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

TABLE OF CONTENTS

1. INTRODUCTION

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

Recommendations on the foundation aspects of the HML design presented in this report were based on the interpretation of the subsurface information obtained during the 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. GEOCRES 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. GEOCRES 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.

The discussion and recommendations for design presented in this report were based on preliminary drawings provided by WSP showing the proposed highway alignment and HML. The approximate locations of the high mast lights 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 supports of the proposed HML 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 HML is distributed throughout the extension area, as shown on the Borehole Location Drawing in Appendix C. A total of fourty two (42) high mast lights (16 in Package 6, 17 in Package 7 and 9 in Package 8) are included in Packages 6, 7 and 8. 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 high mast lights and for other structures, and boreholes drilled in previous investigations by other consultants were used to prepare this report. A total of 44 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 high mast lights 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 Section1 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 high mast light location are provided in the attached tables.

5. FOUNDATION DESIGN FOR OVERHEAD SIGN AND HIGH MAST 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 high mast lighting support consists of a single augered caisson (drilled shaft). 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 high mast lighting 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 HML in fills.

Fill Material	q_u (kPa)	ϕ' (deg.)	γ (kN/m^3)	n_h (MN/m^3)	Kp
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 sloughling 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.

THURBER

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 HM – 6
HIGHWAY 427 EXTENSION - DESIGN PACKAGE 6
HIGH MAST LIGHTING SUPPORTS
FOUNDATION DESIGN PARAMETERS

HML Location/ Station/ID (approx.)	Relevant Borehole	Simplified Stratigraphy	Ground Surface Elev. (m)	Depth Below Existing Grade (m)	Foundation Design Parameters						
					q_u (kPa)	ϕ' (deg.)	γ (kN/m^3)	γ' (kN/m^3)	n_h (MN/m^3)	K_p	Ground water depth (m)
Median 10+550	HM17-40	Clayey Silt -stiff Clayey Silt / Silty Clay - stiff to hard	183.9	0.0 – 0.8 0.8 – 8.2	125 175	- -	18 20	- -	- -	- -	1 (below existing grade)
Median 10+720	E4	Topsoil Clayey Silt – stiff Silty Clay Till – v.stiff/hard Clayey Silt Till – v.stiff	183.0	0.0 – 0.2 0.2 – 0.8 0.8 – 4.5 4.5 – 6.7	- 100 200 175	- - - -	- 18 20 20	- - - -	- - - -	- - - -	1 (below existing grade)
Median 10+860	E5	Topsoil Clayey Silt - stiff Clayey Silt Till - v. stiff	183.2	0.0 – 0.2 0.2 – 0.8 0.8 – 6.7	- 125 175	- - -	- 18 19	- - -	- - -	- - -	2 (below existing grade)
Median 11+020	HM17-19	Topsoil Clayey Silt - firm Silty Clay Till- stiff/v. stiff	183.0	0.0 – 0.2 0.2 – 0.7 0.7 – 8.2	 50 175	 - -	 18 19	 - -	 - -	 - -	1 (below existing grade)
Median 11+150	CLRN17-02	Topsoil Clayey Silt – soft Clayey Silt/Silty Clay Till – stiff/v. stiff Clayey Silt/Silty Clay Till – hard Silty Sand Till - dense	180.3	0.0 - 0.2 0.2 – 0.8 0.8 – 9.0 9.0 – 12.0 12.0 – 12.9	- 40 150 200 -	- - - - 35	- 18 19 20 -	- - - - 10	- - - - 7000	- - - - 3.7	2 (below existing grade)
Median 11+320	HM17-20	Topsoil Clayey Silt - firm	183.2	0.0 – 0.1 0.1 – 0.9	- 50	- -	- 18	- -	- -	- -	1 (below existing grade)

HML Location/ Station/ID (approx.)	Relevant Borehole	Simplified Stratigraphy	Ground Surface Elev. (m)	Depth Below Existing Grade (m)	Foundation Design Parameters						
					q_u (kPa)	ϕ' (deg.)	γ (kN/m^3)	γ' (kN/m^3)	n_h (MN/m^3)	K_p	Ground water depth (m)
		Silty Clay Till- v. stiff		0.9 – 6.7	175	-	19	-	-	-	
Median 11+490	HM17-21	Topsoil Silty Clay - firm Silty Clay – v.stiff Silty Clay Till – v.stiff/ hard	183.5	0.0 – 0.2 0.2 – 0.6 0.6 – 1.5 1.5 – 6.7	- 50 150 175	- - - -	- 18 18 19	- - - -	- - - -	- - - -	1 (below existing grade)
Median 11+670	HM17-22	Topsoil Silty Clay Fill - soft Silty Clay Till – firm/stiff Clayey Silt Till – hard	180.4	0.0 – 0.1 0.1 – 1.1 1.1 – 5.8 5.8 – 8.2	- 25 100 200	- - - -	- 18 19 20	- - - -	- - - -	- - - -	1 (below existing grade)
Median 11+860	HM17-23 S13	Clayey Silt Fill - v. stiff Silty Clay Till -stiff/v.stiff Clayey Silt Till – hard Silty Sand – v.dense Clayey Silt Till – v.stiff	190.3	0.0 – 1.4 1.4 – 9.5 9.5 – 16.3 16.3 – 17.8 17.8 – 19.3	100 125 200 - 175	- - - 38 -	19 19 20 - 20	- - - 10 -	- - - 11000 -	- - - 4.2 -	1 (below existing grade)
Median 12+030	HM17-26 S13	Sandy Silt Fill – compact/dense Silty Clay/Clayey Silt Fill – firm/stiff Silty Clay/Clayey Silt Till – stiff/v. stiff Clayey Silt Till – hard Silty Sand – v.dense Clayey Silt Till – v.stiff	188.4	0.0 – 1.4 1.4 – 3.0 3.0 – 5.3 5.3 – 14.4 14.4 – 15.9 15.9 – 17.4	- 75 150 200 - 175	32 - - 38 -	19 18 19 20 - 20	- - - - 10 -	5000 - - - 11000 -	3.2 - - - 4.2 -	2 (below existing grade)
Langstaff Rd 9+600	STM 17-16	Topsoil Silty Clay -firm Clayey Silt/Silty Clay Till – v stiff	187.2	0.0 – 0.1 0.2 – 1.4 1.4 – 6.7	 50 175	- - -	- 18 19	- - -	- - -	- - -	2 (below existing grade)
E-S Ramp 9+740 (Langstaff)	STM 17-17	Topsoil Clayey Silt/Silty Clay Till – stiff to v. stiff	188.5	0.0 – 0.2 0.2 – 6.7	- 150	- -	- 19	- -	- -	- -	1 (below existing grade)

HML Location/ Station/ID (approx.)	Relevant Borehole	Simplified Stratigraphy	Ground Surface Elev. (m)	Depth Below Existing Grade (m)	Foundation Design Parameters						
					q_u (kPa)	ϕ' (deg.)	γ (kN/m^3)	γ' (kN/m^3)	n_h (MN/m^3)	K_p	Ground water depth (m)
W-N Ramp 9+870 (Langstaff)	HM17-27	Sandy Silt Fill – dense, awl Silty Clay Till -firm to stiff Silty Clay Till -stiff to v. stiff	188.6	0.0 – 1.7 1.7 – 4.0 4.0 - 8.2	- 75 125	32 - -	20 19 19	- - -	5000 - -	3.2 - -	2 (below existing grade)
Median 12+160	FLR17-02	Silty Sand Fill – dense Clayey Silt/Silty Clay Till – stiff/v.stiff	188.8	0.0 – 0.9 0.9 – 12.8	- 150	32 -	20 19	- -	5000 -	3.2 -	1 (below existing grade)
Median 12+340	STM 17-19 LR 17-04	Topsoil Gravelly Sand Fill – loose Silty Clay Fill – soft to firm Clayey Silt/Silty Clay Till – v.stiff Clayey Silt/Silty Clay Till – v.stiff to hard	187.6	0.0 – 0.1 0.1 – 0.9 0.9 – 3.3 3.3 – 6.7 6.7 – 20.0	- - 75 150 175	- 28 - - -	- 19 18 19 20	- - - - -	- 2000 - - -	- 2.8 - - -	1 (below existing grade)
Median 12+830	HM 17-28	Topsoil Silty Clay Till – v.stiff	190.4	0.0 – 0.5 0.5 – 8.2	- 175	- -	- 19	- -	- -	- -	3 (below existing grade)

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. High mast lighting 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 HM – 7
HIGHWAY 427 EXTENSION - DESIGN PACKAGE 7
HIGH MAST LIGHTING SUPPORTS
FOUNDATION DESIGN PARAMETERS

HML Location/ Station/ID (approx.)	Relevant Borehole	Simplified Stratigraphy	Ground Surface Elev. (m)	Depth Below Existing Grade (m)	Foundation Design Parameters						
					q_u (kPa)	ϕ' (deg.)	γ (kN/m^3)	γ' (kN/m^3)	n_h (MN/m^3)	K_p	Ground water depth (m)
Median 13+000	C4	Topsoil Clayey Silt - firm Clayey Silt Till – stiff to very stiff	189.1	0.0 – 0.2 0.2 – 1.5 1.5 – 9.8	- 50 150	- - -	- 18 19	- - -	- - -	- - -	0 m
Median 13+150	STM17-21	Topsoil Silty Clay Fill - firm Clayey Silt/Silty Clay Till - v.stiff	190.4	0.0 – 0.2 0.2 – 0.6 0.6 – 6.7	- 100 175	- - -	- 18 19	- - -	- - -	- - -	1 m (below existing grade)
Median 13+310	C6	Topsoil Clayey Silt – firm Clayey Silt Till – firm to stiff Clayey Silt Till – v stiff to hard	189.7	0.0 – 0.3 0.3 – 0.9 0.9 – 2.2 2.2 – 9.8	- 75 100 175	- - - -	- 18 19 20	- -	- - - -	- - - -	0 m
Median 13+470	C8	Silty Clay Fill – firm Clayey Silt Till – very stiff Clayey Silt Till - hard	186.9	0.0 – 0.6 0.6 – 2.2 2.2 – 9.8	50 175 200	- - -	18 19 20	- - -	- - -	- - -	1.5 m (below existing grade)
Median 13+640	C10	Clayey Silt – firm Clayey Silt Till – v.stiff to hard	188.6	0.0 – 0.6 0.2 – 9.8	50 200	- -	18 20	- -	- -	- -	1 m (below existing grade)
Median 13+790	E14	Silty Clay - stiff Clayey Silt Till – very stiff	191.5	0.0 – 0.6 0.6 – 8.2	100 175	- -	18 19	-	- -	- -	1 m (below existing grade)

HML Location/ Station/ID (approx.)	Relevant Borehole	Simplified Stratigraphy	Ground Surface Elev. (m)	Depth Below Existing Grade (m)	Foundation Design Parameters						
					q_u (kPa)	ϕ' (deg.)	γ (kN/m^3)	γ' (kN/m^3)	n_h (MN/m^3)	K_p	Ground water depth (m)
Median 13+920	HM17-29	Topsoil Silty Clay - firm Silty Clay/Clayey Silt Till - stiff to very.stiff	192.4	0.0 – 0.1 0.1 – 0.7 0.7 – 8.2	- 50 150	- - -	- 18 19	- - -	- - -	- - -	1 m (below existing grade)
Ramp W-N Rutherford Rd. 9+870	HM17-30	Topsoil Silty Clay firm Clayey Silt/Silty Clay Till – stiff/v.stiff	193.5	0.0 – 0.1 0.1 – 0.7 0.7 – 6.9	- 50 150	- - -	- 18 19	- - -	- - -	- - -	2 m (below existing grade)
Ramp E-S Rutherford Rd. 9+920	C15	Topsoil Clayey Silt – firm to stiff Clayey Silt Till – stiff to very stiff	195.2	0.0 – 0.2 0.2 – 0.9 0.9 – 9.8	- 50 150	- - -	- 18 19	- - -	- - -	- - -	2 m (below existing grade)
Median 14+120	RRO -17-01	Topsoil Silty Clay - firm Clayey Silt/Silty Clay Till – stiff to very stiff	194.4	0.0 – 0.1 0.2 – 0.7 0.7 – 9.8	- 50 150	- - -	- 18 19	- - -	- - -	- - -	2 m (below existing grade)
Median 14+260	C13	Topsoil Clayey Silt – stiff Silty Clay Till – v. stiff to hard Clayey Silt Till – stiff to hard	193.8	0.0 – 0.2 0.2 – 0.9 0.9 – 3.0 3.0 – 4.6	- 100 200 150	- - - -	- 18 20 19	- - - 	- - - -	- - - -	2 m (below existing grade)
Median 14+420	E19	Silty Clay - firm/stiff Silty Clay Till – stiff to very stiff Clayey Silt Till – firm to stiff Silty Sand Till - compact	195.3	0.0 – 1.4 1.4 – 5.8 5.8 – 9.1 9.1 – 9.8	100 150 100 -	- - - 32	18 19 19 	- - - 9	- - - 3500	- - - 3.3	2 m (below existing grade)

