THURBER ENGINEERING LTD.

FOUNDATION INVESTIGATION REPORT
GROUND MOUNTED SIGN SUPPORTS
HIGHWAYS 416 & 417
OTTAWA, ONTARIO

Submitted

To

URS Canada Inc.

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OTTAWA, ONTARIO

PART 1: FACTUAL INFORMATION

1.0 INTRODUCTION

This report presents the factual data obtained from a foundation investigation carried out by Thurber Engineering Ltd. (Thurber) for the design of replacements for forty-three (43) ground mounted sign supports at locations along the Highway 417 corridor between Arnprior, Ontario and the Quebec border and one (1) ground mounted sign support along Highway 416 near Ottawa. Thurber has been retained by URS Canada Inc. to carry out this investigation on behalf of the Ministry of Transportation Ontario (MTO) under Assignment No. 4012-E-0001, Part E.

The purpose of this investigation was to determine the subsurface conditions in the vicinity of the proposed sign supports and, based on this data, to provide records of boreholes, laboratory test results and a written description of the subsurface conditions.

2.0 SITE DESCRIPTION

In general, the ground mounted signs are located within the physiographic region known as the Ottawa Valley Clay Plains. This area is located between the Laurentian upland to the north and west, and the Ottawa lowland to the south and east. Native soil deposits typically consist of glacio-lacustrine clayey silts to silty clays that were deposited when the Champlain Sea inundated the Ottawa – St. Lawrence lowland. Bedrock in the site area mainly consists of crystalline limestone of the Ordovician Period which has been subjected to faulting, weathering and erosion. Occasional shale formations and volcanic or metamorphic intrusions are also present.

The ground mounted signs are to be located at various locations along Highway 417 (43 signs) and Highway 416 (1 sign). To the east of Ottawa (east of OR174), Highway 417 typically consists of a four lane freeway with a rural cross-section and vegetated median of variable width. The terrain ranges from flat to gently rolling and the land adjacent to the highway typically consists of farm fields or brush.

Within the urban boundaries of Ottawa, Highway 417 typically consists of a 6 to 8 lane urban freeway.

To the west of Ottawa (west of Eagleson Road), Highway 417 typically consists of a four lane freeway with a rural cross-section and vegetated median of variable width. The terrain ranges from flat to gently rolling and surrounding lands include swamps, farm fields and brush and occasional rock cuts. Highway 416 south of Ottawa is a similar environment.

3.0 INVESTIGATION PROCEDURES

3.1 Field Investigation

The borehole investigation for the proposed ground mounted signs was carried out between September 9 and October 20, 2013. The borehole locations, drilling dates and depths are listed in Table 1 in Appendix A. The approximate borehole locations are shown on the key plans in Appendix A.

The investigation was carried out using a truck mounted drill rig supplied and operated by a specialist drilling contractor.

In these boreholes, soil drilling was carried out using hollow stem augers and all soil samples were obtained using a 50 mm outside diameter split spoon sampler advanced in accordance with the Standard Penetration Test (SPT). In-situ shear vane testing was carried out using an MTO N-vane within soft to firm cohesive deposits. Groundwater conditions in the open boreholes were observed throughout the drilling operations.

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

The northings and eastings reported on the Record of Borehole sheets are based on handheld GPS data and are considered approximate in nature. In general, the boreholes were located on the outside shoulder approximately 5m behind existing signs.

3.2 Laboratory Testing

Geotechnical laboratory testing was carried out in the Thurber laboratory in Oakville, Ontario, and consisted of natural moisture content determination and visual identification of all soil samples in accordance with the current MTO standards. Grain size distribution analysis and Atterberg Limits tests were conducted on selected samples. The laboratory test results are presented on the Record of Borehole sheets in Appendix B and the figures in Appendix C.

4.0 SUBSURFACE STRATIGRAPHY

4.1 General

This section presents a generalized summary of the subsurface conditions encountered in the boreholes. The detailed subsurface soil, rock and groundwater conditions encountered in all boreholes are presented on the Records of Boreholes in Appendix B.

In general, the subsurface conditions encountered in the boreholes consist of fill overlying native silty clay, clay, sand, silty sand, silt or glacial till deposits.

4.1.2 Fill

All boreholes were drilled through the shoulder of the existing highways. Granular fill was encountered at ground surface or beneath the asphalt surface (Borehole 25) in all boreholes. The upper fill generally consisted of sand and gravel with trace to some silt. The thickness of the granular fill ranged from 0.3 to 3.1 m. The granular fill was typically in a compact to very dense state as indicated by SPT 'N' values ranging from 11 to 74 blows per 0.3 m penetration.

The sand and gravel fill was underlain by silty sand fill within seven boreholes (10, 13, 15, 16, 19, 27 and 31). The thickness of the silty sand fill, where present, ranged from 0.6 to 1.8 m. The silty sand fill was typically in a loose to compact state as indicated by SPT 'N' values ranging from 7 to 28 blows per 0.3 m penetration. Measured moisture contents of the silty sand fill materials ranged from 3% to 19%.

Grain size distribution analyses were carried out on several samples of the fill. The results of the analyses are shown on Figures in Appendix C. The results are also summarized in the table below.

Soil Particles	%
Gravel	2 to 15
Sand	60 to 41
Silt	27 to 26
Clay	7 to 11

4.1.3 Sand / Silty Sand / Sand and Silt

Deposits of native sand, silty sand or sand and silt were encountered beneath the fill in 33 of the boreholes. Where encountered, these deposits extend to variable depths ranging from 0.5 m to greater than 3.1 m.

Measured SPT 'N' values within these deposits typically range between 1 and 82 blows per 0.3 m of penetration, with an average of approximately 20. These deposits range from very loose to very dense but are typically compact. Measured moisture contents of samples of these deposits ranged between 4% and 36%.

Grain size distribution analyses were carried out on 28 selected samples. The results of these analyses are presented in Figures in Appendix C. The results are also summarized in the table below.

Soil Particles	%
Gravel	0 to 18
Sand	33 to 94
Silt & Clay	5 to 60

4.1.4 Silt / Sandy Silt

Deposits of native silt and sandy silt were encountered in 5 of the boreholes. Where encountered, these deposits extend to variable depths ranging from 1.2 to 1.8 m below ground surface with thicknesses ranging from 0.2 to 1.2 m.

Measured SPT 'N' values within these deposits range between 8 and 17 blows per 0.3 m of penetration, indicating loose to compact conditions. Measured moisture contents of samples of these deposits ranged between 11% and 26%.

Grain size distribution analyses were carried out on 2 selected samples. The results of these analyses are presented in Figures in Appendix C. The results are also summarized in the table below.

Soil Particles	%
Gravel	0 to 2
Sand	21 to 35
Silt	53 to 62
Clay	10 to 17

4.1.5 Clay / Silty Clay

Deposits of native clay and silty clay were encountered in 29 of the boreholes. Where encountered, the clayey deposits extend to depths between 2.3 m and greater than 4.3 m below ground surface.

Measured 'N' values within these deposits ranged from 1 to 26 blows per 0.3 m, indicating a very soft to very stiff consistency. The results of in-situ vane tests indicated undrained shear strengths ranging from 13 to 80 kPa.

Moisture contents of the cohesive deposits ranged between 8% and 83%. Grain size distribution analyses were carried out on 21 selected samples. The results of these analyses are presented in Figures in Appendix C. Atterberg limits tests were also conducted and the results plotted on plasticity charts shown on Figures in Appendix C. The results are also summarized in the tables below.

Soil Particles	%
Gravel	0 to 10
Sand	0 to 28
Silt	16 to 48
Clay	38 to 82

Index Property	%
Liquid Limit	23 to 79
Plastic Limit	14 to 31
Plasticity Index	9 to 53

The results indicate that low plasticity (CL) silty clay was encountered in Boreholes 19 and 45 and that the remainder of the cohesive deposits were classified as clay of high plasticity (CH).

4.1.6 Glacial Till

Glacial till deposits were encountered in five of the boreholes. Borehole 20 was terminated within the glacial till deposit at a depth of 3.7 m below ground surface. Boreholes 9, 10, 32 and 44 were terminated upon auger refusal at depths ranging from 2.2 to 3.0 m below ground surface.

Measured 'N' values within the glacial till ranged from 25 to 62 blows per 0.3 m indicating compact to very dense deposits. Moisture contents of the glacial till deposits ranged between 3% and 30%.

Grain size distribution analyses were carried out on selected glacial till samples. The results of these analyses are presented in Figures in Appendix C. The results are also summarized in the table below.

Soil Particles	%
Gravel	4 to 63
Sand	30 to 57
Silt	7 to 30
Clay	0 to 16

The glacial till deposits ranged from silty sand, trace to some gravel to sandy gravel trace silt. Cobbles or bedrock pieces were also identified within the glacial till deposits during drilling and it is noted that boulders are also commonly encountered within glacial till deposits in Eastern Ontario.

4.1.7 Bedrock

Possible bedrock was encountered in Boreholes 9, 10, 16, 32 and 44. Weathered shale bedrock was encountered at a depth of 2.6 m blow ground surface in Borehole 16; the borehole was extended to a depth of 3.1 m by augering. Boreholes 10, 11, 21 and 36 were terminated upon auger refusal at depths ranging from 2.2 to 3.0 m below ground surface. The shale bedrock is known to include very hard interbeds.

4.1.8 Groundwater Conditions

Where encountered during drilling, groundwater conditions were documented and are presented on the Record of Borehole sheets in Appendix B. It should be noted that these observed levels are based on short term observations and groundwater levels are subject to seasonal fluctuations and severe climatic events. In addition, local groundwater level at the sign locations may be governed by the water level in ditches adjacent to the highway.

5.0 MISCELLANEOUS

The borehole locations were marked in the field by Thurber. Borehole co-ordinates were measured using a hand-held GPS. Thurber obtained utility clearances prior to drilling. Eastern Ontario Diamond Drilling Limited of Hawkesbury, Ontario, supplied the drill rig and conducted the drilling, sampling and in-situ testing operations.

The drilling and sampling operations in the field were supervised on a full time basis by Ms. Gabrielle Marcotte and Mr. Nick Weil of Thurber. Laboratory testing was carried out by Thurber in its MTO-approved Oakville laboratory. Mr. Shawn Lapain directed the field operations and Mr. Paul Carnaffan, P.Eng. prepared this report.

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

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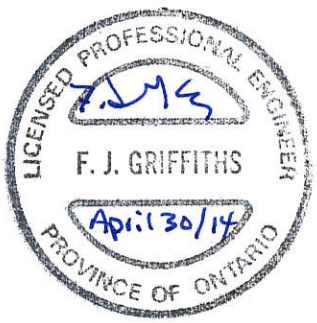
Paul Carnaffan, P.Eng.
Associate, Senior Geotechnical Engineer



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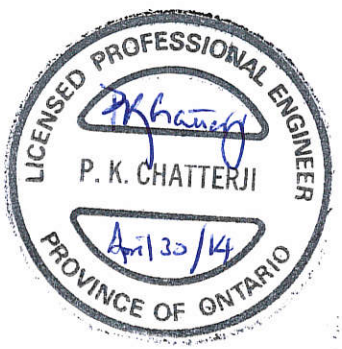

P.K. Chatterji, P.Eng.
Review Principal, Designated MTO Contact

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Appendix A

Borehole Location Drawings

Table 1 – Summary of Sign Locations and Borehole Drilling Dates and Depths

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No.	Revision	Date	URS
			MTO Sign Replacement
			KEY PLAN
			19-4406-6 Highway 417

THURBER ENGINEERING LTD.

ENGINEER: PC	DRAWN GM	APPROVED: FJG
DATE: 09/01/2014	SCALE: N.T.S.	DRAWING NO: 1

No.	Revision	Date	URS
			MTO Sign Replacement
			KEY PLAN
			19-4406-6 Highway 417

THURBER ENGINEERING LTD.

ENGINEER: PC	DRAWN GM	APPROVED: FJG
DATE: 09/01/2014	SCALE: N.T.S.	DRAWING NO: 2

No.	Revision	Date	URS
			MTO Sign Replacement
			KEY PLAN
			19-4406-6 Highway 417

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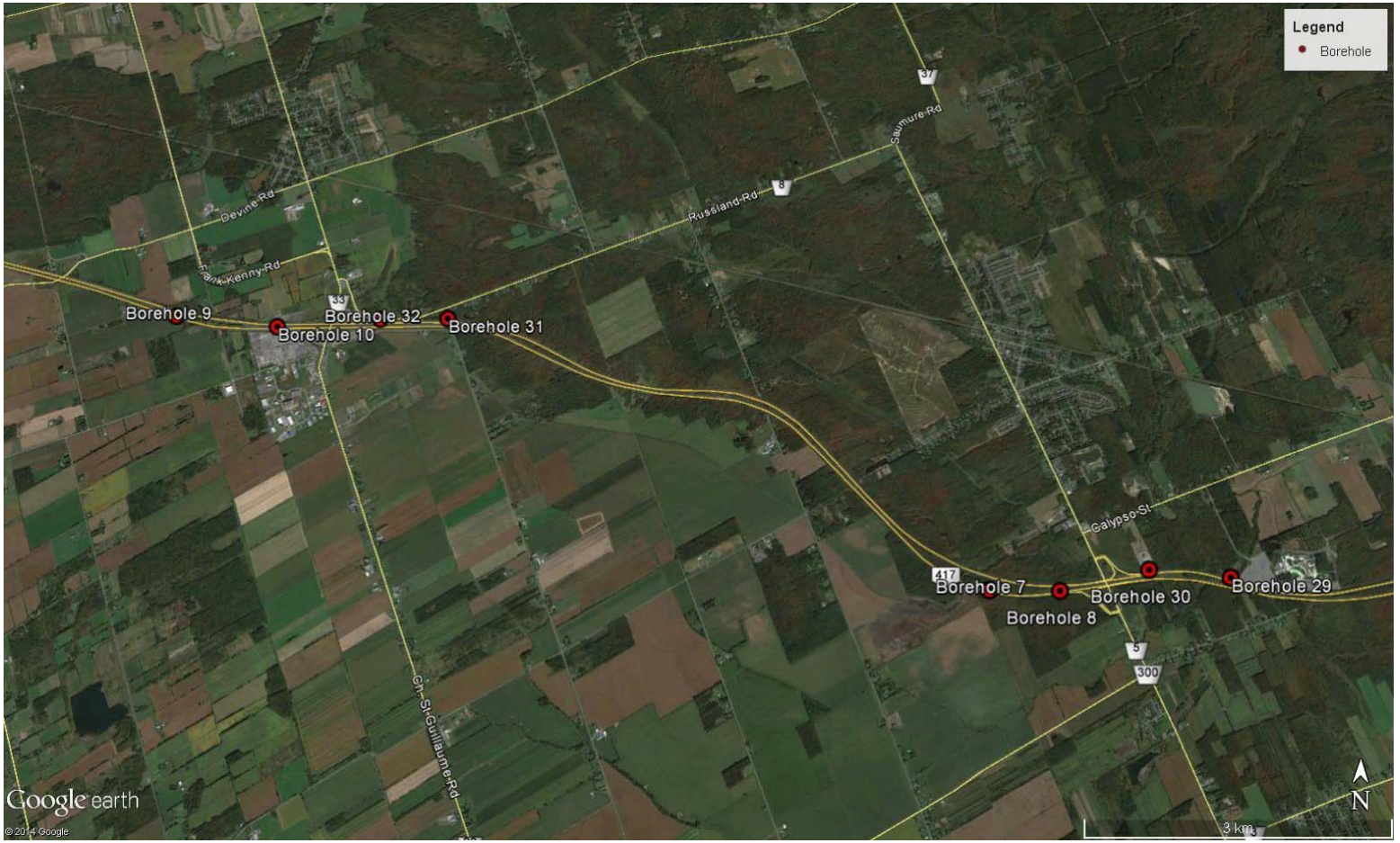
DATE: 09/01/2014	SCALE: N.T.S.	DRAWING NO: 3



