



**FOUNDATION INVESTIGATION REPORT
HINKLER LAKE PATROL YARD
TOWNSHIP OF MARTEL, ONTARIO**

**GEOCRES NO: 410-22
LATITUDE 47.042436 LONGITUDE -83.144281**

Submitted to:

**Ministry of Transportation Ontario Northeast Region
74 McKeown Avenue
North Bay, ON
P1B 9S9**

Submitted by:

**Amec Foster Wheeler
Environment & Infrastructure
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February 16, 2017
Amec Foster Wheeler Project No.: **TY163014**



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Ministry of Transportation Ontario– Northeast Region
Foundation Investigation Report
Proposed Maintenance Structure – Hinkler Lake Patrol Yard
Township of Martel, Ontario
February 2017



PART A

**FOUNDATION INVESTIGATION REPORT
HINKLER LAKE PATROL YARD
TOWNSHIP OF MARTEL, ONTARIO**

1.0 INTRODUCTION

1.1 Background

Amec Foster Wheeler Environment & Infrastructure (Amec Foster Wheeler) has been retained by The Ministry of Transportation Ontario, Northeast Region (MTO), for provision of foundation engineering services at six Patrol Yards as part of the Assignment No. 5015-E-0064.

This report addresses the results of the subsurface investigation carried out by Amec Foster Wheeler at the MTO Hinkler Lake Patrol Yard, located on Highway 129, approximately 82 km north of the MTO Axe Lake Patrol Yard in the Township of Martel, Ontario as shown on Drawing 1.

The terms of reference and scope of work for the foundation engineering services are outlined in MTO's Request for Quotation (RFQ), and associated Addendum and clarification responses for the Assignment.

Amec Foster Wheeler understands the MTO plans to construct a new sand/salt storage building structure at the Hinkler Lake Patrol Yard. The purpose of this investigation was to determine the subsurface conditions and relevant soil properties within the subject site in order to provide recommendations for the foundation design aspects of the proposed development at the yard. The proposed structure is to have an approximate area of 432 m² (18 m by 24 m), as shown on Drawing 1, and on the preliminary site plan provided to Amec Foster Wheeler by the MTO.

1.2 Site Description

The patrol yard is located in the Township of Martel, District of Algoma. The entrance to the site is approximately 25.5 km north of the intersection of Highway 556 and Highway 129. The latitude and longitude coordinates for the site are Latitude 47.042436 and Longitude -83.144281.

At the time of the investigation, a salt/sand storage dome was located in the central portion of the Patrol Yard. An office building was located to the north of the salt/sand dome, adjacent to the site entrance. There was also a garage/fueling station to the east of the salt/sand dome. The remaining areas of the yard were generally vacant land, stockpile areas, and vehicle parking areas. Site photographs are included in Appendix A.

The proposed new structure will be located south of the existing sand/salt dome as shown on Drawing 1.

1.3 Site Geology

The general surficial geology in the area of the site, can be characterized as Glaciofluvial outwash deposits which are comprised of gravel and sand, with some deltaic deposits, according to Ministry of Northern Development and Mines (MNDM) interactive "Quaternary Geology" map.

The bedrock in the area of the site can be described as Neo-to Mesoproterozoic massive to foliated granodiorite to granite. It is located in the Superior Province according to MNDM “Geology Survey August 2003, 1:250,000 Bedrock Geology of Ontario” map.

2.0 INVESTIGATION PROGRAM

2.1 Soil Drilling Investigation

The fieldwork at the site was carried out on October 12 and 13, 2016, when five boreholes (BH16-01 to BH16-05) were advanced within or near the proposed maintenance structure footprint all to a depth of 15.9 m below the existing ground surface. Borehole BH16-02 was offset from the proposed building footprint due to access limitations at the original borehole location.

The borehole locations (referenced to the MTM NAD83 Zone 13 northing and easting co-ordinate system), the ground surface elevations (referenced to Geodetic datum) and the drilled depths are summarized below and are shown on Drawing 1.

Table 1: Hinkler Lake Borehole Summary

Approximate Area	Borehole Designation	Location (MTM NAD83 Zone 13)		Ground Surface Elevation (m)	Borehole Termination Depth (m)
		Northing (m)	Easting (m)		
Southwest Corner	BH16-01	5,211,721	369,840	414.1	15.9
Northwest Corner	BH16-02	5,211,747	369,815	413.9	15.9
Northeast Corner	BH16-03	5,211,748	369,857	414.0	15.9
Southeast Corner	BH16-04	5,211,721	369,861	413.7	15.9
Centre	BH16-05	5,211,738	369,851	413.8	15.9

The ground surface elevation at the borehole locations were surveyed by Amec Foster Wheeler’s personnel. A local benchmark with a known elevation of 414.740 m was used as a reference. The borehole locations were geo-referenced to MTM co-ordinates using a hand-held Global Positioning System (GPS) unit. The ground surface elevations and GPS co-ordinates at the borehole locations are also presented on the Record of Borehole sheets, attached in Appendix B.

The boreholes were advanced using 108 mm inside diameter hollow stem augers and conventional soil sampling methods under the supervision of an Amec Foster Wheeler technician, providing soils information along with relative soil density under the direction of the Amec Foster Wheeler project manager. Soil samples were collected at predetermined depth intervals in accordance with Standard Penetration Testing (SPT) procedures (ASTM D-1586) utilizing a

mechanical hammer. Test results are recorded on the Record of Borehole sheets as 'N'-values. These values provide an indication of the various soil strata's condition with respect to compactness or consistency. The samples were placed in plastic bags and delivered to Amec Foster Wheeler's geotechnical laboratory in Sudbury for further examination and testing. One soil sample was submitted to AGAT Laboratories in Mississauga, Ontario, for analytical testing for pH, chlorides, sulphates and resistivity.

2.2 Laboratory Testing

In accordance with the TOR and Amec Foster Wheeler's proposal for this investigation, the following laboratory tests were conducted:

- Natural water content (63)
- Grain size distribution (15)
- Hydrometer (3)
- pH, chlorides, sulphates, resistivity (1)

The results of in-situ and laboratory tests are presented on the Record of Boreholes in Appendix B. The grain size distribution curves are shown in Appendix C, and the results of soil corrosivity tests are shown in Appendix D

3.0 SUBSURFACE CONDITIONS

In general, the subsurface condition encountered at the site consists of sand to sand and gravel fill underlain by native sand extending to the borehole termination depths. A summary of the subsurface conditions encountered in the boreholes is presented below and on the Record of Borehole sheets included in Appendix B.

3.1 Sand Fill/Gravelly Sand Fill/Sand and Gravel Fill

Non-cohesive fills were present at the ground surface in Boreholes BH16-01 to BH16-05. The thickness of the fill was between 0.7 m and 1.5 m. The fill layer consisted of brown gravelly sand or sand and gravel at Boreholes BH16-01, and BH16-03 to BH16-05, and sand with trace fines (silt and clay) at Borehole BH16-02. The measured SPT 'N' values within the fill ranged between 9 blows and 35 blows per 0.3 m of penetration, indicating a loose to dense, predominantly compact state of compactness.

The laboratory testing on selected fill samples resulted water contents ranging from 3% to 9% of the materials' dry weight.

Four grain size distribution tests were completed on selected samples of the fill layer, the results are as follows:

- Gravel (%): 21 to 39
- Sand (%): 57 to 68
- Silt & Clay Size (%): 4 to 13

The grain size distribution graphs are presented in Appendix C and the grain size distribution test results are shown on the Record of Borehole sheets.

3.2 Sand

A layer of sand was encountered below the fill in all boreholes. The sand extending to the borehole termination depth of 15.9 m at each borehole location. The sand consists of some to trace gravel, silt, and clay. A coarser gravelly sand layer was present interlayered within the sand deposit from approximately 3.0 m to 4.1 m below existing ground surface in Borehole BH16-04. A finer sand layer with no gravel and trace silt and clay was present near the bottom of Boreholes BH16-01, 03, and 05.

Measured SPT 'N' values within the sand ranged between 5 blows to 76 blows per 0.3 m of penetration indicating a loose to very dense state of compactness. The SPT Values also indicate that the sand layer is predominantly compact to dense with the exception of 1.5 m to 3.1 m thick layer of loose sand as encountered in all boreholes with the exception of Borehole BH16-02. The natural moisture content, as measured in selected samples from the boreholes ranged from 2% to 23%.

Fourteen grain size distributions were completed on selected split spoon samples of the sand layer, including the gravelly sand interlayer in Borehole BH16-04, the results summarized are as follows:

- Gravel (%): 0 to 29
- Sand (%): 67 to 94
- Silt & Clay Size (%) 1 to 13

The grain size distribution curves are presented in Appendix C and the grain size distribution test results are shown on the Record of Borehole sheets.

