



THURBER ENGINEERING LTD.

**FOUNDATION INVESTIGATION REPORT
S-E RAMP CONNECTION BRIDGE UNDER METROLINX TRACKS
HIGHWAY 7-NEW, KITCHENER TO GUELPH
G.W.P. 408-88-00**

Geocres Number: 40P8-279

Report

To

WSP

Date: July 17, 2020

File: 11375



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PART 1: FACTUAL INFORMATION

1. INTRODUCTION

This report presents the factual findings obtained from a foundation investigation conducted at the site of the proposed S-E Ramp Rail Bridge under the Metrolinx tracks in the Regional Municipality of Waterloo. This structure is part of the exit ramp from Kitchener Waterloo Expressway (KWE) northbound lanes (NBL) north to the proposed New Highway 7 for the Highway 7-New Project.

The purpose of this investigation was to explore the subsurface conditions at the site, and based on the data obtained, to provide a borehole location plan, records of boreholes, a stratigraphic profile, laboratory test results and a written description of the subsurface conditions. Models of the subsurface conditions under the potential foundation footprint were developed from the data obtained in the course of the current and previous investigations.

Thurber was retained by WSP to carry out the site investigation under the Ministry of Transportation Ontario (MTO) Agreement Order Number 3014-E-0013.

Reference has been made to information on subsurface conditions contained in a previous foundation report prepared for this site during the preliminary design phase. The title of the report is:

- Preliminary, Foundation Investigation and Design Report, S-E Ramp Under CNR Tracks, Highway 7-New, Kitchener to Guelph, G.W.P. 408-88-00, Geocres No. 40P8-162, Report to Ministry of Transportation Ontario West Region, File: 15-64-17, dated June 2, 2009. (Reference 1).

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- Foundation investigation report for C.N.R. Subway, Kitchener-Waterloo Expressway, District #4 (Hamilton), W.J. 66-F-37, W.P. 636-64, Geocres Number 40P8-45, dated July 4, 1966. (Reference 2).

Records of boreholes from the previous reports are attached in Appendix B for reference.

2. SITE DESCRIPTION

The site lies in the proximity of the Kitchener-Waterloo Expressway (KWE), approximately 20.0 m to the east of the existing KWE and Metrolinx bridge and 100.0 m north of Victoria Street. At this location, the proposed S-E Ramp will pass under the existing twin CNR tracks running east-west. Approximately 160.0 m west of the existing Metrolinx bridge, the double tracks emerge from a Metrolinx yard with a number of tracks as well as a spur line. The Metrolinx yard extends some 980.0 m west, to Lancaster Street East. The site lies within an area of industrial and commercial lands and is generally flat.

A vacant lot is currently situated on the south side of Metrolinx tracks; lands on the north side of Metrolinx tracks are vacant and covered with long grass and shrubs.

Based on the Ontario Geological Survey Special Volume 2, The Physiography of Southern Ontario, Third Edition by Chapman and Putnam, the site lies within the physiographic region known as the Waterloo Hills, characterized by ridges of sandy till and kames or kame moraines, with outwash sands occupying the intervening hollows.

Site photographs, are included in Appendix E and show the general nature of the land surrounding the drilling locations.

3. SITE INVESTIGATION AND FIELD TESTING

A detailed site investigation was carried out from July 3, 2019 to July 22, 2019. Four boreholes, numbered CN16-09 to CN16-12, were drilled near the west and east abutments of the proposed structure. Boreholes CN16-09 to CN16-12 ranged in depth from 15.8 m to 35.2 m (Elevation 304.2 to 283.4). It should be noted that no boreholes were drilled to investigate the railway embankment due to access constraints as well as restrictions imposed by Metrolinx.

A summary of the borehole locations, designations, borehole termination depths and termination elevations for each borehole is provided in Table 3.1. The coordinates and elevations of the boreholes are given on the drawings and on the individual Record of



Borehole Sheets. The ground surface elevations and coordinates of the recent boreholes were provided by WSP.

The Record of Borehole sheets for the current investigation boreholes are included in Appendix A, and the Record of Borehole sheets for the previous investigation boreholes are included in Appendix B. The approximate locations of the five boreholes are shown on the attached Borehole Locations and Soil Strata Drawings in Appendix D.

Prior to commencing the site investigation, utility clearances were obtained for all borehole locations. The boreholes were drilled using a track-mounted drill rig and advanced with a combination of hollow stem augers and mud rotary drilling. Samples were obtained at selected depth intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT).

The drilling, sampling and in-situ testing operations were supervised on a full-time basis by a member of Thurber's technical staff. The supervisor logged the boreholes and processed the recovered soil samples for transport to Thurber's laboratory for further examination and testing. Results of field drilling and sampling of the investigation are presented on the Record of Borehole sheets in Appendix A.

Groundwater conditions in the open boreholes were observed during the drilling operations. One piezometer was installed at Borehole CN16-11 to permit for longer term monitoring of groundwater levels. The piezometer consisted of 50 mm diameter PVC pipe with a slotted screen enclosed in filter sand. The location and completion details of the piezometer are summarized in Table 3.1 along with the borehole completion details. The completion of the boreholes were carried out in accordance with the requirements of O. Reg. 903 (as amended by O. Reg. 372/07). The piezometer is planned to be decommissioned in the summer of 2020.



Table 3.1 – Borehole Completion Details

Borehole	Ground Surface Elevation	Borehole Depth / Base Elevation (m)	Piezometer Tip Depth / Elevation (m)	Completion Details
CN16-09	321.6	17.4/304.2	No Installation	Borehole backfilled with bentonite holeplug and cuttings to surface.
CN16-10	319.5	32.2/287.3	No Installation	Borehole backfilled with cement and grout, and bentonite holeplug to surface.
CN16-11	318.6	35.2/283.4	35.1/283.6	Piezometer with 3.0 m slotted screen installed with sand filter from 35.1 m to 31.4 m, bentonite pellets from 31.4 m to 30.5 m, grout from 30.5 m to 4.6 m and bentonite holeplug from 4.6 m to ground surface.
CN16-12	318.7	15.8/302.8	No Installation	Borehole backfilled with cement and grout, and bentonite holeplug to surface.
08-045	322.2	32.1/290.1	No Installation	Borehole backfilled with grout to surface.

4. LABORATORY TESTING

The recovered soil samples were subjected to Visual Identification (VI) and to natural moisture content determination. Selected samples were also subjected to gradation analysis (sieve and hydrometer) and Atterberg Limits testing, where appropriate. The results of this testing program are summarized on the Record of Borehole sheets and figures in Appendix A for the current investigation, and Appendix B for the previous investigation.

In order to assess the potential for sulphate attack on concrete foundations, as well as the potential for corrosion associated with the structure, a sample of native soil was collected and submitted to SGS Canada Inc., a CALA accredited analytical laboratory in Lakefield, Ontario, for analytical testing of corrosivity parameters. The results of the analytical testing are summarized in this report and presented in Appendix C.



5. DESCRIPTION OF SUBSURFACE CONDITIONS

Details of the encountered soil stratigraphy are presented on the Record of Borehole sheets included in Appendix A and Appendix B and on the “Borehole Locations and Soil Strata” drawings included in Appendix D.

An overall description of the stratigraphy is given in the following paragraphs. However, the factual data presented in the Record of Borehole Sheets governs any interpretation of the site conditions. It should be recognized and expected that soil conditions may vary between and beyond borehole locations.

In general, the soil stratigraphy at this site consisted of surficial topsoil overlying a cohesionless fill layer, a layer of native sand, underlain by clayey silt till, silty clay, silty sand, and silt till.

5.1 Topsoil

A layer of topsoil was encountered surficially in four boreholes drilled at this site, CN16-09 to CN16-12. It was generally dark brown in colour. The thickness of the topsoil layer ranged from 100 mm to 125 mm. The topsoil thickness may vary between the borehole locations and in other areas of the site.

5.2 Asphalt

Asphalt with a thickness of 150 mm was encountered surficially at Borehole 08-045, which was drilled in an existing parking lot.

5.3 Cohesionless Fill

Cohesionless fill was encountered immediately below the topsoil in four boreholes at this site, Boreholes CN16-09 to CN16-12, and encountered below the asphalt at Borehole 08-045. The fill consisted of a layer of gravelly sand fill in Boreholes CN16-09 and 08-045, underlain by generally silty sand fill, which was encountered in all of the boreholes.

The gravelly sand fill contained some silt, trace to some clay, occasional cobbles, and occasional organics. A gasoline odour was also noted in Borehole 08-045. The gravelly sand fill was generally brown to black in colour.



The silty sand fill ranged in composition from sand with some silt to sandy silt, and also contained trace to some gravel, trace to some clay, and occasional organics and rootlets.

The gravelly sand fill in Boreholes CN16-09 and 08-045 was 2.1 m thick, and extended to depths of 2.2 to 2.3 m (Elevation 319.9 to 319.4). The silty sand fill ranged in thickness from 1.3 to 2.9 m, with the lower boundary of this layer encountered at depths ranging from 1.4 m to 4.6 m (Elevation 318.1 to 315.7).

SPT N-values recorded in the gravelly sand fill ranged from 12 to 67 blows for 0.3 m penetration, indicating a compact to very dense relative density. The silty sand fill was very loose to compact, with SPT N-values ranging from 1 to 14 blows for 0.3 m penetration.

The moisture content of samples of the soil ranged from 8 to 11 percent for the gravelly sand fill, and generally ranged from 11 to 25 percent for the silty sand fill. Two samples of the silty sand fill in Boreholes CN16-11 and 08-045, were measured to contain moisture contents of 60 and 114 percent, indicating the presence of organics within the samples.

Three samples of the cohesionless fill underwent laboratory gradation analysis. These results are summarized on the Record of Borehole sheets included in Appendix A and the grain size distribution curves for these samples are plotted on Figure A1 of Appendix A. The results of this testing are summarized as follows:

Soil Particles	Gravelly Sand Fill (%)	Silty Sand Fill (%)
Gravel	30	9 to 20
Sand	47	47 to 51
Silt	18	24 to 38
Clay	5	5 to 6

5.4 Organics

A layer of organics was encountered below the cohesionless fill layer in Borehole CN16-09, at a depth of 4.1 m (Elevation 317.5).

The thickness of the organics layer was 0.8 m, with the lower boundary of this layer encountered at a depth of 4.9 m (Elevation 316.7).



The organics layer was generally black in colour and contained occasional roots and rootlets.

The SPT N-Value recorded in the organic layer was 4 blows for 0.3 m penetration, indicating a loose relative density.

The moisture content from a sample of the organics layer was measured to be 47 percent.

5.5 Sand

A native sand layer was encountered below the cohesionless fill in four boreholes at this site, Boreholes CN16-10 to CN16-12 and 08-045. Native sand was encountered below the organics layer in Borehole CN16-09.

The native sand layer was encountered at depths ranging from 1.4 m to 4.9 m (Elevation 318.1 to 315.7), respectively.

The sand layer was brown to grey in colour and contained some silt to silty, trace to some gravel and trace clay, with occasional cobbles encountered in Boreholes CN16-10 and CN16-11.

The thickness of the sand layer ranged from 1.1 m to 3.7 m, with the lower boundary of the sand layer encountered at depths ranging from 4.1 m to 7.2 m (Elevation 315.8 to 312.6).

SPT N-values recorded in the sand ranged from 3 to 46 blows for 0.3 m penetration, indicating a very loose to dense relative density.

Moisture content of samples of the sand generally ranged from 10 percent to 34 percent.

Two samples of the sand underwent laboratory gradation analysis. These results are summarized on the Record of Borehole sheets included in Appendix A and B and the grain size distribution curves for these samples are plotted on Figure A2 and Figure B1. The results of this testing are summarized as follows:



Soil Particles	Sand (%)
Gravel	1 to 16
Sand	72 to 81
Silt and Clay	12 to 18

5.6 Clayey Silt Till

A layer of clayey silt till was encountered below the sand layer in all boreholes at this site, at depths ranging from 4.1 m to 7.2 m (Elevation 315.8 to 312.6).

The clayey silt till was generally grey in colour and contained some sand to sandy and trace gravel. Occasional silty sand seams were encountered in Borehole 08-045.

The thickness of the clayey silt till ranged from 1.5 m to 4.3 m, with the lower boundary encountered at depths ranging from 5.6 m to 10.7 m (Elevation 313.1 to 310.0).

SPT N-values recorded in the clayey silt till ranged from 16 blows to 33 blows for 0.3 m penetration, indicating a very stiff to hard consistency.

Moisture content of samples of the clayey silt till generally ranged from 10 percent to 24 percent.

Three samples of the clayey silt till underwent laboratory gradation analysis and Atterberg Limits testing, the results of which are summarized below. These results are also presented on the Record of Borehole sheets in Appendix A and Appendix B and the grain size distribution curves for these samples are plotted on Figure A3 and Figure B2. The results of the Atterberg Limits tests are plotted on Figure A6 and B5.

Soil Particles	Clayey Silt Till (%)
Gravel	0 to 6
Sand	17 to 23
Silt	49 to 56
Clay	20 to 27



Index Property	(%)
Liquid Limit	22 to 28
Plastic Limit	13 to 16
Plasticity Index	9 to 13

The above results indicate that the clayey silt till is of low plasticity with a group symbol of CL.

It should be noted that glacial tills are known to contain cobbles and boulders.

5.7 Silty Clay

Silty clay was encountered below the clayey silt till layer in all boreholes at this site, at depths ranging from 5.6 m to 10.7 m (Elevation 313.1 to 310.0).

The silty clay was generally grey in colour and contained trace sand and trace gravel. Occasional cobbles and silt lenses were encountered in Borehole 08-045.

Borehole CN16-09 was terminated in the silty clay layer at a depth of 17.4 m (Elevation 304.2). Borehole CN16-12 was terminated in the silty clay layer at a depth of 15.8 m (Elevation 302.8).

In Boreholes CN16-10, CN16-11 and 08-45, the thickness of the silty clay ranged from 15.7 m to 18.4 m, with the lower boundary encountered at depths ranging from 23.9 m to 29.1 m (Elevation 295.6 to 293.1).

