



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**

GEOCRES 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, GEOCRE 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, GEOCRE 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. Eckie 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.

THURBER ENGINEERING LTD.



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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

C_{pen} Shear Strength Determination by Pocket Penetrometer

- (1) SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.
- (2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

UNIFIED SOILS CLASSIFICATION

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

EXPLANATION OF ROCK LOGGING TERMS

<u>ROCK WEATHERING CLASSIFICATION</u>		<u>SYMBOLS</u>	
Fresh (FR)	No visible signs of weathering.		
Fresh Jointed (FJ)	Weathering limited to the surface of major discontinuities.		CLAYSTONE
Slightly Weathered (SW)	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock material.		SILTSTONE
Moderately Weathered (MW)	Weathering extends throughout the rock mass, but the rock material is not friable.		SANDSTONE
Highly Weathered (HW)	Weathering extends throughout the rock mass and the rock is partly friable.		COAL
Completely Weathered (CW)	Rock is wholly decomposed and in a friable condition, but the rock texture and structure are preserved.		Bedrock (general)

<u>DISCONTINUITY SPACING</u>		<u>STRENGTH CLASSIFICATION</u>			
Bedding	Bedding Plane Spacing	Rock Strength	Approximate Uniaxial Compressive Strength		Field Estimation of Hardness*
			(MPa)	(psi)	
Very thickly bedded	Greater than 2m	Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Thickly bedded	0.6 to 2m				
Medium bedded	0.2 to 0.6m	Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Thinly bedded	60mm to 0.2m	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>					
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.				

METRIC

[illegible]

+³, ×³: Numbers refer to Sensitivity

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									
	Continued From Previous Page																
	Silty CLAY , some to with sand Very Soft to Firm Grey Moist		10	SS	1		131										
								2.2									
	Sand seams Wet		11	SS	2		130					16.1				2 32 36 30	
							129										
			12	SS	0		128					0					
							127										
			13	SS	0		126					0					
							125										
	Sandy silt lenses		14	SS	0		124					0					
							123										
			15	SS	3							16.1				0 30 42 28	
								2.1									

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity 20
15 10 5 (%) 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									
	Continued From Previous Page							20 40 60 80 100									
121.7 20.3	Silty CLAY Soft Grey Wet		16	SS	4												
	Silty CLAY , some to with sand, trace gravel, occasional cobbles and boulders, pockets of sand Hard Brown to Grey Moist (TILL)						121										
	Boulder (760mm) from 21.7m to 22.4m		17	SS	100/ 0.150		120										
	Grey		18	SS			119										
	No recovery		19	SS	122		118										
	Pockets of silty sand Wet to Moist		20	SS	106/ 0.250		117										
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

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					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									
142.0	GROUND SURFACE							20	40	60	80	100					
0.0	SAND , some gravel to gravelly, occasional organics Dark Brown to Black		1	SS	35									○			
141.5	Moist (FILL)													○			
0.5	SAND and SILT , some clay, trace gravel Compact Brown Moist (FILL) Clay pockets		2	SS	29		141							○			
			3	SS	19		140							○			3 46 34 17
	Occasional cobbles Dense																
			4	SS	45												
							139							○ ○			
			5	SS	32		138										
	Loose Wet																
137.3														○			
4.7	Sandy SILT , trace clay, with pockets of clay Loose Brown Wet		6	SS	7		137								○		
	Some sand						136								○		
			7	SS	8		135										
134.4																	
7.6	Silty CLAY , silt lenses, varved Very Soft Grey Moist		8	SS	0		134							○			
							133										
			9	SS	0												

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE 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		w P w w L			
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	WATER CONTENT (%)				
	Continued From Previous Page							20 40 60 80 100		20 40 60			
	Silty CLAY Very Soft to Firm Grey Moist		10	SS	1		131						0 0 34 60
	Trace to some sand, trace gravel		11	SS	0		130	1.7 +					
	Wet		12	SS	2		128						
127.4													
14.6	Silty CLAY , some to with sand, trace gravel Very Soft to Stiff Grey Moist to Wet		13	SS	1		127	5.5 +					2 28 38 30
	Occasional sandy silt lenses		14	SS	4		125						
			15	SS	4		123						

+³, ×³: Numbers refer to Sensitivity

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 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 (%)			GR	SA	SI	CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
								20	40	60	80	100					20	40	60																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
	Continued From Previous Page		16	SS	2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					

ONTMT4S 1205.GPJ 2015TEMPLATE(MTO).GDT 3/23/16

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					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						
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									
			3	SS	40									
	Occasional wood pieces		4	SS	36									
139.4														
4.3	ClayeySILT, some sand, trace gravel, occasional wood pieces Firm Grey Moist (FILL)		5	SS	7									
137.6														
6.1	SAND and SILT, trace gravel, trace clay Compact Grey Moist Brown Wet		6	SS	20									
136.5														
7.2	SILT, trace sand and clay Brown Wet		7	SS	10									
135.2														
8.5			8	SS	14									

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									WATER CONTENT (%)			
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE											
	Continued From Previous Page						20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100							
133.5																				
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															
127.2																				
16.5	SAND and SILT , some clay Loose Grey Wet		12	SS	6															
125.4																				
18.3			13	SS	8															

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 NATURAL LIQUID LIMIT MOISTURE CONTENT 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	W _P	W					
	Continued From Previous Page		14	SS	6										0	29	34	37
	Silty CLAY , some to with sand, trace gravel Firm to Stiff Grey Wet						123											
			15	SS	7													
							121											
119.8							120											
23.9	Silty CLAY , some sand, trace gravel Hard Grey Moist (TILL)		16	SS	102/ 0.250		119											
118.2																		
25.5	SAND and SILT , trace gravel, occasional sand seams Very Dense Grey Moist (TILL)		17	SS	117/ 0.300		118											
							117											
116.0			18	SS	109/ 0.225													
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.																	

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+³, ×³: Numbers refer to Sensitivity 20 15 10 5 (%) 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				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											
141.2	GROUND SURFACE							20 40 60 80 100	○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL						× LAB VANE	WATER CONTENT (%)	
0.0								20 40 60 80 100										20 40 60	
0.0	SAND and SILT , some clay, trace gravel Loose to Compact Brown Moist (FILL) <																		

Continued Next Page

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

ONTMT4S 1205.GPJ 2015TEMPLATE(MTO).GDT 3/23/16

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 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				W _p W W _L										
								● QUICK TRIAXIAL × LAB VANE														
	Continued From Previous Page							20	40	60	80	100	20	40	60							
	Silty CLAY , some to with sand, trace gravel Firm Grey Wet						131		2.5													
			9	SS	2													0	32	26	42	
							130															
									3.4													
							129															
			1	TW	PH																	
							128		3.0													
	Firm to Stiff		10	SS	3		127															
126.4									2.8													
14.8	Soft						126															
	Occasional sand seams		11	SS	2																	
							125		2.7													
124.9							124															
16.3			2	TW	PH																	
									2.5													
							123															
			12	SS	3														2	30	37	31
							122		2.7													

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				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				WATER CONTENT (%) W _p W W _L				
	Continued From Previous Page		13	SS	1		121									
	Silty CLAY , some to with sand, trace gravel Stiff Grey Wet Gravelly layer (100mm) at 20.2m						120									
			14	SS	6		118									
							117									
							116									
	Hard		15	SS	54		115								0 36 39 25	
114.2							114									
27.0	Silty CLAY , some sand, trace gravel Hard Grey Moist (TILL)		16	SS	117/ 0.300		113									
							112									
			17	SS	63											

Continued Next Page

+³, ×³: Numbers refer to Sensitivity
 20
15
10
(%) 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 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																
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																	
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						109										

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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									
145.3	GROUND SURFACE							20	40	60	80	100					
0.0	TOPSOIL: (100mm)							20	40	60	80	100					
0.1	SAND and SILT, trace gravel, trace clay Dense to Compact Brown Moist (FILL)		1	SS	33		145										
	Dark Brown		2	SS	23		144										
143.0	Clayey SILT, some sand, trace gravel Stiff Brown (FILL)		3	SS	14		143										
142.3			4	SS	21		142										
141.2	Silty SAND, some clay, trace gravel, occasional cobbles		5	SS	31		141										
139.7	Very Dense Possible cobbles at 6.2m		6	SS	53		139										
138.4	SAND and SILT, trace clay, trace gravel Compact Brown Moist		7	SS	25		138										
			8	SS	14		137										
							136										

Continued Next Page

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

METRIC

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 (%)				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							
	Continued From Previous Page						20 40 60 80 100				W _P W W _L				
134.6 10.7	SAND and SILT , trace clay, trace gravel Compact Brown Wet		9	SS	7									0 6 84 10	
133.6 11.7	SILT , trace gravel, some clay														
	Grey		10	SS	12										
131.5 13.8	Silty CLAY , some to with sand Firm Grey Wet		11	SS	4										
							3.7								
			12	SS	1									0 17 37 46	
			1	TW	PH										
	Firm to Stiff														
			13	SS	1										
							3.8								
							3.7								

+³, ×³: Numbers refer to Sensitivity

METRIC

[illegible]