3.3 Groundwater Conditions

Upon the completion of drilling, groundwater was measured at depths ranging from 9.9 m to 10.9 m below ground surface, except for Borehole BH16-01 in which no groundwater measurement was conducted on completion. The groundwater measurements are shown on the Record of Borehole sheets and are summarized below.

The groundwater at the site is expected to fluctuate seasonally and can be expected to be somewhat higher during the spring months and in response to major weather events.

Table 2: Hinkler Lake Groundwater Measurements

Foundation Element ₁	Borehole Designation	Location (MTM NAD83 Zone 13)		Ground Surface Elevation (m)	Water Level Depth Below Ground Surface (m)
		Northing (m)	Easting (m)		
Southwest Corner	BH16-01	5,211,721	369,840	414.1	Not measured
Northwest Corner	BH16-02	5,211,747	369,815	413.9	10.1
Northeast Corner	BH16-03	5,211,748	369,857	414.0	10.9
Southeast Corner	BH16-04	5,211,721	369,861	413.7	10.1
Centre	BH16-05	5,211,738	369,851	413.8	9.9

3.4 Analytical Results

Split spoon sample number 4 from BH16-05 was sent to an independent laboratory for analytical testing comprising pH, sulphate, resistivity and chloride determination and the test results are presented in Appendix D.

4.0 CLOSURE

This Foundation Investigation Report was prepared by Nicholas Kicz, EIT, and reviewed by Mr. Mehdi Mostakhdemi, M.Sc., P.Eng. Mr. Ty Garde, M.Eng, P.Eng., a Designated MTO Foundations Contact for Amec Foster Wheeler, conducted an independent review of this report.

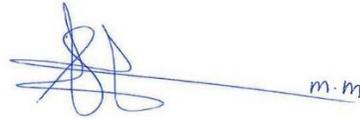
Respectfully submitted,

**Amec Foster Wheeler Environment & Infrastructure,
a Division of Amec Foster Wheeler Americas Limited**

Prepared by:



Nicholas Kicz
Geotechnical Engineer in Training

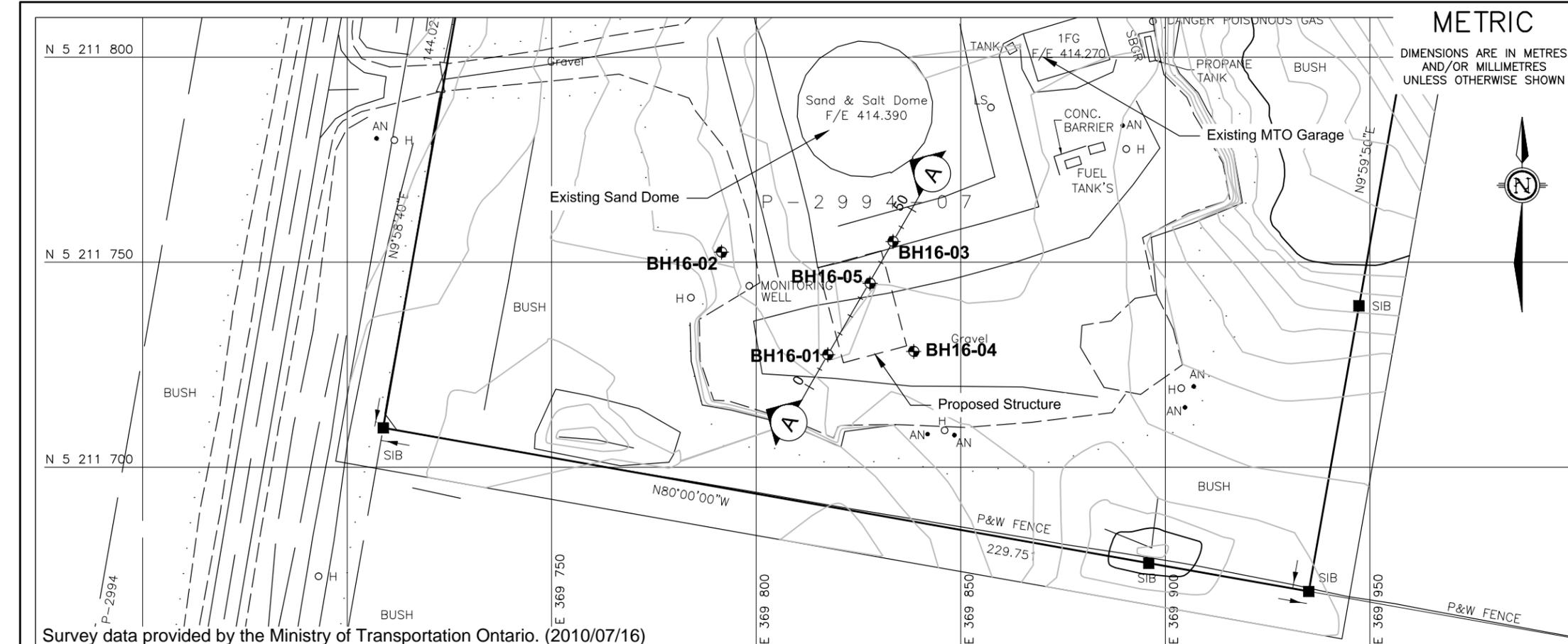


Mehdi Mostakhdemi, M.Sc., P. Eng.
Geotechnical Engineer



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Designated MTO Foundations Contact



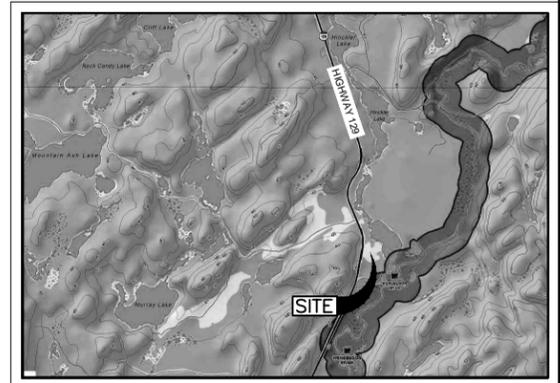


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Foundation Investigation and Design
Assignment No. 5015-E-0064
Hinkler Lake Patrol Yard
Township of Martel, Ontario

PROPOSED STORAGE STRUCTURE
BOREHOLE LOCATION PLAN AND
SOIL STRATA SECTION

DRAWING
1



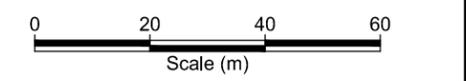
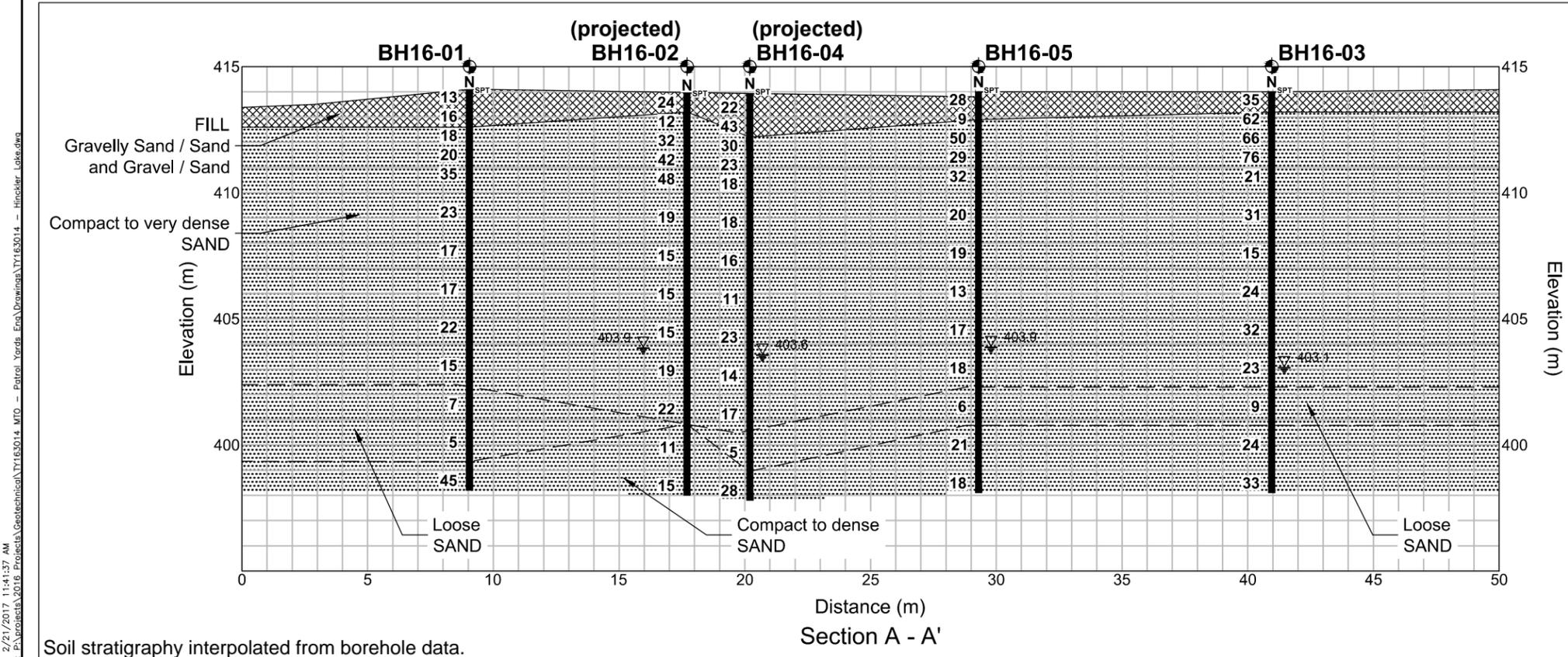
LEGEND