SPT N-values recorded in the silty clay ranged from 13 blows for 0.3 m penetration and 100 blows for 0.275 m penetration, indicating a stiff to hard consistency.

Moisture content of samples of the silty clay generally ranged from 10 percent to 39 percent.

Ten samples of the silty clay underwent laboratory gradation analysis and eight samples underwent Atterberg Limits testing, the results of which are summarized below. These results are also presented on the Record of Borehole sheets in Appendix A and Appendix B and the grain size distribution curves for these



samples are plotted on Figure A4 and Figure B3. The results of the Atterberg Limits tests are plotted on Figure A7 and B6.

Soil Particles	Silty Clay (%)
Gravel	0
Sand	0 to 8
Silt	21 to 51
Clay	47 to 79

Index Property	(%)
Liquid Limit	37 to 63
Plastic Limit	16 to 23
Plasticity Index	20 to 40

The above results indicate that the silty clay is of intermediate to high plasticity with a group symbol of CI to CH.

5.8 Silty Sand

A silty sand layer was encountered below the silty clay in Boreholes CN16-10, CN16-11 and 08-045, at depths ranging from 23.9 m to 29.1 m (Elevation 295.6 to 293.1).

The silty sand was generally grey in colour, and contained trace gravel, trace clay and occasional cobbles. Tri-cone grinding was noted during drilling in this layer.

The thickness of the silty sand layer ranged from 1.1 m to 3.7 m, with the lower boundary encountered at depths ranging from 26.3 m to 30.2 m (Elevation 292.4 to 291.9).

SPT N-values recorded in the silty sand ranged from 59 blows for 0.3 m penetration to 100 blows for 0.275 m penetration, indicating a very dense relative density.



Moisture content of samples of the silty sand generally ranged from 15 percent to 18 percent.

One sample of the silty sand underwent laboratory gradation analysis. These results are summarized on the Record of Borehole sheets included in Appendix A and the grain size distribution curves for these samples are plotted on Figure A5. The results of this testing are summarized as follows:

Soil Particles	Sandy Silt Till (%)
Gravel	7
Sand	64
Silt	24
Clay	5

5.9 Silt Till

A silt till layer was encountered below the silty sand till in Boreholes CN16-10, CN16-11 and 08-045, at depths ranging from 26.3 m to 30.2 m (Elevation 292.4 to 291.9)

Boreholes CN16-10, CN16-11 and 08-045 were terminated in the silt till at the depth of 32.2 m, 35.2 m and 32.1 m, respectively (Elevation 287.3, 283.4 and 290.1).

The silt till was generally grey in colour, and contained some sand to sandy, trace to some clay, trace to some gravel and occasional cobbles. Tricone grinding was noted during drilling in this layer.

The SPT N-value recorded in the silt till ranged from 100 blows for 0.075 m penetration to 100 blows for 0.15 m penetration, indicating a very dense relative density.

Moisture content of samples of the silt till generally ranged from 10 percent to 19 percent.

One sample of the silt till underwent laboratory gradation analysis. These results are summarized on the Record of Borehole sheets included in Appendix B and the



grain size distribution curves for these samples are plotted on Figure B4. The results of this testing are summarized as follows:

Soil Particles	Silt Till (%)
Gravel	0
Sand	11
Silt	81
Clay	8

It should be noted that glacial tills are known to contain cobbles and boulders.

5.10 Groundwater Conditions

Water levels were observed in the boreholes during and upon completion of drilling.

One standpipe piezometer was installed at this site, in Borehole CN16-11, to monitor water levels after completion of drilling. The water levels measured in the piezometer are summarized in Table 5.1.1, along with the measurements in the open boreholes upon completion of drilling.

Table 5.1.1 – Water Level Measurements

Borehole	Date	Water Level (m)		Comment
		Depth	Elevation	
CN16-09	July 3, 2019	4.9	316.7	Open borehole
CN16-10	July 19, 2019	-	-	Water level upon completion not available due to use of drilling mud.
CN16-11	July 29, 2019	9.0	309.7	Piezometer
CN16-12	July 10, 2019	-	-	Water level upon completion not available due to use of drilling mud.
08-045	Aug 15, 2008	-	-	Water level upon completion not available.



Water level was measured at 3.2 m depth (Elevation 319.0) on October 5, 2008, in a piezometer previously installed at the site.

Previous geotechnical investigation conducted in 1966 (Reference 1), indicates that groundwater level is near Elevation 318.4.

The above values are short-term readings and seasonal fluctuations of the groundwater level are to be expected. The groundwater levels may be at a higher elevation after periods of significant or prolonged precipitation.

6. CORROSIVITY AND SULPHATE TEST RESULTS

A sample of the native sand from Borehole CN16-10 (depth of 3.4 m) was submitted for analytical testing of corrosivity parameters and sulphate. The results of the analytical tests are shown in Table 6.1. The laboratory certificates of analysis are presented in Appendix C.

Table 6.1 – Analytical Test Results

Parameter	Units (Soil)	Test Results
		CN16-10 (SS5 at 3.4 m)
Soil Redox Potential	mV	306
Sulphide	%	< 0.02
pH	pH Units	8.56
Chloride	µg/g	25
Sulphate	µg/g	25
Conductivity	uS/cm	195
Resistivity (calculated)	ohms.cm	5100



7. MISCELLANEOUS

Landshark Drilling of Brantford, Ontario supplied a rubber track mounted B-57 drill rig and conducted the drilling, sampling and in-situ testing operations for the investigation.

The coordinates and elevations for the boreholes were provided by WSP.

The drilling and sampling operations in the field, were supervised on a full-time basis by Thurber field technicians.

Geotechnical laboratory testing was carried out at Thurber's geotechnical laboratory in Oakville. Analytical laboratory testing was carried out by SGS Canada Inc.

Overall supervision of the field program for the investigation was conducted by Dr. Nancy Berg, P.Eng. Interpretation of the data and preparation of the report was carried out by Ms. Judy Mei, EIT, and Dr. Nancy Berg, P.Eng.

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



Thurber Engineering Ltd.

A handwritten signature in black ink, appearing to read 'Judy Mei', written over a horizontal line.

Judy Mei, EIT

Geotechnical EIT



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Appendix A

Record of Borehole Sheets and Laboratory Test Results

Present 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.

UNIFIED SOILS CLASSIFICATION

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

EXPLANATION OF ROCK LOGGING TERMS

<u>ROCK WEATHERING CLASSIFICATION</u>		<u>SYMBOLS</u>			
Fresh (FR)	No visible signs of weathering.				
Fresh Jointed (FJ)	Weathering limited to the surface of major discontinuities.		CLAYSTONE		
Slightly Weathered (SW)	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock material.		SILTSTONE		
Moderately Weathered (MW)	Weathering extends throughout the rock mass, but the rock material is not friable.		SANDSTONE		
Highly Weathered (HW)	Weathering extends throughout the rock mass and the rock is partly friable.		COAL		
Completely Weathered (CW)	Rock is wholly decomposed and in a friable condition, but the rock texture and structure are preserved.		Bedrock (general)		
<u>DISCONTINUITY SPACING</u>		<u>STRENGTH CLASSIFICATION</u>			
Bedding	Bedding Plane Spacing	Rock Strength	Approximate Uniaxial Compressive Strength		Field Estimation of Hardness*
			(MPa)	(psi)	
Very thickly bedded	Greater than 2m	Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Thickly bedded	0.6 to 2m				
Medium bedded	0.2 to 0.6m	Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Thinly bedded	60mm to 0.2m				
Very thinly bedded	20 to 60mm	Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Laminated	6 to 20mm				
Thinly Laminated	Less than 6mm	Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
<u>TERMS</u>					
Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length.	Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
Solid Core Recovery: (SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run.	Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
Rock Quality Designation: (RQD)	Total length of sound core recovered in pieces 0.1m in length or larger as a percentage of total core run length.	Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail
Uniaxial Compressive Strength (UCS)	Axial stress required to break the specimen				
Fracture Index: (FI)	Frequency of natural fractures per 0.3m of core run.				

RECORD OF BOREHOLE No CN16-09

2 OF 2

METRIC

GWP# 408-88-00 LOCATION MTM NAD 83 Zone 10: N 4 814 145.3 E 226 267.2 ORIGINATED BY BL
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY BH
 DATUM Geodetic DATE 2019.07.03 - 2019.07.03 LATITUDE _____ LONGITUDE _____ CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								W P
	Continued From Previous Page						20 40 60 80 100	○ UNCONFINED	+ FIELD VANE							
							20 40 60 80 100	● QUICK TRIAXIAL	× LAB VANE							
								WATER CONTENT (%)			20	40	60			
311	Silty CLAY , trace sand Very Stiff to Hard Grey Moist (TILL)		10	SS	13											
310																
309			11	SS	15											
308																
307																
306			12	SS	30											
306			13	SS	15											
305			14	SS	60											0 4 45 51
304.2	17.4															
	END OF BOREHOLE AT 17.4m. BOREHOLE OPEN TO 5.2m. AND WATER LEVEL AT 4.9m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS.															

ONTMT4S2_MTO-11375(GINTDATA).GPJ 2017TEMPLATE(MTO).GDT 7/9/20

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

RECORD OF BOREHOLE No CN16-10

3 OF 4

METRIC

GWP# 408-88-00 LOCATION MTM NAD 83 Zone 10: N 4 814 145.3 E 226 257.3 ORIGINATED BY BL
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers/Tricone COMPILED BY BH
 DATUM Geodetic DATE 2019.08.19 - 2019.08.22 LATITUDE _____ LONGITUDE _____ CHECKED BY JPL

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa						
						20	40	60	80	100	W P	W	W L	
Continued From Previous Page														
	Silty CLAY , trace sand Hard Grey Moist		16	SS	59									
						299								
						298								Tricone grinding
						297								
			17	SS	36									
						296								
295.6 23.9	Silty SAND , trace gravel, trace clay, occasional cobbles Very Dense Grey Moist					295								Tricone grinding
						294								
			18	SS	95									7 64 24 5
						293								
						292								Tricone grinding
291.9 27.6	SILT , sandy to some sand, trace to some gravel, trace clay Very Dense Grey Moist (TILL)					291								
			19	SS	100/ 0.125									
						290								

ONTMT4S2_MTO-11375(GINTDATA).GPJ 2017TEMPLATE(MTO).GDT 7/9/20

Continued Next Page

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

RECORD OF BOREHOLE No CN16-10

4 OF 4

METRIC

GWP# 408-88-00 LOCATION MTM NAD 83 Zone 10: N 4 814 145.3 E 226 257.3 ORIGINATED BY BL
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers/Tricone COMPILED BY BH
 DATUM Geodetic DATE 2019.08.19 - 2019.08.22 LATITUDE _____ LONGITUDE _____ CHECKED BY JPL

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
	Continued From Previous Page					20 40 60 80 100						W P	W	W L		
							○ UNCONFINED	+	FIELD VANE							
							● QUICK TRIAXIAL	×	LAB VANE							
							20 40 60 80 100					20 40 60				
287.3			20	SS	100/ 0.100											
						288										
			21	SS	100/ 0.150											
32.2	END OF BOREHOLE AT 32.2m. CAVED-IN DEPTH AND WATER LEVEL NOT AVAILABLE DUE TO USE OF MUD ROTARY DRILLING. BOREHOLE BACKFILLED WITH CEMENT AND GROUT, THEN HOLEPLUG TO SURFACE.															

ONTMT4S2_MTO-11375(GINTDATA).GPJ_2017TEMPLATE(MTO).GDT_7/9/20

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

RECORD OF BOREHOLE No CN16-11

1 OF 4

METRIC

GWP# 408-88-00 LOCATION MTM NAD 83 Zone 10: N 4 814 188.4 E 226 266.1 ORIGINATED BY BL
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers/Tricone COMPILED BY BH
 DATUM Geodetic DATE 2019.07.10 - 2019.07.10 LATITUDE _____ LONGITUDE _____ CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
318.6	GROUND SURFACE														
0.0	TOPSOIL (125mm)														
0.1	Silty SAND, some gravel to gravelly, trace clay, occasional organics and rootlets Very Loose to Compact Brown Moist (FILL)		1	SS	14									20 51 24 5	
			2	SS	12										
			3	SS	2										
316.4	0.6m thick Clayey SILT layer at 2.3m														
2.3	Silty SAND, trace gravel, trace clay, occasional cobbles Very Loose to Loose Brown Moist		4	SS	3									Switch to tricone	
			5	SS	5										
			6	SS	7										
	Dense		7	SS	41									No recovery (SS7)	
			8	SS	46										
312.6	Clayey SILT, sandy, trace gravel Hard Grey Moist (TILL)		9	SS	32									3 21 49 27	
6.0			10	SS	30										
310.0	Silty CLAY, trace sand Hard Grey Moist														
8.7			11	SS	40										
	0.5m sandy SILT layer at 9.5m														

ONTMT4S2_MTO-11375(GINTDATA).GPJ 2017TEMPLATE(MTO).GDT 7/9/20

Continued Next Page

+³ ×³: Numbers refer to Sensitivity $\frac{20}{15 \pm 5}$ (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No CN16-11

4 OF 4

METRIC

GWP# 408-88-00 LOCATION MTM NAD 83 Zone 10: N 4 814 188.4 E 226 266.1 ORIGINATED BY BL
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers/Tricone COMPILED BY BH
 DATUM Geodetic DATE 2019.07.10 - 2019.07.10 LATITUDE _____ LONGITUDE _____ CHECKED BY JPL

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa							
	Continued From Previous Page														
	SILT , some sand, some clay, trace gravel, occasional cobbles Very Dense Grey Moist (TILL)					288									Tricone grinding
			22	SS	100/ 0.125	286									
			23	SS	100/ 0.150	285									
283.4			24	SS	100/ 0.150	284									
35.2	END OF BOREHOLE AT 35.2m. Piezometer installation consists of 50mm diameter Schedule 40 PVC pipe with a 3.0m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2019.08.11 1.6 317.1 2019.08.29 9.0 309.7				0.150										

