

Prepared By: Matthew Boucher, P.Eng.

Reviewed By: Jason Lee, P.Eng.
P.K. Chatterji, P.Eng.

Prepared For: Peter Bamforth, P.Eng.
Tatiana Ojala, P.Eng.

Date: Wednesday, January 8, 2020

No. H427-0-FND-REP-008-C

Subject: Foundation Investigation and Design Report
Highway 427 Expansion – Package 6,7 & 8 (100% Submission)
Sign Supports

TABLE OF CONTENTS

1.	INTRODUCTION	2
2.	SITE DESCRIPTION AND GEOLOGY BACKGROUND	2
3.	GEOTECHNICAL INVESTIGATION	3
4.	SUBSURFACE CONDITIONS	3
5.	FOUNDATION DESIGN FOR SIGN SUPPORTS	3
5.1	Foundation Parameters	3
5.2	Caisson Installation	5
5.3	Construction Concerns	5
5.4	Construction Inspection and Testing	5

Statement of Limitations and Conditions

Tables of Foundation Design Parameters for Sign Supports (HM-6, HM-7 and HM-8)

APPENDICES

Appendix A	Record of Borehole Sheets – Current Investigation
Appendix B	Record of Borehole Sheets – Previous Investigations
Appendix C	Borehole Location Plans

1. INTRODUCTION

This report provides foundation recommendations for the design and construction of the proposed sign supports to be installed at selected locations along the new extension of Highway 427. This report discusses sign supports located within the Package 6, 7 and 8 limits. The installation of the sign supports constitutes part of the Highway 427 Expansion project in the City of Vaughan, Ontario.

Recommendations on the foundation aspects of the sign support design presented in this report were based on the interpretation of the subsurface information obtained during recently completed geotechnical investigation by Thurber Engineering Ltd. (Thurber) as well as previous investigations the results of which were presented in the reports listed below:

1. GEOCREC 30M13-176: Preliminary Foundation Investigation and Design Report Culverts, Highway 427 Extension from Highway 7 to Major Mackenzie Drive, Ministry of Transportation, Ontario, W.O. 05-20012, dated August, 2009, prepared by Golder Associates.
2. GEOCREC 30M13-177: Preliminary Foundation Investigation and Design Report High Fill Embankments, Highway 427 Extension from Highway 7 to Major Mackenzie Drive, Ministry of Transportation, Ontario, W.O. 05-20012, dated August, 2009, prepared by Golder Associates.
3. GEOCREC 30M13-171: Preliminary Foundation Investigation and Design Report Rutherford Road Overpasses (NBL and SBL), Highway 427 Extension from Highway 7 to Major Mackenzie Drive, Ministry of Transportation, Ontario, W.O. 05-20012, dated August 2009, prepared by Golder Associates.
4. GEOCREC 30M13-172: Preliminary Foundation Investigation and Design Report, West Robinson Creek Bridges (NBL and SBL), Highway 427 Extension from Highway 7 to Major Mackenzie Drive, Ministry of Transportation, Ontario, W.O. 05-20012, dated August 2009, prepared by Golder Associates.

The discussion and recommendations for design presented in this report were based on preliminary drawings provided by WSP showing the proposed highway alignment and sign support locations. The approximate locations of the signs have been listed in the table attached to this report and are shown on the Borehole Location Plans in Appendix C.

Geotechnical design parameters for the sign supports have been provided in a tabularized format following the text of the report.

It is a condition of this report that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

2. SITE DESCRIPTION AND GEOLOGY BACKGROUND

The project site of the Highway 427 Expansion project includes a widening section between Finch Avenue and Highway 7 and the 6.6 km long expansion from Highway 7 to Major Mackenzie Drive in the City of Vaughan, Ontario. Package 6, 7 and 8, the subject of this report, are within the extension section between Highway 7 and the north limit of the project. The proposed sign supports are distributed throughout the extension area, as shown on the Borehole Location Drawing in Appendix C. A total of twenty two (22) sign supports (6 in Package 6, 9 in Package 7 and 7 in Package 8) are addressed in this report. Lands surrounding this site have mainly been used for agricultural purposes, although infrequent commercial properties are located near the proposed highway alignment.

The site is situated within the physiographic region known as the Peel Plain (*The Physiography of Southern Ontario* by L.J. Chapman and D.F. Putnam, 1984). The subsurface conditions in the region generally comprise clayey silt to silty clay till (Halton Till) with interlayers of sand and silt till. Localized recent deposits of sands, silts

and soft clays formed in small glacial meltwater ponds throughout the region and may be encountered near the river and creek valleys. The site is underlain by shale bedrock of the Georgian Bay Formation with siltstone and limestone interlayers.

3. GEOTECHNICAL INVESTIGATION

A combination of boreholes drilled during the recent investigations by Thurber, both specifically for the sign supports and for other structures, and boreholes drilled in previous investigations by other consultants were used to prepare this report. A total of 40 borehole logs were reviewed.

The ground surface elevations at the borehole locations as well as borehole coordinates were provided to Thurber by WSP. The coordinate system MTM NAD 83, Zone 16 was used to establish locations of the boreholes.

The drilling and sampling operations were supervised on a full-time basis by members of Thurber's technical staff. The supervisors logged the boreholes and processed the recovered soil samples for transport to Thurber's laboratory for further examination and testing.

Groundwater conditions were observed in the open boreholes throughout the drilling operations. Standpipe piezometers were installed in selected boreholes, as detailed on the Record of Borehole sheets. Boreholes without piezometers have been decommissioned in general accordance with Ontario Reg. 903. After the final water level readings, the piezometers will be decommissioned in general accordance with Ontario Reg. 903.

The Record of Borehole sheets from the current investigation are enclosed in Appendix A following the text of this report. The locations of boreholes, as well as the proposed sign supports are shown on the Borehole Location Plans enclosed in Appendix C. Boreholes from previous investigation utilized in this report are enclosed in Appendix B.

4. SUBSURFACE CONDITIONS

Details of the encountered soil stratigraphy are presented on the Record of Borehole sheets included in Appendix A. Also, selected boreholes from previous investigations referenced in Section 1 were used in preparation of this report. The Record of Borehole sheets from previous investigations are included in Appendix B.

In general, the soil stratigraphy encountered at this site consisted of either asphalt, topsoil or surficial silty clay to clayey silt overlying a cohesive till deposit. In some boreholes a cohesionless till deposit was encountered below the cohesive till. Occasional cobbles were reported in the till deposit. Cobbles and boulders are inherently present in the till deposits and should be expected during excavations/construction.

The simplified soil stratigraphy, borehole coordinates and design ground water levels at each sign support location are provided in the attached tables.

5. FOUNDATION DESIGN FOR SIGN SUPPORTS

5.1 Foundation 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) and
- Canadian Highway Bridge Design Code and Commentary, 2014 or the most recent edition (Reference 3)

It is understood that a typical sign support consists of an augered caisson (drilled shaft). Some signs will be supported by two caissons while others will be supported by a single caisson. The recommended parameters for foundation design of caissons are provided in the table following the text of this report.

It is recommended that MTO's standard designs in References 1 and 2 be used as a basis for the support foundations design.

To account for 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 organic deposits also be neglected in determination of 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 at 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 , ($q_u = 2 \times c_u$, where c_u is undrained shear strength) is provided for cohesive soils (clayey silt to silty clay fill, native clayey silt or silty clay or clayey silt to silty clay till), the ultimate lateral passive resistance should be calculated in conjunction with the total soil unit weight.

When designing for portions of the caissons below the groundwater level in cohesionless sands and silts, the submerged soil unit weight, γ' , should be used.

The design parameters were provided for the soils encountered beneath the existing ground surface at the borehole locations. The sign supports may be installed through the embankment fill to be placed for the proposed highway. The embankment fill may consist of either granular fill or cohesive fill (reused soils excavated on site). Providing the fills are properly placed and compacted as per specifications, the design parameters presented in the table below may be used for design of the sign supports in fills.

Fill Material	q_u (kPa)	ϕ' (deg.)	γ (kN/m ³)	n_h (MN/m ³)	K_p
Granular Fill - compact	-	32	22	5000	3.3
Cohesive Fill – firm to stiff	80	-	20	-	-

The stabilized groundwater level may be at higher elevation than indicated on the Record of Borehole sheets. The required depth of the drilled shaft will be governed by lateral loads, including wind loads. The length of the caisson should also be sufficient to counteract frost action (upward forces).

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

5.2 Caisson Installation

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

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 at various depths below existing ground surface. The stabilized groundwater levels may be higher than indicated on the record of Borehole sheets. Soil sloughing and water seepage may occur in unsupported holes especially in sands and silts below the groundwater level. The cohesionless soils would also be susceptible to disturbance (basal and sidewall instability) under conditions of unbalanced hydrostatic head. 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. A balancing water head or suitable drilling mud should be used inside the caisson hole in cases where the caisson base is within sands and silts. 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.

5.3 Construction Concerns

Concerns during caisson installation 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 primarily due to unbalanced hydrostatic head. Recommendations on how to address these issues have been outlined in the previous section.

5.4 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 provided in this report.



STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

5. INTERPRETATION OF THE REPORT

- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.
- c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.
- d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

TABLE TS – 6
HIGHWAY 427 EXTENSION - DESIGN PACKAGE 6
SIGN SUPPORTS
FOUNDATION DESIGN PARAMETERS

Sign Number	Approx. Sign Station	Relevant BHs	Simplified Stratigraphy	Ground Surface Elev. (m)	Depth Below Existing Grade (m)	Foundation Design Parameters							Foundation Type
						q_u (kPa)	ϕ' (deg.)	γ (kN/m ³)	γ' (kN/m ³)	n_h (MN/m ³)	K_p	Ground water depth (m)	
OHS-S6	10+667	ZB 17-05 (west leg)	Organics	183.0	0.0 – 0.1	-	-	-	-	-	-	2 (below existing grade)	Standard
			Clayey Silt – firm		0.1 – 0.8	50	-	18	-	-	-		
			Clayey Silt – very stiff		0.8 – 1.5	175	-	19	-	-	-		
			Clayey Silt to Silty Clay Till – Stiff		1.5 – 6.0	125	-	19	-	-	-		
			Clayey Silt to Silty Clay Till – very stiff to hard		6.0 – 8.8	200	-	20	-	-	-		
			Sand and Silt Till – very dense		8.8 – 9.6	-	38	-	11	11000	4.2		
		UC 17-11 (east leg)	Topsoil	183.1	0.0 – 0.1	-	-	-	-	-	-		Standard
			Clayey Silt Fill – stiff		0.1 – 0.8	100	-	18	-	-	-		
			Clayey Silt to Silty Clay Till – stiff		0.8 – 6.0	125	-	19	-	-	-		
			Clayey Silt to Silty Clay Till – very stiff to hard		6.0 – 8.2	200	-	20	-	-	-		
OHS-N8	11+000	HM 17-19 (west leg)	Topsoil	183.0	0.0 – 0.2	-	-	-	-	-	-	1 (below existing grade)	Standard
			Clayey Silt – firm		0.2 – 0.7	50	-	18	-	-	-		
			Silty Clay Till – very stiff		0.7 – 8.2	175	-	20	-	-	-		
		TS 18-27 (east leg)	Clayey Silt – stiff	182.6	0.0 – 0.6	100	-	18	-	-	-		Standard
			Clayey Silt to Silty Clay Till – very stiff		0.6 – 8.2	175	-	20	-	-	-		

