FINAL REPORT

FOUNDATION INVESTIGATION REPORT
New Patrol Yard Structure at MTO Jarvis Patrol Yard, Haldimand County

Agreement No. 3015-E-0017
Assignment No. 6
GWP 3075-16-00
Geocres No. 40I16-28

Prepared for:

Ontario Ministry of Transportation
Regional Director's Office -West Region
Geotechnical Section
659 Exeter Road
London, ON N6E 1L3
Attn: Muhammad Kamran Khan, P.Eng., PMP

Ontario Ministry of Transportation
Pavements and Foundations Section
Materials Engineering and Research Office, Room 223, 2/F
145 Sir William Hearst Avenue
Toronto, ON M3M 0B6
Attn: David Staseff, P.Eng.

exp Services Inc.
November 29, 2017

Ministry of Transportation
Western Region – Geotechnical Section

Foundation Investigation Report

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New Patrol Yard Structure at MTO Jarvis Patrol Yard, Haldimand County

Project Number:
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Prepared By:
Silvana Micic, Ph.D., P.Eng.
Nimesh Tamrakar, M.Eng.

Reviewed By:
TaeChul Kim, M.E.Sc., P.Eng.
Stan E. Gonsalves, M.Eng., P.Eng.

exp Services Inc.
56 Queen St, East, Suite 301
Brampton, ON L6V 4M8
Canada

Silvana Micic, Ph.D., P.Eng.
Senior Geotechnical Engineer

Stan E. Gonsalves, M.Eng., P.Eng.
Principal Engineer
Designated MTO Foundation Contact

Date Submitted:
11/29/2017

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1 FOUNDATION INVESTIGATION REPORT

1.1 Introduction

This report presents the results of a geotechnical investigation carried out by **exp** Services Inc. (**exp**) for the proposed new salt storage structure located at the MTO Jarvis Patrol Yard, located in Haldimand County, Southern Ontario. The work was undertaken under Agreement # 3015-E-0017, Assignment No. 6 (GWP 3075-16-00). The terms of reference (TOR) were as presented in the Ministry of Transportation (MTO) email received on July 27, 2017.

The purpose of this investigation is to establish existing subsurface conditions at the proposed location of the patrol yard structure within construction limits defined by MTO. The site specific geotechnical investigation consisted of field investigation including visual inspection, drilling, soil sampling, and laboratory testing. Factual results of the investigation and laboratory testing are included in this report. The report has been prepared specifically and solely for the project described in the report.

1.2 Site Description and Geological Setting

1.2.1 Site Description

The Jarvis Patrol Yard is located on Old Hwy 3, approximately 1.3 km west of the Hwy 3 and Hwy 6 junction in Jarvis, Haldimand County, Southern Ontario (see Key Map on Drawing 1, Appendix B). The site is bound by West Concession 7 Walpole to the north, Old Hwy 3 to the east, and by farm land to the south and west.

A paved roadway and parking area lead from the site entrance on Old Hwy 3 to an approximately 7x9 m steel shed, which is located approximately 60 m west of entrance gate, and to an approximately 18x32 m gambrel style building, which is located immediately west of the proposed structure.

The topography of the site is considered flat lying with borehole elevations ranging from 210.0 to 210.3 m. The ground surface of the proposed building site consists of gravel near the south end and transitions to tall grass to the north. The area beyond the north boundary of the proposed building consists of bush with mature trees. Photographs of the site are included in Appendix A.

1.2.2 Geological Setting

The Map P.2715 (Physiography of Southern Ontario, Third Edition,1984) Bedrock Geology of Ontario, Southern Sheet, 1991) of the Ministry of Natural Resources indicates that the project area is located at the boundary of Sand Plain and Clay Plain. The Map 2556 (Quaternary Geology of Ontario, Southern Sheet, 1991) of the Ministry of Northern Development and Mines, indicates that the surface conditions consist of glaciolaustrine deposits including silt and clay, minor sand; basin and quiet water deposits. The Map 2544 (Bedrock Geology of Ontario, Southern Sheet, 1991) of the Ministry of Northern

Development and Mines, indicates that the bedrock formation of the project area consists of limestone, dolostone and shale, middle devonian.

1.3 Investigation Procedures

1.3.1 General

The field investigation was performed between August 23 and 25, 2017. The field program consisted of drilling five (5) sampled boreholes (BH-1 to BH-5). The boreholes were strategically located at the patrol yard to provide the subsurface information for the design of the proposed salt storage structure. The borehole locations are shown on Drawing 1 in Appendix B.

The borehole locations (referenced to the MTM NAD83 coordinate system) and their ground surface elevations were surveyed by **exp** personnel, with reference to a temporary benchmark (TBM) established on site. The TBM was set on top of concrete slab on grade located at the east side of the sliding garage door entrance to the large gambrel style building. The elevation of the TBM was assigned 210.0 m, and location of the TBM is shown on Drawing 1, in Appendix B.

The boreholes were advanced using a truck mounted CME-75 drill rig, equipped with a hollow stem augers and diamond bit NW casing. All borehole drilling and sampling operations were performed by a specialist drilling contractor, Elite Drilling Services. Boreholes BH-1, BH-3, and BH-5 were augered to refusal on bedrock then cored to depths ranging from 10.7 m to 11.0 m below grade and boreholes BH-2 and BH-4 were augered to refusal on bedrock at depths of 7.6 m and 7.7 m, respectively.

During the drilling of the boreholes, soil samples were obtained using a 51 mm outside diameter (O.D.) split-spoon sampler in accordance with Standard Penetration Test (SPT) procedures (ASTM D 1586), at intervals shown on the attached borehole logs (Appendix C). The original field (uncorrected) SPT “N” values were recorded on the borehole logs as recommended in the Canadian Foundation Engineering Manual (CFEM pg. 40), and used to provide an assessment of in-situ consistency of cohesive soils or relative density of non-cohesive soils. Field vane testing was conducted in cohesive soil to measure the in-situ undrained shear strength of this soil. Field vane test was conducted in accordance with ASTM D2573-08. When a hard stratum was reached sampling of hard material was performed by diamond core drilling, using a 1.5 m long NQ double tube wireline core barrel.

Upon completion of the drilling operations, groundwater level measurements were carried out in the open holes. All boreholes remained dry upon completion of the drilling operations and the groundwater level at BH-1 was measured at 7.5 m below grade after remaining open for a period of four hours (see Section 1.5). The boreholes were decommissioned by bentonite/cement mixtures in accordance with the Ministry of the Environment Regulation 903, as amended by Regulation 128/03 (the well regulation under the Ontario Water Resources Act).

The fieldwork was supervised by a member of **exp**'s engineering staff who directed the drilling and sampling operation, logged borehole data in accordance with MTO and/or ASTM standards for soils classification, and retrieved soil samples for subsequent laboratory testing and identification.

All the recovered soil samples were placed in labelled moisture-proof bags and returned to **exp**'s Hamilton laboratory for additional visual, textual and olfactory examination, and sampling for laboratory testing.

1.3.2 Laboratory Testing

All samples returned to the laboratory were subjected to visual examination and classification. The laboratory testing program included the determination of natural moisture content, particle size distribution for approximately 25% of the collected soil samples. Atterberg Limits tests were carried out on select cohesive soil samples. Corrosivity package tests were performed on one soil sample. All the laboratory tests were carried out in accordance with MTO and/or ASTM standards as appropriate.

The laboratory test results are provided on the attached borehole log sheets in Appendix C. The results of the grain size analyses are presented graphically in Appendix D.

1.4 Subsurface Conditions

The detailed subsurface soil and groundwater conditions encountered in the boreholes advanced during this investigation, together with the results of the laboratory tests carried out on selected soil samples, are presented on the borehole log sheets in Appendix C. Laboratory test results are provided in Appendix D. The "Explanation of Terms Used in Report" preceding the borehole logs in Appendix C forms an integral part of and should be read in conjunction with this report.

A borehole location plan and stratigraphic section along the proposed salt storage structure are provided in Appendix B. It should be noted that the stratigraphic boundaries indicated on the borehole logs and stratigraphic section are inferred from non-continuous sampling, observations of drilling progress and results of Standard Penetration Tests. These boundaries typically represent transitions from one soil type to another and should not be regarded as exact planes of geological change. Further, subsurface conditions may vary between and beyond the borehole locations.

In general, the stratigraphic sequence at the proposed structure site consists of top granular fill, underlain by native silty clay deposits followed by bedrock. A summary of the soil and groundwater conditions encountered in the boreholes is provided below.

1.4.1 Topsoil

Topsoil was encountered at the surface of boreholes BH-1, BH-2 and BH-5 and ranged in thickness from approximately 0.2 m to 0.3 m. Topsoil thicknesses may further vary beyond the borehole locations.

1.4.2 Asphalt

Asphalt was encountered at the surface of boreholes BH-3 and BH-4 and ranged in thickness from approximately 0.1 m to 0.2 m. Asphalt thicknesses may further vary beyond the borehole locations.

