

**MTO Agreement No. 5011-E-0010
WO No. 2011-11031
Proposed Sand/Salt Storage Facility
Englehart Patrol Yard
Foundation Investigation Report
Geocres No. 31M-95
June 2012**

Prepared for:
Ontario Ministry of Transportation
Northeastern Region
447 McKeown Avenue
North Bay, Ontario
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Prepared by:
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Project No. 121-17876-00



Project No. 121-17876-00

June 29, 2012

Mr. Jean-Pierre Perron, P. Eng.
MTO Project Manager
Ontario Ministry of Transportation
Northeastern Region
447 McKeown Avenue
North Bay, Ontario P1B 9S9

**Re: MTO Agreement No. 5011-E-0010 / WO No.: 2011-11031
Proposed Sand/Salt Storage Facility - Englehart Patrol Yard
Foundation Investigation Report (Geocres No. 31M-95)**

Dear Mr. Perron:

We are pleased to submit our Foundation Investigation Report for the proposed Sand/Salt Storage Facility at the Ontario Ministry of Transportation Northeastern Region (MTO) Englehart Patrol Yard in Englehart, Ontario. A borehole and laboratory testing program was conducted to assess soil and groundwater conditions at the site and provide recommendations for foundation design for the proposed structure.

This report presents the investigation methodology and findings, and was completed in accordance with the Terms of Reference provided in MTO Agreement #5011-E-0010.

We trust that this report meets your current requirements. Please contact us if you have any questions.

Yours truly,
GENIVAR Inc.

A handwritten signature in blue ink, appearing to read "J. Stephen Ash", with a stylized flourish at the end.

J. Stephen Ash, P. Eng., P. Geo.
Consulting Engineer/Business Unit Leader

Table of Contents

Transmittal Letter
Table of Contents

1. INTRODUCTION	1-1
2. SITE DESCRIPTION AND REGIONAL GEOLOGY	2-1
2.1 Site Description	2-1
2.2 Regional Geology	2-1
3. HISTORIC REPORT REVIEW	3-1
4. INVESTIGATION PROCEDURES	4-1
4.1 Subsurface Investigation	4-1
4.2 Laboratory Testing	4-2
5. SUBSURFACE CONDITIONS	5-1
5.1 Soil Profile Summary	5-1
5.1.1 Asphalt Pavement	5-1
5.1.2 Granular Fill	5-1
5.1.3 Silt	5-1
5.1.4 Clayey Silt	5-2
5.1.5 Silt and Clay	5-3
5.1.6 Dynamic Cone Penetration Testing	5-4
5.2 Groundwater Conditions	5-4
6. MISCELLANEOUS INFORMATION.....	6-1
7. CLOSURE	7-1

Drawings

Drawing 1	Borehole Location Plan
Drawing 2	Soil Strata

Tables

Table 4-1	Borehole Numbers, Drilling Depths and Elevations	4-2
Table 4-2	Soil Testing Program – Englehart Yard	4-2
Table 5-1	Consolidation Test Results	5-3
Table 5-2	Summary of Groundwater Levels	5-4
Table 6-1	Summary of Task Responsibilities and Personnel	6-1

Appendices

- Appendix A Borehole Explanation Forms, Borehole Logs
- Appendix B Summary of Particle Size Distribution Results (Table B1), Particle Size Distribution Analyses (Figures B1 to B4), Plasticity Charts (Figures B5 to B7), Consolidation Test Results (Figures B8 to B10)
- Appendix C Site Photographs

1. Introduction

GENIVAR Inc. (GENIVAR) was retained by the Ontario Ministry of Transportation Northeastern Region (MTO) to undertake a geotechnical investigation for the proposed construction of a sand / salt storage facility at the Englehart Patrol Yard, located on Highway 11 at the intersection of Third Street in the Town of Englehart, Ontario. The purpose of the investigation was to assess subsurface conditions at the site and provide recommendations for foundation design at the designated structure location.

The geotechnical investigation was conducted in accordance with MTO Agreement #5011-E-0010. The Foundation Investigation Report is a factual report containing the results of the geotechnical investigation carried out at the Englehart site, including the field and laboratory testing information. Subsurface conditions encountered at the site are described in detail in this report.

2. Site Description and Regional Geology

2.1 Site Description

The Englehart Patrol Yard (site) is located on Highway 11 at the northwest corner of the Highway 11 / Third Street intersection in the Town of Englehart, Ontario. The site layout is shown in Drawing 1 and colour photographs of the site are included in Appendix C.

The site is fairly level with a slight slope to the southwest, and is currently fenced with a drainage ditch along the southern boundary. Surrounding land uses include a baseball diamond, a school, mixed residential, and a Union Gas yard on the east side of Third Street.

The site is an operational MTO Patrol Yard, with access off of Third Street, and is currently occupied by a 6-bay garage/office, a storage shed, and two (2) sand/salt domes. The eastern most dome is structurally condemned and cannot be entered. An above ground diesel fuel storage tank is located off the north side of the storage shed. There is also an oil/water separator for the garage and an enclosed laydown area for pipes and culverts near the shed. The active site zone is partially paved, with a few soil / grass covered areas.

There are two (2) existing monitoring wells on the site, one located on the south side of the entrance at Third Street and one located at the northwest corner of the western most sand/salt dome. Construction details for the wells are not known, but water levels were measured as input to this report. The wells were not sampled.

2.2 Regional Geology

Two different map sources were consulted to determine the regional geology in the Englehart area: i) Map 2661 and Map P2292 'Quaternary Geology – Englehart Area' published by the Ontario Geological Survey (OGS), and ii) Map 5021 'Northern Ontario Engineering Geology Terrain Study Data Base Map – New Liskeard' published by the Ministry of Natural Resources (MNR).

Based on the mapping information, the site is reportedly covered by fine sand, silt, and clay glaciolacustrine deposits. Silty clay is the dominant sediment type in the Englehart area and deposits of this material are reportedly up to 100 m thick. The glaciolacustrine sediments are underlain by Precambrian bedrock, which are part of the Cobalt Group (Huronian Supergroup), a complex metasedimentary formation that includes the following lithologies: feldspathic to quartz arenites, arkoses, pebbly conglomerates, argillites, paraconglomerates, feldspathic wacke, orthoconglomerates, and laminated to massive siltstones. Bedrock was not encountered in the current site investigation, so actual bedrock types below the site and proposed structure are not known.

3. Historic Report Review

A previous geotechnical report for the Englehart Patrol Yard was obtained from the MTO Geocres Library in Downsview, Ontario. The report (Geocres No. 31M-22), titled '*Installation of Service Tank at D.H.O. Yard at Englehart*', was completed in 1962 for the installation of a service tank at the Englehart Yard. The investigation consisted of sampling two (2) borings and two (2) dynamic cone penetration tests in the northern portion of the site. Encountered soil conditions included approximately 0.5 m of sand, gravel, and occasional boulders, overlying silt with loose relative density to a depth of approximately 4.5 m below ground surface. Below 4.5 m, clayey silt with occasional thin silt seams was encountered to the borehole termination depth of 7.0 m below ground surface. Dynamic cone penetration testing was conducted from 7.0 m to a maximum depth of 15.2 m below ground surface. Based on the reported results, the consistency of the clayey silt was soft increasing to medium stiff with depth. Groundwater level was observed to be at elevation 208.4 m to 208.8 m.

4. Investigation Procedures

4.1 Subsurface Investigation

A borehole investigation was performed at the subject site between May 28 and May 30, 2012. The investigation consisted of advancing four (4) exploratory boreholes, designated as BH12-1 through BH12-4, commencing from existing ground level. Borehole locations are shown on Drawing 1 and were located at each of the four corners of the proposed storage structure, as required in the Terms of Reference.

MTO minimum requirements for the borehole investigation outlined a maximum drilling depth of 15.0 m, unless refusal was encountered at shallower depth, or justification for deeper drilling was authorized by the MTO Project Manager. In each of the four boreholes, stiff to firm clayey silt to silt and clay layers, as described in detail in Section 5, were encountered at 15.7 m below ground surface. Augering was terminated at this depth in all four boreholes. Approval was given by the MTO Project Manager to drive Dynamic Cone Penetration Tests (DCPT's) an additional 10 m depth at BH12-1 and BH12-2, and to refusal depth at BH12-3. Ultimately, BH12-3 was terminated on refusal at 43.9 m below ground surface (elevation 165.8 m).

The longitude and latitude of the individual borehole locations were obtained using a hand-held GPS unit in the WGS 84 reference system. These coordinates were provided to the MTO Project Manager for conversion to MTO standard coordinates (Northing and Easting). Borehole elevations were surveyed to a known benchmark: the cut cross in the footing wall of the eastern sand/salt dome, with a reported geodetic elevation of 209.957 metres above sea level (masl) was used. Borehole elevations and coordinates are shown on Drawing 1, and are provided on the borehole logs included in Appendix A.

Drilling and soil sampling was completed using a truck-mounted drill rig operating under the supervision of an experienced GENIVAR soils technician. The boreholes were advanced to the sampling depths by means of continuous flight hollow stem augers. Standard Penetration Test (SPT) N values were recorded for the sampled intervals as the number of blows required to drive a split spoon sampler 305 mm into the soil, using a 63.5 kg drop hammer falling 750 mm (ASTM D1586 procedure). Refusal depth for the purposes of this investigation was defined in the MTO Terms of Reference as the depth at which SPT N values exceed 100 blows for 305 mm of penetration. SPT N values are used in this report to assess consistency for cohesive soils and relative density for non-cohesive materials.

Soil samples were collected using SPT procedures at approximately 0.75 m intervals to 5.0 m depth, 1.5 m intervals to 20 m depth, and 3 m intervals beyond 20 m depth, as per the Terms of Reference. The sampled soil materials from discrete units were logged in the field using visual and tactile methods, and were then placed in labelled plastic bags for transport, future reference, possible laboratory testing, and storage. Soils for laboratory moisture content testing were placed in sealed laboratory jars for transport.

In cohesive deposits, where the consistency of the soil permitted, relatively undisturbed samples (TW) were taken with 70 mm diameter thin-walled (Shelby) tubes, which were pushed into the bottom of the borehole using the hydraulic ram rod of the drill rig. In situ undrained shear strength (c_u) of the soil was measured using an ASTM tapered field vane and standardized procedures.

