

**FOUNDATION INVESTIGATION REPORT
HIGHWAY 404 EXTENSION
FROM GREEN LANE TO QUEENSVILLE SIDEROAD
CULVERTS AT
Sta 30+300 Sta 30+430.5
Sta 32+903 Sta 10+075 QSR
QSR E/W – S Ramp N – E/W QSR
REGION OF YORK
G.W.P. 2109-05-00**

GEOCRES Number: 31D-493

Report to

Philips Engineering / Hatch Mott MacDonald Joint Venture

Thurber Engineering Ltd.
2010 Winston Park Drive, Suite 103
Oakville, Ontario
L6H 5R7
Phone: (905) 829 8666
Fax: (905) 829 1166

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TABLE OF CONTENTS

1	INTRODUCTION	1
2	SITE AND PROJECT DESCRIPTIONS	1
2.1	Four proposed culverts at Queensville Sideroad and Highway 404 interchange.....	1
2.2	Two proposed culverts south of Doane Road	2
3	SITE INVESTIGATION AND FIELD TESTING.....	3
4	LABORATORY TESTING	6
5	DESCRIPTION OF SUBSURFACE CONDITIONS	6
5.1	Four proposed culverts at Queensville Sideroad and Highway 404 interchange.....	6
5.1.1	Topsoil.....	7
5.1.2	Pavement Structure.....	7
5.1.3	Fill.....	7
5.1.4	Clayey Silt and Silty Clay.....	7
5.1.5	Silty Sand.....	8
5.1.6	Sand and Silt till	8
5.1.7	Groundwater Conditions.....	9
5.2	Proposed culvert south of Doane Road.....	14
	(Culvert 5 – Boreholes 08-01 to 08-05).....	14
5.2.1	Topsoil.....	15
5.2.2	Sandy Silt.....	15
5.2.3	Silty Clay	15
5.2.4	Silty Clay Till	16
5.2.5	Groundwater Conditions.....	16
5.3	Proposed culvert south of Doane Road.....	17
	(Culvert 6 – Boreholes 08-10 to 08-14).....	17
5.3.1	Peat	17
5.3.2	Silty Clay	17
5.3.3	Silty Sand.....	18
5.3.4	Silty Clay Till	18
5.3.5	Groundwater Conditions.....	19
6	MISCELLANEOUS	19

Appendices

Appendix A	Record of Borehole Sheets (south of Queensville Sideroad) (Culverts 1 to 4 – Boreholes QSR1-1 to QSR1-3, QSR2-1 to QSR2-4, QSR3-1 to QSR3-5 and QSR4-1 to QSR4-5)
Appendix B	Laboratory Test Results (south of Queensville Sideroad)
Appendix C	Site Photographs (south of Queensville Sideroad)
Appendix D	Drawing titled “Borehole Locations and Soil Strata” (south of Queensville Sideroad) (Culverts 1 – 4)
Appendix E	Record of Borehole Sheets (south of Doane Road) (Culverts 5 and 6 – Boreholes 08-01 to 08-05 and 08-10 to 08-14)
Appendix F	Laboratory Test Results (south of Doane Road)
Appendix G	Site Photographs (south of Doane Road)
Appendix H	Drawing titled “Borehole Locations and Soil Strata” (south of Doane Road) (Culverts 5 and 6)

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1 INTRODUCTION

This report presents the factual findings obtained from a foundation investigation carried out by Thurber Engineering Ltd. (Thurber) for the detail design of a total of six culverts to be installed at the proposed Highway 404 extension from Green Lane to Woodbine Avenue/Ravenshoe Road in the Town of East Gwillimbury, in the Regional Municipality of York. Four proposed culverts will be installed south of the Queensville Sideroad and two culverts south of Doane Road.

The purpose of the investigation was to explore the subsurface conditions at the various sites and, based on the data obtained, provide borehole location plans, borehole logs, stratigraphic profiles, cross-sections, laboratory test results and written descriptions of the subsurface conditions

Thurber carried out the investigation as a sub-consultant to Philips Engineering/Hatch Mott MacDonald Joint Venture under the Ministry of Transportation Ontario (MTO) Agreement Number 2007-E-0027.

2 SITE AND PROJECT DESCRIPTIONS

2.1 Four proposed culverts at Queensville Sideroad and Highway 404 interchange (Culverts 1 to 4)

The sites are located south of the Queensville Sideroad, approximately 750 m west of the existing intersection of Queensville Sideroad and Woodbine Avenue (York Regional Road 8), in the Town of East Gwillimbury, in the Regional Municipality of York.

The natural ground surface at the site has a relatively gently rolling/undulating topography.

An existing CSP culvert carries a tributary of the Maskinonge River under Queensville Sideroad, near Station 10+080. The tributary flows north to south.

The lands surrounding the site are generally undeveloped and/or agricultural. Vegetation consists mainly of tall grass, shrubs and a few mature trees. There are farmsteads to the north and south of Queensville Sideroad.

The proposed culverts will be placed at specific locations along the proposed Highway 404 and Queensville Sideroad interchange to carry a small tributary of the Makinonge River under the proposed Highway 404 extension alignment, existing Queensville Sideroad and new ramps. The designations and approximate locations of the proposed culverts are as follows:

Culvert	Location
1	Queensville Sideroad East/West to Highway 404 South Ramp (E/W- S Ramp) (Site Number 37-1573/C)
2	Highway 404 North to Queensville Sideroad East/West Ramp (N-E/W Ramp) (Site Number 37-1574/C)
3	Highway 404 approximate Station 32+903 (Site Number 37-1575/C)
4	Queensville side Road, approximate Station 10+075 (Site Number 37-1576/C)

Photographs of the site included in Appendix C show the general nature of the surrounding land:

1. A view looking at the north end of existing CSP culvert (north of Queensville Sideroad).
2. View of the site looking south of Queensville Sideroad

2.2 Two proposed culverts south of Doane Road (Culverts 5 and 6)

The site is located approximately 450 m to 600 m south of Doane Road and approximately 450 m west of Woodbine Avenue (York Regional Road 8), in the Town of East Gwillimbury, in the Regional Municipality of York.

The site is currently a wooded area with mature trees, shrubs and long grass. Mount Albert creek is located within the site flowing southerly. A pond located northeast of the culverts has flooded the site of Culvert 6 with a water depth greater than 1.0 m. The pond is approximately 250 m long and 25 m wide.

The designations and approximate locations of the proposed culverts are as follows:

Culvert	Location
5	Proposed Highway 404 extension alignment, Station 30+300 Approx. 600 m south of Doane Road (Site Number 37-1571/C)
6	Proposed Highway 404 extension alignment, Station 30+450 to 30+412 Approx. 450 m south of Doane Road (proposed Highway 404 extension and Mount Albert creek crossing) (Site Number 37-1572/C)

The proposed culverts will carry Mount Albert creek under the proposed Highway 404 extension alignment.

Photographs of the site included in Appendix G show the general nature of the surrounding land:

1 and 2. Views looking at site location of proposed Culvert 5.

3 and 4. Views looking at site location of proposed Culvert 6.

The six culverts are located within the physiographic region known as The Peterborough Drumlin Field, characterized by drumlinized till. The till is typically sandy with shallow coverings of silt and fine sand.

3 SITE INVESTIGATION AND FIELD TESTING

The site investigation and field testing at the locations of the proposed four culverts south of the Queensville Sideroad were carried out from February 25 to March 17, 2008. A total of 17 sampled boreholes were drilled for the proposed culverts.

Boreholes for the proposed Culvert 5, located south of Doane Road were drilled on August 26 and 27, 2009. A total of five sampled boreholes were drilled at this location.

Boreholes for the proposed Culvert 6, located south of Doane Road were drilled on February 17 and 18, 2010. A total of five sampled boreholes were drilled at this location.

A summary of the borehole locations, designations, termination depths and termination elevations drilled for each culvert is provided in Table 3.1. The coordinates and elevations of the boreholes are given on the drawings and on the individual Record of Borehole Sheets. Record of Borehole Sheets are included in Appendices A and E.

Table 3.1 – Borehole Designations

Culvert	Borehole	Station	Location Relative to the Culvert	Borehole Termination Depth (m)	Borehole Termination Elevation (m)	Appendix
1	QSR1-1	10+340	West of E/W-S Ramp	12.8	244.1	A
	QSR1-2	10+340	On E/W-S Ramp	12.8	244.2	
	QSR1-3	10+340	East of E/W-S Ramp	11.0	245.6	
2	QSR2-1	10+120	South of N-E/W Ramp	11.3	244.9	
	QSR2-2	10+115	South of N-E/W Ramp	12.8	243.6	
	QSR2-3	10+108	On N-E/W Ramp	12.8	244.0	
	QSR2-4	10+092	North of N-E/W Ramp	14.3	241.2	
3	QSR3-1	32+886	West of proposed Highway 404	14.3	241.0	
	QSR3-2	32+894	West of proposed Highway 404	12.8	242.7	
	QSR3-3	32+900	Proposed Highway 404	14.3	241.5	
	QSR3-4	32+908	Proposed Highway 404	14.3	241.3	
	QSR3-5	32+915	East of proposed Highway 404	11.1	243.9	
4	QSR4-1	10+095	North of Queensville Sideroad	12.8	240.9	
	QSR4-2	10+090	North of Queensville Sideroad	11.3	243.6	
	QSR4-3	10+080	On Queensville Sideroad	11.3	245.9	
	QSR4-4	10+078	South of Queensville Sideroad	11.3	244.2	
	QSR4-5	10+075	South of Queensville Sideroad	10.7	244.7	
5	08-1	30+300	On proposed Hwy 404 alignment	11.3	245.9	E
	08-2	30+300	West side of proposed Hwy 404 alignment	11.3	245.9	
	08-3	30+302		11.3	246.2	
	08-4	30+300	East side proposed Hwy 404 alignment	11.3	251.5	
	08-5	30+298		11.1	249.7	
6	08-10	30+435	On proposed Hwy 404 alignment	8.2	249.2	E
	08-11	30+441	East side of proposed Hwy 404 alignment	9.1	247.9	
	08-12	30+456		8.5	249.8	
	08-13	30+424	West side of proposed Hwy 404 alignment	9.1	247.8	
	08-14	30+412		9.1	247.9	

The approximate locations of all the boreholes drilled for culverts south of Queensville Sideroad and Doane Road are shown on the Borehole Location Drawings in Appendices D and H, respectively.

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

Hollow and solid stem augering, and continuous split spoon sampling techniques were used to advance the boreholes in the overburden. Samples were obtained at selected intervals using a 50 mm diameter split spoon sampler in conjunction with Standard Penetration Testing (SPT).

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.

Groundwater conditions in the open boreholes were observed throughout the drilling operations. A total of eleven standpipe piezometers consisting of 19 mm PVC pipes with screens were installed in selected boreholes to permit monitoring of groundwater levels. Details of the piezometer installations and other borehole completion details are shown in Table 3.2.

Table 3.2 – Borehole Completion Details

Culvert	Borehole	Piezometer Tip Depth/ Elevation (m)	Completion Details
1	QSR1-1	None installed	Borehole backfilled with holeplug to surface.
	QSR1-2	11.9/245.1	Sand from 11.9 m to 10.1 m, holeplug from 10.1 m to surface.
	QSR1-3	None installed	Borehole backfilled with holeplug to surface.
2	QSR2-1	11.3/244.9	Sand from 11.3 m to 9.4 m, holeplug from 9.4 m to 1.5 m, cuttings from 1.5 m to surface.
	QSR2-2	None installed	Borehole backfilled with holeplug to surface.
	QSR2-3	11.9/244.9	Sand from 11.9 m to 10.1 m, holeplug from 10.1 m to surface.
	QSR2-4	None installed	Borehole backfilled with holeplug to surface.
3	QSR3-1	13.5/241.9	Sand from 13.5 m to 11.7 m, holeplug to surface.
	QSR3-2	None installed	Holeplug to surface.
	QSR3-3	14.3/241.5	Sand from 14.3 m to 12.5 m, holeplug to surface.
	QSR3-4	None installed	Holeplug to 0.6 m then auger cutting to surface.
	QSR3-5	11.1/243.9	Sand from 11.1 m to 9.0 m, bentonite grout from 9.0 m to 0.6 m, and then cuttings to surface.
4	QSR4-1	None installed	Borehole backfilled with holeplug to surface.
	QSR4-2	11.3/243.6	Sand from 11.3 m to 9.4 m, bentonite grout from 9.4 m to 0.6 then cuttings to surface.
	QSR4-3	None installed	Holeplug to 0.2 m then asphalt/cold patch to surface.
	QSR4-4	10.7/244.7	Sand from 10.7 m to 8.5 m, bentonite grout from 8.5 m to surface.
	QSR4-5	None installed	Holeplug to 1.2 m then auger cuttings to surface.

5	08-1	None installed	Borehole backfilled with holeplug to surface.
	08-2	10.7/246.4	Sand from 10.7 m to 8.8 m, holeplug from 8.8 m to surface.
	08-3	None installed	Borehole backfilled with holeplug to surface.
	08-4	11.3/251.5	Sand from 11.3 m to 9.4 m, holeplug from 9.4 m to surface.
	08-5	None installed	Borehole backfilled with holeplug to surface.
6	08-10	None installed	Borehole backfilled with holeplug to surface.
	08-11	None installed	Borehole backfilled with holeplug to surface.
	08-12	8.5/249.8	Sand from 8.5 m to 5.5 m, holeplug from 5.5 m to surface.
	08-13	None installed	Borehole backfilled with holeplug to surface.
	08-14	None installed	Borehole backfilled with holeplug to surface.

4 LABORATORY TESTING

The recovered soil samples were subjected to Visual Identification (VI) and to natural moisture content determination. Selected samples were also subjected to grain size distribution analyses (sieve and hydrometer) and Atterberg Limits testing where appropriate. The results of this testing program for boreholes drilled south of the Queensville Sideroad and Doane Road are shown on the Record of Borehole sheets in Appendices A and E and on the figures contained in Appendices B and F, respectively.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

Reference is made to the Record of Borehole sheets in Appendices A and E for details of the encountered soil stratigraphy in boreholes drilled south of Queensville Sideroad and Doane Road, respectively. Stratigraphic profiles are presented on the Borehole Locations and Soil Strata Drawings in Appendices D and H, for illustrative purposes. Overall descriptions of the stratigraphy are given in the following paragraphs. However, the factual data presented in the Record of Borehole Sheets governs any interpretation of the site conditions. It must be recognized that soil conditions may vary between and beyond borehole locations.

5.1 Four proposed culverts at Queensville Sideroad and Highway 404 interchange (Culverts 1 to 4 - Boreholes QSR1-1 to QSR1-3, QSR2-1 to QSR2-4, QSR3-1 to QSR3-5 and QSR4-1 to QSR4-5)

The soil stratigraphy encountered at the borehole locations typically consists of topsoil or fill underlain by native clayey silt, silty clay and occasional silty sand layers overlying an extensive deposit of sand and silt till.

5.1.1 Topsoil

Topsoil was identified at ground surface in Boreholes QSR2-1 to QSR2-4 and QSR3-1 to QSR3-5 drilled at the proposed locations of Culverts 2 and 3. The topsoil thickness ranged from 300 mm to 500 mm. The topsoil thickness may vary between and beyond the borehole locations and the data is not intended for the purpose of estimating quantities.

5.1.2 Pavement Structure

Pavement structure consisting of approximately 150 mm of asphalt overlying granular (gravelly sand fill) road base was encountered in Borehole QSR4-3 drilled on Queensville Sideroad. The thickness of granular fill was 0.9 m and the underside lay at elevation 256.1 m. The gravelly sand fill is in a dense state with SPT 'N' values of 46 blows per 0.3 m of penetration.

5.1.3 Fill

Fill was encountered surficially in Boreholes QSR4-1 to QSR4-5, drilled in close proximity to Queensville Sideroad. Fill was presumably placed to construct the existing embankment for Queensville Sideroad.

Fill consists of layers of dark brown to brown silty clay and sandy silt containing trace gravel to gravelly and occasional topsoil, organics, rootlets and wood fibres.

The thickness as well as the depth to the base of the fill ranged from 0.6 m to 4.1 m (Elevations 252.2 to 254.2).

Based on recorded SPT 'N' values ranging from 1 to 6 blows for 0.3 m of penetration, the silty clay fill is described as being very soft to firm in consistency. SPT 'N' values of 2 to 46 blows per 0.3 m of penetration, indicating a very loose to compact relative density, were measured in the sandy silt fill in Borehole QSR4-3 and QSR4-5.

The natural moisture content of the samples obtained from the fill layer ranged from 5% to 50%.

5.1.4 Clayey Silt and Silty Clay

Layers of native dark brown to brown clayey silt and silty clay containing trace to some sand, trace gravel and occasional roots, rootlets and topsoil were observed surficially in Boreholes QSR1-1 to QSR1-3. Brown clayey silt containing trace sand to sandy, trace gravel and occasional rootlets was contacted below the topsoil in Boreholes QSR2-2 to QSR2-4 and QSR1-3 to QSR3-5.

Thickness and depth to the base of the clayey silt and silty clay ranged from 1.2 m to 2.3 m (Elevations 254.3 to 255.8) in Boreholes QSR1-1 to QSR1-3.

In Boreholes QSR2-2 to QSR2-4 and QSR3-1 to QSR3-5, thickness of the clayey silt ranged from 0.3 m to 1.1 m. The depth to the base of the clayey silt varied from 0.8 m to 1.4 m (Elevations 253.8 to 256.1).

Based on recorded SPT 'N' values ranging from 3 to 13 blows for 0.3 m of penetration, the native silty clay and clayey silt are described as being soft to stiff in consistency.

The natural moisture content of the samples obtained from the clayey silt and silty clay layers ranged from 18% to 45%.

5.1.5 Silty Sand

Layers of silty sand were contacted in Borehole QSR1-3 at 2.3 m depth (Elevation 254.3) and in Boreholes QSR3-2 and QSR3-3 at 10.6 m depth (Elevations 244.9 and 245.2). Thickness of the silty sand layers ranged from 600 mm to 700 mm.

SPT 'N' values in the silty sand layers were 19 and 40 blows for 0.3 m of penetration, indicating a compact to dense relative density. Moisture content ranged from 10% to 19%.

Grain size distribution curves for three silty sand samples are presented on the Record of Borehole sheets and on Figure B1 of Appendix B. The results of the laboratory tests are summarized as follows:

Soil Particles	(%)
Gravel	0 to 14
Sand	58 to 66
Silt	21
Clay	9
Silt & Clay	28 to 38

5.1.6 Sand and Silt till

An extensive deposit of brown to grey sand and silt till containing trace clay to clayey and trace gravel was observed in all boreholes at depths varying from 0.5 m to 4.1 m (Elevations 252.2 to 256.1).

Boreholes were terminated within the sand and silt till at depths ranging from 10.7 m to 14.3 m (Elevations 240.9 to 245.9).

The SPT 'N' values measured in the sand and silt till ranged from 8 to 107 blows per 0.3 m of penetration, indicating a loose to dense density. The deposit is generally in a compact to dense state. SPT 'N' values higher than 100 blows per 0.15 m of penetration were measured

in the sand and silt till near borehole termination depths in Boreholes QSR1-3, QSR3-5, QSR4-1 and QSR4-5. An SPT 'N' value of 50 blows per 0.15 m of penetration was measured in Borehole QSR3-3 near 3.0 m depth, Elevation 252.8. In Boreholes QSR3-2 and QSR3-3, SPT 'N' values of 0 and 1, indicating a very loose relative density, were measured at 7.7 m and 9.3 m (Elevations 247.8 and 246.5).

The moisture content of samples from this deposit ranges from 10% to 22%.

Grain size distribution curves for several sand and silt till samples are presented on the Record of Borehole sheets and on Figure B2 to B10 of Appendix B. Atterberg Limits test results are presented on Figures B11 to B16 of Appendix B. The results of the laboratory tests are summarized as follows:

Soil Particles	(%)
Gravel	0 to 7
Sand	13 to 53
Silt	35 to 78
Clay	3 to 36

Index Property	(%)
Liquid Limit	14 to 23
Plastic Limit	10 to 15

The above results show that the clayey zones in the sand and silt till are typically of low plasticity with group symbols of CL-ML.

Glacial tills inherently contain cobbles and boulders which may account for some high blow counts.

5.1.7 Groundwater Conditions

Water level was observed in the boreholes during and upon completion of drilling. Eight standpipe piezometers were installed to monitor water levels after completion of drilling. The water levels measured in the piezometers are summarized in Table 5.1, along with the measurements in the boreholes upon completion of drilling.

Table 5.1 – Measured Groundwater Levels

Culvert	Borehole	Date	Water Level (m)		Comment
			Depth	Elevation	
1	QSR1-1	March 5, 2008	1.5	255.4	In open borehole
	QSR1-2	March 5, 2008	1.7	255.3	In open borehole
		March 7, 2008	3.1	253.9	In piezometer
		March 20, 2008	2.2	254.8	In piezometer
		April 18, 2008	Ground surface	257.0	In piezometer
		June 30, 2008	1.1	255.9	In piezometer
		July 29, 2008	1.1	255.9	In piezometer
		October 24, 2008	1.2	255.8	In piezometer
		November 28, 2008	1.3	255.7	In piezometer
		February 6, 2009	1.2	255.8	In piezometer
		February 20, 2009	1.2	255.8	In piezometer
		March 20, 2009	1.1	255.9	In piezometer
		April 22, 2009	1.0	256.0	In piezometer
		May 15, 2009	1.1	255.9	In piezometer
		June 5, 2009	1.4	255.6	In piezometer
		July 29, 2009	0.2	256.8	In piezometer
		August 5, 2009	0.5*	257.5	In piezometer
		September 2, 2009	0.5	256.5	In piezometer
	QSR1-3	March 4, 2008	1.2	255.4	In open borehole

* Water level above ground surface (artesian condition)

Table 5.1 – Measured Groundwater Levels (Cont'd)

Culvert	Borehole	Date	Water Level (m)		Comment
			Depth	Elevation	
2	QSR2-1	March 4, 2008	Ground surface	256.2	In open borehole
		March 7, 2008	3.3	252.9	In piezometer
		March 20, 2008	2.2	254.0	In piezometer
		April 18, 2008	0.3	255.9	In piezometer
		June 30, 2008	0.7	255.5	In piezometer
		July 29, 2008	0.7	255.5	In piezometer
		October 24, 2008	0.7	255.5	In piezometer
		November 28, 2008	0.7	255.5	In piezometer
		February 6, 2009	0.7	255.5	In piezometer
		February 20, 2009	0.6	255.6	In piezometer
		March 20, 2009	0.6	255.6	In piezometer
		April 22, 2009	0.7	255.5	In piezometer
		May 15, 2009	0.7	255.5	In piezometer
		June 5, 2009	1.1	255.1	In piezometer
		July 29, 2009	0.2*	256.4	In piezometer
		August 5, 2009	0.4*	256.6	In piezometer
	QSR2-2	February 28, 2008	5.2	251.2	In open borehole
	QSR2-3	February 28, 2008	5.7	251.1	In open borehole
		March 7, 2008	2.7	254.1	In piezometer
		March 20, 2008	1.1	255.7	In piezometer
		April 18, 2008	Ground surface	256.8	In piezometer
		June 3, 2008	0.7	256.1	In piezometer
		July 29, 2008	0.7	256.1	In piezometer
		October 24, 2008	0.7	256.1	In piezometer
		November 28, 2008	0.8	256.0	In piezometer
		February 6, 2009	0.7	256.1	In piezometer
		February 20, 2009	0.7	256.1	In piezometer
		March 20, 2009	0.7	256.1	In piezometer
		April 22, 2009	0.6	256.2	In piezometer
		May 15, 2009	0.7	256.1	In piezometer
		June 5, 2009	1.0	255.8	In piezometer
		July 29, 2009	0.2*	257.0	In piezometer
		August 5, 2009	0.9*	257.7	In piezometer
	QSR2-4	March 3, 2008	1.0	254.5	In open borehole

* Water level above ground surface (artesian condition)

Table 5.1 – Measured Groundwater Levels (Cont'd)

Culvert	Borehole	Date	Water Level (m)		Comment
			Depth	Elevation	
3	QSR3-1	March 3, 2008	2.0	253.4	In open borehole
		March 7, 2008	2.5	252.9	In piezometer
		March 20, 2008	1.5	253.9	In piezometer
		April 18, 2008	Ground surface	255.4	In piezometer
		June 30, 2008	0.8	254.6	In piezometer
		July 29, 2008	0.8	254.6	In piezometer
		October 24, 2008	0.8	254.6	In piezometer
		November 28, 2008	0.8	254.6	In piezometer
		February 6, 2009	0.8	254.6	In piezometer
		February 20, 2009	0.7	254.5	In piezometer
		March 20, 2009	0.7	254.5	In piezometer
		April 22, 2009	0.7	254.5	In piezometer
		May 15, 2009	0.7	254.5	In piezometer
		June 5, 2009	1.1	254.3	In piezometer
		July 29, 2009	0.2*	255.6	In piezometer
		August 5, 2009	0.9*	256.3	In piezometer
		September 2, 2009	0.9*	256.3	In piezometer
	QSR3-2	February 27, 2008	0.6	254.9	In open borehole
	QSR3-3	February 26, 2008	0.9	254.9	In open borehole
		February 28, 2008	3.2	252.6	In piezometer
		March 3, 2008	2.9	252.9	In piezometer
		March 7, 2008	0.3	255.5	In piezometer
		April 18, 2008	Ground surface	255.8	In piezometer
		June 30, 2008	0.9	254.9	In piezometer
		July 29, 2008	0.5	255.3	In piezometer
		October 24, 2008	1.3	254.5	In piezometer
		November 28, 2008	1.4	254.4	In piezometer
		February 6, 2009	1.2	254.6	In piezometer
		February 20, 2009	1.2	254.6	In piezometer
		March 20, 2009	1.1	254.7	In piezometer
		April 22, 2009	1.0	254.8	In piezometer
		May 15, 2009	1.1	254.7	In piezometer
		June 5, 2009	1.6	254.2	In piezometer
		July 29, 2009	0.4*	256.2	In piezometer
		August 5, 2009	0.9*	256.7	In piezometer
		September 2, 2009	0.8*	256.6	In piezometer
	QSR3-4	February 26, 2008	2.0	253.7	In open borehole

* Water level above ground surface (artesian condition)

Table 5.1 – Measured Groundwater Levels (Cont'd)

Culvert	Borehole	Date	Water Level (m)		Comment
			Depth	Elevation	
3	QSR3-5	February 25, 2008	0.8	254.2	In open borehole
		February 28, 2008	3.0	252.0	In piezometer
		March 7, 2008	2.5	252.5	In piezometer
		March 20, 2008	0.9	254.1	In piezometer
		April 18, 2008	Ground surface	255.0	In piezometer
		June 30, 2008	1.2	253.8	In piezometer
		July 29, 2008	1.2	253.8	In piezometer
		October 24, 2008	1.8	253.2	In piezometer
		November 28, 2008	1.8	253.2	In piezometer
		February 6, 2009	1.7	253.3	In piezometer
		February 20, 2009	1.6	253.4	In piezometer
		March 20, 2009	1.4	253.6	In piezometer
		April 22, 2009	1.2	253.8	In piezometer
		May 15, 2009	1.3	253.7	In piezometer
		June 5, 2009	1.8	253.2	In piezometer
		July 29, 2009	0.3*	255.3	In piezometer
		August 5, 2009	0.9*	255.9	In piezometer
		September 2, 2009	1.0*	256.0	In piezometer
4	QSR4-1	March 7, 2008	1.1	252.6	In open borehole
	QSR4-2	March 20, 2008	3.3	251.6	In piezometer
		April 18, 2008	2.5	252.4	In piezometer
		June 30, 2008	1.0	253.9	In piezometer
		July 29, 2008	0.8	254.1	In piezometer
		October 24, 2008	0.9	254.0	In piezometer
		November 28, 2008	1.0	253.9	In piezometer
		February 6, 2009	0.9	254.0	In piezometer
		February 20, 2009	0.9	254.0	In piezometer
		March 20, 2009	0.8	254.1	In piezometer
		April 22, 2009	0.8	254.1	In piezometer
		May 15, 2009	0.9	254.0	In piezometer
		June 5, 2009	1.3	253.6	In piezometer
		July 29, 2009	0.1*	255.0	In piezometer
		August 5, 2009	1.0*	255.9	In piezometer
		September 2, 2009	0.5*	255.4	In piezometer

* Water level above ground surface (artesian condition)

Table 5.1 – Measured Groundwater Levels (Cont'd)

Culvert	Borehole	Date	Water Level (m)		Comment
			Depth	Elevation	
4	QSR4-3	March 17, 2008	1.5	255.7	In open borehole
	QSR4-4	February 25, 2008	0.8	254.6	In open borehole
		February 28, 2008	3.4	252.0	In piezometer
		March 7, 2008	3.0	252.4	In piezometer
		March 20, 2008	0.6	254.8	In piezometer
		April 18, 2008	Ground surface	255.4	In piezometer
		June 30, 2008	1.0	254.4	In piezometer
		July 10, 2009	0.8	254.6	In piezometer
		July 29, 2008	Ground surface	255.4	In piezometer
		August 5, 2009	0.8*	256.2	In piezometer
		September 2, 2009	0.9*	256.3	In piezometer
	QSR4-5	February 25, 2008	0.8	254.6	In open borehole

* Water level above ground surface (artesian condition)

Monitoring of water levels has been conducted from February 2008 to September 2009. The piezometric readings indicate that the groundwater level at the site is high.

Water level was observed at ground surface in April 2008 at the four culvert locations. Also, water levels were measured approximately 0.2 m to 1.0 m above the existing ground surface (artesian conditions) and at ground surface during the summer season (July to September)

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.

5.2 Proposed culvert south of Doane Road (Culvert 5 – Boreholes 08-01 to 08-05)

The soil stratigraphy encountered at the borehole locations typically consists of topsoil underlain by native sandy silt and overlying a deposit of silty clay. Layers of silt were encountered within the silty clay. A layer of silty clay till was contacted below the silty clay in Borehole 08-05.

Boreholes at the proposed location of Culvert 6 have not been drilled at the time of preparation of this report, due to flooded site conditions and difficult access for drilling equipment.

5.2.1 Topsoil

Topsoil was identified at the ground surface in all the boreholes drilled at the proposed location of Culvert 5. The topsoil thickness ranged from 75 mm to 200 mm. The topsoil thickness may vary between and beyond the borehole locations and the data is not intended for the purpose of estimating quantities.

