silty Clay

Native brown to grey/dark grey silt clay trace to some sand, trace gravel and occasional rootlets and organic odour was encountered below the fill in Boreholes RSE-01, RSE-02, RSE-04, RSE-11, RSE-13, RSE-16 and RSE-17 located at the west and east abutments and approaches.

Based on SPT N-values ranging from 9 to 24 blows for 0.3 m of penetration, the silty clay is described as being stiff to very stiff. The natural moisture contents of the samples recovered from the silty clay layer ranged from 3 to 18%.

The results of laboratory tests carried out on one sample were as follows:

Soil Particles	(%)
Gravel	1
Sand	33
Silt	43
Clay	23

The grain size distribution curve for the sample tested is presented on the Record of Borehole sheet and on Figure B2 of Appendix B.

The base of the silty clay layer was ranging from 2.2 m to 3.0 m (elevation 187.8 to 189.4 m).

5.4 Silty Clay to Clayey Silt Till

Deposits of brown to grey silty clay till and clayey silt till with sand, trace of gravel, occasional rootlets and red shale fragments were contacted below the fill and silty clay in all the boreholes, except in Borehole RSE-14 where the clayey silt till was present below a sand layer.

Based on SPT N-values ranging from 8 blows for 0.3 m of penetration to greater than 50 blows for 0.075 m of penetration, the silty clay till and clayey silt till are described as being stiff to hard. The natural moisture contents of the samples recovered from the silty clay till and clayey silt till layers ranged from 5 to 20%.

The results of laboratory tests carried out on several till samples were as follows:

Soil Particles	(%)
Gravel	0 to 9
Sand	22 to 46
Silt	37 to 62
Clay	14 to 28

Index Property	(%)
Liquid Limit	23 to 40
Plastic Limit	13 to 19
Plasticity Index	9 to 20

The above results show that the silty clay to clayey silt till is typically of low plasticity with a group symbol of CL. One tested sample is of medium plasticity with a group symbol of CI.

Grain size distribution curves for the samples tested are presented on the Record of Borehole sheets and on Figures B3 to B5 of Appendix B. Atterberg Limit test results are presented on Figures B8 to B10 of Appendix B.

The depth to the base of the till deposit layers ranged from 3.4 m to 7.3 m (Elevations 187.6 m to 185.1 m).

Although not encountered in the boreholes, glacial tills inherently contain cobbles and boulders at the lower part of the till may contain pieces and slabs of bedrock which may account for some high blow counts and resistance to augering.

5.5 Silty Sand and Sandy Silt Till

Silty sand and sandy silt till with trace of gravel were contacted below the cohesive till in Boreholes RSE-05 and RSE-08, respectively. A 1.5 m thick layer of silt till was encountered in Borehole RSE-15 at 4.6 m depth (elevation 187.9 m).

Based on recorded SPT N-values of 102 and 50 blows for 0.150 m of penetration, these cohesionless soils are described as very dense. The natural moisture content of the samples obtained from these deposits ranged from 10 to 18%.

The results of laboratory tests carried out on a sample of the silt till were as follows:

Soil Particles	(%)
Gravel	0
Sand	18
Silt	74
Clay	8

Grain size distribution curves for the samples tested are presented on the Record of Borehole sheets and on Figure B6.

The depth to the base of these deposits ranged from 6.1 m to 7.3 m (Elevations 185.1 m to 186.4 m).

Although not encountered in the boreholes, glacial tills inherently contain cobbles and boulders which may account for some high N-values and resistance to augering.

5.6 Sand

A 1.5 m-thick layer of brown sand with trace of silt and trace of gravel was contacted below the fill in Borehole RSE-14, located at the east abutment.

Based on a recorded SPT N-value of 50 blows for 0.15 m of penetration, the sand is described as very dense. The natural moisture content of the sample obtained from the sand layer was 17%.

The depth to the base of the sand was 6.1 m (Elevation 186.4 m).

5.7 Bedrock

The soils described above were found to be underlain by shale bedrock of the Queenston Formation. The shale encountered in the boreholes is described as fine grained, thinly bedded and contains numerous hard interbedded siltstone and limestone layers. The shale bedrock is highly to moderately weathered within the upper 2 m below which the degree of weathering decreases with depth. SPT N-values obtained in the upper part of the shale bedrock ranged from 54 to greater than 100 blows per 0.1 m penetration. Moisture contents

measured within this zone ranged from 2 to 10%. Depth and elevations of the top of bedrock are shown in Table 5.1.

Table 5.1 – Depth and Elevation of Top of Bedrock

Foundation Unit	Borehole	Depth to weathered Shale Bedrock (m)	Top of Weathered Shale Bedrock Elevation (m)
West Abutment			
South	RSE-01	4.0	186.7
	RSE-02	3.8*	186.9*
Centre	RSE-03	-	-
	RSE-04	4.3*	187.5*
North	RSE-05	7.3*	185.1*
	RSE-06	6.1	186.3
East Abutment			
South	RSE10	3.7	185.9
	RSE11	3.4*	186.7*
Centre	RSE12	3.8*	187.3*
	RSE13	4.6	187.2
North	RSE14	7.3*	185.1*
	RSE15	6.1	186.4
West Approach	RSE16	5.8	186.6
East Approach	RSE17	4.0	187.3
Retaining Wall			
Southeast	RSE-09	4.0	187.5
Northwest	RSE-07	6.4	186.6
	RSE-08	6.7	186.0

* Proved by coring below augered depth.

Bedrock cores were collected using NQ sized coring equipment. Total core recovery (TCR) in the bedrock was 100% in most core runs, except in Borehole RSE-12 Run 1 where TCR was 47%.

RQD values ranging from 7% to 84%, recorded for initial core runs in the upper zone of the shale (elevations 185.1 m to 187.5 m) indicate very poor to good rock quality. Higher RQD values were obtained in subsequent core runs, generally 65% to 100%, indicating a good to

excellent rock quality. Fracture Index (FI) of the rock, expressed as fractures per 0.3 m of core, ranged from 0 to greater than 10.

Results of the point load tests conducted on the rock core samples are presented in Table 1 immediately following the text. Average values are also shown on the Record of Borehole sheets. The typical ranges of inferred UCS for various types of rock cores are summarized in Table 5.2.

Table 5.2 – Inferred Unconfined Compressive Strength

Rock Type	Inferred Unconfined Compressive Strength (MPa)
Shale or shale/siltstone	3 to 10
Siltstone	16 to 125
Limestone	24 to 142

It must be noted, however, that point load tests were possible only on less weathered shale or higher strength limestone interbed samples as the more typical weathered shale cores tended to be not suitable for point load testing. Broken zones were observed within the cores at several depths.

The shale bedrock typically contains layers of siltstone and limestone that can be significantly harder than the shale itself. The distribution, thickness and strength of these layers vary from location to location, and these layers typically exhibit less pronounced weathering than the shale. The records of boreholes indicate that within the depths investigated, these hard interbeds range from 20 to 170 mm in thickness. Sampling and interpretation from small diameter boreholes may underestimate the frequency, thickness and strength of the strong layers and therefore geological expertise and past experience must be applied in any decision making process regarding the bedrock.

5.8 Water Levels

Water levels were observed in the boreholes during and upon completion of drilling. Standpipe piezometers were installed in five boreholes to monitor water levels after completion of drilling. The water levels measured in the piezometers are summarized in Table 5.3, along with the measurements in the boreholes upon completion of drilling.

Table 5.3 – Measured Groundwater Levels

Borehole	Date (2007)	Water Level (m)		Comment
		Depth	Elevation	
RSE-02	September 28	1.7	189.0	In piezometer
	October 5	1.6	189.1	
	October 18	1.5	189.2	
	November 1	1.5	189.2	
	November 15	1.3	189.4	
RSE-05	September 20	6.1	186.3	In open borehole
RSE-06	September 9	2.9	189.5	In piezometer
	September 19	2.8	189.6	
	September 28	2.9	189.5	
	October 5	3.1	189.3	
	October 18	2.7	189.7	
	November 1	2.6	189.8	
	November 15	2.7	189.7	
RSE-07	September 12	7.6	185.4	In open borehole
RSE-08	September 28	3.1	189.7	In piezometer
	October 5	3.1	189.6	
	November 1	2.8	190.0	
	November 15	2.9	189.9	
RSE-10	September 14	2.0	187.6	In piezometer
	September 19	1.9	187.7	
	September 28	2.1	187.5	
	October 5	1.9	187.7	
	October 18	1.7	187.9	
	November 1	1.6	188.0	
	November 15	1.4	188.2	
RSE-14	September 19	1.7	190.8	In piezometer
	September 28	1.8	190.7	
	October 5	1.8	190.7	
	October 18	1.8	190.7	
	November 1	1.6	190.9	
	November 15	1.7	190.8	

The piezometric readings indicate that the groundwater levels range from Elevations 187.5 m to 190.9 m.

The above values are short-term readings and seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after the spring snowmelt or after periods of heavy rainfall. Further, perched water may be encountered at higher levels in pockets or zones of more permeable sands and silts within the heterogeneous tills, or within the fill.

6 MISCELLANEOUS

Borehole locations and ground surface elevations were supplied to Thurber by MMM Group Limited.

The drilling and sampling equipment was supplied and operated by DBW Drilling of Ajax Ontario. The field work was supervised on a full time basis by Mr. George Azzopardi of Thurber Engineering Ltd.

Laboratory testing was carried out at Thurber's Laboratory in Oakville, Ontario.

Supervision of the field program, interpretation of the field data and preparation of the investigation report was conducted by Dr. Sydney Pang, P. Eng. and Ms. R. Palomeque Reyna, P.Eng.

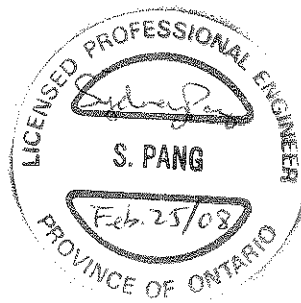
Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects, reviewed the report.