Dynamic cone penetration testing (DCPT) was completed below 15.7 m depth in boreholes BH12-1, BH12-2, and BH12-3 to further evaluate soil consistency at depth. In the DCPT, a 51 mm diameter, 60° Apex cone point, screw-attached to the tip of A-size rods, is driven into the ground using the same driving energy as in the SPT method. By recording the number of blows to drive the cone/rod assembly into the soil every 305 mm, a qualitative record of relative density/consistency is obtained. Although the interpretation of the test results may be difficult because no soil samples are obtained through this method, and the penetration resistances are not necessarily equivalent to N values or undrained shear strengths, useful information is gained by the continuity of the results and by the elimination of

unbalanced hydrostatic effects which may affect SPT N values. In some deposits, soil adhesion to the drill rod assembly may affect DCPT results, and therefore should be taken into account in the geotechnical assessments.

Groundwater conditions within the boreholes were observed during drilling, prior to backfilling. In addition, one (1) groundwater monitoring well was installed in borehole BH12-2 at a depth of 4.6 m below ground surface, to measure static groundwater levels at the site. The monitoring well was installed to meet Ontario Regulation (O. Reg.) 903 requirements, and consists of 51 mm (2 inch) outside diameter environmental grade PVC pipe, with a 1.5 m long No. 10 machine-slotted screen embedded within a sand pack. The sand pack was installed from the bottom of the monitoring well to a depth of approximately 0.3 m above the well screen. A bentonite seal was then placed between the top of the sand pack and the ground surface. The monitoring well is intended for temporary use only, and should be decommissioned prior to or during construction.

Remaining boreholes not completed as monitoring wells were backfilled with drill cuttings mixed with bentonite hole plug, and the top portion of the boreholes was sealed with emulsified asphalt. The backfill material was compacted with the drill rig. As such, the boreholes are abandoned in accordance with O. Reg. 903 requirements, as amended. Table 4.1 below summarizes the borehole numbers and drilling depths and the surveyed elevations.

Table 4-1: Borehole Numbers, Drilling Depths and Elevations

Borehole No.	Drilling Depth Below Existing Ground Surface (m) / Elevation (m)	Dynamic Cone Penetration Test Depth (m) / Elevation (m)	Monitoring Well
BH12-1	15.7/ 193.8	15.7 to 25.9 / 193.8 to 183.6	-
BH12-2	15.7/ 193.8	15.7 to 25.9 / 193.8 to 183.6	Monitoring well installed at 4.6 m depth/EI. 204.9 m
BH12-3	15.7/ 194.0	15.7 to 43.9 / 194.0 to 186.8	-
BH12-4	15.7/ 194.0	-	-

4.2 Laboratory Testing

The following soil testing program, as summarized in Table 4.2, was completed on selected soil samples to confirm the textural classifications and provide geotechnical parameters of the encountered materials.

Table 4-2: Soil Testing Program – Englehart Yard

Test	ASTM Standard	Number of Samples
Natural Moisture Content	ASTM D2216	50
Particle Size Analysis	ASTM D422	16
Atterberg Limits	ASTM D4318	14
Consolidation	ASTM D2435/D2435M-11	1

The minimum number of laboratory tests was set at 25 percent of the samples, according to the MTO Terms of Reference. Low complexity soil tests were completed at GENIVAR's RAQ's certified laboratory in Peterborough. Medium complexity (i.e. consolidation) tests were subcontracted to Golder Associates RAQ's certified laboratory in Mississauga. Laboratory testing results are presented on the borehole logs and in Appendix B. A summary of the particle size distribution results is also included as Table B1 in Appendix B.

5. Subsurface Conditions

The subsurface conditions were explored at the four (4) borehole locations designated as BH12-1 to BH12-4. Borehole locations are shown on Drawing 1 while the subsurface stratigraphic profile for the site is shown on Drawing 2. Detailed borehole logs are provided in Appendix A, and laboratory test results are included in Appendix B.

5.1 Soil Profile Summary

All four of the boreholes encountered a thin layer of asphalt overlying compact granular fill. A silt with some clay layer was encountered beneath the fill, and a relatively thick and firm clayey silt to silt and clay deposit was subsequently penetrated, extending to the borehole termination depth of 15.7 m below ground surface. Based on DCPT results, similar material likely extends to depth. BH12-3 encountered harder material below about 40 m depth (approximate elevation 170 m). Descriptions of the individual soil units are provided in the following subsections.

5.1.1 Asphalt Pavement

A 65 mm to 100 mm thick layer of asphaltic concrete (hot laid mix) was encountered at the surface at each of the borehole locations.

5.1.2 Granular Fill

Below the asphalt pavement, boreholes BH12-1 to BH12-4 encountered a granular fill layer (pavement base/subbase), consisting of 0.2 m to 0.3 m of sand and gravel to gravelly sand, underlain by sand with some gravel extending to the depths (metres below ground surface; mbgs) and elevations (geodetic) shown below:

<u>Borehole No.</u>	<u>Depth to Bottom of Fill Layer (Elevation)</u>
BH12-1	0.7 mbgs (208.8 m)
BH12-2	1.4 mbgs (208.1 m)
BH12-3	2.1 mbgs (207.6 m)
BH12-4	2.0 mbgs (207.7 m)

Laboratory particle size distribution analyses for two (2) samples from the fill layer were completed, and results according to the Unified Soil Classification System (USCS) are summarized below and shown on Figure B1 of Appendix B:

- Gravel (greater than 4.75 mm size) - 24 % to 45 %
- Sand (0.075 mm to 4.75 mm size) - 48 % to 67 %
- Silt and Clay (less than 0.075 mm size) - 7 % to 9 %

Standard Penetration Test results (N Values) recorded in the fill layer ranged between 13 and 16 blows per 305 mm of penetration, indicating compact relative density.

Laboratory determined moisture contents ranged between 4 % and 15 % for samples of the fill, indicating moist to wet material.

5.1.3 Silt

Beneath the granular fill layer, a layer of silt with a trace to some clay and a trace to some fine sand was encountered extending to depths (metres below ground surface; mbgs) and elevations (geodetic) shown below:

<u>Borehole No.</u>	<u>Depth to Bottom of Silt Layer (Elevation)</u>
BH12-1	7.1 mbgl (202.2 m)
BH12-2	7.0 mbgl (202.5 m)
BH12-3	5.7 mbgl (204.0 m)
BH12-4	3.7 mbgl (206.0 m)

Thus, the thickness of the silt layer varied from 1.7 m at borehole BH12-4 to 5.6 m at borehole BH12-2.

Laboratory particle size distribution analyses for six (6) samples from the silt layer were completed, and results according to USCS are summarized below and shown on Figure B2 of Appendix B:

- Gravel (greater than 4.75 mm size) - 0 % to 1 %
- Sand (0.075 mm to 4.75 mm size) - 1 % to 17 %
- Silt (0.002 mm to 0.075 mm size) - 70 % to 84 %
- Clay (less than 0.002 mm size) - 8 % to 15 %

Standard Penetration Test results (N values) recorded in the silt deposit ranged from 3 to 24 blows per 305 mm of penetration. Undrained shear strengths as measured by Field Vane methods ranged from 37 kPa to 42 kPa. Based on these results, the consistency of the silt deposit is described as firm. The sensitivity of the silt layer ranged from 1.9 and 3.7 (low to medium sensitivity).

Atterberg Limits tests performed on three (3) samples from the silt deposit yielded the following index values:

- Liquid Limit (w_L) - 19 % to 22 %
- Plastic Limit (w_P) - 18 % to 20 %
- Plasticity Index (I_P) - 1 % to 3 %

From the USCS plasticity chart included as Figure B5 in Appendix B, the samples may be classified as inorganic silt of low plasticity (ML).

The natural moisture content of samples recovered from the silt layer ranged from 13 % to 30 % based on laboratory testing.

5.1.4 Clayey Silt

A relatively thick clayey silt layer was encountered beneath the silt layer in all four boreholes. In borehole BH12-1 and BH12-2, the clayey silt layer extended to the borehole termination depth of 15.7 m below ground surface, while in boreholes BH12-3 and BH12-4 the clayey silt layer extended to a depth of 12.7 m below ground surface, where the material changed to silt and clay (see subsection 5.1.5).

Laboratory particle size distribution analyses for six (6) samples of the clayey silt unit were completed, and results are summarized below and shown on Figure B3 of Appendix B:

- Gravel (greater than 4.75 mm size) - 0 % to 4 %
- Sand (0.075 mm to 4.75 mm size) - 1 % to 6 %
- Silt (0.002 mm to 0.075 mm size) - 69 % to 78 %
- Clay (less than 0.002 mm size) - 21 % to 30 %

Standard Penetration Test results (N values) recorded for the clayey silt layer ranged from 0 to 7 blows per 305 mm of penetration. Undrained shear strength, as measured by Field Vane tests, ranged from 37 kPa to 70 kPa. Based on the field results, the consistency of the clayey silt deposit is described as firm to stiff. The sensitivity of the clayey silt layer ranged from 2.1 and 3.0 (medium sensitivity).

Atterberg Limits tests for three (3) samples from the deposit yielded the following index values:

- Liquid Limit (w_L) - 21 %
- Plastic Limit (w_P) - 16 % to 19 %
- Plasticity Index (I_P) - 2 % to 5 %

From the USCS plasticity chart included as Figure B6 in Appendix B, the samples may be classified as inorganic clay to silt of low plasticity (CL-ML).

One (1) oedometer test (one dimensional consolidation) was performed on a 70 mm diameter Shelby tube (TW) sample taken from a depth of 8.7 m below ground surface in borehole BH12-3. The results are presented in Figures B8 through B10 in Appendix B. Using the Casagrande method it was determined that the existing overburden pressure (σ_o^l) is equal to the overconsolidated pressure (σ_c^l). Therefore, the soil is considered to be normally consolidated. A summary of the consolidation test results is provided in Table 5.1.

Table 5-1: Consolidation Test Results

Parameter	Measurement
Measured Bulk Unit Weight, γ (kN/m ³)	18.8
Compression Index, C_c	0.22
Swelling Index, c_s	0.027
Coefficient of Consolidation, c_v (cm ² /s)	0.008

Laboratory determined moisture content ranged between 27 % and 34 % for the clayey silt samples, indicating wet material with moisture content above the Liquid Limit (w_L).