1.4.3 Fill: Sand and Gravel

A sand and gravel fill layer was encountered below the layer of top soil or asphalt in all drilled boreholes except in BH-2. The thickness of this fill layer is between 0.2 m and 0.8 m extending from Elev. 210 m to 209.2 m.

This layer consists of sand and gravel with trace to some silt size particles. The material is dark grey and brown in color, and damp. The SPT "N" values within this layer ranged from 13 to 30 blows per 300 mm penetration, corresponding to compact compactness condition.

Laboratory testing performed on selected samples consisted of six (6) moisture content tests. The test results are as follows:

Moisture Content:

- 3% to 4%

The results of the moisture content tests are provided on the record of borehole sheets in Appendix C.

1.4.4 Fill: Clayey Silt

A clayey silt fill layer was encountered below the layer of sand and gravel fill in BH-4. The thickness of this fill layer is about 0.3 m extending from Elev. 209.6 m to 209.3 m. This layer consists of clay and silt with trace of sand and gravel. The material is dark brown in color, and moist.

1.4.5 Silty Clay

A layer of native silty clay was encountered below the fill/topsoil in all boreholes. The silty clay extended to depths ranging between 7.6 m to 8.0 m below the ground surface corresponding to elevations between 202.6 m and 202.4 m. The explored thickness of this layer was between 6.8 m and 7.4 m. BH-2 was terminated in this layer due to auger refusal on assumed bedrock.

The composition of this layer is silt and clay, and trace sand and gravel. The material is brown in color and moist above the 4.6 m depth, while below that depth it became grey in colour and very moist. The plasticity of this cohesive soil was measured to be low to high, but typically moderate. The SPT "N" values within this layer ranged from 6 to 100 blows per 0.3 m penetration, typically 8 to 21 blows per 0.3 m penetration, suggesting stiff to very stiff material in consistency. In addition, one (1) in-situ shear vane test was performed and field result was about 110 kPa.

Laboratory testing performed on selected sample consisted of thirty-one (31) moisture content tests, nine (9) grain size distribution tests and nine (9) Atterberg Limit tests. The test results are as follow:

Moisture Content:

- 16% to 34%

Grain Size Distribution:

- 0% to 4% gravel;
- 0% to 7% sand;
- 27% to % 77silt; and
- 22% to 72% clay

Atterberg limits

- Liquid Limit: 33% to 56%
- Plasticity Index: 15% to 38%

The results of the moisture content, gain size distribution and Atterberg Limit tests are provided on the record of borehole sheets in Appendix C. The result of the grain size distribution test and Atterberg Limit tests performed by exp are also provided on Figure 1,2,4 and 5, respectively, in Appendix D.

1.4.6 Sandy Silty Clay Till

A layer of native sandy silty clay till was encountered below the silty clay in BH-3, BH-4 and BH-5. The till extended to depths ranging between 7.7 m to 7.8 m below the ground surface with elevations ranging between 202.3 m to 202.4 m. The explored thickness of this layer was between 0.1 m and 0.2 m. BH-4 was terminated in this layer due to auger refusal on assumed bedrock.

The composition of this till layer is sand, silt and clay with some gravel. The material is grey in color, moist and low plasticity. The SPT “N” values within this layer were 100 blows per 0.3 m penetration, suggesting hard in consistency.

Laboratory testing performed on selected sample consisted of three (3) moisture content tests, one (1) grain size distribution test and one (1) Atterberg Limit test. The test results are as follow:

Moisture Content:

- 9% to 12%

Grain Size Distribution:

- 16% gravel;
- 24% sand;
- 33% silt; and
- 27% clay

Atterberg limits

- Liquid Limit: 27%
- Plasticity Index: 13%

The results of the moisture content, gain size distribution and Atterberg Limit tests are provided on the record of borehole sheets in Appendix C. The result of the grain size distribution test and Atterberg Limit tests performed by exp are also provided on Figure 3 and 6, respectively, in Appendix D.

1.4.7 Bedrock

The presence of bedrock was found to be approximately between 7.6 m to 8 m below the ground surface. The bedrock was inferred from split spoon refusal in BH-2 and BH-4, or confirmed using coring depth of 3.0 m in BH-1, BH-3 and BH-5. The elevation of the inferred or actual bedrock surface below this site ranges from Elev. 202.4 m to 202.6 m. The inferred or actual bedrock surface depth and elevation encountered at these borehole locations are listed in Table 1.1.

Based on the bedrock cores recovered, the bedrock consists of limestone. In general, the bedrock samples are described as grey in colour and fine grained with nodular appearance, weathered. The Rock Quality Designation (RQD) measured on the core samples typically ranged from approximately 37% to 85%, indicating a rock mass of poor to good quality. Photographs of rock cores are included in Appendix E.

Table 1.1 Depth and elevation of bedrock or possible bedrock surface

Borehole	Depth Below Ground Surface (m)	Elevation (m)	Comments
BH-1	8.0	202.4	Bedrock Cored
BH-2	7.6	202.5	Inferred/ Spoon Refusal
BH-3	7.7	202.3	Bedrock Cored
BH-4	7.7	202.4	Inferred/ Spoon Refusal
BH-5	7.8	202.4	Bedrock Cored

1.5 Groundwater Conditions

Information regarding groundwater levels at the site was obtained by measuring the water levels in the open boreholes upon completion of drilling. Backfilling of Borehole BH-1 was delayed in obtaining a supplemental groundwater level measurement. All boreholes remained dry upon completion of the drilling operations. The subsequent groundwater level reading obtained at BH-1 after a period of four hours following completion was 7.5 m below grade. The water levels are not considered to have stabilized during the short term of the investigation.

1.6 Chemical Analyses

One soil sample was selected for chemical analyses and was sent via courier, in a secure cooler under chain of custody, to AGAT Laboratories., a CALA-certified and accredited laboratory in Mississauga, Ontario. The analytical laboratory results are presented in Appendix D, and are summarized in Table 1.2, below.

Table 1.2. Corrosivity chemical analysis

Sample Identification	pH (unitless)	Soluble Chloride (ppm)	Soluble Sulphate (ppm)	Resistivity (ohm-cm)	Conductivity (mS/cm)
BH5-SS2 Silty Clay	8.9	41	129	2,440	0.409

2 CLOSURE

A subsurface investigation is a limited sampling of a site; the subsurface conditions have been established only at the test hole locations. Should conditions at the site be encountered which differ from those reported at the test locations, we require that we be notified immediately in order to assess this additional information and our recommendations, as appropriate. It may then be necessary to perform additional investigation and analysis.

Contractors bidding on or undertaking any proposed work at this site should, relative to the subsurface conditions, decide on their own investigations, if deemed necessary, as well as their own interpretations of the factual results provided herein, so they may draw their own conclusions as to how the subsurface conditions may affect them. .

This Foundation Investigation and Design Report has been prepared by Silvana Micic, Ph.D., P.Eng. and Nimesh Tamrakar. M.Eng. and reviewed by TaeChul Kim, M.E.Sc., P.Eng. and Stan E. Gonsalves, M.Eng., P.Eng., Designated MTO Foundation Contact. The field investigation was conducted by Dilsher Bhangal, M.Eng.

Yours truly,

exp Services Inc.

Nimesh Tamrakar, M.Eng.
Technical Specialist

Silvana Micic, Ph.D, P.Eng.
Senior Geotechnical Engineer

LICENSED PROFESSIONAL ENGINEER
S. MICIC
100050187
29/11/'17
PROVINCE OF ONTARIO

TaeChul Kim, M.E.Sc., P.Eng.
Senior Geotechnical/Foundation Engineer

Stan E. Gonsalves, M.Eng., P.Eng.
Principal Engineer
Designated MTO Foundation Contact

LICENSED PROFESSIONAL ENGINEER
S.E.M. GONSALVES
29/11/17
PROVINCE OF ONTARIO

Encl.

Appendix A – Photographs

Photo 1: Jarvis Patrol Yard - the proposed new structure area, facing north

Photo 2: Jarvis Patrol Yard-existing Gambrel style shed, facing west

Photo 3: Jarvis Patrol Yard, facing south

Photo 4: Jarvis Patrol Yard, facing east

Photo 5: Facing north from location of BH-4 (Note the existing shed)

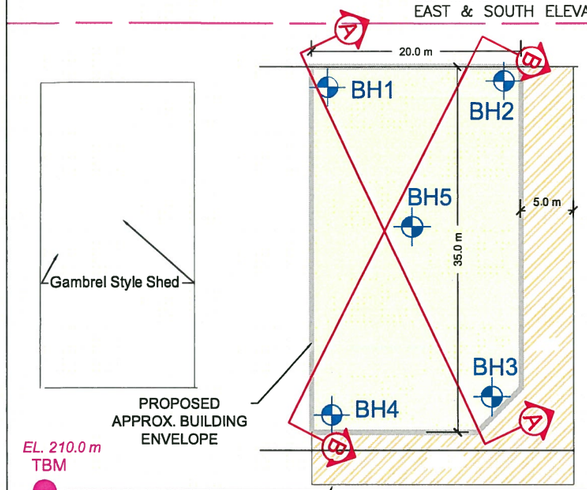
Photo 6: Facing west from location of BH-3