+³, ×³: Numbers refer to Sensitivity

ONTMT4S 1205.GPJ 2015TEMPLATE(MTO).GDT 3/23/16

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 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																
114.6	SAND, trace gravel Dense Grey Wet		19	SS	100/ 0.200		115										
30.7	End of sampling at 30.7m and start of DCPT																
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																

RECORD OF BOREHOLE No M-04

1 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 (%)					
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
									20 40 60 80 100				W _P W W _L				
140.2	GROUND SURFACE																
0.0 0.1	TOPSOIL: (75mm)						140										
	SAND and SILT, trace gravel, some clay Compact to Loose Brown Moist (FILL)		1	SS	19		139					○					
	Occasional roots		2	SS	8		138					○			5 41 43 11		
	Brown to Grey		3	SS	8		137					○					
			4	SS	8		136										
135.5																	
4.7	SAND and SILT, some clay Dense Brown Moist Possible cobbles		5	SS	50		135					○					
134.4																	
5.8	SAND, some silt, some clay Compact Brown Wet		6	SS	16		134					○			0 12 78 10		
133.0																	
7.2							133										
	Loose Wet		7	SS	6		132					○					
130.9																	
9.3	Silty CLAY, trace to some sand Soft Grey Moist		8	SS	1		131					○					

Continued Next Page

+³, ×³: Numbers refer to Sensitivity
 20
15
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		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		W P		W		W L			GR SA SI CL				
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	WATER CONTENT (%)												
	Continued From Previous Page							20 40 60 80 100													
	Silty CLAY , trace sand Firm to Stiff Grey Wet						130	3.0 +													
			1	TW	PH		129						○								
							128	2.9 +													
			9	SS	2		127	3.0 +													
			10	SS	3		126						○								
							125	3.1 +													
			2	TW	PH		124						○								
	Very Stiff						123														
123.4							122														
16.8							121														
122.8	Layer of sandy silt		11	SS	3								○								
17.4																					
			12	SS	6																

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				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				W _p W W _L				
	Continued From Previous Page		13	SS	11		120									
							119									
							118									
117.1																
23.1	SILT , trace sand and clay, trace gravel, occasional sand seams Compact to Dense Grey Moist Wet		14	SS	21		117									
							116									
			15	SS	35										0 5 88 7	
							115									
113.9			16	SS	57		114									
26.3	Silty CLAY , some sand, trace gravel Hard Grey Moist (TILL)						113									
			17	SS	101/ 0.250		112									
			18	SS	108/ 0.225		111								0 11 38 51	

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15 5
10 (%) 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 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						
	Continued From Previous Page																
109.5	Silty CLAY , some sand, trace gravel																
30.7	Hard Grey Moist (TILL) Sand layer (50mm) at 30.6m END OF BOREHOLE AT 30.7m. WATER LEVEL AT 6.8m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.		19	SS	100/ 0.200												

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										
143.2	GROUND SURFACE							20	40	60	80	100						
0.0	TOPSOIL: (50mm)							20	40	60	80	100						
	SAND and SILT, trace gravel Compact Brown to Grey Moist (FILL)		1	SS	26		143											
							142											
141.2			2	SS	26													
2.0	TOPSOIL, occasional rootlets						141											
140.9	Compact Dark Brown (300mm)		3	SS	13													
2.3	Silty SAND, trace clay, trace gravel Compact to Dense Dark Brown to Grey Moist						140											
			4	SS	10													
							139											
	Brown		5	SS	31													
							138											
	Wet		6	SS	26		137											
							136											
136.0							135											
7.2	Silty CLAY, some to with sand, trace gravel Firm Grey Moist		7	SS	4													
							134											
			8	SS	3													

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No R-04

2 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			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	W _p W W _L	WATER CONTENT (%)				
	Continued From Previous Page													
	Silty CLAY , trace to some sand, trace gravel Firm Grey Wet		1	TW	PH		133	2.0						
							132	1.0						
			9	SS	2		131							
	Becoming some to with sand		10	SS	1		130	2.0						
							129	2.0						
128.0			11	SS	1		128							
15.2	SILT , some sand, trace gravel Very Loose Wet						127							
126.9			12	SS	6		126							
16.3							125	2.5						
	Stiff		13	SS	3		124							

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	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)				GR	SA	SI	CL
	Continued From Previous Page							20	40	60	80	100											
123.1			14	SS	8		123							○				3	38	48	11		
20.1	SAND and SILT , some clay, trace gravel Very Dense Grey Moist (TILL)																						
			15	SS	108		122							○									
							121																
120.6	Wet																						
22.6	Dense		16	SS	48		120							○									
119.3							119							○									
23.9	Some clay to clayey, trace gravel Moist		17	SS	100/ 0.250															7	26	43	24
							118																
														○									
			18	SS	100/ 0.250		117																
							116																
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				0.175																		

Continued Next Page

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

METRIC

[illegible]

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					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														
								WATER CONTENT (%)														
143.6	GROUND SURFACE						20	40	60	80	100	W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L		GR	SA	SI	CL			
0.0 0.1	TOPSOIL: (75mm)						20	40	60	80	100											
	Silty SAND , some gravel, trace clay, occasional asphalt fragments Dense to Very Dense Brown Moist (FILL)		1	SS	40								○					11	59	26	4	
			2	SS	59								○									
	Occasional inferred cobbles		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

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No R-06

2 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				WATER CONTENT (%)								
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
	Continued From Previous Page						20 40 60 80 100					W _p W W _L								
132.5	SAND and SILT , trace clay, trace gravel Loose Grey Wet		9	SS	4								○							
11.1	Silty CLAY , some to with sand, trace gravel Firm Grey Wet																			
			10	SS	1								○							
													○							
			1	TW	PH															
			11	SS	3															
			2	TW	PH															
126.5																				
17.1	SAND and SILT , trace gravel, occasional clay layers Loose Grey Wet		12	SS	8								○							
125.3																				
18.3			13	SS	3								○							

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			SHEAR STRENGTH kPa						WATER CONTENT (%)			GR	SA	SI	CL	
								20	40	60	80	100		○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL					× LAB VANE
	Continued From Previous Page		14	SS	8													0	40	39	21
	Silty CLAY , some to with sand, trace gravel Stiff Grey Moist						123														
							122														
							121														
			15	SS	9		120														
							119														
118.0							118														
25.6	SAND and SILT , trace clay, trace gravel Very Dense Grey Moist (TILL)		16	SS	104/ 0.250		117														
116.9							116														
26.7	SAND , trace gravel, some silt and clay Very Dense Grey Moist		17	SS	117/ 0.225		115														
115.3																					
28.3																					
114.3			18	SS	109/ 0.225																
29.3	END OF BOREHOLE AT 29.3.m. WATER LEVEL AT 6.7m UPON COMPLETION. BOREHOLE BACKFILLED WITH																				

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 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 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																
	BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.																

