

**FOUNDATION INVESTIGATION AND DESIGN REPORT
HIGH MAST LIGHTING POLES
OVERHEAD SIGN SUPPORTS
QEW WIDENING
THIRD LINE TO BURLOAK DRIVE
G.W.P. 169-00-00**

GEOCRES NO. 30M5-253

Submitted

To

McCormick Rankin Corporation

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PART 1 FACTUAL INFORMATION

1.0 INTRODUCTION

This report presents the factual data from a foundation investigation carried out by Thurber Engineering Ltd. (Thurber) for the detailed design of high mast lighting (HML) poles and overhead sign (OHS) supports along the alignment of the Queen Elizabeth Way (QEW), from Third Line to Burloak Drive in Oakville, Ontario. This work is part of the QEW widening from Third Line to Burloak Drive. Thurber has been retained by McCormick Rankin Corporation (MRC) to carry out this investigation under the Ministry of Transportation Ontario (MTO) Purchase Order No. 2005-A-000346.

The purpose of this investigation was to determine the subsurface conditions in the general vicinities of the proposed HML poles and OHS supports and, based on this and previously obtained data, to provide a borehole location drawing, records of boreholes, laboratory test results and a written description of the subsurface conditions.

In the preparation of this report and in addition to the boreholes drilled for the HML poles and OHS supports, general reference has been made to information on subsurface conditions contained in other foundation reports under G.W.P. 169-00-00. The titles of these reports are listed as follows:

- Thurber Engineering Ltd. report titled "Foundation Investigation and Design Report, QEW-WB Bronte Creek Bridge Rehabilitation", G.W.P. 169-00-00, Site 10-152/2, GEOCRE No. 30M5-252, File: 19-1351-27, prepared for McCormick Rankin Corporation, January 2007 (Reference 1).
- Thurber Engineering Ltd. report titled "Foundation Investigation and Design Report, Retaining Walls and Privacy Walls, QEW Widening, Third Line to Burloak Drive", G.W.P. 169-00-00, GEOCRE No. 30M5-251, File: 19-1351-27, prepared for McCormick Rankin Corporation, January 2007 (Reference 2).

- Thurber Engineering Ltd. report titled “Foundation Investigation and Design Report, Bronte Road Deep Cuts, QEW Widening, Third Line to Burloak Drive”, G.W.P. 169-00-00, GEOCREs No. 30M5-254, File: 19-1351-27, prepared for McCormick Rankin Corporation, January 2007 (Reference 3).
- Thurber Engineering Ltd. report titled “Foundation Investigation and Design Report, Culvert, SWM Ponds, Utility Crossings and Watermain Protection, QEW Widening, Third Line to Burloak Drive”, G.W.P. 169-00-00, GEOCREs No. 30M5-255, File: 19-1351-27, prepared for McCormick Rankin Corporation, January 2007 (Reference 4).
- Thurber Engineering Ltd. report titled “Foundation Investigation and Design Report, QEW Bronte Creek Twin Bridge, Oakville, Ontario”, G.W.P. 169-00-00, Site 10-150, GEOCREs No. 30M5-236, prepared for McCormick Rankin Corporation, October 2005 (Reference 5).

Records of boreholes from these reports relevant to the HML poles and OHS supports are attached in Appendix A for reference.

2.0 SITE DESCRIPTION

The project area appears to be located adjacent to the shoreline of the former glacial Lake Iroquois. From published geological information, this area is situated at the border between a physiographic region known as the Peel Plain to the north and Iroquois Plain to the south. In this area, the relatively thin native soil deposits typically consist of cohesive soils (some tills) overlying shale bedrock of the Queenston Formation. The till is known to contain shale and limestone fragments, with possible cobbles, boulders, limestone and siltstone interbeds. Glacial lake deposits in the form of stratified silts and sands are present at locations along the shoreline of the glacial lake.

The HML poles and OHS supports were to be located throughout the QEW alignment between Third Line and Burloak Drive. In general, the ground surface in the project area slopes downward from north to south. The existing grades along the QEW range between approximate Elevations 120 m and 123 m within the western portion, and between approximate Elevations 115m and 117 m within the eastern portion. Within the area near Bronte Road on the north side of the QEW, the terrain is largely flat with the ground surface varying between Elevations 121 m and 122 m, then sloping towards the QEW at approximate Elevation 117 m.

Drainage at the site appears to flow southerly towards Lake Ontario, and towards the Bronte Creek valley. This valley is situated immediately west of Bronte Road and incised approximately 28 m below the surrounding tableland. The valley slopes are steep and cut into shale bedrock. Bronte Creek flows southward to Lake Ontario.

3.0 INVESTIGATION PROCEDURES

3.1 Field Investigation

A borehole investigation program for the overall widening project was carried out in November 2006. A substantial number of these boreholes were relevant to the HML and OHS locations. This report focuses on the boreholes drilled and sampled for the HML poles and OHS supports as well as the other boreholes relevant to the HML poles and OHS supports in References 1 to 5, inclusive. The boreholes drilled for the HML poles and OHS supports that are not referenced elsewhere are listed as follows:

Table 3.1 Borehole Depths

Borehole	Drilling Date	Depth (m)
P1	November 14, 2006	6.2
P3	November 16, 2006	5.5
P6	November 20, 2006	6.1
P7	November 21, 2006	6.4
P13	November 13, 2006	6.4
P15	November 6, 2006	4.7
P21	November 23, 2006	5.9
OH1	November 29, 2006	2.5
OH2	November 29, 2006	1.6
OH3	November 21, 2006	6.7
OH5	November 14, 2006	1.7

The approximate locations of the above boreholes are shown on Drawings 19-1351-27-HML1 to -HML4. The investigation was carried out using track and truck mounted drill rigs supplied and operated by specialist drilling contractors.

In these boreholes, all soil and some weathered shale bedrock samples were obtained with a 50 mm outside diameter split spoon sampler driven in accordance with the Standard Penetration Test (SPT). Shale bedrock was cored using an NQ core barrel in conjunction with N size casings. Groundwater conditions in the open boreholes were observed throughout the drilling operations in Boreholes P1, P3, P6, P7, P13, P15, P21, OH1, OH2, OH3 and OH5. One standpipe

piezometer was installed in each of Boreholes P3, P7 and P15 to permit longer term groundwater level monitoring. The borehole completion details are shown in Table 3.2 below.

Table 3.2 – Borehole Completion Details

Borehole Location	Piezometer Tip Depth / Elevation (m)	Completion Details
P1	None Installed	Bentonite grout for full depth
P3	5.5 / 117.3	Sand from 3.2 to 5.5 m, bentonite grout to 0.7 m, drill cuttings then asphalt to surface
P6	None Installed	Bentonite grout for full depth
P7	6.4 / 109.1	Sand from 3.9 to 6.4 m, bentonite grout to 0.3 m, drill cuttings then asphalt to surface
P13	None Installed	Bentonite grout for full depth
P15	4.7 / 113.0	Sand from 2.7 to 4.7 m, bentonite grout to surface
P21	None Installed	Bentonite grout for full depth
OH1	None Installed	Drill cuttings then asphalt to surface
OH2	None Installed	Drill cuttings then asphalt to surface
OH3	None Installed	Drill cuttings then asphalt to surface
OH5	None Installed	Drill cuttings then asphalt to surface

The field work was supervised on a full-time basis by members of our field staff who located the boreholes in the field, cleared borehole locations of underground utilities, directed the drilling, sampling and in-situ testing operations, and logged the boreholes. The soil and rock samples were identified in the field, placed in appropriately labelled containers and core boxes, and transported back to Thurber's laboratory for further examination and testing.

Upon completion of drilling and piezometer installation, the shallower boreholes (less than 3 m depth) were backfilled with drill cuttings, and the deeper boreholes (greater than 3 m depth) were grouted with bentonite holeplug. All boreholes located on paved surfaces were capped with cold patch asphalt.

Results of field sampling and testing are presented on the Records of Boreholes in Appendix A.

3.2 Laboratory Testing

Geotechnical laboratory testing consisted of natural moisture content determination and visual identification of all soil and rock samples in accordance with the current MTO standards. Grain size distribution analysis and Atterberg Limits tests are conducted on selected samples. All rock

core samples were logged and subjected to Rock Quality Designation (RQD) and core recovery measurements. The laboratory test results are presented in Appendix B.

4.0 SUBSURFACE STRATIGRAPHY

4.1 General

This section presents a generalized summary of the subsurface conditions encountered at borehole locations relevant to the HML poles (Boreholes P1, P3, P6, P7, P13, P15 and P21) and OHS posts (Boreholes OH1, OH2, OH3 and OH5) that are not covered in References 1 to 5. The detailed subsurface soil and groundwater conditions encountered in all boreholes relevant to the HML and OHS, including those in References 1 to 5, are presented on the Records of Boreholes in Appendix A.

In general, the subsurface conditions encountered in the boreholes consist of a pavement structure (asphalt, crusher run limestone and occasional concrete) and some silty clay fill overlying native silty clay to silty clay till with occasional silty sand layers. The site is underlain by shale bedrock at shallow depths. The measured groundwater levels ranged typically between 2 m to 3.5 m depths below existing ground surface. The Borehole Locations drawings illustrate the approximate locations of all the boreholes relevant to the HML and OHS.

4.1.1 Pavement Structure and Topsoil

A pavement structure consisting of asphalt, crusher run limestone and occasional concrete was encountered in Boreholes P1, P3, P6, P7, P13, OH1, OH2, OH3 and OH5. The asphalt thickness ranges between 125 mm and 325 mm. A layer of concrete with thickness of 250 mm and 200 mm was encountered below the asphalt in Boreholes P6 and P7, respectively.

Crusher run limestone was encountered in the boreholes referenced in Table 3.1, except Borehole P15. The thickness of this granular material ranges from approximately 0.2 m to 0.7 m. The crusher run limestone is typically in a compact to dense state as indicated by most SPT 'N' values ranging between 17 blows to 52 blows per 0.3 m penetration. Figure B1 indicates the grain size distribution of two samples of crusher run limestone. The measured moisture contents were in the order of 3% to 15%.

In Borehole P15, a topsoil layer of 25 mm in thickness was encountered at ground surface directly overlying native soils. Topsoil is anticipated to exist elsewhere within the site and its thickness will vary between locations.

4.1.2 Fill

Boreholes P1, P6, P7, P21 and OH3 encountered a layer of brown silty clay fill immediately below the crusher run limestone. The thickness of this cohesive fill ranges from 0.5 m to 1.4 m in Boreholes P1, P6, P7 and P21, and measures up to 3 m in Borehole OH3. The fill has topsoil stains and inclusions, and contains trace sand and gravel. The fill in Borehole OH3 contains weathered shale fragments, and extends to elevations ranging from 110.6 m to 119.5 m.

SPT 'N' values of 12 to 22 per 0.3 m penetration indicate that this fill has a stiff to very stiff consistency. Measured moisture contents ranged between approximately 8% and 20%.

4.1.3 Silty Clay to Silty Clay Till

Deposits of native cohesive silty clay to silty clay till were encountered below topsoil, pavement or fill in all boreholes covered in this report except Borehole OH3. These cohesive deposits were encountered to variable depths ranging from 0.1 m to 2.5 m, or between Elevations 110.5 m and 121.2 m. The silty clay to silty clay till is typically brown to occasionally reddish brown in colour. Shale fragments were present within these soils at some locations.

Measured SPT 'N' values ranging between 23 blows and 37 blows per 0.3 m penetration indicate a very stiff to hard consistency. Occasional 'N' values greater than 50 blows for 0.3 m penetration may be attributed to the embedded shale slabs and fragments. Measured moisture contents of samples of these cohesive deposits ranged between approximately 10% and 20%.

Grain size distribution analyses were carried out on selected silty clay to silty clay till samples. The results of these analyses are presented in Figures B2 and B3. Atterberg limits tests were also conducted and the results plotted on plasticity charts shown on Figures B5 and B6. The tested samples had measured plasticity indices ranging between 7% and 19%, and corresponding liquid limits ranging between 22% and 38%, respectively. These values are indicative of a cohesive soil of low to intermediate plasticity (group symbol of CL to CI).

Although not encountered in the boreholes, glacial till inherently contains cobbles and boulders.

4.1.4 Silty Sand

A layer of silty sand was encountered below the silty clay fill in Borehole OH3. The top of the silty sand is at 4.0 m depth or Elevation 110.6 m. This deposit was not fully penetrated in this borehole. Measured SPT 'N' values of 4 and 6 blows indicate that this sand is in a loose state. Measured moisture contents of 20% and 25% were measured in the samples.

4.1.5 Shale Bedrock

The overburden soils are underlain by weathered shale bedrock except in Borehole OH3 where shale was not encountered. Where encountered, augering and SPT sampling was carried out within the upper portion of the weathered shale. Bedrock was proven by coring beyond the augered depth in Boreholes P1, P3, P6, P7, P13, P15 and P21.

The following table summarizes the depth to weathered shale encountered at the borehole locations.

Table 4.1 Depths and Elevations of Shale

Borehole Number	Depth to Weathered Shale (m)	Top of Weathered Shale Elevation (m)
P1*	1.8	119.0
P3*	1.7	121.2
P6*	2.2	113.6
P7*	2.5	112.9
P13*	1.5	115.6
P15*	0.1	117.7
P21*	1.9	110.5
OH1	1.7	119.8
OH2	1.1	119.4
OH3	-	Not Encountered
OH5	0.9	116.1

* Proved by coring below augered depth

The depth and elevation of shale bedrock in the other boreholes reported in References 1 to 5 which are relevant to the HML poles are listed below.

Table 4.2 Depths and Elevations of Shale

Borehole Number	Depth to Weathered Shale (m)	Top of Weathered Shale Elevation (m)
BC3	1.5	113.1
C2	Not encountered	Not encountered
EBT2*	2.4	110.4
EBT5	2.3	110.0
NSR2	3.8	112.7
P17*	1.5	107.8
SW2	3.6	118.0
SW3*	2.7	118.6
SWM1*	1.5	108.1
SWM3	1.1	107.8
UC3	1.1	117.4
UC4*	1.4	116.1
UC5	Not encountered	Not encountered
UC6	Not encountered	Not encountered
UC7	0.9	116.1
UC10	4.1	112.2
UC12*	2.7	110.7
WBT2	0.8	112.3
WBT4	1.1	112.3
WBT5	1.1	112.3
WBT7	1.2	112.5
02-2	1.9	112.5
02-4*	1.5	112.6
06-10*	1.8	114.3

* Proved by coring below augered depth

The shale encountered at this site is fine grained, thinly bedded and reddish brown in colour that is typical of the Queenston Formation. The shale is interbedded with hard, grey limestone with occasional siltstone and some clay seams. The shale is typically in a highly to moderately weathered state within the upper 1 m to 3 m. Below this zone, the degree of weathering decreases with depth, and the shale bedrock becomes harder. Hard limestone interbeds of thickness ranging from 50 to 500 mm were encountered at various depths within the shale.

