



THURBER ENGINEERING LTD.

**FOUNDATION INVESTIGATION REPORT
N-E/W RAMP OVERPASS OVER GUELPH STREET
HIGHWAY 7-NEW, KITCHENER TO GUELPH
G.W.P. 408-88-00**

GEOCRES No. 40P8-282

Latitude 43.466555 °, Longitude -80.469897 °

Report

to

WSP

Date: August 5, 2020
File: 11375



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PART 1: FACTUAL INFORMATION

1. INTRODUCTION

This report presents the factual findings obtained from a detailed foundation investigation conducted at the site of the proposed N-E/W Ramp over the existing Guelph Street, in the Regional Municipality of Waterloo. The proposed N-E/W Ramp is part of the Highway 7-New Project.

The purpose of the 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, cross-sections, laboratory test results and a written description of the subsurface conditions. A model of the subsurface conditions under the potential foundation footprint was developed from the data obtained in the course of the investigation.

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 the 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, N-E Ramp/N – Wellington Ramp Over Guelph Street, Highway 7-New, Kitchener to Guelph, G.W.P. 408-88-00, Geocres No. 40P8-155, Report to Ministry of Transportation Ontario West Region, File: 15-64-17, dated December 2, 2008. (Reference 1).

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2. SITE DESCRIPTION

The site lies within the Kitchener-Waterloo Expressway (KWE) and Guelph Street interchange. At this location, the proposed N-E/W Ramp will cross over an existing section of Guelph Street. A drainage channel, approximately 4m wide and 0.5 to 1m deep, is located on the south side of Guelph Street at this site, running in an approximate east to west direction below the proposed overpass.

The site lies within an area of industrial and commercial lands and is generally flat.

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 kames or kame moraines, with outwash sands occupying the intervening hollows.

3. INVESTIGATION PROCEDURES

A preliminary investigation was carried out at this site in June 2008. Two boreholes numbered 08-002 and 08-004, were drilled at this site. The depths of Boreholes 08-002 and 08-004 were 15.5 m and 17.0 m (Elevations 292.8 and 291.8), respectively.

A detailed geotechnical investigation was conducted between May 9 and June 13, 2018, and consisted of drilling five boreholes (numbered NE16-01 to NE16-05) at the proposed foundation elements of the ramp, and four boreholes (numbered RW18-01 to RW18-04) for two proposed armour stone retaining walls. Boreholes NE16-01 and NE16-05 were drilled at the north and south approach embankments, respectively, extending to 14.2 m and 17.4 m (Elevations 296.1 and 293.4). Boreholes NE16-02, NE16-03, and NE16-04 were drilled at the approximate locations of the north abutment, pier, and south abutment. The foundation boreholes ranged in depth from 17.0 m to 20.2 m (Elevations 292.9 to 290.4). The boreholes for the armour stone retaining walls ranged in depth from 15.6 m to 18.5 (Elevation 294.5 to 291.2).

The Record of Borehole sheets for the present and previous investigations are included in Appendices A and B, respectively.

The approximate locations of the boreholes are shown on the attached Borehole Locations and Soil Strata Drawing in Appendix C. The coordinates and elevations of the current and previous



boreholes are given on the drawings and on the individual Record of Borehole Sheets in Appendices A and B, respectively.

The ground surface elevations and coordinates of the recent as-drilled boreholes were provided by WSP.

Prior to commencing the site investigation, utility clearances were obtained for all borehole locations. Road occupancy permit was also obtained to complete site investigation.

During the current investigation, a rubber-track mounted B-57 drill rig was used in conjunction with hollow-stem augers, tri-cone and casing advancer methods to advance the boreholes. Samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT) in the overburden soils.

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.

Groundwater conditions in the open boreholes were observed throughout the drilling operations. In Boreholes NE16-02, NE16-04, RW18-01, and RW18-02 a standpipe piezometer consisting of 25 mm diameter PVC pipe with a slotted screen was installed and enclosed in filter sand to permit longer-term groundwater level monitoring. The details of standpipe piezometer installations and borehole completion are summarized in Table 3.1. The completion of the boreholes and the standpipe piezometers were carried out in accordance with the requirements of O. Reg. 903 (as amended by O. Reg. 372/07).



Table 3.1 – Borehole Completion Details

Foundation Unit	Borehole	Ground Surface Elevation (m)	Borehole Depth / Base Elevation (m)	Piezometer Tip Elevation (m)	Completion Details
North Approach	NE16-01	310.2	14.2/296.1	None installed	Borehole backfilled with bentonite holeplug and auger cuttings to surface.
North Abutment	NE16-02	309.9	17.0/292.9	16.7/293.2	Piezometer with 3.0 m slotted screen installed with sand filter to 13 m, bentonite mixed with auger cuttings from 13 m to ground surface.
	08-002	308.3	15.5/292.8	15.3/293.0	Piezometer with 1.5 m slotted screen installed with sand filter to 13.1 m, holeplug from 13.1 m to 12.5 m, grout from 12.5 m to 0.9 m, sand from 0.9 m to 0.6 m, holeplug from 0.6 to 0.15, then concrete to surface.
Pier 1	NE16-03	309.9	18.4/291.4	None installed	Borehole backfilled with bentonite holeplug and auger cuttings to surface.
	08-004	308.8	17.0/291.8	No Installation	Benseal to 5.8 m, holeplug from 5.8 m to 75 mm, then asphalt to surface.
South Abutment	NE16-04	310.6	20.2/290.4	18.3/292.3	Piezometer with 3.0 m slotted screen installed with sand filter to 14 m, bentonite mixed with auger cuttings from 14 m to ground surface.
South Approach	NE16-05	310.8	17.4/293.4	None installed	Borehole backfilled with bentonite holeplug and auger cuttings to surface.
Armour Stone Retaining walls	RW18-01	310.4	18.4/291.9	18.2/292.1	Piezometer with 3.0 m slotted screen installed with sand filter to 14.5 m, bentonite mixed with auger cuttings from 14.5 m to ground surface.
	RW18-02	309.9	18.5/291.4	17.7/292.2	Piezometer with 3.0 m slotted screen installed with sand filter to 14 m, bentonite mixed with auger cuttings from 14 m to ground surface.
	RW18-03	310.1	15.6/294.5	None installed	Borehole backfilled with bentonite holeplug and auger cuttings to surface.
	RW18-04	309.8	18.5/291.2	None installed	Borehole backfilled with bentonite holeplug and auger cuttings 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 grain size analysis and Atterberg Limits testing. All the laboratory tests were carried out in accordance with MTO and/or ASTM Standards, as appropriate. The results of the laboratory testing of current and previous investigations are summarized on the Record of Borehole sheets in Appendices A and B, and also presented on the figures included in Appendices A and B.

In order to assess the potential for sulphate attack on concrete foundations, as well as the potential for corrosion associated with the structure, two soil samples were collected. The samples were submitted to SGS Canada Inc., a CALA accredited analytical laboratory in Lakefield, Ontario, for analytical testing of corrosivity parameters and sulphate content. The results of the analytical testing are summarized in Section 6 and are presented in Appendix A.

5. DESCRIPTION OF SUBSURFACE CONDITIONS

Reference is made to the Record of Borehole sheets in Appendices A and B. Details of the encountered soil stratigraphy along the proposed alignment are presented in these appendices and on the “Borehole Locations and Soil Strata” drawings in Appendix C. 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 site is underlain by silty sand fill and silty clay fill overlaying layers of native sands/silts, silty clay to silty clay till, and sand and silt till. Topsoil was encountered superficially in some boreholes. Descriptions of the individual strata are presented below.

5.1 Topsoil

Topsoil was identified at the ground surface in Boreholes NE16-02, NE16-03, and RW18-03. The topsoil thickness ranged from 75 mm to 150 mm.

The topsoil thickness may vary between and beyond the borehole locations, and the data is not intended for the purpose of estimating quantities.



5.2 Fill

A layer of fill was encountered surfically in Boreholes NE16-01, NE16-04, NE16-05, RW18-01, RW18-02, and RW18-04, below the topsoil in Boreholes NE16-02, NE16-03, and RW18-03 and below asphalt in Boreholes 08-002 and 08-004. The fill consisted of layers of cohesive and cohesionless soils. The cohesionless fill consisted of brown to dark brown silty sand/sandy silt, with trace clay, trace to some gravel and occasional organics. The cohesive fill consisted of brown silty clay containing some sand and occasional organics.

The fill layer ranged in thickness from 1.3 m to 3.7 m. The depth to the base of the fill ranged from 1.4 to 3.7 m (Elevations 308.6 to 305.4).

The cohesionless fill is classified as very loose to compact, based on SPT 'N' values ranging from 3 to 26 blows for 0.3 m of penetration. The natural moisture content ranged from 3 percent to 52 percent. The cohesive fill is classified as soft to very stiff, based on SPT 'N' values ranging from 3 to 22 blows for 0.3 m of penetration. The natural moisture content ranged from 11 percent to 26 percent.

Grain size distribution curves of the cohesive and cohesionless fill are presented on the Record of Borehole sheets in Appendices A and B and on Figures A1 and A2 of Appendix A and Figure B1 of Appendix B. The result of laboratory tests carried out on selected samples are as follows:

Soil Particle	Silty clay fill (%)	Silty sand fill (%)
Gravel	0	3 to 5
Sand	0 to 14	49 to 56
Silt	48 to 73	27
Clay	27 to 38	12 to 22

The results of Atterberg Limits for the cohesive fill are presented on the Record of Borehole sheets and in Figure A7 included in Appendix A. The results of Atterberg Limits testing are summarized below:

Liquid Limit	32
Plastic Limit	19
Plasticity Index	13



The above results show that the cohesive fill is of low plasticity with a group symbol of CL.

5.3 Upper Silty Sand, Sandy Silt, Sand and Silt

Layers of native brown to grey silty sand, sandy silt and, sand and silt containing trace clay to clayey, trace to some gravel, and occasional cobbles and boulders were contacted below the fill at depths ranging from 2.2 m to 3.0 m (Elevations 308.1 to 306.9) in Boreholes NE16-03, NE16-04 and RW18-01 to RW18-04. Sand and silt was also encountered at 4.3 m depth in Borehole RW18-03. The thickness of the silty sand, sandy silt and, sand and silt layers ranged from 0.7 m to 3.4 m. The depth to the base of the silty sand, sandy silt and, sand and silt ranged from 3.0 m to 6.1 m (Elevations 307.3 to 304.2).

A 1.3-m thick layer of silty clay was encountered within the sand and silt layer at 3.0 m depth (Elevation 307.1) in Borehole RW18-03.

The SPT 'N' values of the silty sand, sandy silt and, sand and silt layers ranged from 5 to 31 blows per 0.3 m of penetration indicating a loose to dense relative density. The natural moisture contents generally lay in the range of 9 percent to 21 percent.

Grain size distribution curves for the silty sand, sandy silt and, sand and silt samples tested are presented on the Record of Borehole sheets in Appendix A in Figure A3. The results of gradation tests carried out on selected sampled are summarized follows:

Soil Particles	Percentage (%)
Gravel	0
Sand	37 to 79
Silt	19 to 57
Clay	2 to 10



5.4 Silty Clay

Brown to grey silty clay with trace to some sand and trace gravel was encountered below the fill and silty sand/sandy silt/sand and silt layers at depths ranging from 1.4 m to 6.1 m (Elevations 308.6 to 304.2) in all of the boreholes. The silty clay layer ranged in thickness from 7.3 m to greater than 15.4 m.

A 300-mm thick layer of silty sand was contacted within the silty clay near Elevation 295.6 in Borehole NE16-05.

The depth to the base of the silty clay ranged from 11.9 m to 16.3 (Elevations 298.0 to 294.5) in all the boreholes, except in Borehole RW18-01. Borehole RW18-01 was terminated in the silty clay layer at a depth of 18.4 m (Elevation 291.9).

SPT 'N' values in the silty clay ranged from 2 to 46 blows per 0.3 m of penetration, indicating a soft to hard consistency. SPT 'N' values of 88 blows per 0.3 m of penetration to greater than 100 blows per 0.15 m of penetration, indicating a hard consistency, were measured below Elevation 294.0 in Borehole RW18-01. The natural moisture contents generally lay in the range of 15 percent to 33 percent.

Grain size distribution curves for the silty clay samples tested are presented on the Record of Borehole sheets in Figure A4 of Appendix A. The results of gradation tests carried out on selected samples are summarized follows:

Soil Particles	Percentage (%)
Gravel	0
Sand	0 to 13
Silt	29 to 47
Clay	53 to 64

The results of Atterberg Limits are presented on the Record of Borehole sheets and in Figures A8 and A9 included in Appendix A. The results of Atterberg Limits testing are summarized below:

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Liquid Limit	36 to 47
Plastic Limit	17 to 21
Plasticity Index	18 to 26

The above results show that the silty clay is of medium plasticity with a group symbol of CI.

5.5 Lower Sand

Native grey sand containing trace to some silt, trace gravel and trace of clay was contacted in Borehole 08-004 at a depth of 12.2 m (Elevation 296.6).

Thickness of the lower sand layer was 1.5 m. The depth to the base of the sand layer was 13.7 m (Elevation 295.1).

The sand is classified as very dense, based on SPT 'N' value of 90 blows for 0.3 m of penetration. The natural moisture content measured was 20 percent.

Grain size distribution curve for a sand sample, is presented on the Record of Borehole sheets in Appendix B and on Figure B2 of Appendix B. The results of the laboratory test are summarized as follows:

Soil Particles	Percent (%)
Gravel	2
Sand	85
Silt & Clay	13

5.6 Silty Clay Till

Grey silty clay till layers containing some sand to sandy, trace gravel and occasional cobbles were encountered below the silty clay at 11.9 m and 13.3 m depth (Elevations 298.0 and 296.5) in Boreholes RW18-02 and RW18-04 and below the fill at depths of 2.9 m to 3.0 m (Elevation 305.8 to 305.4) in Boreholes 08-002 and 08-004. The silty clay till layers were 2.1 m and 4.8 m in thickness in Boreholes RW18-04 and RW18-02. The till thickness ranged from 8.2 m to 9.2 m in Borehole 08-002 and 08-004.



The depth to the base of the silty clay till was at 16.7 m and 15.4 m (Elevations 293.2 and 294.4) in Borehole RW18-02 and RW18-04, respectively. The depth to the base of till were 11.1 m and 12.2 m (Elevation 297.2 and 296.6) in Borehole 08-002 and 08-004.

SPT 'N' values in the silty clay till ranged from 20 to 68 blows per 0.3 m of penetration, indicating a very stiff to hard consistency. The natural moisture contents generally lay in the range of 15 percent to 31 percent.

Grain size distribution curves for the silty clay till samples tested are presented on the Record of Borehole sheets in Appendices A and B and on Figure A5 of Appendix A and Figure B3 of Appendix B. The results of gradation tests carried out on selected sampled are summarized follows:

Soil Particles	Percentage (%)
Gravel	0 to 4
Sand	1 to 39
Silt	21 to 59
Clay	19 to 78

The results of Atterberg Limits are presented on the Record of Borehole sheets and in Figures B5 included in Appendix B. The results of Atterberg Limits testing are summarized below:

Liquid Limit	41 to 51
Plastic Limit	18 to 22

The above results show that the silty clay till is of medium to high plasticity with a group symbol of CI-CH.

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

5.7 Sand and Silt Till

A deposit of native grey sand and silt till containing some clay to clayey and trace to some gravel and occasional boulders was contacted below the silty clay and silty clay till at depths ranging



from 11.1 m to 16.7 m (Elevations 293.2 to 297.2) in all the boreholes, except in Borehole RW18-01.