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			KEY PLAN
			19-4406-6 Highway 417

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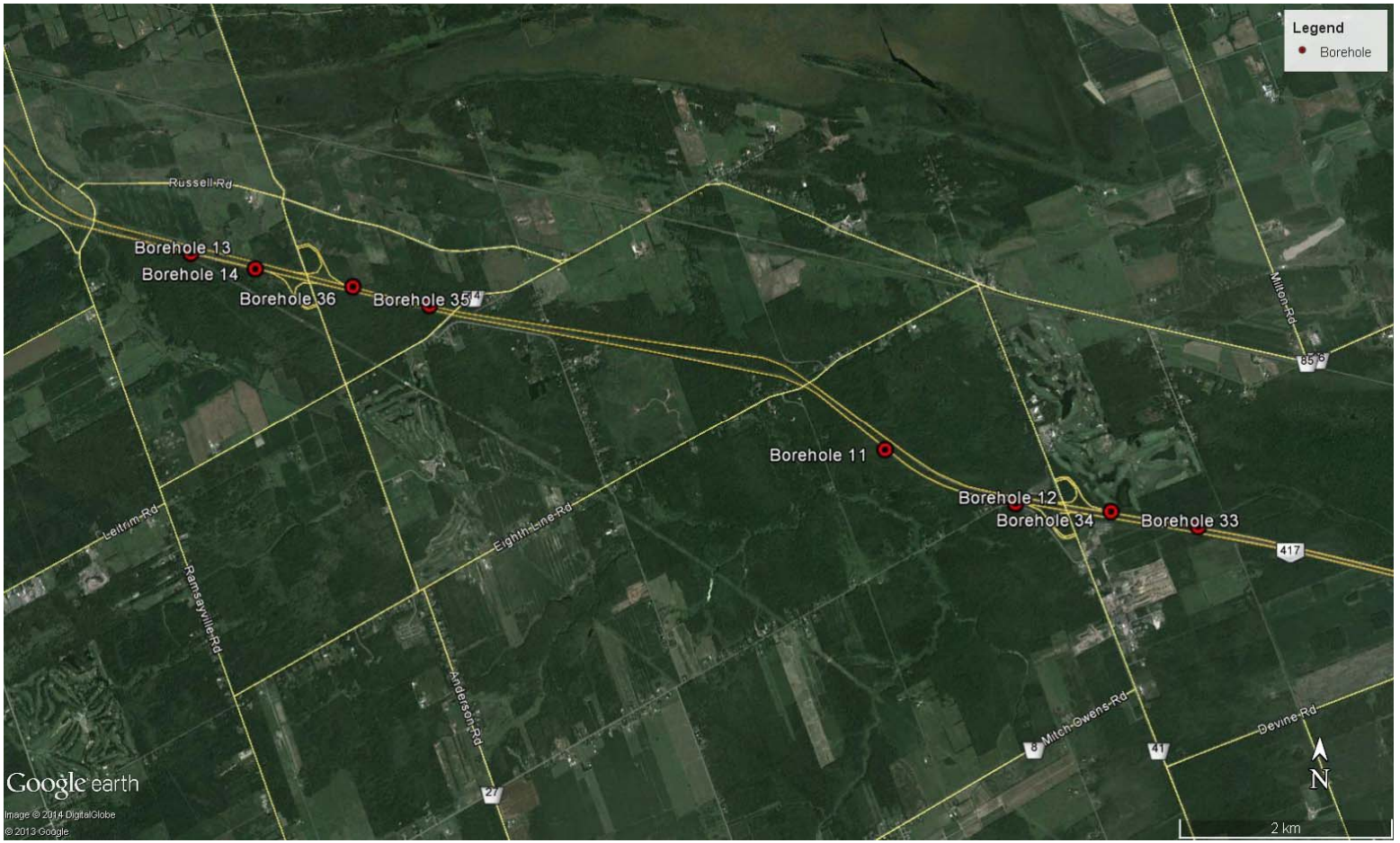
DATE: 09/01/2014	SCALE: N.T.S.	DRAWING NO: 4



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			MTO Sign Replacement
			KEY PLAN
			19-4406-6 Highway 417

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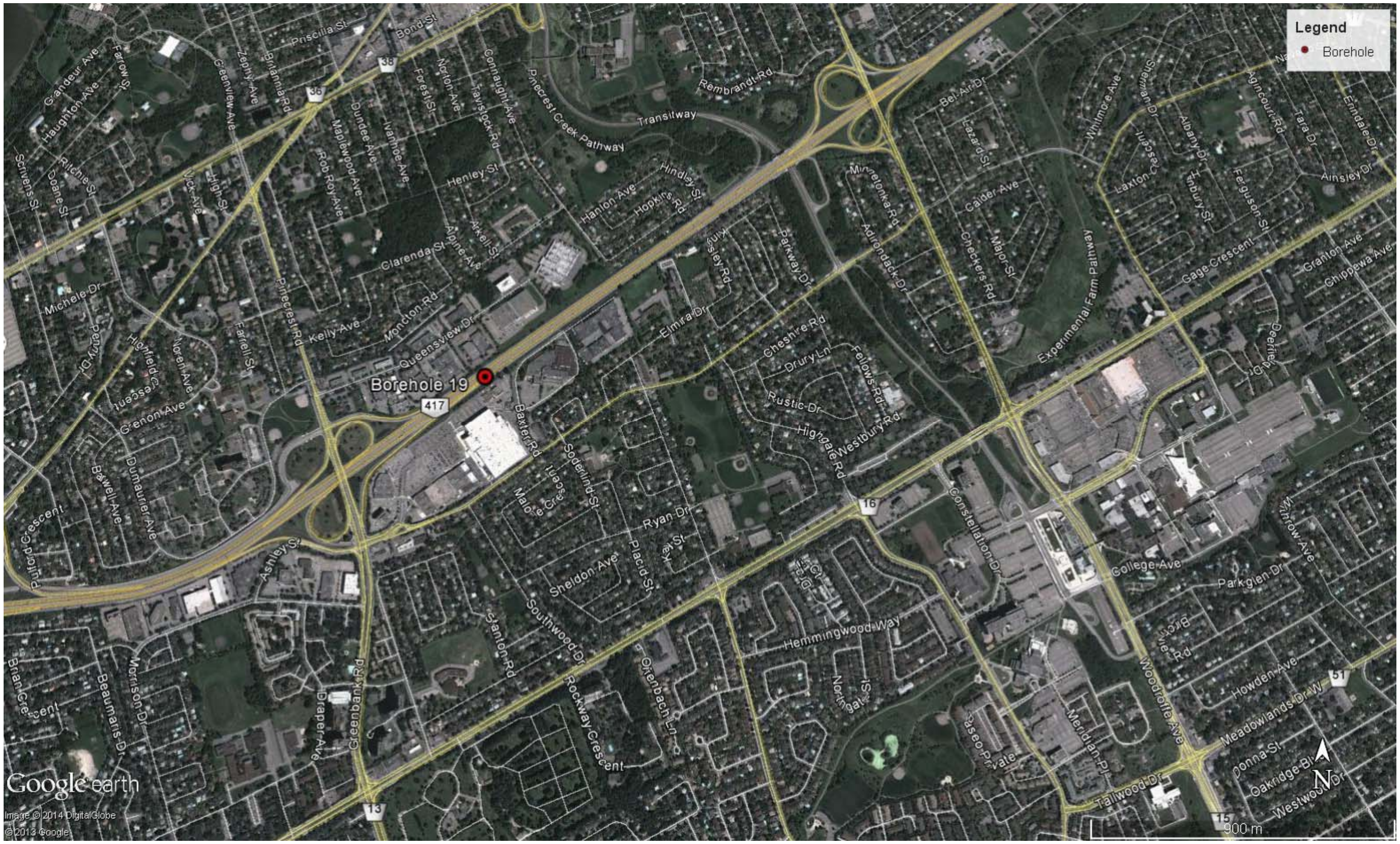

No.	Revision	Date	URS
			MTO Sign Replacement
			KEY PLAN
			19-4406-6 Highway 417

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No.	Revision	Date	URS
			MTO Sign Replacement
			KEY PLAN
			19-4406-6 Highway 416

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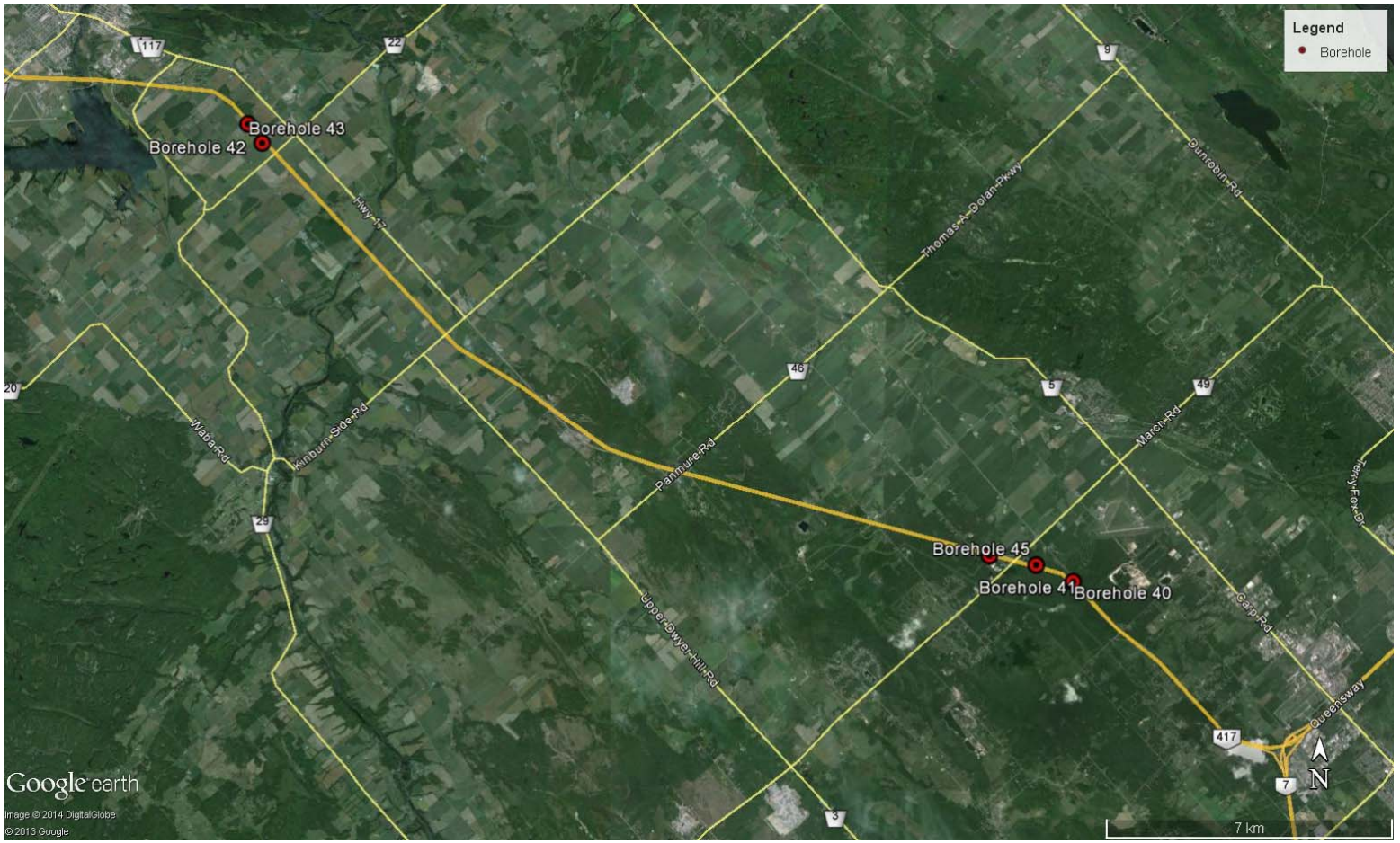
DATE: 09/01/2014	SCALE: N.T.S.	DRAWING NO: 7



No.	Revision	Date	URS
			MTO Sign Replacement
			KEY PLAN
			19-4406-6 Highway 417

THURBER ENGINEERING LTD.