Total Core Recovery (TCR) of the bedrock was generally between 90% and 100%, with occasional values in the order of 60% to 67%. The Rock Quality Designation (RQD) values ranged between 0% and 58% within the upper, highly to moderately weathered zone indicating

very poor to fair rock quality. Below this upper zone, the RQD values varied from 68% to 95% indicating a typically fair to excellent rock quality.

The Fracture Index (FI) of the rock, expressed as fractures per 0.3 m of core, generally ranged from 4 to 10 within the upper highly to moderately weathered zone. Below the upper zone, the FI decreases to a typical range of 1 to 5. Occasional rubble zones such as those encountered in Boreholes P7 and P15 were present. The discontinuities and bedding planes in the rock cores were largely horizontal with occasional clay seams and vertical joints.

Point load tests were carried out on selected rock cores. The Unconfined Compressive Strengths (UCS) of the shale cores, as inferred from the point load test results, typically range from less than 1 MPa to about 10 MPa. The strengths of the harder interbeds range between 25 MPa to occasionally greater than 100 kPa. Higher rock strengths are associated with the hard limestone or siltstone interbeds. It is also apparent that the overall strength of the rock mass increases with depth.

4.1.6 Groundwater Conditions

Groundwater conditions were observed during and upon completion of drilling. The boreholes were largely dry, or wet near the bottom, prior to coring. One piezometer was installed and sealed within the shale in each of Boreholes P3, P7 and P15. The depths, elevations and dates of water level readings taken in these piezometers are presented in the following table.

Borehole	Water Level Depth (m)	Water Level Elevation (m)	Date of Reading
P3	3.5	119.3	December 14, 2006
P7	3.2	112.2	December 14, 2006
P15	2.1	115.6	November 10, 2006
	2.3	115.4	December 8, 2006

The water level in the other boreholes reported in References 1 to 5 which are relevant to HML poles and OHS supports range from 2.3 to 6 m (Elevations 105.5 to 114.7 m)

It should be noted that these piezometric levels are based on short term observations and groundwater levels are subject to seasonal fluctuations. It is also anticipated that there is a regional flow in a southerly direction towards Lake Ontario and locally towards the Bronte Valley.

5.0 MISCELLANEOUS

The borehole locations were marked in the field by surveyors from J.D. Barnes Ltd. who also provided Thurber with the coordinates and geodetic elevations. Thurber obtained utility clearances prior to drilling.

DBW Drilling Limited of Ajax, Ontario supplied the drill rig and conducted the drilling, sampling and in-situ testing operations.

The drilling and sampling operations in the field were supervised on a full time basis by Messrs. Stephane Loranger and George Azzopardi of Thurber.

Laboratory testing was carried out by Thurber Engineering Ltd. in its MTO-approved Oakville laboratory.

Mr. Murray R. Anderson, P.Eng. and Mr. Mark E. Farrant, P.Eng. directed the field operations.

The report was prepared by Mr. Sydney Pang, P.Eng.

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



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PART 2 ENGINEERING DISCUSSION AND RECOMMENDATIONS

6.0 FOUNDATION EVALUATION AND RECOMMENDATIONS

6.1 General

This section of the report presents foundation recommendations for the design of the proposed HML poles. As per the MTO Foundation Engineering Terms of Reference, foundation design recommendations are not required for the OHS supports.

Information on the general layout of the proposed locations of the HML and the OHS was provided to Thurber by MRC. A total of twenty three (23) HML poles and seven (7) overhead signs are proposed to be erected along the QEW alignment. Based on the proposed design layout, Boreholes P-1, P-3, P-6, P-7, P-13, P-15 and P-21 (covered by this report) were drilled near some of the proposed HML locations. It was envisaged that these boreholes, in addition to other boreholes drilled for this project (References 1 to 5), would provide adequate subsurface information for detailed foundation design of the HML poles.

All relevant boreholes drilled in the vicinity of the 23 HML poles and 7 OHS supports are included in Appendix A. Table 1 following the text provides a listing of boreholes relevant to the design of each HML pole.

6.2 Foundation Design Parameters

For design of the HML pole foundations, reference should be made to the following documents.

- Ministry of Transportation, Ontario (2003) "Guidelines for the Design of High Mast Pole Foundations", Third Edition, BRO-006, Engineering Standards Branch, Bridge Office.
- Canadian Highway Bridge Design Code and Commentary (2000). CAN/CSA-S6-00 and S6.1-00.

It is understood that a typical HML pole is supported on a single conventional augered caisson (drilled shaft). Most of the caissons for the HML poles for this project will be embedded into shale bedrock. Table 1 following the text of this report presents the recommended foundation design parameters for the HML caisson foundations.

In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of a caisson within the upper 1.2 m below final grade should be neglected in the foundation design. It is recommended that all topsoil and organics be neglected in determining lateral resistance. It is noted that a downward sloping embankment in front of a caisson will result in reduced lateral passive resistance that should be taken into account during design.

Where an unconfined compressive strength, q_u , ($q_u = 2 \times C_u$, undrained shear strength) is provided for a cohesive soil (silty clay to silty clay till), the ultimate lateral passive resistance should be calculated in conjunction with the total soil unit weight. When designing for portions of the caissons below the groundwater level in cohesionless soils (sands, silts and weathered shale), the submerged soil unit weight, γ' , should be used. The required depth of the drilled shaft will be governed by lateral loads, including wind loads, acting on the pole. The length of the caisson should also be sufficient to counteract frost jacking (upward) forces.

An equivalent caisson width equal to 2 times the caisson diameter may be assumed for lateral resistance calculations. Appropriate load and resistance factors should be applied for caisson design.

6.3 Caisson Installation

Caisson installation should generally be carried out in accordance with SP 903S01.

The contract documents should contain an NSSP alerting the contract bidders of the specific aspects relating to caisson construction for HML pole foundations at this site. Suggested wordings for this NSSP are provided in Appendix C.

Caisson installation equipment must be able to dislodge, handle and remove cobbles, boulders, and to penetrate hard rock slabs, limestone or siltstone interbeds. The shale generally becomes harder with depth below the upper weathered zone. Cobbles, boulders and other obstructions may be present in the glacial till and fill.

Groundwater levels are at relatively shallow depth below existing ground surface. Soil sloughing and water seepage may also occur in unsupported holes. Temporary liners should be available to support the caisson sidewalls and provide seepage cut-off where required.

6.4 Construction Concerns

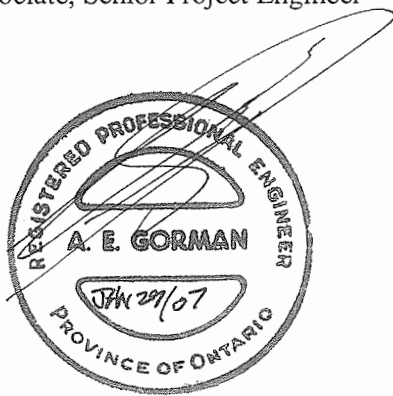
Concerns during caisson construction mainly involve the handling and removal of cobbles or boulders, penetrating hard zones of rock slabs and limestone interbeds, soil sloughing and water seepage from caisson sidewalls. Recommendations on how to address these issues have been outlined in the previous section.

6.5 Construction Inspection and Testing

Caisson construction should be monitored by qualified geotechnical personnel (as per SP 903S01) to verify the soil and rock conditions and to confirm that those conditions are consistent with the design assumptions in this report.



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TABLE 1
GEOTECHNICAL DESIGN PARAMETERS
HIGH MAST LIGHTING POLES
QEW BRONTE CREEK

HML Pole Number and Location	Reference Boreholes ²	Recommended Subsurface Stratigraphy For Design	Depth Below Existing Ground Surface (m)	Geotechnical Design Parameters					
				q_u (kPa)	ϕ' (deg.)	γ (kN/m ³)	γ' (kN/m ³)	K_p	Groundwater Depth (m)
FP1 QEW Station 10+230 o/s 0m	Borehole P1	Sand/Silty Clay (FILL) (dense/very stiff) SHALES (weathered) SHALES (sound)	0.0 – 1.8	-	30	20	10	3.0	3.0 (below existing ground surface)
			1.8 – 4.8	-	40	23	13	4.6	
			4.8 – 6.2	800	-	24	14	-	
P2 QEW Station 10+530 o/s 0m	Boreholes OH1 and P3	Sand (FILL) (compact) Silty Clay (very stiff/hard) SHALES (weathered) SHALES (sound)	0.0 – 0.7	-	30	20	10	3.0	3.0 (below existing ground surface)
			0.7 – 1.7	175	-	20	10	-	
			1.7 – 4.7	-	40	23	13	4.6	
			4.7 – 5.5	800	-	24	14	-	
P3 QEW Station 10+675 o/s 0m	Borehole P3	Sand (FILL) (compact) Silty Clay (very stiff/hard) SHALES (weathered) SHALES (sound)	0.0 – 0.7	-	30	20	10	3.0	3.0 (below existing ground surface)
			0.7 – 1.7	175	-	20	10	-	
			1.7 – 4.7	-	40	23	13	4.6	
			4.7 – 5.5	800	-	24	14	-	

Note : In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.2 m below final grade should be neglected in the foundation design.

P4 QEW Station 10+820 o/s 0m	Borehole OH2	Sand and Gravel (FILL) (dense) Silty Clay (hard) SHALE (weathered) SHALE (sound)	0.0 – 0.8 0.8 – 1.1 1.1 – 4.1 Below 4.1	- 200 - 800	30 - 40 -	20 20 23 24	10 10 13 14	3.0 - 4.6 -	3.0 (below existing ground surface)
P5 QEW Station 10+960 o/s 0m	Borehole UC4 and UC3	Asphalt/Concrete/Sand (FILL) Silty Clay (very stiff/hard) SHALE (weathered) SHALE (sound)	0.0 – 0.8 0.8 – 1.4 1.4 – 4.4 4.4 – 6.2	- 175 - 800	30 - 40 -	20 20 23 24	10 10 13 14	3.0 - 4.6 -	3.0 (below existing ground surface)
P6 QEW Station 11+100 o/s 0m	Borehole P6	Asphalt/Concrete/Sand (FILL) Silty Clay (stiff/hard) SHALE (weathered) SHALE (sound)	0.0 – 0.7 0.7 – 2.2 2.2 – 5.2 5.2 – 6.1	- 150 - 800	30 - 40 -	20 20 23 24	10 10 13 14	3.0 - 4.6 -	3.0 (below existing ground surface)
P7 QEW Station 11+235 o/s 0m	Borehole P7	Asphalt/Concrete/Sand/ Silty Clay (FILL) SHALE (weathered) SHALE (sound)	0.0 – 2.5 2.5 – 5.5 5.5 – 6.4	- - 800	30 40 -	20 23 24	10 13 14	3.0 4.6 -	3.0 (below existing ground surface)

Note : In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.2 m below final grade should be neglected in the foundation design.

P8 QEW Station 11+370 o/s 0m	Boreholes P7 and P9	Asphalt/Concrete (FILL) Silty Clay (TILL) (very stiff/hard) Sandy Silt (very dense) Silty Clay (hard)	0.0 – 0.6 0.6 – 2.1 2.1 – 7.5 7.5 – 9.2	- 175 - 200	30 - 32 -	20 20 21 21	10 10 11 11	3.0 - 3.3 -	4.0 (below existing ground surface)
P9 QEW Station 11+505 o/s 0m	Boreholes UC6 and UC5	Asphalt/Concrete (FILL) Silty Clay (TILL) (very stiff/hard) Sandy Silt (very dense) Silty Clay (hard)	0.0 – 0.6 0.6 – 2.1 2.1 – 7.5 7.5 – 9.2	- 175 - 200	30 - 32 -	20 20 21 21	10 10 11 11	3.0 - 3.3 -	4.0 (below existing ground surface)
P10 QEW Station 11+642 o/s 0m	Boreholes C2 and OH3	Asphalt/Sand (FILL) (compact) Silty Clay (FILL) (firm/stiff) Sand to Silty Sand (loose)	0.0 – 0.8 0.8 – 4.0 4.0 – 6.7	- - -	30 30 30	20 20 20	10 10 10	3.0 3.0 3.0	4.0 (below existing ground surface)
P11 QEW Station 11+775 o/s 0m	Boreholes BC3, 02-2 and 02-4	Silty Clay (firm/stiff) SHALE (weathered) SHALE (sound)	0.0 – 1.9 1.9 – 4.9 4.9 – 6.4	75 - 800	- 40 -	19 23 24	9 13 14	- 4.6 -	4.0 (below existing ground surface)
P12 QEW Station 12+075 o/s 0m	Boreholes UC7 and 06-10	Clayey Silt/Silty Clay (stiff) SHALE (weathered) SHALE (sound)	0.0 – 1.8 1.8 – 4.8 4.8 – 5.6	100 - 800	- 40 -	20 23 24	10 13 14	- 4.6 -	4.0 (below existing ground surface)

Note : In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.2 m below final grade should be neglected in the foundation design.

P13 QEW Station 12+210 o/s 0m	Borehole P13	Sand and Gravel (FILL) (compact) Silty Clay (very stiff) SHALE (weathered) SHALE (sound)	0.0 – 0.8 0.8 – 1.5 1.5 – 4.5 4.5 – 6.4	- 175 - 800	30	20	10	3.0	3.0 - 4.6 -
P14 RAMP S-W Station 9+693 o/s 20m Rt	Boreholes SW2 and SW3	Sand and Gravel (FILL) (compact) Sand (compact) Silty Clay/Clayey Silt (very stiff/hard) SHALE (weathered) SHALE (sound)	0.0 – 0.8 0.8 – 1.5 1.5 – 3.2 3.2 – 6.2 Below 6.2	- - 175 - 800	30 30 - 40 -	20 20 20 23 24	10 10 10 13 14	3.0 3.0 - 4.6 -	1.0 - - - -
P15 QEW Station 12+367 o/s 47m Lt	Borehole P15	SHALE (weathered) SHALE (sound)	0.0 – 3.0 3.0 – 4.7	- 800	40 -	23 24	13 14	4.6 -	2.0 - -
P16 RAMP W-N/S Station 10+475 o/s 22.5m Rt	Boreholes SWM1 and SWM3	Sand and Gravel (FILL) (compact) Silty Clay (very stiff/hard) SHALE (weathered) SHALE (sound)	0.0 – 0.6 0.6 – 1.5 1.5 – 4.5 4.5 – 6.2	- 175 - 800	30 - 40 -	20 20 23 24	10 10 13 14	3.0 - 4.6 -	3.0 - - -

Note : In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.2 m below final grade should be neglected in the foundation design.