Sign Number	Approx. Sign Station	Relevant BHs	Simplified Stratigraphy	Ground Surface Elev. (m)	Depth Below Existing Grade (m)	Foundation Design Parameters							Foundation Type
						q_u (kPa)	ϕ' (deg.)	γ (kN/m ³)	γ' (kN/m ³)	n_h (MN/m ³)	K_p	Ground water depth (m)	
OHS-S5	11+137	CLRN-01 (west leg)	Topsoil	181.0	0.0 – 0.2	-	-	-	-	-	-	1 (below existing grade)	Standard
			Clayey Silt – firm		0.2 – 0.7	50	-	18	-	-	-		
			Clayey Silt to Silty Clay Till – very stiff		0.7 – 8.7	175	-	20	-	-	-		
			Sand and Silt Till – very dense		8.7 – 12.8	-	38	-	11	11000	4.2		
		CLRN-02 (east leg)	Topsoil	180.3	0.0 – 0.2	-	-	-	-	-	-		Standard
			Clayey Silt – soft		0.2 – 0.8	25	-	18	-	-	-		
			Clayey Silt to Silty Clay Till – very stiff		0.8 – 9.0	175	-	20	-	-	-		
			Clayey Silt to Silty Clay Till – hard		9.0 – 12.0	200	-	20	-	-	-		
			Silty Sand Till - dense		12.0 – 12.8	-	35	-	10	7000	3.7		
OHS-N9	11+490	HM 17-21 (west leg)	Topsoil	183.5	0.0 – 0.2	-	-	-	-	-	-	2 (below existing grade)	Standard
			Silty Clay – firm		0.2 – 0.8	50	-	18	-	-	-		
			Silty Clay – very stiff		0.8 – 1.5	150	-	19	-	-	-		
			Silty Clay Till – very stiff		1.5 – 6.7	175	-	20	-	-	-		
		TS 17-30 (east leg)	Topsoil / Organics	181.4	0.0 – 0.2	-	-	-	-	-	-		Standard
			Clayey Silt to Silty Clay Till – stiff to very stiff		0.2 – 8.2	150	-	19	-	-	-		
OHS-3A	12+383	STM 17-19	Topsoil	187.6	0.0 – 0.1	-	-	-	-	-	-	2 (below existing grade)	Standard
			Gravelly Sand Fill – loose		0.1 – 0.9	-	27	18	-	1500	2.7		
			Silty Clay Fill – firm		0.9 – 3.3	75	-	18	-	-	-		
			Clayey Silt to Silty Clay Till – very stiff		3.3 – 6.7	150	-	19	-	-	-		
OHS-S4	12+914	SA 17-01 (west leg)	Topsoil	189.7	0.0 – 0.2	-	-	-	-	-	-	1 (below existing grade)	Standard
			Silty Clay – stiff		0.2 – 0.7	100	-	18	-	-	-		
			Silty Clay Till – stiff		0.7 – 2.1	125	-	19	-	-	-		
			Silty Clay Till – very stiff		2.1 – 9.8	150	-	19	-	-	-		
		TS 18-29 (east leg)	Silty Clay to Clayey Silt – firm	189.4	0.0 – 0.8	75	-	18	-	-	-		Standard
			Clayey Silt to Silty Clay Till – stiff to very stiff		0.8 – 4.6	150	-	19	-	-	-		
			Clayey Silt to Silty Clay Till – very stiff to hard		4.6 – 8.2	175	-	20	-	-	-		

Legend:

q_u	=	unconfined compressive strength, ($q_u = 2 \times c_u$, where c_u is undrained shear strength) (kPa)
ϕ'	=	angle of internal friction (degrees)
γ	=	bulk unit weight (kN/m ³)
γ'	=	submerged unit weight (kN/m ³) – to be used for cohesionless soils below the groundwater table
n_h	=	coefficient of horizontal subgrade reaction (MN/m ³)
K_p	=	coefficient of passive earth pressures

Notes:

1. Traffic sign stations are approximate.
2. For approximate borehole locations reference should be made to the Borehole Location Plan (attached). Borehole coordinates (northings and eastings) are provided on the Record of Borehole sheets.
3. This table should be read in conjunction with the text of this report.
4. To account for frost action and surficial soil 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.
5. If new fill is placed, some caissons may be partially embedded within the new fill.

TABLE TS – 7
HIGHWAY 427 EXTENSION - DESIGN PACKAGE 7
SIGN SUPPORTS
FOUNDATION DESIGN PARAMETERS

Sign Number	Approx. Sign Station	Relevant BHs	Simplified Stratigraphy	Ground Surface Elev. (m)	Depth Below Existing Grade (m)	Foundation Design Parameters							Foundation Type
						q _u (kPa)	φ' (deg.)	γ (kN/m ³)	γ' (kN/m ³)	n _h (MN/m ³)	K _p	Ground water depth (m)	
OHS-N10	13+165	STM 17-21 TS 17-36 (west leg)	Silty Clay – firm to stiff	188.8	0.0 – 1.2	100	-	18	-	-	-	1 (below existing grade)	Standard
			Clayey Silt to Silty Clay Till – very stiff		1.2 – 4.1	150	-	19	-	-	-		
			Clayey Silt to Silty Clay Till – stiff		4.1 – 5.6	100	-	19	-	-	-		
			Clayey Silt to Silty Clay Till - firm		5.6 – 6.7	50	-	18	-	-	-		
OHS-S3	13+375	TS 18-30 (west leg)	Topsoil / Silty Clay with organics	190.5	0.0 – 0.6	-	-	-	-	-	-	1 (below existing grade)	Standard
			Clayey Silt to Silty Clay Till – stiff to very stiff		0.6 – 6.7	150	-	19	-	-	-		
		TS 18-31 (east leg)	Topsoil	190.4	0.0 – 0.1	-	-	-	-	-	-		Standard
			Clayey Silt to Silty Clay Till – stiff		0.1 – 2.3	125	-	19	-	-	-		
			Clayey Silt to Silty Clay Till – very stiff to hard		2.3 – 5.6	200	-	20	-	-	-		
			Clayey Silt to Silty Clay Till – stiff to very stiff		5.6 – 8.2	150	-	19	-	-	-		

Sign Number	Approx. Sign Station	Relevant BHs	Simplified Stratigraphy	Ground Surface Elev. (m)	Depth Below Existing Grade (m)	Foundation Design Parameters							Foundation Type
						q_u (kPa)	ϕ' (deg.)	γ (kN/m ³)	γ' (kN/m ³)	n_h (MN/m ³)	K_p	Ground water depth (m)	
OHS-N11	13+626	TS 17-38 C10 (west leg)	Topsoil Silty Clay – firm Silty Clay Till – very stiff Silty Clay Till – very stiff to hard Silty Clay Till – very stiff	190.9	0.0 – 0.2 0.2 – 0.7 0.7 – 2.1 2.1 – 5.6 5.6 – 6.7	- 100 150 200 150	- - - - -	- 18 19 20 19	- - - - -	- - - - -	- - - - -	1 (below existing grade)	Standard
		TS 17-39 C10 (east leg)	Topsoil Clayey Silt – firm Silty Clay Till – very stiff Silty Clay Till – very stiff Silty Clay Till – stiff	190.0	0.0 – 0.2 0.2 – 0.8 0.8 – 2.1 2.1 – 4.1 4.1 – 6.7	- 50 150 175 125	- - - - -	- 18 19 20 19	- - - - -	- - - - -	- - - - -		Standard
VMS-S1	14+130	S15 (west leg)	Clayey Silt – firm Clayey Silt Till - very stiff Clayey Silt Till – stiff to very stiff Clayey Silt Till – very stiff	194.0	0.0 – 0.8 0.8 – 5.6 5.6 – 8.7 8.7 – 11.9	75 175 150 200	- - - -	18 20 19 20	- - - -	- - - -	- - - -	2 (below existing grade)	Standard
		RRO 17-01 (east leg)	Topsoil Silty Clay – firm Clayey Silt to Silty Clay Till – very stiff Clayey Silt to Silty Clay Till - stiff	194.4	0.0 – 0.1 0.1 – 0.7 0.7 – 5.6 5.6 – 9.8	- 50 150 100	- - - -	- 18 19 19	- - - -	- - - -	- - - -		Standard
QWS-N1	14+697	TS 17-42	Topsoil Sand and Silt Fill – loose Silty Clay Till – very stiff Silty Clay Till – stiff	196.6	0.0 – 0.2 0.2 – 0.7 0.7 – 4.1 4.1 – 6.7	- - 175 125	- 27 - -	- 18 20 19	- - - -	- 1500 - -	- 2. 7 - -	1 (below existing grade)	Standard

Sign Number	Approx. Sign Station	Relevant BHs	Simplified Stratigraphy	Ground Surface Elev. (m)	Depth Below Existing Grade (m)	Foundation Design Parameters							Foundation Type
						q_u (kPa)	ϕ' (deg.)	γ (kN/m ³)	γ' (kN/m ³)	n_h (MN/m ³)	K_p	Ground water depth (m)	
OHS-S2	14+761	TS 17-41 (west leg)	Topsoil Silty Sand Fill – loose Silty Clay Till – very stiff Silty Clay Till – stiff Sand and Silt Till - dense	196.8	0.0 – 0.2 0.2 – 0.6 0.6 – 4.1 4.1 – 5.6 5.6 – 6.6	- - 175 125 -	- 27 - - 35	- 18 20 19 -	- - - - 10	- 1500 - - 7000	- 2. 7 - 3. 7	1 (below existing grade)	Standard
		TS 17-42 (east leg)	Topsoil Sand and Silt Fill – loose Silty Clay Till – very stiff Silty Clay Till – stiff	196.6	0.0 – 0.2 0.2 – 0.7 0.7 – 4.1 4.1 – 6.7	- - 175 125	- 27 - -	- 18 20 19	- - - -	- 1500 - -	- 2. 7 - -	1 (below existing grade)	Standard
TTS-S1	15+007	TS 18-32	Topsoil / Fill with Organics Clayey Silt to Silty Clay Till – very stiff Clayey Silt to Silty Clay Till - stiff	198.1	0.0 – 0.3 0.3 – 4.1 4.1 – 8.2	- 175 125	- - -	- 20 19	- - -	- - -	- - -	1 (below existing grade)	Standard
VMS-N2	15+145	TS 17-44	Topsoil Silty Clay – firm Silty Clay Till – very stiff to hard Silty Clay Till – stiff to very stiff	198.5	0.0 – 0.2 0.2 – 0.8 0.8 – 4.1 4.1 – 6.7	- 50 200 150	- - - -	- 18 20 19	- - - -	- - - -	- - - -	1 (below existing grade)	Standard
OHS-S1	15+272	TS 18-33 (west leg)	Clayey Silt to Silty Clay Till – very stiff to hard Clayey Silt to Silty Clay Till - stiff	199.0	0.0 – 4.1 4.1 – 8.2	175 125	- -	20 19	- -	- -	- -	1 (below existing grade)	Standard
		HM 17-34	Topsoil Silty Clay – firm Silty Clay Till – very stiff to hard Silty Clay Till – stiff to very stiff	198.8	0.0 – 0.2 0.2 – 0.7 0.7 – 5.6 5.6 – 8.2	- 50 200 150	- - - -	- 18 20 19	- - - -	- - - -	- - - -	1 (below existing grade)	Standard

Legend:

q_u = unconfined compressive strength, ($q_u = 2 \times c_u$, where c_u is undrained shear strength) (kPa)
 ϕ' = angle of internal friction (degrees)
 γ = bulk unit weight (kN/m³)

γ'	=	submerged unit weight (kN/m ³) – to be used for cohesionless soils below the groundwater table
n_h	=	coefficient of horizontal subgrade reaction (MN/m ³)
K_p	=	coefficient of passive earth pressures

Notes:

1. Traffic sign stations are approximate.
2. For approximate borehole locations reference should be made to the Borehole Location Plan (attached). Borehole coordinates (northings and eastings) are provided on the Record of Borehole sheets.
3. This table should be read in conjunction with the text of this report.
4. To account for frost action and surficial soil 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.
5. If new fill is placed, some caissons may be partially embedded within the new fill.