Appendix B – Drawings

℄ HALDIMAND COUNTY W CONCESSION 7 WALPOLE

METRIC
DIMENSIONS ARE IN METERS AND/OR MILLMETERS UNLESS OTHERWISE SHOWN.
STATIONS ARE IN KILOMETERS +METERS

36' TO U/S OF ALL TRUSSES
5.0 M ASPHALT APRON ON EAST & SOUTH ELEVATIONS



EXISTING GRAVEL STOCK PILE

PROPOSED APPROX. PAVED AREA

70m

DRY WELL

TILE BED

STORM DRAIN

UNDERGROUND OIL TANK

SEPTIC TANK

PROPOSED GAS LINE

SEWER HOOKUP

5 BAY METAL GARAGE
FIN.FLOOR ELEV.
91.00'

CONC. SIDEWALK

APPROX. LOCATION WATER SERVICE

FLAG POLE

PATROL OFFICE

Existing Steel SHED

PARKING

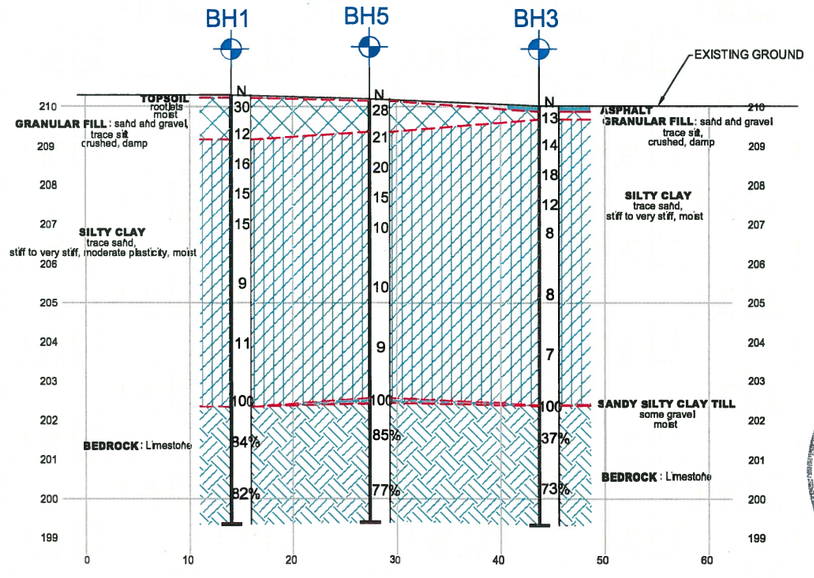
PAVED AREA

PAVED AREA

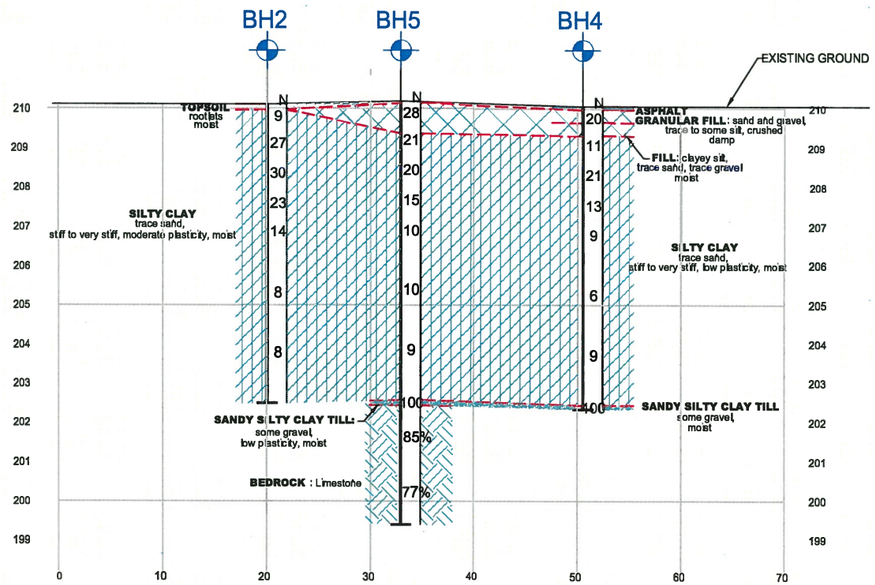
DRIVEWAY

℄ OLD KING'S HIGHWAY 3

PLAN



SECTION A-A



SECTION B-B

LICENSED PROFESSIONAL ENGINEER
S. MICIC
100050187
11/29/2017
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
S.E.M. GONSALVES
11/29/17
PROVINCE OF ONTARIO

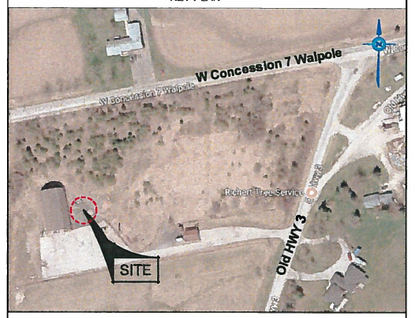
Agreement No. 3015-E-0017
Assignment No. 6
GWP 3075-16-00

NEW PATROL YARD STRUCTURE AT MTO JARVIS PATROL YARD, HALDIMAND COUNTY
BOREHOLE LOCATION PLAN AND SOIL STRATA

SHEET

exp Services Inc.

KEY PLAN



LEGEND

- Borehole
- N — Standard Penetration Test (Blows/0.3 m)
- 73% — Rock Quality Designation (RQD)
- Temporary Bench Mark (EL. 210.0m)

SOIL STRATA SYMBOLS

- ASPHALT
- GRANULAR FILL
- SILTY CLAY
- SANDY SILTY CLAY TILL
- BEDROCK

BH No.	APPROX. ELEV.	MTM CO-ORDINATES	
		NORTH	EAST
BH1	210.3	4748025.2	570948.8
BH2	210.1	4747996.7	570958.3
BH3	210.0	4748026.9	570957.4
BH4	210.1	4748015.6	570957.2
BH5	210.2	4747998.9	570965.3

NOTE

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents

The complete foundation investigation and design report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in the report and related documents are specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen. Cond.

SCALE
HOR 0 5 15 m
VERT 0 5 m

21/11/2017	-	SUBMISSION FOR MTO REVIEW
DATE	BY	DESCRIPTION
		GEOCRES NO. 40I16-28
		PROJECT NO. ADM-00235197-J0

SUBM'D SM	CHECKED SM	DATE	21/11/2017
DRAWN SH	CHECKED SG	APPROVED SG	DWG. 1

Appendix C – Borehole Logs

Explanation of Terms Used on Borehole Records

SOIL DESCRIPTION

Terminology describing common soil genesis:

Topsoil: mixture of soil and humus capable of supporting good vegetative growth.

Peat: fibrous fragments of visible and invisible decayed organic matter.

Fill: where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc.; none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

Till: the term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Terminology describing soil structure:

Desiccated: having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.

Stratified: alternating layers of varying material or color with the layers greater than 6 mm thick.

Laminated: alternating layers of varying material or color with the layers less than 6 mm thick.

Fissured: material breaks along plane of fracture.

Varved: composed of regular alternating layers of silt and clay.

Slickensided: fracture planes appear polished or glossy, sometimes striated.

Blocky: cohesive soil that can be broken down into small angular lumps which resist further breakdown.

Lensed: inclusion of small pockets of different soil, such as small lenses of sand scattered through a mass of clay; not thickness.

Seam: a thin, confined layer of soil having different particle size, texture, or color from materials above and below.

Homogeneous: same color and appearance throughout.

Well Graded: having wide range in grain sized and substantial amounts of all predominantly on grain size.

Uniformly Graded: predominantly on grain size.

All soil sample descriptions included in this report follow generally the ASTM D2487-11 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) with some modification to reflect current MTO practices. The system divides soils into three major categories: (1) coarse grained, (2) fine-grained, and (3) highly organic. The soil is then subdivided based on either gradation or plasticity characteristics. The system provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification. The classification excludes particles larger than 76 mm. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually in accordance with ASTM D2488-09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems. Others may use different classification systems; one such system is the ISSMFE Soil Classification.