HML Location/ Station/ID (approx.)	Relevant Borehole	Simplified Stratigraphy	Ground Surface Elev. (m)	Depth Below Existing Grade (m)	Foundation Design Parameters						
					q_u (kPa)	ϕ' (deg.)	γ (kN/m^3)	γ' (kN/m^3)	n_h (MN/m^3)	K_p	Ground water depth (m)
Median 14+590	HM17-31	Topsoil Sandy Silt Fill – loose Silty Clay Till – v. stiff Silty Clay Till – stiff	196.0	0.0 – 0.2 0.2 – 0.7 0.7 – 5.5 5.5 – 8.2	- - 175 150	- 28 - -	- 18 19 19	- - - -	- 2000 - -	- 2.8 - -	1 m (below existing grade)
Median 14+780	STM17-41	Topsoil Sandy Silt Fill - loose Clayey Silt/Silty Clay Till – v.stiff Clayey Silt/Silty Clay till - stiff	196.8	0.0 – 0.2 0.2 – 0.8 0.8 – 4.0 4.0 – 6.7	- - 175 125	- 28 - -	- 18 19 19	- - - -	- 2000 - -	- 2.8 - -	1 m (below existing grade)
Median 14+940	HM17-32	Topsoil Clayey Silt Fill – firm Clayey Silt/Silty Clay Till – stiff to very stiff	196.9	0.0 – 0.2 0.2 – 0.7 0.7 – 8.2	- 50 150	- - -	- 18 19	- - -	- - -	- - -	1 m (below existing grade)
Median 15+090	HM17-33	Asphalt Sand and Gravel/Sandy Silt Fill - loose Clayey Silt/Silty Clay Till - stiff Clayey Silt/Silty Clay Till – hard Clayey Silt/Silty Clay Till – stiff to very stiff	198.1	0.0 – 0.2 0.2 – 0.8 0.8 – 2.3 2.3 – 4.0 4.0 – 8.2	- - 125 200 150	- 28 - - -	- 18 19 20 19	- - - - -	- 2000 - - -	- 2.8 - - -	1 m (below existing grade)
Median 15+240	HM17-34	Topsoil Silty Clay Fill– firm Silty Clay Till –v. stiff/hard Silty Clay Till –stiff to very stiff	198.8	0.0 – 0.2 0.2 – 0.7 0.7 – 5.5 5.5 – 8.2	- 50 200 150	- - - -	- 18 20 19	- - - -	- - - -	- - - -	1 m (below existing grade)

Legend:

q_u	=	unconfined compressive strength, (q_u = 2 x 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. High mast lighting chainages 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 HM – 8
HIGHWAY 427 EXTENSION - DESIGN PACKAGE 8
HIGH MAST LIGHTING SUPPORTS
FOUNDATION DESIGN PARAMETERS

HML Location/ Station/ID (approx.)	Relevant Borehole No	Simplified Stratigraphy	Ground Surface Elev. (m)	Depth Below Existing Grade (m)	Foundation Design Parameters						
					q_u (kPa)	ϕ' (deg.)	γ (kN/m^3)	γ' (kN/m^3)	n_h (MN/m^3)	K_p	Ground water depth (m)
Median 15+420	WR17-01	Topsoil	199.8	0.0 – 0.1	-	-	-	-	-	-	4 (below existing grade)
		Silty Clay – firm		0.1 – 0.7	75	-	18	-	-	-	
		Silty Clay Till – v.stiff/hard		0.7 – 5.5	175	-	19	-	-	-	
		Silty Clay Till – stiff		5.5 – 9.0	125	-	19	-	-	-	
		Silty Clay Till - hard		9.0 – 9.8	200	-	20	-	-	-	
Median 15+610	WR17-04	Topsoil	194.7	0.0 – 0.1	-	-	-	-	-	-	3 (below existing grade)
		Clayey Silt- soft		0.1 – 0.7	40	-	18	-	-	-	
		Clayey Silt Till – firm/stiff		0.7 – 4.4	100	-	19	-	-	-	
		Silty Clay/Clayey Silt Till – Hard		4.4 – 16.3	200	-	20	-	-	-	
		Silt – dense		16.3 – 21.0	-	34	-	10	5500	3.5	
		Silt – compact		21.0 – 28.5	-	32	-	10	3500	3.2	
Median 15+800	STM17-47	Topsoil	202.2	0.0 – 0.2	-	-	-	-	-	-	1 (below existing grade)
		Clayey Silt – firm		0.2 – 0.9	75	-	18	-	-	-	
		Clayey Silt/Silty Clay Till – v.stiff		0.9 – 4.0	175	-	19	-	-	-	
		Clayey Silt/Silty Clay Till - stiff		4.0 – 6.7	125	-	19	-	-	-	
Median 15+970	CPR 17-12	Topsoil	201.8	0.0 – 0.1	-	-	-	-	-	-	8 (below existing grade)
		Clayey Silt-firm		0.1 – 0.7	75	-	18	-	-	-	
		Clayey Silt/Silty Clay Till – v.stiff		0.7 – 4.0	175	-	19	-	-	-	
		Clayey Silt/Silty Clay Till – stiff		4.0 – 11.0	125	-	19	-	-	-	
		Sand and Silt Till – v.dense		11.0 – 12.3	-	38	-	10	11000	4.2	

HML Location/ Station/ID (approx.)	Relevant Borehole No	Simplified Stratigraphy	Ground Surface Elev. (m)	Depth Below Existing Grade (m)	Foundation Design Parameters						
					q_u (kPa)	ϕ' (deg.)	γ (kN/m^3)	γ' (kN/m^3)	n_h (MN/m^3)	K_p	Ground water depth (m)
Median 16+090	CPR17-13	Topsoil Clayey Silt – soft/firm Clayey Silt Till – stiff/v.stiff, Sand and Silt Till – v. dense	201.9	0.0 – 0.1 0.1 – 1.4 1.4 – 10.9 10.9 – 12.2	- 50 150 -	- - - 38	- 18 19 -	- - - 10	- - - 11000	- - - 4.2	8 (below existing grade)
Median 16+280	FMMO 17-05	Topsoil Clayey Silt – firm Clayey Silt/Silty Clay Till – firm / stiff	203.5	0.0 – 0.1 0.1 – 0.7 0.7 – 5.8	- 50 100	- - -	- 18 19	- - -	- - -	- - -	3 (below existing grade)
Median 16+480	MMO 17-01	Topsoil Clayey Silt – firm to stiff Clayey Silt/Silty Clay Till – stiff to v.stiff	204.8	0.0 – 0.1 0.1 – 1.6 1.6 – 9.8	- 100 125	- - -	- 18 19	- - -	- - -	- - -	3 (below existing grade)
Ramp E-S at MMD 9+260	HM17-35	Topsoil Clayey Silt – firm Clayey Silt – v. stiff Clayey silt/Silty Clay Till – stiff / v. stiff	205.8	0.0 – 0.1 0.1 – 0.6 0.6 – 2.3 2.3 - 8.2	- 50 150 175	- - - -	- 18 18 19	- - - -	- - - -	- - - -	1 (below existing grade)
Ramp E-S at MMD 9+070	HM17-36	Topsoil Clayey Silt –firm Clayey Silt – v. stiff Clayey Silt Till – v.stiff/ hard Clayey silt/Silty Clay Till – stiff / v. stiff	205.2	0.0 – 0.1 0.1 – 0.6 0.6 – 2.3 2.3 – 4.0 4.0 - 8.2	- 50 150 175 150	- - - - -	- 18 18 19 19	- - - - -	- - - - -	- - - - -	1 (below existing grade)

Legend:

q_u	=	unconfined compressive strength, (q_u = 2 x 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. High mast lighting chainages 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

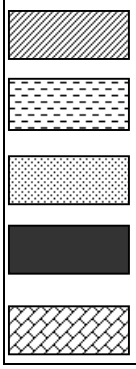
ROCK WEATHERING CLASSIFICATION

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 (MPa)**	**(psi)**	**Field Estimation of Hardness***
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			

Ministry of Transportation
Ontario

THURBER

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

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
180.3	GROUND SURFACE										
0.0	**TOPSOIL:** (150mm)										
0.2	Clayey **SILT**, trace sand, trace roots Soft Dark Brown		1	SS	3		180				
179.5	Moist										
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				
	Occasional sand seam		8	SS	23		173				
			9	SS	100/ 0.025		172				
	Cobbles at 9.2m depth						171				

Continued Next Page

+ ^{3}, × ^{3}: Numbers refer to Sensitivity

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

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Ministry of Transportation
Ontario

THURBER

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

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100): ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page						170				
			10	SS	101/ 0.225				○		
168.3							169				
12.0	Silty **SAND**, some clay, trace gravel, trace shale fragments Dense Grey Moist (TILL)		11	SS	38		168		○ ○		0 62 25 13
167.5											
12.8	END OF BOREHOLE AT 12.8m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.										

+ ³, × ³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

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Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No CPR 17-12 1 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

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
201.8	GROUND SURFACE										
0.0	**TOPSOIL:** (100mm)										
0.1	Clayey **SILT**, trace sand, trace gravel, trace organics, rootlets Firm Brown Moist		1	SS	7						
201.1											
0.7	Clayey **SILT** to Silty **CLAY**, trace to some sand, trace gravel, occasional cobbles Stiff to Very Stiff Brown Moist (TILL)		2	SS	15		201				
			3	SS	22		200				
			4	SS	24		199				
			5	SS	19		198				
			6	SS	11		197				
	Layer of sandy silt from 6.1m to 6.6m		7	SS	38		196				
			8	SS	11		195				
			9	SS	11		194				
							193				
							192				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

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

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100): ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
190.8			10	SS	70/ 0.125		191		○		
11.0	**SAND** and **SILT**, some clay, trace gravel, occasional cobbles and boulders Very Dense Grey Moist (TILL)						190		○		
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.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE
10

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THURBER

RECORD OF BOREHOLE No CPR 17-13 1 OF 2 METRIC

W.P. _____ LOCATION N 4 853 494.6 E 292 190.5 ORIGINATED BY JZ

HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.05.12 - 2017.05.12 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
201.9	GROUND SURFACE										
0.0	**TOPSOIL:** (100mm)										
0.1	Clayey **SILT**, some sand, trace gravel, trace organics Firm Brown Moist		1	SS	5						
			2	SS	4		201				
200.5											
1.4	Clayey **SILT** to Silty **CLAY**, trace to some sand, trace gravel Stiff to Very Stiff Brown to Grey Moist (TILL)		3	SS	12		200				
			4	SS	25		199				
			5	SS	27		198				0 16 49 35
			6	SS	16		197				
			7	SS	8		196				
			8	SS	13		195				
			9	SS	15		194				0 10 50 40
							193				
							192				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15}\oplus\frac{5}{10}$ (%) STRAIN AT FAILURE

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THURBER

RECORD OF BOREHOLE No CPR 17-13 2 OF 2 METRIC

W.P. _____ LOCATION N 4 853 494.6 E 292 190.5 ORIGINATED BY JZ

HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.05.12 - 2017.05.12 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
191.0	Clayey **SILT** to Silty **CLAY**, trace to some sand, trace gravel Stiff to Very Stiff Brown to Grey Moist (TILL)										
10.9	**SAND** and **SILT**, gravelly Very Dense Brown Moist (TILL)		10	SS	72		191		○		21 64 15 (SI+CL)
							190				
189.1			11	SS	69				○		
12.8	END OF BOREHOLE AT 12.8m. BOREHOLE DRY UPON COMPLETION. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen.										

WATER LEVEL READINGS

DATE	DEPTH(m)	ELEV.(m)
2017.06.29	4.6	197.3
2017.06.29	9.4	192.5
2017.10.23	9.6	192.3

+ ³, × ³: Numbers refer to Sensitivity

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

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 5/11/18

Ministry of Transportation
Ontario

THURBER

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

W.P. _____ LOCATION N 4 849 967.1 E 293 713.8 ORIGINATED BY CAR

HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.05.19 - 2017.05.19 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
188.8	GROUND SURFACE										
0.0	Silty **SAND**, trace to some clay and gravel, trace organics, trace asphalt fragments Dense Brown Moist (FILL)		1	SS	39						
187.9							188				
0.9	Clayey **SILT** to Silty **CLAY**, some sand to sandy, trace gravel, occasional cobbles and boulders Stiff to Very Stiff Brown to Grey Moist (TILL)		2	SS	14						
			3	SS	13		187				
			4	SS	19	▼					
			5	SS	20		186				
	Becoming grey		6	SS	15		185				
			7	SS	13		184				
			8	SS	15		183				
			9	SS	24		182				
							181				
							180				
							179				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

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

Ministry of Transportation
Ontario

THURBER

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

W.P. _____ LOCATION N 4 849 967.1 E 293 713.8 ORIGINATED BY CAR

HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.05.19 - 2017.05.19 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
							178		○		
			10	SS	23						
							177				
176.0			11	SS	15				○		
							176				
12.8	END OF BOREHOLE AT 12.8m. 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	2.5	186.3
2017.10.18	2.5	186.3

$+^3$, $\times^3$: Numbers refer to Sensitivity

$15 \overset{20}{\underset{10}{\oplus}} 5$ (%) STRAIN AT FAILURE

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 5/11/18

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No FMMO 17-05 1 OF 2 METRIC

W.P. _____ LOCATION N 4 853 679.8 E 292 063.9 ORIGINATED BY TF

HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.05.12 - 2017.05.12 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
203.5	GROUND SURFACE										
0.0	**TOPSOIL:** (100mm)										
0.1	Clayey **SILT**, trace gravel, organics Firm Brown Moist		1	SS	5		203				
202.8											
0.7	Clayey **SILT** to Silty **CLAY**, trace to some sand, trace gravel, occasional cobbles and boulders Firm to Very Stiff Brown to Grey Moist (TILL)		2	SS	11		202				
			3	SS	9		201				
			4	SS	8						
			5	SS	6		200				0 15 38 47
			6	SS	9		199				
						▽	198	+			
			7	SS	9		197				
			8	SS	8		196				
			9	SS	8		195	+			
							194				0 18 41 41

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

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

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 5/11/18

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No FMMO 17-05 2 OF 2 METRIC

W.P. _____ LOCATION N 4 853 679.8 E 292 063.9 ORIGINATED BY TF

HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.05.12 - 2017.05.12 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
							193				
			10	SS	20						
							192				
190.7			11	SS	5		191				
12.8	END OF BOREHOLE AT 12.8m. WATER LEVEL AT 5.8m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.										