5.1.5 Silt and Clay

Underlying the clayey silt layer, a layer of silt and clay with a trace of sand was encountered at boreholes BH12-3 and BH12-4, at a depth of 12.7 m below ground surface (elevation 197.0 m). The unit extended to the borehole termination depths of 15.7 m (elevation 194.0 m).

Laboratory particle size distribution analyses for two (2) samples from the silt and clay layer were completed, and results are summarized below and shown in Figure B4 of Appendix B:

- Gravel (greater than 4.75 mm size) - 0 %
- Sand (0.075 mm to 4.75 mm size) - 2 %
- Silt (0.002 mm to 0.075 mm size) - 56 % to 61 %
- Clay (less than 0.002 mm size) - 37 % to 42 %

Undrained shear strength, as measured by Field Vane tests, ranged from 37 kPa to 50 kPa, indicating the consistency of the silt and clay deposit is firm. The sensitivity of the silt and clay ranged from between 2.0 and 2.5 (medium sensitivity). It is notable that SPT N values were less than 1 in this material (weight of hammer).

Atterberg Limits tests for two (2) samples from the deposit yielded the following index values:

- Liquid Limit (w_L) - 25 % to 28 %
- Plastic Limit (w_P) - 16 %
- Plasticity Index (I_P) - 9 % to 12 %

From the USCS plasticity chart included as Figure B7 of Appendix B, the samples may be classified as inorganic clay of low plasticity (CL).

Laboratory determined moisture content ranged from 30 % to 34 % for the silt and clay samples indicating wet material with moisture content above the liquid limit.

5.1.6 Dynamic Cone Penetration Testing

Dynamic cone penetration testing (DCPT) was performed below the borehole termination depth of 15.7 m at boreholes BH12-1, BH12-2, and BH12-3. The DCPT's extended to a depth of 25.9 m below ground surface (elevation 183.6 m) at BH12-1 and BH12-2, and to 43.9 m below ground surface (elevation 165.8 m) at BH12-3. Refusal, defined by MTO as 100 blows per 305 mm of penetration, was encountered at BH12-3 at a depth of 41.5 m below ground surface (elevation 168.2 m).

Refusal conditions extended to 43.9 m (elevation 165.8 m), upon which the DCPT was terminated in the very dense/hard material.

The DCPT results indicate that the firm to stiff clayey silt and/or silt and clay deposits may extend to a depth of 41.5 m below ground surface (elevation 168.2 m).

5.2 Groundwater Conditions

Groundwater conditions were observed in the open boreholes upon completion of drilling. The static water levels in the BH12-2 monitoring well (MW) and the two (2) existing onsite monitoring wells also were measured. Results are summarized in Table 5.1.

Table 5-2: Summary of Groundwater Levels

Location	Measured Groundwater Depth mbgs (elevation m)	Date Measured
BH12-1	0.9 (208.6)	28 May 2012
BH12-2 (MW)	1.0 (208.5)	30 May 2012 (one day after completion)
BH12-3	1.0 (208.7)	30 May 2012
BH12-4	1.0 (208.7)	30 May 2012
MW (entrance)	0.7 (n/a)	30 May 2012
MW (NW corner sand dome)	1.2 (n/a)	30 May 2012

Note: mbgs = metres below ground surface; MW signifies monitoring well.

Based on the water level measurements and moisture condition of the inspected soil samples, the groundwater level within the footprint of the proposed structure, at the time of the field investigation, was estimated to be 1.0 m below ground surface.

It should be noted that groundwater levels may fluctuate seasonally and in response to climatic conditions. Due to the fine-grained soils at the site, a potential for development of perched groundwater exists after wet seasons and periods of rainfall, and groundwater may rise close to the ground surface.

6. Miscellaneous Information

The following GENIVAR personnel and subcontractors responsible for completion of this geotechnical investigation are summarized in Table 6.1.

Table 6-1: Summary of Task Responsibilities and Personnel

Task	Name	Address	Phone
Buried Utility Locates	Peter Flowerday Central Cable Contractors	Wanapitae, ON	705-694-5256
Drilling	Kyle Gilmore Abraflex Drilling	Lively, ON	705-222-2272
Field Supervision	Dave Lembke, C.E.T., rcji GENIVAR Inc.	Peterborough, ON	705-743-6850
Project Coordinator	Jennifer Wales, P. Eng. GENIVAR Inc.	Peterborough, ON	705-743-6850
Laboratory Low Complexity	Kelly Whitney, C.E.T. GENIVAR Inc.	Peterborough, ON	705-743-6850
Laboratory Medium Complexity	Marijana Manojlovic, B.Sc. Golder Associates	Mississauga, ON	905-567-4444
Report Preparation	Raid Khamis, P. Eng. GENIVAR Inc.	Brampton, ON	905-799-8220
Report Review	Steve Ash, P. Eng., P. Geo. GENIVAR Inc.	Peterborough, ON	705-743-6850
RAQ's Key Contact	Andrew Hims, P. Eng. GENIVAR Inc.	Collingwood, ON	705-444-2788

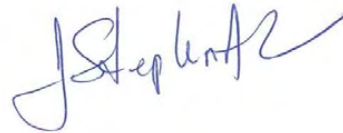
7. Closure

The data presented in this geotechnical report, and the quality thereof, is based on a scope of work authorized by the Client. While we believe the borehole information to be representative of site conditions, subsurface conditions between and beyond the test hole locations may vary. GENIVAR accepts no liability for use of or reliance on the report information by third parties, without express written consent.

Prepared by:
GENIVAR Inc.



Raid Khamis, P. Eng., PMP, LEED® AP BD+C
Project Engineer



J. Stephen Ash, P. Eng., P. Geo.
Consulting Engineer/Business Unit Leader

Reviewed by:



Andrew G. Hims, M.Sc., P. Eng.
Consulting Engineer

Drawings

Drawing 1 – Borehole Location


Drawing 2 – Soil Strata

[illegible]

The diagram is a geological cross-section oriented Northwest (B) to Southeast (B'). The vertical axis represents ELEVATION (mASL) from 184 to 210. The horizontal axis represents DISTANCE (m) from 0 to 60. Two boreholes are shown: BOREHOLE BH12-4 on the left and BOREHOLE BH12-2 on the right. The ground surface is marked with a dashed line. The soil profile is divided into several layers: GRAVELLY SAND FILL (top, hatched), SILT (middle, diagonal lines), CLAYEY SILT (lower middle, diagonal lines), and SILT & CLAY (bottom, diagonal lines). The borehole logs show soil descriptions and depths: BH12-4 has depths of 14, 14, 13, 6, 4, 4, 15.7m, and labels for Compact, Firm, Stiff, and WOH. BH12-2 has depths of 15, 12, 12, 6, 5, 3, 7, 15.7m, and labels for Compact, Firm, PH, WOH, Stiff, and CONE. A cone test result is shown at the bottom right, with a value of 25.9.

2

1. THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION.
2. COORDINATES AT BOREHOLE LOCATIONS WERE BY HANDHELD GPS.
3. BOREHOLE ELEVATIONS WERE SURVEYED RELATIVE TO THE EXISTING CUT CROSS IN THE FOOTING WALL OF THE SAND/SALT DOME (EL. 209.957 m).

LEGEND			
N	Blows/0.3m (Std. Pen Test, 475 J / blow)		
CONE	Blow/0.3m (60° Cone, 475 J / blow)		
	Water Level At Time Of Investigation		
WOH	Weight of Hammer (N<1)		
PH	Thinwall Advanced Hydraulically		

BH No	ELEVATION (mASL)	COORDINATES NORTHING	(NAD 83 Zone17) EASTING
12-1	209.465	5296882.3	584290.9
12-2	209.473	5296882.7	584316.5
12-3	209.665	5296909.5	584314.6
12-4	209.671	5296908.8	584293.3

- NOTE -

THE ACTUAL SOIL STRATIFICATION HAS BEEN VERIFIED FROM DATA OBTAINED AT THE BOREHOLE LOCATIONS ONLY. THE INFERRED CONTACTS SHOWN ARE BASED ON GEOLOGICAL EVIDENCE AND THESE MAY VARY FROM THOSE SHOWN BETWEEN BORINGS.

REVISIONS				
	DATE	BY	DESCRIPTION	
GEOCRESS No. 31M-95				
HWY. No. 11		DIST NEW LISKEARD		
SUBM'D --	CHECKED JSA	DATE JUNE 2012	SITE --	
DRAWN PLB	CHECKED --	APPROVED --	DWG --	

GENIVAR



SITE PLAN MAPPING REF. NO.:
MTO PLAN H-286-11-1. CONT No WP No 2004-50-001, OCT 2005,
PLATE 286-11/36-0, SHEET 1 OF 1.

Appendix A

Borehole Explanation Forms

Borehole Logs

BOREHOLE LOG EXPLANATION FORM

This explanatory section provides the background to assist in the use of the borehole logs. Each of the headings used on the borehole log, is briefly explained.

DEPTH

This column gives the depth of interpreted geologic contacts in metres below ground surface.

STRATIGRAPHIC DESCRIPTION

This column gives a description of the soil based on a tactile examination of the samples and/or laboratory test results. Each stratum is described according to the following classification and terminology.

<u>Soil Classification*</u>		<u>Terminology</u>	<u>Proportion</u>
Clay	<0.002 mm		
Silt	0.002 to 0.06 mm	"trace" (e.g. trace sand)	<10%
Sand	0.06 to 2 mm	"some" (e.g. some sand)	10% - 20%
Gravel	2 to 60 mm	adjective (e.g. sandy)	20% - 35%
Cobbles	60 to 200 mm	"and" (e.g. and sand)	35% - 50%
Boulders	>200 mm	noun (e.g. sand)	>50%

* Extension of MIT Classification system unless otherwise noted.

The use of the geologic term "till" implies that both disseminated coarser grained (sand, gravel, cobbles or boulders) particles and finer grained (silt and clay) particles may occur within the described matrix.