ONTMT4S2_MTO-11375(GINTDATA).GPJ 2017TEMPLATE(MTO).GDT 7/9/20

RECORD OF BOREHOLE No CN16-12

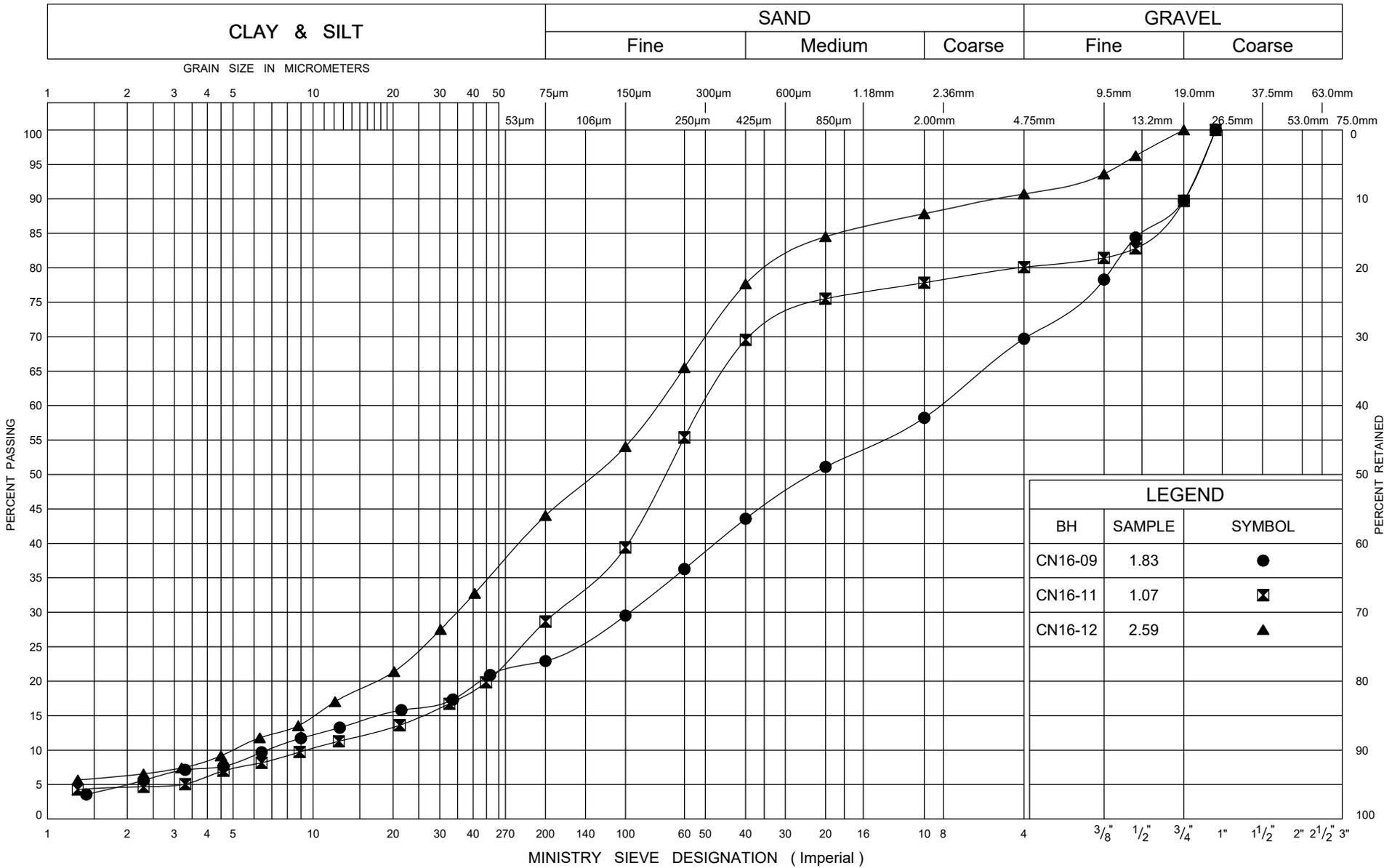
2 OF 2

METRIC

GWP# 408-88-00 LOCATION MTM NAD 83 Zone 10: N 4 814 194.5 E 226 265.5 ORIGINATED BY BL
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers/Tricone COMPILED BY BH
 DATUM Geodetic DATE 2019.07.10 - 2019.07.10 LATITUDE _____ LONGITUDE _____ CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
	Continued From Previous Page						20 40 60 80 100	○ UNCONFINED	+ FIELD VANE						
							20 40 60 80 100	● QUICK TRIAXIAL	× LAB VANE						
										WATER CONTENT (%)					
										20	40	60			
302.8	Silty CLAY , trace sand Hard Grey Moist		10	SS	63		308								
			11	SS	100/ 0.275		306								
			12	SS	35		305							0 3 41 56	
			13	SS	63		303								
15.8	END OF BOREHOLE AT 15.8m. CAVED-IN DEPTH AND WATER LEVEL NOT AVAILABLE DUE TO USE OF MUD ROTARY DRILLING. BOREHOLE BACKFILLED WITH CEMENT AND GROUT, THEN BENTONITE HOLEPLUG TO SURFACE.														

