THURBER ENGINEERING LTD.

FOUNDATION INVESTIGATION REPORT
GROUND MOUNTED SIGN SUPPORTS
HIGHWAY 401/COUNTY ROAD 30
BRIGHTON, ON
AGREEMENT 4017-E-0047
ASSIGNMENT 4

Geocres No.: 31C-281

Report to:

Ontario Ministry of Transportation

Latitude: 44.062620
Longitude: -77.783679

September 2019
Thurber File No.: 24731

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PART 1. FACTUAL INFORMATION

1 INTRODUCTION

This report presents the factual data obtained from a foundation investigation conducted by Thurber Engineering Ltd. (Thurber) for the design of the two ground mounted sign supports at locations along the eastbound Highway 401 west of the County Road 30 Interchange within the County of Northumberland. Thurber carried out the investigation as a consultant to the Ministry of Transportation (MTO) as part of Assignment No. 4 under Retainer Agreement No. 4017-E-0047.

No previous foundation investigation information for the existing signs was available.

The purpose of this investigation was to explore the subsurface conditions at the sites and, based on this data, provide record of boreholes, laboratory test results and a written description of the subsurface conditions.

2 SITE DESCRIPTION

The two ground mounted signs are to be located adjacent to the eastbound lanes of Highway 401 approximately 1.8 km and 800 m west of the County Road 30 overpass structure, respectively. Highway 401 near the site locations consist of a four lane freeway with a rural cross-section and vegetated median of variable width. The highway embankment at the sign locations is performing well with no noticeable signs of settlement or erosion. The terrain ranges from flat to gently rolling and the land adjacent to the highway typically consists of farm fields or forests.

Based on published geological information in The Physiography of Southern Ontario by Chapman and Putnam (1984), the signs are located within the physiographic region known as Iroquois Plain. The Iroquois Plain generally consists of glacio-lacustrine sand and silty sand. The soil deposit is underlain by limestone bedrock.

Site photographs showing the general conditions at the sites are presented in Appendix D.

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3 SITE INVESTIGATION AND FIELD TESTING

The field investigation was carried out on December 3rd, 2018 and included advancing one borehole at each of the two sign locations. The drilling was carried out using a truck mounted CME 55 drill rig.

The northing, easting and elevation of the boreholes are shown on the Borehole Location Drawing No. 1 in Appendix A, the individual Record of Borehole sheets in Appendix B and in Table 3-1. The termination depth of each of the boreholes is also provided in Table 3-1 below. The site is within MTM Zone 9.

Table 3-1: Borehole Summary

Borehole	Location	Northing (m) MTM Z9	Easting (m) MTM Z9	Ground Surface Elevation (m)	Borehole Depth (m)
18-4	Outside shoulder of Hwy 401 EB, 1.8 km west of CR30	4881096.1	201956.5	200.7	8.2
18-5	Outside shoulder of Hwy 401 EB, 0.8 km west of CR30	4881854.1	202642.3	202.5	8.1

As a component of our standard procedures and due diligence, Thurber contacted Ontario One Call to provide utility locates/clearances for the intended borehole locations in advance of the investigation.

The subsurface stratigraphy encountered in the boreholes was recorded in the field by Thurber personnel. Split spoon samples were collected at regular depth intervals in all boreholes during the completion of Standard Penetration Tests (SPT), following the methods described in ASTM Standard D1586-11. All soil samples recovered from the boreholes were placed in moisture-proof containers and the samples were transported to Thurber's Ottawa geotechnical laboratory for further examination and testing.

The open-hole groundwater levels were measured upon completion of drilling. The boreholes were backfilled with a low-permeability mixture of auger cuttings and bentonite pellets in general accordance with Ontario MOE Regulation 903.

The as-drilled locations of the boreholes were recorded using a handheld GPS and verified with measurements in the field using a measuring wheel relative to existing highway features (existing signs and edge of asphalt). The measurements were converted to northing and easting grid coordinates (MTM Zone 9) based on the georeferenced CAD drawing provided by the MTO. The ground surface elevations at the borehole locations were

measured by Thurber with a rod and level relative to the highway elevation and confirmed using digital terrain mapping provided by the MTO.

4 LABORATORY TESTING

The recovered soil samples were subjected to inspection and to natural moisture content determination. Selected samples were also subjected to gradation analysis (hydrometer and/or sieve) and Atterberg Limit testing. The results of these tests are summarized on the Record of Borehole sheets included in Appendix B. One sample of soil recovered from within each of borehole was selected and submitted for analytical testing of corrosivity parameters. All laboratory test results are provided in Appendix C.

5 GENERAL DESCRIPTION OF SUBSURFACE CONDITIONS

Details of the soil stratigraphy encountered in the boreholes are presented on the Record of Borehole sheets in Appendix B. A Borehole Location Plan is presented on Drawing No. 1 in Appendix A. An overall description of the stratigraphy is given in the following sections; however, the factual data presented on the Borehole Records governs any interpretation of the site conditions.

In general, the stratigraphy in the boreholes is characterized by granular fill, overlying sandy silt and glacial till.

More detailed descriptions of the individual strata are presented below.

5.1 Silty Sand to Sand, Fill

A layer of embankment fill was encountered from surface in Boreholes 18-4 and 18-5 consisting of sand with gravel to silty sand with gravel. The underside of this fill was at 0.6 and 1.5 m below the existing roadway surface (elev. 200.1 and 201.0 m) in Boreholes 18-4 and 18-5, respectively.

The SPT tests conducted in the silty sand with gravel fill gave N-values ranging from 16 to 20 blows, indicating a compact relative density.