The compactness of cohesionless soils and the consistency of cohesive soils are defined by the following:

<u>COHESIONLESS SOIL</u>		<u>COHESIVE SOIL</u>		
Compactness	Standard Penetration Resistance "N", Blows / 0.3 m	Consistency	Standard Penetration Resistance "N", Blows / 0.3 m	Undrained Shear Strength (cu) (kPa)
Very Loose	0 to 4	Very Soft	0 to 2	0 to 12
Loose	4 to 10	Soft	2 to 4	12 to 25
Compact	10 to 30	Firm	4 to 8	25 to 50
Dense	30 to 50	Stiff	8 to 15	50 to 100
Very Dense	Over 50	Very Stiff	15 to 30	100 to 200
		Hard	Over 30	Over 200

The moisture conditions of cohesionless and cohesive soils are defined as follows.

COHESIONLESS SOILS

Dry
Moist
Wet
Saturated

COHESIVE SOILS











DTPL - Drier Than Plastic Limit
APL - About Plastic Limit
WTPL - Wetter Than Plastic Limit
MWTPL - Much Wetter Than Plastic Limit

STRATIGRAPHY

Symbols may be used to pictorially identify the interpreted stratigraphy of the soil and rock strata.

MONITOR DETAILS

This column shows the position and designation of standpipe and/or piezometer ground water monitors installed in the borehole. Also the water level may be shown for the date indicated.

	Standpipe		Geotextile Material / Liner		Granular Backfill
	Piezometer		Borehole Seal (Bentonite Grout)		Granular (Filter) Pack
	Screened Interval		Cement Seal		Native Soil Backfill / Cave / Slough
	Borehole Seal (Peltonite, Bentonite or Hole Plug)				

Where monitors are placed in separate boreholes, these are shown individually in the "Monitor Details" column. Otherwise, monitors are in the same borehole. For further data regarding seals, screens, etc., the reader is referred to the summary of monitor details table.

SAMPLE

These columns describe the sample type and number, the "N" value, the water content, the percentage recovery, and Rock Quality Designation (RQD), of each sample obtained from the borehole where applicable. The information is recorded at the approximate depth at which the sample was obtained. The legend for sample type is explained below.

SS = Split Spoon	GS = Grab Sample
TW = Thin Walled Shelby Tube	CS = Channel Sample
AS = Auger Flight Sample	WS = Wash Sample
CC = Continuous Core	RC = Rock Core
PH = TW Advanced Hydraulically	

$$\% \text{ Recovery} = \frac{\text{Length of Core Recovered Per Run}}{\text{Total Length of Run}} \times 100$$

Where rock drilling was carried out, the term RQD (Rock Quality Designation) is used. The RQD is an indirect measure of the number of fractures and soundness of the rock mass. It is obtained from the rock cores by summing the length of core recovered, counting only those pieces of sound core that are 100 mm or more in length. The RQD value is expressed as a percentage and is the ratio of the summed core lengths to the total length of core run. The classification based on the RQD value is given below.

RQD Classification

RQD (%)

Very poor quality	< 25
Poor quality	25 - 50
Fair quality	50 - 75
Good quality	75 - 90
Excellent quality	90 - 100

TEST DATA

The central section of the log provides graphs which are used to plot selected field and laboratory test results at the depth at which they were carried out. The plotting scales are shown at the head of the column.

Dynamic Penetration Resistance - The number of blows required to advance a 51 mm diameter, 60° steel cone fitted to the end of 45 mm OD drill rods, 0.3 m into the subsoil. The cone is driven with a 63.5 kg hammer over a fall of 750 mm.

Standard Penetration Resistance - Standard Penetration Test (SPT) "N" Value - The number of blows required to advance a 51 mm diameter standard split-spoon sampler 300 mm into the subsoil, driven by means of a 63.5 kg hammer falling freely a distance of 750 mm. In cases where the split spoon does not penetrate 300 mm, the number of blows over the distance of actual penetration in millimetres is shown as $\frac{x\text{Blows}}{\text{mm}}$

Water Content - The ratio of the mass of water to the mass of oven-dry solids in the soil expressed as a percentage.

W_P - Plastic Limit of a fine-grained soil expressed as a percentage as determined from the Atterberg Limit Test.

W_L - Liquid Limit of a fine-grained soil expressed as a percentage as determined from the Atterberg Limit Test.

REMARKS

The last column describes pertinent drilling details, field observations and/or provides an indication of other field or laboratory tests that were performed.

RECORD OF BOREHOLE No BH12-1

1 OF 2

METRIC

LOCATION ENGLEHART PATROL YARD N 5 296 882.3; E 584 290.9

















ORIGINATED BY DCL

BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGERS WITH SPT AND DCPT

COMPILED BY JW

DATUM GEODETTIC DATE 5.28.12 - 5.28.12

CHECKED BY RK

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							W _P	W	W _L		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	WATER CONTENT (%)										
209.5								20	40	60	80	100							
208.9	ASPHALT: 75 mm THICK		1	SS	16		209							○					
208.8	GRANULAR FILL: GRAVELLY SAND TO SAND SOME GRAVEL FILL BROWN, COMPACT, MOIST TO WET		2	SS	15		208								○				
0.7	SILT: SILT, SOME CLAY, SOME FINE SAND BROWN TO GREY, VERY STIFF TO FIRM, WTP		3	SS	24		207									○			0 16 70 14
			4	SS	3		206									○			
			5	SS	4		205									○			
			6	SS	4		204									○			
			7	SS	3		203									○			0 10 76 14
			8	SS	WOH		202										○		
			9	SS	3		201										○		
			10	SS	WOH		200										○		0 2 73 25
			11	SS	WOH		199										○		
			12	SS	WOH		197										○		0 1 69 30
			13	TW	PH														
																			
																			

Continued Next Page

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

METRIC

ORIGINATED BY DCL

COMPILED BY JW

CHECKED BY RK

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

RECORD OF BOREHOLE No BH12-2

1 OF 2

METRIC

LOCATION ENGLEHART PATROL YARD N 5 296 882.7; E 584 316.5




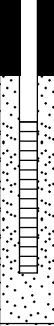


ORIGINATED BY DCL

BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGERS WITH SPT AND DCPT

COMPILED BY JW

DATUM GEODETIC DATE 5.29.12 - 5.29.12

CHECKED BY RK

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%)				GR	SA	SI	CL	
209.5	ASPHALT: 65 mm THICK		1	SS	15		209										45	48	(7)		
208.9			2	SS	12																
208.1	SILT: MOTTLED SILT, SOME SAND, TRACE CLAY, TRACE GRAVEL CHANGING TO SILT SOME CLAY TRACE SAND AT 2.9 m DEPTH BROWNISH GREY TO GREY, FIRM, WET		3	SS	12		208										1	9	78 12		
1.4			4	SS	6																
			5	SS	5																
			6	SS	3														0	1	84 15
			7	TW	PH																
202.5	CLAYEY SILT: CLAYEY SILT, TRACE SAND, DILATANT LAYERS GREY, STIFF, WTP		8	SS	WOH		202														
7.0																					
			9	SS	WOH																
			10	SS	WOH														0	1	78 21
			11	SS	WOH																
			12	SS	WOH																

Continued Next Page

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

RECORD OF BOREHOLE No BH12-2

2 OF 2

METRIC

LOCATION ENGLEHART PATROL YARD N 5 296 882.7; E 584 316.5

ORIGINATED BY DCL

BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGERS WITH SPT AND DCPT

COMPILED BY JW

DATUM GEODETTIC DATE 5.29.12 - 5.29.12

CHECKED BY RK

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W _p	W	W _L			
193.8			13	SS	7		194										
15.7	CONTINUOUS DYNAMIC CONE PENETRATION TEST BELOW 15.7 m DEPTH. NO SOIL SAMPLING COMPLETED.						193										
							192										
							191										
							190										
							189										
							188										
							187										
							186										
							185										
							184										
183.6	END OF BOREHOLE																
25.9																	

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

RECORD OF BOREHOLE No BH12-3

1 OF 3

METRIC

LOCATION ENGLEHART PATROL YARD N 5 296 909.5; E 584 314.6

ORIGINATED BY DCL

BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGERS WITH SPT AND DCPT

COMPILED BY JW

DATUM GEODETIC DATE 5.29.12 - 5.30.12

CHECKED BY RK

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)				
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE											
209.7																				
208.0	ASPHALT: 90 mm THICK		1	SS	16															
	GRANULAR FILL: GRAVELLY SAND TO SAND, SOME GRAVEL FILL BROWN, COMPACT, MOIST TO WET		2	SS	13															
			3	SS	13															
207.6																				
206.1	SILT: SILT, SOME FINE SAND, TRACE CLAY, DILATANT, LOW PLASTICITY GREY, STIFF TO FIRM, WTPL		4	SS	10															
			5	SS	4															
			6	SS	3															
			7	SS	3															
204.0	CLAYEY SILT: CLAYEY SILT , TRACE SAND GREY, FIRM, WTPL OCCASIONAL LAYERS OF SILT, SOME CLAY, NO DISCERNABLE STRUCTURE EVIDENCE OF VARVES / LAMINATION		8	SS	WOH															
5.7																				
			9	SS	WOH															
			10	TW	PH															
			11	SS	WOH															
			12	SS	WOH															
			13	SS	WOH															
197.0																				
12.7		SILT AND CLAY: SILT AND CLAY , TRACE SAND GREY, FIRM, WTPL																		
				14	SS	WOH														

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

METRIC

ORIGINATED BY DCL

COMPILED BY JW

CHECKED BY RK

Continued Next Page

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

METRIC

ORIGINATED BY DCL

COMPILED BY JW

CHECKED BY RK

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

METRIC

ORIGINATED BY DCL

COMPILED BY JW

CHECKED BY RK

Continued Next Page

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

RECORD OF BOREHOLE No BH12-4

2 OF 2

METRIC

LOCATION ENGLEHART PATROL YARD N 5 296 908.8; E 584 293.3

ORIGINATED BY DCL

BOREHOLE TYPE CONTINUOUS FLIGHT HOLLOW STEM AUGERS WITH SPT AND DCPT

COMPILED BY JW

DATUM GEODETIC DATE 5.30.12 - 5.30.12

CHECKED BY RK

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					W _p W W _L 10 20 30						
194.0	<u>SILT AND CLAY:</u> SILT AND CLAY, TRACE SAND GREY, STIFF, WTPL (<i>continued</i>)		14	SS	WOH												
15.7	END OF BOREHOLE FIELD VANE TEST COMPLETED AT 16.2 m DEPTH.																