5.2.2 Sandy Silt

Native brown sandy silt containing some clay and trace gravel was contacted below the topsoil in Boreholes 08-03 to 08-05. The thickness of the sandy silt varies from 0.8 m to 1.5 m.

The depth to the base of the sandy silt layer varies from 0.9 m to 1.6 m (Elevations 255.8 to 261.3).

SPT 'N' values measured in the sandy silt ranged from 3 to 10 blows per 0.3 m of penetration, indicating a very loose to compact relative density. The moisture content of samples from this layer ranges from 19% to 28%.

5.2.3 Silty Clay

A deposit of brown to grey silty clay was contacted below the topsoil in Boreholes 08-01 and 08-02 and below the sandy silt layer in Boreholes 08-03 to 08-05. Layers of silt containing some clay were encountered within the silty clay deposit. The thickness of the silty clay was 9.7 m in Borehole 08-05.

The depth to the base of the silty clay was contacted at 10.6 m (Elevation 250.2) in Borehole 08-05.

Boreholes 08-01 to 08-04 were terminated within the silty clay at 11.3 m depth (Elevations 245.9 to 251.5).

SPT 'N' values measured in the silty clay ranged from 3 to 47 blows per 0.3 m of penetration, indicating a soft to hard consistency. In general, the clay is stiff to very stiff. The moisture content of samples from this deposit ranges from 17% to 42%.

Grain size distribution curves for several silty clay samples are presented on the Record of Borehole sheets and on Figures F1 to F3 of Appendix F. Grain size distribution curves for

the silt samples are presented on the Record of Borehole sheets and on Figure F4 of Appendix F. Atterberg Limits test results are presented on Figures F5 and F6 of Appendix F. The results of the laboratory tests are summarized as follows:

Soil Particles	Silty Clay (%)	Silt (%)
Gravel	0	0
Sand	0 to 9	0 to 4
Silt	33 to 79	81 to 85
Clay	21 to 66	13 to 19

Liquid Limit	20 to 51	-
Plastic Limit	13 to 21	-

The above results show that the silty clay is typically of medium plasticity with a group symbol of CI. Two samples were classified as low plastic with a group symbol of CL. One sample was medium to high plastic with group symbols of CI-CH.

5.2.4 Silty Clay Till

Grey silty clay till was contacted below the silty clay at 10.6 m (Elevation 250.2) in Borehole 08-05.

Borehole 08-05 was terminated within the silty clay till at 11.1 m depth (Elevation 249.7).

An SPT 'N' value measured in the silty clay till was 84 blows per 0.3 m of penetration, indicating a hard consistency. The moisture content of was 18%.

5.2.5 Groundwater Conditions

Water level was observed in the boreholes during and upon completion of drilling. Two standpipe piezometers were installed to monitor water levels after completion of drilling. The water levels measured in the piezometers are summarized in Table 5.2, along with the measurements in the boreholes upon completion of drilling.

Table 5.2 – Measured Groundwater Levels

Culvert	Borehole	Date	Water Level (m)		Comment
			Depth	Elevation	
5	08-01	August 27, 2009	1.6	255.6	In open borehole
	08-02	August 26, 2009	0.6	256.5	In open borehole
		September 2, 2009	6.2	250.9	In piezometer
	08-03	August 26, 2009	4.8	252.6	In open borehole
	08-04	August 27, 2009	1.5	261.3	In open borehole
		September 2, 2009	5.9	256.9	In piezometer
	08-05	August 27, 2009	4.3	256.5	In open borehole

Piezometric readings indicate that water level ranged from elevation 250.9 to 261.3.

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.

5.3 Proposed culvert south of Doane Road (Culvert 6 – Boreholes 08-10 to 08-14)

Boreholes 08-10 to 08-14 were advanced with light weight tripod drilling equipment to facilitate access to the flooded wetland area. The lightweight tripod drilling method employed continuous split spoon sampling.

The soil stratigraphy encountered at the borehole locations typically consists of peat underlain by native silty clay till.

5.3.1 Peat

Peat was identified at the ground surface in all the boreholes drilled at the proposed location of Culvert 6. The peat thickness ranged from 10 mm to 1100 mm. The peat thickness may vary between and beyond the borehole locations and the data is not intended for the purpose of estimating quantities. The peat is in a loose state and the moisture content ranges from 20% to 95%.

5.3.2 Silty Clay

Native brown silty clay was contacted below the peat in Borehole 08-13 at 0.6 m. The layer was 0.3 m thick with an underside elevation of 256.0 m.

The SPT 'N' value in the silty clay was 28 blows per 0.3 m penetration, indicating the clay layer to be in a very stiff state. The moisture content of the layer is 19%.

5.3.3 Silty Sand

Native silty sand was encountered in Boreholes 08-12 and 08-13. The layer ranged in thickness from 0.3 m to 0.7 m, with an underside elevation between 255.9 and 255.7 m. The SPT 'N' values in the sand layer ranged from 11 to 20 blows per 0.3 m penetration, indicating that the layer is in a compact state. The moisture content of the layer is in the order of 21%.

The results of a grain size distribution test for a sample of the silty sand from Borehole 08-12 is presented on the Record of Borehole sheet and on Figure F11 of Appendix F. The results of the laboratory tests are summarized as follows:

Soil Particles	(%)
Gravel	0
Sand	60
Silt	26
Clay	14

5.3.4 Silty Clay Till

An extensive deposit of brown to grey silty clay till containing trace sand was observed in all boreholes at depths varying from 1.1 m to 2.4 m (Elevations 255.3 to 256.2).

Boreholes were terminated within the silty clay till at depths ranging from 8.2 m to 9.1 m (Elevations 247.8 to 249.8).

The SPT 'N' values measured in the silty clay till ranged from 6 blows per 0.3 m to 50 blows per 0.15 m of penetration. The deposit is generally in a stiff to very stiff state.

The moisture content of samples from this deposit ranged from 18% to 35%.

Grain size distribution curves for the silty clay till samples are presented on the Record of Borehole sheets and on Figure F7 to F10 of Appendix F. Atterberg Limits test results are presented on Figures F12 to F14 of Appendix F. The results of the laboratory tests are summarized as follows:

Soil Particles	(%)
Gravel	0
Sand	0 to 6
Silt	32 to 82
Clay	17 to 66

Index Property	(%)
Liquid Limit	23 to 39
Plastic Limit	7 to 20

The above results show that the silty clay till is typically of low to medium plasticity with group symbol of CL-CI.

Glacial tills inherently contain cobbles and boulders.

5.3.5 Groundwater Conditions

One standpipe piezometer was installed in Borehole 08-12 to monitor water levels after completion of drilling. The water level measured in the piezometer is summarized in Table 5.3.

Table 5.3 – Measured Groundwater Levels

Culvert	Borehole	Date	Water Level (m)		Comment
			Depth	Elevation	
6	08-12	March 4, 2010	5.7	252.6	In piezometer
		March 9, 2010	6.2	252.1	In piezometer

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.

Groundwater was also observed at the surface of the site due to flooding from the pond to the northeast of the culvert.

6 MISCELLANEOUS

Borehole locations were selected by Thurber Engineering Ltd. Surveyors from J. D. Barnes obtained the co-ordinates and the ground surface elevations at each borehole.

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

DBW Drilling of Ajax, Ontario and Walker Drilling Ltd. from Utopia, Ontario supplied track mounted CME 75 and D90 drill rigs and conducted the drilling, sampling and in-situ testing operations for Culverts 1 to 5. OGS Drilling Inc. from Almonte, Ontario supplied a lightweight tripod mounted drill rig and conducted the drilling, sampling and in-situ testing operations for Culvert 6.

The field program was supervised on a full time basis by Ms. Eckie Siu, Mr. George Azzopardi and Mr. Luke Gilarski of Thurber.

Routine laboratory testing was carried out by Thurber Engineering Ltd.

Overall supervision of the field program was conducted by Mr. Alastair E. Gorman, P.Eng., Mr. Weiss Medhawi, P.Eng., Ms. R. Palomeque Reyna, P.Eng., and Mr. Tony Harte.

Interpretation of the data and preparation of the report were carried out by Ms. R. Palomeque Reyna, P.Eng., and Mr. Tony Harte.

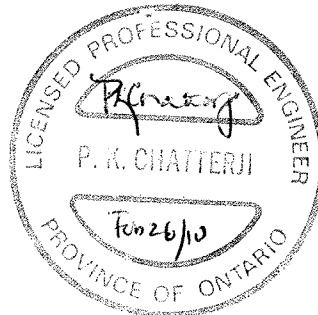
The report was reviewed by Dr. P.K. Chatterji, P.Eng. a Designated Principal Contact for MTO Foundations Projects.

Thurber Engineering Ltd.

Rocío Palomeque Reyna, P.Eng.
Geotechnical Engineer



Alastair E. Gorman, P.Eng.
Senior Foundations Engineer



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

Appendix A
Record of Borehole Sheets
(south of Queensville Sideroad)

Culverts 1 to 4

**Boreholes QSR1-1 to QSR1-3, QSR2-1 to QSR2-4, QSR3-1 to QSR3-5
and QSR4-1 to QSR4-5**

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
CLAY SHALE			
SANDSTONE			
SILTSTONE			
CLAYSTONE			
COAL			

RECORD OF BOREHOLE No QSR1-1

1 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 888 726.4 E 309 717.9, Station 10+070, CL ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.03.05 - 2008.03.05 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					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							WATER CONTENT (%)			
								20 40 60 80 100										
								20 40 60 80 100										
					○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT W _P W W _L								
256.9																		
0.0	Clayey SILT, trace sand, trace gravel, trace roots and rootlets Firm to Stiff Dark Brown		1	SS	5													
			2	SS	6													
			3	SS	10													
254.6																		
2.3	SAND and SILT, some clay, trace gravel Compact to Dense Brown Moist (TILL) occasional oxide staining 																	

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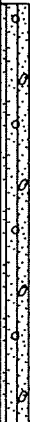
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Sensitivity 20
15 10 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No QSR1-1

2 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 888 726.4 E 309 717.9, Station 10+070, CL. ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.03.05 - 2008.03.05 CHECKED BY AEG

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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE									
	Continued From Previous Page							20	40	60	80	100					
244.1	SAND and SILT, some clay to clayey, trace gravel Dense to very Dense Grey Moist (TILL)						246										0 19 61 20
			10	SS	66												
			11	SS	41												
12.8	END OF BOREHOLE AT 12.8m. BOREHOLE OPEN AND WATER LEVEL AT 1.5m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO SURFACE.																

RECORD OF BOREHOLE No QSR1-2

1 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 888 743.6 E 309 733.3, Station 10+070, 25m Lt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.03.05 - 2008.03.05 CHECKED BY AEG

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			20	40	60	80	100						20
257.0	Clayey SILT, trace to some sand, trace gravel, occasional roots Soft to Firm Dark Brown to Brown		1	SS	4													
255.8			2	SS	6													
1.2	SAND and SILT, some clay, trace gravel, occasional oxide staining Loose to Dense Brown Moist (TILL)		3	SS	12													
			4	SS	18													
			5	SS	37													
			6	SS	24													
			7	SS	13													
			8	SS	20													
			9	SS	29													
	Wet																	
	Grey																	

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Sensitivity

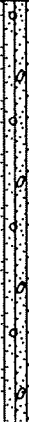

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No QSR1-2

2 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 888 743.6 E 309 733.3, Station 10+070, 25m Lt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.03.05 - 2008.03.05 CHECKED BY AEG

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	○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE									
Continued From Previous Page								20 40 60 80 100										
244.2	SAND and SILT, some clay to clayey, trace gravel Very Dense Grey Moist (TILL)		10	SS	61		247								2 19 59 20			
							246											
			11	SS	69		245									0 31 53 16		
12.8	END OF BOREHOLE AT 12.8m. BOREHOLE OPEN TO 11.9m AND WATER LEVEL AT 1.7m 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) 2008.03.07 3.1 253.9 2008.03.20 2.2 254.8 2008.04.18 Ground surface 257.0 2008.06.30 1.1 255.9 2008.07.29 1.1 255.9 2008.10.24 1.2 255.8 2008.11.28 1.3 255.7 2009.02.06 1.2 255.8 2009.02.20 1.2 255.8 2009.03.20 1.1 255.9 2009.04.22 1.0 256.0 2009.05.15 1.1 255.9 2009.06.05 1.4 255.6 2009.07.29 0.2 256.8 2009.08.05 0.5* 257.5 2009.09.02 0.5 256.5 2009.09.21 0.1 256.9 * (above ground surface)																	

ONTMT4S 0596.GPJ 11/24/09

METRIC

SOIL PROFILE						SAMPLES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUEID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						20 40 60 80 100	WATER CONTENT (%)							
											SHEAR STRENGTH kPa								
											○ UNCONFINED + FIELD VANE				● QUICK TRIAXIAL × LAB VANE				
256.6	0.0	Silty CLAY, trace sand, trace gravel, trace roots, occasional topsoil Soft Dark Brown		1	SS	4	V												
		Layer of Sand							256										
		Stiff Brown		2	SS	13			255										
				3	SS	12													
254.3	2.3	Silty SAND, trace gravel, trace clay Compact Brown Wet		4	SS	19			254							4 66 21 9			
253.6	3.0	SAND and SILT, some clay, trace gravel Compact to Very Dense Grey Moist (TILL)		5	SS	27			253							1 26 55 18			
				6	SS	43			252										
				7	SS	67			251										
				8	SS	107			250										
			9	SS	29		249							0 29 60 11					
							248												
							247												

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No QSR1-3

2 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 888 763.1 E 309 750.7, Station 10+070, 25m Rt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.03.04 - 2008.03.04 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80					
245.6	Continued From Previous Page SAND and SILT , some clay to clayey, trace gravel Very Dense Grey Moist (TILL)		10	SS	100/		246									0 13 66 21
11.0	END OF BOREHOLE AT 10.9m. BOREHOLE OPEN AND WATER LEVEL AT 1.2m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO SURFACE.				150											

RECORD OF BOREHOLE No QSR2-1

1 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 888 837.7 E 309 753.3, Station 10+120, 30m Lt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.03.04 - 2008.03.04 CHECKED BY AEG

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	
256.2												
0.0	TOPSOIL: (500mm)		1	SS	3		256					
255.7			2	SS	17		255					
0.5	SAND and SILT, some clay, trace gravel, occasional oxide staining Compact to Dense Brown Moist (TILL)		3	SS	20		254					0 33 54 13
	Grey		4	SS	40		253					
			5	SS	42		252					
	Clayey		6	SS	15		251					1 23 55 21
			7	SS	25		250					
	Wet		8	SS	32		249					
			9	SS	28		248					
							247					1 29 52 18

Continued Next Page

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

RECORD OF BOREHOLE No QSR2-1

2 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 888 837.7 E 309 753.3, Station 10+120, 30m Lt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.03.04 - 2008.03.04 CHECKED BY AEG

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					
	Continued From Previous Page																
	SAND and SILT, some clay, trace gravel Compact Grey (TILL)		10	SS	26		246										
244.9																	
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND WATER LEVEL AT SURFACE 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) 2008.03.07 3.3 252.9 2008.03.20 2.2 254.0 2008.04.18 0.3 255.9 2008.06.30 0.7 255.5 2008.07.29 0.7 255.5 2008.10.24 0.7 255.5 2008.11.28 0.7 255.5 2009.02.06 0.7 255.5 2009.02.20 0.6 255.6 2009.03.20 0.6 255.6 2009.04.22 0.7 255.5 2009.05.15 0.7 255.5 2009.06.05 1.1 255.1 2009.07.29 0.2* 256.4 2009.08.05 0.4* 256.6 2009.09.21 0.8* 257.0 * (above ground surface)						245										

RECORD OF BOREHOLE No QSR2-2

1 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 888 857.3 E 309 746.3, Station 10+115, 10m Lt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.02.28 - 2008.02.28 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40					
256.4														
0.0	TOPSOIL: (500mm)		1	SS	5									
255.9														
0.5	Clayey SILT, some sand to sandy, trace gravel, occasional rootlets													
255.6	Stiff													
0.8	Brown		2	SS	10									
	SAND and SILT, trace to some clay, trace gravel, occasional oxide staining													
	Compact													
	Brown													
	Moist		3	SS	11									
	(TILL)													
	Wet													
			4	SS	20									
			5	SS	23									
			6	SS	10									
			7	SS	29									
			8	SS	11									
			9	SS	21									

Continued Next Page

+³ . X³ : Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No QSR2-2

2 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 888 857.3 E 309 746.3, Station 10+115, 10m Lt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.02.28 - 2008.02.28 CHECKED BY AEG

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		
	Continued From Previous Page													
	SAND and SILT, trace clay Compact to Very Dense Grey Moist (TILL)		10	SS	27		246							0 18 77 5
							245							
			11	SS	51		244							
243.6														
12.8	END OF BOREHOLE AT 12.8m. BOREHOLE OPEN TO 12.8m AND WATER LEVEL AT 5.2m UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH HOLE PLUG TO SURFACE.													

METRIC

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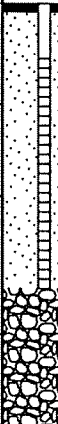
+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No QSR2-3

2 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 888 877.1 E 309 738.6, Station 10+108, 10m Rt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.02.28 - 2008.02.28 CHECKED BY AEG

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 (%)			
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL							x LAB VANE		
	Continued From Previous Page						20	40	60	80	100								
244.0	SAND and SILT, trace gravel, trace clay Compact to Dense Grey Moist (TILL)		10	SS	17		246												
			11	SS	31		245												
12.8	END OF BOREHOLE AT 12.8m. BOREHOLE OPEN TO 12.8m AND WATER LEVEL AT 5.7m 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) 2008.03.07 2.7 254.1 2008.03.20 1.1 255.7 2008.04.18 Ground surface 256.8 2008.06.30 0.7 256.1 2008.07.29 0.7 256.1 2008.10.24 0.7 256.1 2008.11.28 0.8 256.0 2009.02.06 0.7 256.1 2009.02.20 0.7 256.1 2009.03.20 0.7 256.1 2009.04.22 0.6 256.2 2009.05.15 0.7 256.1 2009.06.05 1.0 255.8 2009.07.29 0.2* 257.0 2009.08.05 0.9* 257.7 2009.09.21 0.2 256.6 * (above ground surface)																		

RECORD OF BOREHOLE No QSR2-4

2 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 888 899.7 E 309 732.2, Station 10+092, 30m Rt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.03.03 - 2008.03.03 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100							PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L
								SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
	Continued From Previous Page																
	SAND and SILT, some clay, trace gravel Compact Grey Wet (TILL)		10	SS	26		245						○				
							244										
			11	SS	27		243						○	1 15 66 18			
							242						○				
241.2	Dense		12	SS	36												
14.3	END OF BOREHOLE AT 14.3m. BOREHOLE OPEN AND WATER LEVEL AT 1.0m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO SURFACE.																

RECORD OF BOREHOLE No QSR3-1

1 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 888 957.8 E 309 742.3, Station 32+786, 65m Rt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.03.03 - 2008.03.03 CHECKED BY AEG

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	20 40 60 80 100	20 40 60 80 100					
255.4															
0.0	TOPSOIL: (500mm)		1	SS	5		255								
254.9															
0.5	Clayey SILT, some sand, trace gravel, occasional oxide staining														
254.6	Stiff to Very Stiff														
0.8	Brown		2	SS	15										
	SAND and SILT, some clay, trace gravel														
	Compact to Dense														
	Brown														
	Moist														
	(TILL)		3	SS	20										
			4	SS	20										
			5	SS	11										
	Grey		6	SS	16										1 30 54 15
			7	SS	44										
			8	SS	13										1 34 52 13
			9	SS	22										0 53 40 7

Continued Next Page

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

RECORD OF BOREHOLE No QSR3-1

2 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 888 957.8 E 309 742.3, Station 32+786, 65m Rt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.03.03 - 2008.03.03 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				
	Continued From Previous Page							20 40 60 80 100				
	SAND and SILT, some clay, trace gravel Dense Grey Moist (TILL) Wet		10	SS	39							
			11	SS	37							
			12	SS	32							0 26 55 19
241.0												
14.3	END OF BOREHOLE AT 14.3m. BOREHOLE OPEN TO 13.5m AND WATER LEVEL AT 2.0m 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) 2008.03.07 2.5 252.9 2008.03.20 1.5 253.9 2008.04.18 Ground surface 255.4 2008.06.30 0.8 254.6 2008.07.29 0.8 254.6 2008.10.24 0.8 254.6 2008.11.28 0.8 254.6 2009.02.06 0.8 254.6 2009.02.20 0.7 254.5 2009.03.20 0.7 254.5 2009.04.22 0.7 254.5 2009.05.15 0.7 254.5 2009.06.05 1.1 254.3 2009.07.29 0.2* 255.6 2009.08.05 0.9* 256.3 2009.09.02 0.9* 256.3 2009.09.21 0.4* 255.8 * (above ground surface)											

ONTMT4S 0596.GPJ 11/24/09

RECORD OF BOREHOLE No QSR3-2

1 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 888 980.1 E 309 763.6, Station 32+794, 40m Rt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.02.27 - 2008.02.27 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL						× LAB VANE	W _P	W
255.5							20	40	60	80	100							
0.0	TOPSOIL: (400mm)		1	SS	4								○					
255.2																		
0.4	Clayey SILT, some sand, trace gravel						255						○					
254.7	Soft																	
0.8	Brown																	
	SAND and SILT, some clay, trace gravel		2	SS	8		254						○					
	Loose to Compact																	
	Brown																	
	Moist																	
	(TILL)		3	SS	13								○		1 32 50 17			
			4	SS	13		253						○					
			5	SS	14		252						○					
	Grey						251						○					
			6	SS	28		250											
			7	SS	20		249						○		2 37 50 11			
							248											
	Very Loose		8	SS	0		247						○					
	Wet																	
	Moist						246						○					
	Dense		9	SS	36													

Continued Next Page

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

RECORD OF BOREHOLE No QSR3-2

2 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 888 980.1 E 309 763.6, Station 32+794, 40m Rt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.02.27 - 2008.02.27 CHECKED BY AEG


SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)
								20 40 60 80 100										
	Continued From Previous Page																	
	SAND and SILT, some gravel, some clay Dense Grey Moist (TILL) layer of silty sand (600mm)		10	SS	40											14 58 28 (SI+CL)		
	Compact		11	SS	21											1 31 53 15		
242.7																		
12.8	END OF BOREHOLE AT 12.8m. BOREHOLE OPEN AND WATER LEVEL AT 0.6m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO SURFACE.																	

RECORD OF BOREHOLE No QSR3-3

2 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 888 988.6 E 309 787.5, Station 32+800, 15m Rt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.02.26 - 2008.02.26 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE LIQUID CONTENT			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 x LAB VANE			W _p	W	W _L		
	Continued From Previous Page							20	40	60	80	100	20	40	60		
	SAND and SILT, trace to some clay, trace gravel Dense Grey Moist (TILL) Layer of silty sand (600mm)		10	SS	40												0 62 38 (SI+CL)
			11	SS	34												
241.5																	1 39 49 11
14.3	END OF BOREHOLE AT 14.3m. BOREHOLE OPEN AND WATER LEVEL AT 0.9m 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) 2008.02.28 3.2 252.6 2008.03.07 2.9 252.9 2008.03.20 0.3 255.5 2008.04.18 Ground surface 255.8 2008.06.30 0.9 254.9 2008.07.29 0.5 255.3 2008.10.24 1.3 254.5 2008.11.28 1.4 254.4 2009.02.06 1.2 254.6 2009.02.20 1.2 254.6 2009.03.20 1.1 254.7 2009.04.22 1.0 254.8 2009.05.15 1.1 254.7 2009.06.05 1.6 254.2 2009.07.29 0.4* 256.2 2009.08.05 0.9* 256.7 2009.09.02 0.8* 256.6 2009.09.21 0.6* 256.4 * (above ground surface)																

RECORD OF BOREHOLE No QSR3-4

2 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 888 993.1 E 309 812.0, Station 32+808, 10m Rt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.02.26 - 2008.02.26 CHECKED BY AEG

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						20	40	60
	Continued From Previous Page							SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					WATER CONTENT (%) w _p w w _L			kN/m ³				
	SAND and SILT, some clay, trace gravel Compact to Very Dense Grey Wet (TILL)		10	SS	18		245													
							244													
			11	SS	42		243										2	21	58	19
							242													
241.3			12	SS	59															
14.3	END OF BOREHOLE AT 14.3m. BOREHOLE OPEN AND WATER LEVEL AT 2.0m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO 0.6m THEN AUGER CUTTINGS TO SURFACE.																			

RECORD OF BOREHOLE No QSR3-5

1 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 889 014.4 E 309 833.5, Station 32+815, 35m Lt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.02.25 - 2008.02.25 CHECKED BY AEG

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							
255.0							20 40 60 80 100	○ UNCONFINED	+ FIELD VANE	WATER CONTENT (%)			kN/m ³	GR SA SI CL	
0.0	TOPSOIL: (500mm)		1	SS	2		255								
254.6															
0.5	Clayey SILT, trace gravel, occasional oxide staining Soft to Stiff Brown		2	SS	9		254								
253.8															
1.2	SAND and SILT, some clay to clayey, trace gravel Compact to Dense Brown Moist (TILL)		3	SS	31		253								
			4	SS	11		252								
			5	SS	18		251								
			6	SS	19		250								
			7	SS	16		249								
			8	SS	13		248								
	Grey Wet		9	SS	15		247								
							246								
	Very Stiff														

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

RECORD OF BOREHOLE No QSR3-5

2 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 889 014.4 E 309 833.5, Station 32+815, 35m Lt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.02.25 - 2008.02.25 CHECKED BY AEG



SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	*N* VALUES			SHEAR STRENGTH kPa						
								20	40	60	80	100		
	Continued From Previous Page													
	SAND and SILT, trace gravel Grey Moist (TILL)						245							
243.9			10	SS	100/ .150		244							
11.1	END OF BOREHOLE AT 11.1m. BOREHOLE OPEN AND WATER LEVEL AT 0.8m UPON COMPLETION. Piezometer installation consists of 19mm diameter schdule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2008.02.28 3.0 252.0 2008.03.07 2.5 252.5 2008.03.20 0.9 254.1 2008.04.18 Ground surface 255.0 2008.06.30 1.2 253.8 2008.07.29 1.2 253.8 2008.10.24 1.8 253.2 2008.11.28 1.8 253.2 2009.02.06 1.7 253.3 2009.02.20 1.6 253.4 2009.03.20 1.4 253.6 2009.04.22 1.2 253.8 2009.05.15 1.3 253.7 2009.06.05 1.8 253.2 2009.07.29 0.3* 255.3 2009.08.05 0.9* 255.9 2009.09.02 1.0* 256.0 2009.09.21 0.7* 255.7 * (above ground surface)													

RECORD OF BOREHOLE No QSR4-1

1 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 889 148.9 E 309 855.8, Station 10+088, 50m Lt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.03.07 - 2008.03.07 CHECKED BY AEG

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																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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253.7	Silty CLAY , trace sand, trace gravel, trace organics and topsoil Firm Dark Brown (FILL)		1	SS	4		253																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			

Continued Next Page

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

METRIC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa		WATER CONTENT (%)				
								20 40 60 80 100	20 40 60 80 100	W _P W W _L				
	Continued From Previous Page													
	SAND and SILT, some clay, trace gravel Very Dense Grey Moist (TILL)		10	SS	100/ .150		243						1 22 60 1	
							242							
240.9 12.8	END OF BOREHOLE AT 12.8m. BOREHOLE OPEN TO 12.8m AND WATER LEVEL AT 1.1m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLE PLUG TO SURFACE.		11	SS	82									

RECORD OF BOREHOLE No QSR4-2

1 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 889 123.9 E 309 859.4, Station 10+084, 25m Lt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.03.07 - 2008.03.07 CHECKED BY AEG

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						
254.9								20 40 60 80 100						
0.0	Silty CLAY, trace sand, trace gravel, some topsoil, occasional rootlets Firm Dark Brown (FILL)		1	SS	6			○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE						
254.2								20 40 60 80 100						
0.6	SAND and SILT, some clay, trace gravel, occasional oxide staining Loose to Compact Brown Moist (TILL)		2	SS	9									
			3	SS	20									
	Dense to Compact		4	SS	50									1 29 52 18
			5	SS	25									
	Grey Wet		6	SS	26									
			7	SS	31									1 26 56 17
			8	SS	27									
	Moist		9	SS	42									2 35 52 11

Continued Next Page

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

RECORD OF BOREHOLE No QSR4-2

2 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 889 123.9 E 309 859.4, Station 10+084, 25m Lt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.03.07 - 2008.03.07 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																																															
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa																																																							
	Continued From Previous Page																																																														
243.6	SAND and SILT, some clay, trace gravel Dense to Very Dense Grey Moist (TILL)		10	SS	50		244																																																								
11.3	END OF BOREHOLE AT 11.3m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: <table border="1"> <thead> <tr> <th>DATE</th> <th>DEPTH (m)</th> <th>ELEV. (m)</th> </tr> </thead> <tbody> <tr><td>2008.03.20</td><td>3.3</td><td>251.6</td></tr> <tr><td>2008.04.18</td><td>2.5</td><td>252.4</td></tr> <tr><td>2008.06.30</td><td>1.0</td><td>253.9</td></tr> <tr><td>2008.07.29</td><td>0.8</td><td>254.1</td></tr> <tr><td>2008.10.24</td><td>0.9</td><td>254.0</td></tr> <tr><td>2008.11.28</td><td>1.0</td><td>253.9</td></tr> <tr><td>2009.02.06</td><td>0.9</td><td>254.0</td></tr> <tr><td>2009.02.20</td><td>0.9</td><td>254.0</td></tr> <tr><td>2009.03.20</td><td>0.8</td><td>254.1</td></tr> <tr><td>2009.04.22</td><td>0.8</td><td>254.1</td></tr> <tr><td>2009.05.15</td><td>0.9</td><td>254.0</td></tr> <tr><td>2009.06.05</td><td>1.3</td><td>253.6</td></tr> <tr><td>2009.07.29</td><td>0.1*</td><td>255.0</td></tr> <tr><td>2009.08.05</td><td>1.0*</td><td>255.9</td></tr> <tr><td>2009.09.02</td><td>0.5*</td><td>255.4</td></tr> <tr><td>2009.09.21</td><td>0.3</td><td>254.6</td></tr> </tbody> </table> * (above ground surface)	DATE	DEPTH (m)	ELEV. (m)	2008.03.20	3.3	251.6	2008.04.18	2.5	252.4	2008.06.30	1.0	253.9	2008.07.29	0.8	254.1	2008.10.24	0.9	254.0	2008.11.28	1.0	253.9	2009.02.06	0.9	254.0	2009.02.20	0.9	254.0	2009.03.20	0.8	254.1	2009.04.22	0.8	254.1	2009.05.15	0.9	254.0	2009.06.05	1.3	253.6	2009.07.29	0.1*	255.0	2009.08.05	1.0*	255.9	2009.09.02	0.5*	255.4	2009.09.21	0.3	254.6											
DATE	DEPTH (m)	ELEV. (m)																																																													
2008.03.20	3.3	251.6																																																													
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2008.06.30	1.0	253.9																																																													
2008.07.29	0.8	254.1																																																													
2008.10.24	0.9	254.0																																																													
2008.11.28	1.0	253.9																																																													
2009.02.06	0.9	254.0																																																													
2009.02.20	0.9	254.0																																																													
2009.03.20	0.8	254.1																																																													
2009.04.22	0.8	254.1																																																													
2009.05.15	0.9	254.0																																																													
2009.06.05	1.3	253.6																																																													
2009.07.29	0.1*	255.0																																																													
2009.08.05	1.0*	255.9																																																													
2009.09.02	0.5*	255.4																																																													
2009.09.21	0.3	254.6																																																													