Recorded moisture contents ranged from 5 to 10%. The results of a grain size analysis conducted on one sample of the fill indicated this material to consist of 34% gravel, 54% sand and 12% fines. These results are illustrated on Figure C1 in Appendix C.

5.2 Sandy Silt (ML)

A native deposit of sandy silt was encountered beneath the embankment fill in Borehole 18-5 with a thickness of 3.1 m. The underside of the sandy silt layer was at elevation 197.9 m. Trace amounts of gravel were noted in this layer and some organics were encountered in the upper 0.5 m.

SPT tests conducted this layer gave N-values ranging from 7 to 13 blows indicating a loose to compact relative density.

Recorded moisture contents of the sandy silt typically ranged from 12 to 15%. A moisture content of 26% was recorded in an upper sample containing organics. The results of grain size analysis conducted on one sample of the sandy silt indicated this material to consist of 7% gravel, 41% sand, 43% silt and 9% clay. These results are illustrated on Figure C2 in Appendix C.

An Atterberg Limit test completed on one sample of the sandy silt indicated that the material is non-plastic.

5.3 Silty Sand (SM) Glacial Till

A deposit of glacial till consisting of silty sand with varying amounts of gravel was encountered below the fill in Borehole 18-4 and below the sandy silt in Borehole 18-5. Occasional cobbles were noted throughout this layer in Borehole 18-5, while occasional to frequent cobbles were noted in the lower portion of this layer in Borehole 18-4. In Borehole 18-4, the silty sand till was noted to be 5.5 m thick with a base elevation of 194.6 m. Borehole 18-5 was terminated within the silty sand till at elevation 194.4 m.

The SPT tests conducted in this layer gave N-values ranging from 13 to 95 blows, indicating a compact to very dense relative density.

Recorded moisture contents ranged from 7 to 13%. The results of grain size analyses conducted on three samples of the silty sand till are summarized in the Table 5-1 below and are illustrated on Figure C3 in Appendix C.

Table 5-1: Grain Size Summary - Silty Sand (SM) Glacial Till

Soil Particle	Percentage (%)	
Gravel	9 – 18	
Sand	45 – 51	
Silt	29	38 – 40
Clay	8	

An Atterberg Limit test completed on a sample of the silty sand till indicated that the material is non-plastic.

5.4 Sandy Silty Clay (CL-ML) Glacial Till

A deposit of glacial till consisting of sandy silty clay was encountered below the silty sand till in Borehole 18-4. Borehole 18-4 was terminated 2.1 m into the sandy silty clay till at elevation 192.5 m. Occasional to frequent cobbles were noted in this layer.

The SPT tests conducted in this layer gave N-values ranging from 93 to greater than 100 blows, indicating a very dense (or hard) relative density.

Recorded moisture contents were 6 and 9%. The results of grain size analysis conducted on one sample of the sandy silty clay indicated this material to consist of 6% gravel, 40% sand, 40% silt and 14% clay. These results are illustrated on Figure C4 in Appendix C.

An Atterberg Limit test was completed on a sample of the sandy silty clay and indicated that the fines have a low plasticity (CL-ML). This result is illustrated on Figure C5 in Appendix C.

5.5 Groundwater

The open-hole groundwater levels were measured on December 3, 2018 upon completion of drilling. The recorded water at that time were 2.1 m and 2.7 m below the ground surface (elev. 198.6 m and 199.8 m) in Boreholes 18-4 and 18-5, respectively.

These observations are considered short term. It should be noted that the groundwater level at the time of construction may be different and seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after periods of significant and/or prolonged precipitation.

5.6 Analytical Testing

One sample of the native soil from each borehole was submitted for analysis of pH, water soluble sulphate, sulphide and chloride concentrations, and conductivity and resistivity. The analysis results are summarized in Table 5-2. A copy of the test results is provided in Appendix C.

Table 5-2: Results of Chemical Analysis

Borehole (Sample)	Depth (mbgs)	Sulphate (μg/g)	pH (-)	Resistivity (Ohm-cm)	Conductivity (uS/cm)	Chloride (μg/g)	Sulphide (%)
18-4 (SS5)	3.0 – 3.6	11	7.97	3,350	298	128	< 0.02
18-5 (SS4)	2.3 – 2.9	8	7.78	2,400	417	184	< 0.02

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6 MISCELLANEOUS

The sign locations were provided in advance of the investigation by the Ministry of Transportation. Thurber staked and/or marked the borehole locations in the field and obtained utility clearances prior to drilling. Thurber surveyed the borehole locations and ground surface elevations based on benchmarks provided by MTO. CCC Geotechnical and Environmental Drilling of Ottawa, Ontario supplied and operated the drilling equipment to carry out the drilling, sampling, and in-situ testing. The drilling, and sampling operations in the field were supervised on a full-time basis by Sean O'Bryan, C.E.T., of Thurber. Laboratory testing was carried out by Thurber in its MTO-approved laboratory in Ottawa.