Appendix B

Laboratory Test Results

Grain Size Analysis

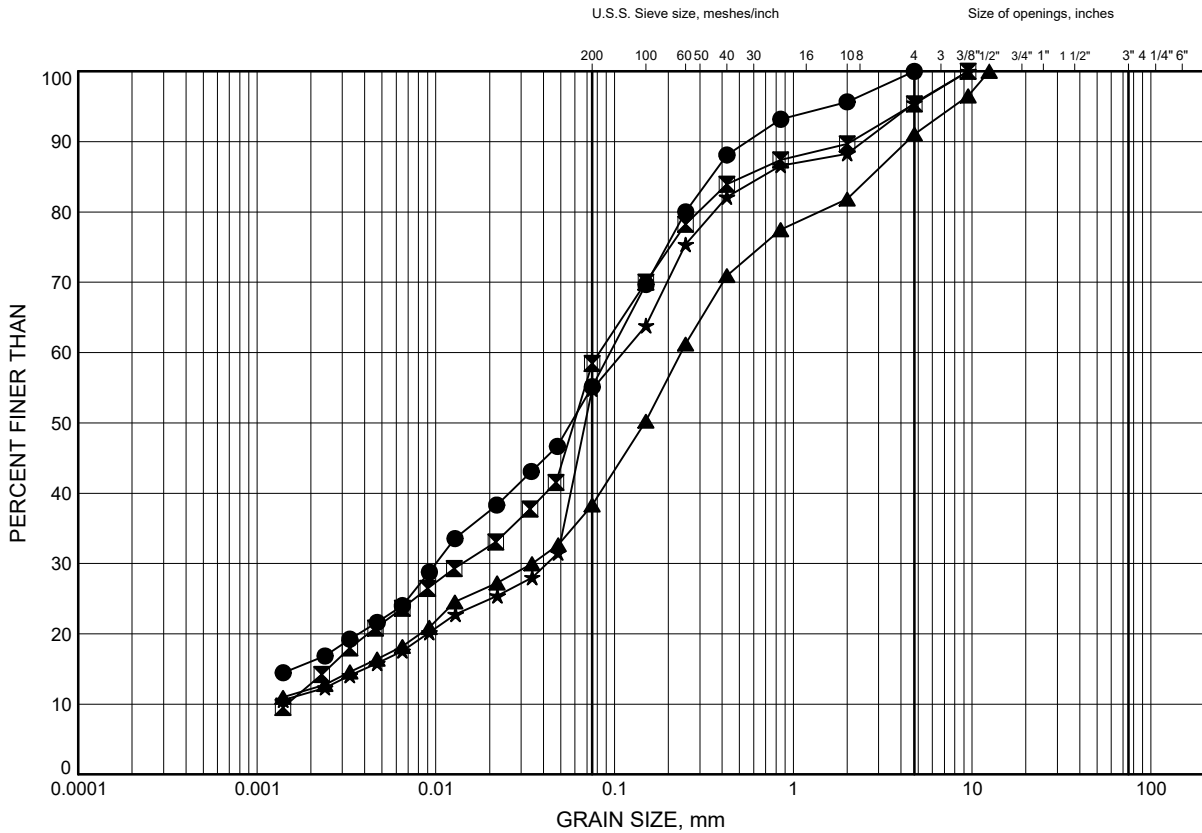
Atterberg Limits Test Results

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

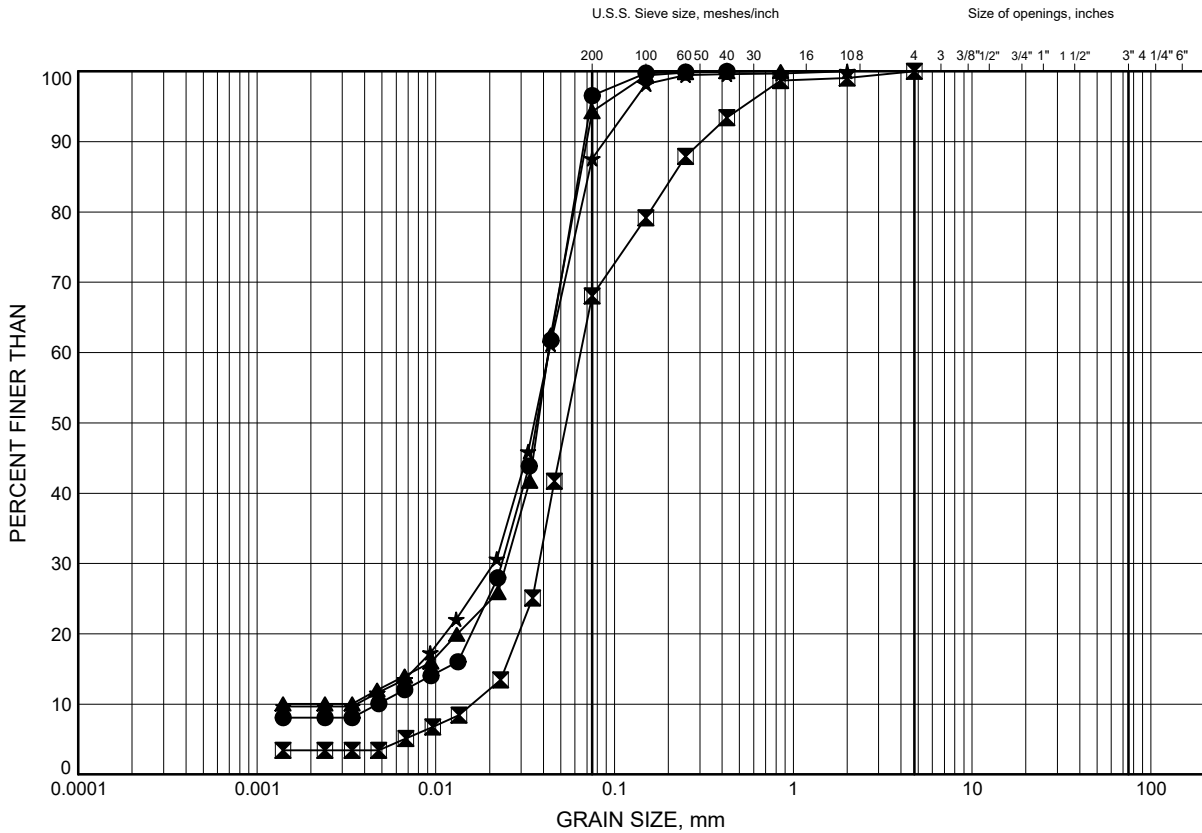


Prep'd AN
Chkd. SKP

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

FIGURE B2

SANDS & SILTS



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

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	M-01	7.92	135.78
⊠	M-02	7.92	133.28
▲	M-03	10.97	134.33
★	M-04	6.40	133.80