ENGINEER: PC	DRAWN GM	APPROVED: FJG
DATE: 09/01/2014	SCALE: N.T.S.	DRAWING NO: 8

Table 1
Summary of Sign Locations and Borehole Drilling Dates and Depths

Sign No.	Sign ID.	HIGHWAY	MESSAGE	Borehole	Drilling Date	Depth (m)
1	417_EB_0001	417 E/B	(Advance) Ch. Prescott & Russell Rd., P&R 4 (trapezoid), Chute-a-Blondeau, P&R 14 (trapezoid), St. Eugene, 1 km	1	12-Sep-13	3.7
2	417_EB_0002	417 E/B	(Turn Off) Ch. Prescott & Russell Rd., P&R 4 (trapezoid), Chute-a-Blondeau, P&R 14 (trapezoid), St. Eugene	2	12-Sep-13	3.7
3	417_EB_0003	417 E/B	(Advance) Hwy 34 (crown), P&R 34 (trapezoid),Van Kleek Hill, Hawkesbury, 1 km	39	10-Oct-13	3.7
4	417_EB_0004	417 E/B	(Advance) Ch. Highland Rd., St. Isidore, Maxville, 1 km	3	09-Sep-13	4.1
5	417_EB_0005	417 E/B	(Turn Off) Ch. Highland Rd., St. Isidore, Maxville	4	09-Sep-13	3.7
6	417_EB_0006	417 E/B	(Advance) Hwy 138 (crown), Moose Creek, Monkland, Cornwall, 1 km	5	12-Sep-13	3.7
7	417_EB_0007	417 E/B	(Turn Off) Hwy 138 (crown), Moose Creek, Monkland, Cornwall	6	12-Sep-13	3.5
8	417_EB_0008	417 E/B	(Advance) P&R 5 (trapezoid), Ch. Limoges Rd., Limoges, Crysler, 1 km	7	22-Sep-13	3.7
9	417_EB_0009	417 E/B	(Turn Off) P&R 5 (trapezoid), Ch. Limoges Rd., Limoges, Crysler	8	20-Oct-03	3.1
10	417_EB_0010	417 E/B	(Advance) Ch. Rockdale Rd., P&R 33 (trapezoid), Vars, Embrun, 1 km	9	21-Sep-13	3.0
11	417_EB_0011	417 E/B	(Turn Off) Ch. Rockdale Rd., P&R 33 (trapezoid), Vars, Embrun	10	22-Sep-13	2.9
12	417_EB_0012	417 E/B	(Advance) Ch. Boundary Rd., P&R 41 (trapezoid), Carlsbad Springs, Russell, Marionville, 1 km	11	22-Sep-13	3.7
13	417_EB_0013	417 E/B	(Turn Off) Ch. Boundary Rd., P&R 41 (trapezoid), Carlsbad Springs, Russell, Marionville	12	22-Sep-13	4.0
14	417_EB_0014	417 E/B	(Advance) Ottawa 27 (trapezoid), Ch. Anderson Rd., Metcalfe, 1 km	13	17-Sep-13	3.7
15	417_EB_0015	417 E/B	(Turn Off) Ottawa 27 (trapezoid), Ch. Anderson Rd., Metcalfe	14	17-Sep-03	3.4
16	417_EB_0016	417 E/B	(Advance) Ottawa 49 (trapezoid), Ch. March Rd., Carp, Almonte, 1 km	40	09-Oct-13	3.1
17	417_EB_0017	417 E/B	(Turn Off) Ottawa 49 (trapezoid), Ch. March Rd., Carp, Almonte	41	09-Oct-13	3.1
18	417_EB_0018	417 E/B	(Distance Assurance) Montreal 78	15	11-Sep-13	3.7
19	417_EB_0019	417 E/B	(Distance Assurance) Montreal 96	16	11-Sep-13	3.1
20	417_EB_0020	417 E/B	(Distance Assurance) Vankleek Hill 38, Hawkesbury 49, Montreal 129	17	11-Sep-13	4.3
21	417_EB_0021	417 E/B	Install 400 metres west of the Galetta Side Road bridge structure	44	09-Oct-13	2.2
	417_EB_0022	417 E/B	Install at the location of the existing Maple Leaf ? Logo Infocentre Via rue Metcalfe Street sign location, except further up the hill	19	20-Oct-13	3.1
	417_EB_0023	417 E/B	City of / Ville d' Ottawa Population 900,000	45	09-Oct-13	3.1
22	417_WB_0001	417 W/B	(Advance) Ch. Prescott & Russell Rd., P&R 14 (trapezoid), St. Eugene, P&R 4 (trapezoid), Chute-a-Blondeau, 1 km	20	13-Sep-13	3.7
23	417_WB_0002	417 W/B	(Turn Off) Ch. Prescott & Russell Rd., P&R 14 (trapezoid), St. Eugene, P&R 4 (trapezoid), Chute-a-Blondeau	21	13-Sep-13	3.4
24	417_WB_0003	417 W/B	(Advance) P&R 17 (trapezoid), Hawkesbury, Rockland, 1 km	22	11-Sep-13	3.7
25	417_WB_0004	417 W/B	(Advance) Hwy 34 (crown), P&R 34 (trapezoid), Alexandria, 1 km	23	13-Sep-13	3.7
26	417_WB_0005	417 W/B	(Turn Off) Hwy 34 (crown), P&R 34 (trapezoid), Alexandria	24	13-Sep-13	3.7
27	417_WB_0006	417 W/B	(Advance) Ch. Highland Rd., Maxville, St. Isidore, 1 km	25	09-Sep-13	3.7
28	417_WB_0007	417 W/B	(Turn Off) Ch. Highland Rd., Maxville, St. Isidore	26	09-Sep-13	4.3
29	417_WB_0008	417 W/B	(Advance) Hwy 138 (crown), Moose Creek, Monkland, Cornwall, 1 km	27	11-Sep-13	4.3
30	417_WB_0009	417 W/B	(Turn Off) Hwy 138 (crown), Moose Creek, Monkland, Cornwall	28	11-Sep-13	3.7
31	417_WB_0010	417 W/B	(Advance) P&R 5 (trapezoid), Ch. Limoges Rd., Embrun, Limoges, 1 km	29	20-Oct-13	3.7
32	417_WB_0011	417 W/B	(Turn Off) P&R 5 (trapezoid), Ch. Limoges Rd., Embrun, Limoges	30	20-Oct-13	3.1

Table 1
Summary of Sign Locations and Borehole Drilling Dates and Depths

Sign No.	Sign ID.	HIGHWAY	MESSAGE	Borehole	Drilling Date	Depth (m)
33	417_WB_0012	417 W/B	(Advance) Ch. Rockdale Rd., P&R 33 (trapezoid), Russell, Vars, 1 km	31	22-Sep-13	3.7
34	417_WB_0013	417 W/B	(Turn Off) Ch. Rockdale Rd., P&R 33 (trapezoid), Russell, Vars	32	22-Sep-13	2.4
35	417_WB_0014	417 W/B	(Advance) Ch. Boundary Rd., P&R 41 (trapezoid), Marionville, Carlsbad Springs, 1 km	33	22-Sep-13	3.7
36	417_WB_0015	417 W/B	(Turn Off) Ch. Boundary Rd., P&R 41 (trapezoid), Marionville, Carlsbad Springs	34	22-Sep-13	3.1
37	417_WB_0016	417 W/B	(Advance) P&R 27 (trapezoid), Ch. Anderson Rd., Metcalfe, 1 km	35	22-Sep-13	3.7
38	417_WB_0017	417 W/B	(Turn Off) P&R 27 (trapezoid), Ch. Anderson Rd., Metcalfe	36	17-Sep-13	3.7
39	417_WB_0018	417 W/B	(Advance) Ottawa 49 (trapezoid), Ch. March Rd., Almonte, Carp, 1 km	42	09-Oct-13	3.4
40	417_WB_0019	417 W/B	(Turn Off) Ottawa 49 (trapezoid), Ch. March Rd., Almonte, Carp	43	09-Oct-13	3.4
41	417_WB_0020	417 W/B	(Distance Assurance) Casselman 8, Ottawa 59	37	12-Sep-13	3.7
42	416_SB_001	416 SB	Smiths Falls, Via, Ottawa 6 (trapezoid), Prom. Roger Stevens Dr.	38	17-Sep-13	3.7

Appendix B

Record of Boreholes

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SYMBOLS, ABBREVIATIONS AND TERMS USED ON TEST HOLE RECORDS

TERMINOLOGY DESCRIBING COMMON SOIL GENESIS

Topsoil	mixture of soil and humus capable of supporting vegetative growth
Peat	mixture of fragments of decayed organic matter
Till	unstratified glacial deposit which may include particles ranging in sizes from clay to boulder
Fill	material below the surface identified as placed by humans (excluding buried services)

TERMINOLOGY DESCRIBING SOIL STRUCTURE:

Desiccated	having visible signs of weathering by oxidization of clay materials, shrinkage cracks, etc.
Fissured	having cracks, and hence a blocky structure
Varved	composed of alternating layers of silt and clay
Stratified	composed of alternating successions of different soil types, e.g. silt and sand
Layer	> 75 mm in thickness
Seam	2 mm to 75 mm in thickness
Parting	< 2 mm in thickness

RECOVERY:

For soil samples, the recovery is recorded as the length of the soil sample recovered.

N-VALUE:

Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 63.5 kg hammer falling 0.76 m, required to drive a 50 mm O.D. split spoon sampler 0.3 m into undisturbed soil. For samples where insufficient penetration was achieved and N-value cannot be presented, the number of blows are reported over the sampler penetration in millimetres (e.g. 50/75).

DYNAMIC CONE PENETRATION TEST (DCPT):

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to an “A” size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone 0.3 m into the soil. The DCPT is used as a probe to assess soil variability.

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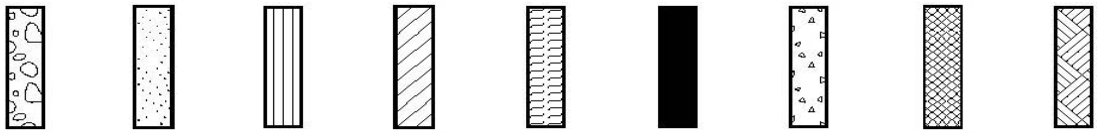
STRATA PLOT:
Strata plots symbolize the soil and bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.



Boulders
Cobbles
Gravel

Sand

Silt

Clay

Organics

Asphalt

Concrete

Fill

Bedrock

TEXTURING CLASSIFICATION OF SOILS

Classification	Particle Size
Boulders	Greater than 200 mm
Cobbles	75 – 200 mm
Gravel	4.75 – 75 mm
Sand	0.075 – 4.75 mm
Silt	0.002 – 0.075 mm
Clay	Less than 0.002 mm

SAMPLE TYPES

SS	Split spoon samples
ST	Shelby tube or thin wall tube
DP	Direct push sample
PS	Piston sample
BS	Bulk sample
WS	Wash sample
HQ, NQ, BQ etc.	Rock core sample obtained with the use of standard size diamond coring equipment

TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

Descriptive Term	Undrained Shear Strength (kPa)
Very Soft	12 or less
Soft	12 – 25
Firm	25 – 50
Stiff	50 – 100
Very Stiff	100 – 200
Hard	Greater than 200

NOTE: Clay sensitivity is defined as the ratio of the undisturbed strength over the remolded strength.

TERMS DESCRIBING CONSISTENCY (COHESIONLESS SOILS ONLY)

Descriptive Term	SPT "N" Value
Very Loose	Less than 4
Loose	4 – 10
Compact	10 – 30
Dense	30 – 50
Very Dense	Greater than 50

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MODIFIED UNIFIED SOIL CLASSIFICATION

Major Divisions		Group Symbol	Typical Description
COARSE GRAINED SOIL	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	SILT AND CLAY SOILS $W_L < 35\%$	ML	Inorganic silts, 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.
		OL	Organic silts and organic silty-clays of low plasticity.
	SILT AND CLAY SOILS $35\% < W_L < 50\%$	MI	Inorganic compressible fine sandy silt with clay of medium plasticity, clayey silts.
		CI	Inorganic clays of medium plasticity, silty clays.
		OI	Organic silty clays of medium plasticity.
	SILT AND CLAY SOILS $W_L > 50\%$	MH	Inorganic silts, micaceous or diatomaceous fine sandy of silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of high plasticity, organic silts.
HIGHLY ORGANIC SOILS		Pt	Peat and other organic soils.

Note - W_L= Liquid Limit

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THURBER

RECORD OF BOREHOLE No 1

1 OF 1

METRIC

GWP# _____ LOCATION N 5 045 072.0 E 541 419.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 9.12.13 - 9.12.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, compact, dark brown, moist **(FILL)**		1	SS	17				○		
0.8	**SAND**, trace silt, compact, brown with black layers, moist to wet		2	SS	25				○		
			3	SS	20				○		0 91 9 (SI+CL)
			4	SS	28				○		
2.4	**SAND**, some silt, trace gravel, compact, brown with black horizontal seams, moist to wet		5	SS	10				○		
			6	SS	11				○		2 86 12 (SI+CL)
3.7	End of Borehole Borehole caved in to depth of 1.5 m upon removal of augers										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 2

1 OF 1

METRIC

GWP# _____ LOCATION N 5 044 759.0 E 542 320.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 9.12.13 - 9.12.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, dense, dark brown, moist **(FILL)**		1	SS	34				○		
0.6	**SAND** some silt, loose to dense, brown to grey, moist to wet		2	SS	6				○		
			3	SS	22				○		
			4	SS	31				○		
			5	SS	12				○		0 89 11 (SI+CL)
			6	SS	10				○		
3.6	**CLAY**, stiff, greyish brown, moist								○		
	End of Borehole										
3.7	Borehole caved in to depth of 1.6 m upon removal of augers										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 3

1 OF 1

METRIC

GWP# _____ LOCATION N 5 020 419.0 E 506 747.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 9.9.13 - 9.9.13 CHECKED BY PC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	WATER CONTENT (%)	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L	γ kN/m^3	GR SA SI CL
0.0	SAND and GRAVEL, trace silt, compact, grey, dry **(FILL)**		1	SS	25						
0.6	Gravelly SAND, compact, brown to dark grey, moist to wet **(FILL)**		2	SS	21						
			3	SS	17						
1.5	**CLAY (CH)** some silt, stiff to firm, brown, moist		4	SS	15						0 4 24 72
			5	SS	5						
3.0	**CLAY (CH)** some silt, firm, grey		6	SS	2						
4.1	End of Borehole										

○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

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

20
15 ⊕ 5
10
(%) STRAIN AT FAILURE

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
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THURBER

RECORD OF BOREHOLE No 4

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METRIC

GWP# _____ LOCATION N 5 020 799.0 E 507 447.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 9.9.13 - 9.9.13 CHECKED BY PC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100 ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	w_P w w_L 20 40 60	γ kN/m^3	GR SA SI CL
0.0	SAND and GRAVEL, trace silt, dense, grey, dry **(FILL)**		1	SS	32						
0.6	**SAND**, some gravel, some silt, compact to dense, dark brown, moist		2	SS	27						18 53 19 10
			3	SS	35						
1.8	**CLAY (CH)**, some silt, very stiff to stiff, brown, moist		4	SS	20						
			5	SS	14						
			6	SS	12						0 5 19 76
3.7	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

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Ontario

THURBER

RECORD OF BOREHOLE No 5

1 OF 1

METRIC

GWP# _____ LOCATION N 5 018 834.0 E 499 930.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 9.12.13 - 9.12.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, compact, dark brown, moist **(FILL)**		1	SS	27						
0.8	**SAND**, compact to loose, brown, moist		2	SS	22						
1.5	**CLAY (CH)**, some silt, some sand, stiff to firm, brown, moist		3	SS	9						
			4	SS	6						0 11 20 69
2.4	**CLAY (CH)**, soft, grey, wet		5	SS	WH			+2			
3.7	End of Borehole										

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

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

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THURBER

RECORD OF BOREHOLE No 6

1 OF 1

METRIC

GWP# _____ LOCATION N 5 019 037.0 E 500 740.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 9.12.13 - 9.12.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, dense, dark grey, moist **(FILL)**		1	SS	33				○		
0.6	**SILT** some sand, loose, moist		2	SS	8				○		
1.2	**CLAY (CH)**, some silt, some sand, firm to stiff, brown, moist		3	SS	6				○		
			4	SS	8				○ — ○ — ○		0 14 23 63
2.4	**CLAY (CH)**, soft, grey, wet		5	SS	WH				○		
								+			
3.5	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 7

1 OF 1

METRIC

GWP# _____ LOCATION N 5 017 665.0 E 479 873.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 22.9.13 - 22.9.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, compact, dark grey, moist **(FILL)**		1	SS	21				○		
0.6	**SAND**, compact, brown, moist		2	SS	19				○		
1.2	**SAND and SILT (ML)**, trace clay, compact to dense, mottled greyish brown to brown, moist to wet		3	SS	18				○		
			4	SS	33				○		0 40 53 7
			5	SS	14				○		
			6	SS	16				○		
3.7	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