Overall project management and direction of the field program was provided by Stephen Dunlop, P.Eng. Interpretation of the field data and preparation of this report was completed by Justin Gray P.Eng., and Stephen Dunlop, P.Eng. The report was reviewed by Dr. Fred Griffiths, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

For Justin Gray, P.Eng.
Geotechnical Engineer

Stephen Dunlop, P.Eng.
Senior Geotechnical Engineer

Fred Griffiths, Ph.D., P.Eng.
MTO Review Principal
Senior Geotechnical Engineer

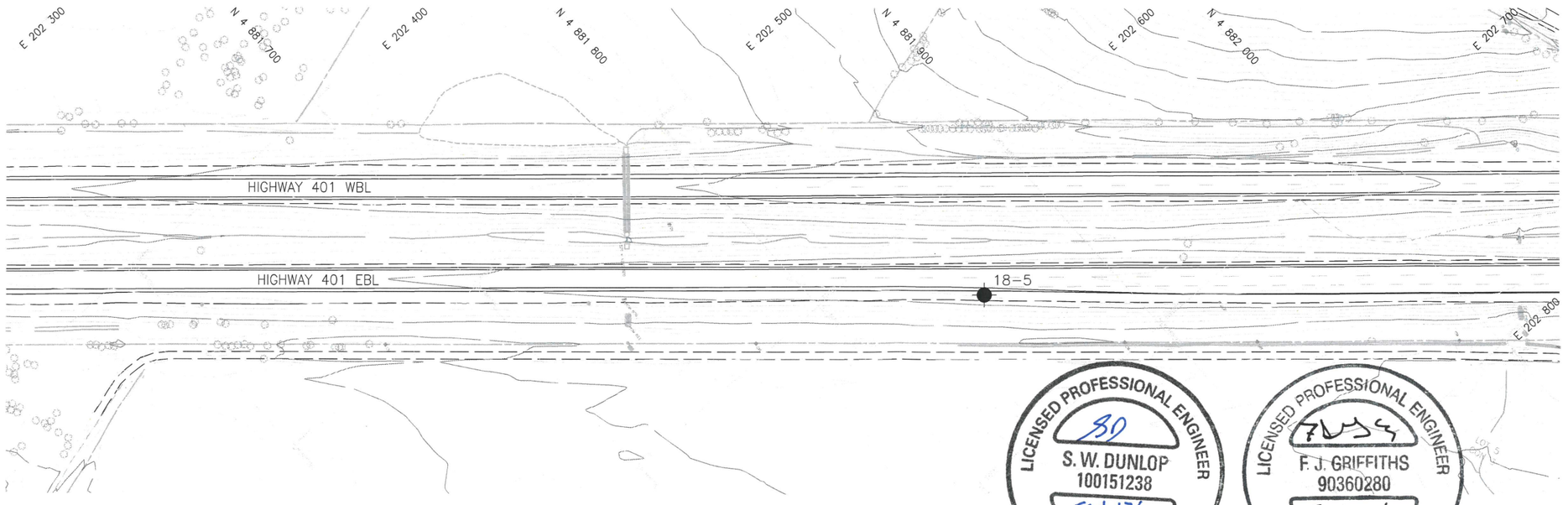
Appendix A.

Borehole Locations

MINISTRY OF TRANSPORTATION, ONTARIO

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN



40 0 40 80m

SCALE 1:2000

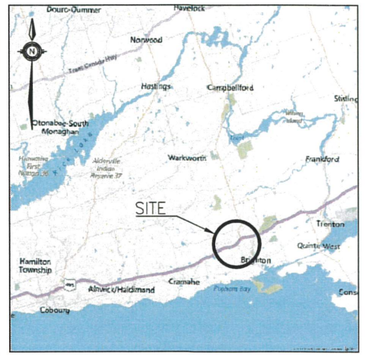
CONT No
WP No

HIGHWAY 401
COUNTY ROAD 30
GROUND MOUNTED SIGN SUPPORTS
BOREHOLE LOCATIONS PLAN

SHEET

Ontario

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
18-4	200.7	4 881 096.1	201 956.5
18-5	202.5	4 881 854.1	202 642.3

-NOTES-

1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
3) Coordinate system is MTM NAD 83 Zone 9.

GEOCRES No. 31C-281

LICENSED PROFESSIONAL ENGINEER
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Sept. 13/19
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
F. J. GRIFFITHS
90360280
Sept 13/19
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REVISIONS		
DATE	BY	DESCRIPTION

DESIGN	JG	CHK	–	CODE	LOAD	DATE	SEP 2019
DRAWN	MFA	CHK	JG	SITE	STRUCT	DWG	1

FILENAME: N:\Drafting\24000\24731\TED-24731-BHPL.dwg
PLOTDATE: 9/12/2019 1:48 PM

Appendix B.

Record of Borehole Sheets

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SYMBOLS, ABBREVIATIONS AND TERMS USED ON TEST HOLE RECORDS

TERMINOLOGY DESCRIBING COMMON SOIL GENESIS

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

TERMINOLOGY DESCRIBING SOIL STRUCTURE:

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

RECOVERY:

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

N-VALUE:

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

DYNAMIC CONE PENETRATION TEST (DCPT):

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

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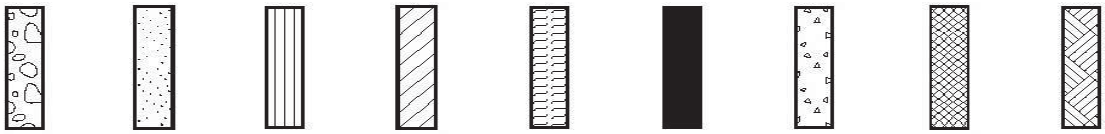
STRATA PLOT:
Strata plots symbolize the soil and bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.