RECORD OF BOREHOLE No QSR4-3

1 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 889 098.8 E 309 863.0, Station 10+080, centreline ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.03.17 - 2008.03.17 CHECKED BY AEG

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 NATURAL MOISTURE CONTENT LIQUID LIMIT w _p w w _L						
257.2								20 40 60 80 100		20 40 60					
0.0	ASPHALT: (150mm)						257						1 23 55 21		
0.2	Gravelly SAND Dense Dark Brown Dry (FILL)		1	SS	46										
256.1			2	SS	19										
1.1	Sandy SILT, some clay, trace gravel Very Loose to Compact Brown Wet (FILL)		3a	SS	2										
255.3			3b	SS											
1.8	Silty CLAY, some sand, trace gravel, some organics and topsoil Soft to Firm Brown (FILL)		4	SS	4										
	occasional wood fibres	5	SS	6											
253.0							253								
4.1	SAND and SILT, some clay to clayey, trace gravel, occasional oxide staining Compact Grey Moist (TILL)		6	SS	11										
			7	SS	19										
			8	SS	74										
			9	SS	84										
	Very Dense												7 48 35 10		

Continued Next Page

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

RECORD OF BOREHOLE No QSR4-3

2 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 889 098.8 E 309 863.0, Station 10+080, centreline ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.03.17 - 2008.03.17 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
	Continued From Previous Page																
245.9	SAND and SILT, some clay, trace gravel Dense Grey (TILL)		10	SS	38		247									1 33 48 18	
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN TO 6.7m AND WATER LEVEL AT 1.5m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO 0.2m THEN ASPHALT/ COLD PATCH TO SURFACE.						246										

RECORD OF BOREHOLE No QSR4-4

1 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 889 074.3 E 309 868.5, Station 10+078, 25m Rt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.02.25 - 2008.02.25 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT				
								20 40 60 80 100		20 40 60				
255.4	Silty CLAY , mixed with topsoil, trace sand, occasional rootlets Very soft to firm Brown Moist (FILL) occasional wood fibres		1	SS	1									
			2	SS	4									
			3	SS	4									
253.3	SAND and SILT , some clay, trace gravel Compact to Dense Grey Moist (TILL)		4	SS	32									
			5	SS	15									
			6	SS	18									
			7	SS	37									
			8	SS	26									
			9	SS	14									

Continued Next Page

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

RECORD OF BOREHOLE No QSR4-4

2 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 889 074.3 E 309 868.5, Station 10+078, 25m Rt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.02.25 - 2008.02.25 CHECKED BY AEG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID 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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE									WATER CONTENT (%) W P W W L																															
244.2	Continued From Previous Page SAND and SILT, some clay, trace gravel Compact Grey Moist (TILL)		10	SS	27		245									2 31 49 18																																
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN TO 10.7m AND WATER LEVEL AT 0.8m UPON COMPLETION. Piezometer installation consists of 19mm diameter schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: <table border="1"> <thead> <tr> <th>DATE</th> <th>DEPTH (m)</th> <th>ELEV. (m)</th> </tr> </thead> <tbody> <tr><td>2008.02.28</td><td>3.4</td><td>252.0</td></tr> <tr><td>2008.03.07</td><td>3.0</td><td>252.4</td></tr> <tr><td>2008.03.20</td><td>0.6</td><td>254.8</td></tr> <tr><td>2008.04.18</td><td>Ground surface</td><td>255.4</td></tr> <tr><td>2008.06.30</td><td>1.0</td><td>254.4</td></tr> <tr><td>2008.07.10</td><td>0.8</td><td>254.6</td></tr> <tr><td>2008.07.29</td><td>Ground surface</td><td>255.4</td></tr> <tr><td>2008.08.05</td><td>0.8*</td><td>256.2</td></tr> <tr><td>2008.09.02</td><td>0.9*</td><td>256.3</td></tr> <tr><td>2008.09.21</td><td>0.8*</td><td>256.2</td></tr> </tbody> </table> * (above ground surface)	DATE	DEPTH (m)	ELEV. (m)	2008.02.28	3.4	252.0	2008.03.07	3.0	252.4	2008.03.20	0.6	254.8	2008.04.18	Ground surface	255.4	2008.06.30	1.0	254.4	2008.07.10	0.8	254.6	2008.07.29	Ground surface	255.4	2008.08.05	0.8*	256.2	2008.09.02	0.9*	256.3	2008.09.21	0.8*	256.2														
DATE	DEPTH (m)	ELEV. (m)																																														
2008.02.28	3.4	252.0																																														
2008.03.07	3.0	252.4																																														
2008.03.20	0.6	254.8																																														
2008.04.18	Ground surface	255.4																																														
2008.06.30	1.0	254.4																																														
2008.07.10	0.8	254.6																																														
2008.07.29	Ground surface	255.4																																														
2008.08.05	0.8*	256.2																																														
2008.09.02	0.9*	256.3																																														
2008.09.21	0.8*	256.2																																														

RECORD OF BOREHOLE No QSR4-5

1 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 889 049.6 E 309 873.1, Station 10+075, 50m Rt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.02.25 - 2008.02.25 CHECKED BY AEG

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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE								WATER CONTENT (%)	
255.4								20 40 60 80 100									
0.0	Clayey SILT, mixed with topsoil, trace sand, occasional rootlets Soft to Stiff Brown (FILL)		1	SS	2		255										
254.8																	
0.6	Sandy SILT, some clay Loose to Compact Brown Moist (FILL)		2	SS	4		254										
			3	SS	8												
253.0								253									
2.4	SAND and SILT, some clay to clayey, trace gravel, occasional oxide staining Compact Grey (TILL)		4	SS	20												
				5	SS		11	252								0 20 58 22	
				6	SS		12	251								2 18 44 36	
								250									
				7	SS	17	249										
								248									
				8	SS	14	247										
								246									
			9	SS	15										2 31 49 18		

Continued Next Page

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

RECORD OF BOREHOLE No QSR4-5

2 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 889 049.6 E 309 873.1, Station 10+075, 50m Rt ORIGINATED BY ES
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.02.25 - 2008.02.25 CHECKED BY AEG

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 X LAB VANE											
						20 40 60 80 100 20 40 60 80 100					W _P	W	W _L				
											WATER CONTENT (%)						
											20	40	60				
	Continued From Previous Page																
244.7	SAND and SILT, some clay, trace gravel Very Dense Grey Moist (TILL)		10	SS	100/		245										
10.7	END OF BOREHOLE AT 10.7m. BOREHOLE OPEN AND WATER LEVEL AT 0.8m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO 1.2m THEN AUGER CUTTINGS TO SURFACE.				.075												

Appendix B
Laboratory Test Results
(south of Queensville Sideroad)

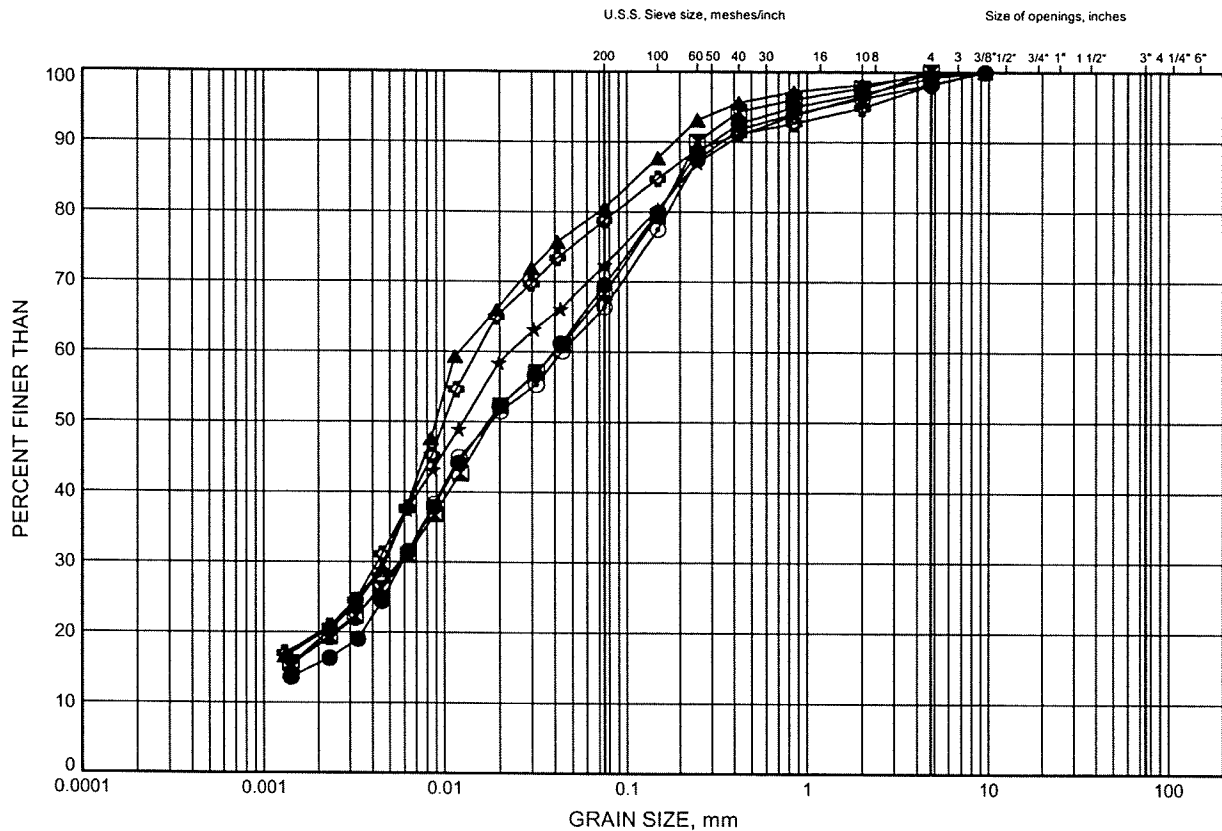
Culverts 1 to 4

**Boreholes QSR1-1 to QSR1-3, QSR2-1 to QSR2-4, QSR3-1 to QSR3-5
and QSR4-1 to QSR4-5**

Hwy 404 Extension GRAIN SIZE DISTRIBUTION

FIGURE B1

SAND & SILT TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	QSR1-1	2.59	254.33
⊠	QSR1-1	9.45	247.47
▲	QSR1-1	12.50	244.42
★	QSR1-2	3.35	253.69
⊙	QSR1-2	7.92	249.12
⊗	QSR1-2	10.97	246.07

GRAIN SIZE DISTRIBUTION - THURBER 0596.GPJ 10/5/09

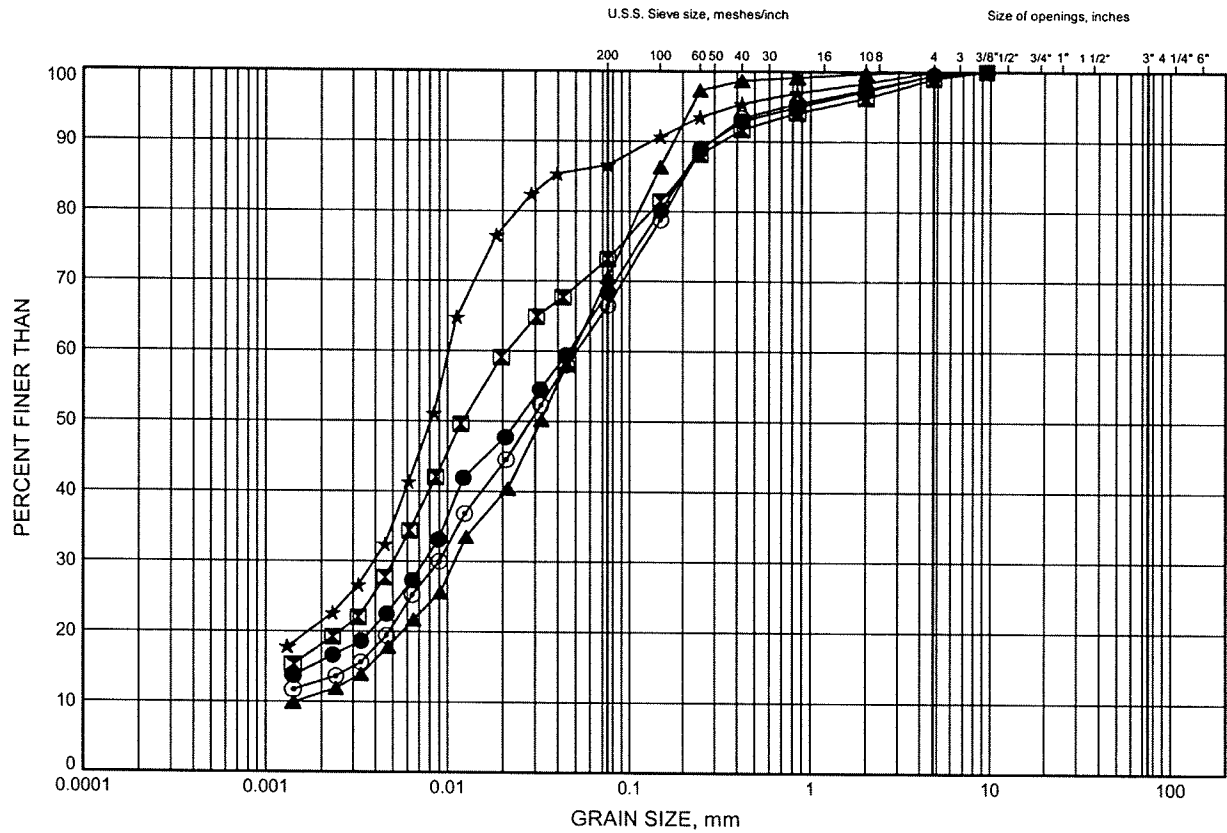
W.P.# .2109-05-00.....
Prepared By .AN.....
Checked By .RPR.....



Hwy 404 Extension GRAIN SIZE DISTRIBUTION

FIGURE B2

SAND & SILT TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	QSR1-2	12.50	244.54
⊠	QSR1-3	3.35	253.26
▲	QSR1-3	7.92	248.69
★	QSR1-3	10.82	245.79
⊙	QSR2-1	1.83	254.37

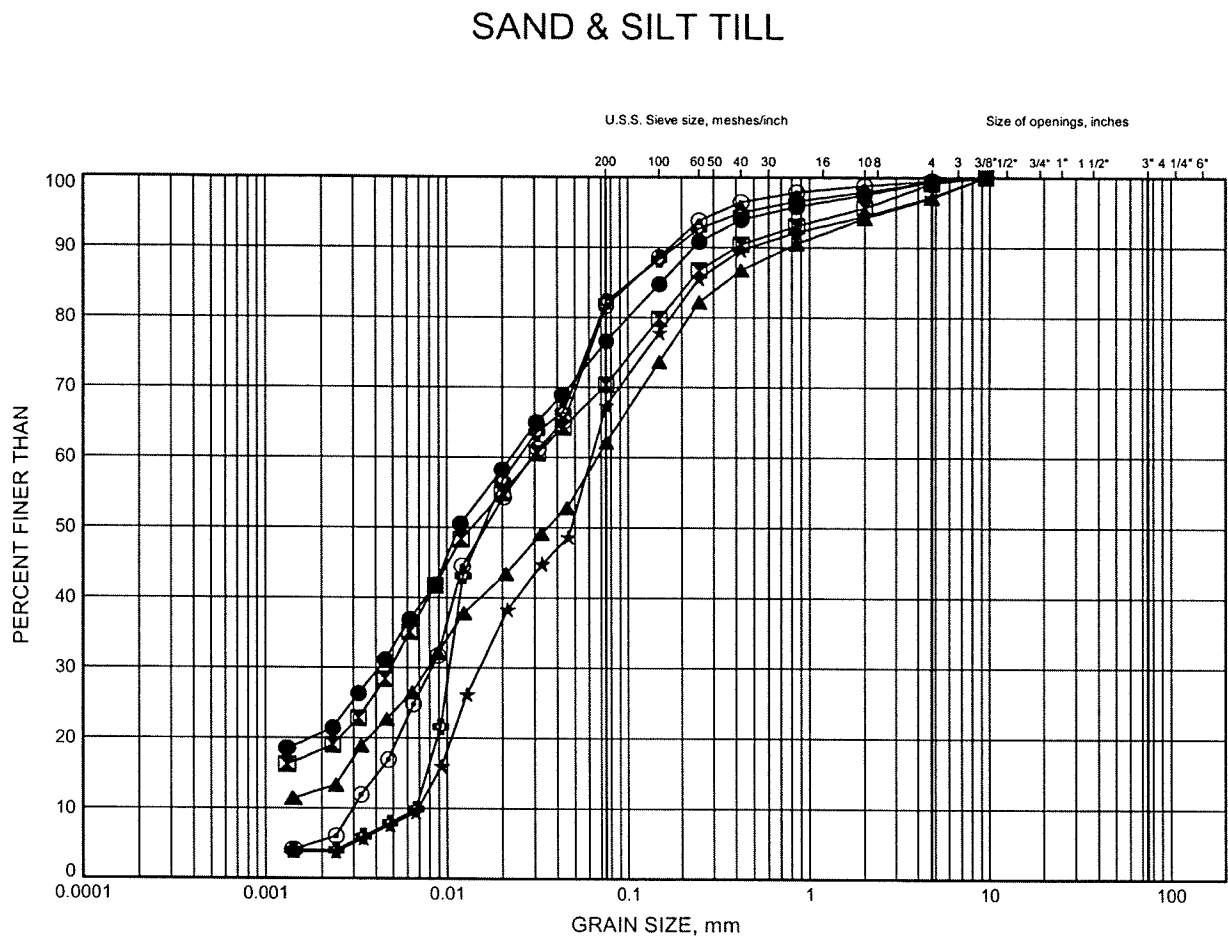
GRAIN SIZE DISTRIBUTION - THURBER 0596.GPJ 10/5/09

W.P.# .2109-05-00.....
Prepared By .AN.....
Checked By .RPR.....



Hwy 404 Extension
GRAIN SIZE DISTRIBUTION

FIGURE B3



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	QSR2-1	4.88	251.32
⊠	QSR2-1	9.45	246.75
▲	QSR2-2	3.35	253.01
★	QSR2-2	7.92	248.44
⊙	QSR2-2	10.97	245.39
⊛	QSR2-3	3.35	253.48

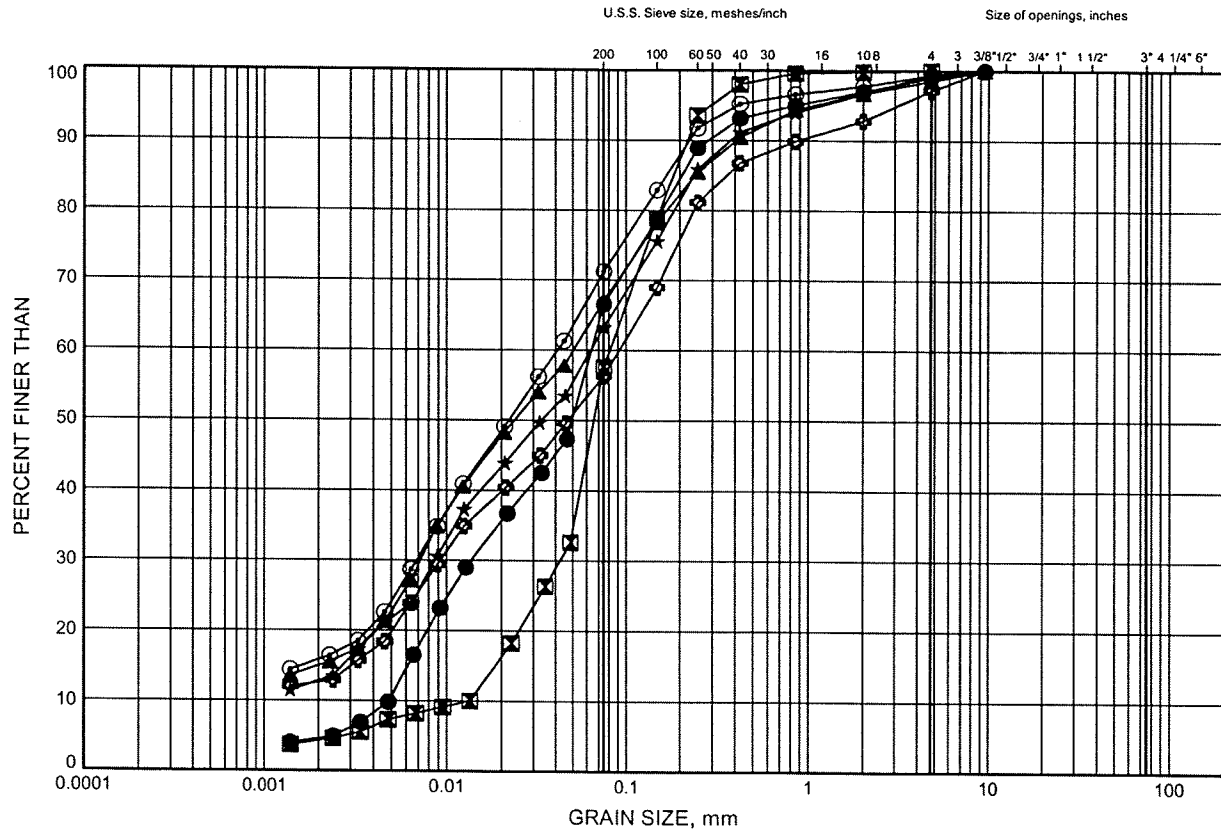


W.P.# .2109:05-00.....
Prepared By .AN.....
Checked By .RPR.....

Hwy 404 Extension GRAIN SIZE DISTRIBUTION

FIGURE B4

SAND & SILT TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	QSR2-3	6.40	250.43
⊠	QSR2-3	10.97	245.86
▲	QSR2-4	2.59	252.91
★	QSR2-4	3.35	252.15
⊙	QSR2-4	6.40	249.10
⊛	QSR2-4	9.45	246.05

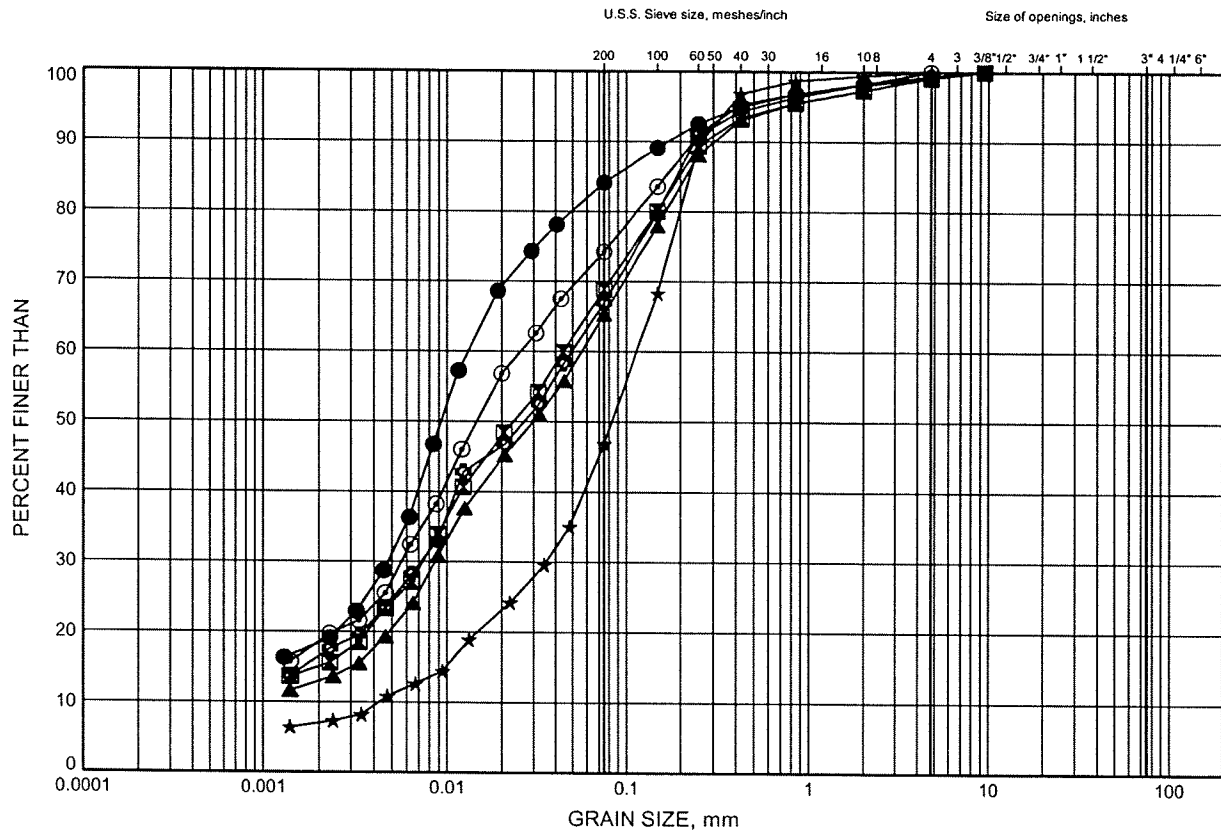


W.P.# .2109:05:00.....
Prepared By .AN.....
Checked By .RPR.....

Hwy 404 Extension GRAIN SIZE DISTRIBUTION

FIGURE B5

SAND & SILT TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	QSR2-4	12.50	243.00
⊠	QSR3-1	4.88	250.49
▲	QSR3-1	7.92	247.45
★	QSR3-1	9.45	245.92
⊙	QSR3-1	14.02	241.35
⊛	QSR3-2	1.83	253.68

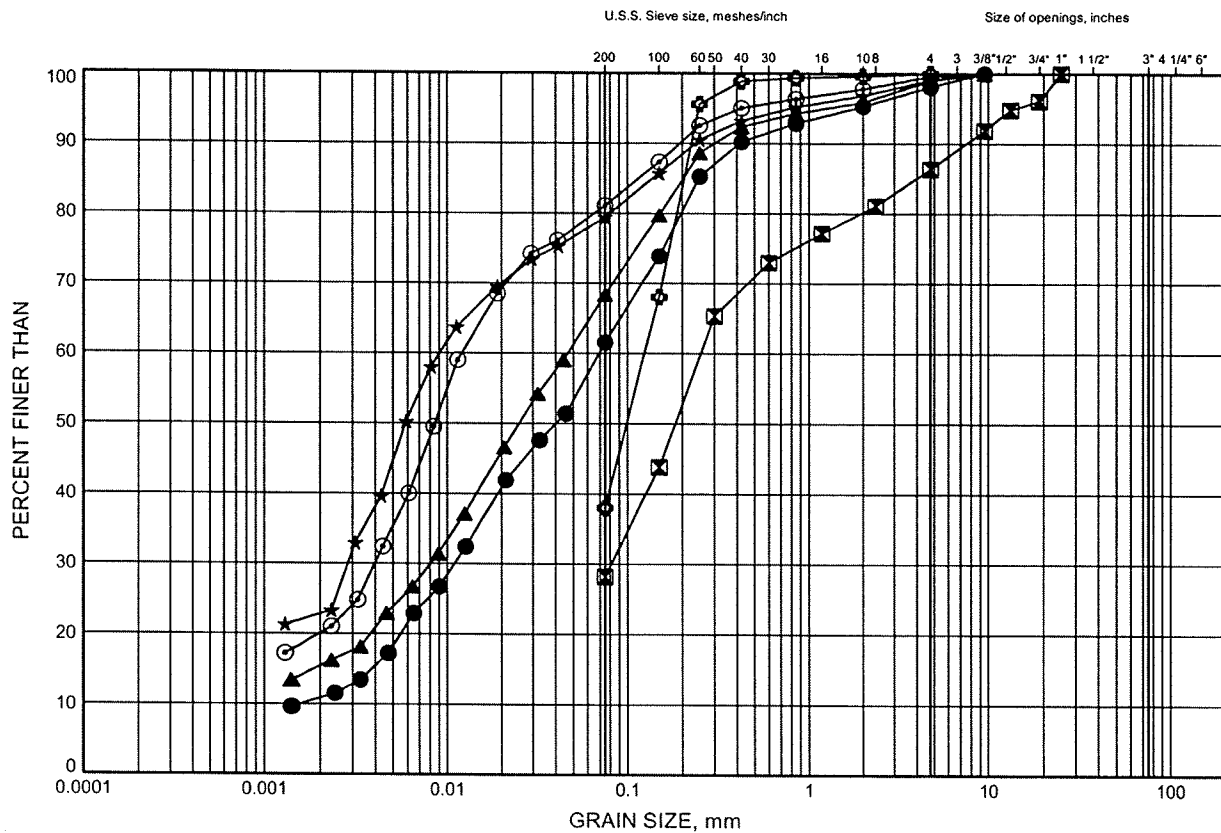


W.P.# 2109-05-00.....
Prepared By .AN.....
Checked By .RPR.....