All of the boreholes, except Borehole RW18-01, were terminated within the sand and silt till at depths ranging from 14.2 m to 20.2 m (Elevation 296.1 to 290.4).

The SPT 'N' values of the sand and silt till ranged from 50 to over 100 blows per 0.3 m of penetration indicating a very dense state. The natural moisture contents generally lay in the range of 6 percent to 19 percent.

Grain size distribution curves for the sand and silt till samples tested are presented on the Record of Borehole sheets in Appendices A and B and on Figure A6 of Appendix A and Figure B4 in Appendix B. The results of gradation tests carried out on selected sampled are summarized follows:

Soil Particles	Percentage (%)
Gravel	0 to 17
Sand	29 to 50
Silt	30 to 55
Clay	10 to 24

The results of Atterberg Limits conducted on the clayey zone encountered within the sand and silt till, are presented on the Record of Borehole sheets and in Figure A10 included in Appendix A. The results of Atterberg Limits testing are summarized below:

Liquid Limit	16
Plastic Limit	11
Plasticity Index	5

The above results show that the clayey zone of the sand and silt till is of low plasticity with a group symbol of CL-ML.

Glacial tills inherently contain cobbles and boulders.



5.8 Groundwater Conditions

Groundwater conditions were observed during drilling operations, and groundwater levels were measured in the open boreholes upon completion of drilling. Standpipe piezometers were installed in Boreholes NE16-02, NE16-04, RW18-01, and RW18-02 to monitor the groundwater level at the site. The groundwater levels measured in the open boreholes and in the standpipe piezometers are summarized below.

Table 5.1 – Water Level Measurements

Foundation Unit	Borehole	Date	Water Level (m)		Remark
			Depth	Elevation	
North Approach	NE16-01	June 11, 2018	Dry	-	Open Borehole
North Abutment	NE16-02	June 25, 2018	2.8	307.1	Piezometer
	08-002	July 16, 2008	5.5	302.8	Piezometer
		Aug. 20, 2008	5.5	302.8	
Pier 1	NE16-03	June 12, 2018	13.6	296.3	Open Borehole
	08-004	June 11, 2008	1.5	307.3	Open Borehole
South Abutment	NE16-04	May 16, 2018	3.1	307.5	Piezometer
		May 31, 2018	3.0	307.6	
		June 25, 2018	3.5	307.1	
South Approach	NE16-05	June 14, 2018	Water level not taken due to the use of mud while drilling		-
Amour Stone Retaining Walls	RW18-01	June 25, 2018	3.5	306.9	Piezometer
	RW18-02	May 14, 2018	2.8	307.1	Piezometer
		May 31, 2018	2.7	307.2	
		June 25, 2018	2.7	307.2	
	RW18-03	June 13, 2018	4.7	305.4	Open Borehole
	RW18-04	May 10, 2018	Water level not taken due to the use of mud while drilling		-



The groundwater levels above are short-term readings, and seasonal fluctuations of the groundwater levels 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

Samples of the silty sand fill and native silty sand from Boreholes NE16-04 and RW18-04 were 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 A.

Table 6.1 – Analytical Test Results

Parameter	Units (Soil)	Test Results	Test Results
		RW18-04 SS 4 Depth 2.3 m	NE16-04 SS 4 Depth 2.4 m
		Silty sand	Silty sand fill
Sulphide	%	<0.02	0.03
Chloride	µg/g	200	100
Sulphate	µg/g	130	130
pH	No unit	8.16	8.72
Electrical Conductivity	µS/cm	300	291
Resistivity	Ohms.cm	3330	3440
Redox Potential	mV	192	217

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 present investigation.

The coordinates for the boreholes were obtained with GPS equipment by Thurber, and the elevations were provided by WSP.

The drilling and sampling operations in the field for the current investigation 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 current report was carried out by Ms. R. Palomeque Reyna, P.Eng. 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.

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Appendix A

Record of Borehole Sheets, Laboratory Test Results, and Analytical Laboratory Test Results (Current 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

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


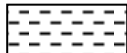



 Water Level
 Shear Strength Determination by Pocket Penetrometer

- (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	Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Very thinly bedded	20 to 60mm				
Laminated	6 to 20mm	Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
Thinly Laminated	Less than 6mm				
<u>TERMS</u>		Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length.	Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
Solid Core Recovery: (SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run.	Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail
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 NE16-01

1 OF 2

METRIC

GWP# 408-88-00 LOCATION N-E/W Ramp over Guelph Street, MTM NAD 83 Zone 10: N 4 814 741.0 E 225 955.1 ORIGINATED BY AF
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2018.06.11 - 2018.06.11 LATITUDE 43.468430 LONGITUDE -80.474466 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								20 40 60 80 100					
310.2	GROUND SURFACE												
0.0	Silty SAND, some gravel, occasional rootlets and organics Compact to Loose Brown to Dark Brown Moist (FILL)		1	SS	12								
			2	SS	8								
308.0													
2.3	Silty CLAY, trace gravel, trace sand Stiff to Very Stiff Brown Moist		3	SS	16								
	Grey		4	SS	14								
			5	SS	14								
			6	SS	22								
			7	SS	17								
			8	SS	19								

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+³, ×³: Numbers refer to Sensitivity

20
15 10 5 0
(%) STRAIN AT FAILURE

ONTMT4S2 MTO-11375(GINTDATA)GPJ 2017TEMPLATE(MTO).GDT 5/19/20

RECORD OF BOREHOLE No NE16-01

2 OF 2

METRIC

GWP# 408-88-00 LOCATION N-E/W Ramp over Guelph Street, MTM NAD 83 Zone 10: N 4 814 741.0 E 225 955.1 ORIGINATED BY AF
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2018.06.11 - 2018.06.11 LATITUDE 43.468430 LONGITUDE -80.474466 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								20 40 60 80 100					
	Continued From Previous Page												
	Silty CLAY, trace gravel, trace sand Very Stiff Grey Moist		9	SS	16		300						
							299						
			10	SS	19		298						
297.0							297						
13.3	SAND and SILT, some gravel, some clay Very Dense Grey Moist (TILL)		11	SS	100								16 39 30 15
296.1													
14.2	END OF BOREHOLE AT 14.2m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.												

ONTMT4S2 MTO-11375(GINTDATA)\GPU 2017TEMPLATE(MTO).GDT 5/19/20

METRIC

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+³, ×³: Numbers refer to Sensitivity

ONTMT4S2 MTO-11375(GINTDATA).GPJ 2017TEMPLATE(MTO).GDT 5/19/20

RECORD OF BOREHOLE No NE16-02

2 OF 2

METRIC

GWP# 408-88-00 LOCATION N-E/W Ramp over Guelph Street, MTM NAD 83 Zone 10: N 4 814 729.5 E 225 959.7 ORIGINATED BY AF
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers/Mud Rotary COMPILED BY MP
 DATUM Geodetic DATE 2018.06.10 - 2018.06.10 LATITUDE 43.468327 LONGITUDE -80.474407 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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE								
	Continued From Previous Page															
	Silty CLAY, trace gravel, trace sand Very Stiff to Stiff Grey Moist		9	SS	26		299									
							298									
			10	SS	13											
296.7							297									
13.3	SAND and SILT, some gravel, some clay, occasional boulders Very Dense Grey Moist (TILL)		11	SS	100/ 0.275		296									
							295									
			12	SS	100/ 0.150											
							294									
292.9			13	SS	100/ 0.125		293									
17.0	END OF BOREHOLE AT 17.0m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.0m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2018.06.25 2.8 307.1															

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RECORD OF BOREHOLE No NE16-03

1 OF 2

METRIC

GWP# 408-88-00 LOCATION N-E/W Ramp over Guelph Street, MTM NAD 83 Zone 10: N 4 814 698.6 E 225 965.5 ORIGINATED BY AF
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers/Mud Rotary COMPILED BY MP
 DATUM Geodetic DATE 2018.06.12 - 2018.06.12 LATITUDE 43.468050 LONGITUDE -80.474330 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							WATER CONTENT (%) PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT w _p w w _L			
309.9	GROUND SURFACE							20	40	60	80	100						
0.0 0.1	TOPSOIL: (75mm) Silty SAND, some clay, trace gravel Compact to Very Loose Brown Moist (FILL)						309							○				5 56 27 12
			1	SS	11													
			2	SS	3		308								○			
307.7																		
2.2	Silty SAND, trace to some gravel, trace clay Loose to Compact Brown Moist		3	SS	23		307							○				
			4	SS	5										○			
							306											
	occasional boulders		5	SS	16		305							○				
304.2																		
5.6	Silty CLAY, trace sand, trace gravel Very Stiff Grey Moist		6	SS	25		304								○			
							303											
			7	SS	27		302								○			
							301									○		
			8	SS	20													
							300											

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+³, ×³: Numbers refer to
Sensitivity

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(%) STRAIN AT FAILURE



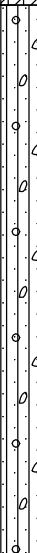



ONTMT4S2 MTO-11375(GINTDATA)\GPJ 2017TEMPLATE(MTO).GDT 5/19/20

RECORD OF BOREHOLE No NE16-03

2 OF 2

METRIC

GWP# 408-88-00 LOCATION N-E/W Ramp over Guelph Street, MTM NAD 83 Zone 10: N 4 814 698.6 E 225 965.5 ORIGINATED BY AF
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers/Mud Rotary COMPILED BY MP
 DATUM Geodetic DATE 2018.06.12 - 2018.06.12 LATITUDE 43.468050 LONGITUDE -80.474330 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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)				GR	SA	SI	CL	
								20 40 60 80 100	W _P W W _L											
Continued From Previous Page																				
295.1 14.8	Silty CLAY, trace sand Very Stiff to Hard Grey Moist		9	SS	18		299										0	7	30	63
			10	SS	23															
			11	SS	46															
291.4 18.4	SAND and SILT, some clay to clayey, trace gravel Very Dense Grey Moist (TILL)		12	SS	100/ 0.100		295													
			13	SS	100/ 0.175															
291.4 18.4	END OF BOREHOLE AT 18.4m. WATER LEVEL AT 13.6m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.		14	SS	100/ 0.150															

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RECORD OF BOREHOLE No NE16-04

1 OF 3

METRIC

GWP# 408-88-00 LOCATION N-E/W Ramp over Guelph Street, MTM NAD 83 Zone 10: N 4 814 679.8 E 225 980.2 ORIGINATED BY JP
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers/Casing Advance COMPILED BY MP
 DATUM Geodetic DATE 2018.05.10 - 2018.05.11 LATITUDE 43.467882 LONGITUDE -80.474146 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							PLASTIC LIMIT w _p NATURAL MOISTURE CONTENT w LIQUID LIMIT w _L	
310.6	GROUND SURFACE						20	40	60	80	100	20	40	60		
0.0	Silty CLAY, some sand, trace gravel Firm Brown Moist (FILL)		1	SS	6							○				
												○				
			2	SS	8							○				0 14 48 38
309.1																
1.5	Silty SAND, trace to some gravel, trace clay Loose to Compact Brown Moist (FILL)		3	SS	5							○				
	occasional organics		4	SS	17								○			
307.6																
3.0	Sandy SILT, trace gravel, occasional cobbles Compact Grey Wet		5	SS	20							○				
			6	SS	13							○				
304.5																
6.1	Silty CLAY, trace gravel, trace sand Very Stiff Grey Moist		7	SS	18							○				
			8	SS	18							○				
			9	SS	29							○				

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+³, ×³: Numbers refer to
Sensitivity

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(%) STRAIN AT FAILURE

ONTMT4S2 MTO-11375(GINTDATA)\GPJ 2017TEMPLATE(MTO).GDT 5/19/20

METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		NATURAL MOISTURE CONTENT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT w _p		
	Continued From Previous Page											
	Silty CLAY, trace sand Very Stiff Grey Moist		10	SS	24		300					
			11	SS	20		298					0 0 36 64
			12	SS	26		297					
295.7							296					
14.9	SAND and SILT, some clay, trace gravel Very Dense Grey Wet (TILL)		13	SS	50		295					
			14	SS	102/ 0.225		294					
			15	SS	100/ 0.100		292					
							291					

(%) STRAIN AT FAILURE

CONTMT4S2 MTO-11375(GINTDATA).GPJ 2017TEMPLATE(MTO).GDT 5/19/20

RECORD OF BOREHOLE No NE16-04

3 OF 3

METRIC

GWP# 408-88-00 LOCATION N-E/W Ramp over Guelph Street, MTM NAD 83 Zone 10: N 4 814 679.8 E 225 980.2 ORIGINATED BY JP
DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers/Casing Advance COMPILED BY MP
DATUM Geodetic DATE 2018.05.10 - 2018.05.11 LATITUDE 43.467882 LONGITUDE -80.474146 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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
290.4	SAND and SILT: (TILL)	q	16	SS	135/												
20.2	END OF BOREHOLE AT 20.2m. Piezometer installation consists of 50mm diameter Schedule 40 PVC pipe with a 3.0m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2018.05.16 3.1 307.5 2018.05.31 3.0 307.6 2018.06.25 3.5 307.1				0.200												

ONTMT4S2 MTO-11375(GINTDATA).GPJ 2017TEMPLATE(MTO).GDT 5/19/20

RECORD OF BOREHOLE No NE16-05

1 OF 2

METRIC

GWP# 408-88-00 LOCATION N-E/W Ramp over Guelph Street, MTM NAD 83 Zone 10: N 4 814 667.0 E 225 983.9 ORIGINATED BY JP
DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers/Casing Advance COMPILED BY MP
DATUM Geodetic DATE 2018.05.11 - 2018.05.14 LATITUDE 43.467767 LONGITUDE -80.474099 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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)				GR	SA	SI	CL		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	20	40	60	80	100	W _P		W	W _L				
310.8	GROUND SURFACE																				
0.0	Silty SAND to Sandy SILT, trace gravel, trace to some clay Loose to Compact Brown Wet (FILL)		1	SS	5								○								
			2	SS	5								○								
			3	SS	11								○								
			4	SS	26								○								
			5	SS	12									○							
307.1																					
3.7	Silty CLAY, trace sand, trace gravel Very Stiff to Hard Grey Moist																				
			6	SS	15								○								
			7	SS	23								○								
			8	SS	30								○	—				0	0	38	62
			9	SS	29								○								

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

ONTMT4S2 MTO-11375(GINTDATA)\GPJ 2017TEMPLATE(MTO).GDT 5/19/20

RECORD OF BOREHOLE No NE16-05

2 OF 2

METRIC

GWP# 408-88-00 LOCATION N-E/W Ramp over Guelph Street, MTM NAD 83 Zone 10: N 4 814 667.0 E 225 983.9 ORIGINATED BY JP
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers/Casing Advance COMPILED BY MP
 DATUM Geodetic DATE 2018.05.11 - 2018.05.14 LATITUDE 43.467767 LONGITUDE -80.474099 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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)				GR	SA	SI	CL	
								20 40 60 80 100	W _P W W _L											
Continued From Previous Page																				
	Silty CLAY, trace sand, trace gravel Very Stiff Grey Moist						300													
			10	SS	20															
								299												
			11	SS	28															
								298												
			12	SS	20		297													
							296													
295.6																				
15.2	Silty SAND, trace gravel																			
295.3	Grey		13	SS	26															
15.5	Wet							295												
294.5																				
16.3	SAND and SILT, some clay, trace gravel Very Dense Grey Wet (TILL)						294													
			14	SS	100															
293.4																				
17.4	END OF BOREHOLE AT 17.4m. BOREHOLE OPEN UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.																			