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

Appendix B

Summary of Particle Size Distribution
Results (Table B1)

Particle Size Distribution Analyses
(Figures B1 to B4)

Plasticity Chart
(Figures B5 to B7)

Consolidation Test Results
(Figures B8 to B10)

Table B1: Summary of Grain Size Distribution and Hydrometer Tests

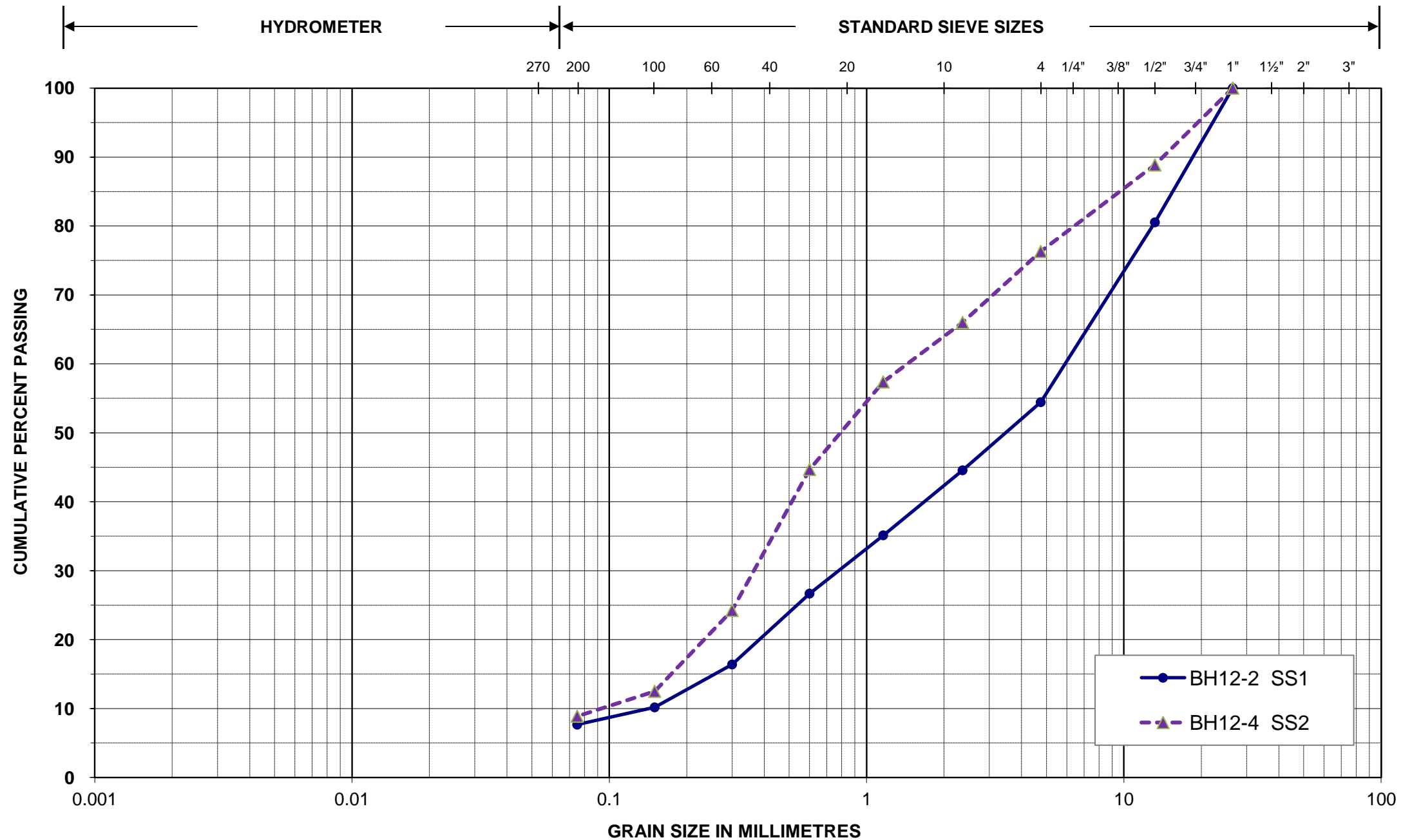
Borehole No.	Sample ID	Soil Description	Percentage Retained (%)			
			Gravel	Sand	Silt	Clay
BH12-1	SS4	Silt, some sand, some clay	0	16	70	14
BH12-1	SS7	Silt, some sand, some clay	0	10	76	14
BH12-1	SS10	Clayey silt, some sand	0	2	73	25
BH12-1	SS12	Clayey silt, trace sand	0	1	69	30
BH12-2	SS1	Sand and gravel, trace silt	45	48	7	
BH12-2	SS3	Silt, some clay, trace sand, trace gravel	1	9	78	12
BH12-2	SS6	Silt, some clay, trace sand	0	1	84	15
BH12-2	SS10	Clayey silt, trace sand	0	1	78	21
BH12-3	SS4	Silt, some sand, trace clay	0	17	75	8
BH12-3	SS8	Clayey silt, trace sand, trace gravel	4	6	70	20
BH12-3	SS11	Clayey silt, trace sand	0	1	76	23
BH12-3	SS14	Silt and clay, trace sand	0	1	57	42
BH12-4	SS2	Gravelly sand, trace silt	24	67	9	
BH12-4	SS5	Silt, some clay, trace sand	0	5	81	14
BH12-4	SS9	Clayey silt, trace sand	0	4	76	20
BH12-4	SS13	Silt and clay	0	0	63	37

Terminology **Proportion**

“trace” (e.g. trace sand)	< 10%
“some” (e.g. some sand)	10% to 20%
adjective (e.g. sandy)	20% to 35%
“and” (e.g. and sand)	35% to 50%
Noun (e.g. sand)	> 50%



PARTICLE SIZE DISTRIBUTION



Unified Classification System

SILT AND CLAY	SAND	GRAVEL
---------------	------	--------

Project Name: MTO Agreement # 5011-E-0010 (Englehart)

Project No.: 121-17876-00

Figure No.: B1

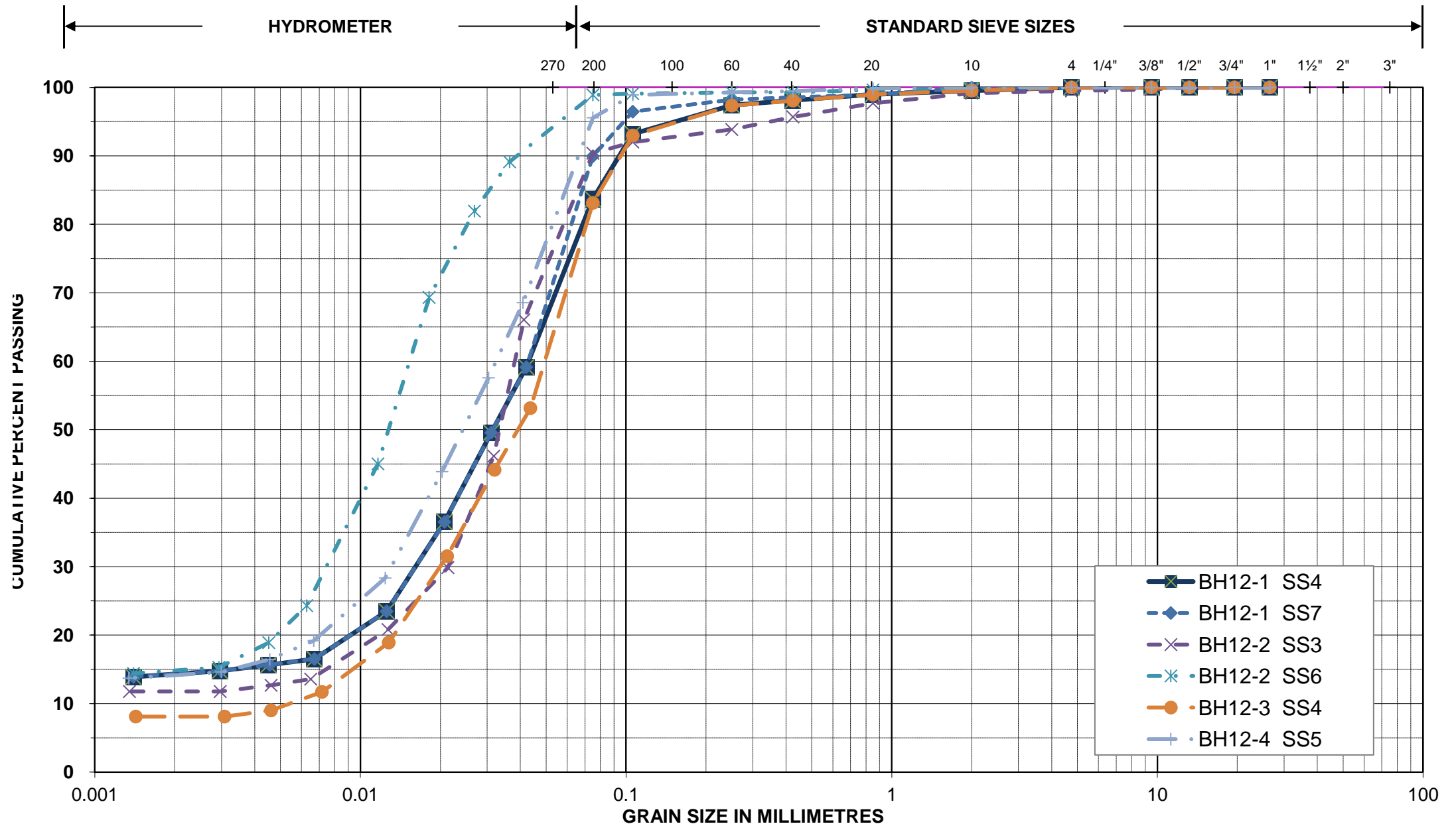
Remarks: Sand and gravel, trace silt



GENIVAR

PARTICLE SIZE DISTRIBUTION

ASTM D422



Unified Classification System

SILT AND CLAY

SAND

GRAVEL

Project Name: MTO Agreement # 5011-E-0010 (Englehart)