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Review Principal



Highway 401 Widening – Hurontario Street South to Highway 401 East Ramp

RSE-2	DEPTH			Is (MPa)	Is50 (MPa)	Inferred UCS (MPa)	Rock Type					
	FT.	IN.	(m)					Inferred UC Test Average				
RUN #1	14	4	4.37	0.000	0.000	3.00	limestone	RUN #1:				
	18	3	5.56	5.849	5.231	125.55	siltstone			AVERAGE	MAX	MIN
								Shale				
								Siltstone	125.55	125.55	125.55	
								Shale/Siltstone				
								Limestone	3.00	3.00	3.00	
RUN #2	19	6	5.94	0.000	0.000	3.00	shale	RUN #2:				
	20	7	6.27	0.000	0.000	3.00	shale		Shale	3.00	3.00	3.00
	21	6	6.55	0.000	0.000	3.00	shale	Siltstone				
	22	4	6.81	0.000	0.000	3.00	shale	Shale/Siltstone	3.00	3.00	3.00	
	23	6	7.16	0.000	0.000	3.00	shale, siltstone	Limestone				
								SUMMARY	AVERAGE	MAX	MIN	
								Shale	3.00	3.00	3.00	
								Siltstone	125.55	125.55	125.55	
								Shale/Siltstone	3.00	3.00	3.00	
							Limestone	3.00*	3.00*	3.00*		

* Untypically low value

RSE-4	DEPTH			Is (MPa)	Is50 (MPa)	Inferred UCS	Rock Type	Inferred UC Test Average				
	FT.	IN.	(m)									
RUN #1	21	7	6.58	0.000	0.000	3.00	shale	RUN #1:				
	23	7	7.19	3.116	3.384	81.22	siltstone		AVERAGE	MAX	MIN	
	24	6	7.47	0.000	0.000	3.00	shale, siltstone	Shale	3.00	3.00	3.00	
								Siltstone	81.22	81.22	81.22	
								Shale/Siltstone	3.00	3.00	3.00	
								Limestone				
RUN #2	24	11	7.59	0.000	0.000	3.00	shale, siltstone	RUN #2:				
	26	1	7.95	0.000	0.000	3.00	shale	Shale	3.00	3.00	3.00	
	28	5	8.66	0.000	0.000	3.00	shale	Siltstone	52.14	52.14	52.14	
	29	6	8.99	2.172	2.172	52.14	siltstone	Shale/Siltstone	3.00	3.00	3.00	
								Limestone				
								SUMMARY	AVERAGE	MAX	MIN	
								Shale	3.00	3.00	3.00	
								Siltstone	66.68	81.22	52.14	
								Shale/Siltstone	3.00	3.00	3.00	
								Limestone				

TABLE 1 -Point Load and Unconfined Compression Test Results
 Highway 401 Widening – Hurontario Street South to Highway 401 East Ramp

RSE-5	DEPTH			Is (MPa)	Is50 (MPa)	Inferred UCS	Rock Type	Inferred UC Test Average			
	FT.	IN.	(m)								
RUN #1	26	5	8.05	3.760	4.119	98.85	siltstone	RUN #1:	AVERAGE	MAX	MIN
	27	8	8.43	0.000	0.000	3.00	shale				
	28	7	8.71	0.374	0.433	10.39	shale				
	29	5	8.97	0.000	0.000	3.00	shale				
	30	4	9.25	0.307	0.320	7.68	shale, siltstone				
RUN #2	30	8	9.35	0.000	0.000	3.00	shale, siltstone	RUN #2:	AVERAGE	MAX	MIN
	32	1	9.78	3.702	4.105	98.52	limestone				
	32	10	10.01	0.666	1.173	28.14	siltstone				
	33	7	10.24	0.000	0.000	3.00	shale, siltstone				
	25	2	7.67	0.248	0.288	6.90	shale, siltstone				
								SUMMARY	AVERAGE	MAX	MIN

RSE-11	DEPTH			Is (MPa)	Is50 (MPa)	Inferred UCS	Rock Type	Inferred UC Test Average			
	FT.	IN.	(m)								
RUN #1	17	11	5.46	0.393	0.363	8.70	shale, siltstone	RUN #1:	AVERAGE	MAX	MIN
	19	9	6.02	2.930	3.315	79.55	siltstone				
RUN #2	19	9	6.02	0.000	0.000	3.00	shale, siltstone	RUN #2:	AVERAGE	MAX	MIN
	21	1	6.43	0.000	0.000	3.00	shale, siltstone				
	22	6	6.86	0.338	0.336	8.06	shale				
	23	6	7.16	0.000	0.000	3.00	shale, siltstone				
	24	3	7.39	2.506	2.664	63.94	siltstone				
								SUMMARY	AVERAGE	MAX	MIN

TABLE 1 -Point Load and Unconfined Compression Test Results
 Highway 401 Widening – Hurontario Street South to Highway 401 East Ramp

RSE-12	DEPTH			Is (MPa)	Is50 (MPa)	Inferred UCS	Rock Type	Inferred UC Test Average			
	FT.	IN.	(m)								
RUN #2	20	7	6.27	5.401	5.374	128.98	limestone	RUN #1:			
	22	0	6.71	0.334	0.334	8.02	shale, siltstone		AVERAGE	MAX	MIN
	23	3	7.09	0.000	0.000	3.00	shale	Shale	3.00	3.00	3.00
								Siltstone			
								Shale/Siltstone	8.02	8.02	8.02
								Limestone	128.98	128.98	128.98
RUN #3	24	3	7.39	0.000	0.000	3.00	shale	RUN #2:			
	24	11	7.59	0.000	0.000	3.00	siltstone	Shale	3.00	3.00	3.00
	25	11	7.90	0.000	0.000	3.00	shale, siltstone	Siltstone	9.52	16.04	3.00
	26	9	8.15	0.668	0.668	16.04	siltstone	Shale/Siltstone	3.00	3.00	3.00
	28	1	8.56	0.578	1.001	24.02	limestone	Limestone			
RUN #4	26	6	8.08	0.000	0.000	3.00	shale, siltstone	RUN #3:			
								Shale			
								Siltstone			
								Shale/Siltstone	3.00	3.00	3.00
								Limestone			
								SUMMARY	AVERAGE	MAX	MIN
								Shale	3.00	3.00	3.00
								Siltstone	9.52	16.04	3.00
								Shale/Siltstone	4.67	8.02	3.00
								Limestone	76.50	128.98	24.02

RSE-14	DEPTH			Is (MPa)	Is50 (MPa)	Inferred UCS	Rock Type	Inferred UC Test Average			
	FT.	IN.	(m)								
RUN #1	26	8	8.13	1.083	1.126	27.01	Siltstone	RUN #1:			
	27	10	8.48	0.000	0.000	3.00	shale		AVERAGE	MAX	MIN
	29	1	8.86	0.000	0.000	3.00	shale	Shale	3.00	3.00	3.00
								Siltstone	27.01	27.01	27.01
								Shale/Siltstone			
								Limestone			
RUN #2	31	3	9.53	0.328	0.331	7.94	shale, siltstone	RUN #2:			
	31	11	9.73	5.784	5.899	141.58	limestone	Shale	3.00	3.00	3.00
	32	9	9.98	4.178	4.576	109.83	limestone	Siltstone			
	33	8	10.26	0.000	0.000	3.00	shale, siltstone	Shale/Siltstone	5.47	7.94	3.00
	34	9	10.59	0.000	0.000	3.00	shale	Limestone	125.70	141.58	109.83
								SUMMARY	AVERAGE	MAX	MIN
								Shale	3.00	3.00	3.00
								Siltstone	27.01	27.01	27.01
								Shale/Siltstone	5.47	7.94	3.00
								Limestone	125.70	141.58	109.83

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

ROCK WEATHERING CLASSIFICATION		SYMBOLS			
Fresh (FR)	No visible signs of weathering.				
Fresh Jointed (FJ)	Weathering limited to the surface of major discontinuities.		CLAYSTONE		
Slightly Weathered (SW)	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock material.		SILTSTONE		
Moderately Weathered (MW)	Weathering extends throughout the rock mass, but the rock material is not friable.		SANDSTONE		
Highly Weathered (HW)	Weathering extends throughout the rock mass and the rock is partly friable.		COAL		
Completely Weathered (CW)	Rock is wholly decomposed and in a friable condition, but the rock texture and structure are preserved.		Bedrock (general)		
DISCONTINUITY SPACING		STRENGTH CLASSIFICATION			
Bedding	Bedding Plane Spacing	Rock Strength	Approximate Uniaxial Compressive Strength		Field Estimation of Hardness*
			(MPa)	(psi)	
Very thickly bedded	Greater than 2m	Extremely Strong	Greater than 250	Greater than 36,000	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	15,000 to 36,000	Requires many blows of geological hammer to break
Thinly bedded	60mm to 0.2m				
Very thinly bedded	20 to 60mm	Strong	50-100	7,500 to 15,000	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	3,500 to 7,500	Breaks under single blow of geological hammer.
TERMS		Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length.	Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
Solid Core Recovery: (SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run.	Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail
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 RSE-01

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South to HWY 401 East Ramp N 4 832 165.3 E 290 098.5 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007-09-12 - 2007-09-12 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)		
								20 40 60 80 100							
190.7															
0.0	TOPSOIL: (75mm)														
0.1	Silty CLAY, trace to some sand, trace gravel, occasional rootlets Hard to Stiff Brown to Mottled Brown Grey (FILL)		1	SS	40										
			2	SS	14										
189.2															
1.5	Silty CLAY, trace sand, occasional rootlets Stiff Dark Grey		3	SS	9										
188.5															
2.2	Clayey SILT with sand, trace gavel Hard Brown to Mottled Brown (TILL) occasional reddish brown to brown shale fragments		4	SS	52										
			5	SS	50/ .150										
186.7															
4.0	SHALE, highly weathered, thinly bedded, reddish brown														
185.8			6	SS	118										
4.9	END OF BOREHOLE AND AUGER REFUSAL AT 4.9m. BOREHOLE OPEN AND DRY TO 4.9m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.														

RECORD OF BOREHOLE No RSE-02

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South to HWY 401 East Ramp N 4 832 161.2 E 290 099.6 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers/NQ Coring COMPILED BY MFA
 DATUM Geodetic DATE 2007-09-17 - 2007-09-19 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								20 40 60 80 100		PLASTIC LIMIT W _P NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L					
190.7															
0.0															
0.1	TOPSOIL: (100mm)														
	Silty CLAY, trace to some sand, trace gravel, occasional rootlets Very Stiff to Hard Brown (FILL)		1	SS	26										
			2	SS	86										
189.3															
1.4	Silty CLAY, trace sand, occasional rootlets Stiff Dark Grey to Mottled Dark Grey/Grey		3	SS	14										
188.5															
2.2	Clayey SILT with sand, trace gravel, occasional oxide lenses Hard Mottled Brown/Grey (TILL)		4	SS	44										
			5	SS	87										
186.9															
3.8	SHALE, highly to moderately weathered, fine grained, thinly bedded, reddish brown, with occasional green siltstone interbeds Coring started at 4.26m Highly broken zones at 4.24 to 4.37, 4.57 to 4.62, 4.88 to 5.08, and 5.23 to 5.39m Green siltstone interbed at 4.27 to 4.37m Limestone interbeds at 4.37 to 4.42 and 5.69 to 5.79m Slightly weathered to fresh Green siltstone interbeds at 5.79 to 5.92, 6.10 to 6.15, 6.96 to 7.03, and 7.19m		1	RUN											
			2	RUN											
183.5															
7.2	END OF BOREHOLE AND AUGER REFUSAL AT 7.2m. BOREHOLE OPEN AND DRY TO 7.2m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Sep28/07 1.7 189.0 Oct05/07 1.6 189.1 Oct18/07 1.5 189.2 Nov01/07 1.5 189.2 Nov15/07 1.3 189.4														

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

ONTMT4S 2311.GPJ 2/21/08

RECORD OF BOREHOLE No RSE-03

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South to HWY 401 East Ramp N 4 832 171.8 E 290 104.9 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007-09-12 - 2007-09-12 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kn/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
191.4							20	40	60	80	100									
0.0	TOPSOIL: (75mm)																			
0.1	Clayey SILT, trace to some sand, trace gravel		1	SS	47															
190.7	Hard																			
0.7	Brown (FILL)																			
	SILT, clayey, some sand, trace gravel Very Stiff		2	SS	18															
189.9	Brown (FILL)																			
1.4	Clayey SILT with sand, trace gravel Very Stiff to Hard Mottled Brown/Grey (TILL)		3	SS	19															
	Mottled Reddish Brown to Brown																			
			4	SS	18															
			5	SS	85															
187.6																				
3.8	END OF BOREHOLE AND AUGER REFUSAL AT 3.8m, PROBABLE BEDROCK. BOREHOLE OPEN AND DRY TO 3.8m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.																			