P17 RAMP W-N/S Station 10+340 o/s 17.0m Rt	Borehole P17	Silty Clay/Clayey Silt (stiff/hard) SHALES (weathered) SHALES (sound)	0.0 – 2.3 2.3 – 5.3 5.3 – 6.1	175 - 800	- 40 -	20 23 24	10 13 14	- 4.6 -	3.0 (below existing ground surface)
P18 QEW Station 12+295 o/s 42.5m ORt	Borehole UC10	Sand (FILL) (compact) Silty Clay (very stiff/stiff) SHALES (weathered) SHALES (sound)	0.0 – 0.7 0.7 – 4.1 4.1 – 7.1 Below 7.1	- 100 - 800	30 - 40 -	20 20 23 24	10 10 13 14	3.0 - 4.6 -	2.0 (below existing ground surface)
P19 QEW Station 12+445 o/s 0m	Borehole EBT2	Sand and Gravel (FILL) (compact) Clayey Silt/Silty Clay (very stiff/firm) SHALES (weathered) SHALES (sound)	0.0 – 0.6 0.6 – 2.4 2.4 – 5.4 5.4 – 6.2	- 75 - 800	30 - 40 -	20 20 23 24	10 10 13 14	3.0 - 4.6 -	3.0 (below existing ground surface)
P20 QEW Station 12+565 o/s 0m	Boreholes EBT5 and NSR2	Sand and Gravel (FILL) (compact) Silty Clay (firm/stiff) SHALES (weathered) SHALES (sound)	0.0 – 0.6 0.6 – 3.0 3.0 – 6.0 Below 6.0	- 50 - 800	30 - 40 -	20 20 23 24	10 10 13 14	3.0 - 4.6 -	3.0 (below existing ground surface)

Note : In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.2 m below final grade should be neglected in the foundation design.

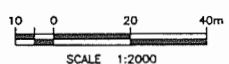
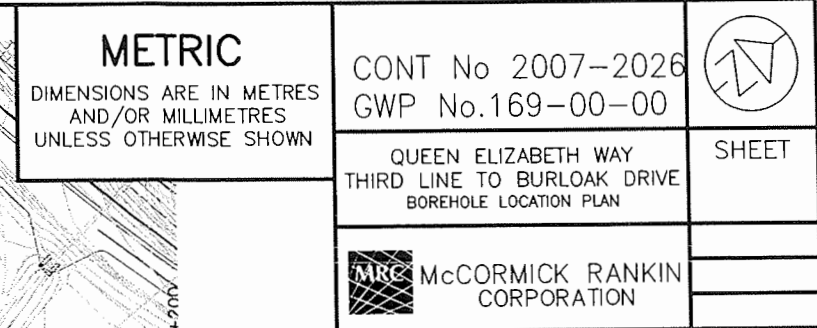
P21 QEW Station 12+695 o/s 0m	Boreholes P21 and WBT2	Sand and Gravel (FILL) (compact) Silty Clay (very stiff) SHALES (weathered) SHALES (sound)	0.0 – 0.8 0.8 – 1.9 1.9 – 4.9 4.9 – 5.9	- 150 - 800	30 - 40 -	20 20 23 24	10 10 13 14	3.0 - 4.6 -	3.0 (below existing ground surface)
P22 QEW Station 12+820 o/s 0m	Boreholes WBT4 and WBT5	Sand and Gravel (FILL) (compact/dense) Silty Clay (very stiff) SHALES (weathered) SHALES (sound)	0.0 – 0.6 0.6 – 1.1 1.1 – 4.1 Below 4.1	- 150 - 800	30 - 40 -	20 20 23 24	10 10 13 14	3.0 - 4.6 -	3.0 (below existing ground surface)
P23 QEW Station 12+945 o/s 0m	Boreholes UC12 and UC11	Sand (FILL) (dense) Silty Clay (very stiff) SHALES (weathered) SHALES (sound)	0.0 – 0.8 0.8 – 2.7 2.7 – 5.3 5.3 – 6.2	- 150 - 800	30 - 40 -	20 20 23 24	10 10 13 14	3.0 - 4.6 -	3.0 (below existing ground surface)
All Locations	-	New Fill - SSM (see Note 3)	Variable height above original ground	-	30	20	-	3.0	Below base of new fill

Notes:

1. This table must be read in conjunction with the text of this report.
2. Refer to Records of Boreholes for details.
3. It is possible that new fill may be placed as part of the QEW reconstruction. It is therefore anticipated that some caissons may be partially embedded within the new fill.

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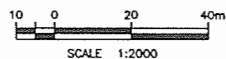
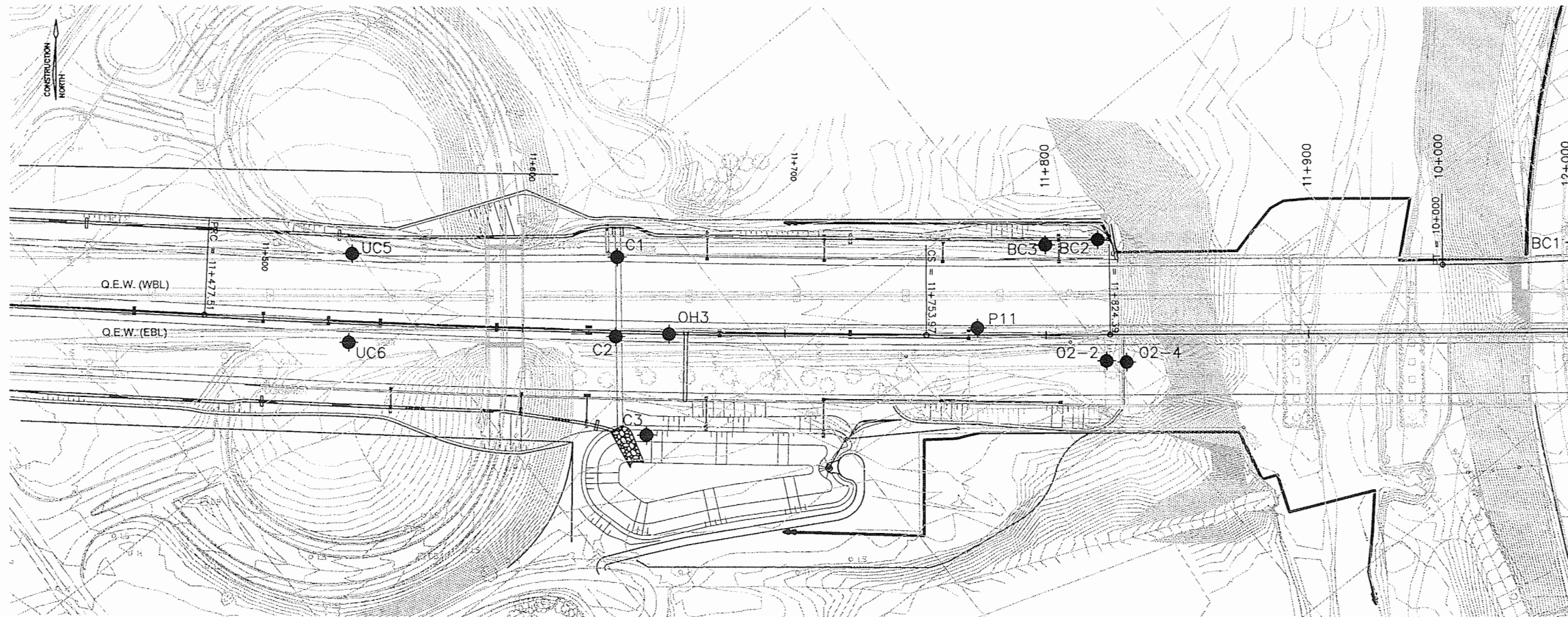
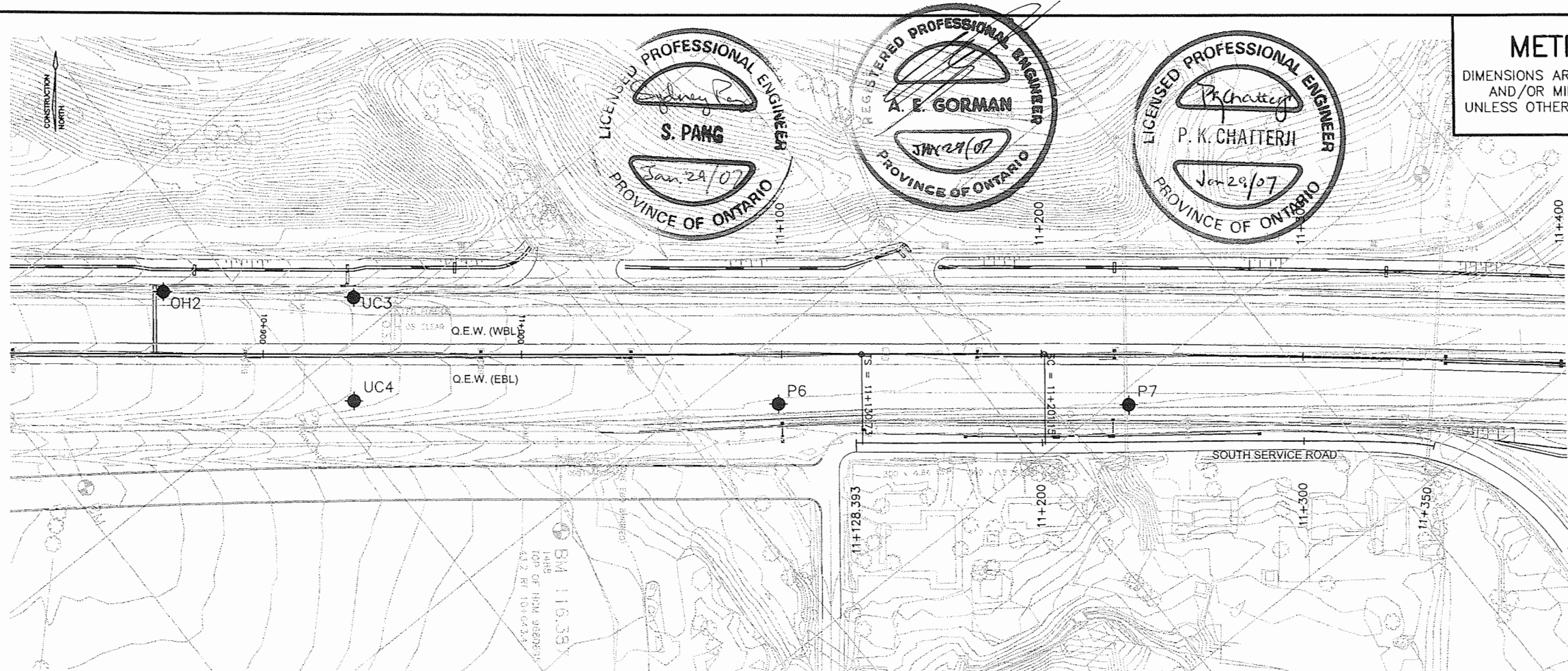
Note : In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.2 m below final grade should be neglected in the foundation design.



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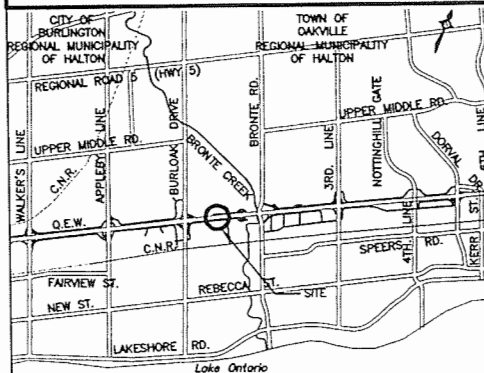
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GWP No.169-00-00

QUEEN ELIZABETH WAY
THIRD LINE TO BURLOAK DRIVE
BOREHOLE LOCATION PLAN

MRC MCCORMICK RANKIN
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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
- W Water Level
- HA Head Artesian Water
- P Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

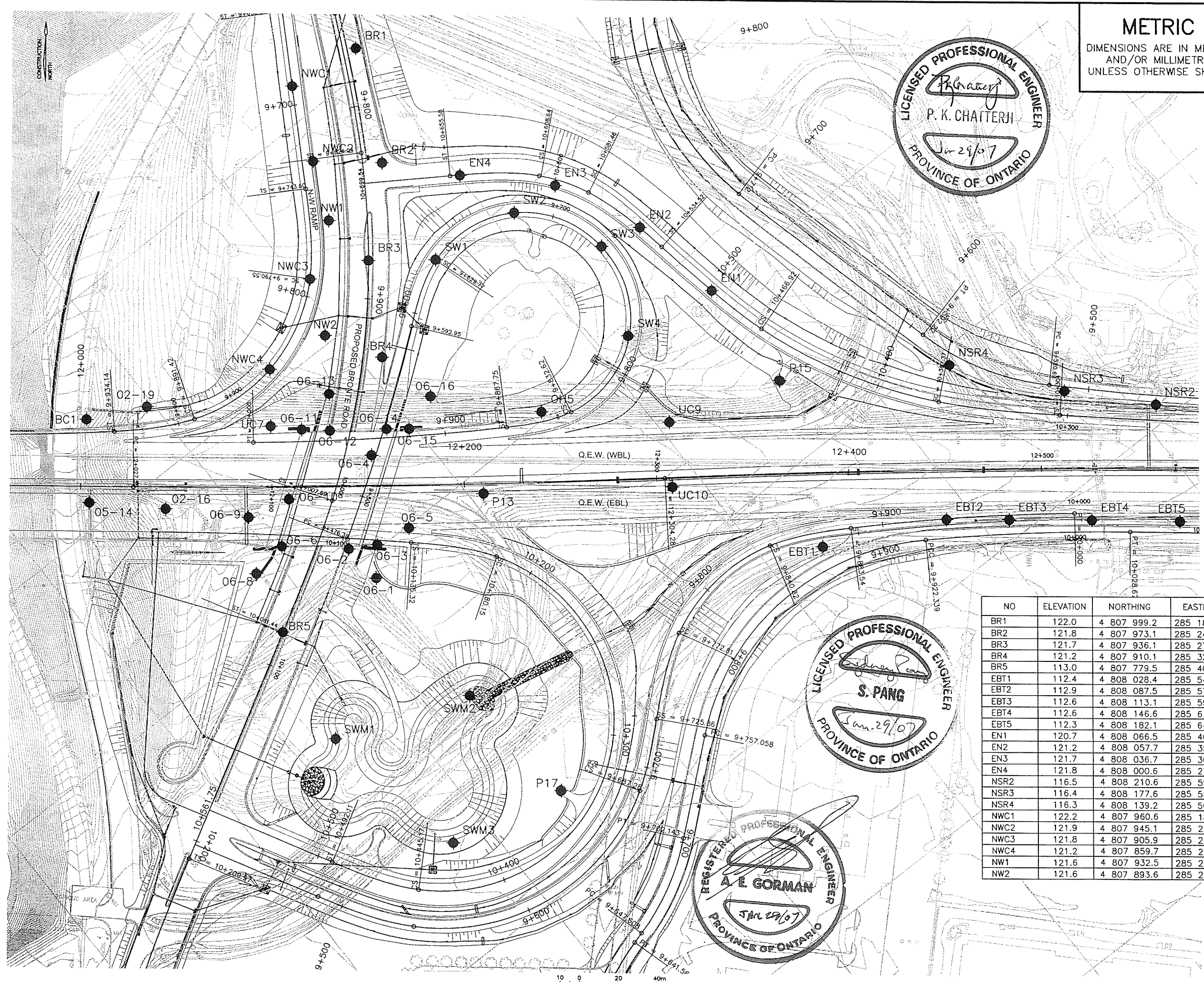
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BC2	115.4	4 807 625.7	285 138.0
BC3	114.6	4 807 608.7	285 127.1
C1	113.9	4 807 477.5	285 028.6
C2	114.4	4 807 457.7	285 052.3
C3	117.0	4 807 443.0	285 089.1
OH2	120.6	4 806 876.8	284 539.9
OH3	114.5	4 807 474.2	285 064.2
P6	115.9	4 807 035.9	284 721.0
P7	115.4	4 807 141.0	284 805.2
P11	114.9	4 807 567.9	285 135.8
UC3	118.5	4 806 933.3	284 587.2
UC4	118.8	4 806 908.4	284 618.4
UC5	114.9	4 807 398.6	284 964.4
UC6	114.8	4 807 376.0	284 990.4
02-2	114.4	4 807 598.6	284 176.7
02-4	114.4	4 807 604.3	285 181.9