+ ³, × ³: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 5/11/18

Ministry of Transportation
Ontario

THURBER

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

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
183.0	GROUND SURFACE										
0.0	**TOPSOIL:** (150mm)										
0.2	Clayey **SILT**, trace sand, trace gravel, trace organics and rootlets		1	SS	4						
182.3	Firm										
0.7	Brown 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						0 23 39 38
			5	SS	19		180				
			6	SS	27		179				
			7	SS	28		178				
			8	SS	26		177				
174.8							176				
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.						175				

WATER LEVEL READINGS

DATE	DEPTH(m)	ELEV.(m)
2017.07.07	0.4	182.6
2017.10.24	1.2	181.8

+ ³, × ³: Numbers refer to Sensitivity

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

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 5/11/18

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HM 17-20 1 OF 1 METRIC

W.P. _____ LOCATION N 4 849 144.1 E 293 839.2 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

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
183.2	GROUND SURFACE										
0.0	**TOPSOIL:** (125mm)						183				
0.1	Clayey **SILT**, some sand, trace gravel, trace rootlets Firm Dark Brown		1	SS	4				○		
182.2	Moist						182				
0.9	Silty **CLAY**, some sand, trace gravel Very Stiff Brown to Grey Moist (TILL)		2	SS	17				○		
			3	SS	23		181		⊢○⊣		2 20 42 36
			4	SS	29				○		
			5	SS	27		180		○		
			6	SS	24		179		○		
			7	SS	20		178		○		
176.4							177				
6.7	END OF BOREHOLE AT 6.7m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\oplus^{20}_{10}{}^{15}_{5}$ (%) STRAIN AT FAILURE

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 5/11/18

Ministry of Transportation
Ontario

THURBER

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

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
183.5	GROUND SURFACE										
0.0	**TOPSOIL:** (150mm)										
0.2	Silty **CLAY**, some sand, trace gravel, trace rootlets Firm to Very Stiff Brown Dry		1	SS	4		183		○		
			2	SS	21				○		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				○		
			4	SS	29		181		○		
			5	SS	30	▼	180				
			6	SS	21		179		○		
							178				
			7	SS	26		177		○		
176.8											
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

$+^3$, $\times^3$: Numbers refer to Sensitivity

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

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 5/11/18

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HM 17-22 1 OF 1 METRIC

W.P. _____ LOCATION N 4 849 495.5 E 293 789.3 ORIGINATED BY TM

HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.05.29 - 2017.05.29 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
180.4	GROUND SURFACE										
0.0	**TOPSOIL:** (125mm)					▽					
0.1	Silty **CLAY**, some sand, trace gravel, trace rootlets Soft Brown Moist (FILL)		1	SS	2		180				
179.3			2	SS	7		179				
1.1	Silty **CLAY**, trace to some sand, trace gravel, occasional cobbles Firm to Stiff Brown Moist (TILL)		3	SS	7		178				
			4	SS	18		177				
			5	SS	12		176				
			6	SS	14		175				
174.6											
5.8	Clayey **SILT**, sandy, trace gravel, occasional cobbles Hard Grey Moist (TILL)		7	SS	44		174				6 27 49 18
			8	SS	73		173				
172.1											
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE CAVED IN TO 0.8m AND WATER LEVEL AT 0.2m. BOREHOLE BACKFILLED WITH GROUT TO SURFACE.										

+ ^{3}, × ^{3}: Numbers refer to Sensitivity

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

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 5/11/18

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HM 17-23 1 OF 1 METRIC

W.P. _____ LOCATION N 4 849 685.3 E 293 763.0 ORIGINATED BY TF

HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.05.26 - 2017.05.26 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
190.3	GROUND SURFACE										
0.0	Clayey **SILT**, sandy, trace gravel, occasional cobbles Very Stiff Brown Moist (FILL)		1	SS	20		190				
			2	SS	21						2 28 49 21
188.9							189				
1.4	Silty **CLAY**, some sand, trace gravel, occasional cobbles Firm to Very Stiff Brown to Grey Moist (TILL)		3	SS	11						
			4	SS	16		188				
			5	SS	5		187				
			6	SS	14		186				
			7	SS	18		185				
			8	SS	15		184				
182.1							183				
8.2	END OF BOREHOLE AT 8.2m. Well installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.										

+ ³, × ³: Numbers refer to Sensitivity

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

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 5/11/18

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HM 17-26 1 OF 1 METRIC

W.P. _____ LOCATION N 4 849 845.1 E 293 741.5 ORIGINATED BY TF

HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.05.29 - 2017.05.29 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
188.4	GROUND SURFACE										
0.0	Sandy **SILT**, trace clay, trace gravel Compact to Dense Dark Brown to Brown Moist (FILL)		1	SS	42		188				
			2	SS	25						
187.0							187				
1.4	Silty **CLAY** to Clayey **SILT**, trace to some sand, trace gravel Firm to Stiff Brown Moist (FILL)		3	SS	5	▼					
			4	SS	9		186				
185.4											
3.0	Silty **CLAY** to clayey **SILT**, trace to some sand, trace gravel Stiff to Very Stiff Brown to Grey Moist (TILL)		5	SS	15		185				
			6	SS	16		184				
			7	SS	25						
			8	SS	11		183				
			9	SS	10		182				
			10	SS	9		181				
180.2			11	SS	13						
8.2	END OF BOREHOLE AT 8.2m. Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen.										

WATER LEVEL READINGS

DATE	DEPTH(m)	ELEV.(m)
2017.07.10	5.3	183.1
2017.10.18	1.6	186.8

+ ³, × ³: Numbers refer to Sensitivity

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

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 5/11/18

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HM 17-27 1 OF 1 METRIC

W.P. _____ LOCATION N 4 849 841.7 E 293 853.5 ORIGINATED BY TF

HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.05.26 - 2017.05.26 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
188.6	GROUND SURFACE										
0.0	Sandy **SILT**, trace clay, trace gravel, occasional cobbles Dense Brown / Grey Moist (FILL)		1	SS	30		188		○		
			2	SS	49				○		
186.9							187				
1.7	Silty **CLAY**, some sand to sandy, trace gravel Firm to Very Stiff Brown Moist (TILL)		3	SS	14				○		0 21 47 32
			4	SS	5		186		○		
			5	SS	5				○		
							185				
			6	SS	20		184		○		
			7	SS	10		183		○		
			8	SS	11		182		○		
180.4							181				
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

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

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 5/11/18

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HM 17-28 1 OF 1 METRIC

W.P. _____ LOCATION N 4 850 661.2 E 293 657.0 ORIGINATED BY CAR

HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.05.29 - 2017.05.29 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
190.4	GROUND SURFACE										
0.0 / 189.9	**TOPSOIL**		1	SS	9		190				
0.5	Silty **CLAY**, some sand, trace gravel, occasional cobbles Very Stiff Brown to Grey Moist (TILL)		2	SS	18		189				
			3	SS	21		188				
			4	SS	20		187				0 26 40 34
			5	SS	20	▼	186				
			6	SS	19		185				
			7	SS	24		184				
182.2			8	SS	23		183				
8.2	END OF BOREHOLE AT 8.2m. 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 7.2 183.2 2017.10.23 3.4 187.0										

+ ³, × ³: Numbers refer to Sensitivity

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

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 5/11/18

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HM 17-29 1 OF 1 METRIC

W.P. _____ LOCATION N 4 851 675.3 E 293 238.1 ORIGINATED BY OA

HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.06.07 - 2017.06.07 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
192.4	GROUND SURFACE										
0.0 / 0.1	**TOPSOIL:** (75mm)										
	Silty **CLAY**, trace sand, trace gravel, occasional topsoil lenses		1	SS	5		192				
191.7 / 0.7	Firm Brown Moist										
	Clayey **SILT** to Silty **CLAY**, trace to some sand, trace gravel Stiff to Very Stiff Brown to Grey Moist (TILL)		2	SS	16	▼	191				
			3	SS	20						
			4	SS	18		190				0 11 43 46
			5	SS	21		189				
			6	SS	14		188				
			7	SS	12		187				
			8	SS	10		186				
184.2							185				
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE DRY UPON COMPLETION OF DRILLING. 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	6.7	185.7
2017.10.23	1.0	191.4

$+^3$, $\times^3$: Numbers refer to Sensitivity

$15 \oplus {}^{20}_{10} 5$ (%) STRAIN AT FAILURE

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 4/11/18

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HM 17-30 1 OF 1 METRIC

W.P. _____ LOCATION N 4 851 733.8 E 293 329.7 ORIGINATED BY OA

HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.06.07 - 2017.06.07 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
193.5	GROUND SURFACE										
0.0 / 0.1	**TOPSOIL:** (75mm)										
	Silty **CLAY**, some sand, trace gravel Firm Brown Moist		1	SS	4		193		○		0 15 38 47
192.8 / 0.7	Clayey **SILT** to Silty **CLAY**, trace sand, trace gravel, occasional cobbles Stiff to Very Stiff Brown to Grey Moist (TILL)		2	SS	14		192		○		
			3	SS	13		191		○		
			4	SS	30	▼	190		○		
			5	SS	26		189		○		
			6	SS	11		188		⊢●		
			7	SS	10		187		○		
			8	SS	13		186		○		
185.3 / 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)
2017.06.19	6.9	186.6
2017.10.23	2.6	190.9

$+^3$, $\times^3$: Numbers refer to Sensitivity

$15 \overset{20}{\underset{10}{\oplus}} 5$ (%) STRAIN AT FAILURE

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 4/11/18

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HM 17-31 1 OF 1 METRIC

W.P. _____ LOCATION N 4 852 167.1 E 292 834.5 ORIGINATED BY KK

HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.05.23 - 2017.03.23 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
196.0	GROUND SURFACE										
0.0	**TOPSOIL:** (150mm)										
0.2	Sandy **SILT**, trace clay, trace gravel, trace organics (topsoil) Loose Brown Moist (FILL)		1	SS	6						
195.3											
0.7	Silty **CLAY**, some sand, trace gravel, occasional cobbles Very Stiff Brown to Grey Moist (TILL)		2	SS	19		195				
			3	SS	21		194				
			4	SS	23						
			5	SS	29		193				
							192				
			6	SS	22		191				
							190				
			7	SS	12		189				
			8	SS	16		188				
187.8											
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 4/11/18

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HM 17-32 1 OF 1 METRIC

W.P. _____ LOCATION N 4 852 451.7 E 292 638.1 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

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
196.9	GROUND SURFACE										
0.0	**TOPSOIL:** (150mm)										
0.2	Clayey **SILT**, trace to some sand, trace gravel, trace organics Firm Brown Moist (FILL)		1	SS	6	▽			○		
196.2											
0.7	Clayey **SILT** to Silty **CLAY**, some sand, trace gravel, occasional cobbles Stiff to Hard Brown to Grey Moist (TILL)		2	SS	12		196		○		
			3	SS	22		195		○		
			4	SS	23		194		○		
			5	SS	20		193		○		
			6	SS	10		192		○		
			7	SS	34		191		○ ○		
	Cobbles at 6.7m						190				
	Clayey silt with sand below 7.5m dpeth		8	SS	10		189		○		2 35 45 18
188.7									○		
8.2	END OF BOREHOLE AT 8.2m. WATER LEVEL AT 0.5m UPON COMPLETION OF BOREHOLE. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 4/11/18

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HM 17-33 1 OF 1 METRIC

W.P. | LOCATION Rutherford Road N 4 852 583.4 E 292 570.8 | ORIGINATED BY JZ

HWY 427 | BOREHOLE TYPE Solid Stem Augers | COMPILED BY AN

DATUM Geodetic | DATE 2017.05.26 - 2017.05.26 | CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
198.1	GROUND SURFACE						198				
0.0	**ASPHALT:** (150mm)										
0.2 / 197.6	**SAND** and **GRAVEL** Loose Brown Moist (FILL)		1	SS	8						
0.5 / 197.3											
0.8	Sandy **SILT**, trace clay, trace gravel Loose Brown Moist (FILL)		2	SS	10		197				
	Clayey **SILT** to Silty **CLAY**, trace to some sand, trace gravel Stiff to Hard Brown Moist (TILL)		3	SS	12						
			4	SS	36		196				
			5	SS	33		195				
			6	SS	13		194				0 6 45 49
			7	SS	11		193				
			8	SS	16		192				
189.9							191				
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.						190				