ONTMT4S2 MTO-11375(GINTDATA)GPJ 2017TEMPLATE(MTO).GDT 5/19/20

+³, ×³: Numbers refer to
Sensitivity

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(%) STRAIN AT FAILURE

METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT						UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT w _P w w _L WATER CONTENT (%)							
310.4	GROUND SURFACE														
0.0	Silty SAND , some gravel, trace gravel Compact Brown Moist (FILL)		1	SS	13										
308.9															
1.5	Silty CLAY , trace sand, occasional organics and rootlets Soft Brown Moist (FILL)		2	SS	4										
308.1															
2.3	SAND and SILT , trace gravel, occasional rootlets Compact Brown Moist		3	SS	20										
307.3															
3.0	Silty CLAY , some sand Stiff to Hard Grey Moist		4	SS	11										
			5	SS	24										
			6	SS	16										
			7	SS	38										
			8	SS	12										

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No RW18-01

2 OF 2

METRIC

GWP# 408-88-00 LOCATION Retaining Wall 18, MTM NAD 83 Zone 10: N 4 814 668.4 E 225 945.1 ORIGINATED BY AF
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2018.06.11 - 2018.06.11 LATITUDE 43.467775 LONGITUDE -80.474578 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 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						
	Silty CLAY , trace sand Very Stiff Grey Moist		9	SS	28		300									
							299									
			10	SS	21		298									
							297									
			11	SS	15		296									
							295									
	Hard		12	SS	30		294									
							293									
			13	SS	88											
291.9			14	SS	100/		292									0 4 42 54
18.4	END OF BOREHOLE AT 18.4m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.0m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2018.06.25 3.5 306.9				0.150											

ONTMT452 MTO-11375.GPJ 2017TEMPLATE(MTO).GDT 10/19/18

RECORD OF BOREHOLE No RW18-02

1 OF 3

METRIC

GWP# 408-88-00 LOCATION Retaining Wall 18, MTM NAD 83 Zone 10: N 4 814 657.2 E 225 955.6 ORIGINATED BY JP
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers/Casing Advance COMPILED BY MP
 DATUM Geodetic DATE 2018.05.09 - 2018.05.09 LATITUDE 43.467676 LONGITUDE -80.474447 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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)				
								20 40 60 80 100				w _P w w _L				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE								
309.9	GROUND SURFACE															
0.0	Silty CLAY , some sand, with organics Soft to Very Stiff Brown Moist (FILL) Layer of silty sand (300mm)		1	SS	3											
			2	SS	12		309									
			3	SS	12		308									
			4	SS	22											
306.9							307								0 0 73 27	
3.0	SAND and SILT , trace clay, occasional cobbles Loose Brown Wet		5	SS	8										0 37 57 6	
							306									
305.3																
4.6	Silty CLAY , trace sand Stiff to Very Stiff Grey Moist		6	SS	10		305									
							304									
			7	SS	22											
							303									
			8	SS	22		302									
							301									
			9	SS	30											
	Hard						300									

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No RW18-02

2 OF 3

METRIC

GWP# 408-88-00 LOCATION Retaining Wall 18, MTM NAD 83 Zone 10: N 4 814 657.2 E 225 955.6 ORIGINATED BY JP
DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers/Casing Advance COMPILED BY MP
DATUM Geodetic DATE 2018.05.09 - 2018.05.09 LATITUDE 43.467676 LONGITUDE -80.474447 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						WATER CONTENT (%) PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT w _P w w _L			
	Continued From Previous Page							20	40	60	80	100					
298.0	Silty CLAY , some sand, trace gravel Hard Grey Moist		10	SS	35												
11.9	Silty CLAY , some sand to sandy, trace gravel Very Stiff to Hard Grey Moist (TILL)		11	SS	28												
			12	SS	35												
			13	SS	49												
293.2																	
16.7	SAND and SILT , some clay, trace sand Very Dense Grey Moist (TILL)		14	SS	95												
	Clayey zone at 18.1m																
291.4			15	SS	50/												
18.5	END OF BOREHOLE AT 18.5m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 3.0m slotted screen.				0.075												

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

METRIC

[illegible]

RECORD OF BOREHOLE No RW18-03

1 OF 2

METRIC

GWP# 408-88-00 LOCATION Retaining Wall 18, MTM NAD 83 Zone 10: N 4 814 690.4 E 225 966.9 ORIGINATED BY AF
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2018.06.13 - 2018.06.13 LATITUDE 43.467976 LONGITUDE -80.474313 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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa			WATER CONTENT (%)							
								20 40 60 80 100			w _P w w _L							
						○ UNCONFINED + FIELD VANE												
						● QUICK TRIAXIAL x LAB VANE												
310.1	GROUND SURFACE																	
0.0	TOPSOIL: (150mm)																	
0.2	Silty SAND , trace gravel, occasional organics Compact to Loose Brown Moist (FILL)		1	SS	25		310											
							309						○					
			2	SS	4									○				
307.8							308											
2.3	SAND and SILT , some gravel Dense Brown Wet		3	SS	31								○					
307.1							307						○					
3.0	Silty CLAY , trace sand, trace gravel Very Stiff Grey Moist		4	SS	18													
305.9							306											
4.3	SAND and SILT , trace to some clay Compact Grey Wet		5	SS	20		305						○					
304.5																		
5.6	Silty CLAY , trace sand, trace gravel Very Stiff to Hard Grey Moist		6	SS	24		304						○					
							303											
			7	SS	21		302						○					
			8	SS	33		301						○					

Continued Next Page

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

RECORD OF BOREHOLE No RW18-03

2 OF 2

METRIC

GWP# 408-88-00 LOCATION Retaining Wall 18, MTM NAD 83 Zone 10: N 4 814 690.4 E 225 966.9 ORIGINATED BY AF
DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP
DATUM Geodetic DATE 2018.06.13 - 2018.06.13 LATITUDE 43.467976 LONGITUDE -80.474313 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 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 W W _L								
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					WATER CONTENT (%)								
	Continued From Previous Page							20	40	60	80	100									
	Silty CLAY , trace sand, trace gravel Very Stiff to Hard Grey Moist						300														
			9	SS	31		299														
							298														
			10	SS	19		297														
							296														
			11	SS	33		295														
295.3																					
14.8	SAND and SILT , some clay, trace gravel Very Dense Grey Moist (TILL)(Clayey zone)		12	SS	100/ 0.225																
294.5																					
15.6	END OF BOREHOLE AT 11.0m. WATER LEVEL AT 4.7m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.																				

ONTMT452 MTO-11375.GPJ 2017TEMPLATE(MTO).GDT 10/19/18

RECORD OF BOREHOLE No RW18-04

1 OF 2

METRIC

GWP# 408-88-00 LOCATION Retaining Wall 18, MTM NAD 83 Zone 10: N 4 814 681.7 E 225 972.5 ORIGINATED BY JP
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers/Casing Advance COMPILED BY MP
 DATUM Geodetic DATE 2018.05.09 - 2018.05.10 LATITUDE 43.467898 LONGITUDE -80.474242 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE LIQUID CONTENT LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa			WATER CONTENT (%)					
								○ UNCONFINED + FIELD VANE	● QUICK TRIAXIAL × LAB VANE							
								20 40 60 80 100		20 40 60						
309.8	GROUND SURFACE															
0.0	Sandy SILT , some clay, trace gravel Very Loose to Loose Brown Moist (FILL)		1	SS	3											
			2	SS	4											
			3	SS	5											
307.6																
2.2	Silty SAND , trace gravel, trace clay, occasional cobbles Compact Grey Wet		4	SS	11											
			5	SS	11											
305.2																
4.6	Silty CLAY , trace to some sand Stiff to Very Stiff Grey Moist		6	SS	27											
			7	SS	15											
			8	SS	14											
			9	SS	29											

Continued Next Page

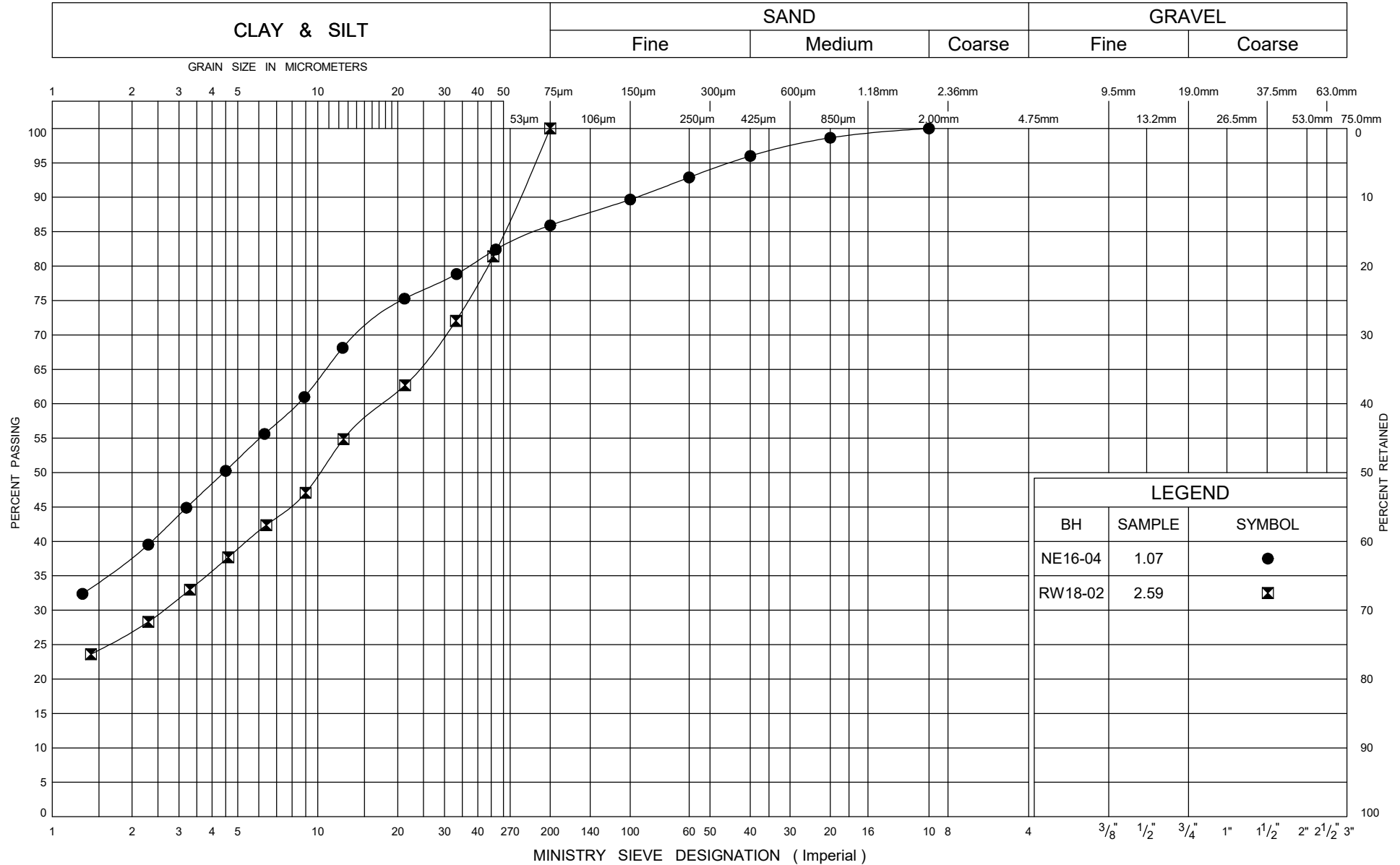
+³, ×³: Numbers refer to Sensitivity 20 15 10 5 0 (%) STRAIN AT FAILURE

METRIC

[illegible]