-NOTE-

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS		DATE		BY	DESCRIPTION	DATE
JAN 07	SKP			FINAL		
DESIGN	SKP	CHK	PKC	CODE	LOAD	DATE JAN 2007
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PH-D-757 06-00
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CREATED: DEC 08
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P. K. CHATTERJI
Jan 29/07
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LICENSED PROFESSIONAL ENGINEER
S. PANG
Jan 29/07
PROVINCE OF ONTARIO

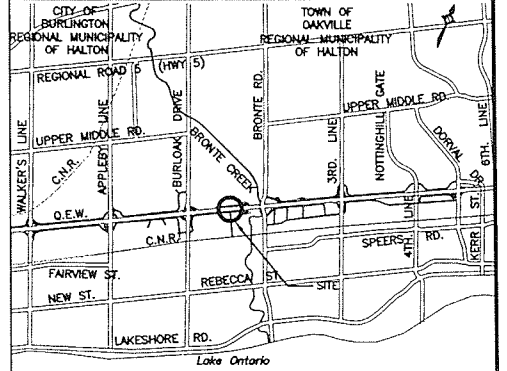
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GWP No.169-00-00
QUEEN ELIZABETH WAY
THIRD LINE TO BURLOAK DRIVE
BOREHOLE LOCATION PLAN
SHEET

MCCORMICK RANKIN CORPORATION

THURBER ENGINEERING LTD.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS



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
BR1	122.0	4 807 999.2	285 188.8
BR2	121.8	4 807 973.1	285 243.7
BR3	121.7	4 807 936.1	285 279.1
BR4	121.2	4 807 910.1	285 323.1
BR5	113.0	4 807 779.5	285 403.3
EBT1	112.4	4 808 028.4	285 541.6
EBT2	112.9	4 808 087.5	285 570.0
EBT3	112.6	4 808 113.1	285 590.4
EBT4	112.6	4 808 146.6	285 617.1
EBT5	112.3	4 808 182.1	285 646.1
EN1	120.7	4 808 066.5	285 401.0
EN2	121.2	4 808 057.7	285 352.0
EN3	121.7	4 808 036.7	285 308.3
EN4	121.8	4 808 000.6	285 273.4
NSR2	116.5	4 808 210.6	285 590.7
NSR3	116.4	4 808 177.6	285 555.6
NSR4	116.3	4 808 139.2	285 507.9
NWC1	122.2	4 807 960.6	285 183.6
NWC2	121.9	4 807 945.1	285 220.8
NWC3	121.8	4 807 905.9	285 267.8
NWC4	121.2	4 807 859.7	285 291.8
NW1	121.6	4 807 932.5	285 249.9
NW2	121.6	4 807 893.6	285 295.8

NO	ELEVATION	NORTHING	EASTING
OH5	117.0	4 807 957.4	285 396.5
P13	117.1	4 807 906.7	285 411.0
P15	117.7	4 808 065.2	285 460.2
P17	109.3	4 807 841.9	285 557.7
SWM1	109.7	4 807 766.4	285 464.3
SWM2	109.7	4 807 835.1	285 489.2
SWM3	108.9	4 807 780.5	285 544.1
SW1	121.5	4 807 963.5	285 300.0
SW2	121.5	4 808 011.0	285 306.0
SW3	121.3	4 808 036.1	285 347.9
SW4	120.6	4 808 017.5	285 392.9
UC7	117.0	4 807 841.5	285 315.4
UC9	116.0	4 808 006.0	285 441.4
UC10	116.3	4 807 986.2	285 468.8
02-16	116.5	4 807 771.4	285 267.6
02-19	116.0	4 807 796.9	285 267.6
05-14	107.4	4 807 741.9	285 288.1
06-2	113.4	4 807 833.96	285 390.64
06-4	117.3	4 807 873.68	285 359.85
06-9	116.0	4 807 802.7	285 345.3
06-10	116.1	4 807 820.4	285 351.1
06-14	116.8	4 807 888.38	285 353.96

-NOTE-
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

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DRAWN	MFA	CHK	PKC
CODE			
SITE			
LOAD			
STRUCT			
DWG	HML	3	

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METRIC

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GWP No.169-00-00

QUEEN ELIZABETH WAY
THIRD LINE TO BURLOAK DRIVE
BOREHOLE LOCATION PLAN

MCCORMICK RANKIN
CORPORATION

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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
NSR1	114.4	4 808 251.5	285 627.4
P21	112.4	4 808 279.3	285 722.8
UC12	113.1	4 808 467.2	285 862.6
WBC1	114.8	4 808 566.0	285 889.5
WBC2	115.4	4 808 592.0	285 914.6
WBC3	114.5	4 808 623.3	285 939.5
WBT1	113.4	4 808 282.6	285 653.1
WBT2	113.1	4 808 316.7	285 682.6
WBT3	113.1	4 808 359.6	285 716.9
WBT4	113.4	4 808 386.3	285 738.2
WBT5	113.3	4 808 422.1	285 766.8
WBT6	113.6	4 808 457.3	285 794.9
WBT7	113.7	4 808 489.4	285 825.2

-NOTE-
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LICENSED PROFESSIONAL ENGINEER
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LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
Jan 24/07
PROVINCE OF ONTARIO

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REVISIONS		DATE		BY		DESCRIPTION	
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Appendix A

Records of Boreholes

19-1351-27



SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

1. TEXTURAL CLASSIFICATION OF SOILS

CLASSIFICATION	PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	Greater than 200mm	same
Cobbles	75 to 200mm	same
Gravel	4.75 to 75mm	5 to 75mm
Sand	0.075 to 4.75mm	Not visible particles to 5mm
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to the naked eye
Clay	Less than 0.002mm	Plastic particles, not visible to the naked eye

2. COARSE GRAIN SOIL DESCRIPTION (50% greater than 0.075mm)

TERMINOLOGY	PROPORTION
Trace or Occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)	APPROXIMATE SPT ⁽¹⁾ 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction

- 1) Laboratory Triaxial Testing
- 2) Field Insitu Vane Testing
- 3) Laboratory Vane Testing
- 4) SPT value
- 5) Pocket Penetrometer

4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	SPT 'N' VALUE
Very Loose	Less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

5. LEGEND FOR RECORDS OF BOREHOLES

SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE	SS Split Spoon Sample	WS Wash Sample	AS Auger (Grab) Sample
	TW Thin Wall Shelby Tube Sample	TP Thin Wall Piston Sample	
	PH Sampler Advanced by Hydraulic Pressure	PM Sampler Advanced by Manual Pressure	
	WH Sampler Advanced by Self Static Weight	RC Rock Core	SC Soil Core

$$\text{Sensitivity} = \frac{\text{Undisturbed Shear Strength}}{\text{Remoulded Shear Strength}}$$



Water Level

C_{pen}


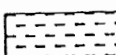



Shear Strength Determination by Pocket Penetrometer

- (1) SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.
- (2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

UNIFIED SOILS CLASSIFICATION

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

EXPLANATION OF ROCK LOGGING TERMS

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

DISCONTINUITY SPACING		STRENGTH CLASSIFICATION			
Bedding	Bedding Plane Spacing	Rock Strength	Approximate Uniaxial Compressive Strength		Field Estimation of Hardness*
			(MPa)	(psi)	
Very thickly bedded	Greater than 2m	Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Thickly bedded	0.6 to 2m				
Medium bedded	0.2 to 0.6m	Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Thinly bedded	60mm to 0.2m				
Very thinly bedded	20 to 60mm	Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Laminated	6 to 20mm				
Thinly Laminated	Less than 6mm	Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.

TERMS					
Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length.	Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
Solid Core Recovery: (SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run.	Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
Rock Quality Designation: (RQD)	Total length of sound core recovered in pieces 0.1m in length or larger as a percentage of total core run length.	Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail
Uniaxial Compressive Strength (UCS)	Axial stress required to break the specimen				
Fracture Index: (FI)	Frequency of natural fractures per 0.3m of core run.				



RECORD OF BOREHOLE No P1

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 806 455.45 E 284 275.07 ORIGINATED BY SLL
 HWY QEW BOREHOLE TYPE Solid Stem Auger/NQ Core Barrel COMPILED BY MFA
 DATUM Geodetic DATE 14.11.06 - 15.11.06 CHECKED BY MEF

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						
120.8														
0.0	ASPHALT: (150 mm)													
0.2	CRUSHER RUN LIMESTONE													
120.1	Dense		1	SS	36									
	Brown													
	Moist													
0.7	Silty CLAY, some sand, trace gravel													
	Very Stiff		2	SS	22									
	Dark Brown													
	(FILL)													
119.5														
1.4	Silty CLAY, trace sand, trace shale													
	fragments													
	Very Stiff													
119.0	Brown		3	SS	30									
	(Cl)													
1.8	Highly to moderately weathered, thinly													
	bedded, reddish brown, very weak to													
	weak SHALE with greenish grey													
	limestone interbeds		4	SS	50/ .100									
	Limestone interbed at 2.74 to 2.90 m													
			5	SS	50/ .075									
	Vertical joints at 3.66 to 3.74, 4.14 to													
	4.19, and 4.35 to 4.38		1	RUN										
	Vertical joint at 4.88 to 5.00 m													
	Limestone interbeds at 5.28 to 5.38													
	and 5.57 to 5.59 m		2	RUN										
114.6														
6.2	END OF BOREHOLE AT 2.52 m.													
	BOREHOLE BACKFILLED WITH													
	BENTONITE HOLEPLUG AND													
	PATCHED WITH ASPHALT AT													
	SURFACE.													

RECORD OF BOREHOLE No P3

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 806 696.07 E 284 456.04 ORIGINATED BY SLL
 HWY QEW BOREHOLE TYPE Solid Stem Auger/NQ Core Barrel COMPILED BY MFA
 DATUM Geodetic DATE 16.11.06 - 17.11.06 CHECKED BY MEF

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				
122.8								20 40 60 80 100				
0.0	ASPHALT: (125 mm)							○ UNCONFINED + FIELD VANE				
0.1	CRUSHER RUN LIMESTONE							● QUICK TRIAXIAL x LAB VANE				
122.2	Compact Brown Moist		1	SS	23			20 40 60 80 100				
0.7	Silty CLAY, some sand, trace roots Very Stiff Brown (CL)		2	SS	25		122					0 0 64 36
121.2												
1.7	Highly weathered, thinly bedded, very weak to medium strong, reddish brown, SHALE with greenish grey limestone interbeds		3	SS	71/ .225		121					
			4	SS	50/ .100							
	Limestone interbeds at 3.20 to 3.25 and 3.61 to 3.66 m		1	RUN			120					RUN 1# TCR=60%, SCR=0%, RQD=0%
			2	RUN			119					RUN 2# TCR=79%, SCR=53%, RQD=0%, UCS=26MPa
118.4												
4.4	Becoming moderately to slightly weathered Limestone interbeds at 4.57 to 4.60, 4.72 to 4.85, and 5.49 to 5.52 m		3	RUN			118					RUN 3# TCR=100%, SCR=100%, RQD=68%, UCS=6MPa
			4	RUN								RUN 4# TCR=100%, SCR=100%, RQD=95%, UCS=12MPa
117.3												
5.5	END OF BOREHOLE AT 5.54 m. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.											
	WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 14.12.06 3.47 119.33											

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

RECORD OF BOREHOLE No P6

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 807 035.86 E 284 721.00 ORIGINATED BY SLL
 HWY QEW BOREHOLE TYPE Solid Stem Auger/NQ Core Barrel COMPILED BY MFA
 DATUM Geodetic DATE 20.11.06 - 21.11.06 CHECKED BY MEF

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					
115.9 0.0	ASPHALT: (175 mm)							20 40 60 80 100					
115.4 0.2	CONCRETE: (250 mm)							20 40 60 80 100					
115.2 0.4	CRUSHER RUN LIMESTONE							20 40 60 80 100					
115.2 0.7	Brown (FILL)							20 40 60 80 100					
114.5 1.4	Silty CLAY, topsoil stained Stiff Dark Brown (FILL)		1	SS	12		115	20 40 60 80 100					
113.6 2.2	Silty CLAY, some sand to sandy, trace gravel, occasional shale fragments Hard Brown (TILLYCL)		2	SS	37		114	20 40 60 80 100					2 23 48 28
112.8 3.1	Highly weathered, thinly bedded, reddish brown, very weak SHALE with greenish grey limestone interbeds		3	SS	97/ .200		113	20 40 60 80 100					
109.7 6.1	Becoming moderately to slightly weathered, weak to medium strong Clay seam at 3.28 to 3.30 m		4	SS	50/ .050		112	20 40 60 80 100				FI	RUN 1# TCR=95%, SCR=80%, RQD=12%, UCS=26MPa
	Limestone interbeds at 3.84 to 3.89, 3.96 to 4.01, and 4.37 to 4.50 m		1	RUN			111	20 40 60 80 100				10	
	Limestone interbed at 4.77 to 4.88 m		2	RUN			110	20 40 60 80 100				8	RUN 2# TCR=98%, SCR=97%, RQD=58%, UCS=7MPa
								20 40 60 80 100				4	
								20 40 60 80 100				7	
								20 40 60 80 100				1	
								20 40 60 80 100				4	
								20 40 60 80 100				3	
								20 40 60 80 100				1	
								20 40 60 80 100				5	
								20 40 60 80 100				1	
	END OF BOREHOLE AT 6.15 m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND PATCHED WITH ASPHALT AT SURFACE.							20 40 60 80 100					