Hwy 404 Extension GRAIN SIZE DISTRIBUTION

FIGURE B6

SAND & SILT TILL



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

LEGEND

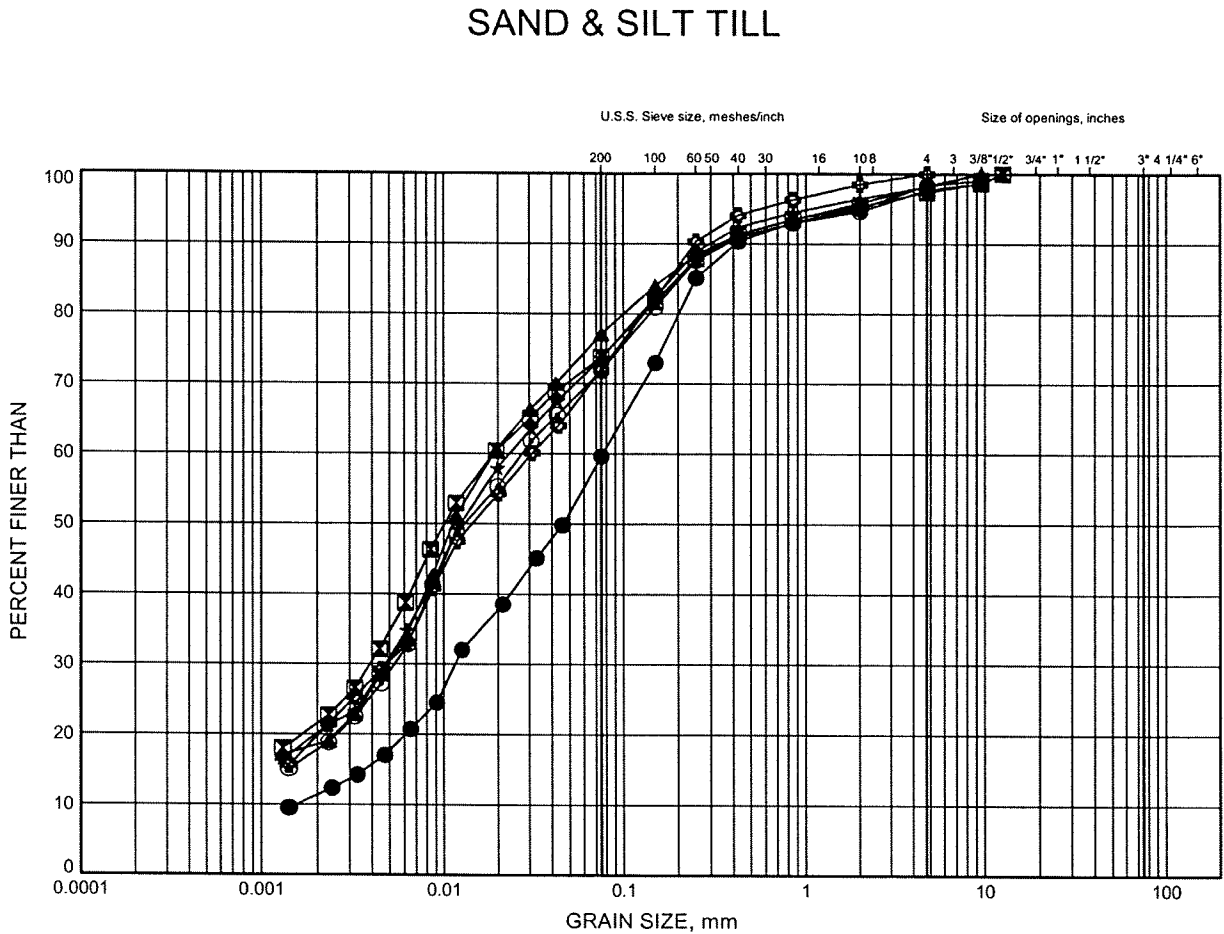
SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	QSR3-2	6.40	249.11
⊠	QSR3-2	10.60	244.91
▲	QSR3-2	12.50	243.01
★	QSR3-3	4.88	250.96
⊙	QSR3-3	7.92	247.92
⊗	QSR3-3	10.60	245.24



W.P.# 2109:05-00.....
Prepared By .AN.....
Checked By .RPR.....

Hwy 404 Extension
GRAIN SIZE DISTRIBUTION

FIGURE B7



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	QSR3-3	14.02	241.82
⊠	QSR3-4	6.40	249.25
▲	QSR3-4	12.50	243.15
★	QSR3-5	2.59	252.44
⊙	QSR3-5	6.40	248.63
⊕	QSR3-5	9.45	245.58

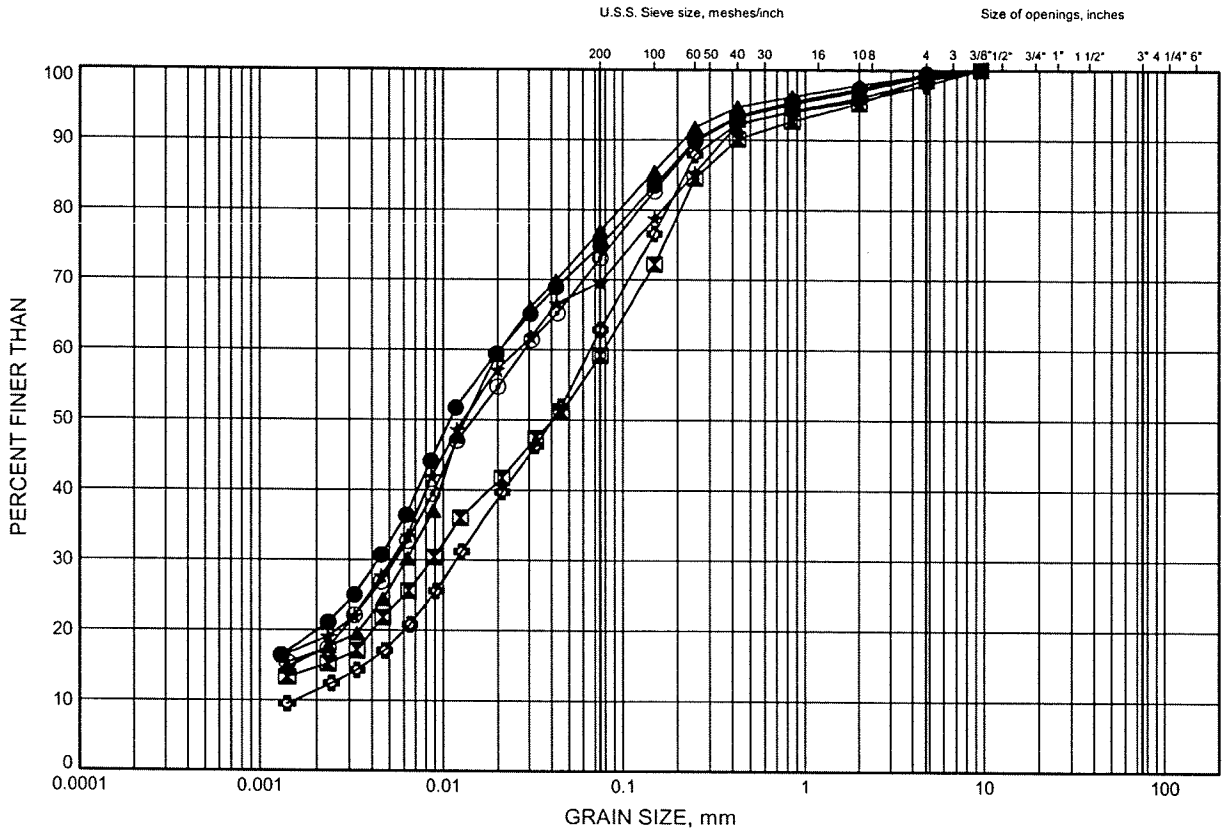


W.P.# 2109-05-00.....
Prepared By AN.....
Checked By RPR.....

Hwy 404 Extension GRAIN SIZE DISTRIBUTION

FIGURE B8

SAND & SILT TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	QSR4-1	2.59	251.15
⊠	QSR4-1	6.40	247.34
▲	QSR4-1	10.90	242.84
★	QSR4-2	2.59	252.26
⊙	QSR4-2	6.40	248.45
⊛	QSR4-2	9.45	245.40

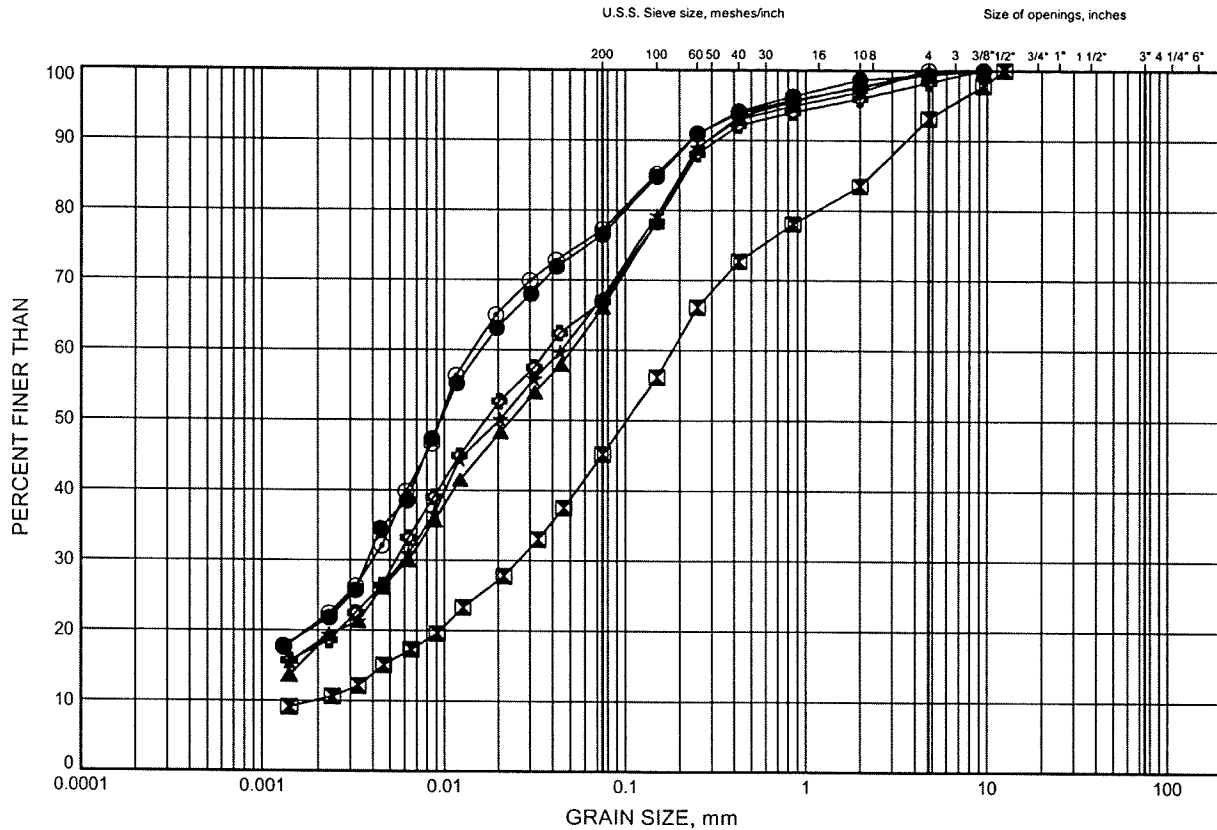


W.P.# 2109-05-00.....
Prepared By .AN.....
Checked By .RPR.....

Hwy 404 Extension GRAIN SIZE DISTRIBUTION

FIGURE B9

SAND & SILT TILL



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

LEGEND

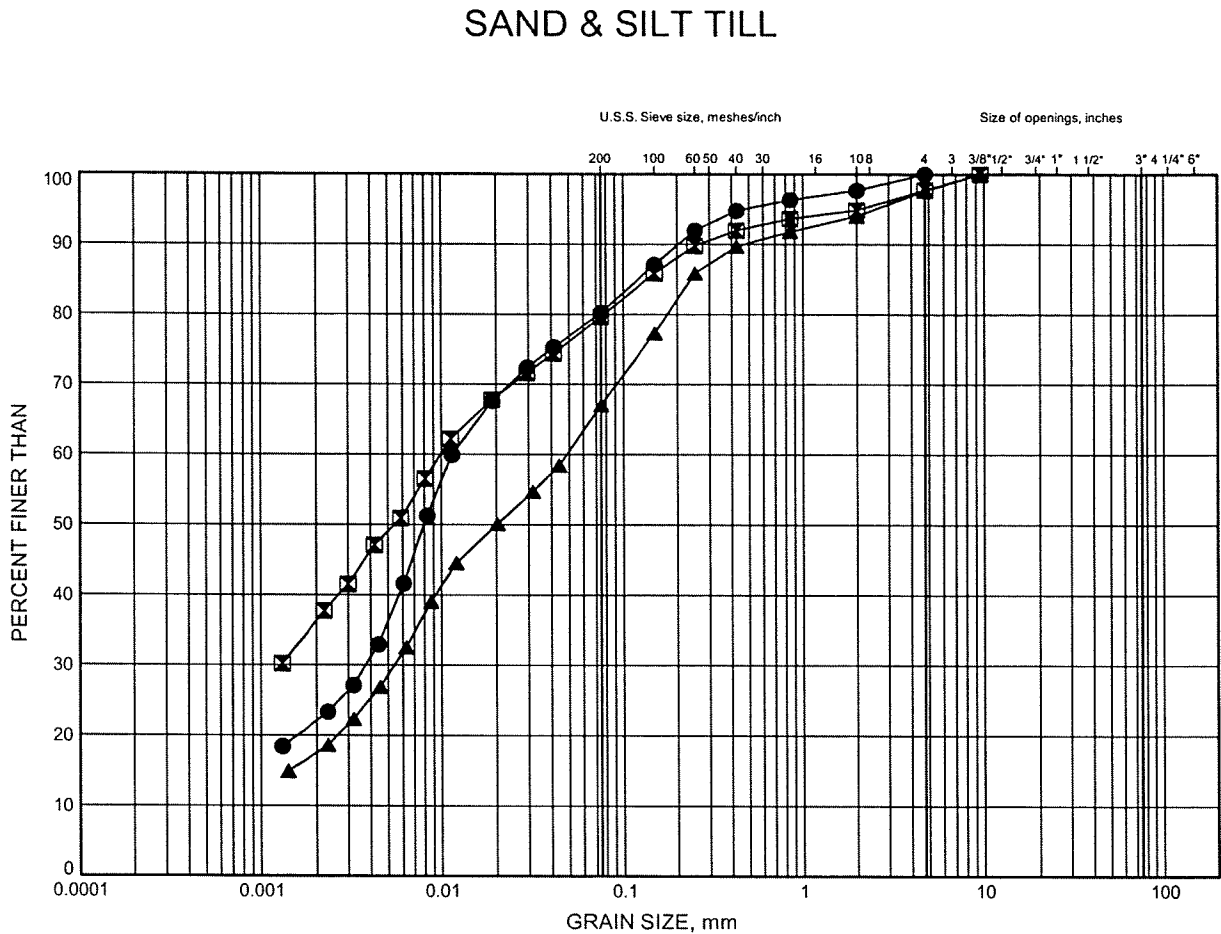
SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	QSR4-3	4.88	252.27
⊠	QSR4-3	7.92	249.23
▲	QSR4-3	10.97	246.18
★	QSR4-4	3.35	252.08
⊙	QSR4-4	7.92	247.51
⊛	QSR4-4	10.97	244.46



W.P.# 2109-05-00
Prepared By AN
Checked By RPR

Hwy 404 Extension
GRAIN SIZE DISTRIBUTION

FIGURE B10



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	QSR4-5	3.35	252.08
⊠	QSR4-5	4.88	250.55
▲	QSR4-5	9.45	245.98

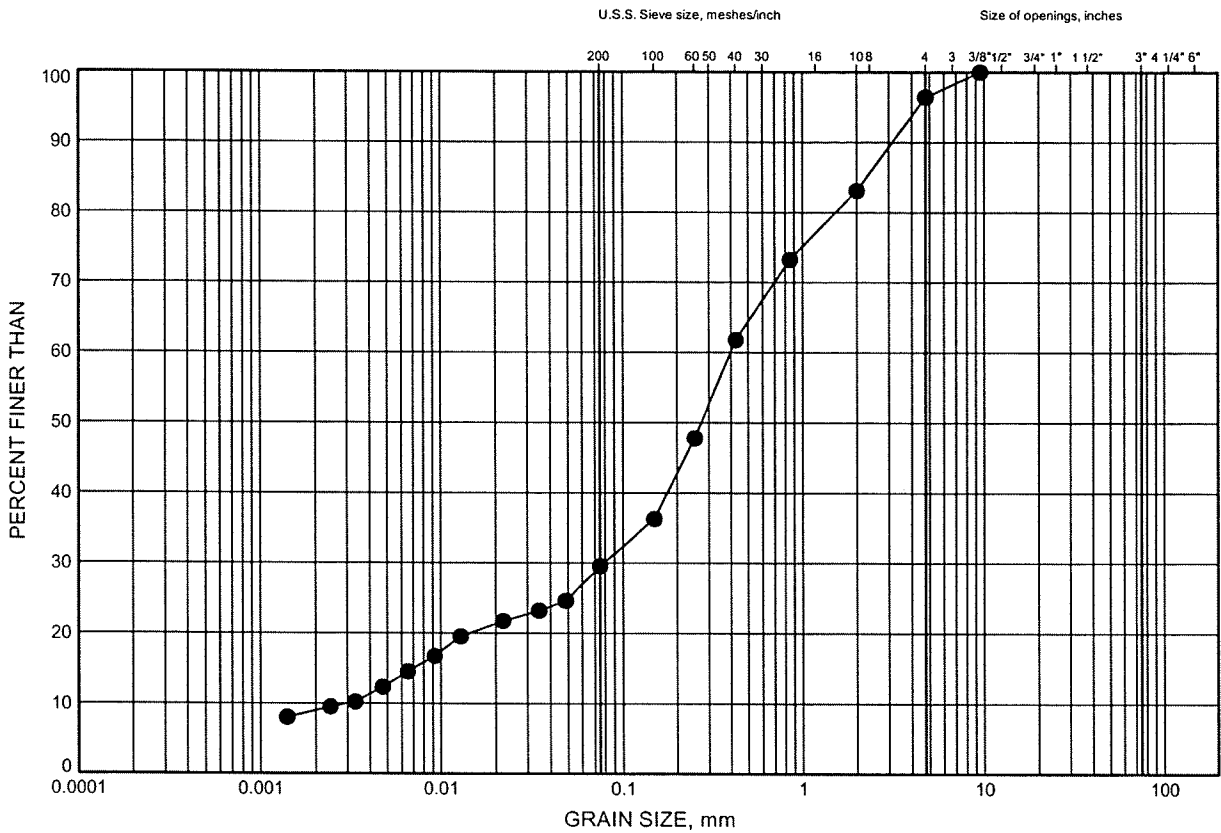


W.P.# 2109-05-00.....
Prepared By AN.....
Checked By RPR.....

Hwy 404 Extension
GRAIN SIZE DISTRIBUTION

FIGURE B11

SILTY SAND



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	QSR1-3	2.59	254.02



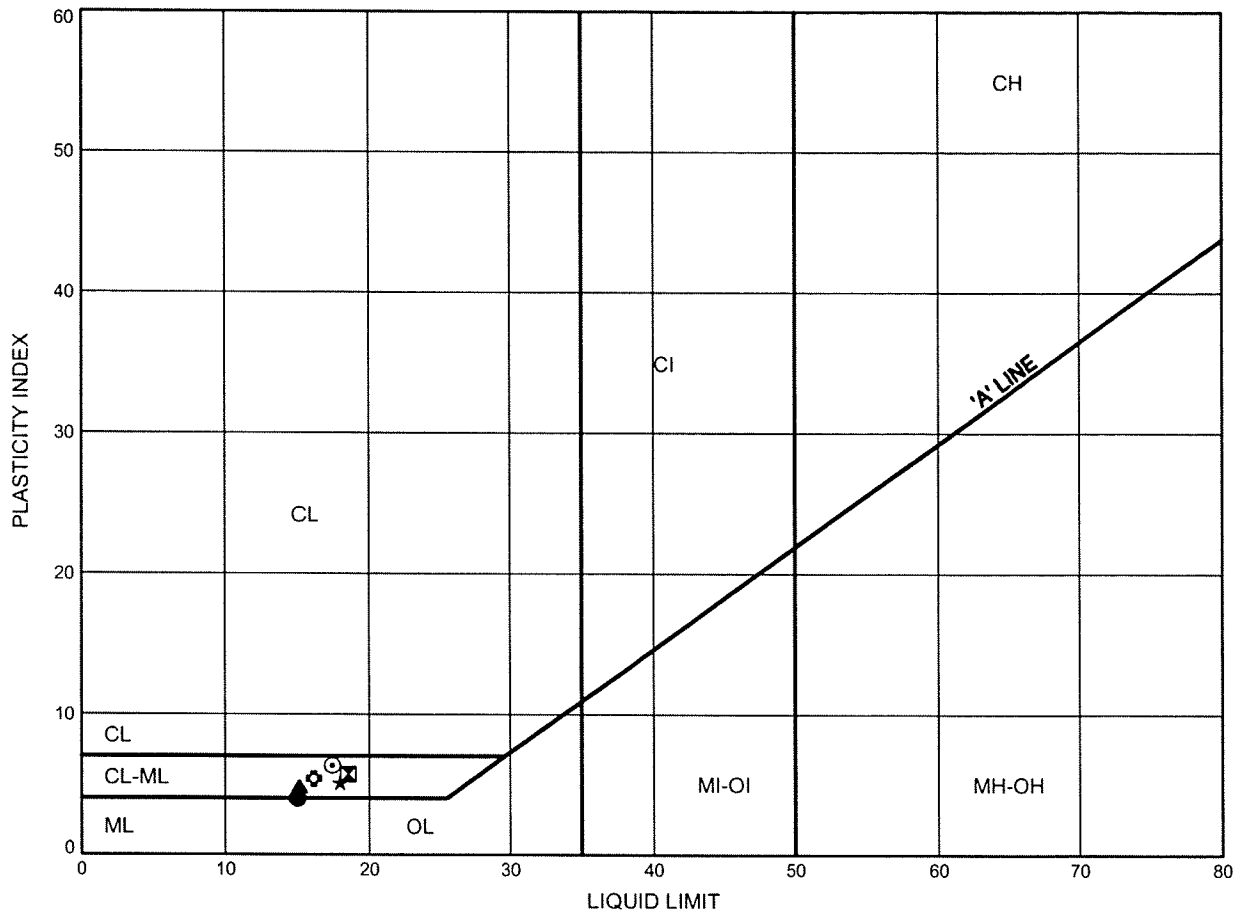
W.P.# .2109-05-00.....
Prepared By .AN.....
Checked By .RPR.....

Hwy 404 Extension

ATTERBERG LIMITS TEST RESULTS

FIGURE B12

SAND & SILT TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	QSR1-1	9.45	247.47
⊠	QSR1-2	3.35	253.69
▲	QSR1-2	7.92	249.12
★	QSR1-2	10.97	246.07
⊙	QSR2-1	4.88	251.32
⊛	QSR2-1	9.45	246.75

Date October 2009
Project 2109-05-00

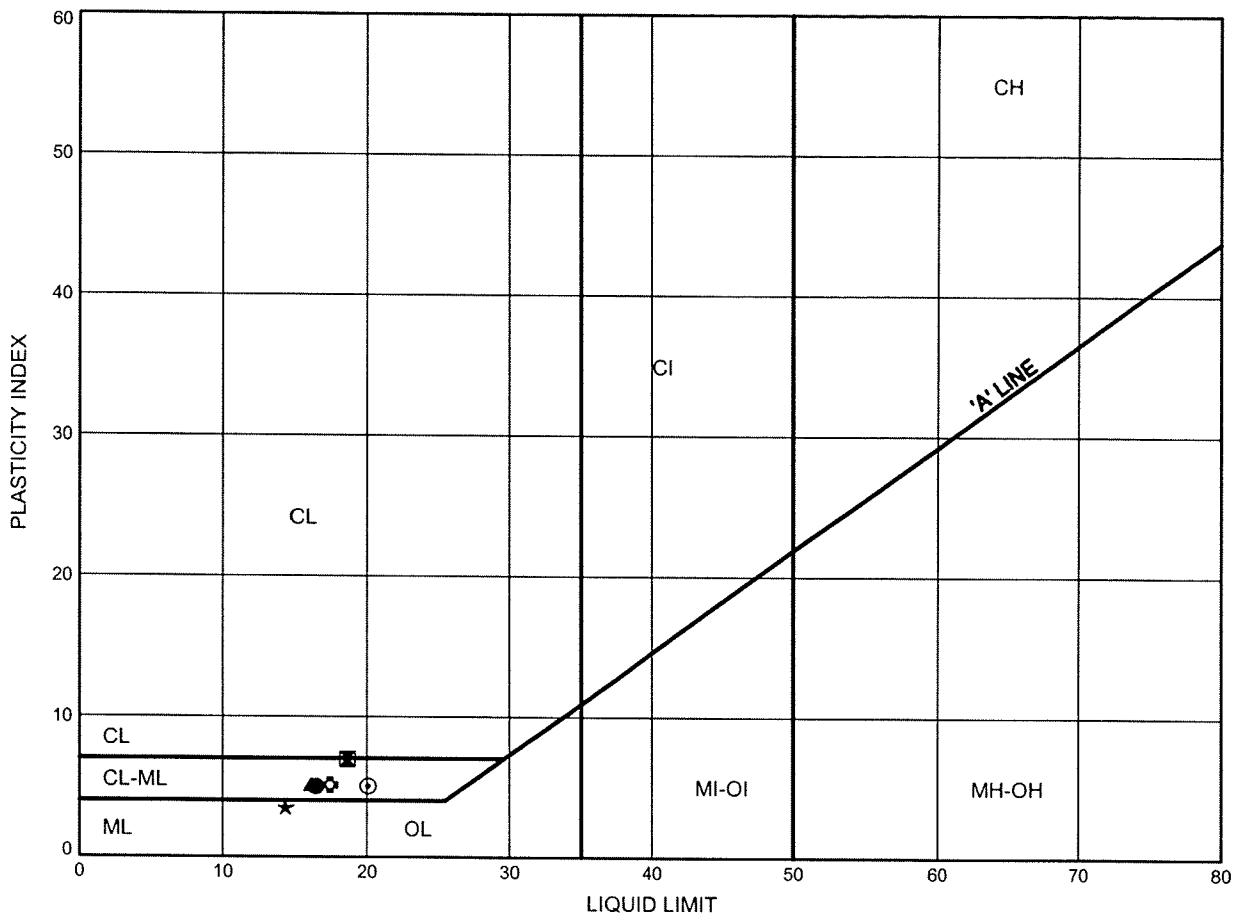


Prep'd AN
Chkd. RPR

Hwy 404 Extension
ATTERBERG LIMITS TEST RESULTS

FIGURE B13

SAND & SILT TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	QSR2-2	7.92	248.44
■	QSR2-3	3.35	253.48
▲	QSR2-3	6.40	250.43
★	QSR2-4	6.40	249.10
⊙	QSR2-4	12.50	243.00
⊛	QSR3-1	3.35	252.02

Date October 2009
 Project 2109-05-00

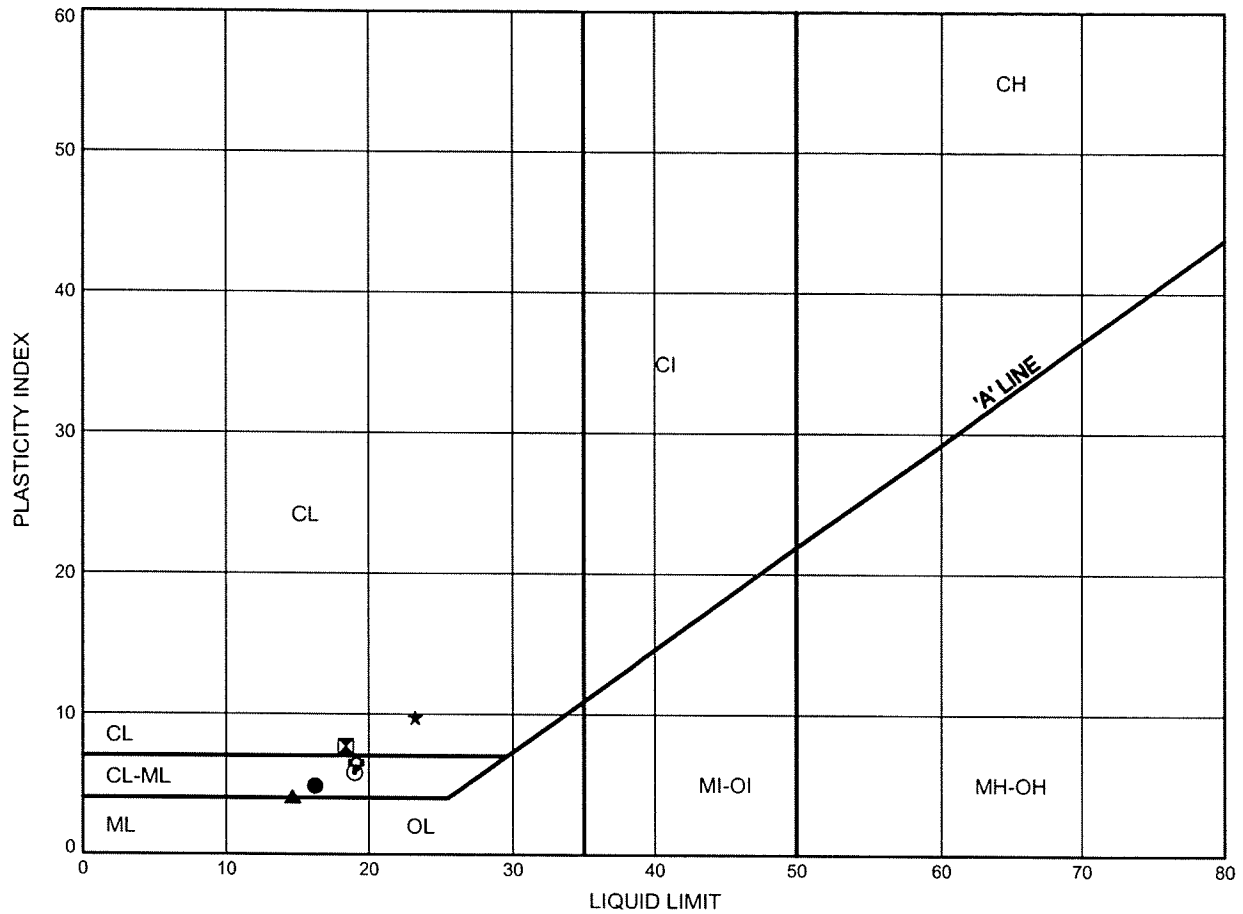


Prep'd AN
 Chkd. RPR

Hwy 404 Extension ATTERBERG LIMITS TEST RESULTS

FIGURE B14

SAND & SILT TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	QSR3-1	14.02	241.35
⊠	QSR3-2	1.83	253.68
▲	QSR3-2	12.50	243.01
★	QSR3-3	4.88	250.96
⊙	QSR3-3	7.92	247.92
⊕	QSR3-4	6.40	249.25

Date ..October 2009.....
Project ..2109-05-00.....