+³, ×³: Numbers refer to Sensitivity

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

Silty Clay Fill

FIG No A1

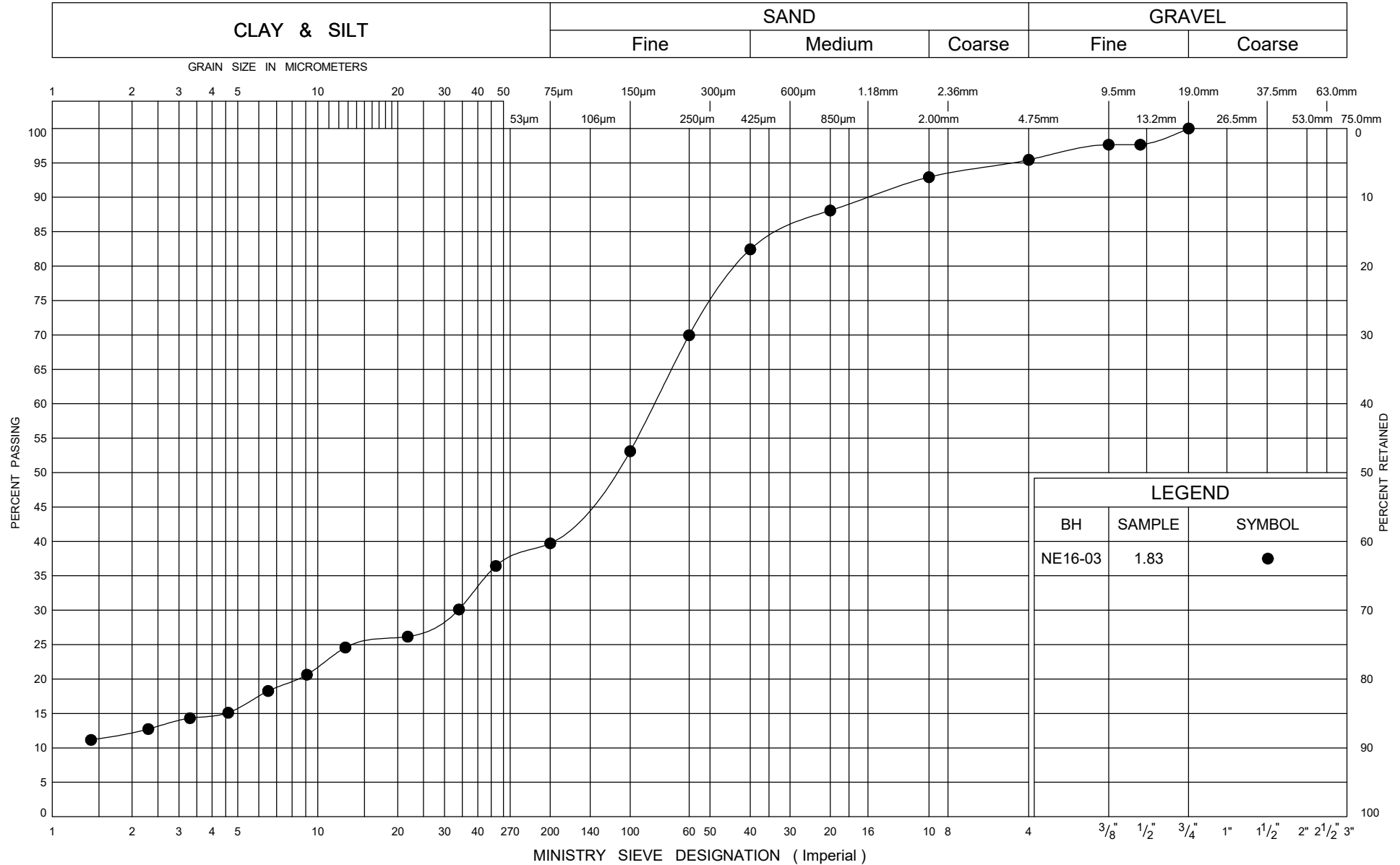
W P 408-88-00

N-E/W Ramp over Guelph Street



Ministry of
Transportation

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

GRAIN SIZE DISTRIBUTION

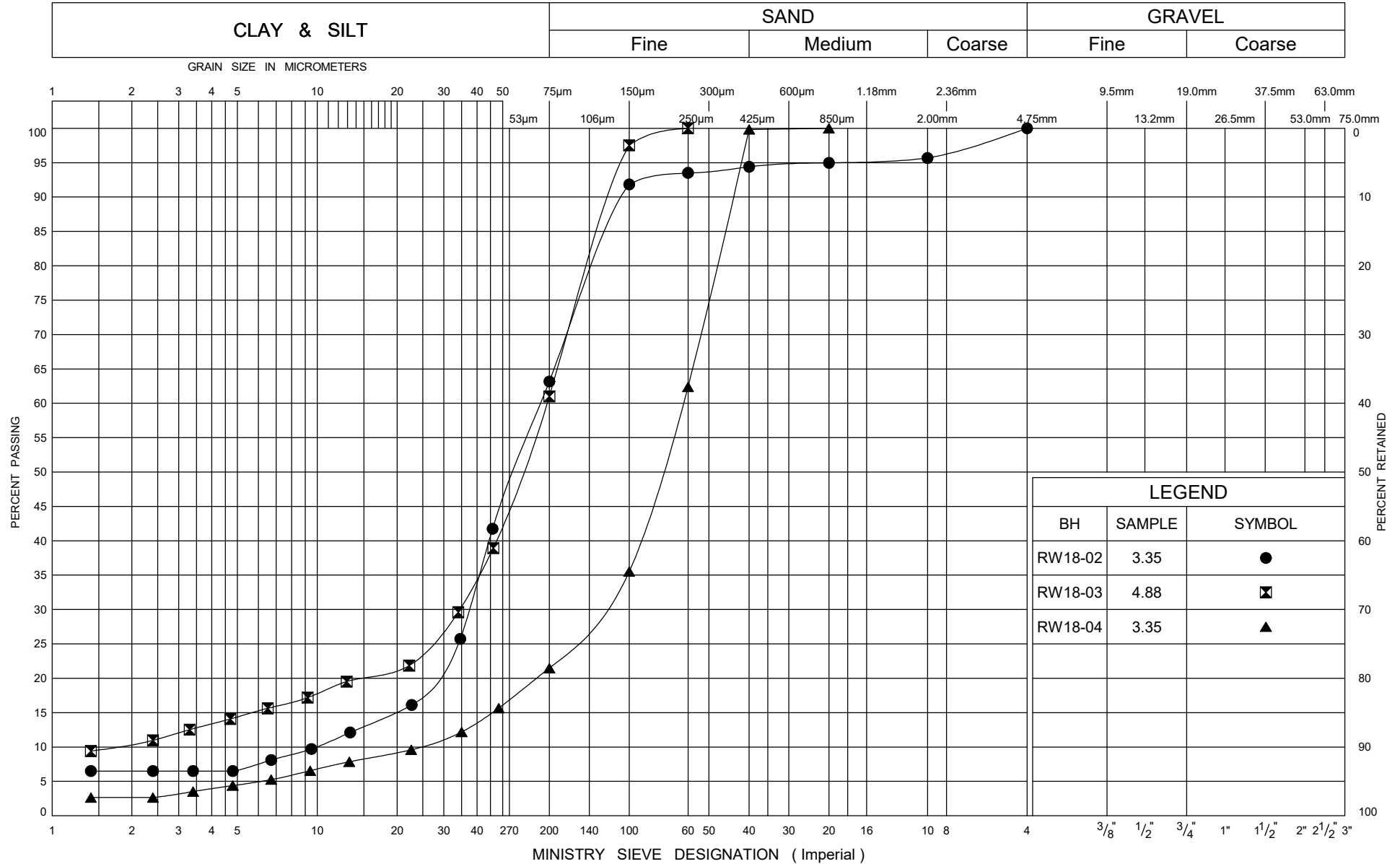
Silty Sand Fill

FIG No A2

W P 408-88-00

N-E/W Ramp over Guelph Street

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

GRAIN SIZE DISTRIBUTION

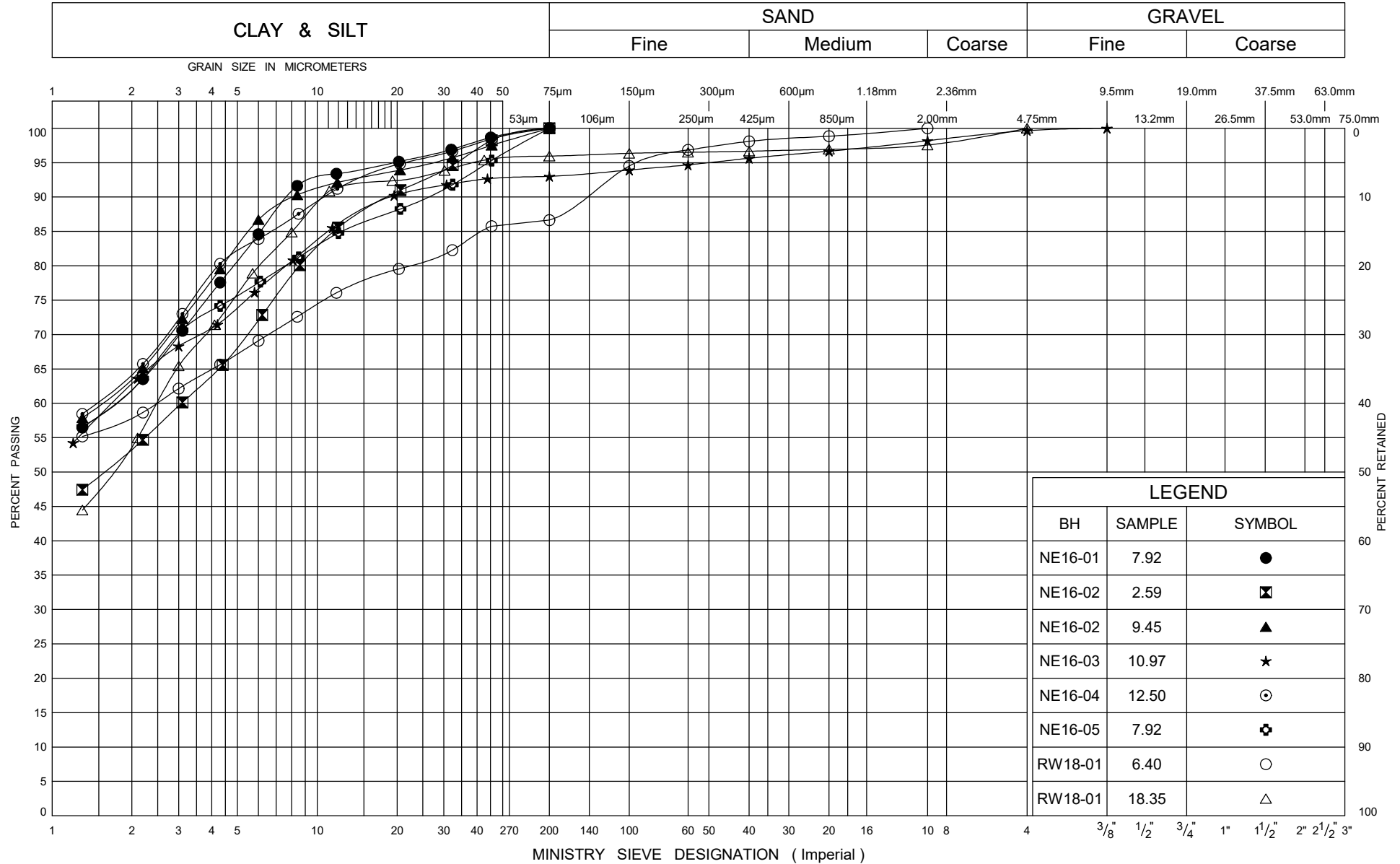
Sand and Silt and Silty Sand

FIG No A3

W P 408-88-00

N-E/W Ramp over Guelph Street

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

GRAIN SIZE DISTRIBUTION

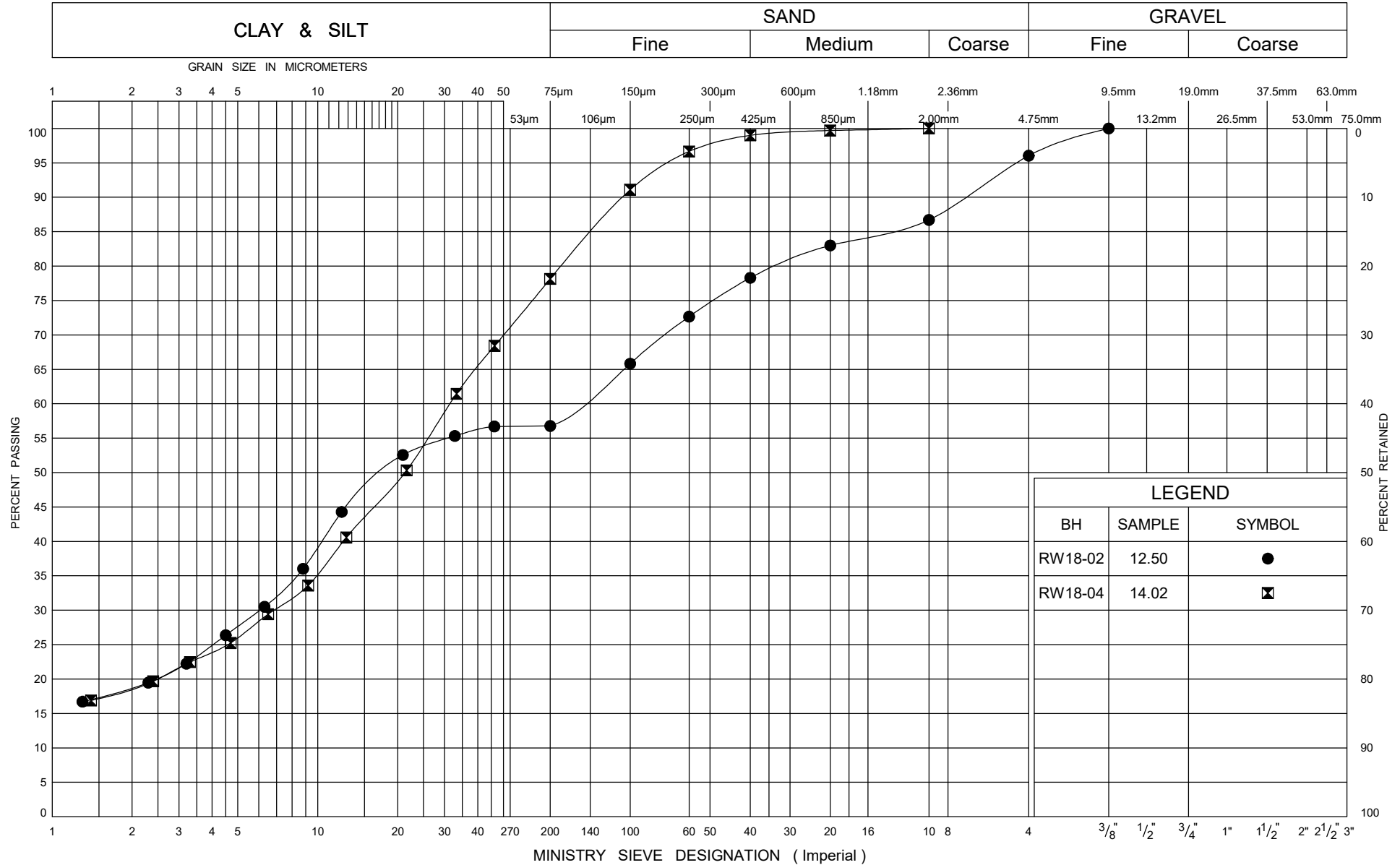
Silty Clay

FIG No A4

W P 408-88-00

N-E/W Ramp over Guelph Street

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

GRAIN SIZE DISTRIBUTION

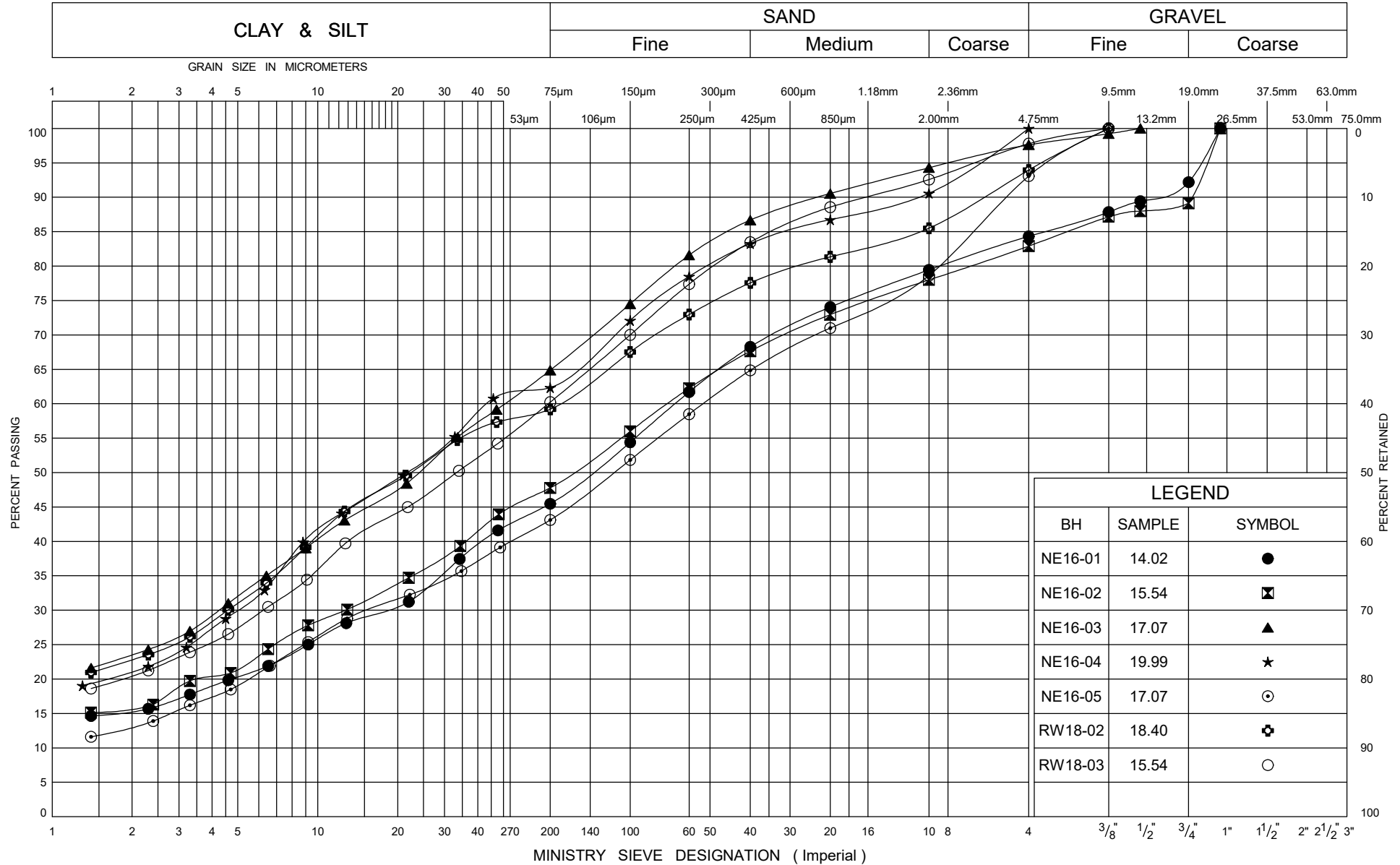
Silty Clay Till