RECORD OF BOREHOLE No P13

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 807 906.71 E 285 411.03 ORIGINATED BY SLL
 HWY QEW BOREHOLE TYPE Solid Stem Auger/NQ Core Barrel COMPILED BY MFA
 DATUM Geodetic DATE 13.11.06 - 13.11.06 CHECKED BY MEF

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		
117.1	ASPHALT: (150 mm)													
0.0	CRUSHER RUN LIMESTONE													
0.2	Compact		1	SS	26		117							
116.3	Brown													
0.8	Moist													
	(FILL)													
	Silty CLAY, some sand		2	SS	24		116							0 11 70 20
	Very Stiff													
115.6	Brown													
	(CL)													
1.5	Highly weathered, thinly bedded, reddish brown, very weak SHALE with greenish grey limestone interbeds		3	SS	44		115							
			4	SS	50/									
	Limestone interbeds at 2.47 to 2.54, 2.79 to 2.90, and 2.94 to 2.99 m				.100									
			1	RUN			114						FI	RUN 1# TCR=67%, SCR=39%, RQD=13%
113.8	becoming moderately to slightly weathered, weak													
3.4													7	RUN 2# TCR=92%, SCR=88%, RQD=30%
	Limestone interbeds at 4.16 to 4.21, 4.47 to 4.52, and 4.57 to 4.62 m		2	RUN			113						4	
													1	
													4	
													1	
	Limestone interbeds at 5.41 to 5.51, 5.79 to 5.84, and 6.35 to 6.39 m		3	RUN			112						7	RUN 3# TCR=100%, SCR=95%, RQD=81%
													4	
													1	
110.7	END OF BOREHOLE AT 6.40 m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND PATCHED WITH ASPHALT AT SURFACE.						111						2	
6.4													3	

+ 3, x 3: Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No P15

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 808 065.17 E 285 460.18 ORIGINATED BY SLL
 HWY QEW BOREHOLE TYPE Solid Stem Auger/INQ Core Barrel COMPILED BY MFA
 DATUM Geodetic DATE 06.11.06 - 06.11.06 CHECKED BY MEF

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		
117.7	TOPSOIL: (25 mm)													
0.1	Silty CLAY, some sand Hard Dark Brown		1	SS	91									
	Highly to moderately weathered, thinly bedded, reddish brown, very weak to medium strong SHALE with greenish grey limestone interbeds		2	SS	50/ .100		117							
			3	SS	50/ .100		116						FI	
	Limestone interbeds at 1.68 to 1.71 and 2.13 to 2.18 m		1	RUN									9	RUN 1# TCR=100%, SCR=82%, RQD=32%
	Rubble zones at 2.32 to 2.37, and 2.74 to 2.77 m						115						>10	
	Limestone interbeds at 3.25 to 3.32, 3.40 to 3.55, 3.63 to 3.69, and 3.91 to 4.14 m		2	RUN			114						6	RUN 2# TCR=100%, SCR=97%, RQD=48%
	Clay seam at 4.16 to 4.18 m												4	
113.0													3	
4.7	END OF BOREHOLE AT 4.72 m. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.													
	WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 08.12.06 2.10 115.60 10.11.06 2.27 115.43													

RECORD OF BOREHOLE No OH1

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 806 542.93 E 284 268.60 ORIGINATED BY SLL
 HWY QEW BOREHOLE TYPE Solid Stem Auger COMPILED BY MFA
 DATUM Geodetic DATE 29.11.06 - 29.11.06 CHECKED BY MEF

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	w _L					
121.5						20	40	60	80	100	20	40	60	GR	SA	SI	CL
0.0	ASPHALT: (125 mm)																
0.1	CRUSHER RUN LIMESTONE Compact Brown		1	SS	22												
120.7	Moist (FILL)																
0.8	Silty CLAY, trace sand, trace gravel, trace shale fragments Hard Brown (CL)		2	SS	34												
119.8																	
1.7	Highly weathered, thinly bedded, reddish brown, SHALE Hard		3	SS	54												
119.0			4	SS	50/												
2.5	END OF BOREHOLE AT 2.52 m. BOREHOLE OPEN AND DRY TO BOTTOM ON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS AND PATCHED WITH ASPHALT AT SURFACE.				.075												

RECORD OF BOREHOLE No OH2

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 806 876.80 E 284 539.91 ORIGINATED BY SLI
 HWY QEW BOREHOLE TYPE Solid Stem Auger COMPILED BY MFA
 DATUM Geodetic DATE 29.11.06 - 29.11.06 CHECKED BY MEF

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		
120.6														
0.0	ASPHALT: (150 mm)													
0.2	CRUSHER RUN LIMESTONE													
119.8	Dense Brown Moist		1	SS	40		120							
0.8	(FILL)													
119.4	Silty CLAY, trace sand, trace gravel, occasional shale fragments		2	SS	85									0 9 67 23
1.1	Hard Reddish Brown													
119.0	(CL-ML)													
1.6	Highly weathered, thinly bedded, reddish brown, SHALE		3	SS	507									
	Hard				.075									
	END OF BOREHOLE AT 1.60 m. BOREHOLE OPEN AND DRY TO BOTTOM ON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS AND PATCHED WITH ASPHALT AT SURFACE.													

RECORD OF BOREHOLE No OH3

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Bur Oak Drive N 4 807 474.22 E 285 064.23 ORIGINATED BY SLL
 HWY QEW BOREHOLE TYPE Solid Stem Auger COMPILED BY MFA
 DATUM Geodetic DATE 21.11.06 - 21.11.06 CHECKED BY MEF

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		
114.5												
0.0	ASPHALT: (325 mm)											
114.2												
0.3	CRUSHER RUN LIMESTONE Compact Brown Moist (FILL)		1	SS	17		114					
113.5												
1.0	Silty CLAY, some sand, trace gravel, trace shale fragments Stiff to Very Stiff Brown (FILL)		2	SS	15		113					
			3	SS	12							
	numerous highly weathered shale fragments											
			4	SS	16		112					
			5	SS	14		111					
110.6												
4.0	Silty SAND, some gravel Loose Reddish Brown Wet						110					
			6	SS	4							
							109					
			7	SS	6		108					
107.8												
6.7	END OF BOREHOLE AT 6.71 m. BOREHOLE OPEN TO 4.72 m AND WATER LEVEL AT 4.42 m UPON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS AND PATCHED WITH BENTONITE HOLEPLUG AT SURFACE.											

RECORD OF BOREHOLE No OH5

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 807 957.35 E 285 396.45 ORIGINATED BY SLL
 HWY QEW BOREHOLE TYPE Solid Stem Auger COMPILED BY MFA
 DATUM Geodetic DATE 14.11.06 - 14.11.06 CHECKED BY MEF

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								
117.0							20	40	60	80	100	20	40	60					
0.0	ASPHALT: (125 mm)						117												
0.1	CRUSHER RUN LIMESTONE																		
	Very Dense																		
	Brown		1	SS	52											25 55 20			
116.2	Moist															(SI+CL)			
116.8	(FILL)																		
0.9	Silty CLAY, some sand, some shale fragments		2	SS	82/ 225		116												
	Hard																		
	Reddish Brown																		
115.3	Highly weathered, thinly bedded, reddish brown, SHALE		3	SS	50/ .125														
1.7	Hard																		
	END OF BOREHOLE AT 1.65 m. BOREHOLE OPEN AND DRY TO BOTTOM ON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS AND PATCHED WITH ASPHALT AT SURFACE.																		

RECORD OF BOREHOLE No BC3

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 807 608.69 E 285 127.11 ORIGINATED BY JHL
 HWY QEW BOREHOLE TYPE Solid Stem Auger COMPILED BY MFA
 DATUM Geodetic DATE 29.11.06 - 29.11.06 CHECKED BY MEF

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		
114.6														
0.0	TOPSOIL: (100 mm)													
0.1	Silty CLAY, trace sand Stiff to Very Stiff Brown (CL)		1	SS	9		114							0 1 77 22
			2	SS	16									
113.1														
1.5	Highly weathered, thinly bedded, reddish brown, SHALE Hard		3	SS	102		113							
112.0			4	SS	104/ 225		112							
2.7	END OF BOREHOLE AT 2.66 m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND DRILL CUTTINGS.													

RECORD OF BOREHOLE No C2

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 807 457.70 E 285 052.30 ORIGINATED BY SLI
 HWY QEW BOREHOLE TYPE Solid Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 15.11.06 - 15.11.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	
114.4												
0.0	ASPHALT: (200 mm)											
0.2	CRUSHER RUN LIMESTONE											
113.6	Compact Brown Moist (FILL)		1	SS	29		114					
0.8	Silty CLAY, some sand, trace gravel, occasional shale fragments Very Stiff to Firm Brown (FILL)(CL)		2	SS	19		113					
			3	SS	5							
			4	SS	10		112					5 15 69 11
			5	SS	12		111					
110.3												
4.1	Silty SAND, trace gravel Loose Brown Wet		6	SS	4		110					
							109					
108.3												
6.1	Silty SAND, some gravel, occasional shale fragments Loose Reddish Brown Wet		7	SS	4		108					16 60 24 (SI+CL)
107.7												
6.7	END OF BOREHOLE AT 6.71 m. BOREHOLE OPEN TO 6.71 m AND DRY TO BOTTOM UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND PATCHED WITH ASPHALT AT SURFACE.											

ONTMT4S 5127A.GPJ 19/12/06

RECORD OF BOREHOLE No EBT2

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 808 087.45 E 285 569.95 ORIGINATED BY GA
 HWY QEW BOREHOLE TYPE Solid Stem Auger/NQ Core Barrel COMPILED BY MFA
 DATUM Geodetic DATE 22.11.06 - 22.11.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
112.9	ASPHALT: (100 mm)											
0.0	SAND and GRAVEL											
0.1	Compact		1	SS	19							
112.3	Brown											
0.6	Dry											
	(FILL)											
	Silty CLAY, trace sand, occasional		2	SS	18							
	shale fragments											
	Very Stiff											
111.4	Reddish Brown											
	(FILL)											
1.5	Silty CLAY, some sand, occasional		3	SS	6							
	shale fragments											
	Firm											
	Reddish Brown											
	(TILL)											
110.4												
2.4	Highly to moderately weathered, thinly		4	SS	25							
	bedded, reddish brown, very weak to											
	weak, SHALE, with greenish grey											
	limestone interbeds											
	Clay seam at 3.28 to 3.31 m		5	SS	50/							
					.075							
	Rubble zone from 3.73 to 3.81 m											
			1	RUN								
	Limestone interbeds at 4.21 to 4.24											
	Limestone interbeds at 4.82 to 4.88,											
	5.02 to 5.05, 6.15 to 6.22 m											
	Clay seam at 5.38 to 5.43 m		2	RUN								
	Limestone interbeds at 5.57 to 5.62,											
	and 5.67 to 5.72 m											
106.7												
6.2	END OF BOREHOLE AT 6.18 m.											
	Piezometer installation consists of											
	19mm diameter Schedule 40 PVC pipe											
	with a 1.52m slotted screen.											
	WATER LEVEL READINGS:											
	DATE DEPTH(m) ELEV.(m)											
	08.12.06 4.40 108.50											

RECORD OF BOREHOLE No EBT5

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 808 182.11 E 285 646.12 ORIGINATED BY GA
 HWY QEW BOREHOLE TYPE Solid Stem Auger COMPILED BY MFA
 DATUM Geodetic DATE 23.11.06 - 23.11.06 CHECKED BY MEF

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			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								20	40	60						80	100	20
112.3																		
0.0	SAND and GRAVEL Compact Brown Dry (FILL)		1	SS	19													
111.7																		
0.6	Silty CLAY, some sand, trace gravel Firm Reddish Brown (FILL)(CI)		2	SS	5													
110.7																		
1.5	Silty CLAY, some sand, trace gravel Stiff Reddish Brown (TILL)		3	SS	13													
110.0																		
2.3	Highly weathered, thinly bedded, reddish brown, SHALE Hard		4	SS	50/ .150													
109.1																		
3.1	END OF BOREHOLE AT 3.15 m. BOREHOLE OPEN AND DRY TO BOTTOM ON 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) 08.12.06 Dry		5	SS	50/ .100													

+ 3, X 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No NSR2

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 808 210.61 E 285 590.69 ORIGINATED BY GA
 HWY QEW BOREHOLE TYPE Solid Stem Auger COMPILED BY MFA
 DATUM Geodetic DATE 21.11.06 - 21.11.06 CHECKED BY MEF

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 40 60 80 100	20 40 60 80 100					
116.5 0.0	CRUSHER RUN LIMESTONE Compact Brown		1	SS	15		116								51 39 10 (SI+CL)
115.9 0.6	(FILL) Silty CLAY, some sand, trace gravel, occasion shale fragments Firm to Stiff Reddish Brown (FILL)(CI)		2	SS	8		115								
114.2			3	SS	6		114								
2.3	Silty CLAY, trace rootlets and wood fibres Firm to Stiff Dark Brown (TILL)		4	SS	8		113								0 20 53 28
113.4 3.0	SAND, trace silt Compact Brown Moist		5	SS	16		112								
112.7 3.8	Highly weathered, thinly bedded, reddish brown, SHALE Hard														
111.7 4.7	END OF BOREHOLE AT 4.72 m. BOREHOLE OPEN AND DRY TO BOTTOM ON 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) 08.12.06 3.22 113.28 14.12.06 3.52 112.98		6	SS	50/ .150										

