



**FOUNDATION INVESTIGATION REPORT
HORNEPAYNE PATROL YARD
HORNEPAYNE, ONTARIO**

**GEOCRES NO: 42F-51
LATITUDE 49.224773 LONGITUDE -84.772648**

Submitted to

Ministry of Transportation Ontario Northeast Region

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North Bay, ON
P1S

Submitted by

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3 March 2014

Amec Foster Wheeler Project No. **TY163014**

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Ministry of Transportation Ontario– Northeast Region
Foundation Investigation Report
Proposed Maintenance Structure – Hornepayne Patrol Yard
Hornepayne, Ontario
March 2014



PART A

FOUNDATION INVESTIGATION REPORT HORNEPAYNE PATROL YARD HORNEPAYNE, ONTARIO

1.0 INTRODUCTION

1.1 Background

Amec Foster Wheeler Environment & Infrastructure (Amec Foster Wheeler) has been retained by The Minister of Transportation Ontario, Northeast Region (MTO), for provision of foundation engineering services at six patrol yards as part of the Assignment No. 01/E006.

This report addresses the results of the subsurface investigation carried out by Amec Foster Wheeler at the MTO Ormepaone Patrol Yard, located on the west side of Roundhouse Road., approximately 100 m south of Highway 631, 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 that MTO plans to construct a new sand/salt storage building at the Ormepaone 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. This structure is to have an approximate area of 100 m² (10 m by 20 m), as shown on Drawing 1, and on Drawing 2 which was provided to Amec Foster Wheeler by the MTO.

1.2 Site Description

The patrol yard is located in Ormepaone, Ontario, in the Township of Ormepaone, District of Algoma. The entrance to the site is located approximately 100 m south of Highway 631 on the west side of Roundhouse Road. The latitude and longitude coordinates for the site are Latitude 46.22003 and Longitude -82.00260.

At the time of the investigation, one large salt/sand storage dome was located in the southeast portion of the patrol yard and one smaller salt storage building was located just to the north of the salt/sand dome. One office/garage building was located to the northwest of the salt/sand dome, adjacent to the site entrance and Roundhouse Road. The remaining areas of the yard were generally vacant land, stockpile areas, and vehicle parking areas. A shallow north to south oriented swale was present in the western portion on the patrol yard and intersected the proposed storage building footprint. Photographs of the site are included in Appendix A.

The new proposed structure will be constructed west of the existing sand/salt dome, in a vacant portion of the property, 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 and till, predominantly a sand to silt, sand matrix, high content of clasts, and often low carbonate content. This data is 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 Metasedimentary rocks, Paragneiss and migmatites. MNDM “Geology Survey August 2003, 1:250,000 Bedrock Geology of Ontario” map indicates. The site is located in the Superior Province.

2.0 INVESTIGATION PROGRAM

2.1 Soil Drilling Investigation

The fieldwork at the site was carried out on October 1, 1 and 20, 2016, when five boreholes HH1601 to HH1605 were advanced within the proposed sand/salt storage structure footprint to depths between 10.0 m and 12.0 m below the existing ground surface.

The borehole locations referenced to the MTM NAD83 Zone 13 northing and easting coordinate system, the ground surface elevations referenced to Geodetic datum and the drilled depths are summarized below and are shown on Drawing 1. The borehole locations were relocated slightly from the originally planned locations to avoid uneven ground due to the swale in the vicinity of the building footprint.

Table 1: Hornepayne Borehole Summary

Foundation Element ¹	Borehole Designation	Location (MTM NAD83 Zone 13)		Ground Surface Elevation (m)	Borehole Depth ² (m)
		Northing (m)	Easting (m)		
Northeast Corner	HH1601	4,444,341	244,404	324.0	12.0
Southeast Corner	HH1602	4,444,344	244,412	324.4	12.2
Southwest Corner	HH1603	4,444,344	244,444	324.3	11.6
Northwest Corner	HH1604	4,444,364	244,443	324.4	10.0
Centre	HH1605	4,444,360	244,444	324.4	12.0

1 – All foundation elements refer to location in the footprint of the proposed development.

2 – Depth includes depth of coring.

The ground surface elevations at the borehole locations were surveyed by Amec Foster Wheeler personnel. The top of a rock plug set in concrete with a known elevation of 32.03 m was used as a local benchmark. The borehole locations were also georeferenced to MTM coordinates using a handheld Global Positioning System (GPS) unit. The elevations and GPS coordinates can also be found on the Record of Borehole sheets.

The boreholes were advanced using 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 D1586) 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 Terms of Reference (TOR) and Amec Foster Wheeler's proposal for this investigation, the following laboratory tests were conducted:

- Natural water content (%)
- Grain size distribution – sieve only (%)
- Grain size distribution (sieve and hydrometer) (%)
- Atterberg Limits (%)
- pH, chlorides, sulphates, resistivity (Ω·m)

The results of in-situ and laboratory tests are presented in the Record of Boreholes in Appendix. The grain size distribution curves and plasticity chart are found in Appendix C, and the results of soil corrosivity tests are included in Appendix D.

3.0 SUB-SURFACE CONDITIONS

In general, the subsurface conditions at the site consists of surficial fill underlain by sequential silt and sand deposits overlying clayey silt till. A summary of the subsurface conditions encountered in the boreholes is presented below and the Record of Borehole sheets are included in Appendix.

3.1 Sand/Gravelly Sand Fill

Sand fill was encountered at the ground surface in boreholes 16-01 to 16-03, and gravelly sand fill was encountered at the ground surface in boreholes 16-04 and 16-05 advanced at the site. The thickness of the fill ranged between 0.3 m and 1.0 m at the borehole locations. The measured SPT 'N' values ranged between 13 blows and 31 blows per 0.3 m of penetration indicating a compact to dense state.

The completed lab testing on selected fill samples measured water contents ranging from 10% to 15% of the materials dry weight.

Three grain size distributions were completed on selected split spoon samples of the fill material; the results are as follows:

- Gravel 0% to 30%
- Sand 61% to 100%
- Silt and Clay Size 0% to 10%

The grain size distribution curves are presented in Appendix C.

3.2 Silt

A layer of brown to grey silt was encountered below the fill material at all of the borehole locations. The silt deposit was contacted at depths between 0.3 m and 1.0 m below ground surface (Elevations 326.0 m and 326.1 m), and the deposit ranged in thickness from 0.3 m to 0.5 m. The deposit was comprised of silt, trace to some clay and trace to some sand and gravel.

The measured SPT 'N' values ranged between 6 blows and 10 blows per 0.3 m of penetration indicating a loose to dense state of compactness with the exception of a 1.1 m to 2.0 m thick layer of loose silt which was encountered in all boreholes with the exception of borehole 16-03. The natural moisture content, as measured in collected split spoon samples from all boreholes ranged from 30% to 200%.

Three grain size distributions were conducted on selected split spoon samples of the silt deposit; the results are as follows:

- Gravel 0%
- Sand 0% to 2%
- Silt 80% to 100%
- Clay 0% to 10%
-

The grain size distribution curves are presented in Appendix C.

3.3 Sand

Sand some silt and clay and trace was encountered below the silt in boreholes 16-01 and 16-02. The sand was encountered at depths of 6.6 m and 6.1 m (Elevations 321.4 m and 320.4 m) respectively. The thickness of the sand deposit was 2.4 m and 1.4 m at the two boreholes, respectively. The measured SPT 'N' values ranged from 35 blows to 48 blows per 0.3 m of penetration, indicating a dense state for full sand samples where the sample interval did not encounter a transition in soil strata.

The natural moisture content, as measured in collected split spoon samples of the sand ranged from 10% to 14%.

One grain size distribution was completed on the split spoon sample collected of the silt/sand, the results are as follows:

- Gravel 0%
- Sand 98%
- Silt/Clay 2%

The grain size distribution curve is presented in Appendix C.

3.4 Gravelly Sand

Gravelly sand with trace silt and clay was encountered below the silt in borehole 16-03. The gravelly sand was encountered at a depth of 1.6 m (Elevation 321.4 m). The thickness of the gravelly sand deposit was 2.4 m at the borehole location. The measured SPT 'N' values ranged from 3 blows to greater than 100 blows per 0.3 m of penetration indicating a dense to very dense state.

