



**FOUNDATION INVESTIGATION REPORT
FOR
HIGHWAY 401 AND WESTCHESTER BOURNE UNDERPASS AND
INTERCHANGE IMPROVEMENTS
SITE NO. 19-375, HIGHWAY 401
LONDON, ONTARIO
ASSIGNMENT NO. 3016-E-0009
WORK ORDER NO. 13
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DWG. No. WB-A – Borehole Location Coordinates & Elevations
 Notes and References, Legend

DWG. No. WB-1 – Borehole Location Plan

DWG. Nos. WB-2/3 – Soil Stratigraphy

Explanation of Terms Used in Report

Record of Borehole Sheets 1 to 28, N1 to N3, S1 to S3 and C1 and C2

Appendix A – Grain Size Distribution Charts	Figures WB1-GS-1A/B, WB1-GS-2 Figures WB1-GS-3A/B, WB1-GS-4 Figures WB1-GS-5, WB2-GS-1, WB2-GS-2 Figures WB3-GS-1A/B, WB3-GS-2 Figures WB4-GS-1, WB4-GS-2 Figures WB5-GS-1, WB5-GS-2 Figures WB6-GS-1, WB6-GS-2A/B, WB6-GS-3 Figures WB7-GS-1, WB7-GS-2 Figures WB8-GS-1, WB9-GS-1A/B
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Plasticity Charts	Figures WB1-PC-1A/B/C, WB1-PC-2A/B Figures WB2-PC-1A/B, WB3-PC-1A/B Figures WB4-PC-1A/B, WB5-PC-1 Figures WB6-PC-1, WB6-PC-2A/B, WB6-PC-3 Figures WB7-PC-1, WB8-PC-1A/B Figures WB9-PC-1A/B
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Appendix B – Results of Chemical Tests Provided by SGS Canada Inc.

FOUNDATION INVESTIGATION REPORT
for
HIGHWAY 401 UNDERPASS AND INTERCHANGE IMPROVEMENTS
WESTCHESTER BOURNE AND HIGHWAY 401
LONDON, ONTARIO
ASSIGNMENT NO. 3016-E-0009, WORK ORDER NO. 13

1. INTRODUCTION

WSP Canada Group Limited (WSP) has retained Peto MacCallum Ltd. (PML) on behalf of the Ministry of Transportation Ontario (MTO) to conduct the geotechnical investigation in support of the Design Build Ready Report for Agreement No. 3016-E-0009, Work Order No. 13. The Design Build Ready package under Agreement No. 3016-E-0009-013 includes foundation investigation reports for the proposed four (4) overhead signs along Highway 401 at Westchester Bourne (formerly Highway 74), improvements to interchange and replacement of the underpass located at the interchange of Highway 401 and Westchester Bourne.

A foundation investigation report for the proposed overhead signs along the Highway 401 was completed by PML under a separate cover.

This report summarizes the results of the foundation investigation carried out for the proposed exit and entry ramps, and replacement of the existing underpass located at the interchange of Highway 401 and Westchester Bourne in London, Ontario.

The purpose of the investigation was to explore the subsurface conditions expected to influence the design of the replacement structure.

2. SITE DESCRIPTION

The existing Highway 401 roadway is slightly depressed from the natural topography, and accommodates a total of six (6) lanes of vehicular traffic; three (3) westbound lanes and three (3) eastbound lanes. The existing Westchester Bourne accommodates one (1) northbound and one (1) southbound lanes of vehicular traffic and oriented at a skewed angle to Highway 401. The site is generally a flat area, with the exception of the highway and bridge embankments. The site is surrounded by long grass and coniferous forestation with mature trees and shrubs.



The surrounding area is mainly used for farming. A Husky fuel station is located in the southwest quadrant of the Highway 401 and Westchester Bourne interchange. Dorchester is the residential and commercial core of the Municipality of Thames Centre and is located approximately 6.0 km northeast of the site.

3. FIELD INVESTIGATION PROCEDURES

The fieldwork for this investigation was carried out between September 26, 2018 and November 23, 2018. A total of 36 boreholes were advanced to depths ranging from 12 m to 50 m. The Record of Borehole sheets are appended to this report. The borehole coordinates and elevations are presented in DWG. No. WB-A. The borehole location plan is presented in DWG. No. WB-1 and the soil stratigraphic profiles are presented on DWG. Nos. WB-2 and WB-3.

A summary of the borehole depths and locations with respect to the proposed structure are provided on the table below.

Table 3.0 – Summary of Borehole Depths and Locations

FOUNDATION LOCATION	BOREHOLE ID	DEPTH BELOW GROUND LEVEL (m)
North Approach	N-1	15.8
North Abutment	N-2	48.9
North Abutment	N-3	41.8
Centre Pier	C-1	45.7
Centre Pier	C-2	41.3
South Approach	S-1	15.8
South Abutment	S-2	41.8
South Abutment	S-3	50.5



Table 3.0 – Summary of Borehole Depths and Locations

FOUNDATION LOCATION	BOREHOLE ID	DEPTH BELOW GROUND LEVEL (m)
Future W-N/S Ramp	1	14.3
	2	12.8
	3	12.8
	4	14.3
	5	12.8
Future W/S-E Ramp	6	12.8
	7	14.3
	8	14.3
	9	12.8
	10	12.8
South of South Approach	11	15.8
	12	15.8
	13	15.8
Future E-N/S Ramp	14	12.8
	15	14.3
Future W/S-W Ramp	16	12.8
	17	14.3
	18	12.8
	19	14.3
	20	14.3