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		

0.002	0.006	0.02	0.06	0.2	0.6	2.0	6.0	20	60	200

EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter, construction debris) is based upon the proportion of these materials present and as described below in accordance with Note 16 in ASTM D2488-09a:

Table a: Percent or Proportion of Soil, Pp

	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5≤Pp≤10%
Little	15≤Pp≤25%
Some	30≤Pp≤45%
Mostly	50≤Pp≤100%

The standard terminology to describe cohesionless soils includes the compactness as determined by the Standard Penetration Test 'N' value:

Table b: Apparent Density of Cohesionless Soil

	'N' Value (blows/0.3 m)
Very Loose	N<5
Loose	5≤N<10
Compact	10≤N<30
Dense	30≤N<50
Very Dense	50≤N

The standard terminology to describe cohesive soils includes consistency, which is based on undrained shear strength as measured by insitu vane tests, penetrometer tests, unconfined compression tests or similar field and laboratory analysis, Standard Penetration Test 'N' values can also be used to provide an approximate indication of the consistency and shear strength of fine grained, cohesive soils:

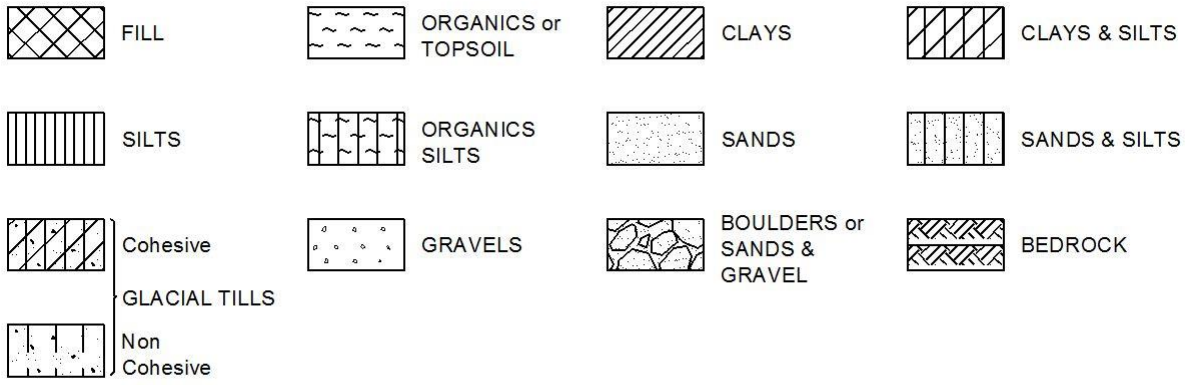
Table c: Consistency of Cohesive Soil

Consistency	Vane Shear Measurement (kPa)	'N' Value
Very Soft	<12.5	<2
Soft	12.5-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

Note: 'N' Value - The Standard Penetration Test records the number of blows of a 140 pound (64kg) hammer falling 30 inches (760mm), required to drive a 2 inch (50.8mm) O.D. split spoon sampler 1 foot (305mm). For split spoon samples where full penetration is not achieved, the number of blows is reported over the sampler penetration in meters (e.g. 50/0.15).

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols:



WATER LEVEL MEASUREMENT

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

SS	Split spoon sample (obtained from the Standard Penetration Test)
WS	Wash sample
BS	Bulk sample
TW	Thin wall sample or Shelby tube
PS	Piston sample
AS	Auger sample
VT	Vane test
GS	Grab sample
HQ, NQ, etc.	Rock core samples obtained with the use of standard size diamond drilling bits

STRESS AND STRAIN

u_w	kPa	Pore water pressure
r_u	1	Pore pressure ratio
σ	kPa	Total normal stress
σ'	kPa	Effective normal stress
τ	kPa	Shear stress
$\sigma_1, \sigma_2, \sigma_3$	kPa	Principal stresses
ε	%	Linear strain
$\varepsilon_1, \varepsilon_2, \varepsilon_3$	%	Principal strains
E	kPa	Modulus of linear deformation
G	kPa	Modulus of shear deformation
μ	1	Coefficient of friction

MECHANICALL PROPERIES OF SOIL

m_v	kPa^{-1}	Coefficient of volume change
c_c	1	Compression index
c_s	1	Swelling index
c_r	1	Recompression index
c_v	m^2/s	Coefficient of consolidation
H	m	Drainage path
T_V	1	Time factor
U	%	Degree of consolidation
σ'_{v0}	kPa	Effective overburden pressure
σ'_P	kPa	Preconsolidation pressure
τ_f	kPa	Shear strength
c'	kPa	Effective cohesion intercept
ϕ'	$-^\circ$	Effective angle of internal friction
c_u	kPa	Apparent cohesion intercept
ϕ_u	$-^\circ$	Apparent angle of internal friction
τ_R	kPa	Residual shear strength
τ_r	kPa	Remoulded shear strength
S_t	1	Sensitivity = c_u/τ_r

PHYSICAL PROPERTIES OF SOIL

P_s	kg/m^3	Density of solid particles
γ_s	kN/m^3	Unit weight of solid particles
ρ_w	kg/m^3	Density of water
γ_w	kN/m^3	Unit weight of water
ρ	kg/m^3	Density of soil
γ	kN/m^3	Unit weight of soil
ρ_d	kg/m^3	Density of dry soil
γ_d	kN/m^3	Unit weight of dry soil
ρ_{sat}	kg/m^3	Density of saturated soil
γ_{sat}	kN/m^3	Unit weight of saturated soil
ρ'	kg/m^3	Density of submerged soil
γ'	kN/m^3	Unit weight of submerged soil
e	1, %	Void ratio
n	1, %	Porosity
w	1, %	Water content
S_r	%	Degree of saturation
W_L	%	Liquid limit
W_P	%	Plastic limit
W_s	%	Shrinkage limit
I_P	%	Plasticity index = $(W_L - W_P)$
I_L	%	Liquidity index = $(W - W_P)/I_P$
I_C	%	Consistency index = $(W_L - W)/I_P$
e_{max}	1, %	Void ratio in loosest state
e_{min}	1, %	Void ratio in densest state
I_D	1	Density index = $(e_{max} - e)/(e_{max} - e_{min})$
D	mm	Grain diameter
D_n	mm	N percent - diameter
C_u	1	Uniformity coefficient
h	m	Hydraulic head or potential
q	m^3/s	Rate of discharge
v	m/s	Discharge velocity
i	1	Hydraulic gradient
k	m/s	Hydraulic conductivity
j	kN/m^3	Seepage force

RECORD OF BOREHOLE No BH-1

1 OF 1 **METRIC**

W.P. GWP 3075-16-00 LOCATION Old HWY 3, Jarvis, ON ORIGINATED BY DB

DIST West HWY 3 BOREHOLE TYPE CME-55 Truck Mount, Continuous Flight Solid Stem Augers COMPILED BY JG

DATUM Geodetic DATE 2017.08.23 - 2017.08.25 LATITUDE 42.881531 LONGITUDE -80.131222 CHECKED BY SM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
210.3	Ground Surface										
210.2 / 0.1	**TOPSOIL:** brown, moist, rootlets										
	GRANULAR FILL: sand and gravel, trace silt, grey, damp, crushed		1	SS	30		210				
209.2			2	SS	12						
1.1	**SILTY CLAY:** trace sand, brown, moist, stiff to very stiff, moderate plasticity		3	SS	16		209				0 1 56 43
			4	SS	15		208				
	trace gravel, high plasticity below 3.1 m depth		5	SS	15		207				4 7 37 52
	grey, very moist below below 4.6 m depth		6	SS	9		206				
			7	SS	11		205				
202.4			8	SS	100	▽	204				
8.0	**BEDROCK:** limestone, grey RUN 1 (7.95 - 9.43 m): recovery 100%, RQD 84% (good) RUN 2 (9.43 - 10.95 m): recovery 100%, RQD 82% (good)						203				
							202				
							201				
199.4							200				
11.0	**End of Borehole at 11.0 m.** Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole remained dry upon completion of auger drilling. Four hours following completion, the groundwater level was measured at 7.5 m below grade. 3. Borehole open to 8.0 m below ground surface upon completion of auger drilling.										

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

ONTARIO MTO ADM-00235197-J0 - SALT STORAGE DOME.GPJ ONTARIO MTO.GDT 20/9/17

RECORD OF BOREHOLE No BH-2

1 OF 1 **METRIC**

W.P. GWP 3075-16-00 LOCATION Old HWY 3, Jarvis, ON ORIGINATED BY DB

DIST West HWY 3 BOREHOLE TYPE CME-55 Truck Mount, Continuous Flight Solid Stem Augers COMPILED BY JG

DATUM Geodetic DATE 2017.08.23 - 2017.08.23 LATITUDE 42.881273 LONGITUDE -80.131108 CHECKED BY SM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
210.1	Ground Surface										
210.0	**TOPSOIL:** brown, moist, rootlets										
0.2	**SILTY CLAY:** brown, moist, stiff to very stiff, moderate plasticity		1	SS	9		210				
			2	SS	27		209				
			3	SS	30		208				
	trace sand at 2.3 m depth		4	SS	23						0 1 49 51
	grey below 3.1 m depth		5	SS	14		207				
							206				
	very moist, high plasticity below 4.6 m depth		6	SS	8						0 0 27 72
							205				
			7	SS	8		204				
							203				
202.5											
7.6	**End of Borehole at 7.6 m due to auger refusal on assumed bedrock.**										

Notes:
1. This log is to be read with the subject report and project numbers as presented above.
2. Borehole remained dry upon completion of drilling.
3. Borehole open to 7.6 m below ground surface upon completion of drilling.

