



THURBER ENGINEERING LTD.

**FOUNDATION INVESTIGATION AND DESIGN REPORT
HIGH-OCCUPANCY TOLL AND
HIGH-OCCUPANCY TOLL HMS SIGN SUPPORTS
HIGHWAY 400
MAJOR MACKENZIE DRIVE TO NORTH OF KING ROAD
TORONTO, ONTARIO
G.W.P. 2539-04-00**

GEOCRES NO. 30M13-224

Submitted

to

SNC-Lavalin Inc.

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PART 1 FACTUAL INFORMATION

1.0 INTRODUCTION

This report presents the factual data obtained from previous foundation investigations in order to provide foundation recommendations for the detailed design of High-Occupancy Toll (HOT) and High-Occupancy Toll HMS (HOT HMS) sign supports to be located at specific locations along Highway 400, from Major Mackenzie Drive to north of King Road, in the Regional Municipality of York, Ontario. This is a part of the overall project for the proposed widening of Highway 400 to accommodate additional lanes of traffic.

Thurber has been retained by SNC-Lavalin Inc. (SLI) to carry out this study under the Ministry of Transportation Ontario (MTO) Agreement No. 2005-E-0036.

The purpose of this investigation was to review currently available subsurface information near the proposed locations of the HOT and HOT HMS sign supports and, based on this data, to provide borehole locations plans, records of boreholes, and a written description of the subsurface conditions.

For preparation of this report, reference has been made to previous reports listed as follows:

- Thurber Engineering Ltd. report titled "Foundation Investigation Report, Overhead and Cantilevered Sign Supports, Highway 400, Major Mackenzie Drive to King Road, Toronto, Ontario", G.W.P. 2539-04-00, Geocres No. 30M13-194, Report to SNC-Lavalin, File No. 19-92-68 dated December 19, 2011 (Reference 1).



- Thurber Engineering Ltd. report titled “Foundation Investigation Report, Retaining Structures, Teston Road to King Road, Highway 400 Widening, Vaughan, Ontario”, G.W.P. 2539-04-00, Geocres No. 30M13-166, Report to SNC-Lavalin, File No. 19-92-68, dated June 1, 2009 (Reference 2).
- Thurber Engineering Ltd. report titled “Foundation Investigation Report, High Mast Lighting Poles, Highway 400, Major Mackenzie Drive to north of Teston Road, Toronto, Ontario”, G.W.P. 2539-04-00, Geocres No. 30M13-164, Report to SNC-Lavalin, File No. 19-92-68, dated April 1, 2010 (Reference 3).
- Thurber Engineering Ltd. report titled “Foundation Investigation Report, Proposed Culvert Extensions and New Culvert, Highway 400 Widening, Major Mackenzie Drive to King Road, York Region, Ontario”, G.W.P. 192-00-00 and 2539-04-00, Geocres No. 30M13-190, Report to SNC-Lavalin, File No. 19-92-68, dated May 7, 2012 (Reference 4).
- Thurber Engineering Ltd. report titled “Foundation Investigation Report, High Embankments, Teston Road to King Road, Highway 400 Widening, Vaughan, Ontario”, G.W.P. 2539-04-00, Geocres No. 30M13-178, Report to SNC-Lavalin, File No. 19-92-68, dated June 1, 2009 (Reference 5).

2.0 SITE DESCRIPTION

The twenty one (21) HOT and seven (7) HOT HMS sign supports are to be located at the median along the alignment of the proposed Highway 400 widening, between the interchange at Major Mackenzie Drive and about 1 km north of King Road.

The project area is located within the physiographic region known as the South Slope which is comprised predominantly of the Halton drift (till). The Halton till is an interbedded complex of clayey silt to silt till and sand. This deposit comprises a slightly hummocky till plain, into which the surface watercourses have eroded 10 to 15 m deep gullies. Relatively recent fluvial sediments have been deposited in the gullies. The Halton drift overlies bedrock at depths in the order of 100 m in the vicinity of the project area.

Drainage in the vicinity of the project area is largely controlled by the Humber River and its tributaries. Localized drainage is facilitated by the creeks flowing within the gullies.



The land use adjacent to this section of Highway 400 is largely rural and agricultural, although residential and commercial developments have increased in recent years.

3.0 SITE INVESTIGATION AND FIELD TESTING

A site investigation was not included in the scope of the current project. Instead as per the terms of reference, borehole information from the previous investigations at the site should be used for developing foundation recommendations.

Tables 1 and 2 at the end of the text indicate the reference boreholes that were used to assess the subsurface conditions at the proposed HOT and HOT HMS sign support locations. These are generally based on the closest available boreholes to each sign support. A total of thirty five (35) boreholes, previously drilled for other projects, were selected for preparation of this report. Since the boreholes were drilled between 2009 and 2012, and there has been recent and ongoing reconstruction of the highway and its structures, it is possible that the current ground surface elevations may differ and the subsurface stratigraphy may include additional fill that is not shown on the reference borehole logs. The approximate locations of the proposed HOT, HOT HMS and boreholes in the vicinity are shown on the Borehole Location Drawings in Appendix B. It is noted that only the selected boreholes have been used for foundation design purposes.

4.0 SUBSURFACE CONDITIONS

Details of the encountered soil stratigraphy are presented on the Record of Borehole sheets in Appendix A obtained from previous investigations. Subsurface conditions depicted in these boreholes have been described in References 1 to 5. A general description of the stratigraphy established at relevant boreholes near the proposed HOT and HOT HMS sign support is presented below.

In general, the subsurface conditions encountered in the boreholes consist of a pavement structure of 150 mm to 280 mm thick asphalt and 0.7 m to 1.7 m thick, typically compact to very dense granular fill overlying firm to very stiff clayey silt to silty clay embankment fill. The embankment fill was found ranging between 0.4 m and 9.1 m in thickness. Underlying the embankment fill is an extensive deposit of native, stiff to hard clayey silt to silty clay till which contains typically compact to very dense sand and



silt interlayers. Where fully penetrated, this cohesive till ranged from 4.3 m to 10.1 m in thickness. At some locations, the cohesive till is underlain by deposits of dense to very dense sandy silt to silt and sand till. This cohesionless till was fully penetrated only in one borehole and the thickness was 1.7 m. The other boreholes were terminated within this till at depths ranging from 10.2 m to 11.3 m. It is noted that glacial tills inherently contain cobbles and boulders, and were inferred by the refusal 'N' values recorded in some boreholes.

Short term observations indicate that the groundwater levels vary between 2 m and 9 m depths below ground surface. It is noted that groundwater levels are subject to seasonal fluctuations and severe climatic events. These levels are likely to be higher during the wet seasons.

5.0 MISCELLANEOUS

Ms. Rocio Palomeque Reyna, P.Eng. interpreted the available subsurface information and prepared the report. The report was reviewed by Dr. Sydney Pang, P.Eng., and Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.



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PART 2 ENGINEERING DISCUSSION AND RECOMMENDATIONS

6.0 GENERAL

This section of the report presents foundation recommendations for the design of the proposed High-Occupancy Toll (HOT) and High-Occupancy Toll HMS (HOT HMS) sign supports.

This foundation investigation and design report with the interpretation and recommendations are intended for the use of the Ministry of Transportation, and shall not be used or relied upon for any other purposes or by any other parties including the construction contractor. The contractor must make their own interpretation based on the factual data in Part 1 of the report. Where comments are made on construction, they are provided only in order to highlight those aspects which could affect the design of the project. Contractors must make their own interpretation of the factual information provided as it may affect equipment selection, proposed construction methods and scheduling.

This project includes a total of twenty-one (21) HOT and seven (7) HOT HMS signs. The HOT sign will be of the cantilever type supported on one median caisson, while the HOT HMS sign will be supported on one median caisson and one outside caisson.

Information on the proposed locations of the signs was provided to Thurber by SLI. Based on the proposed design layout, selected boreholes drilled during previous investigations and in close proximity to each proposed sign location were used to evaluate the soil and groundwater conditions for foundation design. The Record of Borehole sheets for these boreholes are presented in Appendix A. Tables 1 and 2



immediately following the text of this report indicates the relevant boreholes that are used for the design of the HOT and HOT HMS sign supports.

6.1 Foundation Design Parameters

Design of the sign support foundations should be carried out in accordance with the following document.

- Ministry of Transportation, Ontario (2015) "Sign Support Manual", Highway Standards Branch, Bridge Office (Reference 1).

Reference should also be made to the following documents.

- Ministry of Transportation, Ontario (2004) "Guidelines for the Design of High Mast Pole Foundations", Fourth Edition, BRO-009, Engineering Standards Branch, Bridge Office (Reference 2).
- Canadian Highway Bridge Design Code and Commentary (2010). CAN/CSA-S6-00 and S6.1-00 (Reference 3).

It is understood that a typical HOT sign support consists of a single conventional augered caisson (drilled shaft). Table 1 following the text of this report presents the recommended foundation design parameters for the design of such caissons. For an HOT HMS with two supports, both caissons should be designed using the same set of foundation design parameters as recommended in Table 2.

It is recommended that MTO's standard drawings for the various sign types and other relevant foundation design recommendations in Reference 1 be used as a basis for the sign support designs. The foundation design parameters in Tables 1 and 2 should be used in conjunction with Reference 2 to confirm that the standard designs are adequate.

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.



Where downward sloping fill or native soil exists in front of a caisson, reduction of lateral passive resistance should be taken into consideration during design. For foundation design of the caissons, it should be assumed that full lateral resistance can only be mobilized where the width of the soil in front of or behind the caisson is equal to or greater than approximately four (4) times the diameter of the caissons. For sloping ground in front of a caisson, the magnitude of the mobilized passive resistance can be estimated by interpolating between zero passive resistance at the level where the slope face intersects the pile, and full passive resistance at the level where the slope face is at a horizontal distance equal to or greater than four (4) times the diameter of the caisson.

Where an unconfined compressive strength, q_u , ($q_u = 2 \times C_u$, undrained shear strength) is provided for a cohesive soil (clayey silt to silty clay fill, silty clay till or clayey silt 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 sands and silts, 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 sign. 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.

6.2 Caisson Installation

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

The contract documents should contain an NSSP alerting the contract bidders of the specific aspects relating to caisson construction for HOT and HOT HMS foundation supports at this site. Suggested wordings for this NSSP are provided in Appendix C.

Caisson installation equipment must be able to dislodge, handle, remove cobbles and boulders, to penetrate obstructions within the fill and to drill through hard or very dense layers, where encountered.



The short term groundwater levels were measured to be between 2 m and 9 m depths below existing ground surface. The stabilized groundwater levels may be higher. Soil sloughing and water seepage may occur in unsupported holes especially in sands and silts below the groundwater level. Temporary liners must be available to support the caisson sidewalls and to provide seepage cut-off where required. Any accumulated water may have to be pumped out from the hole prior to placing concrete. Should it be considered impractical to remove the accumulated water inside the hole, it is recommended that the concrete be placed by the tremie method.

6.4 Construction Concerns

Concerns during caisson construction mainly involve the handling and removal of cobbles or boulders, or other obstructions in the fill and till, drilling through hard/very dense soils, soil sloughing and water seepage from caisson sidewalls, and basal instability. 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 OPSS 903) to verify the soil conditions and to confirm that those conditions are consistent with the design assumptions in this report.



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TABLE 1
FOUNDATION DESIGN PARAMETERS
HOT SIGN SUPPORTS
HIGHWAY 400 WIDENING
MAJOR MACKENZIE DRIVE TO KING ROAD
G.W.P. 2539-04-00

HOT Number and Location (Station)	Stationing of HOT Equipment	Reference Borehole	Reference Simplified Subsurface Stratigraphy For Design	Depth Below Existing Ground Surface (m)	Foundation Design Parameters						
					q_u (kPa)	ϕ' (deg.)	n_h (MN/m ³)	K_p	γ (kN/m ³)	γ' (kN/m ³)	Ground water Depth (m)
TS01	18+378	11-02	Sand/Clayey Silt (Fill)	0.2 – 2.3	-	30	3.0	3.0	20	-	4
		11T-01	Clayey Silt Till	2.3 – 5.5	100	-	-	-	19	-	(below existing grade)
		11T-02	Clayey Silt Till	5.5 – 11.0	200	-	-	-	20	-	
TS02	18+936	11-03 OH-01	Sand (Fill)	0.2 – 1.3	-	30	3.0	3.0	20	-	5
			Clayey Silt Till	1.3 – 6.0	100	-	-	-	19	-	(below existing grade)
			Silt and Sand Till	6.0 – 11.0	-	35	7.0	3.7	21	11	
TS03	19+336	11-04	Sand/Clayey Silt (Fill)	0.3 – 3.0	-	30	3.0	3.0	20	-	5
			Sandy Silt	3.0 – 6.0	-	32	4.0	3.2	20	10	(below existing grade)
			Sand	6.0 – 10.0	-	33	5.0	3.4	20	10	
			Silty Clay Till	10.0 – 11.0	200	-	-	-	20	-	
TS04	19+832	11-06	Sand (Fill)	0.3 – 1.6	-	30	3.0	3.0	20	-	5
			Silty Clay	1.6 – 4.5	100	-	-	-	19	-	(below existing grade)
			Silty Clay Till	4.5 – 9.5	200	-	-	-	20	-	
			Sandy Silt Till	9.5 – 11.0	-	35	7.0	3.7	21	11	
TS05	20+511	06-01E 06-02E	Sand/Silty Clay (Fill)	0.0 – 4.2	-	30	3.0	3.0	20	-	5
			Clayey Silt	4.2 – 5.8	100	-	-	-	18	-	(below existing grade)
			Sand	5.8 – 8.7	-	32	4.0	3.2	20	10	
			Silt Till/Sandy Silt	8.7 – 11.0	-	35	7.0	3.7	21	11	

- Notes: 1. This table must be read in conjunction with the text of this report.
2. 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.
3. If new fill is placed, some caissons may be partially embedded within the new fill.