+ ³, × ³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

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

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
198.8	GROUND SURFACE										
0.0	**TOPSOIL:** (175mm)										
0.2	Silty **CLAY**, trace sand, trace gravel, trace organics (rootlets)		1	SS	6						
198.1	Firm										
0.7	Brown Moist										
	Silty **CLAY**, trace to some sand, trace gravel, occasional cobbles Stiff to Hard Brown to Grey Moist (TILL)		2	SS	25		198				
			3	SS	30		197				
			4	SS	34		196				
			5	SS	39		195				
			6	SS	26		194				
			7	SS	16		193				
			8	SS	13		192				
190.6							191				
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

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

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 4/11/18

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HM 17-35 1 OF 1 METRIC

W.P. _____ LOCATION N 4 853 829.0 E 291 605.1 ORIGINATED BY ES

HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.06.26 - 2017.06.26 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
205.8	GROUND SURFACE										
0.0 / 0.1	**TOPSOIL:** (75mm)										
	Clayey **SILT**, some sand, trace gravel, trace roots in upper 0.5m zone Firm to Very Stiff Brown Moist		1	SS	5						
			2	SS	20		205				
			3	SS	23		204				
203.5											
2.3	Clayey **SILT** to Silty **CLAY**, some sand, trace gravel, occasional oxide staining in upper zone, occasional cobbles Very Stiff Brown to Grey Moist (TILL)		4	SS	24		203				
			5	SS	14		202				
			6	SS	20		201				
			7	SS	25		200				
			8	SS	16		199				
197.5							198				
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

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

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 5/11/18

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HM 17-36 1 OF 1 METRIC

W.P. _____ LOCATION N 4 853 835.3 E 291 737.3 ORIGINATED BY ES

HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.06.26 - 2017.06.26 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100): ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
205.2	GROUND SURFACE									
0.0	**TOPSOIL:** (100mm)									
0.1	Clayey **SILT**, some sand, trace gravel Firm to Very Stiff Brown Moist		1	SS	5		205			
			2	SS	15		204			
			3	SS	19		203			
202.9										
2.3	Clayey **SILT** to Silty **CLAY**, some sand, trace gravel, occasional oxide staining, occasional cobbles Stiff to Hard Brown to Grey Moist (TILL)		4	SS	34		202			
			5	SS	21		201			
			6	SS	14		200			
			7	SS	16		199			
			8	SS	14		198			
196.9							197			
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.									

$+^3$, $\times^3$: Numbers refer to Sensitivity

20
15 5
10
(%) STRAIN AT FAILURE

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 5/11/18

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No HM 17-40 1 OF 1 METRIC

W.P. _____ LOCATION N 4 848 388.4 E 293 940.9 ORIGINATED BY KK

HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.07.26 - 2017.07.26 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
183.9	GROUND SURFACE										
0.0	Clayey **SITL**, trace sand, trace gravel Stiff Brown Moist		1	SS	13						
183.1											
0.8	Clayey **SILT** to Silty **CLAY**, trace to some sand, trace gravel, occasional cobbles Stiff to Hard Brown Moist (TILL)		2	SS	33		183				
			3	SS	34		182				
			4	SS	31		181				
			5	SS	20		180				
			6	SS	14		179				
			7	SS	30		178				
			8	SS	49		177 176				3 22 52 23
175.7											
8.2	END OF BOREHOLE AT 8.2m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.										

+ ³, × ³: Numbers refer to Sensitivity

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

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 5/11/18

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No LR 17-04 1 OF 3 METRIC

W.P. _____ LOCATION Langstaff Road Underpass N 4 849 934.7 E 293 728.7 ORIGINATED BY TF

HWY 427 BOREHOLE TYPE Hollow Stem Augers/Tricone/HQ Coring COMPILED BY AN

DATUM Geodetic DATE 2017.05.17 - 2017.05.18 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
188.2	GROUND SURFACE										
0.0	**ASPHALT:** (75mm)										
0.1											
187.8	Sandy **SILT**, some gravel, trace organics		1	SS	12		188				
0.4	Compact Dark Brown Moist (FILL)		2	SS	7		187				
	Clayey **SILT**, trace sand, trace gravel Stiff Dark Brown to Black Moist (FILL)		3	SS	13		186				
186.7											
1.5	Clayey **SILT** to Silty **CLAY**, some sand to sandy, trace gravel, occasional cobbles Stiff to Hard Brown Moist (TILL)		4	SS	16		185				
			5	SS	17		184				0 23 42 35
			6	SS	20		183				
	Becoming grey		7	SS	16	▼	182				
			8	SS	18		181				
			9	SS	29		180				
							179				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

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

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 12/5/17

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No LR 17-04 2 OF 3 METRIC

W.P. _____ LOCATION Langstaff Road Underpass N 4 849 934.7 E 293 728.7 ORIGINATED BY TF

HWY 427 BOREHOLE TYPE Hollow Stem Augers/Tricone/HQ Coring COMPILED BY AN

DATUM Geodetic DATE 2017.05.17 - 2017.05.18 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Clayey **SILT** to Silty **CLAY**, some sand to sandy, trace gravel, occasional cobbles Hard Brown Moist (TILL)		10	SS	31		178				0 21 52 27
							177				
			11	SS	35		176				
			12	SS	27		175				
			13	SS	45		174				
			14	SS	21		173				
			15	SS	12		172				
			16	SS	22		171				
							170				
							169				

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$+^3$, $\times^3$: Numbers refer to Sensitivity

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

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 12/5/17

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No LR 17-04 3 OF 3 METRIC

W.P. _____ LOCATION Langstaff Road Underpass N 4 849 934.7 E 293 728.7 ORIGINATED BY TF

HWY 427 BOREHOLE TYPE Hollow Stem Augers/Tricone/HQ Coring COMPILED BY AN

DATUM Geodetic DATE 2017.05.17 - 2017.05.18 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	Clayey **SILT** to Silty **CLAY**, some sand to sandy, trace gravel, occasional cobbles Very Stiff Brown Moist (TILL)						168				
			17	SS	27		167		○		
166.1											
22.1	**SAND** and **SILT**, some clay, some gravel Very Dense Grey Moist (TILL)		18	SS	80		166		○		11 45 34 10
165.0									○	FI	
23.2	**SHALE**, highly to slightly weathered, thinly laminated, very weak to weak with strong limestone interbeds, grey: (Georgian Bay Formation)		1	RUN			165			>10	RUN #1 TCR=100% SCR=71% RQD=25%
	Clay seam (275mm) at 23.2m									4	
	Sub-vertical fracture at 23.9m									4	
							164			3	
	Highly fractured zone (175mm) at 24.4m		2	RUN						>10	RUN #2 TCR=87% SCR=67% RQD=30%
	Clay seam at 24.9m									4	
	Limestone layer (100mm) at 25.1m						163			1	
										4	
										3	
			3	RUN			162			>10	RUN #3 TCR=100% SCR=73% RQD=40% UCS=7.3MPa (Shale) UCS=50.4MPa (Limestone)
	Vertical fracture (150mm) at 27.2m									5	
160.8							161			3	
										3	
										5	
27.4	END OF BOREHOLE AT 27.4m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.										

WATER LEVEL READINGS

DATE	DEPTH(m)	ELEV.(m)
2017.08.08	5.5	182.7
2017.10.25	5.4	182.8

+ ³, × ³: Numbers refer to Sensitivity

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

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 12/5/17

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No MMO 17-01 1 OF 2 METRIC

W.P. _____ LOCATION N 4 853 823.5 E 291 904.6 ORIGINATED BY ES

HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.06.28 - 2017.06.28 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
204.8	GROUND SURFACE										
0.0	**TOPSOIL:** (125mm)										
0.1	Clayey **SILT**, some sand, trace gravel Firm to Stiff Brown Moist		1	SS	6						
			2	SS	11		204				
203.2											
1.6	Clayey **SILT** to Silty **CLAY**, trace sand, trace gravel Very Stiff to Stiff Brown to Grey Moist (TILL)		3	SS	21		203				
			4	SS	22		202				
			5	SS	15		201				
			6	SS	13		200				0 5 40 55
			7	SS	16		199				
			8	SS	12		198 197				
			9	SS	26		196				
195.0											
9.8	END OF BOREHOLE AT 9.8m.										

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

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

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 5/11/18

Ministry of Transportation
Ontario

THURBER

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

W.P. _____ LOCATION N 4 853 823.5 E 291 904.6 ORIGINATED BY ES

HWY 427 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.06.28 - 2017.06.28 CHECKED BY ME

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 × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

20
15 5
10
(%) STRAIN AT FAILURE

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 5/11/18

Ministry of Transportation
Ontario

THURBER

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

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
194.4	GROUND SURFACE									
0.0	**TOPSOIL:** (125mm)									
0.1	Silty **CLAY**, some sand, trace gravel, trace organics Firm Brown Moist		1	SS	6		194			
193.7 / 0.7	Clay **SILTY** to Silty **CLAY**, some sand, trace gravel, occasional cobbles and boulders Stiff to Very Stiff Brown to Grey Moist (TILL)		2	SS	16		193			
			3	SS	18					
			4	SS	22		192			0 13 42 45
			5	SS	18		191			
			6	SS	24		190			
			7	SS	12		189			
			8	SS	10		188			
			9	SS	10		187			
184.6							186			
9.8	END OF BOREHOLE AT 9.8m.						185			

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

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

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Ministry of Transportation
Ontario

THURBER

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 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	BOREHOLE OPEN TO 6.4m AND DRY. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

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

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 4/11/18

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No STM 17-16 1 OF 1 METRIC

W.P. _____ LOCATION N 4 849 838.6 E 293 617.1 ORIGINATED BY OA

HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.07.07 - 2017.07.07 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100): ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
187.2	GROUND SURFACE									
0.0	**TOPSOIL:** (50mm)						187			
0.0	Silty **CLAY**, trace sand, trace gravel Firm Brown Moist		1	SS	6			○		
			2	SS	5		186	○		
185.8										
1.4	Silty **CLAY** to Clayey **SILT**, trace to some sand, some gravel Very Stiff Brown Moist (TILL)		3	SS	16		185	○		
			4	SS	21			○		
			5	SS	23		184	○		
			6	SS	17		183	○		
			7	SS	21		182			
180.5							181	○		
6.7	END OF BOREHOLE AT 6.7m. BOREHOLE DRY UPON COMPLETION BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.									

$+^3$, $\times^3$: Numbers refer to Sensitivity

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

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Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No STM 17-17 1 OF 1 METRIC

W.P. _____ LOCATION N 4 849 925.3 E 293 607.4 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

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
188.2	GROUND SURFACE										
0.0	**TOPSOIL:** (250mm)										
0.2	Clayey **SILT** to Silty **CLAY**, some sand, trace gravel, occasional cobbles Stiff to Very Stiff Brown Moist (TILL)		1	SS	6		188		○		
			2	SS	18		187		○		
			3	SS	17		186		○		
			4	SS	26		185		○		
			5	SS	24		184		○		
			6	SS	13		183		⊣○⊢		
			7	SS	15		182		○		
181.5											
6.7	END OF BOREHOLE AT 6.7m. BOREHOLE OPEN TO 4.9m AND DRY. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

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Ministry of Transportation
Ontario

THURBER

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

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
187.6	GROUND SURFACE										
0.0	**TOPSOIL:** (50mm)										
0.0	Gravelly **SAND**, some silt Loose Brown Moist (FILL)		1	SS	7		187				
186.7											
0.9	Silty **CLAY**, trace sand, trace gravel, with organics Soft to Firm Brown to Black Moist (FILL)		2	SS	4		186				
			3	SS	6						
			4	SS	7		185				
184.3											
3.3	Clayey **SILT** to Silty **CLAY**, some sand, trace gravel, occasional cobbles Stiff to Very Stiff Brown to Grey Moist (TILL)		5	SS	15		184				
			6	SS	24		183				
							182				
			7	SS	16						
180.9							181				
6.7	END OF BOREHOLE AT 6.7m. BOREHOLE OPEN TO 5.5m AND DRY. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.										

+ ^{3}, × ^{3}: Numbers refer to Sensitivity

15 20 10 5 (%) STRAIN AT FAILURE

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Ministry of Transportation
Ontario

THURBER

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

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
190.4	GROUND SURFACE									
0.0	**TOPSOIL:** (175mm)									
0.2	Silty **CLAY**, trace sand, trace gravel, trace organics Firm Brown Moist		1	SS	8		190			
189.8										
0.6	Clayey **SILT** to Silty **CLAY**, trace to some sand, trace gravel, occasional cobble Very Stiff Brown to Grey Moist (TILL)		2	SS	17		189			
			3	SS	16					
			4	SS	15		188			
			5	SS	24		187			
			6	SS	27		186			
							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.									

