



THURBER ENGINEERING LTD.



**FOUNDATION INVESTIGATION REPORT
HIGHWAY 401 OVERPASS AT
GO STATION PARKING LOT AND LESLIE STREET
HIGHWAY 401 AND LESLIE STREET INTERCHANGE
CITY OF TORONTO
W.P. 2061-13-00, Site 37-206/1-4**

GEOCRETS NO.: 30M14-463

Report to

WSP

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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 widening and rehabilitation of the Highway 401 overpass structures at the GO Station Parking Lot and Leslie Street in Toronto, Ontario. The structures will be replaced and realigned as part of the proposed replacement of the Highway 401 and Leslie Street interchange. Parallel studies on potential corrosivity of the soil and groundwater on existing deep foundations are currently in progress to facilitate decisions regarding whether the existing bridge foundations will be incorporated into the new structures.

The purpose of the investigation was to explore the subsurface conditions at the structure location, and based on the data obtained, to provide borehole locations and soil strata drawings with stratigraphic profile and cross sections, records of boreholes, laboratory test results and a written description of the subsurface conditions. A model of the subsurface conditions was developed from the data obtained during the course of the present investigation and selected data from a preliminary investigation.

Thurber was retained by MMM Group Limited (MMM) to carry out the foundation investigation at this site on behalf of the Ministry of Transportation Ontario (MTO) under Consultant Assignment No. 2013-E-0032.

During the preparation of this report and in addition to the boreholes drilled, reference has been made to information on subsurface conditions contained in previous foundation reports for the site. The titles of these reports are listed as follows:

- Coffey Geotechnics Inc. report titled “Preliminary Foundation Investigation and Design Reports, Oriole GO Parking Overpass Structure, Highway 401 Rehabilitation from Leslie



Street to Warden Avenue, MTO Central Region”, G.W.P. 2130-01-00, GEOCREs No. 30M14-333, Delcan Corporation, Project TRANETOB01245AA-AC, dated September 30, 2011 (Reference 1).

- Coffey Geotechnics Inc. report titled “Preliminary Foundation Investigation and Design Reports, Leslie Street Overpass Structure, Highway 401 Rehabilitation from Leslie Street to Warden Avenue”, MTO Central Region, G.W.P. 2130-01-00, GEOCREs No. 30M14-332, Delcan Corporation, Project TRANETOB01245AA-AD, dated September 30, 2011 (Reference 2).

2 SITE AND PROJECT DESCRIPTION

The site is located within the Highway 401 and Leslie Street interchange in Toronto, Ontario, where the overpasses carry the Highway 401 lanes over the GO Transit railway, Oriole GO Station Parking Lot and Leslie Street. It is understood that the existing westbound collectors will be removed to foundation level and new westbound express overpass, substructure and superstructure, constructed on the modified existing foundations. Following construction of the new westbound express, the existing westbound express will be removed to foundation level and a new eastbound express built on its footprint. Following the construction of the new eastbound express, the existing eastbound collector traffic will be shifted to the existing eastbound express lanes and a new eastbound express overpass constructed on its current footprint. Once all of the new overpasses are constructed, the existing eastbound express overpass will be removed. The reuse of existing foundations within the new westbound and eastbound collectors, and new eastbound express structures, has not been confirmed at this time dependent upon the future condition assessment of the existing foundations.

The site lies within an area of industrial and commercial lands and the terrain is generally flat. Overall, this physiographic region is slightly undulating and decreases in elevation in a southerly direction toward Lake Ontario.

According to the Physiography of Southern Ontario by L.J. Chapman and D.F. Putnam, 1984, the project site is located within the Physiographic Region known as the South Slope. The South Slope is a drumlinized till plain that has formed as a result of glacial action and deposition of till materials just south of the Oak Ridges Moraine. The South Slope contains a variety of soils that have developed over the till. The depth of the overburden in the general area can be expected to be more than 50 m. Within and adjacent to the Don River valley, the site area is underlain by glacio-lacustrine sands, silts and glacial deposits.

3 SITE INVESTIGATION AND FIELD TESTING

The site investigation and field testing for this project was carried out from April 2 to 22, 2015. A total of four boreholes (numbered M-01 to M-04) were drilled at the site to depths ranging from 27.7 to 31.1 m (Elevations 109.5 to 116.0 m). Boreholes were drilled at each corner of the existing structure. Boreholes M-02 and M-03 were supplemented by dynamic cone penetration testing (DCPT) conducted from the base of the sampled boreholes and extended to practical refusal.

Boreholes R-03, R-04 and R-06 advanced for the W-N/S Ramp structure are utilized for the preparation of this report. General reference has also been made to Boreholes B7, B8, B15, B16, 1A, 2A, 3A and E2 drilled during the previous investigation conducted in 1964, 1967 and 2010 (References 1 and 2).

The approximate locations of the boreholes referenced above are shown on the attached Borehole Locations and Soil Strata Drawing in Appendix C. The coordinates and elevations of the boreholes are given on the drawing and on the individual Record of Borehole Sheets in Appendix A.

The borehole locations were established in the field by Thurber relative to existing site features. Utility clearance was obtained at all borehole locations prior to drilling.

During the current investigation, a track mounted D54 drill rig was used in conjunction with hollow-stem augers to advance the boreholes. Soil samples were obtained at selected intervals using a split spoon sampler in conjunction with the Standard Penetration Test (SPT).

In addition to the SPT samples, six thin wall Shelby tube samples of cohesive soils were collected from Boreholes M-01 to M-04 at selected depths. The in situ shear strength of the cohesive soils was also assessed using an MTO 'N' size shear vane.

The drilling and sampling 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 were observed in the open boreholes during and upon completion of the drilling operations. Standpipe piezometers consisting of a 19 mm diameter Schedule 40 PVC pipe with a 3.0 m long slotted screen were installed within a column of filter sand in two boreholes to permit longer term groundwater level monitoring. The completion details of the piezometers and Boreholes M-01 to M-04 are summarized in Table 3.1.

Table 3.1 – Piezometer and Borehole Completion Details

Borehole Number	Piezometer Tip Depth / Elevation (m)	Completion Details
M-01	None installed	Backfilled with bentonite holeplug and auger cuttings to 0.5 m, cement to 0.1m, then asphalt to surface.
M-02	29.9/111.3	Backfilled with filter sand from 31.1 m to 26.1 m, bentonite holeplug from 26.1 m to 23.8 m, bentonite holeplug and auger cuttings from 23.8 m to 4.5 m, then bentonite holeplug to ground surface.
M-03	30.5/114.8	Backfilled with filter sand from 30.7 m to 26.7 m, bentonite holeplug from 26.7 m to 24.4 m, bentonite holeplug and auger cuttings from 24.4 m to ground surface.
M-04	None installed	Backfilled with bentonite holeplug and auger cuttings to surface.

4 LABORATORY TESTING

All recovered soil samples were subjected to visual identification and to natural moisture content determination. At least 25% of the recovered soil samples were subjected to grain size distribution analysis. Atterberg Limits tests were carried out on selected samples of native silty clay to determine the plasticity characteristics. The results of the laboratory testing are summarized on the Record of Borehole sheets included in Appendix A and are presented on the figures included in Appendix B.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

Reference is made to the Record of Borehole sheets in Appendix A. Details of the encountered soil stratigraphy are presented in these records in Appendix A, and on the “Borehole Locations and Soil Strata” drawings in Appendix C. General description of the stratigraphy is given in the following paragraphs. The factual information recorded at the borehole locations governs any interpretation of the site conditions. The following descriptions are based on subsurface information obtained from Boreholes M-01 to M-04 advanced specifically for the subject overpass bridges as part of the current investigation.

In general, the stratigraphy at the proposed GO Station Parking Lot and Leslie Street overpass consists of surficial topsoil or asphalt overlying sand and silt fill, which is underlain by native sands and silts. An extensive deposit of typically firm to stiff silty clay was encountered below the

sands and silts. The silty clay is underlain by deposits of hard silty clay till to very dense sand and silt till. The groundwater level is typically in the order of 5 m to 8 m below the existing grade of the GO parking lot.

5.1 Asphalt

A surficial layer of asphalt with a thickness of 75 mm was encountered in Borehole M-01.

5.2 Topsoil

Topsoil was encountered surficially in Boreholes M-03 and M-04. The thickness of the topsoil ranged from 75 mm to 100 mm.

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

5.3 Sand and Silt Fill

A layer of brown to grey sand and silt fill was contacted below the asphalt in Borehole M-01, surficially in Borehole M-02 and below the topsoil in Boreholes M-03 and M-04. The sand and silt fill contained trace gravel, trace to some clay and occasional roots and wood pieces. Occasional cobbles were encountered within this fill in Boreholes M-01 to M-03. The thickness of the sand and silt fill ranged from 4.2 to 7.2 m. The depth to the base of the sand and silt fill varied from 4.3 m to 7.2 m (Elevations 134.0 to 139.4 m). A 1.5m thick layer of silty sand fill was interbedded with the sand and silt fill between Elevations 141.2 and 139.7 m in Borehole M-03.

Most SPT 'N' values measured in the sand and silt fill ranged from 15 to 53 blows per 0.3 m of penetration, indicating a compact to very dense condition. SPT 'N' values of 5 and 8 blows per 0.3 m of penetration, indicating loose zones, were encountered in Borehole M-02 near Elevations 140.0 m and 137.8 m, and in Borehole M-04 below Elevation 138.8 m. An SPT 'N' value of 88 blows per 0.3 m of penetration, indicating a very dense state, was measured in Borehole M-02 near Elevation 134.8 m. The moisture content in the sand and silt fill ranged from 6 to 18 percent.

Three samples of the sand and silt fill and one sample of the silty sand fill were subjected to laboratory gradation analysis. Grain size distribution curves for the sand and silt fill samples are presented on the Record of Borehole sheets included in Appendix A and on Figure B1 of Appendix B. The results of the laboratory tests are summarized as follows:

Soil Particles	Sand and Silt Fill Percentage (%)	Silty Sand Fill Percentage (%)
Gravel	0 to 5	9
Sand	37 to 48	53
Silt	39 to 46	26
Clay	11 to 16	12

5.4 Clayey Silt Fill

A 1.8 m thick layer of grey clayey silt fill containing some sand, trace gravel and occasional wood pieces was contacted below the sand and silt fill in Borehole M-01, at 4.3m depth. A 700 mm thick layer of brown clayey silt containing some sand and trace gravel was contacted within the sand and silt fill in Borehole M-03 at 2.3 m depth. The depth to the base of the clayey silt fill was 6.1 m to 3.0 m (Elevations 137.6 to 142.3 m).

SPT 'N' values in the clayey silt fill were 7 and 14 blows per 0.3 m of penetration, indicating a firm to stiff consistency. The moisture contents were 17 and 19 percent.

5.5 Sands and Silts

Native brown to grey deposits of sand and silt and sandy silt were encountered below the fill in all the boreholes. These layers typically contained trace gravel and trace clay. Possible cobbles were inferred in Borehole M-04 near Elevation 134.7 m. The thickness of the sands and silts varied from 1.5 m to 6.9 m. The depth to the base of the sands and silts ranged from 8.7 m to 13.8 m (Elevations 130.9 to 133.5 m).

SPT 'N' values of the sands and silts ranged from 6 to 25 blows per 0.3 m of penetration, indicating a loose to compact condition. An SPT 'N' value of 50 blows per 0.3 m of penetration, indicating a dense state, was measured in Borehole M-04 near 4.7 m depth (Elevation 135.4 m). The measured moisture contents varied from 2 to 25 percent.