- BOREHOLE LOCATION - 2016 INVESTIGATION
- N_{SPT} STANDARD PENETRATION TEST VALUE
- 10 BLOWS/0.3m UNLESS OTHERWISE STATED (STD. PEN. TEST, 475 J/BLOW)
- R REFUSAL
- ▽ WATER LEVEL UPON COMPLETION OF DRILLING
- EXISTING STRUCTURE
- - - PROPOSED STRUCTURE

- NOTES**
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING FOUNDATION DESIGN REPORT.
 - THE INTERPRETED STRATIGRAPHY REPRESENTS SIMPLIFIED SUBSURFACE CONDITIONS. THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN DEFINED AT BOREHOLE LOCATIONS ONLY. CONDITIONS BETWEEN BOREHOLE LOCATIONS COULD DIFFER FROM ILLUSTRATED CONDITIONS.
 - ELEVATIONS ARE REFERENCED TO GEODETIC DATUM.

NUMBER	ELEVATION (m)	CO-ORDINATES (MTM, NAD 83 ZONE 13)	
		NORTHING (m)	EASTING (m)
TESTHOLES BY OTHERS			
BH16-01	414.1	5211721	0369840
BH16-02	413.9	5211747	0369815
BH16-03	414.0	5211748	0369857
BH16-04	413.7	5211721	0369861
BH16-05	413.8	5211738	0369851

SITE LOCATION
LATITUDE/LONGITUDE 47.042436, -83.144281



REVISIONS	DATE	REV. BY	DESCRIPTION
02/21/2017	1	NFK	REVISED PER MTO COMMENTS

DESIGN NFK CHK DMC CODE LOAD
DRAWN MAT CHK NFK GEOCRES 410-22 DATE 09-FEB-17

DATE PLOTTED: 2/21/2017 11:41:37 AM
FILE LOCATION: P:\Projects\2016\Projects\Geotechnical\TY163014_MTO - Patrol_Yards_Eng\Drawings\TY163014 - Hinkler_Lake.dwg

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APPENDIX A
SITE PHOTOGRAPHS



Photo 1

Drill rig auguring borehole with view of existing dome, photo taken facing northeast

12 Oct 2016



Photo 2

View of drill to the left and part of the dome on the right. View facing northwest of patrol yard landscape

12 Oct 2016



Photo 3

Drillers adjusting steel, with rig set up over borehole. View of flat area of site and west tree line

13 Oct 2016

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APPENDIX B

RECORD OF BOREHOLE NO. BH16-01 to BH 16-05

EXPLANATION OF BOREHOLE LOG

This form describes some of the information provided on the borehole logs, which is based primarily on examination of the recovered samples, and the results of the field and laboratory tests. Additional description of the soil/rock encountered is given in the accompanying geotechnical report.

GENERAL INFORMATION

Project details, borehole number, location coordinates and type of drilling equipment used are given at the top of the borehole log.

SOIL LITHOLOGY

Elevation and Depth

This column gives the elevation and depth of inferred geologic layers. The elevation is referred to the datum shown in the Description column.

Lithology Plot

This column presents a graphic depiction of the soil and rock stratigraphy encountered within the borehole.

Description

This column gives a description of the soil strata, based on visual and tactile examination of the samples augmented with field and laboratory test results. Each stratum is described according to the *MTC Soil Classification Manual*.

The compactness condition of cohesionless soils (SPT) and the consistency of cohesive soils (undrained shear strength) are defined as follows (*Ref. MTC Soil Classification Manual*):

Compactness of Cohesionless Soils	SPT N-Value*
Very loose	0 to 5
Loose	5 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

Consistency of Cohesive Soils	Undrained Shear Strength kPa
Very soft	0 to 12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very stiff	100 to 200
Hard	Over 200

* For penetration of less than 0.3 m, N-values are indicated as the number of blows for the penetration achieved (e.g. 50/25: 50 blows for 25 centimeter penetration).

Soil Sampling

Sample types are abbreviated as follows:

SS	Split Spoon	TW	Thin Wall Open (Pushed)	RC	Rock Core	GS	Grab Sample
AS	Auger Sample	TP	Thin Wall Piston (Pushed)	WS	Washed Sample	AR	Air Return Sample

Additional information provided in this section includes sample numbering, sample recovery and numerical testing results.

Field and Laboratory Testing

Results of field testing (e.g., SPT, pocket penetrometer, and vane testing) and laboratory testing (e.g., natural moisture content, and limits) executed on the recovered samples are plotted in this section.

Instrumentation Installation

Instrumentation installations (monitoring wells, piezometers, inclinometers, etc.) are plotted in this section. Water levels, if measured during fieldwork, are also plotted. These water levels may or may not be representative of the static groundwater level depending on the nature of soil stratum where the piezometer tips are located, the time elapsed from installation to reading and other applicable factors.

Comments

This column is used to describe non-standard situations or notes of interest.

BEDROCK DESCRIPTION

STRENGTH CLASSIFICATION

Term (Grade)	Field Identification	Approximate Range of Uniaxial Compressive Strength (MPa)
Extremely Weak (R0)	Indented by thumbnail.	0.25 – 1.0
Very Weak (R1)	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife.	1.0 – 5.0
Weak (R2)	Can be peeled with a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer.	5.0 – 25
Medium Strong (R3)	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single firm blow of geological hammer.	25 – 50
Strong (R4)	Specimen requires more than one blow of geological hammer to fracture it.	50 – 100
Very Strong (R5)	Specimen requires many blows of geological hammer to fracture it.	100 – 250
Extremely Strong (R6)	Specimen can only be chipped with geological hammer.	>250

JOINT SPACING CLASSIFICATION

Term	Average Joint Spacing (m)
Extremely close	< 0.02
Very close	0.02 – 0.06
Close	0.06 – 0.20
Moderately close	0.20 – 0.6
Wide	0.6 – 2.0
Very wide	2.0 – 6.0
Extremely wide	> 6.0

ROCK QUALITY CLASSIFICATION

Rock Quality Designation, RQD (%)	Description of Rock Quality
0 – 25	Very Poor
25 – 50	Poor
50 – 75	Fair
75 – 90	Good
90 – 100	Excellent

Reference: Deere et al, 1967

WEATHERING CLASSIFICATION

Term (Grade)	Description
Fresh (W1)	No visible sign of rock material weathering; perhaps slight discoloration on major discontinuity surfaces.
Slightly Weathered (W2)	Discoloration indicates weathering of rock material on discontinuity surfaces. Less than 5 % of rock mass altered.
Moderately Weathered (W3)	Less than half of the rock material is decomposed and/or disintegrated into a soil. Fresh or discoloured rock is present either as a continuous framework or as core stones.
Highly Weathered (W4)	More than half of the rock material is decomposed and/or disintegrated into a soil. Fresh or discoloured rock is present either as a discontinuous framework or as core stones.
Completely Weathered (W5)	All rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.
Residual Soil (W6)	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume but the soil has not been significantly transported.

Reference: Brown, 1981, "Suggested Methods for Rock Characterization Testing and Monitoring". International Society for Rock Mechanics.

TERMINOLOGY

Rock Quality Designation (RQD) is defined as the percentage of intact core pieces longer than 100 mm (4 inches) to the total length of core. The core should be at least NW size (54.7 mm or 2.15 inches in diameter) and typically 5 ft (nominally 1.5 m) in length.

Solid Core Recovery (SCR) is defined as the percentage of intact cylindrical core pieces to the total length of core.

Total Core Recovery (TCR) is defined as the percentage of intact core pieces to the total length of core.

GROUNDWATER

☒ Groundwater level at completion of drilling.

☑ Groundwater level several hours after completion of drilling.