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No BH-3

1 OF 1 **METRIC**

W.P. GWP 3075-16-00 LOCATION Old HWY 3, Jarvis, ON ORIGINATED BY DB

DIST West HWY 3 BOREHOLE TYPE CME-55 Truck Mount, Continuous Flight Solid Stem Augers COMPILED BY JG

DATUM Geodetic DATE 2017.08.23 - 2017.08.25 LATITUDE 42.881546 LONGITUDE -80.131116 CHECKED BY SM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
210.0	Ground Surface										
209.8	**ASPHALT** (~150 mm thick)										
209.7	**GRANULAR FILL:** sand and gravel, trace silt, grey, damp, crushed		1	SS	13						
0.4	**SILTY CLAY:** trace sand, brown, moist, stiff to very stiff		2	SS	14		209				
			3	SS	18		208				
			4	SS	12						
	very moist, high plasticity below 3.1 m depth		5	SS	8		207				0 1 41 58
	grey below below 4.6 m depth		6	SS	8		206				
	firm below 6.1 m depth		7	SS	7		205				0 1 35 64
202.4							204				
202.3	**SANDY SILTY CLAY TILL:** some gravel, grey, moist		8	SS	100		203				
7.7	**BEDROCK:** limestone, grey RUN 1 (7.65 - 9.12 m): recovery 98%, RQD 37% (poor) RUN 2 (9.12 - 10.70 m): recovery 100%, RQD 73% (fair)						202				
							201				
							200				
199.3											
10.7	**End of Borehole at 10.7 m.**										

Notes:
1. This log is to be read with the subject report and project numbers as presented above.
2. Borehole remained dry upon completion of auger drilling.
3. Borehole open to 7.7 m below ground surface upon completion of auger drilling.

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MTO ADM-00235197-J0 - SALT STORAGE DOME.GPJ ONTARIO MTO.GDT 20/9/17

RECORD OF BOREHOLE No BH-4

1 OF 1 **METRIC**

W.P. GWP 3075-16-00 LOCATION Old HWY 3, Jarvis, ON ORIGINATED BY DB

DIST West HWY 3 BOREHOLE TYPE CME-55 Truck Mount, Continuous Flight Solid Stem Augers COMPILED BY JG

DATUM Geodetic DATE 2017.08.23 - 2017.08.23 LATITUDE 42.881444 LONGITUDE -80.13112 CHECKED BY SM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
210.1	Ground Surface										
210.0 / 0.1	**ASPHALT:** (~90 mm thick)										
209.6 / 0.4	**GRANULAR FILL:** sand and gravel, trace to some silt, dark grey and brown, damp, crushed		1	SS	20						
209.3 / 0.8	**FILL:** clayey silt, dark brown, moist, trace sand, trace gravel		2	SS	11		209				
	SILTY CLAY: trace sand, brown, moist, stiff to very stiff, low plasticity		3	SS	21						0 1 77 22
			4	SS	13		208				0 1 54 45
	very moist below 3.1 m depth		5	SS	9		207				
	occasional silt seam, very moist, grey below 4.6 m depth		6	SS	6		206				
							205	+ 2.7			
			7	SS	9		204				
							203				
202.4 / 7.7	**SANDY SILTY CLAY TILL:** some gravel, grey, moist		8	SS	100						
	End of Borehole at 7.7 m due to auger refusal on assumed bedrock.										

Notes:
1. This log is to be read with the subject report and project numbers as presented above.
2. Borehole remained dry upon completion of drilling.
3. Borehole open to 7.7 m below ground surface upon completion drilling.

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

ONTARIO MTO ADM-00235197-J0 - SALT STORAGE DOME.GPJ ONTARIO MTO.GDT 20/9/17

RECORD OF BOREHOLE No BH-5

1 OF 1 **METRIC**

W.P. GWP 3075-16-00 LOCATION Old HWY 3, Jarvis, ON ORIGINATED BY DB

DIST West HWY 3 BOREHOLE TYPE CME-55 Truck Mount, Continuous Flight Solid Stem Augers COMPILED BY JG

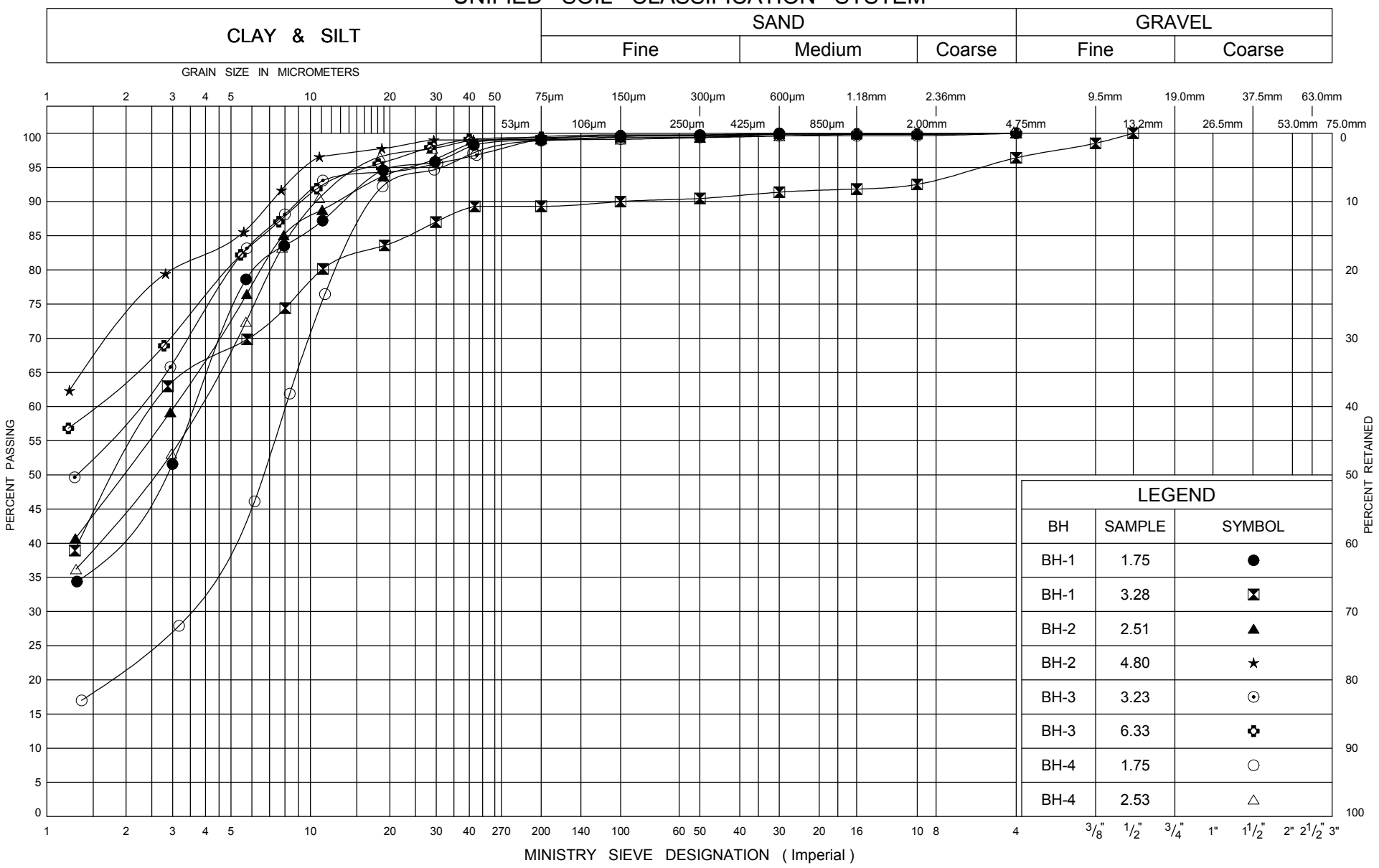
DATUM Geodetic DATE 2017.08.23 - 2017.08.25 LATITUDE 42.881292 LONGITUDE -80.131023 CHECKED BY SM

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
210.2	Ground Surface										
210.0 / 0.2	**TOPSOIL:** brown, moist, rootlets										
209.8 / 0.4	**GRANULAR FILL:** sand and gravel, trace silt, grey, damp, crushed		1	SS	28						
209.4											
0.8	**SILTY CLAY:** trace sand, trace gravel, brown, moist, stiff to very stiff, moderate plasticity		2	SS	21						1 1 40 58
			3	SS	20						
			4	SS	15						
			5	SS	10						
	grey, very moist below below 4.6 m depth		6	SS	10						
			7	SS	9						
202.6											
202.4 / 7.8	**SANDY SILTY CLAY TILL:** some gravel, grey, moist, low plasticity		8	SS	100						16 24 33 27
	BEDROCK: limestone, grey RUN 1 (7.75 - 9.27 m): recovery 100%, RQD 85% (good) RUN 2 (9.27 - 10.80 m): recovery 100%, RQD 77% (good)										
199.4											
10.8	**End of Borehole at 10.8 m.** Notes: 1. This log is to be read with the subject report and project numbers as presented above. 2. Borehole remained dry upon completion of auger drilling. 3. Borehole open to 7.8 m below ground surface upon completion of auger drilling.										