Samples of the silty sands and silts were subjected to laboratory gradation analysis. Results of the tests are presented on the Record of Borehole sheets included in Appendix A and on Figure B2 of Appendix B. The results of the laboratory test are summarized as follows:

Soil Particles	Sandy Silt Percentage (%)	Sand Percentage (%)	Silt Percentage (%)
Gravel	0	0	0
Sand	32	12	3 to 6
Silt	65	78	84 to 88
Clay	3	10	9 to 10

5.6 Silty Clay

An extensive deposit of grey silty clay was contacted below the sands and silts in all the boreholes at depths ranging from 8.7 m to 13.8 m. The silty clay generally contained some to with sand and trace gravel, and has a stratified structure with sand seams. A 1.8 m thick layer of sand and silt was encountered within the silty clay deposit in Borehole M-01 at 16.5 m depth. A 0.6 m thick layer of sandy silt was also encountered in Borehole M-04 at 16.8 m depth. The thickness of the silty clay deposit ranged from 11.9 m to 18.3 m. The depths to the base of the silty clay ranged from 23.1 m to 27.0 m (Elevations 114.2 to 119.8m).

In general the SPT 'N' values measured in the silty clay ranged from 0 to 11 blows per 0.3 m of penetration. In situ vane testing indicated that the undrained shear strength ranges from 20 kPa to 50 kPa, increasing to 105 kPa with depth. This data indicated that the silty clay has a typically firm consistency with occasional soft zones, becoming stiff with depth. An SPT 'N' value of 54 blows per 0.3 m of penetration, indicating a hard consistency, was measured in Borehole M-02 at about 26.0 m depth. The moisture contents of the silty clay ranged from 8 to 46 percent.

Samples of the silty clay were subjected to gradation analysis and Atterberg Limits testing. Grain size distribution results are presented on the Record of Borehole sheets of Appendix A and on Figures B3 and B4 of Appendix B. Atterberg Limits test results are shown on the Records of Boreholes and also presented on Figures B7 and B8 of Appendix B. The results of the laboratory test are summarized as follows:

Soil Particles	Percentage (%)
Gravel	0 to 2
Sand	6 to 36
Silt	26 to 46
Clay	21 to 63

Soil Particles	Percentage (%)
Liquid Limit	18 to 44
Plasticity Index	7 to 24

The results indicate that the silty clay typically has low plasticity (CL), except for one sample from Borehole M-04, obtained at 14.0 m depth, which has medium plasticity (CI).

5.7 Silt

A layer of grey silt containing trace sand and clay, trace gravel and occasional sand seams was contacted below the silty clay at 23.1 m depth in Borehole M-04. The thickness of the silt was 3.2 m. The depth to the base of the silt was 26.3 m (Elevation 113.9 m).

The SPT 'N' values of the silt were 21 and 35 blows per 0.3 m of penetration, indicating a compact to dense state. The moisture content varied from 13 to 24 percent.

A sample of the silt was subjected to laboratory gradation analysis. Results of the test is presented on the Record of Borehole sheets included in Appendix A and on Figure B5 of Appendix B. The results of the laboratory test are summarized as follows:

Soil Particles	Percentage (%)
Gravel	0
Sand	5
Silt	88
Clay	7

5.8 Silty Clay Till

Grey silty clay till containing some sand and trace gravel was contacted below the silty clay in Boreholes M-01 to M-03 at depths ranging from 23.9 m to 27.0 m and below the silt in Borehole M-04 at 26.3 m depth. The thickness of the silty clay till ranged from 1.6m to 4.1 m. The depth to the base of the silty clay till was 25.5 m and 28.0 m (Elevations 118.2 and 117.3 m), in Boreholes M-01 and M-03, respectively. Sampling in Boreholes M-02 and M-04 was terminated within the silty clay till at 31.1 m and 30.7 m depths (Elevations 110.1 and 109.5 m), respectively. Borehole M-02 continued below sampling until DCPT refusal.

The SPT 'N' values measured in the silty clay till ranged from 63 blows per 0.3 m of penetration to greater than 100 blows for less than 0.3 m of penetration, indicating a hard consistency. The moisture contents of the silty clay till ranged from 12 to 18 percent.

Two samples of the silty clay till were subjected to gradation analysis and Atterberg Limits testing. Grain size distribution results are presented on the Record of Borehole sheets of Appendix A and in Figure B6 of Appendix B. Atterberg Limits test results are shown on the Records of Boreholes and also presented on Figure B9 of Appendix B. The results of the laboratory test are summarized as follows:

Soil Particles	Percentage (%)
Gravel	0
Sand	9 to 11
Silt	38 to 43
Clay	48 to 51

Soil Particles	Percentage (%)
Liquid Limit	34
Plasticity Index	17

The results indicate that the silty clay till has low plasticity (CL).

Glacial till deposits contain cobbles and boulders which may account for the high SPT 'N' values and resistance to augering.

5.9 Sand and Silt

Grey sand and silt till containing trace of gravel and occasional sand seams was contacted below the silty clay till at 25.5 m depth in Borehole M-01. Borehole M-01 was terminated within this till at 27.7 m depth, or Elevation 116.0 m.

The SPT 'N' values measured in the sand and silt were greater than 100 blows for less than 0.3 m of penetration indicating a very dense state. The measured moisture content on one sample was 11 percent.

Glacial till deposits contain cobbles and boulders which may account for the high SPT 'N' values and resistance to augering.

5.10 Sand

Grey sand containing trace of gravel was contacted below the silty clay till at 28.0 m depth in Borehole M-03, which was terminated within the sand at 30.7 m depth (Elevation 114.6m).

The SPT 'N' values measured in the sand were 47 blows per 0.3 m of penetration and greater than 100 blows for less than 0.3 m of penetration, indicating a dense to very dense state. The measured moisture content on one sample was 16 percent.

5.11 Groundwater Level

Water levels were observed in the open boreholes upon completion of drilling operations. Two standpipe piezometers were installed in selected boreholes to monitor water levels after completion of drilling. The water levels measured in the piezometers are summarized

in Table 5.2, which includes water levels observed in the open boreholes upon completion of drilling.

Table 5.2 – Water Level Measurements

Borehole Number	Date	Water Levels		Comment
		Depth (m)	Elevation (m)	
M-01	April 10, 2015	7.3	136.4	Open borehole
M-02	June 17, 2015	4.9	136.3	Piezometer
	February 25, 2016	6.8	134.4	
M-03	April 22, 2015	7.0	138.3	Piezometer
	June 3, 2015	6.9	138.4	
	June 17, 2015	6.9	138.4	
	January 30, 2016	6.7	138.6	
	February 25, 2016	8.2	137.1	
M-04	April 20, 2015	6.8	133.4	Open borehole

The groundwater readings at this site are short term observations. It is noted that some seasonal fluctuation of the water level has been recorded in Boreholes M-02 and M-03.

Seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at higher elevations after the spring snowmelt or after periods of heavy rainfall.

6 MISCELLANEOUS

The borehole locations on site were initially established by Thurber. Underground utility clearances were obtained for the borehole locations prior to drilling. The northing and easting coordinates and elevation at each as-drilled borehole location were provided by MMM.

The drilling and sampling equipment was supplied and operated by Walker Drilling Ltd. of Utopia, Ontario. The field work was supervised on a full time basis by Ms. Eekie Siu of Thurber.

Laboratory testing was carried out at Thurber's Toronto area, MTO approved, high complexity laboratory.

Overall supervision of the field program was conducted by Mr. Stephane Loranger, C.E.T. of Thurber. Compilation of data and preparation of the report were carried out by Mr. Sydney Pang, P.Eng. and Ms. R. Palomeque Reyna, P.Eng.

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

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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				
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 B-01

2 OF 3

METRIC

W.P. 2061-13-00 LOCATION Ramp N-W N 4 847 438.5 E 315 652.2 ORIGINATED BY MNW
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.05.08 - 2015.05.12 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 (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				WATER CONTENT (%)						
						20	40	60	80	100	20	40	60			
	Continued From Previous Page															
	Silty CLAY , some to with sand Very Soft to Firm Grey Moist		10	SS	1											
	Sand seams Wet		11	SS	2										2 32 36 30	
			12	SS	0											
			13	SS	0											
	Sandy silt lenses		14	SS	0											
			15	SS	3										0 30 42 28	

ONTMT4S_1205.GPJ 2015TEMPLATE(MTO).GDT 3/23/16

Continued Next Page

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

RECORD OF BOREHOLE No B-01

3 OF 3

METRIC

W.P. 2061-13-00 LOCATION Ramp N-W N 4 847 438.5 E 315 652.2 ORIGINATED BY MNW
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.05.08 - 2015.05.12 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 (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
						20 40 60 80 100											
						○ UNCONFINED + FIELD VANE											
						● QUICK TRIAXIAL × LAB VANE											
						20 40 60 80 100											
121.7 20.3	Continued From Previous Page Silty CLAY Soft Grey Wet Silty CLAY , some to with sand, trace gravel, occasional cobbles and boulders, pockets of sand Hard Brown to Grey Moist (TILL) Boulder (760mm) from 21.7m to 22.4m Grey No recovery Pockets of silty sand Wet to Moist		16	SS	4												
			17	SS	100/ 0.150												
			18	SS													
			19	SS	122												
			20	SS	106/ 0.250												
116.9 25.1	END OF BOREHOLE AT 25.1m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Feb 25/2016 4.3 137.7																

ONTMT4S_1205.GPJ 2015TEMPLATE(MTO).GDT 3/23/16

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

RECORD OF BOREHOLE No B-02

1 OF 3

METRIC

W.P. 2061-13-00 LOCATION Ramp N-W N 4 847 431.5 E 315 664.4 ORIGINATED BY MNW
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.05.07 - 2015.05.07 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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100								
						PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT W _p W W _L WATER CONTENT (%)								
142.0	GROUND SURFACE													
0.0	SAND , some gravel to gravelly, occasional organics Dark Brown to Black Moist (FILL) SAND and SILT , some clay, trace gravel Compact Brown Moist (FILL) Clay pockets Occasional cobbles Dense Loose Wet		1	SS	35									
141.5			2	SS	29	141								
0.5			3	SS	19	140								3 46 34 17
			4	SS	45	139								
			5	SS	32	138								
137.3	Sandy SILT , trace clay, with pockets of clay Loose Brown Wet Some sand		6	SS	7	137								
4.7			7	SS	8	136								
134.4	Silty CLAY , silt lenses, varved Very Soft Grey Moist		8	SS	0	134								
7.6							135							
			9	SS	0	133								

ONTMT4S_1205.GPJ_2015TEMPLATE(MTO).GDT_3/23/16

Continued Next Page

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

RECORD OF BOREHOLE No B-02

2 OF 3

METRIC

W.P. 2061-13-00 LOCATION Ramp N-W N 4 847 431.5 E 315 664.4 ORIGINATED BY MNW
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.05.07 - 2015.05.07 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			SHEAR STRENGTH kPa						
						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100								
						WATER CONTENT (%)								
						PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	W _p	W	W _L			
Continued From Previous Page														
	Silty CLAY Very Soft to Firm Grey Moist		10	SS	1								0 0 34 66	
	Trace to some sand, trace gravel		11	SS	0		1.7							
	Wet		12	SS	2									
127.4														
14.6	Silty CLAY , some to with sand, trace gravel Very Soft to Stiff Grey Moist to Wet		13	SS	1			5.5					2 28 38 32	
	Occasional sandy silt lenses		14	SS	4									
			15	SS	4									

ONTMT4S_1205.GPJ_2015TEMPLATE(MTO).GDT_3/23/16

Continued Next Page

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

RECORD OF BOREHOLE No B-02

3 OF 3

METRIC

W.P. 2061-13-00 LOCATION Ramp N-W N 4 847 431.5 E 315 664.4 ORIGINATED BY MNW
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.05.07 - 2015.05.07 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 (%)
	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							
121.0	Silty CLAY , some to with sand, trace gravel Very Soft Brown to Grey Wet		16	SS	2													9 33 32 26
21.0	Silty CLAY , some to with sand, trace gravel Hard Brown to Grey Wet (TILL)		17	SS	100/ 0.175													
	Varved Moist Auger grinding at 24.6m Tricone at 24.6m Spoon bouncing		18	SS	107/ 0.200													0 29 45 26
115.6	Poor recovery		19	SS	108													
26.4	END OF BOREHOLE AT 26.4m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.																	