RECORD OF BOREHOLE No RSE-04

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South to HWY 401 East Ramp N 4 832 172.4 E 290 110.7
 HWY 401 BOREHOLE TYPE Solid Stem Augers/NQ Coring
 DATUM Geodetic DATE 2007-09-19 - 2007-09-20
 ORIGINATED BY GA
 COMPILED BY MFA
 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)		
191.8															
0.0	TOPSOIL: (75mm)														
0.1	Clayey SILT with sand, trace gravel, occasional rootlets Stiff to Hard Brown (FILL)		1	SS	30										
			2	SS	18								1 36 44 19		
			3	SS	12										
189.6															
2.2	Silty CLAY, some sand, trace gravel, occasional rootlets Very Stiff Dark Grey		4	SS	15								1 33 43 23		
188.8															
3.0	Silty CLAY, some sand, trace gravel Hard Mottled Brown (TILL)		5	SS	49								2 32 44 22		
187.5															
4.3	SHALE, highly to moderately weathered, fine grained, thinly bedded, reddish brown, with frequent green siltstone interbeds, occasional limestone interbeds, and clay seams		6	SS	54										
					</										

ONTMT4S 2311.GPJ 2/21/08

+ 3, x 3. Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No RSE-05

1 OF 2

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South to HWY 401 East Ramp N 4 832 183.5 E 290 116.5 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers/NO Coring COMPILED BY MFA
 DATUM Geodetic DATE 2007-09-14 - 2007-09-20 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
192.4	TOPSOIL: (100mm)												
0.0													
0.1	Silty CLAY, some sand, trace gravel, occasional rootlets Hard Brown (FILL)		1	SS	32		192						
			2	SS	41		191						
	Stiff Mottled Brown to Greenish Grey/Grey		3	SS	11		190						
190.2			4	SS	8		189						
2.2	Clayey SILT with sand, occasional rootlets Stiff Mottled Brown to Greenish Grey/Grey (TILL)		5	SS	14		188						
			6	SS	50/ .150		187						
187.8	Silty CLAY, some sand, trace gravel Hard Brown (TILL)		7	SS	102		186						
4.6			8	SS	100/ .150		185						
186.3	Silty SAND, trace gravel Very Dense Grey to Reddish Brown (TILL)		1	RUN			184						
6.1							183						
185.1	SHALE, highly weathered, fine grained, thinly bedded, reddish brown, with occasional green siltstone and limestone interbeds Coring Started at 7.94m Slightly weathered to fresh Green siltstone interbeds at 7.95 to 8.05, 8.31 to 8.33, 9.12 to 9.17, 9.17 to 9.22, and 9.30 to 9.35m Highly broken zone at 7.95 to 8.05m Limestone interbeds at 8.05 to 8.13 and 8.21 to 8.25m												
7.3													
	Slightly weathered to fresh Limestone interbed at 9.75 to 9.81m Green siltstone interbeds at 9.45 to 9.50, 9.55, 9.68 to 9.78, 9.85 to 9.96,												

Continued Next Page

+ 3, X 3: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No RSE-05

2 OF 2

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South to HWY 401 East Ramp N 4 832 183.5 E 290 116.5 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers/NQ Coring COMPILED BY MFA
 DATUM Geodetic DATE 2007-09-14 - 2007-09-20 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
	Continued From Previous Page																
	10.01 to 10.16, 10.34 to 10.42, 10.44 to 10.54, 10.62 to 10.67, and 10.74 to 10.77m Highly broken zone at 9.83 to 9.96m		2	RUN			182									0	GR SA SI CL
181.6																0	
10.8	END OF BOREHOLE AT 10.8m. BOREHOLE OPEN TO 10.8m AND WATER LEVEL AT 6.1m UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.																

RECORD OF BOREHOLE No RSE-06

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South to HWY 401 East Ramp N 4 832 178.8 E 290 118.0 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007-09-13 - 2007-09-13 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED + FIELD VANE									
								● QUICK TRIAXIAL x LAB VANE									
							20	40	60	80	100	WATER CONTENT (%)					
							20	40	60	80	100	20	40	60			
192.4																	
0.0	TOPSOIL: (75mm)																
0.1	Silty CLAY, trace to some sand, trace gravel Hard to Stiff Brown (FILL)		1	SS	38												
			2	SS	19												
			3	SS	16												
	occasional rootlets and wood fibres Mottled Grey to Greenish Grey		4	SS	14												
189.4																	
3.0	Silty CLAY, some sand, trace gravel Stiff Greenish Brown (TILL)		5	SS	14												
			6	SS	50/ .150												
186.3																	
6.1	SHALE, highly weathered, thinly bedded, reddish brown		7	SS	105												
186.0																	
6.4	END OF BOREHOLE AND AUGER REFUSAL AT 6.4m. BOREHOLE OPEN AND DRY TO 6.4m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Sep09/07 2.9 189.5 Sep19/07 2.8 189.6 Sep28/07 2.9 189.5 Oct05/07 3.1 189.3 Oct18/07 2.7 189.7 Nov01/07 2.6 189.8 Nov15/07 2.7 189.7																

RECORD OF BOREHOLE No RSE-07

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South to HWY 401 East Ramp N 4 832 188.4 E 290 126.1 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007-09-12 - 2007-09-12 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20	40	60	80			100
193.0														
0.0	SAND, occasional gravel: (FILL)													
0.1														
	Silty CLAY, trace sand, trace gravel, occasional shale fragments Stiff to Very Stiff Reddish Brown to Brown (FILL)		1	SS	29									
			2	SS	11									
	Mottled Brown/Grey to Reddish Brown		3	SS	25									
190.8														
2.2	Silty CLAY, some sand, trace gravel, occasional rootlets Very Stiff to Hard Mottled Brown/Grey to Brown (TILL)		4	SS	18									1 31 44 24
			5	SS	37									
188.4														
4.6	Clayey SILT with sand, trace gravel Hard Brown (TILL)		6	SS	74									9 33 42 16
186.6														
6.4	SHALE, highly weathered, thinly bedded, reddish brown		7	SS	100/ .150									
185.3														
7.7	END OF BOREHOLE AT 7.7m. BOREHOLE OPEN TO 7.7m AND WATER LEVEL AT 7.6m UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 0.3m, THEN CUTTINGS TO SURFACE.		8	SS	100/ .100									

+³ x³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No RSE-08

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South to HWY 401 East Ramp N 4 832 196.9 E 290 134.6
 HWY 401 BOREHOLE TYPE Solid Stem Augers
 DATUM Geodetic DATE 2007-09-24 - 2007-09-24
 ORIGINATED BY GA
 COMPILED BY MFA
 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)			
								20 40 60 80 100								20 40 60			
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE											
192.8																			
0.0	SAND, trace silt, trace gravel Compact Brown (FILL)		1	SS	29														
192.1																			
0.7	Silty CLAY, trace to some sand, trace gravel Very Stiff Brown (FILL)		2	SS	16														
191.3																			
1.4	Silty CLAY with sand, trace gravel, occasional rootlets Stiff to Hard Grey to Greenish Grey (TILL) Greenish Grey to Brown occasional iron oxide staining		3	SS	11														
			4	SS	20														
			5	SS	53														
			6	SS	92														
186.7																			
6.1	Sandy SILT, trace gravel Very Dense Grey (TILL)		7	SS	50/ 150														
186.0																			
6.7	SHALE, highly weathered, thinly bedded, reddish brown																		
185.0			8	SS	100/ .125														
7.7	END OF BOREHOLE AT 7.7m. BOREHOLE OPEN TO 7.7m AND WATER LEVEL AT 7.7m UPON COMPLETION OF DRILLING. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Sep28/07 3.1 189.7 Oct05/07 3.1 189.7 Nov01/07 2.8 190.0 Nov15/07 2.9 189.9																		

+ 3 × 3: Numbers refer to
Sensitivity




20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No RSE-09

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South to HWY 401 East Ramp N 4 832 138.6 E 290 093.9 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007-09-13 - 2007-09-13 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)	
191.5								20	40	60	80	100					
0.0	Sandy SILT, some clay, trace to some sand, trace gravel Compact Brown (FILL)		1	SS	18		191										
190.8			2	SS	34												
0.7	Clayey SILT to silty CLAY, trace to some sand, trace gravel Hard Brown (FILL) occasional wood fibres and rootlets, organic odour Dark Grey		3	SS	32		190										
189.3																	
2.2	Clayey SILT with sand, trace gravel Hard Brown to Mottled Brown/Grey (TILL) occasional shale fragments		4	SS	64		189										
			5	SS	50/ .150		188										
187.5																	
4.0	SHALE, highly weathered, thinly bedded, reddish brown																
186.9																	
4.6	END OF BOREHOLE AND AUGER REFUSAL AT 4.6m. BOREHOLE OPEN AND DRY TO 4.6m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.						187										

RECORD OF BOREHOLE No RSE-10

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South to HWY 401 East Ramp N 4 832 148.6 E 290 103.3 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007-09-13 - 2007-09-13 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
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			kN/m ³			GR SA SI CL			
189.6																					
0.0																					
0.1	TOPSOIL: (100mm)																				
	Silty CLAY, trace to some sand, trace gravel, occasional rootlets Very Stiff to Hard Brown (FILL)		1	SS	21																
			2	SS	39																
188.1																					
1.4	Clayey SILT with sand, trace gravel, occasional iron oxide staining Very Stiff to Hard Mottled Brown/Grey (TILL)		3	SS	16																
			4	SS	54																
			5	SS	50/ .150																
185.9																					
3.7	SHALE, highly weathered, thinly bedded, reddish brown																				
185.0																					
4.6	END OF BOREHOLE AND AUGER REFUSAL AT 4.6m. BOREHOLE OPEN AND DRY TO 4.6m UPON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Sep14/07 2.0 187.6 Sep19/07 1.9 187.7 Sep28/07 2.1 187.5 Oct05/07 1.9 187.7 Oct18/07 1.7 187.9 Nov01/07 1.6 188.0 Nov15/07 1.4 188.2																				

RECORD OF BOREHOLE No RSE-11

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South to HWY 401 East Ramp N 4 832 144.5 E 290 104.5
 HWY 401 BOREHOLE TYPE Solid Stem Augers/NQ Coring
 DATUM Geodetic DATE 2007-09-17 - 2007-09-24
 ORIGINATED BY GA
 COMPILED BY MFA
 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
								WATER CONTENT (%)				
190.0												
0.0 0.1	TOPSOIL: (75mm)											
	Silty CLAY, trace to some sand, trace gravel, occasional rootlets Very Stiff to Hard Brown (FILL)		1	SS	26		190					
			2	SS	33		189					
188.6												
1.4	Silty CLAY, trace sand, trace gravel, occasional rootlets Very Stiff Mottled Dark Grey/Grey		3	SS	24		188					
187.8												
2.2	Silty CLAY, some sand, occasional shale fragments Hard Brown to Reddish Brown Moist (TILL)		4	SS	58		187					
186.7												
3.4	SHALE, highly to slightly weathered, fine grained, thinly bedded, reddish brown, with occasional green siltstone interbeds		5	SS	107		186					
	Coring started at 4.50m Highly broken zone at 4.57 to 5.41m Green siltstone interbeds at 5.49, 5.61 to 5.69, and 5.77 to 5.94m		1	RUN			185					
	Slightly weathered to fresh Limestone interbed at 7.47 to 7.54m Green siltstone interbeds at 6.15 to 6.20, 6.55, 6.91 to 6.93, 7.01, 7.11, 7.21 to 7.26, 7.29, 7.34, and 7.39 to 7.47m		2	RUN			184					
182.5							183					
7.5	END OF BOREHOLE AT 7.5m. BOREHOLE OPEN AND DRY TO 7.5m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.											