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

Appendix D – Laboratory Data

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of Transportation
Ontario

GRAIN SIZE DISTRIBUTION

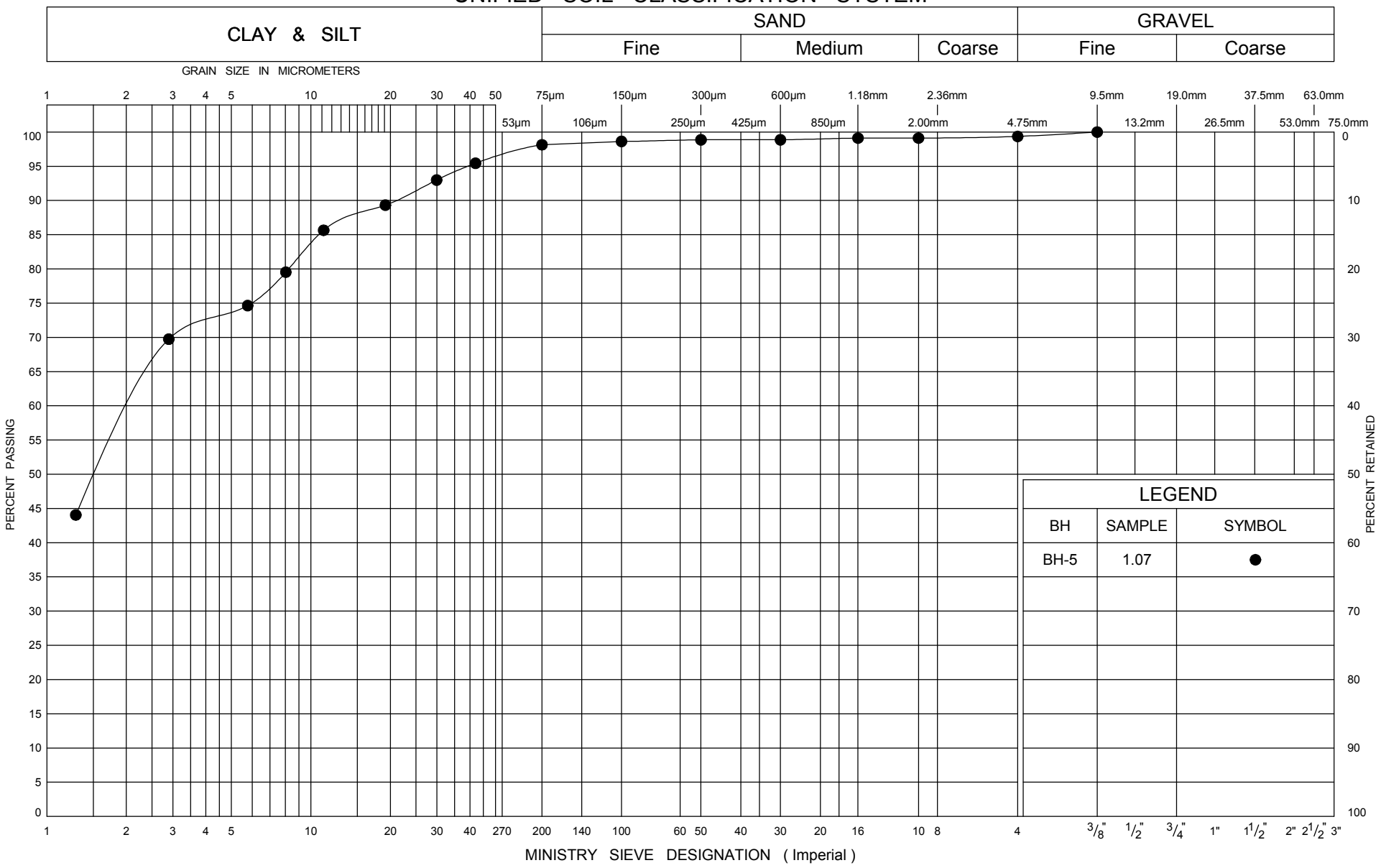
FIG No 1

W P (GWP 3075-16-00)

3015-E-0017, Assignment 6

ONTARIO MOT GRAIN SIZE ADM-0023519Z-J0 - SALT STORAGE DOME.GPJ ONTARIO MOT.GDT 9/19/17

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of Transportation
Ontario

GRAIN SIZE DISTRIBUTION

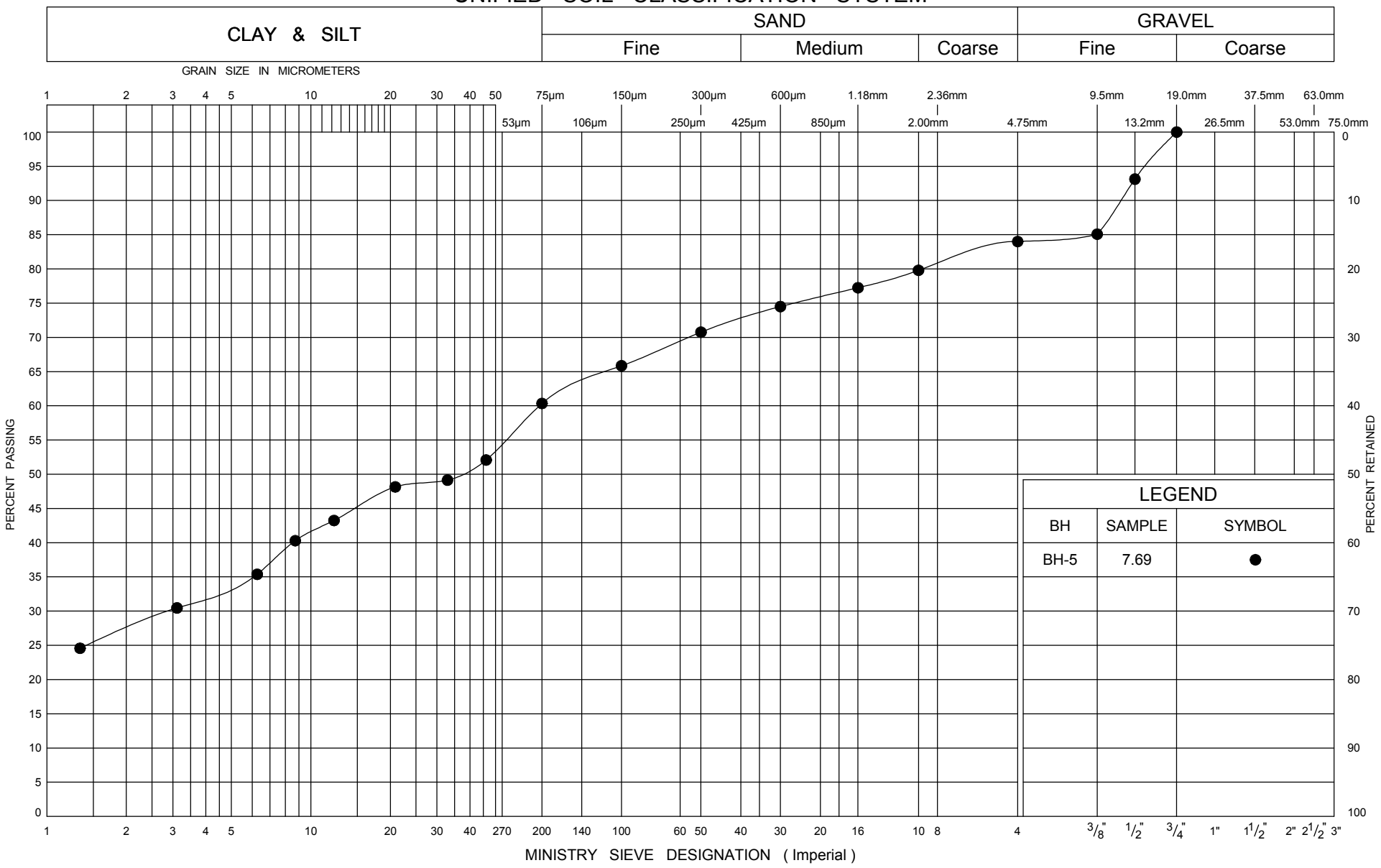
FIG No 2

W P (GWP 3075-16-00)