ONTMT4S_1205.GPJ_2015TEMPLATE(MTO).GDT_3/23/16

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

RECORD OF BOREHOLE No M-01

1 OF 3

METRIC

W.P. 2061-13-00 LOCATION N 4 847 413.8 E 315 679.6 ORIGINATED BY ES
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.04.08 - 2015.04.10 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							
143.7	GROUND SURFACE														
0.0	ASPHALT: (75mm)														
0.1	SAND and SILT, some clay, trace gravel, occasional cobbles Compact Brown to Grey Moist (FILL)		1	SS	15										
	Very Dense to Dense		2	SS	50										
	Occasional wood pieces		3	SS	40										
			4	SS	36									0 45 39 16	
139.4	Clayey SILT, some sand, trace gravel, occasional wood pieces Firm Grey Moist (FILL)		5	SS	7										
137.6	SAND and SILT, trace gravel, trace clay Compact Grey Moist Brown Wet		6	SS	20										
136.5	SILT, trace sand and clay Brown Wet		7	SS	10									0 3 88 9	
135.2			8	SS	14										
8.5															

ONTMT4S_1205.GPJ 2015TEMPLATE(MTO).GDT 3/23/16

Continued Next Page

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

RECORD OF BOREHOLE No M-01

2 OF 3

METRIC

W.P. 2061-13-00 LOCATION N 4 847 413.8 E 315 679.6 ORIGINATED BY ES
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.04.08 - 2015.04.10 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							
133.5	Continued From Previous Page														
10.2	Silty CLAY , some to with sand, trace gravel Firm Grey Wet		9	SS	1										
					1	TW	PH								
					10	SS	0								
					11	SS	3								
					12	SS	6								
					13	SS	8								
127.2	SAND and SILT , some clay Loose Grey Wet														
16.5															
125.4															
18.3															

ONTMT4S_1205.GPJ_2015TEMPLATE(MTO).GDT_3/23/16

Continued Next Page

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

RECORD OF BOREHOLE No M-01

3 OF 3

METRIC

W.P. 2061-13-00 LOCATION N 4 847 413.8 E 315 679.6 ORIGINATED BY ES
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.04.08 - 2015.04.10 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										WATER CONTENT (%)	
						20	40	60	80	100	20	40	60		GR	SA	SI	CL	
	Continued From Previous Page																		
	Silty CLAY , some to with sand, trace gravel Firm to Stiff Grey Wet		14	SS	6														
119.8																			
23.9	Silty CLAY , some sand, trace gravel Hard Grey Moist (TILL)		16	SS	102/ 0.250														
118.2																			
25.5	SAND and SILT , trace gravel, occasional sand seams Very Dense Grey Moist (TILL)		17	SS	117/ 0.300														
116.0																			
27.7	END OF BOREHOLE AT 27.7m. WATER LEVEL AT 7.3m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO 0.5m, CEMENT TO 0.1m, THEN ASPHALT TO SURFACE.		18	SS	109/ 0.225														

ONTMT4S_1205.GPJ 2015TEMPLATE(MTO).GDT 3/23/16

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

RECORD OF BOREHOLE No M-02

1 OF 4

METRIC

W.P. 2061-13-00 LOCATION N 4 847 431.8 E 315 852.7 ORIGINATED BY ES
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.04.21 - 2015.04.22 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						
141.2	GROUND SURFACE					20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE								
0.0	SAND and SILT, some clay, trace gravel Loose to Compact Brown Moist (FILL)					20 40 60 80 100 WATER CONTENT (%) W _p W W _L								
141			1	SS	5									
140			2	SS	16									
139	Wet		3	SS	17									
138			4	SS	8									
137														
136	Dense Moist		5	SS	41								5	37 46 12
135	Occasional cobbles Very Dense		6	SS	88									
134.0														
134	Sandy SILT, trace clay Compact Brown Wet		7	SS	22									0 32 65 3
133														
132.5														
132	Silty CLAY, some to with sand, trace gravel Soft Grey Wet		8	SS	3									

ONTMT4S_1205.GPJ_2015TEMPLATE(MTO).GDT_3/23/16

Continued Next Page

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

RECORD OF BOREHOLE No M-02

2 OF 4

METRIC

W.P. 2061-13-00 LOCATION N 4 847 431.8 E 315 852.7 ORIGINATED BY ES
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.04.21 - 2015.04.22 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								
						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				WATER CONTENT (%) 20 40 60						
	Continued From Previous Page															
	Silty CLAY, some to with sand, trace gravel Firm Grey Wet		9	SS	2		131		2.5							
							130								0 32 26 42	
			1	TW	PH		129									
							128		3.0							
	Firm to Stiff		10	SS	3		127									
126.4	Soft						126		2.8							
14.8	Occasional sand seams		11	SS	2		125									
124.9							124		2.7							
16.3			2	TW	PH		123									
							122		2.5						2 30 37 31	
									2.7							

ONTMT4S_1205.GPJ 2015TEMPLATE(MTO).GDT 3/23/16

Continued Next Page

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

RECORD OF BOREHOLE No M-02

3 OF 4

METRIC

W.P. 2061-13-00 LOCATION N 4 847 431.8 E 315 852.7 ORIGINATED BY ES
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.04.21 - 2015.04.22 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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100								
						WATER CONTENT (%)								
						PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	W _p	W	W _L			
	Continued From Previous Page													
	Silty CLAY, some to with sand, trace gravel Stiff Grey Wet Gravelly layer (100mm) at 20.2m		13	SS	1									
			14	SS	6									
	Hard		15	SS	54								0 36 39 25	
114.2														
27.0	Silty CLAY, some sand, trace gravel Hard Grey Moist (TILL)		16	SS	117/ 0.300									
			17	SS	63									

ONTMT4S_1205.GPJ_2015TEMPLATE(MTO).GDT_3/23/16

Continued Next Page

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

RECORD OF BOREHOLE No M-02

4 OF 4

METRIC

W.P. 2061-13-00 LOCATION N 4 847 431.8 E 315 852.7 ORIGINATED BY ES
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.04.21 - 2015.04.22 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			20	40	60	80					
	Continued From Previous Page															
110.1	Silty CLAY , some sand, trace gravel, occasional sand seams Hard Grey Moist (TILL)		18	SS	75		111									
31.1	End of sampling at 31.1m and start of DCPT						110									
109.0							109									
32.2	END OF BOREHOLE AT 32.2m DEPTH UPON DCPT REFUSAL. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.0m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Jun 03/2015 27.2 114.0 Jun 17/2015 4.9 136.3 Feb 25/2016 6.8 134.4															

ONTMT4S_1205.GPJ_2015TEMPLATE(MTO).GDT_3/23/16

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

RECORD OF BOREHOLE No M-03

1 OF 4

METRIC

W.P. 2061-13-00 LOCATION N 4 847 317.6 E 315 777.0 ORIGINATED BY ES
 HWY 401 BOREHOLE TYPE Hollow Stem Augers/Dynamic Cone Penetration Test COMPILED BY AN
 DATUM Geodetic DATE 2015.04.02 - 2015.04.07 CHECKED BY MEF

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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE WATER CONTENT (%) 20 40 60								
145.3	GROUND SURFACE													
0.0	TOPSOIL: (100mm)													
0.1	SAND and SILT, trace gravel, trace clay Dense to Compact Brown Moist (FILL)		1	SS	33									
	Dark Brown		2	SS	23									
143.0	Clayey SILT, some sand, trace gravel Stiff Brown (FILL)		3	SS	14									
142.3			4	SS	21									
141.2	Silty SAND, some clay, trace gravel, occasional cobbles		5	SS	31									9 53 26 12
139.7	Very Dense Possible cobbles at 6.2m		6	SS	53									
138.4	SAND and SILT, trace clay, trace gravel Compact Brown Moist		7	SS	25									
			8	SS	14									

ONTMT4S_1205.GPJ 2015TEMPLATE(MTO).GDT 3/23/16

Continued Next Page

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

RECORD OF BOREHOLE No M-03

2 OF 4

METRIC

W.P. 2061-13-00 LOCATION N 4 847 317.6 E 315 777.0 ORIGINATED BY ES
 HWY 401 BOREHOLE TYPE Hollow Stem Augers/Dynamic Cone Penetration Test COMPILED BY AN
 DATUM Geodetic DATE 2015.04.02 - 2015.04.07 CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
						20	40	60	80	100	20	40	60				
134.6	Continued From Previous Page SAND and SILT, trace clay, trace gravel Compact Brown Wet	[Strat Plot]	9	SS	7	[Water]	135									0 6 84 10	
10.7																	SILT, trace gravel, some clay
133.6	Grey	[Strat Plot]	10	SS	12	[Water]	133										
11.7																	
131.5	Silty CLAY, some to with sand Firm Grey Wet	[Strat Plot]	11	SS	4	[Water]	131										
13.8																	
	Firm to Stiff	[Strat Plot]	12	SS	1	[Water]	130				3.7					0 17 37 46	
	Firm to Stiff	[Strat Plot]	1	TW	PH	[Water]	128										
	Firm to Stiff	[Strat Plot]	13	SS	1	[Water]	127										
	Firm to Stiff	[Strat Plot]	1	SS	1	[Water]	126										

ONTMT4S_1205.GPJ_2015TEMPLATE(MTO).GDT_3/23/16

Continued Next Page

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

RECORD OF BOREHOLE No M-03

3 OF 4

METRIC

W.P. 2061-13-00 LOCATION N 4 847 317.6 E 315 777.0 ORIGINATED BY ES
 HWY 401 BOREHOLE TYPE Hollow Stem Augers/Dynamic Cone Penetration Test COMPILED BY AN
 DATUM Geodetic DATE 2015.04.02 - 2015.04.07 CHECKED BY MEF

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	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	W _p W W _L			
								WATER CONTENT (%)						
								20 40 60						
	Continued From Previous Page													
	Silty CLAY, some to with sand Stiff Grey Wet		14	SS	0									
	Sand seams		15	SS	11								0 33 46 21	
119.0			16	SS	15									
26.3	Silty CLAY, trace sand Hard Grey Moist (TILL)													
117.3			17	SS	102/ 0.225								0 9 43 48	
28.0	SAND, trace gravel Dense Grey Wet													
			18	SS	47									

ONTMT4S_1205.GPJ_2015TEMPLATE(MTO).GDT_3/23/16

Continued Next Page

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

RECORD OF BOREHOLE No M-03

4 OF 4

METRIC

W.P. 2061-13-00 LOCATION N 4 847 317.6 E 315 777.0 ORIGINATED BY ES
 HWY 401 BOREHOLE TYPE Hollow Stem Augers/Dynamic Cone Penetration Test COMPILED BY AN
 DATUM Geodetic DATE 2015.04.02 - 2015.04.07 CHECKED BY MEF

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										
114.6	SAND, trace gravel Dense Grey Wet																
30.7	End of sampling at 30.7m and start of DCPT		19	SS	100/ 0.200												
114.1																	
31.2	END OF BOREHOLE AT 31.2m UPON DCPT REFUSAL. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.04m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Apr 22/2015 7.0 138.3 Jun 03/2015 6.9 138.4 Jun 17/2015 6.9 138.4 Jan 30/2016 6.7 138.6 Feb 25/2016 8.2 137.1																

ONTMT4S_1205.GPJ 2015TEMPLATE(MTO).GDT 3/23/16

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

RECORD OF BOREHOLE No M-04

2 OF 4

METRIC

W.P. 2061-13-00 LOCATION N 4 847 328.9 E 315 910.0 ORIGINATED BY ES
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.04.17 - 2015.04.20 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					○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				WATER CONTENT (%)						
	Silty CLAY , trace sand Firm to Stiff Grey Wet					130		3.0								
			1	TW	PH											
						129										
			9	SS	2	128		2.9								
						127		3.0								
			10	SS	3	126									0	6 31 63
						125		3.1								
			2	TW	PH	124										
	Very Stiff															
123.4																
16.8	Layer of sandy silt		11	SS	3	123										
122.8																
17.4																
			12	SS	6	122										
						121										
								3.3								