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

RECORD OF BOREHOLE No RSE-12

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South to HWY 401 East Ramp N 4 832 154.3 E 290 108.9 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers/NQ Coring COMPILED BY MFA
 DATUM Geodetic DATE 2007-09-17 - 2007-09-19 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
191.1	TOPSOIL: 75mm)													
0.0 0.1	Silty CLAY, trace to some sand, trace gravel, occasional rootlets Hard to Very Stiff Brown (FILL)		1	SS	34		191							
			2	SS	20		190							
189.2			3	SS	15		189							
2.0	Silty CLAY, some sand, trace gravel Hard Mottled Brown/Grey (TILL) occasional oxide lenses		4	SS	46		188							
			5	SS	50/ .200		187							
187.3	SHAILE, highly to moderately weathered, fine grained, thinly bedded, reddish brown, with limestone and green siltstone interbeds Coring started at 4.50m Highly broken zone at 4.57 to 5.28m		1	RUN			186							RUN 1# TCR=47%, SCR=7%, RQD=7%, UCS=46MPa
3.8			2	RUN			185							RUN 2# TCR=100%, SCR=81%, RQD=66%, UCS=9MPa
			3	RUN			184							RUN 3# TCR=100%, SCR=100%, RQD=92%, UCS=3MPa
			4	RUN			183							RUN 4# TCR=100%, SCR=100%, RQD=100%, UCS=3MPa
182.0	END OF BOREHOLE AT 9.1m. BOREHOLE OPEN AND DRY TO 9.1m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.													

+ 3, X 3: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No RSE-13

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South to HWY 401 East Ramp N 4 832 156.4 E 290 116.2 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007-09-12 - 2007-09-12 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE LIQUID CONTENT LIMIT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa			W _P W W _L				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	WATER CONTENT (%)						
191.8							20 40 60 80 100								
0.0	Silty CLAY, trace to some sand, trace gravel, occasional rootlets Hard to Stiff Brown (FILL)		1	SS	35										
			2	SS	23										
			3	SS	9										
189.5															
2.3	Silty CLAY, trace to some sand, trace gravel, occasional rootlets Very Stiff Mottled Brown/Grey to Grey		4	SS	16										
188.7															
3.0	Clayey SILT with sand, trace gravel Hard Brown (TILL)		5	SS	45										
187.2															
187.2	SHALE, highly weathered, thinly bedded, reddish brown		6	SS	100/ .125										
4.7	END OF BOREHOLE AT 4.7m. BOREHOLE OPEN AND DRY TO 4.7m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.														

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

RECORD OF BOREHOLE No RSE-14

1 OF 2

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South to HWY 401 East Ramp N 4 832 166.8 E 290 121.3 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers/NQ Coring COMPILED BY MFA
 DATUM Geodetic DATE 2007-09-17 - 2007-09-18 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	
192.5	TOPSOIL: (75mm)											
0.0 0.1	SHALE, highly weathered, reddish brown: (FILL)		1	SS	32		192					
191.8	Silty CLAY, some sand, trace gravel Stiff to Very Stiff Reddish Brown to Brown (FILL)		2	SS	19		191					
0.7	occasional rootlets Dark Grey to Grey		3	SS	13		190					
			4	SS	14		189					
			5	SS	10		188					
187.9	SAND, trace silt, trace gravel Very Dense Brown Moist to Wet		6	SS	50/ .150		187					
186.4	Clayey SILT with sand, trace gravel, occasional to trace shale fragments Hard Brown (TILL)		7	SS	111		186					
185.1	SHALE, moderately to highly weathered, fine grained, thinly bedded, reddish brown, with green siltstone interbeds Coring started at 7.77m Highly broken zone at 7.77 to 7.92m Green siltstone interbeds at 7.77 to 7.85, 8.13 to 8.18, and 9.09 to 9.14m		8	SS	100/ .150		185					
7.3	Green siltstone interbeds at 9.37 to 9.40, 9.45 to 9.47, 9.83 to 9.91, 9.98, 10.54, and 10.72m Limestone interbeds at 9.60 to 9.75		1	RUN			184					
							183					

Continued Next Page

+³, X³: Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No RSE-14

2 OF 2

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South to HWY 401 East Ramp N 4 832 166.8 E 290 121.3 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers/NQ Coring COMPILED BY MFA
 DATUM Geodetic DATE 2007-09-17 - 2007-09-18 CHECKED BY RPR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80	100	W _p	W		
	Continued From Previous Page and 10.01 to 10.26m		2	RUN												
181.6																
10.8	END OF BOREHOLE AT 10.8m. BOREHOLE OPEN AND DRY TO 10.8m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) Sep19/07 1.7 190.8 Sep28/07 1.8 190.7 Oct05/07 1.8 190.7 Oct18/07 1.8 190.7 Nov01/07 1.6 190.9 Nov15/07 1.7 190.8															

RECORD OF BOREHOLE No RSE-15

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South to HWY 401 East Ramp. N 4 832 162.7 E 290 122.5 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007-09-12 - 2007-09-12 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
192.5	TOPSOIL: (50mm)													
192.0	Clayey SILT with sand, occasional shale fragments Stiff to Hard Reddish Brown (FILL)		1	SS	30		192							
			2	SS	16		191							
	occasional rootlets Mottled Brown/Grey		3	SS	11		190							
	Grey to Dark Grey		4	SS	8		189							
			5	SS	17		188							0 28 50 22
187.9							188							
4.6	SILT, some sand, trace clay, occasional iron oxide staining Very Dense Brown (TILL)		6	SS	50/ .075		187							0 18 74 8
186.4							186							
6.1	SHALE, highly weathered, thinly bedded, reddish brown		7	SS	50/ .150									
185.7														
6.7	END OF BOREHOLE AND AUGER REFUSAL AT 6.7m. BOREHOLE OPEN AND DRY TO 6.7m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 0.2m, THEN CUTTINGS TO SURFACE.													

+³ X³ Numbers refer to
Sensitivity 20
15 10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No RSE-16

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South to HWY 401 East Ramp N 4 832 192.2 E 290 114.6 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007-09-13 - 2007-09-13 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								20 40 60 80 100							
192.4															
0.1	TOPSOIL: (50mm)		1	SS	28		192								
	Silty CLAY with sand, occasional shale fragments Very Stiff to Hard Reddish Brown to Brown (FILL)		2	SS	50/ .150		191								
190.2			3	SS	17									0 31 44 25	
2.2	Silty CLAY, trace sand, occasional rootlets, organic odour Very Stiff Dark Grey to Grey		4	SS	18		190								
189.4			5	SS	33		189							2 32 47 19	
3.0	Silty CLAY, some sand, trace gravel Hard Mottled Brown/Grey to Greenish Brown (TILL)		6	SS	50/ .150		188							4 32 44 20	
	Brown						187								
186.6			7	SS	100/ .150										
5.8	SHALE, highly weathered, thinly bedded, reddish brown														
186.2															
6.2	END OF BOREHOLE AT 6.2m. BOREHOLE OPEN AND DRY TO 6.2m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.														

RECORD OF BOREHOLE No RSE-17

1 OF 1

METRIC

G.W.P. 2107-05-00 LOCATION Hurontario St. South to HWY 401 East Ramp N 4 832 134.2 E 290 109.1 ORIGINATED BY GA
 HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2007-09-13 - 2007-09-13 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								20	40	60						80	100	20
191.3																		
0.9	TOPSOIL: (75mm)																	
0.1	Silty CLAY, trace to some sand, trace gravel, occasional rootlets Very Stiff to Hard Brown (FILL)		1	SS	17													
			2	SS	36													
189.9																		
1.4	Silty CLAY, trace sand, occasional rootlets, organic odour Very Stiff Grey		3	SS	16													
189.1																		
2.2	Silty CLAY, some sand, trace gravel Very Stiff to Hard Mottled Brown/Grey (TILL)		4	SS	21													
			5	SS	68													
187.3																		
4.0	SHALE, highly weathered, thinly bedded, reddish brown																	
186.7																		
4.6	END OF BOREHOLE AND AUGER REFUSAL AT 4.6m. BOREHOLE OPEN AND DRY TO 4.6m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.		6	SS	50/.000													

+³, X³: Numbers refer to Sensitivity
 20
 15 10 5 0
 (%) STRAIN AT FAILURE

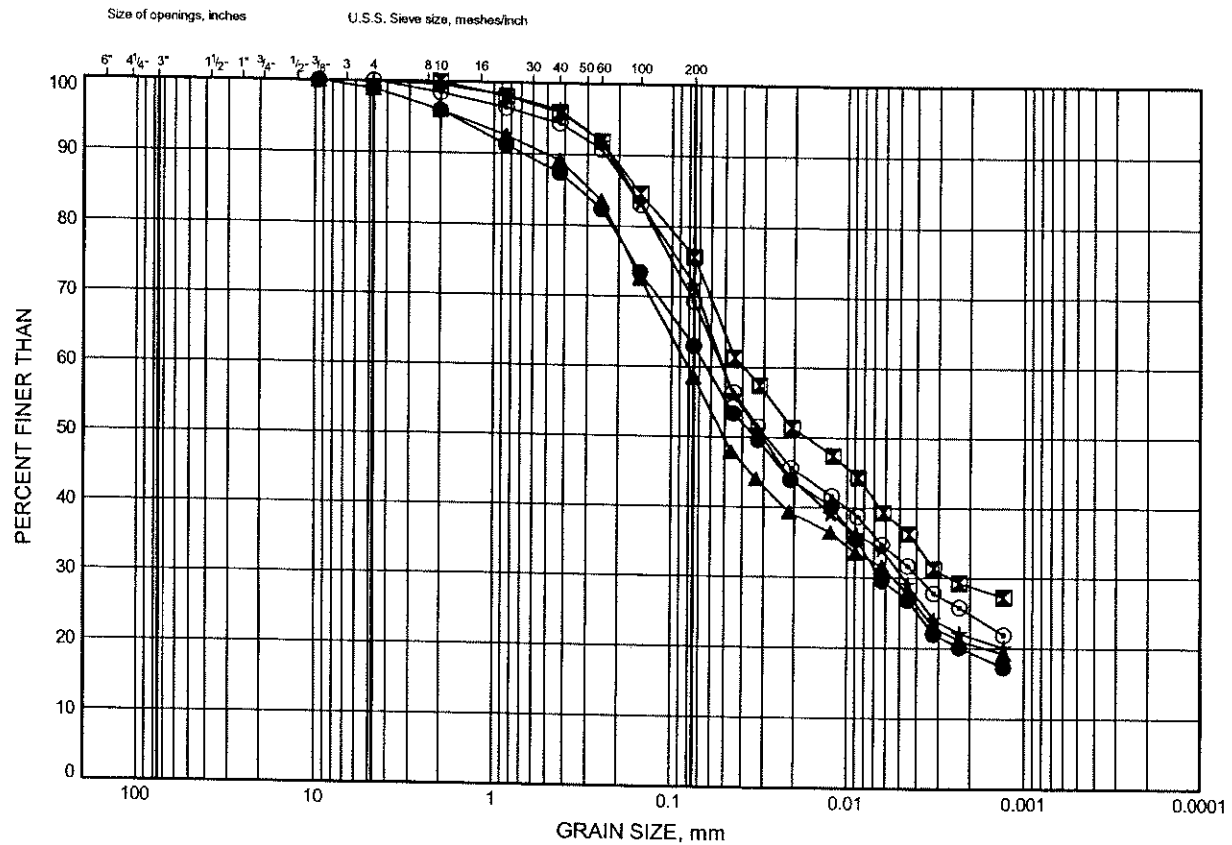
Appendix B

Laboratory Test Results

Hwy 401/410 to Credit River
GRAIN SIZE DISTRIBUTION

FIGURE B1

SILTY CLAY / CLAYEY SILT FILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	RSE-04	1.07	190.75
⊠	RSE-06	2.59	189.83
▲	RSE-14	3.35	189.11
★	RSE-15	3.35	189.10
⊙	RSE-16	1.83	190.58