3015-E-0017, Assignment 6

ONTARIO MOT GRAIN SIZE ADM-0023519Z-J0 - SALT STORAGE DOME.GPJ ONTARIO MOT.GDT 9/19/17

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of Transportation
Ontario

GRAIN SIZE DISTRIBUTION

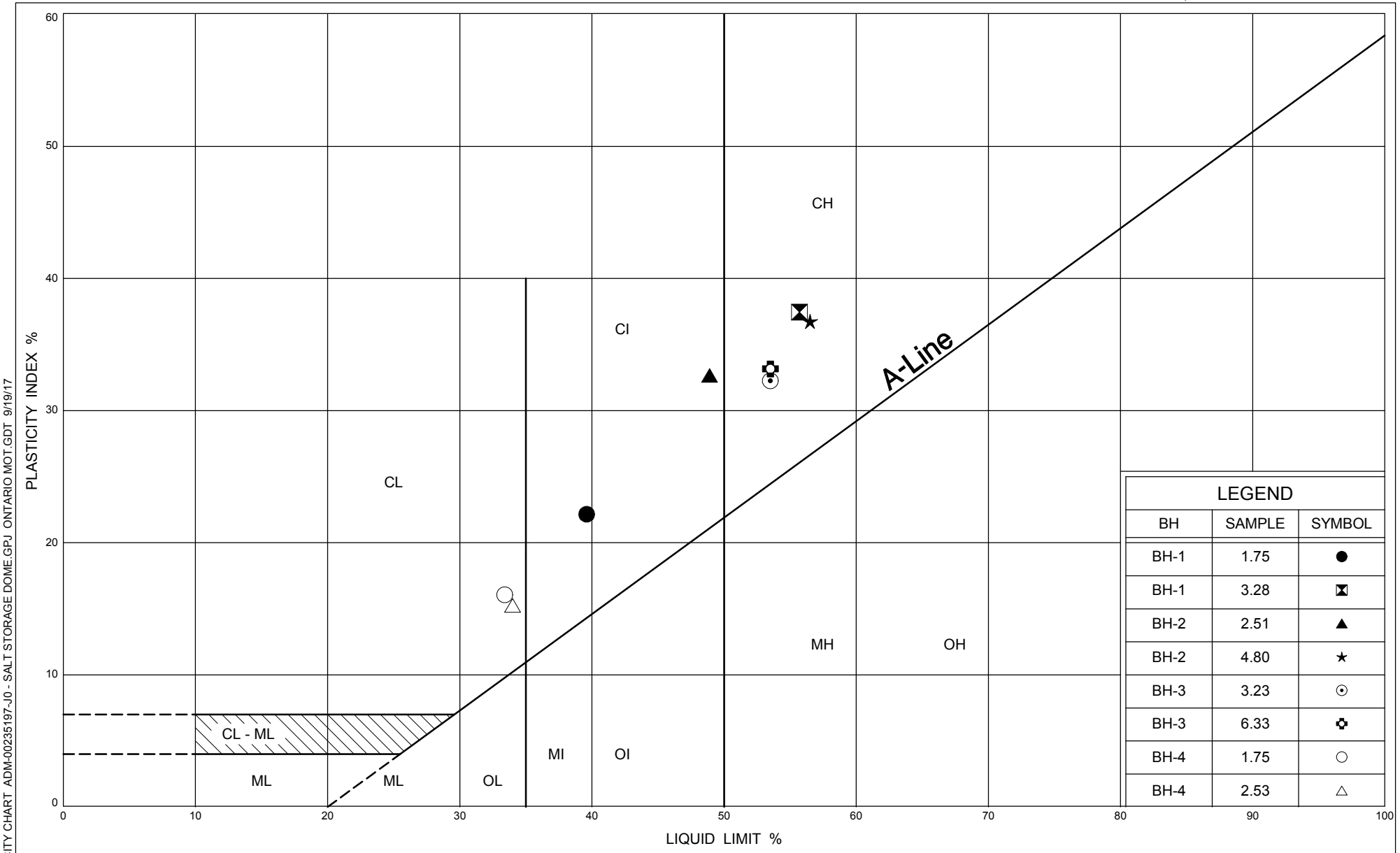
FIG No 3

W P (GWP 3075-16-00)

3015-E-0017, Assignment 6

ONTARIO MOT GRAIN SIZE ADM-0023519Z-J0 - SALT STORAGE DOME.GPJ ONTARIO MOT.GDT 9/19/17

Oct 75, FF - S - 21



LEGEND		
BH	SAMPLE	SYMBOL
BH-1	1.75	●
BH-1	3.28	⧓
BH-2	2.51	▲
BH-2	4.80	★
BH-3	3.23	⊙
BH-3	6.33	✿
BH-4	1.75	○
BH-4	2.53	△

Ministry of Transportation
Ontario

PLASTICITY CHART

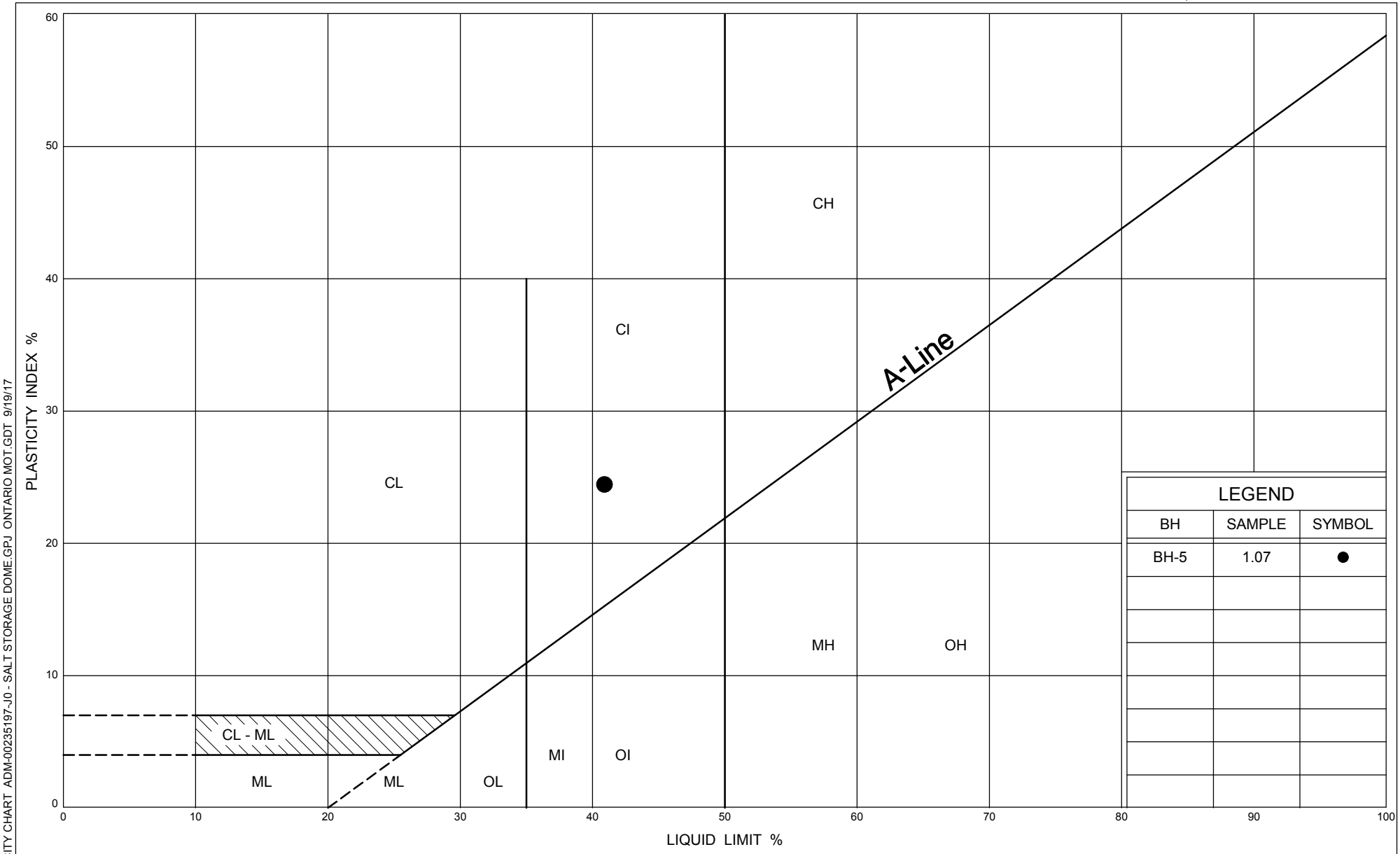
FIG No 4

W P (GWP 3075-16-00)