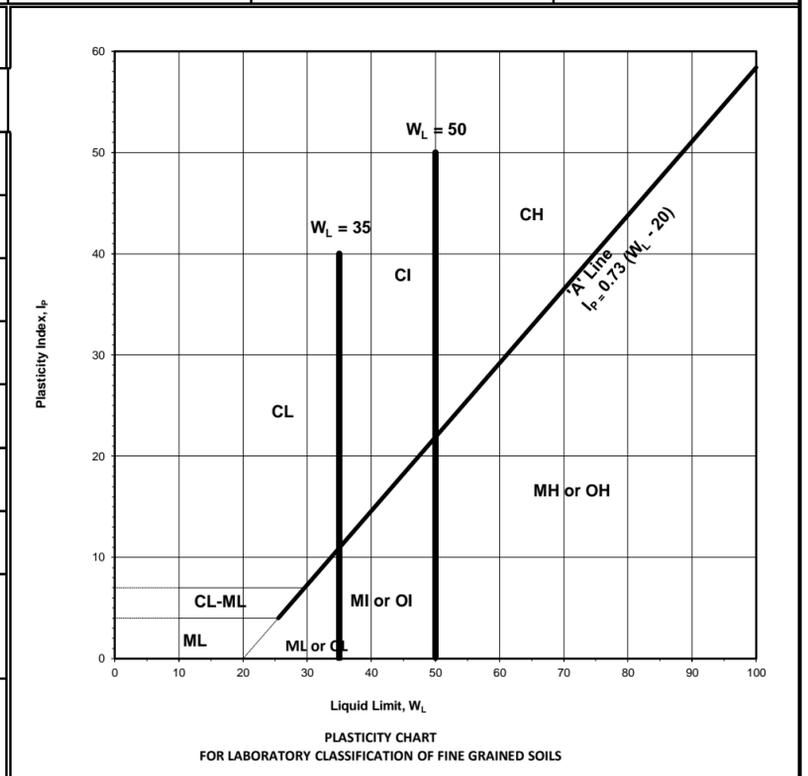


MTC SOIL CLASSIFICATION
Based on MTC Soil Classification Manual



MAJOR DIVISION		GROUP SYMBOL	TYPICAL DESCRIPTION	INFORMATION REQUIRED FOR DESCRIBING SOILS	LABORATORY CLASSIFICATION CRITERIA				
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75µm)	GRAVELS MORE THAN HALF THE COARSE FRACTION LARGER THAN 4.75mm	CLEAN GRAVELS (LITTLE OR NO FINES)	WIDE RANGE IN GRAIN SIZE & SUBSTANTIAL AMOUNTS OF ALL INTERMEDIATE PARTICLE SIZE	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	<p>FOR UNDISTURBED SOILS ADD INFORMATION ON STRATIFICATION, DEGREE OF COMPACTNESS, CEMENTATION, MOISTURE CONDITION & DRAINAGE CHARACTERISTICS</p> <p>USE GRAIN SIZE CURVE IN IDENTIFYING THE FACTORS AS GIVEN UNDER FIELD IDENTIFICATION</p> <p>DETERMINE PERCENTAGE OF GRAVEL & SAND FROM GRAIN SIZE CURVE. DEPENDING ON PERCENTAGE OF FINES (FRACTION SMALLER THAN 75 µm) COARSE GRAINED SOILS ARE CLASSIFIED AS FOLLOWS:</p> <p>LESS THAN 5% G.W., G.P., S.W., S.P. MORE THAN 12% G.M., G.C., S.M., S.C. 5% TO 12% BORDER LINE CASES REQUIRE USE OF DUAL SYMBOL.</p>			
		GRAVEL WITH FINES (APPLICABLE AMOUNT OF FINES)	NON PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE ML BELOW)	GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES		$C_u = \frac{D_{60}}{D_{10}}$ GREATER THAN 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ BETWEEN 1 AND 3		
		SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75mm	CLEAN SANDS (LITTLE OR NO FINES)	WIDE RANGE IN GRAIN SIZE & SUBSTANTIAL AMOUNT OF ALL INTERMEDIATE PARTICLE SIZES	SW		WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	NOT MEETING ALL GRADATION REQUIREMENTS FOR GW	
			SANDS WITH FINES (APPLICABLE AMOUNT OF FINES)	NON PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE ML BELOW)	SM		SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW A-LINE OR I_p LESS THAN 4 ABOVE A-LINE WITH I_p BETWEEN 4 AND 7 ARE BORDERLINE CASES REQUIRING USE OF DUAL SYMBOLS	
	FINE-GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75µm)	SILT AND CLAYS	IDENTIFICATION PROCEDURE ON FRACTION SMALLER THAN 425µm						
			LIQUID LIMIT LESS THAN 35	DRY STRENGTH (CRUSHING CHARACTERISTICS)	DILATANCY (REACTION TO SHAKING)		TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)		
				NONE	QUICK		NONE	ML	INORGANIC SILTS & SANDY SILTS OR SLIGHTLY PLASTICITY, ROCK FLOUR
		MEDIUM TO HIGH		NONE TO VERY SLOW	MEDIUM		CL	SILTY CLAYS (INORGANIC), GRAVELLY CLAYS, SANDY CLAYS, LEAN CLAYS	
		SLIGHT TO MEDIUM	SLOW	SLIGHT	OL		ORGANIC SILT OF LOW PLASTICITY, ORGANIC SANDY SILTS		
		LIQUID LIMIT BETWEEN 35 AND 50	NONE TO SLIGHT	SLOW TO QUICK	SLIGHT		MI	INORGANIC COMPRESSIBLE FINE SANDY SILT WITH CLAY OF MEDIUM PLASTICITY, CLAYEY SILTS	
HIGH	NONE		MEDIUM TO HIGH	CI	SILTY CLAYS (INORGANIC) OF MEDIUM PLASTICITY				
SLIGHT TO MEDIUM	VERY SLOW		SLIGHT	OI	ORGANIC SILTY CLAYS OF MEDIUM PLASTICITY				
LIQUID LIMIT GREATER THAN 50	SLIGHT TO MEDIUM	SLOW TO NONE	MEDIUM	MH	INORGANIC SILTS, HIGHLY COMPRESSIBLE MICACEOUS OR DIATOMACEOUS FINE SANDY SILTS, ELASTIC SILTS				
	HIGH TO VERY HIGH	NONE	HIGH	CH	CLAYS (INORGANIC) OF HIGH PLASTICITY, FAT CLAYS				
	MEDIUM TO HIGH	NONE TO VERY SLOW	SLIGHT TO MEDIUM	OH	ORGANIC CLAYS OF HIGH PLASTICITY				
HIGH ORGANIC SOILS	READILY IDENTIFIED BY COLOUR, ODOUR, SPONGY FEEL & FREQUENTLY BY FIBROUS TEXTURE			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS				

FRACTION	U.S STANDARD SIEVE SIZE		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
	PASSING	RETAINED	PERCENT	DESCRIPTOR
GRAVEL	COARSE	75 mm	26.5 mm	Over 30 AND / WITH
	FINE	26.5 mm	4.75 mm	20-30 (ey) or (y)
SAND	COARSE	4.75 mm	2.00 mm	12-20 Some
	MEDIUM	2.00 mm	425 µm	5-12 Trace to some
	FINE	425 µm	75 µm	1-5 Trace
FINES (SILT OR CLAY BASED ON PLASTICITY)		75 µm		
OVERSIZED MATERIAL				
ROUNDED OR SUBROUNDED: COBBLES 75 mm TO 200 mm BOULDERS > 200 mm			NOT ROUNDED: ROCK FRAGMENTS > 75 mm ROCKS > 0.76 CUBIC METRE IN VOLUME	



RECORD OF BOREHOLE No. BH16-01

1 OF 3

G.W.P. 5015-E-0064 LOCATION 0369840 E, 5211721 N ORIGINATED BY PW
 DIST HWY 129 BOREHOLE TYPE Hollow Stem Augers (108 mm I.D. - 210 mm O.D.) COMPILED BY PW
 DATUM MTM NAD 83 Zone 13 DATE 12 October 2016 CHECKED BY TJG
 PROJECT Foundation Investigation and Design Report - Hinkler Lake Patrol Yard, Township of Martel, Ontario JOB NO. TY163014

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE				"N" VALUES	SHEAR STRENGTH kPa								
						20	40	60	80	100	20	40	60				
414.1 0.0	SE Corner of Proposed Building GRAVELLY SAND trace to some fines compact (FILL)	[Patterned]	SS	1	13											26 68 (6)	
412.7 1.5	SAND trace fines trace to some gravel compact to dense	[Patterned]	SS	2	16												
			SS	3	18												
			SS	4	20												
			SS	5	35												
			SS	6	23												
			SS	7	17											9 88 (3)	

Continued Next Page

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

RECORD OF BOREHOLE No. BH16-01

2 OF 3

G.W.P. 5015-E-0064 LOCATION 0369840 E, 5211721 N ORIGINATED BY PW
 DIST HWY 129 BOREHOLE TYPE Hollow Stem Augers (108 mm I.D. - 210 mm O.D.) COMPILED BY PW
 DATUM MTM NAD 83 Zone 13 DATE 12 October 2016 CHECKED BY TJG
 PROJECT Foundation Investigation and Design Report - Hinkler Lake Patrol Yard, Township of Martel, Ontario JOB NO. TY163014