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE
10

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Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No STM 17-41 1 OF 1 METRIC

W.P. | LOCATION N 4 852 314.6 E 292 722.8 | 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

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
196.8	GROUND SURFACE									
0.0	**TOPSOIL:** (50mm)									
0.2	Sandy **SILT**, trace clay, trace gravel, trace organics Loose Brown Moist		1	SS	6					
196.0										
0.8	Clayey **SILT** to Silty **CLAY**, trace to some sand, trace gravel Stiff to Very Stiff Brown to Grey Moist (TILL)		2	SS	23		196			
			3	SS	27		195			
			4	SS	24	▼				
			5	SS	22		194			0 7 39 54
							193			
			6	SS	11		192			
							191			
			7	SS	11	▽				
190.1										
6.7	END OF BOREHOLE AT 6.7m. WATER LEVEL AT 6.3m UPON COMPLETION OF BOREHOLE. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.									

WATER LEVEL READINGS

DATE	DEPTH(m)	ELEV.(m)
2017.05.31	6.0	190.8
2017.06.29	0.6	196.2
2017.10.23	2.3	194.5

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

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Ministry of Transportation
Ontario

THURBER

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

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100): ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
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					
			4	SS	24		200			
			5	SS	27		199			
			6	SS	15		198			
			7	SS	10		197			
195.5							196			
6.7	END OF BOREHOLE AT 6.7m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.									

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\oplus^{20}_{10}$ (%) STRAIN AT FAILURE

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Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No WR 17-01 1 OF 2 METRIC

W.P. _____ LOCATION N 4 852 916.1 E 292 436.3 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

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
199.8	GROUND SURFACE										
0.0	**TOPSOIL:** (125mm)										
0.1	Silty **CLAY**, trace sand, trace gravel, trace organics, rootlets Firm Dark Brown Moist		1	SS	7						
199.1											
0.7	Silty **CLAY**, trace sand, trace gravel Stiff to Hard Brown to Grey Moist (TILL)		2	SS	21		199				
			3	SS	34		198				
			4	SS	24		197				
			5	SS	24		196				
			6	SS	22		195				
			7	SS	10		194				
			8	SS	13		193				
			9	SS	34		192				
190.0							191				
9.8	END OF BOREHOLE AT 9.8m.										

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

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

Ministry of Transportation
Ontario

THURBER

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

W.P. _____ LOCATION N 4 852 916.1 E 292 436.3 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 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	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										
	BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

20
15 5
10
(%) STRAIN AT FAILURE

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Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No WR 17-04 1 OF 5 METRIC

W.P. _____ LOCATION N 4 853 081.4 E 292 428.4 ORIGINATED BY JZ

HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.06.26 - 2017.06.28 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
194.7	GROUND SURFACE										
0.0	**TOPSOIL:** (100mm)										
0.1	Clayey **SILT**, trace sand, trace gravel, trace organics, rootlets		1	SS	3						
194.0	Soft										
0.7	Grey										
	Moist										
	Clayey **SILT**, trace sand, trace gravel		2	SS	6		194				
	Firm to Stiff										
	Brown to Grey										
	Moist										
	(TILL)		3	SS	8		193				
	Hard augering										
			4	SS	14		192				
			5	SS	10	▼	191				
190.3											
4.4	Silty **CLAY**, sandy, trace gravel		6	SS	131		190				
	Hard										
	Grey						189				
	Moist		7	SS	94						
	(TILL)						188				
			8	SS	144/ 0.200		187				
							186				
			9	SS	153/ 0.275						0 29 46 25
							185				

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

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

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Ontario

THURBER

RECORD OF BOREHOLE No WR 17-04 2 OF 5 METRIC

W.P. _____ LOCATION N 4 853 081.4 E 292 428.4 ORIGINATED BY JZ

HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.06.26 - 2017.06.28 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
184.5	Continued From Previous Page										
10.2	Clayey **SILT**, trace to some sand, trace gravel Hard Grey Wet (TILL)		10	SS	80		184				
			11	SS	60		183				
			12	SS	54		182				
			13	SS	42		181				0 0 77 23
178.4							180				
16.3	**SILT**, trace clay to clayey, trace sand Dense Grey Wet		14	SS	33		179				
			15	SS	35		178				
							177				
							176				
							175				

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity

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

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Ontario

THURBER

RECORD OF BOREHOLE No WR 17-04 3 OF 5 METRIC

W.P. _____ LOCATION N 4 853 081.4 E 292 428.4 ORIGINATED BY JZ

HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.06.26 - 2017.06.28 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
	SILT, trace clay to clayey, trace sand Dense to Compact Grey Wet		16	SS	39		174				
			17	SS	16		173				
			18	SS	13		172				
			19	SS	13		171				
			20	SS	16		170				
			21	SS	22		169				
166.2							168				
28.5	Sandy **SILT**, trace clay, trace gravel Compact to Dense Grey Wet (TILL)		22	SS	46		167				0 26 67 7
							166				
							165				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

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

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Ontario

THURBER

RECORD OF BOREHOLE No WR 17-04 4 OF 5 METRIC

W.P. _____ LOCATION N 4 853 081.4 E 292 428.4 ORIGINATED BY JZ

HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.06.26 - 2017.06.28 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100): ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
			23	SS	24		164		○		
			24	SS	19		163		○		
			25	SS	20		162		○		
159.4							161		○		
35.3	Clayey **SILT**, with sand, trace gravel Very Stiff to Hard Grey Moist (TILL)		26	SS	26		160		○		5 40 41 14
			27	SS	144/ 0.275		159		○		
	Shale fragments		28	SS	146/ 0.225		158		○		
			29	SS	100/ 0.025		157		○		
							156				
							155				

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+ ³, × ³: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

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THURBER

RECORD OF BOREHOLE No WR 17-04 5 OF 5 METRIC

W.P. _____ LOCATION N 4 853 081.4 E 292 428.4 ORIGINATED BY JZ

HWY 427 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2017.06.26 - 2017.06.28 CHECKED BY ME

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page										
154.5											
40.2	END OF BOREHOLE AT 40.2m ON REFUSAL. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.										

WATER LEVEL READINGS

DATE	DEPTH(m)	ELEV.(m)
2017.08.08	3.7	191.0
2017.10.23	3.9	190.8

$+^3$, $\times^3$: Numbers refer to Sensitivity

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

ONTMT4S MTO-19484.GPJ 2017TEMPLATE(MTO).GDT 5/11/18

Golder Associates

RECORD OF BOREHOLE No C4

1 OF 1 **METRIC**

PROJECT 06-1111-012
W.O. 05-20012
DIST Central HWY 427
DATUM Geodetic

LOCATION N 4850789.6 ;E 293627.7
BOREHOLE TYPE 200 mm Outside Diameter Hollow Stem Augers
DATE April 1, 2009

ORIGINATED BY JEB
COMPILED BY TB/VA
CHECKED BY SMM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
189.1	GROUND SURFACE						189				
0.0	TOPSOIL										
0.2	CLAYEY SILT, trace to some sand, containing organics and rootlets to a depth of 0.6 m Firm Brown Moist		1	SS	4						
			2	SS	5		188				0 11 52 37
187.7											
1.5	CLAYEY SILT, some sand, trace gravel (TILL), containing thin sand and silty sand layers Stiff to very stiff Brown to grey Moist		3	SS	13						
			4	SS	20		187				
	Becoming grey below a depth of 3.1 m		5	SS	24		186				4 19 58 19
			6	SS	20		185				
			7	SS	29						
							184				
	Containing about 25 mm thick layer of sand at a depth of 6.4 m		8	SS	23		183				
							182				
	Containing about 100 mm thick layer of silty sand at a depth of 7.9 m		9	SS	14		181				
			10	SS	22		180				
179.4											
9.8	END OF BOREHOLE										

NOTES:

1. A 50 mm diameter monitoring well was installed at a depth of 9.1 m (Elev. 180.0 m).

Water level measurements

Date	Depth	Elev.
On Completion	Dry	
April 24, 2009	1.1 m	188.0 m
May 13, 2009	0.5 m	188.6 m
May 21, 2009	0.5 m	188.6 m
June 15, 2009	0.9 m	188.2 m
July 09, 2009	0.7 m	188.4 m

$+^3, \times^3$: Numbers refer to Sensitivity $\circ^{3\%}$ STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No C6

1 OF 1 **METRIC**

PROJECT 06-1111-012
W.O. 05-20012
DIST Central HWY 427
DATUM Geodetic

LOCATION N 4851082.9 ;E 293567.1
BOREHOLE TYPE 200 mm Outside Diameter Hollow Stem Augers
DATE March 31, 2009

ORIGINATED BY JEB
COMPILED BY PKS/VA
CHECKED BY SMM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
189.7	GROUND SURFACE										
0.0 / 189.4	TOPSOIL		1	SS	7	▽	189				
0.3 / 188.8	CLAYEY SILT, trace gravel, trace sand (Reworked) Firm Brown Moist		2	SS	7	▼					
0.9	CLAYEY SILT, some sand, trace gravel (TILL), containing sand seams Firm to hard Grey Moist		3	SS	13		188				
			4	SS	32		187		o ⊢		4 19 51 26
	Augers grinding at 1.5 m and 3.5 m depth Becoming grey below a depth of 3.8 m		5	SS	34		186				
			6	SS	28						
			7	SS	18		185				
			8	SS	18		184		o ⊢		
			9	SS	19		183				
	Augers grinding at a depth of 8.7 m		10	SS	19		182				
180.0							181				
9.8	END OF BOREHOLE						180				

NOTES:

1. A 50 mm diameter monitoring well was installed at a depth of 9.1 m (Elev. 180.6 m).

Water level measurements

Date	Depth	Elev.
On Completion	Dry	
April 24, 2009	0.3 m	189.4 m
May 13, 2009	1.2 m	188.5 m
May 21, 2009	1.1 m	188.6 m
June 15, 2009	1.0 m	188.7 m
July 09, 2009	0.4 m	189.3 m

$+^3, \times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No C8

1 OF 1 **METRIC**

PROJECT 06-1111-012 | W.O. 05-20012 | DIST Central HWY 427 | DATUM Geodetic

LOCATION N 4851323.3 ;E 293481.9 | BOREHOLE TYPE 200 mm Outside Diameter Hollow Stem Augers | DATE March 30, 2009

ORIGINATED BY JEB | COMPILED BY PKS/VA | CHECKED BY SMM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
186.9	GROUND SURFACE										
0.0	CLAYEY SILT, trace gravel, trace sand, containing rootlets Firm Brown Moist		1	SS	4				○		
186.3 0.6	CLAYEY SILT, some sand, trace gravel, containing sand seams and cobbles (TILL) Very stiff to hard Brown to grey Moist		2	SS	17		186		○		1 13 62 24
			3	SS	29		185				
			4	SS	47				○ ⊢		
	Containing sand seams between depths of 3.0 m and 3.7 m		5	SS	36		184		○		
	Becoming grey below a depth of 3.8 m		6	SS	27		183		○ ⊢		
			7	SS	20		182		○		
							181				
			8	SS	38						
	Cobbles encountered a a depth of 7.0 m						180				
			9	SS	101		179		○		
							178				
177.2			10	SS	107				○		
9.8	END OF BOREHOLE										

NOTES:

1. A 50 mm diameter monitoring well was installed at a depth of 9.1 m (Elev. 177.8 m).

Water level measurements

Date	Depth	Elev.
On Completion	Dry	
April 24, 2009	1.7 m	185.2 m
May 21, 2009	2.5 m	184.4 m
June 15, 2009	2.3 m	184.6 m
July 09, 2009	2.2 m	184.7 m

$+^3, \times^3$: Numbers refer to Sensitivity $\circ^{3\%}$ STRAIN AT FAILURE

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

Golder Associates

RECORD OF BOREHOLE No C10

1 OF 1 **METRIC**

PROJECT 06-1111-012
W.O. 05-20012
DIST Central HWY 427
DATUM Geodetic

LOCATION N 4851421.5 ; E 293435.4
BOREHOLE TYPE 200 mm Outside Diameter Hollow Stem Augers
DATE March 30, 2009

ORIGINATED BY JEB
COMPILED BY PKS/VA
CHECKED BY SMM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
188.6	GROUND SURFACE										
0.0	CLAYEY SILT, trace sand, containing rootlets (Reworked) Firm Brown Moist		1	SS	4						
188.0							188				
0.6	CLAYEY SILT, some sand, trace gravel, containing cobbles (TILL) Very stiff to hard Brown to grey Moist Augers grinding at a depth of 1.5 m		2	SS	106*						
			3	SS	27		187		○		5 20 52 23
			4	SS	22		186				
			5	SS	36						
	Becoming grey below a depth of 3.8 m		6	SS	23		185				
			7	SS	23		184				
							183				
			8	SS	20				○		
							182				
			9	SS	69		181				
	Cobbles encountered at a depth of 8.5 m						180				
			10	SS	99		179				
178.9											
9.8	END OF BOREHOLE										

NOTES:

1. A 50 mm diameter monitoring well was installed at a depth of 9.1 m (Elev. 179.5 m).

Water level measurements

Date	Depth	Elev.
On Completion	Dry	
April 24, 2009	7.6 m	181.0 m
May 13, 2009	8.0 m	180.6 m
May 21, 2009	7.9 m	180.7 m
June 15, 2009	7.9 m	180.7 m
July 09, 2009	7.6 m	181.0 m

* High SPT "N" value as a result of split spoon bouncing on cobbles

$+^3$, $\times^3$: Numbers refer to Sensitivity $\circ^{3\%}$ STRAIN AT FAILURE

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

Golder Associates

RECORD OF BOREHOLE No C13

1 OF 1 **METRIC**

PROJECT 06-1111-012
W.O. 05-20012
DIST Central HWY 427
DATUM Geodetic

LOCATION N 4851936.1 ;E 293054.4
BOREHOLE TYPE 200 mm Outside Diameter Hollow Stem Augers
DATE April 6, 2009