Table 3.0 – Summary of Borehole Depths and Locations

FOUNDATION LOCATION	BOREHOLE ID	DEPTH BELOW GROUND LEVEL (m)
North of North Approach	21	15.8
	22	15.8
Existing N/S-W Ramp	23	12.8
	24	12.8
	25	12.0
Existing N/S-E Ramp	26	12.8
	27	12.8
	28	12.8

The proposed borehole locations and coordinates were provided by WSP. The coordinates for proposed borehole locations were provided in MTM NAD 83 Northing and Easting. The boreholes were staked out by PML engineering staff, in conformance with the coordinates provided by WSP. Some of the boreholes were relocated during field work due to presence of underground utilities and difficulty to access the planned location of boreholes by drill rig. The locations of boreholes, as drilled, were surveyed by WSP. The vertical and horizontal accuracy of the survey are within 0.1 m. All elevations reported in this report are referred to in MTM NAD 83 Northing and Easting (MTM Zone – ON10) Geodetic datum and expressed in meters.

Traffic control services where required were provided by Almon Equipment Ltd. of Toronto, Ontario, in accordance with Ontario Traffic Manual, Book 7-Temporary Conditions (2014).

PML engineering staff arranged for the clearance of underground services and appropriate permit applications. The respective utility companies cleared the underground services at the borehole locations. Public and private utility authorities were informed and all of the utility clearance documents were obtained before the commencement of drilling work. Fieldwork was supervised on a full-time basis by PML staff operating under the direction of an engineer.



The boreholes were advanced using continuous flight hollow stem augers powered by a truck mounted CME-75 drill rig. The drilling equipment was supplied and operated by Landshark Drilling Inc. (Landshark) of Brantford, Ontario. Landshark is a specialist drilling contractor and the drilling crews worked under the full-time supervision of a member of the PML engineering staff.

Representative soil samples were recovered starting from the existing ground surface (or immediately below the asphalt/concrete layer) and continued at 0.75 m intervals to a depth of 6.0 m using a conventional 51 mm outer diameter split spoon sampler. The samples below 6.0 m to 20.0 m depth were recovered at 1.5 m intervals. Below 20 m depth to the depth of termination of boreholes, the samples were recovered at 3.0 m intervals. The sampler was driven by an automatic hammer in accordance with the Standard Penetration Test (SPT) procedure. Standard penetration tests were conducted simultaneously with the sampling operation to assess the strength characteristics of the substrata.

The soil samples were identified in the field in accordance with the MTO Soil Classification procedures and transported to the Toronto PML laboratory for further visual classification and testing. Index tests (water content determination, grain size distribution and Atterberg limits) were carried out on selected representative samples.

The groundwater conditions at the borehole locations were observed during the drilling by visual examination of the soil samples, sampler and drill rods as the samples were retrieved. In addition, water level measurements were taken in the open boreholes upon completion of drilling. In addition, groundwater level was recorded in a 19.0 mm diameter piezometer installed in Borehole N-3 located north of Highway 401.

Upon completion of drilling, the boreholes were backfilled in accordance with the MTO guidelines and MOE Regulation 903 for borehole abandonment procedures.



4. LABORATORY TEST PROCEDURES

4.1 Soil Testing

Laboratory tests on representative SPT samples recovered during the fieldwork were conducted by the laboratory owned by PML, located in Toronto. The laboratory testing program included the following:

- Natural moisture content determinations (539)
- Grain size distribution analysis (124)
- Atterberg limit tests (128)

All laboratory tests to determine the index properties were performed in accordance with the MTO test procedures, which follow the American Society for Testing Materials (ASTM) standards, with the exception of specific gravity (LS-705) and hydrometer test (LS-702). All the test results are summarized on the attached Record of Borehole Logs provided with the report.

4.2 Chemical Analysis

Six (6) selected samples were sent to SGS Canada Inc. (SGS) in Toronto, Ontario, which is accredited by Canadian Analytical Laboratory Association (CALA) for corrosivity analyses.

5. SITE GEOLOGY AND SUBSURFACE CONDITIONS

5.1 Site Geology

In general, the project area is located within the Mount Elgin Ridges physiographic region, which consists of a series of ridges and vales, as outlined in *The Physiography of Southern Ontario* (Chapman and Putnam, 1984). The ridges are composed mainly of pale brown calcareous clay or silty clay deposits, and it is common to find alluvium of gravel, sand or silt in the vales. The ridges are well drained, while poor drainage prevails in the hollows.

Based on the Bedrock Geology map (MRD126-REV1, 2011) published by the Ontario Ministry of Northern Development and Mines (MNDM), the project site lies within the Dundee rock formation. The project area consists mainly of middle Devonian limestone, dolostone, and shale. The Bedrock Surface map (Map 3.3, 2004) published by Conservation Ontario based on the



Middlesex-Elgin Groundwater Study, suggests that the bedrock surface in this area is expected to be encountered at about El. 230.0 to El. 220.1.

The Quaternary Geology map published by the MNDM indicates that the sub-surface conditions in this area consist of Port Stanley Till comprised of strongly calcareous, moderate to low clast silt to sandy silt.

5.2 Subsurface Conditions

The subsurface conditions encountered during the course of the investigation, together with the field and laboratory test results are shown on the attached Record of Borehole Sheets. The borehole locations are shown in DWG. No. WB-1 and stratigraphic profile sections in DWG. Nos. WB-2 and WB-3. The boundaries between soil strata have been established at the borehole locations only. The boundaries of soil strata between and beyond the boreholes are assumed and may vary from location to location.

The details of the subsoil conditions encountered along the alignment of proposed underpass, future entry and exit ramps and in the area of existing ramps are provided separately. The groundwater level observed is also provided under each area of investigation. Groundwater levels are subject to seasonal fluctuations and precipitation patterns.