HOT SIGN SUPPORTS

Highway 400 Widening, Major MacKenzie Drive to King Road

HOT Number and Location (Station)	Stationing of HOT Equipment	Reference Borehole	Reference Simplified Subsurface Stratigraphy For Design	Depth Below Existing Ground Surface (m)	Foundation Design Parameters						
					q_u (kPa)	ϕ' (deg.)	n_h (MN/m ³)	K_p	γ (kN/m ³)	γ' (kN/m ³)	Ground water Depth (m)
TS06	21+066	HML-09 11-T05 11-T06	Sand (Fill)	0.2 – 1.3	-	30	3.0	3.0	20	-	5 (below existing grade)
			Silty Clay	1.3 – 3.0	70	-	-	-	18	-	
			Silty Clay Till	3.0 – 7.0	180	-	-	-	19	-	
			Silt to Sandy Silt	7.0 – 11.0	-	32	4.0	3.2	20	10	
TS07	21+527	11-09	Sand (Fill)	0.3 – 1.2	-	30	3.0	3.0	20	-	5 (below existing grade)
			Silty Clay Till	1.2 – 5.0	160	-	-	-	19	-	
			Silty Clay Till	5.0 – 11.0	200	-	-	-	20	-	
TS08	21+747	11-10	Sand (Fill)	0.3 – 1.3	-	30	3.0	3.0	20	-	5 (below existing grade)
			Silty Clay (Fill)	1.3 – 4.0	100	-	-	-	18	-	
			Silty Clay (Fill)	4.0 – 10.0	120	-	-	-	18	-	
			Clayey Silt Till	10.0 – 11.0	200	-	-	-	20	-	
TS09	21+968	11-11	Sand (Fill)	0.3 – 1.6	-	30	3.0	3.0	20	-	5 (below existing grade)
			Silty Clay (Fill)	1.6 – 8.0	150	-	-	-	19	-	
			Clayey Silt Till	8.0 – 11.0	180	-	-	-	19	-	
TS10	22+200	11-12	Sand (Fill)	0.3 – 1.3	-	30	3.0	3.0	20	-	4 (below existing grade)
			Silty Clay Till	1.3 – 5.0	120	-	-	-	18	-	
			Silty Clay Till	5.0 – 11.3	180	-	-	-	19	-	

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3. If new fill is placed, some caissons may be partially embedded within the new fill.

HOT SIGN SUPPORTS

Highway 400 Widening, Major MacKenzie Drive to King Road

HOT Number and Location (Station)	Stationing of HOT Equipment	Reference Borehole	Reference Simplified Subsurface Stratigraphy For Design	Depth Below Existing Ground Surface (m)	Foundation Design Parameters						
					q_u (kPa)	ϕ' (deg.)	n_h (MN/m ³)	Kp	γ (kN/m ³)	γ' (kN/m ³)	Ground water Depth (m)
TS11	22+624	11-13 C16-A C16-B	Sand (Fill) Silty Clay Till	0.3 – 1.3 1.3 – 11.0	- 180	30 -	3.0 -	3.0 -	20 19	- -	4 (below existing grade)
TS12	23+024	C17-A C17-B	Clayey Silt (Fill) Silty Clay Till Sand	0.0 – 0.9 0.9 – 7.0 7.0 – 8.0	50 180 -	- - 33	- - 5.0	- - 3.4	18 19 20	- - 10	3 (below existing grade)
TS13	23+522	11-14	Sand/Clayey Silt (Fill) Silty Clay Till Silty Clay Till	0.3 – 2.5 2.5 – 5.0 5.0 – 11.0	- 150 200	30 - -	3.0 - -	3.0 - -	20 18 20	- - -	5 (below existing grade)
TS14	24+237	11-16	Sand (Fill) Silty Clay (Fill) Clayey Silt Till Silty Clay Till	0.3 – 1.2 1.2 – 4.5 4.5 – 9.0 9.0 – 11.0	- 80 180 160	30 - - -	3.0 - - -	3.0 - - -	20 17 19 19	- - - -	3 (below existing grade)
TS15	10+058	11-17 C20	Sand (Fill) Clayey Silt (Fill) Silty Clay Till	0.3 – 1.3 1.3 – 4.5 4.5 – 11.0	- 80 180	30 - -	3.0 - -	3.0 - -	20 17 19	- - -	4 (below existing grade)
TS16	10+726	11-18 06-20E	Sand (Fill) Sandy Silt Silty Clay Till	0.3 – 1.3 1.3 – 6.0 6.0 – 11.0	- - 200	30 32 -	3.0 4.0 -	3.0 3.2 -	20 20 20	- 10 -	5 (below existing grade)

- Notes: 1. This table must be read in conjunction with the text of this report.
2. 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.
3. If new fill is placed, some caissons may be partially embedded within the new fill.

HOT SIGN SUPPORTS

Highway 400 Widening, Major MacKenzie Drive to King Road

HOT Number and Location (Station)	Stationing of HOT Equipment	Reference Borehole	Reference Simplified Subsurface Stratigraphy For Design	Depth Below Existing Ground Surface (m)	Foundation Design Parameters						
					q_u (kPa)	ϕ' (deg.)	n_h (MN/m ³)	K_P	γ (kN/m ³)	γ' (kN/m ³)	Ground water Depth (m)
TS17	11+216	11-19	Sand (Fill) Clayey Silt (Fill) Sand	0.2 – 1.2 1.2 – 10.0 10.0 – 11.0	- 150 -	30 - 35	3.0 - 7.0	3.0 - 3.7	20 19 21	- - 11	6 (below existing grade)
TS18	11+785	HML-07	Silty Clay Silty Clay Till	0.2 – 2.2 2.2 – 11.0	120 200	- -	- -	- -	18 20	- -	6 (below existing grade)
TS19	12+329	HML-08	Sand (Fill) Silty Clay Silty Clay Till Silty Clay Till	0.2 – 1.3 1.3 – 2.4 2.4 – 4.0 4.0 - 11.0	- 120 170 200	30 - - -	3.0 - - -	3.0 - - -	20 18 19 20	- - - -	4 (below existing grade)
TS20	12+646	11-20	Sand/Clayey Silt (Fill) Silty Clay Till Sandy Silt	0.2 – 2.2 2.2 – 7.5 7.5 – 10.0	- 170 -	30 - 34	3.0 - 5.5	3.0 - 3.5	20 19 20	- - 10	6 (below existing grade)
TS21	12+988	11-21	Sand/Clayey Silt (Fill) Silty Clay Till Sand	0.2 – 2.3 2.3 – 7.5 7.5 – 11.0	- 150 -	30 - 34	3.0 - 5.5	3.0 - 3.5	20 19 20	- - 10	6 (below existing grade)

- Notes: 1. This table must be read in conjunction with the text of this report.
2. 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.
3. If new fill is placed, some caissons may be partially embedded within the new fill.

HOT SIGN SUPPORTS

Highway 400 Widening, Major MacKenzie Drive to King Road

HOT Number and Location (Station)	Stationing of HOT Equipment	Reference Borehole	Reference Simplified Subsurface Stratigraphy For Design	Depth Below Existing Ground Surface (m)	Foundation Design Parameters						
					q_u (kPa)	ϕ' (deg.)	n_h (MN/m ³)	K_p	γ (kN/m ³)	γ' (kN/m ³)	Ground water Depth (m)
All Locations	-	-	New Fill – SSM (see Note 3)	Variable height above ground surface	-	30	3.0	3.0	20	-	Below base of new fill

LEGEND

q_u	=	Unconfined Compressive Strength (= 2 x C_u , undrained shear strength) (kPa)
ϕ'	=	Angle of Internal Friction (degrees)
n_h	=	Coefficient of Horizontal Subgrade Reaction (MN/m ³ or X 10 ³ kN/m ³)
K_p	=	Coefficient of Passive Earth Pressure
γ	=	Soil Unit Weight (kN/m ³)
γ'	=	Submerged Soil Unit Weight (kN/m ³) – to be used only for cohesionless soils below the groundwater table

- Notes: 1. This table must be read in conjunction with the text of this report.
2. 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.
3. If new fill is placed, some caissons may be partially embedded within the new fill.

TABLE 2
FOUNDATION DESIGN PARAMETERS
HOT HMS SIGN SUPPORTS
HIGHWAY 400 WIDENING
MAJOR MACKENZIE DRIVE TO KING ROAD
G.W.P. 2539-04-00

HOT HMS Number and Location (Station)	Stationing of HOT HMS	Reference Borehole	Reference Simplified Subsurface Stratigraphy For Design	Depth Below Existing Ground Surface (m)	Foundation Design Parameters						
					q_u (kPa)	ϕ' (deg.)	n_h (MN/m ³)	K_p	γ (kN/m ³)	γ' (kN/m ³)	Ground water Depth (m)
HMS1	17+565	11-01 (17+900)	Sand (Fill) Clayey Silt Till Clayey Silt Till	0.2 – 1.5 1.5 – 4.0 4.0 – 11.0	- 120 200	30 - -	3.0 - -	3.0 - -	20 19 20	- - -	5 (below existing grade)
HMS2	19+065	OH-01	Sand (Fill) Clayey Silt Till Silt and Sand Till	0.2 – 1.3 1.3 – 8.0 8.0 – 9.0	- 100 -	30 - 35	3.0 - 7.0	3.0 - 3.7	20 19 21	- - 11	5 (below existing grade)
HMS3	21+600	HM-02 11-09	Sand (Fill) Silty Clay Till Silty Clay Till	0.3 – 2.3 2.3 – 5.0 5.0 – 11.0	- 160 200	30 - -	3.0 - -	3.0 - -	20 19 20	- - -	5 (below existing grade)
HMS4	24+310	11-16	Sand (Fill) Silty Clay (Fill) Clayey Silt Till Silty Clay Till	0.3 – 1.2 1.2 – 4.5 4.5 – 9.0 9.0 – 11.0	- 80 150 170	30 - - -	3.0 - - -	3.0 - - -	20 18 20 20	- - - -	3 (below existing grade)

- Notes: 1. This table must be read in conjunction with the text of this report.
2. 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.
3. If new fill is placed, some caissons may be partially embedded within the new fill.

HOT HMS Stations
Highway 400 Widening, Major MacKenzie Drive to King Road

HOT HMS Number and Location (Station)	Stationing of HOT HMS	Reference Borehole	Reference Simplified Subsurface Stratigraphy For Design	Depth Below Existing Ground Surface (m)	Foundation Design Parameters						
					q_u (kPa)	ϕ' (deg.)	n_h (MN/m ³)	K_P	γ (kN/m ³)	γ' (kN/m ³)	Ground water Depth (m)
HMS5	13+350	11-22 (Approx. 13+110)	Sand/Clayey Silt (Fill)	0.2 – 2.4	-	30	3.0	3.0	20	-	4
			Silty Clay Till	2.4 – 7.5	150	-	-	-	19	-	(below existing grade)
			Silts and Sands	7.5 – 11.0	-	32	4.0	3.2	20	10	
HMS6	10+100	11-17 C20	Sand (Fill)	0.3 – 1.3	-	30	3.0	3.0	20	-	5
			Clayey Silt (Fill)	1.3 – 4.5	80	-	-	-	18	-	(below existing grade)
			Silty Clay Till	4.5 – 11.0	180	-	-	-	19	-	
HMS7	22+084	11-11	Sand (Fill)	0.3 – 1.6	-	30	3.0	3.0	20	-	5
			Silty Clay (Fill)	1.6 – 8.0	160	-	-	-	19	-	(below existing grade)
			Clayey Silt Till	8.0 – 11.0	180	-	-	-	20	-	

- Notes: 1. This table must be read in conjunction with the text of this report.
2. 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.
3. If new fill is placed, some caissons may be partially embedded within the new fill.

HOT HMS Number and Location (Station)	Stationing of HOT HMS	Reference Borehole	Reference Simplified Subsurface Stratigraphy For Design	Depth Below Existing Ground Surface (m)	Foundation Design Parameters						
					q_u (kPa)	ϕ' (deg.)	n_h (MN/m ³)	K_p	γ (kN/m ³)	γ' (kN/m ³)	Ground water Depth (m)
All Locations		-	New Fill – SSM (see Note 3)	Variable height above ground surface	-	30	3.0	3.0	20	-	Below base of new fill

LEGEND

q_u	=	Unconfined Compressive Strength (= 2 x C_u , undrained shear strength) (kPa)
ϕ'	=	Angle of Internal Friction (degrees)
n_h	=	Coefficient of Horizontal Subgrade Reaction (MN/m ³ or X 10 ³ kN/m ³)
K_p	=	Coefficient of Passive Earth Pressure
γ	=	Soil Unit Weight (kN/m ³)
γ'	=	Submerged Soil Unit Weight (kN/m ³) – to be used only for cohesionless soils below the groundwater table

- Notes: 1. This table must be read in conjunction with the text of this report.
2. 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.
3. If new fill is placed, some caissons may be partially embedded within the new fill.



Appendix A

Record of Boreholes

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
 Shear Strength Determination by Pocket Penetrometer

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

EXPLANATION OF ROCK LOGGING TERMS


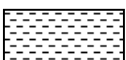

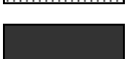

ROCK WEATHERING CLASSIFICATION

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

DISCONTINUITY SPACING

Bedding	Bedding Plane Spacing
Very thickly bedded	Greater than 2m
Thickly bedded	0.6 to 2m
Medium bedded	0.2 to 0.6m
Thinly bedded	60mm to 0.2m
Very thinly bedded	20 to 60mm
Laminated	6 to 20mm
Thinly Laminated	Less than 6mm

SYMBOLS

	CLAYSTONE
	SILTSTONE
	SANDSTONE
	COAL
	BEDROCK

STRENGTH CLASSIFICATION

Rock Strength	Approximate Uniaxial Compressive Strength		Field Estimation of Hardness*
	(MPa)	(psi)	
Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail

TERMS

Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length
Solid Core Recovery:(SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run
Rock Quality Designation:(RQD)	Total length of sound core recovered in pieces 0.1m in length or larger as a % of total core run length.
Uniaxial Compressive Strength (UCS)	Axial stress required to break the specimen
Fracture Index:(FI)	Frequency of natural fractures per 0.3m of core run.

UNIFIED SOILS CLASSIFICATION

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

RECORD OF BOREHOLE No 11-01

1 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 855 902.6 E 300 955.0 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.24 - 2011.01.24 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					WATER CONTENT (%)		
								20 40 60 80 100					20 40 60		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE					w _p w w _L		
227.7															
0.0	ASPHALT: (150mm)														
0.2	SAND, trace to some gravel, trace silt Dense Brown Moist (FILL)		1	GS											
			1	SS	33							10 81 9 (SI+CL)			
226.2															
1.5	Clayey SILT, with sand, trace gravel Stiff to Very Stiff Brown Moist (TILL)		2	SS	14										
			3	SS	8										
			4	SS	15							0 39 48 13			
223.6															
4.1	Becomes hard														
			5	SS	38										
	Becomes grey		6	SS	34										
			7	SS	36										
			8	SS	33							1 25 53 21			

Continued Next Page

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

RECORD OF BOREHOLE No 11-01

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 855 902.6 E 300 955.0 ORIGINATED BY ES
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.01.24 - 2011.01.24 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			20	40					
	Continued From Previous Page													
216.4	Clayey SILT, with sand, trace gravel Stiff to Hard Grey Moist (TILL)		9	SS	29		217							
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN TO 9.7m AND WATER LEVEL AT 5.4m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 9.4m, CUTTINGS TO 0.6m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.													