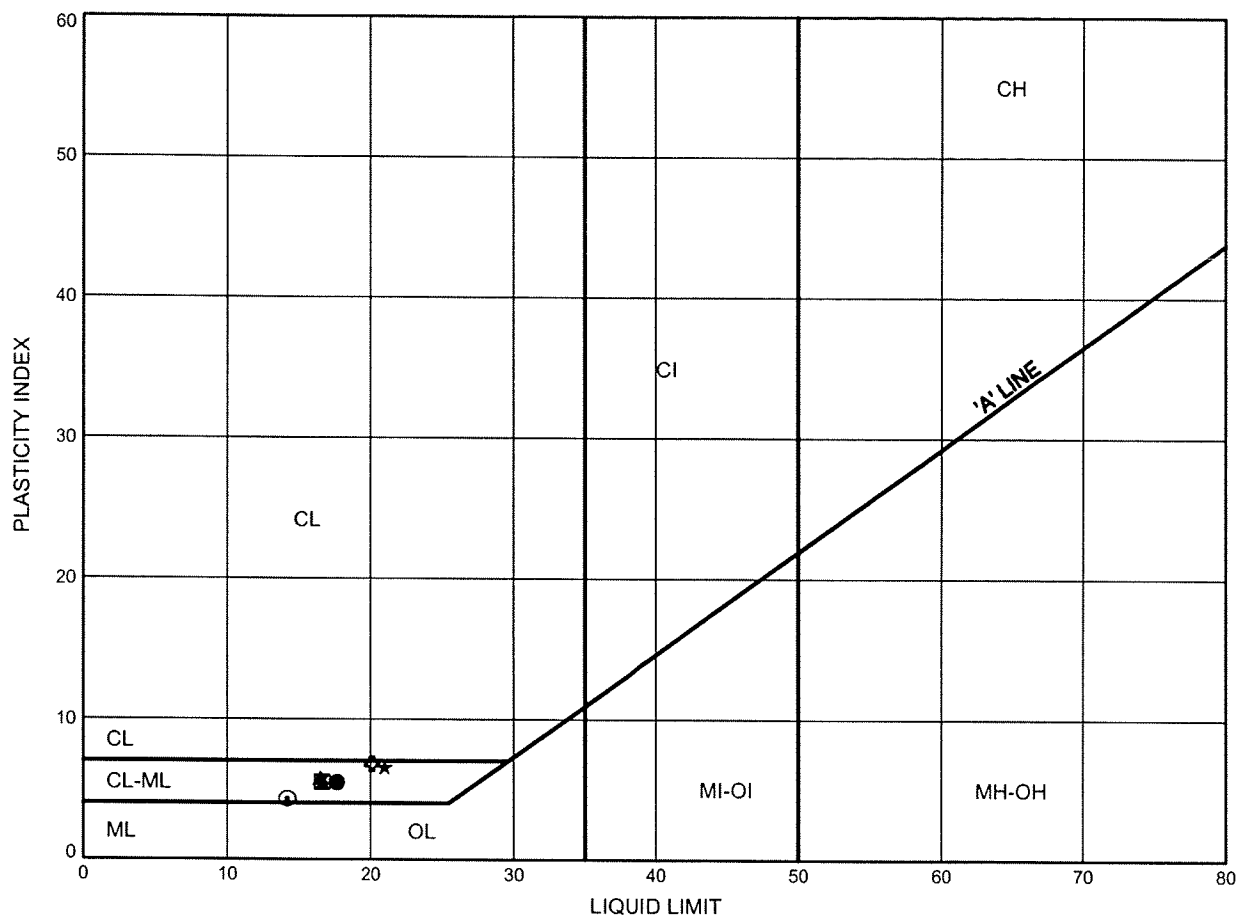


Prep'dAN.....
Chkd.RPR.....

Hwy 404 Extension ATTERBERG LIMITS TEST RESULTS

FIGURE B15

SAND & SILT TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	QSR3-5	2.59	252.44
☒	QSR3-5	6.40	248.63
▲	QSR3-5	9.45	245.58
★	QSR4-1	2.59	251.15
⊙	QSR4-1	6.40	247.34
⊕	QSR4-2	2.59	252.26

Date October 2009

Project 2109-05-00



Prep'd AN

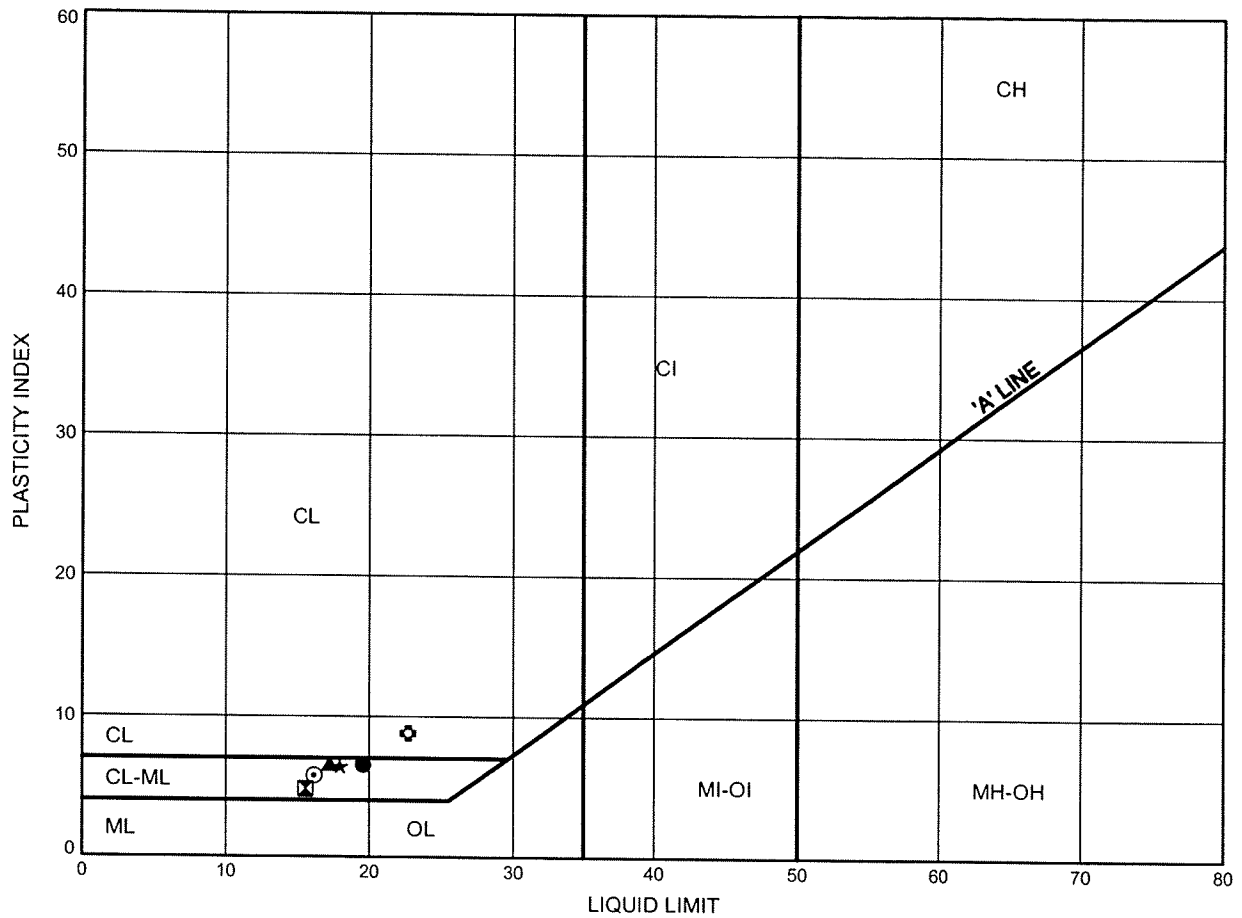
Chkd. RPR

Hwy 404 Extension

ATTERBERG LIMITS TEST RESULTS

FIGURE B16

SAND & SILT TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	QSR4-3	4.88	252.27
⊠	QSR4-3	10.97	246.18
▲	QSR4-4	3.35	252.08
★	QSR4-4	7.92	247.51
⊙	QSR4-4	10.97	244.46
⊛	QSR4-5	3.35	252.08

Date October 2009
 Project 2109-05-00

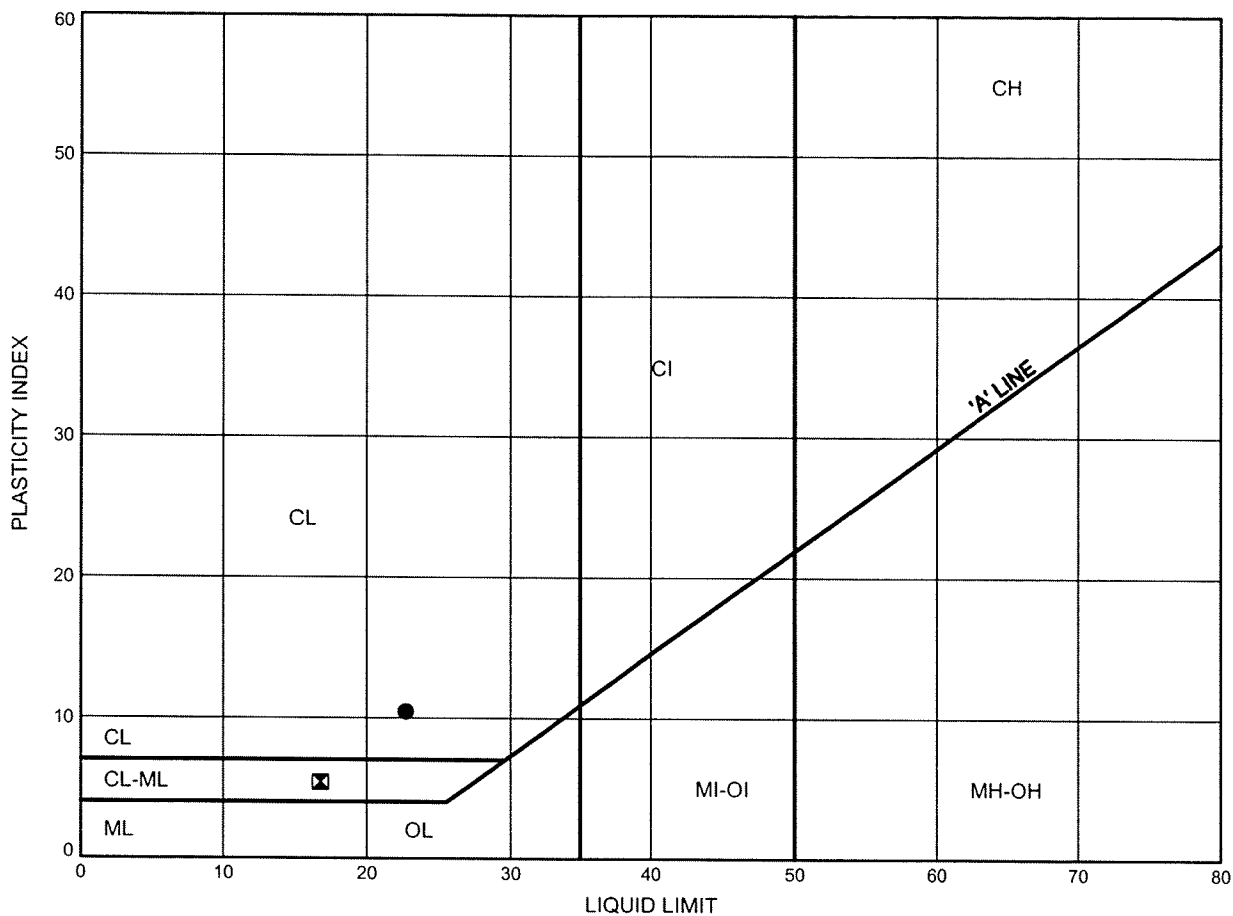


Prep'd AN
 Chkd. RPR

Hwy 404 Extension
ATTERBERG LIMITS TEST RESULTS

FIGURE B17

SAND & SILT TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	QSR4-5	4.88	250.55
⊠	QSR4-5	9.45	245.98

Date October 2009
 Project 2109-05-00



Prep'd AN
 Chkd. RPR

Appendix C

**Site Photographs
(south of Queensville Sideroad)**

Culverts 1 to 4

**Boreholes QSR1-1 to QSR1-3, QSR2-1 to QSR2-4, QSR3-1 to QSR3-5
and QSR4-1 to QSR4-5**

Culverts

Highway 404 Extension from Green Lane to Queensville Sideroad



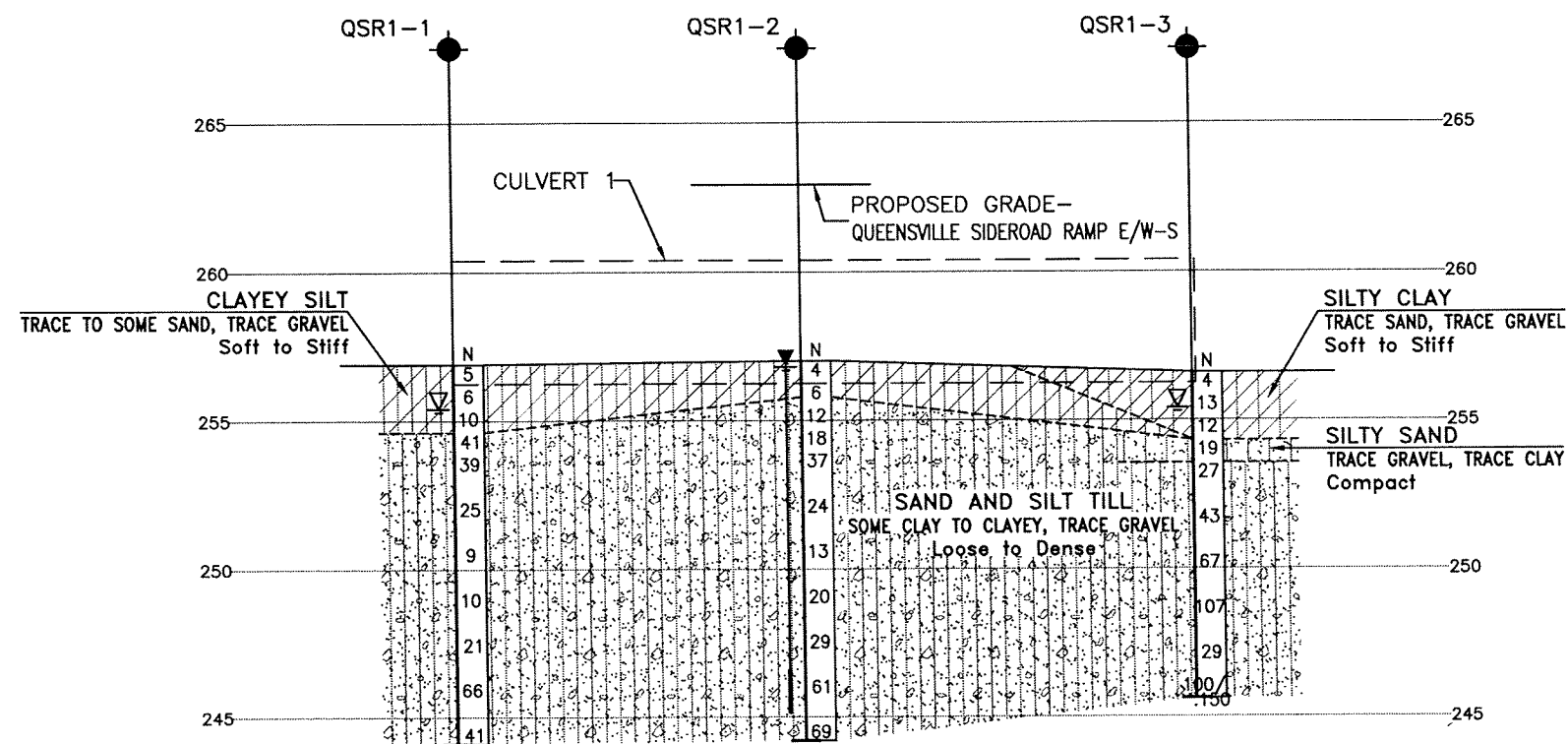
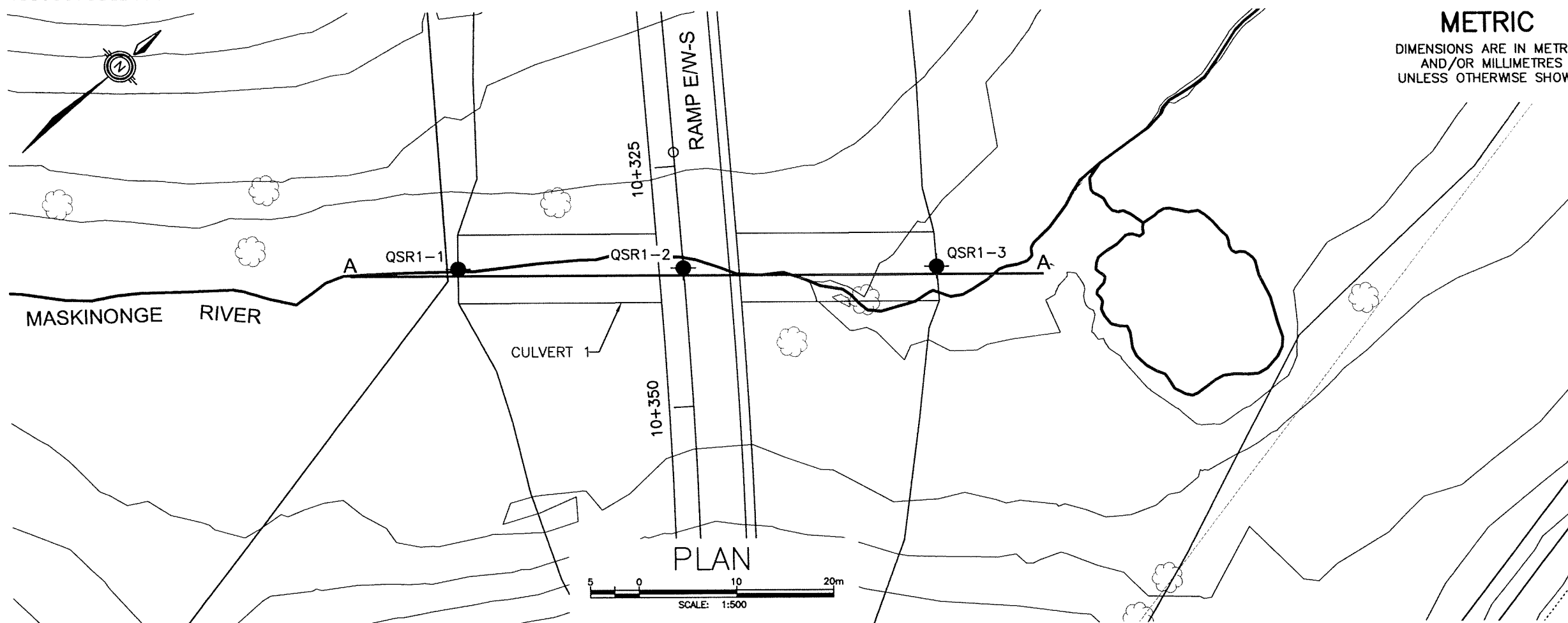
Photograph 1 – View of north end of existing CPS culvert (north of Queensville Sideroad)



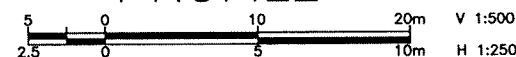
Photograph 2 – View of the site looking south of Queensville Sideroad

Appendix D
Drawing titled “Borehole Locations and Soil Strata”
(south of Queensville Sideroad)

Culverts 1 to 4
Boreholes QSR1-1 to QSR1-3, QSR2-1 to QSR2-4, QSR3-1 to QSR3-5
and QSR4-1 to QSR4-5



PROFILE

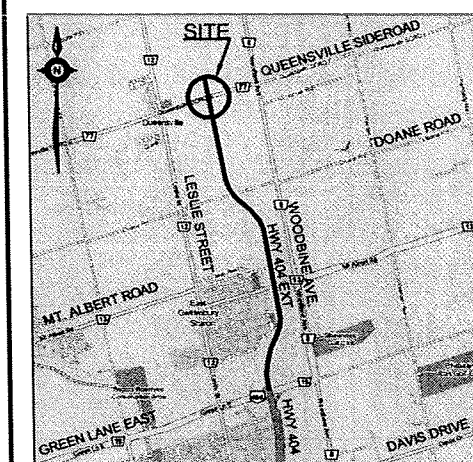


METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN





CONT No
GWP No 2109-05-00

HIGHWAY 404 EXTENSION
CULVERT AT E/W-S RAMP
QUEENSVILLE INTERCHANGE
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET
451



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

[illegible]

-NOTES-

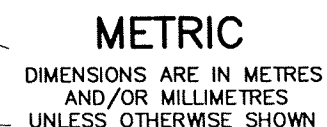
- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCRES No. 31D-493

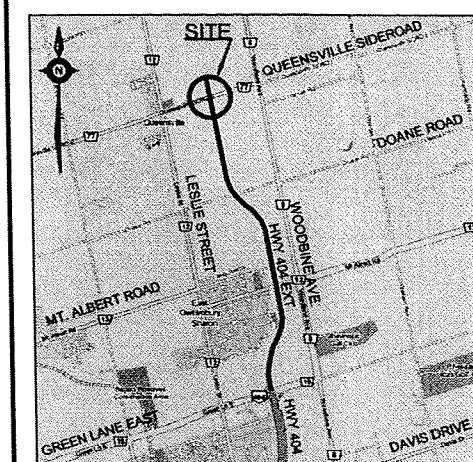


DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

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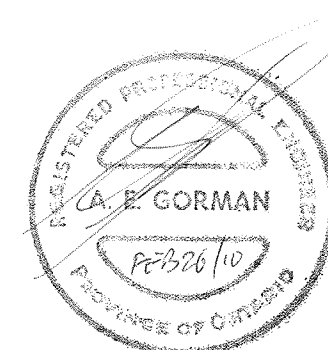
SHEET
447

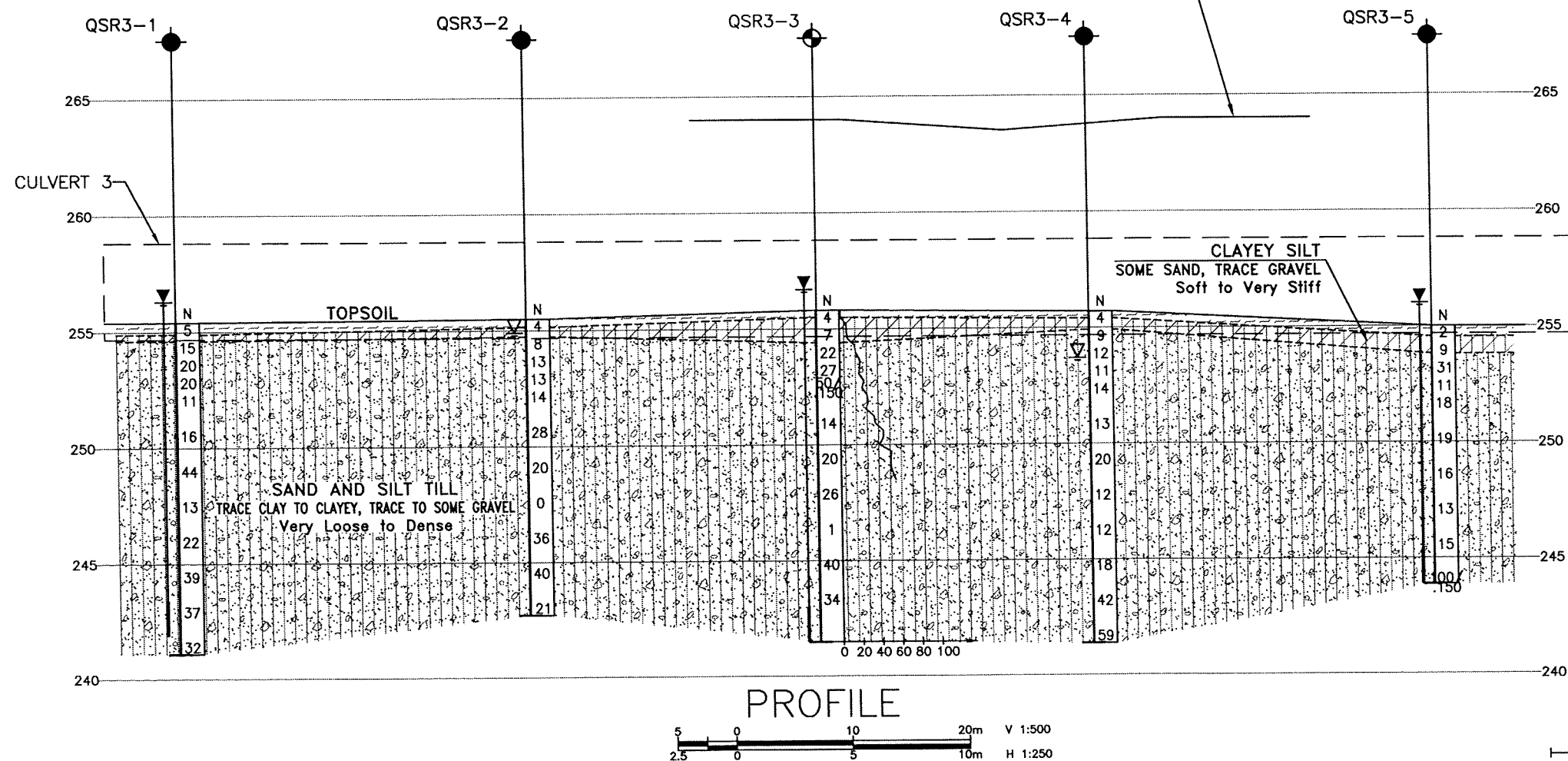
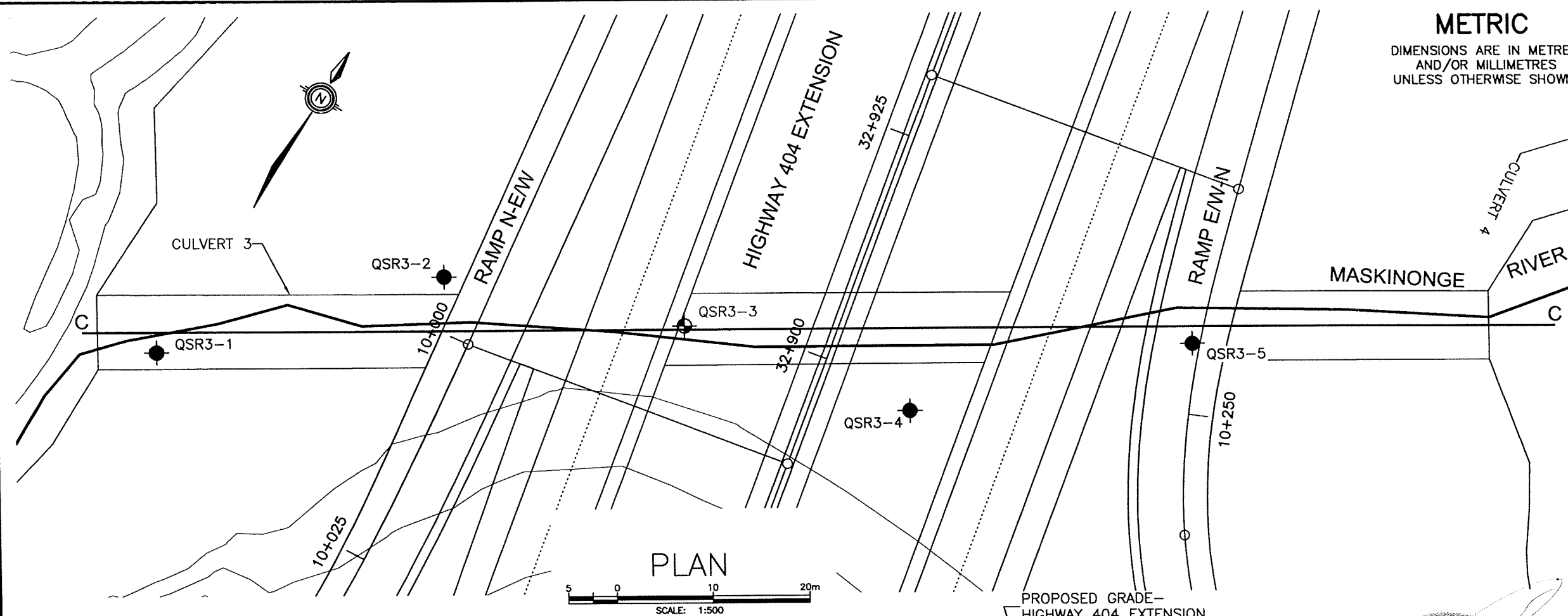


LEGEND

NO	ELEVATION	NORTHING	EASTING
QSR2-1	256.2	4 888 837.7	309 753.3
QSR2-2	256.4	4 888 857.3	309 746.3
QSR2-3	256.8	4 888 877.1	309 738.8
QSR2-4	255.5	4 888 899.7	309 732.2

- 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.