5.2.1 Highway 401 Underpass Structure at the Intersection of Westchester Bourne

Boreholes N-1 to N-3, C-1, C-2 and S-1 to S-3 were drilled along the alignment of proposed underpass structure. The approximate locations of the boreholes advanced during current investigation are shown on DWG. No. WB-1. The stratigraphy profile is presented in DWG. No. WB-2.

The subsurface conditions encountered at this site can be categorized into six (6) zones as follows;

- Topsoil
- Pavement Structure
- Sandy Silt Fill
- Clayey Silt, some/with sand, trace/some gravel
- Silt, trace/some sand, trace gravel
- Clayey Silt, trace/some sand, trace/some gravel Till

Summarized descriptions of each layer are presented below.



5.2.1.1 Topsoil

A layer of topsoil was encountered at the existing ground surface (El. 282.2 to El. 284.4) in Boreholes N-1, N-2 and S-1 to S-3. The thickness of topsoil was approximately 300 mm.

5.2.1.2 Pavement Structure

Pavement structure, comprised of 150 mm thick asphalt over silty sand with gravel, was encountered immediately at the existing ground surface in Boreholes C-1 and C-2 at El. 280.8 and El. 280.6, respectively. The granular fill extended to 1.2 m (El. 279.6) and 1.5 m (El. 279.1) below the existing ground surface in Boreholes C-1 and C-2, respectively.

The SPT “N”-values recorded for the gravelly sand fill layer ranged from 21 to 38, indicating compact to dense state of compaction. The moisture contents of the gravelly sand fill were between 4.5% and 5.5%.

5.2.1.3 Sandy Silt (Fill)

Sandy silt fill was encountered below the topsoil in Borehole N-1 at 0.3 m (El. 284.1) and extends to 1.8 m (El. 282.6). The SPT “N”-values recorded were 5 and 7. Moisture content determinations were 22.0% and 22.2%.

5.2.1.4 Clayey Silt, Some/with Sand, Trace/Some Gravel

Clayey silt was encountered below granular fill in Boreholes C-1 and C-2 at 1.2 m (El. 279.6) and 1.5 m (279.1), whereas, the clayey silt was encountered in Borehole N-1 below sandy silt fill at 1.8 m (El. 282.6). In Boreholes N-2, S-1, S-2 and S-3, the clayey silt was encountered below topsoil at 0.3 m (El. 282.2 to El. 283.6). The clayey silt was encountered at the existing ground surface (El. 284.3) at Borehole N-3 location.

The SPT “N”-values recorded for the clayey silt ranged between 4 and 31, indicating firm to hard in consistency. Moisture content determinations for the clayey silt ranged from 10.2% to 29.8%, with an average moisture content of 16.9%.

The grain size distribution results of eighteen (18) representative samples are presented on Figure WB1-GS-1A/B and a total of twenty (20) Atterberg limits test results are presented on Figure WB1-PC-1A/B/C. These samples contained 0 to 17% gravel, 11% to 24% sand, 46% to



85% silt and 4% to 26% clay sized particles. The liquid limits of the clayey silt samples were between 20 and 26 and the plastic limits were between 12 and 15, respectively. The values of plasticity index computed range between 7 and 12. Based on the results of Atterberg limit tests, the soil may be classified as clayey silt of low plasticity (CL/CL-ML) in the Unified Soil Classification System (USCS).

5.2.1.5 Silt, Trace/Some Sand, Trace Gravel

Silt was encountered following clayey silt in all boreholes at depths ranging from 10.7 m to 15.0 m (El. 268.8 to El. 270.2) below the existing ground surface. The silt extends to 15.0 m to 18.9 m (El. 264.8 to El. 268.6) below the existing ground surface. Borehole N-1 was terminated in the silt layer at 15.8 m (El. 268.6).

The SPT "N"-values recorded for the silt ranged between 25 and 104, indicating compact to very dense in compactness. Moisture content determinations of the silt ranged from 18.3% to 22.8%, with an average moisture content of 21.0%.

The grain size distribution results of nine (9) representative samples are presented on Figure WB1-GS-2. These samples contained 1 to 12% sand, 87% to 94% silt and 1% to 9% clay sized particles.

5.2.1.6 Clayey Silt, Trace/Some Sand, Trace/Some Gravel Till

Clayey silt till was encountered following silt in all boreholes, except in Borehole N-1, at 15.0 m to 18.9 m (El. 264.8 to El. 268.6). This layer extended to 15.8 m to 50.5 m (El. 266.4 to El. 232.0). Very dense sandy silt to silty sand till layer was encountered within the clayey silt till layer in Boreholes C-1, C-2, S-2, S-3 and N-2 at 36.6 m to 42.7 m (El. 244.2 to El. 240.6). The sandy silt to silty sand till layer extended to 41.3 to 48.6 m (El. 240.7 to El. 235.3). In Boreholes N-2, C-1 and S-3, the sandy silt to silty sand till layer was fully penetrated at depths of 42.7 m to 48.6 m (El. 235.3 to El. 238.1) below the existing ground surface. Boreholes C-2 and S-2 were terminated in the silty sand to sandy silt till layer at 41.3 m (El. 239.3) and 41.8 m (El. 240.7).

The SPT "N"-values recorded for the clayey silt till ranged between 16 blows for 0.3 m penetration and 121 blows for 0.2 m penetration, indicating very stiff to hard in consistency. Moisture content



determinations of the clayey silt till ranged from 8.7% to 23.9%, with an average moisture content of 16.3%.