+³. X³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

METRIC

[illegible]

+ 3, × 3: Numbers refer to Sensitivity

RECORD OF BOREHOLE No 11-02

2 OF 2

METRIC

2539-04-00 LOCATION N 4 856 296.0 E 300 893.8 ORIGINATED BY ES
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.01.24 - 2011.01.24 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			20	40					
	Continued From Previous Page													
218.4	Clayey SILT, with sand, trace gravel Hard Grey (TILL)		9	SS	45		219							
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN TO 10.6m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 9.1m, CUTTINGS TO 1.8m, BENTONITE HOLEPLUG TO 0.4m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.													

+ 3, x 3: Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11T-01

1 OF 2

METRIC

2539-04-00 LOCATION N 4 856 427.7 E 300 851.1 ORIGINATED BY JM
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.11.10 - 2011.11.10 CHECKED BY LPG

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		
231.0	GROUND SURFACE													
0.0	Clayey SILT, some sand, trace gravel, trace roots Stiff Brown Moist (FILL)		1	AS										
			1	SS	12									
229.6														
1.4	Clayey SILT, with sand Stiff Brown Moist (FILL)		2	SS	12									0 23 50 27
228.7														
2.3	Clayey SILT, with sand, trace gravel Very Stiff to Hard Brown Moist (TILL)		3	SS	20									
			4	SS	39									0 29 49 22
			5	SS	100/ 0.275									
			6	SS	100									1 24 54 21
			7	SS	71									
222.4	Silty CLAY, some sand, trace gravel Hard Brown Moist (TILL)		8	SS	52									1 13 59 27

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11T-01

2 OF 2

METRIC

2539-04-00 LOCATION N 4 856 427.7 E 300 851.1 ORIGINATED BY JM
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.11.10 - 2011.11.10 CHECKED BY LPG

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _P	W	W _L		
	Continued From Previous Page																
220.3																	
10.7																	
220.0	SAND, trace silt Very Dense Brown Moist		9	SS	65/	0.150											
11.0	END OF BOREHOLE AT 11.0m. BOREHOLE OPEN TO 11.0m AND DRY. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Dec09/11 10.5 220.5																

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

RECORD OF BOREHOLE No 11T-02

1 OF 2

METRIC

2539-04-00 LOCATION N 4 856 430.7 E 300 875.7 ORIGINATED BY JM
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.11.07 - 2011.11.07 CHECKED BY LPG

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					
231.3	GROUND SURFACE						20	40	60	80	100		
0.0	ASPHALT:(150mm)						20	40	60	80	100		
0.2	SAND and GRAVEL Compact Brown Moist (FILL)		1	AS									
			1	SS	17								
229.6													
1.7	Silty CLAY, occasional sand, occasional gravel Firm Grey Moist (FILL)		2	SS	8								
229.0													
2.3	Silty CLAY, some sand, trace gravel Firm to Stiff Brown Moist (TILL)		3	SS	9								
			4	SS	8								
227.2													
4.1	Clayey SILT, with sand, trace gravel Stiff Brown Moist (TILL)		5	SS	11								
225.7													
5.6	Becoming hard		6	SS	53								
			7	SS	100/ 0.225								
222.9													
8.4	Silty CLAY, some sand, trace gravel Hard Brown Moist (TILL)		8	SS	73								

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11T-02

2 OF 2

METRIC

2539-04-00 LOCATION N 4 856 430.7 E 300 875.7 ORIGINATED BY JM
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.11.07 - 2011.11.07 CHECKED BY LPG

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	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
	Continued From Previous Page													
221.1														
10.2	SAND and SILT, trace clay Very Dense Brown Moist (TILL)		9	SS	50/ 0.075		221							
220.4														
10.9	END OF BOREHOLE AT 10.9m AND WATER LEVEL AT 5.8m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG FROM 10.9m TO 1.5m, CUTTINGS FROM 1.5m TO 0.15m THEN ASPHALT TO SURFACE.													

+³, ×³: Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-03

1 OF 2

METRIC

2539-04-00 LOCATION N 4 856 883.1 E 300 798.1 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.25 - 2011.01.25 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		
236.3	GROUND SURFACE											
0.0	ASPHALT:(200mm)											
0.2	SAND, some gravel		1	GS			236					
235.6	Brown											
0.7	Moist (FILL)											
235.0	SAND, fine grained, trace gravel		1	SS	35		235					
1.3	Dense											
	Brown											
	Moist (FILL)											
	Clayey SILT, with sand, trace gravel		2	SS	9		234					
	Stiff to Very Stiff											
	Brown											
	Moist (TILL)		3	SS	10		233					
			4	SS	21							
232.2	Hard						232					
4.1			5	SS	50/ 150		231					
230.8							230					
5.5							229					
230.2	SILT and SAND, some clay, trace gravel		6	SS	85		228					
6.1	Very Dense						227					
	Brown											
	Moist (TILL)											
228.6			7	SS	81/ 0.280							
228.6	SAND, some silt and clay											
7.9			8	SS	50/ 150							

Continued Next Page

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

RECORD OF BOREHOLE No 11-03

2 OF 2

METRIC

2539-04-00 LOCATION N 4 856 883.1 E 300 798.1 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.25 - 2011.01.25 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _P	W	W _L		
	Continued From Previous Page																
225.2	SILT and SAND, trace clay, trace gravel Very Dense Brown Moist (TILL)		9	SS	75		225									0 63 35 2	
11.1	END OF BOREHOLE AT 11.1m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 9.8m, CUTTINGS TO 0.9m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.																

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

RECORD OF BOREHOLE No OH-1

1 OF 2

METRIC

G.W.P. _____ LOCATION Hwy 400 / Teston Road, N 4 857 004, E 300 750 ORIGINATED BY TK
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY SL/SS
 DATUM Geodetic DATE 20.07.04 - 20.07.04 CHECKED BY MA

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		
236.3	Clayey, Sandy SILT, some organics, trace gravel Very Stiff Dark Brown		1	SS	23		236							
234.8	Clayey, Sandy SILT, trace gravel, occasional cobbles Stiff Brown (TILL)(ML)		2	SS	8		235							
1.5	becoming Hard		3	SS	50/ .127		234							
			4	SS	50/ .127		233							
			5	SS	50/ .127		232							
			6	SS	50/ .127		231							
			7	SS	50/ .127		230							
228.6	Sandy SILT, fine grained Very Dense Brown (ML-NONPLASTIC)						229							
7.8							228							
227.1	END OF BOREHOLE AT 9.3 m. BOREHOLE DRY AND OPEN TO 9.1m. BOREHOLE BACKFILLED WITH													

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

ONTMT4 5156A.GPJ 18/08/04

RECORD OF BOREHOLE No OH-1

2 OF 2

METRIC

G.W.P. _____ LOCATION Hwy 400 / Teston Road, N 4 857 004, E 300 750
 HWY 400 BOREHOLE TYPE Solid Stem Augers
 DATUM Geodetic DATE 20.07.04 - 20.07.04

ORIGINATED BY TK
 COMPILED BY SL/SS
 CHECKED BY MA

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
	BENSEAL.																

ONTMT4 5166A.GPJ 18/09/04

RECORD OF BOREHOLE No 11-04

1 OF 2

METRIC

2539-04-00 LOCATION N 4 857 283.8 E 300 730.0 ORIGINATED BY ES
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.01.25 - 2011.01.25 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		
240.6	GROUND SURFACE												
0.0 240.3	ASPHALT:(250mm)												
0.3 240.0	SAND, some gravel Brown Moist (FILL)		1	GS			240						
0.6 239.4	SAND, fine grained, trace gravel Compact Brown Moist (FILL)		1	SS	11		239						
1.2 237.7	Clayey SILT, some sand, trace gravel Firm to Stiff Brown Moist (FILL)		2	SS	9		238						
			3	SS	7		237						
2.9	Sandy SILT, some clay, trace gravel Dense to Very Dense Brown Moist		4	SS	30		236						0 20 65 15
			5	SS	55		235						
							234						
6.1 234.5	SAND, fine grained, some silt, trace clay Dense to Very Dense Brown Moist to Wet		6	SS	50		233						0 85 14 1
			7	SS	32		232						
			8	SS	57		231						
230.7													

Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-04

2 OF 2

METRIC

2539-04-00 LOCATION N 4 857 283.8 E 300 730.0 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.25 - 2011.01.25 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		
	Continued From Previous Page						SHEAR STRENGTH kPa						
							○ UNCONFINED + FIELD VANE						
							● QUICK TRIAXIAL x LAB VANE						
							20	40	60	80	100		
							WATER CONTENT (%)						
							20	40	60				
9.9	Silty CLAY, with sand, trace gravel Hard Grey Moist (TILL)												
229.3			9	SS	72	230							0 21 48 31
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND WATER LEVEL AT 6.7m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 9.7m, CUTTINGS TO 0.6m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.												

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

METRIC

[illegible]

+ 3, × 3: Numbers refer to Sensitivity

ONTMT4S 9268.GPJ 2015TEMPLATE(MTO).GDT 11/18/16

RECORD OF BOREHOLE No 11-06

2 OF 2

METRIC

2539-04-00 LOCATION N 4 857 877.7 E 300 623.8 ORIGINATED BY ES
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.01.25 - 2011.01.25 CHECKED BY SKP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
	Continued From Previous Page																
233.0	Sandy SILT, trace gravel Brown Moist (TILL)		9	SS	50/ .150		233										
10.8	END OF BOREHOLE AT 10.8m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 9.4m, CUTTINGS TO 0.9m, BENTONITE HOLEPLUG TO 0.6m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.																

ONTWT4S 9268.GPJ 2015TEMPLATE(MTO).GDT 11/18/16

+³, ×³: Numbers refer to Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 06-01E

2 OF 2

METRIC

2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 858 436.64 E 300 547.79 ORIGINATED BY SLL
 HWY 400 BOREHOLE TYPE Solid Stem Auger COMPILED BY MFA
 DATUM Geodetic DATE 2006.12.13 - 2006.12.13 CHECKED BY TJH

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	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
	Continued From Previous Page													
227.8	Silty CLAY, some sand, trace gravel Hard						228							
10.3	SAND, with silt Very Dense Grey Wet		10	SS	50/									
227.1														
11.0	END OF BOREHOLE AT 11.0 m. BOREHOLE OPEN TO 10.31 m AND DRY UPON COMPLETION. BOREHOLE GROUTED WITH BENTONITE TO SURFACE.													

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 06-02E

1 OF 2

METRIC

2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 858 509.65 E 300 536.45 ORIGINATED BY SLL
HWY 400 BOREHOLE TYPE Solid Stem Auger COMPILED BY MFA
DATUM Geodetic DATE 2006.12.12 - 2006.12.13 CHECKED BY TJH

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		
236.9	GROUND SURFACE												
0.0	Silty SAND, trace gravel Loose Brown Moist (FILL)		1	SS	8								
236.3													
0.7	Silty CLAY, with sand Stiff Brown Moist (FILL)		2	SS	11		236						1 23 51 25
			3	SS	13		235						
234.7													
2.2	Silty CLAY, some sand, trace gravel Stiff Brown Moist (FILL)		4	SS	12		234						
			5	SS	13		233						
232.7													
4.2	Clayey SILT, with sand, trace rootlets and wood fragments, stained topsoil Stiff Grey Moist		6	SS	9		232						0 23 61 16
231.1													
5.8	SAND, some silt, some gravel Compact Brown Wet (saturated)		7	SS	18		231						
							230						
			8	SS	30		229						
228.3													
8.7	SILT, with sand, trace gravel Very Dense Grey Moist (TILL)		9	SS	70		228						
							227						

Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 06-02E

2 OF 2

METRIC

2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 858 509.65 E 300 536.45 ORIGINATED BY SLL
HWY 400 BOREHOLE TYPE Solid Stem Auger COMPILED BY MFA
DATUM Geodetic DATE 2006.12.12 - 2006.12.13 CHECKED BY TJH

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
							20	40	60	80	100	20	40	60			
Continued From Previous Page																	
226.6	SILT, with sand, trace gravel Very Dense (TILL)																
10.4	Sandy SILT, trace clay Very Dense Grey Moist		10	SS	75		226										
225.7																	
11.3	END OF BOREHOLE AT 11.28 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) 20.02.07 8.9 228.0 27.03.07 8.8 228.1																

+³, ×³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11T-05

1 OF 2

METRIC

2539-04-00 LOCATION N 4 858 839.4 E 300 428.7 ORIGINATED BY RK
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.10.19 - 2011.10.19 CHECKED BY LPG

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	20 40 60 80 100		
235.4	GROUND SURFACE												
0.0	TOPSOIL, some sand, some rootlets: (50mm) Dark Brown Moist		1	SS	9		235						
	Sandy SILT, some clay, trace rootlets Loose to Compact Brown Wet		2	SS	10		234						
			3	SS	8		233						0 34 51 15
			4	SS	28		232						
232.5	Some gravel						231						
3.0	Clayey SILT		5	SS	23		230						0 24 54 22
231.7			6	SS	29		229						
3.7			7	SS	5		228						
	Becoming grey Wet						227						
229.3			8	SS	34		226						51 42
6.1	SAND and SILT, trace clay Dense Grey Wet (TILL)		9	SS	100								
228.2	Sandy SILT, trace gravel, trace clay, occasional sand seam Very Dense Grey Wet (TILL)		10	SS	114								
7.2													

Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11T-05

2 OF 2

METRIC

2539-04-00 LOCATION N 4 858 839.4 E 300 428.7 ORIGINATED BY RK
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.10.19 - 2011.10.19 CHECKED BY LPG

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			20	40	60	80	100					
	Continued From Previous Page																
224.2			11	SS	45		225									0 26 65 9	
11.3	END OF BOREHOLE AT 11.3m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Dec09/11 6.2 229.2																

ONTMT4S 9268.GPJ 2015TEMPLATE(MTO).GDT 11/18/16

RECORD OF BOREHOLE No 11T-06

1 OF 2

METRIC

2539-04-00 LOCATION N 4 858 845.2 E 300 463.2 ORIGINATED BY JM
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.11.08 - 2011.11.08 CHECKED BY LPG

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 (%)			
																		w _p	w	w _L
241.5	GROUND SURFACE							20	40	60	80	100					GR SA SI CL			
0.0	ASPHALT:(200mm)							20	40	60	80	100								
0.2	SAND and GRAVEL Compact Brown Moist (FILL)		1	AS			241													
240.2			1	SS	16															
1.3	Clayey SILT, some sand, trace gravel Very Stiff to Hard Brown Moist (TILL)		2	SS	17		240										0 20 55 25			
			3	SS	25		239													
			4	SS	48		238													
			5	SS	64		237										1 14 63 22			
235.9							236													
5.6	SILT, some sand, trace gravel, trace clay Dense to Very Dense Brown Moist (TILL)		6	SS	48		235													
	Becoming wet		7	SS	61		234										0 12 82 6			
			8	SS	47		233													
							232													

Continued Next Page

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

RECORD OF BOREHOLE No 11T-06

2 OF 2

METRIC

2539-04-00 LOCATION N 4 858 845.2 E 300 463.2 ORIGINATED BY JM
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.11.08 - 2011.11.08 CHECKED BY LPG

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT Y kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20	40	60	80	100	W _P	W	W _L		
	Continued From Previous Page															
231.3																
10.2	Clayey SILT, with sand, trace gravel Hard Grey Moist (TILL)		9	SS	71	231										2 21 53 24
230.2																
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN TO 11.3m AND DRY. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG FROM 11.3m TO 1.5m, CUTTINGS FROM 1.5m TO 0.2m THEN ASPHALT TO SURFACE.															