ONTM4S2_MTO-11375(GINTDATA).GPJ 2017TEMPLATE(MTO).GDT 7/9/20

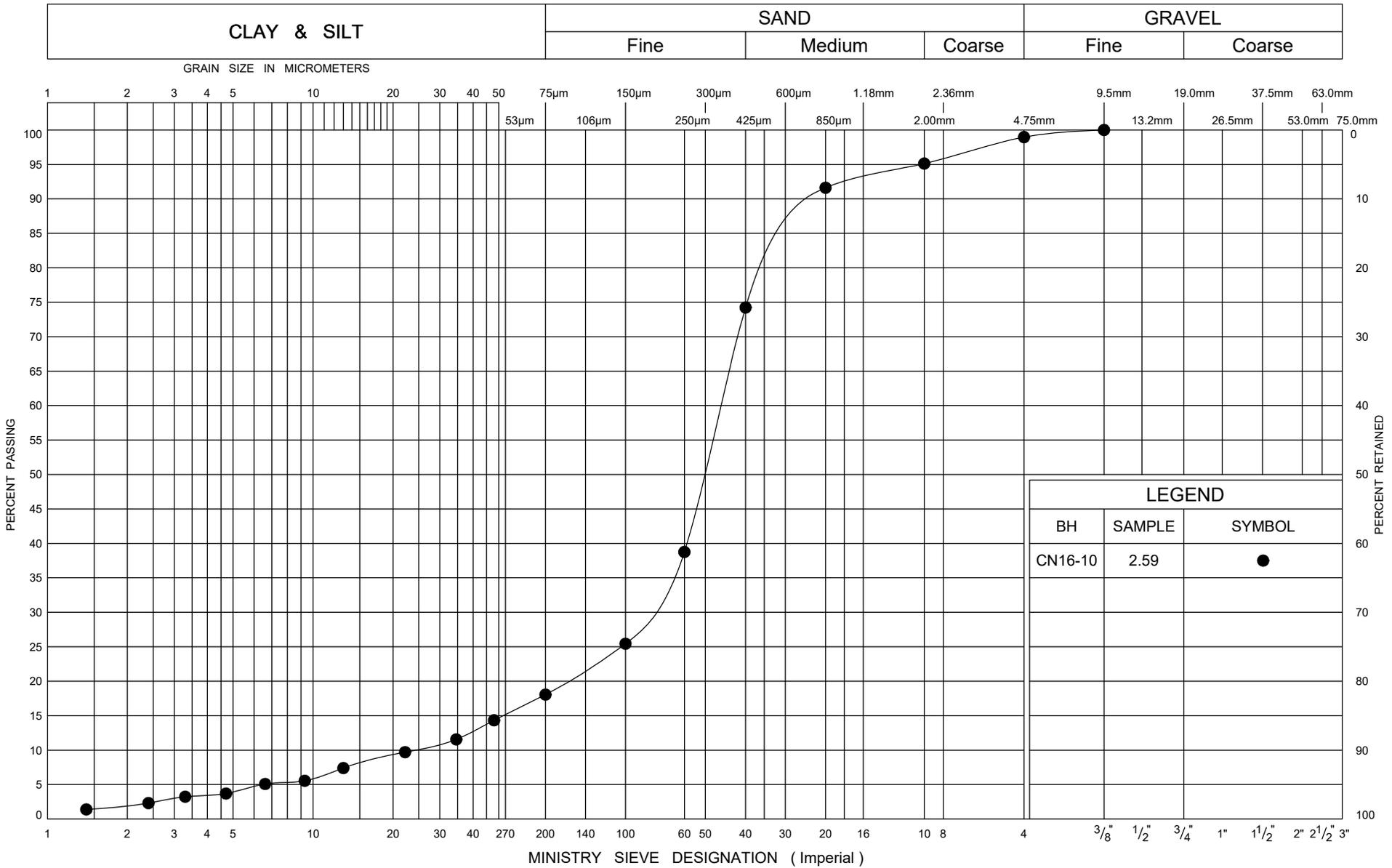


ONTARIO MOT GRAIN SIZE 2 MTO-11375(GINTDATA)\GPJ_ONTARIO MOT.GDT 1/7/20



GRAIN SIZE DISTRIBUTION FILL

FIG No A1
W P 408-88-00

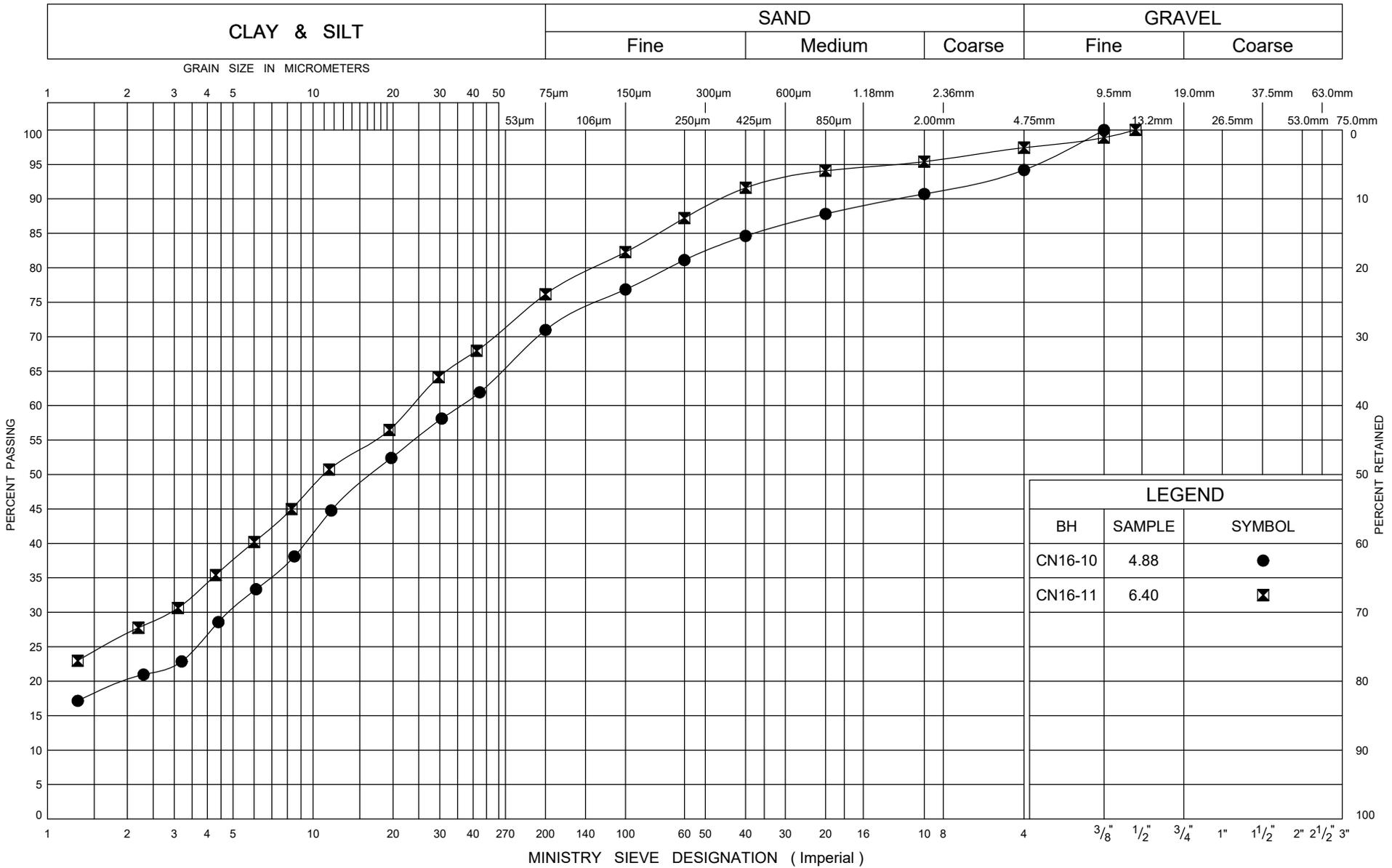


ONTARIO MOT GRAIN SIZE 2 MTO-11375(GINTDATA).GPJ ONTARIO MOT.GDT 1/7/20



GRAIN SIZE DISTRIBUTION SAND

FIG No A2
W P 408-88-00



ONTARIO MOT GRAIN SIZE 2 MTO-11375(GINTDATA)\GPJ_ONTARIO MOT.GDT 1/7/20

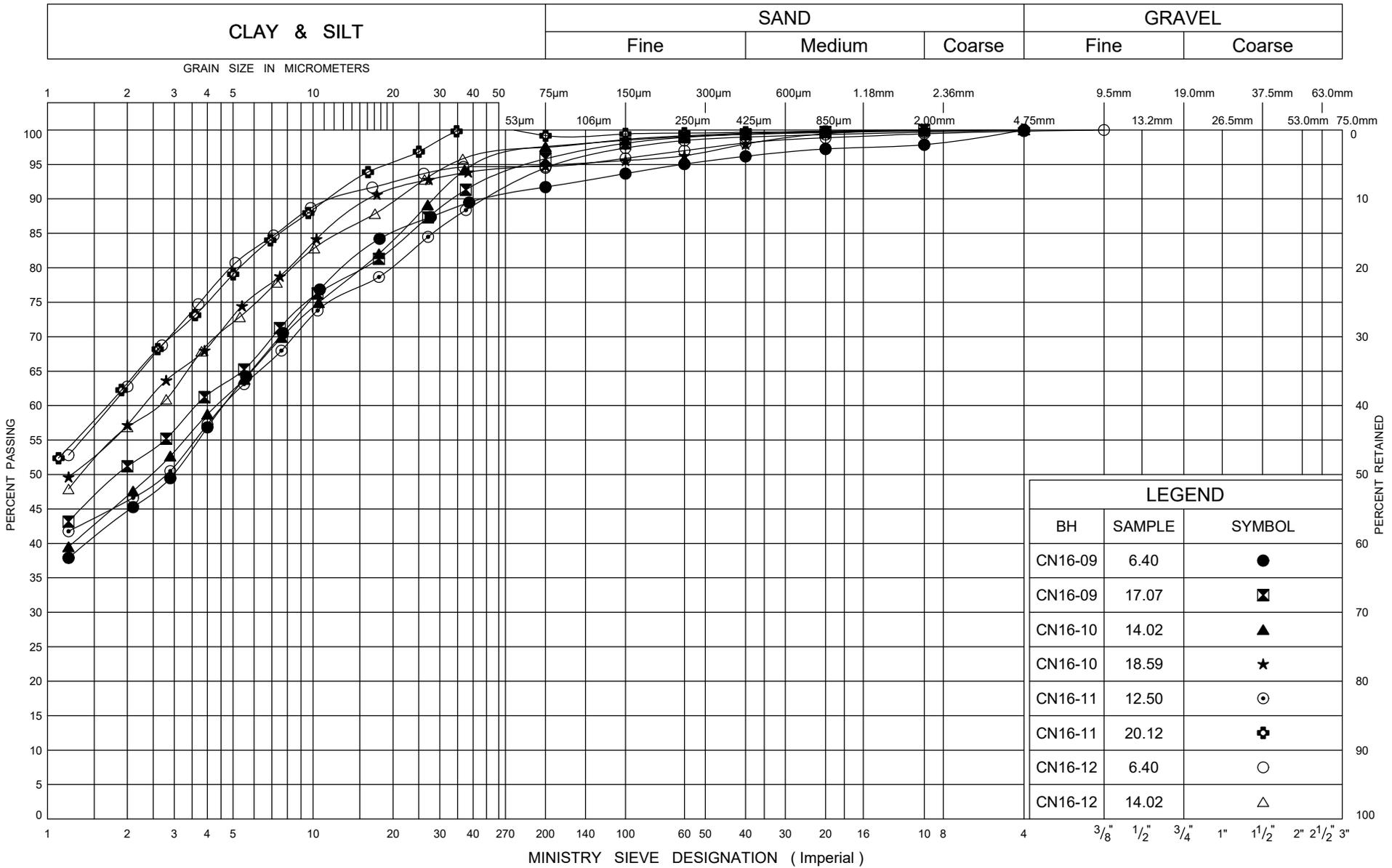


GRAIN SIZE DISTRIBUTION

Clayey SILT TILL

FIG No A3

W P 408-88-00

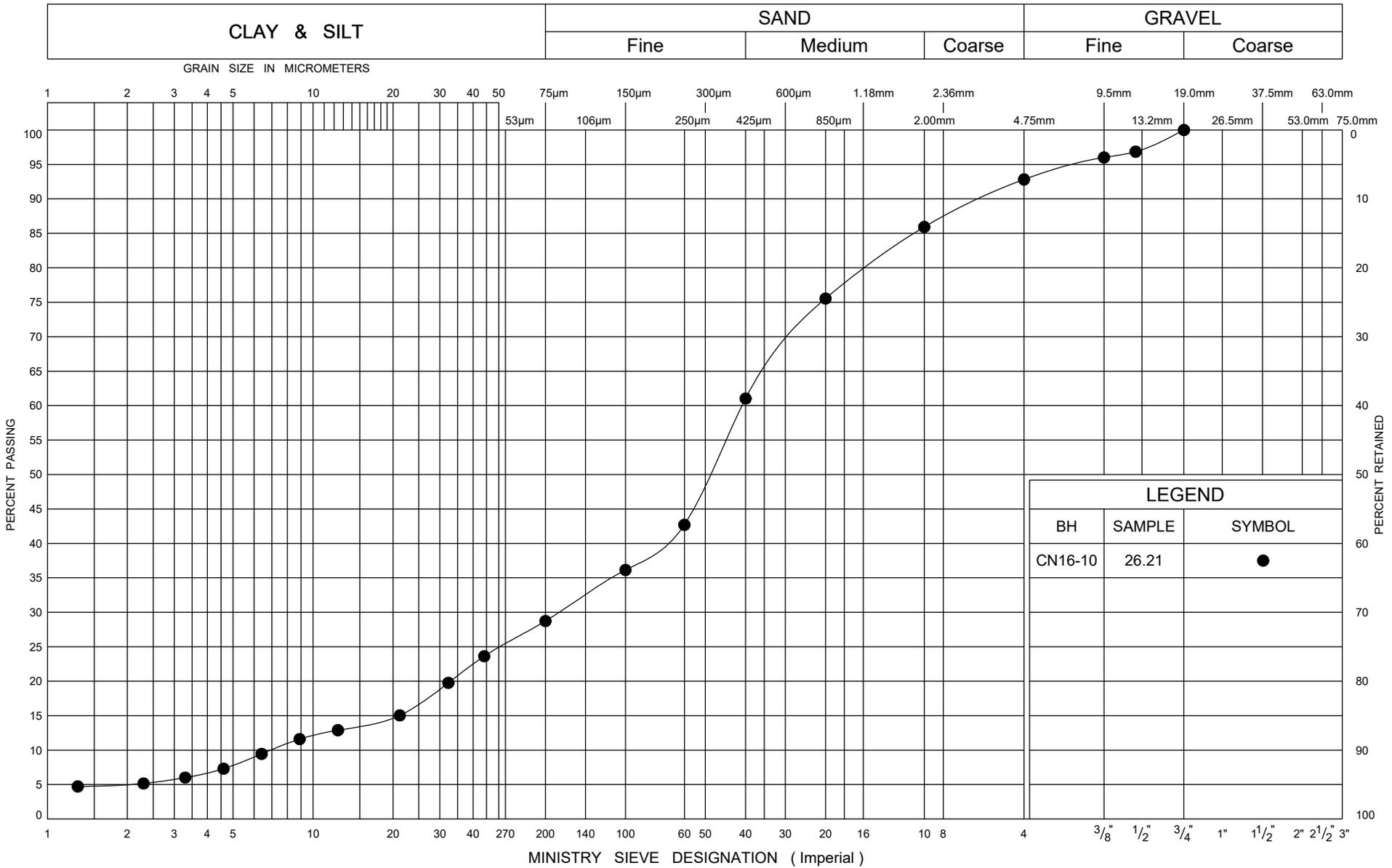


ONTARIO MOT GRAIN SIZE 2 MTO-11375(GINTDATA)\GPJ_ONTARIO MOT.GDT 1/7/20



GRAIN SIZE DISTRIBUTION
Silty CLAY

FIG No A4
W P 408-88-00



ONTARIO MOT GRAIN SIZE 2 MTO-11375(GINTDATA)\GPJ_ONTARIO MOT.GDT 1/7/20

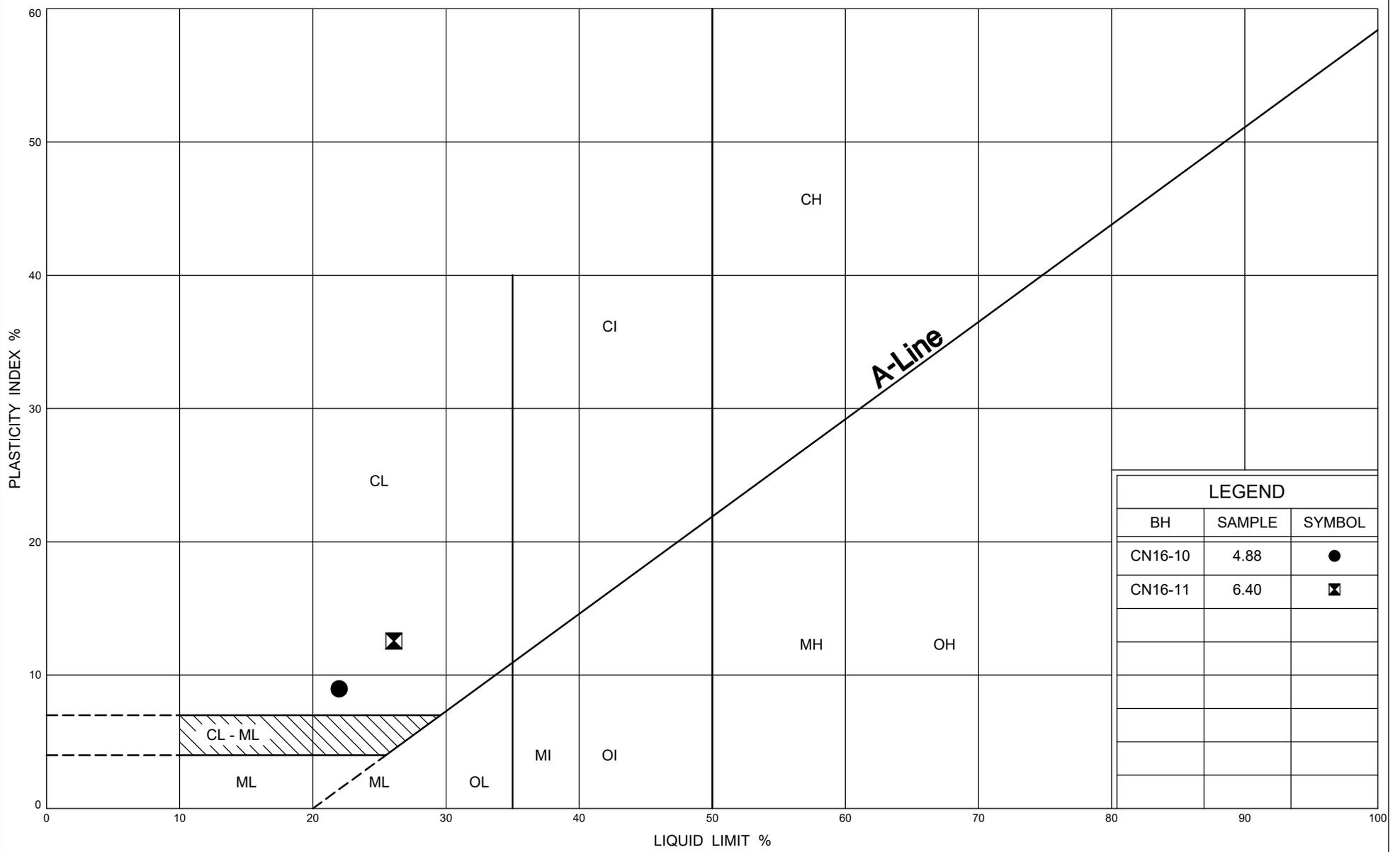


GRAIN SIZE DISTRIBUTION

Silty SAND

FIG No A5

W P 408-88-00



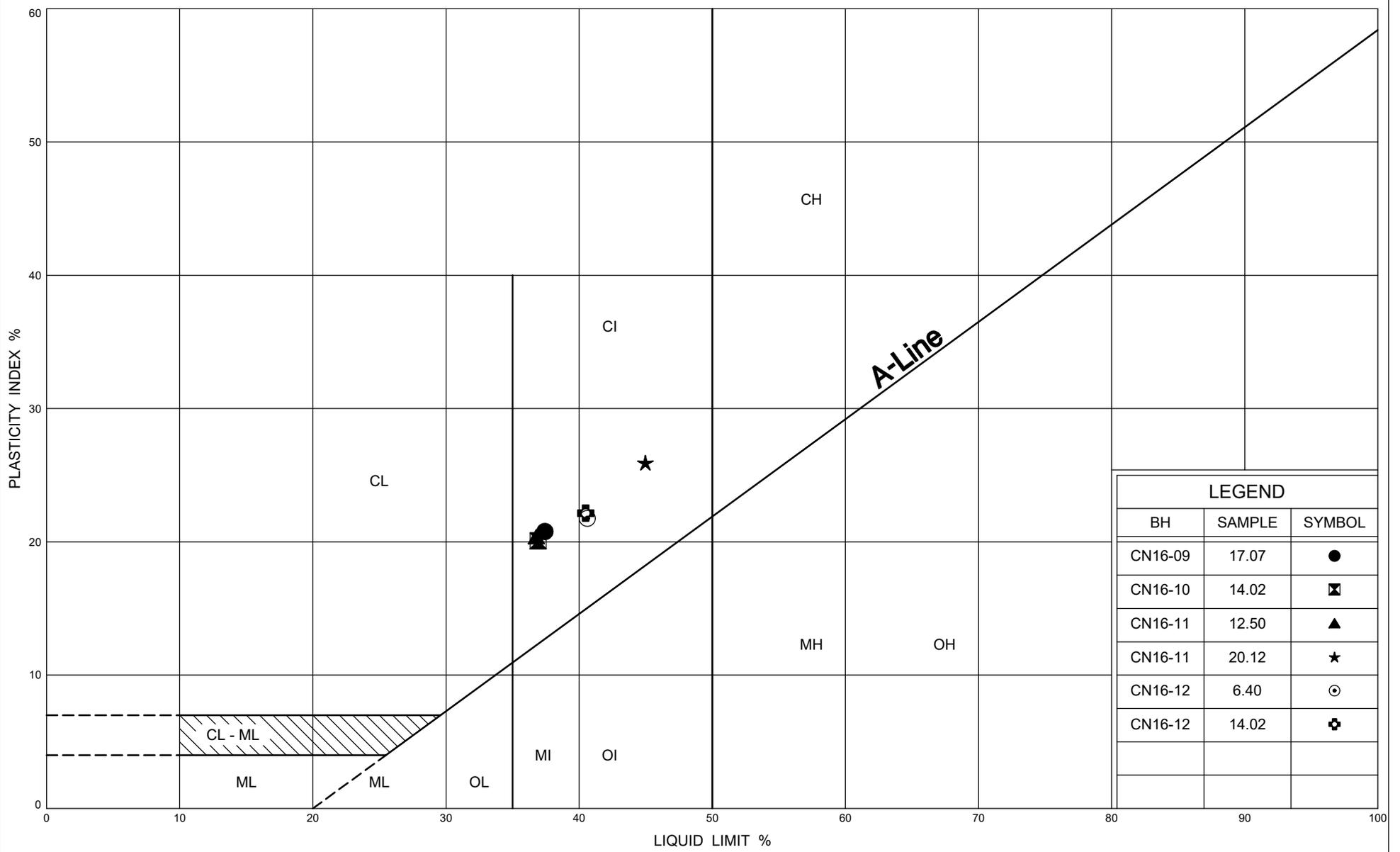
LEGEND		
BH	SAMPLE	SYMBOL
CN16-10	4.88	●
CN16-11	6.40	⊠

ONTARIO MOT PLASTICITY CHART MTO-11375(GINTDATA).GPJ_ONTARIO MOT.GDT_1/7/20



PLASTICITY CHART
Clayey SILT TILL

FIG No A6
W P 408-88-00



LEGEND		
BH	SAMPLE	SYMBOL
CN16-09	17.07	●
CN16-10	14.02	⊠
CN16-11	12.50	▲
CN16-11	20.12	★
CN16-12	6.40	⊙
CN16-12	14.02	⊕

ONTARIO MOT PLASTICITY CHART MTO-11375(GINTDATA).GPJ_ONTARIO MOT.GDT_1/7/20



PLASTICITY CHART
Silty CLAY

FIG No A7
W P 408-88-00



Appendix B

Record of Borehole Sheets and Laboratory Test Results

Previous 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

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

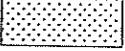
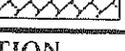
 Water Level
 C_{pen} Shear Strength Determination by Pocket Penetrometer

- (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.