ONTMT4S_1205.GPJ 2015TEMPLATE(MTO).GDT 3/23/16

Continued Next Page

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

RECORD OF BOREHOLE No M-04

3 OF 4

METRIC

W.P. 2061-13-00 LOCATION N 4 847 328.9 E 315 910.0 ORIGINATED BY ES
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.04.17 - 2015.04.20 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			SHEAR STRENGTH kPa						
	Continued From Previous Page					20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE								
						PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT W _p W W _L WATER CONTENT (%)								
						20 40 60								
117.1	Silty CLAY , trace sand Stiff Grey Wet		13	SS	11									
23.1	SILT , trace sand and clay, trace gravel, occasional sand seams Compact to Dense Grey Moist Wet		14	SS	21									
			15	SS	35									0 5 88 7
113.9	Silty CLAY , some sand, trace gravel Hard Grey Moist (TILL)		16	SS	57									
26.3			17	SS	101/ 0.250									
			18	SS	108/ 0.225									0 11 38 51

ONTMT4S_1205.GPJ 2015TEMPLATE(MTO).GDT 3/23/16

Continued Next Page

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

RECORD OF BOREHOLE No M-04

4 OF 4

METRIC

W.P. 2061-13-00 LOCATION N 4 847 328.9 E 315 910.0 ORIGINATED BY ES
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.04.17 - 2015.04.20 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										
	Continued From Previous Page																	
109.5	Silty CLAY , some sand, trace gravel						110											
30.7	Hard Grey Moist (TILL) Sand layer (50mm) at 30.6m		19	SS	100/	0.200												
	END OF BOREHOLE AT 30.7m. WATER LEVEL AT 6.8m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.																	

ONTMT4S_1205.GPJ 2015TEMPLATE(MTO).GDT 3/23/16

RECORD OF BOREHOLE No R-04 1 OF 4 METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 301.7 E 315 659.3 ORIGINATED BY ES
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.03.17 - 2015.03.17 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			SHEAR STRENGTH kPa						
						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE WATER CONTENT (%) 20 40 60								
143.2	GROUND SURFACE													
0.0	TOPSOIL: (50mm) SAND and SILT, trace gravel Compact Brown to Grey Moist (FILL)		1	SS	26									
141.2			2	SS	26									
2.0 140.9	TOPSOIL, occasional rootlets Compact Dark Brown (300mm)		3	SS	13									
2.3	Silty SAND, trace clay, trace gravel Compact to Dense Dark Brown to Grey Moist		4	SS	10								0 61 32 7	
	Brown		5	SS	31									
	Wet		6	SS	26									
136.0														
7.2	Silty CLAY, some to with sand, trace gravel Firm Grey Moist		7	SS	4								0 32 35 33	
			8	SS	3									

ONTMT4S_1205.GPJ 2015TEMPLATE(MTO).GDT 3/23/16

Continued Next Page

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

RECORD OF BOREHOLE No R-04

3 OF 4

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 301.7 E 315 659.3 ORIGINATED BY ES
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.03.17 - 2015.03.17 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	NUMBER	TYPE	"N" VALUES			20	40	60	80	100						20	40
123.1	Continued From Previous Page	14	SS	8														
20.1	SAND and SILT, some clay, trace gravel Very Dense Grey Moist (TILL)																	3 38 48 11
		15	SS	108														
120.6	Wet																	
22.6	Dense	16	SS	48														
119.3																		
23.9	Some clay to clayey, trace gravel Moist	17	SS	100/ 0.250														7 26 43 24
		18	SS	100/ 0.250														
115.6	Occasional sand seams	19	SS	108/ 0.175														
27.6	END OF BOREHOLE AT 27.6m. BOREHOLE CAVED FROM 27.6m TO 15.5m DEPTHS UPON COMPLETION. WATER LEVEL AT 5.9m UPON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS: DATE DEPTH (m) ELEV. (m) Mar 31/2015 4.5 138.7 Apr 22/2015 4.7 138.5 Jun 03/2015 4.6 138.6 Jun 17/2015 4.6 138.6																	

ONTMT4S_1205.GPJ 2015TEMPLATE(MTO).GDT 3/23/16

Continued Next Page

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

RECORD OF BOREHOLE No R-04

4 OF 4

METRIC

W.P. 2061-13-00 LOCATION W-N/S Ramp Leslie St. / CNR Overhead N 4 847 301.7 E 315 659.3 ORIGINATED BY ES
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.03.17 - 2015.03.17 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	20			40	60	80	100	W _p					
	Continued From Previous Page Feb 25/2016 5.4 137.8																	

ONTMT4S_1205.GPJ 2015TEMPLATE(MTO).GDT 3/23/16

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

RECORD OF BOREHOLE No R-06

1 OF 4

METRIC

W.P. 2061-13-00 LOCATION N 4 847 318.2 E 315 729.5 ORIGINATED BY ES
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.04.01 - 2015.04.01 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								WATER CONTENT (%)	
						20	40	60	80	100	20	40	60	GR	SA	SI	CL
143.6	GROUND SURFACE																
0.0 0.1	TOPSOIL: (75mm) Silty SAND , some gravel, trace clay, occasional asphalt fragments Dense to Very Dense Brown Moist (FILL)		1	SS	40						○						
	Occasional inferred cobbles		2	SS	59						○			11	59	26	4
	Compact		3	SS	35						○						
			4	SS	15						○						
139.5																	
4.1	SAND , trace silt and clay, trace gravel Loose to Compact Dark Brown to Brown Moist to Wet		5	SS	8						○						
			6	SS	24						○			2	83	15	(SI+CL)
136.4																	
7.2	SAND and SILT , trace clay, trace gravel Compact Grey Wet		7	SS	16						○						
			8	SS	11						○			0	39	57	4

ONTMT4S_1205.GPJ 2015TEMPLATE(MTO).GDT 3/23/16

Continued Next Page

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

RECORD OF BOREHOLE No R-06

3 OF 4

METRIC

W.P. 2061-13-00 LOCATION N 4 847 318.2 E 315 729.5 ORIGINATED BY ES
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.04.01 - 2015.04.01 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			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	GR
	Continued From Previous Page																	
	Silty CLAY , some to with sand, trace gravel Stiff Grey Moist		14	SS	8													0 40 39 21
118.0																		
25.6	SAND and SILT , trace clay, trace gravel Very Dense Grey Moist (TILL)		16	SS	104/ 0.250													
116.9																		
26.7	SAND , trace gravel, some silt and clay Very Dense Grey Moist		17	SS	117/ 0.225													8 82 10 (SI+CL)
115.3																		
28.3																		
114.3																		
29.3	END OF BOREHOLE AT 29.3.m. WATER LEVEL AT 6.7m UPON COMPLETION. BOREHOLE BACKFILLED WITH		18	SS	109/ 0.225													

ONTMT4S_1205.GPJ_2015TEMPLATE(MTO).GDT_3/23/16

Continued Next Page

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

RECORD OF BOREHOLE No R-06

4 OF 4

METRIC

W.P. 2061-13-00 LOCATION N 4 847 318.2 E 315 729.5 ORIGINATED BY ES
 HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2015.04.01 - 2015.04.01 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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					W _p	W	W _L					
	Continued From Previous Page BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.																	

ONTMT4S_1205.GPJ 2015TEMPLATE(MTO).GDT 3/23/16

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

Appendix B

Laboratory Test Results

Grain Size Analysis

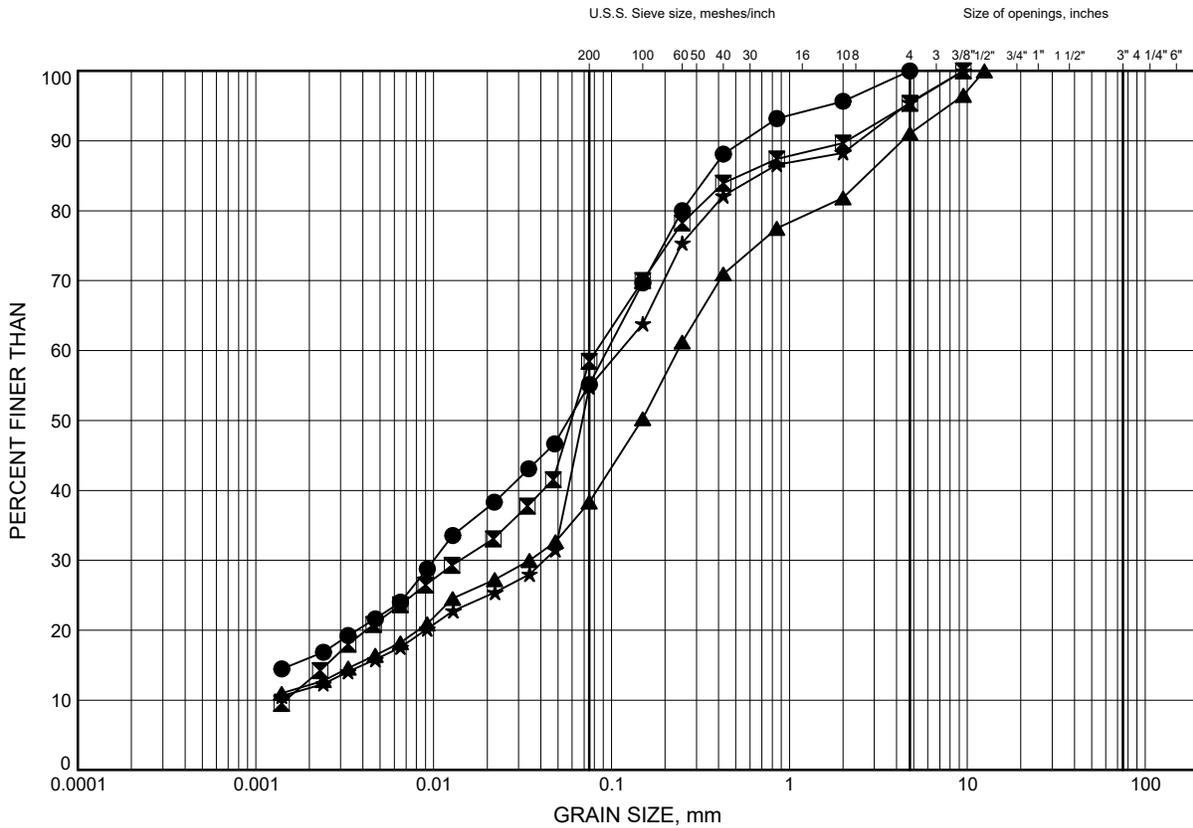
Atterberg Limits Test Results

19-5161-205

Hwy 401 Leslie Street 2013-E-0032
GRAIN SIZE DISTRIBUTION

FIGURE B1

SAND & SILT / Silty SAND FILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	M-01	3.24	140.46
⊠	M-02	4.88	136.32
▲	M-03	4.88	140.42
★	M-04	1.83	138.37