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE				"N" VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)
								20	40	60	80	100		20	40	60		
							407											
			SS	8	17		8											
							9											
			SS	9	22		405											
							10											
			SS	10	15		404											
							11											
402.4 11.7	SAND some silt loose						403											
			SS	11	7		402											0 87 13 0
							13											
							401											

Continued Next Page

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

RECORD OF BOREHOLE No. BH16-01

3 OF 3

G.W.P. 5015-E-0064	LOCATION 0369840 E, 5211721 N	ORIGINATED BY PW
DIST _____ HWY 129	BOREHOLE TYPE Hollow Stem Augers (108 mm I.D. - 210 mm O.D.)	COMPILED BY PW
DATUM MTM NAD 83 Zone 13	DATE 12 October 2016	CHECKED BY TJG
PROJECT Foundation Investigation and Design Report - Hinkler Lake Patrol Yard, Township of Martel, Ontario		JOB NO. TY163014

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT W _p W W _L			SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE				"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
								20	40	60	80	100	20	40	60		
399.4 14.8	SAND trace to some silt dense	SS	12		5		400						20				0 88 12 0
398.3 15.9	END OF BOREHOLE						399						19				0 94 6 0
<p>Notes:</p> <p>1) Borehole was backfilled with bentonite and auger cuttings on completion.</p>																	

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

RECORD OF BOREHOLE No. BH16-02

1 OF 3

G.W.P. 5015-E-0064 LOCATION 0369815 E, 5211747 N ORIGINATED BY PW
 DIST HWY 129 BOREHOLE TYPE Hollow Stem Augers (108 mm I.D. - 210 mm O.D.) COMPILED BY PW
 DATUM MTM NAD 83 Zone 13 DATE 12 October 2016 CHECKED BY TJG
 PROJECT Foundation Investigation and Design Report - Hinkler Lake Patrol Yard, Township of Martel, Ontario JOB NO. TY163014

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE				"N" VALUES	SHEAR STRENGTH kPa								
						20	40	60	80	100							
413.9	SW Corner of Proposed Building		SS	1	24												
0.0	SAND trace fines some gravel compact (FILL)																
413.2			SS	2	12											1 87 (12)	
0.7	SAND trace to some fines trace to some gravel compact to dense																
			SS	3	32												
			SS	4	42												
			SS	5	48												
			SS	6	19												
			SS	7	15											16 81 (3)	

Continued Next Page

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No. BH16-02

2 OF 3

G.W.P. 5015-E-0064 LOCATION 0369815 E, 5211747 N ORIGINATED BY PW
 DIST HWY 129 BOREHOLE TYPE Hollow Stem Augers (108 mm I.D. - 210 mm O.D.) COMPILED BY PW
 DATUM MTM NAD 83 Zone 13 DATE 12 October 2016 CHECKED BY TJG
 PROJECT Foundation Investigation and Design Report - Hinkler Lake Patrol Yard, Township of Martel, Ontario JOB NO. TY163014

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE				"N" VALUES	SHEAR STRENGTH kPa								
								20	40	60	80	100		20	40	60	
	SAND trace to some fines trace to some gravel compact																
			SS	8	15		406										
							405										
			SS	9	15												
							404										
							403										
			SS	10	19												
							402										
			SS	11	22												
							401										
							400										

Continued Next Page

+³, ×³: Numbers refer to Sensitivity ○³: STRAIN AT FAILURE

RECORD OF BOREHOLE No. BH16-02

3 OF 3

G.W.P. 5015-E-0064	LOCATION 0369815 E, 5211747 N	ORIGINATED BY PW
DIST _____ HWY 129	BOREHOLE TYPE Hollow Stem Augers (108 mm I.D. - 210 mm O.D.)	COMPILED BY PW
DATUM MTM NAD 83 Zone 13	DATE 12 October 2016	CHECKED BY TJG
PROJECT Foundation Investigation and Design Report - Hinkler Lake Patrol Yard, Township of Martel, Ontario		JOB NO. TY163014

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT CONTENT CONTENT			SOIL VAPOUR READING	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE				"N" VALUES	SHEAR STRENGTH kPa					W _p	W			W _L
398.1	SAND compact		SS	12	11													
15.9			SS	13	15													
15.9	END OF BOREHOLE																	
	<p>Notes:</p> <p>1) Groundwater was encountered at a depth of 10.1 m at completion.</p> <p>2) Borehole was backfilled with bentonite and auger cuttings on completion.</p>																	

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

RECORD OF BOREHOLE No. BH16-03

1 OF 3

G.W.P. 5015-E-0064 LOCATION 0369857 E, 5211748 N ORIGINATED BY PW
 DIST HWY 129 BOREHOLE TYPE Hollow Stem Augers (108 mm I.D. - 210 mm O.D.) COMPILED BY PW
 DATUM MTM NAD 83 Zone 13 DATE 12 October 2016 - 13 October 2016 CHECKED BY TJG
 PROJECT Foundation Investigation and Design Report - Hinkler Lake Patrol Yard, Township of Martel, Ontario JOB NO. TY163014

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT			SOIL VAPOUR READING	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE				"N" VALUES	SHEAR STRENGTH kPa					W _p	W			W _L
						20	40	60	80	100					GR	SA	SI	CL
414.0	NW Corner of Proposed Building																	
0.0	GRAVELLY SAND some fines dense (FILL)		SS	1	35													21 66 (13)
413.3	SAND trace to some fines some gravel compact to very dense																	
0.7			SS	2	62													
			SS	3	66													
			SS	4	76													
			SS	5	21													
			SS	6	31													
			SS	7	15													

Continued Next Page

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No. BH16-03

2 OF 3

G.W.P. 5015-E-0064 LOCATION 0369857 E, 5211748 N ORIGINATED BY PW
 DIST HWY 129 BOREHOLE TYPE Hollow Stem Augers (108 mm I.D. - 210 mm O.D.) COMPILED BY PW
 DATUM MTM NAD 83 Zone 13 DATE 12 October 2016 - 13 October 2016 CHECKED BY TJG
 PROJECT Foundation Investigation and Design Report - Hinkler Lake Patrol Yard, Township of Martel, Ontario JOB NO. TY163014

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT			SOIL VAPOUR READING	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE				"N" VALUES	SHEAR STRENGTH kPa					W _p	W		
						20	40	60	80	100						GR SA SI CL	
	SAND trace to some fines some gravel compact																
			SS	8	24		8	406									
							9	405									
			SS	9	32											18 79 (3)	
							10	404									
			SS	10	23		11	403									
402.3 11.7	SAND trace to some fines loose																
			SS	11	9												
400.8 13.3	SAND trace fines trace to some gravel compact to dense						13	401									

Continued Next Page

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

RECORD OF BOREHOLE No. BH16-03

3 OF 3

G.W.P. 5015-E-0064 LOCATION 0369857 E, 5211748 N ORIGINATED BY PW
 DIST HWY 129 BOREHOLE TYPE Hollow Stem Augers (108 mm I.D. - 210 mm O.D.) COMPILED BY PW
 DATUM MTM NAD 83 Zone 13 DATE 12 October 2016 - 13 October 2016 CHECKED BY TJG
 PROJECT Foundation Investigation and Design Report - Hinkler Lake Patrol Yard, Township of Martel, Ontario JOB NO. TY163014

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE				"N" VALUES	SHEAR STRENGTH kPa								
398.2	SAND trace fines trace to some gravel compact to dense		SS	12	24												
15.9			SS	13	33												
15.9	END OF BOREHOLE																
	Notes: 1) Groundwater was encountered at a depth of 10.9 m at completion. 2) Borehole was backfilled with bentonite and auger cuttings on completion.																