The natural moisture content, as measured in collected split spoon samples of the sand ranged from 10% to 14%.

One grain size distribution was completed on a split spoon sample collected of the gravelly sand, the results are as follows:

- Gravel 2%
- Sand 66%
- Silt/Clay 32%

The grain size distribution curve is presented in Appendix C.

3.5 Cobbles and Boulders

A nest of cobbles and boulders, with sand and gravel was encountered below the silt in borehole 16-01. The cobble and boulder nest extended from 6.3 m to 16 m below ground surface (321.0 m to 314.3 m). The cobble and boulder nest could not be penetrated by augers and coring was necessary to advance the borehole through this zone. The soil matrix was removed by the coring process and therefore cannot be identified.

3.6 Clayey Silt

Clayey silt with some sand and trace gravel was encountered below the silt layer in borehole 16-01. The clayey silt was 2.2 m in thickness and extended to Elevation 314.6 m. One measured SPT 'N' value within the clayey silt was 6 blows per 0.3 m of penetration indicating a hard consistency.

Atterberg limit testing conducted on split spoon sample from borehole 16-01, resulted a liquid limit of 20, a plastic limit of 16 and a plasticity index of 13, indicating the clayey silt is low plasticity.

A plasticity chart is presented in Appendix C.

3.7 Clayey Silt (Till)

A layer of clayey silt till was encountered below the sand, cobbles and boulders and clayey silt deposits at all borehole locations. All of the boreholes were terminated in the clayey silt till deposit at depths between 10.0 m and 12.0 m.

Measured SPT testing 'N' values within the till were greater than 100 blows per 0.3 m of penetration indicating a hard consistency. The clayey silt till was difficult to penetrate with the soil augers and rotary coring using a N sized core barrel was used to advance the boreholes in the cohesive till, which precluded standard penetration testing.

Atterberg limit testing conducted on split spoon samples from boreholes 16-01 and 16-02 resulted liquid limits of 21 and 26, plastic limits of 11 and 12, and plasticity indices of 10 and 14 indicating a clayey silt till of low plasticity. A plasticity chart is presented in Appendix C.

3.8 Groundwater Conditions

At the completion of drilling, groundwater was encountered in borehole 16-01 at a depth of 3.2 m below ground surface. The remaining boreholes were dry upon completion. The field schedule permitted the measurement of the groundwater levels the day following the drilling with the exception of borehole 16-02, because the drilling crew demobilized after that borehole was

completed. The groundwater measurements are shown on the Record of Borehole sheets and are summarized below.

Table 2: Hornepayne Groundwater Measurements

Foundation Element	Borehole Designation	Ground Surface Elevation (m)	Water Level Depth Below Ground Surface (m)	
			Upon Completion of Drilling	Following Day of Drilling ¹
Northeast Corner	BH16-01	324.0	3.2	1.3
Southeast Corner	BH16-02	324.4	Drill	Not Measured
Southwest Corner	BH16-03	324.3	Drill	1.4
Northwest Corner	BH16-04	324.4	Drill	1.2
Centre	BH16-05	324.4	Drill	2.4

1 – Water level measurements were taken twice in BH16-01 and BH16-03, BH16-04, and BH16-05 (upon borehole completion and again the following day).

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.

4.0 CLOSURE

This Foundation Design Report was prepared by Nicholas Mic, EIT, and reviewed by Mr. Mehdi Mostakhdemi, M.Sc., P.Eng. Mr. T. 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



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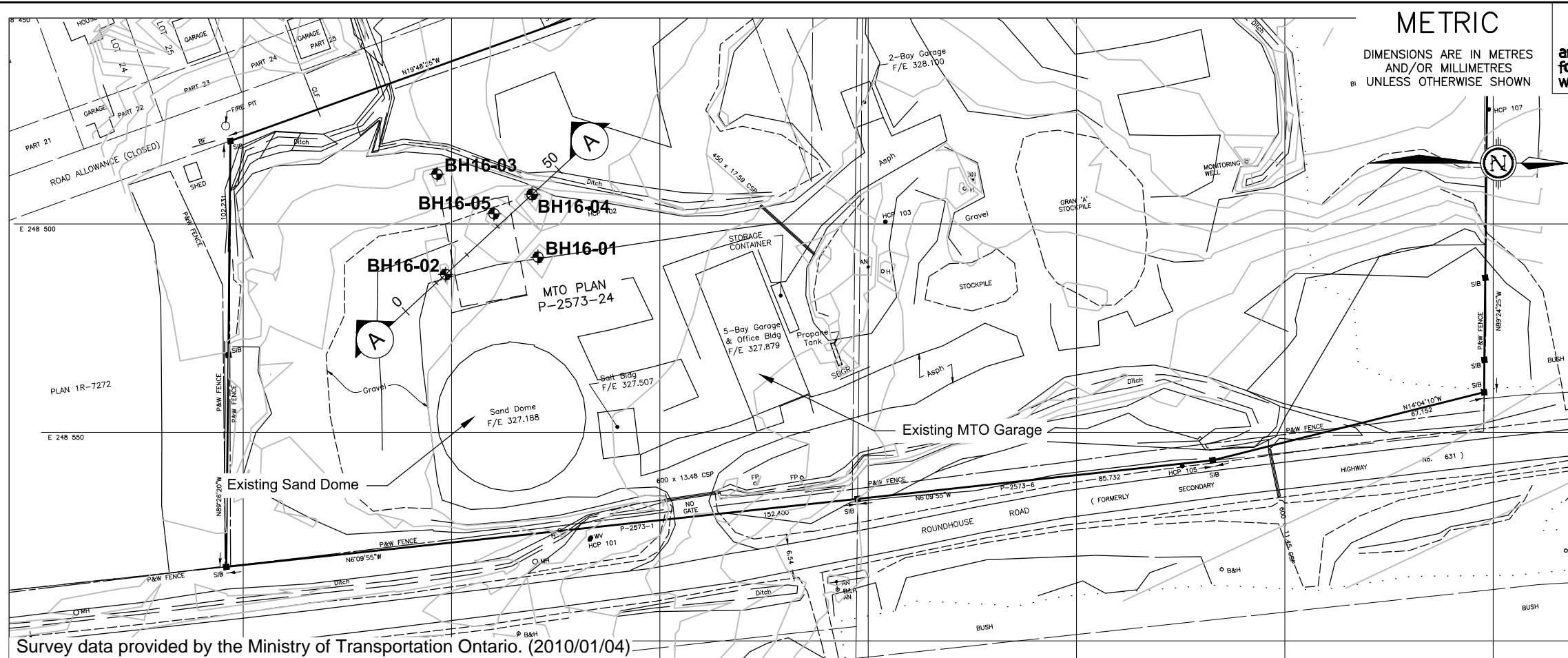
Mehdi Mostakhdemi, M.Sc., P. Eng.
Geotechnical Engineer