UNIFIED SOILS CLASSIFICATION

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

EXPLANATION OF ROCK LOGGING TERMS

ROCK WEATHERING CLASSIFICATION		SYMBOLS				
Fresh (FR)	No visible signs of weathering.		CLAYSTONE			
Fresh Jointed (FJ)	Weathering limited to the surface of major discontinuities.			SILTSTONE		
Slightly Weathered (SW)	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock material.				SANDSTONE	
Moderately Weathered (MW)	Weathering extends throughout the rock mass, but the rock material is not friable.				COAL	
Highly Weathered (HW)	Weathering extends throughout the rock mass and the rock is partly friable.				Bedrock (general)	
Completely Weathered (CW)	Rock is wholly decomposed and in a friable condition, but the rock texture and structure are preserved.					
DISCONTINUITY SPACING		STRENGTH CLASSIFICATION				
Bedding	Bedding Plane Spacing	Rock Strength	Approximate Uniaxial Compressive Strength		Field Estimation of Hardness*	
			(MPa)	(psi)		
Very thickly bedded	Greater than 2m	Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer	
Thickly bedded	0.6 to 2m	Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break	
Medium bedded	0.2 to 0.6m	Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break	
Thinly bedded	60mm to 0.2m	Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.	
Very thinly bedded	20 to 60mm	Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty	
Laminated	6 to 20mm	Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.	
Thinly Laminated	Less than 6mm	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 percentage 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.					

RECORD OF BOREHOLE No 08-045

1 OF 4

METRIC

G.W.P. 408-88-00 LOCATION N 4 814 152.87 E 226 282.83 ORIGINATED BY SA
 HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2008.08.15 - 2008.08.19 CHECKED BY RPR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa						
						20	40	60	80	100	20	40	60	GR SA SI CL
322.2														
0.0	ASPHALT: (150mm)		1	AS										
0.2	Gravelly SAND, some silt, occasional to numerous cobbles, gasoline odour Compact to Very Dense Dark Brown to Black Moist (FILL)		1	SS	20									
			2	SS	67									
319.9														
2.3	Sandy SILT, some clay, trace gravel, decayed wood fragments, mortar, glass pieces, strong gasoline odour, possible contamination, occasional organics Very Loose to Loose Black Wet (FILL)		3	SS	7									
			4	SS	1									
317.7														
4.6	SAND, some gravel, some silt, trace clay Compact Grey Wet		5	SS	25									16 72 12 (SI+CL)
315.8														
6.4	Clayey SILT, some sand, trace gravel Very Stiff to Hard Grey (TILL)		6	SS	16									
			7	SS	35									0 17 55 27
	occasional silty sand seams		8	SS	26									

Continued Next Page

+³ × 3³: Numbers refer to Sensitivity
 20
 15 10 5 10 (% STRAIN AT FAILURE)



RECORD OF BOREHOLE No 08-045

2 OF 4

METRIC

G.W.P. 408-88-00 LOCATION N 4 814 152.87 E 226 282.83 ORIGINATED BY SA
 HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2008.08.15 - 2008.08.19 CHECKED BY RPR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40					
311.6	Continued From Previous Page Clayey SILT, some sand, trace gravel Very Stiff to Hard Grey (TILL)													
10.7	Silty CLAY, trace sand, occasional cobbles Very Stiff to Hard Grey		9	SS	38									
			10	SS	26									0 2 33 65
			11	SS	37									
			12	SS	78									
	trace gravel		13	SS	101									
			14	SS	95									0 5 45 50

Continued Next Page

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

ONTMT4S 641TR.GPJ 11/25/08

RECORD OF BOREHOLE No 08-045

3 OF 4

METRIC

G.W.P. 408-88-00 LOCATION N 4 814 152.87 E 226 282.83 ORIGINATED BY SA
 HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2008.08.15 - 2008.08.19 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60					
	Continued From Previous Page														
	Silty CLAY, trace gravel, occasional cobbles Hard Grey		15	SS	86										
			16	SS	96										
			17	SS	59										
			18	SS	50									0 0 21 79	
			19	SS	51										
	occasional thin grey silt layers		20	SS	57										
293.1			21	SS	100/										
29.1	Silty SAND Very Dense Grey Wet (TILL)				.275										

ONTM/T4S 6417R.GPJ 11/25/08

Continued Next Page

+³ × 3³: Numbers refer to Sensitivity
 20
 15
 10
 (% STRAIN AT FAILURE)

RECORD OF BOREHOLE No 08-045

4 OF 4

METRIC

G.W.P. 408-88-00 LOCATION N 4 814 152.87 E 226 282.83 ORIGINATED BY SA
 HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2008.08.15 - 2008.08.19 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	T _N VALUES			20	40	60	80	100					
292.0	Continued From Previous Page																
30.2	SILT, some sand, trace clay Very Dense Grey Wet (TILL) Layer of gravel (400mm)		22	SS	100/ .250							o				0 11 81 8	
	Layer of gravel (200mm)																
290.1			23	SS	100/ .075							o					
32.1	END OF BOREHOLE AT 32.1m. BOREHOLE BACKFILLED WITH GROUT TO SURFACE.																

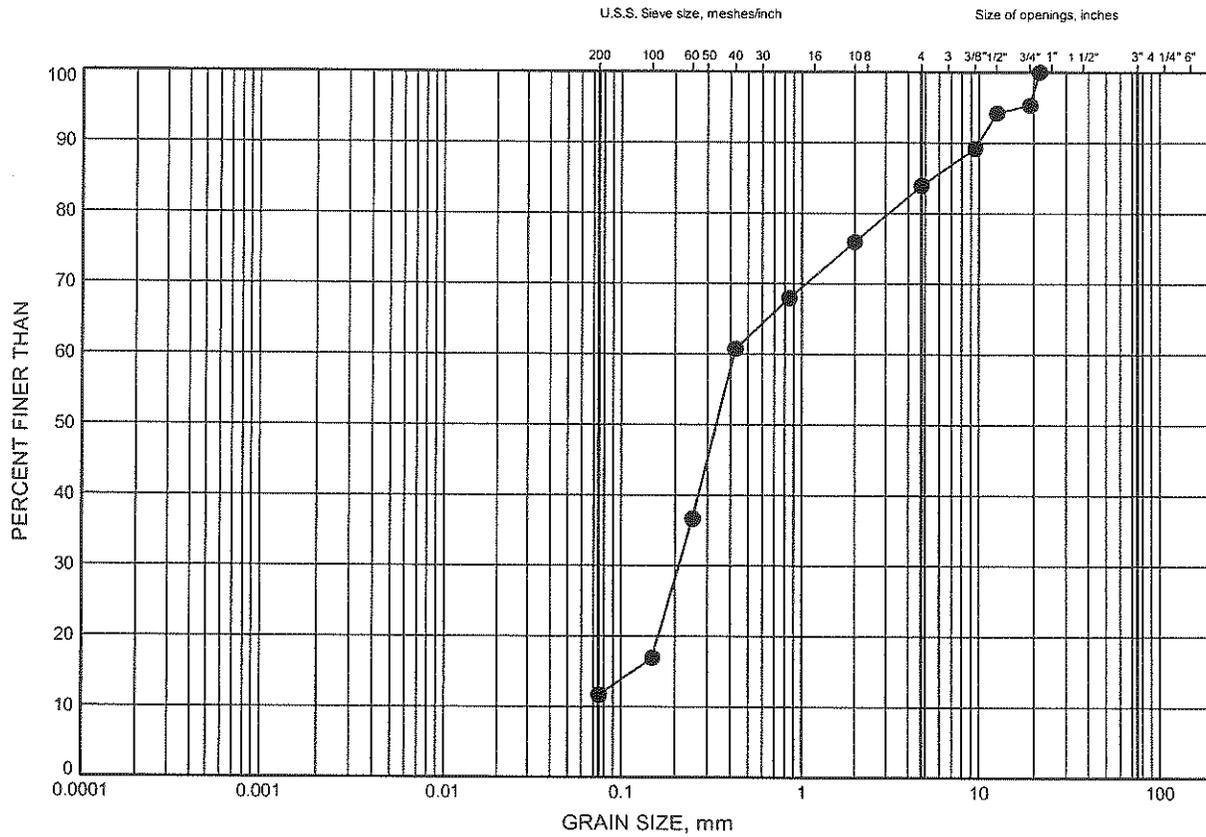
ONTMT4S 6417R.GPJ 11/25/08

+³, X³: Numbers refer to
Sensitivity 20
15 5
10 (%) STRAIN AT FAILURE

Highway 7 - New GRAIN SIZE DISTRIBUTION

FIGURE B1

SAND



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-045	4.88	317.35

GRAIN SIZE DISTRIBUTION - THURBER 6417R.GPJ 11/24/08

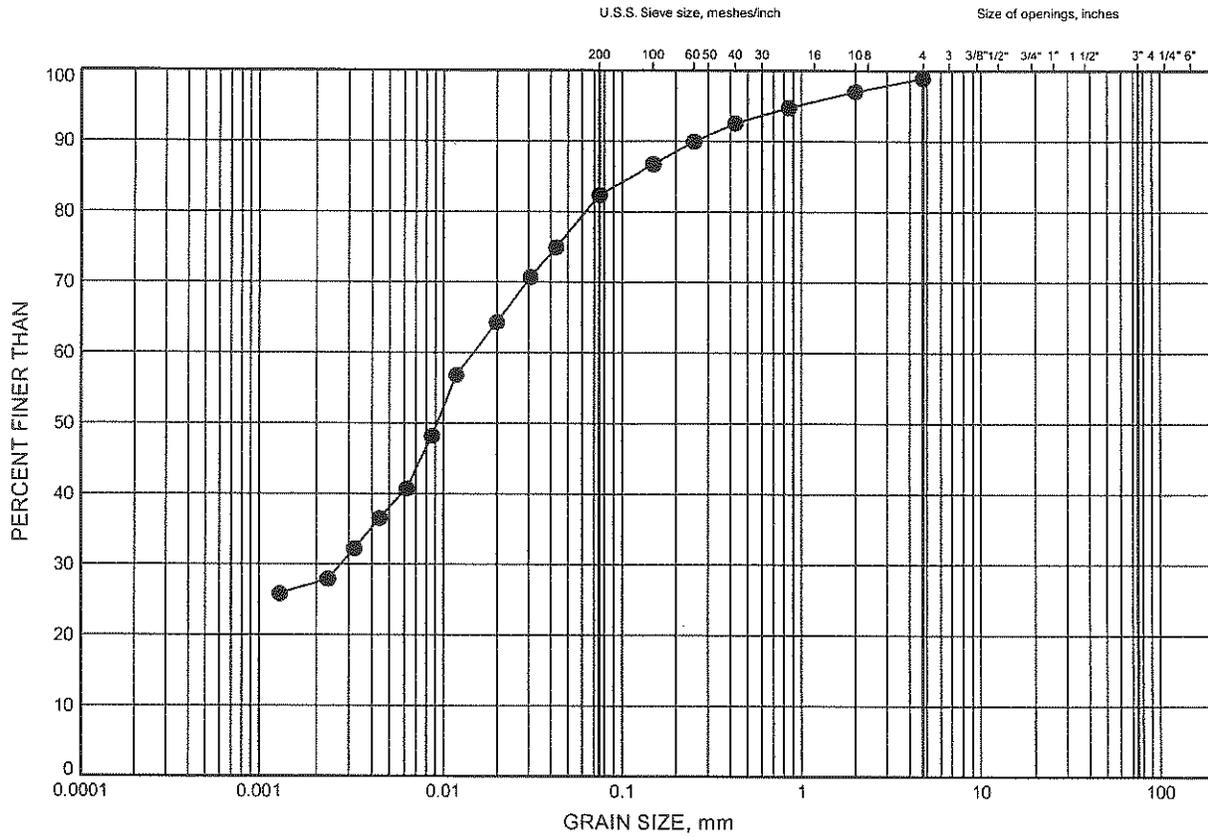
W.P.# .408-88-00.....
 Prepared By .AN.....
 Checked By .RPR.....