FIG No A5

W P 408-88-00

N-E/W Ramp over Guelph Street

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

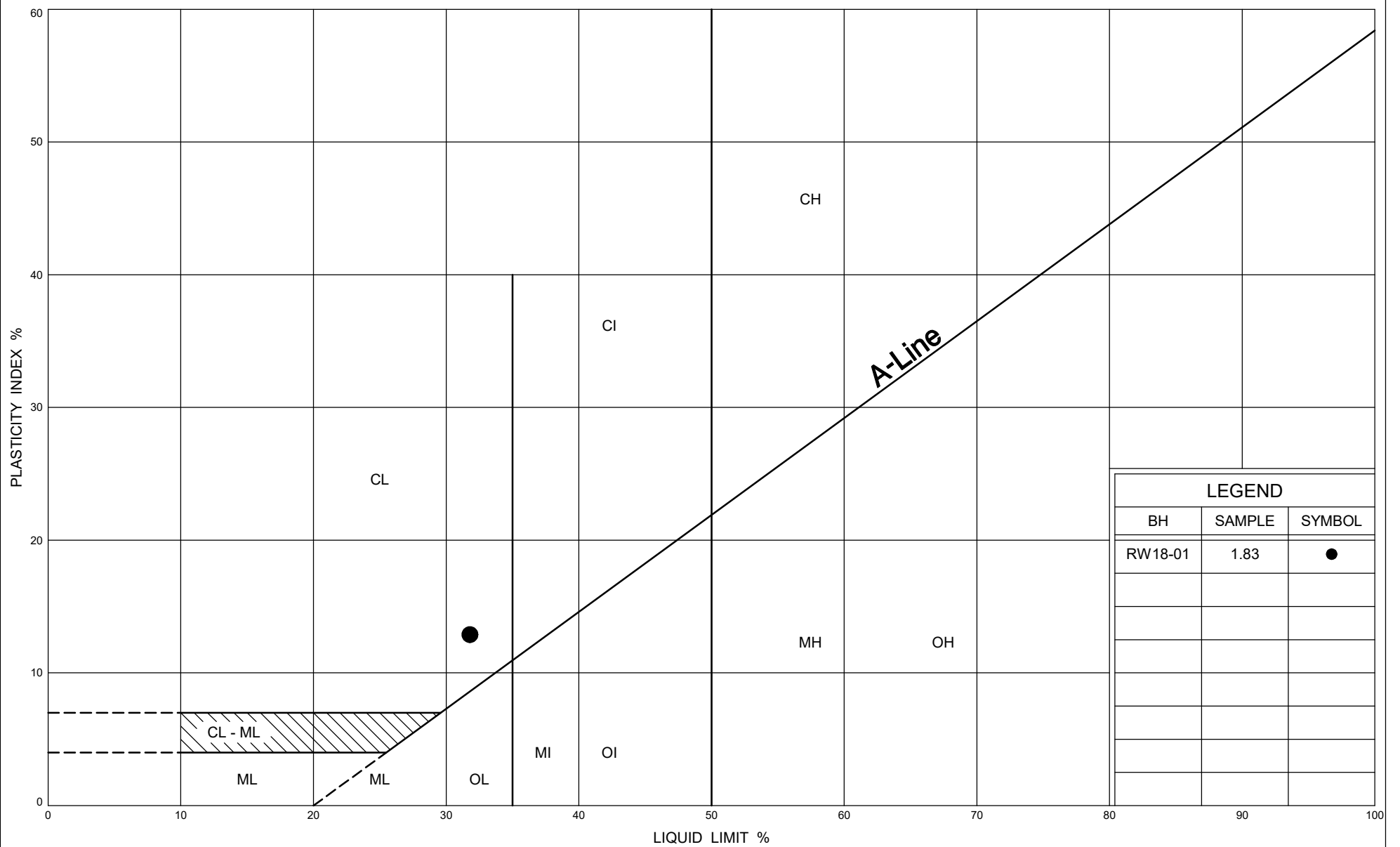
GRAIN SIZE DISTRIBUTION

Sand and Silt Till

FIG No A6

W P 408-88-00

N-E/W Ramp over Guelph Street



Ministry of
Transportation

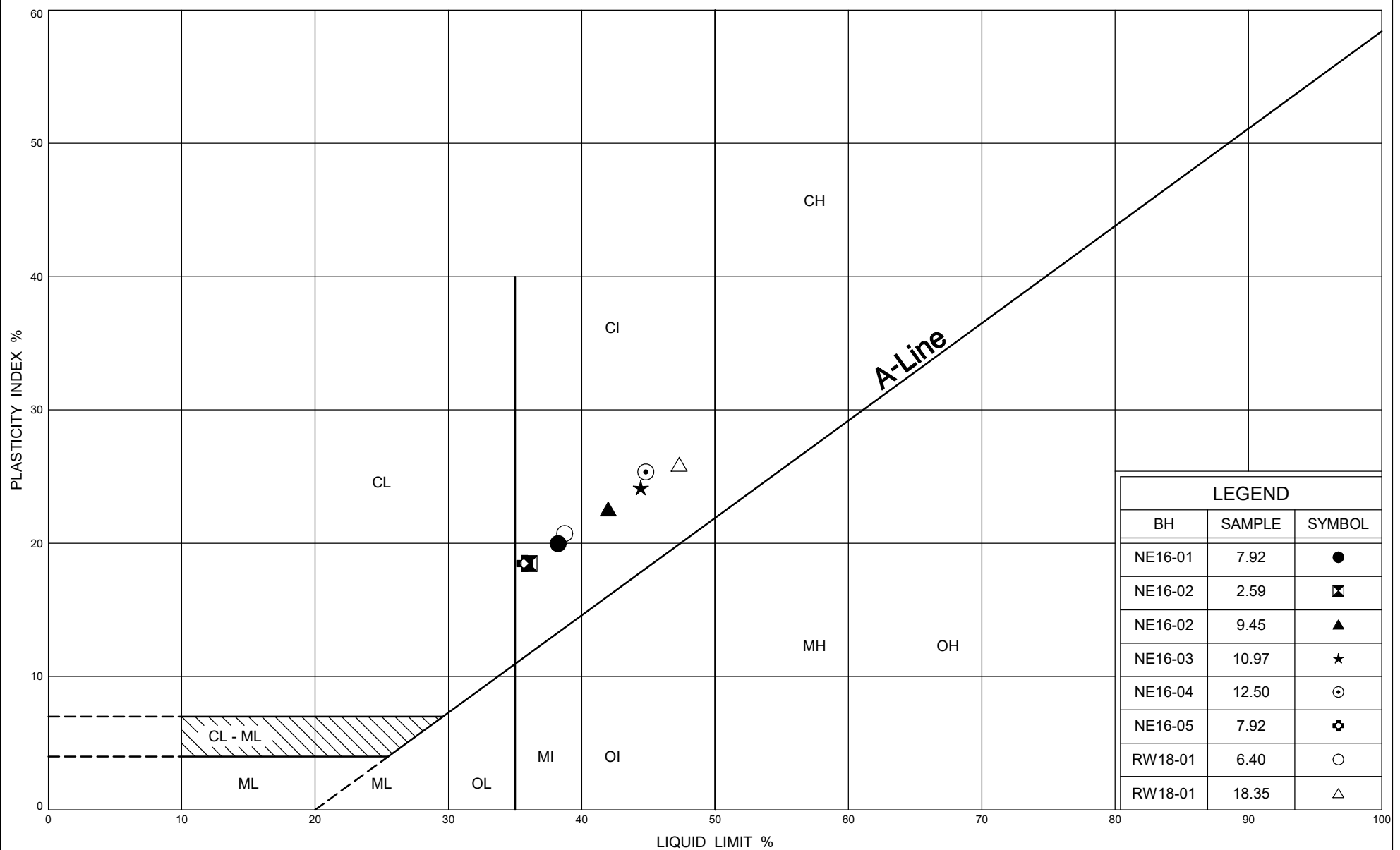
PLASTICITY CHART

Silty Clay Fill

FIG No A7

W P 408-88-00

N-E/W Ramp over Guelph Street



Ministry of
Transportation

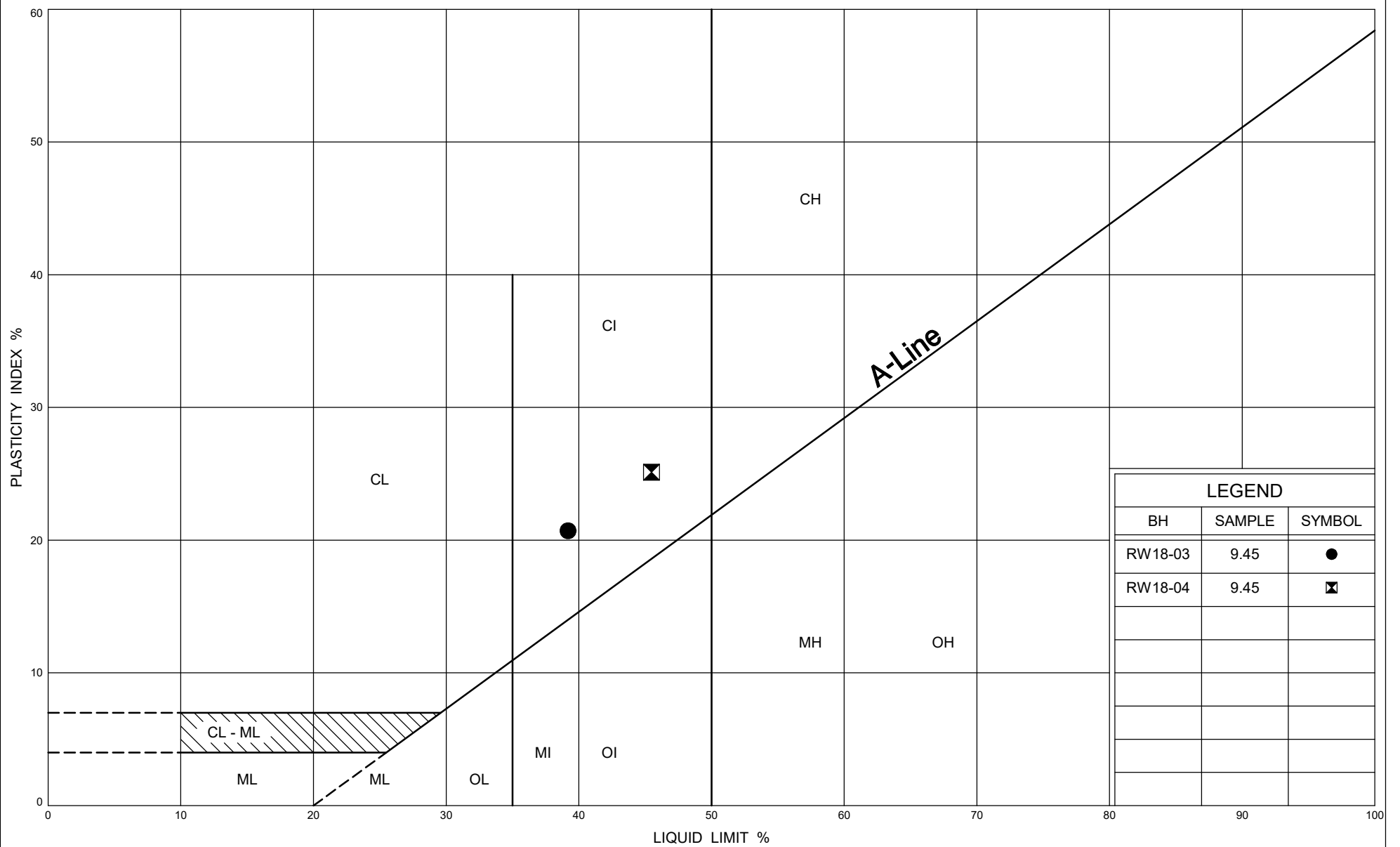
PLASTICITY CHART

Silty Clay

FIG No A8

W P 408-88-00

N-E/W Ramp over Guelph Street



Ministry of
Transportation

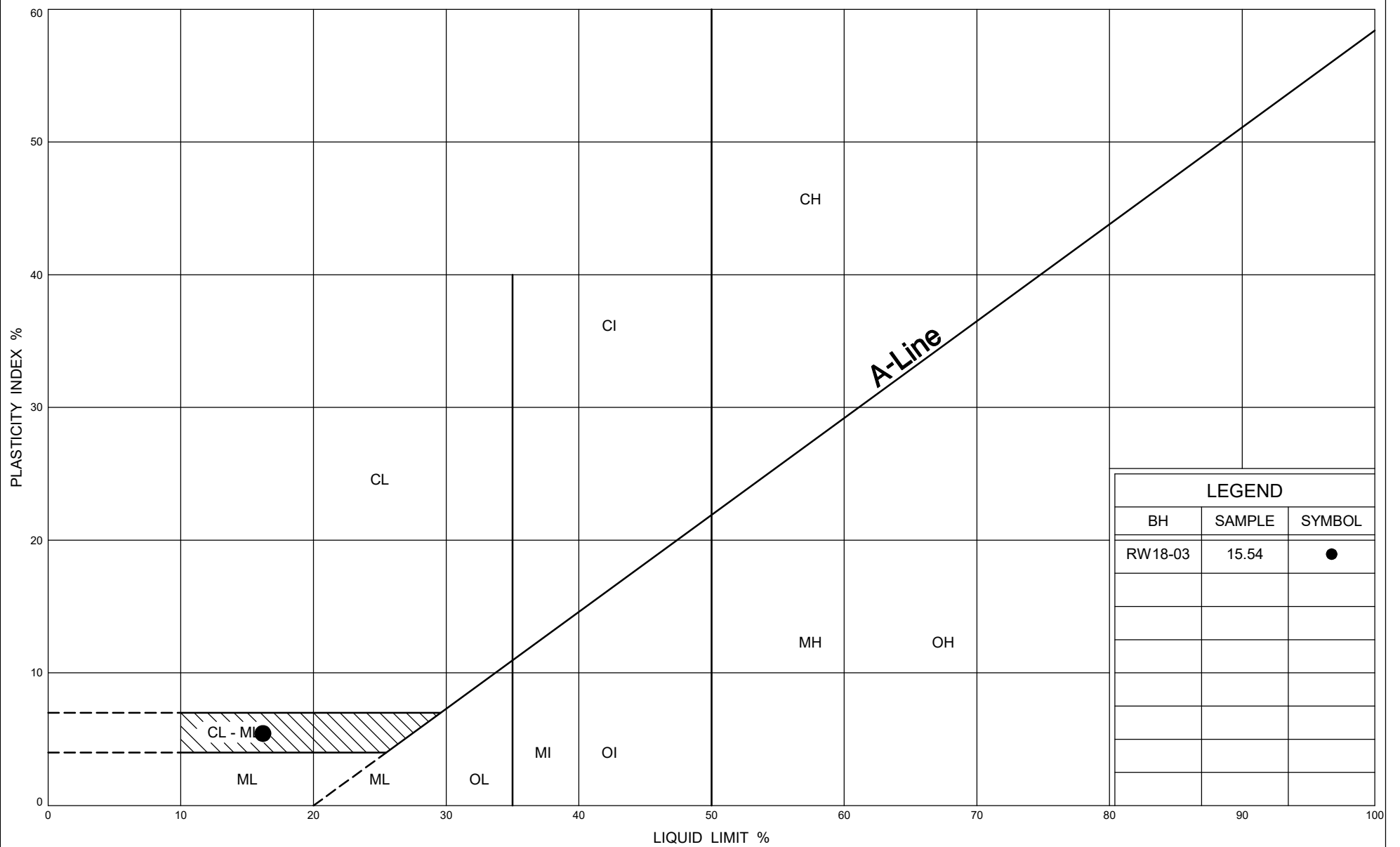
PLASTICITY CHART

Silty Clay

FIG No A9

W P 408-88-00

N-E/W Ramp over Guelph Street



Ministry of
Transportation

PLASTICITY CHART

Sand and Silt Till (Clayey zone)

FIG No A10

W P 408-88-00

N-E/W Ramp over Guelph Street



FINAL REPORT

CA14855-MAY18 R1

11375 Rocío Reyna

Prepared for

Thurber Engineering Ltd.