Date March 2016
 W.P. 2061-13-00

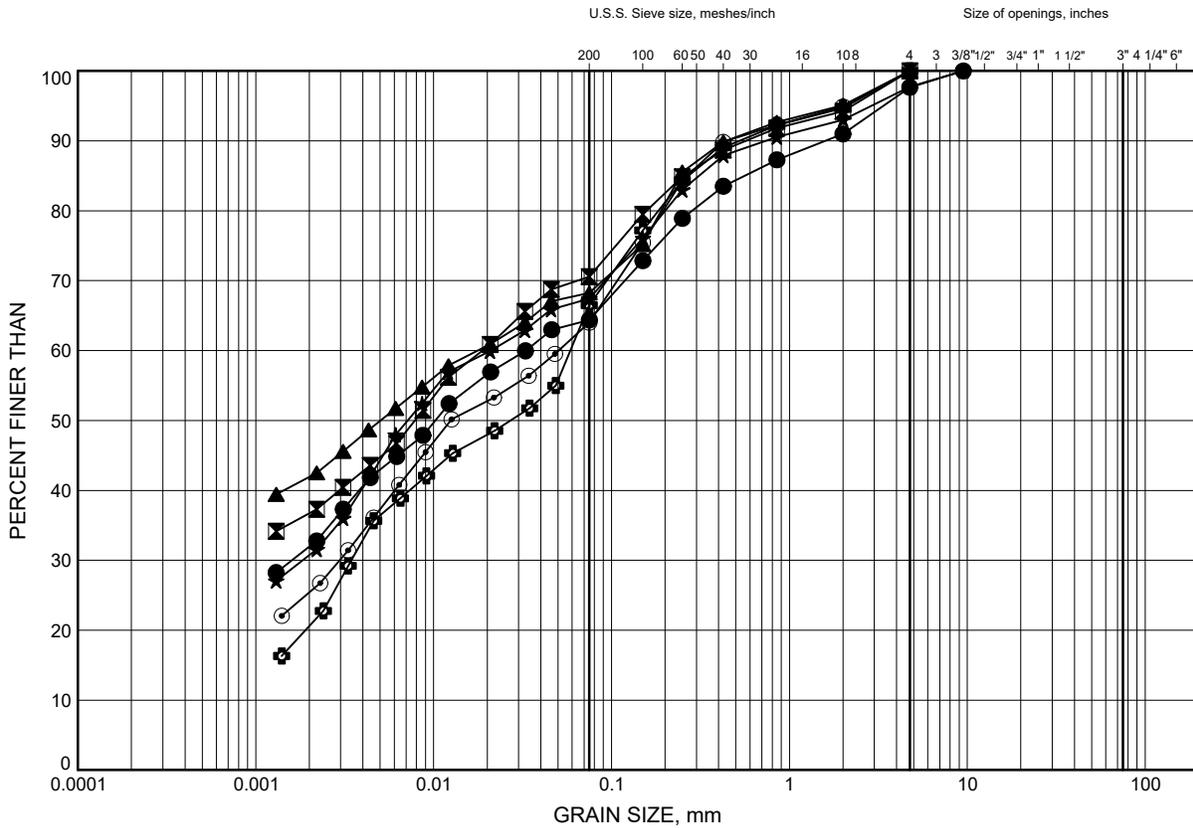


Prep'd AN
 Chkd. SKP

Hwy 401 Leslie Street 2013-E-0032
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)
●	M-01	14.02	129.68
⊠	M-01	20.12	123.58
▲	M-02	10.97	130.23
★	M-02	18.59	122.61
⊙	M-02	26.21	114.99
⊕	M-03	23.16	122.14

Date March 2016
 W.P. 2061-13-00

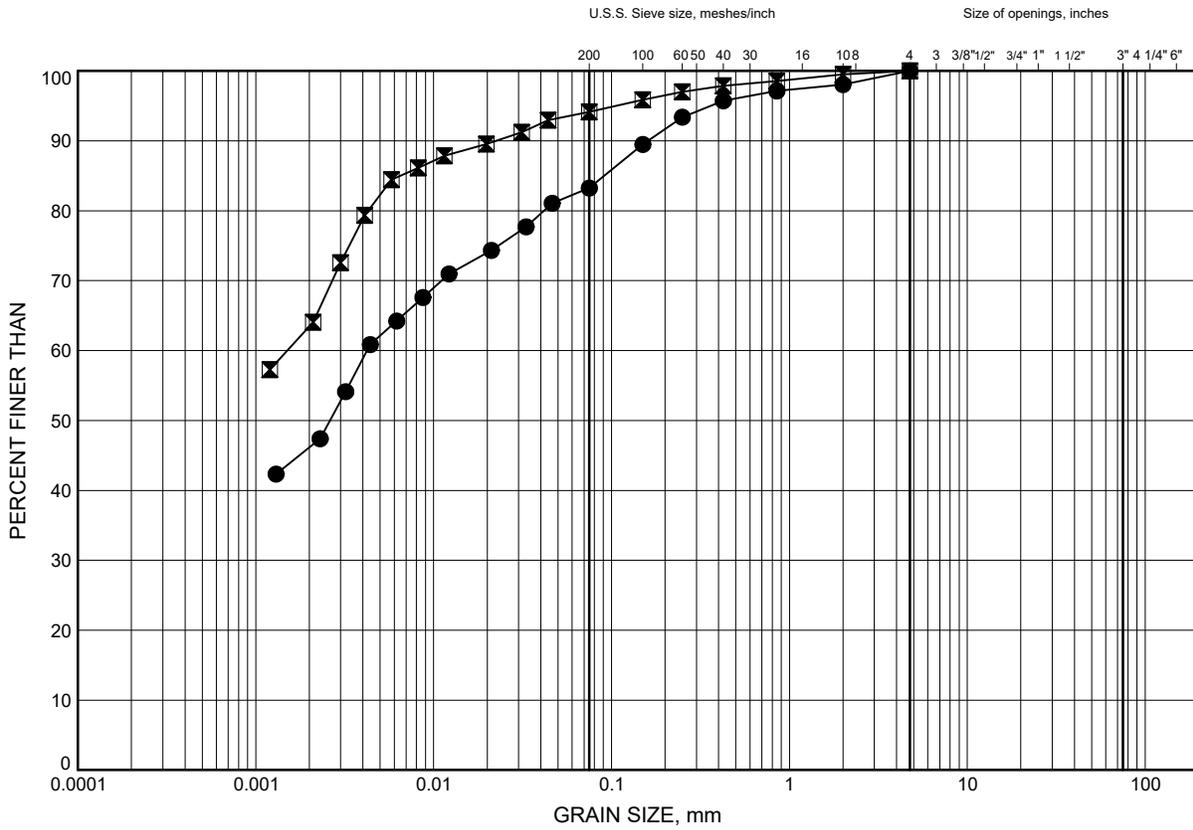


Prep'd AN
 Chkd. SKP

Hwy 401 Leslie Street 2013-E-0032
GRAIN SIZE DISTRIBUTION

FIGURE B4

Silty CLAY



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	M-03	15.54	129.76
⊠	M-04	14.02	126.18

GRAIN SIZE DISTRIBUTION - THURBER 1205.GPJ 3/22/16

Date March 2016
 W.P. 2061-13-00

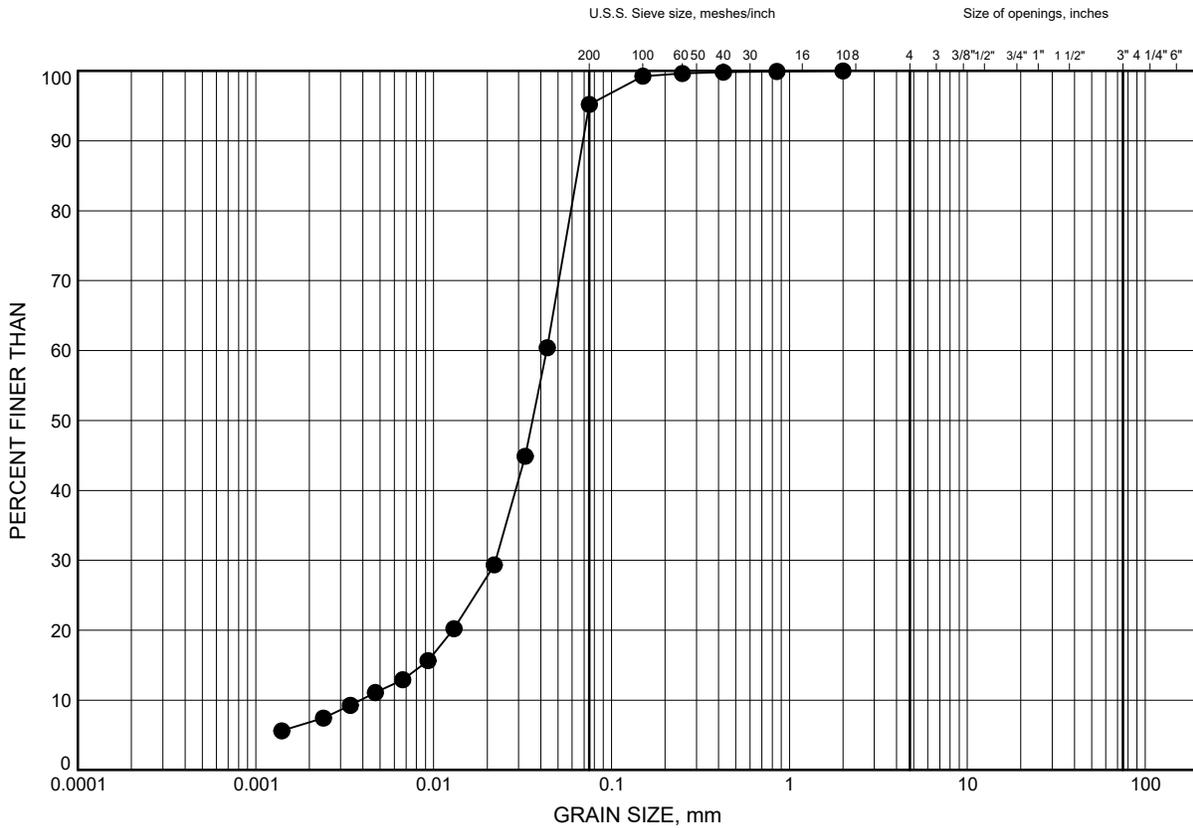


Prep'd AN
 Chkd. SKP

Hwy 401 Leslie Street 2013-E-0032
GRAIN SIZE DISTRIBUTION

FIGURE B5

SILT



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	M-04	24.69	115.51

GRAIN SIZE DISTRIBUTION - THURBER 1205.GPJ 3/23/16

Date March 2016
 W.P. 2061-13-00

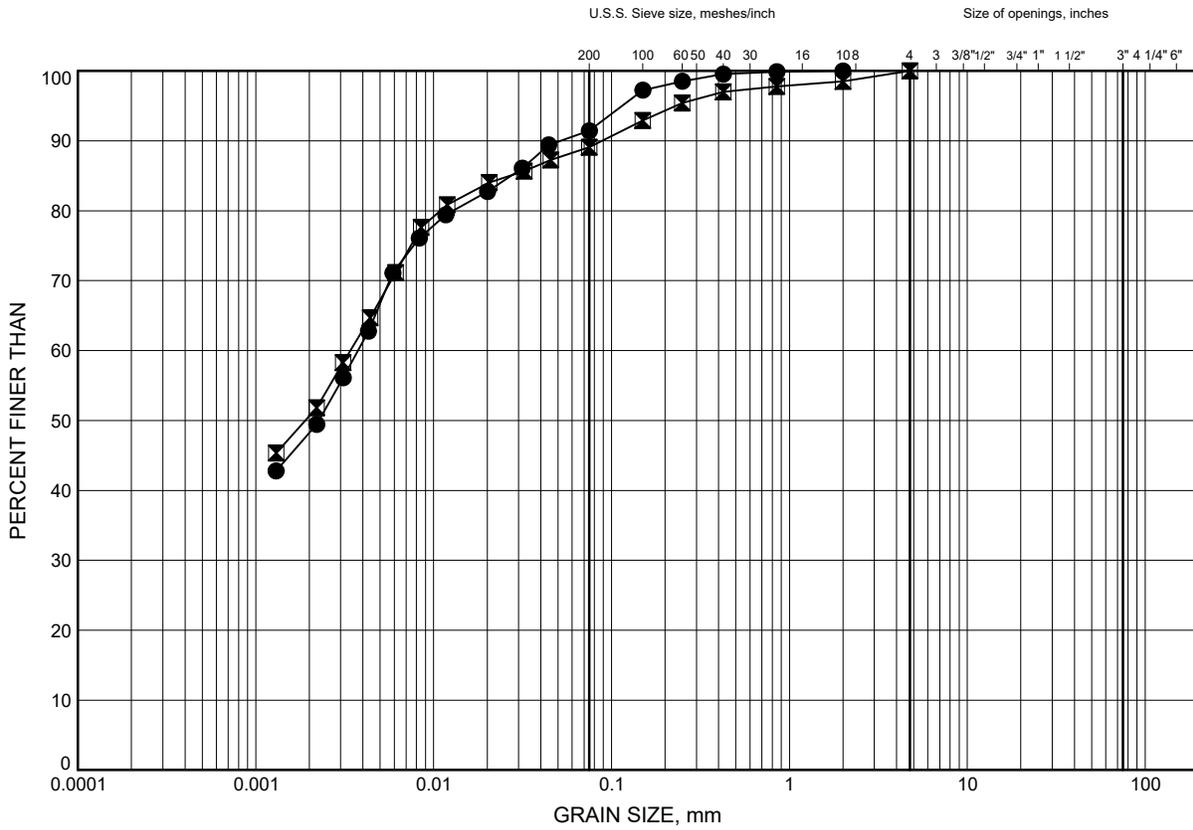


Prep'd AN
 Chkd. SKP

Hwy 401 Leslie Street 2013-E-0032
GRAIN SIZE DISTRIBUTION

FIGURE B6

Silty CLAY TILL



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	M-03	27.74	117.56
⊠	M-04	29.26	110.94