TABLE TS – 8
HIGHWAY 427 EXTENSION - DESIGN PACKAGE 8
SIGN SUPPORTS
FOUNDATION DESIGN PARAMETERS

Sign Number	Approx. Sign Station	Relevant BHs	Simplified Stratigraphy	Ground Surface Elev. (m)	Depth Below Existing Grade (m)	Foundation Design Parameters							Foundation Type
						q_u (kPa)	ϕ' (deg.)	γ (kN/m ³)	γ' (kN/m ³)	n_h (MN/m ³)	K_p	Ground water depth (m)	
OHS-N12	15+449	S24 (west leg)	Topsoil Silty Clay Till – very stiff Clayey Silt Till –stiff to very stiff Clayey Silt Till - hard	199.2	0.0 – 0.1 0.1 – 3.7 3.7 – 8.7 8.7 – 12.7	- 175 150 200	- - - -	- 20 19 20	- - - -	- - - -	- - - -	2 (below existing grade)	Standard
		TS 17-45 (east leg)	Topsoil Silty Sand – loose Silty Clay Till – very stiff to hard Silty Clay Till – very stiff	197.6	0.0 – 0.2 0.2 – 1.1 1.1 – 4.1 4.1 – 6.7	- - 200 150	- 28 - -	- 18 20 19	- - - -	- 2000 - -	- 2.8 - -		Standard
QWS-N2	15+799	STM 17-47	Topsoil Clayey Silt – firm Clayey Silt to Silty Clay Till – stiff to very stiff	202.2	0.0 – 0.2 0.2 – 0.9 0.9 – 6.7	- 75 150	- - -	- 18 19	- - -	- - -	- - -	6 (below existing grade)	Standard
OHS-N13	15+955	CPR 17-12 (west leg)	Topsoil Clayey Silt – firm Clayey Silt to Silty Clay Till – stiff to very stiff Clayey Silt to Silty Clay Till – hard Clayey Silt to Silty Clay Till – stiff Sand and Silt Till – very dense	201.8	0.0 – 0.1 0.1 – 0.7 0.7 – 5.6 5.6 – 7.2 7.2 – 11.0 11.1 – 12.3	- 75 150 200 100 -	- - - - - 38	- 18 -19 20 19 -	- - - - - 10	- - - - - 11000	- - - - - 4.2	6 (below existing grade)	Standard
		CPR 17-11 (east leg)	Topsoil Clayey Silt – firm Clayey Silt to Silty Clay Till – very stiff Clayey Silt to Silty Clay Till – stiff Clayey Silt to Silty Clay Till – hard Sand and Silt Till – very dense	201.3	0.0 – 0.1 0.1 – 1.2 1.2 – 4.1 4.1 – 10.2 10.2 – 11.7 11.7 – 12.8	- 50 150 125 200 -	- - - - - 38	- 18 19 19 20 -	- - - - - 10	- - - - - 11000	- - - - - 4.2		Standard

Sign Number	Approx. Sign Station	Relevant BHs	Simplified Stratigraphy	Ground Surface Elev. (m)	Depth Below Existing Grade (m)	Foundation Design Parameters							Foundation Type
						q_u (kPa)	ϕ' (deg.)	γ (kN/m ³)	γ' (kN/m ³)	n_h (MN/m ³)	K_p	Ground water depth (m)	
OHS-N14	16+209	TS 18-34 (west leg)	Topsoil Clayey Silt – Stiff Clayey Silt to Silty Clay Till – very stiff to hard Clayey Silt to Silty Clay Till - stiff		0.0 – 0.1 0.1 – 0.9 0.9 – 2.1 2.1 – 8.2	- 125 200 100	- - - -	- 18 20 19	- - - -	- - - -	- - - -	2 (below ground surface)	Standard
		E23 (east leg)	Topsoil Clayey Silt Till – very stiff Silty Clay Till – hard Silty Clay Till – very stiff Silty Clay Till - hard	203.0	0.0 – 0.2 0.2 – 2.2 2.2 – 2.9 2.9 – 10.2 10.2 – 11.3	- 150 200 150 200	- - - - -	- 19 20 19 20	- - - - -	- - - - -	- - - - -		Standard
OHS-N15	16+398	FMMO 17-04 (west leg)	Topsoil Clayey Silt – firm to stiff Clayey Silt to Silty Clay Till – very stiff Clayey Silt to Silty Clay Till – stiff Clayey Silt to Silty Clay Till - hard	203.5	0.0 – 0.1 0.1 – 1.5 1.5 – 4.1 4.1 – 11.7 11.7 – 12.8	- 100 150 100 200	- - - - -	- 18 19 19 20	- - - - -	- - - - -	- - - - -	2 (below ground surface)	Standard
		TS 18-35 (east leg)	Silty Clay – stiff Silty Clay to Clayey Silt Till – very stiff to hard Silty Clay to Clayey Silt Till – stiff	204.3	0.0 – 0.8 0.8 – 4.1 4.1 – 8.2	100 175 100	- - -	18 20 19	- - -	- - -	- - -		Standard
OHS-M2	10+261 Ramp S-E/W MMD	TS 18-36 (west leg)	Topsoil Clayey Silt – firm Clayey Silt to Silty Clay Till – very stiff Clayey Silt to Silty Clay Till - stiff	202.6	0.0 – 0.1 0.1 – 0.8 0.8 – 4.1 4.1 – 8.2	- 75 150 100	- - - -	- 18 19 19	- - - -	- - - -	- - - -	2 (below ground surface)	Standard
		TS 18-37 (east leg)	Topsoil Silty Clay - firm Clayey Silt to Silty Clay Till – stiff Clayey Silt to Silty Clay Till – very stiff Clayey Silt to Silty Clay Till – stiff	203.3	0.0 – 0.1 0.1 – 0.8 0.8 – 2.3 2.3 – 5.6 5.6 – 8.2	- 50 125 175 125	- - - - -	- 18 19 20 19	- - - - -	- - - - -	- - - - -		Standard

Sign Number	Approx. Sign Station	Relevant BHs	Simplified Stratigraphy	Ground Surface Elev. (m)	Depth Below Existing Grade (m)	Foundation Design Parameters							Foundation Type
						q_u (kPa)	ϕ' (deg.)	γ (kN/m ³)	γ' (kN/m ³)	n_h (MN/m ³)	K_p	Ground water depth (m)	
OHS-M3	10+376 Ramp S-E/W MMD	TS 18-38 (west leg)	Clayey Silt – very stiff	202.8	0.0 – 0.8	150	-	19	-	-	-	2 (below ground surface)	Standard
			Clayey Silt to Silty Clay Till – very stiff to hard		0.8 – 4.1	200	-	20	-	-	-		
			Clayey Silt to Silty Clay Till – stiff		4.1 – 8.2	100	-	19	-	-	-		
		TS 18-39 (east leg)	Clayey Silt – stiff		0.0 – 0.9	100	-	18	-	-	-		Standard
			Clayey Silt to Silty Clay Till – hard		0.9 – 2.1	200	-	20	-	-	-		
			Clayey Silt to Silty Clay Till – very stiff		2.1 – 5.6	150	-	19	-	-	-		
			Clayey Silt to Silty Clay Till - stiff		5.6 – 8.2	100	-	19	-	-	-		

Legend:

q_u	=	unconfined compressive strength, ($q_u = 2 \times c_u$, where c_u is undrained shear strength) (kPa)
ϕ'	=	angle of internal friction (degrees)
γ	=	bulk unit weight (kN/m ³)
γ'	=	submerged unit weight (kN/m ³) – to be used for cohesionless soils below the groundwater table
n_h	=	coefficient of horizontal subgrade reaction (MN/m ³)
K_p	=	coefficient of passive earth pressures

Notes:

1. Traffic sign stations are approximate.
2. For approximate borehole locations reference should be made to the Borehole Location Plan (attached). Borehole coordinates (northings and eastings) are provided on the Record of Borehole sheets.
3. This table should be read in conjunction with the text of this report.
4. To account for frost action and surficial soil 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.
5. If new fill is placed, some caissons may be partially embedded within the new fill.

Appendix A

Record of Borehole Sheets – Recent Investigation

SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

1. TEXTURAL CLASSIFICATION OF SOILS

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

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

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

3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

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

NOTE: Hierarchy of Soil Strength Prediction

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

4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

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

5. LEGEND FOR RECORDS OF BOREHOLES

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

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

 Water Level

C_{pen} Shear Strength Determination by Pocket Penetrometer

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

EXPLANATION OF ROCK LOGGING TERMS


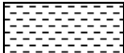



ROCK WEATHERING CLASSIFICATION

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			

METRIC

CHECKED BY ME

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No CLRN 17-01 2 OF 2 METRIC

W.P. _____ LOCATION Culvert at Sta 11+130 N 4 848 935.7 E 293 815.0 ORIGINATED BY KK
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.13 - 2017.06.13 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)
	Continued From Previous Page							20	40	60	80	100					
			10	SS	100/ 0.125		170										
							169										
168.2			11	SS	100/ 0.100												
12.8	END OF BOREHOLE AT 12.8m. Piezometer installation consists of two 25mm diameter Schedule 40 PVC pipe with a 1.52m and 3.05m slotted screen. DEEP PIEZOMETER WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2017.07.10 4.6 176.4 2017.10.24 1.5 179.5 SHALLOW PIEZOMETER WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2017.07.10 1.5 179.5 2017.10.24 1.5 179.5																

RECORD OF BOREHOLE No CLRN 17-02 1 OF 2 METRIC

W.P. _____ LOCATION Culvert at Sta 11+130 N 4 848 956.3 E 293 845.5 ORIGINATED BY ES/KK
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.12 - 2017.06.13 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
180.3	GROUND SURFACE							20 40 60 80 100					
0.0	TOPSOIL: (150mm)							20 40 60 80 100					
0.2	Clayey SILT , trace sand, trace roots Soft Dark Brown Moist		1	SS	3		180						
179.5													
0.8	Clayey SILT to Silty CLAY , some sand, trace gravel, occasional oxide stains in upper 0.5m zone Stiff to Hard Brown to Grey Moist (TILL)		2	SS	18		179						
			3	SS	24		178						
			4	SS	36		177						
			5	SS	12		176						
			6	SS	20		175						
			7	SS	24		174						
							173						
	Occasional sand seam		8	SS	23		172						
							171						
	Cobbles at 9.2m depth												

Continued Next Page

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

RECORD OF BOREHOLE No CLRN 17-02 2 OF 2 METRIC

W.P. _____ LOCATION Culvert at Sta 11+130 N 4 848 956.3 E 293 845.5 ORIGINATED BY ES/KK
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.12 - 2017.06.13 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100						
Continued From Previous Page							<div><div>20406080100</div><div>○ UNCONFINED + FIELD VANE</div><div>● QUICK TRIAXIAL × LAB VANE</div></div> <div><div>PLASTIC LIMIT</div><div>NATURAL MOISTURE CONTENT</div><div>LIQUID LIMIT</div><div>W_P W W_L</div><div>WATER CONTENT (%)</div><div>204060</div></div>							
168.3	Silty SAND , some clay, trace gravel, trace shale fragments Dense Grey Moist (TILL)		10	SS	101/ 0.225		170							0 62 25 13
12.0														
167.5			11	SS	38		169							
12.8	END OF BOREHOLE AT 12.8m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.						168							

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 1/21/19

RECORD OF BOREHOLE No CPR 17-11

1 OF 2

METRIC

W.P. _____ LOCATION N 4 853 420.6 E 292 288.9 ORIGINATED BY KK
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.20 - 2017.06.20 CHECKED BY ME

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						
201.3	GROUND SURFACE													
0.0	TOPSOIL: (100mm)													
0.1	Clayey SILT , some sand, trace gravel, trace gravel Firm Brown Moist		1	SS	6									
200.1			2	SS	7									
1.2	Clayey SILT to Silty CLAY , trace sand to sandy, trace gravel Stiff to Very Stiff Grey Moist (TILL)		3	SS	15									
			4	SS	20									
			5	SS	20									
			6	SS	12									
			7	SS	12									
			8	SS	11									
			9	SS	16									

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No CPR 17-11

2 OF 2

METRIC

W.P. _____ LOCATION N 4 853 420.6 E 292 288.9 ORIGINATED BY KK
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.20 - 2017.06.20 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
	Continued From Previous Page							20 40 60 80 100						
			10	SS	110		191							5 28 48 19
189.6							190							
11.7	SAND and SILT , some clay, trace gravel Very Dense Grey Moist (TILL)		11	SS	101		189							
188.5														
12.8	END OF BOREHOLE AT 12.8m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.													

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

METRIC

[illegible]

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No CPR 17-12

2 OF 2

METRIC

W.P. _____ LOCATION N 4 853 404.7 E 292 249.4 ORIGINATED BY KK
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.20 - 2017.06.20 CHECKED BY ME

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																	
	Continued From Previous Page						20	40	60	80	100						
190.8			10	SS	70/ 0.125												
11.0	SAND and SILT , some clay, trace gravel, occasional cobbles and boulders Very Dense Grey Moist (TILL)																
189.5			11	SS	100/ 0.100												
12.3	END OF BOREHOLE AT 12.3m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND GROUT TO SURFACE.																