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HML-9

1 OF 2

METRIC

G.W.P. 2539-04-00

LOCATION

Major Mackenzie Drive to N of Teston Road N 4 859 107.83 E 300 393.68

ORIGINATED BY SLL

HWY 400

BOREHOLE TYPE

Solid Stem Augers

COMPILED BY ES

DATUM Geodetic

DATE

2007.11.19 - 2007.11.19

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 (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								20 40 60 80 100					
								20 40 60 80 100					
246.3													
0.0	ASPHALT: (165mm)												
0.2	SAND, trace silt Compact Brown Moist (FILL)		1	AS		246							
245.1			1	SS	11								
1.3	Silty CLAY, some sand, topsoil stained, trace sand seams, trace rootlets Stiff to Firm Dark Brown Moist		2	SS	9	245							
			3	SS	6	244							
243.4												0 22 53 24	
3.0	Silty CLAY, some sand, trace gravel Very Stiff to Hard Brown Moist (TILL)		4	SS	27	243							
			5	SS	41	242							
												0 17 52 30	
	thin sand seams		6	SS	35	240							
239.1													
7.2	SILT, some sand, trace clay Compact Grey Wet		7	SS	20	239							
238.4													
7.9	Silty CLAY, stratified Very Stiff Grey Moist												
237.9													
8.5	Silty CLAY, some sand, trace gravel Hard Grey Moist (TILL)					238							
236.8			8	SS	92/ 275	237							
9.5	Sandy SILT, trace clay Very Dense Brown												

Continued Next Page

+³, X³: Numbers refer to
Sensitivity

20
15-5
10 (%) STRAIN AT FAILURE

ONTMT4S 9268.GPJ 3/29/10

RECORD OF BOREHOLE No HML-9

2 OF 2

METRIC

G.W.P. 2539-04-00 LOCATION Major Mackenzie Drive to N of Teston Road N 4 859 107.83 E 300 393.68 ORIGINATED BY SLL
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
 DATUM Geodetic DATE 2007.11.19 - 2007.11.19 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 (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
	Continued From Previous Page							SHEAR STRENGTH kPa						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE						
								WATER CONTENT (%)						
								20	40	60	80	100		
235.1	Sandy SILT, trace clay Very Dense Brown Moist		9	SS	50		236							0 29 66 6
11.3	END OF BOREHOLE AT 11.28m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 150mm THEN CONCRETE TO SURFACE. Piezometer installation consists of 30mm diameter schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2008.01.31 COULD NOT BE LOCATED (PRESUMED DESTROYED)													

+³, X³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

METRIC

ORIGINATED BY TK

COMPILED BY SL/SS

CHECKED BY SMS

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity

RECORD OF BOREHOLE No HM-2

2 OF 2

METRIC

G.W.P. _____ LOCATION Hwy 400 / Teston Road, N 4 859 416, E 300 343 ORIGINATED BY TK
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY SU/SS
 DATUM Geodetic DATE 2004.07.19 - 2004.07.19 CHECKED BY SMS

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			20 40 60 80 100	20 40 60 80 100					
250.0														
239.3														
10.7	SAND, trace silt Very Dense Grey Wet (SP)		8	SS	92		239							
238.9														
11.1	END OF BOREHOLE AT 11.1 m. Piezometer installation consists of 19 mm diameter Schedule 40 PVC pipe with a 1.52 m slotted screen. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 2004.08.05 10.7 239.3													

+³, X³: Numbers refer to
Sensitivity

20
15
10
5
0
5
10
15
20
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-09

1 OF 2

METRIC

2539-04-00 LOCATION N 4 859 400.1 E 300 368.3 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.26 - 2011.01.26 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		
249.4	GROUND SURFACE											
0.0 249.1	ASPHALT:(250mm)											
0.3 248.8	SAND, some gravel Brown Moist (FILL)		1	GS			249					
0.6 248.2	SAND, fine grained Compact Brown Moist (FILL)		1	SS	11		248					
1.2	Silty CLAY, with sand, trace gravel Very Stiff to Hard Brown Moist (TILL)		2	SS	28		247					
			3	SS	19							0 23 55 22
			4	SS	28		246					
							245					
			5	SS	34							
							244					
243.3												
6.1 242.8	SILT and SAND, trace gravel Very Dense Grey Moist		6	SS	50/ 150		243					
6.6	Becomes grey						242					
			7	SS	32		241					
							240					0 25 47 28
			8	SS	60							

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Continued Next Page

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

RECORD OF BOREHOLE No 11-09

2 OF 2

METRIC

2539-04-00 LOCATION N 4 859 400.1 E 300 368.3 ORIGINATED BY ES
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.01.26 - 2011.01.26 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		
	Continued From Previous Page							SHEAR STRENGTH kPa						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
								WATER CONTENT (%)						
								20	40	60	80	100		
238.1			9	SS	58		239							
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 9.7m, CUTTINGS TO 0.9m, BENTONITE HOLEPLUG TO 0.4m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.													

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-10

1 OF 2

METRIC

2539-04-00 LOCATION N 4 859 723.2 E 300 313.0 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.27 - 2011.01.27 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		
251.0	GROUND SURFACE											
0.0	ASPHALT:(250mm)											
250.7												
0.3	SAND, some gravel		1	GS								
250.3	Brown											
0.7	Moist											
	(FILL)											
	SAND, fine grained		1	SS	17		250					
249.7	Compact											
1.3	Brown											
	Moist											
	(FILL)											
	Silty CLAY, with sand, trace gravel		2	SS	7		249					
	Firm to Very Stiff											
	Brown											
	(FILL)											
			3	SS	11		248					
			4	SS	9		247					
			5	SS	17		246					
			6	SS	12		245					
			7	SS	12		244					
			8	SS	28		243					
							242					
	Becomes grey											
							241					

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-10

2 OF 2

METRIC

2539-04-00 LOCATION N 4 859 723.2 E 300 313.0 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.27 - 2011.01.27 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		
	Continued From Previous Page							SHEAR STRENGTH kPa						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						
								WATER CONTENT (%)						
								20	40	60	80	100		
								PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT				
								W _p	W	W _L				
240.9														
10.1	Clayey SILT, with sand, trace gravel Hard Grey (TILL)		9	SS	41		240							0 32 50 18
239.7														
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 9.7m, CUTTINGS TO 0.9m, BENTONITE HOLEPLUG TO 0.4m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.													

+ 3, x 3 : Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-11

1 OF 2

METRIC

2539-04-00 LOCATION N 4 859 889.9 E 300 284.5 ORIGINATED BY ES
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.01.27 - 2011.01.27 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	20 40 60 80 100	20 40 60		
252.0	GROUND SURFACE											
0.0 251.7	ASPHALT:(250mm)											
0.3	SAND, some gravel Brown Moist (FILL)		1	GS								
251.3 0.7	SAND, fine grained, trace gravel Dense Brown Moist (FILL)		1	SS	33		251					
250.4 1.6	Silty CLAY, trace gravel Very Stiff to Hard Brown Moist (FILL)		2	SS	16		250					
			3	SS	29		249					
			4	SS	32		248					
			5	SS	77		247					
			6	SS	33		246					
			7	SS	30		245					
243.9 8.1	Clayey SILT, with sand, trace gravel Very Stiff Grey Moist (TILL)		8	SS	19		244					
							243					

Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-11

2 OF 2

METRIC

2539-04-00 LOCATION N 4 859 889.9 E 300 284.5 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.27 - 2011.01.27 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 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	W _P	W	W _L		
	Continued From Previous Page																
	Clayey SILT, with sand, trace gravel Hard Grey Moist (TILL)		9	SS	61												
240.7 11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 10.0m, CUTTINGS TO 0.9m, BENTONITE HOLEPLUG TO 0.4m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.																

ONTMT4S 9268.GPJ 2015TEMPLATE(MTO).GDT 11/18/16

RECORD OF BOREHOLE No 11-12

1 OF 2

METRIC

2539-04-00 LOCATION N 4 860 215.2 E 300 224.2 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.27 - 2011.01.27 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		
255.2	GROUND SURFACE											
0.0	ASPHALT:(280mm)											
254.9												
0.3	SAND, some gravel Brown Moist (FILL)		1	GS			255					
254.5												
0.7	SAND, fine grained, trace gravel Compact Brown Moist (FILL)		1	SS	21		254					
253.9												
1.3	Silty CLAY, with sand, trace gravel Stiff to Hard Brown (TILL)		2	SS	10		253					
			3	SS	14							
			4	SS	18		252					1 24 52 23
							251					
	Becomes grey		5	SS	17		250					
							249					
			6	SS	27							
							248					
			7	SS	34		247					
							246					0 16 55 29
	Hard		8	SS	67							

Continued Next Page

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

RECORD OF BOREHOLE No 11-12

2 OF 2

METRIC

2539-04-00 LOCATION N 4 860 215.2 E 300 224.2 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.27 - 2011.01.27 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 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	W _P	W	W _L		
	Continued From Previous Page																
243.9	Silty CLAY, with sand, trace gravel Very Stiff Grey (TILL)		9	SS	26												
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND WATER LEVEL AT 7.9m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 10.0m, CUTTINGS TO 0.9m, BENTONITE HOLEPLUG TO 0.4m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.																

ONTM74S 9288.GPJ 2015TEMPLATE(MTO).GDT 11/18/16

RECORD OF BOREHOLE No 11-13

1 OF 2

METRIC

2539-04-00 LOCATION N 4 860 470.9 E 300 180.5 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.28 - 2011.01.28 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		
257.6	GROUND SURFACE												
0.0 257.3	ASPHALT:(250mm)												
0.3 256.9	SAND, some gravel Brown Moist (FILL)		1	GS			257						
0.6 256.3	SAND, some silt, trace gravel Compact Brown (FILL)		1	SS	18		256						0 88 12 (SI+CL)
1.3	Silty CLAY, trace to some sand, trace gravel Very Stiff to Hard Brown Moist (TILL)		2	SS	20		255						
	Occasional sand seams, occasional oxide staining		3	SS	36		254						0 19 54 27
			4	SS	31		253						
			5	SS	22		252						
	Becomes grey		6	SS	22		251						
			7	SS	38		250						
			8	SS	22		249						
							248						9 35

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity


20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-13

2 OF 2

METRIC

2539-04-00 LOCATION N 4 860 470.9 E 300 180.5 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.28 - 2011.01.28 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			20	40	60	80	100					
	Continued From Previous Page																
246.3	Silty CLAY, trace to some sand, trace gravel Hard Grey Moist (TILL) 200mm sandy silt layer at 10.6m		9	SS	35		247										
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND WATER LEVEL AT 8.5m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 9.4m, CUTTINGS TO 0.9m, BENTONITE HOLEPLUG TO 0.4m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.																

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

RECORD OF BOREHOLE No C-16A

1 OF 1

METRIC

2539-04-00 LOCATION N 4 860 492.9 E 300 211.0 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.03.21 - 2011.03.21 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		
258.2	GROUND SURFACE													
0.0 0.1	TOPSOIL: (75mm)													
	Clayey SILT, some sand, trace gravel, trace organics Firm Brown Moist		1	SS	7		258							
257.1														
1.0	Clayey SILT, some sand, trace gravel Stiff to Very Stiff Brown Moist (TILL)		2	SS	10		257							
	Mottled Brown/Grey		3	SS	18									0 27 59 14
	Occasional sand seams		4	SS	17		256							
255.2														
3.0	Hard		5	SS	31		255							
254.0														
4.1	Silty CLAY, some sand, trace gravel Hard Brown Moist (TILL)		6	SS	61		254							0 14 60 26
	Occasional sand seams, occasional oxide staining						253							
			7	SS	64		252							
251.1														
7.0	SILT and SAND, trace clay, trace gravel Very Dense Grey Moist		8	SS	52		251							1 34 56 9
250.1														
8.1	END OF BOREHOLE AT 8.1m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.													
	WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Oct.05/11 5.0 253.2													

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No C-16B

1 OF 1

METRIC

2539-04-00 LOCATION N 4 860 480.3 E 300 154.3 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers (Mini Moe) COMPILED BY AN
 DATUM Geodetic DATE 2011.03.18 - 2011.03.18 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		
255.5	GROUND SURFACE													
0.8	TOPSOIL: (25mm)													
	Clayey SILT, some sand, occasional wood fibres Firm to Very Stiff Dark Brown to Brown Moist		1	SS	5		255							
			2	SS	20									
254.0							254							
1.4	Silty CLAY, some sand, trace gravel, occasional oxide staining Stiff to very stiff Brown Moist (TILL)		3	SS	14									
			4	SS	26		253							
252.5														
3.0	Occasional sand seams Hard		5	SS	51		252							
							251							
	Becomes Grey		6	SS	48									
							250							
			7	SS	57		249							
			8	SS	45		248							
247.4														
8.1	END OF BOREHOLE AT 8.1m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Oct.05/11 2.2 253.3													

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+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No C-17A

1 OF 1

METRIC

2539-04-00 LOCATION N 4 860 941.6 E 300 132.9 ORIGINATED BY SLL
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2010.12.16 - 2010.12.16 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		
260.4	GROUND SURFACE													
0.0	TOPSOIL: (150mm)													
0.2	Clayey SILT, topsoil stained with rootlets, occasional sand pockets Firm to Hard Brown Moist		1	SS	6		260							
			2	SS	11									
			3	SS	35		259							
258.3														
2.2	Silty CLAY, some sand, trace gravel Hard Brown Moist (TILL)		4	SS	63		258							0 13 55 32
			5	SS	60		257							
			6	SS	50		256							
	Becomes grey		7	SS	37		255							
			8	SS	30		254							0 20 48 32
	Occasional silty sand seams						253							
252.2	END OF BOREHOLE AT 8.2m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 2.4m, THEN CUTTINGS TO SURFACE.													
8.2														