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THURBER

RECORD OF BOREHOLE No 8

1 OF 1

METRIC

GWP# _____ LOCATION N 5 017 591.0 E 480 575.1 ORIGINATED BY NW

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY GM

DATUM _____ DATE 20.10.13 - 20.10.13 CHECKED BY PC

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
0.0	Silty SAND and GRAVEL, compact, grey, moist, **(FILL)**		1	SS	21				○		
0.6	**Silty SAND**, loose to compact, brown, moist		2	SS	4				○		
			3	SS	11				○		0 61 32 7
			4	SS	12				○		
2.3	**SAND and SILT**, very loose, grey, wet		5	SS	1				○		0 59 39 2
3.1	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

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Ontario

THURBER

RECORD OF BOREHOLE No 9

1 OF 1

METRIC

GWP# _____ LOCATION N 5 020 424.0 E 471 323.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 21.9.13 - 21.9.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, dense, dry **(FILL)**		1	SS	47				○		
0.6	Silty SAND, some clay, trace gravel, dense, greyish brown to brown, moist, **(TILL)**		2	SS	32				○		
			3	SS	32				○		
	occasional to frequent shale fragments		4	SS	35				○		8 47 29 16
			5	SS	50/ 0.13m				○		
3.0	End of Borehole Auger Refusal on Possible Bedrock										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 10

1 OF 1

METRIC

GWP# _____ LOCATION N 5 020 324.0 E 472 402.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 22.9.13 - 22.9.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, dense, grey, dry **(FILL)**		1	SS	32						
0.6	Silty SAND, compact, brown, moist **(FILL)**		2	SS	28						
			3	SS	11						
1.5	**CLAY (CH) and SILT**, trace sand, occasional rootlets at top, stiff to very stiff, dark grey, moist		4	SS	26						0 8 48 44
2.4	Silty SAND some gravel, occasional cobbles, very dense, dark grey **(TILL)**		5	SS	55/ 0.13m						
2.9	End of Borehole Auger Refusal on Possible Bedrock										

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

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
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THURBER

RECORD OF BOREHOLE No 11

1 OF 1

METRIC

GWP# _____ LOCATION N 5 022 466.0 E 463 394.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 22.9.13 - 22.9.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, compact, dark grey, moist **(FILL)**										
0.2	SAND, compact to dense, brown to grey, moist to wet **(FILL)**		1	SS	17				○		
			2	SS	25				○		
			3	SS	38				○		
1.8	**Silty SAND**, trace gravel, trace clay, very dense to compact, brownish grey to grey, wet		4	SS	82				○		
			5	SS	21				○		5 67 25 3
			6	SS	14				○		
3.7	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 12

1 OF 1

METRIC

GWP# _____ LOCATION N 5 021 945.0 E 464 620.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 22.9.13 - 22.9.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, compact, grey, moist **(FILL)**										
0.2	SAND, compact, brown, moist **(FILL)**		1	SS	14						
0.6	**SAND and SILT**, trace clay, occasional rootlets, compact to very dense, grey, moist to wet		2	SS	13						
			3	SS	18						
			4	SS	53						0 53 39 8
			5	SS	14						
3.1	**CLAY (CH)**, firm, grey, moist		6	SS	WH			7			0 9 24 67
4.0	End of Borehole										

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

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

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THURBER

RECORD OF BOREHOLE No 13

1 OF 1

METRIC

GWP# _____ LOCATION N 5 024 356.0 E 456 651.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 17.9.13 - 17.9.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, dense, dark grey, dry **(FILL)**		1	SS	35						
0.3	Silty SAND, dense to compact, brown, moist **(FILL)**		2	SS	22						
			3	SS	17						
	occasional organic matter		4	SS	19						
2.1	**CLAY (CH)**, stiff to firm, mottled grey/brown, dry to moist		5	SS	6						0 0 26 74
			6	SS	5						
3.7	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

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THURBER

RECORD OF BOREHOLE No 14

1 OF 1

METRIC

GWP# _____ LOCATION N 5 024 200.0 E 457 288.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 17.9.13 - 17.9.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, compact, dark greyish brown, dry **(FILL)**		1	SS	28				○					
0.6	**Silty SAND**, some clay, compact, brown, moist to wet		2	SS	15				○					
			3	SS	22				○					
			4	SS	18				○		0	68	21	11
2.4	**Silty CLAY**, firm, grey, moist		5	SS	2				○					
3.4	End of Borehole							14						

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

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THURBER

RECORD OF BOREHOLE No 15

1 OF 1

METRIC

GWP# _____ LOCATION N 5 045 527.0 E 540 037.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 9.11.13 - 9.11.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, compact, brownish grey, dry **(FILL)**		1	SS	28				○		
0.6	Silty SAND some gravel, compact, dark brown, moist, **(FILL)**		2	SS	18				○		
1.2	**SAND and SILT**, some clay, trace gravel, compact to dense, brown to grey, moist		3	SS	15				○		0 44 36 20
			4	SS	34				○		
			5	SS	25				○		7 48 36 9
	becomes wet		6	SS	16				○		
3.7	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 16

1 OF 1

METRIC

GWP# _____ LOCATION N 5 035 101.0 E 525 310.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 9.11.13 - 9.11.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, occasional asphalt fragments, dense, dark grey, dry **(FILL)**		1	SS	50						
0.6	Silty SAND, occasional shale fragments, compact, dark brown, dry **(FILL)**		2	SS	16						
1.2	**CLAY (CH)** some silt, very stiff, brown, dry to moist		3	SS	16						
			4	SS	13						0 0 18 82
			5	SS	35						
2.6	Weathered **Shale**										
3.1	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 17

1 OF 1

METRIC

GWP# _____ LOCATION N 5 019 378.0 E 501 961.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 9.11.13 - 9.11.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, dense, brown, dry **(FILL)**		1	SS	36						
0.6	**Silty SAND** some gravel, dense to compact, brown, moist		2	SS	33						
			3	SS	14						
1.9	**CLAY (CH)** some silt, some sand, very stiff to firm, brown, dry		4	SS	18						0 10 20 70
			5	SS	5						
3.1	**CLAY**, firm, grey, moist		6	SS	2			+4			
4.3	End of Borehole										

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

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 19

1 OF 1

METRIC

GWP# _____ LOCATION N 5 017 828.0 E 438 564.0 ORIGINATED BY NW

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 10.10.13 - 10.10.13 CHECKED BY PC

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
0.0	Silty SAND and GRAVEL, grey, compact, dry to moist **(FILL)**		1	SS	19						
			2	SS	7						
0.9	Silty SAND, grey, loose, wet **(FILL)**										
			3	SS	5						
1.5	Sandy **SILT and CLAY (CL)**, grey, firm to stiff, moist										0 24 38 38
			4	SS	6			+ 6			
2.3	**Silty SAND** some gravel, loose, grey										
			5	SS	4						
3.1	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 20

1 OF 1

METRIC

GWP# _____ LOCATION N 5 044 225.0 E 544 140.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 13.9.13 - 13.9.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, compact to dense, dark brown, moist **(FILL)**		1	SS	29									
			2	SS	43									
1.2	**Silty SAND**, trace gravel, trace clay, dense to compact, brownish grey, moist		3	SS	39						2	80	12	6
			4	SS	29									
2.4	Silty SAND, some gravel, trace clay, compact to dense, moist **(TILL)**		5	SS	25									
			6	SS	40						16	46	30	8
3.7	End of Borehole													

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 21

1 OF 1

METRIC

GWP# _____ LOCATION N 5 044 424.0 E 543 402.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 13.9.13 - 13.9.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, compact, dark brown, moist **(FILL)**		1	SS	23				○		
0.6	**SAND**, trace silt, trace gravel, compact, grey, moist to wet		2	SS	28				○		1 89 10 (SI+CL)
			3	SS	23	▽			○		
1.8	**CLAY (CH)**, very stiff to stiff, brown, moist to wet		4	SS	7				○		
			5	SS	2				○——●		0 0 34 66
3.4	End of Borehole							7			

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 22

1 OF 1

METRIC

GWP# _____ LOCATION N 5 045 586.0 E 540 164.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 9.11.13 - 9.11.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, compact, blackish grey, dry **(FILL)**		1	SS	26						
0.3	SAND, compact, brown, moist **(FILL)**		2	SS	14						
0.9	**Silty SAND**, compact, brown to grey, wet		3	SS	12						
			4	SS	17						
2.4	**Silty CLAY**, firm to stiff, brown, moist		5	SS	7						
			6	SS	10						
3.7	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 23

1 OF 1

METRIC

GWP# _____ LOCATION N 5 035 922.0 E 526 240.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 13.9.13 - 13.9.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, dense, dark brown, moist **(FILL)**		1	SS	39				○		
			2	SS	33				○		
0.8	**Silty SAND** some gravel, dense, dark grey to dark brown, moist		3	SS	33				○		
1.8	**CLAY**, some silt, very stiff to firm, brown, moist		4	SS	26				○		0 4 17 79
			5	SS	4				○		
3.1	**Silty CLAY**, firm, grey, wet		6	SS	5				○		
3.7	End of Borehole										

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

20
15 ⊕ 5
10
(%) STRAIN AT FAILURE

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 24

1 OF 1

METRIC

GWP# _____ LOCATION N 5 035 376.0 E 525 574.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 13.9.13 - 13.9.13 CHECKED BY PC

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
0.0	Silty SAND and GRAVEL, compact, dark brownish grey, moist **(FILL)**		1	SS	28				○		
	occasional shale fragments		2	SS	20				○		
1.2	Sandy **SILT**, some gravel, compact, dark brown, moist		3	SS	11				○		
1.4	**CLAY (CH)**, some silt, very stiff to stiff, brown, moist		4	SS	24				w_P — ○ — w_L		0 7 16 77
			5	SS	8						
3.1	**CLAY (CH)**, firm to soft, grey, moist		6	SS	2				○		
3.7	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 25

1 OF 1

METRIC

GWP# _____ LOCATION N 5 022 136.0 E 508 688.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 9.9.13 - 9.9.13 CHECKED BY PC

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
0.0	**140 mm of ASPHALT**										
0.1	SAND and GRAVEL, trace silt, dense, grey, dry **(FILL)**		1	SS	47				○		
0.6	**SAND and SILT** some clay, trace gravel, dense to compact, brown, moist		2	SS	49				○		9 43 35 13
			3	SS	27				○		
			4	SS	16				○		
2.1	**Silty CLAY**, very stiff to stiff, brown, moist		5	SS	16				○		
			6	SS	12						
3.7	End of Borehole										

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

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

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 26

1 OF 1

METRIC

GWP# _____ LOCATION N 5 021 471.0 E 508 163.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 9.9.13 - 9.9.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, dense, grey, dry **(FILL)**		1	SS	40						
0.3	SAND, dense, brown, dry **(FILL)**										
0.6	**Silty SAND** some gravel, compact, brown/grey, moist		2	SS	26						
1.1	**CLAY** some silt, stiff, brown, moist		3	SS	14						
			4	SS	12						
			5	SS	8						0 0 19 81
3.1	**Silty CLAY**, stiff, grey, moist		6	SS	4						
								+ 6			
4.3	End of Borehole										

$+^3$, $\times^3$: 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 27

1 OF 1

METRIC

GWP# _____ LOCATION N 5 019 509.0 E 502 396.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 9.11.13 - 9.11.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, dense, black/grey, dry **(FILL)**		1	SS	35				○		
0.3	Silty SAND, compact, brown, moist **(FILL)**		2	SS	15				○		
1.2	**SAND and SILT**, some gravel, some clay, compact, brown, moist to wet		3	SS	15				○		10 33 47 10
2.0	**CLAY (CH)**, very stiff to stiff, brown, mottled, moist		4	SS	15				○		
			5	SS	7				○		
3.1	**CLAY (CH)**, soft, grey		6	SS	2			+	○——○——○		0 0 22 78
4.3	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 28

1 OF 1

METRIC

GWP# _____ LOCATION N 5 019 317.0 E 501 625.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 9.11.13 - 9.11.13 CHECKED BY PC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	WATER CONTENT (%)	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L	γ kN/m^3	GR SA SI CL
0.0	SAND and GRAVEL, trace silt, dense, grey to brown, dry **(FILL)**		1	SS	33			○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	20 40 60		
0.6	Sandy **SILT**, some clay, trace gravel, compact, brown, moist		2	SS	15						2 35 53 10
			3	SS	8						
1.8	**CLAY (CH)** some silt, stiff, brown, moist		4	SS	12						
2.4	**CLAY (CH)** some silt, soft, grey, moist		5	SS	2						
3.7	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 29

1 OF 1

METRIC

GWP# _____ LOCATION N 5 017 830.7 E 482 311.1 ORIGINATED BY NW

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY GM

DATUM _____ DATE 20.10.13 - 20.10.13 CHECKED BY PC

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 (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	Silty SAND and GRAVEL, compact, grey, moist,**(FILL)**		1	SS	29						
0.6	**Silty SAND**, compact, brown, moist to wet		2	SS	12						
			3	SS	16						0 61 35 4
			4	SS	12						
2.4	**SILT and CLAY**, stiff, brown, moist		5	SS	1						0 4 37 59
3.7	End of Borehole										

○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

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Ontario

THURBER

RECORD OF BOREHOLE No 30

1 OF 1

METRIC

GWP# _____ LOCATION N 5 017 891.6 E 481 482.1 ORIGINATED BY NW

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY GM

DATUM _____ DATE 20.10.13 - 20.10.13 CHECKED BY PC

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	Silty SAND and GRAVEL, compact, grey, moist,**(FILL)**		1	SS	25				○		
0.6	**Silty SAND**, compact to loose, brown to grey, moist to wet		2	SS	13				○		
			3	SS	20				○		
			4	SS	12				○		
			5	SS	9				○		0 73 25 2
3.1	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
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THURBER

RECORD OF BOREHOLE No 31

1 OF 1

METRIC

GWP# _____ LOCATION N 5 020 437.0 E 474 211.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 22.9.13 - 22.9.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, dense, grey, dry **(FILL)**		1	SS	33						
0.3	Silty SAND, some clay, compact, brown to brownish grey, moist **(FILL)**		2	SS	18						
			3	SS	20	▽					2 60 27 11
1.8	**SAND**, some silt, trace clay, trace gravel, frequent rootlets and wood fragments near top, compact to dense, dark grey to greyish black, wet		4	SS	17						
			5	SS	32						4 72 18 6
	Very loose		6	SS	1						
3.7	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

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Ontario

THURBER

RECORD OF BOREHOLE No 32

1 OF 1

METRIC

GWP# _____ LOCATION N 5 020 418.0 E 473 471.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 22.9.13 - 22.9.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, compact, grey, dry to moist, **(FILL)**		1	SS	23				○		
0.8	**Sandy SILT**, compact, grey mottled, moist		2	SS	12				○		
1.2	Silty SAND some clay, trace gravel, frequent shale fragments, dense to very dense, brown, moist, **(TILL)**		3	SS	35	▽			○		
			4	SS	62				○		4 57 28 11
2.4	End of Borehole Auger Refusal on Possible Bedrock										

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

20
15 ⊕ 5
10
(%) STRAIN AT FAILURE

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 33

1 OF 1

METRIC

GWP# _____ LOCATION N 5 021 722.0 E 466 354.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 22.9.13 - 22.9.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace to some silt, compact, grey to rediish brown, dry, **(FILL)**		1	SS	18						
			2	SS	27						
1.2	**SAND**, some silt, dense to loose, yellow to brown, wet		3	SS	20						
			4	SS	31						0 86 10 4
			5	SS	6						
3.1	**Silty CLAY**, firm to soft, grey, moist		6	SS	1						
3.7	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 34

1 OF 1

METRIC

GWP# _____ LOCATION N 5 021 869.0 E 465 526.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 22.9.13 - 22.9.13 CHECKED BY PC

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
0.0	Silty SAND and GRAVEL, trace silt, compact, dark grey, moist **(FILL)**		1	SS	20				○		
0.6	**Silty SAND**, trace clay, compact to dense, brown, moist		2	SS	23				○		
			3	SS	24				○		
			4	SS	32				○		1 63 32 4
2.4	End of Borehole Borehole terminated - silty sand flowed up into augers.										