Highway 7 - New GRAIN SIZE DISTRIBUTION

FIGURE B2

CLAYEY SILT TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-045	7.92	314.30

GRAIN SIZE DISTRIBUTION - THURBER 6417R.GPJ 11/24/08

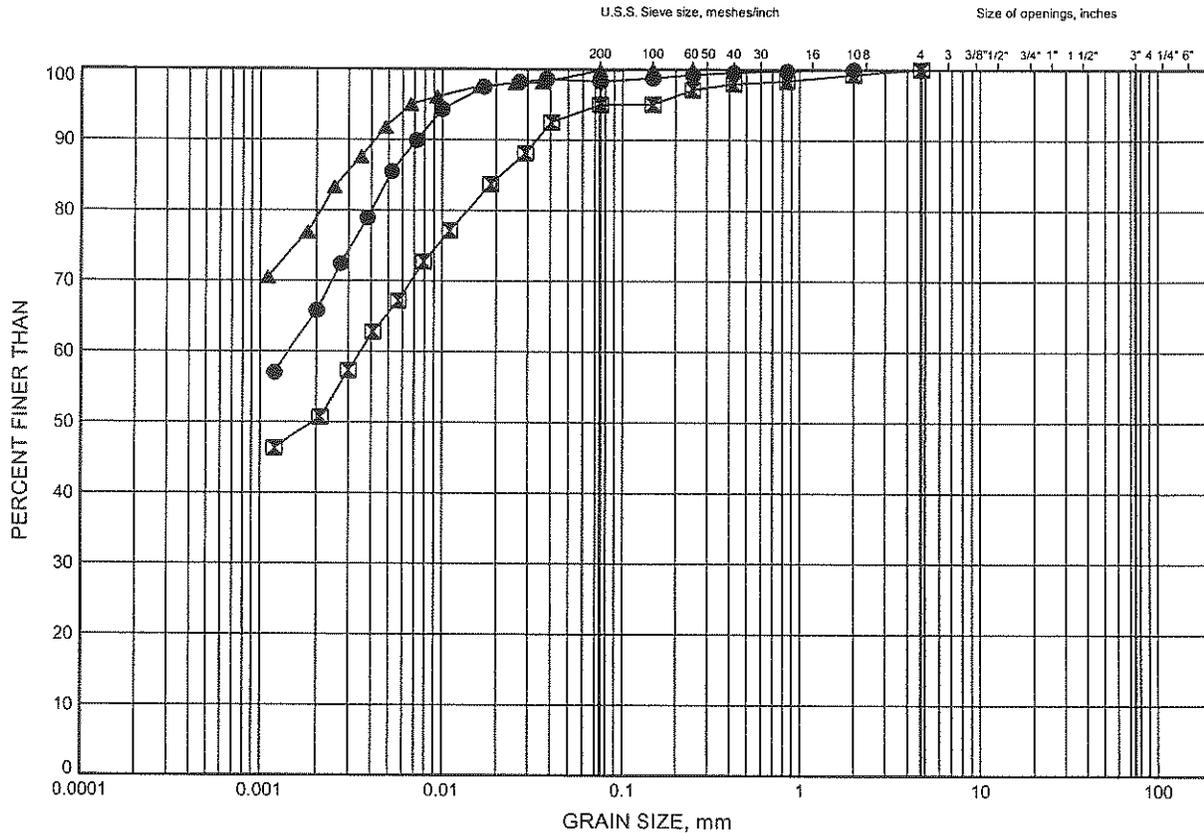
W.P.# .408-88-00.....
 Prepared By .AN.....
 Checked By .RPR.....



Highway 7 - New GRAIN SIZE DISTRIBUTION

FIGURE B3

SILTY CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-045	12.50	309.73
⊠	08-045	18.59	303.63
▲	08-045	24.69	297.54

GRAIN SIZE DISTRIBUTION - THURBER 8417R.GPJ 11/24/08

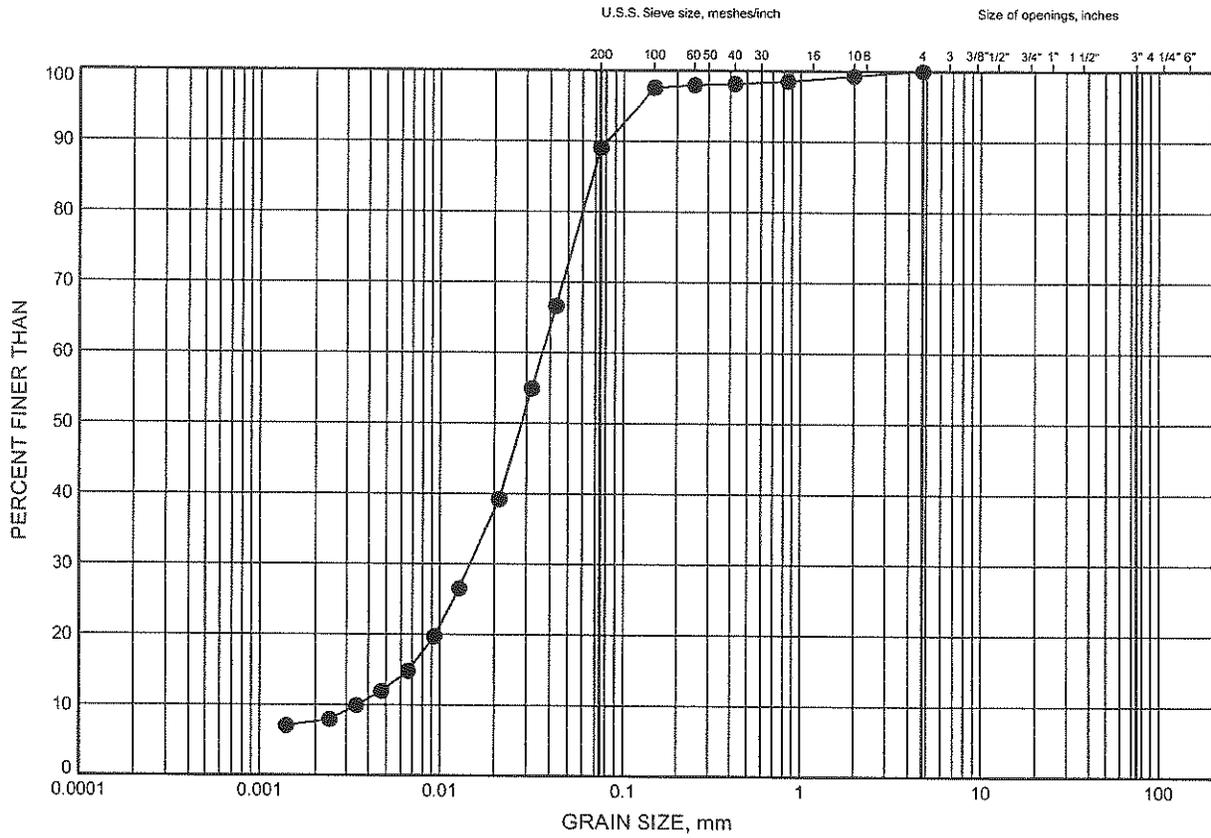
W.P.# .408-88-00.....
 Prepared By .AN.....
 Checked By .RPR.....



Highway 7 - New GRAIN SIZE DISTRIBUTION

FIGURE B4

SILT TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-045	30.66	291.57

GRAIN SIZE DISTRIBUTION - THURBER 6417R.GPJ 11/24/08

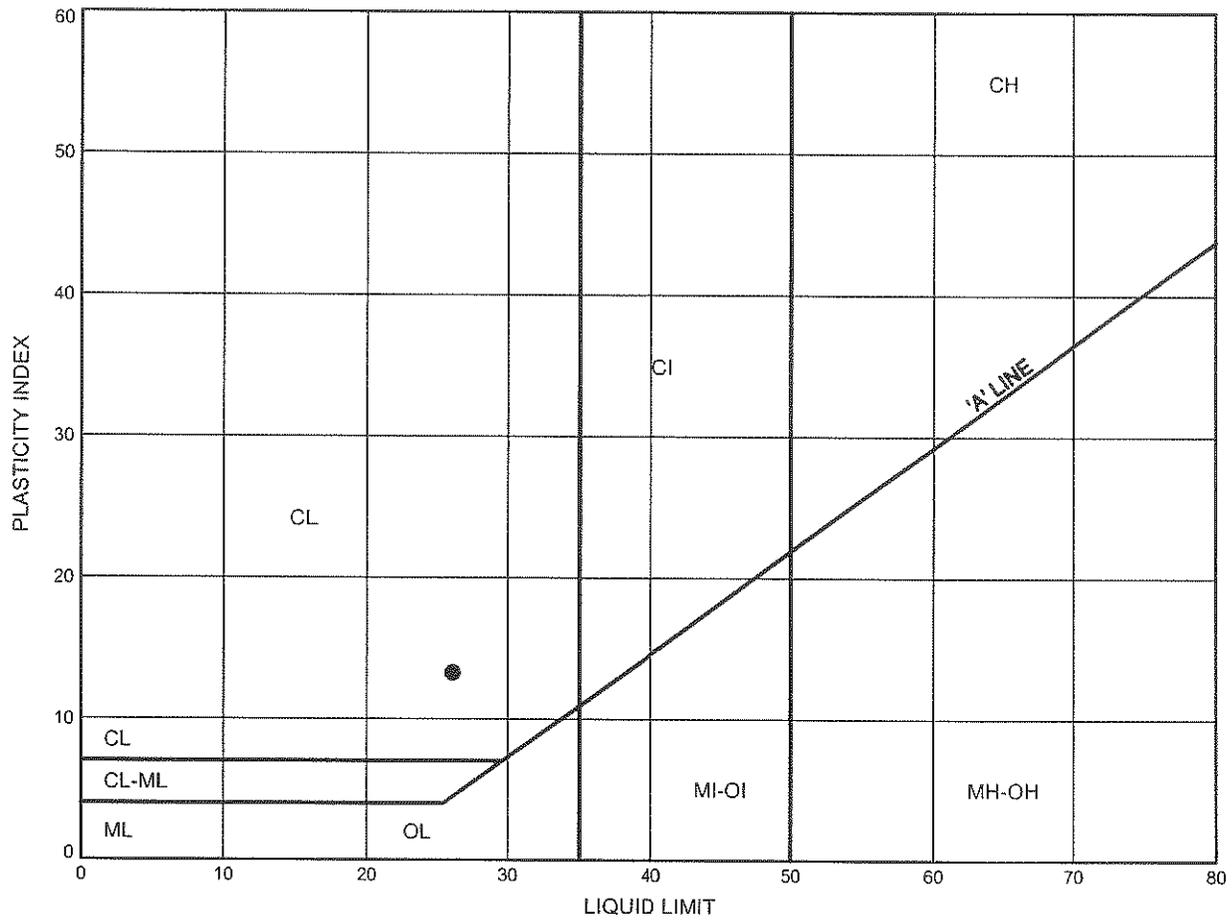
W.P.# .408-88-00.....
 Prepared By .AN.....
 Checked By .RPR.....



Highway 7 - New
ATTERBERG LIMITS TEST RESULTS

FIGURE B5

CLAYEY SILT TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	08-045	7.92	314.30

THURBALT 6417R.GPJ 11/24/08

Date November 2008

Project 408-88-00



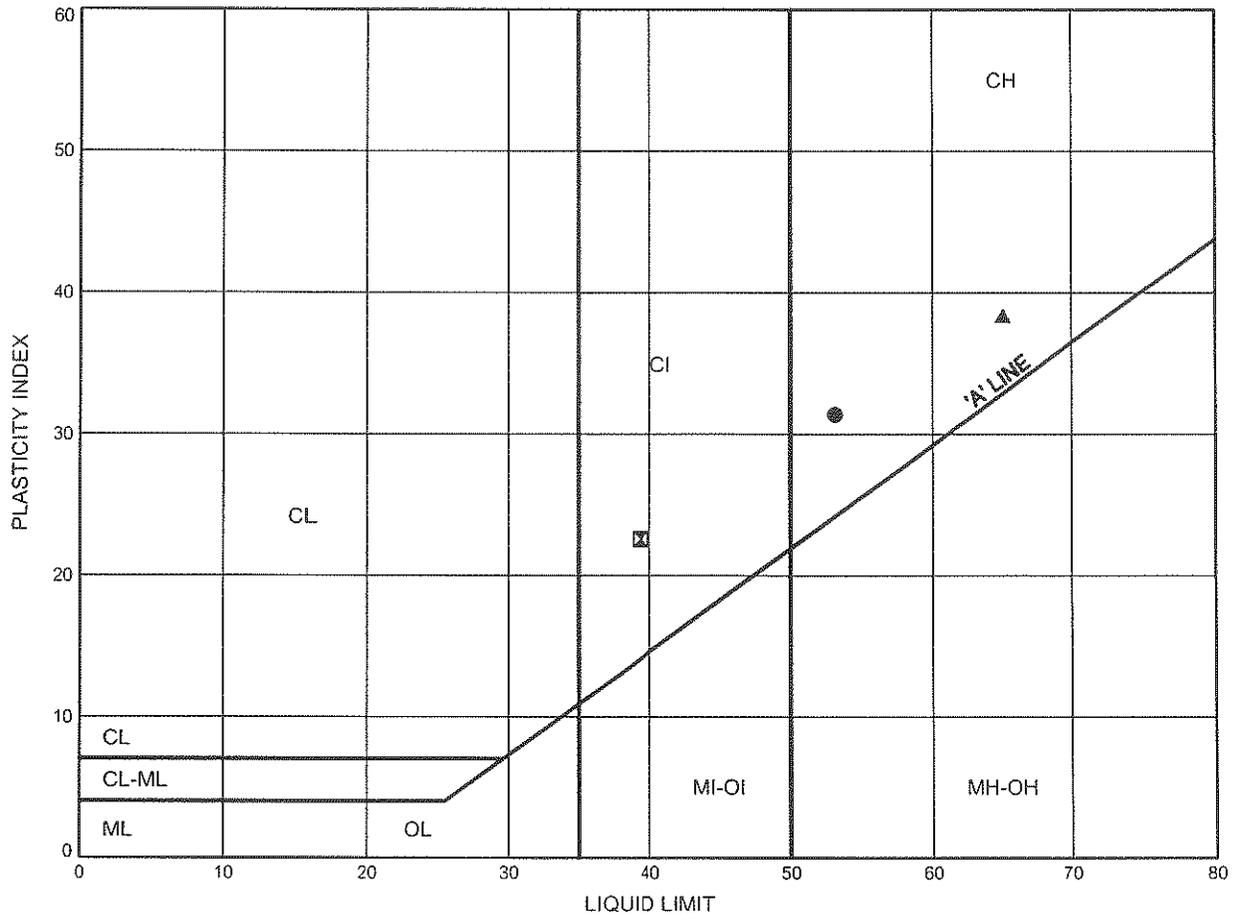
Prep'd AN

Chkd. RPR

Highway 7 - New
ATTERBERG LIMITS TEST RESULTS

FIGURE B6

SILTY CLAY



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	08-045	12.50	309.73
◻	08-045	18.59	303.63
▲	08-045	24.69	297.54

THURBALT 6417R.GPJ 11/24/08

Date November 2008

Project 408-88-00



Prep'd AN

Chkd. RPR



Appendix C

Analytical Laboratory Test Results (Present Investigation)



FINAL REPORT

CA14437-AUG19 R1

11375 Hwy 7 New, Kitchener

Prepared for

Thurber Engineering Ltd.