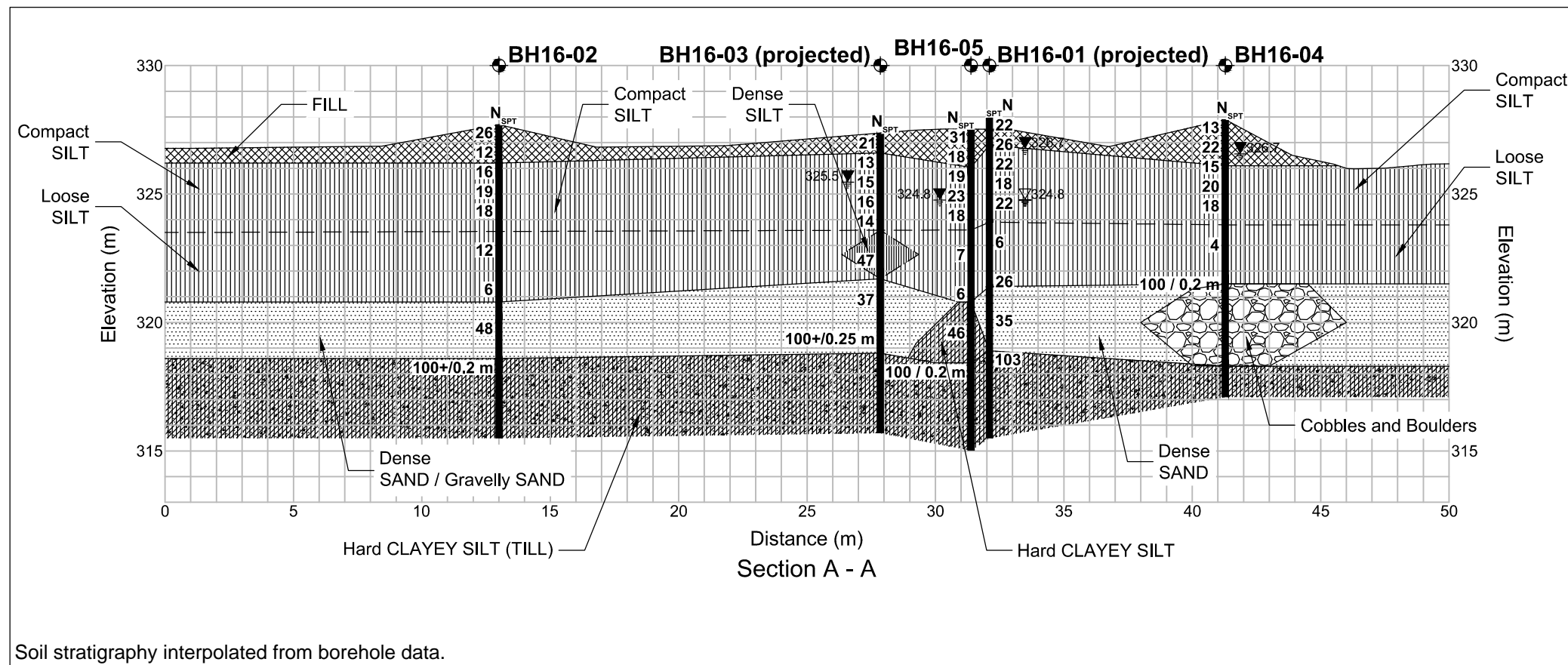
T. Garde, M. Eng., M. Eng., P. Eng.,
Designated MTO Foundations Contact



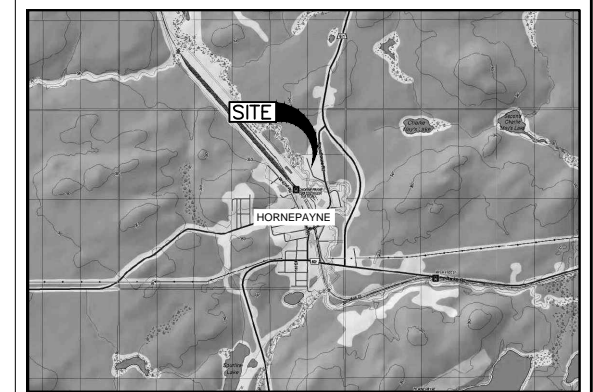
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PLAN



CENTERLINE PROFILE



KEY PLAN



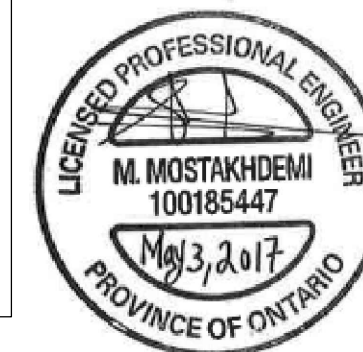
Approximate Scale (km)

LEGEND

- BOREHOLE LOCATION
- STANDARD PENETRATION TEST VALUE
- BLOWS/0.3m UNLESS OTHERWISE STATED
(STD. PEN. TEST, 475 J/BLOW)
- WATER LEVEL UPON COMPLETION OF DRILLING
- WATER LEVEL ONE DAY AFTER COMPLETION
- 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	CO-ORDINATES (MTM, NAD 83 ZONE 13)	
		NORTHING	EASTING
TESTHOLES BY OTHERS			
BH16-01	328.0	5454371	0248508
BH16-02	327.7	5454349	0248512
BH16-03	327.3	5454347	0248488
BH16-04	327.9	5454369	0248493
BH16-05	327.7	5454360	0248498
SITE LOCATION LATITUDE/LONGITUDE 49.224773, -84.772648			

Approximate Scale (m)

REVISIONS	03/05/2017	2	NK	ISSUED TO CLIENT
	01/05/2017	1	NK	REVISED PER MTO COMMENTS
	DATE	REV. BY		DESCRIPTION
DESIGN	NFK	CHK	DMC	CODE
DRAWN	MAT	CHK	NFK	GEOCRES: 42F-51
	DATE			LOAD
				15-FEB-17

DOC: TY163014 - HORNEPAYNE

APPENDIX A

SITE PHOTOGRAPHS



Photo 1

View of drilling operations facing north. The salt storage structure is shown on the right hand side.

14 Oct 2016



Photo 2

Swale or creek just to the west of the drilling area. TY1600 was moved south to avoid drilling in it.

14 Oct 2016



Photo 3

General view of patrol yard showing paved area, MTO garage on left, and salt storage, and dome on right.

15 Oct 2016



Photo 4

View along backside of site in area of boreholes, the swale/creek is running along the left hand side.

20 Oct 2016

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 stratigraphic 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 to 100

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., 10/2000 blows for 20 centimeter penetration).

Soil Sampling

Sample types are abbreviated as follows:

SS Split Spoon	TW Thin Wall Open (Pushed)	RC Rock Core	GS Grab Sample
AU 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.	0.2 – 1.0
Very Weak (R1)	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife.	1.0 – 10
Weak (R2)	Can be peeled with a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer.	10 – 20
Medium Strong (R3)	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single firm blow of geological hammer.	20 – 40
Strong (R4)	Specimen requires more than one blow of geological hammer to fracture it.	40 – 100
Very Strong (R5)	Specimen requires many blows of geological hammer to fracture it.	100 – 200
Extremely Strong (R6)	Specimen can only be chipped with geological hammer.	200

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 – 40	Poor
40 – 60	Fair
60 – 80	Good
80 – 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 10% 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 (12.5 mm or 0.5 inches in diameter) and typically 0.5 ft (0.15 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.