Boulders
Cobbles
Gravel

Sand

Silt

Clay

Organics

Asphalt

Concrete

Fill

Bedrock

TEXTURING CLASSIFICATION OF SOILS

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

TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

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

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

SAMPLE TYPES

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

TERMS DESCRIBING CONSISTENCY (COHESIONLESS SOILS ONLY)

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

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MODIFIED UNIFIED SOIL CLASSIFICATION

Major Divisions		Group Symbol	Typical Description
COARSE GRAINED SOIL	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILT AND CLAY SOILS $W_L < 35\%$	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		OL	Organic silts and organic silty-clays of low plasticity.
	SILT AND CLAY SOILS $35\% < W_L < 50\%$	MI	Inorganic compressible fine sandy silt with clay of medium plasticity, clayey silts.
		CI	Inorganic clays of medium plasticity, silty clays.
		OI	Organic silty clays of medium plasticity.
	SILT AND CLAY SOILS $W_L > 50\%$	MH	Inorganic silts, micaceous or diatomaceous fine sandy of silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of high plasticity, organic silts.
HIGHLY ORGANIC SOILS		Pt	Peat and other organic soils.

Note - W_L= Liquid Limit

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EXPLANATION OF ROCK LOGGING TERMS

ROCK WEATHERING CLASSIFICATION

Fresh (FR)	No visible signs of weathering.
Fresh Jointed (FJ)	Weathering limited to surface of major discontinuities.
Slightly Weathered (SW)	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock materials.
Moderately Weathered (MW)	Weathering extends throughout the rock mass, but the rock material is not friable.
Highly Weathered (HW)	Weathering extends throughout the rock mass and the rock is partly friable.
Completely Weathered (CW)	Rock is wholly decomposed and in a friable condition, but the rock texture and structures are preserved.

TERMS

Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length.
Solid Core Recovery: (SCR)	Percent ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run.
Rock Quality Designation: (RQD)	Total length of sound core recovered in pieces 0.1 m in length or larger, as a percentage of total core length
Unconfined Compressive Strength: (UCS)	Axial stress required to break the specimen.
Fracture Index: (FI)	Frequency of natural fractures per 0.3 m of core run.

DISCONTINUITY SPACING

Bedding	Bedding Plane Spacing
Very thickly bedded	Greater than 2 m
Thickly bedded	0.6 to 2 m
Medium bedded	0.2 to 0.6 m
Thinly bedded	60 mm to 0.2 m
Very thinly bedded	20 to 60 mm
Laminated	6 to 20 mm
Thinly laminated	Less than 6 mm

STRENGTH CLASSIFICATION

Rock Strength	Approximate Uniaxial Compressive Strength (MPa)
Extremely Strong	Greater than 250
Very Strong	100 – 250
Strong	50 – 100
Medium Strong	25 – 50
Weak	5 – 25
Very Weak	1 – 5
Extremely Weak	0.25 – 1

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No 18-4

1 OF 1

METRIC

GWP# 4012-18-00 LOCATION Lat: 44.062641°, Long: -77.783711° MTM z9: N 4 881 096.1 E 201 956.5 ORIGINATED BY SOB

HWY 401/CR 30 BOREHOLE TYPE HSA COMPILED BY AC

DATUM Geodetic DATE 2018.12.03 - 2018.12.03 CHECKED BY SD

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
200.7	**Gravel Shoulder**										
0.0	SAND with gravel compact brown		1	SS	16				○		
200.1	**FILL**										
0.6	**SILTY SAND (SM)** some gravel **TILL** compact brown		2	SS	13		200		○		11 51 38 (SI+CL)
			3	SS	17		199		○		
			4	SS	17	▼	198		○		
197.7											
3.0	**SILTY SAND (SM)** with gravel **TILL** occasional to frequent cobbles compact to very dense brown		5	SS	25		197		○		
			6	SS	41				○		18 45 29 8 non-plastic
			7	SS	63		196		○		
194.6							195				
6.1	**SANDY SILTY CLAY (CL-ML)** trace gravel **TILL** occasional to frequent cobbles very dense brown		8	SS	100/ 200 mm		194		○⊣		6 40 40 14
			9	SS	93		193		○		
192.5											
8.2	End of Borehole Open hole water level at 2.1 m upon completion of drilling										

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

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

DOUBLE LINE 24731 - HWY 401 CR 30 SIGNS.GPJ 2012TEMPLATE(MTO).GDT 13/9/19

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RECORD OF BOREHOLE No 18-5

1 OF 1

METRIC

GWP# 4012-18-00 | LOCATION Lat: 44.069561°, Long: -77.775303° MTM z9: N 4 881 854.1 E 202 642.3 | ORIGINATED BY SOB

HWY 401/CR 30 | BOREHOLE TYPE HSA | COMPILED BY AC

DATUM Geodetic | DATE 2018.12.03 - 2018.12.03 | CHECKED BY SD

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
202.5	**Gravel Shoulder**										
0.0	SILTY SAND with gravel compact brown **FILL**		1	SS	20		202		○		
			2	SS	16				○		34 54 12 (SI+CL)
201.0							201				
1.5	**SANDY SILT (ML)** trace gravel loose to compact dark brown to light brown -some organics from 1.5 to 2.0 m		3	SS	7					○	
			4	SS	7	▼	200		○		
			5	SS	9		199		○		7 41 43 9 non-plastic
			6	SS	13				○		
197.9							198				
4.6	**SILTY SAND** trace gravel **TILL** occasional cobbles very dense brown		7	SS	50				○		
			8	SS	59		197				
							196		○		9 51 40 (SI+CL)
194.4			9	SS	95		195		○		
8.1	End of Borehole Open hole water level at 2.7 m upon completion of drilling										

+ ³, × ³: Numbers refer to Sensitivity

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

DOUBLE LINE 24731 - HWY 401 CR 30 SIGNS.GPJ 2012TEMPLATE(MTO).GDT 13/9/19

Appendix C.