Date November 2007

Project 2107-05-00



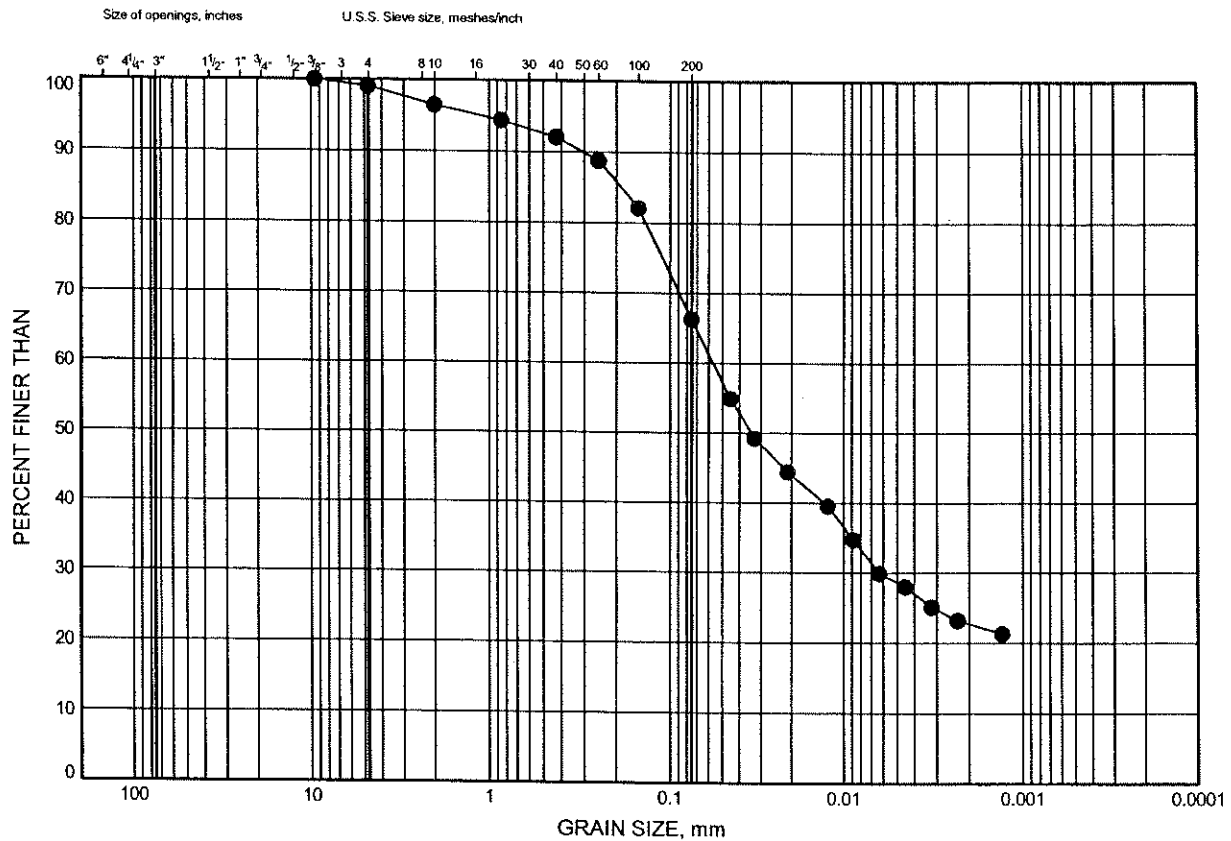
Prep'd MFA

Chkd. RPR

Hwy 401/410 to Credit River
GRAIN SIZE DISTRIBUTION

FIGURE B2

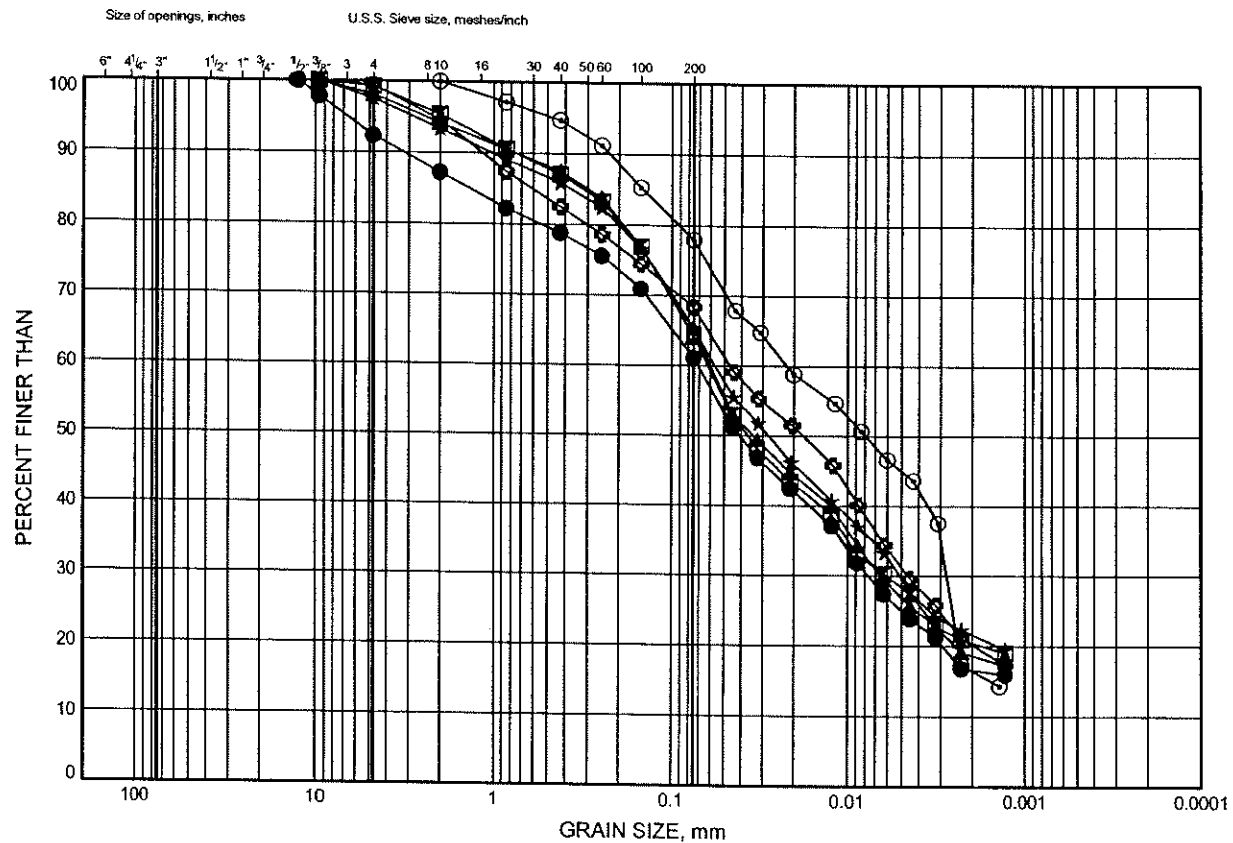
SILTY CLAY



Hwy 401/410 to Credit River
GRAIN SIZE DISTRIBUTION

FIGURE B3

SILTY CLAY / CLAYEY SILT TILL



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	RSE-01	2.59	188.09
■	RSE-02	2.59	188.06
▲	RSE-03	1.83	189.53
★	RSE-04	3.35	188.46
⊙	RSE-05	2.59	189.81
⊕	RSE-05	4.88	187.52

Date November 2007

Project 2107-05-00



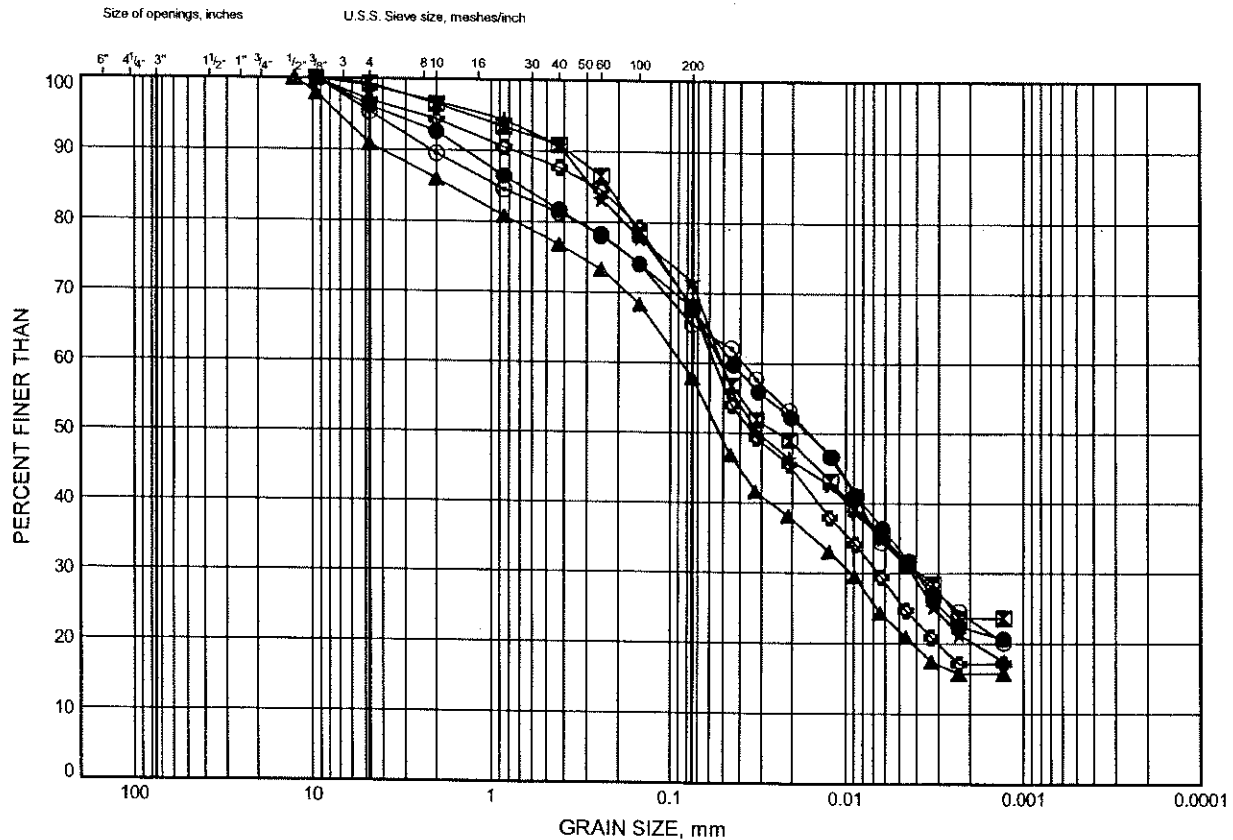
Prep'd MFA

Chkd. RPR

Hwy 401/410 to Credit River GRAIN SIZE DISTRIBUTION

FIGURE B4

SILTY CLAY / CLAYEY SILT TILL



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	RSE-06	4.88	187.54
⊠	RSE-07	2.59	190.40
▲	RSE-07	4.88	188.11
★	RSE-08	2.59	190.16
⊙	RSE-08	4.88	187.88
⊕	RSE-09	2.59	188.91