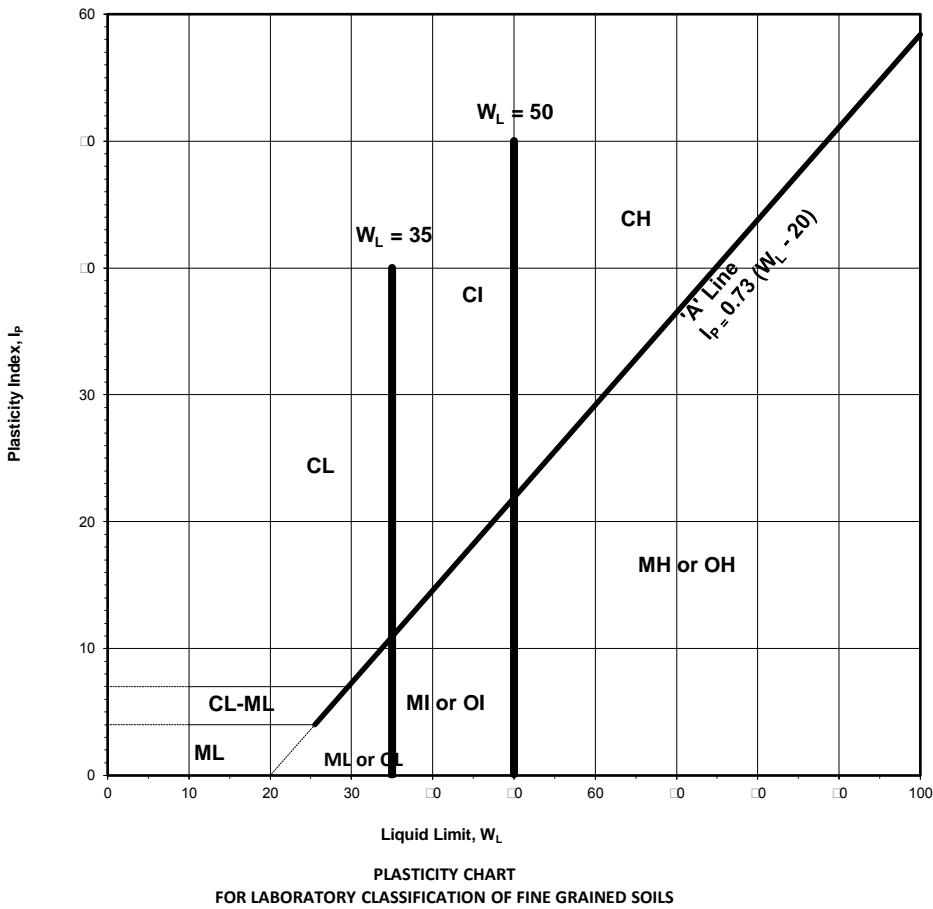


MTC SOIL CLASSIFICATION
Based on MTC Soil Classification Manual



MAJOR DIVISION					GROUP SYMBOL	TYPICAL DESCRIPTION	INFORMATION REQUIRED FOR DESCRIBING SOILS	LABORATORY CLASSIFICATION CRITERIA				
COARSE GRAINED SOILS (MORE THAN 50% BY WEIGHT LARGER THAN 0.075mm)	GRAVELS (MORE THAN 50% BY WEIGHT LARGER THAN 0.075mm)	CLEAN GRAVELS (LITTLE OR NO FINES)	WIDE RANGE IN GRAIN SIZE (SUBSTANTIAL AMOUNTS OF ALL INTERMEDIATE PARTICLE SIZES)		GW	WELL GRADED GRAVELS, GRAVEL SAND MIXTURES, LITTLE OR NO FINES	GIVE TYPE, NAME, IF NECESSARY, INDICATE APPROXIMATE PERCENTAGE OF SAND, GRAVEL, MAJOR GRAIN SIZE, ANGULARITY, SURFACE CONDITION, HARDNESS OF THE COARSE GRAINS, LOCAL OR GEOLOGICAL NAME, OTHER PERTINENT DESCRIPTIVE INFORMATION, AND SYMBOL IN PARENTHESES. FOR UNDISTURBED SOILS ADD INFORMATION ON STRATIFICATION, DEGREE OF COMPACTNESS, CEMENTATION, MOISTURE CONDITION, DRAINAGE CHARACTERISTICS	C _u ≤ 6, D ₆₀ / D ₁₀ ≥ 4 GREATER THAN 4				
			PREDOMINANTLY ONE SIZE OF A RANGE OF SIZES WITH SOME INTERMEDIATE SIZES MISSING		GP	POORLY GRADED GRAVELS, GRAVEL SAND MIXTURES, LITTLE OR NO FINES		C _u > 6, D ₆₀ / D ₁₀ ≥ 4 BETWEEN 1 AND 3				
		GRAVEL WITH FINES (APPLICABLE AMOUNT OF FINES)	NON PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE ML BELOW)		GM	SILTY GRAVELS, POORLY GRADED GRAVEL SAND MIXTURES		C _c ≤ 2, D ₃₀ ² / (D ₁₀ × D ₆₀) ≤ 6 BETWEEN 1 AND 3				
			PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE CL BELOW)		GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL SAND MIXTURES						
	SANDS (MORE THAN 50% BY WEIGHT SMALLER THAN 0.075mm)	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				
			PREDOMINANTLY ONE SIZE OR A RANGE OF SIZES WITH SOME INTERMEDIATE SIZE MISSING		SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES						
		SANDS WITH FINES (APPLICABLE AMOUNT OF FINES)	NON PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE ML BELOW)		SM	SILTY SANDS, POORLY GRADED SAND SILT MIXTURES		ATTENTION LIMITS BELOW A LINE OR Ip LESS THAN 10				
			PLASTIC FINES (FOR IDENTIFICATION PROCEDURES SEE CL BELOW)		SC	CLAYEY SANDS, POORLY GRADED SAND MIXTURES		ATTENTION LIMITS ABOVE A LINE WITH Ip GREATER THAN 10				
								ATTENTION LIMITS ABOVE A LINE WITH Ip GREATER THAN 10				
								ATTENTION LIMITS ABOVE A LINE WITH Ip GREATER THAN 10				
FINE GRAINED SOILS (MORE THAN 50% BY WEIGHT SMALLER THAN 0.075mm)	SILT AND CLAYS	IDENTIFICATION PROCEDURE ON FRACTION SMALLER THAN 0.075mm					GIVE TYPE, NAME, IF NECESSARY, INDICATE DEGREE AND CHARACTER OF PLASTICITY, AMOUNT AND MAJOR GRAIN SIZE OF COARSE GRAINS, COLOUR IN WET CONDITION, ODOUR, IF ANY, LOCAL OR GEOLOGICAL NAME, OTHER PERTINENT DESCRIPTIVE INFORMATION, AND SYMBOL IN PARENTHESES. FOR UNDISTURBED SOILS AND INFORMATION ON STRUCTURE, STRATIFICATION, CONSISTENCY IN UNDISTURBED AND REMOLDED STATES, MOISTURE, DRAINAGE CONDITION.	DETERMINE PERCENTAGE OF GRAVEL AND SAND FROM GRAIN SIZE CURVE. DEPENDING ON PERCENTAGE OF FINES (FRACTION SMALLER THAN 0.075mm) COARSE GRAINED SOILS ARE CLASSIFIED AS FOLLOWS:				
		LIQUID LIMIT LESS THAN 3% AND 0.0075mm	DRY STRENGTH (CRUSHING CHARACTERISTICS)	DILATANCY (REACTION TO SQUEEZING)	TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)			LESS THAN 12% GW, GP, SW, SP MORE THAN 12% GM, GC, SM, SC ORDERLINE CASES REQUIRE USE OF DUAL SYMBOL.				
			NONE	SLIGHT	NONE	ML		C _u ≤ 6, D ₆₀ / D ₁₀ ≥ 4 GREATER THAN 6				
			MEDIUM TO SLIGHT	NONE TO VERY SLOW	MEDIUM	CL		C _c ≤ 2, D ₃₀ ² / (D ₁₀ × D ₆₀) ≤ 6 BETWEEN 1 AND 3				
		LIQUID LIMIT BETWEEN 3% AND 10%	SLIGHT TO MEDIUM	SLOW	SLIGHT	OL		NOT MEETING ALL GRADATION FOR SW				
			NONE TO SLIGHT	SLOW TO SLIGHT	SLIGHT	MI		ATTENTION LIMITS BELOW A LINE OR Ip LESS THAN 10				
			SLIGHT	NONE	MEDIUM TO SLIGHT	CI		ATTENTION LIMITS ABOVE A LINE WITH Ip GREATER THAN 10				
		LIQUID LIMIT GREATER THAN 10%	SLIGHT TO MEDIUM	VERY SLOW	SLIGHT	OI		ATTENTION LIMITS ABOVE A LINE WITH Ip GREATER THAN 10				
			SLIGHT TO MEDIUM	SLOW TO NONE	MEDIUM	MO		ATTENTION LIMITS ABOVE A LINE WITH Ip GREATER THAN 10				
			SLIGHT TO VERY SLIGHT	NONE	SLIGHT	CO		ATTENTION LIMITS ABOVE A LINE WITH Ip GREATER THAN 10				
		LIQUID LIMIT GREATER THAN 10%	MEDIUM TO SLIGHT	NONE TO VERY SLOW	SLIGHT TO MEDIUM	OD		ATTENTION LIMITS ABOVE A LINE WITH Ip GREATER THAN 10				
		ORGANIC SOILS		READILY IDENTIFIED BY COLOUR, ODOUR, SPONGY FEEL OR 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		
GRAVEL	COARSE	PASSING	RETAINED	PERCENT	DESCRIPTOR
		75 mm	2.0 mm	Over 30	AND WITH
SAND	FINE	2.0 mm	0.075 mm	20-30	less than
	COARSE	0.075 mm	2.0 mm	12-20	Some
	MEDIUM	2.0 mm	0.075 mm	1-12	Trace to some
FINES (SILT OR CLAY BASED ON PLASTICITY)	COARSE	0.075 mm	2.0 mm	1-12	Trace
	FINE	0.075 mm	2.0 mm	1-12	Trace
OVERSIZED MATERIAL					
ROUNDED OR SUBROUNDED COBBLES 20 mm TO 200 mm OR CULVERS 200 mm				NOT ROUNDED ROCK FRAGMENTS 20 mm ROCKS 0.06 CU MIC METRE IN VOLUME	