[illegible]



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

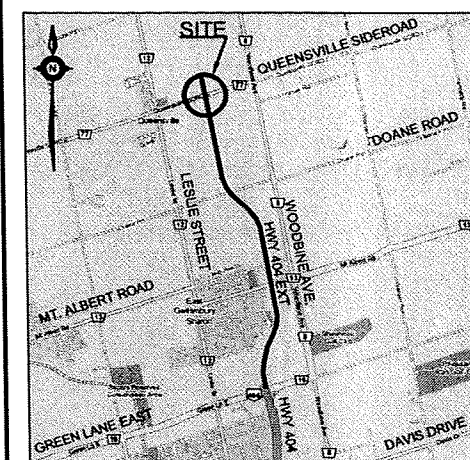
CONT No
GWP No 2109-05-00
HIGHWAY 404 EXTENSION
CULVERT AT STATION 32+90.3
QUEENSVILLE INTERCHANGE
BOREHOLE LOCATIONS AND SOIL STRATA



SHEET
463








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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
QSR3-1	255.4	4 888 957.8	309 742.3
QSR3-2	255.5	4 888 980.1	309 763.6
QSR3-3	255.8	4 888 988.6	309 787.5
QSR3-4	255.7	4 888 993.1	309 812.0
QSR3-5	255.0	4 889 014.4	309 833.5

-NOTES-

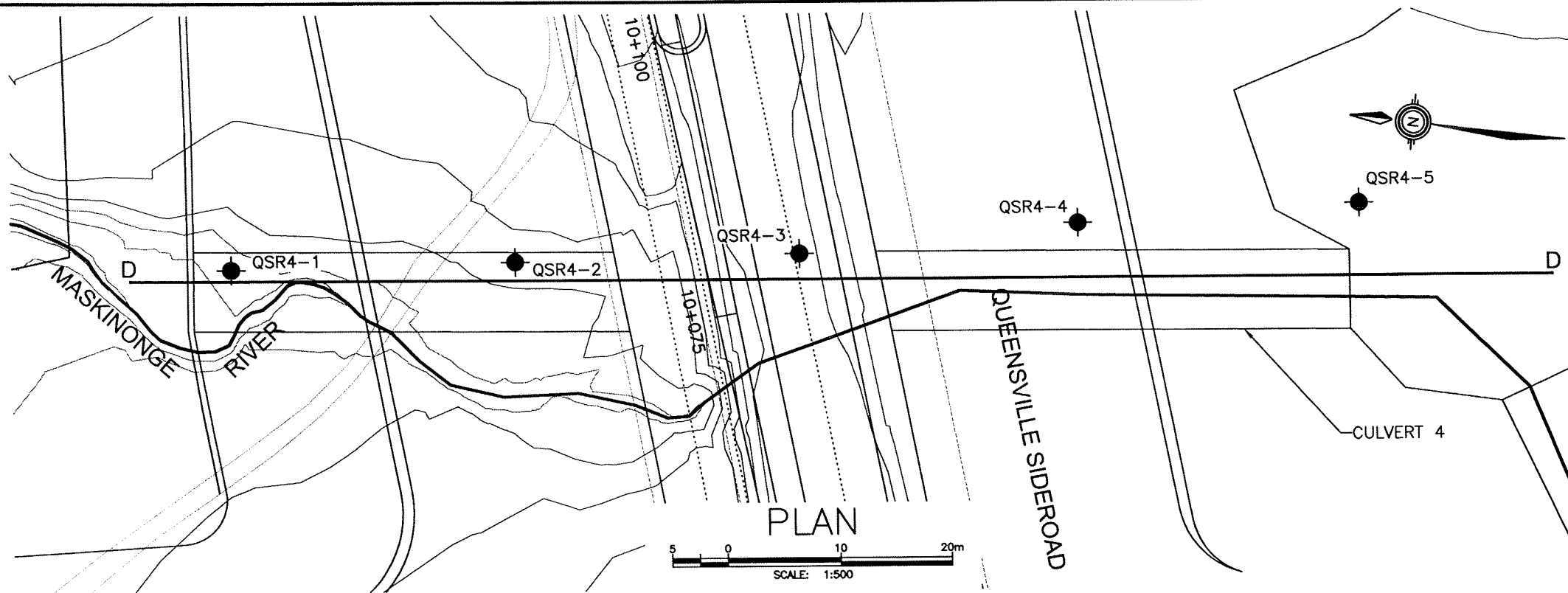
- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCRES No. 31D-493

REVISIONS								
	DATE	BY				DESCRIPTION		
DESIGN	RPR	CHK	AEG	CODE		LOAD	DATE	MAR. 20
DBAWN	NFA	CHK	RBP	SUF 37-1575/STRUCT		LDWG		

FILENAME: D:\Drafting\19\1805\96\led0596-CulvertatQSR(31D-493).dwg

MINISTRY OF TRANSPORTATION, ONTARIO
PLOT SCALE 1:1
PLOT NO. 207
PLOT DATE 08-05



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

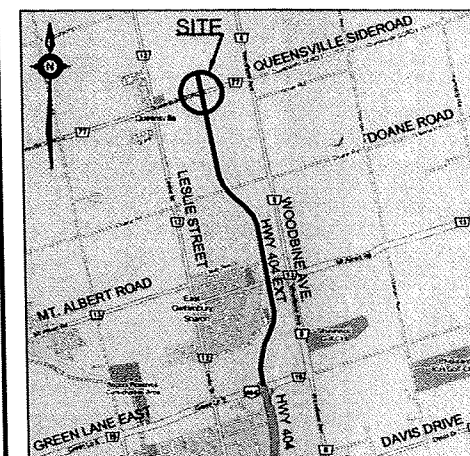
CONT No
GWP No 2109-05-00

HIGHWAY 404 EXTENSION
CULVERT AT QUEENSVILLE SIDEROAD
QUEENSVILLE INTERCHANGE
BOREHOLE LOCATIONS AND SOIL STRATA



SHEET
443

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KEYPLAN LEGEND

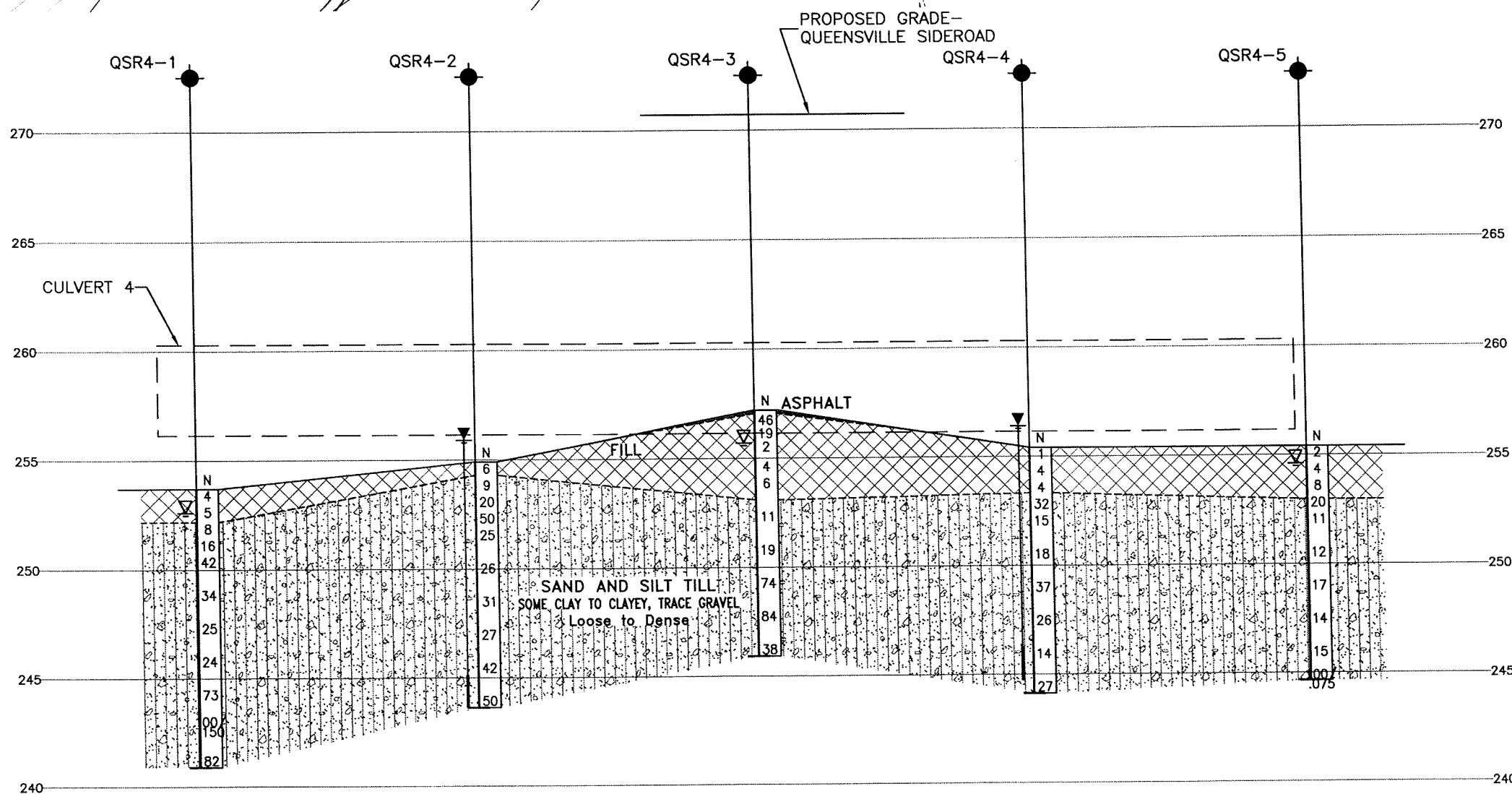
- Borehole
- Borehole and Cone
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60' Cone, 475J/blow)
- PH Pressure, Hydraulic
- Water Level
- Head Artesian Water
- Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
QSR4-1	253.7	4 889 148.9	309 855.8
QSR4-2	254.9	4 889 123.9	309 859.4
QSR4-3	257.2	4 889 098.8	309 863.0
QSR4-4	255.4	4 889 074.3	309 868.5
QSR4-5	255.4	4 889 049.6	309 873.1

NOTES

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

GEOCRES No. 31D-493

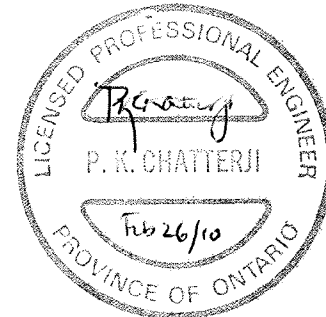
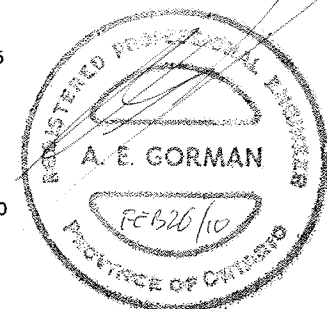


PROFILE

5 0 10 20m V 1:500
2.5 0 5 10m H 1:250

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	RPR	CHK AEG	CODE
DRAWN	MFA	CHK RPR	SITE 37-1576/CSTRUCT
			DATE MAR. 2010
			DWG



FILENAME: D:\Projects\10\1605\GWP\4040506-Culvert\31D-493.dwg
PLOT DATE: Mar 05, 2010 - 11:39m

Appendix E
Record of Borehole Sheets
(south of Doane Road)

Culverts 5 and 6
Boreholes 08-01 to 08-05 and 08-10 to 08-14

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
CLAY SHALE			
SANDSTONE			
SILTSTONE			
CLAYSTONE			
COAL			

RECORD OF BOREHOLE No 08-01

1 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 886 603.28 E 310 715.60 ORIGINATED BY GA
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2009.08.27 - 2009.08.27 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		
257.2												
0.0	TOPSOIL: (200mm)						257					
0.2	Silty CLAY, trace sand, iron oxide staining Soft to Very Stiff Brown		1	SS	3							
			2	SS	4		256					
			3	SS	18		255					
			4	SS	17		254					0 2 50 48
	Occasional silt seams		5	SS	15		253					
			6	SS	15		252					0 1 46 53
			7	SS	17		251					0 0 79 21
	Grey		8	SS	21		250					
			9	SS	32		249					
	Hard						248					0 5 68 27

Continued Next Page

+³ ×³ : Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 08-01

2 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 886 603.28 E 310 715.60 ORIGINATED BY GA
HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2009.08.27 - 2009.08.27 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE						
	Continued From Previous Page							40 80 120 160 200	WATER CONTENT (%) 20 40 60						
245.9	Silty CLAY, trace sand Hard Grey		10	SS	43		247								
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN TO 10.6m AND WATER LEVEL AT 1.6m. BOREHOLE BACKFILLED WITH HOLEPLUG TO SURFACE.						246								

RECORD OF BOREHOLE No 08-02

1 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 886 589.18 E 310 694.94 ORIGINATED BY GA
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2009.08.26 - 2009.08.26 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					w _p w w _L		
257.1						20 40 60 80 100	20 40 60								
0.0	TOPSOIL: (75mm)														
0.1	Silty CLAY, trace sand, iron oxide staining Soft to Firm Brown		1	SS	3										
			2	SS	3										
			3	SS	7										
	Becoming stiff to very stiff		4	SS	16										
			5	SS	14										
			6	SS	15										
	Grey		7	SS	13										
	Layers of silt, some clay		8	SS	26										
			9	SS	37										
	Hard														

Continued Next Page

+ 3 . X 3 : Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

ONTMT4S 0596.GPJ 10/5/09

RECORD OF BOREHOLE No 08-02

2 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 886 589.18 E 310 694.94 ORIGINATED BY GA
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2009.08.26 - 2009.08.26 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
Continued From Previous Page																
	Silty CLAY, trace to some sand, trace gravel Very Stiff Grey						247									
245.9			10	SS	28		246									
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND WATER LEVEL AT 0.6m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2009.09.02 6.2 250.9															

RECORD OF BOREHOLE No 08-03

1 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 886 576.91 E 310 673.12 ORIGINATED BY GA
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2009.08.26 - 2009.08.26 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
257.4 0.0 0.1	TOPSOIL: (100mm) Sandy SILT, some clay, iron oxide staining Loose to Compact Brown Wet		1	SS	4		257							
			2	SS	10		256							
255.8 1.6	Silty CLAY, iron oxide staining Stiff to Very Stiff		3	SS	17		255							
			4	SS	17		254							
			5	SS	14		253							
			6	SS	15		252							
	Grey		7	SS	17		251							
	Trace sand		8	SS	20		250							
			9	SS	19		249							
							248							

Continued Next Page

+ 3 x 3 Numbers refer to
Sensitivity

20
15 10 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 08-03

2 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 886 576.91 E 310 673.12 ORIGINATED BY GA
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2009.08.26 - 2009.08.26 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 Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80					
	Continued From Previous Page															
246.2	Silty CLAY, trace sand Hard Grey		10	SS	42		247									
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND WATER LEVEL AT 4.8m. BOREHOLE BACKFILLED WITH HOLEPLUG TO SURFACE.															

RECORD OF BOREHOLE No 08-04

2 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 886 615.39 E 310 735.70 ORIGINATED BY GA
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2009.08.27 - 2009.08.27 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 Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
	Continued From Previous Page																
251.5	Silty CLAY, trace sand Hard Grey		10	SS	47		252										
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN TO 10.6m AND WATER LEVEL AT 1.5m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2009.09.02 5.9 256.9																

RECORD OF BOREHOLE No 08-05

1 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 886 625.73 E 310 761.36 ORIGINATED BY GA
 HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2009.08.27 - 2009.08.27 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									
260.8							20 40 60 80 100										
0.0	TOPSOIL: (100mm)						40 80 120 160 200										
0.1	Sandy SILT, some clay, iron oxide staining Very Loose Brown Damp		1	SS	3												
259.9																	
0.9	Silty CLAY, iron oxide staining Stiff to Very Stiff Brown		2	SS	8									0 0 59 41			
			3	SS	24												
			4	SS	14												
	Occasional silt seams		5	SS	10									0 0 36 64			
			6	SS	16												
	Layers of silt, some clay																
	Grey		7	SS	10												
			8	SS	15									0 0 81 19			
	Layers of silt																
			9	SS	23												

Continued Next Page

+³ × 3³ : Numbers refer to Sensitivity 20 15 10 5 0 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 08-05

2 OF 2

METRIC

G.W.P. 2109-05-00 LOCATION N 4 886 625.73 E 310 761.36 ORIGINATED BY GA
HWY 404 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2009.08.27 - 2009.08.27 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			20 40 60 80 100							PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L
								SHEAR STRENGTH kPa									
	Continued From Previous Page																
250.2	Silty CLAY Very Stiff to Hard Grey																
10.6	Silty CLAY , trace to some sand, trace gravel Hard		10	SS	84		250										
249.7	Grey																
11.1	(TILL) END OF BOREHOLE AT 11.1m. BOREHOLE OPEN TO 10.6m AND WATER LEVEL AT 4.3m. BOREHOLE BACKFILLED WITH HOLEPLUG TO SURFACE.																

RECORD OF BOREHOLE No 08-10

1 OF 1

METRIC

G.W.P. 2109-05-00 LOCATION N 4 886 714.15 E 310 638.52 ORIGINATED BY LG
 HWY 404 BOREHOLE TYPE Continuous Spoon Sampling with Tripod COMPILED BY AN
 DATUM Geodetic DATE 2010.02.18 - 2010.02.18 CHECKED BY TH

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				
257.4								20 40 60 80 100				
0.0	ICE							○ UNCONFINED ▲ C _{pen} ● QUICK TRIAXIAL × LAB VANE				
0.2	WATER							PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT W _P W W _L WATER CONTENT (%)				
256.6							257					
0.8	PEAT		2	SS	2							
256.2												
1.2	Silty CLAY, trace sand Firm to Very Stiff Brown Wet (TILL)(CL-CI)		3	SS	11		256					
			4	SS	9		255					0 3 53 44
			5	SS	17							
			6	SS	24		254					
			7	SS	23							0 2 32 66
			8	SS	29		253					
			9	SS	27							
			10	SS	36		252					0 0 57 43
			11	SS	29		251					
			12	SS	28							
			13	SS	32		250					0 0 77 23
249.2			14	SS	50/							
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.				0.150							

ONTMT4S(CPEN) 0596.GPJ 3/11/10

RECORD OF BOREHOLE No 08-11

1 OF 1

METRIC

G.W.P. 2109-05-00 LOCATION N 4 886 733.41 E 310 655.58 ORIGINATED BY LG
 HWY 404 BOREHOLE TYPE Continuous Spoon Sampling with Tripod COMPILED BY AN
 DATUM Geodetic DATE 2010.02.18 - 2010.02.18 CHECKED BY TH

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 (%)					
257.0							20 40 60 80 100						
0.0	WATER						257						
256.4													
0.6	PEAT, some sand		2	SS	2		256						
255.3			3	SS	3								
1.7	Silty CLAY, trace sand Firm to Very Stiff Brown Wet (TILL)(CL-CI)		4	SS	6		255						
			5	SS	19								0 4 36 60
			6	SS	17		254						
			7	SS	25								0 6 48 46
			8	SS	16								
			9	SS	27		252						
			10	SS	22								0 1 70 29
			11	SS	19		251						
			12	SS	23								
			13	SS	30		250						
			14	SS	23		249						0 1 73 26
			15	SS	53								
247.9							248						
9.1	END OF BOREHOLE AT 9.1m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.												

ONTMT4S(CPEN) 0596.GPJ 3/11/10

+³ ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 08-12

1 OF 1

METRIC

G.W.P. 2109-05-00 LOCATION N 4 886 759.24 E 310 668.13 ORIGINATED BY LG
 HWY 404 BOREHOLE TYPE Continuous Spoon Sampling with Tripod COMPILED BY AN
 DATUM Geodetic DATE 2010.02.18 - 2010.02.18 CHECKED BY TH

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					
258.3								20 40 60 80 100					
0.0	ICE							20 40 60 80 100					
0.2	WATER							20 40 60 80 100					
256.6								20 40 60 80 100					
255.6	PEAT							20 40 60 80 100					
1.7	Silty SAND, some clay Compact		4	SS	11			20 40 60 80 100					0 60 26 14
255.9	Brown Wet							20 40 60 80 100					
2.4	Silty CLAY, trace sand Stiff to Very Stiff Grey Moist (TILL)(CL-CI)		5	SS	27			20 40 60 80 100					
			6	SS	35			20 40 60 80 100					
			7	SS	39			20 40 60 80 100					0 4 41 55
			8	SS	42			20 40 60 80 100					
			9	SS	23			20 40 60 80 100					
			10	SS	33			20 40 60 80 100					0 1 70 29
			11	SS	31			20 40 60 80 100					
			12	SS	39			20 40 60 80 100					0 1 82 17
			13	SS	30			20 40 60 80 100					
			14	SS	61			20 40 60 80 100					
249.8								20 40 60 80 100					
8.5	END OF BOREHOLE AT 8.5m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2010.03.04 5.7 252.6 2010.03.10 6.2 252.1												

ONTMT4S(CPEN)_0596.GPJ 3/11/10

RECORD OF BOREHOLE No 08-13

1 OF 1

METRIC

G.W.P. 2109-05-00 LOCATION N 4 886 691.28 E 310 623.35 ORIGINATED BY JM
 HWY 404 BOREHOLE TYPE Continuous Spoon Sampling with Tripod COMPILED BY AN
 DATUM Geodetic DATE 2010.02.17 - 2010.02.17 CHECKED BY TH

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				
256.9							20 40 60 80 100	○ UNCONFINED	▲ C _{pen}			
0.0	PEAT		1	SS	8			● QUICK TRIAXIAL	×	LAB VANE		
256.3								WATER CONTENT (%)				
0.6	Silty CLAY							W _P	W	W _L		
256.0			2	SS	28		256					
0.9	Silty SAND											
255.7	Compact Brown Wet		3	SS	22							0 3 69 28
1.2	Silty CLAY, trace sand Very Stiff to Hard Brown Wet (TILL)(CL)		4	SS	27		255					
			5	SS	54							
			6	SS	47		254					0 1 54 45
			7	SS	45		253					
			8	SS	28							
			9	SS	17		252					0 2 41 57
			10	SS	30							
			11	SS	31		251					
			12	SS	28		250					0 0 61 39
			13	SS	31							
			14	SS	39		249					
			15	SS	47							
247.8							248					0 0 66 34
9.1	END OF BOREHOLE AT 9.1m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.											

ONTWT4S(CPEN) 0596 GPJ 3/9/10

RECORD OF BOREHOLE No 08-14

1 OF 1

METRIC

G.W.P. 2109-05-00 LOCATION N 4 886 669.08 E 310 609.07 ORIGINATED BY JM
 HWY 404 BOREHOLE TYPE Continuous Spoon Sampling with Tripod COMPILED BY AN
 DATUM Geodetic DATE 2010.02.17 - 2010.02.17 CHECKED BY TH

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				
257.0							20 40 60 80 100					
0.0	ICE						○ UNCONFINED ▲ C _{pen} ● QUICK TRIAXIAL × LAB VANE					
0.2	PEAT		1	SS	1		20 40 60 80 100					
255.9			2	SS	7		20 40 60 80 100					
1.1	Silty CLAY, trace sand Firm to Very Stiff Brown Wet (TILL)(CL-CI)		3	SS	6		20 40 60 80 100					
			4	SS	7		20 40 60 80 100					
			5	SS	31		20 40 60 80 100				0 0 57 43	
			6	SS	46		20 40 60 80 100					
			7	SS	47		20 40 60 80 100					
			8	SS	28		20 40 60 80 100					
			9	SS	20		20 40 60 80 100				0 0 38 62	
			10	SS	14		20 40 60 80 100					
			11	SS	17		20 40 60 80 100				0 2 39 59	
			12	SS	21		20 40 60 80 100					
			13	SS	26		20 40 60 80 100					
			14	SS	25		20 40 60 80 100				0 0 72 28	
			15	SS	28		20 40 60 80 100					
247.9							20 40 60 80 100					
9.1	END OF BOREHOLE AT 9.1m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.						20 40 60 80 100					

ONTMT4S(CPEN) 0596 GPJ 3/9/10

Appendix F
Laboratory Test Results
(south of Doane Road)

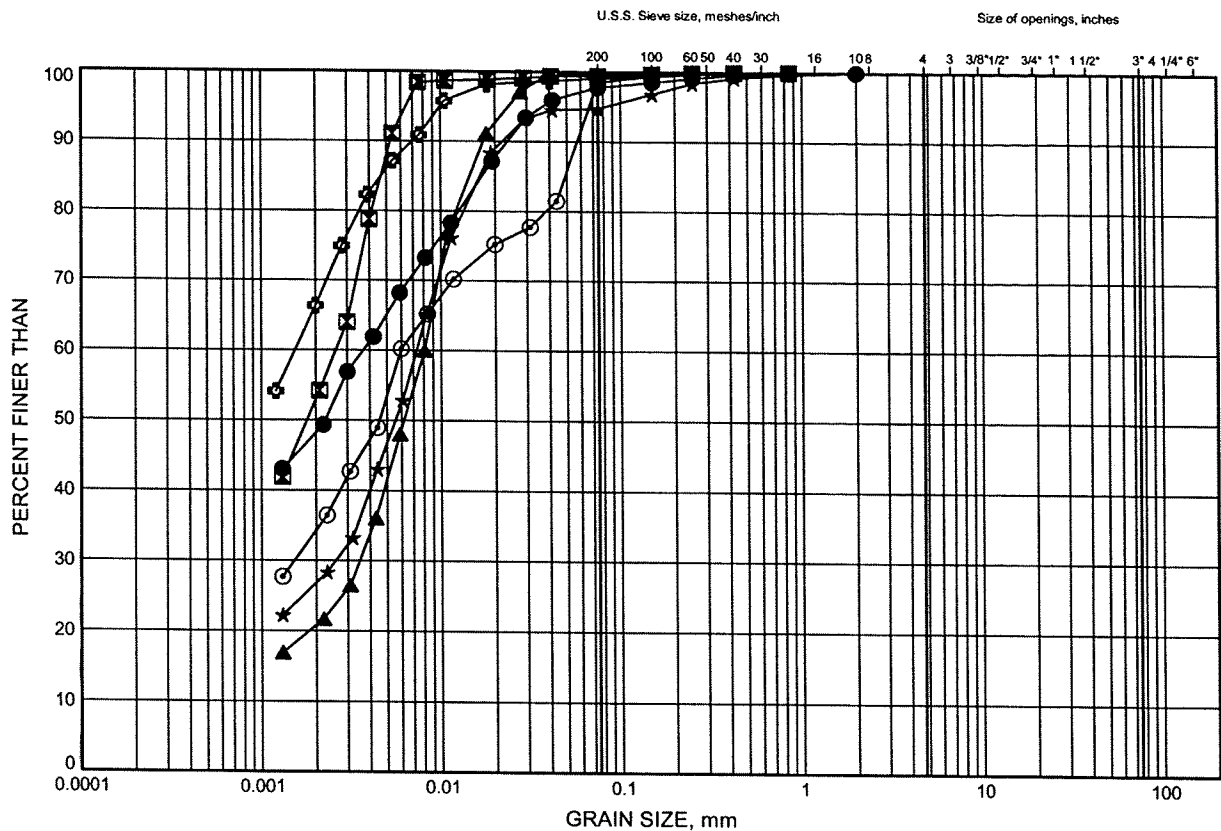
Culverts 5 and 6

Boreholes 08-01 to 08-05 and 08-10 to 08-14

Hwy 404 Extension GRAIN SIZE DISTRIBUTION

FIGURE F1

SILTY CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-01	2.59	254.56
⊠	08-01	4.88	252.27
▲	08-01	6.40	250.75
★	08-01	9.45	247.70
⊙	08-02	1.83	255.30
⊕	08-02	4.88	252.25

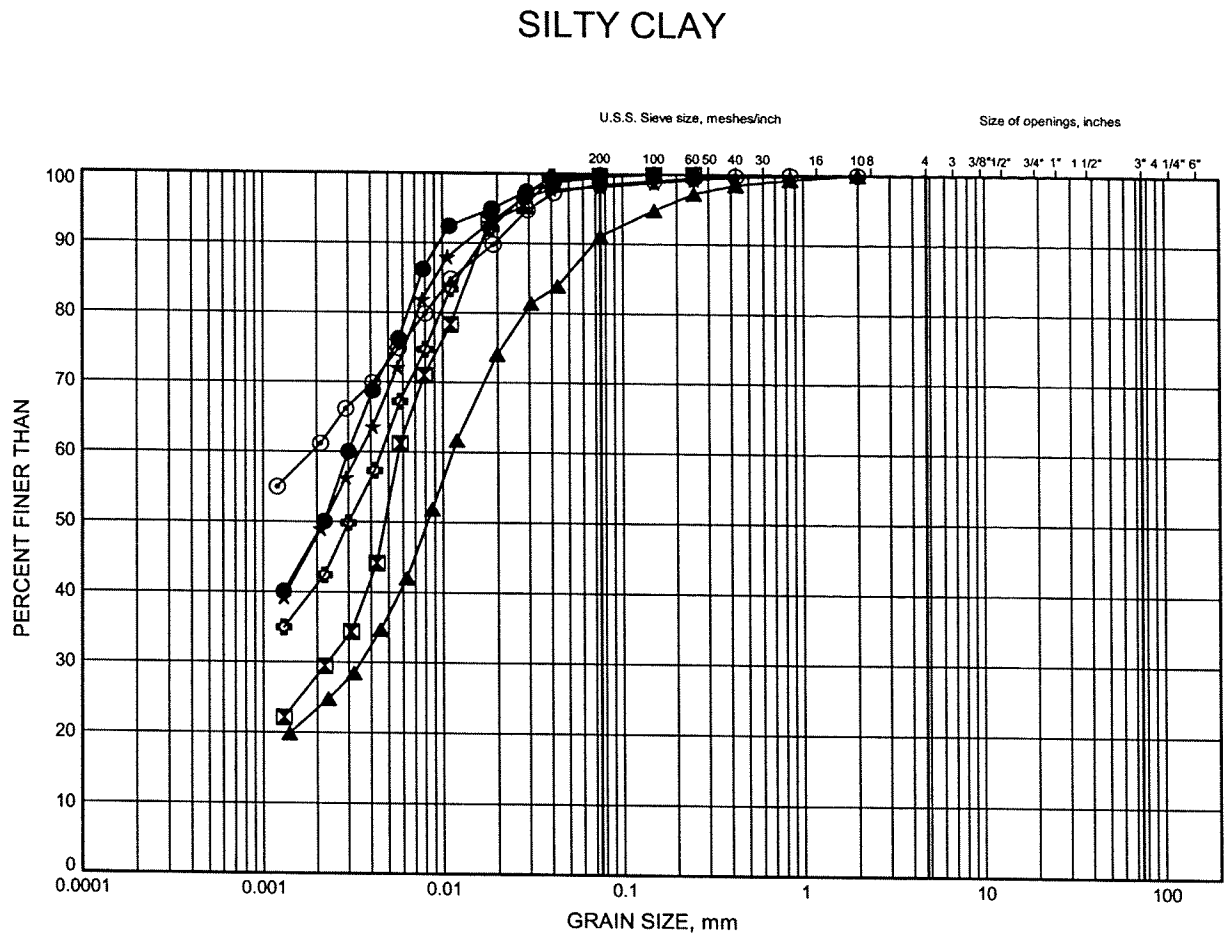
GRAIN SIZE DISTRIBUTION - THURBER 0596.GPJ 9/10/09

W.P.# .2109-05-00.....
Prepared By .AN.....
Checked By .RPR.....