GRAIN SIZE DISTRIBUTION - THURBER 1205.GPJ 3/23/16

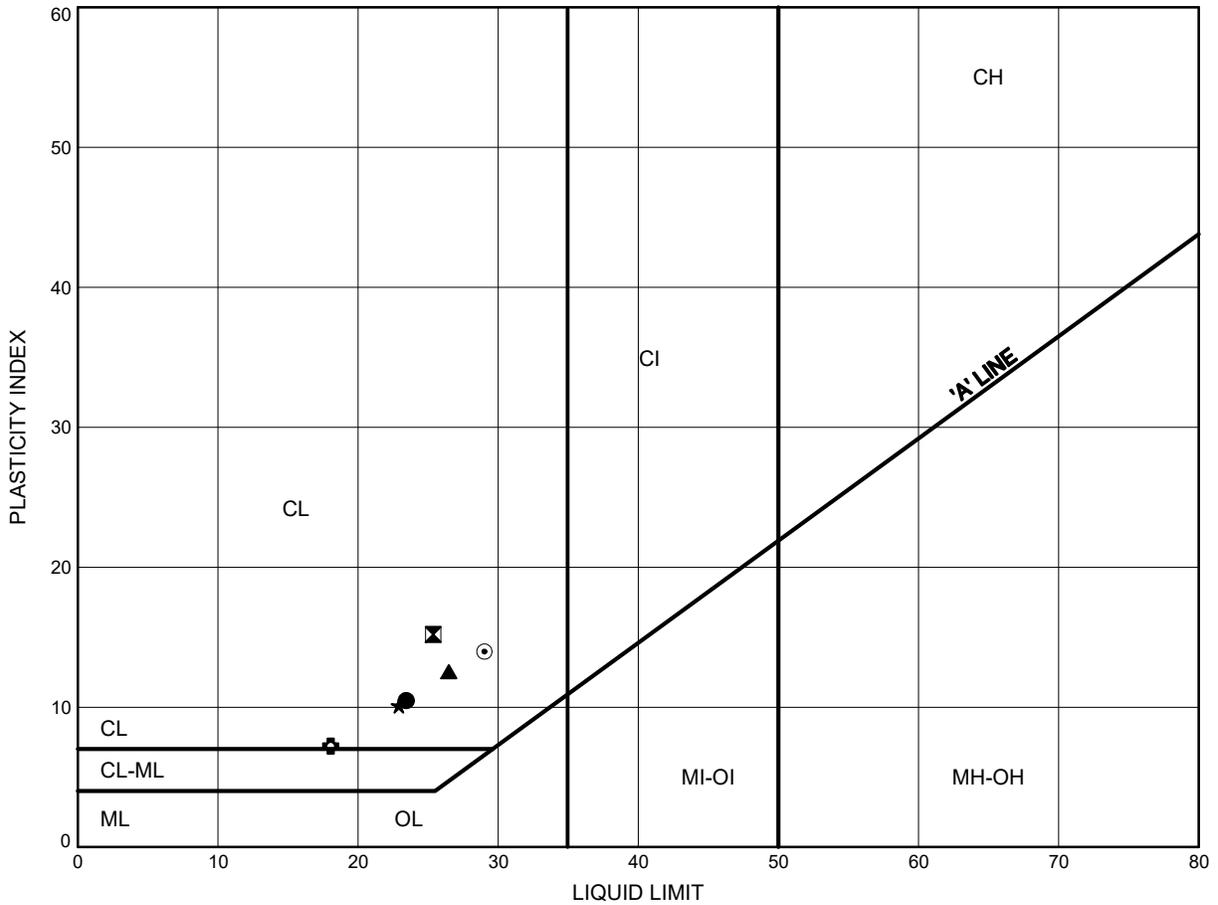
Date March 2016
 W.P. 2061-13-00



Prep'd AN
 Chkd. SKP

ATTERBERG LIMITS TEST RESULTS

Silty CLAY



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	M-01	14.02	129.68
⊠	M-01	20.12	123.58
▲	M-02	10.97	130.23
★	M-02	18.59	122.61
⊙	M-03	15.54	129.76
⊕	M-03	23.16	122.14

Date March 2016
 W.P. 2061-13-00

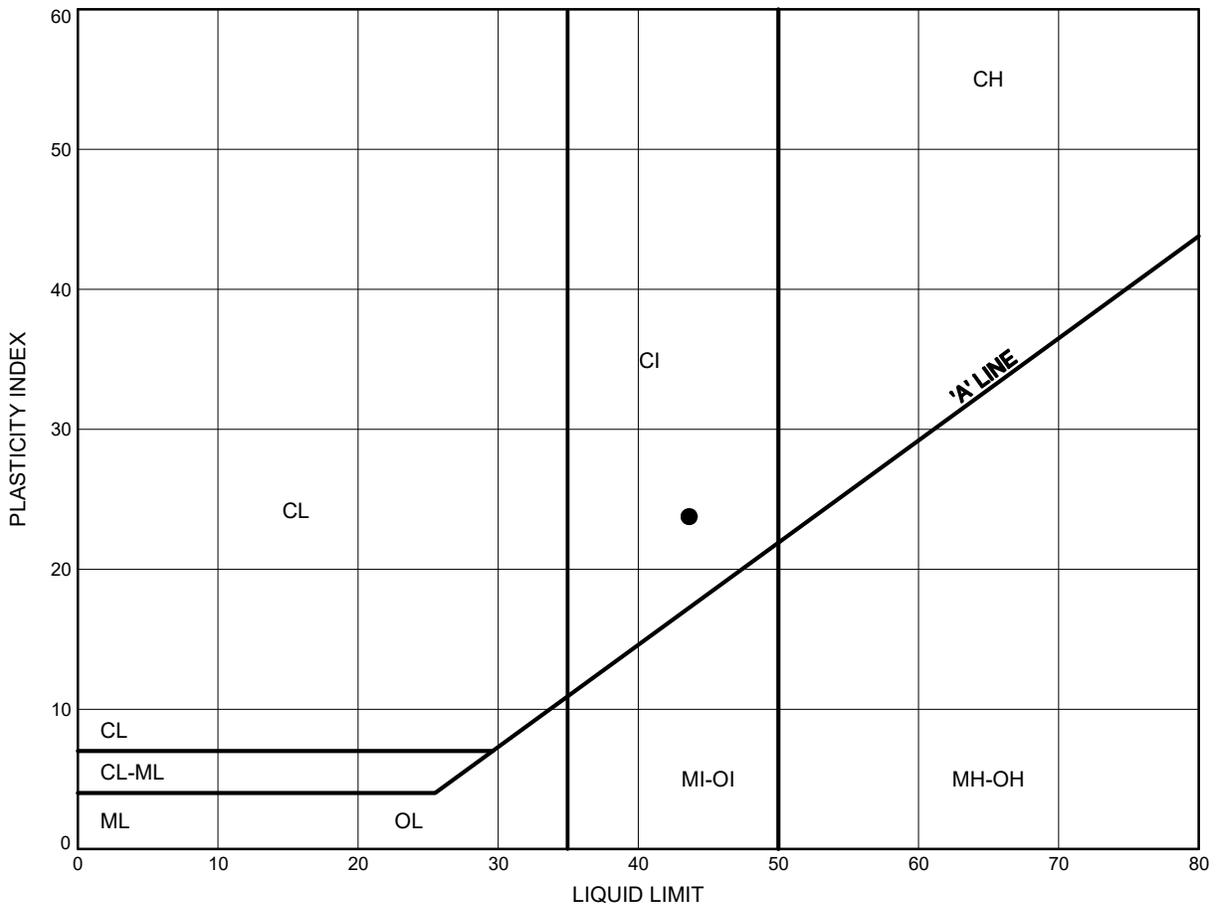


Prep'd AN
 Chkd. SKP

Hwy 401 Leslie Street 2013-E-0032
ATTERBERG LIMITS TEST RESULTS

FIGURE B8

Silty CLAY



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	M-04	14.02	126.18

THURBALT 1205.GPJ 3/23/16

Date March 2016
 W.P. 2061-13-00

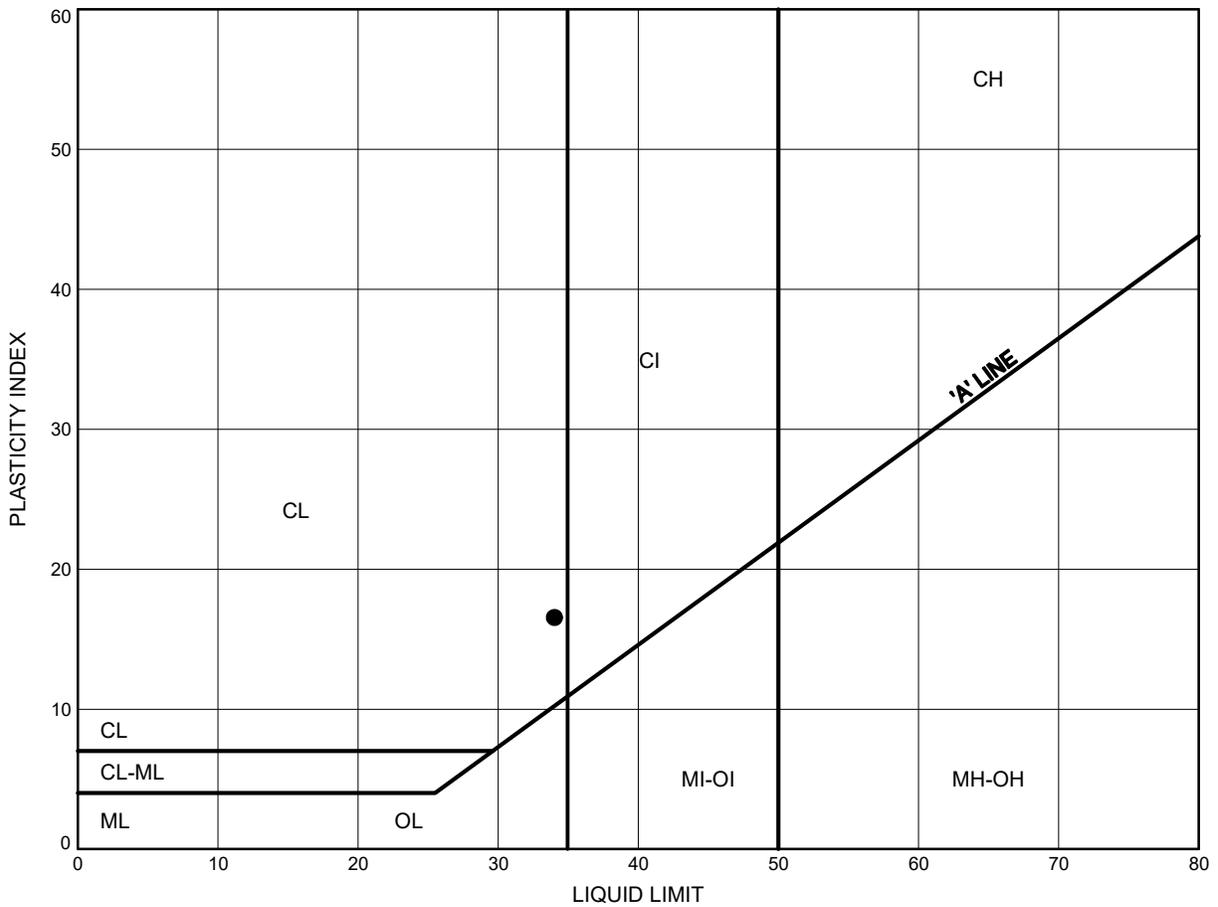


Prep'd AN
 Chkd. SKP

Hwy 401 Leslie Street 2013-E-0032
ATTERBERG LIMITS TEST RESULTS

FIGURE B9

Silty CLAY TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	M-04	29.26	110.94