The grain size distribution results of twelve (12) representative samples from clayey silt are presented on Figure WB1-GS-3A/B and a total of sixteen (16) Atterberg limits test results are presented on Figure WB1-PC-2A/B. These samples contained 0 to 13% gravel, 0% to 21% sand, 53% to 65% silt and 15% to 45% clay sized particles. The liquid limits of the clayey silt samples were between 17 and 32 and the plastic limits were between 12 and 17, respectively. The values of plasticity index computed range between 5 and 15. Based on the results of Atterberg limit tests, the soil may be classified as clayey silt of low plasticity (CL/CL-ML) in the USCS.

The SPT "N"-values recorded for the silty sand to sandy silt till ranged between 70 blows for 0.3 m penetration and 136 blows for 0.2 m penetration, indicating very dense in compactness. Moisture content determinations of the silty sand to sandy silt till ranged from 9.2% to 16.6%, with an average moisture content of 13.1%.

The grain size distribution results of two (2) representative samples from silty sand till are presented on Figure WB1-GS-4. These samples contained 0 to 4% gravel, 39% to 73% sand, 19% to 53% silt and 4% to 8% clay sized particles.

The grain size distribution results of two (2) representative samples from sandy silt till are presented on Figure WB1-GS-5. These samples contained 0 to 3% gravel, 16% to 34% sand, 64% to 68% silt and 2% to 13% clay sized particles.

5.2.1.7 Groundwater

Groundwater observations were made during and upon completion of auguring in each borehole. Groundwater level recorded upon completion of auguring of Borehole N-1 was at 14.0 m (El. 270.4) below the existing ground surface. Other boreholes were charged with drilling mud/water and groundwater level could not be established.

The groundwater level in Borehole N-3 on December 24, 2018 was measured in the 19 mm diameter piezometer at 0.5 m (El. 283.8) below the existing ground surface.



5.2.2 Future W-N/S Ramp from Highway 401 East to Westchester Bourne

Boreholes 1 to 5 were drilled along the proposed alignment of future W-N/S Ramp from Highway 401 east to Westchester Bourne. The approximate locations of the boreholes advanced during current investigation are shown on DWG. No. WB-1. The stratigraphy profile is presented in DWG. No. WB-2.

The subsurface conditions encountered at this site can be categorized into 5 (five) zones as follows.

- Topsoil
- Fill
- Clayey Silt, some/with sand, trace gravel
- Silt, trace/some clay, trace sand
- Lower Clayey Silt

Summarized descriptions of each layer are presented below.

5.2.2.1 Topsoil

A layer of topsoil was encountered at the existing ground surface (El. 277.4 to El. 282.6) in Boreholes 1 to 5. The thickness of topsoil approximately ranged from 200 mm to 300 mm.

5.2.2.2 Fill

The composition of the fill along the site varied from Sandy Silt /Silty Sand to Clayey Silt.

5.2.2.2.1 *Silty Sand to Sandy Silt (Fill)*

A silty sand to sandy silt fill layer, with varying proportions of gravel and clay, was encountered in Boreholes 2 and 4 below topsoil at 0.3 m and 0.2 m (El. 277.2 and El. 282.4) below the existing ground surface and extends to 1.5 (El. 276.0 and 281.1), respectively.

The SPT "N"-values recorded in the cohesionless fill varied from 2 to 11 blows, indicating very loose to compact state of compaction. Moisture content determinations of the cohesionless fill ranged between 5.1% and 11.6%. The fill layer may be encountered between and beyond borehole locations.



5.2.2.2.2 *Clayey Silt (Fill)*

Clayey silt fill was encountered below silty sand to sandy silt fill in Borehole 4 at 1.5 m (El. 281.1) and extends to 3.8 m (El. 278.8). In Borehole 5, the clayey silt fill was encountered below topsoil at 0.2 m (El. 281.2) and extends to 2.0 m (El. 279.4). Asphalt debris was encountered within the clayey silt fill.

The SPT “N”-values recorded in the clayey silt fill varied widely from 6 to 32 blows, indicating firm to hard consistency. The higher SPT “N”-values are most probably due to the presence of asphalt debris. Moisture content determinations of the clayey silt fill samples ranged between 4.2% and 16.3%.

5.2.2.3 *Clayey Silt, Some/With Sand, Trace Gravel*

Clayey silt was encountered below the topsoil in Boreholes 1 and 3 at 0.3 m and 0.2 m (El. 277.1 and El. 281.1), respectively. In Boreholes 2, 4 and 5, the clayey silt was encountered below the fill at 1.5 m to 3.8 m (El. 279.4 to El. 276.0). This layer extends to 12.2 m to 14.3 m (El. 263.1 to El. 269.1) below the existing ground surface. A compact silt layer was encountered within the clayey silt layer in Borehole 1 at 7.6 m (El. 269.8), which extended to 12.2 m (El. 265.2) below the existing ground surface. Presence of cobbles was assessed based on drilling rate in Borehole 3 from 10.7 m to 11.0 m (El. 270.6 to El. 270.3). Borehole 2 was terminated in the clayey silt at 12.8 m (El. 264.7) below the existing ground surface.

The SPT “N”-values recorded ranged between 1 and 35, indicating very soft to hard consistency. Localized SPT “N”-values of 87 blows for 0.25 m penetration was recorded in Borehole 3 at the depth the presence of cobbles was assessed. Moisture content determinations of the clayey silt ranged from 10.8% to 26.4%, with an average moisture content of 14.5%.