Project No.: 121-17876-00

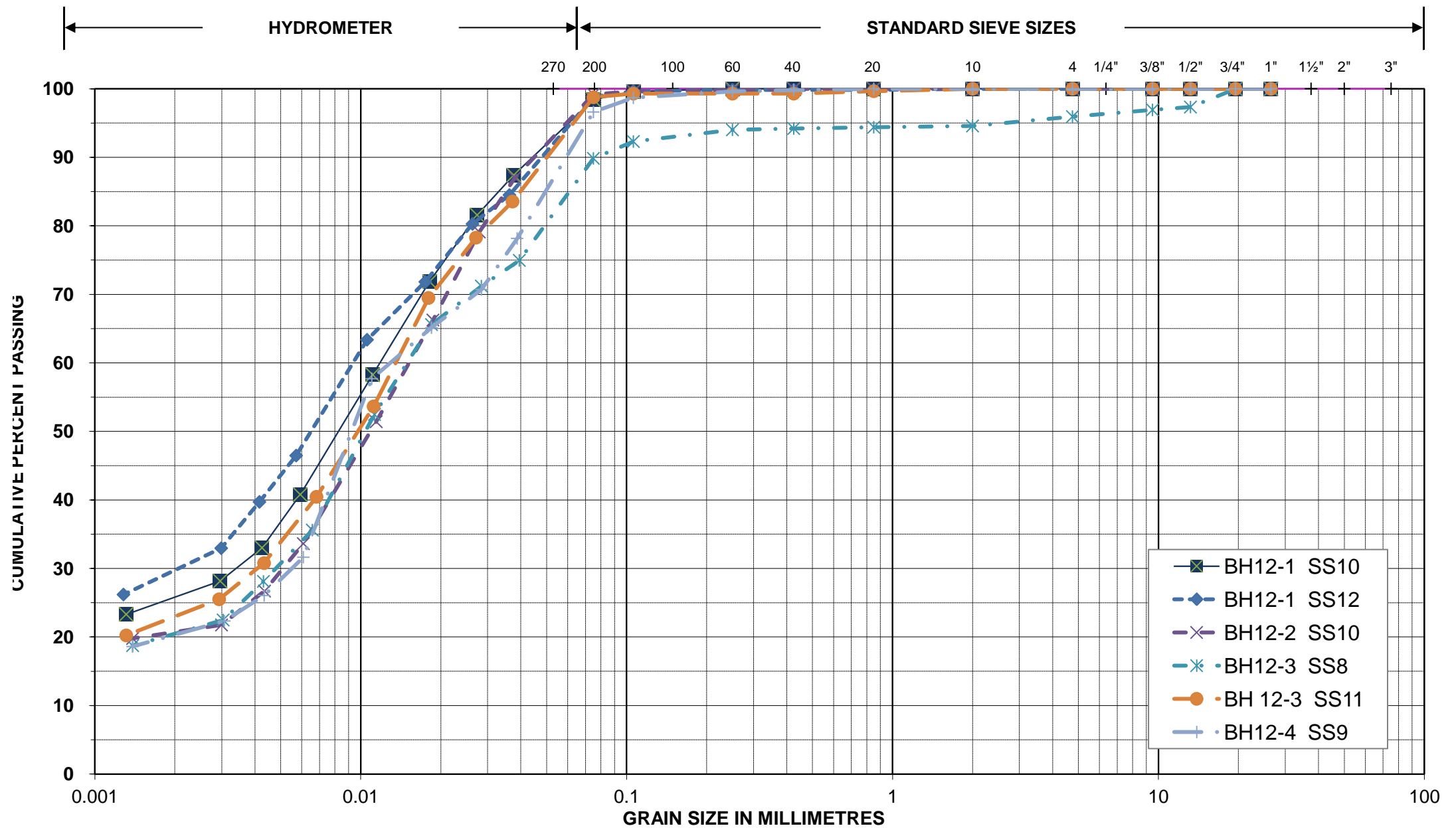
Figure No.: B2

Remarks: Silt, some clay, trace to some sand



GENIVAR

PARTICLE SIZE DISTRIBUTION ASTM D422



Unified Classification System

SILT AND CLAY	SAND	GRAVEL
---------------	------	--------

Project Name: MTO Agreement # 5011-E-0010 (Englehart)

Project No.: 121-17876-00

Figure No.: B3

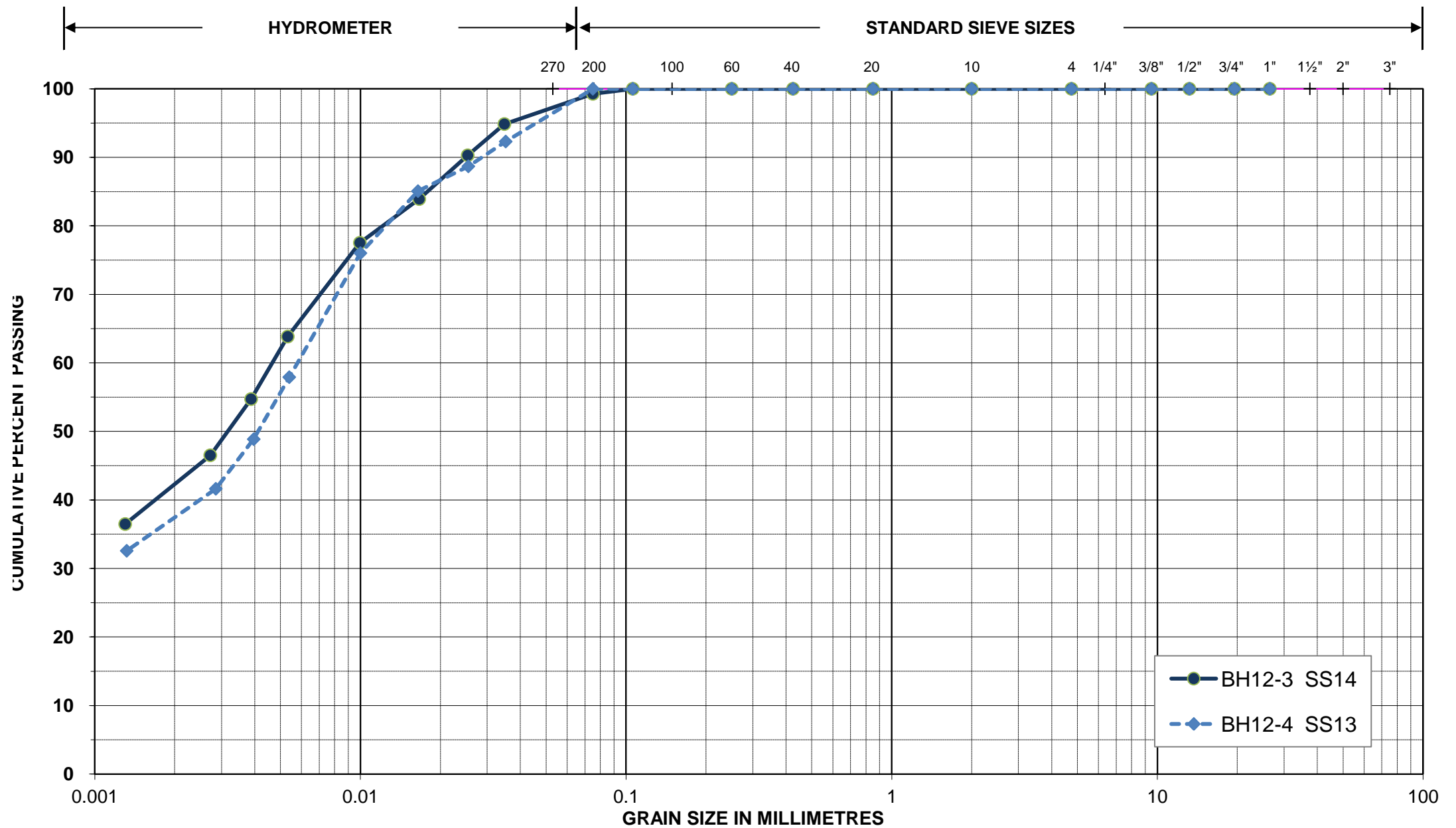
Remarks: Clayey silt, trace sand



GENIVAR

PARTICLE SIZE DISTRIBUTION

ASTM D422



Unified Classification System

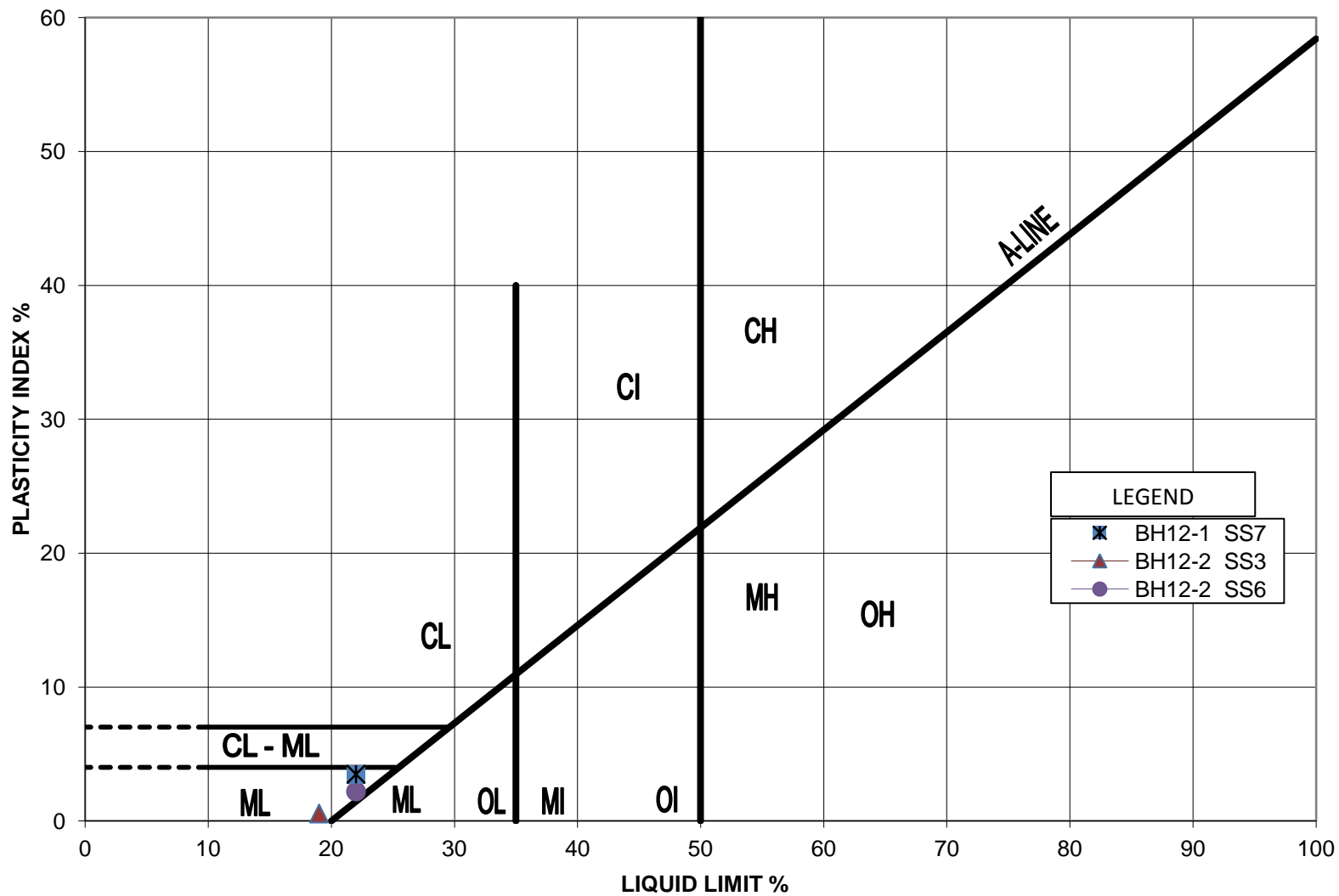
SILT AND CLAY	SAND	GRAVEL
---------------	------	--------