THURBALT 1205.GPJ 3/23/16

Date March 2016
 W.P. 2061-13-00



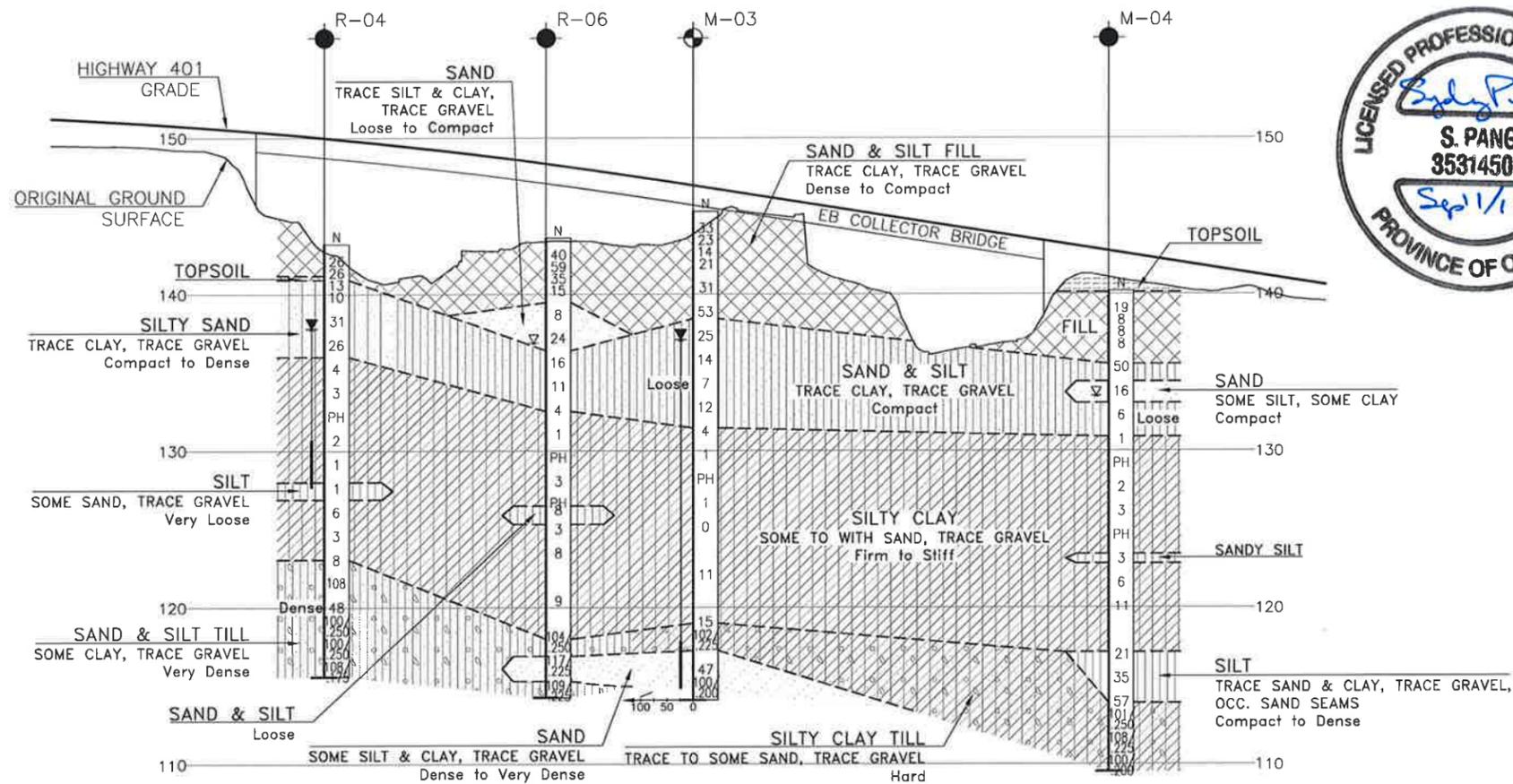
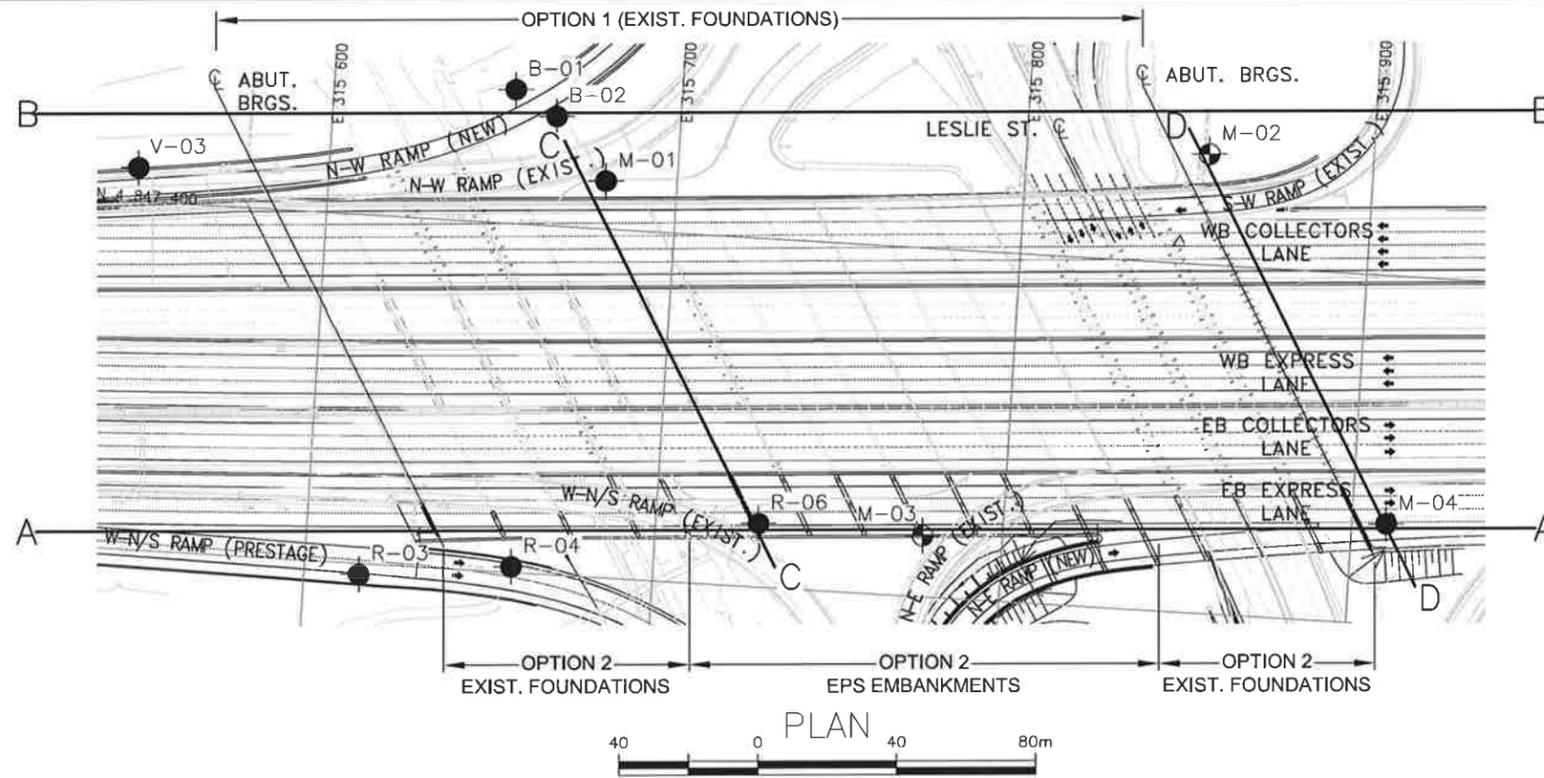
Prep'd AN
 Chkd. SKP

Appendix C

Drawings titled “Borehole Locations and Soil Strata”

19-5161-205

MINISTRY OF TRANSPORTATION, ONTARIO



PROFILE ALONG A-A



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

CONT No
WP No 2061-13-00

HIGHWAY 401 OVERPASS
AT GO PARKING LOT
AND LESLIE STREET
BOREHOLE LOCATIONS AND SOIL STRATA



SHEET



THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

- Borehole
- ◆ Borehole and Cone
- 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
B-01	142.0	4 847 438.5	315 652.2
B-02	142.0	4 847 431.5	315 664.4
M-01	143.7	4 847 413.8	315 679.6
M-02	141.2	4 847 431.8	315 852.7
M-03	145.3	4 847 317.6	315 777.0
M-04	140.2	4 847 328.9	315 910.0
R-03	144.9	4 847 296.9	315 615.8
R-04	143.2	4 847 301.7	315 659.3
R-06	143.6	4 847 318.2	315 729.5
V-03	144.6	4 847 409.6	315 545.7