+ 3, X 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No. BH16-04

2 OF 3

G.W.P. 5015-E-0064 LOCATION 0369861 E, 5211721 N ORIGINATED BY PW
 DIST HWY 129 BOREHOLE TYPE Hollow Stem Augers (108 mm I.D. - 210 mm O.D.) COMPILED BY PW
 DATUM MTM NAD 83 Zone 13 DATE 13 October 2016 CHECKED BY TJG
 PROJECT Foundation Investigation and Design Report - Hinkler Lake Patrol Yard, Township of Martel, Ontario JOB NO. TY163014

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	SOIL VAPOUR READING COV/ TOV (ppm)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE				"N" VALUES	SHEAR STRENGTH kPa								
								20	40	60	80	100					
	SAND trace fines trace gravel compact																
			SS	8	11		8										
							9										
			SS	9	23												
							10										
			SS	10	14		11										4 94 (2)
							12										
			SS	11	17												
							13										
400.5 13.3	SAND trace fines trace gravel loose																

Continued Next Page

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

RECORD OF BOREHOLE No. BH16-05

3 OF 3

G.W.P. 5015-E-0064	LOCATION 0369851 E, 5211738 N	ORIGINATED BY PW
DIST _____ HWY 129	BOREHOLE TYPE Hollow Stem Augers (108 mm I.D. - 210 mm O.D.)	COMPILED BY PW
DATUM MTM NAD 83 Zone 13	DATE 13 October 2016	CHECKED BY TJG
PROJECT Foundation Investigation and Design Report - Hinkler Lake Patrol Yard, Township of Martel, Ontario		JOB NO. TY163014

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			SOIL VAPOUR READING	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE				"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)							
								20	40	60	80	100	W _p	W	W _L	20	40	60	COV/ TOV (ppm)	GR SA SI CL	
398.0	SAND compact	SS	12		21																0 94 (6)
15.9		SS	13		18		399							20							
398.0	END OF BOREHOLE					398															
	Notes: 1) Groundwater was encountered at a depth of 9.9 m at completion. 2) Borehole was backfilled with bentonite and auger cuttings on completion.																				

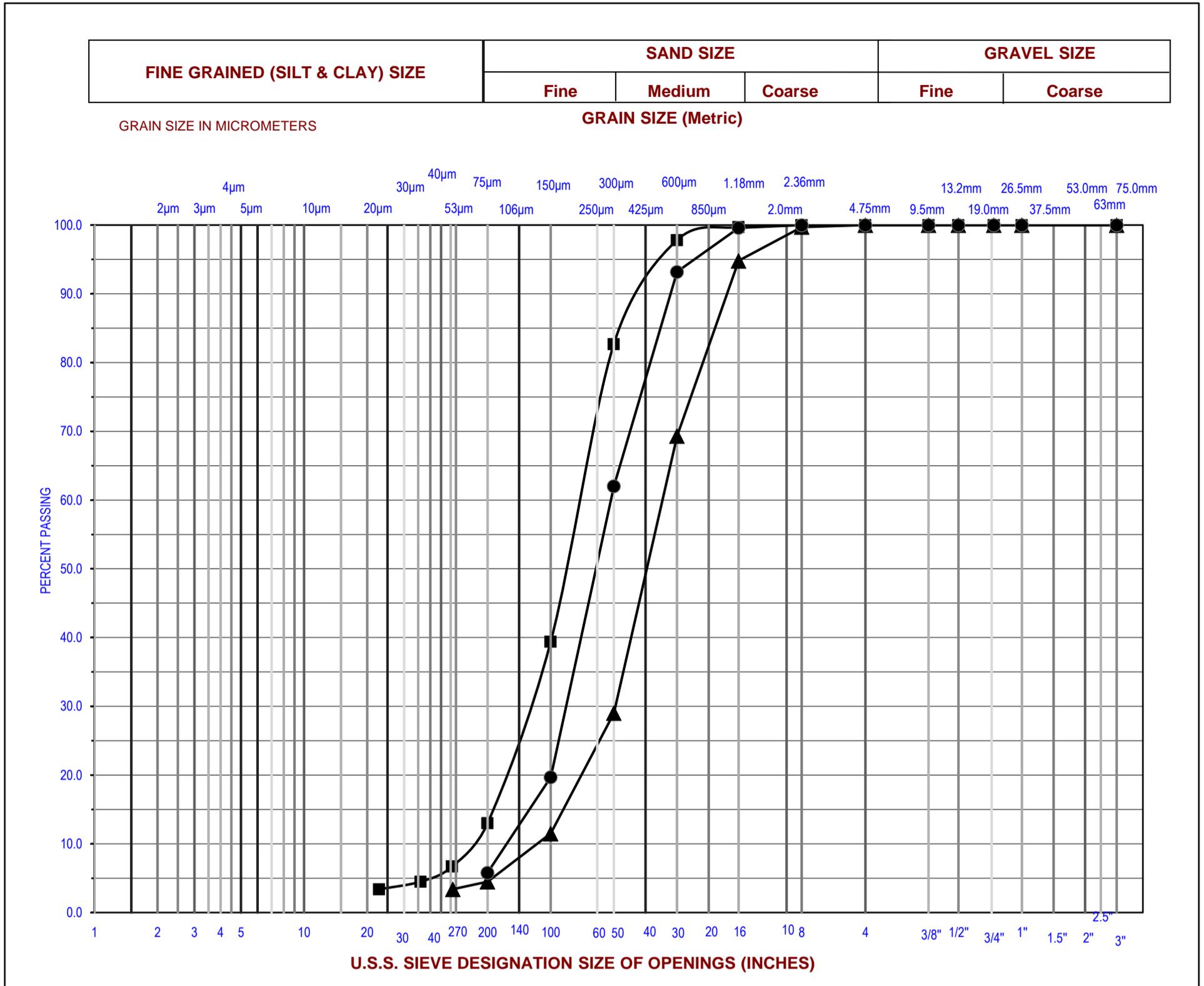
+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Ministry of Transportation Ontario– Northeast Region
Foundation Investigation Report
Proposed Maintenance Structure – Hinkler Lake Patrol Yard
Township of Martel, Ontario
February 2017



APPENDIX C
LABORATORY TESTING RESULTS

FIGURE C2A - SIEVE AND HYDROMETER
SAND, trace to some silt, trace to some gravel



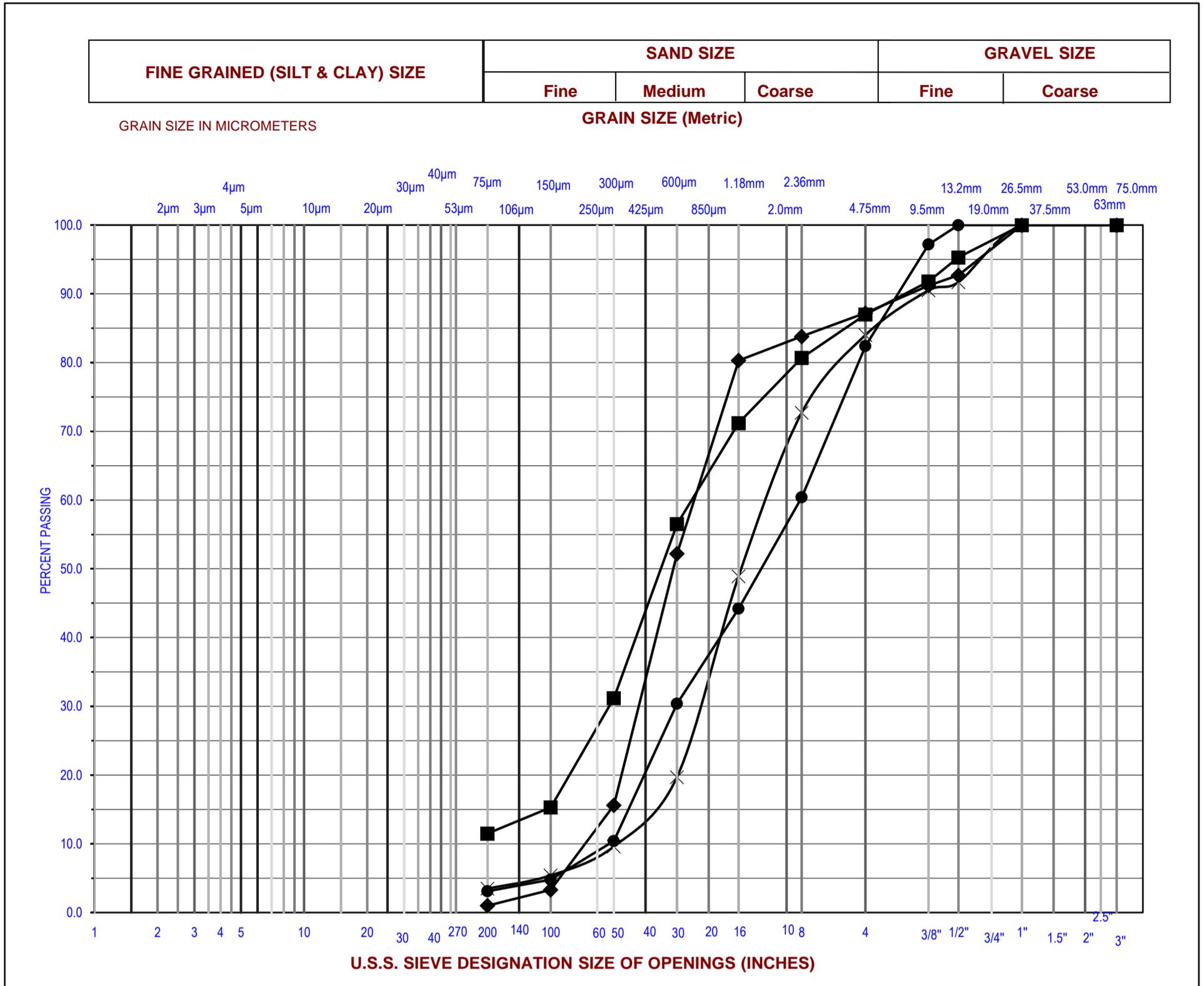
LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)	GRAVEL(%)	SAND (%)	SILT (%)	CLAY (%)
■	16-01	SS11	401.6	0	87	13	0
▲	16-01	SS12	400.2	0	88	12	0
●	16-01	SS13	398.6	0	94	6	0

Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited 131 Fielding Road, Lively, Ontario Canada, P3Y1L7 PH: (705) 682-2632, FX: (705) 682-2260 www.amecfw.com	SIEVE AND HYDROMETER	Project No.: TY163014	
		Tested By:	Reviewed By:
		MMD	TG

FIGURE C2B - GRAIN SIZE DISTRIBUTION

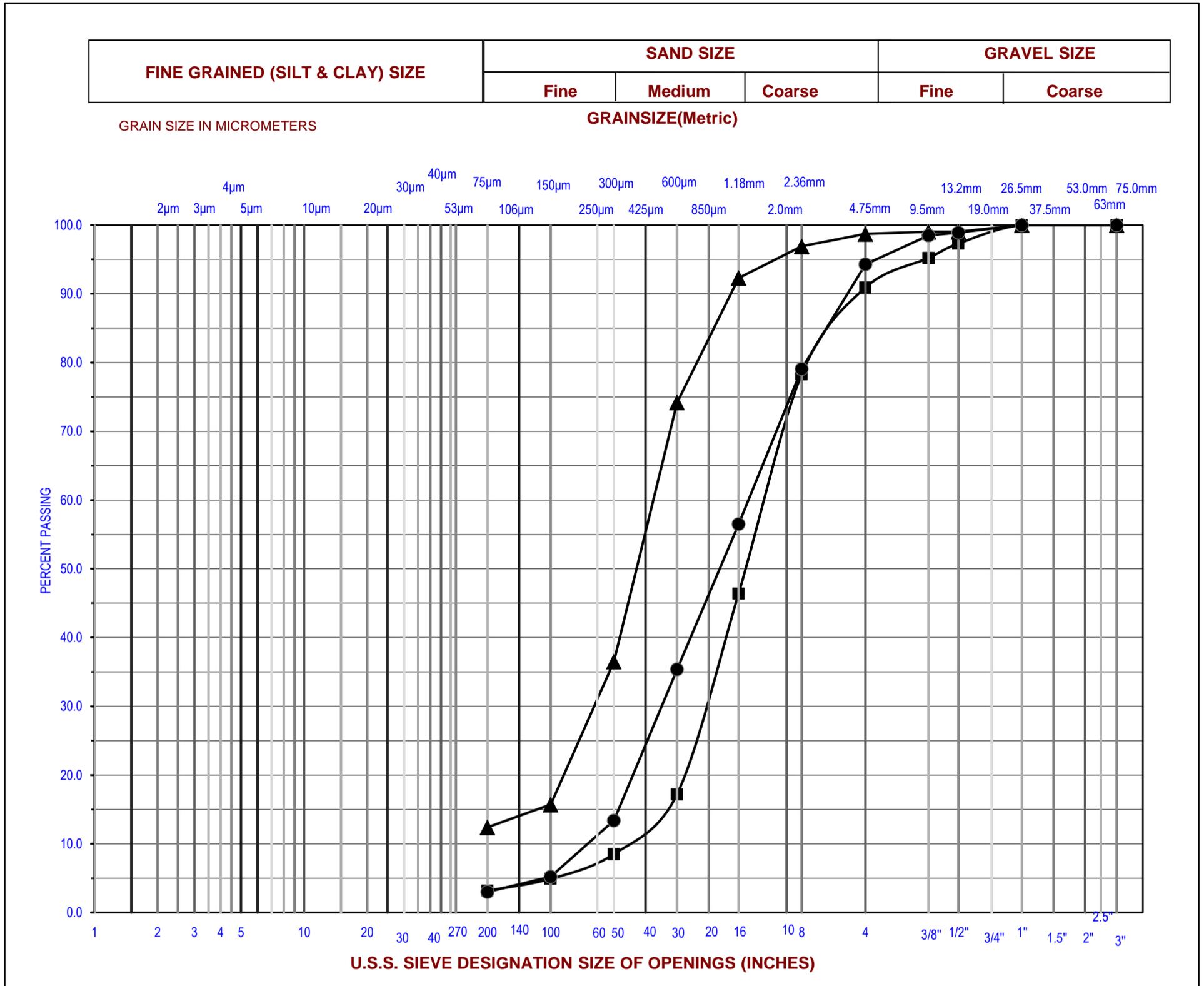
SAND, trace to some silt, trace to som gravel



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)	GRAVEL(%)	SAND (%)	SILT & CLAY (%)
X	16-02	SS7	407.5	16	80	4
◊	16-02	SS11	401.4	13	86	1
●	16-03	SS9	404.6	18	79	3
■	16-05	SS2B	412.7	13	75	12

FIGURE C2C- GRAIN SIZE DISTRIBUTION
SAND, trace to some silt, trace to some gravel



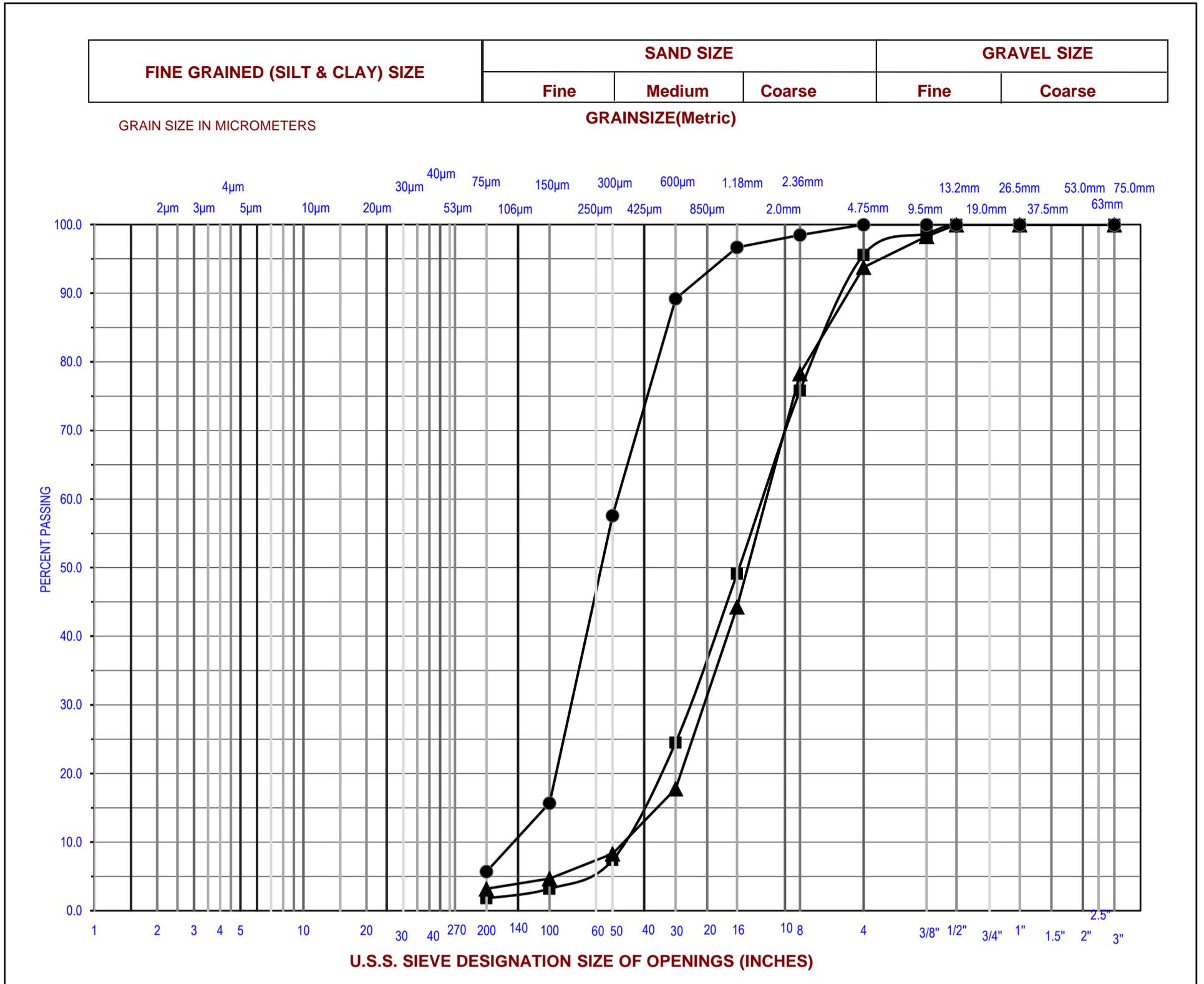
LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)	GRAVEL(%)	SAND (%)	SILT (%)
■	16-01	SS7	407.7	9	88	3
▲	16-02	SS2	412.8	1	87	12
●	16-03	SS12	399.9	6	91	3

Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited 131 Fielding Road, Lively, Ontario Canada, P3Y1L7 PH: (705) 682-2632, FX: (705) 682-2260 www.amecfw.com	GRAIN SIZE DISTRIBUTION	Project No.: TY163014	
		Tested By:	Reviewed By:
		MMD	TJG

FIGURE C2D - GRAIN SIZE DISTRIBUTION

SAND, trace to some silt, trace to some gravel



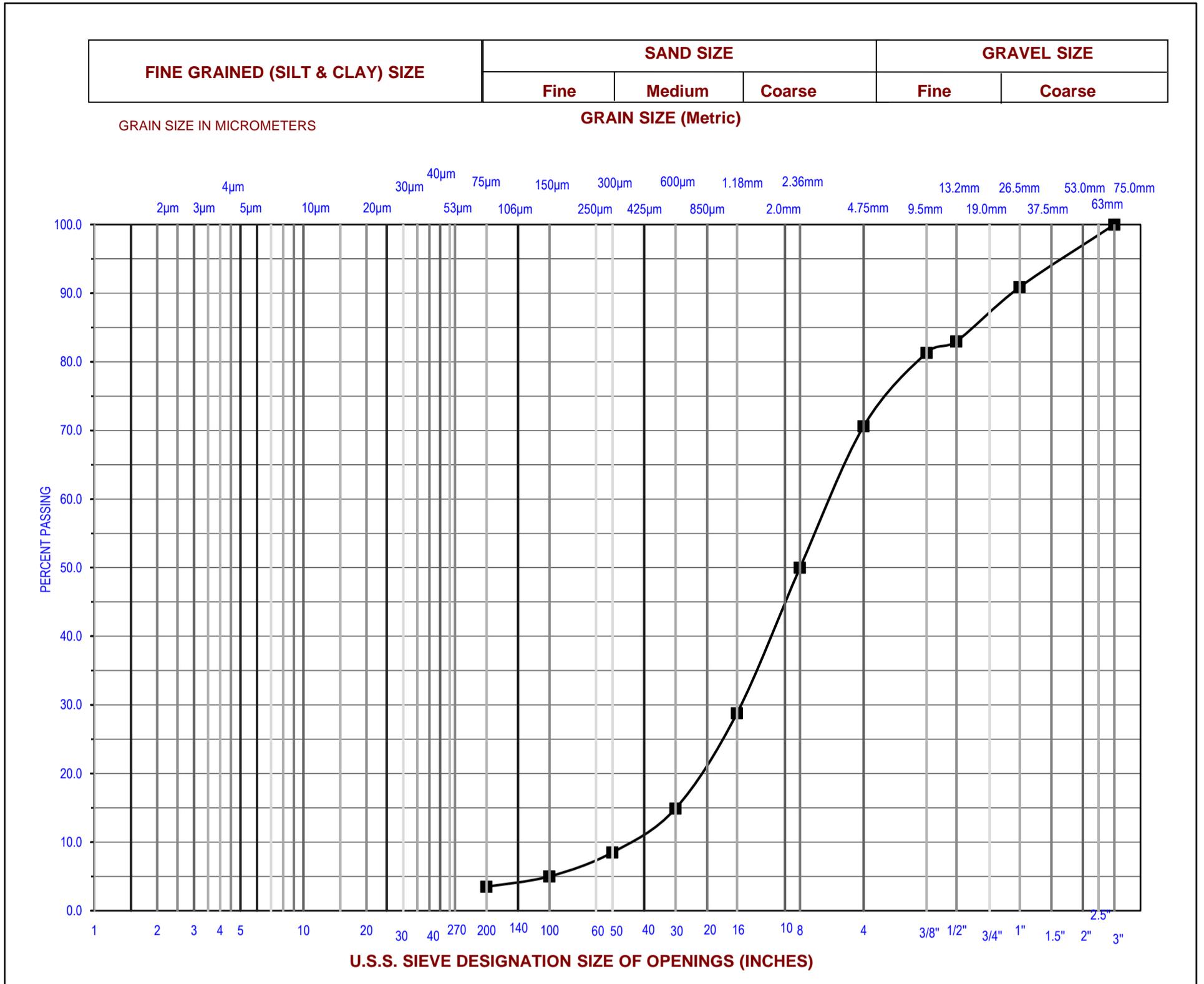
LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)	GRAVEL(%)	SAND (%)	SILT & CLAY (%)
■	16-04	SS10	402.7	4	94	2
▲	16-05	SS7	407.4	6	91	3
●	16-05	SS12	398.8	0	94	6

Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited 131 Fielding Road, Lively, Ontario Canada, P3Y1L7 PH: (705) 682-2632, FX: (705) 682-2260 www.amecfw.com	GRAIN SIZE DISTRIBUTION	Project No.:	TY163014
		Tested By:	Reviewed By:
		MMD	TJG

FIGURE C3 - GRAIN SIZE DISTRIBUTION

GRAVELLY SAND, trace silt



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)	GRAVEL(%)	SAND (%)	SILT & CLAY (%)
■	16-04	SS5	410.4	29	67	4

Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited 131 Fielding Road, Lively, Ontario Canada, P3Y1L7 PH: (705) 682-2632, FX: (705) 682-2260 www.amecfcw.com	GRAIN SIZE DISTRIBUTION	Project No.:	TY163014
		Tested By:	Reviewed By:
		MMD	TJG

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APPENDIX D
ANALYTICAL RESULTS

**CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR
131 FIELDING ROAD
LIVELY, ON P3Y1L7
(705) 682-2632**

ATTENTION TO: David Brown

PROJECT: TY163014

AGAT WORK ORDER: 16U160642

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

DATE REPORTED: Nov 22, 2016

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

***NOTES**

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.



Certificate of Analysis

AGAT WORK ORDER: 16U160642

PROJECT: TY163014

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
<http://www.agatlabs.com>

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

ATTENTION TO: David Brown

SAMPLING SITE:

SAMPLED BY:

Inorganic Chemistry (Soil)

DATE RECEIVED: 2016-11-15

DATE REPORTED: 2016-11-22

		HIN BH16-05		
SAMPLE DESCRIPTION:		SS4		
SAMPLE TYPE:		Soil		
DATE SAMPLED:		2016-10-13		
Parameter	Unit	G / S	RDL	8017753
pH, 2:1 CaCl ₂ Extraction	pH Units			6.70
Chloride (2:1)	µg/g		2	45
Sulphate (2:1)	µg/g		2	28
Electrical Conductivity (2:1)	mS/cm		0.005	0.152
Resistivity (2:1)	ohm.cm		1	6580

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
8017753 EC/Resistivity, Chloride and Sulphate were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl₂ extract prepared at 2:1 ratio.
 Please note that sample was received and analyzed past hold time.

Certified By:

Amanjot Bhela

Quality Assurance

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR
PROJECT: TY163014
SAMPLING SITE:

AGAT WORK ORDER: 16U160642
ATTENTION TO: David Brown
SAMPLED BY:

Soil Analysis

RPT Date: Nov 22, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE		MATRIX SPIKE			
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Inorganic Chemistry (Soil)

pH, 2:1 CaCl ₂ Extraction	8017932		7.23	7.18	0.7%	NA	101%	80%	120%	NA			NA		
Chloride (2:1)	8018372		42	43	2.4%	< 2	104%	80%	120%	102%	80%	120%	104%	70%	130%
Sulphate (2:1)	8018372		64	65	1.6%	< 2	94%	80%	120%	100%	80%	120%	102%	70%	130%
Electrical Conductivity (2:1)	8013796		4.59	4.59	0.0%	< 0.005	99%	90%	110%	NA			NA		

Comments: NA signifies Not Applicable.

Certified By: _____

Amanjot Bhela



Method Summary

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 16U160642

PROJECT: TY163014

ATTENTION TO: David Brown

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
pH, 2:1 CaCl ₂ Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Electrical Conductivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Resistivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION

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Foundation Investigation Report
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Township of Martel, Ontario
February 2017



APPENDIX E
LIMITATIONS OF REPORT

AMEC FOSTER WHEELER ENVIRONMENT & INFRASTRUCTURE

LIMITATIONS OF REPORT

The conclusions and recommendations given in this report are based on information determined at the borehole locations. The information contained herein in no way reflects on the environmental aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the geotechnical engineer be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in test holes.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final design stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of boreholes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices. No other warranty is expressed or implied.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Amec Foster Wheeler accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.