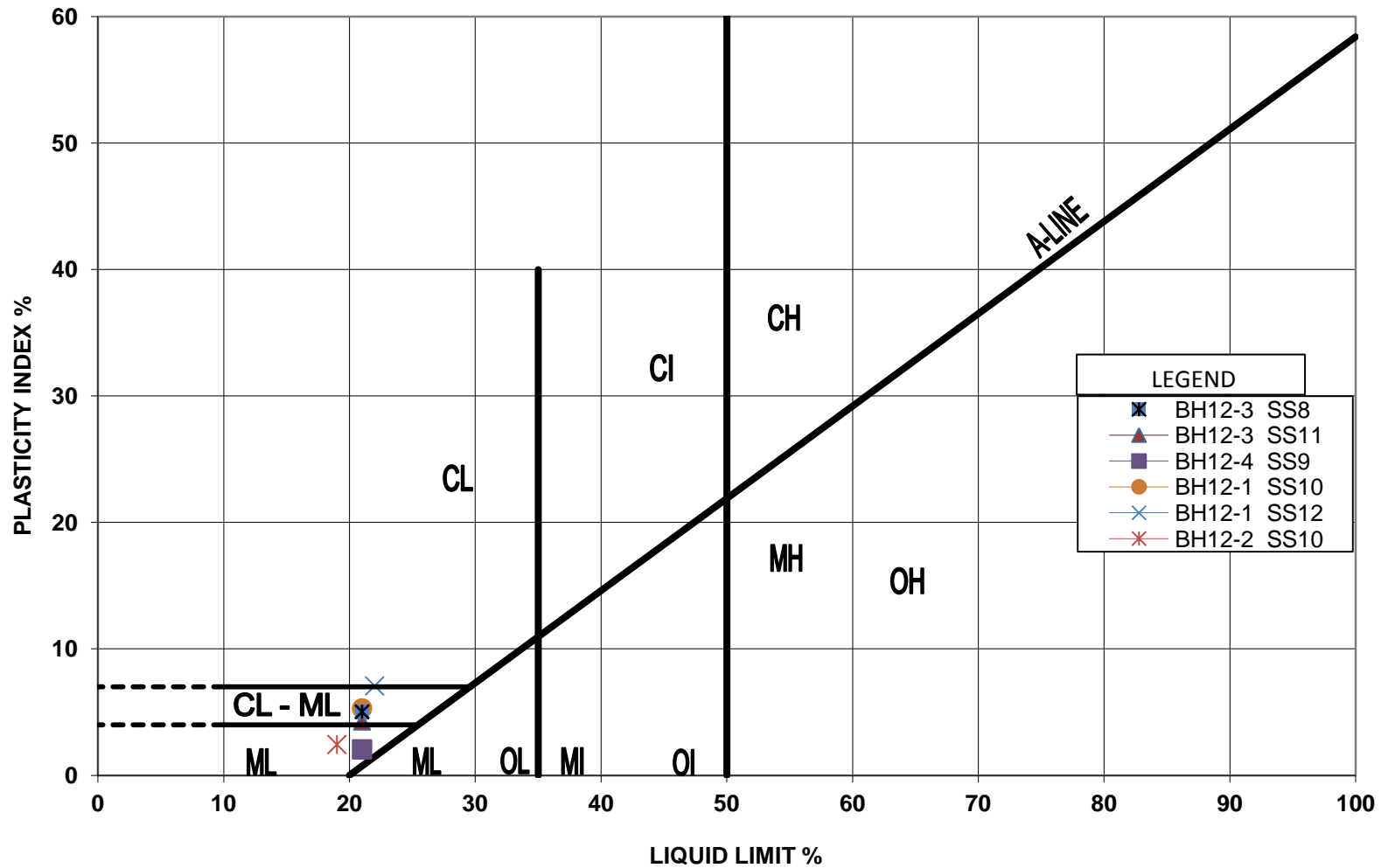
Project Name: MTO Agreement # 5011-E-0010 (Englehart)

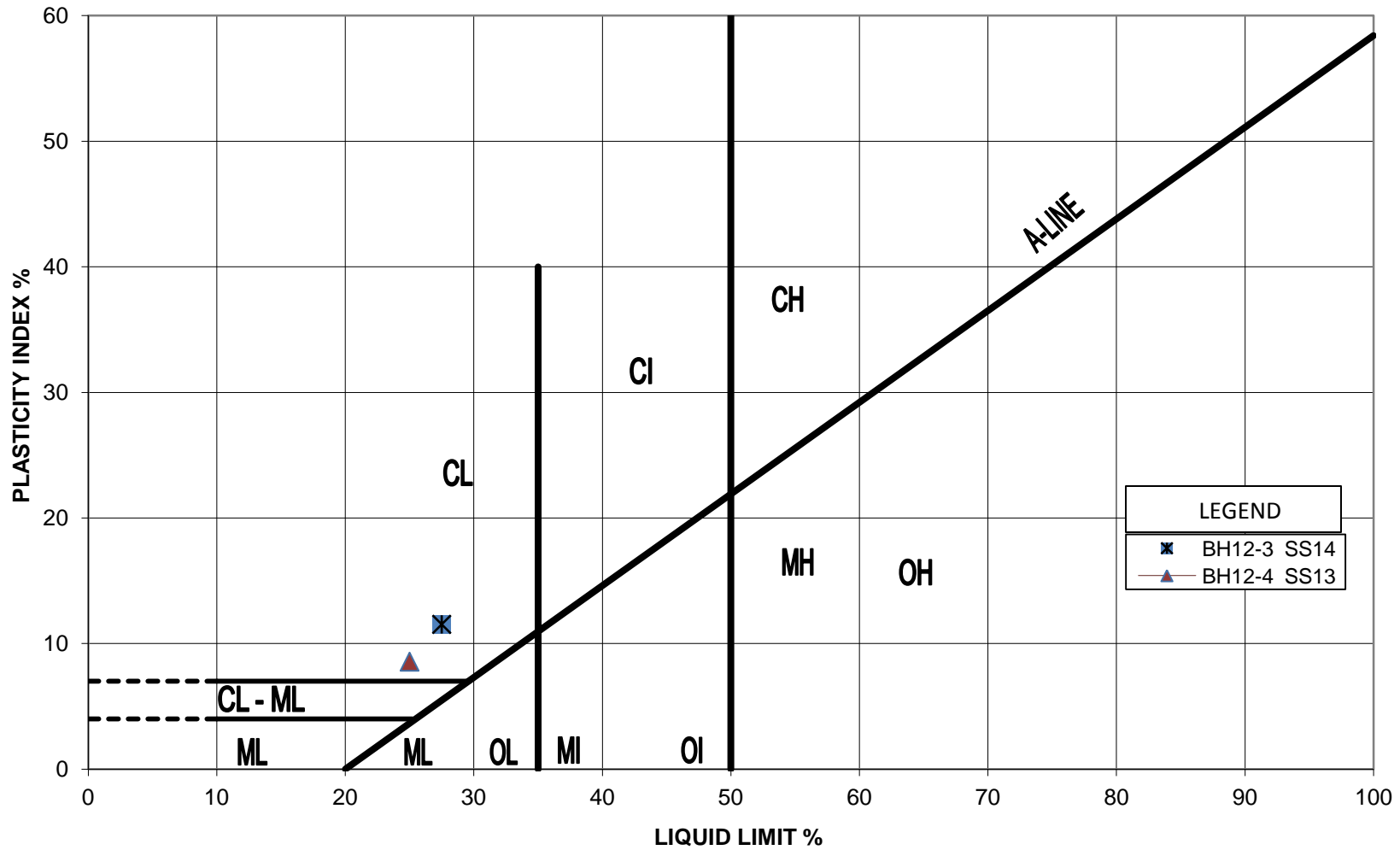
Project No.: 121-17876-00

Figure No.: B4

Remarks: Silt and clay







CONSOLIDATION TEST SUMMARY**FIGURE B8****SAMPLE IDENTIFICATION**

Project Number	12-1183-0067	Sample Number	S10
Borehole Number	12-3	Sample Depth, m	8.4-9.0

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	1		
Date Started	6/07/2012		
Date Completed	6/14/2012		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	2.54	Unit Weight, kN/m ³	18.79
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m ³	14.39
Area, cm ²	31.61	Specific Gravity, measured	2.75
Volume, cm ³	80.22	Solids Height, cm	1.354
Water Content, %	30.52	Volume of Solids, cm ³	42.81
Wet Mass, g	153.68	Volume of Voids, cm ³	37.41
Dry Mass, g	117.74	Degree of Saturation, %	96.1

TEST COMPUTATIONS

Axial Stress kPa	Corr. Height cm	Void Ratio	Average Height cm	t ₉₀ sec	c _v cm ² /s	m _v m ² /kN	k cm/s
0.00	2.538	0.874	2.538				
25.41	2.508	0.852	2.523	107	1.26E-02	4.59E-04	5.67E-07
51.75	2.495	0.842	2.502	282	4.71E-03	1.94E-04	8.97E-08
100.12	2.468	0.822	2.482	205	6.37E-03	2.25E-04	1.40E-07
198.79	2.416	0.783	2.442	623	2.03E-03	2.08E-04	4.14E-08
399.40	2.308	0.704	2.362	185	6.39E-03	2.12E-04	1.33E-07
796.28	2.236	0.650	2.272	101	1.08E-02	7.18E-05	7.62E-08
1590.81	2.169	0.601	2.202	126	8.16E-03	3.30E-05	2.64E-08
796.28	2.174	0.605	2.171				
399.40	2.184	0.612	2.179				
198.79	2.191	0.617	2.187				
25.37	2.217	0.636	2.204				

Note:

k calculated using cv based on t₉₀ values.