Hwy 404 Extension GRAIN SIZE DISTRIBUTION

FIGURE F2



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-03	2.59	254.84
⊠	08-03	6.40	251.03
▲	08-03	9.45	247.98
★	08-04	1.83	260.97
⊙	08-04	3.35	259.45
⊕	08-05	1.07	259.76

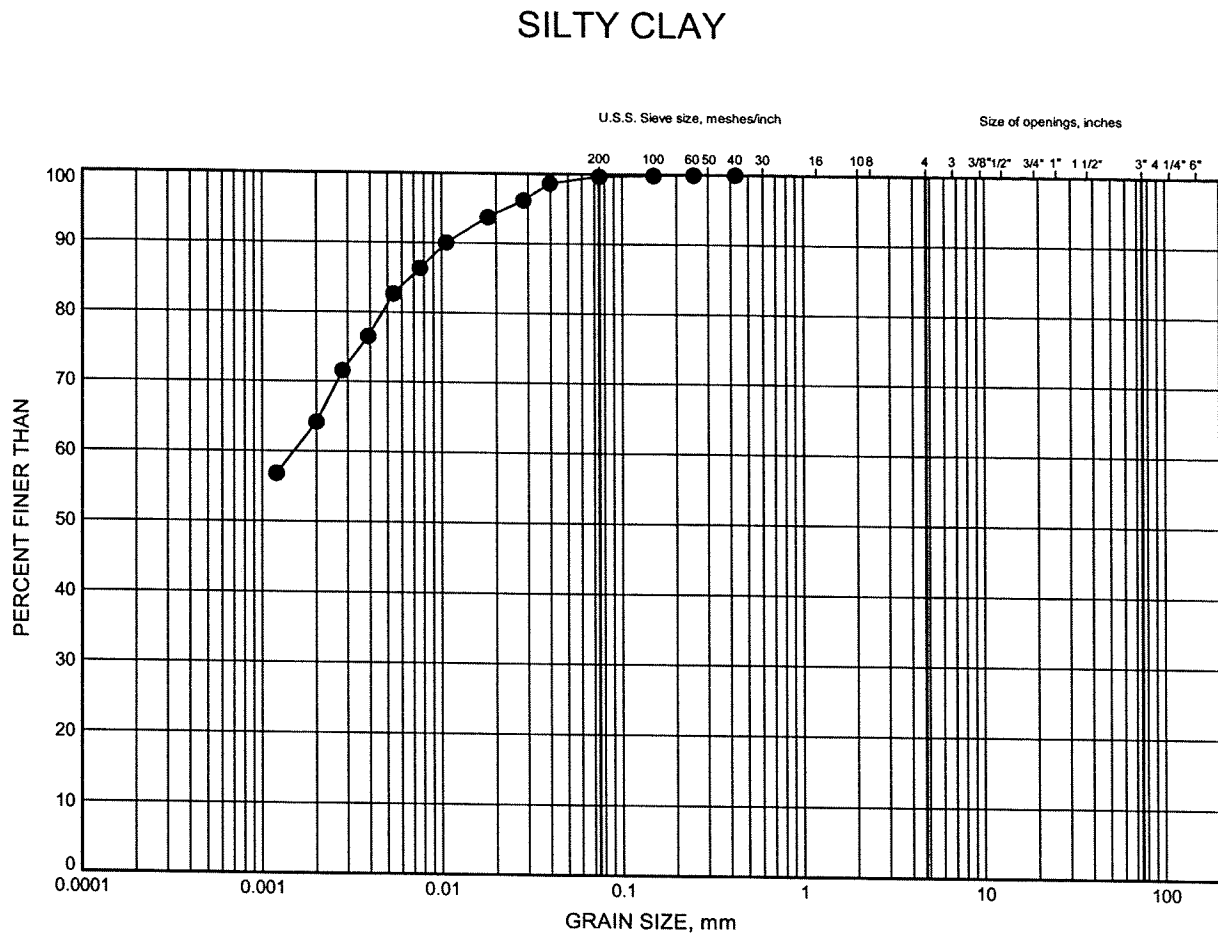
GRAIN SIZE DISTRIBUTION - THURBER 0596.GPJ 9/10/09

W.P.# 2109-05-00.....
Prepared By .AN.....
Checked By .RPR.....



Hwy 404 Extension GRAIN SIZE DISTRIBUTION

FIGURE F3



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-05	3.35	257.48

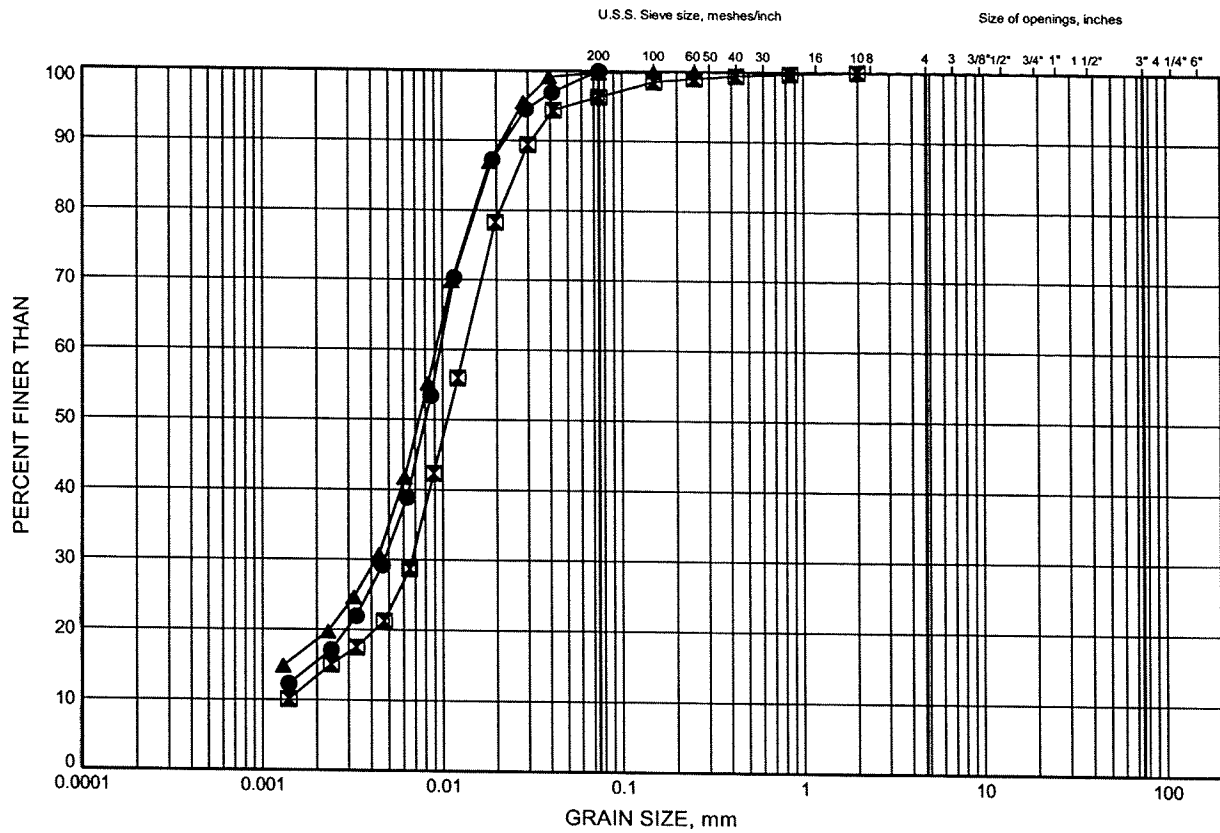


W.P.# 2109-05-00.....
Prepared By AN.....
Checked By RPR.....

Hwy 404 Extension GRAIN SIZE DISTRIBUTION

FIGURE F4

SILT (Some Clay)



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-02	7.92	249.21
⊠	08-04	7.92	254.88
▲	08-05	7.92	252.91

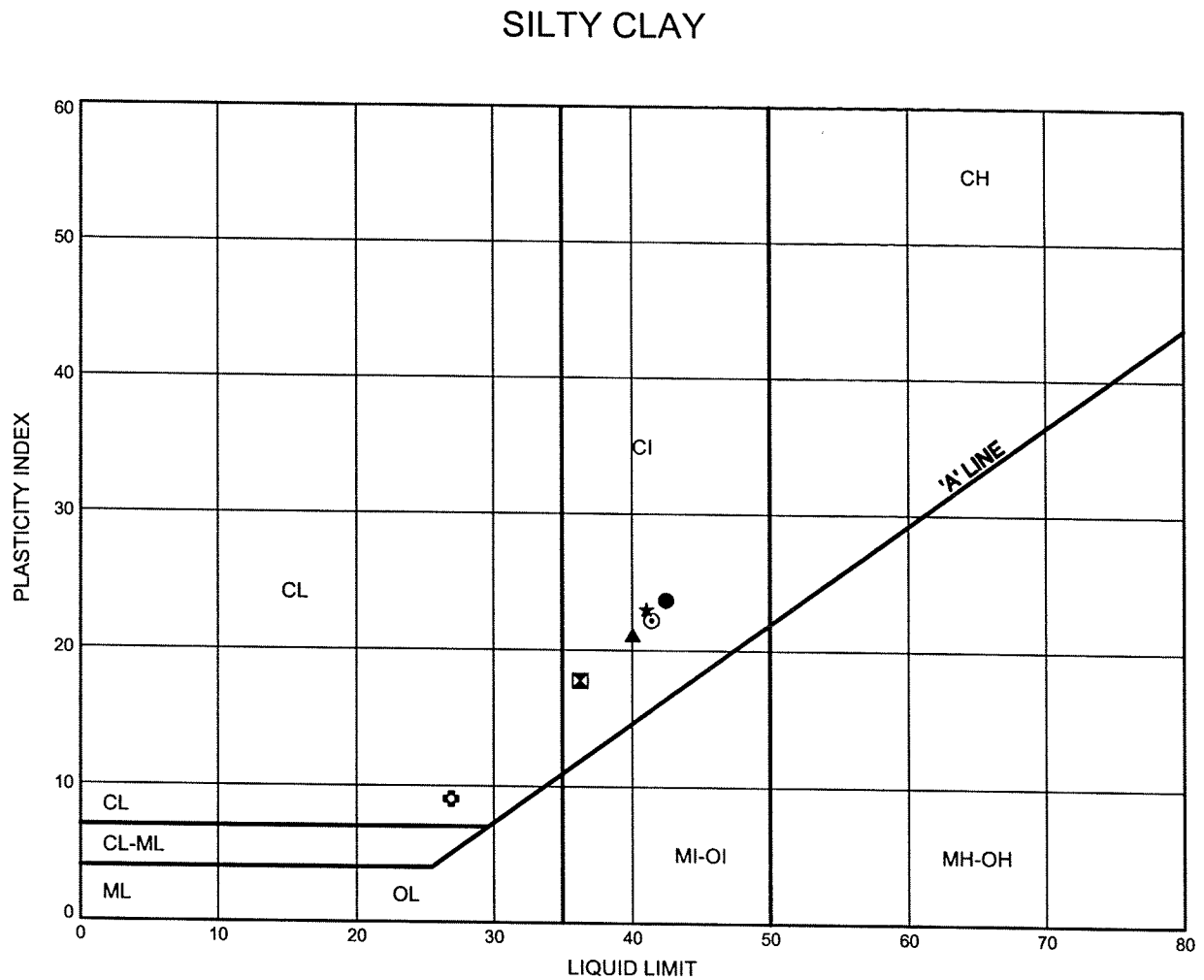
GRAIN SIZE DISTRIBUTION - THURBER 0596.GPJ 9/10/09

W.P.# .2109-05:00.....
Prepared By .AN.....
Checked By .RPR.....



Hwy 404 Extension ATTERBERG LIMITS TEST RESULTS

FIGURE F5



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	08-01	2.59	254.56
⊠	08-01	4.88	252.27
▲	08-02	1.83	255.30
★	08-02	4.88	252.25
⊙	08-03	2.59	254.84
⊕	08-03	6.40	251.03

Date September 2009
Project 2109-05-00

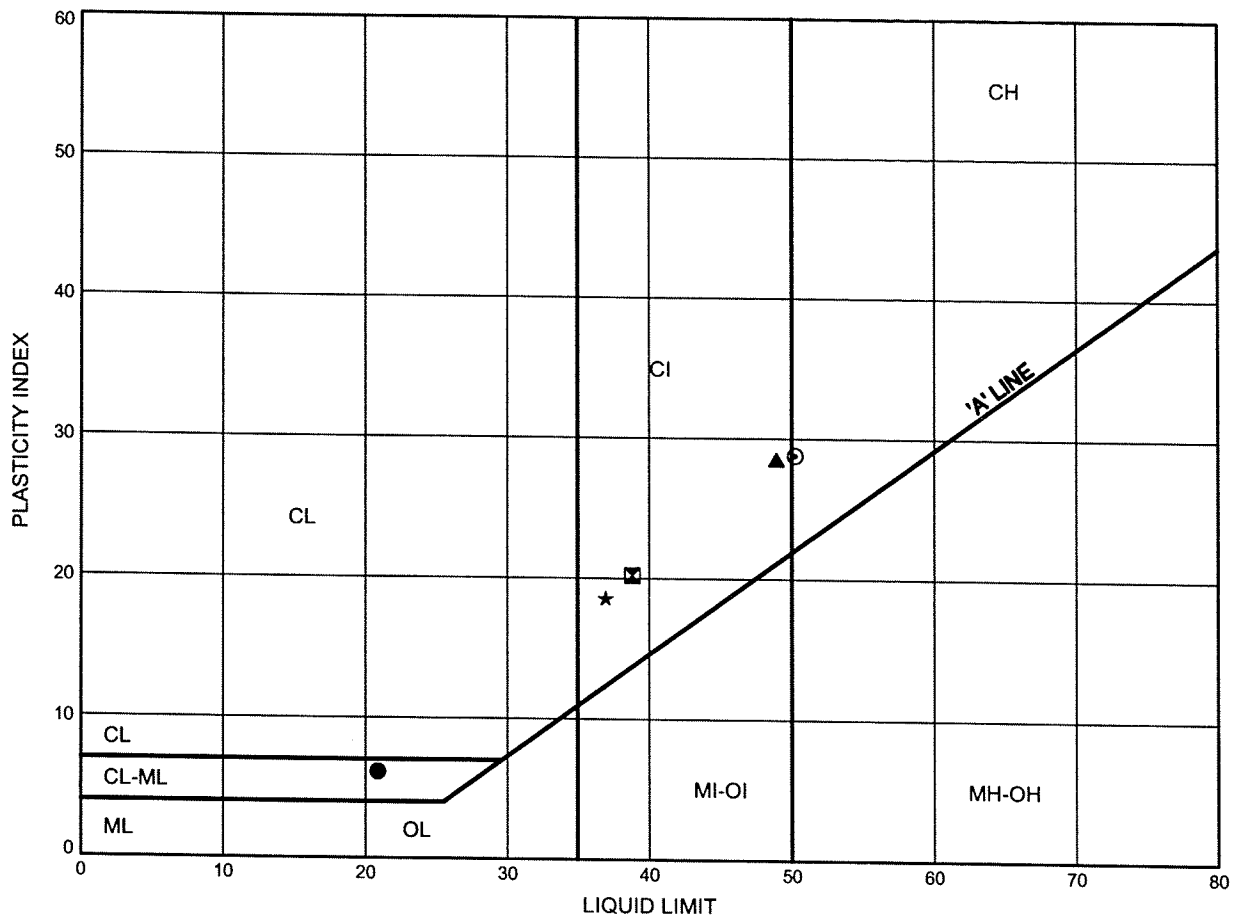


Prep'd AN
Chkd. RPR

Hwy 404 Extension
ATTERBERG LIMITS TEST RESULTS

FIGURE F6

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	08-03	9.45	247.98
⊠	08-04	1.83	260.97
▲	08-04	3.35	259.45
★	08-05	1.07	259.76
⊙	08-05	3.35	257.48

THURBALT 0596.GPJ 9/10/09

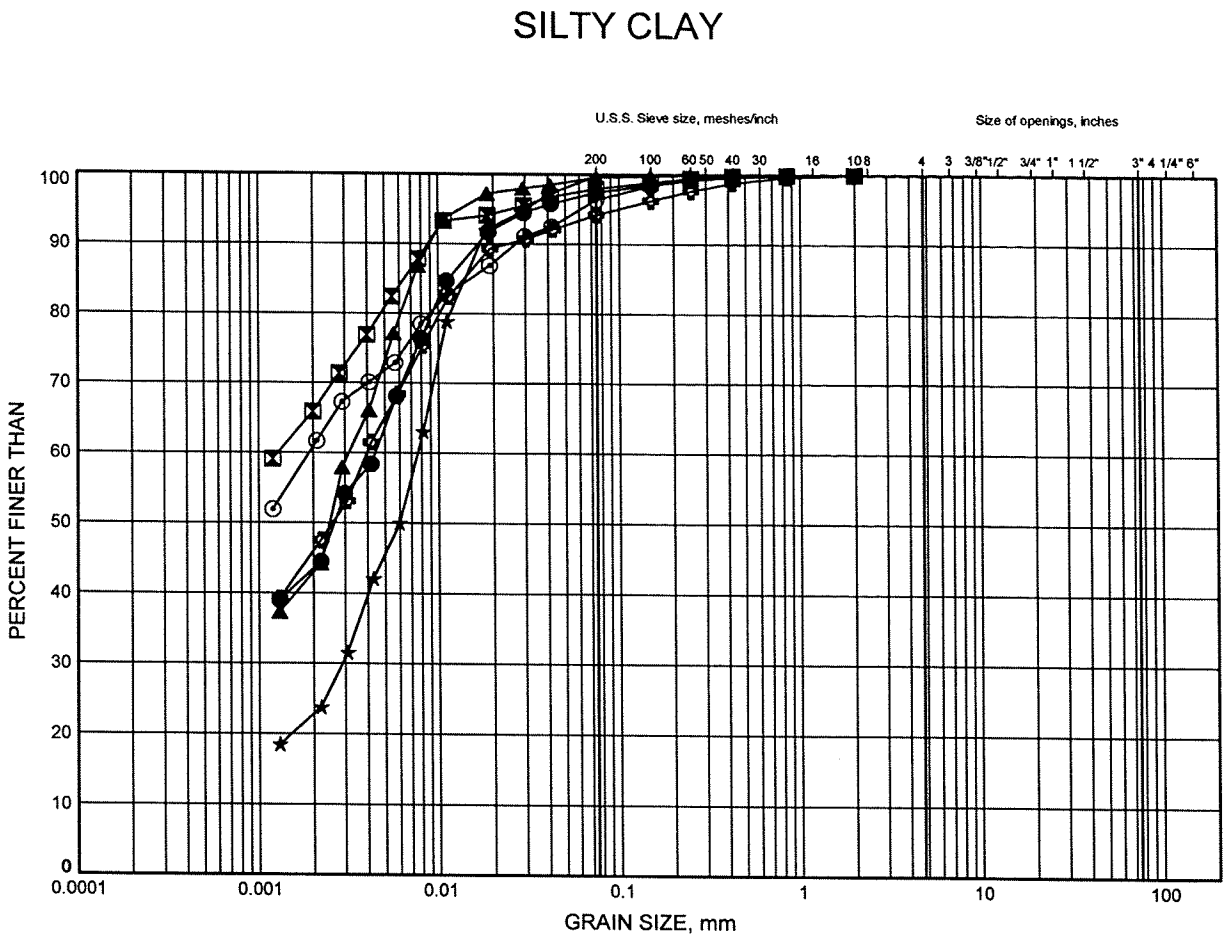
Date September 2009
 Project 2109-05-00



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 Chkd. RPR

Hwy 404 Extension
GRAIN SIZE DISTRIBUTION

FIGURE F7



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-10	2.13	255.27
⊠	08-10	3.96	253.44
▲	08-10	5.79	251.61
★	08-10	7.62	249.78
⊙	08-11	2.74	254.26
⊕	08-11	3.96	253.04

GRAIN SIZE DISTRIBUTION - THURBER 0596.GPJ 3/5/10

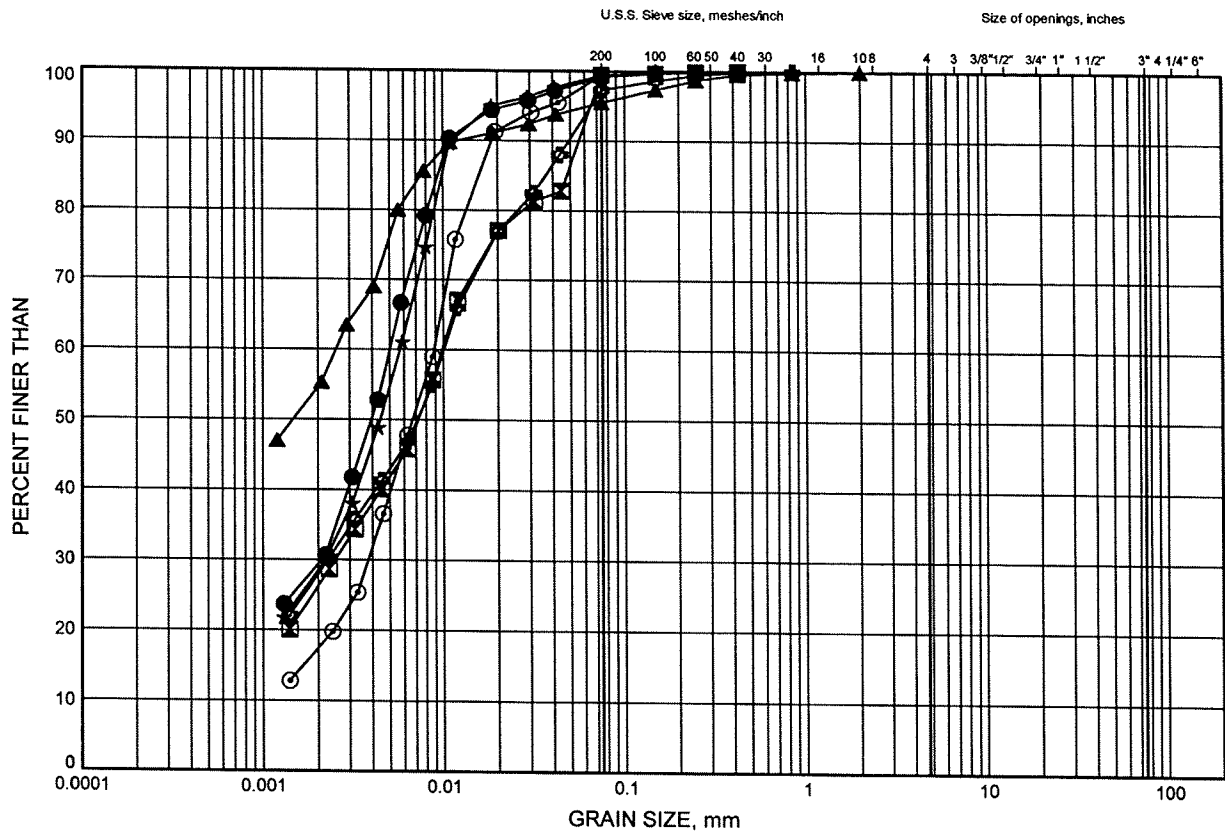
W.P.# 2109-05-00.....
Prepared By AN.....
Checked By TJH.....



Hwy 404 Extension GRAIN SIZE DISTRIBUTION

FIGURE F8

SILTY CLAY



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

LEGEND

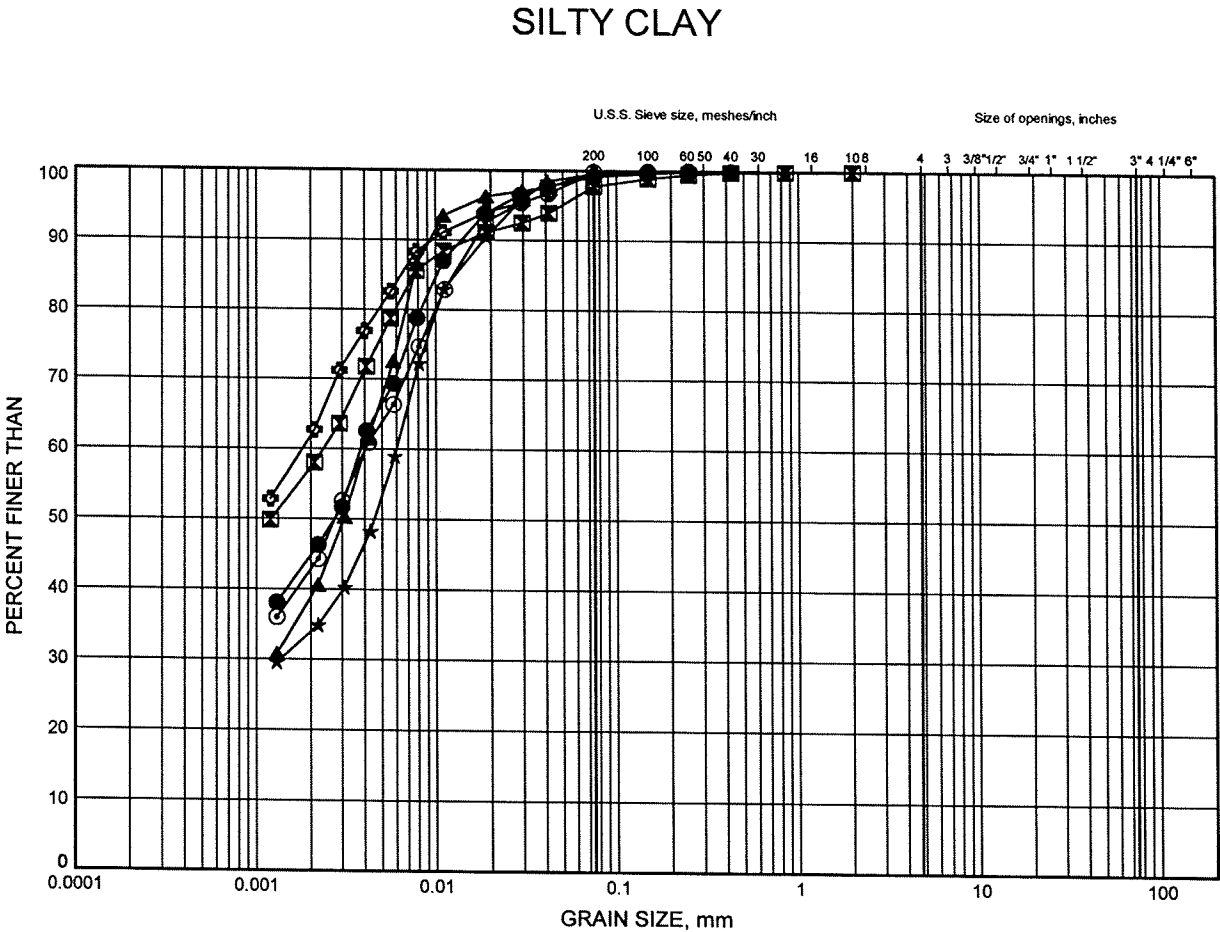
SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-11	5.79	251.21
⊠	08-11	8.23	248.77
▲	08-12	3.96	254.34
★	08-12	5.79	252.51
⊙	08-12	7.01	251.29
⊕	08-13	1.52	255.38



W.P.# 2109-05-00.....
Prepared By AN.....
Checked By TJH.....

Hwy 404 Extension
GRAIN SIZE DISTRIBUTION

FIGURE F9



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-13	3.35	253.55
⊠	08-13	5.18	251.72
▲	08-13	7.01	249.89
★	08-13	8.84	248.06
⊙	08-14	2.74	254.26
⊕	08-14	5.18	251.82

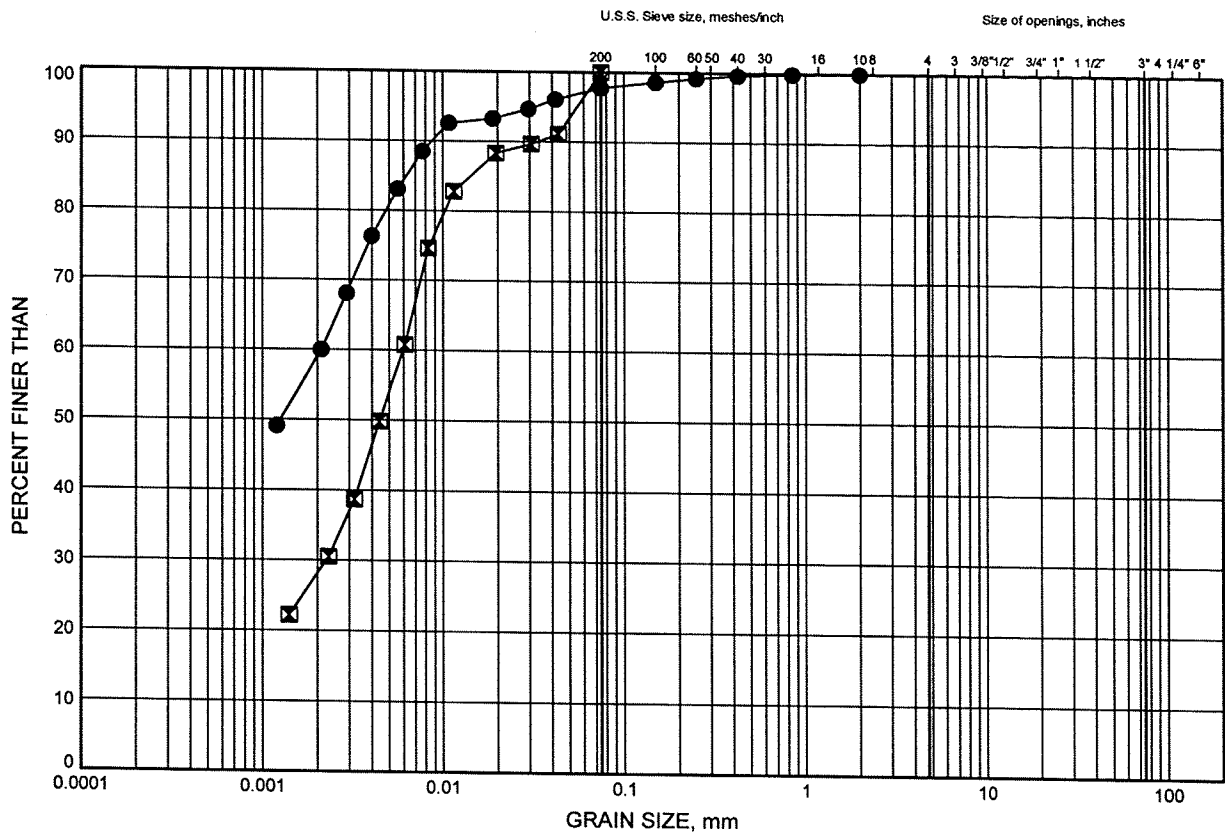


W.P.# 2109-05-00.....
 Prepared By AN.....
 Checked By T.JH.....