RECORD OF BOREHOLE No P17

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 807 841.87 E 285 557.72 ORIGINATED BY GA
 HWY QEW BOREHOLE TYPE Solid Stem Auger/NQ Core Barrel COMPILED BY MFA
 DATUM Geodetic DATE 27.11.06 - 27.11.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
109.3												
0.0 0.1	TOPSOIL: (75 mm) Silty CLAY, trace to some sand, trace gravel, occasional rootlets Stiff to Hard Reddish Brown (TILL)(CL)		1	SS	11		109					
			2	SS	27		108					0 3 66 31
107.8							108					
1.5	Highly to moderately weathered, thinly bedded, reddish brown, very weak to weak, SHALE, with greenish grey limestone interbeds		3	SS	42		107					0 1 78 21
			4	SS	81/ 200		107					
	Limestone interbeds at 3.23 to 3.30, 3.74 to 3.77, 4.35 to 4.37, and 4.52 to 4.57 m Rubble zones from 3.30 to 3.40, 3.61 to 3.66, and 4.52 to 4.57 m		1	RUN			106					RUN 1# TCR=100%, SCR=83%, RQD=52%
							105					
	Limestone interbeds at 4.77 to 4.80, 5.00 to 5.08, 5.36 to 5.39, 5.54 to 5.57, and 5.74 to 5.76 m Rubble zone from 4.80 to 4.82 m		2	RUN			104					RUN 2# TCR=100%, SCR=97%, RQD=87%, UCS=8MPa
103.2												
6.1	END OF BOREHOLE AT 6.10 m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 14.12.06 3.14 106.16											

RECORD OF BOREHOLE No SW2

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 808 010.95 E 285 306.03 ORIGINATED BY SLL
 HWY QEW BOREHOLE TYPE Solid Stem Auger COMPILED BY MFA
 DATUM Geodetic DATE 08.11.06 - 08.11.06 CHECKED BY MEF

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										
								20 40 60 80 100								20 40 60		
121.5																		
0.0	TOPSOIL: (100 mm)																	
0.1	Silty CLAY, some shale fragments, trace roots		1	SS	9										0 3 47 50			
120.8	Stiff Brown						121											
0.7	(Cl)																	
	SAND, trace gravel																	
120.2	Compact		2	SS	25													
	Brown																	
1.3	Wet																	
	Silty CLAY, trace sand						120											
	Very Stiff																	
	Brown		3	SS	27										0 1 66 32			
	(CL)																	
			4	SS	29		119											
118.6																		
2.9	Silty CLAY, sandy, trace gravel																	
	Hard																	
118.0	Grey (TILL)		5	SS	43		118								2 26 51 18			
3.6	Highly weathered, thinly bedded, reddish brown, SHALE																	
117.6	Hard		6	SS	50/													
3.9	END OF BOREHOLE AT 3.91 m. BOREHOLE OPEN TO 3.05 m AND WATER LEVEL AT 1.11 m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.				.100													

RECORD OF BOREHOLE No SW3

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 808 036.05 E 285 347.89 ORIGINATED BY GA
 HWY QEW BOREHOLE TYPE Solid Stem Auger/HQ Core Barrel COMPILED BY MFA
 DATUM Geodetic DATE 30.11.06 - 30.11.06 CHECKED BY MEF

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					
121.3								20 40 60 80 100					
0.0	TOPSOIL (200mm)												
0.2	CRUSHER RUN LIMESTONE, trace silt, occasional asphalt fragments		1	SS	18		121						
120.6	Brown												
0.8	Dry (FILL)												
	SAND, trace silt		2	SS	11								
	Compact												
119.8	Brown						120						
1.5	Dry												
	Silty CLAY		3	SS	16								
	Very Stiff												
	Brown												
119.0													
2.3	Silty CLAY, sandy, trace gravel						119						
	Hard		4	SS	70/ .300								
118.6	Reddish Brown												
2.7	(TILL)												
	Highly to moderately weathered, thinly bedded, reddish brown, very weak to medium strong, SHALE, with greenish limestone interbeds		5	SS	50/ .050		118						
	Limestone interbeds at 3.25 to 3.28 m, 4.01 to 4.04 m, 4.11 to 4.14 m, 4.19 to 4.24, and 4.29 to 4.32 m												
	Sub vertical joint from 3.56 to 3.71 m		1	RUN									
116.9							117						
4.5	Becoming slightly weathered to fresh												
	Limestone interbeds at 5.08 to 5.16, 5.23 to 5.26, 5.51 to 5.54, 5.64 to 5.67, and 5.84 to 5.94 m		2	RUN			116						
	Limestone interbeds at 6.81 to 6.83, 7.16 to 7.19, 7.28 to 7.34, and 7.42 to 7.52 m		3	RUN			115						
	Limestone interbed at 7.80 to 8.02m		4	RUN			114						
							113						
112.3													
9.1	END OF BOREHOLE AT 9.07 m. BOREHOLE OPEN TO BOTTOM UPON COMPLETION. BOREHOLE GROUTED WITH BENTONITE TO SURFACE.												

ONTMT4S 5127A.GPJ 19/12/06

RECORD OF BOREHOLE No SWM1

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 807 766.37 E 285 464.27 ORIGINATED BY GA
 HWY QEW BOREHOLE TYPE Solid Stem Auger/NQ Core Barrel COMPILED BY WM
 DATUM Geodetic DATE 23.11.06 - 23.11.06 CHECKED BY MEF

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			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
109.7	ASPHALT: (40 mm)										
109.1	SAND and GRAVEL Compact Brown Dry to Damp (FILL)		1	SS	19						
108.1	Silty CLAY, trace to some sand Very Stiff Reddish Brown Dry (TILL)(CL-CI)		2	SS	15						0 13 42 45
107.1	Highly to moderately weathered, thinly bedded, very weak to weak, reddish brown, SHALE with greenish grey limestone interbeds		3	SS	89/ .200						
106.1	Rubble zone from 3.18 to 3.25 m		4	SS	50/ .075						
105.1	Limestone interbeds at 3.61 to 3.66, and 4.09 to 4.11 m		1	RUN							RUN 1# TCR=100%, SCR=93%, RQD=26%
104.1	Limestone interbeds at 4.32 to 4.35, 5.11 to 5.13, and 5.41 to 5.54 m		2	RUN							RUN 2# TCR=100%, SCR=96%, RQD=63%, UCS=17MPa
103.3	Becoming moderately to slightly weathered Limestone interbeds at 5.77 to 5.81, and 6.01 to 6.06 m		3	RUN							RUN 3# TCR=100%, SCR=100%, RQD=81%, UCS=12MPa
103.3	END OF BOREHOLE AT 6.32 m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.										
	WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 14.12.06 4.16 105.54										

RECORD OF BOREHOLE No SWM3

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 807 780.51 E 285 544.08 ORIGINATED BY GA
 HWY QEW BOREHOLE TYPE Solid Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 27.11.06 - 27.11.06 CHECKED BY MEF

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		
108.9 0.0 0.1	TOPSOIL: (75 mm) Silty CLAY, some sand to sandy, trace gravel, occasional rootlets Firm to Hard Mottled Brown/Reddish Brown (TILL)		1	SS	6									
107.8 1.1	Highly weathered, thinly bedded, reddish brown, hard SHALE		2	SS	74		108							
			3	SS	50/ .100									
106.6 2.3	END OF BOREHOLE AT 2.33 m. BOREHOLE OPEN AND DRY TO BOTTOM ON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.		4	SS	50/ .075		107							

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RECORD OF BOREHOLE No UC3

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 806 933.25 E 284 587.22 ORIGINATED BY SLL
 HWY QEW BOREHOLE TYPE Solid Stem Agers COMPILED BY WM
 DATUM Geodetic DATE 29.11.06 - 29.11.06 CHECKED BY MEF

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										
118.5																				
0.0	ASPHALT: (110 mm)																			
0.1	CONCRETE: (240 mm)																			
118.1																				
0.4	CRUSHER RUN LIMESTONE																			
117.7	Brown						118													
0.8	Dry (FILL)																			
117.4	Silty CLAY, trace sand, occasional shale fragments		1	SS	91										0 9 74 18					
1.1	Hard																			
	Reddish Brown																			
116.8	(TILL)						117													
1.7	Highly weathered, thinly bedded, reddish brown SHALE		2	SS	50/ .050															
	Hard																			
	END OF BOREHOLE AT 1.72 m. BOREHOLE OPEN AND DRY TO BOTTOM ON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS AND PATCHED WITH ASPHALT AT SURFACE.																			

METRIC

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							WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE						
118.8 0.0	ASPHALT: (275 mm)														
118.5 0.3	CRUSHER RUN LIMESTONE														
118.2 0.6	Compact Brown (FILL)		1	SS	17										
	Silty CLAY, trace sand														
117.4	Hard Reddish Brown (TILL)(CL)		2	SS	67										
1.4	Highly to moderately weathered, thinly bedded, reddish brown, very weak SHALE with greenish grey limestone interbeds		3	SS	75										
			4	SS	50/ .075										
			5	SS	50/ .100										
	Limestone interbed at 3.45 to 3.51 m														
	Rubble zone from 3.71 to 4.01 m		1	RUN											
	Clay seam at 3.81 to 3.84 m														
114.5 4.3	becoming slightly weathered to fresh, very weak to weak		2	RUN											
	Limestone interbeds at 5.00 to 5.11, 5.43 to 5.49, and 5.69 to 5.74 m		3	RUN											
112.6 6.2	END OF BOREHOLE AT 6.25 m. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.														
WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 14.12.06 3.26 115.54															

ONTMT4S 5127A.GPJ 19/01/07

+ 3, $\times 3$; Numbers refer to Sensitivity

RECORD OF BOREHOLE No UC5

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Bur Oak Drive N 4 807 398.59 E 284 964.40 ORIGINATED BY SLJ
 HWY QEW BOREHOLE TYPE Solid Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 14.11.06 - 14.11.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								20 40 60 80 100								20 40 60		
								20 40 60 80 100								20 40 60		
114.9																		
0.0	ASPHALT: (140 mm)																	
0.2	CRUSHER RUN LIMESTONE Dense Brown Moist (FILL)		1	SS	30													
114.1																		
0.8	Silty CLAY, some sand, some shale fragments Very Stiff Brown		2	SS	20		114											
113.1																		
1.8	Sandy SILT, some clay, trace gravel Compact Brown		3	SS	17		113							6 33 48 13				
112.7	Moist to Wet																	
2.2	SAND, some gravel, trace silt Very Dense Brown		4	SS	50/ .150													
112.1	Moist																	
2.8	Sandy SILT, trace clay, trace gravel Very Dense Brown Wet		5	SS	58		112							2 22 67 9				
							111											
			6	SS	61		110											
109.7																		
5.2	END OF BOREHOLE AT 5.18 m. BOREHOLE OPEN TO 4.42 m AND DRY ON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 0.9m, DRILL CUTTINGS TO 0.1m AND PATCHED WITH ASPHALT AT SURFACE.																	

RECORD OF BOREHOLE No UC6

1 OF 2

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 807 376.00 E 284 990.35 ORIGINATED BY SLL
 HWY QEW BOREHOLE TYPE Solid Stem Auger COMPILED BY MFA
 DATUM Geodetic DATE 23.11.06 - 23.11.06 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
114.8	ASPHALT: (375 mm)											
114.4												
114.2	CONCRETE: (250 mm)											
0.6	Silty CLAY, some sand, trace gravel Very Stiff to Hard Brown (TILL)		1	SS	23		114					
			2	SS	50/ .125		113					
112.7												
2.1	Sandy SILT, some clay, trace gravel Very Dense Brown Moist		3	SS	84/ 275		112					2 28 61 9
			4	SS	59							
							111					
110.7												
4.1	SILT, trace sand, trace clay, trace gravel Very Dense Brown Moist (TILL)		5	SS	82		110					1 9 82 8
							109					
			6	SS	58		108					
							107					
107.3												
7.5	Silty CLAY, trace shale fragments Hard Reddish Brown (TILL)		7	SS	50/ .150		107					
							106					
105.6												
9.2	END OF BOREHOLE AT 9.22 m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		8	SS	50/ .075							

Continued Next Page

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

ONTMT4S 5127A.GPJ 19/01/07

METRIC

[illegible]

RECORD OF BOREHOLE No UC7

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 807 841.45 E 285 315.39 ORIGINATED BY SLL
 HWY QEW BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 28.11.06 - 28.11.06 CHECKED BY MEF

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		
117.0														
0.0	ASPHALT: (240 mm)						117							
0.2	CONCRETE: (260 mm)													
116.5														
0.5	Silty CLAY, some shale fragments													
115.1	Hard Brown (TILL)		1	SS	50/		116							
0.9	Highly weathered, thinly bedded, reddish brown, SHALE				.125									
115.3	Hard		2	SS	50/									
					.050									
1.7	END OF BOREHOLE AT 1.68 m. BOREHOLE OPEN AND DRY TO BOTTOM ON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS AND PATCHED WITH ASPHALT AT SURFACE.													

+ 3, x 3: Numbers refer to Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No UC10

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 807 986.16 E 285 468.85 ORIGINATED BY SLL
 HWY QEW BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 25.11.06 - 25.11.06 CHECKED BY MEF

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 (%)	
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 × LAB VANE									
116.3																
0.0	ASPHALT: (100 mm)															
0.1	CRUSHER RUN LIMESTONE															
115.6	Compact		1	SS	21		116									
0.7	Brown															
	Moist															
	(FILL)															
	Silty CLAY, some sand, trace gravel		2	SS	22		115									
	Very Stiff to Stiff															
	Brown															
	(CL)															
			3	SS	14											
			4	SS	10		114									
	becoming hard: (TILL)		5	SS	82/ 250		113									
112.2																
4.1	Highly weathered, thinly bedded, reddish brown, SHALE Hard						112									
111.5			6	SS	50/ 100											
4.8	END OF BOREHOLE AT 4.82 m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.															
	WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 14.12.06 2.31 113.99															

RECORD OF BOREHOLE No WBT2

1 OF 1

METRIC

W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 808 316.65 E 285 682.57 ORIGINATED BY GA
 HWY QEW BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 21.11.06 - 21.11.06 CHECKED BY MEF

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	20 40 60 80 100	PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	
113.1													
0.0	CRUSHER RUN LIMESTONE Compact Brown Dry (FILL)		1	SS	20		113						9 (SI+CL)
112.3													
0.8	Highly weathered, thinly bedded, reddish brown, SHALE Very Stiff to Hard		2	SS	20		112						69
			3	SS	50/ .150								
110.7			4	SS	50/ .125		111						
2.4	END OF BOREHOLE AT 2.41 m. BOREHOLE OPEN AND DRY TO BOTTOM ON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG.												