RECORD OF BOREHOLE No FMMO 17-04 1 OF 2 METRIC

W.P. _____ LOCATION N 4 853 730.4 E 291 984.4 ORIGINATED BY TF
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.22 - 2017.06.22 CHECKED BY ME

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						
203.5	GROUND SURFACE													
0.0	TOPSOIL: (125mm)													
0.1	Clayey SILT , trace sand, trace gravel, occasional oxide stains Firm to Stiff Brown Moist		1	SS	7									
			2	SS	12									
202.0														
1.5	Clayey SILT to Silty CLAY , trace to some sand, trace gravel Stiff to Very Stiff Brown to Grey Moist (TILL)		3	SS	19									
			4	SS	26									
			5	SS	15									
			6	SS	9									
			7	SS	12									
			8	SS	10									
			1	TW										
			9	SS	14									

Continued Next Page

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

RECORD OF BOREHOLE No FMMO 17-04 2 OF 2 METRIC

W.P. _____ LOCATION N 4 853 730.4 E 291 984.4 ORIGINATED BY TF
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.22 - 2017.06.22 CHECKED BY ME

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									
	Continued From Previous Page																
			10	SS	11		193										
							192										
190.7	Hard		11	SS	40		191										
12.8	END OF BOREHOLE AT 12.8m. BOREHOLE DRY UPON COMPLETION. Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2017.06.29 Dry - 2017.10.23 3.8 199.7																

RECORD OF BOREHOLE No HM 17-19

1 OF 1

METRIC

W.P. _____ LOCATION N 4 848 845.7 E 293 880.1 ORIGINATED BY KK
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.15 - 2017.06.15 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)							
183.0	GROUND SURFACE							20	40	60	80	100					GR	SA	SI	CL
0.0	TOPSOIL: (150mm)							20	40	60	80	100								
0.2	Clayey SILT , trace sand, trace gravel, trace organics and rootlets Firm		1	SS	4										○					
182.3	Brown																			
0.7	Moist																			
	Silty CLAY , some sand to sandy, trace gravel, occasional cobbles Stiff to Very Stiff Brown to Grey Moist (TILL)		2	SS	12		182								○					
			3	SS	17		181								○					
			4	SS	25		180								○					0 23 39 38
			5	SS	19		179								○					
			6	SS	27		178								○					
							177													
			7	SS	28		176								○					
							175								○					
174.8			8	SS	26															
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE DRY UPON COMPLETION. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2017.07.07 0.4 182.6 2017.10.24 1.2 181.8																			

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 1/21/19

RECORD OF BOREHOLE No HM 17-21

1 OF 1

METRIC

W.P. _____ LOCATION N 4 849 312.6 E 293 815.5 ORIGINATED BY ES
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.12 - 2017.06.12 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				W P	W	W L			WATER CONTENT (%)	
183.5	GROUND SURFACE							20	40	60	80	100						
0.0	TOPSOIL: (150mm)																	
0.2	Silty CLAY , some sand, trace gravel, trace rootlets Firm to Very Stiff Brown Dry		1	SS	4		183							o				
			2	SS	21									d	—			0 21 44 35
182.0							182											
1.5	Silty CLAY , some sand, trace gravel Very Stiff to Hard Brown to Grey Moist (TILL)		3	SS	20									o				
			4	SS	29		181							o				
			5	SS	30		180											
			6	SS	21		179							d	—			
			7	SS	26		178											
176.8							177							o				
6.7	END OF BOREHOLE AT 6.7m. BOREHOLE DRY UPON COMPLETION. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2017.06.19 1.3 182.2 2017.07.10 1.4 182.1 2017.10.24 3.4 180.1																	

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 1/21/19

RECORD OF BOREHOLE No HM 17-34

1 OF 1

METRIC

W.P. _____ LOCATION N 4 852 735.2 E 292 513.6 ORIGINATED BY JZ
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.09 - 2017.06.09 CHECKED BY ME

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					WATER CONTENT (%)						
						20	40	60	80	100	20	40	60				
198.8	GROUND SURFACE																
0.0	TOPSOIL: (175mm)																
0.2	Silty CLAY , trace sand, trace gravel, trace organics (rootlets) Firm Brown Moist		1	SS	6												
198.1																	
0.7	Silty CLAY , trace to some sand, trace gravel, occasional cobbles Stiff to Hard Brown to Grey Moist (TILL)		2	SS	25												
			3	SS	30												
			4	SS	34												
			5	SS	39												
			6	SS	26												
			7	SS	16												
			8	SS	13												
190.6																	
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.																

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 1/21/19

RECORD OF BOREHOLE No RRO 17-01

1 OF 2

METRIC

W.P. _____ LOCATION Rutherford Road Overpass N 4 851 822.1 E 293 142.6 ORIGINATED BY CAR
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.06 - 2017.06.06 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
194.4	GROUND SURFACE							20	40	60	80	100		
0.0	TOPSOIL: (125mm)							20	40	60	80	100		
0.1	Silty CLAY , some sand, trace gravel, trace organics		1	SS	6		194							
193.7	Firm													
0.7	Brown Moist													
	Clay SILTY to Silty CLAY , some sand, trace gravel, occasional cobbles and boulders		2	SS	16		193							
	Stiff to Very Stiff													
	Brown to Grey													
	Moist (TILL)		3	SS	18		192							
			4	SS	22		191							
			5	SS	18		190							
			6	SS	24		189							
			7	SS	12		188							
			8	SS	10		187							
			9	SS	10		186							
184.6	END OF BOREHOLE AT 9.8m.						185							
9.8														

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No RRO 17-01 2 OF 2 METRIC

W.P. _____ LOCATION Rutherford Road Overpass N 4 851 822.1 E 293 142.6 ORIGINATED BY CAR
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.06 - 2017.06.06 CHECKED BY ME

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									
							20	40	60	80	100						
	Continued From Previous Page																
	BOREHOLE OPEN TO 6.4m AND DRY. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.																

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 1/21/19

RECORD OF BOREHOLE No SA 17-01

1 OF 2

METRIC

W.P. _____ LOCATION Street 'A' N 4 850 734.3 E 293 599.0 ORIGINATED BY CAR
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.05.26 - 2017.05.26 CHECKED BY AMP

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						
189.7	GROUND SURFACE							20 40 60 80 100						
0.0	TOPSOIL: (175mm)							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
0.2	Silty CLAY , trace sand, trace gravel Stiff Brown		1	SS	9		189							
189.0	Moist													
0.7	Silty CLAY , trace to some sand, trace gravel, occasional cobbles Stiff to Very Stiff Brown to Grey Moist (TILL)		2	SS	13		188							
			3	SS	14									
			4	SS	25		187							
			5	SS	19		186							
			6	SS	27		185							
			7	SS	14		184							
			8	SS	17		183							
			</											

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

METRIC

[illegible]

RECORD OF BOREHOLE No STM 17-19

1 OF 1

METRIC

W.P. _____ LOCATION N 4 850 191.9 E 293 699.4 ORIGINATED BY CAR
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.05.23 - 2017.05.23 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
187.6	GROUND SURFACE													
0.0	TOPSOIL: (50mm)													
	Gravelly SAND , some silt Loose Brown Moist		1	SS	7								○	
186.7	(FILL)													
0.9	Silty CLAY , trace sand, trace gravel, with organics Soft to Firm Brown to Black Moist (FILL)		2	SS	4								○	
			3	SS	6								○	
			4	SS	7								○	
184.3			5	SS	15									
3.3	Clayey SILT to Silty CLAY , some sand, trace gravel, occasional cobbles Stiff to Very Stiff Brown to Grey Moist (TILL)													
			6	SS	24								○	
			7	SS	16								○	
180.9														
6.7	END OF BOREHOLE AT 6.7m. BOREHOLE OPEN TO 5.5m AND DRY. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.													

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 1/21/19

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

RECORD OF BOREHOLE No STM 17-21

1 OF 1

METRIC

W.P. _____ LOCATION High Mast Pole N 4 850 935.2 E 293 595.2 ORIGINATED BY CAR
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.05.31 - 2017.05.31 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
190.4	GROUND SURFACE							20	40	60	80	100			
0.0	TOPSOIL: (175mm)							20	40	60	80	100			
0.2	Silty CLAY , trace sand, trace gravel, trace organics		1	SS	8		190								
189.8	Firm														
0.6	Brown														
	Moist														
	Clayey SILT to Silty CLAY , trace to some sand, trace gravel, occasional cobble		2	SS	17		189								
	Very Stiff														
	Brown to Grey														
	Moist														
	(TILL)		3	SS	16		188								
			4	SS	15		187								
			5	SS	24		186								
			6	SS	27		185								
			7	SS	21		184								
183.7															
6.7	END OF BOREHOLE AT 6.7m. BOREHOLE OPEN TO 4.6m AND DRY. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.														

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 1/21/19

RECORD OF BOREHOLE No STM 17-22

1 OF 1

METRIC

W.P. _____ LOCATION N 4 850 967.9 E 293 644.2 ORIGINATED BY CAR
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.05.30 - 2017.05.30 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
190.5	GROUND SURFACE							20	40	60	80	100				
0.0	TOPSOIL: (200mm)							20	40	60	80	100				
0.2	Silty CLAY , some sand, trace gravel, trace organics		1	SS	0		190							○		
189.9	Very Soft															
0.6	Brown Wet															
	Clayey SILT to Silty CLAY , trace to some sand, trace gravel, occasional cobbles		2	SS	18		189							○		
	Stiff to Very Stiff															
	Brown to Grey		3	SS	17		188							○		
	Moist (TILL)															
			4	SS	11		187							○		
			5	SS	16		186							○		
			6	SS	19		185							○		
			7	SS	12		184							○		
183.8																
6.7	END OF BOREHOLE AT 6.7m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.															
	WATER LEVEL READINGS															
	DATE DEPTH(m) ELEV.(m)															
	2017.06.19 1.2 189.3															
	2017.10.20 1.6 188.9															

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 1/21/19

RECORD OF BOREHOLE No STM 17-47

1 OF 1

METRIC

W.P. _____ LOCATION N 4 853 287.4 E 292 345.5 ORIGINATED BY JZ
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.13 - 2017.06.13 CHECKED BY ME

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 (%)				
								20 40 60 80 100	w P w w L						
202.2	GROUND SURFACE														
0.0	TOPSOIL: (200mm)														
0.2	Clayey SILT , trace sand, trace gravel, trace organics (rootlets) Firm Brown Moist		1	SS	7		202								
201.3															
0.9	Clayey SILT to Silty CLAY , trace to some sand, trace gravel, occasional cobbles Stiff to Very Stiff Brown to Grey Moist (TILL)		2	SS	19		201								
			3	SS	23		200								
			4	SS	24		199								
			5	SS	27		198								
			6	SS	15		197								
			7	SS	10		196								
195.5															
6.7	END OF BOREHOLE AT 6.7m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.														

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 1/21/19

RECORD OF BOREHOLE No TS 17-30

1 OF 1

METRIC

W.P. _____ LOCATION N 4 849 330.4 E 293 847.0 ORIGINATED BY ES
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.12 - 2017.06.12 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%) W _P W W _L				
181.4	GROUND SURFACE																
0.0	TOPSOIL: (150mm)																
0.2	Clayey SILT , some sand, trace gravel, roots and rootlets		1	SS	4		181							○			
180.7	Firm																
0.7	Dark Brown to Brown																
	Moist																
	Silty CLAY , some sand, trace gravel, oxide stains		2	SS	10		180							○			
	Stiff to Hard																
	Brown																
	Moist																
	(TILL)		3	SS	17									○			
			4	SS	37		179							○			
			5	SS	36		178							○			
177.8																	
3.6	SAND and SILT , trace clay, trace gravel						177										
	Very Dense																
	Brown																
	Moist																
	(TILL)																
176.6														○			
4.8	Silty CLAY , some sand, trace gravel, occasional cobbles		6	SS	59		176							○			
	Hard																
	Brown																
	Moist																
	(TILL)																
			7	SS	32		175							○			
174.7																	
6.7	END OF BOREHOLE AT 6.7m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.																