BOUNDARY CLASSIFICATION SOILS POSSESSING CHARACTERISTICS OF TWO GROUPS ARE DESIGNATED BY COMBINATIONS OF GROUP SYMBOLS FOR EXAMPLE GW/GC WELL GRADED GRAVEL SAND MIXTURE WITH CLAY BINDER



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

www.amecfw.com

RECORD OF BOREHOLE No. BH16-01

G.W.P. 5015-E-0064	LOCATION 0248508 E, 5454371 N	1 OF 3	ORIGINATED BY PW
DIST _____ HWY _____	BOREHOLE TYPE Hollow Stem Augers (108 mm I.D. - 210 mm O.D.)		COMPILED BY PW
DATUM MTM NAD 83 ZONE 13	DATE 14 October 2016 - 15 October 2016		CHECKED BY TJG
PROJECT Foundation Investigation and Design Report - Hornepayne Patrol Yard, Hornepayne, Ontario			JOB NO. TY163014

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			SOIL VAPOUR READING	REMARKS & GRAIN SIZE DISTRIBUTION (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa					WATER CONTENT (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
									○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					W _p	W	W _L		COV/ TOV (ppm)	GR	SA	SI	CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
328.0	NE Corner of Proposed Building		1	SS	22																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					

Continued Next Page

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



2 OF 3

G.W.P. 5015-E-0064	LOCATION 0248508 E, 5454371 N	2 OF 3	ORIGINATED BY PW
DIST _____ HWY _____	BOREHOLE TYPE Hollow Stem Augers (108 mm I.D. - 210 mm O.D.)		COMPILED BY PW
DATUM MTM NAD 83 ZONE 13	DATE 14 October 2016 - 15 October 2016		CHECKED BY TJG
PROJECT Foundation Investigation and Design Report - Hornepayne Patrol Yard, Hornepayne, Ontario		JOB NO.	TY163014

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Continued Next Page

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



3 OF 3

3 OF 3

G.W.P. 5015-E-0064	LOCATION 0248508 E. 5454371 N	3 OF 3	ORIGINATED BY PW
DIST _____ HWY _____	BOREHOLE TYPE Hollow Stem Augers (108 mm I.D. - 210 mm O.D.)		COMPILED BY PW
DATUM MTM NAD 83 ZONE 13	DATE 14 October 2016 - 15 October 2016		CHECKED BY TJG
PROJECT Foundation Investigation and Design Report - Hornepayne Patrol Yard, Hornepayne, Ontario			JOB NO. TY163014

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



Ontario

RECORD OF BOREHOLE No. BH16-02

amec foster wheeler



1 OF 3

G.W.P. 5015-E-0064 LOCATION 0248512 E, 5454349 N ORIGINATED BY PW
 DIST HWY BOREHOLE TYPE Hollow Stem Augers (108 mm I.D. - 210 mm O.D.) COMPILED BY PW
 DATUM MTM NAD 83 ZONE 13 DATE 15 October 2016 CHECKED BY TJG
 PROJECT Foundation Investigation and Design Report - Hornepayne Patrol Yard, Hornepayne, Ontario JOB NO. TY163014

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT 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		COV/ TOV (ppm)	GR	SA	SI	CL
									20	40	60	80	100									
327.7	SE Corner of Proposed Building																					
0.0	SAND trace gravel compact (FILL)		1	SS	26									7 _O								
								327														
			2	SS	12		1							6 _O								
326.3																						
1.5	SILT trace to some clay trace sand compact		3	SS	16			326						17 _O								
							2															
			4	SS	19									22 _O								
							3	325														
			5	SS	18									24 _O								
							4	324														
			6	SS	12		5	323						21 _O								
322.1																						
5.7	SILT trace to some clay trace sand loose						6	322														
			7	SS	6									24 _O				0 2 92 6				
320.8								321														
6.9																						

Continued Next Page

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



2 OF 3

SOIL PROFILE								DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			SOIL VAPOUR READING		REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	SHEAR STRENGTH kPa		W _p	W	W _L	COV/ TOV (ppm)	GR	SA	SI	CL
319.4	SAND trace to some silt and clay trace to some gravel dense		8	SS	48		8	320										
8.4	Sandy CLAYEY SILT trace gravel hard (TILL)		9	SS	100+/- 0.2 m		9	319										
			10	NQ			10	318										
			11	NQ			11	317										
315.5							12	316										
12.2	END OF BOREHOLE																	
Notes: 1) Borehole was backfilled with bentonite and auger cuttings on completion. 2) Practical auger refusal was reached at 9.3 m depth. Beyond that depth the borehole was advanced using a core barrel to borehole termination. 3) Pocket Penetrometer Test of BH16-02 NQ11 results equal 440 kPa, indicating the Till consistency is hard.																		

Continued Next Page

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



Ontario

RECORD OF BOREHOLE No. BH16-02

amec foster wheeler



3 OF 3

G.W.P. 5015-E-0064 LOCATION 0248512 E, 5454349 N ORIGINATED BY PW
 DIST HWY BOREHOLE TYPE Hollow Stem Augers (108 mm I.D. - 210 mm O.D.) COMPILED BY PW
 DATUM MTM NAD 83 ZONE 13 DATE 15 October 2016 CHECKED BY TJG
 PROJECT Foundation Investigation and Design Report - Hornepayne Patrol Yard, Hornepayne, Ontario JOB NO. TY163014

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			SOIL VAPOUR READING	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE				"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
	4) Borehole was dry upon completion on October 15, 2016.																

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

RECORD OF BOREHOLE No. BH16-03

1 OF 2

G.W.P. 5015-E-0064 LOCATION 0248488 E, 5454347 N ORIGINATED BY PW
 DIST HWY BOREHOLE TYPE Hollow Stem Augers (108 mm I.D. - 210 mm O.D.) COMPILED BY PW
 DATUM MTM NAD 83 ZONE 13 DATE 20 October 2016 CHECKED BY TJG
 PROJECT Foundation Investigation and Design Report - Hornepayne Patrol Yard, Hornepayne, 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	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				SHEAR STRENGTH kPa								WATER CONTENT (%)
									○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL						
327.3	SW Corner of Proposed Building		1	SS	21				20 40 60 80 100	20 40 60							
0.0	SAND trace silt trace gravel compact (FILL)							327					14 _○				
326.6																	
0.7	SILT trace clay and sand compact		2	SS	13		1						24 _○				
								326									
			3	SS	15		2						22 _○				
								325									
			4	SS	16								24 _○				
							3										
			5	SS	14			324					24 _○		0 2 94 4		
							4										
								323									
			6	SS	47		5						17 _○				
								322									
321.7																	
5.6	GRAVELLY SAND trace to some silt dense						6										
			7	SS	37			321					10 _○				

Continued Next Page

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



2 OF 2

2 OF 2

G.W.P. 5015-E-0064	LOCATION 0248488 E, 5454347 N	2 OF 2	ORIGINATED BY PW
DIST _____ HWY _____	BOREHOLE TYPE Hollow Stem Augers (108 mm I.D. - 210 mm O.D.)		COMPILED BY PW
DATUM MTM NAD 83 ZONE 13	DATE 20 October 2016		CHECKED BY TJG
PROJECT Foundation Investigation and Design Report - Hornepayne Patrol Yard, Hornepayne, Ontario		JOB NO.	TY163014

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



1 OF 2


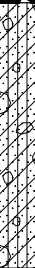
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+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE



2 OF 2

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT				SHEAR STRENGTH kPa			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			SOIL VAPOUR READING	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES				20 40 60 80 100				W _p W W _L			WATER CONTENT (%)				
									SHEAR STRENGTH kPa				WATER CONTENT (%)							
	COBBLES/BOULDERS some sand some gravel		9	NQ																
318.3 9.6	CLAYEY SILT some sand to sandy trace gravel hard (TILL)		10	NQ																
317.1 10.8	END OF BOREHOLE		11	NQ																
Notes: 1) Borehole dry upon completion on October 20, 2016. 2) Groundwater was encountered at a depth of 1.2 m on October 21, 2016 in open borehole. 3) Borehole was backfilled with bentonite and auger cuttings on completion. 4) Practical auger refusal was reached at 6.4 m depth. Beyond that depth the borehole was advanced using a core barrel to borehole termination.																				