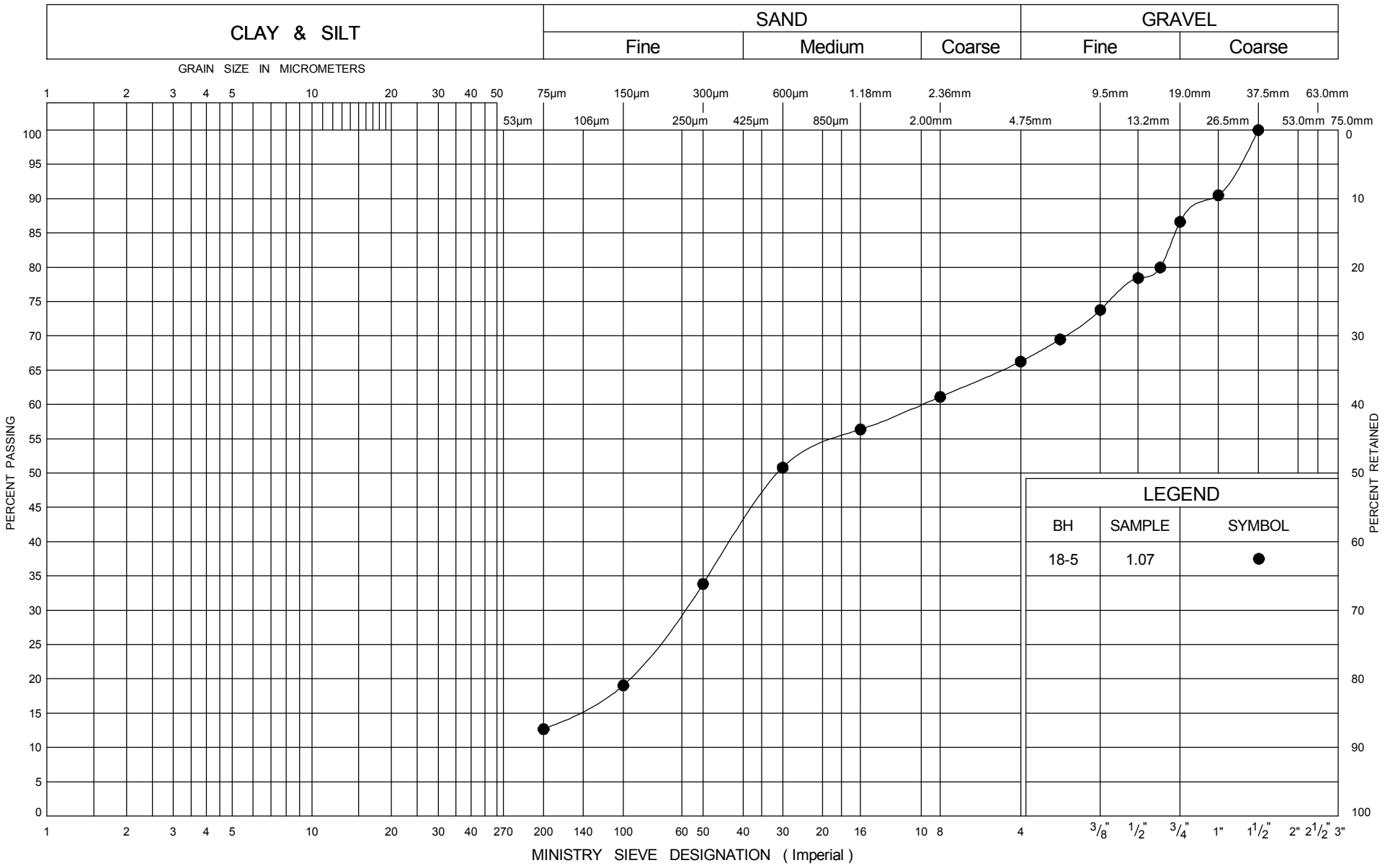
Laboratory Testing

Appendix C.1

Particle Size Analysis Figures

Atterberg Limit Testing

UNIFIED SOIL CLASSIFICATION SYSTEM



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GRAIN SIZE DISTRIBUTION

FILL

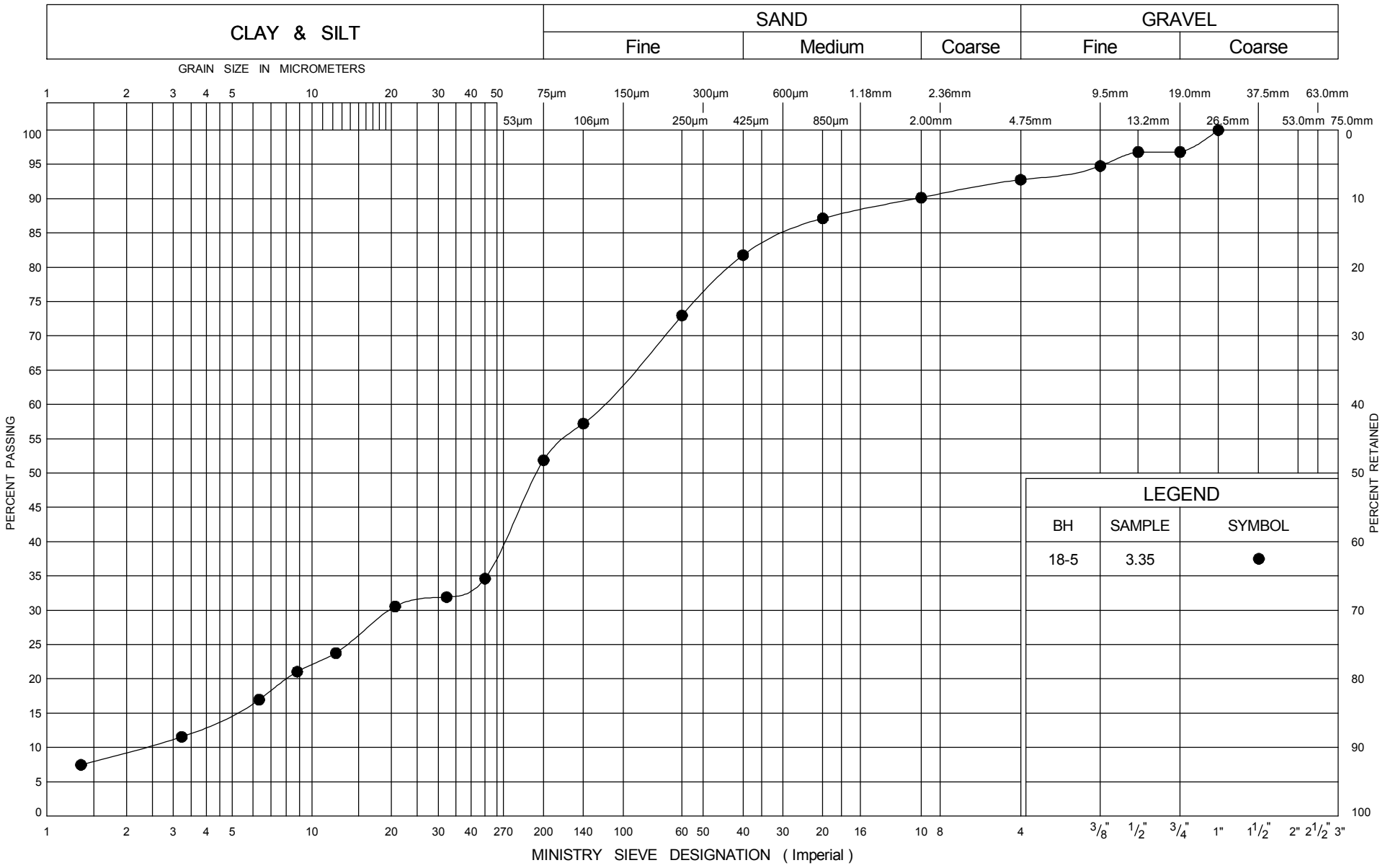
FIG No C1

W P -

Hwy 401/CR30 Signs

ONTARIO MOT GRAIN SIZE 24731 - HWY 401 CR 30 SIGNS.GPJ ONTARIO MOT.GDT 13/12/18

UNIFIED SOIL CLASSIFICATION SYSTEM



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GRAIN SIZE DISTRIBUTION

Sandy Silt (ML)