The grain size distribution results of seven (7) representative samples from clayey silt are presented on Figure WB2-GS-1 and a total of thirteen (13) Atterberg limits test results including seven (7) corresponding to grain size distribution results are presented on Figures WB2-PC-1A/B. These samples contained 1% to 9% gravel, 16% to 23% sand, 52% to 56% silt and 20% to 26% clay sized particles. The liquid limits of the clayey silt samples were between 21 and 26 and the plastic limits were between 13 and 15, respectively. The values of plasticity index computed



range between 7 and 11. Based on the results of Atterberg limit tests, the soil may be classified as clayey silt of low plasticity (CL/CL-ML) in the USCS.

The SPT “N”-values recorded in the silt deposit encountered within the clayey silt ranged from 10 to 22 blows. Moisture content determinations for silt samples ranged from 21.8% to 22.7%.

A grain size analysis performed on a silt sample from Borehole 1 is presented in Figure WB2-GS-2. The sample contained 2% sand, 88% silt and 10% clay sized particles.

5.2.2.4 Silt, Trace/Some Clay, Trace Sand

A compact to dense silt was encountered below the clayey silt in Boreholes 3 to 5 at 12.2 m to 13.7 m (El. 269.1 to El. 268.9) and extended to the termination depth of the boreholes at 12.8 m to 14.3 m (El. 268.6 to El. 268.3).

The SPT “N”-values recorded generally varied from 18 to 40 blows, indicating compact to dense state of compactness.

The grain size analysis performed on selected samples from Boreholes 3 and 4 are presented on Figure WB2-GS-2. The sample contained 2% to 4% sand, 86% to 89% silt and 7% to 12% clay sized particles. Moisture content determinations of the silt samples ranged between 18.7% and 24.1%.

5.2.2.5 Lower Clayey Silt

A lower clayey silt was encountered below the silt layer in Borehole 1 at a depth of 12.2 m (El. 265.2) and extended to depth of 14.3 m (El. 263.1), the termination depth of borehole.

Two SPT “N”-values recorded were 10 and 12, indicating stiff consistency. Moisture content determinations of the lower clayey silt ranged from 11.7% to 26.4%, with an average moisture content of 19.1%.

Atterberg limits test results for a clayey silt sample are presented on Figure WB2-PC-1A. The liquid limit of the clayey silt sample was 27 and the plastic limit was 12, respectively. The values of plasticity index computed was 15. Based on the results of Atterberg limit tests, the soil may be classified as clayey silt of low plasticity (CL) in the USCS.



5.2.2.6 Groundwater

Groundwater observations were made during and upon completion of auguring in each borehole. Groundwater in Borehole 3 was first observed during auguring at 6.1 m (El. 275.2) below the existing ground surface. Groundwater level recorded in Boreholes 1 and 2 upon completion of auguring were at 9.2 m and 9.3 m (El. 268.2 and El. 268.3) below the existing ground surface. Groundwater was not observed upon completion of drilling, of Borehole 3.

5.2.3 Future W/S-E Ramp from Westchester Bourne to Highway 401 East

Boreholes 6 to 10 were drilled along the proposed alignment of future W/S-E Ramp from Westchester Bourne to Highway 401 east. The approximate locations of the boreholes advanced during current investigation are shown on DWG. No. WB-1. The stratigraphy profile is presented in DWG. No. WB-2.

The subsurface conditions encountered at this site can be categorized into 4 (four) zones as follows.

- Topsoil
- Fill
- Clayey Silt, trace/some sand, trace gravel
- Silt, trace clay, trace sand, trace gravel

Summarized descriptions of each layer are presented below.

5.2.3.1 Topsoil

A layer of topsoil was encountered at the existing ground surface (El. 279.3 to El. 282.4) in Boreholes 6, 8, 9, and 10. The thickness of topsoil approximately ranged from 200 mm to 300 mm.

5.2.3.2 Fill

The composition of the fill along the site varied from Sandy Silt /Silty Sand to Clayey Silt.

5.2.3.2.1 Silty Sand to Sandy Silt (Fill)

A silty sand to sandy silt fill layer, with varying proportions of gravel and clay, was encountered in Boreholes 6, 8 and 10 below topsoil at 0.2 m to 0.3 m (El. 282.0 to El. 279.0) below the existing ground surface and extends to 0.8 m to 4.4 m (El. 278.5 to 277.9), respectively.



The SPT “N”-values recorded in the cohesionless fill varied from 3 to 40 blows, indicating very loose to dense state of compaction. Moisture content determinations of the cohesionless fill ranged between 8.7% and 26.0%. The fill layer may be encountered between and beyond borehole locations.

5.2.3.2.2 Clayey Silt (Fill)

Clayey silt fill was encountered in Borehole 9 below topsoil at 0.2 m (El. 282.2) and extends to 0.9 m (El. 281.5). The SPT “N”-values recorded in the clayey silt fill was 7 blows, indicating firm consistency. Moisture content determination of the clayey silt fill sample was 18.7%.

5.2.3.3 Clayey Silt, Trace/Some Sand, Trace Gravel

Clayey silt was encountered below the fill deposits in Boreholes 6, 8, 9 and 10 at 0.8 m to 4.4 m (El. 281.5 to El. 277.9), whereas this layer was encountered at the existing ground surface (El. 281.6) in Borehole 7. This layer extends to 10.7 m to 12.8 m (El. 270.2 to 268.6) below the existing ground surface. Borehole 9 was terminated within this deposit at the depth of 12.8 m (El. 269.6) below the existing ground surface.

The SPT “N”-values recorded generally ranged between 5 and 36, indicating firm to hard consistency. Moisture content determinations of the clayey silt ranged from 10.3% to 19.0%, with an average moisture content of 14.3%.