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

RECORD OF BOREHOLE No. BH16-05

G.W.P. 5015-E-0064	LOCATION 0248498 E, 5454360 N	1 OF 3	ORIGINATED BY PW
DIST _____ HWY _____	BOREHOLE TYPE Hollow Stem Augers (108 mm I.D. - 210 mm O.D.)	COMPILED BY PW	
DATUM MTM NAD 83 ZONE 13	DATE 20 October 2016	CHECKED BY TJG	
PROJECT Foundation Investigation and Design Report - Hornepayne Patrol Yard, Hornepayne, Ontario			JOB NO. TY163014

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL LIMIT MOISTURE CONTENT LIQUID 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			COV/ TOV (ppm)	GR	SA
327.7 0.0	Centre of Proposed Building		1	SS	31									11 _o							
	Gravelly SAND trace to some silt and clay compact to dense (FILL)			2	SS	18									5 _o						
326.3 1.5	SILT trace to some clay trace sand loose to compact		3	SS	19									22 _o							
				4	SS	23									20 _o						
				5	SS	18									25 _o						
323.6 4.1	SILT trace to some clay trace sand loose		6	SS	7									7 _o							
				7	SS	6									20 _o						
320.8 6.9																					

Continued Next Page

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



Ontario

RECORD OF BOREHOLE No. BH16-05

amec foster wheeler



3 OF 3

G.W.P. 5015-E-0064 LOCATION 0248498 E, 5454360 N ORIGINATED BY PW
 DIST HWY BOREHOLE TYPE Hollow Stem Augers (108 mm I.D. - 210 mm O.D.) COMPILED BY PW
 DATUM MTM NAD 83 ZONE 13 DATE 20 October 2016 CHECKED BY TJG
 PROJECT Foundation Investigation and Design Report - Hornepayne Patrol Yard, Hornepayne, Ontario JOB NO. TY163014

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	DEPTH m	ELEVATION m	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT			LIQUID LIMIT W _L	SOIL VAPOUR READING	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE				"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)				
	4) Practical auger refusal was reached at 9.4 m depth. Beyond that depth the borehole was advanced using a core barrel to borehole termination.																	

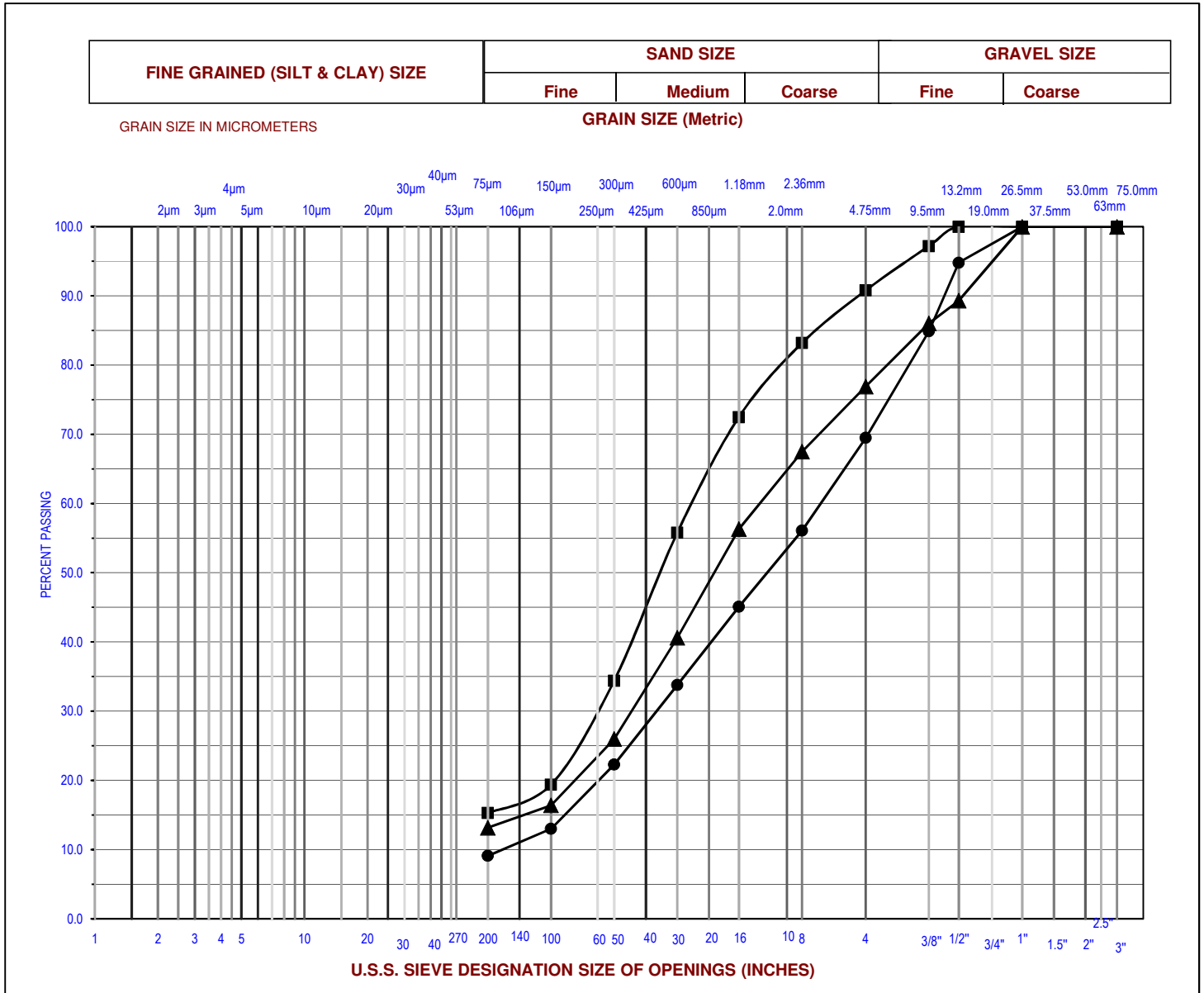
+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