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

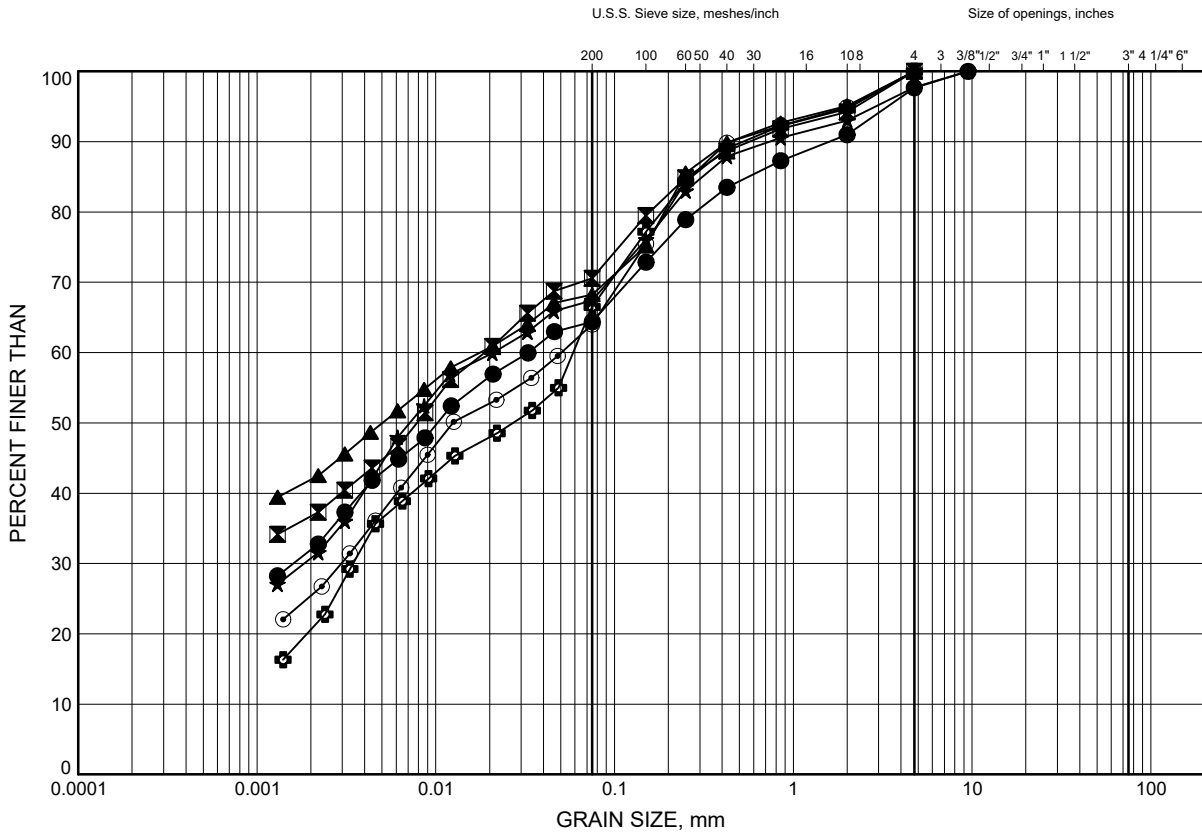


Prep'd AN
Chkd. SKP

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

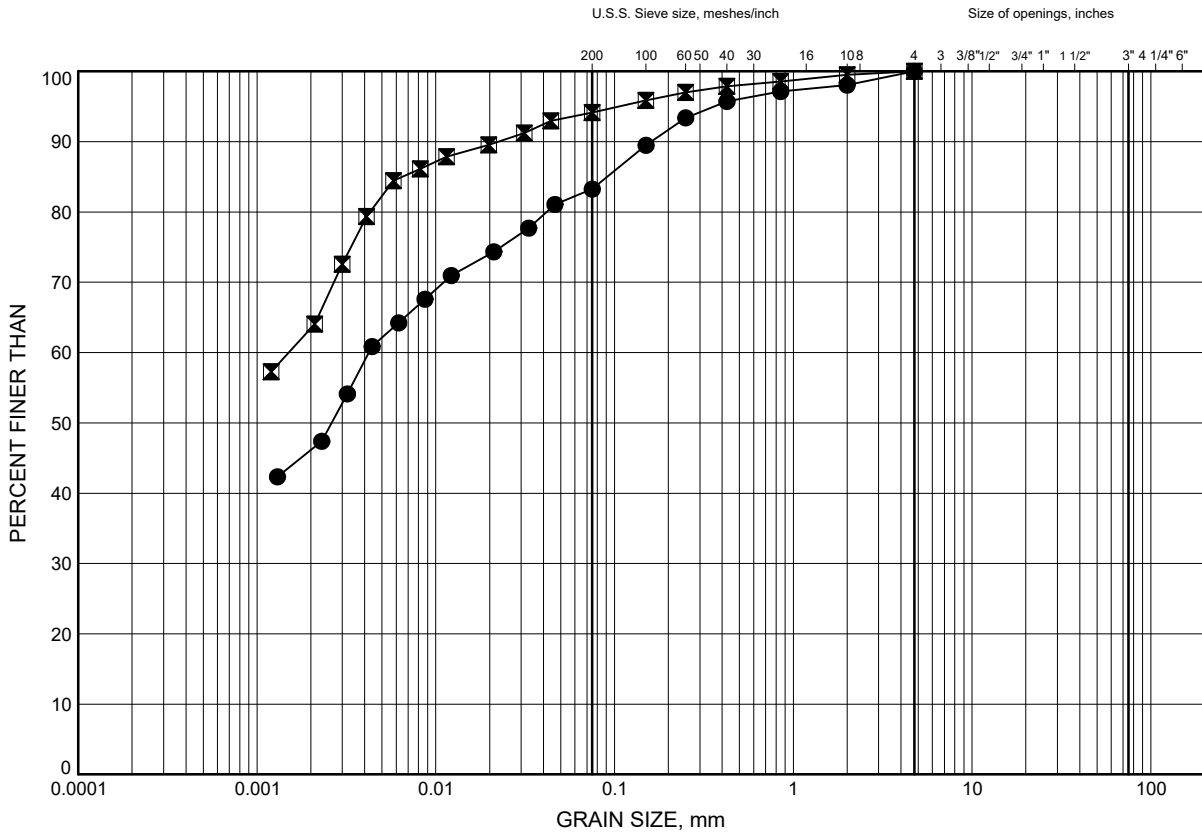


Prep'd AN
Chkd. SKP

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

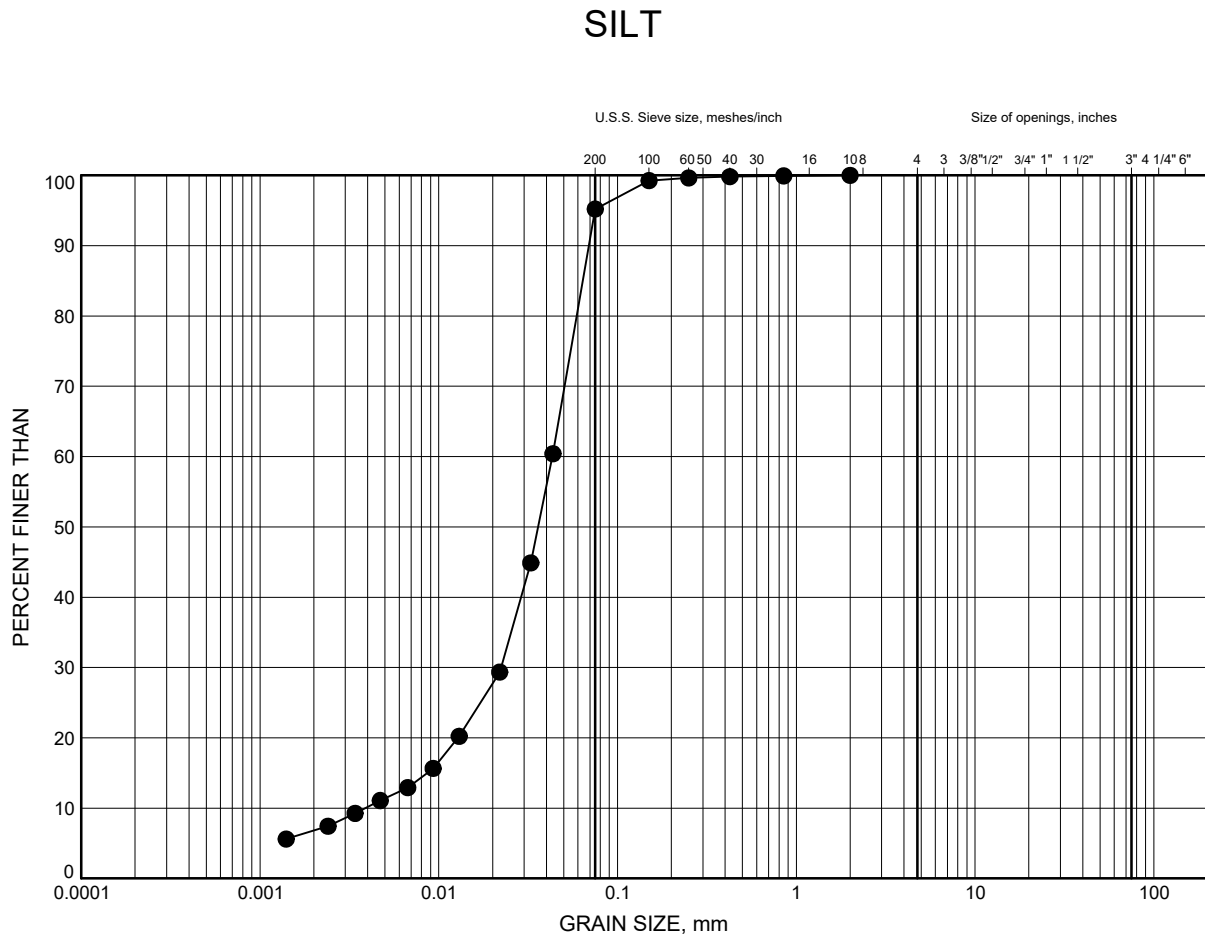
Date March 2016
W.P. 2061-13-00



Prep'd AN
Chkd. SKP

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

FIGURE B5