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 1/21/19

RECORD OF BOREHOLE No TS 17-36

1 OF 1

METRIC

W.P. _____ LOCATION N 4 851 007.7 E 293 598.8 ORIGINATED BY CAR
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.02 - 2017.06.02 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE		WATER CONTENT (%) w _P w w _L				
189.9	GROUND SURFACE							20	40	60	80	100		
0.0	TOPSOIL: (200mm)													
0.2	Silty CLAY , trace to some sand, trace gravel, trace organics (rootlets)		1	SS	8									
189.3	Firm													
0.6	Brown Moist (FILL)													
	Silty CLAY , trace to some sand, trace gravel, occasional cobbles		2	SS	17									
	Stiff to Very Stiff													
	Brown to Grey													
	Moist (TILL)		3	SS	19									
			4	SS	18									
			5	SS	13									
			6	SS	13									
			7	SS	9									
183.2														
6.7	END OF BOREHOLE AT 6.7m. BOREHOLE OPEN TO 4.6m AND DRY. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.													

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 1/21/19

RECORD OF BOREHOLE No TS 17-38

1 OF 1

METRIC

W.P. _____ LOCATION N 4 851 375.3 E 293 442.4 ORIGINATED BY CAR
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.13 - 2017.06.13 CHECKED BY ME

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									
190.9	GROUND SURFACE							20	40	60	80	100					
0.0	TOPSOIL: (150mm)							20	40	60	80	100					
0.2	Silty CLAY , trace sand, trace gravel, trace organics (rootlets)		1	SS	8												
190.2	Firm																
0.7	Brown Moist																
	Silty CLAY , some sand, trace gravel, occasional cobbles		2	SS	18		190										
	Very Stiff to Hard																
	Brown to Grey																
	Moist																
	(TILL)		3	SS	20		189										
			4	SS	35		188										
			5	SS	28		187										
			6	SS	31		186										0 13 52 35
							185										
			7	SS	20												
184.2	END OF BOREHOLE AT 6.7m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.																
6.7																	
	WATER LEVEL READINGS																
	DATE DEPTH(m) ELEV.(m)																
	2017.06.19 1.4 189.5																
	2017.10.23 2.1 188.8																
	2017.10.31 3.2 187.7																

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 1/21/19

RECORD OF BOREHOLE No TS 17-39

1 OF 1

METRIC

W.P. _____ LOCATION N 4 851 390.4 E 293 473.6 ORIGINATED BY CAR
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.13 - 2017.06.13 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
190.0	GROUND SURFACE							20	40	60	80	100					
0.0	TOPSOIL: (150mm)							20	40	60	80	100					
0.2	Silty CLAY , trace sand, trace gravel, trace organics (rootlets)		1	SS	4												
189.3	Firm																
0.7	Brown																
	Moist																
	Silty CLAY , some sand, trace gravel, occasional cobbles		2	SS	18		189										
	Very Stiff to Hard																
	Brown to Grey																
	Moist																
	(TILL)		3	SS	18		188										
			4	SS	28		187										
			5	SS	25												
							186										
			6	SS	12		185										
							184										
			7	SS	12												
183.3	END OF BOREHOLE AT 6.7m. BOREHOLE OPEN TO 5.2m AND DRY. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.																
6.7																	

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 1/21/19

RECORD OF BOREHOLE No TS 17-41

1 OF 1

METRIC

W.P. _____ LOCATION N 4 852 272.0 E 292 703.2 ORIGINATED BY JZ
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.05.24 - 2017.05.24 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
196.8	GROUND SURFACE													
0.0	TOPSOIL: (150mm)													
0.2	Silty SAND , some clay, trace gravel, trace organics		1	SS	8									
196.2	Loose													
0.6	Dark Brown Moist (FILL)		2	SS	19		196							
	Silty CLAY , trace to some sand, trace gravel													
	Very Stiff													
	Brown to Grey		3	SS	27		195							0 17 47 36
	Moist (TILL)													
			4	SS	26		194							
			5	SS	21		193							
			6	SS	12		192							
191.2							191							
5.6	SAND and SILT , some clay													
	Dense													
	Grey													
	Moist													
	(TILL)		7	SS	37									
190.2														
190.9														
6.7	END OF BOREHOLE AT 6.7m. WATER LEVEL AT 0.2m UPON COMPLETION OF BOREHOLE. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.													

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 1/21/19

RECORD OF BOREHOLE No TS 17-42

1 OF 1

METRIC

W.P. _____ LOCATION N 4 852 290.8 E 292 732.1 ORIGINATED BY JZ
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.05.23 - 2017.05.23 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							WATER CONTENT (%) w _P w w _L				
196.6	GROUND SURFACE					▽	196												
0.0	TOPSOIL: (150mm)																		
0.2	SAND and SILT, trace clay, trace gravel, trace organics (rootlets)		1	SS	5														
195.9	Loose Brown Moist (FILL)																		
0.7	Brown Moist (FILL)		2	SS	19														
	Silty CLAY, some sand, trace gravel, occasional cobbles																		
	Stiff to Very Stiff Brown/Grey Moist (TILL)																		
									</										

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 1/21/19

RECORD OF BOREHOLE No TS 17-44

1 OF 1

METRIC

W.P. _____ LOCATION N 4 852 679.9 E 292 565.5 ORIGINATED BY JZ
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.12 - 2017.06.12 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								20 40 60 80 100					
198.5	GROUND SURFACE												
0.0	TOPSOIL: (200mm)												
0.2	Silty CLAY , trace sand, trace gravel, trace organics (rootlets) Firm Brown		1	SS	6								
197.7	Brown												
0.8	Moist												
	Silty CLAY , trace to some sand, trace gravel, occasional cobbles, occasional oxidized staining Stiff to Hard Brown to Grey Moist (TILL)		2	SS	24								
			3	SS	23								
			4	SS	34								
			5	SS	34								
			6	SS	18								
			7	SS	12								
191.8													
6.7	END OF BOREHOLE AT 6.7m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.												

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 1/21/19

RECORD OF BOREHOLE No TS 17-45

1 OF 1

METRIC

W.P. _____ LOCATION N 4 852 965.0 E 292 485.4 ORIGINATED BY JZ
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE - CHECKED BY ME

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									
197.6	GROUND SURFACE																
0.0	TOPSOIL: (175mm)																
0.2	Silty SAND , trace clay, trace gravel, trace organics (rootlets) Loose Brown Moist		1	SS	6												
196.5			2	SS	9												
1.1	Silty CLAY , some sand, trace gravel, occasional cobbles Stiff to Hard Brown Moist (TILL)		3	SS	29												
			4	SS	30												
			5	SS	32												
			6	SS	15												
			7	SS	16												
190.9	END OF BOREHOLE AT 6.7m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.																
6.7																	

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 1/21/19

RECORD OF BOREHOLE No TS 18-27

1 OF 1

METRIC

W.P. _____ LOCATION N 4 848 863.2 E 293 906.3 ORIGINATED BY JM
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2018.08.27 - 2018.08.27 CHECKED BY ME

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									
182.6	GROUND SURFACE							20	40	60	80	100					
0.0	Clayey SILT , trace sand, trace gravel, trace organics and rootlets Stiff Brown Moist		1	SS	10												
182.0							182										
0.6	Clayey SILT to Silty CLAY , some sand, trace gravel, orange staining Very Stiff Brown to Grey Moist (TILL)		2	SS	22												
			3	SS	24		181										
			4	SS	26		180										
			5	SS	25		179										
							178										
	Becoming grey		6	SS	17												
							177										
			7	SS	18		176										2 16 40 42
							175										
174.4			8	SS	28												
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.																

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 2/1/19

RECORD OF BOREHOLE No TS 18-29

1 OF 1

METRIC

W.P. _____ LOCATION N 4 850 725.0 E 293 616.7 ORIGINATED BY JM
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2018.08.24 - 2018.08.24 CHECKED BY ME

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											
189.4	GROUND SURFACE							20	40	60	80	100							
0.0	Silty CLAY to Clayey SILT , trace sand, trace rootlets, trace organics Firm Brown Moist		1	SS	7		189												
188.6																			
0.8	Clayey SILT to Silty CLAY , some sand, trace gravel, occasional cobbles Stiff to Hard Brown Moist (TILL)		2	SS	13		188												
			3	SS	19														
	Becoming grey		4	SS	17		187												
			5	SS	17		186												
							185												
			6	SS	24		184												
							183												
			7	SS	20														
							182												
			8	SS	70														
181.2																			
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE DRY UPON COMPLETION. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.5m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2018.08.24 Dry -																		

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 2/1/19

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

RECORD OF BOREHOLE No TS 18-30

1 OF 1

METRIC

W.P. _____ LOCATION N 4 851 164.4 E 293 489.7 ORIGINATED BY JM
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2018.08.24 - 2018.08.24 CHECKED BY ME

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										
190.6	GROUND SURFACE							20	40	60	80	100						
0.0	SILT , some organics, some sand Stiff Dark Brown Moist		1	SS	16		190											
0.2	Clayey SILT to Silty CLAY , some sand, trace gravel Stiff to Very Stiff Brown Moist (TILL)		2	SS	16		189											
			3	SS	18		189											
			4	SS	12		188											
			5	SS	14		187											
	Becoming grey		6	SS	25		186											
							185											
			7	SS	14		184											1 16 55 28
			8	SS	13		183											
182.3																		
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE OPEN TO 7.6m AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.																	

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 2/1/19

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No TS 18-31

1 OF 1

METRIC

W.P. _____ LOCATION N 4 851 173.1 E 293 514.2 ORIGINATED BY JM
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2018.08.24 - 2018.08.24 CHECKED BY ME

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								
190.4	GROUND SURFACE							20	40	60	80	100				
0.0	TOPSOIL: (25mm) Clayey SILT to Silty CLAY , some sand, trace gravel, occasional cobbles Stiff to Hard Brown Moist (TILL)		1	SS	12											
			2	SS	38											
			3	SS	12											
			4	SS	32											
	Becoming grey Cobble at 3.3m		5	SS	36											
186.0																
4.4	SAND and SILT layer															
185.5			6	SS	27											3 42 38 17
4.9																
			7	SS	13											
			8	SS	19											
182.2																
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.															

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 2/1/19

RECORD OF BOREHOLE No TS 18-32

1 OF 1

METRIC

W.P. _____ LOCATION N 4 852 527.8 E 292 560.5 ORIGINATED BY JM
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2018.08.23 - 2018.08.23 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)	
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE							
198.1	GROUND SURFACE																	
0.0	TOPSOIL , mixed with sand and gravel Stiff Brown Moist (150mm) CRUSHED ROCK AND CONCRETE with organics Moist (FILL) Clayey SILT to Silty CLAY , trace sand, trace organics, trace gravel Stiff to Very Stiff Brown Moist (TILL) Becoming grey		1	SS	9													
190.8			2	SS	20													
0.3			3	SS	25													
			4	SS	19													
			5	SS	22													
			6	SS	15													
			7	SS	10													
			8	SS	15													
189.9																		
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.																	

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 2/1/19

RECORD OF BOREHOLE No TS 18-33

1 OF 1

METRIC

W.P. _____ LOCATION N 4 852 752.3 E 292 478.5 ORIGINATED BY JM
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2018.08.23 - 2018.08.23 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					W _p	W	W _L		
199.0	GROUND SURFACE																
0.0	Clayey SILT to Silty CLAY , some sand to sandy, trace gravel Stiff to Hard Brown Moist (TILL)		1	SS	22												
			2	SS	39												
			3	SS	22												
			4	SS	36												
			5	SS	26												
	Becoming grey		6	SS	10											3 22 45 30	
			7	SS	14											16 37 34 13	
			8	SS	15												
190.8	END OF BOREHOLE AT 8.2m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.5m slotted screen.																
8.2	WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2018.08.23 Dry -																

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 2/1/19

RECORD OF BOREHOLE No TS 18-34

1 OF 1

METRIC

W.P. _____ LOCATION _____ ORIGINATED BY JM
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2018.08.20 - 2018.08.20 CHECKED BY ME

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				
0.0	GROUND SURFACE																
	TOPSOIL: (25mm) Clayey SILT , trace sand, trace gravel, occasional oxide stains Stiff Brown Moist		1	SS	12												
0.9	Clayey SILT to Silty CLAY , some sand to sandy, trace gravel Stiff to Hard Brown Moist (TILL)		2	SS	22											1 29 39 31	
			3	SS	33												
	Becoming grey		4	SS	11												
			5	SS	10												
			6	SS	13												
			7	SS	10											0 11 48 41	
			8	SS	13												
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.																