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

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 34B 1 OF 1 METRIC

GWP# _____ LOCATION N 5 021 868.6 E 465 534.4 ORIGINATED BY NW

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY GM

DATUM _____ DATE 20.10.13 - 20.10.13 CHECKED BY PC

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
0.0	Silty SAND and GRAVEL, compact, grey, moist, **(FILL)**		1	SS	11						
0.6	**Silty SAND**, compact to very loose, brown to grey, moist to wet		2	SS	17						
			3	SS	16						
			4	SS	15						0 62 32 6
			5	SS	1						
3.1	End of Borehole										

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

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 35

1 OF 1

METRIC

GWP# _____ LOCATION N 5 023 849.0 E 458 967.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 22.9.13 - 22.9.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, compact, dark grey, dry **(FILL)**										
0.2	SAND, compact, brown to brown/grey, moist **(FILL)**		1	SS	11				○		
			2	SS	16				○		
1.2	**Silty SAND**, trace clay, compact to dense, brown.grey, wet		3	SS	16				○		0 75 21 4
			4	SS	31				○		
2.4	**SAND and SILT** some clay, compact, grey, wet		5	SS	18				○		0 50 37 13
									○		
3.3	**Silty CLAY**, frequent sand seams, firm, grey, moist		6	SS	6					○	
3.7	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 36

1 OF 1

METRIC

GWP# _____ LOCATION N 5 024 026.0 E 502 402.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 17.9.13 - 17.9.13 CHECKED BY PC

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	SAND, compact, brown, moist **(FILL)**		1	SS	24				○		
0.6	**SAND**, trace silt, compact to very dense, brown to grey, moist to wet		2	SS	14	▽			○		
			3	SS	25				○		
			4	SS	35				○		0 91 9 (SI+CL)
			5	SS	26				○		
			6	SS	56				○		
3.7	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 37

1 OF 1

METRIC

GWP# _____ LOCATION N 5 019 032.0 E 500 719.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 9.12.13 - 9.12.13 CHECKED BY PC

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
0.0	SAND and GRAVEL, trace silt, compact , dark brown/ grey, moist **(FILL)**		1	SS	29				○		
0.6	**Silty SAND**, compact, brown, moist		2	SS	14				○		2 64 24 10
1.2	**Silty CLAY**, firm, grey, moist		3	SS	7				○		
1.8	**Silty Sandy CLAY (CL)**, trace gravel, firm to soft, grey, moist		4	SS	6				○		
			5	SS	1				○		10 28 21 41
								4 +			
3.7	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 38

1 OF 1

METRIC

GWP# _____ LOCATION N 5 000 385.0 E 446 211.0 ORIGINATED BY GM

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 17.9.13 - 17.9.13 CHECKED BY PC

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	Gravelly Silty SAND, dense to compact, dark grey to brown, dry to wet, **(FILL)**		1	SS	34				○		
			2	SS	39				○		
			3	SS	30				○		25 41 26 8
			4	SS	39				○		
			5	SS	21				○		
3.1	**Silty CLAY**, very stiff, brown, moist		6	SS	19				○		
3.7	End of Borehole										

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

(%) STRAIN AT FAILURE

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 39

1 OF 1

METRIC

GWP# _____ LOCATION N 5 033 486.2 E 523 786.8 ORIGINATED BY NW

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 10.10.13 - 10.10.13 CHECKED BY PC

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	Silty SAND, some gravel, grey, compact, moist **(FILL)**		1	SS	29				○		
0.6	SAND and GRAVEL some silt, occasional cobbles, compact to very dense, brown **(FILL)**		2	SS	13				○		
			3	SS	74				○		45 38 17 (SI+CL)
1.8	**CLAY (CH)**, firm, brown, moist		4	SS	7				○		
			5	SS	4				○ — ●		0 0 23 77
3.0	**CLAY**, firm, grey							+ 11	○		
3.7	End of Borehole										

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

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

(%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 40

1 OF 1

METRIC

GWP# _____ LOCATION N 5 017 737.0 E 418 602.9 ORIGINATED BY NW

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 10.9.13 - 10.9.13 CHECKED BY PC

SOIL PROFILE			SAMPLES			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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
0.0	Silty SAND and GRAVEL, compact, grey, dry **(FILL)**		1	SS	25				○		
0.5	**SAND**, trace silt, trace gravel, compact, brown, dry to moist		2	SS	20				○		
			3	SS	18				○		
			4	SS	25				○		1 94 5 (SI+CL)
			5	SS	10				○		
3.1	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 41

1 OF 1

METRIC

GWP# _____ LOCATION N 5 018 149.9 E 417 713.0 ORIGINATED BY NW

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 10.9.13 - 10.9.13 CHECKED BY PC

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
0.0	Silty SAND and GRAVEL, compact, grey, dry **(FILL)**		1	SS	19				○		
			2	SS	19				○		
1.2	**SAND**, trace gravel, trace silt, compact to loose, brown to grey, wet		3	SS	17				○		
			4	SS	9				○		5 86 9 (SI+CL)
			5	SS	11				○		
3.1	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 42

1 OF 1

METRIC

GWP# _____ LOCATION N 5 028 818.2 E 398 902.3 ORIGINATED BY NW

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 10.9.13 - 10.9.13 CHECKED BY PC

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
0.0	Silty SAND and GRAVEL, trace silt, dense, grey, dry **(FILL)**		1	SS	32				○		
	occasional cobbles		2	SS	34				○		
1.3	**Sandy SILT** some clay, compact, grey, moist		3	SS	17				○		0 21 62 17
1.8	**CLAY (CH)**, firm to stiff, brown, moist		4	SS	3				○		
									○		
			5	SS	7				○		0 0 23 77
3.4	End of Borehole										

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

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

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation Ontario

THURBER

RECORD OF BOREHOLE No 43

METRIC

GWP#

LOCATION N 5 029 335.1 E 398 473.0

ORIGINATED BY NW

HWY 417 & 416

BOREHOLE TYPE Hollow Stem Augers

COMPILED BY SML

DATUM

DATE 10.9.13 - 10.9.13

CHECKED BY PC

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLE NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	GR	SA	SI	CL
0.0	Silty SAND and GRAVEL, compact to dense, grey, dry **(FILL)**		1	SS	25									
	occasional cobbles below 0.7 m		2	SS	37									
			3	SS	16									
1.8	**CLAY (CH)**, stiff to firm, brown to brownish grey, moist		4	SS	8						0	0	30	70
			5	SS	5									
3.4	End of Borehole													

Legend: 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. REMARKS & GRAIN SIZE DISTRIBUTION (%).

+ 3, × 3: Numbers refer to Sensitivity

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

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 44

1 OF 1

METRIC

GWP# _____ LOCATION N 5 018 677.8 E 415 613.8 ORIGINATED BY NW

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 10.9.13 - 10.9.13 CHECKED BY PC

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
0.0	Silty SAND and GRAVEL, compact to very dense, grey, dry to wet **(FILL)**		1	SS	28				○		
	occasional cobbles		2	SS	60				○		
1.2	Sandy GRAVEL, trace silt, dense to very dense, grey **(TILL)**		3	SS	32				○		63 30 7 (SI+CL)
			4	SS	70/ 225mm				○		
2.2	End of Borehole Auger Refusal on Possible Bedrock										

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

(%) STRAIN AT FAILURE

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 45

1 OF 1

METRIC

GWP# _____ LOCATION N 5 018 397.2 E 416 588.8 ORIGINATED BY NW

HWY 417 & 416 BOREHOLE TYPE Hollow Stem Augers COMPILED BY SML

DATUM _____ DATE 10.9.13 - 10.9.13 CHECKED BY PC

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
0.0	Silty SAND and GRAVEL, compact, grey, dry **(FILL)**		1	SS	22				○		
0.7	**SAND**, some silt, trace clay, compact, brown to grey, moist		2	SS	26				○		
			3	SS	19				○		0 82 13 5
			4	SS	17				○		
2.3	**Silty CLAY (CL)**, firm to soft, grey, moist		5	SS	3				○		
3.1	End of Borehole										

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

15 20 10 5 (%) STRAIN AT FAILURE

ONTMT4S 19-4406-6 SIGNS JAN 16.GPJ 2012TEMPLATE(MTO).GDT 29/4/14

Appendix C

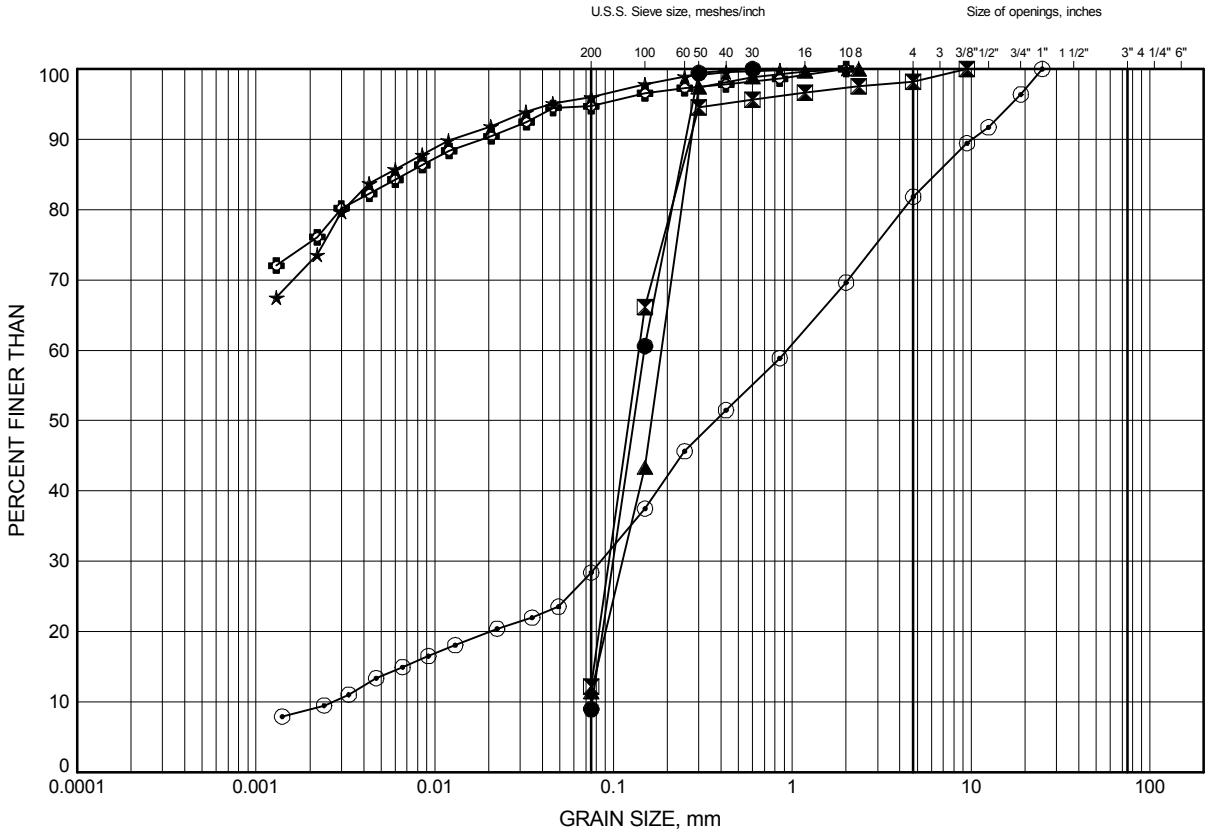
Geotechnical Laboratory Test Results

THURBER

Part E: MTO Signage Replacement

GRAIN SIZE DISTRIBUTION

FIGURE 1



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	1	1.52	
⊠	1	3.35	
▲	2	2.74	
★	3	2.13	
⊙	4	0.91	
✿	4	3.35	

Date January 2014

Prep'd PC

Chkd. FJG

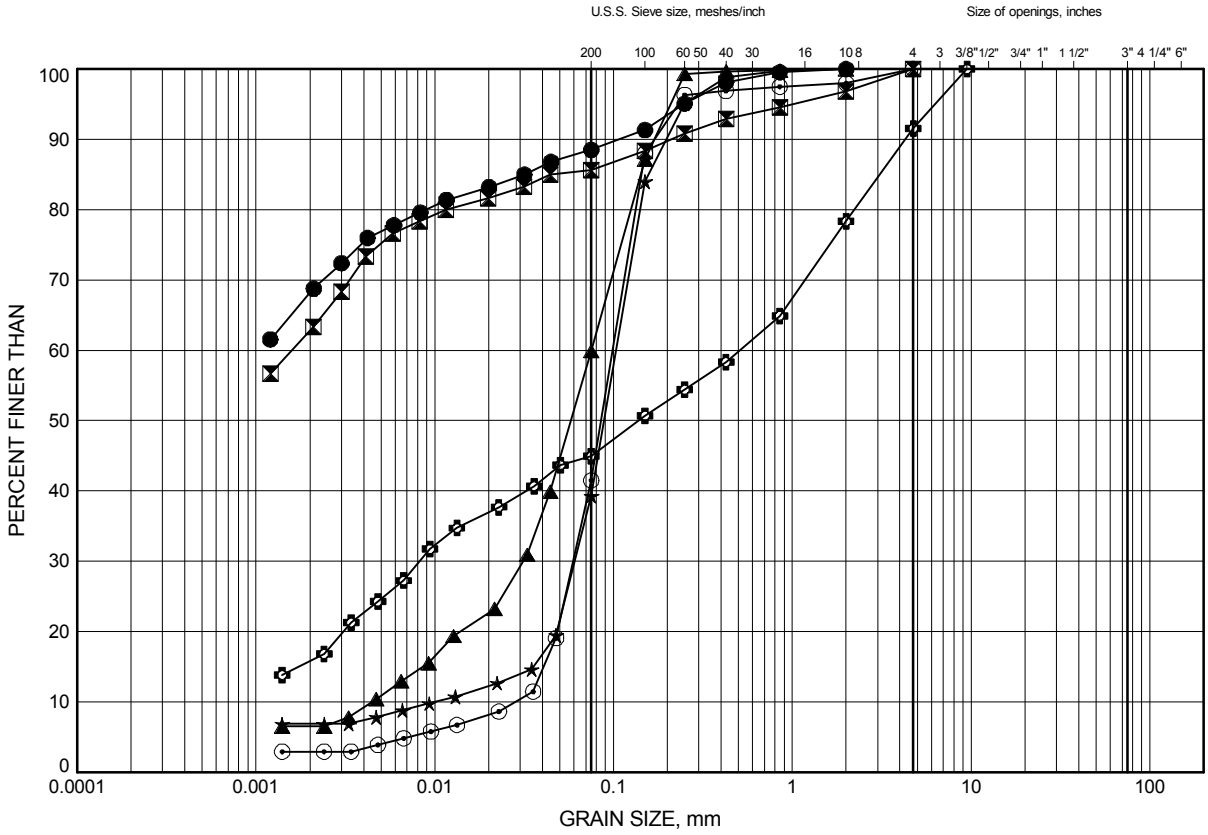
THURBER

GRAIN SIZE DISTRIBUTION - THURBER 4066 SIGNS LAB.GPJ 1/9/14

Part E: MTO Signage Replacement

GRAIN SIZE DISTRIBUTION

FIGURE 2



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	5	2.13	
⊠	6	2.13	
▲	7	2.13	
★	8	1.52	
⊙	8	2.74	
✿	9	2.13	