Hwy 404 Extension GRAIN SIZE DISTRIBUTION

FIGURE F10

SILTY CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-14	6.40	250.60
⊠	08-14	8.23	248.77

GRAIN SIZE DISTRIBUTION - THURBER 0596.GPJ 3/5/10

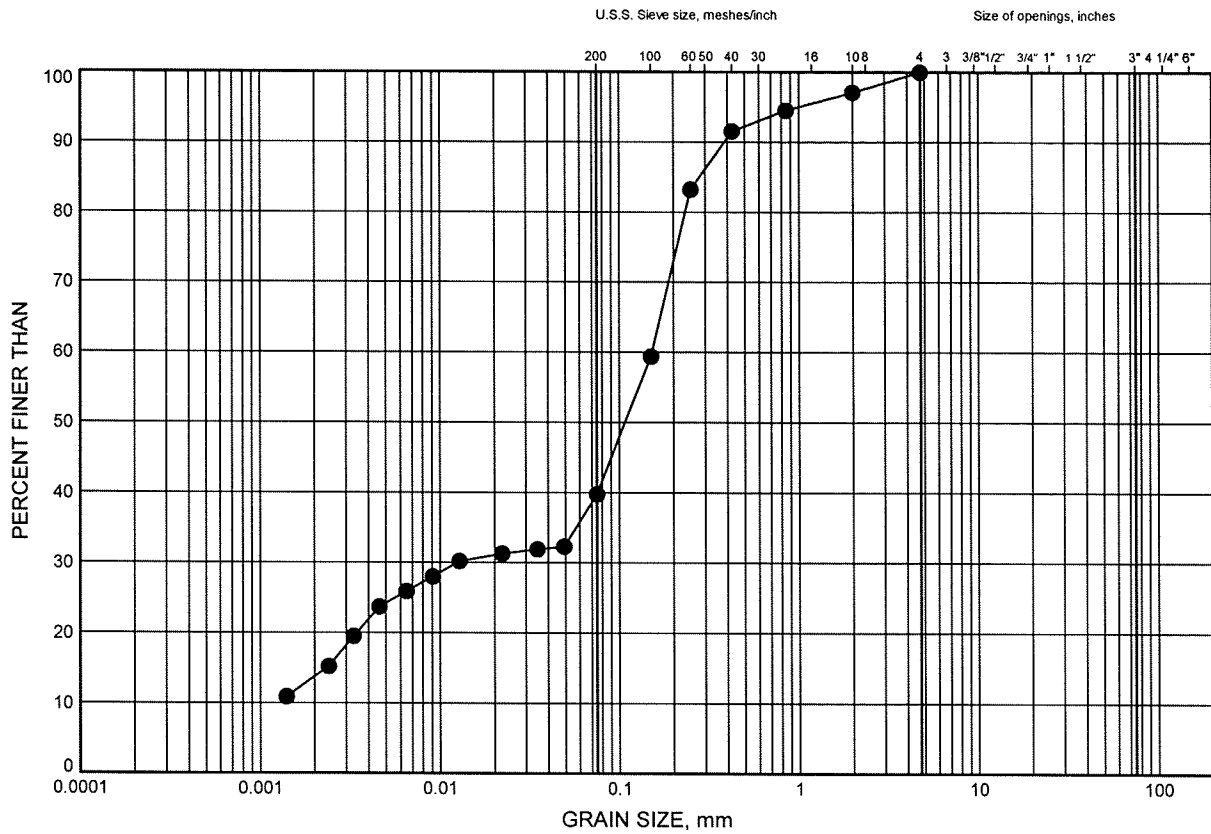
W.P.# 2109-05-00
Prepared By AN
Checked By TJH



Hwy 404 Extension GRAIN SIZE DISTRIBUTION

FIGURE F11

SILTY SAND



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-12	2.13	256.17

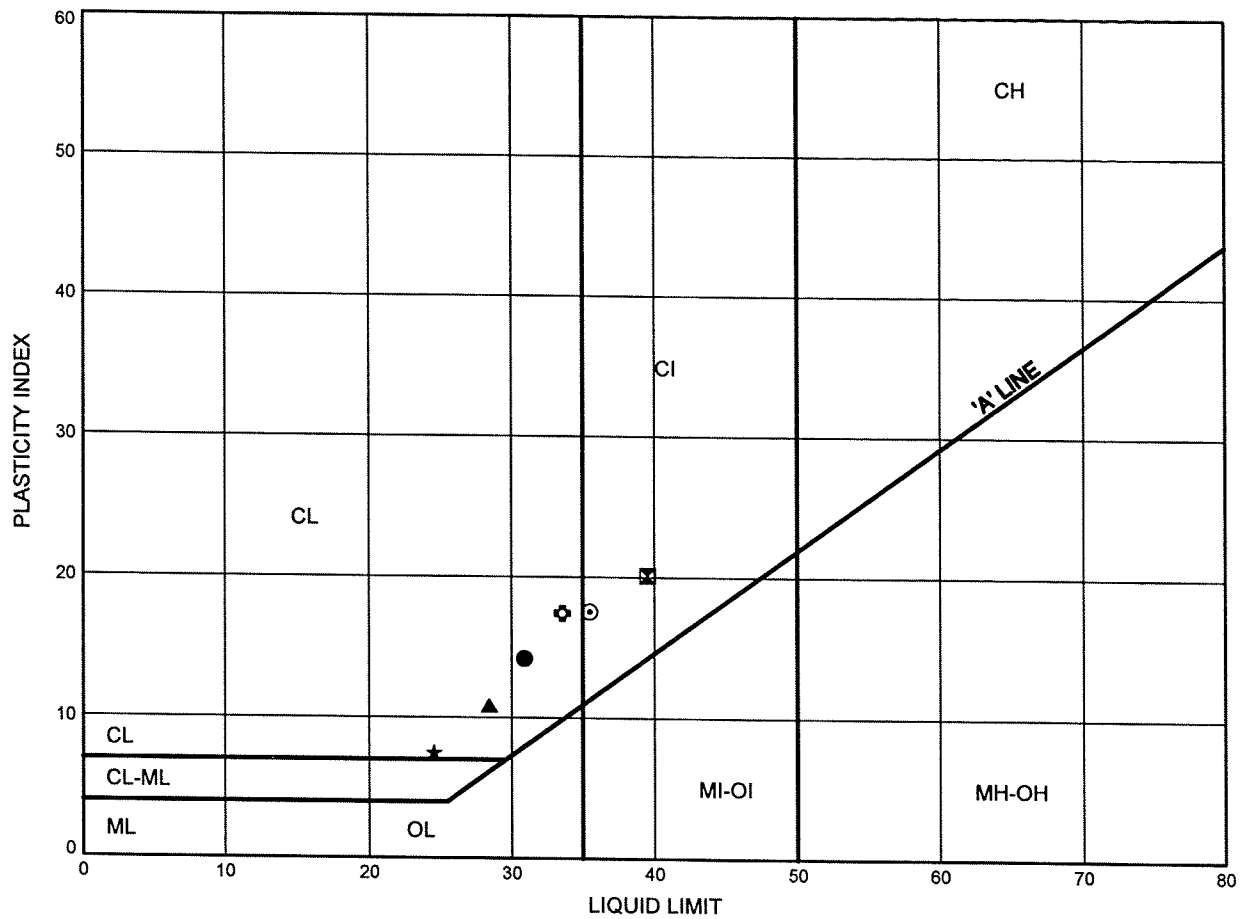


W.P.# 2109-05-00.....
Prepared By AN.....
Checked By TJH.....

Hwy 404 Extension ATTERBERG LIMITS TEST RESULTS

FIGURE F12

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	08-10	2.13	255.27
⊠	08-10	3.96	253.44
▲	08-10	5.79	251.61
★	08-10	7.62	249.78
⊙	08-11	2.74	254.26
⊕	08-11	3.96	253.04

Date March 2010
Project 2109-05-00

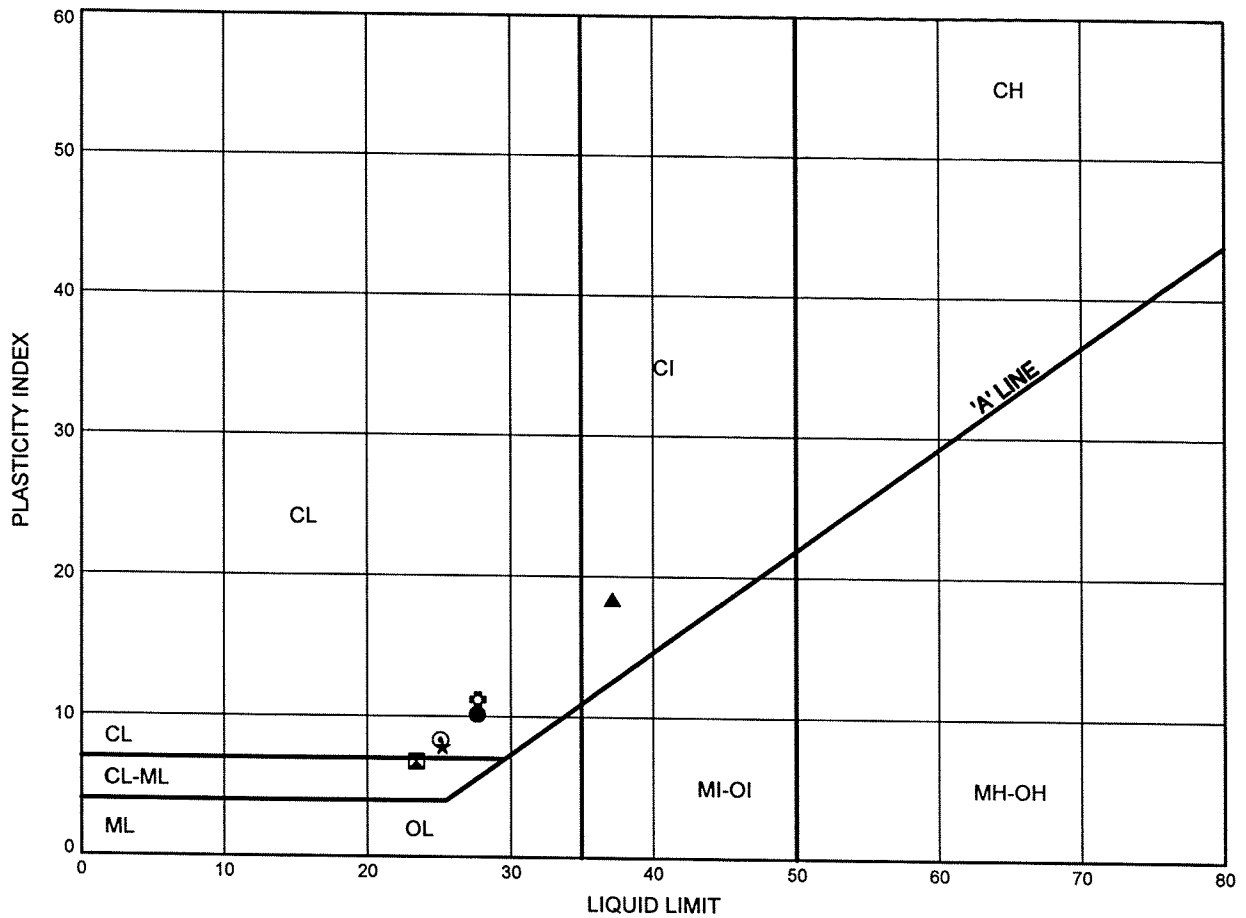


Prep'd AN
Chkd. TJH

Hwy 404 Extension ATTERBERG LIMITS TEST RESULTS

FIGURE F13

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	08-11	5.79	251.21
⊠	08-11	8.23	248.77
▲	08-12	3.96	254.34
★	08-12	5.79	252.51
⊙	08-12	7.01	251.29
⊕	08-13	1.52	255.38

Date March 2010
Project 2109-05-00

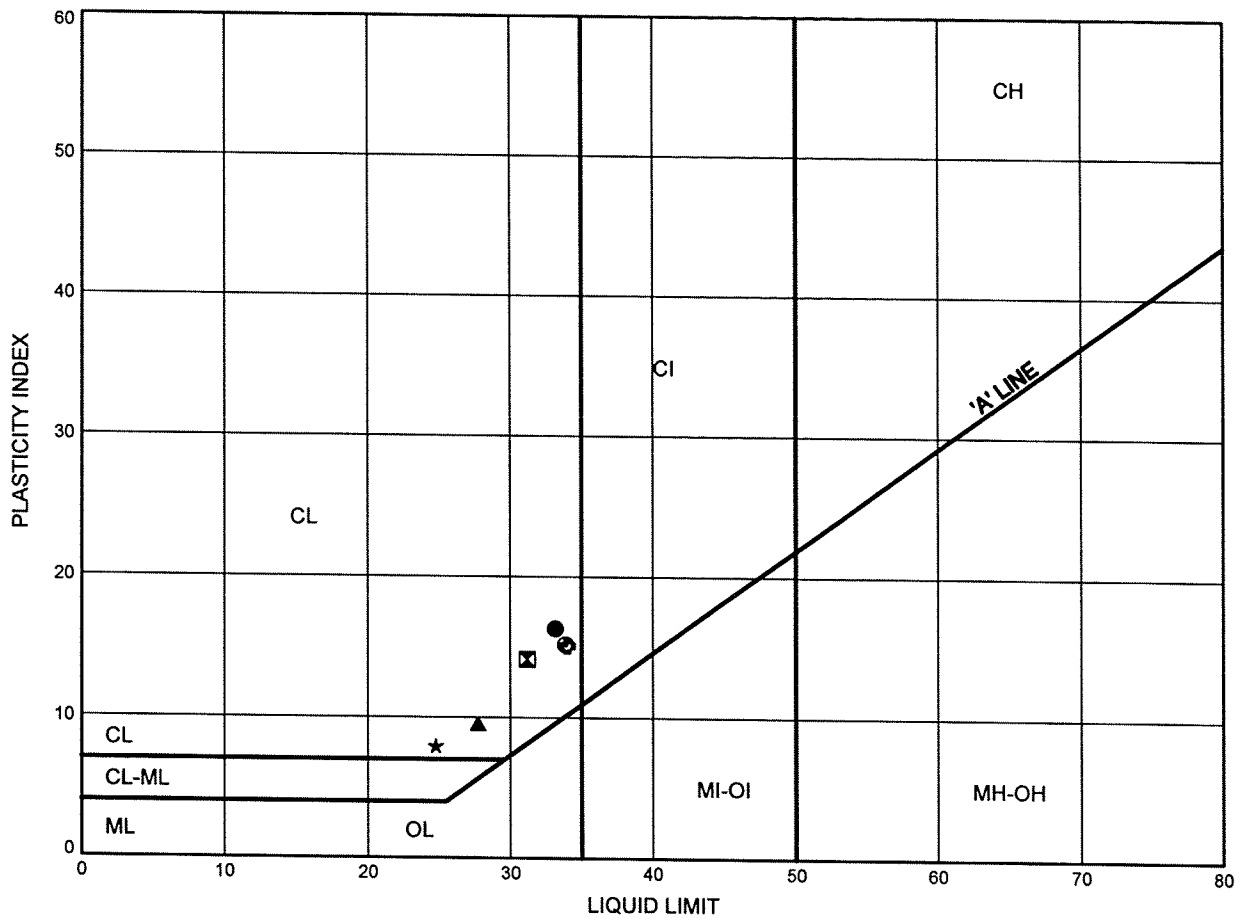


Prep'd AN
Chkd. TJH

Hwy 404 Extension ATTERBERG LIMITS TEST RESULTS

FIGURE F14

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	08-13	3.35	253.55
⊠	08-13	5.18	251.72
▲	08-13	7.01	249.89
★	08-13	8.84	248.06
⊙	08-14	2.74	254.26
⊕	08-14	5.18	251.82

Date March 2010
Project 2109-05-00

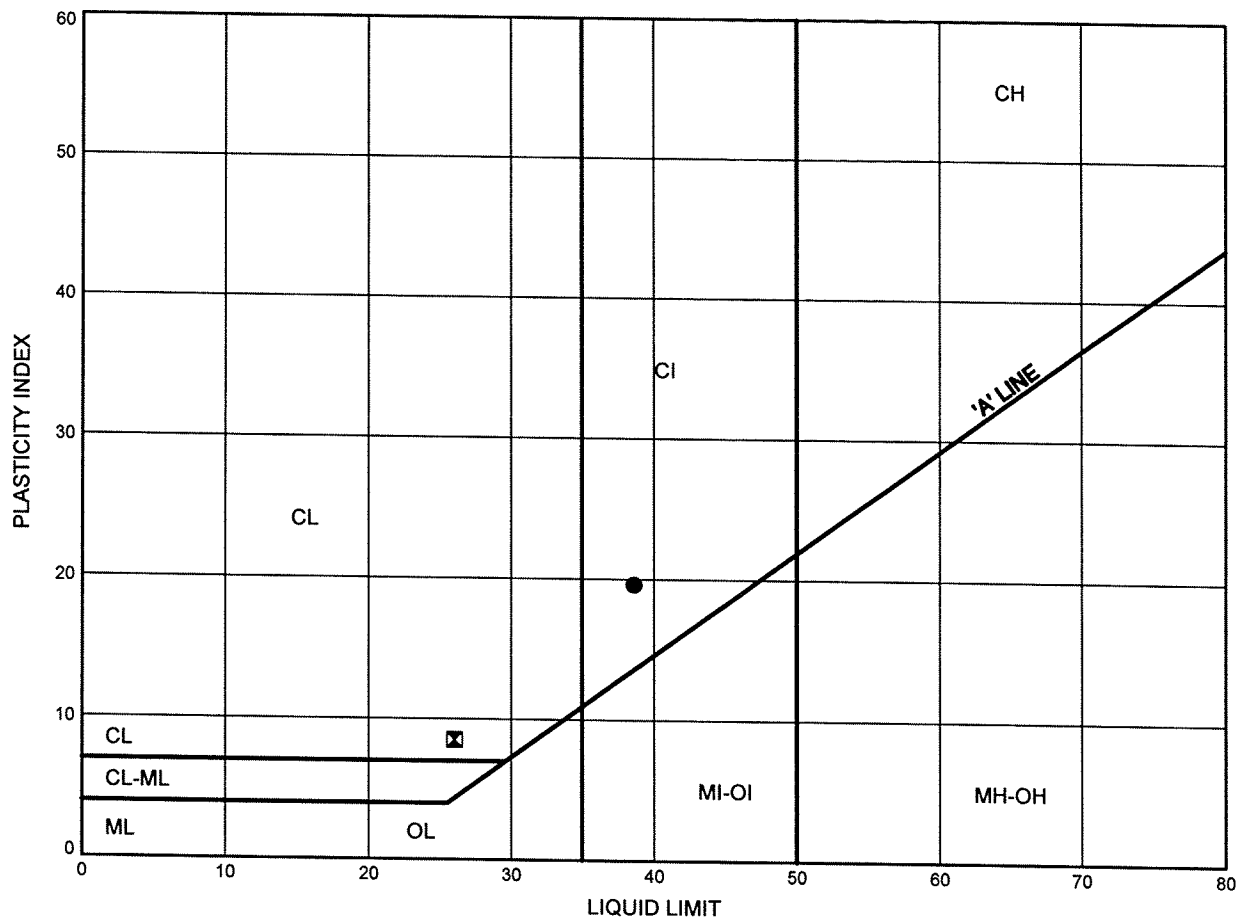


Prep'd AN
Chkd. TJH

Hwy 404 Extension ATTERBERG LIMITS TEST RESULTS

FIGURE F15

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	08-14	6.40	250.60
⊗	08-14	8.23	248.77

Appendix G

**Site Photographs
(south of Doane Road)**

Culverts 5 and 6

Boreholes 08-01 to 08-05 and 08-10 to 08-14

Culverts

Highway 404 Extension from Green Lane to Queensville Sideroad



Photograph 1 – Site location of Culvert 5



Photograph 2 – Site location of Culvert 5

Culverts
Highway 404 Extension from Green Lane to Queensville Sideroad



Photograph 3 – Site location of Culvert 6



Photograph 4 – Site location of Culvert 6

Culverts

Highway 404 Extension from Green Lane to Queensville Sideroad

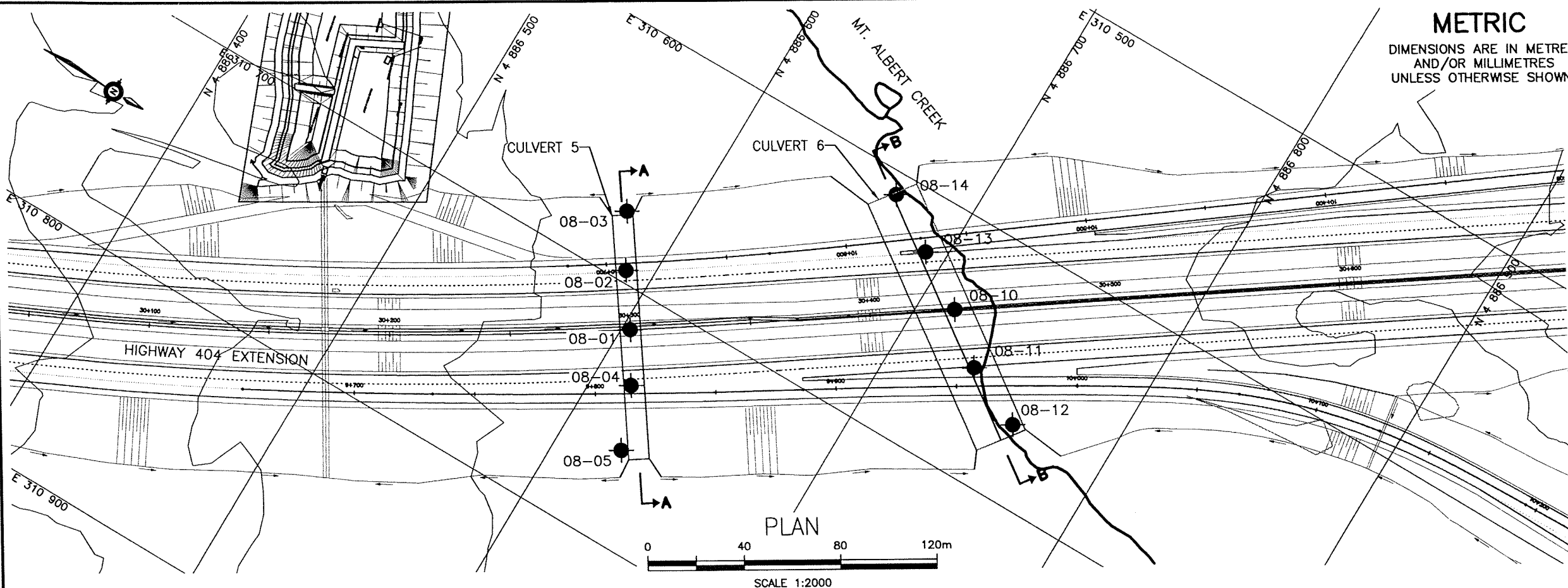
Appendix H

**Drawing titled “Borehole Locations and Soil Strata”
(south of Doane Road)**

Culverts 5 and 6

Boreholes 08-01 to 08-05 and 08-10 to 08-14

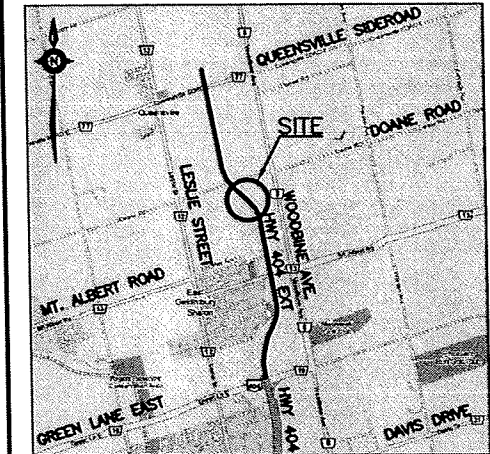
MINISTRY OF TRANSPORTATION, ONTARIO



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

CONT No GWP No 2109-05-00		
HIGHWAY 404 EXTENSION CULVERT AT STATION 30+300 SOUTH OF DOANE ROAD BOREHOLE LOCATIONS AND SOIL STRATA		
SHEET 455		

THURBER ENGINEERING LTD.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS



KEYPLAN

LEGEND

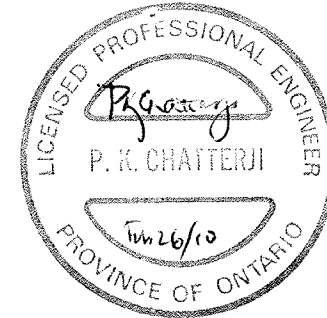
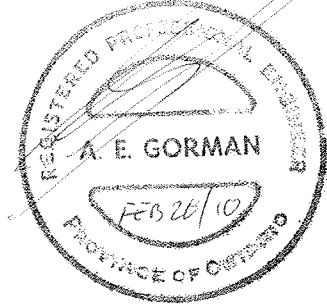
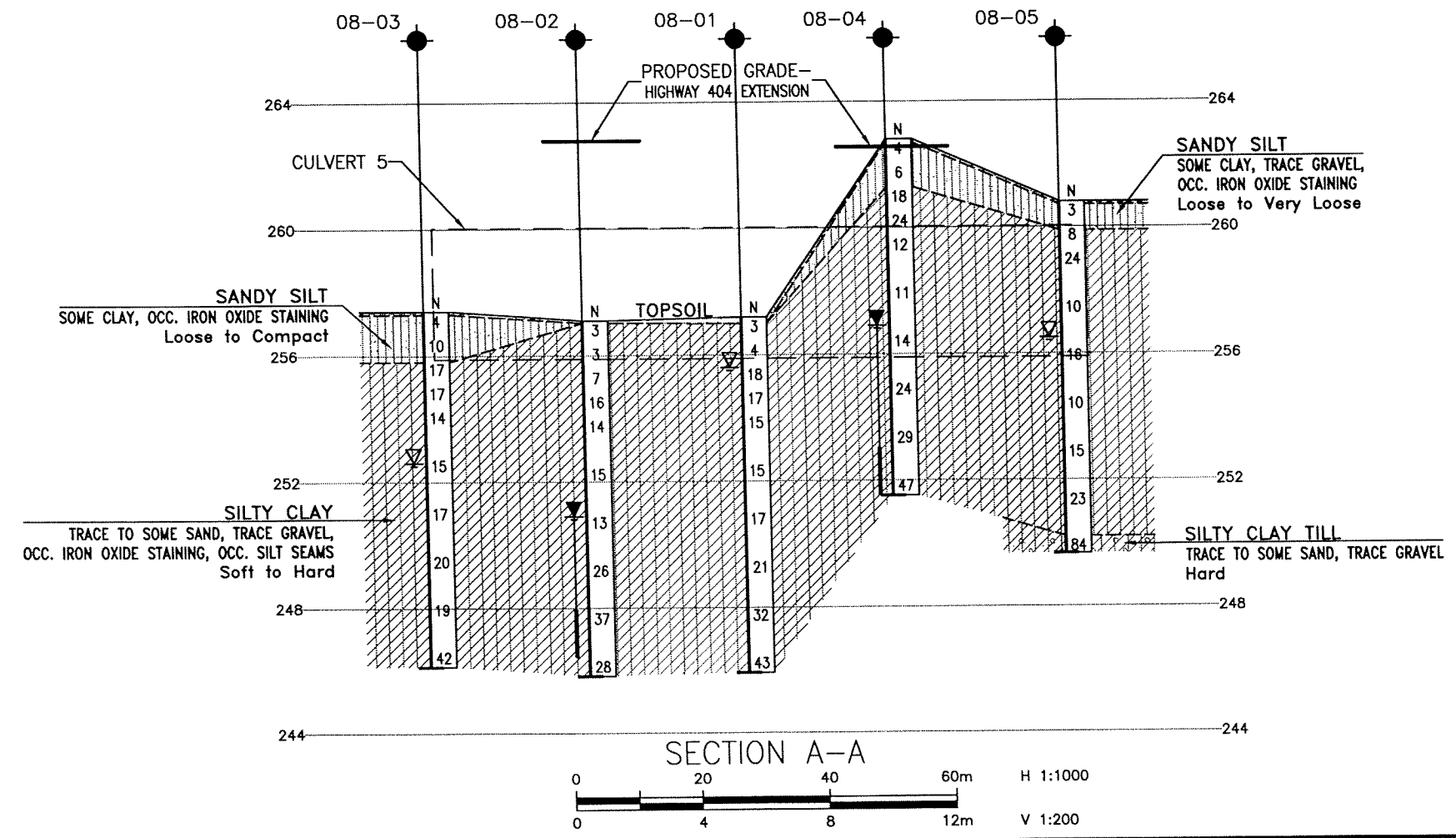
- ◆ Borehole
- ◆ Borehole and Cone
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60' Cone, 475J/blow)
- PH Pressure, Hydraulic
- W Water Level
- W Head Artesian Water
- P Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
08-01	257.2	4 886 603.3	310 715.6
08-02	257.1	4 886 589.2	310 694.9
08-03	257.4	4 886 576.9	310 673.1
08-04	262.8	4 886 615.4	310 735.7
08-05	260.8	4 886 625.7	310 761.4
08-10	257.4	4 886 714.2	310 638.6
08-11	257.0	4 886 733.4	310 655.6
08-12	258.3	4 886 759.2	310 668.1
08-13	256.9	4 886 691.6	310 623.8
08-14	257.0	4 886 669.1	310 609.1

-NOTES-

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

GEOCRES No. 31D-493



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	RPR	CHK	PKC
DRAWN	MFA	CHK	AEG