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 2/1/19

RECORD OF BOREHOLE No TS 18-35

1 OF 1

METRIC

W.P. _____ LOCATION N 4 853 760.7 E 292 000.0 ORIGINATED BY JM
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2018.08.20 - 2018.08.20 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								20 40 60 80 100							
204.3	GROUND SURFACE														
0.0	CLAY , silty, some sand, trace to some rootlets, trace organics Stiff Brown Moist		1	SS	10		204							1 16 37 46	
203.5															
0.8	Silty CLAY to Clayey SILT , some sand, trace gravel Stiff to Hard Brown Moist (TILL)		2	SS	26		203								
			3	SS	16		202								
	Becoming grey		4	SS	34		201								
			5	SS	28		200								
			6	SS	12		199								
			7	SS	12		198								
			8	SS	9		197								
196.0															
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.														

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 2/1/19

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No TS 18-36

1 OF 1

METRIC

W.P. _____ LOCATION N 4 853 735.7 E 292 098.0 ORIGINATED BY JM
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2018.08.23 - 2018.08.23 CHECKED BY ME

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									
							20	40	60	80	100						
202.6	GROUND SURFACE																
0.0	TOPSOIL: (25mm) Clayey SILT , trace to some rootlets, trace gravel, orange staining Firm Brown to Grey Moist		1	SS	7												
201.8																	
0.8	Silty CLAY to Clayey SILT , trace to some sand, trace gravel, occasional cobbles Stiff to Very Stiff Brown Moist (TILL) Becoming grey		2	SS	15												
			3	SS	12												
			4	SS	24												
			5	SS	17												
			6	SS	10												
			7	SS	10												
			8	SS	9												
194.3	END OF BOREHOLE AT 8.2m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.5m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2018.08.23 Dry -																

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 2/1/19

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

METRIC

[illegible]

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No TS 18-38

1 OF 1

METRIC

W.P. _____ LOCATION N 4 853 852.1 E 292 110.9 ORIGINATED BY JM
 HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2018.08.20 - 2018.08.20 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
202.8	GROUND SURFACE							20	40	60	80	100	PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L		
0.0	Clayey SILT , trace sand, trace gravel, occasional oxide stains Very Stiff Brown Moist		1	SS	16									○			
202.0																	
0.8	Clayey SILT to Silty CLAY , trace to some sand Stiff to Hard Brown Moist (TILL)		2	SS	30		202							○			
			3	SS	30		201							○			
			4	SS	31		200							○	1		0 12 45 43
			5	SS	24									○			
							199										
	Becoming grey		6	SS	10		198							○			
														○			
							197										
			7	SS	12									○			
							196										
			8	SS	10		195							○			
194.6																	
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.																

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 2/1/19

RECORD OF BOREHOLE No TS 18-39

1 OF 1

METRIC

W.P. _____ LOCATION _____ ORIGINATED BY JM
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2018.08.20 - 2018.08.20 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
							20	40	60	80	100	W _p	W	W _L			
0.0	Clayey SILT , trace sand, trace gravel, trace rootlets, trace organics Stiff Brown Moist		1	SS	11												
0.9	Clayey SILT to Silty CLAY , some sand, trace gravel Stiff to Hard Brown Moist (TILL)		2	SS	37												
			3	SS	31												
	Becoming grey		4	SS	24												
			5	SS	16												
			6	SS	18												
			7	SS	12												
			8	SS	11												
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE DRY UPON COMPLETION. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.5m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2018.08.20 Dry -																

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 2/1/19

RECORD OF BOREHOLE No UC 17-11

1 OF 1

METRIC

W.P. _____ LOCATION N 4 848 488.8 E 293 926.1 ORIGINATED BY TF
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.06.16 - 2017.06.16 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
								<div><div>20406080100</div><div>○ UNCONFINED + FIELD VANE</div><div>● QUICK TRIAXIAL × LAB VANE</div></div>					<div><div>204060</div><div>WATER CONTENT (%)</div></div>						
183.1	GROUND SURFACE																		
0.0	TOPSOIL: (75mm) Clayey SILT , trace sand, trace gravel, trace roots Stiff Brown Moist (FILL) Clayey SILT to Silty CLAY , sandy, trace gravel, occasional cobbles Firm to Hard Brown to Grey Moist (TILL) Becoming grey		1	SS	10														
0.1																			
182.3			2	SS	19														
0.8																			
			3	SS	13													3 27 39 31	
			4	SS	12														
		5	SS	7															
			6	SS	12														
			7	SS	24														
			8	SS	30												2 25 49 24		
174.9																			
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE DRY UPON COMPLETION. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2017.07.07 Dry - 2017.10.24 2.3 180.8																		

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 1/21/19

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No ZB 17-05

1 OF 2

METRIC

W.P. _____ LOCATION Zenway Blvd. Underpass N 4 848 482.4 E 293 883.5 ORIGINATED BY ES
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.07.04 - 2017.07.04 CHECKED BY ME

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					WATER CONTENT (%)						
						20	40	60	80	100	20	40	60				
183.0	GROUND SURFACE																
0.0	ORGANICS: (100mm)																
0.1	Clayey SILT , some sand, trace gravel, trace roots Firm to Very Stiff Brown Moist		1	SS	5												
			2	SS	26												
181.5																	
1.5	Clayey SILT to Silty CLAY , sandy, trace gravel, occasional sand seams Stiff to Hard Brown to Grey Moist (TILL)		3	SS	24												
			4	SS	13												
			5	SS	12												
			6	SS	10												
			7	SS	26												
			8	SS	36												
174.2																	
8.8	SAND and SILT , trace to some clay, trace gravel Very Dense Grey Moist (TILL)		9	SS	100/ 0.275												
173.4																	
9.6	END OF BOREHOLE AT 9.8m.																

Continued Next Page

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

RECORD OF BOREHOLE No ZB 17-05

2 OF 2

METRIC

W.P. _____ LOCATION Zenway Blvd. Underpass N 4 848 482.4 E 293 883.5 ORIGINATED BY ES
 HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2017.07.04 - 2017.07.04 CHECKED BY ME

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
	Continued From Previous Page																
	BOREHOLE DRY UPON COMPLETION. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2017.07.07 8.6 174.4 2017.08.09 2.2 180.8 2017.10.24 2.4 180.6																

Appendix B

Record of Borehole Sheets – Previous Investigations

[illegible]

MIS-MTO 001 06-1111-012.GPJ GAL-MISS.GDT 8/5/09 SAC/DE

+3, X3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT 06-1111-012

RECORD OF BOREHOLE No E23

1 OF 1 METRIC

W.O. 05-20012

LOCATION N 4853605.7 :E 292135.4

ORIGINATED BY JEB

DIST Central HWY 427

BOREHOLE TYPE 108 mm Diameter Solid Stem Augers

COMPILED BY PKS

DATUM Geodetic

DATE April 29, 2009

CHECKED BY SMN

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 × REMOULDED						
203.0	GROUND SURFACE							20 40 60 80 100						
0.0	TOPSOIL													
0.2	CLAYEY SILT, some sand, trace gravel (TILL) Stiff to very stiff Brown Moist		1	SS	9		202							
			2	SS	29									
			3	SS	25		201							
200.8	SILTY CLAY, trace sand, trace gravel (TILL) Very stiff to hard Brown, becoming grey below a depth of 3.0 m Moist		4	SS	33		200							
2.2			5	SS	20									
			6	SS	19		199							
			7	SS	16		198							
							197							
			8	SS	21		196							
							195							
			9	SS	16		194							
			10	SS	19		193							
							192							
191.7	END OF BOREHOLE		11	SS	45									
11.3	NOTES: 1. Open borehole dry upon completion of drilling. 2. Borehole backfilled with bentonite.													

MIS-MTO 001 06-1111-012.GPJ GAL-MISS.GDT 8/5/09 SAC/DD

PROJECT 06-1111-012		RECORD OF BOREHOLE No S15		1 OF 2 METRIC	
W.O. 05-20012		LOCATION N 4851810.8 E 293098.7		ORIGINATED BY JEB	
DIST Central HWY 427		BOREHOLE TYPE 200 mm Outside Diameter Hollow Stem Augers		COMPILED BY TB/A	
DATUM Geodetic		DATE March 25, 2009		CHECKED BY SMM	




SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)				
								○ UNCONFINED	+ FIELD VANE						● QUICK TRIAXIAL	× REMOULDED	20	40	60
194.0 0.0	GROUND SURFACE		1	SS	7									GR SA SI CL					
193.2 0.8	CLAYEY SILT, trace gravel, trace sand, containing organics (REWORKED) Firm Brown Moist		2	SS	21														
	CLAYEY SILT, some sand, trace gravel (TILL) Stiff to very stiff Brown Moist Containing sand seam at depths of 1.2 m and 1.8 m		3	SS	25														
			4	SS	24														
			5	SS	22														
			6	SS	26														
			7	SS	21														
			8	SS	18														
			9	SS	14														
			10	SS	13														
			11	SS	29														
182.1 11.9	Containing about 50 mm thick sandy silt layer at a depth of 11.4 m SAND and SILT, trace to some gravel, some clay (TILL) Dense to very dense Grey Wet		12	SS	31														
			13	SS	34														

MIS-MTO 001 06-1111-012.GPJ GAL-MISS.GDT 8/5/09 SAC/DD

Continued Next Page

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT <u>06-1111-012</u>		RECORD OF BOREHOLE No S15		2 OF 2 METRIC	
W.O. <u>05-20012</u>		LOCATION <u>N 4851810.8 ; E 293096.7</u>		ORIGINATED BY <u>JEB</u>	
DIST <u>Central</u> HWY <u>427</u>		BOREHOLE TYPE <u>200 mm Outside Diameter Hollow Stem Augers</u>		COMPILED BY <u>TB/A</u>	
DATUM <u>Geodetic</u>		DATE <u>March 25, 2009</u>		CHECKED BY <u>SMW</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED 20 40 60 80 100	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES							
	— CONTINUED FROM PREVIOUS PAGE —											
177.7	SAND and SILT, trace to some gravel, some clay (TILL) Dense to very dense Grey Wet		14	SS	130		178					
16.3	CLAYEY SILT, trace sand Hard Grey Moist		15	SS	40/0.15		177					0 2 80 18
176.0	CLAYEY SILT, some sand, trace gravel (TILL) Hard Grey Moist		16	SS	101		176					
175.1	END OF BOREHOLE											
18.9	NOTES: 1. Water level in open borehole at a depth of 7.6 m below ground surface (Elev. 186.4 m) upon completion of drilling. 2. Borehole backfilled with bentonite.											