Date January 2014

Prep'd PC

Chkd. FJG

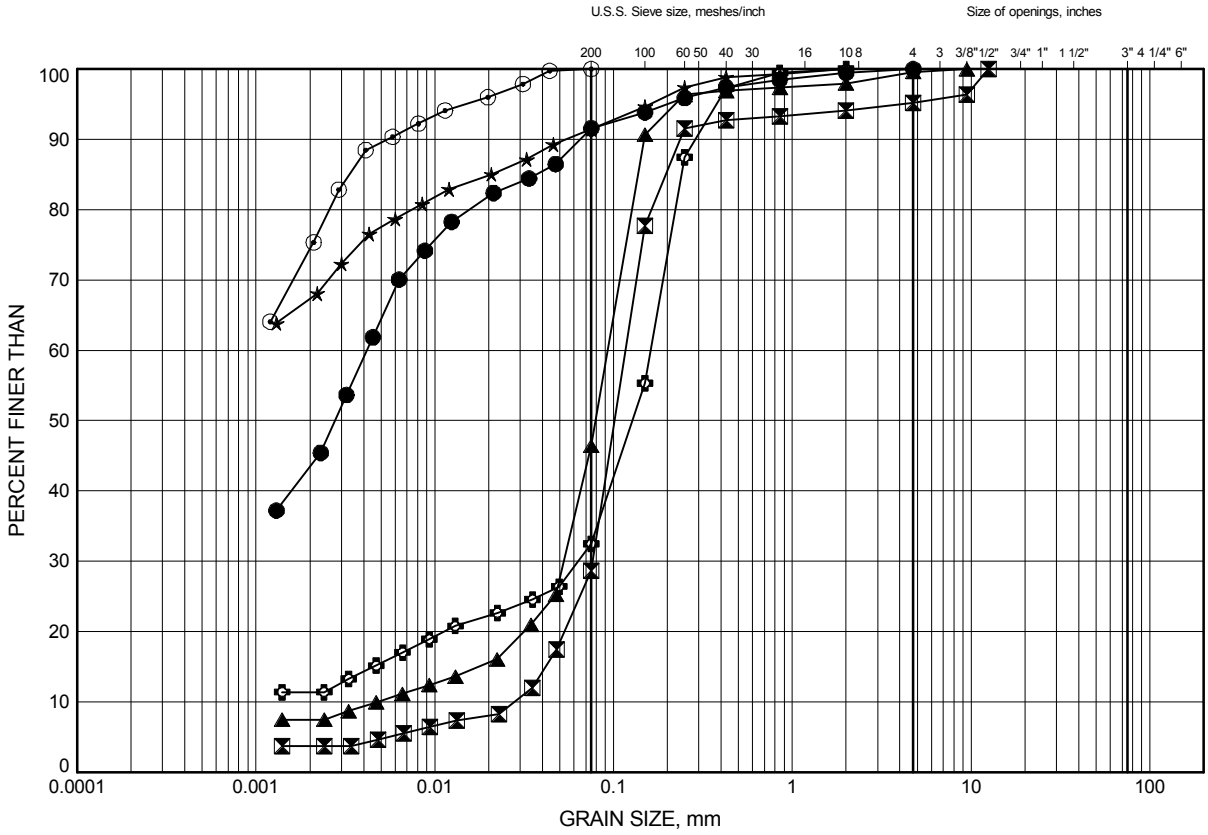
THURBER

GRAIN SIZE DISTRIBUTION - THURBER 4066 SIGNS LAB.GPJ 1/9/14

Part E: MTO Signage Replacement

GRAIN SIZE DISTRIBUTION

FIGURE 3



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	10	2.13	
⊠	11	2.74	
▲	12	2.13	
★	12	3.35	
⊙	13	2.74	
✿	14	2.13	

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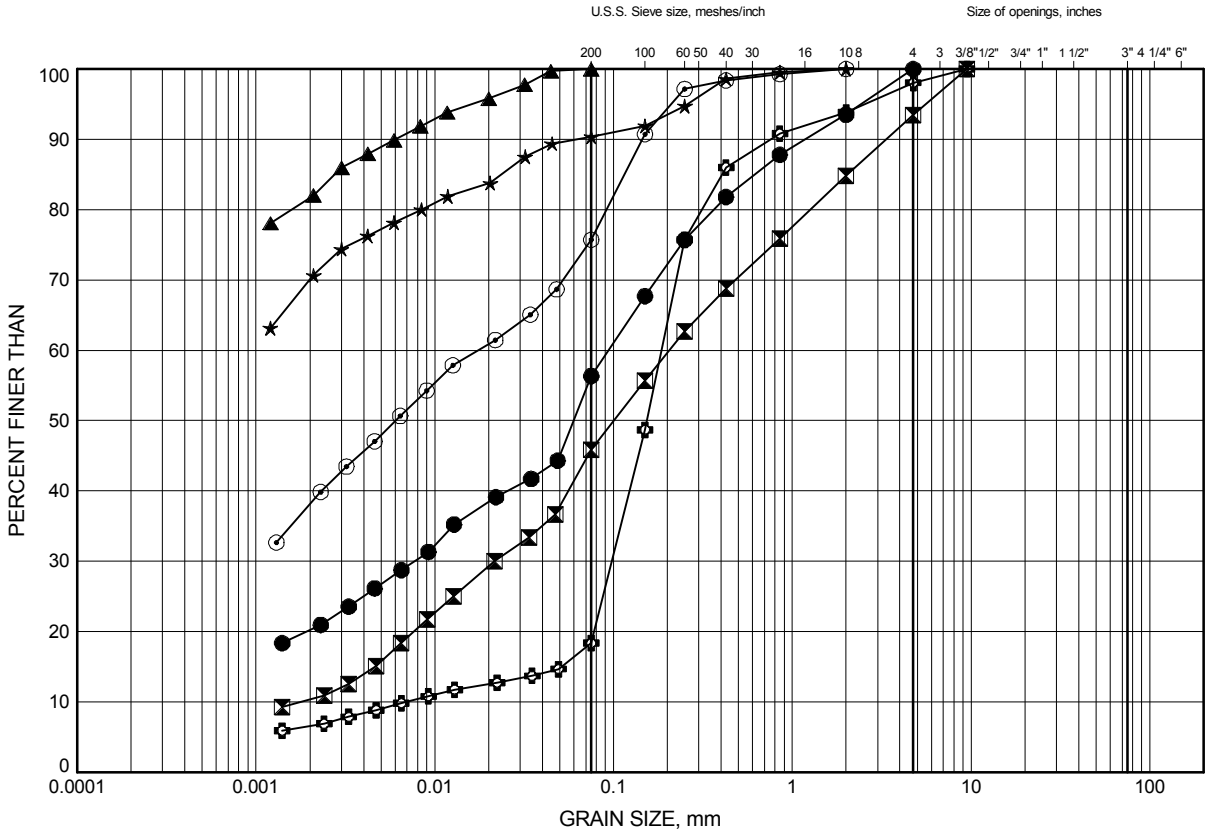
GRAIN SIZE DISTRIBUTION - THURBER 4066 SIGNS LAB.GPJ 1/9/14

Part E: MTO Signage Replacement

GRAIN SIZE DISTRIBUTION

FIGURE 4



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	15	1.52	
⊠	15	2.74	
▲	16	2.13	
★	17	2.25	
⊙	19	1.65	
✿	20	1.52	

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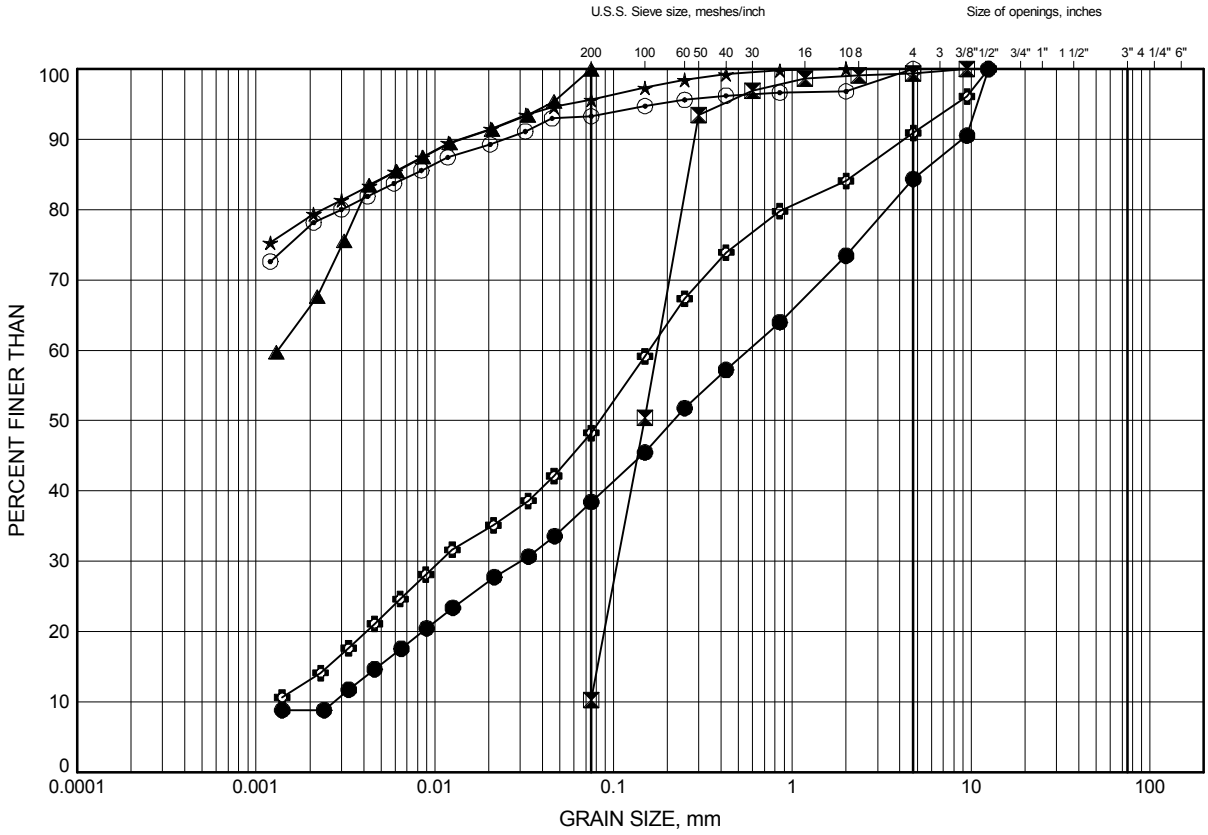
GRAIN SIZE DISTRIBUTION - THURBER 4066 SIGNS LAB.GPJ 1/9/14

Part E: MTO Signage Replacement

GRAIN SIZE DISTRIBUTION

FIGURE 5



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	20	3.35	
⊠	21	0.91	
▲	21	2.74	
★	23	2.13	
⊙	24	2.13	
✿	25	0.91	

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GRAIN SIZE DISTRIBUTION - THURBER 4066 SIGNS LAB.GPJ 1/9/14

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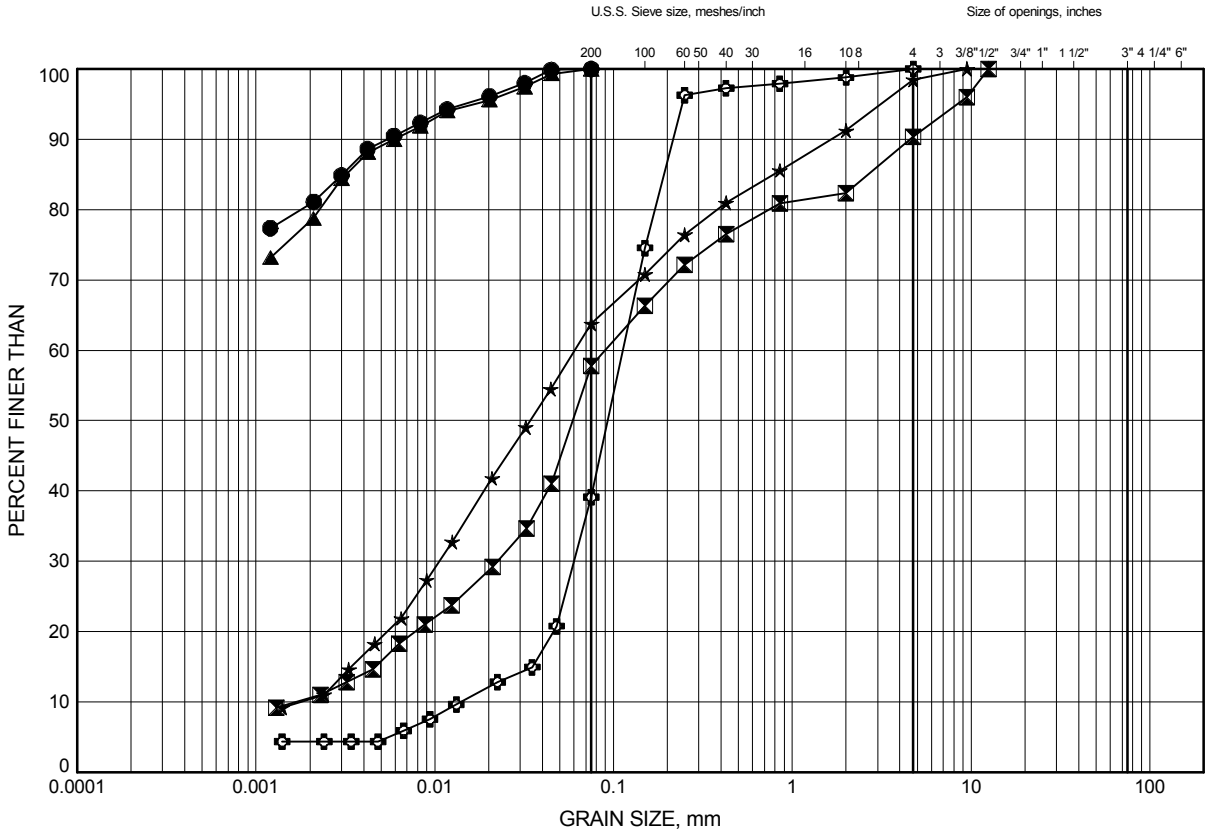
GRAIN SIZE DISTRIBUTION