3015-E-0017, Assignment 6

ONTARIO MOT PLASTICITY CHART ADM-00235197-J0 - SALT STORAGE DOME.GPJ ONTARIO MOT.GDT 9/19/17

Oct 75, FF - S - 21



ONTARIO MOT PLASTICITY CHART ADM-00235197-J0 - SALT STORAGE DOME.GPJ ONTARIO MOT.GDT 9/19/17

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Ontario

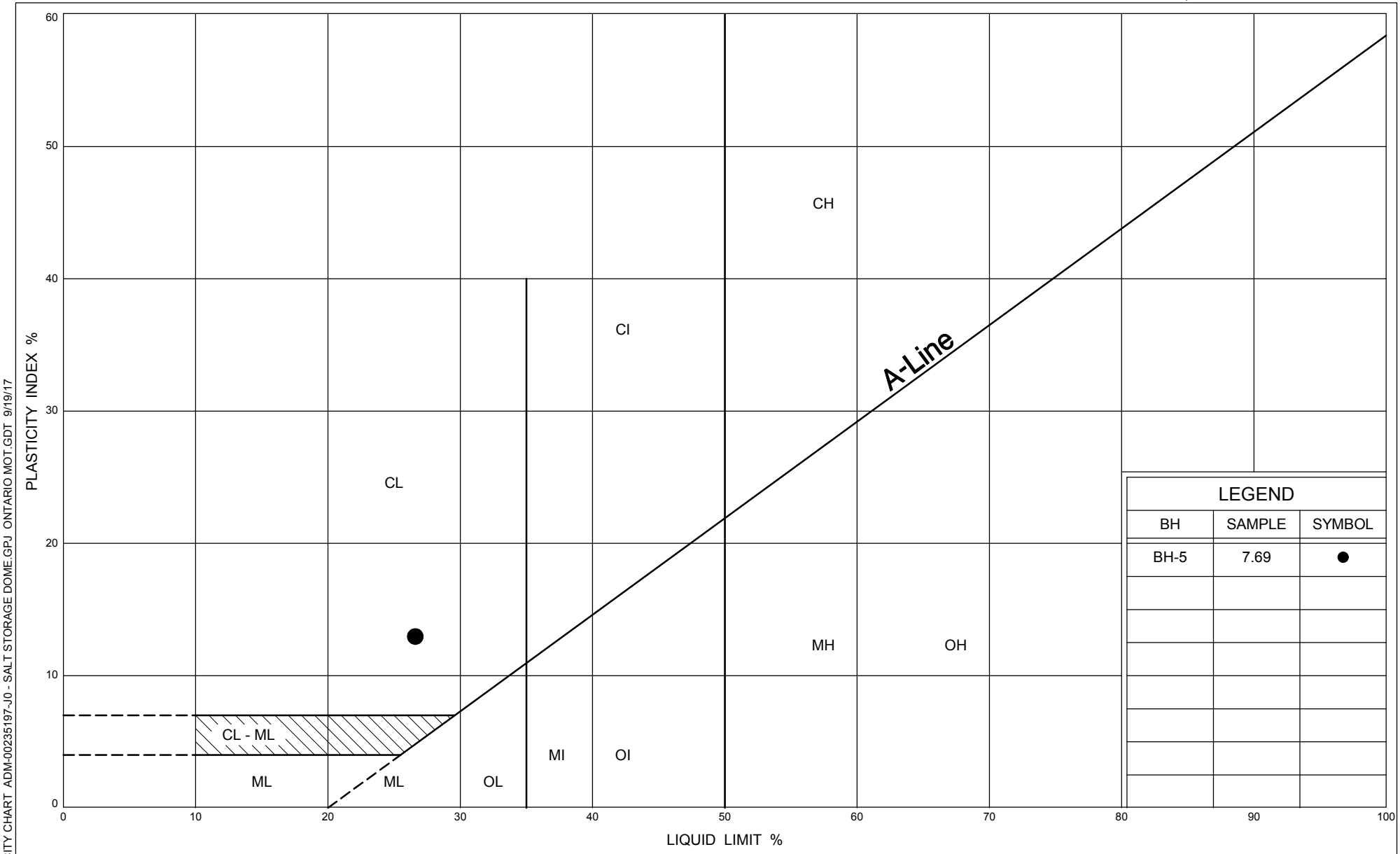
PLASTICITY CHART

FIG No 5

W P (GWP 3075-16-00)

3015-E-0017, Assignment 6

Oct 75, FF - S - 21



ONTARIO MOT PLASTICITY CHART ADM-00235197-J0 - SALT STORAGE DOME.GPJ ONTARIO MOT.GDT 9/19/17

Ministry of Transportation
Ontario

PLASTICITY CHART

FIG No 6

W P (GWP 3075-16-00)

3015-E-0017, Assignment 6

AGAT Laboratories

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

CLIENT NAME: EXP. SERVICES INC.
80 BANCROFT STREET
HAMILTON, ON L8E2W5
(905) 573-4000

ATTENTION TO: Jeff Golder

PROJECT: Borehole Investigation

AGAT WORK ORDER: 17H254496

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

DATE REPORTED: Sep 07, 2017

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

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Certificate of Analysis

AGAT WORK ORDER: 17H254496

PROJECT: Borehole Investigation

CLIENT NAME: EXP. SERVICES INC.

ATTENTION TO: Jeff Golder

SAMPLING SITE:

SAMPLED BY:

Corrosivity Package

DATE RECEIVED: 2017-08-29

DATE REPORTED: 2017-09-07

		SAMPLE DESCRIPTION:		BH-5 SS2
		SAMPLE TYPE:		Soil
		DATE SAMPLED:		2017-08-23
Parameter	**Unit**	**G / S**	**RDL**	**8676073**
Sulfide (S2-)	%		0.05	<0.05
Chloride (2:1)	µg/g		2	41
Sulphate (2:1)	µg/g		2	129
pH (2:1)	pH Units		NA	8.90
Electrical Conductivity (2:1)	mS/cm		0.005	0.409
Resistivity (2:1)	ohm.cm		1	2440

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

8676073 EC, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

*Sulphide analyzed at AGAT 5623 McAdam

Certified By: Amanjot Bhela

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

Quality Assurance

CLIENT NAME: EXP. SERVICES INC.

AGAT WORK ORDER: 17H254496

PROJECT: Borehole Investigation

ATTENTION TO: Jeff Golder

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Sep 07, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Corrosivity Package															
Sulfide (S2-)	8676073	8676073	< 0.05	< 0.05	NA	< 0.05	97%	80%	120%	NA			NA		
Chloride (2:1)	8676073	8676073	41	44	7.1%	< 2	97%	80%	120%	98%	80%	120%	102%	70%	130%
Sulphate (2:1)	8676073	8676073	129	139	7.5%	< 2	94%	80%	120%	97%	80%	120%	99%	70%	130%
pH (2:1)	8676073	8676073	8.90	8.93	0.3%	NA	101%	90%	110%	NA			NA		
Electrical Conductivity (2:1)	8676073	8676073	0.409	0.427	4.3%	< 0.005	95%	90%	110%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Amanjot Bhela

AGAT Laboratories

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

Method Summary

CLIENT NAME: EXP. SERVICES INC.

AGAT WORK ORDER: 17H254496

PROJECT: Borehole Investigation

ATTENTION TO: Jeff Golder

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sulfide (S2-)	MIN-200-12025	ASTM E1915-09	GRAVIMETRIC
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
pH (2:1)	INOR 93-6031	MSA part 3 & SM 4500-H+ B	PH METER
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

AGAT Laboratories

LARGE BLK

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water intended for human consumption)

Laboratory Use Only

Work Order #: 1711254496

Cooler Quantity: Sm cooler

Arrival Temperatures: 7.6 | 7.3 | 7.2 | 7.3 | 7.1 | 6.9

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes:

Report Information:

Company: exp Services Inc.
Contact: Jeffrey Golder
Address: 80 Bancroft Street
Hamilton, ON L8E 2W5
Phone: 905.573.4000 x5022 Fax:
Reports to be sent to:
1. Email: jeffrey.golder@exp.com
2. Email:

Regulatory Requirements:

(Please check all applicable boxes)

☒ No Regulatory Requirement

☐ Regulation 153/04
Table (Indicate One) ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One) ☐ Coarse ☐ Fine

☐ Sewer Use
☐ Sanitary ☐ Storm
Region (Indicate One)

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
(Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☐ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☒ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ 1 Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

Project Information:

Project: Borehole Investigation
Site Location: MTO Storage Dome, Jarvis, ON
Sampled By: DiSher
AGAT Quote #: 159061 PO: ADM-235197-J0
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI (Please Circle) Y / N	Metals and Inorganics	Metal Scan	Hydride Forming Metals	Client Custom Metals	ORPs: ☐ B-HWS ☐ Cl⁻ ☐ CN⁻ ☐ Cr^{6+} ☐ EC ☐ FOC ☐ NO_3/NO_2 ☐ Total N ☐ Hg ☐ pH ☐ SAR	Nutrients: ☐ TP ☐ NH_3 ☐ TKN ☐ NO_3 ☐ NO_2 ☐ NO_3/NO_2	Volatiles: ☐ VOC ☐ BTEX ☐ THM	CCME Fractions 1 to 4	ABNs	PAHs	Chlorophenols	PCBs	Organochlorine Pesticides	TCLP Metals/Inorganics	Sewer Use	pH, Sulphate, Sulphide	Chloride, resistivity	Conductivity				
BH-5 SS2	AUG 23	—	1	S																				X	X	X			

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Jeff Golder	Aug 29/17	9:00	Daniella Jaic	8/29/17	2:50pm
Daniella Jaic	8/30/17	1:15		8/30/17	1:30
	8/30/17	12:45			

Page 1 of 1

N°:

Appendix E –
Rock Core Photographs

Project No: ADM 00235197-J0
BH No: 1 Run No: 1 & 2
Sample Depth: 8.0 m to 11.0 m
Elevation: 202.4 m to 199.4 m
Description: Limestone
Date: August 23 to 25, 2017

Figure E1. Rock cores from BH-1

Project No: ADM 00235197-J0
BH No: 3 Run No: 1 & 2
Sample Depth: 7.7 m to 10.7 m
Elevation: 202.3 m to 199.3 m
Description: Limestone
Date: August 23 to 25, 2017

Figure E2. Rock cores from BH-3

Project No: ADM 00235197-J0
BH No: 5 Run No: 1 & 2
Sample Depth: 7.8 m to 10.8 m
Elevation: 202.4 m to 199.4 m
Description: Limestone
Date: August 23 to 25, 2017

Figure E3. Rock cores from BH-5