First Page

CLIENT DETAILS

Client **Thurber Engineering Ltd.**

Address **103, 2010 Winston Park Drive
Oakville, ON
L6H 5R7, Canada**

Contact **Nancy Berg**

Telephone **905-829-8666 x 228**

Facsimile

Email **nberg@thurber.ca**

Project **11375 Hwy 7 New, Kitchener**

Order Number

Samples **Soil (5)**

LABORATORY DETAILS

Project Specialist **Rob Irwin B.Sc., C.Chem**

Laboratory **SGS Canada Inc.**

Address **185 Concession St., Lakefield ON, K0L 2H0**

Telephone **705-652-2361**

Facsimile **705-652-6365**

Email **rob.irwin@sgs.com**

SGS Reference **CA14437-AUG19**

Received **08/13/2019**

Approved **08/19/2019**

Report Number **CA14437-AUG19 R1**

Date Reported **08/19/2019**

COMMENTS

Temperature of Sample upon Receipt: 4 degrees C
Cooling Agent Present: yes
Custody Seal Present: no

Chain of Custody Number: 009972

Corrosivity Index is based on the American Water Works Corrosivity Scale according to AWWA C-105. An index greater than 10 indicates the soil matrix may be corrosive to cast iron alloys.

SIGNATORIES

Rob Irwin B.Sc., C.Chem



TABLE OF CONTENTS

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Legend.....	7
Annexes.....	8



FINAL REPORT

CA14437-AUG19 R1

Client: Thurber Engineering Ltd.

Project: 11375 Hwy 7 New, Kitchener

Project Manager: Nancy Berg

Samplers: Nancy Berg

PACKAGE: - Corrosivity Index (SOIL)

Sample Number	5	6	7	8	9
Sample Name	CN16-10 SS5	CN16-04 SS4	CN16-15 SS4	RW24-02 SS4	NE16-09 SS4
Sample Matrix	Soil	Soil	Soil	Soil	Soil
Sample Date	19/07/2019	23/07/2019	18/07/2019	06/08/2019	06/08/2019

Parameter	Units	RL	Result	Result	Result	Result	Result	
Corrosivity Index								
Corrosivity Index	none	1	4	1	5	11	14	
Soil Redox Potential	mV	-	306	312	255	263	227	
Sulphide	%	0.02	< 0.02	< 0.02	0.02	< 0.02	< 0.02	
pH	pH Units	0.05	8.56	8.29	7.88	8.18	8.66	
Resistivity (calculated)	ohms.cm	-9999	5100	3200	2500	780	1400	

PACKAGE: - General Chemistry (SOIL)

Sample Number	5	6	7	8	9
Sample Name	CN16-10 SS5	CN16-04 SS4	CN16-15 SS4	RW24-02 SS4	NE16-09 SS4
Sample Matrix	Soil	Soil	Soil	Soil	Soil
Sample Date	19/07/2019	23/07/2019	18/07/2019	06/08/2019	06/08/2019

Parameter	Units	RL	Result	Result	Result	Result	Result	
General Chemistry								
Conductivity	uS/cm	2	195	317	400	1280	736	

PACKAGE: - Metals and Inorganics (SOIL)

Sample Number	5	6	7	8	9
Sample Name	CN16-10 SS5	CN16-04 SS4	CN16-15 SS4	RW24-02 SS4	NE16-09 SS4
Sample Matrix	Soil	Soil	Soil	Soil	Soil
Sample Date	19/07/2019	23/07/2019	18/07/2019	06/08/2019	06/08/2019

Parameter	Units	RL	Result	Result	Result	Result	Result	
Metals and Inorganics								
Moisture Content	%	0.1	20.1	6.1	24.6	13.1	6.5	
Sulphate	µg/g	0.4	25	12	100	31	13	



FINAL REPORT

CA14437-AUG19 R1

Client: Thurber Engineering Ltd.

Project: 11375 Hwy 7 New, Kitchener

Project Manager: Nancy Berg

Samplers: Nancy Berg

PACKAGE: - Other (ORP) (SOIL)

Sample Number	5	6	7	8	9
Sample Name	CN16-10 SS5	CN16-04 SS4	CN16-15 SS4	RW24-02 SS4	NE16-09 SS4
Sample Matrix	Soil	Soil	Soil	Soil	Soil
Sample Date	19/07/2019	23/07/2019	18/07/2019	06/08/2019	06/08/2019

Parameter	Units	RL	Result	Result	Result	Result	Result
Other (ORP)							
Chloride	µg/g	0.4	25	7.8	60	760	430

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-IENVIIC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chloride	DIO0262-AUG19	µg/g	0.4	<0.4	9	20	93	80	120	98	75	125
Sulphate	DIO0262-AUG19	µg/g	0.4	<0.4	13	20	94	80	120	96	75	125

Carbon/Sulphur

Method: ASTM E1915-07A | Internal ref.: ME-CA-IENVIARD-LAK-AN-020

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Sulphide	ECS0029-AUG19	%	0.02	<0.02	ND	20	110	80	120			

Conductivity

Method: SM 2510 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0246-AUG19	uS/cm	2	< 0.002	0	10	100	90	110	NA		

QC SUMMARY

pH

Method: SM 4500 | Internal ref.: ME-CA-ENVIEWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0246-AUG19	pH Units	0.05	NA	0		100			NA		

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS Insufficient sample for analysis.
RL Reporting Limit.
 ↑ Reporting limit raised.
 ↓ Reporting limit lowered.
NA The sample was not analysed for this analyte
ND Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This report must not be reproduced, except in full. This report supersedes all previous versions.

-- End of Analytical Report --

Request for Laboratory Services and CHAIN OF CUSTODY

Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
 - London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8080 Fax: 519-672-0361

Laboratory Information Section - Lab use only

Received By: Oleg Mozhin
 Received Date (mm/dd/yy): 8/15/19 (mm/dd/yy)
 Received Time: 11:05

Received By (signature): [Signature]
 Custody Seal Present: NO
 Custody Seal Intact: NO

Cooling Agent Present: Ice
 Temperature Upon Receipt (°C): 9.90/9.0

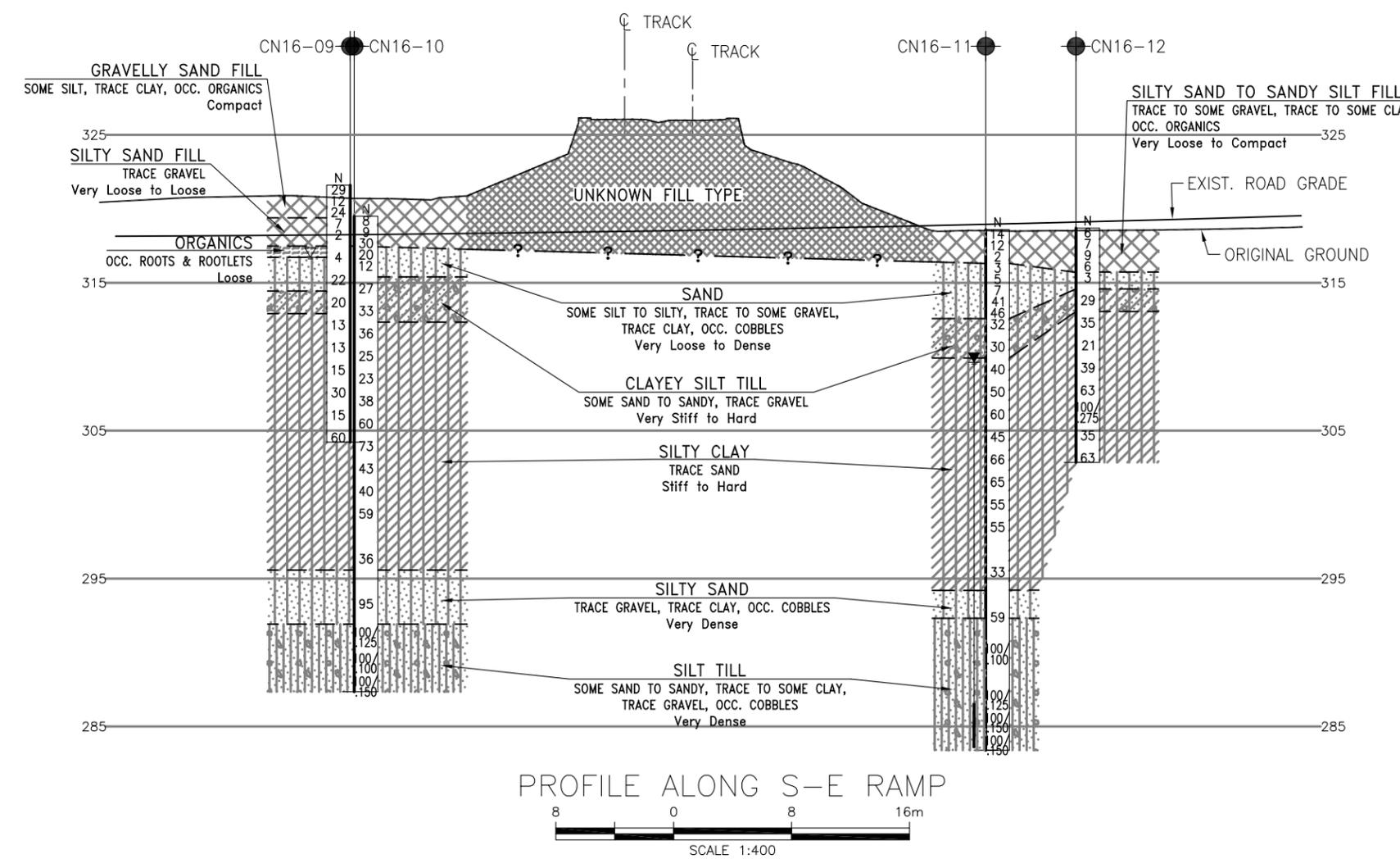
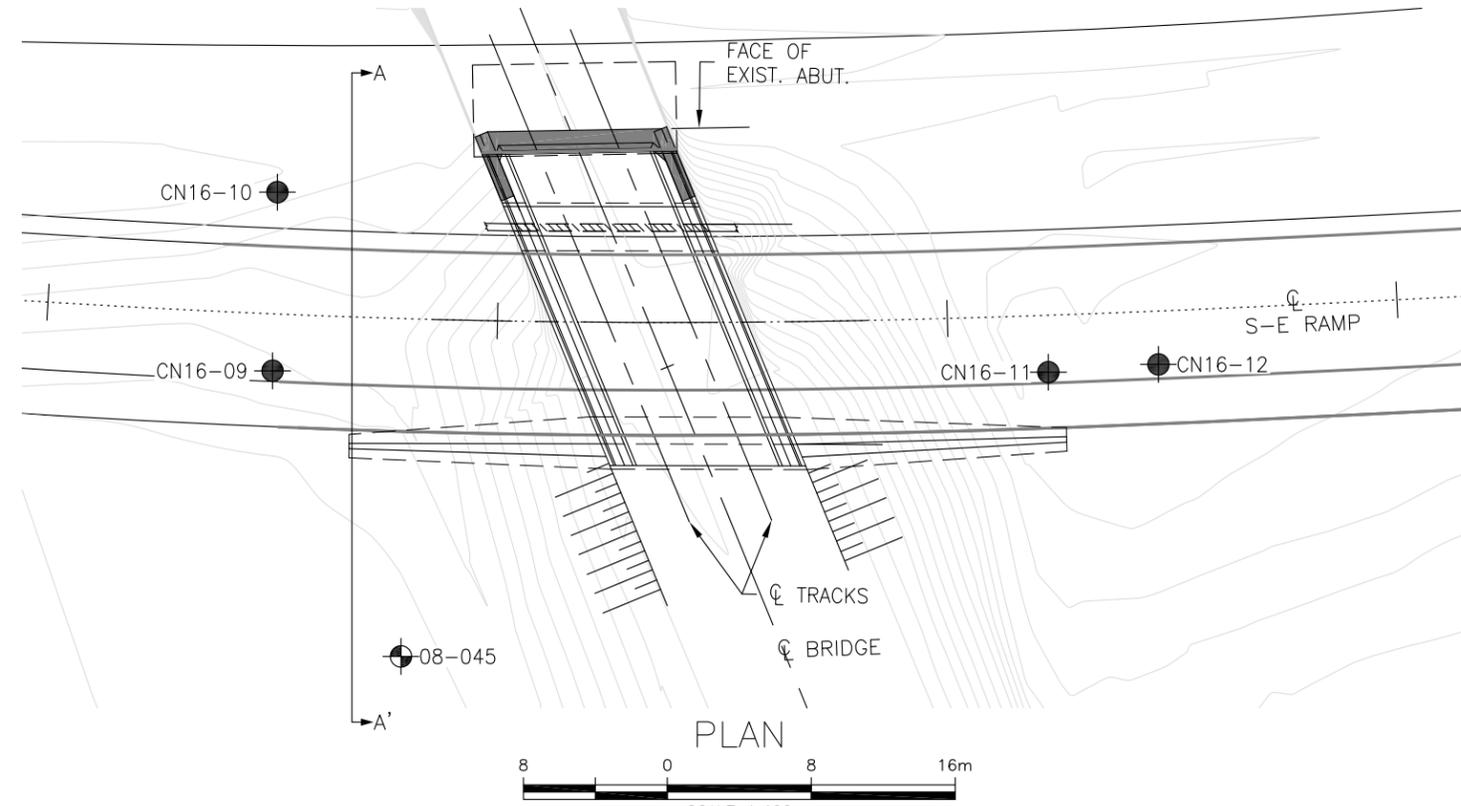
LAB LIMS #: 0A14437-Aug19