First Page

CLIENT DETAILS

Client Thurber Engineering Ltd.

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

Contact Rocio Reyna

Telephone 905-829-8666 x 263

Facsimile

Email rreyna@thurber.ca

Project 11375 Rocio Reyna

Order Number

Samples Soil (2)

LABORATORY DETAILS

Project Specialist Deanna Edwards, B.Sc, C.Chem

Laboratory SGS Canada Inc.

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

Telephone 705-652-2000

Facsimile 705-652-6365

Email deanna.edwards@sgs.com

SGS Reference CA14855-MAY18

Received 05/28/2018

Approved 06/01/2018

Report Number CA14855-MAY18 R1

Date Reported 06/01/2018

COMMENTS

Temperature of Sample upon Receipt: 11 degrees C

Cooling Agent Present: No

Custody Seal Present: No

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

Deanna Edwards, B.Sc, C.Chem





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QC Summary..... 5-6

Legend..... 7

Annexes..... 8-9



FINAL REPORT

CA14855-MAY18 R1

Client: Thurber Engineering Ltd.

Project: 11375 Rocío Reyna

Project Manager: Rocío Reyna

Samplers: N/A

PACKAGE: - Corrosivity Index (SOIL)

Sample Number	5	6
Sample Name	NE16-04 SS4	RW18-04 SS4
Sample Matrix	Soil	Soil
Sample Date	05/05/2018	09/05/2018

Parameter	Units	RL		Result	Result
Corrosivity Index					
Corrosivity Index	none	1		7.5	1.0
Soil Redox Potential	mV	-		217	192
Sulphide	%	0.02		0.03	< 0.02
pH	no unit	0.05		8.72	8.16
Resistivity (calculated)	ohms.cm	-9999		3440	3330

PACKAGE: - General Chemistry (SOIL)

Sample Number	5	6
Sample Name	NE16-04 SS4	RW18-04 SS4
Sample Matrix	Soil	Soil
Sample Date	05/05/2018	09/05/2018

Parameter	Units	RL		Result	Result
General Chemistry					
Conductivity	uS/cm	2		291	300

PACKAGE: - Metals and Inorganics (SOIL)

Sample Number	5	6
Sample Name	NE16-04 SS4	RW18-04 SS4
Sample Matrix	Soil	Soil
Sample Date	05/05/2018	09/05/2018

Parameter	Units	RL		Result	Result
Metals and Inorganics					
Moisture Content	%	0.1		10.6	18.7
Sulphate	µg/g	0.4		130	130



FINAL REPORT

CA14855-MAY18 R1

Client: Thurber Engineering Ltd.
Project: 11375 Rocío Reyna
Project Manager: Rocío Reyna
Samplers: N/A

PACKAGE: - Other (ORP) (SOIL)

Sample Number	5	6
Sample Name	NE16-04 SS4	RW18-04 SS4
Sample Matrix	Soil	Soil
Sample Date	05/05/2018	09/05/2018

Parameter	Units	RL		Result	Result
Other (ORP)					
Chloride	µg/g	0.4		100	200



FINAL REPORT

CA14855-MAY18 R1

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	DIO0502-MAY18	µg/g	0.4	<0.4	12	20	93	80	120	108	75	125
Sulphate	DIO0502-MAY18	µg/g	0.4	<0.4	0	20	97	80	120	97	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	ECS0053-MAY18	%	0.02	<0.02	ND	20	91	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	EWL0517-MAY18	uS/cm	2	< 0.002	5	10	101	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	EWL0517-MAY18	no unit	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.

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-- End of Analytical Report --



SAMPLE INTEGRITY REPORT

Project Number: 11375

SGS Sample ID CA14855-May 18
Date / Time Sampled May 5 + 9, 2018
Client Sample ID See CoC

ONTARIO REGULATION 153/04

ALL

Sample Submission General Sample Integrity Violations

- | | |
|--|--------------------------|
| Temperature >10 C upon receipt if not sampled same day | <input type="checkbox"/> |
| No evidence of cooling trend initiated if sampled same day | <input type="checkbox"/> |
| Chain of Custody not submitted | <input type="checkbox"/> |
| Chain of Custody incomplete | <input type="checkbox"/> |
| Chain of Custody not signed / dated | <input type="checkbox"/> |
| Chain of Custody not a current version | <input type="checkbox"/> |
| Bottles / Samples listed on CoC but not received | <input type="checkbox"/> |
| Bottles / Samples received but not listed on the CoC | <input type="checkbox"/> |
| Sample container received empty | <input type="checkbox"/> |

Sample Specific Sample Integrity Violations

- | | | | | | | | |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Sample received past hold time | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Incorrect preservation (including no preservation where required) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Headspace present in VOC vial (aqueous) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Sample(s) received frozen | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Bottle(s) broken or damaged in transport | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Discrepancy between sample label and chain of custody | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Analysis requirements absent / unclear | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Missing or incorrect sample label(s) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Inappropriate sample container used | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Insufficient number of bottles received | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Limited sample volume | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Insufficient sample volume | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Sample contains multiple phases | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Sediment Log

- | | | | | | | | |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Groundwater samples contain visible sediment / particulate | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Groundwater contains greater than 1cm of sediment / particulate matter in bottle | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Additional Comments/Remarks:

No issues upon receipt



Initials:

Kes



Appendix B

Record of Borehole Sheets and Laboratory Test Results (Previous Investigation)

RECORD OF BOREHOLE No 08-002

1 OF 2

METRIC

G.W.P. 408-88-00 LOCATION N 4 814 728.23 E 225 979.86 ORIGINATED BY ES
 HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.06.05 - 2008.06.06 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						
308.3								20 40 60 80 100						
0.9	ASPHALT: (50mm)		1	AS			308							
307.5	SAND and GRAVEL, some silt Grey to Brown Moist (FILL)													
0.8	Silty CLAY, some sand, trace gravel, some organics, occasional black staining Firm to Stiff Dark Grey (FILL)		1	SS	13		307							
			2	SS	5									
306.2							306							
2.1	SAND and GRAVEL, trace silt, occasional clayey silt seams Compact Grey Wet (FILL)		3	SS	10									
305.4							305							
2.9	Silty CLAY, trace sand Very Stiff to Hard Dark Grey (TILL)		4	SS	21									0 1 44 55
							304							
			5	SS	29									
							303							
			6	SS	41		302							
							301							
			7	SS	38		300							0 3 43 54
							299							
			8	SS	42									

Continued Next Page

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

RECORD OF BOREHOLE No 08-002

2 OF 2

METRIC

G.W.P. 408-88-00 LOCATION N 4 814 728.23 E 225 979.86 ORIGINATED BY ES
 HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.06.05 - 2008.06.06 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
	Continued From Previous Page							SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
								PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT w _p w w _L WATER CONTENT (%)						
297.2	Silty CLAY, trace gravel Hard Grey (TILL)		9	SS	68		298							
11.1	Sandy SILT, trace gravel, trace to some clay Very Dense Grey Moist (TILL)						297							
			10	SS	107		296							5 43 42 10
							295							
			11	SS	100/ 225		294							
292.8			12	SS	100/ 275		293							1 33 54 12
15.5	END OF BOREHOLE AT 15.5m. BOREHOLE OPEN AND WATER LEVEL AT 5.5m UPON COMPLETION OF DRILLING. Piezometer installation consists of 19mm diameter schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) 2008.07.16 5.5 302.8 2008.08.20 5.5 302.8													

+³ × 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 08-004

1 OF 2

METRIC

G.W.P. 408-88-00 LOCATION N 4 814 712.58 E 225 985.09 ORIGINATED BY SLL
 HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.06.10 - 2008.06.12 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 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
308.8								20	40	60	80	100				
0.0	ASPHALT: (100mm)															
0.1	SAND and GRAVEL Brown Moist (FILL)		1.5	AS												
308.1																
0.7	SAND, SILT and CLAY, trace gravel, variable proportions of mixed soils Compact Brown Moist to Wet (FILL)		1	SS	20		308									3 49 27 22
307.3																
1.5	SAND, some silt to silty, gas odour Dense Grey Wet (FILL)		2	SS	14		307									
			3	SS	43											
305.8							306									
3.0	Silty CLAY, trace sand Very Stiff to Hard Grey (TILL)		4	SS	20		305									
			5	SS	31		304									0 1 41 58
							303									
			6	SS	31		302									
			7	SS	30		301									1 4 39 57
							300									
			8	SS	37		299									

Continued Next Page

+ 3 . X 3 : Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 08-004

2 OF 2

METRIC

G.W.P. 408-88-00 LOCATION N 4 814 712.58 E 225 985.09 ORIGINATED BY SLL
 HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.06.10 - 2008.06.12 CHECKED BY RPR

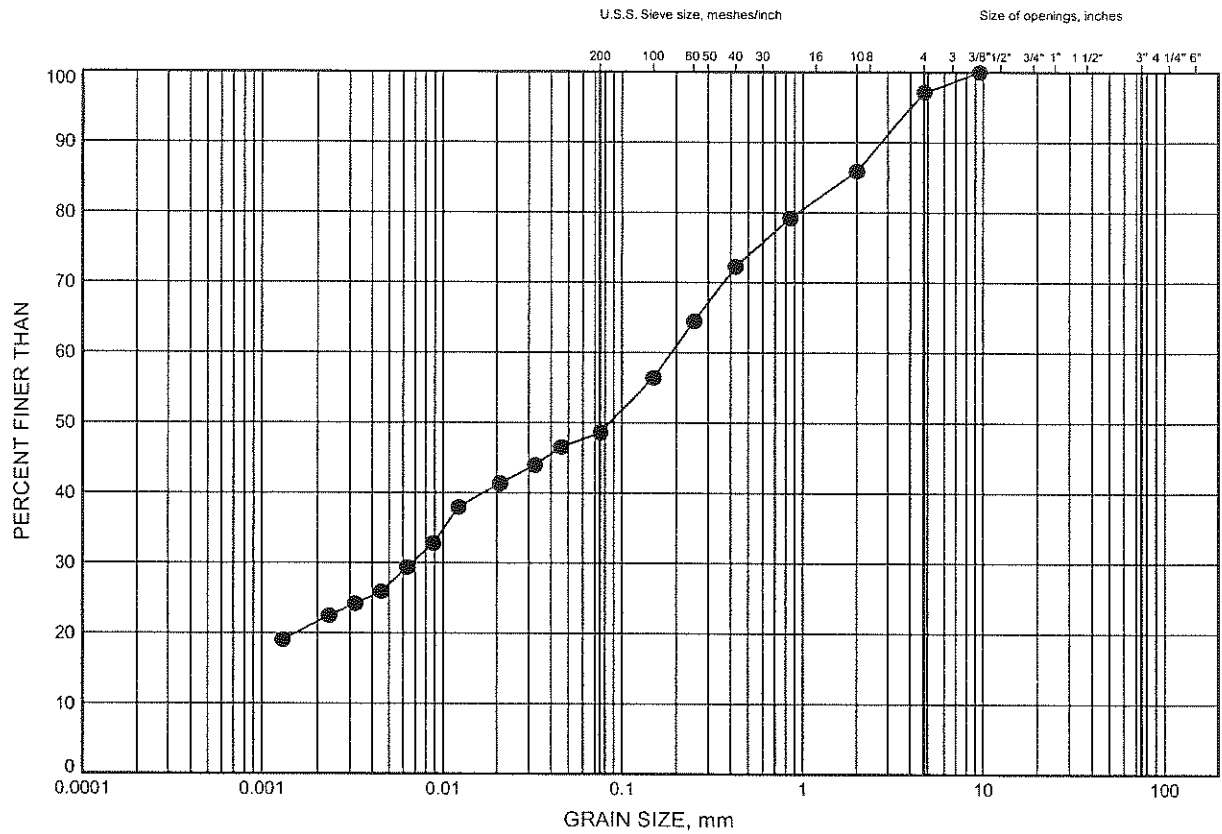
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL × LAB VANE			
Continued From Previous Page							20 40 60 80 100	PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L			
	Silty CLAY, trace sand Hard Grey (TILL)						298					0 1 21 78	
	Layer of silt: (700mm)		9	SS	42								
296.6													
12.2	SAND, trace to some silt, trace gravel, trace clay Very Dense Grey Wet		10	SS	90		296					2 85 13 (SI+CL)	
295.1													
13.7	Sandy SILT, some clay, trace gravel, occasional cobbles Very Dense Grey Moist (TILL)		11	SS	101/ 275		295						
	occasional clayey silt seams		12	SS	137		294					2 29 55 14	
291.8			13	SS	110/ 200		292						
17.0	END OF BOREHOLE AT 17.0m. BOREHOLE OPEN TO 16.8m AND WATER LEVEL AT 1.5m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENSEAL TO 5.8m THEN HOLEPLUG TO 75mm AND ASPHALT TO SURFACE.												