Date November 2007

Project 2107-05-00



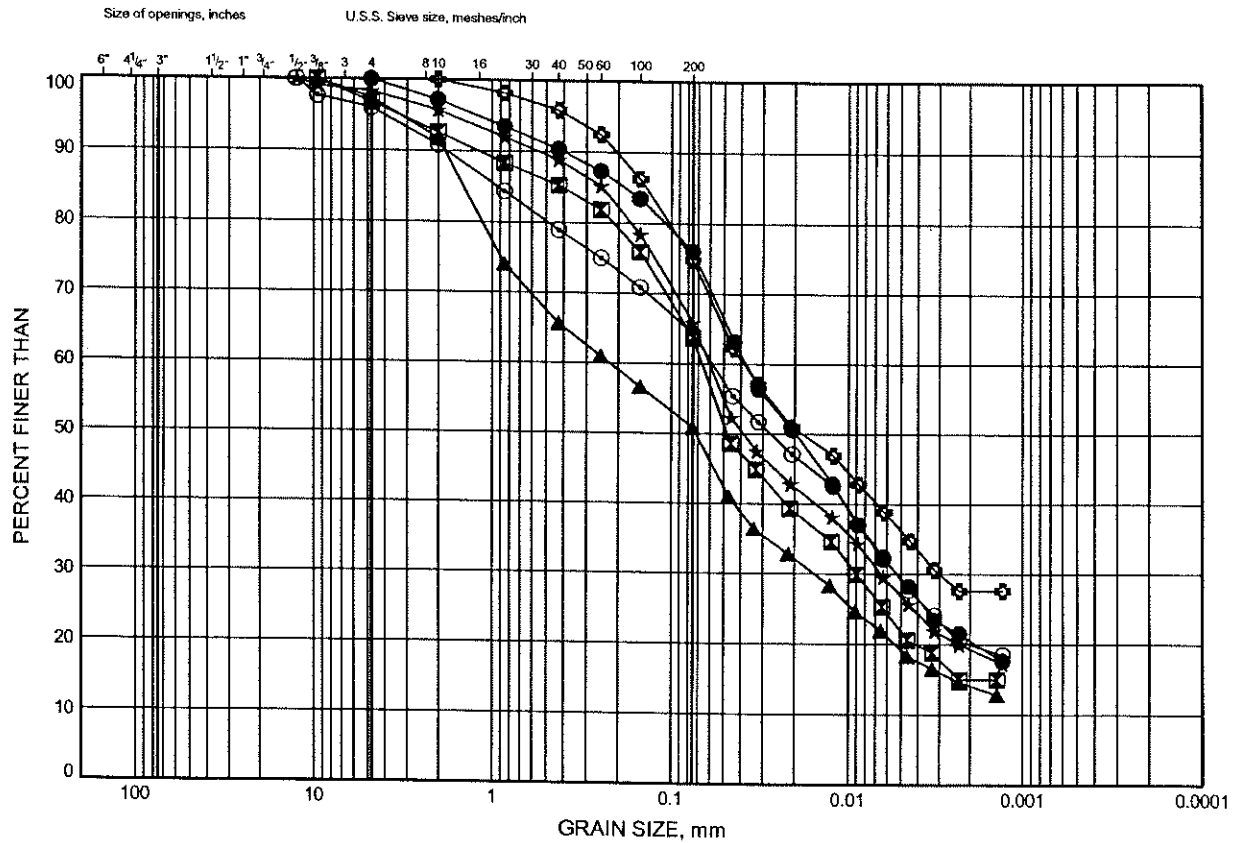
Prep'd MFA

Chkd. RPR

Hwy 401/410 to Credit River
GRAIN SIZE DISTRIBUTION

FIGURE B5

SILTY CLAY / CLAYEY SILT TILL



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

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	RSE-11	3.35	186.69
⊠	RSE-13	3.35	188.42
▲	RSE-14	6.40	186.06
★	RSE-16	3.35	189.05
⊙	RSE-16	4.88	187.53
⊛	RSE-17	2.59	188.72

Date November 2007

Project 2107-05-00



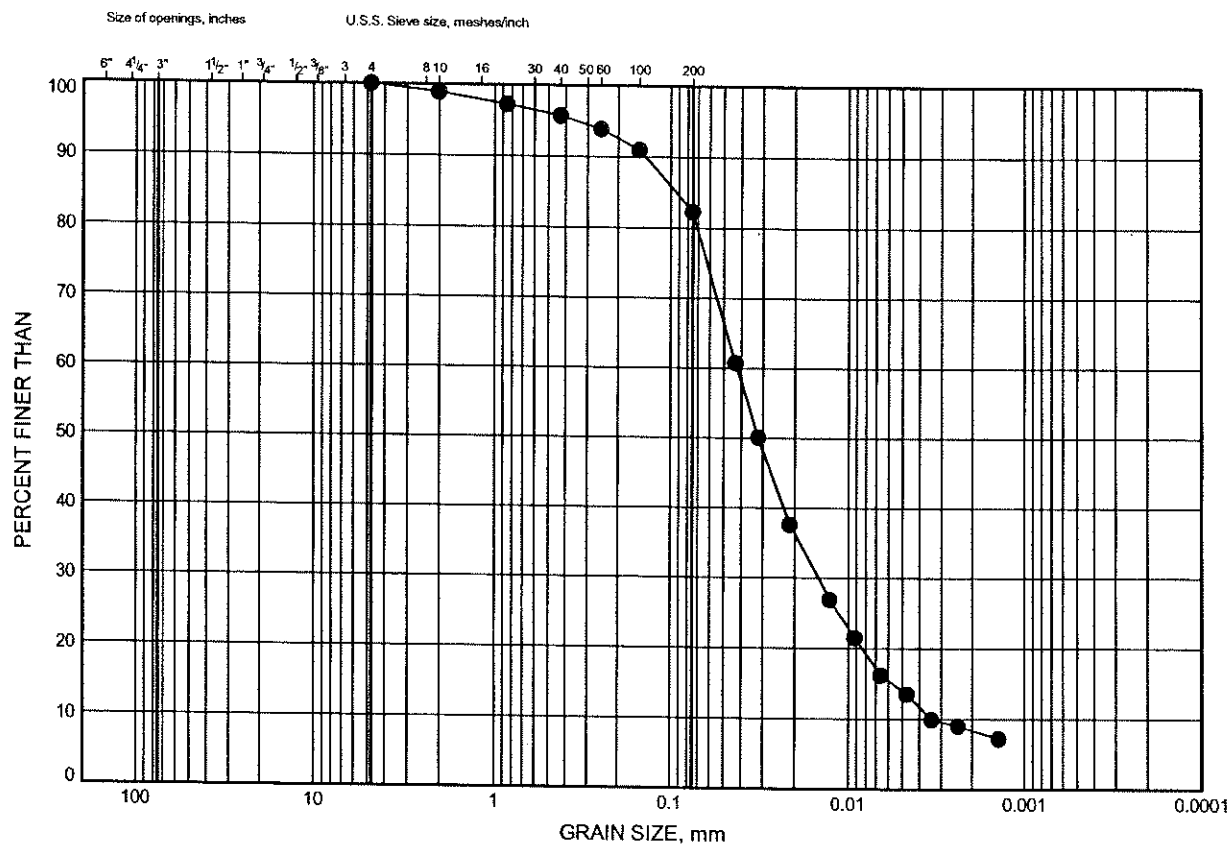
Prep'd MFA

Chkd. RPR

Hwy 401/410 to Credit River GRAIN SIZE DISTRIBUTION

FIGURE B6

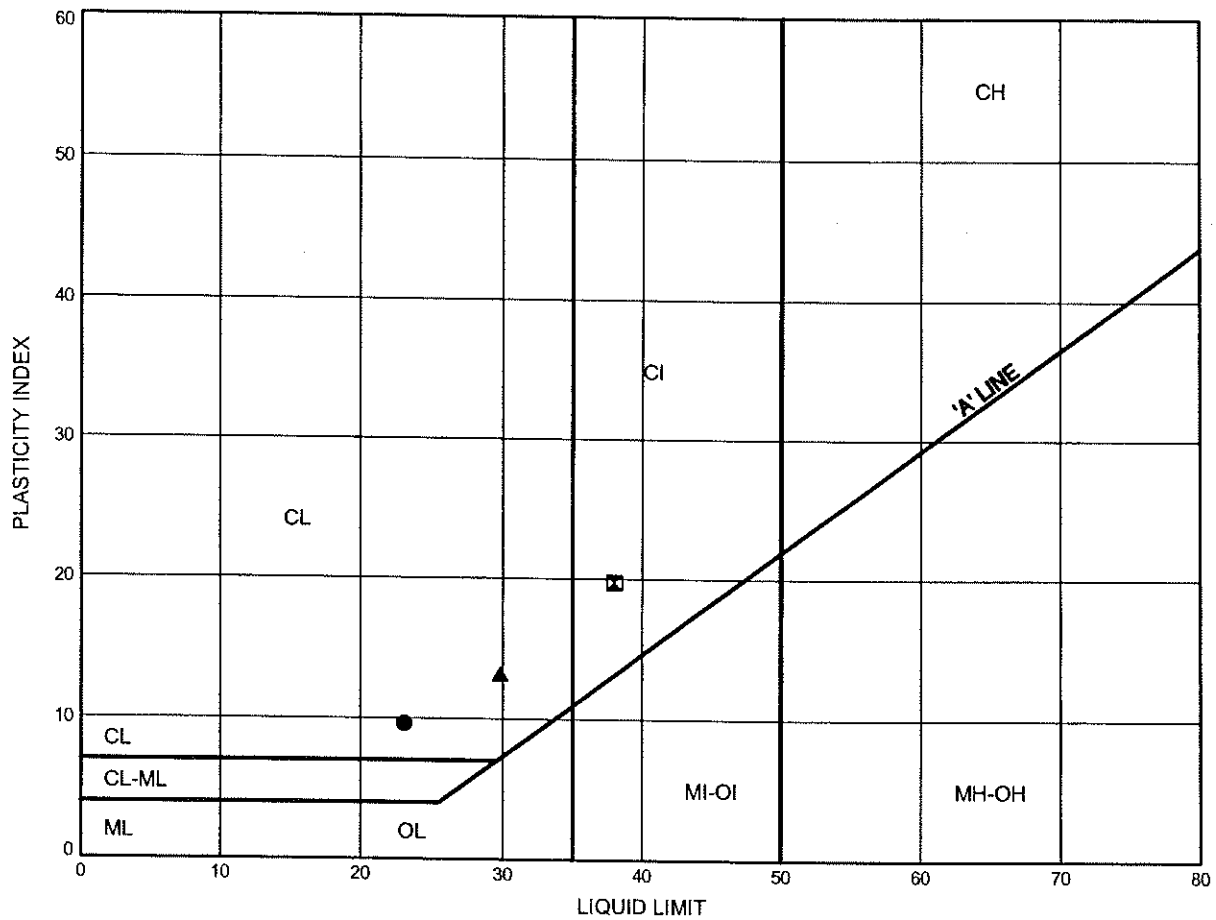
SILT TILL



Hwy 401/410 to Credit River
ATTERBERG LIMITS TEST RESULTS

FIGURE B7

SILTY CLAY / CLAYEY SILT FILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	RSE-04	1.07	190.75
⊠	RSE-06	2.59	189.83
▲	RSE-14	3.35	189.11