The grain size distribution results of twelve (12) representative samples from clayey silt are presented on Figure WB3-GS-1A/B and a total of fifteen (15) Atterberg limits test results are presented on Figure WB3-PC-1A/B. These samples contained 0 to 6% gravel, 9% to 20% sand, 52% to 58% silt and 21% to 33% clay sized particles. The liquid limits of the clayey silt samples were between 21 and 28 and the plastic limits were between 13 and 15, respectively. The values of plasticity index computed range between 8 and 11. Based on the results of Atterberg limit tests, the soil may be classified as clayey silt of low plasticity (CL) in the USCS.

5.2.3.4 Silt, Trace Clay, Trace Sand, Trace Gravel

A compact to very dense silt was encountered below the clayey silt in Boreholes 6 to 8 and 10 at 10.7 m to 13.7 m (El. 270.2 to El. 268.6) and extended to the termination of the boreholes at 12.8 m to 14.3 m (El. 268.4 to El. 266.5), respectively.



The SPT “N”-values recorded generally varied from 10 to 58 blows, indicating compact to very dense state of compactness. Moisture content determinations of the silt samples ranged between 15.9% and 24.0%.

The grain size analysis performed on selected four (4) samples from Boreholes 6, 7, 8 and 10 are presented on Figure WB3-GS-2. The sample contained 2% to 11% sand, 85% to 94% silt and 3% to 11% clay sized particles.

5.2.3.5 Groundwater

Groundwater observations were made during and upon completion of auguring in each borehole. Groundwater in Borehole 6 was first observed during auguring at 11.0 m (El. 270.2) below the existing ground surface. Groundwater level recorded in Borehole 10 upon completion of auguring was at 10.4 m (El. 268.9) below the existing ground surface. Groundwater was not observed in Boreholes 6 to 9 upon completion of auguring.

5.2.4 South of South Approach along Westchester Bourne

Boreholes 11 to 13 were drilled along Westchester Bourne near the area south of south approach to the underpass. The approximate locations of the boreholes advanced during current investigation are shown on DWG. No. WB-1. The stratigraphy profile is presented in DWG. No. WB-2.

The subsurface conditions encountered at this site can be categorized into 4 (four) zones as follows.

- Topsoil
- Fill
- Clayey Silt, trace/some sand, trace gravel
- Silt, trace clay, trace sand

Summarized descriptions of each layer are presented below.

5.2.4.1 Topsoil

A layer of topsoil was encountered at the existing ground surface (El. 279.0 to El. 281.7) in Boreholes 11, 12, and 13. The thickness of topsoil approximately ranged from 200 mm to 300 mm.

5.2.4.2 Fill

The composition of the fill along the site varied from Sandy Silt /Silty Sand to Clayey Silt.



5.2.4.2.1 Clayey Silt (Fill)

Clayey silt fill was encountered in Boreholes 12 and 13 below the topsoil at 0.2 m (El. 280.5) and 0.3 m (El. 278.7) below the existing ground surface. The layer extends to 2.3 m (278.4) and 0.8 m (El. 278.2) in Boreholes 12 and 13, respectively.

The SPT “N”-values recorded in the clayey silt fill varied from 3 to 5 blows, indicating soft to firm consistency. Moisture content determinations of the clayey silt fill samples ranged between 24.2% and 27.6%.

5.2.4.2.2 Silty Sand to Sandy Silt, Trace Gravel (Fill)

Silty sand to sandy silt fill layer, with varying proportions of gravel and clay, was encountered in Boreholes 11 and 13. Silty sand fill layer was encountered in Borehole 11 at 0.3 m (El. 281.4) below the topsoil and extends to 1.5 m (El. 280.2) below the existing ground surface, whereas, the sandy silt fill layer was encountered below the clayey silt fill layer at 0.8 m (El. 278.2) and extends to 1.5 m (El. 277.5), below the existing ground surface.

The SPT “N”-values recorded in the cohesionless fill varied from 4 to 10 blows, indicating loose to compact state of compaction. Moisture content determinations of the cohesionless fill ranged between 16.7% and 22.5%. The fill layer may be encountered between and beyond borehole locations.

5.2.4.3 Clayey Silt, Trace/Some Sand, Trace Gravel

Clayey silt was encountered below cohesionless fill in Boreholes 11 and 13, whereas this layer was encountered below the clayey silt fill in Borehole 12. This deposit was encountered at 1.5 m to 2.3 m (El. 280.2. to El. 277.5) and extends to 12.5 m to 15.8 m (El. 269.2 to El. 263.2) below the existing ground surface. Boreholes 12 and 13 were terminated within this deposit at the depth of 15.8 m (El. 264.9 and El. 263.2) below the existing ground surface.

The SPT “N”-values recorded generally ranged between 3 and 5, indicating soft to firm consistency. Moisture content determinations of the clayey silt ranged from 12.3% to 24.2%, with an average moisture content of 14.9%.



The in-situ vane shear strength (C_u) of the clayey soil in Borehole 13, between El. 272.0 and El. 271.0, was determined to be 105 kPa, with a sensitivity of 6.

The grain size distribution results of three (3) representative samples from clayey silt are presented on Figure WB4-GS-1 and a total of eleven (11) Atterberg limits test results including three (3) corresponding to grain size distribution results are presented on Figure WB4-PC-1A/B. These samples contained 1% to 7% gravel, 14% to 18% sand, 54% to 57% silt and 24% to 25% clay sized particles. The liquid limits of the clayey silt samples were between 22 and 31 and the plastic limits were between 13 and 16, respectively. The values of plasticity index computed range between 8 and 15. Based on the results of Atterberg limit tests, the soil may be classified as clayey silt of low plasticity (CL) in the USCS.