FIGURE 6



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	26	2.74	
⊠	27	1.52	
▲	27	3.35	
★	28	0.91	
⊙	28	2.74	
✿	29	1.52	

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GRAIN SIZE DISTRIBUTION - THURBER 4066 SIGNS LAB.GPJ 1/9/14

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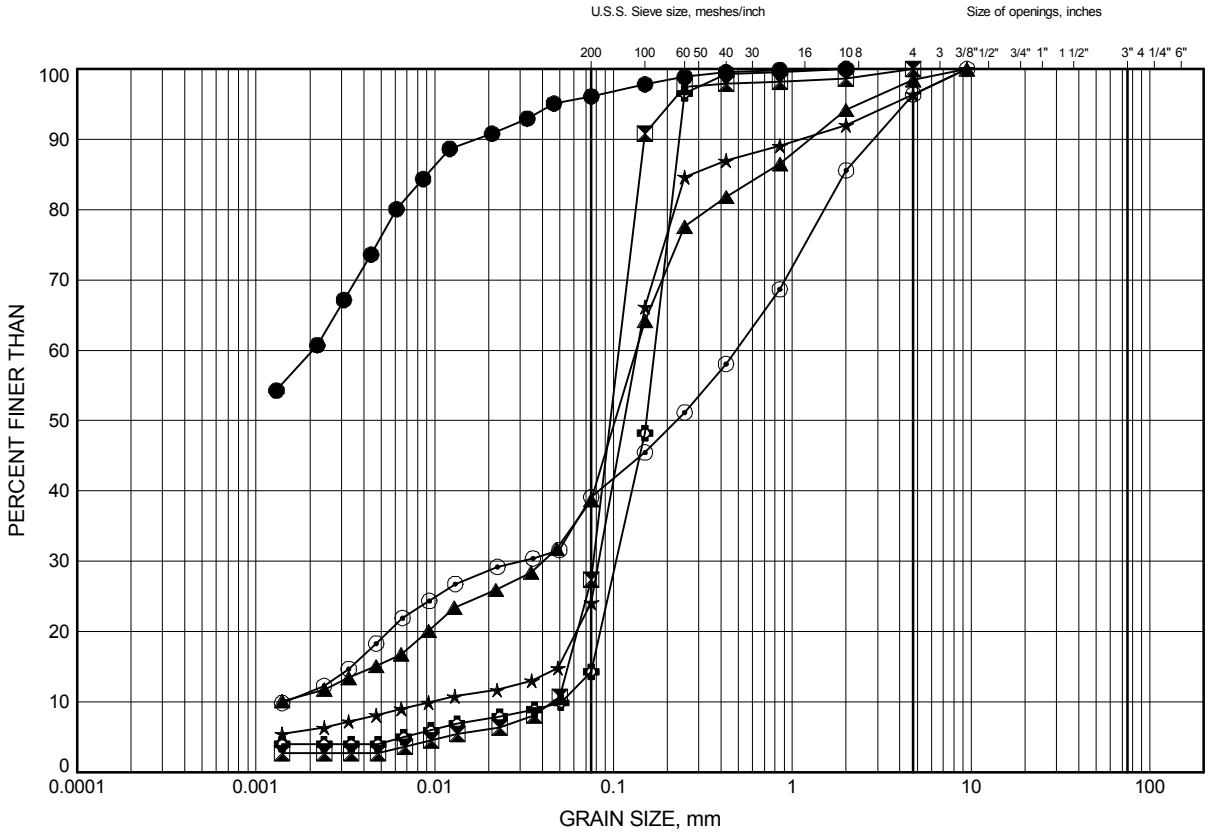
GRAIN SIZE DISTRIBUTION

FIGURE 7



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	29	2.74	
⊠	30	2.74	
▲	31	1.52	
★	31	2.74	
⊙	32	2.13	
✿	33	2.13	

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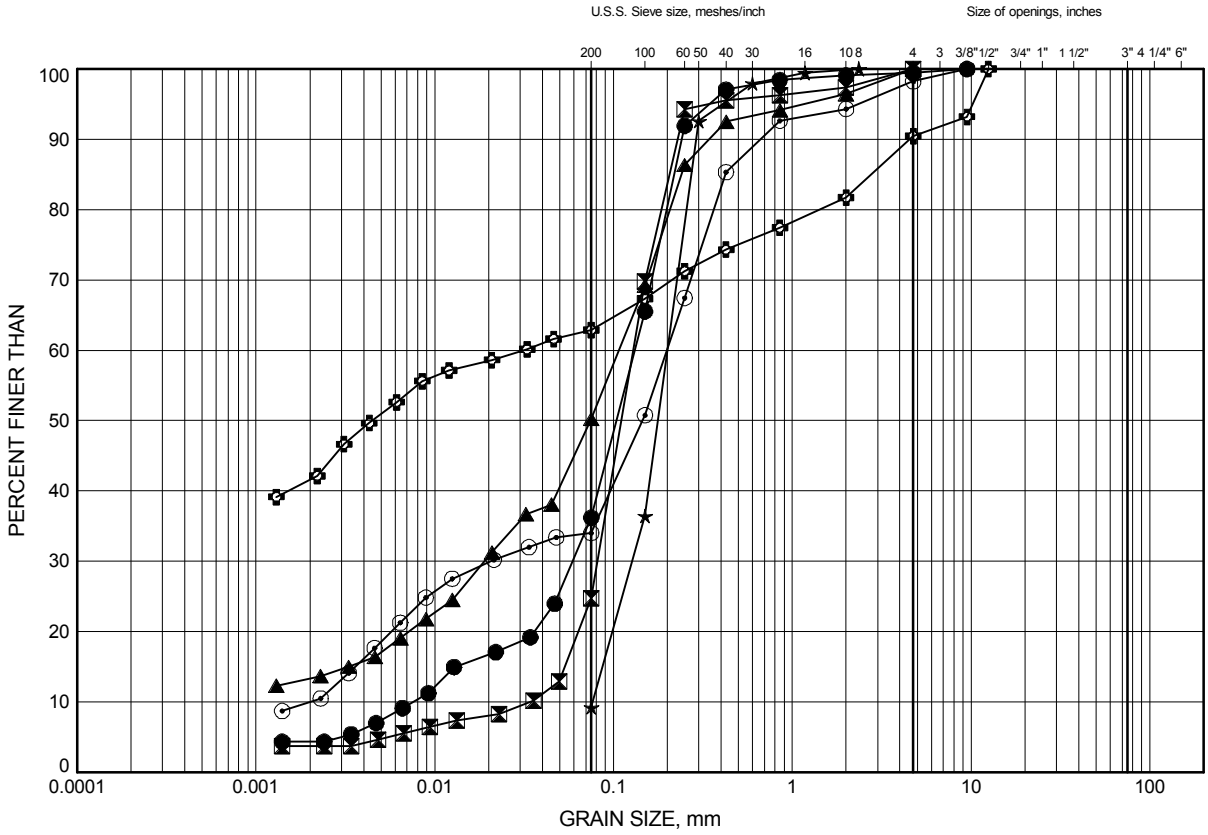
GRAIN SIZE DISTRIBUTION

FIGURE 8



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	34	2.13	
⊠	35	1.52	
▲	35	2.74	
★	36	2.13	
⊙	37	0.91	
✿	37	2.74	

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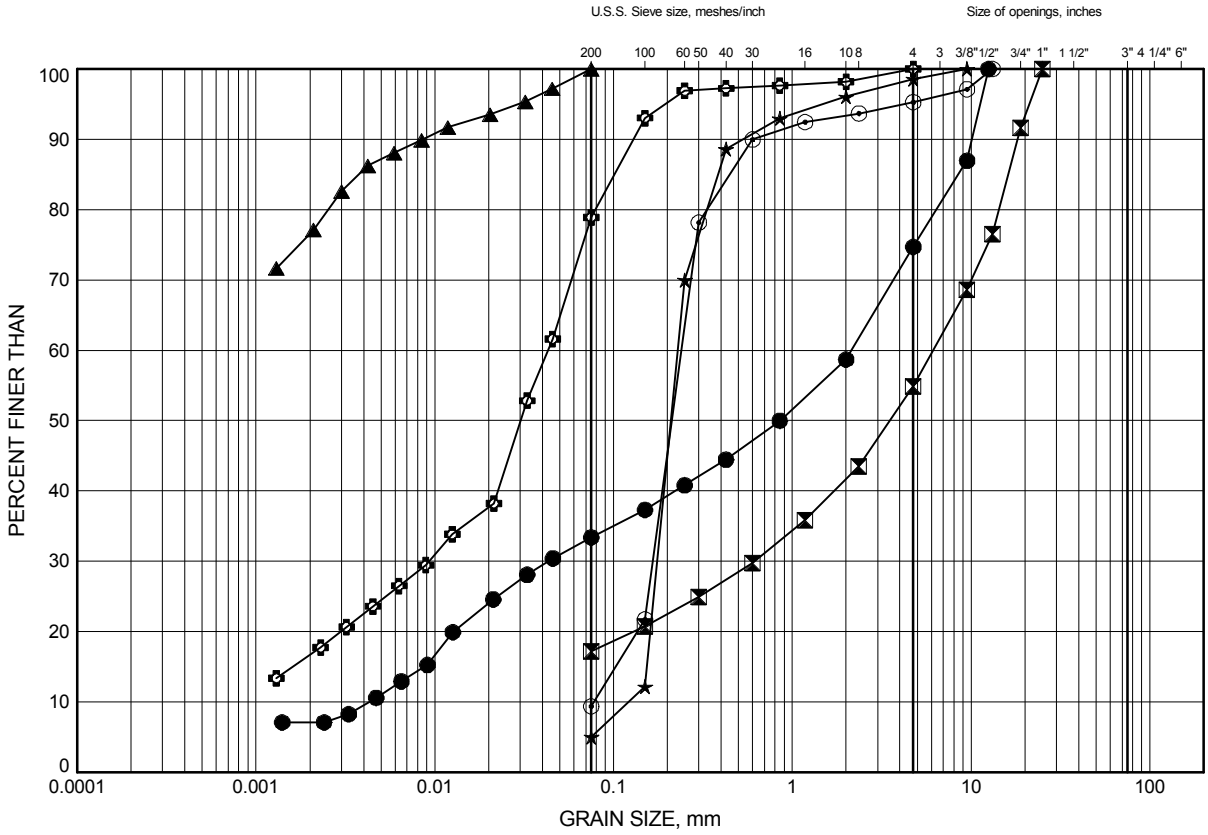
GRAIN SIZE DISTRIBUTION

FIGURE 9



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	38	1.52	
⊠	39	1.52	
▲	39	2.74	
★	40	2.13	
⊙	41	2.13	
✿	42	1.58	

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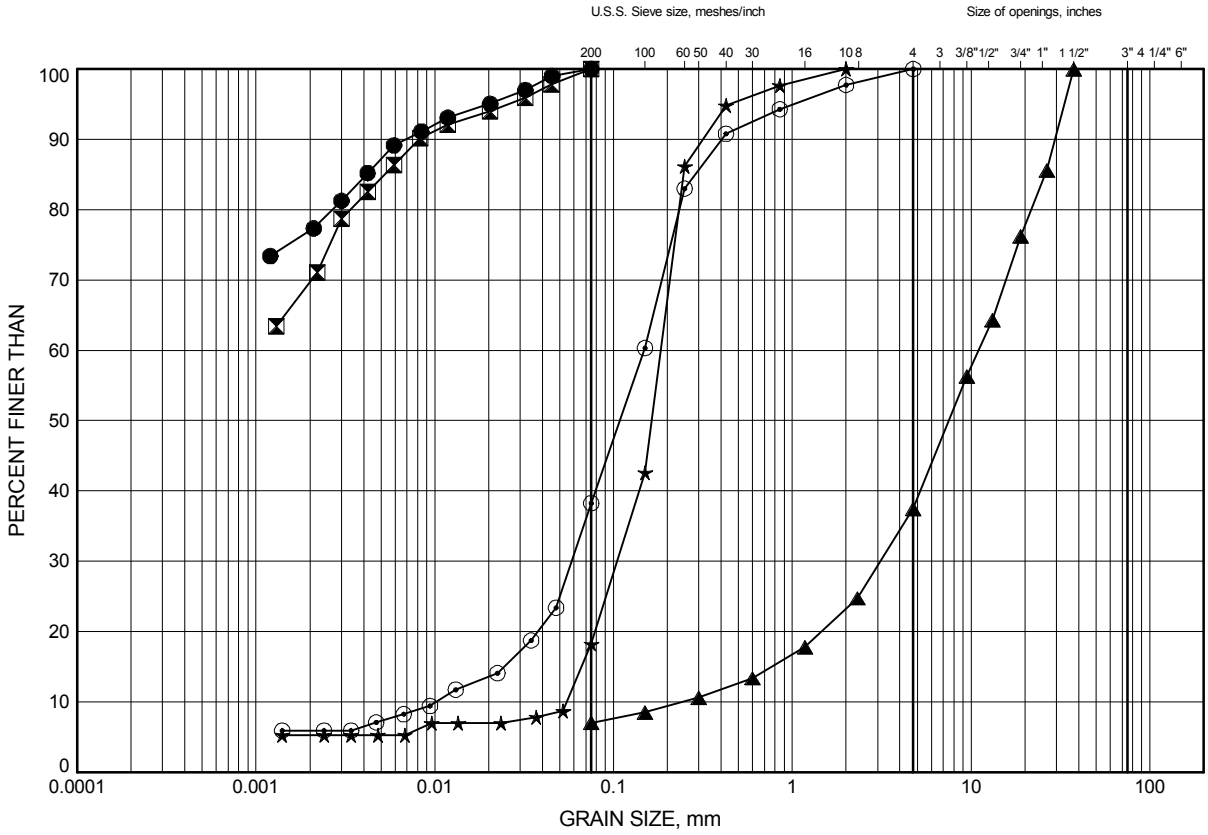
GRAIN SIZE DISTRIBUTION

FIGURE 10



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	42	3.05	
⊠	43	2.13	
▲	44	1.52	
★	45	1.52	
⊙	34B	2.13	