RECORD OF BOREHOLE No WBT4

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 808 386.27 E 285 738.21 ORIGINATED BY GA
 HWY QEW BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 21.11.06 - 21.11.06 CHECKED BY MEF

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			20 40 60 80 100	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	
113.4												
0.0	CRUSHER RUN LIMESTONE Dense Brown Dry (FILL)		1	SS	34		113					
112.7												
0.6	Silty CLAY, trace to some sand, trace gravel											
112.3	Very Stiff Reddish Brown (TILL)(CL)		2	SS	24		112					
1.1	Highly weathered, thinly bedded, very weak, reddish brown, SHALE Hard		3	SS	50/ .150							
110.9			4	SS	50/ .150		111					
2.4	END OF BOREHOLE AT 2.44 m. BOREHOLE OPEN AND DRY TO BOTTOM ON 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) 08.12.06 Dry											

RECORD OF BOREHOLE No WBT5

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 808 422.09 E 285 766.83 ORIGINATED BY GA
 HWY QEW BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 21.11.06 - 21.11.06 CHECKED BY MEF

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		
113.3														
0.0	CRUSHER RUN LIMESTONE													
	Compact		1	SS	23		113							
112.7	Brown													
	Dry													
0.6	(FILL)													
	Silty CLAY, trace to some sand, trace													
112.3	gravel													
	Hard		2	SS	36		112							
1.1	Reddish Brown													
	(TILL)													
	Highly weathered, thinly bedded,													
	reddish brown, SHALE		3	SS	50/									0 0 78 22
	Hard				.150									
111.0														
			4	SS	50/		111							
2.4	END OF BOREHOLE AT 2.39 m.													
	BOREHOLE OPEN AND DRY TO													
	BOTTOM ON COMPLETION.													
	BOREHOLE BACKFILLED WITH													
	BENTONITE HOLEPLUG.				.100									

RECORD OF BOREHOLE No WBT7

1 OF 1

METRIC

W.P. 169-00-00 LOCATION QEW, Third Line to Burloak Drive N 4 808 489.44 E 285 825.22 ORIGINATED BY SLL
 HWY QEW BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 14.11.06 - 14.11.06 CHECKED BY MEF

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		
113.7														
0.0	ASPHALT (150 mm)													
0.2	CRUSHER RUN LIMESTONE													
112.9	Dense Brown Moist (FILL)		1	SS	32		113							
0.8	Silty CLAY, trace to some sand, trace gravel													
112.5	Hard Reddish Brown (TILL)		2	SS	31									79
1.2	Highly weathered, thinly bedded, reddish brown, SHALE		3	SS	50/									
112.0	Hard				.075									
1.8	END OF BOREHOLE AT 1.75 m. BOREHOLE OPEN AND DRY TO BOTTOM ON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS TO 0.2m THEN ASPHALT TO SURFACE.													

RECORD OF BOREHOLE No 02-2

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION N 4 807 598.6 E 285 176.7 ORIGINATED BY MT
 HWY QEW BOREHOLE TYPE Hollow Stem Augers COMPILED BY HS
 DATUM Geodetic DATE 18.02.02 - 18.02.02 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 (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
114.4														
0.0	SILT, some clay, some sand, trace limestone fragments, occasional greenish interbeds, occasional shale fragments Very Stiff Reddish Brown (POSSIBLE FILL)		1	SS	15		114							
112.5			2	SS	23		113							
1.9	SHALE, weathered, weak, thinly bedded, reddish brown		3	SS	100/ .125		112							
111.4														
3.0	END OF THE BOREHOLE AT 3.05 m. BOREHOLE DRY ON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.													

RECORD OF BOREHOLE No 02-4

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION N 4 807 604.3 E 285 181.9 ORIGINATED BY MT
 HWY QEW BOREHOLE TYPE Hollow Stem Augers/NQ Core Barrel COMPILED BY HS
 DATUM Geodetic DATE 18.02.02 - 18.02.02 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	
114.1												
0.0	Clayey SILT, trace sand, occasional greenish limey pockets, trace sandstone fragments Firm Reddish Brown (POSSIBLE FILL)(CL-ML)		1	SS	5		114					
112.6							113					
1.5	SHALE, weathered, thinly bedded, occasional limey interbeds, reddish brown		2	SS	72		112					
			3	SS	100/ 125							
111.1							111					
3.0	Moderately weathered, very weak to weak, thinly bedded, reddish brown, SHALE weathered to slightly weathered		1	RUN								RUN 1# TCR=100%, SCR=82%, RQD=64%
			2	RUN			110					RUN 2# TCR=100%, SCR=94%, RQD=90%
	4.42 - 4.47m siltstone layer											
	Becoming moderately to highly weathered						109					RUN 3# TCR=97%, SCR=17%, RQD=10%
			3	RUN			108					
107.7												
6.4	END OF THE BOREHOLE AT 6.40m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.83m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) July 21/ 05 5.1 Oct. 27/ 05 5.0 Dec. 14/ 06 Destroyed											

RECORD OF BOREHOLE No 06-10

1 OF 1

METRIC

G.W.P. 169-00-00 LOCATION N 4 807 820.4 E 285 351.1 (Bronte) ORIGINATED BY SLL
 HWY QEW BOREHOLE TYPE Solid Stem Augers / NQ Rock Coring COMPILED BY JHL
 DATUM Geodetic DATE 12.06.06 - 12.06.06 CHECKED BY SKP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE				
							20 40 60 80 100						
116.1													
0.0	TOPSOIL: (100 mm)		1	SS	10								
0.1	Stiff Clayey SILT, trace to some gravel Stiff Reddish Brown Moist (TILL)		2	SS	8								
	sand seam (50 mm)												
114.3			3	SS	65								
1.8	SHALE, weathered, with grey limestone layer Reddish Brown		4	SS	50/ 125								
113.5			1	RUN									
2.6	SHALE, moderately to slightly weathered, fine grained, thinly bedded, reddish brown, with frequent grey strong LIMESTONE interbeds, and occasional clay seams Limestone layers from 2.64 to 2.92 m Limestone layer (50 mm) at 3.25 m Clay seam (50 mm) at 3.49 m		2	RUN									
	Limestone layer (50 mm) at 4.65, 4.77 m		3	RUN									
110.5	Limestone layer (50 mm) at 5.31, 5.47 m												
5.6	END OF BOREHOLE AT 5.61 m. BOREHOLE GROUTED WITH BENTONITE TO SURFACE.												

Appendix B

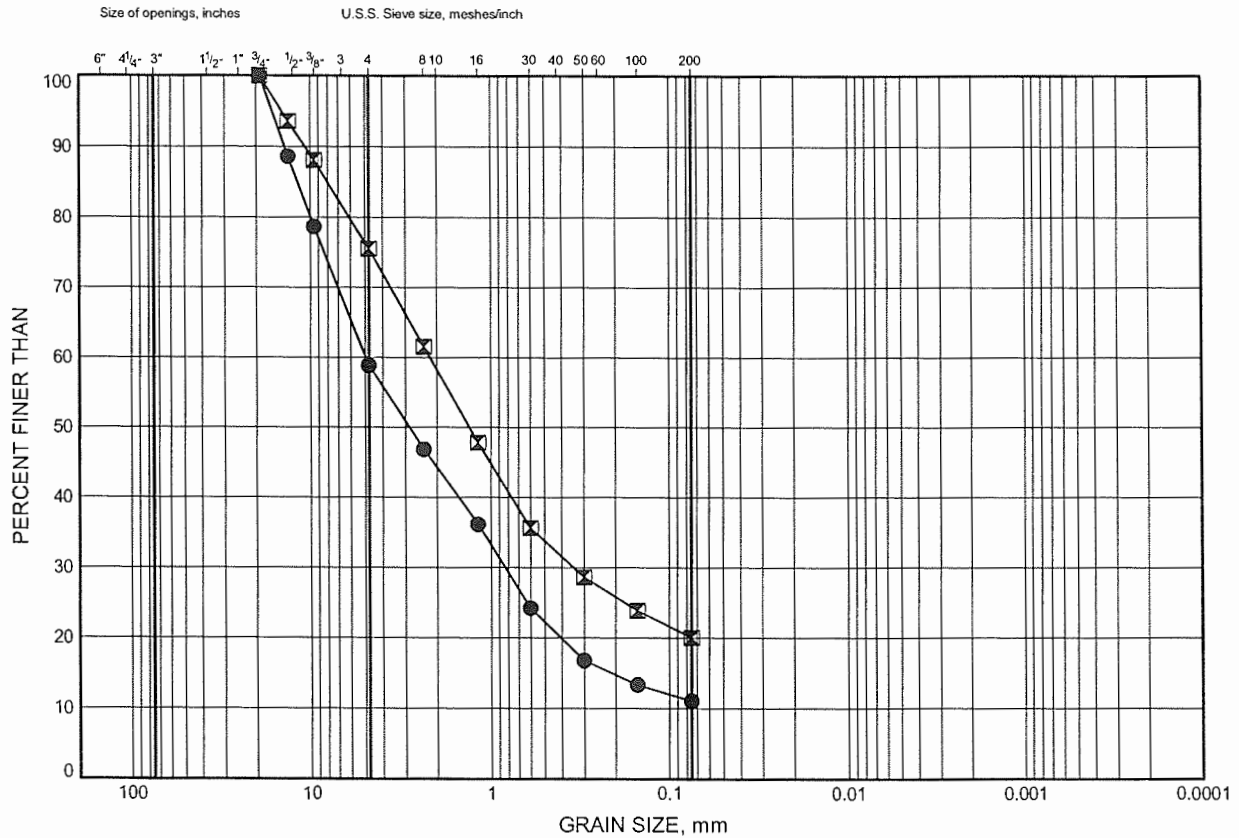
Geotechnical Laboratory Test Results

19-1351-27

GRAIN SIZE DISTRIBUTION

FIGURE B1

CRUSHER RUN LIMESTONE

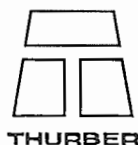


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	OH1	0.46	121.04
☒	OH5	0.46	116.54

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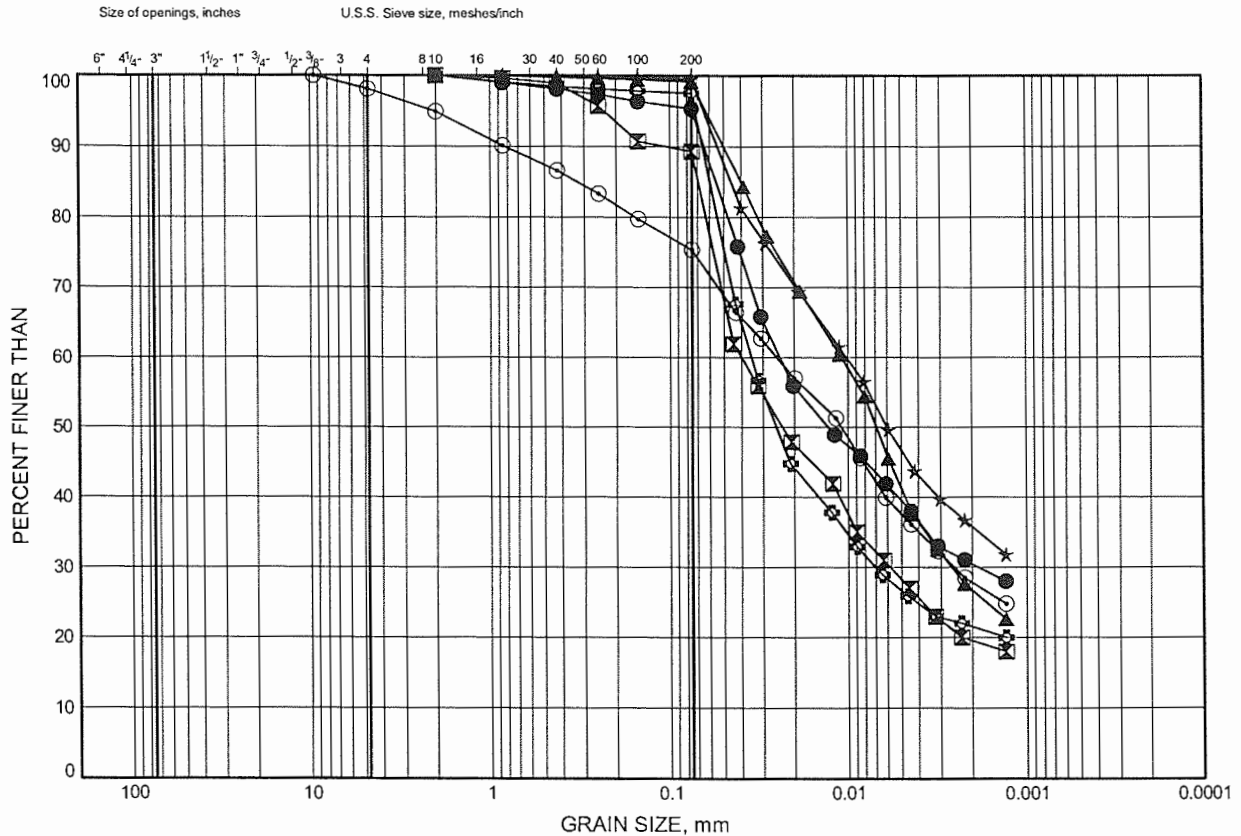
Prep'd WM

Chkd. SKP

GRAIN SIZE DISTRIBUTION

FIGURE B2

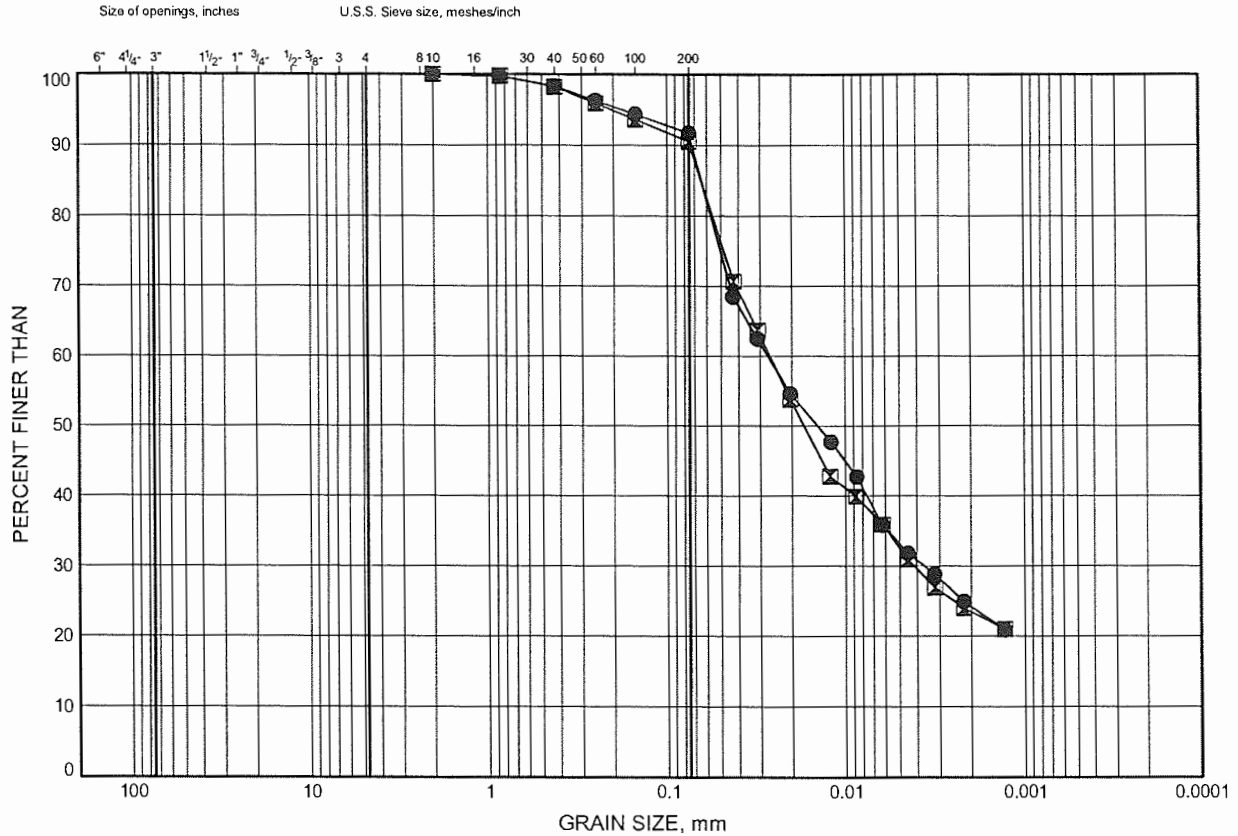
SILTY CLAY TO SILTY CLAY TILL



GRAIN SIZE DISTRIBUTION

FIGURE B3

SILTY CLAY TO SILTY CLAY TILL

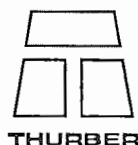


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	OH1	1.07	120.43
⊠	OH2	0.99	119.60