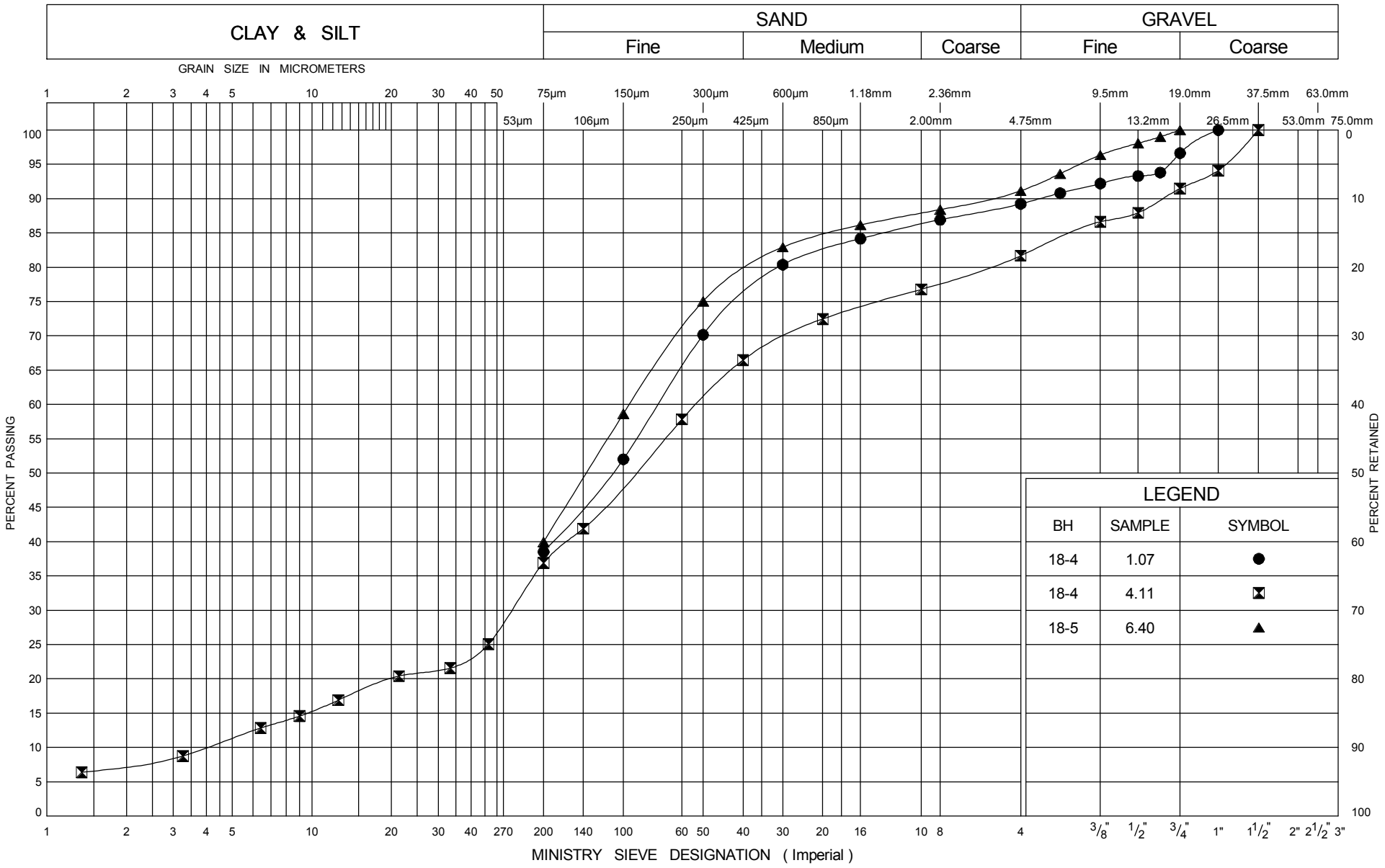
FIG No C2

W P -

Hwy 401/CR30 Signs

ONTARIO MOT GRAIN SIZE 24731 - HWY 401 CR 30 SIGNS.GPJ ONTARIO MOT.GDT 13/12/18

UNIFIED SOIL CLASSIFICATION SYSTEM



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GRAIN SIZE DISTRIBUTION

Silty Sand TILL

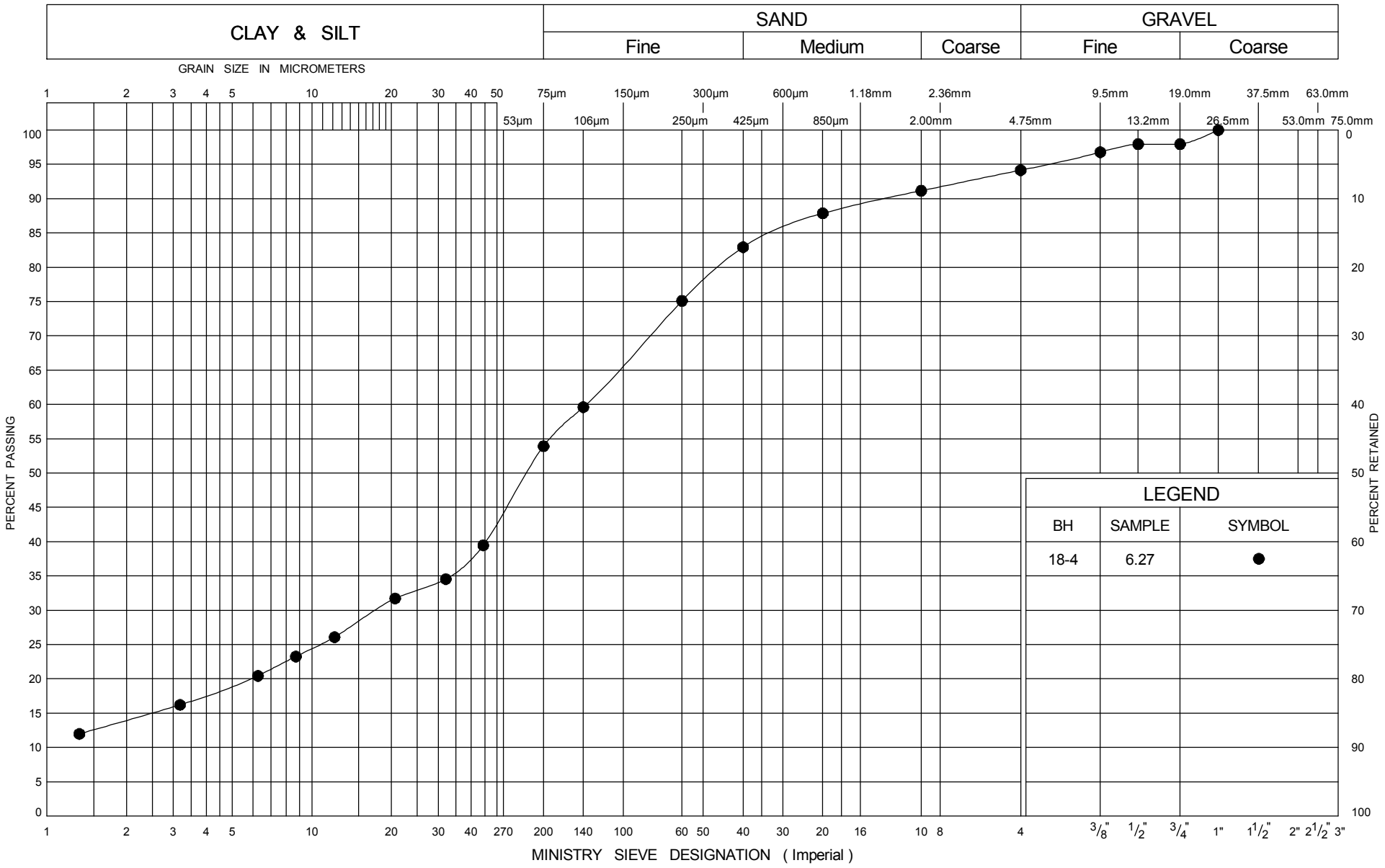
FIG No C3

W P -

Hwy 401/CR30 Signs

ONTARIO MOT GRAIN SIZE 24731 - HWY 401 CR 30 SIGNS.GPJ ONTARIO MOT.GDT 13/12/18

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of Transportation
Ontario

GRAIN SIZE DISTRIBUTION

Sandy Silty Clay TILL

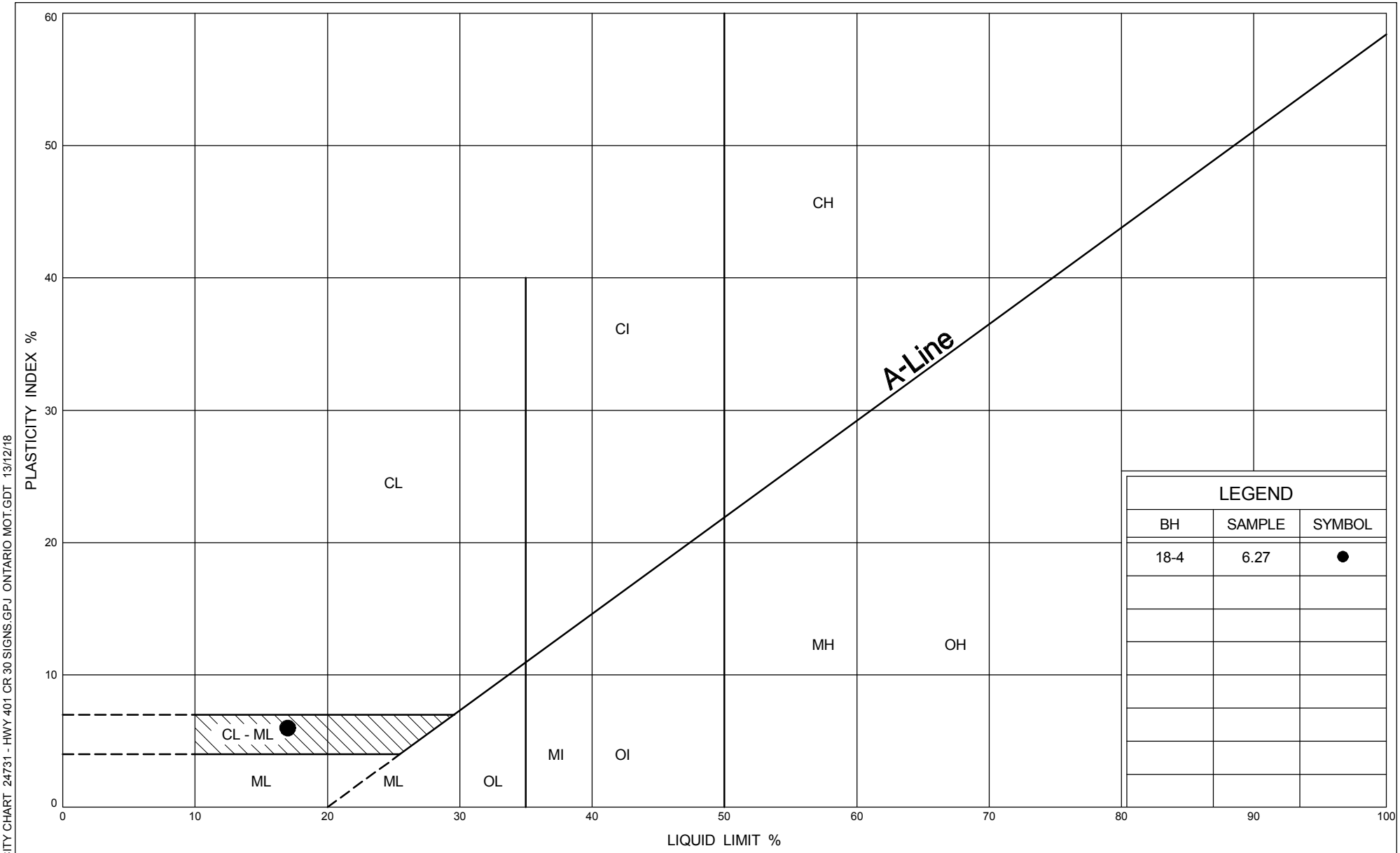
FIG No C4

W P -