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GRAIN SIZE DISTRIBUTION - THURBER 4066 SIGNS LAB.GPJ 1/9/14

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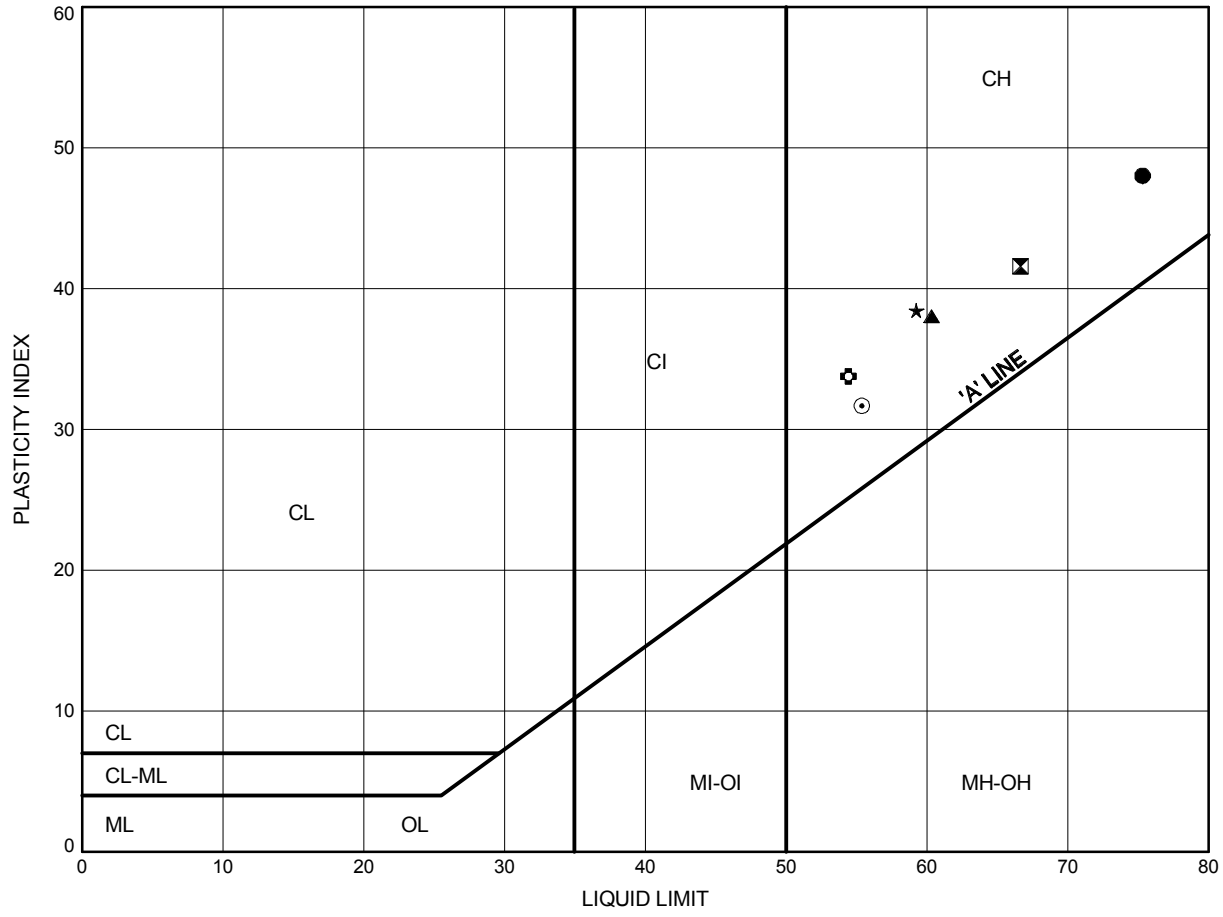
ATTERBERG LIMITS TEST RESULTS

FIGURE 11



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	3	2.13	
⊠	4	3.35	
▲	5	2.13	
★	6	2.13	
⊙	10	2.13	
✿	12	3.35	

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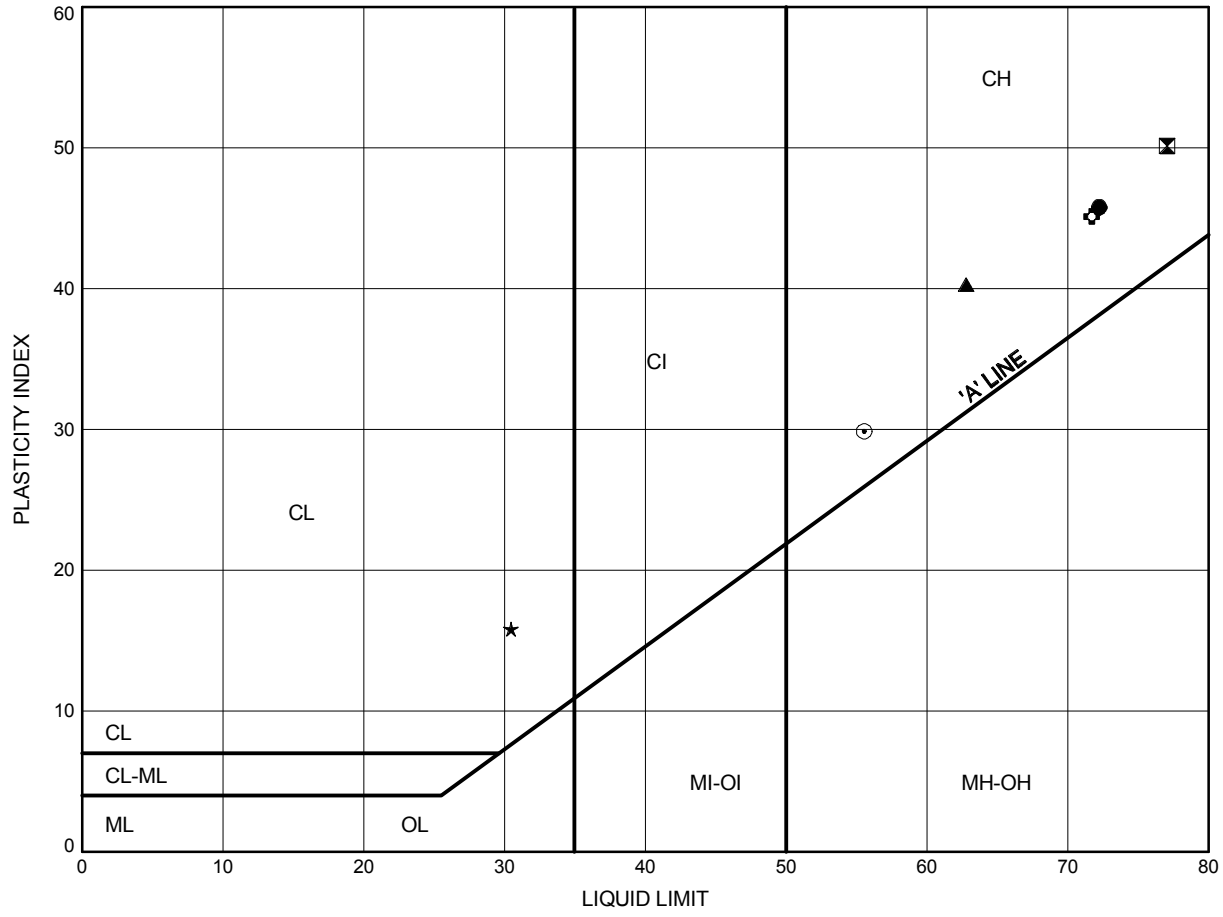
Part E: MTO Signage Replacement

ATTERBERG LIMITS TEST RESULTS

FIGURE 12



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	13	2.74	
⊠	16	2.13	
▲	17	2.25	
★	19	1.65	
⊙	21	2.74	
✿	24	2.13	

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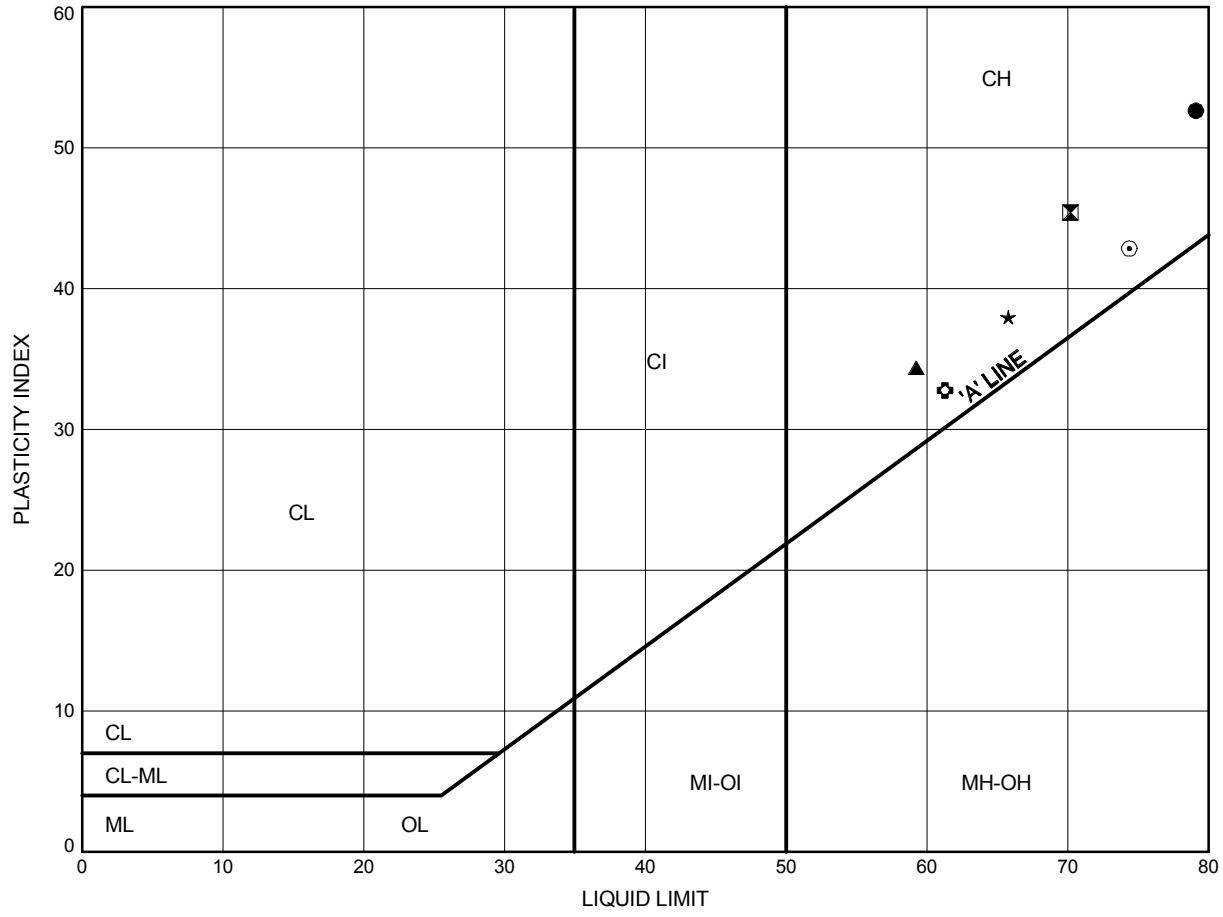
ATTERBERG LIMITS TEST RESULTS

FIGURE 13



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	27	3.35	
⊠	28	2.74	
▲	29	2.74	
★	39	2.74	
⊙	42	3.05	
✿	43	2.13	

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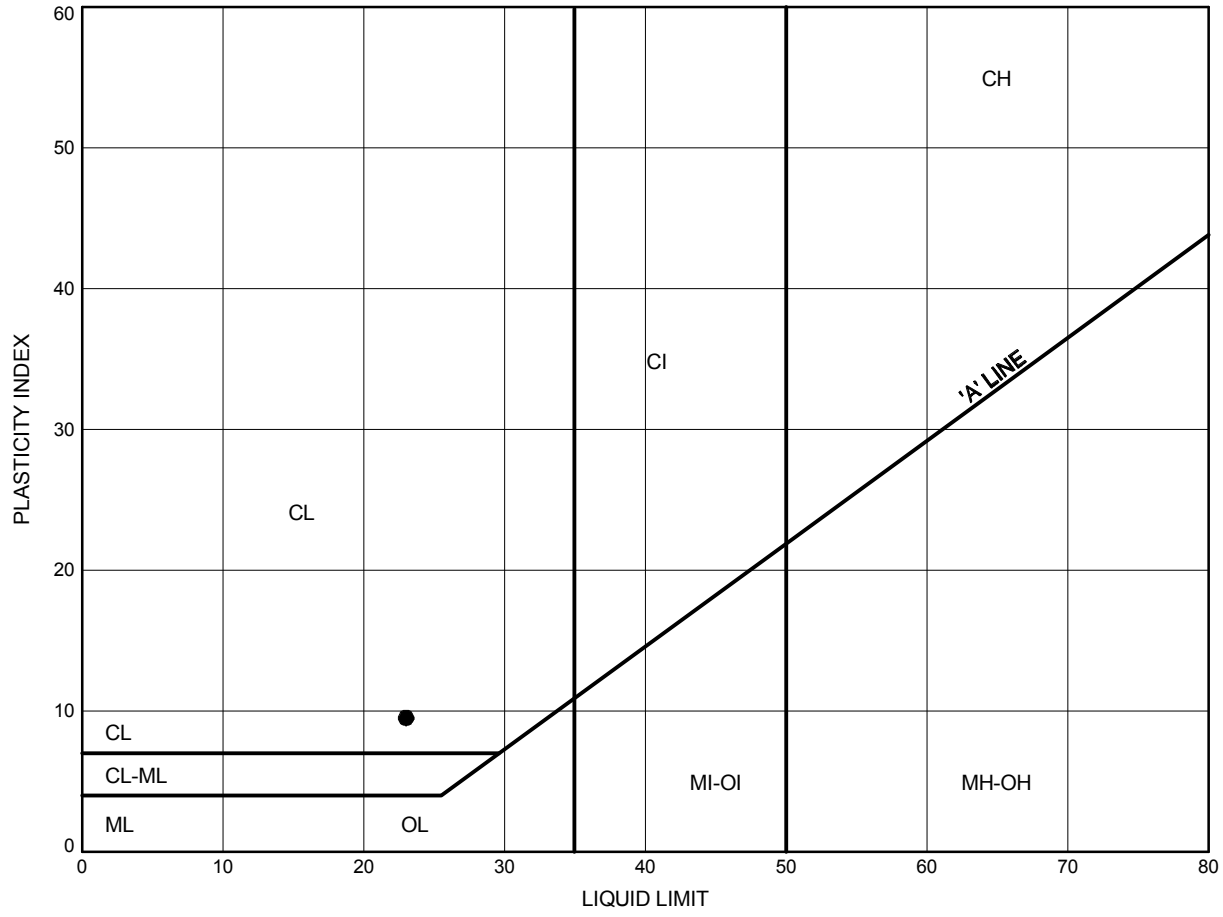
ATTERBERG LIMITS TEST RESULTS

FIGURE 14



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	45	2.74	

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