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

RECORD OF BOREHOLE No C-17B

1 OF 1

METRIC

2539-04-00 LOCATION N 4 860 927.5 E 300 072.3 ORIGINATED BY ES
HWY 400 BOREHOLE TYPE Solid Stem Augers (Mini Moe) COMPILED BY AN
DATUM Geodetic DATE 2011.03.21 - 2011.03.21 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		
258.4	GROUND SURFACE													
0.0	TOPSOIL: (50mm)													
	Clayey SILT, some sand, trace roots		1	SS	4		258							
	Firm													
	Dark Brown to Brown													
257.5	Moist													
0.9	Silty CLAY, some sand, trace gravel,		2	SS	17		257							0 21 50 29
	occasional sand pockets													
	Very Stiff to Hard													
	Brown to Grey													
	Moist													
	(TILL)													
			3	SS	23		256							
			4	SS	38		255							
			5	SS	47		254							
			6	SS	34		253							0 13 53 34
			7	SS	24		252							
251.2							251							
7.2	SAND, fine grained													
	Compact													
	Grey													
	Moist													
			8	SS	28									
250.1														
8.2	END OF BOREHOLE AT 8.2m.													
	Piezometer installation consists of													
	19mm diameter Schedule 40 PVC pipe													
	with a 1.52m slotted screen.													
	WATER LEVEL READINGS:													
	DATE DEPTH (m) ELEV. (m)													
	Oct.05/11 3.4 255.0													

ONTMT4S 9268.GPJ 2015TEMPLATE(MTO).GDT 11/18/16

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

RECORD OF BOREHOLE No 11-14

1 OF 2

METRIC

2539-04-00 LOCATION N 4 861 542.3 E 299 997.5 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.31 - 2011.03.31 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 w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	
271.6	GROUND SURFACE											
0.0	ASPHALT:(280mm)											
271.3												
0.3	SAND, some gravel		1	GS								
270.9	Dark Brown											
0.6	Moist (FILL)											
	SAND, trace gravel		1	SS	24							
	Compact											
	Brown											
270.0	Moist											
1.6	(FILL)											
	Clayey SILT, some sand, trace gravel		2	SS	9							
	Stiff											
	Brown to Dark Brown											
269.1	(FILL)											
2.5	Silty CLAY, with sand, trace gravel		3	SS	13							
	Stiff to Hard											
	Brown											
	Moist											
	(TILL)		4	SS	19							1 23 49 27
			5	SS	27							
			6	SS	34							
	Becomes grey											
			7	SS	26							
			8	SS	36							1 14 44 41

Continued Next Page

+³ ×³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-14

2 OF 2

METRIC

2539-04-00 LOCATION N 4 861 542.3 E 299 997.5 ORIGINATED BY ES
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.01.31 - 2011.03.31 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	20	40	60	80					
	Continued From Previous Page															
260.3	Silty CLAY, with sand, trace gravel Hard Grey Moist (TILL)		9	SS	49	261										
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND WATER LEVEL AT 8.8m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 9.9m, CUTTINGS TO 0.4m, BENTONITE HOLEPLUG TO 0.1m, THEN ASPHALT TO SURFACE.															

RECORD OF BOREHOLE No 11-16

1 OF 2

METRIC

2539-04-00 LOCATION N 4 862 124.3 E 299 902.5 ORIGINATED BY ES
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.01.28 - 2011.01.28 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	20 40 60 80 100		
274.5	GROUND SURFACE												
0.0	ASPHALT:(280mm)												
274.2													
0.3	SAND, some gravel		1	GS									
273.9	Brown												
0.7	Moist												
	(FILL)												
273.3	SAND, trace gravel		1	SS	26								
1.2	Compact												
	Brown												
	Moist												
	(FILL)												
	Silty CLAY, with sand, trace gravel		2	SS	16								
	Very Stiff to Firm												
	Brown												
	(FILL)												
	Becomes grey												
			3	SS	14								
	Occasional roots and rootlets		4	SS	7								
270.3													
4.3	Clayey SILT, with sand, trace gravel,												
	occasional clay seams												
	Stiff to Hard												
	Brown		5	SS	14								
	Moist												
	(TILL)												
			6	SS	39								
	Occasional oxide staining												
			7	SS	47								
	Becomes grey												
265.4													
9.1	Silty CLAY, trace sand, trace gravel		8	SS	18								
	Very Stiff												
	Grey												
	Moist												
	(TILL)												

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-16

2 OF 2

METRIC

2539-04-00 LOCATION N 4 862 124.3 E 299 902.5 ORIGINATED BY ES
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.01.28 - 2011.01.28 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	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
	Continued From Previous Page													
263.3	Silty CLAY, trace sand, trace gravel Very Stiff Grey Moist (TILL)		9	SS	21		264							
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND WATER LEVEL AT 3.6m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 10.0m, CUTTINGS TO 0.9m, BENTONITE HOLEPLUG TO 0.4m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.													

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-17

1 OF 2

METRIC

2539-04-00 LOCATION N 4 862 616.7 E 299 818.6 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.31 - 2011.01.31 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		
280.4	GROUND SURFACE											
0.0 280.2	ASPHALT:(250mm)											
0.3	SAND, some gravel Brown Moist (FILL)		1	GS			280					
279.8 0.7	SAND, trace gravel Compact Brown Moist (FILL)		1	SS	24		279					
279.1 1.3	Clayey SILT, some sand, trace gravel Stiff to Firm Brown Moist (FILL)		2	SS	14		278					
			3	SS	8		277					
			4	SS	7		276					
276.0 4.4	Silty CLAY, with sand, trace gravel Very Stiff to Hard Brown Moist (TILL)		5	SS	30		275					
			6	SS	27		274					
			7	SS	25		273					
	Becomes grey		8	SS	24		272					
							271					

Continued Next Page

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

RECORD OF BOREHOLE No 11-17

2 OF 2

METRIC

2539-04-00 LOCATION N 4 862 816.7 E 299 818.6 ORIGINATED BY ES
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.01.31 - 2011.01.31 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	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40						60	80	100	20
	Continued From Previous Page																	
269.1	Silty CLAY , with sand, trace gravel Hard Grey Moist (TILL)		9	SS	39		270											
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND WATER LEVEL AT 5.1m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 9.7m, CUTTINGS TO 0.9m, BENTONITE HOLEPLUG TO 0.4m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.																	

ONTMT4S 9268.GPJ 2015TEMPLATE(MTO).GDT 11/18/16

+ ³, × ³: Numbers refer to
Sensitivity

20
15
10
5
0
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No C-20

1 OF 1

METRIC

2539-04-00 LOCATION N 4 862 554,4 E 299 795.3 ORIGINATED BY SLL
 HWY 400 BOREHOLE TYPE Solid Stem Augers (Mini Moe) COMPILED BY AN
 DATUM Geodetic DATE 2011.03.17 - 2011.03.17 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		
277.1	GROUND SURFACE													
0.0	Clayey SILT, some sand, trace gravel, trace roots Stiff Brown Moist		1	SS	13		277							
	Brown to Dark Brown		2	SS	0		276							
275.5														
1.6	Silty CLAY, some sand, trace gravel Very Stiff to Hard Mottled Brown/Grey Moist (TILL)		3	SS	16		275							
			4	SS	25		274							
			5	SS	33		273							
			6	SS	36		272							
			7	SS	35		271							
			8	SS	34		270							
268.9							269							
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE DRY UPON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Oct.05/11 2.8 274.3													

ONTMT4S 9288.GPJ 2015TEMPLATE(MTO).GDT 11/18/16

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

RECORD OF BOREHOLE No 11-18

1 OF 2

METRIC

2539-04-00 LOCATION N 4 863 126.1 E 299 731.1 ORIGINATED BY ES
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.01.31 - 2011.01.31 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		
277.1	GROUND SURFACE											
0.0 276.9	ASPHALT: (250mm)						277					
0.3 276.5	SAND, some gravel Brown Moist (FILL)		1	GS								
0.6 275.8	SAND, trace gravel Dense Brown Moist (FILL)		1	SS	38		276					
1.3	Silty CLAY, some sand, trace gravel Stiff to Very Stiff Brown Moist (TILL)		2	SS	19		275					
			3	SS	11							0 16 46 38
	Occasional oxide staining		4	SS	26		274					
			5	SS	19		273					
							272					
271.0 6.1	SAND, fine grained, some silt, trace clay, occasional oxide staining		6	SS	21		271					0 78 20 2
270.6 6.6	Compact Brown Moist						270					
			7	SS	23		269					
			8	SS	43		268					0 27 53 20

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-18

2 OF 2

METRIC

2539-04-00 LOCATION N 4 863 126.1 E 299 731.1 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.01.31 - 2011.01.31 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	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
	Continued From Previous Page													
266.2	Silty CLAY, with sand, trace gravel Hard Grey Moist (TILL)		9	SS	55/ 150		267							
11.0	END OF BOREHOLE AT 11.0m. BOREHOLE OPEN AND WATER LEVEL AT 4.5m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 9.7m, CUTTINGS TO 0.3m, HOLEPLUG TO 0.1m, THEN ASPHALT TO SURFACE.													

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RECORD OF BOREHOLE No 06-20E

1 OF 1

METRIC

2539-04-00 LOCATION Hwy 400, Teston Road to King Road N 4 863 242.19 E 299 738.77 ORIGINATED BY SLL
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY WM
DATUM Geodetic DATE 2007.01.11 - 2007.01.11 CHECKED BY TJH

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	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
271.5	GROUND SURFACE													
0.0	TOPSOIL: (125 mm)													
0.1	Silty CLAY, trace gravel, trace roots Firm to Stiff Dark Brown Moist (FILL)		1	SS	7		271							
			2	SS	9									
270.1							270							
1.4	Clayey SILT, some sand, trace gravel Firm to Stiff Brown Moist to Wet		3	SS	8									
269.3														
2.2	Sandy SILT, some clay Compact Brown Moist to Wet		4	SS	22		269							
			5	SS	22		268							
							267							
			6	SS	21									
							266							
265.7														
5.8	Silty CLAY, some sand, trace gravel Hard Grey Moist (TILL)(CL)		7	SS	47		265							
264.8														
6.7	END OF BOREHOLE AT 6.71 m. BOREHOLE OPEN TO 2.44 m UPON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO SURFACE. WATER LEVEL READINGS: DATE DEPTH(m) ELEV.(m) 11.01.07 2.1 269.4													

ONTMT4S 9268.GPJ 2015TEMPLATE(MTO).GDT 11/18/16

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

RECORD OF BOREHOLE No 11-19

1 OF 2

METRIC

2539-04-00	LOCATION	N 4 863 618.0 E 299 647.5	ORIGINATED BY	ES
HWY 400	BOREHOLE TYPE	Solid Stem Augers	COMPILED BY	AN
DATUM Geodetic	DATE	2011.02.03 - 2011.02.03	CHECKED BY	MEF

[illegible]

Continued Next Page

Numbers refer to Sensitivity

ONTMT4S 9268.GPJ 2015TEMPLATE(MTO).GDT 11/18/16



RECORD OF BOREHOLE No 11-19

2 OF 2

METRIC

2539-04-00 LOCATION N 4 863 618.0 E 299 647.5 ORIGINATED BY ES
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.02.03 - 2011.02.03 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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	W _P W W _L	WATER CONTENT (%)						
Continued From Previous Page																	
257.3																	
10.3	SAND, trace silt, trace gravel Dense Brown Moist		9	SS	35		257								0 89 11 (SI+CL)		
256.3																	
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 9.7m, CUTTINGS TO 0.9m, BENTONITE HOLEPLUG TO 0.4m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.																

RECORD OF BOREHOLE No HML-7

1 OF 2

METRIC

2539-04-00 LOCATION Major Mackenzie Drive to N of Teston Road N 4 858 417.30 E 300 624.78 ORIGINATED BY SLL
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
DATUM Geodetic DATE 2007.11.23 - 2007.11.23 CHECKED BY SKP

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			20 40 60 80 100	20 40 60 80 100	20 40 60					
245.5	GROUND SURFACE														
0.0	TOPSOIL: (150mm)														
0.2	Silty CLAY, some sand, trace rootlets Very Stiff to Stiff Brown Moist		1	SS	18										
			2	SS	11									0	28 45 27
243.3	Silty CLAY, some sand, trace gravel Very Stiff to Hard Brown Moist (TILL)		3	SS	27										
2.2			4	SS	41									1	22 57 20
			5	SS	84/ 275										
			6	SS	82										
			7	SS	54									0	19 50 31
	Grey		8	SS	40										

Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HML-7

2 OF 2

METRIC

2539-04-00 LOCATION Major Mackenzie Drive to N of Teston Road N 4 858 417.30 E 300 624.78 ORIGINATED BY SLL
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
DATUM Geodetic DATE 2007.11.23 - 2007.11.23 CHECKED BY SKP

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		
	Continued From Previous Page						SHEAR STRENGTH kPa						
							○ UNCONFINED + FIELD VANE						
							● QUICK TRIAXIAL x LAB VANE						
							20	40	60	80	100		
							WATER CONTENT (%)						
							20	40	60				
234.2	Silty CLAY, some sand, trace gravel Very Hard Grey Moist (TILL)		9	SS	40	235							1 26 51 22
11.3	END OF BOREHOLE AT 11.28m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE. Piezometer installation consists of 30mm diameter schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2008.01.31 FOUND DESTROYED												

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HML-8

1 OF 2

METRIC

2539-04-00 LOCATION Major Mackenzie Drive to N of Teston Road N 4 858 798.88 E 300 450.26 ORIGINATED BY SLL
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
DATUM Geodetic DATE 2007.11.19 - 2007.11.19 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 (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
240.4	GROUND SURFACE													
0.0	ASPHALT:(175mm)													
0.2	SAND, trace gravel Compact Brown Moist (FILL)		1	AS			240							
239.1			1	SS	25									
1.3	Silty CLAY, some sand, topsoil stained Stiff Dark Brown Moist		2	SS	12		239							0 20 50 30
238.0														
2.4	Silty CLAY, some sand, trace gravel Very Stiff Brown Moist (TILL)		3	SS	23		238							
			4	SS	21		237							0 19 56 25
	Grey		5	SS	29		236							
							235							
	becoming Hard		6	SS	41		234							1 22 53 24
							233							
			7	SS	82		232							
			8	SS	40		231							

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No HML-8

2 OF 2

METRIC

2539-04-00 LOCATION Major Mackenzie Drive to N of Teston Road N 4 858 798.88 E 300 450.26 ORIGINATED BY SLL
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY ES
DATUM Geodetic DATE 2007.11.19 - 2007.11.19 CHECKED BY SKP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
	Continued From Previous Page																
229.1	Silty CLAY, some sand, trace gravel Hard Grey Moist (TILL)		9	SS	48												
11.3	END OF BOREHOLE AT 11.28m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 150mm THEN ASPHALT TO SURFACE.																