Date November 2007
 Project 2107-05-00

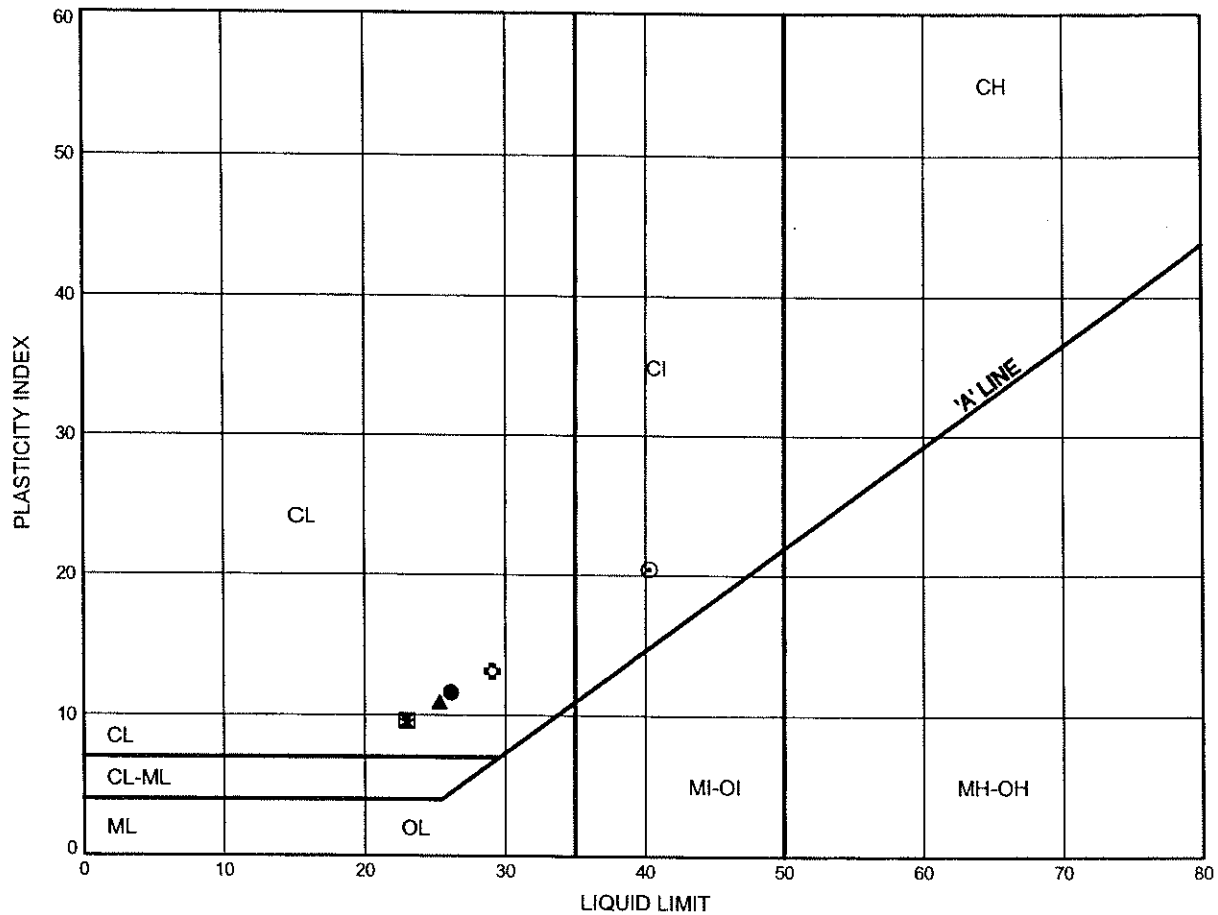


Prep'd MFA
 Chkd RPR

Hwy 401/410 to Credit River
ATTERBERG LIMITS TEST RESULTS

FIGURE B8

SILTY CLAY / CLAYEY SILT TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	RSE-01	2.59	188.09
⊠	RSE-02	2.59	188.06
▲	RSE-03	1.83	189.53
★	RSE-04	3.35	188.46
⊙	RSE-05	2.59	189.81
⊗	RSE-06	4.88	187.54

Date November 2007
 Project 2107-05-00

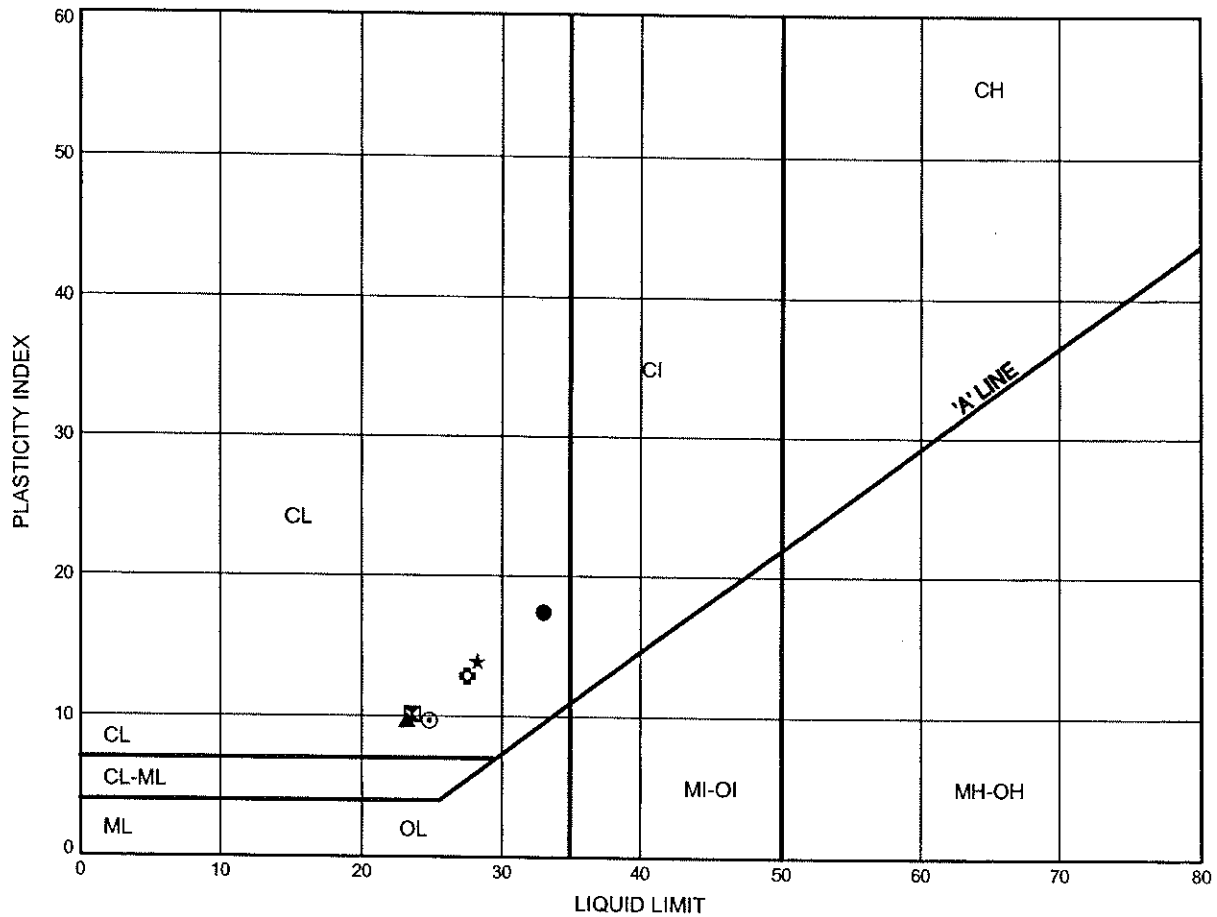


Prep'd MFA
 Chkd. RPR

Hwy 401/410 to Credit River
ATTERBERG LIMITS TEST RESULTS

FIGURE B9

SILTY CLAY / CLAYEY SILT TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	RSE-07	2.59	190.40
⊠	RSE-07	4.88	188.11
▲	RSE-09	2.59	188.91
★	RSE-10	1.83	187.76
⊙	RSE-11	3.35	186.69
⊛	RSE-12	2.59	188.56

Date November 2007
 Project 2107-05-00

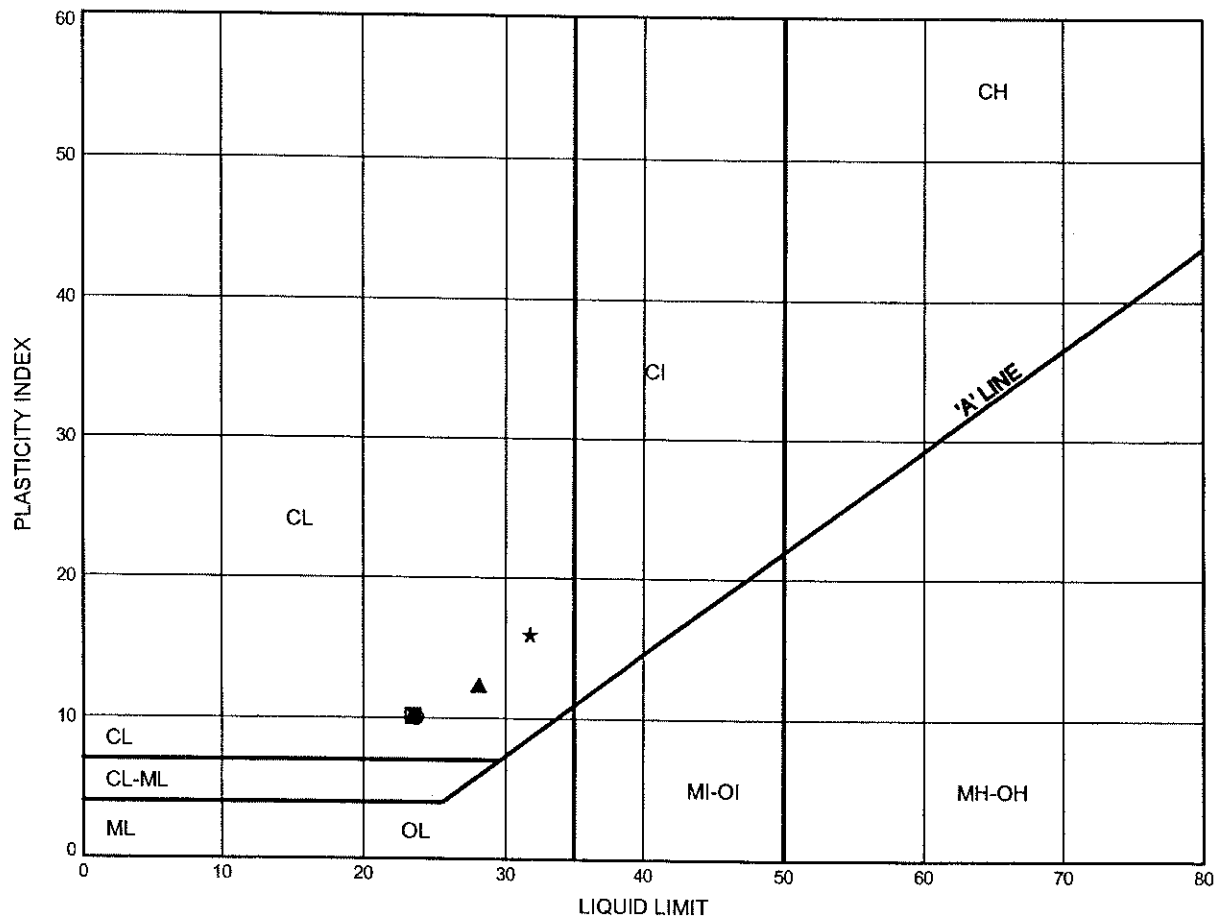


Prep'd MFA
 Chkd. RPR

Hwy 401/410 to Credit River
ATTERBERG LIMITS TEST RESULTS

FIGURE B10

SILTY CLAY / CLAYEY SILT TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	RSE-13	3.35	188.42
⊠	RSE-16	3.35	189.05
▲	RSE-16	5.18	187.22
★	RSE-17	2.59	188.72