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

Highway 7 - New GRAIN SIZE DISTRIBUTION

FIGURE B1

Sand, Silt and Clay FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-004	1.07	307.73

GRAIN SIZE DISTRIBUTION - THURBER 6417R.GPJ 12/3/08

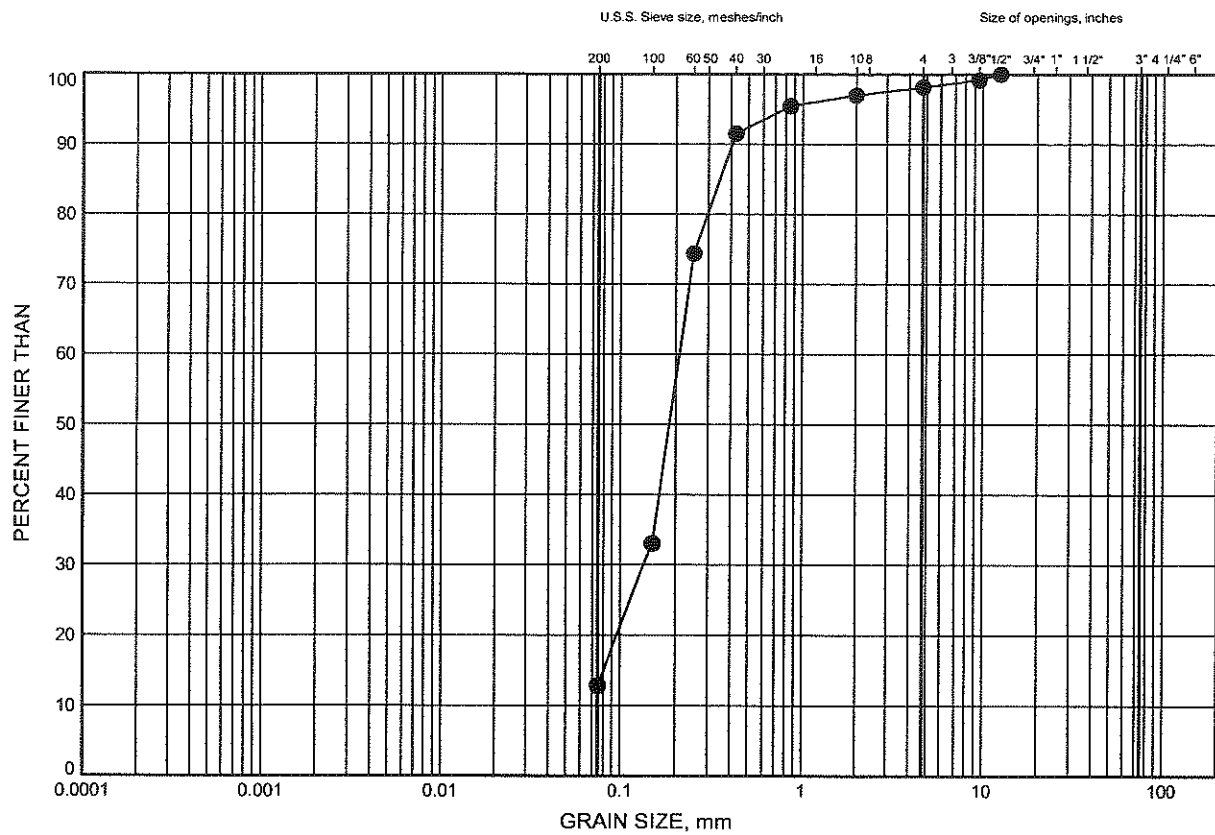
W.P.# 408-88-00
Prepared By AN
Checked By RPR



Highway 7 - New GRAIN SIZE DISTRIBUTION

FIGURE B2

Sand



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-004	12.48	296.32

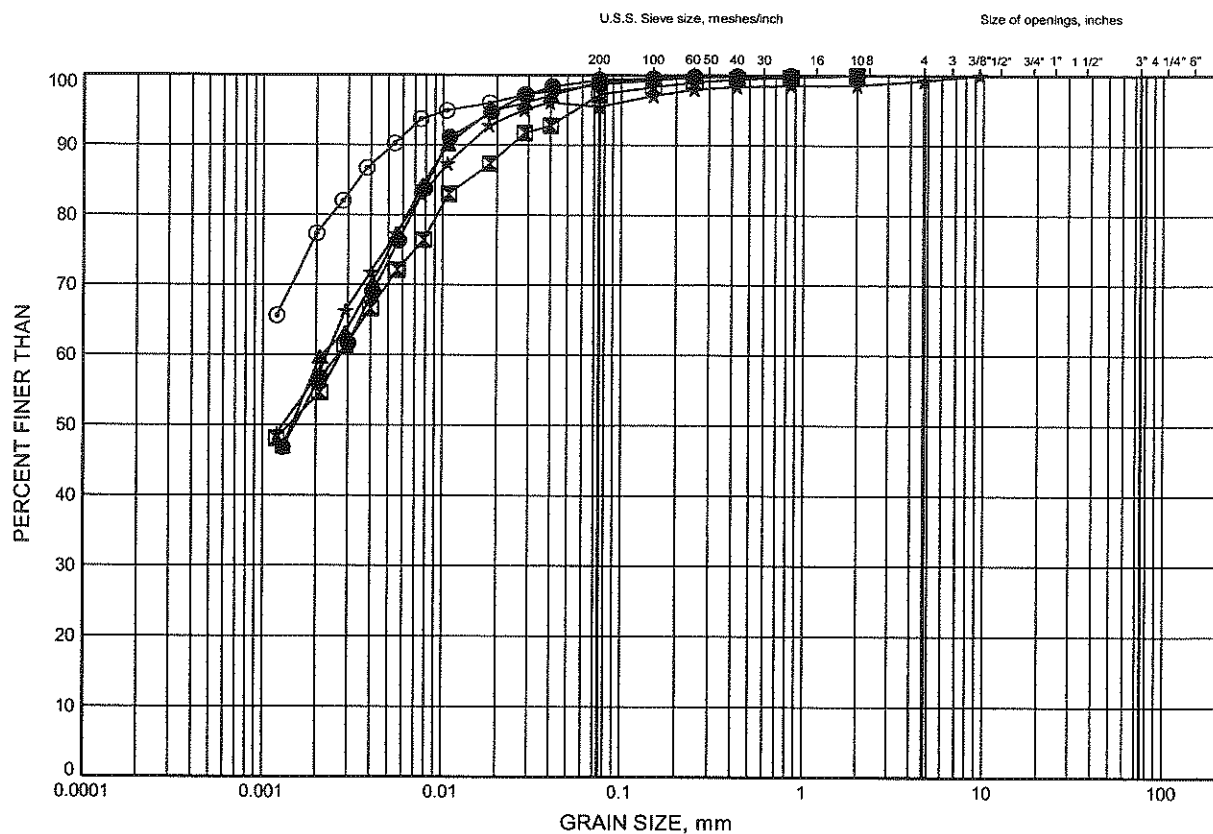


W.P.# 408-88-00
Prepared By AN
Checked By RPR

Highway 7 - New GRAIN SIZE DISTRIBUTION

FIGURE B3

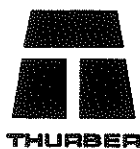
Silty Clay TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-002	3.35	304.95
⊠	08-002	7.92	300.38
▲	08-004	4.88	303.92
★	08-004	7.92	300.88
⊙	08-004	10.82	297.98

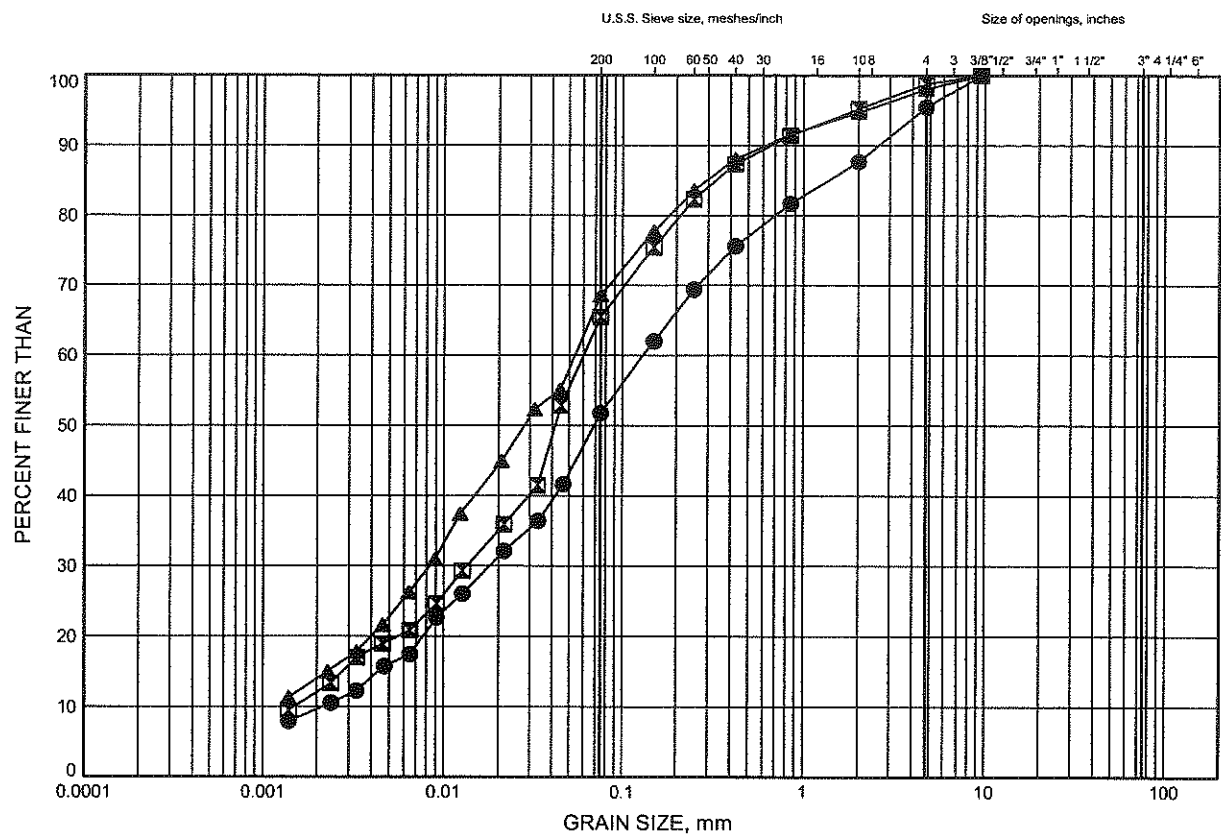


W.P.# .408-88-00.....
Prepared By .AN.....
Checked By .RPR.....

Highway 7 - New
GRAIN SIZE DISTRIBUTION

FIGURE B4

Sandy Silt TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	08-002	12.42	295.88
⊠	08-002	15.36	292.94
▲	08-004	15.39	293.41

GRAIN SIZE DISTRIBUTION - THURBER 6417R.GPJ 11/29/08

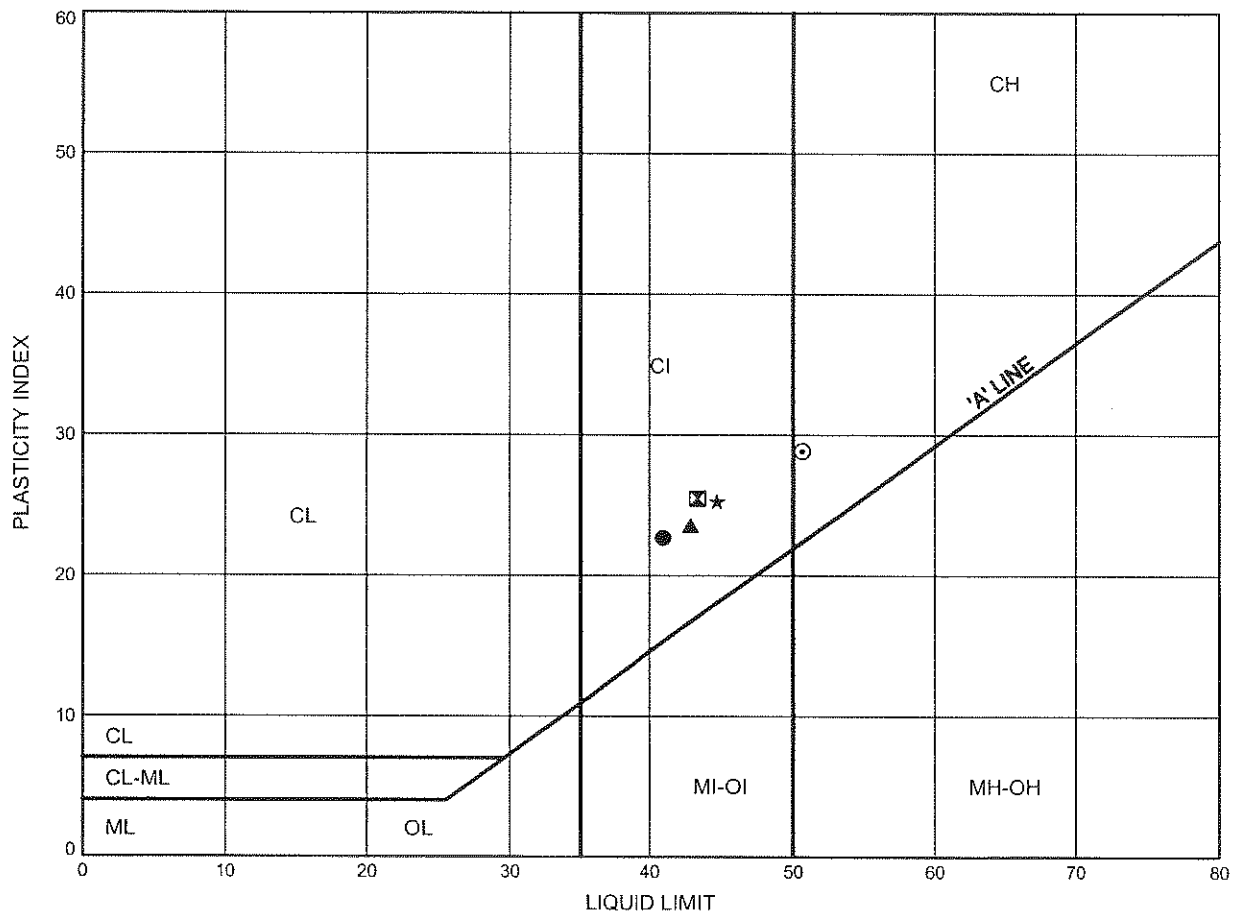
W.P.# 408-88-00
Prepared By AN
Checked By RPR



Highway 7 - New ATTERBERG LIMITS TEST RESULTS

FIGURE B5

Silty Clay TILL



SYMBOL	BH	DEPTH (m)	ELEV. (m)
●	08-002	3.35	304.95
⊠	08-002	7.92	300.38
▲	08-004	4.88	303.92
★	08-004	7.92	300.88
⊙	08-004	10.82	297.98