SILT 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

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

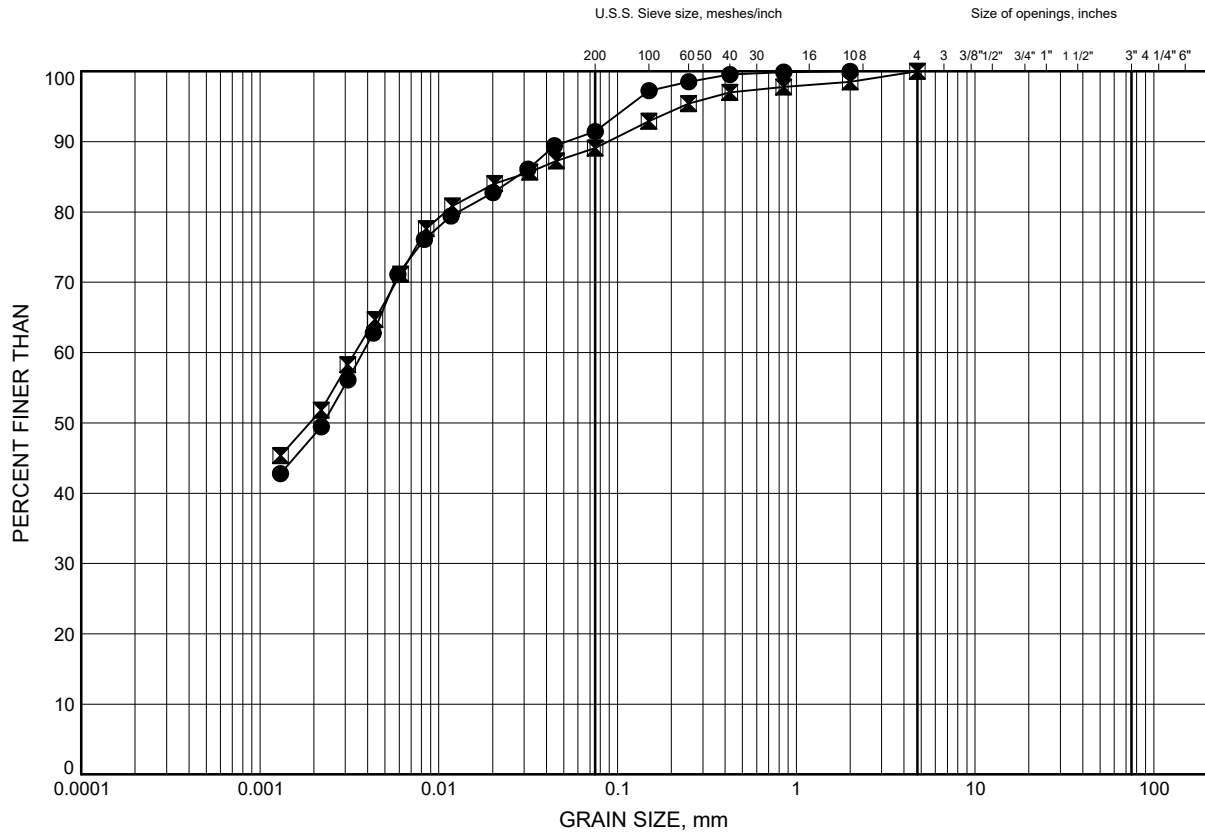


Prep'd AN
Chkd. SKP

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

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



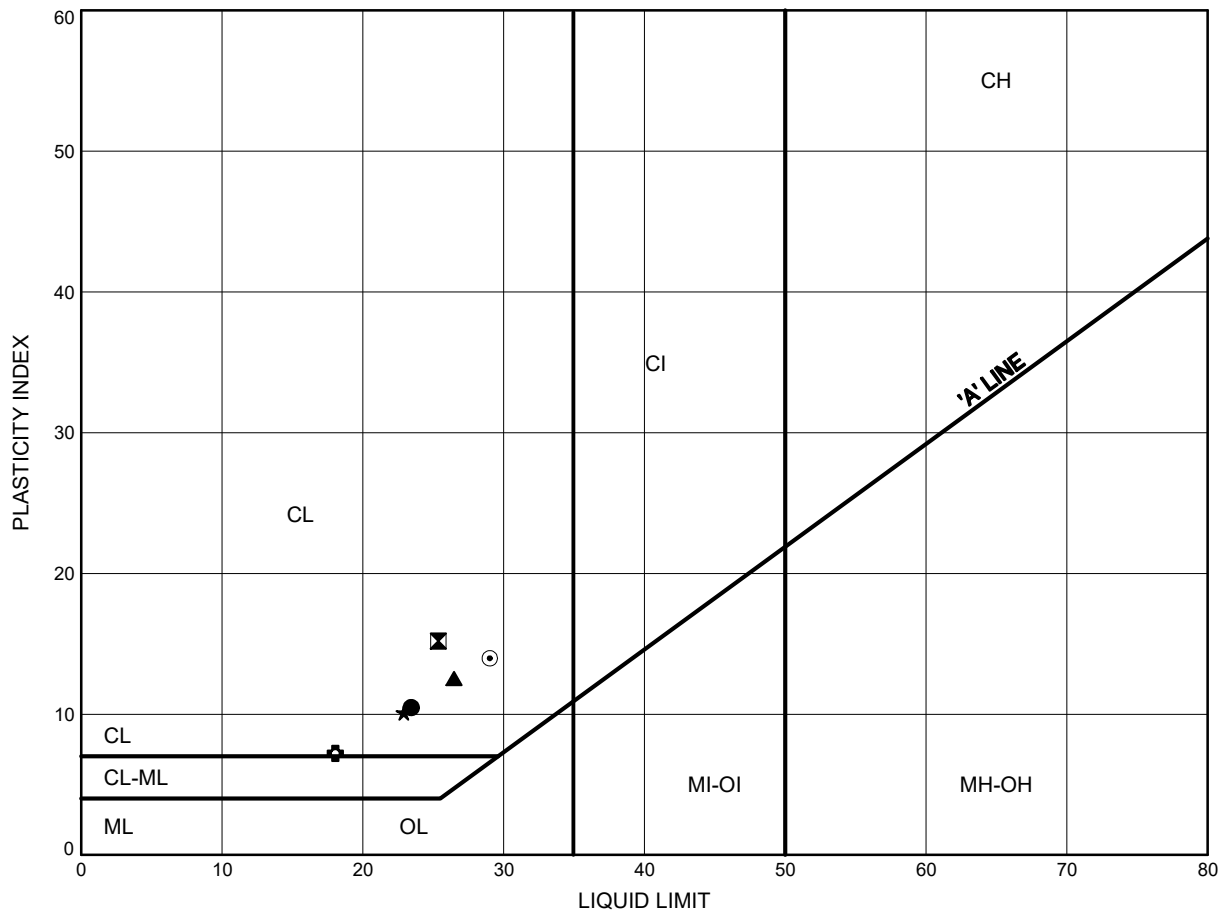
Prep'd AN
Chkd. SKP

Hwy 401 Leslie Street 2013-E-0032

ATTERBERG LIMITS TEST RESULTS

FIGURE B7

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



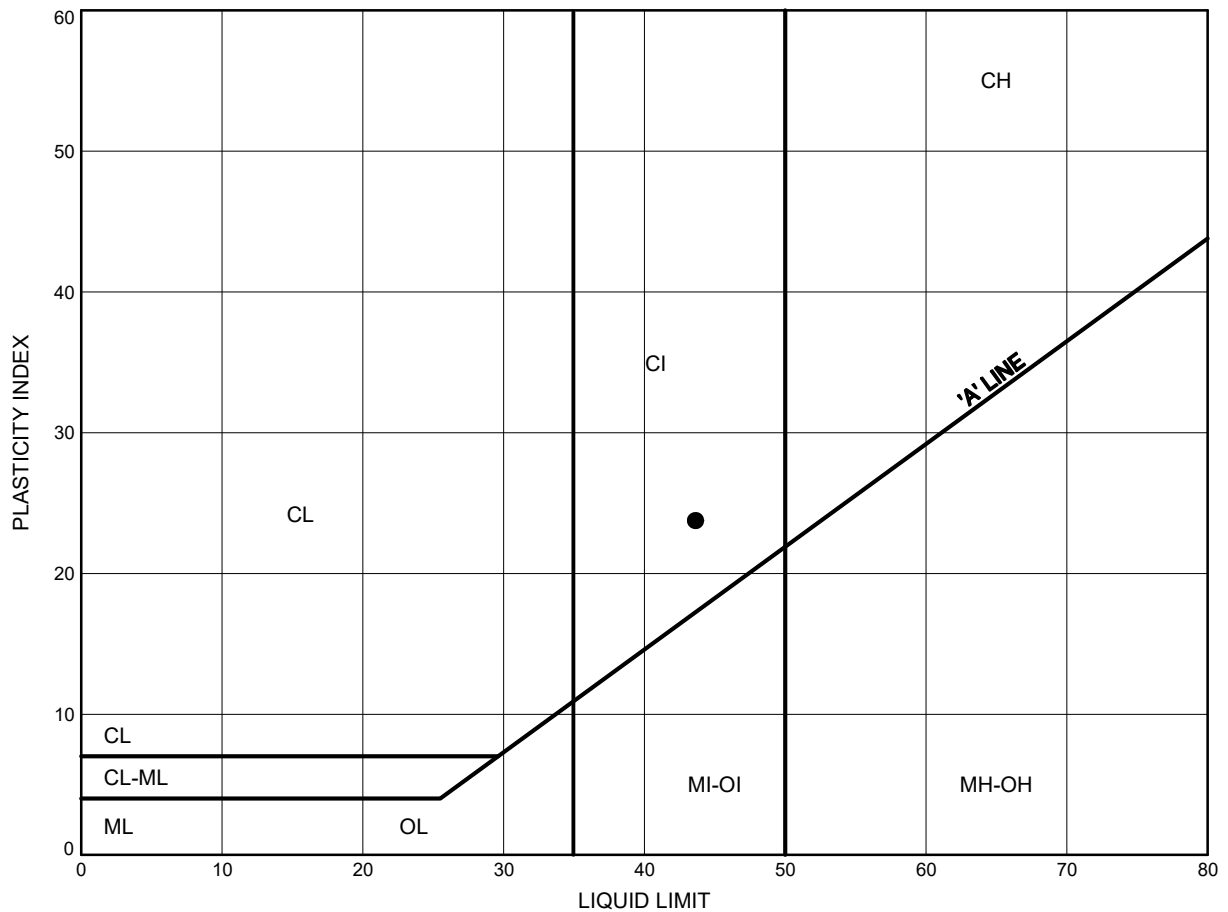