Date December 2006

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THURBER

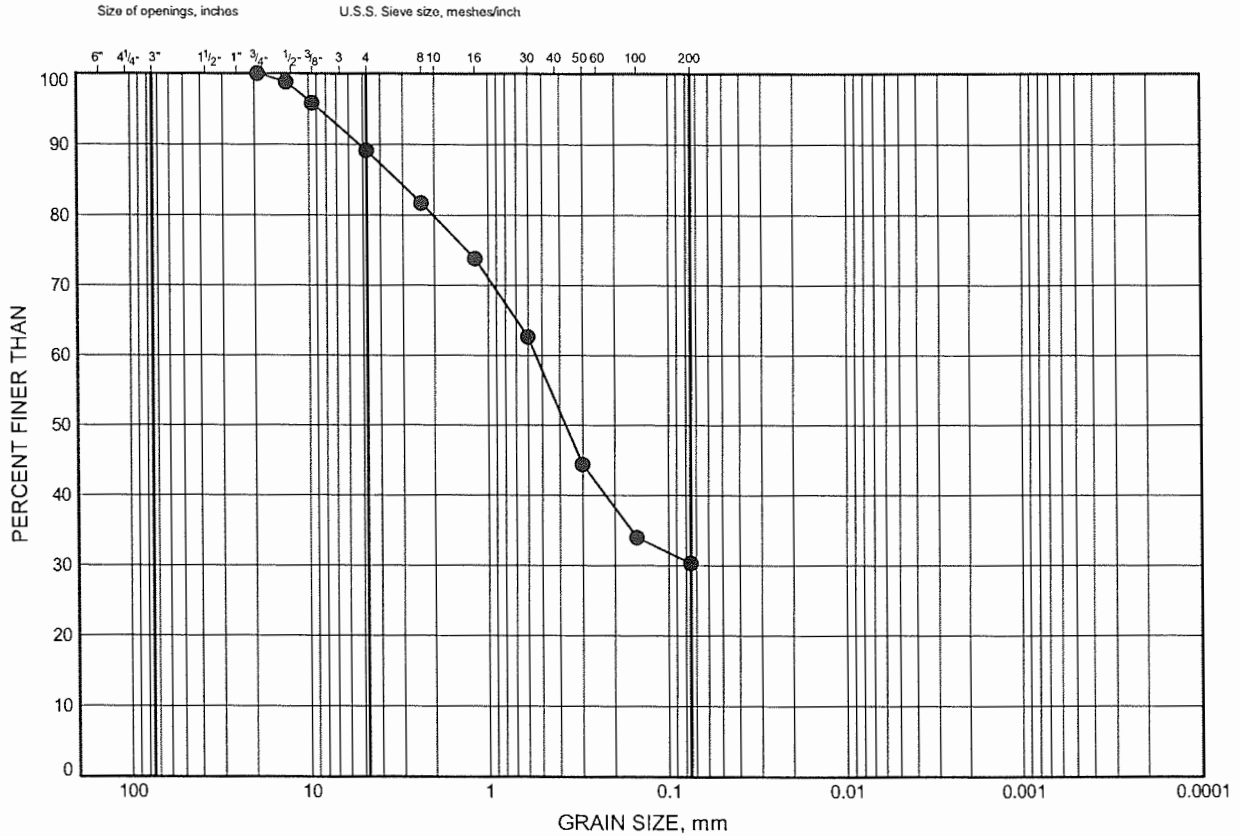
Prep'd WM

Chkd. SKP

GRAIN SIZE DISTRIBUTION

FIGURE B4

SILTY SAND

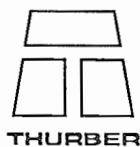


COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	OH3	4.88	109.66

Date December 2006

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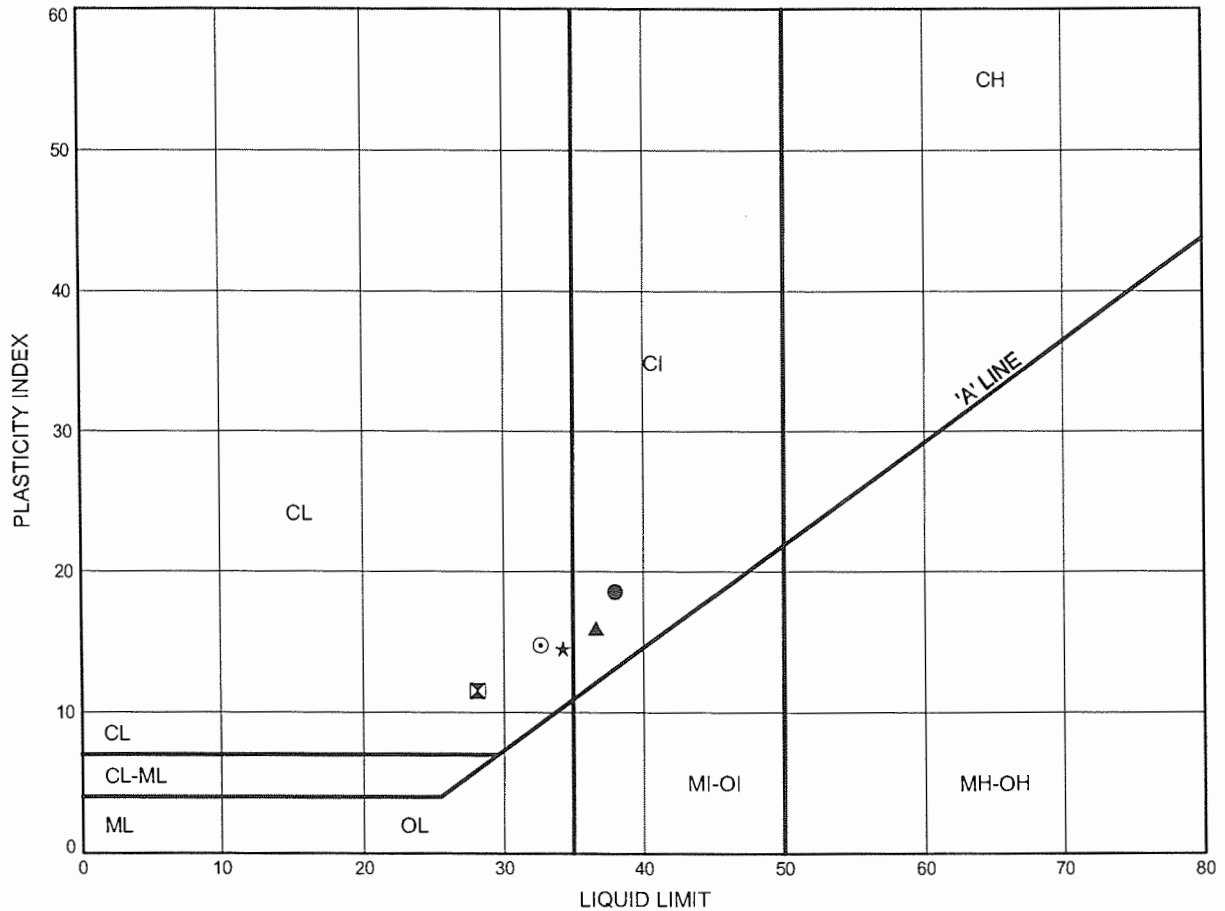
Prep'd WM

Chkd. SKP

ATTERBERG LIMITS TEST RESULTS

FIGURE B5

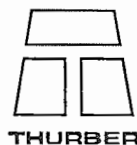
SILTY CLAY TO SILTY CLAY TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	P1	1.68	119.16
⊠	P13	1.07	116.05
▲	P21	1.83	110.57
★	P3	1.07	121.78
⊙	P6	1.83	114.03

Date December 2006

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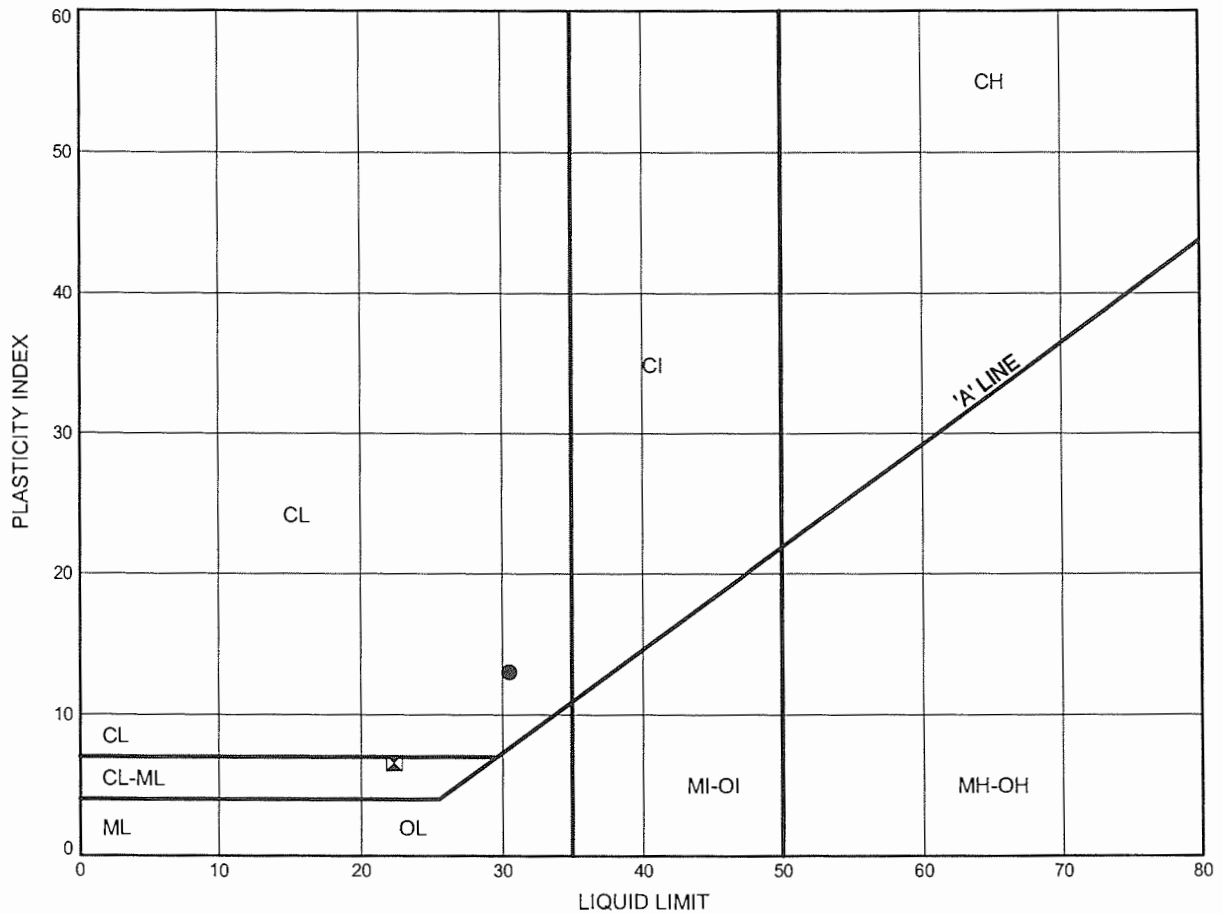
Prep'd WM

Chkd. SKP

ATTERBERG LIMITS TEST RESULTS

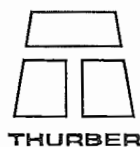
FIGURE B6

SILTY CLAY TO SILTY CLAY TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	OH1	1.07	120.43
⊠	OH2	0.99	119.60

Date December 2006
Project 169-00-00



Prep'd WM
Chkd. SKP

Appendix C
List of Special Provisions
and
Suggested Text for NSSP

List of Special Provisions Referenced in this Report

SP 903S01

Suggested Text for NSSP on “Caisson Construction for HML Pole Foundations”

The Contractor is advised that variable types of subsurface materials may be encountered at the high mast lighting (HML) pole locations. For additional information regarding soil and rock conditions, the Contractor is referred to the Foundation Investigation Report.

For bidding purposes, the Contractor shall assume the following:

1. The subsurface conditions at a HML location are the same as those encountered in the borehole closest to the subject HML location.
2. There is a probability that occasional cobbles and boulders may be encountered within the glacial till deposits. Obstructions may also be present within the fill. The strength of the shale bedrock increases with depth below the upper 1 to 3 m (weathered) zone, and hard limestone and siltstone interbeds are present in the shale. Caisson installation equipment must be able to penetrate these obstructions and hard layers.
3. Water seepage and/or soil sloughing into the caisson hole will occur from existing fill and cohesionless soils at some locations. The cohesionless soils would be susceptible to disturbance under conditions of unbalanced hydrostatic head. Temporary liners shall be available on site, or be made available on very short notice, to support the caisson sidewalls and provide seepage cut-off where required.

The Contractor is responsible for constructing the high mast pole foundations without disturbing the material at the sides or bases of the foundations.