5.2.4.4 Silt, Trace Clay, Trace Sand

A compact to dense silt was encountered below the clayey silt in Borehole 11 at 12.5 m (El. 269.2) and extended to the termination depth of the borehole at 15.8 m (El. 265.9) below the existing ground surface.

The SPT "N"-values recorded generally varied from 14 to 32 blows, indicating compact to dense state of compactness. Moisture content determinations of the silt samples were 18.1% and 19.5%.

The grain size analysis performed on selected sample from Borehole 11 is presented on Figure WB4-GS-2. The sample contained 8% sand, 87% silt and 5% clay sized particles.

5.2.4.5 Groundwater

Groundwater observations were made during and upon completion of auguring in each borehole. Groundwater was first observed during auguring in Borehole 13 at 3.8 m (El. 275.2) below the existing ground surface. Groundwater level recorded in Boreholes 11 and 13 upon completion of auguring were at depths of 12.8 m (El. 268.9) and 9.8 m (El. 269.2) below the existing ground surface, respectively. Groundwater was not observed in Borehole 12 upon completion of auguring.



5.2.5 Future E-N/S Ramp from Highway 401 West to Westchester Bourne

Boreholes 14 and 15 were drilled along the proposed alignment of future E-N/S Ramp from Highway 401 west to Westchester Bourne. The approximate locations of the boreholes advanced during current investigation are shown on DWG. No. WB-1. The stratigraphy profile is presented in DWG. No. WB-3.

The subsurface conditions encountered at this site can be categorized into 5 (five) zones as follows.

- Topsoil
- Fill
- Peat
- Clayey Silt, trace to some sand, trace gravel
- Silt, some sand, some clay

Summarized descriptions of each layer are presented below.

5.2.5.1 Topsoil

A layer of topsoil was encountered at the existing ground surface (El. 284.0) in Borehole 14. The thickness of topsoil approximately was 300 mm.

5.2.5.2 Fill

The composition of the fill along the site varied from Silty Sand with Gravel to Clayey Silt.

5.2.5.2.1 *Silty Sand with Gravel (Fill)*

Silty sand with gravel fill was encountered in Borehole 14 below topsoil at 0.3 m (El. 283.7) and extends to 1.5 m (El. 282.5) below the existing ground surface, respectively.

The SPT “N”-values recorded in the cohesionless fill were 30 and 43 blows, indicating dense state of compaction. Moisture content determinations of the cohesionless fill ranged were 10.2% and 14.7%. The fill layer may be encountered between and beyond borehole locations.



5.2.5.2.2 *Clayey Silt (Fill)*

Clayey silt fill was encountered in Borehole 15 at the existing ground surface (El. 284.9) and extends to 2.2 m (El. 282.7). Asphalt and wood debris were encountered with the fill deposit from 1.5 m (El. 283.4) to 2.2 m (El. 282.7) below the existing ground surface.

The SPT “N”-values recorded in the clayey silt fill varied widely from 6 to 11 blows, indicating firm to stiff consistency. Moisture content determinations of the clayey silt fill samples ranged between 12.9% and 15.6%.

5.2.5.3 *Peat*

Peat was encountered in Borehole 15 at 2.2 m (EL 282.7) and extended to 6.1 m (El. 278.8) below the existing ground surface. Asphalt debris was present within the top portion of the peat deposit from El. 282.7 to El. 282.0.

The SPT “N”-values recorded in the peat varied from 1 to 7 blows, indicating very soft to firm consistency. Higher SPT values at the upper portion could be probably due to the presence of asphalt debris. Moisture content determinations of the fibrous organic soil sample ranged between 80.8% and 454.6%.

5.2.5.4 *Silt, Some Sand, Some Clay*

Silt of 0.6 m thickness was encountered following the peat in Borehole 15 at 6.1 m (El. 278.8) and extended to 6.7 m (El. 278.2). A SPT “N”-value recorded was 2 blows, indicating very loose compactness state. A moisture content determination of the silt sample was 24.1%.

The grain size analysis performed on a selected sample from Borehole 15 is presented on Figure WB5-GS-2. The sample contained 15% sand, 76% % silt and 9% clay sized particles.

5.2.5.5 *Clayey Silt, Trace to Some Sand, Trace Gravel*

Clayey silt was encountered below silty sand to sandy silt fill in Borehole 14 at 1.5 m (El. 282.5). In Borehole 15, the clayey silt layer was encountered below silt at 6.7 m (El. 278.2). The cohesive layer extended to the termination depths of 12.8 m (El. 271.2) and 14.3 m (El. 270.6) below the existing ground surface in Boreholes 14 and 15, respectively.



The SPT “N”-values recorded varied between 1 and 19, indicating very soft to very stiff consistency. Moisture content determinations of the clayey silt ranged from 10.4% to 21.2%, with an average value of 14.8%.

The in-situ vane shear strengths (C_u) of the clayey soil in Borehole 15, between El. 279.0 and El. 274.0, were between 91 kPa and 113 kPa, with sensitivity ranging between 3 and 6.

The grain size distribution results of seven (7) representative samples from clayey silt are presented on Figure WB5-GS-1 and a total of seven (7) Atterberg limits test results are presented on Figure WB5-PC-1. These samples contained 0 to 9% gravel, 1% to 21% sand, 52% to 77% silt and 22% to 33% clay sized particles. The liquid limits of the clayey silt samples were between 21 and 25 and the plastic limits were between 10 and 16, respectively. The values of plasticity index computed range between 7 and 14. Based on the results of Atterberg limit tests, the soil may be classified as clayey silt of low plasticity (CL/CL-ML) in the USCS.