PROJECT 06-1111-012

RECORD OF BOREHOLE No S24

1 OF 1 METRIC

W.O. 05-20012

LOCATION N 4852954.8 : E 292466.5

ORIGINATED BY DD

DIST Central HWY 427

BOREHOLE TYPE 200 mm Outside Diameter Hollow Stem Augers

COMPILED BY VA

DATUM Geodetic

DATE March 3, 2009

CHECKED BY SMM *SMM*

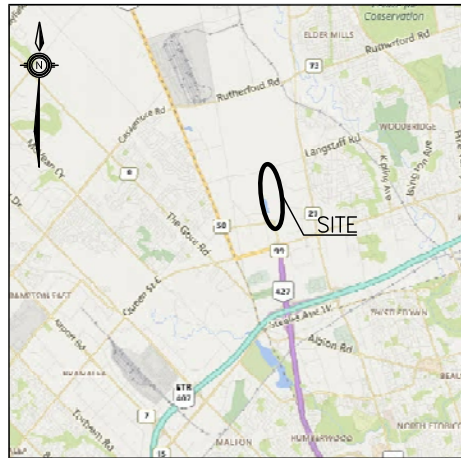
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED 20 40 60 80 100	+ FIELD VANE 20 40 60 80 100						
199.2	GROUND SURFACE														
8.9	TOPSOIL														
	SILTY CLAY, some sand, trace gravel, (TILL) containing rootlets to a depth of 0.6 m Stiff to very stiff Brown to grey Moist		1	SS	14		199								
			2	SS	22		198							2 13 49 36	
			3	SS	28		197								
			4	SS	26		196								
			5	SS	26		195								
195.5	CLAYEY SILT some to with sand, trace gravel, containing cobbles below a depth of 9.8 m (TILL) Stiff to hard Grey Moist to wet		6	SS	13		194								
			7	SS	17		193								
			8	SS	18		192								
			9	SS	20		191								
			10	SS	113		190								
	Auger grinding at a depth of 9.8 m						189								
	Wet below a depth of 10.7 m		11	SS	11/0.25		188							5 32 50 13	
			12	SS	113		187								
186.6	END OF BOREHOLE														
12.7	NOTES: 1. Water level in open borehole at a depth of 8.0 m below ground surface (Elev. 191.2 m) upon completion of drilling. 2. Borehole backfilled with bentonite.														

MIS-MTO 001 06-1111-012.GPJ GAL-MISS.GDT 8/5/09 SAC/DD

Appendix C

Borehole Location Plans

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



KEYPLAN

LEGEND

- Borehole (By Thurber)
- Borehole (By Others)

NO	ELEVATION	NORTHING	EASTING
CLRN 17-01	181.0	4 848 935.7	293 815.0
CLRN 17-02	180.3	4 848 956.3	293 845.5
HM 17-19	183.0	4 848 845.7	293 880.1
HM 17-21	183.5	4 849 312.6	293 815.5
TS 17-30	181.4	4 849 330.4	293 847.0
TS 18-27	182.6	4 848 863.2	293 906.3
UC 17-11	183.1	4 848 488.8	293 926.1
ZB 17-05	183.0	4 848 482.4	293 883.5

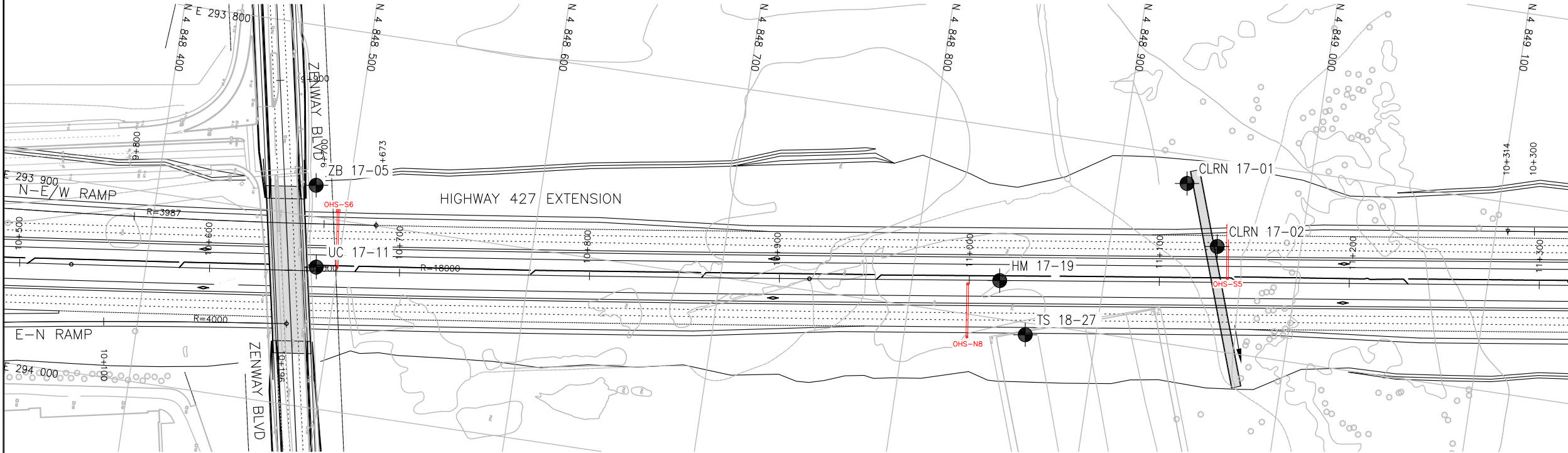
-NOTES-

- 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.

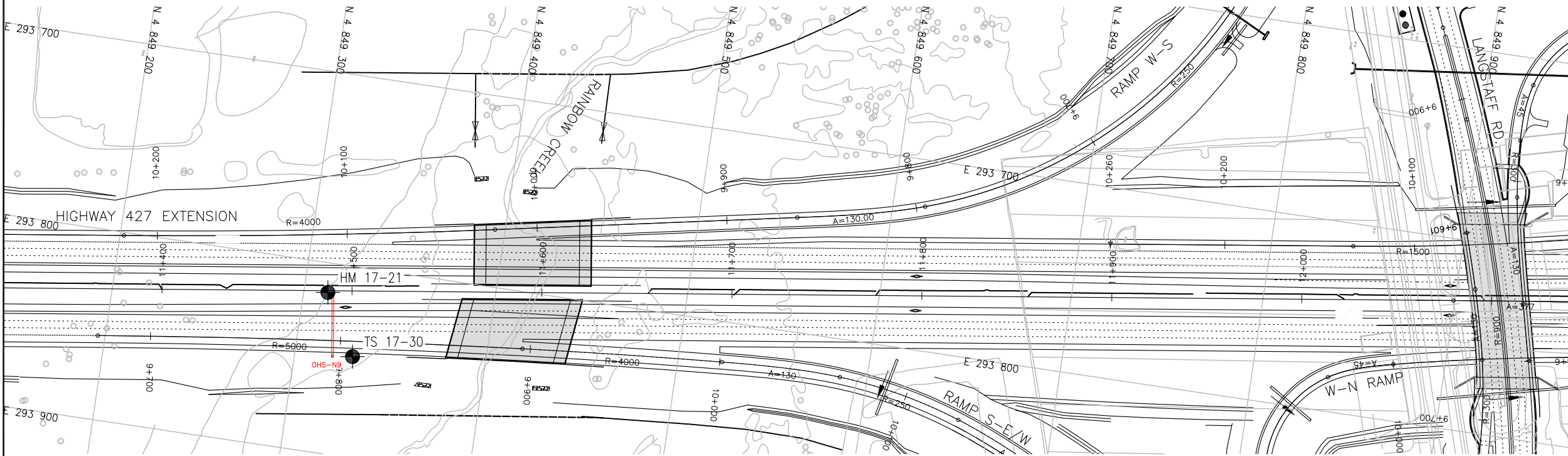
GEOCRES No.

HWY 427 EXPANSION
SIGN SUPPORTS
FINCH AVENUE TO ALBION ROAD
PACKAGE 6, 7 AND 8
BOREHOLE LOCATIONS PLAN

PROJECT ID.	STAGE IDENTIFIER	DESIGN PACKAGE NUMBER	DISCIPLINE	STRUCTURE NUMBER	DOCUMENT TYPE	DRAWING NUMBER	REVISION NUMBER
H427-D	N	0	FDN		DWG		A



PLAN

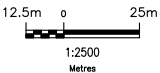


PLAN

FILENAME: H:\Drafting\9000\19484\1ED19484-PLR-HWY 427 (TrafficSigns).dwg
PLOTDATE: 2/1/2019 11:19 AM

NO.	DATE	REVISIONS	BY	CHK	LEAD DES.	PROJ. MGR.
A	19/02/01	90% SUBMISSION TO CA	AN	MB	JL	JL

SCALE :



1:2500
Metres

DESIGNED	M. BOUCHER	MB	19/02/01
DRAWN	A. NOOR	AN	19/02/01
CHECKED	M. BOUCHER	MB	19/02/01
APPROVED LEAD ENGINEER	J. LEE	JL	19/02/01
APPROVED PROJ. MANAGER	J. LEE	JL	19/02/01
NAME (PRINT)		INIT.	DATE



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



THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

- Borehole (By Thurber)
- Borehole (By Others)

NO	ELEVATION	NORTHING	EASTING
C10	188.6	4 851 421.5	293 435.4
SA 17-01	189.7	4 850 734.3	293 599.0
STM 17-19	187.6	4 850 191.9	293 699.4
STM 17-21	190.4	4 850 935.2	293 595.2
STM 17-22	190.5	4 850 967.9	293 644.2
TS 17-36	189.9	4 851 007.7	293 598.8
TS 17-38	190.9	4 851 375.3	293 442.4
TS 17-39	190.0	4 851 390.4	293 473.6
TS 18-29	189.4	4 850 725.0	293 616.7
TS 18-30	190.6	4 851 164.4	293 489.7
TS 18-31	190.4	4 851 173.1	293 514.2

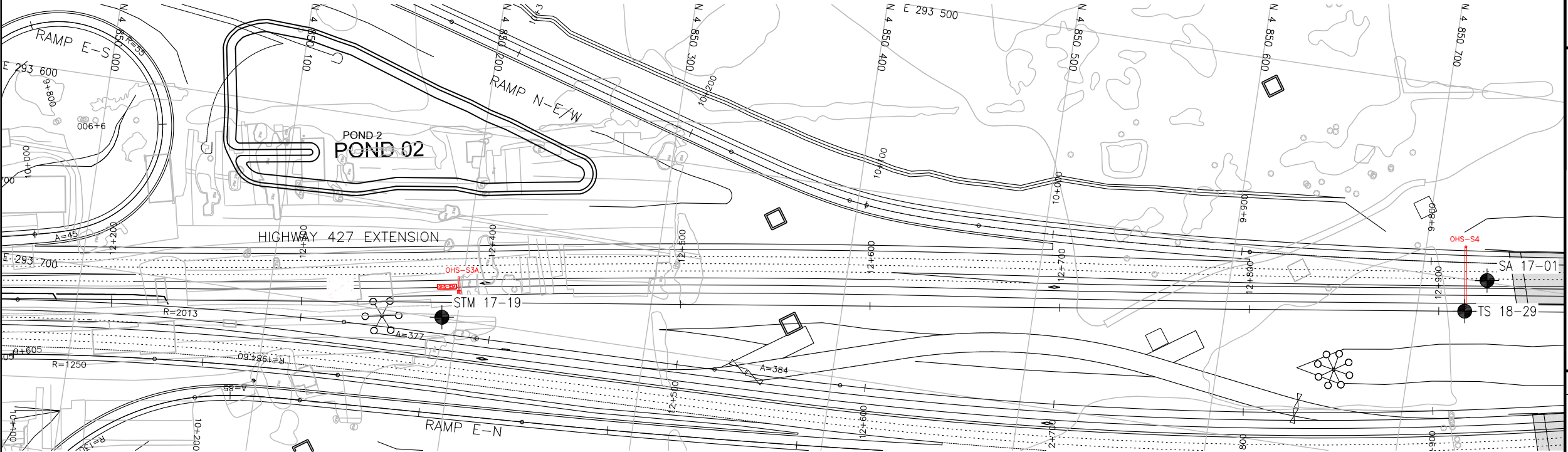
-NOTES-

- 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.