ORIGINATED BY JEB
COMPILED BY PKS
CHECKED BY SMM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
193.8	GROUND SURFACE										
0.0	TOPSOIL										
0.2	CLAYEY SILT, trace sand, trace gravel, containing rootlets (Reworked) Stiff Brown Moist		1	SS	8						
192.9							193				
0.9	SILTY CLAY, trace sand, trace gravel (TILL) Very stiff to hard Brown Moist		2	SS	18						
			3	SS	33		192				
			4	SS	32						
							191				
			5	SS	48						
							190				
			6	SS	28						
189.2											
4.6	CLAYEY SILT, trace to some sand, trace gravel (TILL) Stiff to hard Grey Moist		7	SS	35		189				
							188				
			8	SS	14						
							187				
			9	SS	15		186				
							185				
			10	SS	18						
184.1											
9.8	END OF BOREHOLE										

NOTES:

1. Open borehole dry upon completion of drilling.
2. Borehole backfilled with bentonite.

$+^3$, $\times^3$: Numbers refer to Sensitivity $\circ^{3\%}$ STRAIN AT FAILURE

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

Golder Associates

RECORD OF BOREHOLE No C15

1 OF 1 **METRIC**

PROJECT 06-1111-012
W.O. 05-20012
DIST Central HWY 427
DATUM Geodetic

LOCATION N 4851914.4 ; E 292897.6
BOREHOLE TYPE 200 mm Outside Diameter Hollow Stem Augers
DATE April 2, 2009

ORIGINATED BY JEB
COMPILED BY VA
CHECKED BY SMM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (o 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
195.2	GROUND SURFACE						195				
0.0	TOPSOIL										
0.2	CLAYEY SILT, trace sand, trace gravel, containing rootlets (Reworked) Firm to stiff Brown Moist		1	SS	5						
194.3							194				
0.9	CLAYEY SILT, trace to some sand, trace gravel, containing cobbles (TILL) Stiff to very stiff Brown to grey Moist		2	SS	12						
			3	SS	26		193				
			4	SS	27	▽					1 14 43 42
	Augers grinding at a depth of 3.0 m		5	SS	29		192				
	Becoming grey at a depth of 3.8 m		6	SS	14		191				
			7	SS	22		190				
			8	SS	14		189				
			9	SS	13		188				
	Contains silty sand layers below a depth of 9.1 m		10	SS	13		187				
185.5							186				
9.8	END OF BOREHOLE										

NOTES:

1. A 50 mm diameter monitoring well was installed at a depth of 9.1 m (Elev. 186.1 m).

Water level measurements

Date	Depth	Elev.
On Completion	Dry	
April 24, 2009	2.8 m	192.4 m
May 21, 2009	1.9 m	193.3 m
June 15, 2009	1.9 m	193.3 m
July 09, 2009	1.8 m	193.4 m

$+^3$, $\times^3$: Numbers refer to Sensitivity $o^{3\%}$ STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No E4

1 OF 1 **METRIC**

PROJECT 06-1111-012 | W.O. 05-20012 | LOCATION N 4848534.0 ;E 293931.7 | ORIGINATED BY JEB
DIST Central | HWY 427 | BOREHOLE TYPE 108 mm Diameter Solid Stem Augers | COMPILED BY PKS/VA
DATUM Geodetic | DATE April 7, 2009 | CHECKED BY SMM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
183.0	GROUND SURFACE										
0.0	TOPSOIL										
0.2	CLAYEY SILT, trace sand, trace gravel, containing rootlets (Reworked) Stiff Brown Moist		1	SS	9						
182.2							182				
0.8	SILTY CLAY, some sand, trace gravel (TILL) Very stiff to hard Brown to grey Moist		2	SS	23						
			3	SS	30		181				
			4	SS	35						
			5	SS	33		180				4 20 46 30
	Becoming grey at a depth of 3.8 m		6	SS	18		179				
178.5											
4.5	CLAYEY SILT, trace sand, trace gravel (TILL) Very stiff Grey Moist		7	SS	16		178				
							177				
176.3			8	SS	24						
6.7	END OF BOREHOLE										

NOTES:

1. Open borehole dry upon completion of drilling.
2. Borehole backfilled with bentonite

$+^3, \times^3$: Numbers refer to Sensitivity $\circ^{3\%}$ STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No E5

1 OF 1 **METRIC**

PROJECT 06-1111-012 | W.O. 05-20012 | LOCATION N 4848694.6 ;E 293894.9 | ORIGINATED BY JEB

DIST Central HWY 427 | BOREHOLE TYPE 200 mm Outside Diameter Hollow Stem Augers | COMPILED BY PKS/VA

DATUM Geodetic | DATE April 7, 2009 | CHECKED BY SM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
183.2	GROUND SURFACE										
0.0	TOPSOIL										
0.2	CLAYEY SILT, trace sand, trace gravel, containing rootlets (Reworked) Stiff Brown Moist		1	SS	11		183				
182.4											
0.8	CLAYEY SILT, some sand, trace gravel (TILL) Very stiff Brown to grey Moist		2	SS	14		182				
			3	SS	20						
			4	SS	27		181				
			5	SS	21		180				
	Becoming grey at a depth of 3.8 m		6	SS	23		179				4 25 50 21
	Containing sand layer between depths of 4.9 m and 5.0 m		7	SS	22		178				
176.5			8	SS	20		177				
6.7	END OF BOREHOLE										

NOTES:

1. Open borehole dry upon completion of drilling.
2. Borehole backfilled with bentonite

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Golder Associates

RECORD OF BOREHOLE No E14

1 OF 1 **METRIC**

PROJECT 06-1111-012
W.O. 05-20012
DIST Central HWY 427
DATUM Geodetic

LOCATION N 4851566.2 ;E 293346.5
BOREHOLE TYPE 108 mm Diameter Solid Stem Augers
DATE March 25, 2009

ORIGINATED BY JEB
COMPILED BY VA
CHECKED BY SMM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (o 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
191.5	GROUND SURFACE										
0.0	CLAYEY SILT, trace sand, trace gravel, containing rootlets (Reworked) Stiff Brown Moist		1	SS	10		191		o		
190.9 / 0.6	CLAYEY SILT, some sand, some gravel (TILL), containing oxidation zones to a depth of 1.4 m Very stiff to hard Brown, becoming grey at 3.7 m depth Moist		2	SS	27				o		
			3	SS	35		190		o——		
			4	SS	29		189		o		
			5	SS	33				o		
			6	SS	20		188		o——		18 15 45 22
	Containing cobbles at a depth of 4.4 m		7	SS	17		187		o		
	Containing cobbles at a depth of 5.5 m						186				
			8	SS	21		185		o		
	Containing cobbles at a depth of 7.3 m						184				
183.3			9	SS	18				o		
8.2	END OF BOREHOLE										

NOTES:

1. Open borehole dry upon completion of drilling.
2. Borehole backfilled with bentonite.

$+^3$, $\times^3$: Numbers refer to Sensitivity $o^{3\%}$ STRAIN AT FAILURE

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

Golder Associates

RECORD OF BOREHOLE No E19

1 OF 1 **METRIC**

PROJECT 06-1111-012
W.O. 05-20012
DIST Central HWY 427
DATUM Geodetic

LOCATION N 4852013.6 ;E 292935.7
BOREHOLE TYPE 200 mm Outside Diameter Hollow Stem Augers
DATE April 1, 2009

ORIGINATED BY JEB
COMPILED BY TB/VA
CHECKED BY SMM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: o 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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
195.3	GROUND SURFACE										
0.0	SILTY CLAY, trace to some sand, trace gravel, containing rootlets to a depth of 0.6 m and organics Firm to stiff Brown, becoming dark brown at a depth of 0.3 m Moist		1	SS	7		195				
193.9			2	SS	12				42		
1.4	SILTY CLAY, trace to some sand, trace gravel (TILL) Stiff to very stiff Brown to grey Moist		3	SS	15		194				
			4	SS	25		193				
			5	SS	21		192				
			6	SS	14						
			7	SS	13		191				
189.5							190				
5.8	CLAYEY SILT, some sand, trace gravel (TILL) Firm to stiff Grey Moist		8	SS	9		189				
			9	SS	7	▽	188				
186.2							187	+ >120			
9.1	Silty SAND, trace gravel, trace clay Compact Grey Wet		10	SS	18		186				
185.6											
9.8	END OF BOREHOLE										

NOTES:

1. Water level in open borehole at a depth of 7.9 m below ground surface (Elev. 187.4 m) upon completion of drilling.

2. Borehole backfilled with bentonite.

$+^3$, $\times^3$: Numbers refer to Sensitivity o 3% STRAIN AT FAILURE

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

Golder Associates

RECORD OF BOREHOLE No S13

1 OF 3 **METRIC**

PROJECT 06-1111-012 | LOCATION N 4849885.0 ;E 293730.1 | ORIGINATED BY CR
W.O. 05-20012 | | COMPILED BY PKS/VA
DIST Central HWY 427 | BOREHOLE TYPE 200 mm Outside Diameter Hollow Stem Augers | CHECKED BY SMM
DATUM Geodetic | DATE March 30 & 31, 2009

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
187.7	GROUND SURFACE						187				
0.0	ASPHALT										
0.2	Silty sand, some gravel (FILL) Compact Brown Moist		1	SS	15						
186.9							186				
0.8	Clayey silt, some sand, trace gravel (FILL) Very stiff Brown Moist		2	SS	12						
			3	SS	29						
	SILTY CLAY, trace sand, trace gravel (TILL) Stiff to hard Brown Moist		4	SS	27		185				
			5	SS	35						
			6	SS	31		184				
183.1											
4.6	CLAYEY SILT, some sand, trace gravel, containing cobbles (TILL) Very stiff to hard Grey Moist Augers grinding at 5.2 m depth		7	SS	21		183				
							182				
			8	SS	22		181				
	Augers grinding at 8.4 m depth		9	SS	43	▽	180				
							179				
			10	SS	43		178				
			11	SS	55		177				
							176				
			12	SS	48		175				
174.0							174				
13.7	Silty SAND, trace gravel Very dense Grey Wet		13	SS	59						
							173				

Continued Next Page

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

Golder Associates

RECORD OF BOREHOLE No S13

2 OF 3 **METRIC**

PROJECT 06-1111-012 | LOCATION N 4849885.0 ;E 293730.1 | ORIGINATED BY CR
W.O. 05-20012 | | COMPILED BY PKS/VA
DIST Central HWY 427 | BOREHOLE TYPE 200 mm Outside Diameter Hollow Stem Augers | CHECKED BY SMM
DATUM Geodetic | DATE March 30 & 31, 2009

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	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/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	— CONTINUED FROM PREVIOUS PAGE —										
172.5											
15.2	CLAYEY SILT, some sand, trace gravel (TILL) Very stiff Grey Wet		14	SS	28		172				
170.0											
17.7	SAND, trace to some silt, trace gravel Compact Grey Wet		15	SS	22		171				1 87 9 3
							170				
167.9											
19.8	CLAYEY SILT, some sand, trace gravel (TILL) Hard Grey Wet						169				
	Augers grinding at 21.0 m depth		16	SS	199		168				
							167				
	Augers grinding at 22.0 m depth		17	SS	80		166				
163.9							165				
23.8	SHALE (BEDROCK) Grey		18	SS	50/0.10		164				
							163				
			19	SS	50/0.05		162				
160.2											
27.5	END OF BOREHOLE		20	SS	00/0.01		161				

Continued Next Page

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

Appendix B

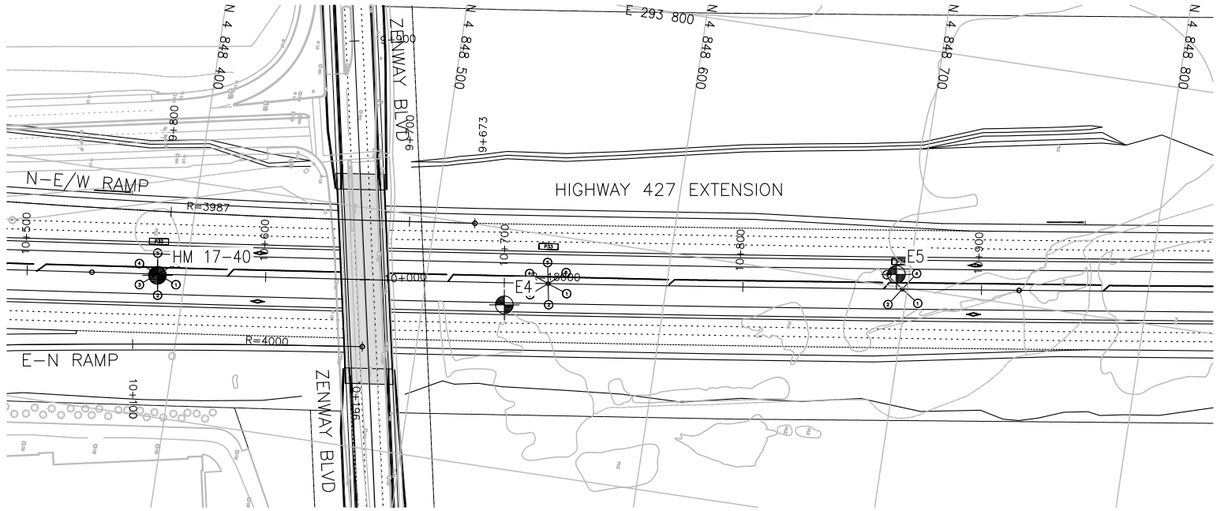
Record of Borehole Sheets – Previous Investigations