ONT\MT4S 9288.GPJ 2015\TEMPLATE(MTO).GDT 11/18/16

+³, ×³: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-20

1 OF 2

METRIC

2539-04-00 LOCATION N 4 865 160.6 E 299 383.2 ORIGINATED BY MAT
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.05.03 - 2011.05.03 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		
309.4	GROUND SURFACE											
0.0	ASPHALT:(150mm)											
0.2	SAND, some gravel Compact (FILL)		1	SS	22		309					
308.6												
0.8	Clayey SILT, trace sand, trace gravel Stiff Grey Moist (FILL)		2	SS	11		308					
			3	SS	12							
307.2												
2.2	Silty CLAY, some sand, trace gravel Very Stiff to Hard Brown Moist (TILL)		4	SS	16		307					
			5	SS	22		306					0 16 50 34
			6	SS	27		305					
			7	SS	36		303					
301.8							302					
7.6	Sandy SILT, trace clay Dense Brown Moist		8	SS	37		301					0 28 66 6
300.2												
9.1	Silty CLAY, some sand Hard Grey Moist (TILL)		9	SS	38		300					
299.6												
9.8												

Continued Next Page

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

ONTMT4S 9268.GPJ 2015TEMPLATE(MTO).GDT 11/18/16

RECORD OF BOREHOLE No 11-20

2 OF 2

METRIC

2539-04-00 LOCATION N 4 865 160.6 E 299 383.2 ORIGINATED BY MAT
HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2011.05.03 - 2011.05.03 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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _P	W	W _L		
	Continued From Previous Page																
	END OF BOREHOLE AT 9.8m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 1.0m, CONCRETE MIX TO 0.1m, THEN ASPHALT TO SURFACE.																

ONTMT4S 9266.GPJ 2015TEMPLATE(MTO).GDT 11/18/16

RECORD OF BOREHOLE No 11-21

2 OF 2

METRIC

2539-04-00 LOCATION N 4 865 500.3 E 299 331.6 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.02.01 - 2011.02.01 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		
	Continued From Previous Page							SHEAR STRENGTH kPa						
								○ UNCONFINED + FIELD VANE						
								● QUICK TRIAXIAL × LAB VANE						
								20	40	60	80	100		
								WATER CONTENT (%)						
								20	40	60				
295.2							296							
10.9	Silty CLAY, some sand, trace gravel		9	SS	48		295							0 12 58 30
294.9	Hard Grey (TILL)													
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND WATER LEVEL AT 7.0m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 10.0m, CUTTINGS TO 0.7m, BENTONITE HOLEPLUG TO 0.4m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.													

+ 3, × 3 Numbers refer to
Sensitivity

20
15
10
5
0
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-22

1 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 865 555.8 E 299 322.0 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.02.01 - 2011.02.01 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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa			WATER CONTENT (%)				
								○ UNCONFINED	+ FIELD VANE						
								● QUICK TRIAXIAL	x LAB VANE						
305.6						20	40	60	80	100	W _p	W	W _L		
0.0	ASPHALT: (230mm)														
0.2	SAND, some gravel Brown Moist (FILL)		1	GS											
304.8															
0.8	SAND, some silt, trace gravel Dense Brown Moist (FILL)		1	SS	30										
304.4															
1.2	Clayey SILT, some sand, trace gravel Very Stiff Brown to Dark Grey (FILL)		2	SS	21										
303.2															
2.4	Silty CLAY, with sand, trace gravel Very Stiff Brown Moist (TILL)		3	SS	16										
			4	SS	20										
			5	SS	16										
			6	SS	24										
	Becomes grey														
297.9	Silty SAND, trace clay Compact Brown Moist		7	SS	17										
7.7															
296.9															
8.7	SILT, some clay, trace sand Compact Grey Moist		8	SS	18										
295.7															

Continued Next Page

+³, X³: Numbers refer to Sensitivity

20
15-5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11-22

2 OF 2

METRIC

W.P. 2539-04-00 LOCATION N 4 865 555.8 E 299 322.0 ORIGINATED BY ES
 HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2011.02.01 - 2011.02.01 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			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	W _p W W _L	20 40 60			
9.9	Sandy SILT, trace gravel Compact Grey Moist		9	SS	28	295								
294.3														
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND WATER LEVEL AT 4.2m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 9.7m, CUTTINGS TO 0.7m, BENTONITE HOLEPLUG TO 0.4m, CONCRETE TO 0.1m, THEN ASPHALT TO SURFACE.													



Appendix B

Borehole Locations Drawings

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

HIGHWAY 400
CONT No
GWP No 2539-04-00



HWY 400 WIDENING
HOT TOLL & HOT HMS
SIGN SUPPORT
BOREHOLE LOCATIONS PLAN

SHEET



THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

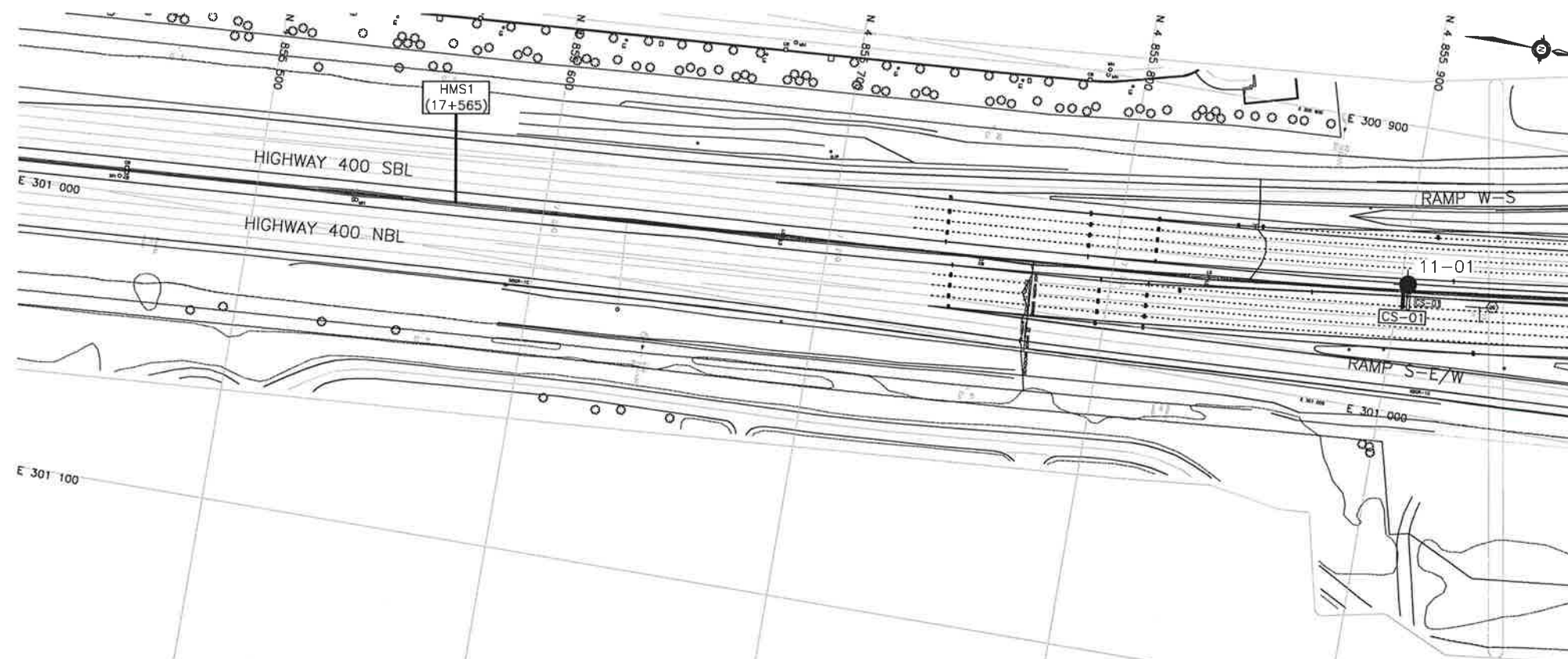
- Borehole
- Borehole and Cone
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60' Cone, 475J/blow)
- PH Pressure, Hydraulic
- Water Level
- Head Artesian Water
- Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
11-01	227.7	4 855 902.6	300 955.0

-NOTES-

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

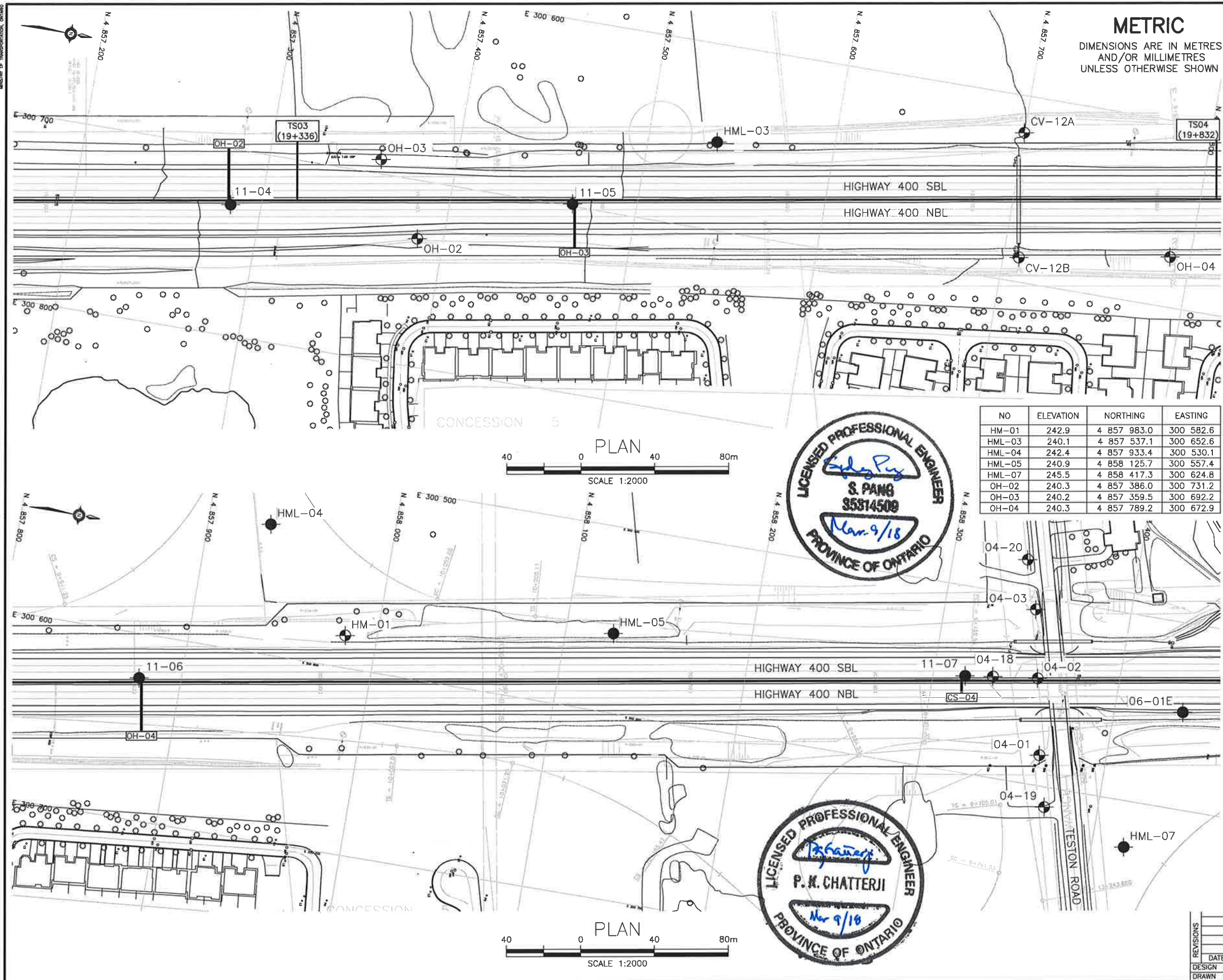
GEOCRES No. 30M13-224



PLAN



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	RPR	CHK	SKP
DRAWN	WFA	AN	CHK
PKC	SITE	STRUCT	DWG
1			

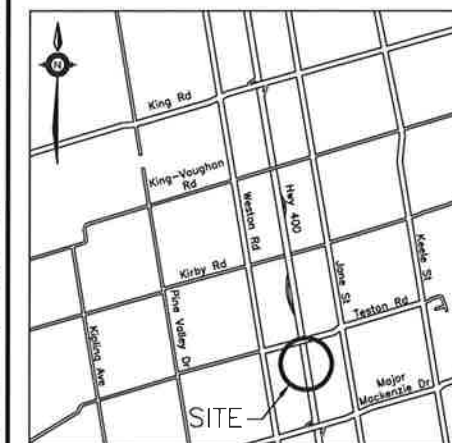


HIGHWAY 400
CONT No
GWP No 2539-04-00



HWY 400 WIDENING
HOT TOLL & HOT HMS
SIGN SUPPORT
BOREHOLE LOCATIONS PLAN

SHEET



KEYPLAN
LEGEND

	Borehole
	Borehole and Cone
	Blows /0.3m (Std Pen Test, 475J/blow)
	Blows /0.3m (60' Cone, 475J/blow)
	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
	Rock Quality Designation (RQD)
	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
04-01	245.0	4 858 363.9	300 583.6
04-02	239.0	4 858 356.0	300 542.9
04-03	244.2	4 858 348.8	300 506.4
04-18	239.5	4 858 332.0	300 546.0
04-19	245.4	4 858 371.2	300 610.7
04-20	243.5	4 858 339.9	300 480.6
06-01E	238.1	4 858 436.6	300 547.8
11-04	240.6	4 857 283.8	300 729.9
11-05	241.4	4 857 465.5	300 698.7
11-06	243.8	4 857 877.7	300 623.8
11-07	239.6	4 858 317.2	300 548.1
CV-12A	239.3	4 857 699.9	300 619.9
CV-12B	240.0	4 857 708.5	300 686.8

-NOTES-

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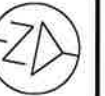
GEOCRES No. 30M13-224

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	RPR	CHK	SKP
DRAWN	MFA	CHK	PKC
LOAD			
STRUCT			
DWG			
DATE	MAR	2018	

METRIC

DIMENSIONS ARE IN METRES
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HIGHWAY 400	
CONT No	
GWP No 2539-04-00	








HWY 400 WIDENING
HOT TOLL & HOT HMS
SIGN SUPPORT
BOREHOLE LOCATIONS PLAN

SHEET



KEYPLAN
LEGEND

NO	ELEVATION	NORTHING	EASTING
HM-02	250.0	4 859 414.8	300 334.5
HML-08	240.4	4 858 798.9	300 450.3
HML-09	246.3	4 859 107.8	300 393.7
OH-05	239.9	4 858 758.9	300 452.7