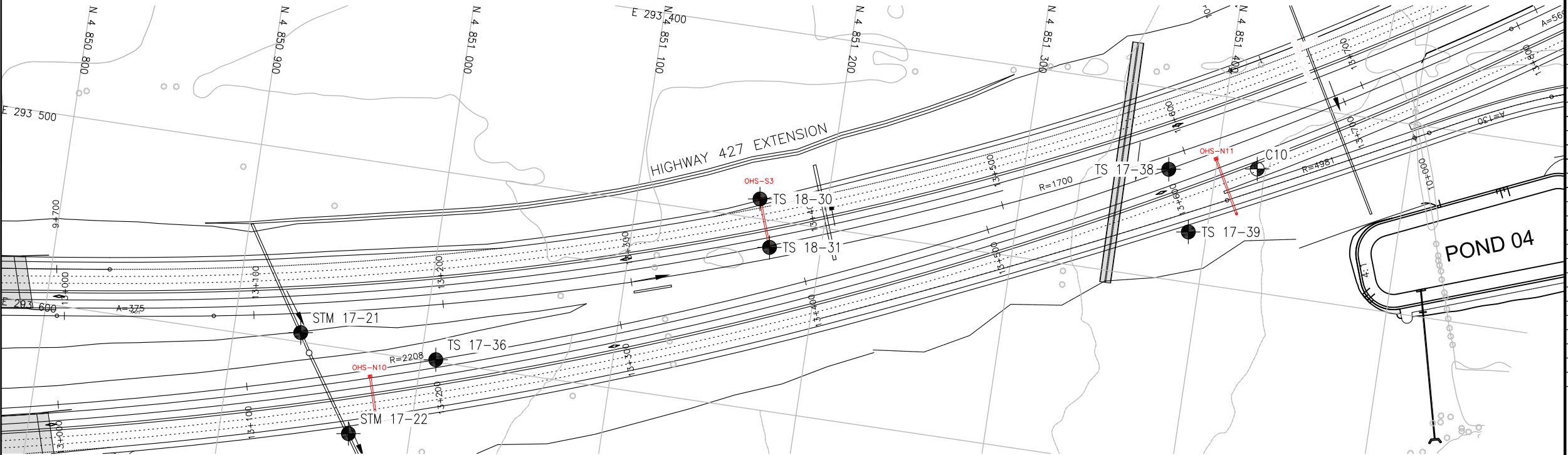
GEOCRES No.

HWY 427 EXPANSION
SIGN SUPPORTS
FINCH AVENUE TO ALBION ROAD
PACKAGE 6, 7 AND 8
BOREHOLE LOCATIONS PLAN

PROJECT ID.	STAGE IDENTIFIER	DESIGN PACKAGE NUMBER	DISCIPLINE	STRUCTURE NUMBER	DOCUMENT TYPE	DRAWING NUMBER	REVISION NUMBER
H427-D	N	0	FDN		DWG		A

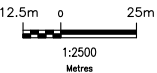


PLAN



PLAN

SCALE :



DESIGNED	M. BOUCHER	MB	19/02/01
DRAWN	A. NOOR	AN	19/02/01
CHECKED	M. BOUCHER	MB	19/02/01
APPROVED LEAD ENGINEER	J. LEE	JL	19/02/01
APPROVED PROJ. MANAGER	J. LEE	JL	19/02/01
NAME (PRINT)		INIT.	DATE

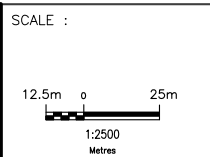


FILENAME: H:\Drafting\19000\19484\TED19484-PLR-HWY 427 (TrafficSigns).dwg
PLOT DATE: 2/1/2019 11:38 AM

NO.	DATE	REVISIONS	BY	CHK	LEO. ENG.	PROJ. MGR.
A	19/02/01	90% SUBMISSION TO CA	AN	MB	JL	JL

FILENAME: H:\Drafting\19000\19484\TED19484-PLR-HWY 427 (TrafficSigns).dwg
PLOTDATE: 2/1/2019 11:23 AM

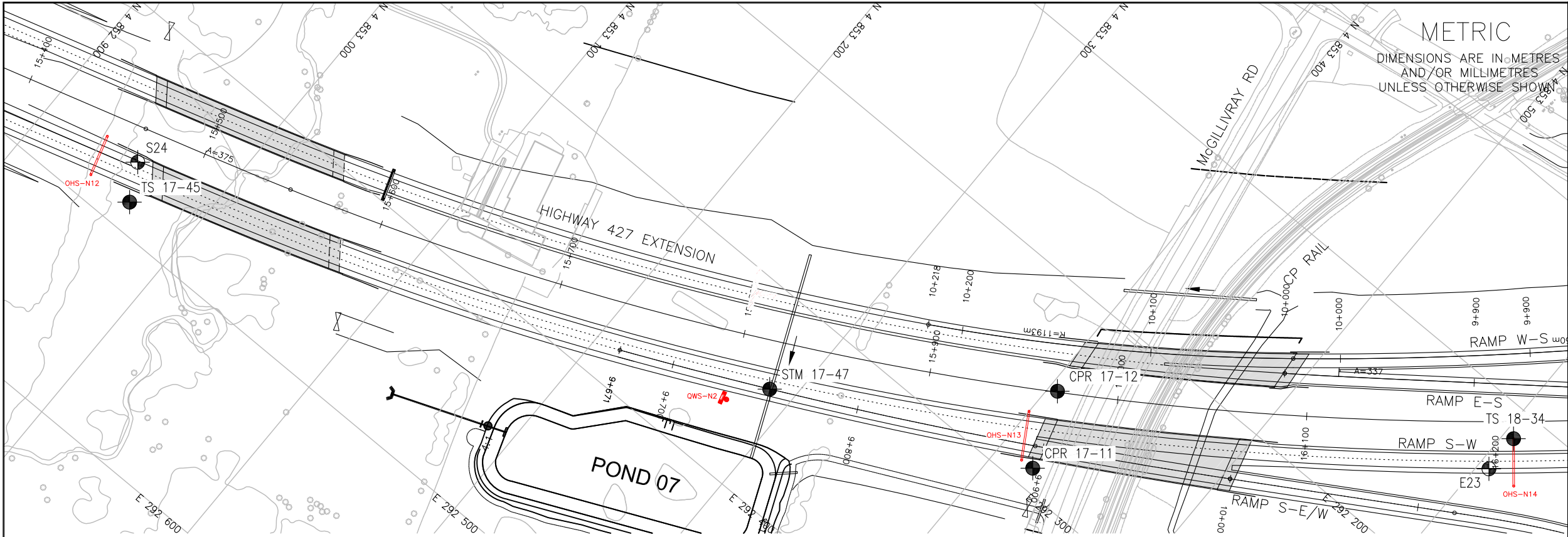
A	19/02/01	90% SUBMISSION TO CA	AN	MB	JL	JL
NO.	DATE	REVISIONS	BY	CHK	LEO. ENG.	PROJ. MGR.



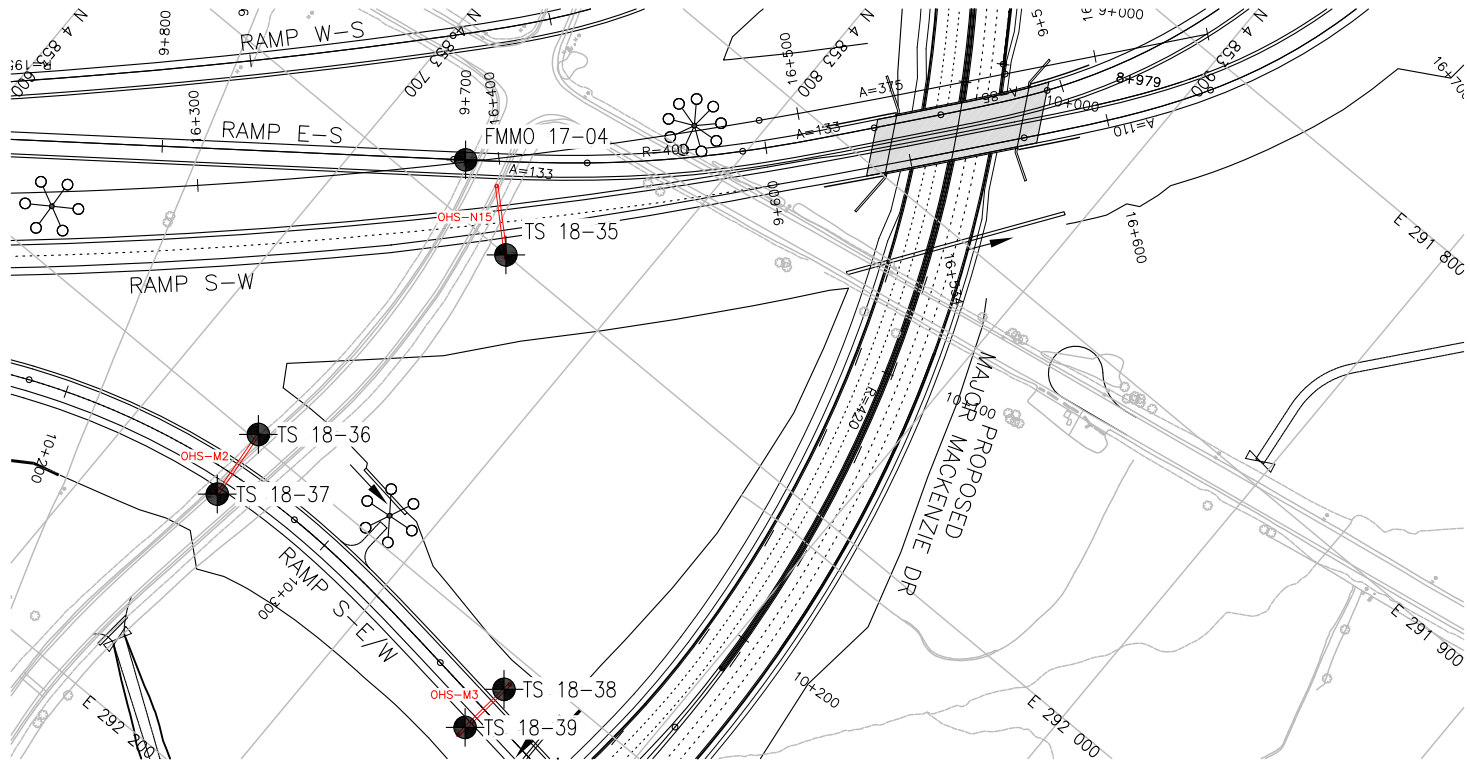
DESIGNED	M. BOUCHER	MB	19/02/01
DRAWN	A. NOOR	AN	19/02/01
CHECKED	M. BOUCHER	MB	19/02/01
APPROVED LEAD ENGINEER	J. LEE	JL	19/02/01
APPROVED PROJ. MANAGER	J. LEE	JL	19/02/01
NAME (PRINT)	INIT.	DATE	



TITLE HWY 427 EXPANSION SIGN SUPPORTS FINCH AVENUE TO ALBION ROAD PACKAGE 6, 7 AND 8 BOREHOLE LOCATIONS PLAN						
PROJECT ID.	STAGE IDENTIFIER	DESIGN PACKAGE NUMBER	DISCIPLINE	STRUCTURE NUMBER	DOCUMENT TYPE	DRAWING REVISION NUMBER
H427-D	N	0	FDN		DWG	A

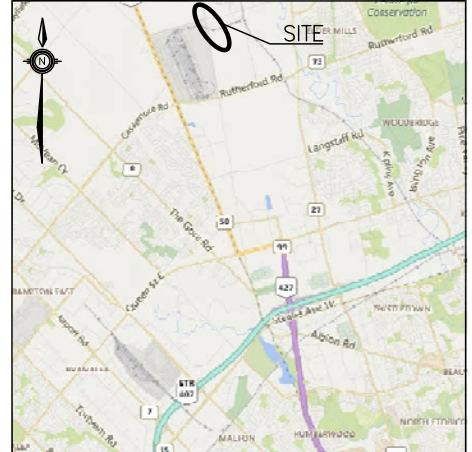


PLAN



PLAN

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



KEYPLAN

LEGEND

- Borehole (By Thurber)
- ⊕ Borehole (By Others)

NO	ELEVATION	NORTHING	EASTING
CPR 17-11	201.3	4 853 420.6	292 288.9
CPR 17-12	201.8	4 853 404.7	292 249.4
E23	203.0	4 853 605.7	292 135.4
FMMO 17-04	203.5	4 853 730.4	291 984.4
S24	199.2	4 852 954.8	292 466.5
STM 17-47	202.2	4 853 287.4	292 345.5
TS 17-45	197.6	4 852 965.0	292 485.4
TS 18-34	0.0	4 853 605.5	292 114.9
TS 18-35	204.3	4 853 760.7	292 000.0
TS 18-36	202.6	4 853 735.7	292 098.0
TS 18-37	203.3	4 853 737.9	292 121.9
TS 18-38	202.8	4 853 852.1	292 110.9
TS 18-39	0.0	4 853 850.3	292 128.8

-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.