Appendix C

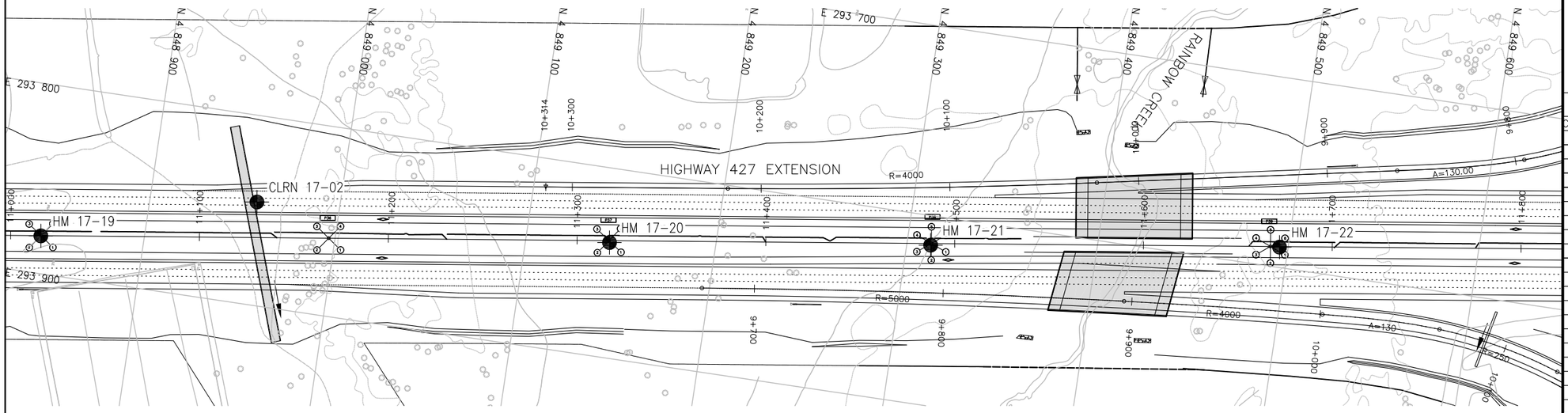
Borehole Location Plans

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

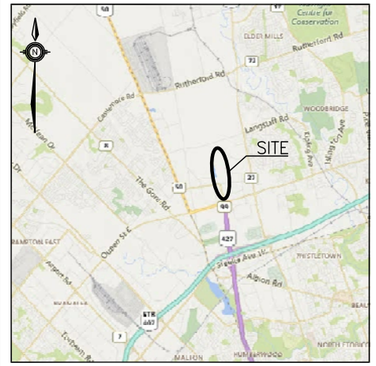


PLAN



PLAN

THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

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

NO	ELEVATION	NORTHING	EASTING
CLRN 17-02	180.3	4 848 956.3	293 845.5
E4	183.0	4 848 534.0	293 931.7
E5	183.2	4 848 694.6	293 894.9
HM 17-19	183.0	4 848 845.7	293 880.1
HM 17-20	183.2	4 849 144.1	293 839.2
HM 17-21	183.5	4 849 312.6	293 815.5
HM 17-22	180.4	4 849 495.5	293 789.3
HM 17-40	183.9	4 848 388.4	293 940.9

-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.

NO.	DATE	REVISIONS	BY	CHK	LEAD. DISC.	PROJ. MAN.
A	19/01/21	90% SUBMISSION TO CA	AN	KS	JL	JL

SCALE :

12.5m 0 25m

1:2500

Metres

CONSULTANT

DESIGNED	M. BOUCHER	MB	19/01/21
DRAWN	A. NOOR	AN	19/01/21
CHECKED	M. BOUCHER	MB	19/01/21
APPROVED LEAD ENGINEER	J. LEE	JL	19/01/21
APPROVED PROJ. MANAGER	J. LEE	JL	19/01/21
	NAME (PRINT)	INIT.	DATE

Ontario

link427

LOCAL | INTEGRATED | NEIGHBOURLY | KNOWLEDGEABLE

TITLE

HWY 427 EXPANSION
HIGH MAST LIGHTING
HIGHWAY 7 TO LANGSTAFF ROAD
PACKAGE 6, 7 AND 8
BOREHOLE LOCATIONS PLAN

PROJECT ID.	STAGE INDENTIFIER	DESIGN PACKAGE NUMBER	DISCIPLINE	STRUCTURE NUMBER	DOCUMENT TYPE	DRAWING NUMBER	REVISION NUMBER
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METRIC

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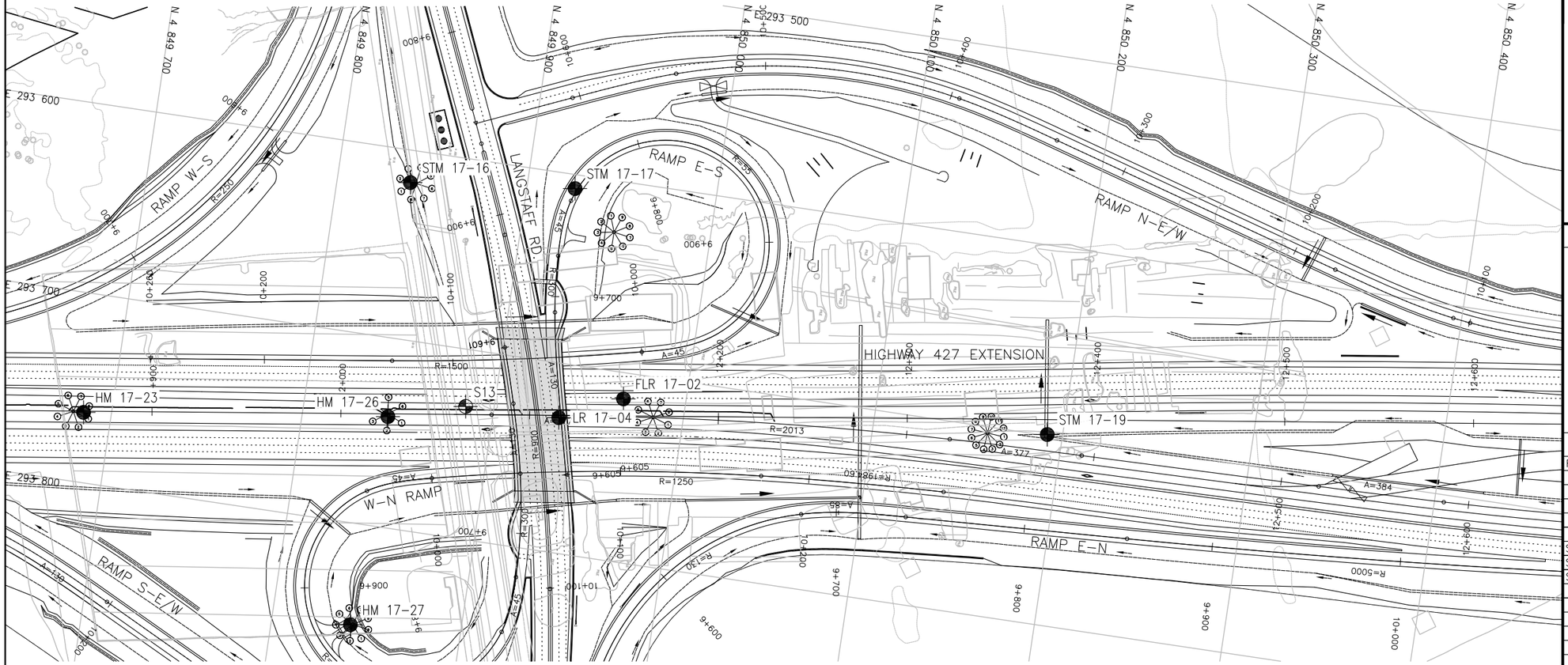
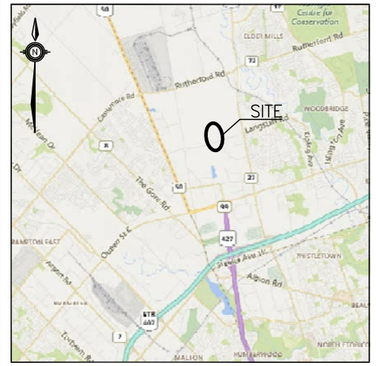
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN



PLAN

THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

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

NO	ELEVATION	NORTHING	EASTING
FLR 17-02	188.8	4 849 967.1	293 713.8
HM 17-23	190.3	4 849 685.3	293 763.0
HM 17-26	188.4	4 849 845.1	293 741.5
HM 17-27	188.6	4 849 841.7	293 853.5
LR 17-04	188.2	4 849 934.7	293 728.7
S13	187.7	4 849 885.0	293 730.1
STM 17-16	187.2	4 849 838.6	293 617.1
STM 17-17	188.2	4 849 925.3	293 607.4
STM 17-19	187.6	4 850 191.9	293 699.4

-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.

NO.	DATE	REVISIONS	BY	CHK	LEAD. DISC.	PROJ. MAN.
A	19/01/21	90% SUBMISSION TO CA	AN	KS	JL	JL

SCALE :

12.5m 0 25m

1:2500

Metres

CONSULTANT

DESIGNED	M. BOUCHER	MB	19/01/21
DRAWN	A. NOOR	AN	19/01/21
CHECKED	M. BOUCHER	MB	19/01/21
APPROVED LEAD ENGINEER	J. LEE	JL	19/01/21
APPROVED PROJ. MANAGER	J. LEE	JL	19/01/21
	NAME (PRINT)	INIT.	DATE

Ontario

link427
LOCAL | INTEGRATED | NEIGHBOURLY | KNOWLEDGEABLE

TITLE

HWY 427 EXPANSION
HIGH MAST LIGHTING
LANGSTAFF ROAD
PACKAGE 6, 7 AND 8
BOREHOLE LOCATIONS PLAN

PROJECT ID.	STAGE INDENTIFIER	DESIGN PACKAGE NUMBER	DISCIPLINE	STRUCTURE NUMBER	DOCUMENT TYPE	DRAWING NUMBER	REVISION NUMBER
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METRIC

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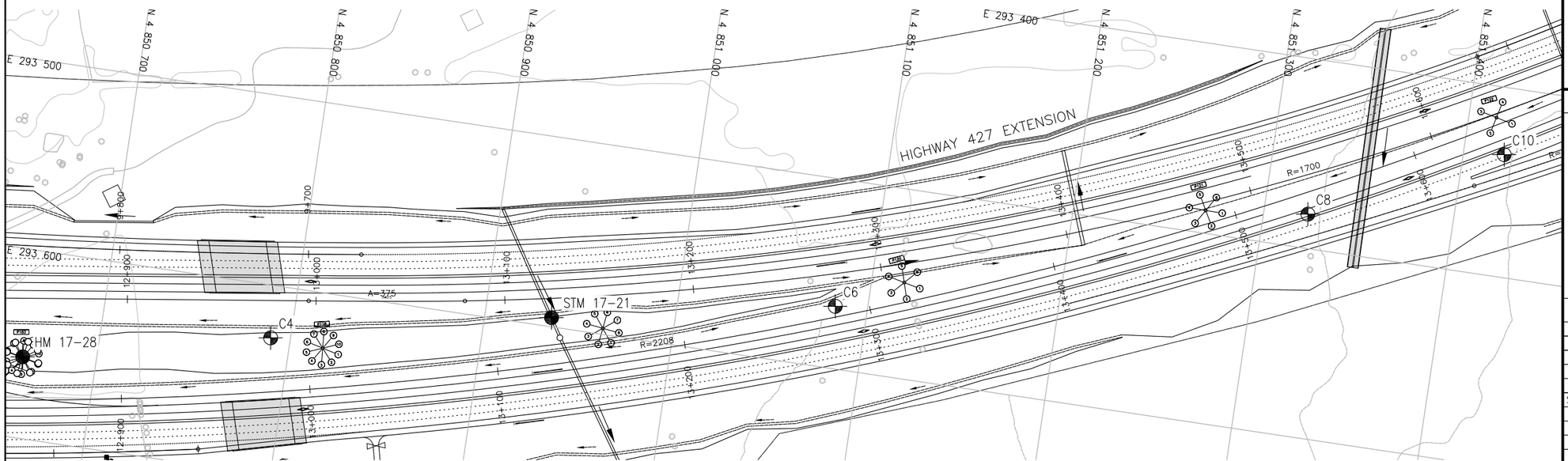
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN



THURBER ENGINEERING LTD.

KEYPLAN

LEGEND

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

NO	ELEVATION	NORTHING	EASTING
C4	189.1	4 850 789.6	293 627.7
C6	189.7	4 851 082.9	293 567.1
C8	186.9	4 851 323.3	293 481.9
C10	188.6	4 851 421.5	293 435.4
HM 17-28	190.4	4 850 661.2	293 657.0
STM 17-21	190.4	4 850 935.2	293 595.2

-NOTES-

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GEOCRES No.