Consolidation loading and unloading schedule assigned by the client.

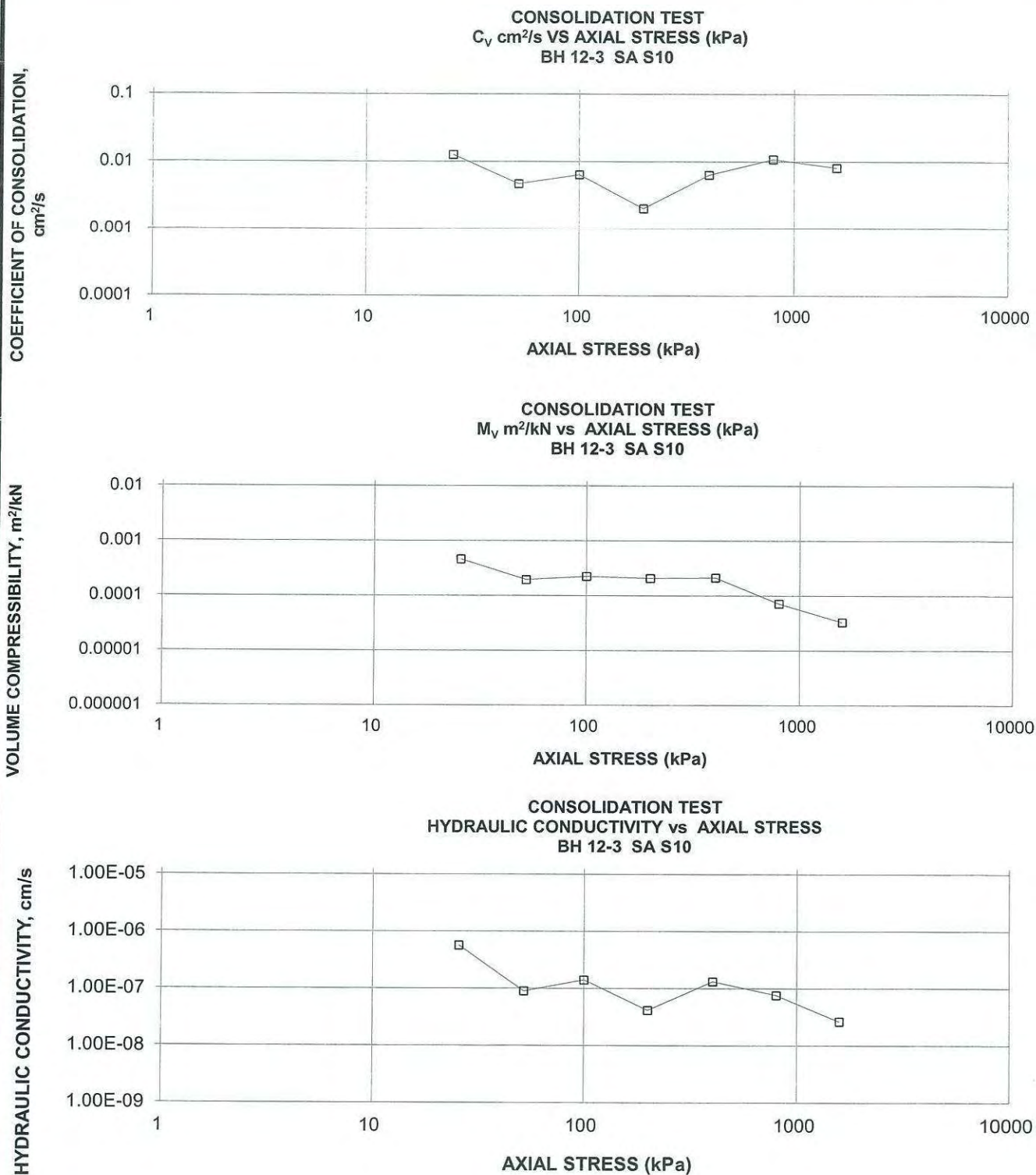
Specimen taken 12cm from bottom of the tube.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	2.22	Unit Weight, kN/m ³	20.36
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m ³	16.48
Area, cm ²	31.61	Specific Gravity, measured	2.75
Volume, cm ³	70.06	Solids Height, cm	1.354
Water Content, %	23.53	Volume of Solids, cm ³	42.81
Wet Mass, g	145.44	Volume of Voids, cm ³	27.25
Dry Mass, g	117.74		

CONSOLIDATION TEST SUMMARY

FIGURE B9



Project No. 12-1183-0067

Prepared By: LFG

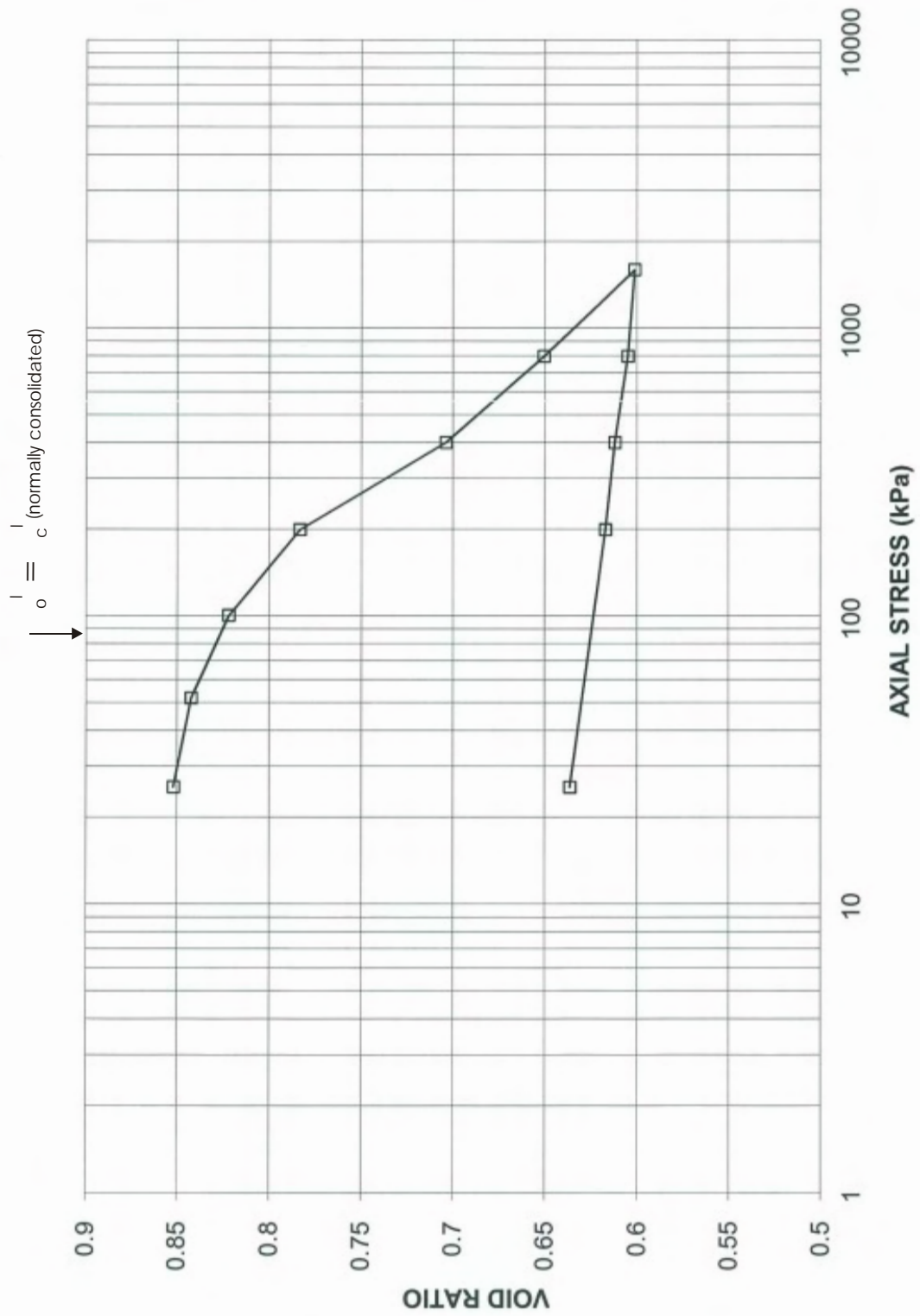
Golder Associates

Checked By: *[Signature]*

CONSOLIDATION TEST VOID RATIO VS LOG AXIAL STRESS

FIGURE B10

CONSOLIDATION TEST
VOID RATIO vs AXIAL STRESS
BH 12-3 SA S10



Appendix C

Site Photographs

**MTO AGREEMENT #5011-E-0010
ENGLEHART PATROL YARD**



Photograph 1: East side of 6-bay garage. Looking north.



Photograph 2: Existing sand/salt domes, dome on the right to be removed. Looking northwest.

**MTO AGREEMENT #5011-E-0010
ENGLEHART PATROL YARD**



Photograph 3: Existing shed and above ground diesel storage tank. Looking east.



Photograph 4: Eastern-most sand/salt dome. Location of proposed structure. Looking north.

**MTO AGREEMENT #5011-E-0010
ENGLEHART PATROL YARD**



Photograph 5: North side of existing domes. Looking east.



Photograph 6: Northern area of the site. Looking northwest.