Prep'd AN
Chkd. SKP

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

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



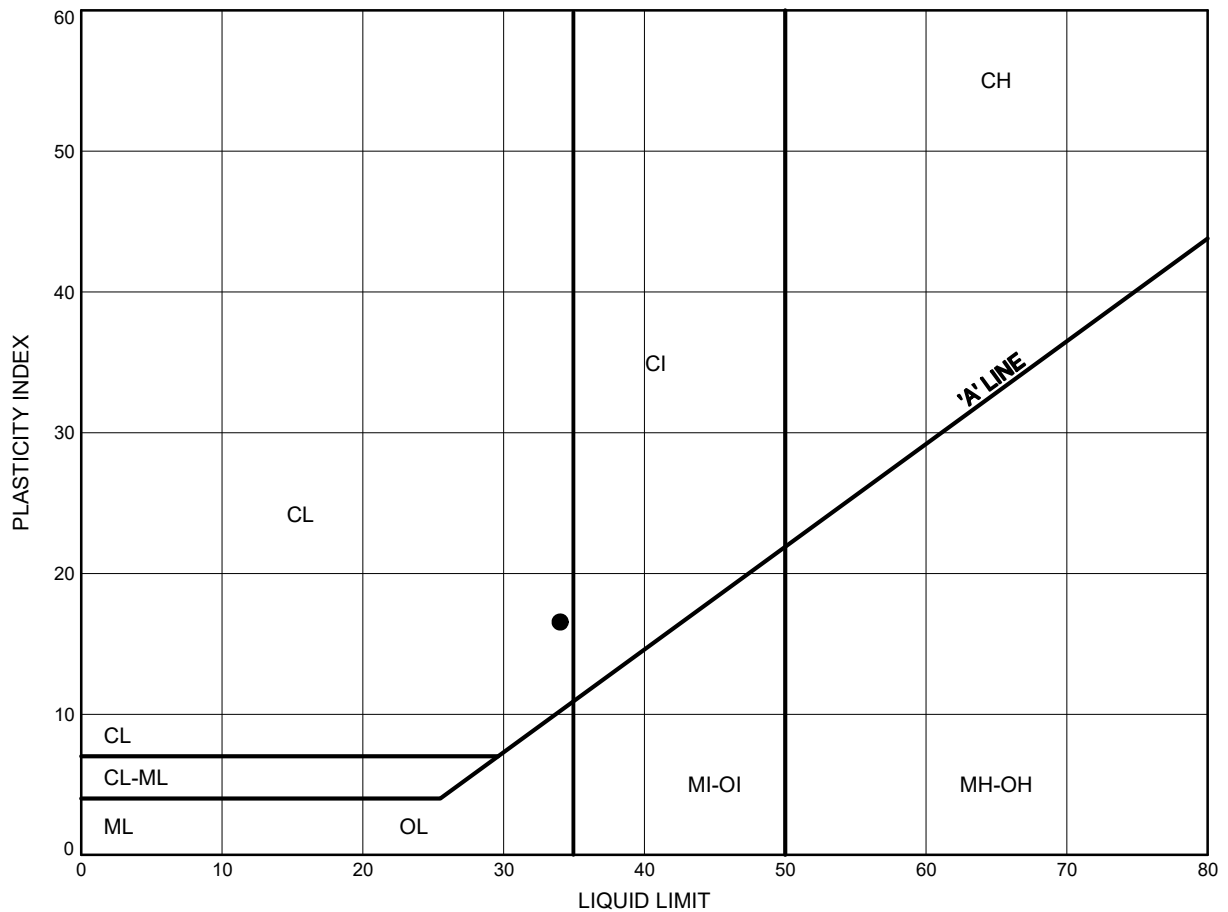
Prep'd AN
Chkd. SKP

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

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

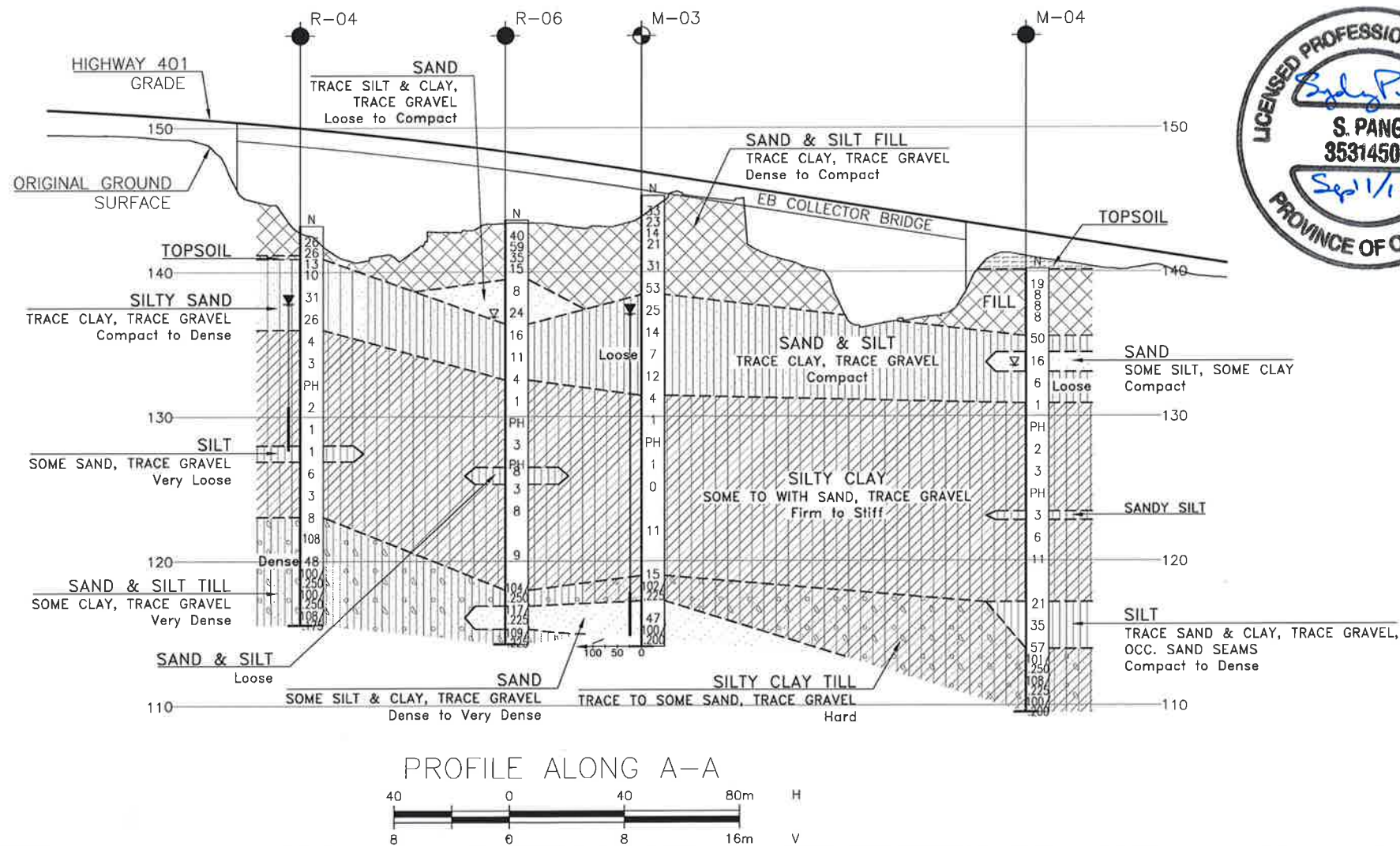
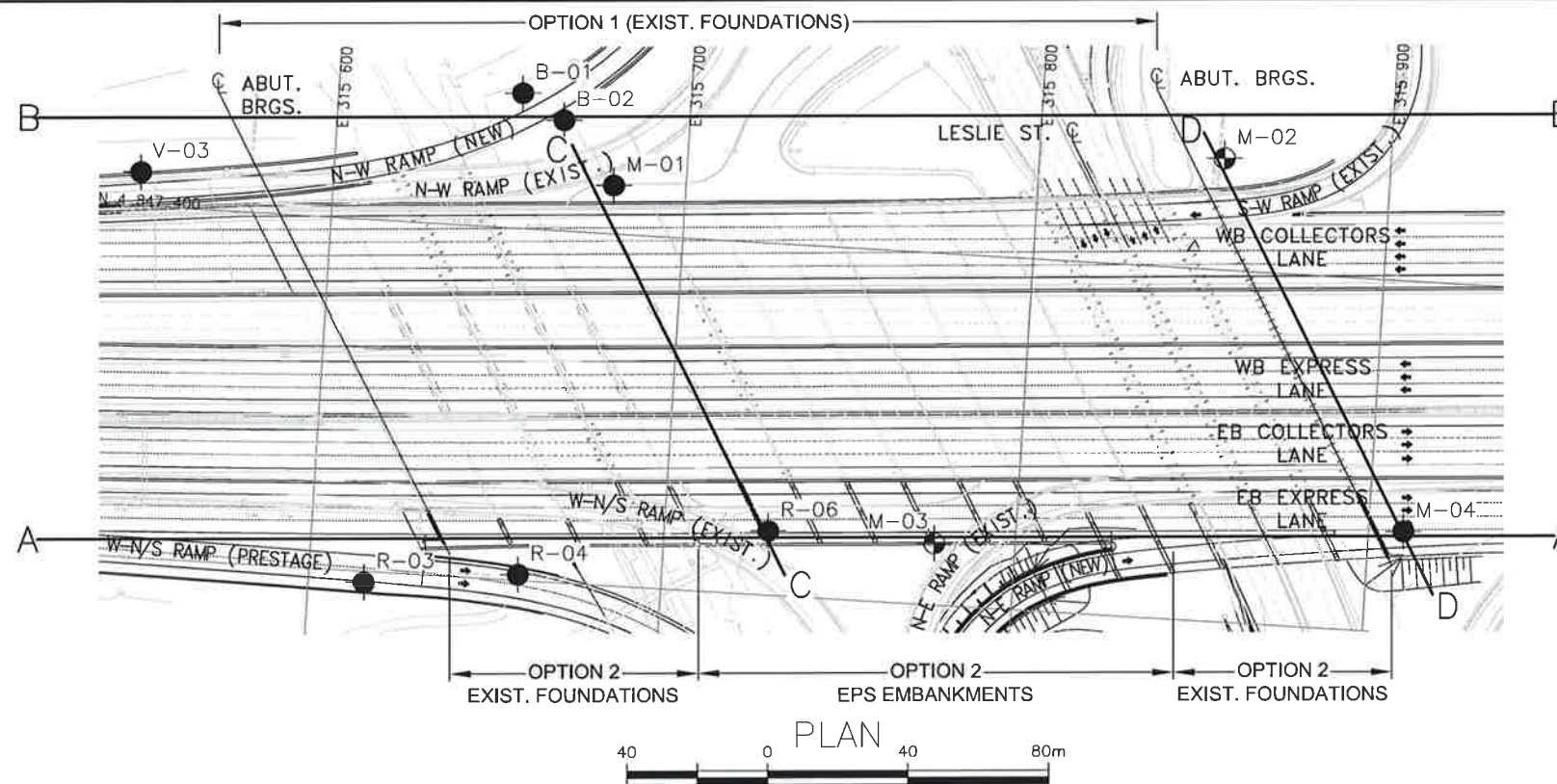


Prep'd AN
Chkd. SKP

Appendix C

Drawings titled “Borehole Locations and Soil Strata”