Hwy 401/CR30 Signs

ONTARIO MOT GRAIN SIZE 24731 - HWY 401 CR 30 SIGNS.GPJ ONTARIO MOT.GDT 13/12/18

Oct 75, FF - S - 21



ONTARIO MOT PLASTICITY CHART 24731 - HWY 401 CR 30 SIGNS.GPJ ONTARIO MOT.GDT 13/12/18

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PLASTICITY CHART

FIG No C5

W P -

Hwy 401/CR30 Signs

Appendix C.2

Analytical Testing Results

Certificate of Analysis

Client: Thurber Engineering Ltd.

Client PO: 24731

Report Date: 12-Dec-2018

Order Date: 6-Dec-2018

Project Description: HWY 401/CR30

	Client ID:	18-3, SS4, 5'9"-7'9"	18-4, SS5, 10'-12'	18-5, SS4, 7'6"-9'6"	-
	Sample Date:	12/03/2018 09:00	12/03/2018 09:00	12/03/2018 09:00	-
	Sample ID:	1849437-01	1849437-02	1849437-03	-
	MDL/Units	Soil	Soil	Soil	-
Physical Characteristics					
% Solids	0.1 % by Wt.	89.9	93.4	88.3	-
General Inorganics					
Conductivity	5 uS/cm	238	298	417	-
pH	0.05 pH Units	7.70	7.97	7.78	-
Resistivity	0.10 Ohm.m	42.6	33.5	24.0	-
Anions					
Chloride	5 ug/g dry	52	128	184	-
Sulphate	5 ug/g dry	9	11	8	-
Subcontract					
Sulphide	0.02 %	<0.02 [1]	<0.02 [1]	<0.02 [1]	-

Appendix D.

Site Photographs

Photo 1. Looking at Sign Location #1 at approximately Sta. 11+600 (2018/12/07)

Photo 2. Looking at Sign Location #2 at approximately Sta. 12+600 (2018/12/07)