APPENDIX C

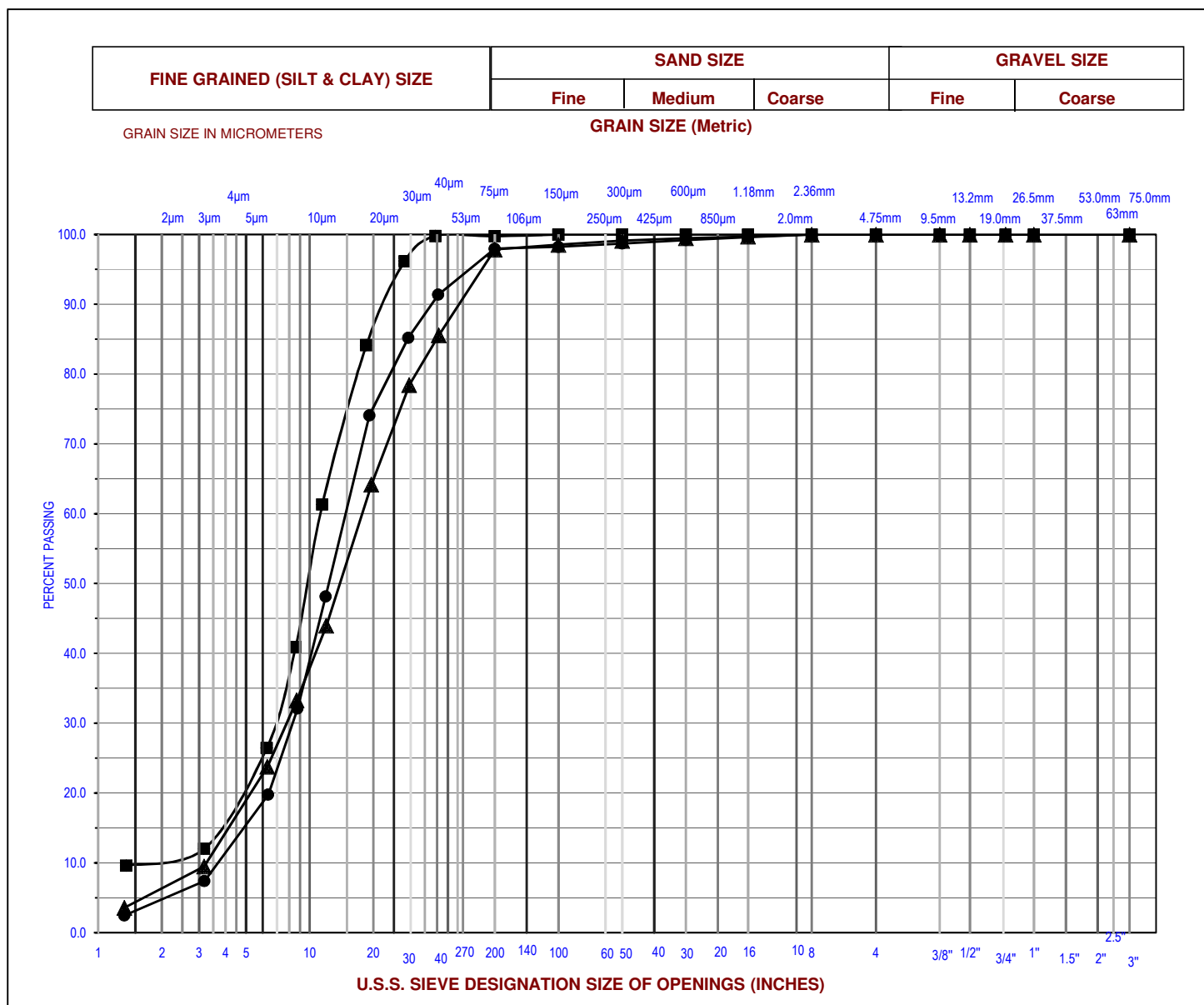
LABORATORY TESTING RESULTS

FIGURE C1 - GRAIN SIZE DISTRIBUTION

SAND / Gravelly SAND (FILL)


LEGEND

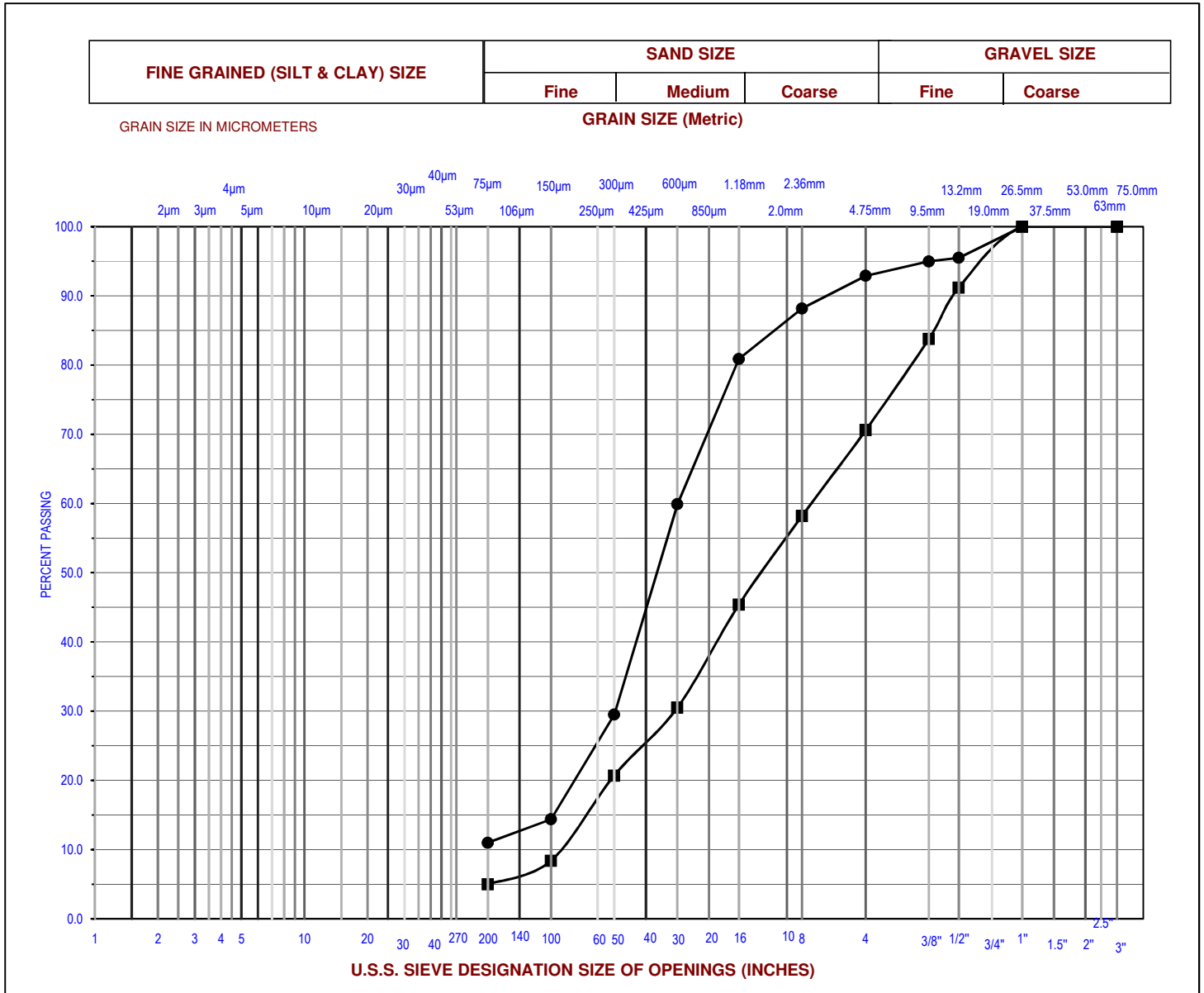
SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)	GRAVEL (%)	SAND (%)	SILT & CLAY (%)
■	BH16-01	SS1	327.7	9	76	15
▲	BH16-04	SS1	327.7	23	64	13
●	BH16-05	SS2	326.6	30	61	9

FIGURE C2 - SIEVE AND HYDROMETER
SILT

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)	GRAVEL(%)	SAND (%)	SILT (%)	CLAY (%)
■	BH16-01	SS5	324.7	0	0	90	10
▲	BH16-02	SS7	321.3	0	2	92	6
●	BH16-03	SS5	323.9	0	2	94	4