19-5161-205



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

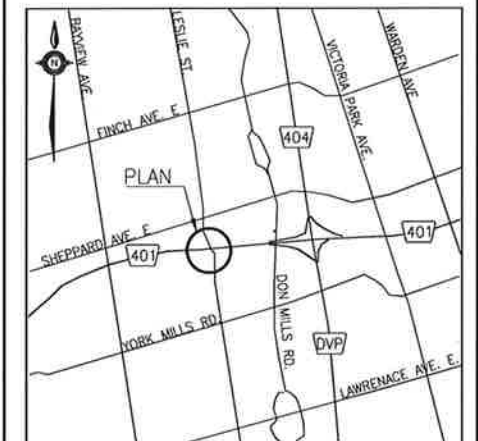


CONT No
WP No 2061-13-00

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

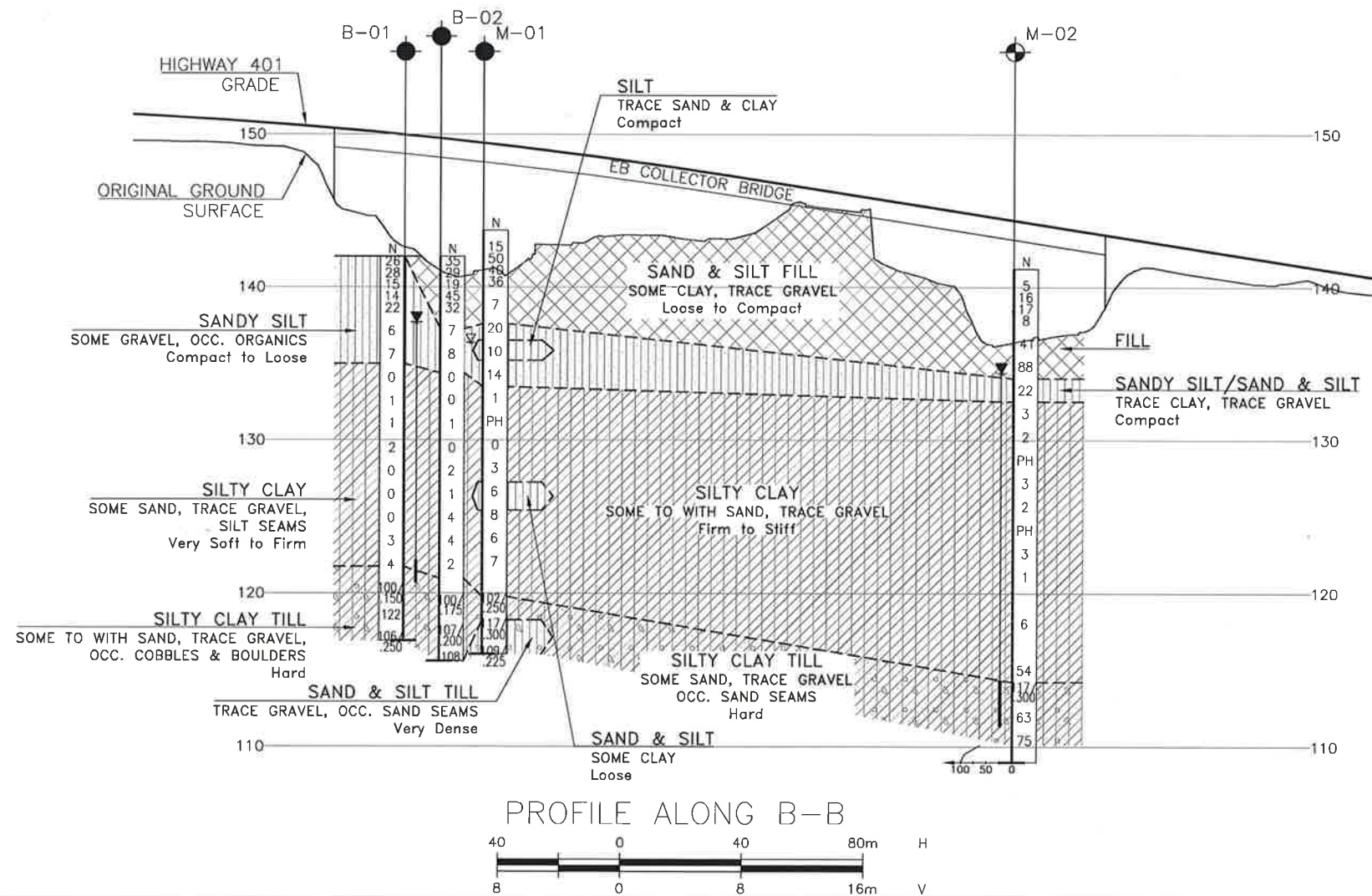
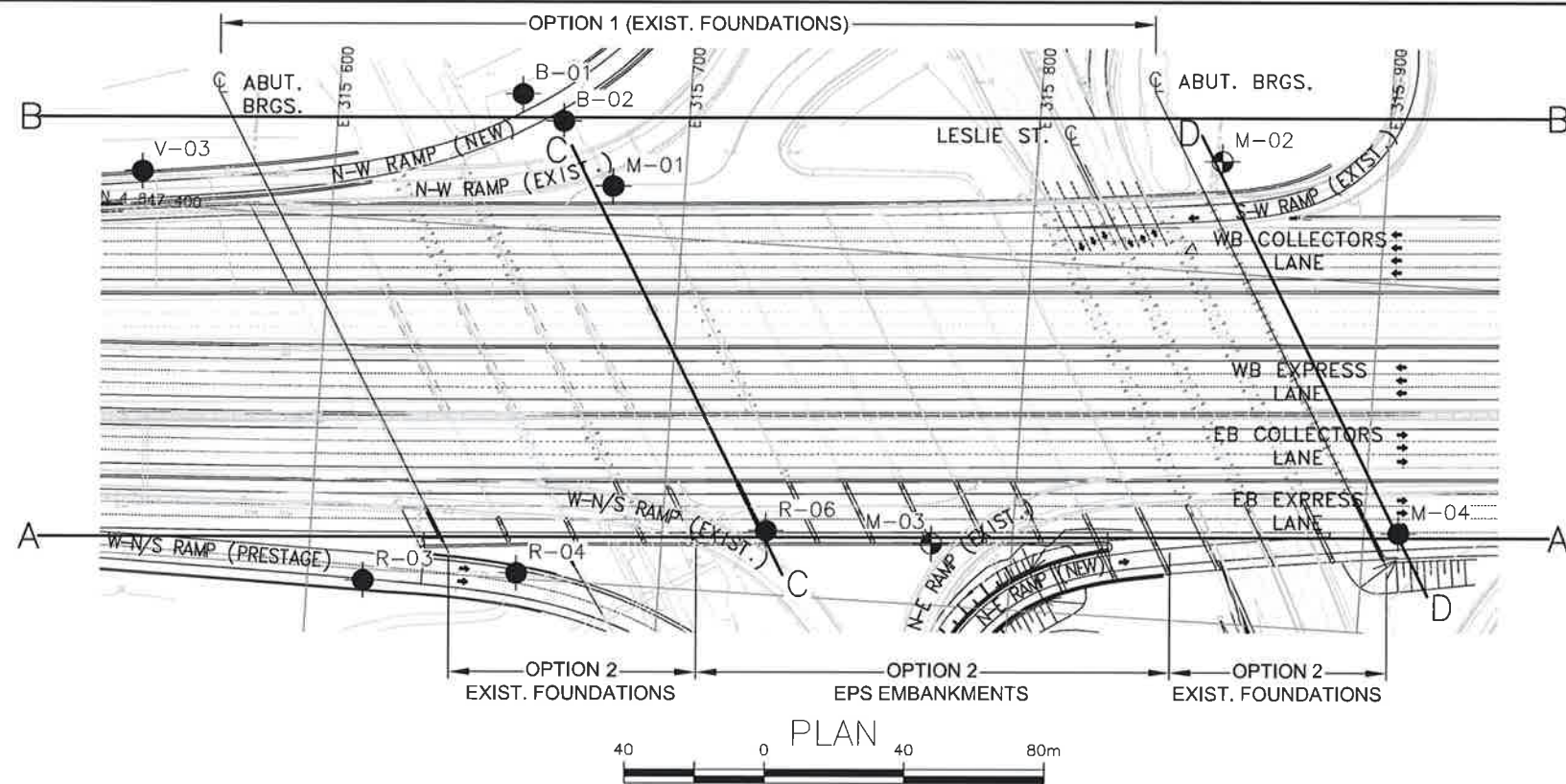
NO	ELEVATION	NORTHING	EASTING
B-01	142.0	4 847 438.5	315 652.2
B-02	142.0	4 847 431.5	315 664.4
M-01	143.7	4 847 413.8	315 679.6
M-02	141.2	4 847 431.8	315 852.7
M-03	145.3	4 847 317.6	315 777.0
M-04	140.2	4 847 328.9	315 910.0
R-03	144.9	4 847 296.9	315 615.8
R-04	143.2	4 847 301.7	315 659.3
R-06	143.6	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
DRAWN	AN	CHK	SKP
SITE	37-206/1-4	STRUCT	DWG 1
DATE	SEP 2017		



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
- W 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
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GEOCREs No. 30M14-463