	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
06-02E	236.9	4 858 509.7	300 536.5
06-03E	236.7	4 858 555.2	300 528.8
06-04W	246.1	4 859 096.3	300 383.5
06-05W	240.9	4 859 131.2	300 359.1
06-06W	249.5	4 859 182.8	300 352.5
06-30E	233.0	4 858 670.5	300 523.6
06-31E	238.2	4 858 705.1	300 508.9
11-08	247.2	4 859 141.5	300 412.5
11-09	249.4	4 859 400.1	300 368.3
11-10	251.0	4 859 723.2	300 313.0
C14	—	4 859 205.9	300 438.2
CV-13A	229.0	4 858 645.1	300 533.6
CV-13B	229.7	4 858 656.8	300 557.6

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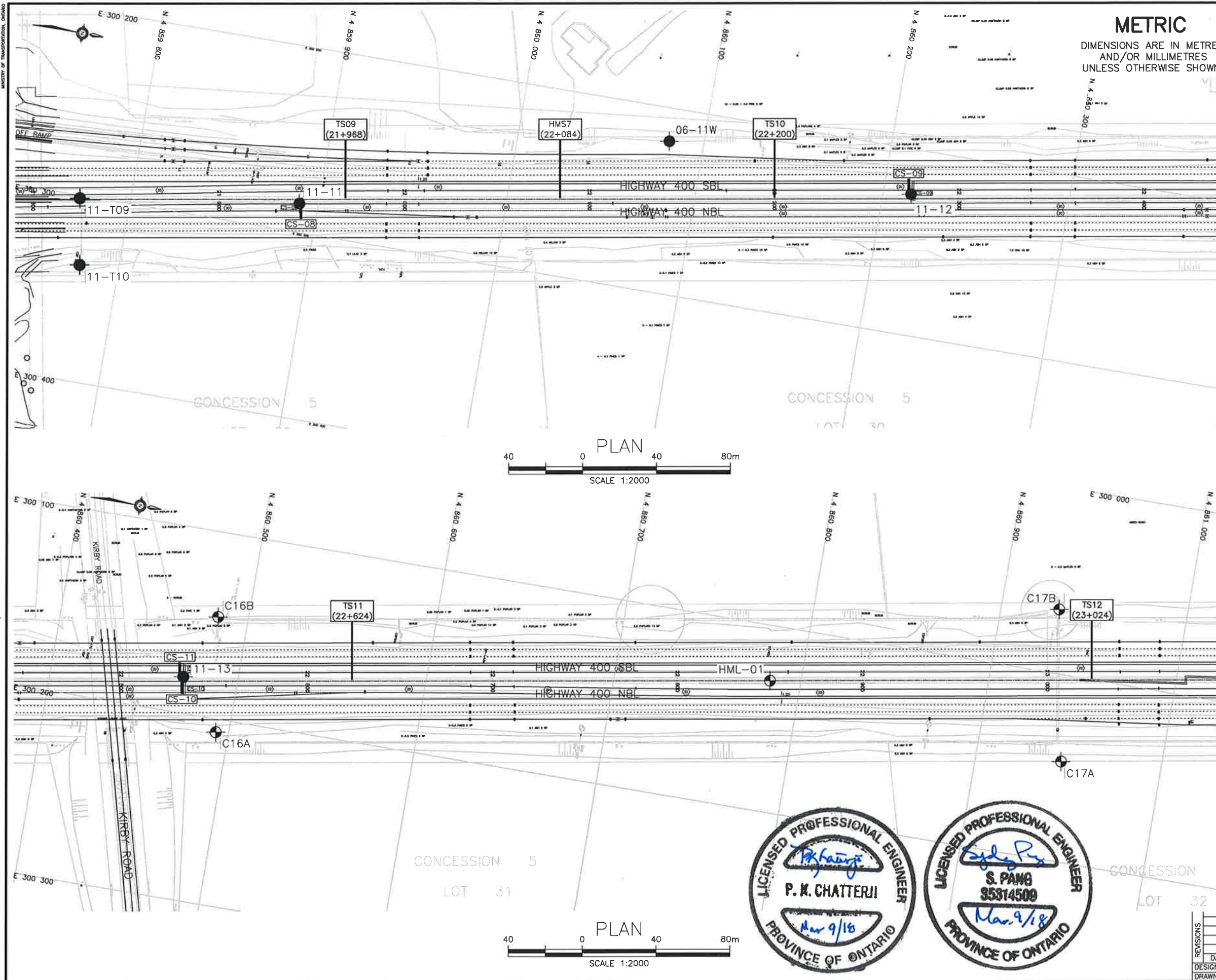
GEOCRES No. 30M13-224

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PLOTDATE: 3/5/2018 4:20 PM

A circular professional engineer seal for the Province of Ontario. The outer ring contains the text "LICENSED PROFESSIONAL ENGINEER" at the top and "PROVINCE OF ONTARIO" at the bottom. In the center, the name "P. M. CHATTERJI" is printed. Handwritten in blue ink over the seal are the signature "P. M. Chatterji" and the date "Mar 9/18".

LICENSED PROFESSIONAL ENGINEER
S. PANG
85314509
Mar. 9/18
PROVINCE OF ONTARIO



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CONT No
GWP No 2539-04-00



HWY 400 WIDENING
HOT TOLL & HOT HMS
SIGN SUPPORT
BOREHOLE LOCATIONS PLAN

SHEET



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
06-11W	—	4 860 081.3	300 217.9
11-11	252.0	4 859 889.9	300 284.5
11-12	255.2	4 860 215.2	300 224.2
11-13	257.6	4 860 470.9	300 180.5
C16A	—	4 860 493.2	300 207.0
C16B	—	4 860 483.9	300 145.6
C17A	—	4 860 945.9	300 146.3
C17B	—	4 860 931.1	300 065.6
HML-01	—	4 860 783.4	300 129.6

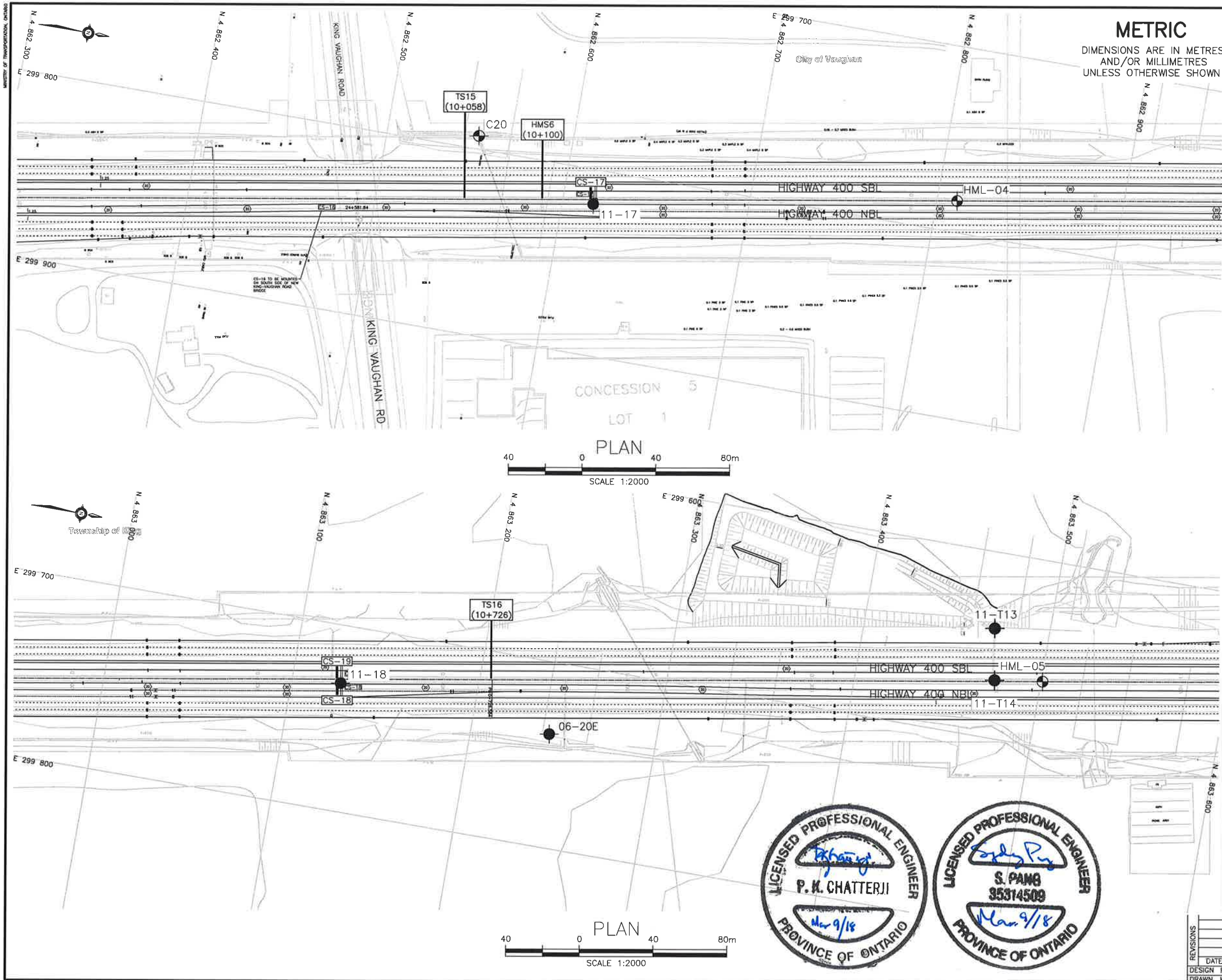
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GEOCRES No. 30M13-224



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	RPR	CHK SKP	CODE
DRAWN	NFA/AN	CHK PKC	SITE
			LOAD
			STRUCT
			DWG 5
			DATE MAR 2018

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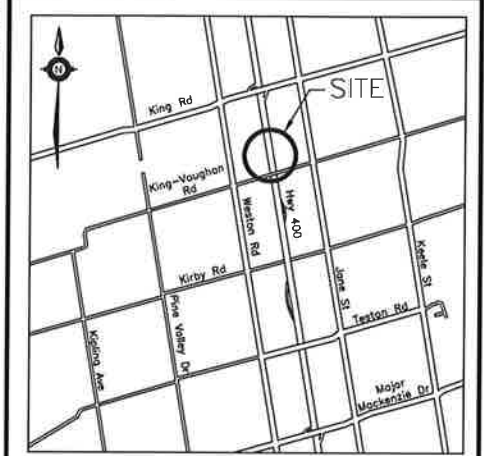
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UNLESS OTHERWISE SHOWN

HIGHWAY 400
CONT No
GWP No 2539-04-00

HWY 400 WIDENING
HOT TOLL & HOT HMS
SIGN SUPPORT
BOREHOLE LOCATIONS PLAN

SNC-LAVALIN

THURBER ENGINEERING LTD.



NO	ELEVATION	NORTHING	EASTING
06-20E	—	4 863 242.2	299 738.8
11-17	280.4	4 862 616.7	299 818.6
11-18	277.1	4 863 126.1	299 731.1
C20	—	4 862 549.3	299 792.8
HML-04	—	4 862 810.8	299 782.9
HML-05	—	4 863 500.8	299 664.9

-NOTES-

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GEOCRES No. 30M13-224

LICENSED PROFESSIONAL ENGINEER

P. K. CHATTERJI

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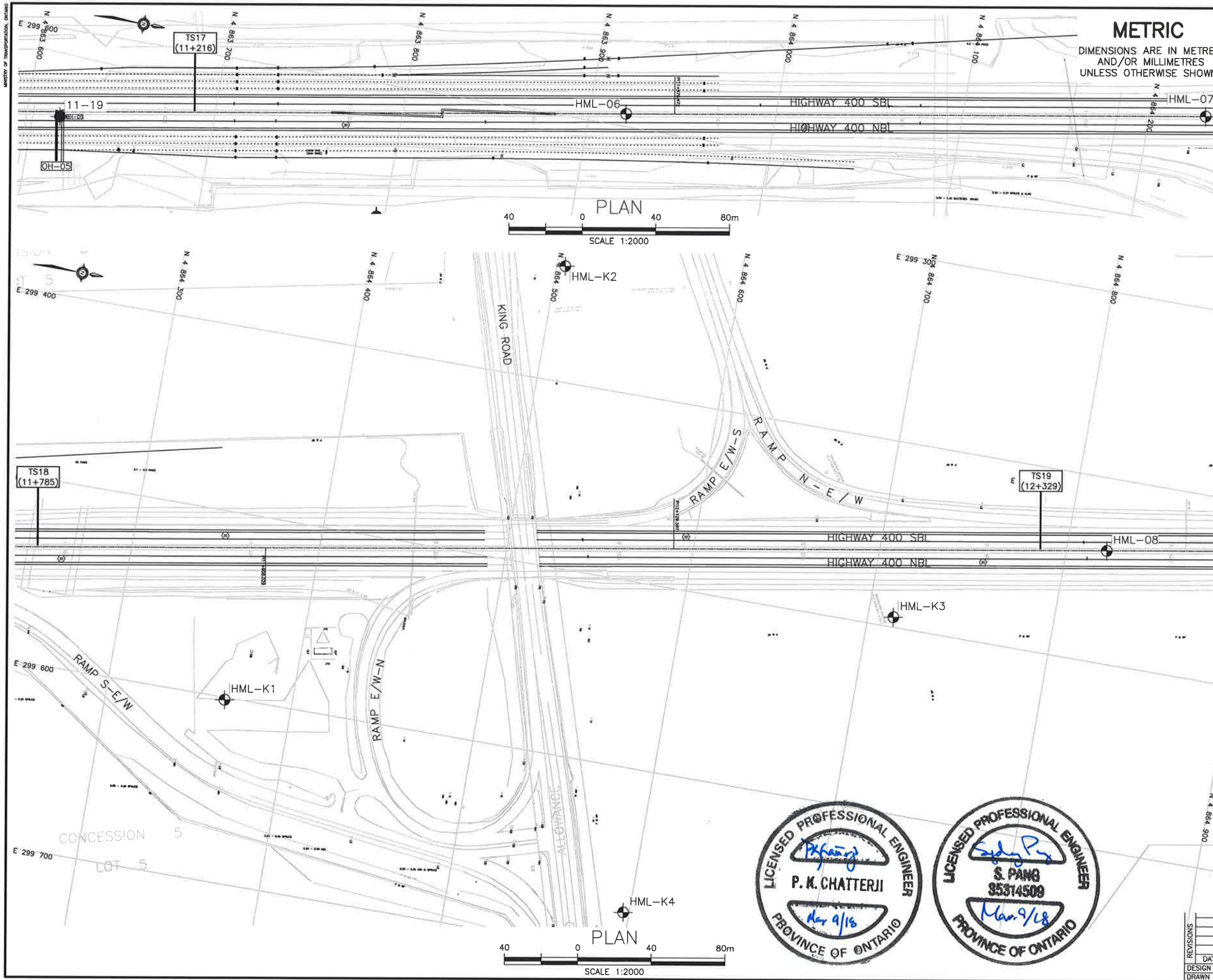
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S. PANG