Date December 2008
Project 408-88-00

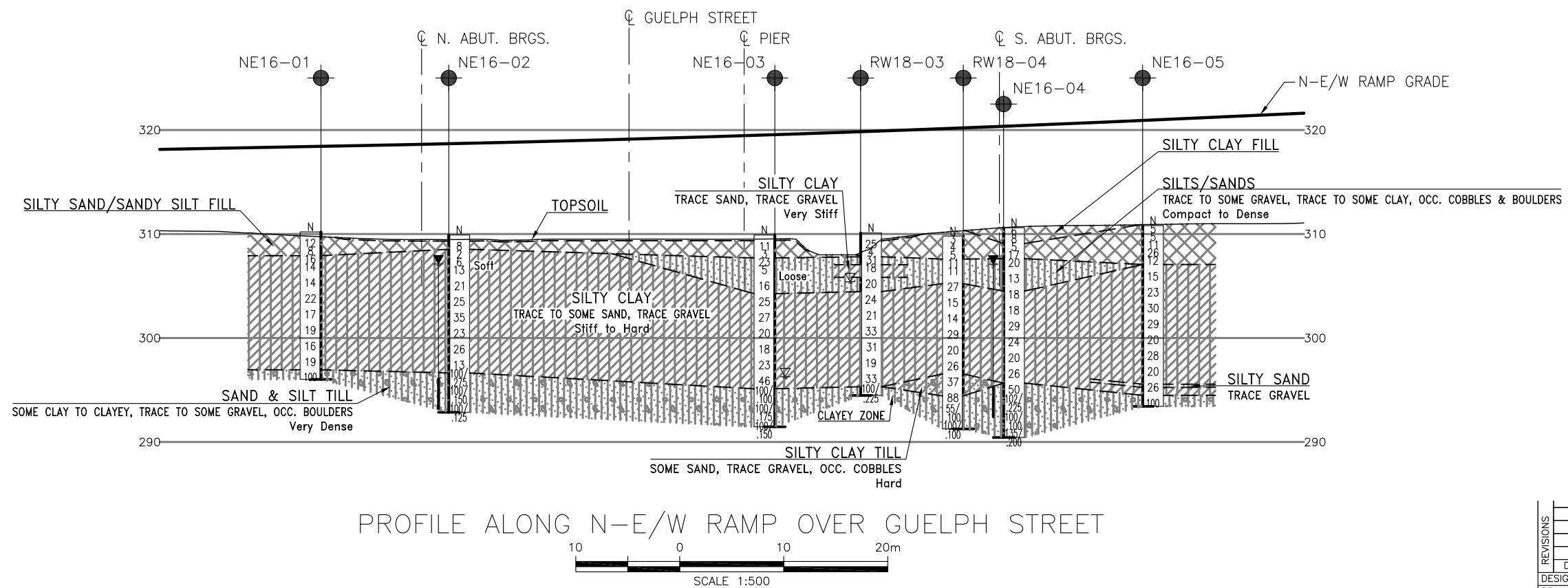
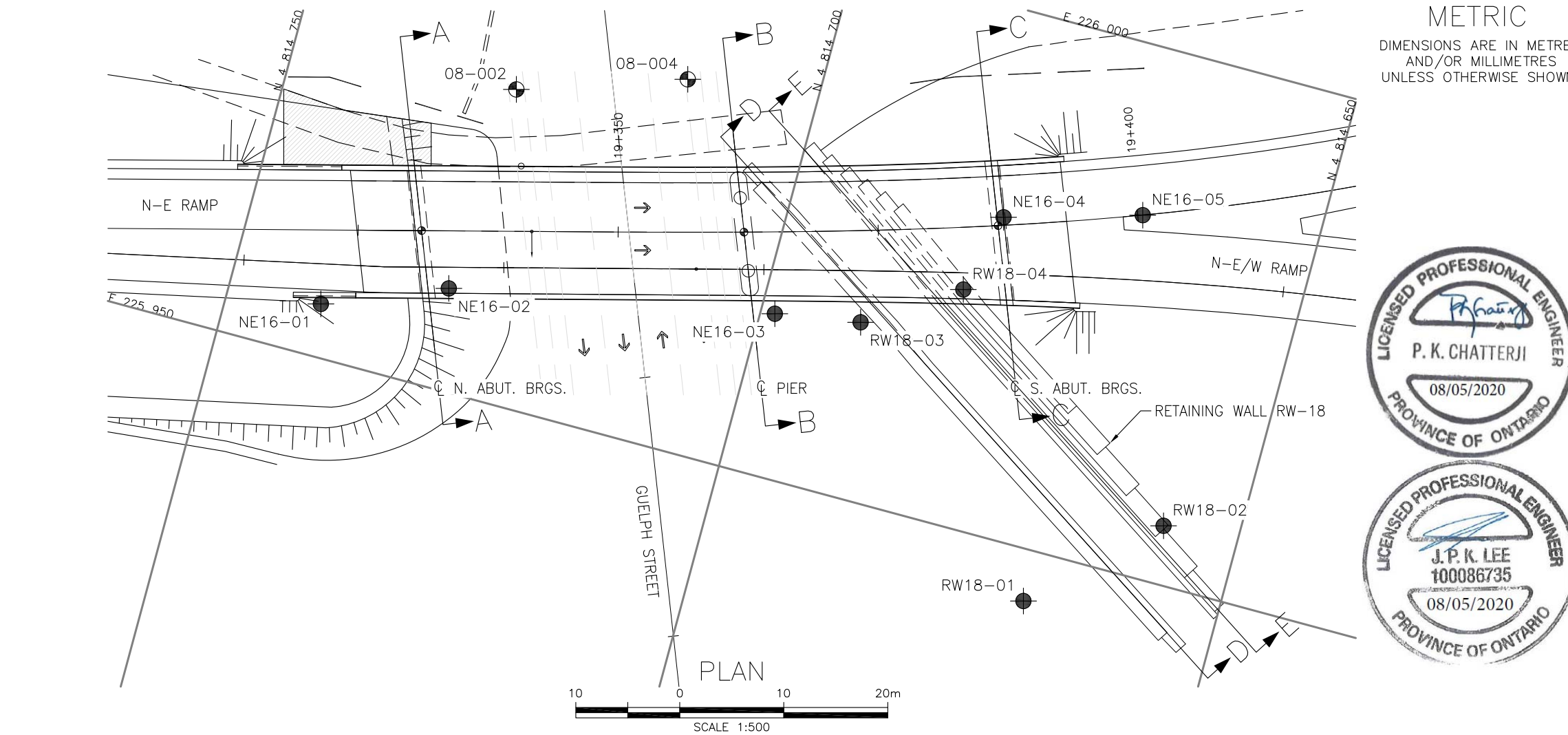


Prep'd AN
Chkd. RPR



Appendix C

Borehole Locations and Soil Strata Drawing

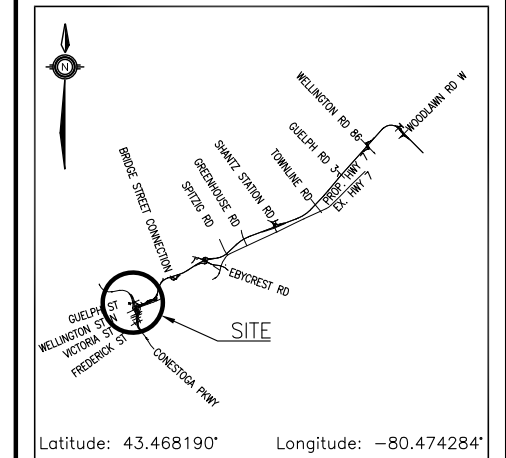


METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN



CONT No
GWP No 408-88-00

HIGHWAY 7
N-E/W RAMP OVER GUELPH ST
PROPOSED BRIDGE
BOREHOLE LOCATIONS AND SOIL STRATA



KEYPLAN

LEGEND

●	Borehole (Current Investigation)
⊙	Borehole (2008 Investigation)
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
NE16-01	310.2	4 814 741.0	225 955.1
NE16-02	309.9	4 814 729.5	225 959.7
NE16-03	309.9	4 814 698.6	225 965.5
NE16-04	310.6	4 814 679.8	225 980.2
NE16-05	310.8	4 814 667.0	225 983.9
RW18-01	310.4	4 814 668.4	225 945.1
RW18-02	309.9	4 814 657.2	225 955.6
RW18-03	310.1	4 814 690.4	225 966.9
RW18-04	309.8	4 814 681.7	225 972.5
08-002	308.3	4 814 728.2	225 979.9
08-004	308.8	4 814 712.6	225 985.1

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. 40P8-282

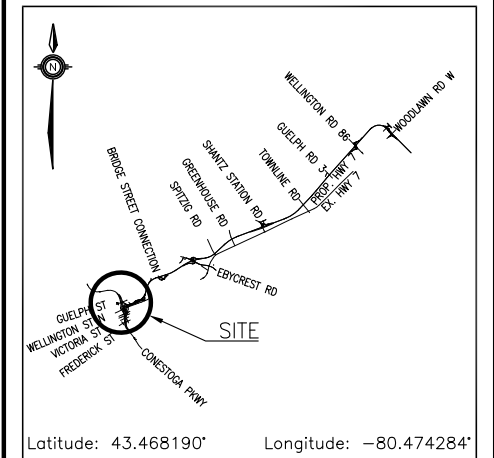
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METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
GWP No 408-88-00

HIGHWAY 7
N-E/W RAMP OVER GUELPH ST
PROPOSED BRIDGE
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET



KEYPLAN

LEGEND

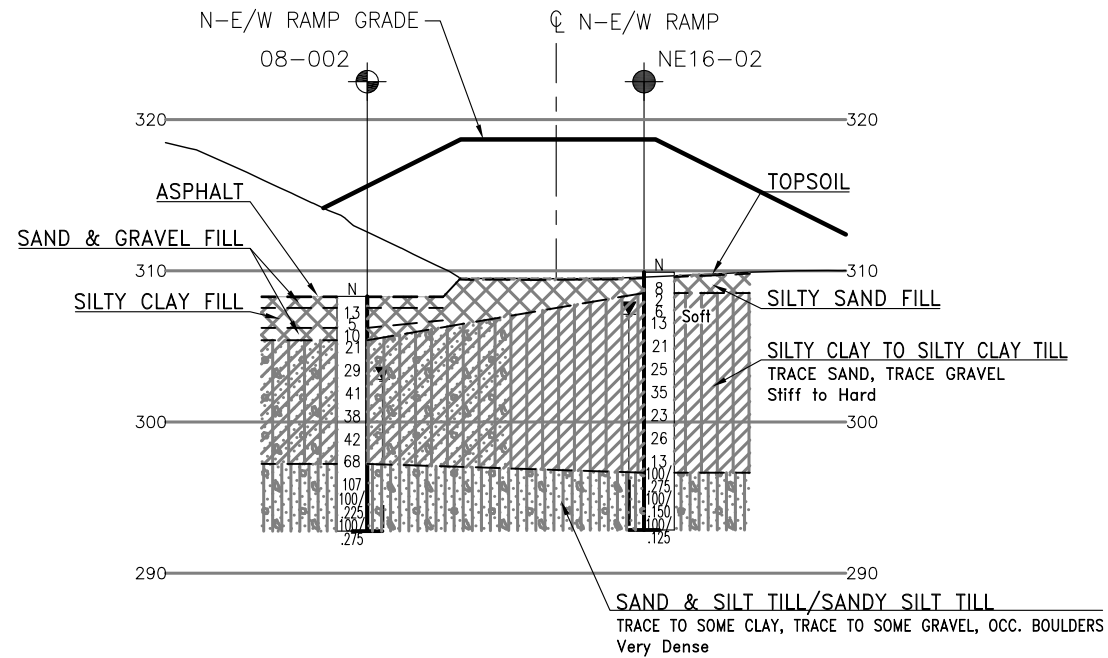
	Borehole (Current Investigation)
	Borehole (2008 Investigation)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

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08-004	308.8	4 814 712.6	225 985.1

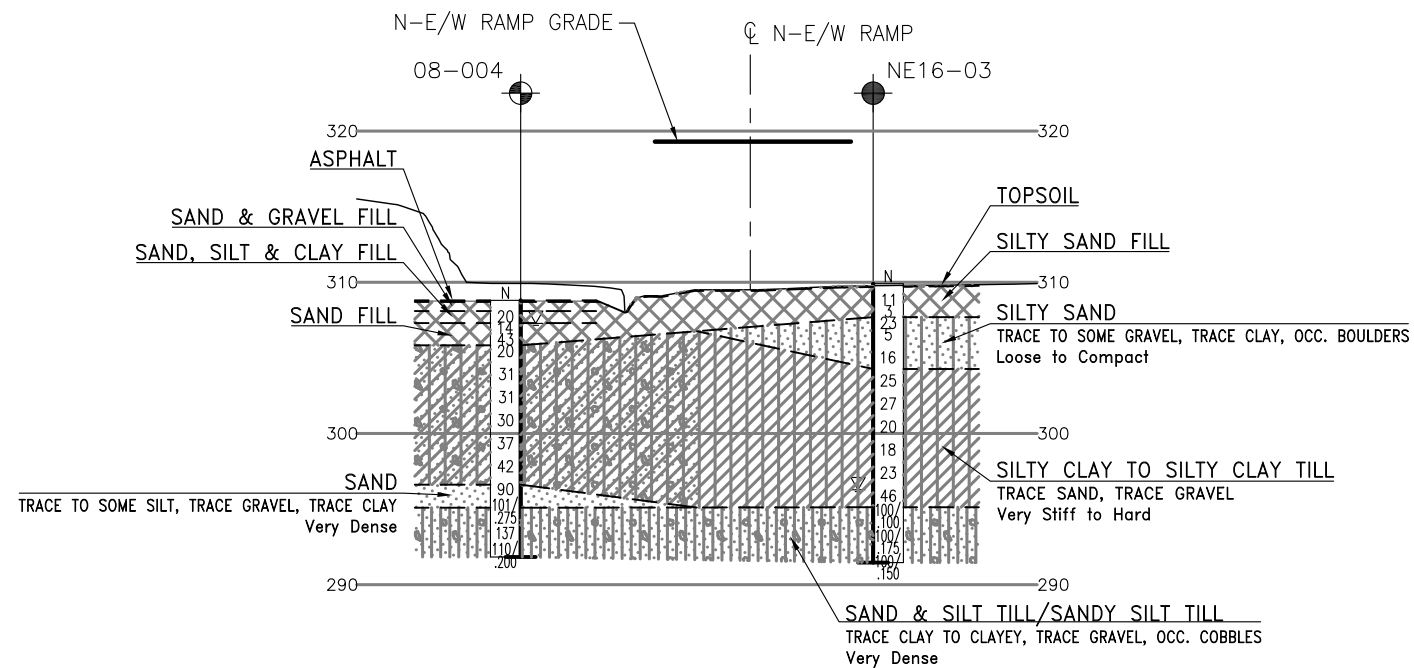
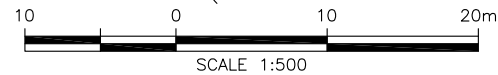
-NOTES-

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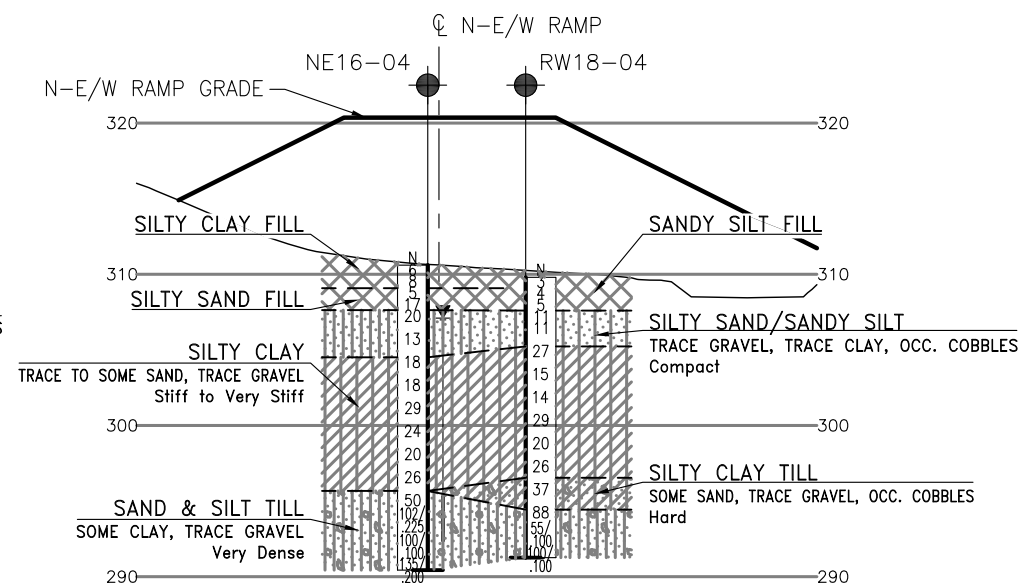
GEOCRES No. 40P8-282



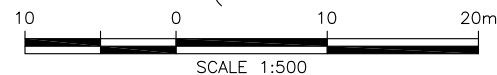
SECTION A-A (NORTH ABUTMENT)



SECTION B-B (PIER)



SECTION C-C (SOUTH ABUTMENT)



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