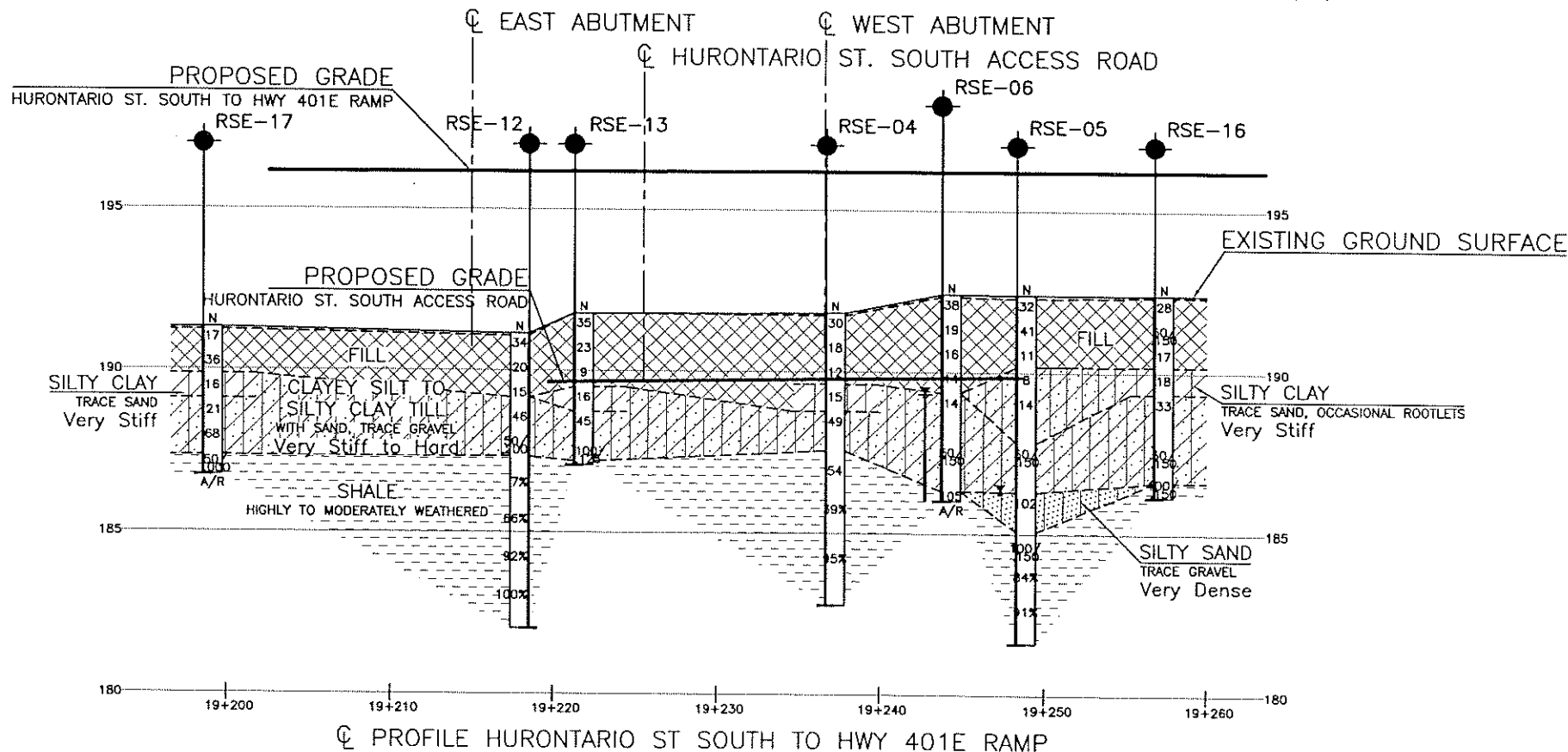
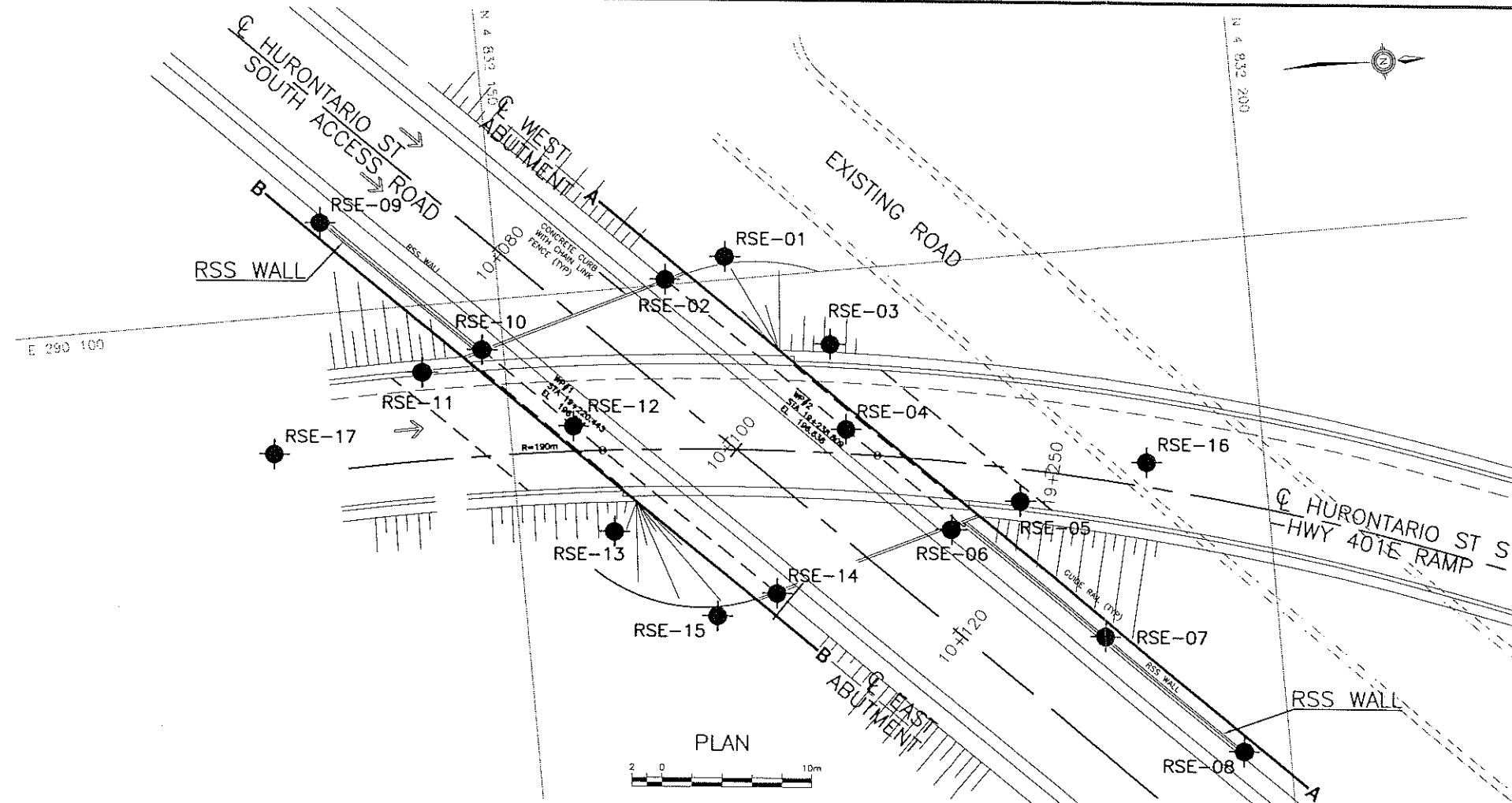
Date November 2007
 Project 2107-05-00



Prep'd MFA
 Chkd. RPR

Appendix C

Borehole Locations and Soil Strata Drawing



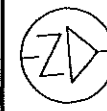
DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

2 0 10m
1 0 5m
HOR
VER

Refer to DWG 2 for Sections A-A and B-B.

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

HIGHWAY 401
SITE No 24-757
GWP No 2107-05-00

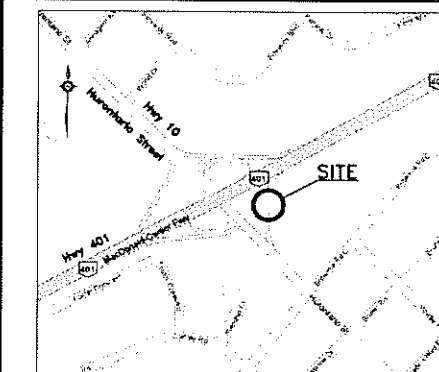


HURONTARIO ST. SOUTH TO
HWY 401 EAST RAMP
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

Marshall Macklin Monaghan
PROJECT MANAGERS • ENGINEERS • SURVEYORS • PLANNERS

THURBER ENGINEERING LTD.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS



KEYPLAN

LEGEND

- ◆ Borehole (Present Investigation, 2007)
- ⊕ 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
RSE-01	190.7	4 832 165.3	290 098.5
RSE-02	190.7	4 832 161.2	290 099.6
RSE-03	191.4	4 832 171.8	290 104.9
RSE-04	191.8	4 832 172.4	290 110.7
RSE-05	192.4	4 832 183.5	290 116.5
RSE-06	192.4	4 832 178.8	290 118.0
RSE-07	193.0	4 832 188.4	290 126.1
RSE-08	192.8	4 832 196.9	290 134.6
RSE-09	191.5	4 832 138.6	290 093.9
RSE-10	189.6	4 832 148.6	290 103.3
RSE-11	190.0	4 832 144.5	290 104.5
RSE-12	191.1	4 832 154.3	290 108.9
RSE-13	191.8	4 832 156.4	290 116.2
RSE-14	192.5	4 832 166.8	290 121.3
RSE-15	192.5	4 832 162.7	290 122.5
RSE-16	192.4	4 832 192.2	290 114.6
RSE-17	191.3	4 832 134.2	290 109.1

-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.

GEOCRE No. 30M12-266

REVISIONS	DATE	BY	DESCRIPTION
DESIGN AEG	CHK	SKP	CODE
DRAWN MFA	CHK	PKC	SITE
			LOAD
			STRUCT.
			SCHEME
			DWG 1