-NOTES-

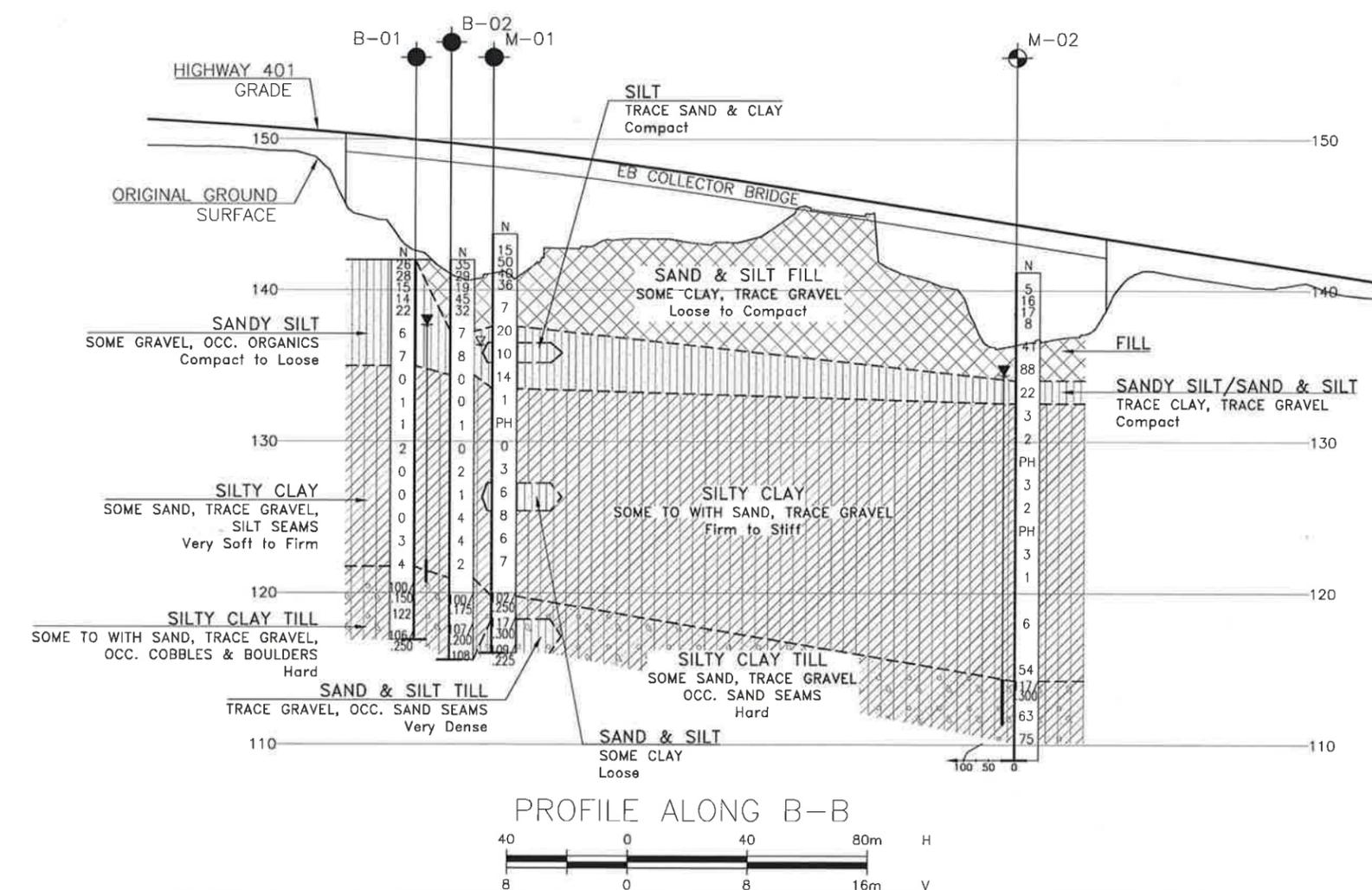
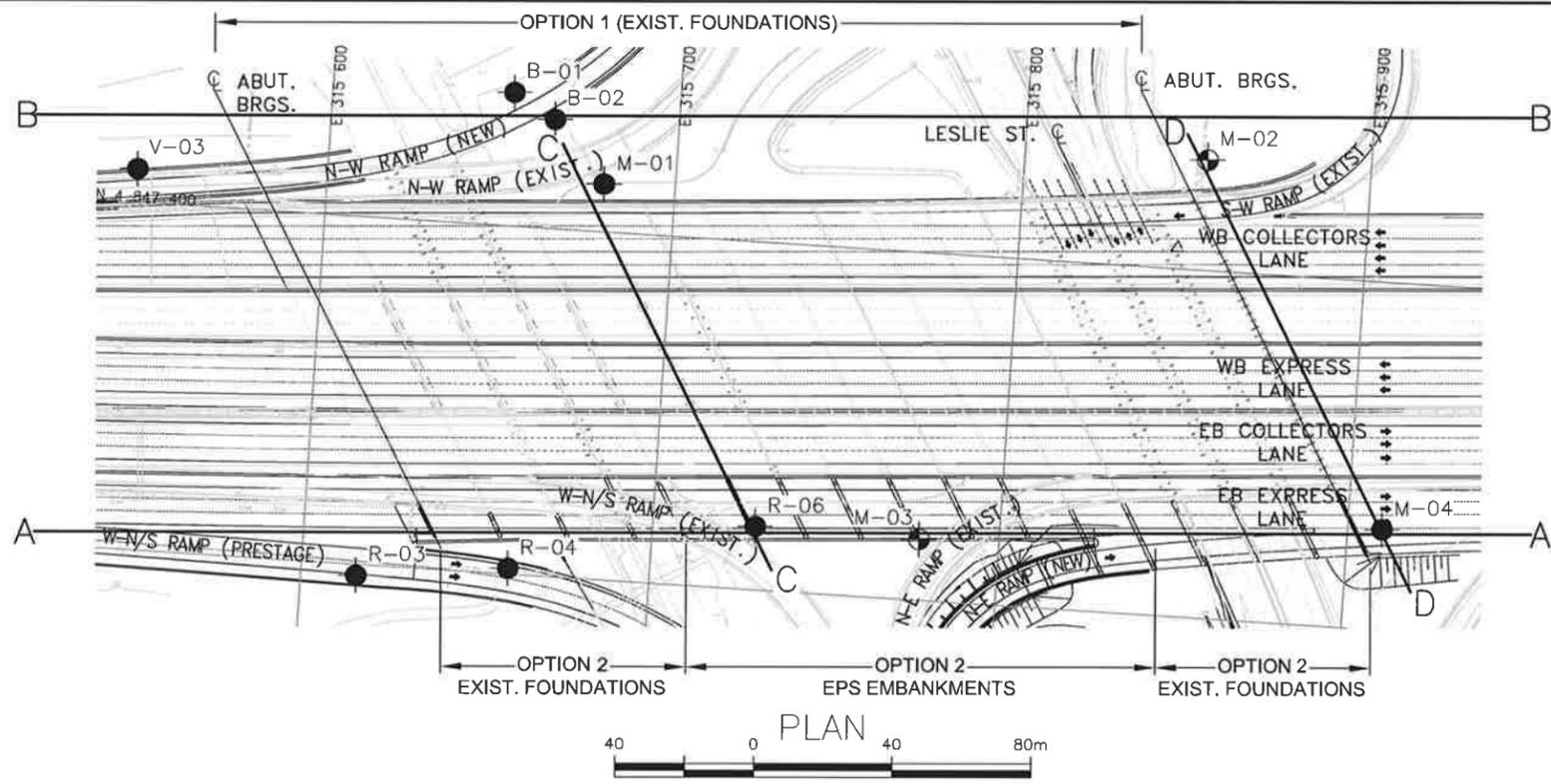
- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEORES No. 30M14-463

DATE	BY	DESCRIPTION
DESIGN	SKP	CHK
DRAWN	AN	CHK

CODE	LOAD	DATE
SITE 37-206/1-4	STRUCT	SEP 2017
DWG 1		

FILENAME: H:\Drafting\19\5161\205\1205\1205-BoreholePlan&Profile (Hwy401&LeslieSt.BridgeReplacement).dwg
PLOTDATE: 9/12/2017 9:12 AM



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

CONT No
WP No 2061-13-00

HIGHWAY 401 OVERPASS
AT GO PARKING LOT
AND LESLIE STREET
BOREHOLE LOCATIONS AND SOIL STRATA

THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

- ◆ Borehole
- ◆ Borehole and Cone
- 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
B-01	142.0	4 847 438.5	315 652.2
B-02	142.0	4 847 431.5	315 664.4
M-01	143.7	4 847 413.8	315 679.6
M-02	141.2	4 847 431.8	315 852.7
M-03	145.3	4 847 317.6	315 777.0
M-04	140.2	4 847 328.9	315 910.0
R-03	144.9	4 847 296.9	315 615.8
R-04	143.2	4 847 301.7	315 659.3
R-06	143.6	4 847 318.2	315 729.5
V-03	144.6	4 847 409.6	315 545.7

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

GEOCREs No. 30M14-463



REVISIONS	DATE	BY	DESCRIPTION

DESIGN	SKP	CHK	CODE	LOAD	DATE
					SEP 2017

DRAWN AN CHK SKP SITE 37-206/1-4|STRUCT DWG 2

MINISTRY OF TRANSPORTATION, ONTARIO

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

CONT No
WP No 2061-13-00
HIGHWAY 401 OVERPASS
AT GO PARKING LOT
AND LESLIE STREET
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET



KEYPLAN

LEGEND

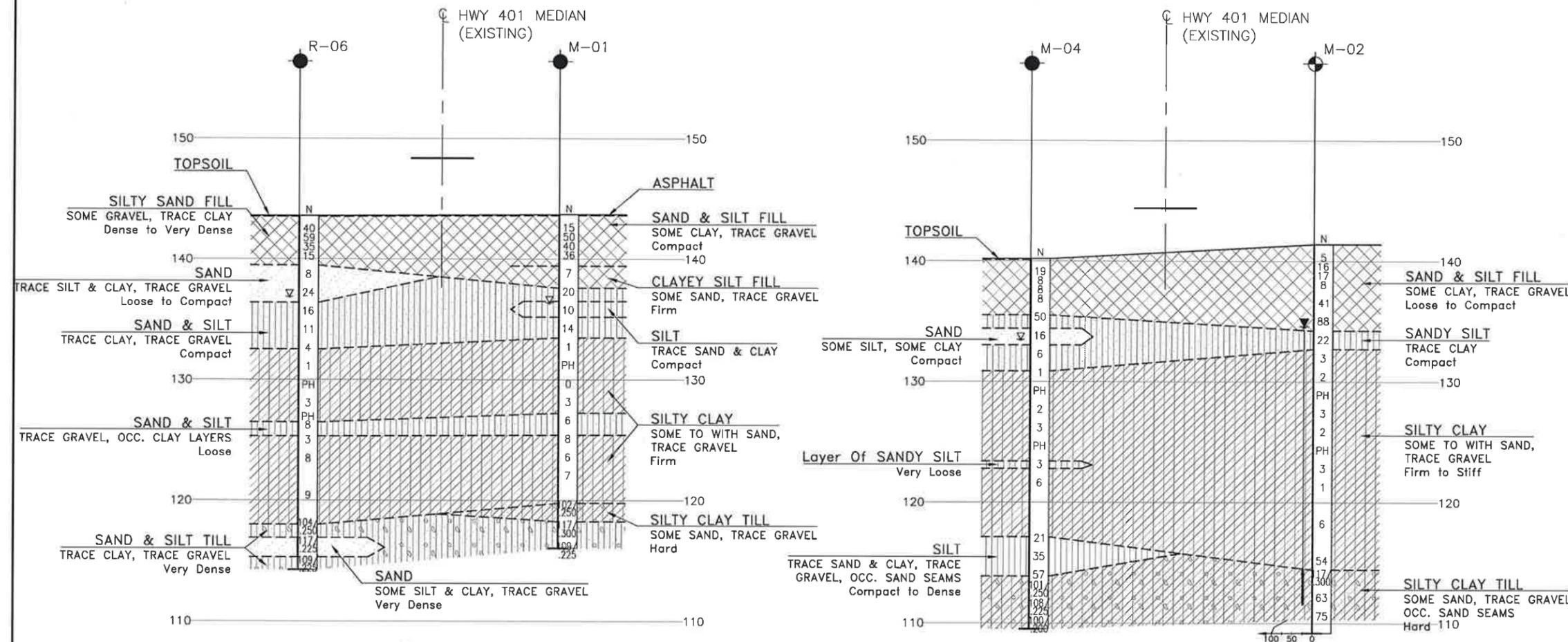
- Borehole
- ⊕ Borehole and Cone
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- ∇ Water Level
- ⊥ Head Artesian Water
- ⊥ Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
B-01	142.0	4 847 438.5	315 652.2
B-02	142.0	4 847 431.5	315 664.4
M-01	143.7	4 847 413.8	315 679.6
M-02	141.2	4 847 431.8	315 852.7
M-03	145.3	4 847 317.6	315 777.0
M-04	140.2	4 847 328.9	315 910.0
R-03	144.9	4 847 296.9	315 615.8
R-04	143.2	4 847 301.7	315 659.3
R-06	143.6	4 847 318.2	315 729.5
V-03	144.6	4 847 409.6	315 545.7

-NOTES-

- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
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GEOCREs No. 30M14-463



SECTION C-C

SECTION D-D



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	SKP	CHK	CODE LOAD
DRAWN	AN	CHK SKP	SITE 37-206/1-4 STRUCT DWG 3

FILENAME: H:\Projects\1015161\205\Net1205-BoreholePlan.dwg (Hwy401&LeslieSt.BridgeReplacement).dwg
PLOTDATE: 9/12/2017 8:12 AM