REPORT INFORMATION		INVOICE INFORMATION		PROJECT INFORMATION					
Company: <u>Thurber Engineering Ltd</u> Contact: <u>Nancy Berg</u> Address: <u>103 - 2010 Winston Peak Dr</u> <u>Oakville On L6H 5A7</u> Phone: <u>647-633-8417</u> Email: <u>nberg@thurber.ca</u> Email: _____		<input type="checkbox"/> (same as Report Information) Company: _____ Contact: _____ Address: _____ Phone: _____ Email: _____		Quotation #: _____ P.O. #: _____ Project #: <u>11375</u> Site Location/ID: <u>How 7 New, Kitchens</u> TURNAROUND TIME (TAT) REQUIRED TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day <input checked="" type="checkbox"/> Regular TAT (5-7days) <input type="checkbox"/> 1 Day <input type="checkbox"/> 2 Days <input type="checkbox"/> 3 Days <input type="checkbox"/> 4 Days RUSH TAT (Additional Charges May Apply): <input type="checkbox"/> 1 Day <input type="checkbox"/> 2 Days <input type="checkbox"/> 3 Days <input type="checkbox"/> 4 Days PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION Specify Due Date: _____ Rush Confirmation ID: _____					
REGULATIONS Regulation 153/04: Table 1 <input type="checkbox"/> R/P/I Soil Texture: _____ Table 2 <input type="checkbox"/> I/C/C Coarse <input type="checkbox"/> Table 3 <input type="checkbox"/> A/O Medium <input type="checkbox"/> Table <input type="checkbox"/> _____ Fine <input type="checkbox"/> Other Regulations: <input type="checkbox"/> Reg 347/558 (3 Day min TAT) <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> PWQO <input type="checkbox"/> MMER <input type="checkbox"/> CCME <input type="checkbox"/> Other: <input type="checkbox"/> MISA Sewer By-Law: <input type="checkbox"/> Sanitary <input type="checkbox"/> Storm Municipality: _____									
RECORD OF SITE CONDITION (RSC)		DATE SAMPLED		TIME SAMPLED		# OF BOTTLES		MATRIX	
SAMPLE IDENTIFICATION 1 <u>CN16-10 555</u> 2 <u>CN16-04 554</u> 3 <u>CN16-15 554</u> 4 <u>RW24-02 554</u> 5 <u>NE16-09 554</u> 6 _____ 7 _____ 8 _____ 9 _____ 10 _____ 11 _____ 12 _____		July 19/19 July 23/19 July 18/19 Aug 6/19 Aug 7/19		_____ _____ _____ _____ _____		1 1 1 1 1		Soil Soil Soil Soil Soil	
ANALYSIS REQUESTED Field Filtered (Y/N) Metals & Inorganics PAH <input type="checkbox"/> ABN <input type="checkbox"/> SVOC(all) <input type="checkbox"/> PCB Total <input type="checkbox"/> Aroclor <input type="checkbox"/> PHC F1-F4 <input type="checkbox"/> VOC <input type="checkbox"/> BTEX <input type="checkbox"/> BTEX/F1 <input type="checkbox"/> F2-F4 <input type="checkbox"/> VOC <input type="checkbox"/> BTEX <input type="checkbox"/> THM <input type="checkbox"/> Pesticides OC <input type="checkbox"/> OP <input type="checkbox"/> TCLP M&I <input type="checkbox"/> VOC <input type="checkbox"/> PCB <input type="checkbox"/> B(a)P <input type="checkbox"/> ABN <input type="checkbox"/> Igit. <input type="checkbox"/> Water Pkg Gen. <input type="checkbox"/> Ext. <input type="checkbox"/> Sewer Use: _____ COMMENTS: _____									
NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY									
Observations/Comments/Special Instructions									
Sampled By (NAME): <u>Nancy Berg</u> Signature: <u>[Signature]</u> Date: <u>08/15/19</u> (mm/dd/yy)						Pink Copy - Client			
Relinquished by (NAME): <u>Nancy Berg</u> Signature: <u>[Signature]</u> Date: <u>08/15/19</u> (mm/dd/yy)						Yellow & White Copy - SGS			



Appendix D

Borehole Locations and Soil Strata Drawing



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



CONT No
GWP No 408-88-00

HIGHWAY 7
S-E RAMP CONNECTION BRIDGE
UNDER METROLINX TRACKS
BOREHOLE LOCATIONS AND SOIL STRATA



THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

- Borehole (Current Investigation)
- ⊙ Borehole (Previous Investigation By Thurber)
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- ☼ Water Level
- ☼ Head Artesian Water
- ⊥ Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
08-045	322.2	4 814 152.9	226 282.8
CN16-09	321.6	4 814 145.3	226 267.2
CN16-10	319.5	4 814 145.3	226 257.3
CN16-11	318.6	4 814 188.4	226 266.1
CN16-12	318.7	4 814 194.5	226 265.5

-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.
- 3) Coordinate system is MTM NAD 83 Zone 10.

GEORES No. 40P8-279

REVISIONS	DATE	BY	DESCRIPTION

DESIGN	CHK	PKC	CODE	LOAD	DATE
NB	AN				JUL 2020

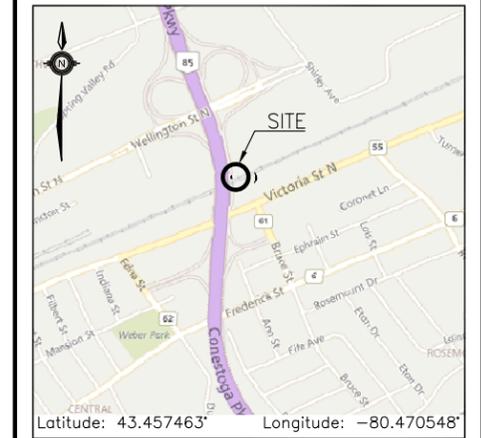
DRAWN	CHK	NB	SITE	STRUCT	DWG
AN					1

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

CONT No
GWP No 408-88-00

HIGHWAY 7
S-E RAMP CONNECTION BRIDGE
UNDER METROLINX TRACKS
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET



KEYPLAN

LEGEND

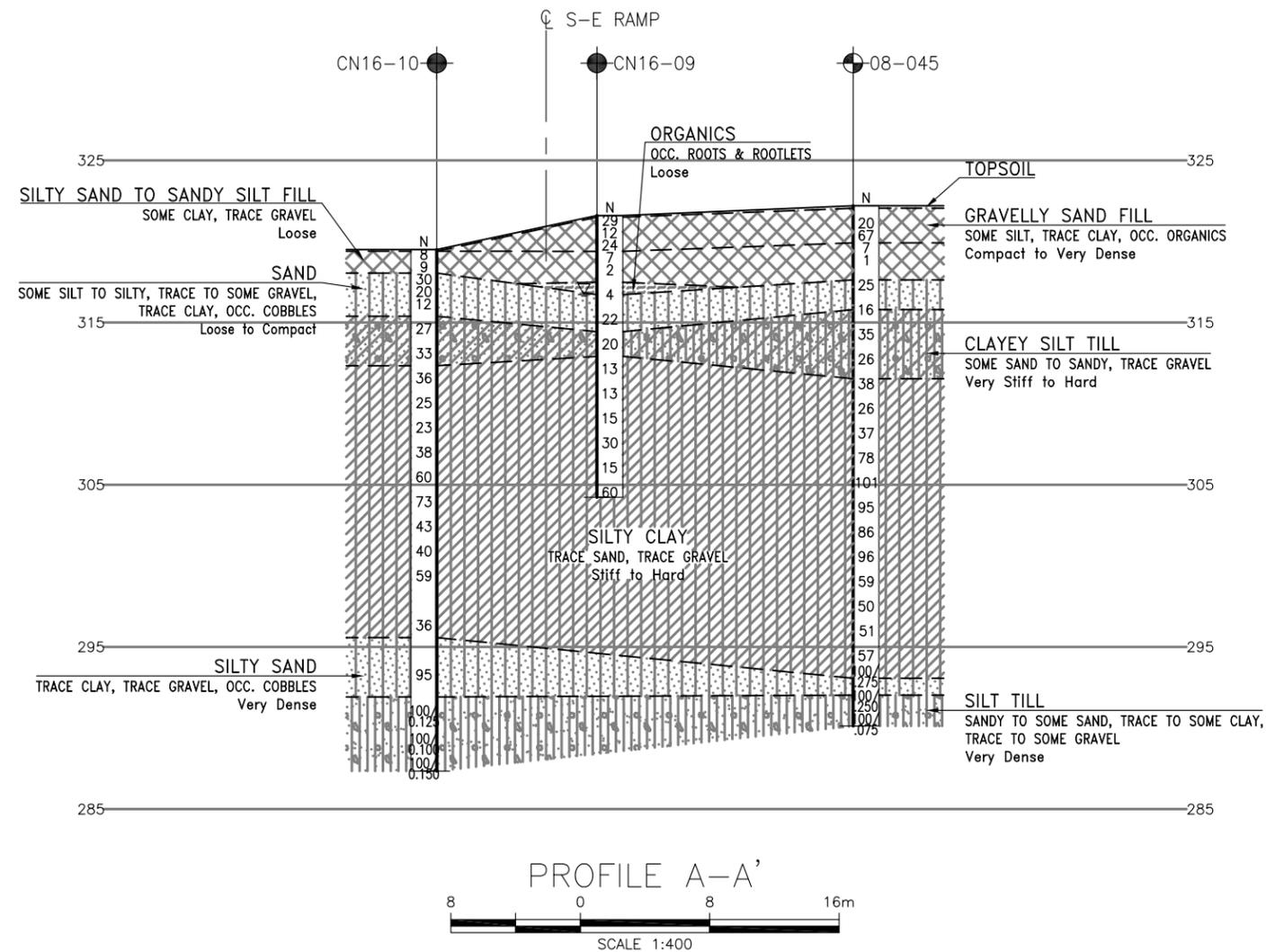
	Borehole (Current Investigation)
	Borehole (Previous Investigation By Thurber)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
08-045	322.2	4 814 152.9	226 282.8
CN16-09	321.6	4 814 145.3	226 267.2
CN16-10	319.5	4 814 145.3	226 257.3
CN16-11	318.6	4 814 188.4	226 266.1
CN16-12	318.7	4 814 194.5	226 265.5

-NOTES-

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- Coordinate system is MTM NAD 83 Zone 10.

GEOCREs No. 40P8-279



REVISIONS	DATE	BY	DESCRIPTION

DESIGN NB	CHK PKC	CODE	LOAD	DATE	JUL 2020
DRAWN AN	CHK NB	SITE	STRUCT	DWG 1	



Appendix E

Site Photographs

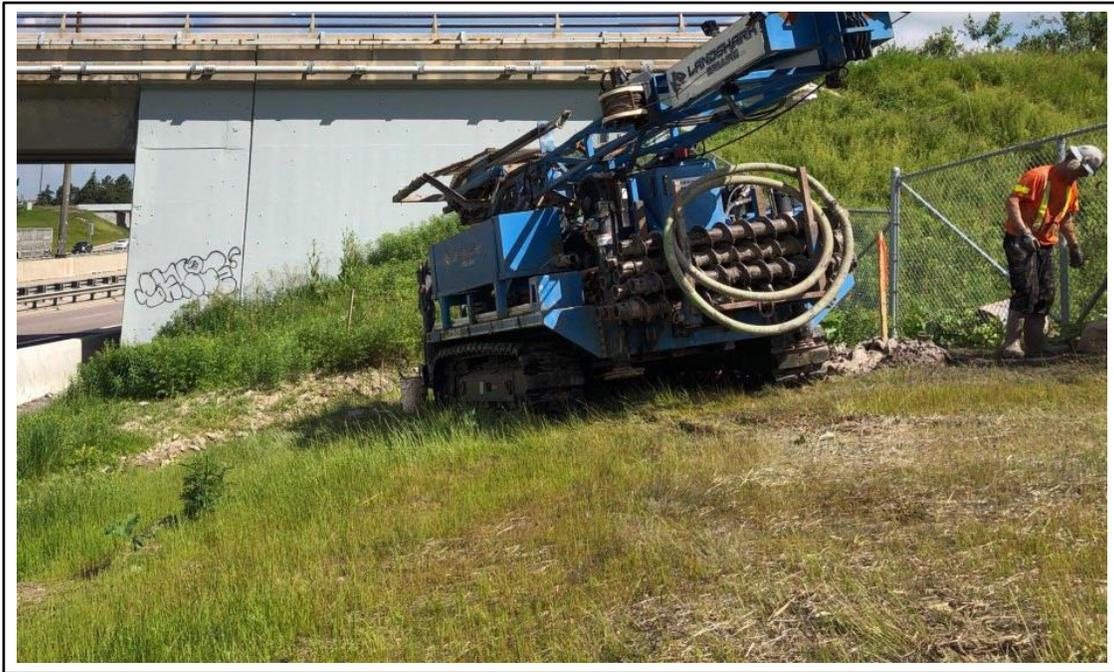


Photo 1: Borehole CN 16-09, looking North at the existing East Abutment of the Metrolinx Bridge



Photo 2: Borehole CN 16-10, looking North at the existing East Abutment of the Metrolinx Bridge



Photo 3: Borehole CN 16-11, looking South at the existing East Abutment of the Metrolinx Bridge



Photo 4: Borehole CN 16-12, looking South at the existing East Abutment of the Metrolinx Bridge