NO.	DATE	REVISIONS	BY	CHK	LEAD. DISC.	PROJ. MAN.
A	19/01/21	90% SUBMISSION TO CA	AN	MB	JL	JL

SCALE :

12.5m 0 25m

1:2500
Metres

CONSULTANT

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APPROVED PROJ. MANAGER	J. LEE	JL	19/01/21
	NAME (PRINT)	INIT.	DATE

Ontario

link427
LOCAL | INTEGRATED | NEIGHBOURLY | KNOWLEDGEABLE

TITLE

HWY 427 EXPANSION
HIGH MAST LIGHTING
LANGSTAFF RD. EAST ROBINSON CREEK
PACKAGE 6, 7 AND 8
BOREHOLE LOCATIONS PLAN

PROJECT ID.	STAGE INDENTIFIER	DESIGN PACKAGE NUMBER	DISCIPLINE	STRUCTURE NUMBER	DOCUMENT TYPE	DRAWING NUMBER	REVISION NUMBER
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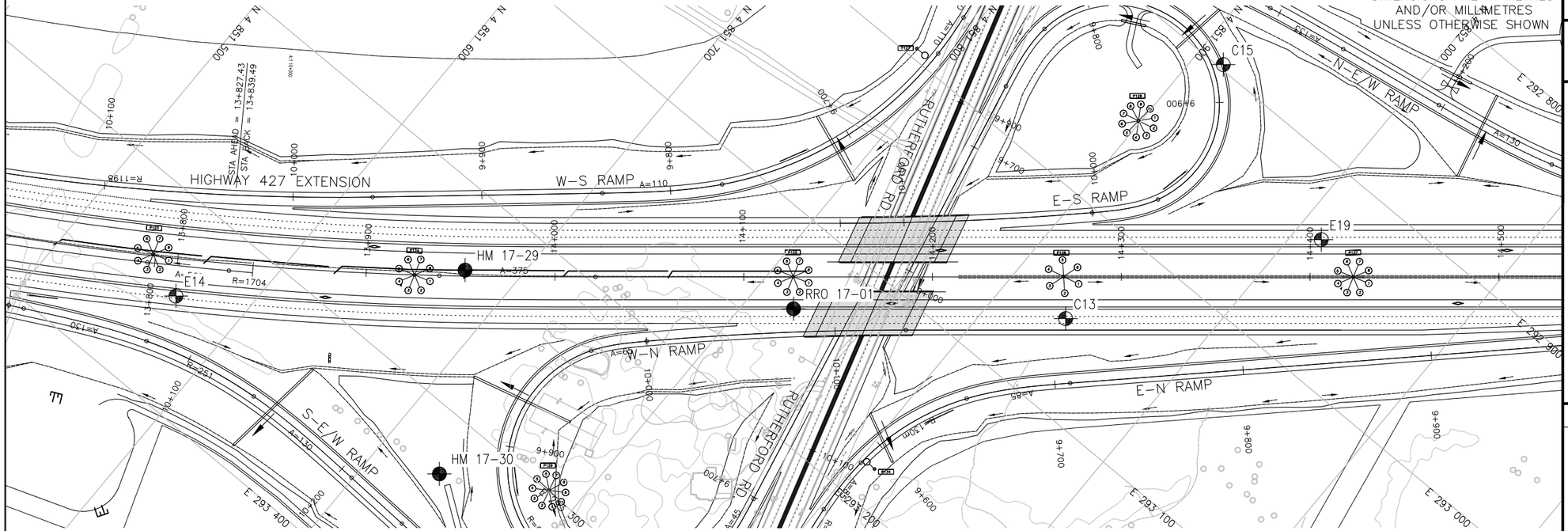
METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN



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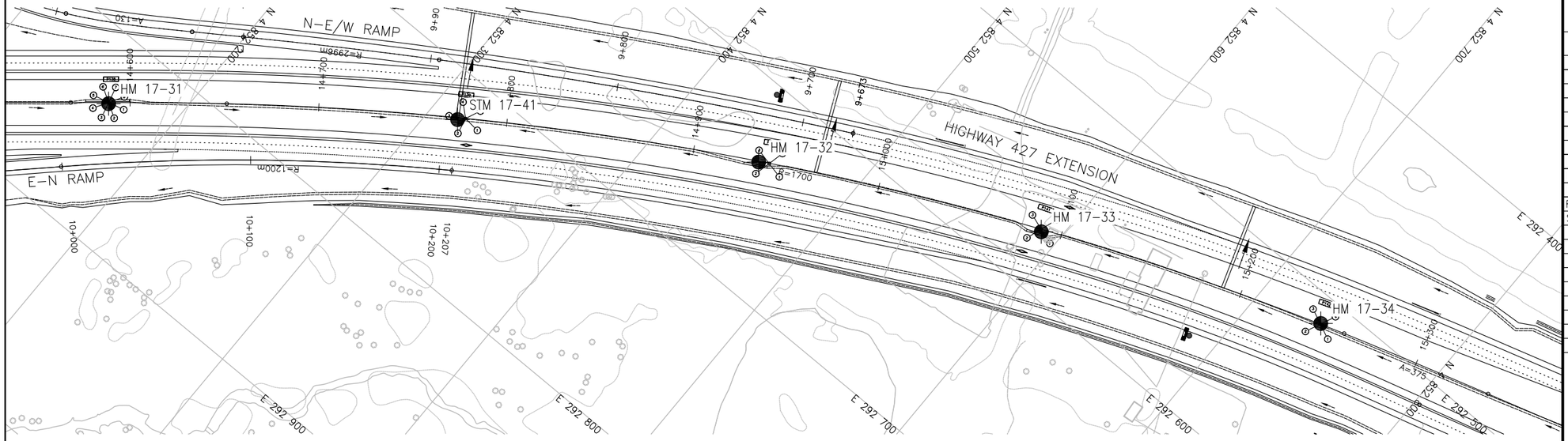
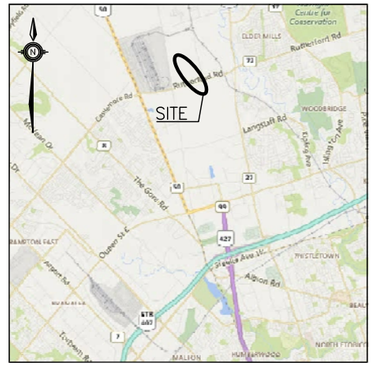


PLAN

THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

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

NO	ELEVATION	NORTHING	EASTING
C13	193.8	4 851 936.2	293 054.4
C15	195.2	4 851 914.4	292 897.6
E14	191.5	4 851 566.2	293 346.5
E19	195.3	4 852 013.6	292 935.7
HM 17–29	192.4	4 851 675.2	293 238.1
HM 17–30	193.5	4 851 733.7	293 329.7
HM 17–31	196.0	4 852 167.1	292 834.5
HM 17–32	196.9	4 852 451.6	292 638.2
HM 17–33	198.1	4 852 590.3	292 570.8
HM 17–34	198.8	4 852 735.2	292 513.6
RRO 17–01	194.4	4 851 822.0	293 142.6
STM 17–41	196.8	4 852 314.6	292 722.8

-NOTES-

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GEOCRES No.

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A	19/01/21	90% SUBMISSION TO CA	AN	MB	JL	JL

SCALE : 12.5m 0 25m — 1:2500 Metres

CONSULTANT				
	DESIGNED	M. BOUCHER	MB	19/01/21
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	APPROVED LEAD ENGINEER	J. LEE	JL	19/01/21
	APPROVED PROJ. MANAGER	J. LEE	JL	19/01/21
		NAME (PRINT)	INIT.	DATE

Ontario

link427 — LOCAL | INTEGRATED | NEIGHBOURLY | KNOWLEDGEABLE

TITLE

HWY 427 EXPANSION
HIGH MAST LIGHTING
EAST ROBINSON CREEK TO MAJOR MACKENZIE DR.
PACKAGE 6, 7 AND 8
BOREHOLE LOCATIONS PLAN

PROJECT ID.	STAGE INDENTIFIER	DESIGN PACKAGE NUMBER	DISCIPLINE	STRUCTURE NUMBER	DOCUMENT TYPE	DRAWING NUMBER	REVISION NUMBER
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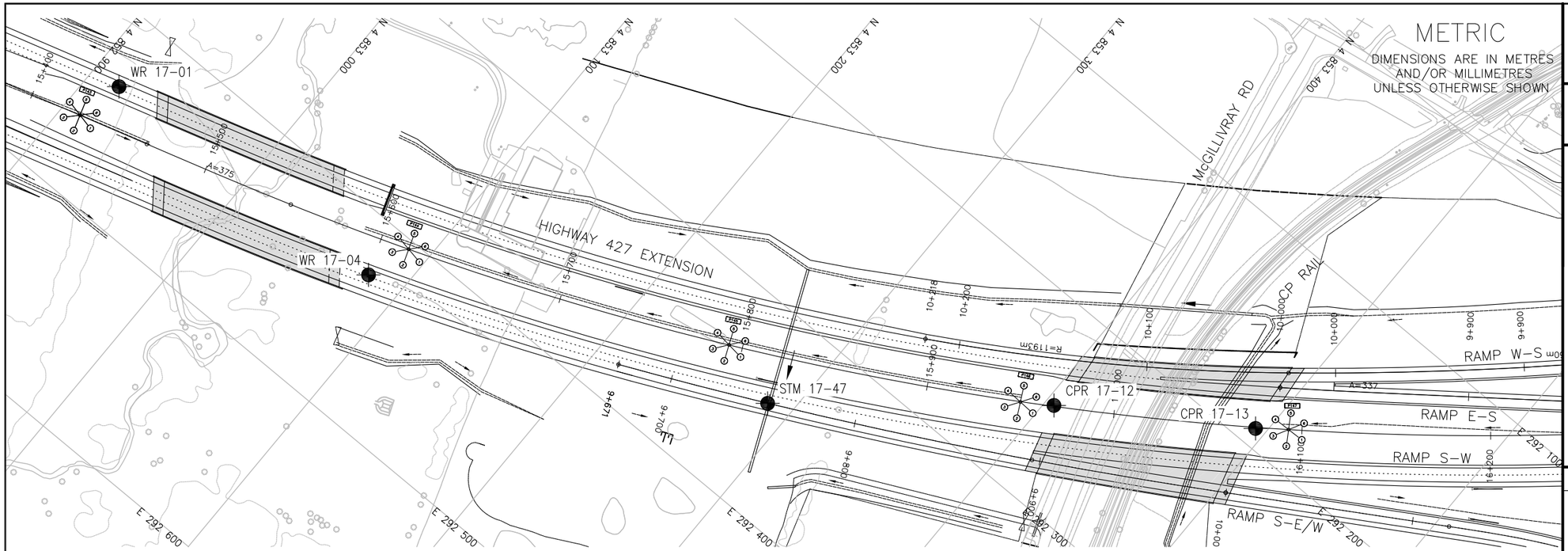
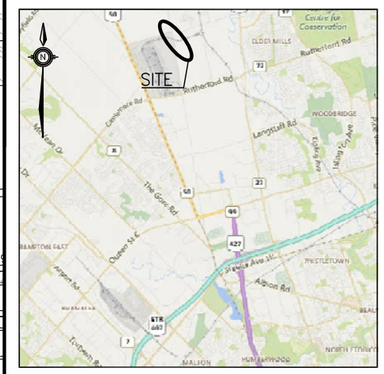
METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN



PLAN



LEGEND

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

NO	ELEVATION	NORTHING	EASTING
CPR 17-12	201.8	4 853 404.7	292 249.4
CPR 17-13	201.9	4 853 494.6	292 190.5
FMMO 17-05	203.5	4 853 679.8	292 063.9
HM 17-35	205.8	4 853 829.0	291 605.1
HM 17-36	205.2	4 853 835.3	291 737.3
MMO 17-01	204.8	4 853 823.5	291 904.6
STM 17-47	202.2	4 853 287.4	292 345.5
WR 17-01	199.8	4 852 916.1	292 436.3
WR 17-04	194.7	4 853 081.4	292 428.4

-NOTES-

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GEOCRES No.

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A	19/01/21	90% SUBMISSION TO CA	AN	MB	JL	JL

SCALE : 12.5m 0 25m — 1:2500 Metres

CONSULTANT				
DESIGNED	M. BOUCHER	MB	19/01/21
DRAWN	A. NOOR	AN	19/01/21
CHECKED	M. BOUCHER	MB	19/01/21
APPROVED LEAD ENGINEER	J. LEE	JL	19/01/21
APPROVED PROJ. MANAGER	J. LEE	JL	19/01/21
	NAME (PRINT)	INIT.	DATE

THURBER ENGINEERING LTD.

Ontario

link427 — LOCAL | INTEGRATED | NEIGHBOURLY | KNOWLEDGEABLE

TITLE

HWY 427 EXPANSION
HIGH MAST LIGHTING
McGILLIVRY ROAD TO MAJOR MACKENZIE DR.
PACKAGE 6, 7 AND 8
BOREHOLE LOCATIONS PLAN

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

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