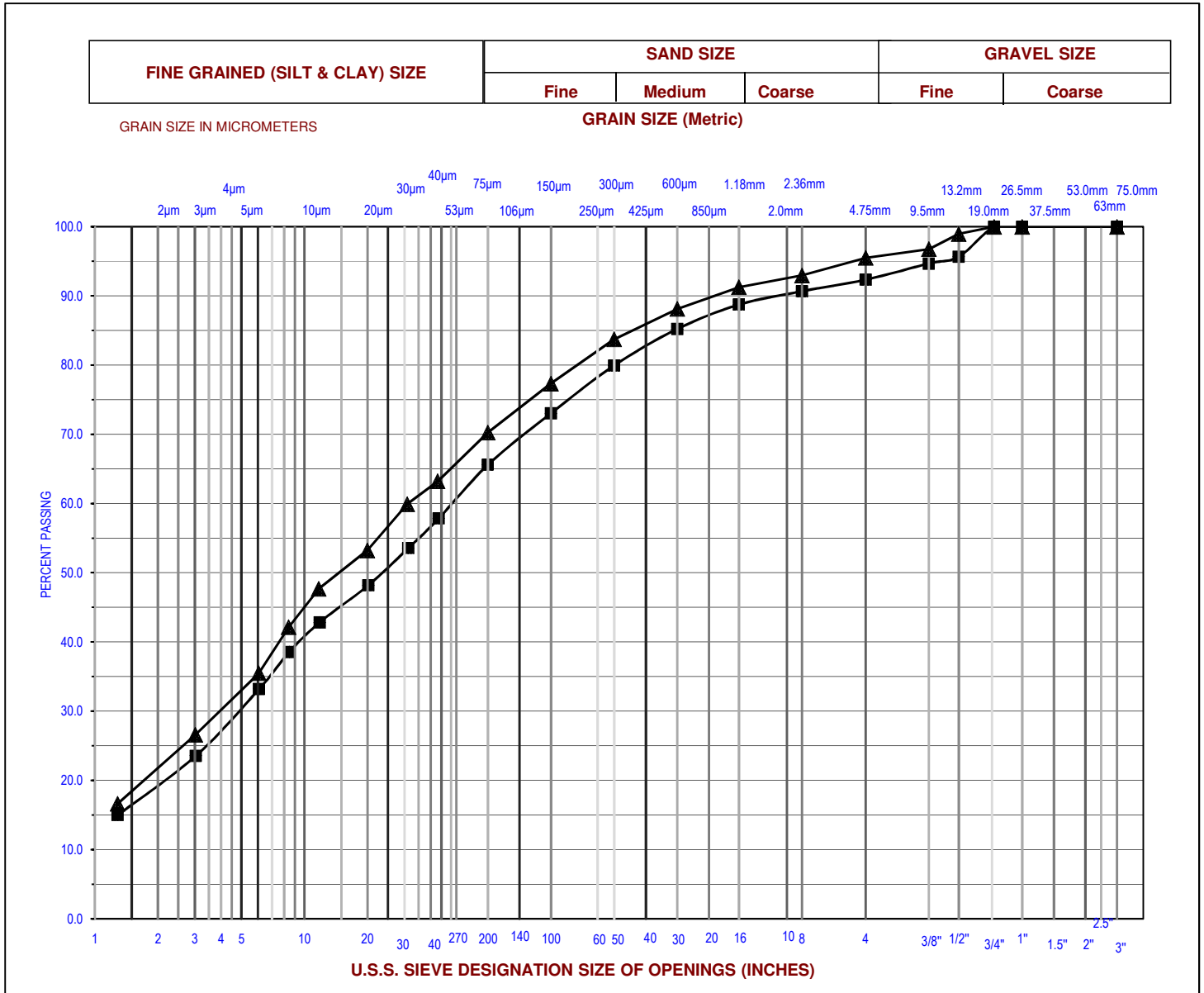
FIGURE C3 - GRAIN SIZE DISTRIBUTION

SAND / Gravelly SAND


LEGEND

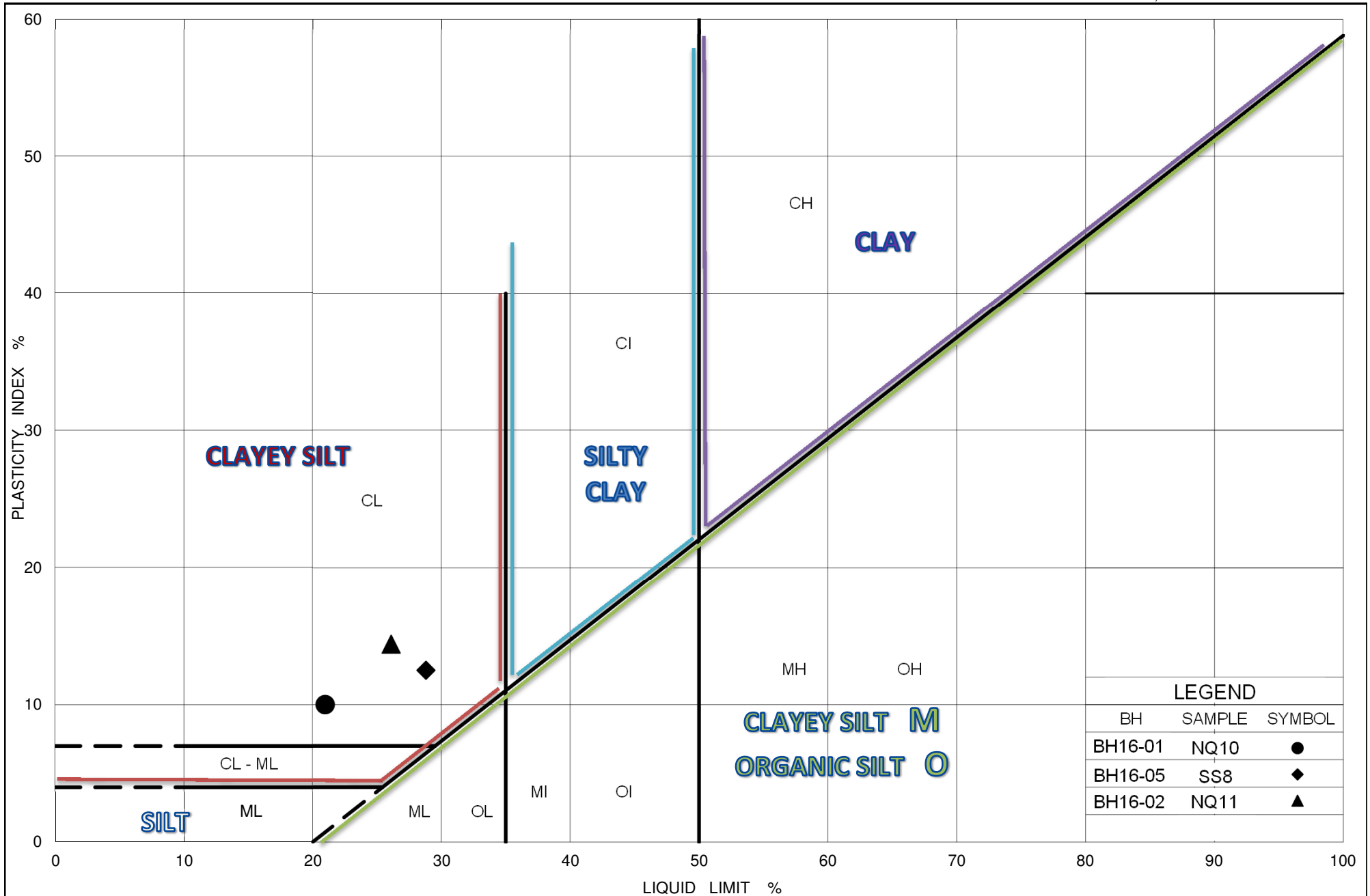
SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)	GRAVEL(%)	SAND (%)	SILT & CLAY (%)
■	BH16-03	SS8	319.5	29	66	5
●	BH16-01	SS8	320.1	7	82	11

FIGURE C4 - SIEVE AND HYDROMETER
CLAYEY SILT (TILL)



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION (m)	GRAVEL(%)	SAND (%)	SILT (%)	CLAY (%)
■	BH16-01	NQ10	317.8	7	27	47	19
▲	BH16-02	NQ11	316.3	4	26	49	21



Ministry of
Transportation

Ontario

PLASTICITY CHART CLAYEY SILT & CLAYEY SILT (TILL)

Figure No. C5

Project No. TY163014 - Hornepayne PY

Checked By: TJG

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: 16U160647

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.



AGAT Laboratories

Certificate of Analysis

AGAT WORK ORDER: 16U160647

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: 2016-11-16

DATE REPORTED: 2016-11-22

		HOR BH16-01,		
SAMPLE DESCRIPTION:		SS3		
SAMPLE TYPE:		Soil		
DATE SAMPLED:		2016-10-14		
Parameter	Unit	G / S	RDL	8018006
pH, 2:1 CaCl ₂ Extraction	pH Units			7.85
Chloride (2:1)	µg/g	4		956
Sulphate (2:1)	µg/g	4		27
Electrical Conductivity (2:1)	mS/cm		0.005	1.84
Resistivity (2:1)	ohm.cm		1	543

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
8018006 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.

Elevated RDL indicates the degree of sample dilution prior to the analysis for Anions in order to keep analytes within the calibration range of the instrument and to reduce matrix interference.

Please note that sample was received and analyzed past hold time.

Certified By:

Amanjot Bhela



Quality Assurance

CLIENT NAME: AMEC FOSTER WHEELER ENVIRO&INFRASTR

AGAT WORK ORDER: 16U160647

PROJECT: TY163014

ATTENTION TO: David Brown

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Nov 22, 2016

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: 16U160647

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

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.