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	SKP	CHK	CODE
DRAWN	AN	CHK	SKP
SITE	37-206/1-4	STRUCT	DWG 2
DATE	SEP 2017		

MINISTRY OF TRANSPORTATION, ONTARIO

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

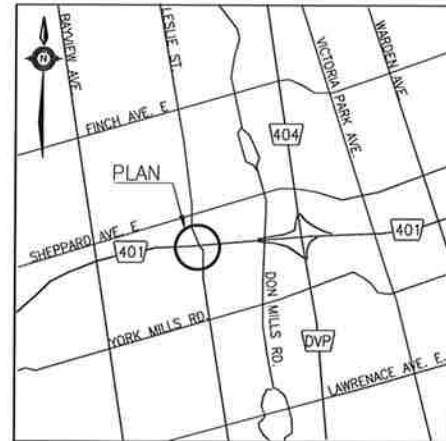
CONT No
WP No 2061-13-00

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

SHEET



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
- Rock Quality Designation (RQD)
- Auger Refusal

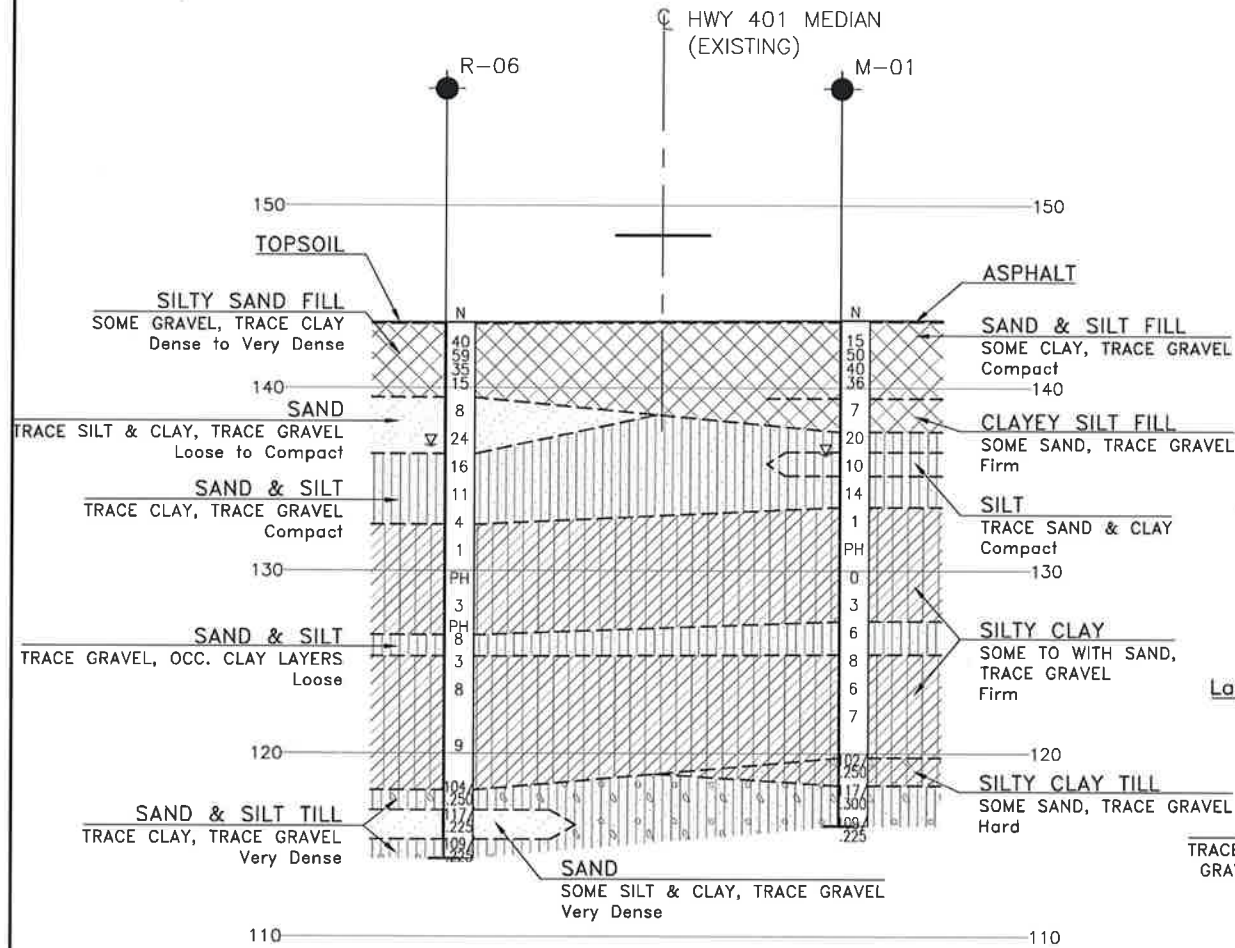
NO	ELEVATION	NORTHING	EASTING
B-01	142.0	4 847 438.5	315 652.2
B-02	142.0	4 847 431.5	315 664.4
M-01	143.7	4 847 413.8	315 679.6
M-02	141.2	4 847 431.8	315 852.7
M-03	145.3	4 847 317.6	315 777.0
M-04	140.2	4 847 328.9	315 910.0
R-03	144.9	4 847 296.9	315 615.8
R-04	143.2	4 847 301.7	315 659.3
R-06	143.6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

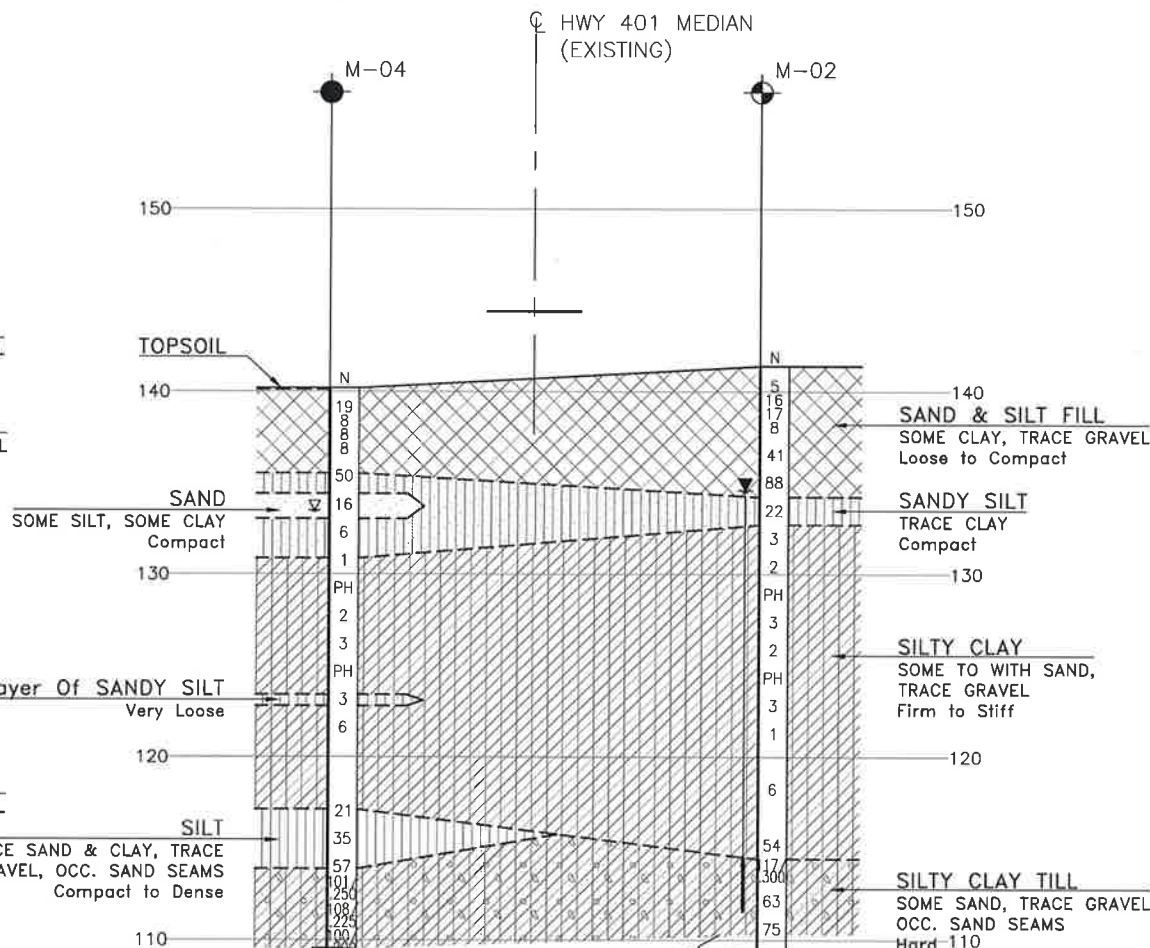
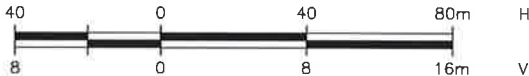
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GEOCRES No. 30M14-463

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	SKP	CHK	CODE
DRAWN	AN	CHK	SKP
DATE	SEP 2017		
PLTDATE	9/12/2017	8:12 AM	



SECTION C-C



SECTION D-D



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PLOTDATE: 9/12/2017 8:12 AM