PROVINCE OF ONTARIO

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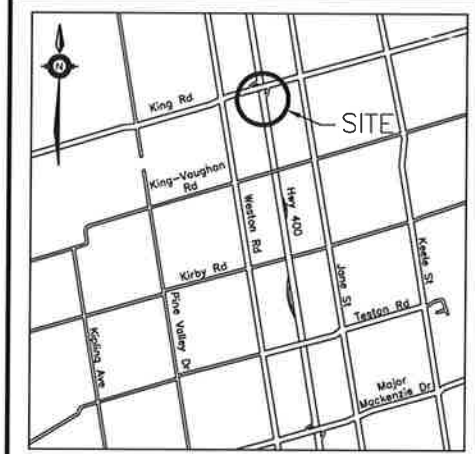


HWY 400 WIDENING
HOT TOLL & HOT HMS
SIGN SUPPORT
BOREHOLE LOCATIONS PLAN

SHEET



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KEYPLAN

LEGEND

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

NO	ELEVATION	NORTHING	EASTING
11-19	267.6	4 863 618.0	299 647.5
HML-06	-	4 863 919.7	299 593.2
HML-07	-	4 864 230.3	299 540.3
HML-08	-	4 864 821.7	299 439.1
HML-K1	-	4 864 363.7	299 601.3
HML-K2	-	4 864 504.6	299 337.6
HML-K3	-	4 864 713.6	299 494.5
HML-K4	-	4 864 596.8	299 677.5

-NOTES-

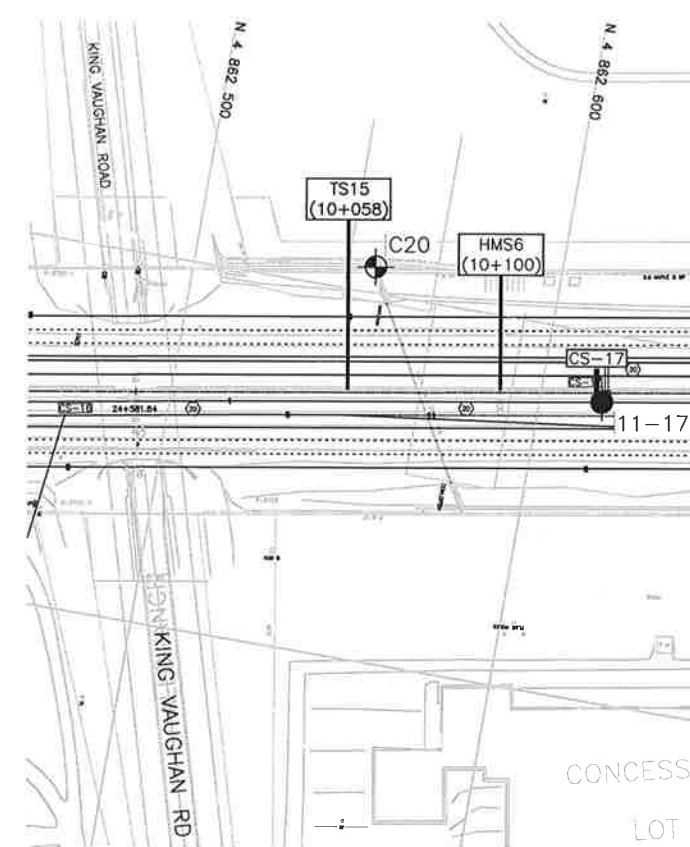
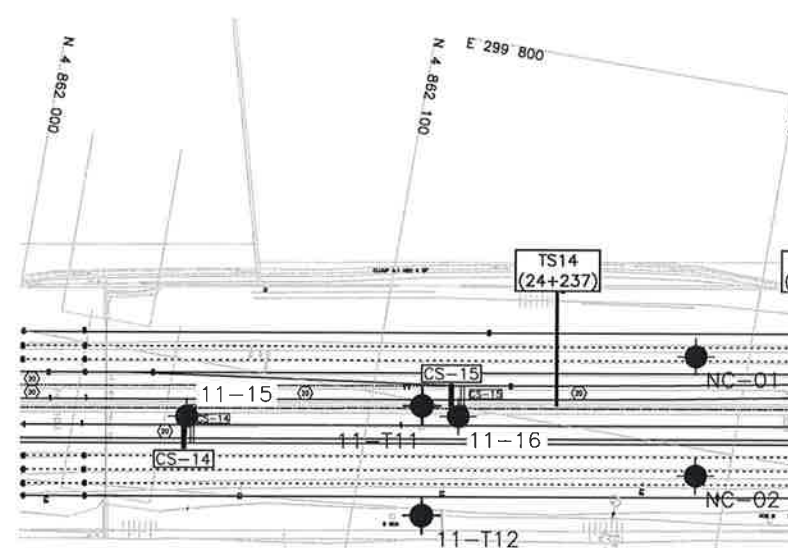
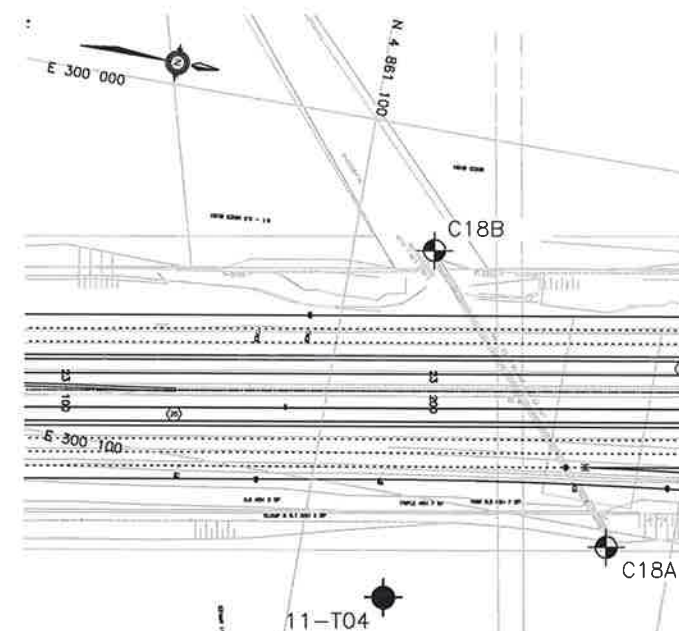
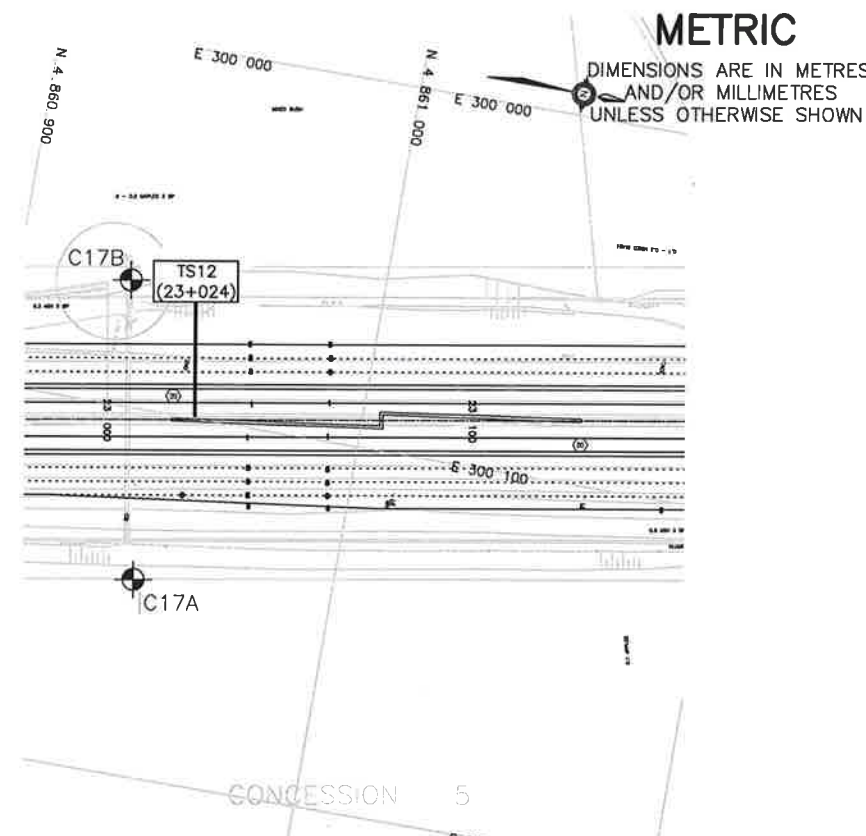
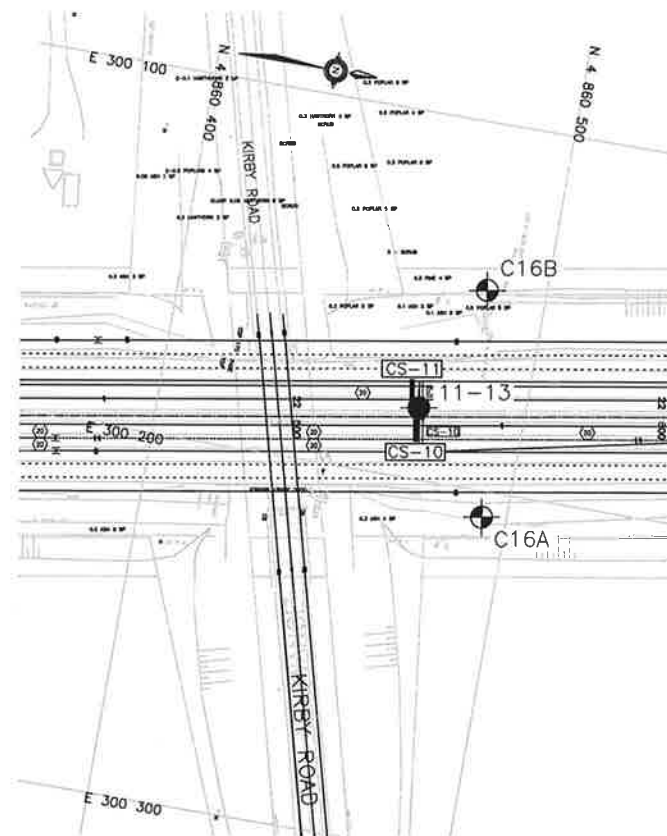
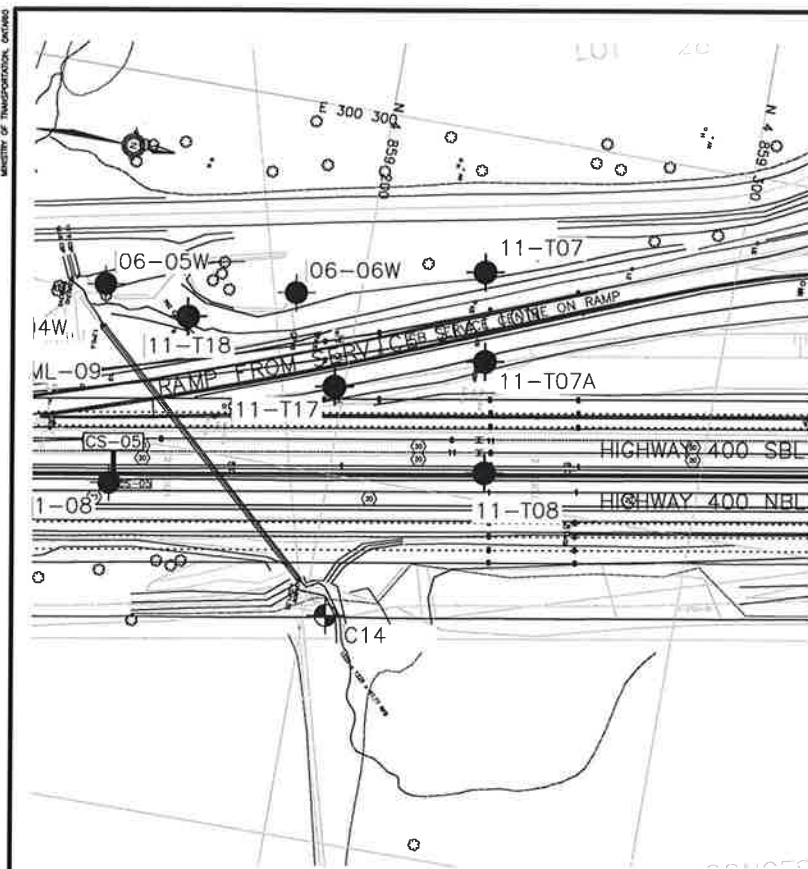
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GEOCREs No. 30M13-224



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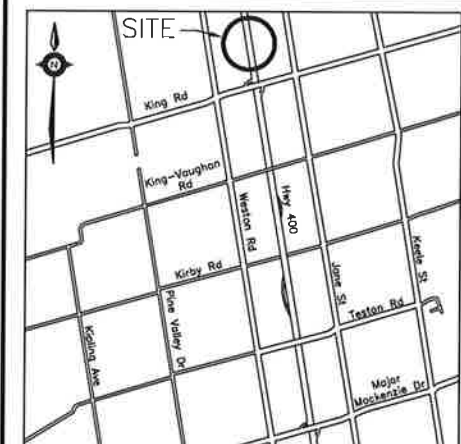


HWY 400 WIDENING
HOT TOLL & HOT HMS
SIGN SUPPORT
BOREHOLE LOCATIONS PLAN

SHEET








THURBER ENGINEERING LTD.



KEYPLAN

L E G E N D

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

[illegible]

-NOTES-

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

GEOCRES No. 30M13-224

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Appendix C

List of Special Provisions and Suggested Text for NSSP



List of Special Provisions Referenced in this Report

OPSS 903

Suggested Text for NSSP on:

“Augered Caisson Construction for HOT and HOT HMS Support Foundations”

The Contractor is advised that variable types of subsurface materials may be encountered at the locations of the HOT and HOT HMS foundations. For additional information regarding subsurface conditions, the Contractor is referred to the Foundation Investigation Report.

For bidding purposes, the Contractor shall assume the following:

1. The subsurface conditions at an augered caisson location are the same as those encountered in the borehole closest to the subject caisson location.
2. Cobbles, boulders and rock fragments may be encountered within the glacial till deposits. Obstructions including rubble, cobbles and boulders may also be present within the embankment fills. The soil matrix is anticipated to become harder or denser with depth. Caisson installation equipment must be able to dislodge, handle, remove or otherwise penetrate these obstructions and hard/very dense 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. All concrete should be placed in the dry. Should it be impractical to remove accumulated water in the caisson hole, tremie techniques should be used to place the concrete.

The Contractor is responsible for constructing the HOT and HOT HMS foundations without disturbing the material at the sides or bases of the foundations.