5.2.5.6 Groundwater

Groundwater observations were made during and upon completion of auguring in each borehole. Groundwater level in Borehole 15 was at 11.0 m (El. 273.9) below the existing ground surface upon completion of auguring.

5.2.6 Future W/S-W Ramp from Westchester Bourne to Highway 401 West

Boreholes 16 to 20 were drilled along the proposed alignment of future W/S-W ramp from Westchester Bourne to Highway 401 west. The approximate locations of the boreholes advanced during current investigation are shown on DWG. No. WB-1. The stratigraphy profile is presented in DWG. No. WB-3.



The subsurface conditions encountered at this site can be categorized into 5 (five) zones as follows.

- Topsoil
- Fill
- Organic Silt/Silt
- Clayey Silt, trace to with sand, trace gravel
- Silty Sand with gravel

Summarized descriptions of each layer are presented below.

5.2.6.1 Topsoil

A layer of topsoil was encountered at the existing ground surface (El. 284.0 to El. 286.6) in Boreholes 16 to 20. The thickness of topsoil approximately ranged from 200 mm to 300 mm (El. 283.8 to El. 286.3).

5.2.6.2 Fill

The composition of the fill along the site varied from clayey silt to silty sand.

5.2.6.2.1 Clayey Silt With/Some Sand, Some/Trace Gravel (Fill)

Clayey silt fill was encountered below the topsoil in Boreholes 16, 17, 19 and 20 at 0.3 m (El. 284.8 to El. 286.3) below the existing ground surface. The clayey silt fill extends to 2.3 m to 3.0 m (El. 282.8 to El. 284.3). Asphalt debris was encountered within the clayey silt fill in Boreholes 16, 19 and 20 at varying depths.

The SPT “N”-values recorded in the clayey silt fill varied from 6 to 20 blows, indicating firm to very stiff consistency. Moisture content determinations of the clayey silt fill samples ranged between 8.1% and 17.6%.

5.2.6.2.2 Silty Sand with Gravel (Fill)

Silty sand with gravel fill was encountered in Boreholes 16 and 20 at 3.0 m (El. 283.3) and 2.3 m (El. 284.3) and extends to 3.8 m (El. 282.5) and 3.1 m (El. 283.5) below the existing ground surface, respectively.



The SPT “N”-values recorded in the silty sand with gravel fill were 6 and 10 blows, indicating loose to compact state of compactness. Moisture content determinations of the samples were reported 10.6% and 15.3%.

5.2.6.3 Organic Silt/Silt

Organic silt was encountered in Boreholes 16, 17, 19 and 20 at 2.3 m to 3.8 m (El. 282.5 to El. 283.8) and extends to 3.4 m to 6.4 m (El. 282.3 to El. 280.2) below the existing ground surface, respectively.

The SPT “N”-values recorded in the organic fill ranged from 1 to 8 blows. Moisture content determinations of the samples ranged between 21.7% and 166.1%.

The grain size analysis performed on a selected organic silt sample from Borehole 20 is presented on Figure WB6-GS-1 and the respective Atterberg limits test results are presented on Figure WB6-PC-1. The sample contained 12% sand, 70% silt and 18% clay sized particles. The liquid limit was 36 and the plastic limit was 23. The plasticity index determined was 13.

A very loose silt deposit was encountered following organic silt in Borehole 16 at 4.5 m (El. 281.8), which extends to 5.2 m (El. 281.1) below the existing ground surface. A loose silty deposit was encountered above the organic silt at 2.3 m (El. 282.8) in Borehole 17 and extends to 3.1 m (El. 282.0). The SPT “N”-values recorded were 3 and 5. Two moisture content determinations of silt samples were 14.5% and 17.9%.

5.2.6.4 Clayey Silt, Trace to With Sand, Trace Gravel

Clayey silt was encountered in below organic silt/silt in Boreholes 16, 17, 19 and 20 at 3.4 m to 6.4 m (El. 282.3 to 280.2). In Borehole 18, the clayey silt was encountered below topsoil at 0.2 m (El. 283.8). This layer extends to 12.8 m to 14.3 m (El. 273.5 to 270.8). All boreholes, except Borehole 20, were terminated in the clayey silt.

The SPT “N”-values recorded ranged between 3 and 46, indicating soft to hard consistency. Moisture content determinations of the samples from clayey silt layer ranged from 10.1% to 43.9%, with an average value of 15.4%



The in-situ vane shear strengths (C_u) of the clayey soil in Boreholes 16 to 18, between El. 282.0 and El. 278.0, were between 76 kPa and 91 kPa, with sensitivity ranging between 2 and 8.

The grain size distribution results of sixteen (16) representative samples from clayey silt are presented on Figure WB-6-GS-2A/B and sixteen (16) Atterberg limits test results are presented on Figure WB6-PC-2A/B. These samples contained 0 to 11% gravel, 11% to 23% sand, 48% to 62% silt and 15% to 30% clay sized particles. The liquid limits of the clayey silt samples were between 16 and 25 and the plastic limits were between 12 and 15, respectively. The values of plasticity index computed range between 4 and 10. Based on the results of Atterberg limit tests, the soil may be classified as clayey silt of low plasticity (CL/CL-ML) in the USCS.

5.2.6.5 Silty Sand with Gravel

Compact silty sand with gravel was encountered below the clayey silt in Borehole 20 at 13.7 m (El. 272.9), which extends to the termination depth of 14.3 m (El. 272.3) below the existing ground surface.

The SPT "N"-value recorded was 20 blows, indicating compact state of compaction. Moisture content determination results of the silty sand deposit was 8.6%.

The grain size analysis performed on a selected sample from Borehole 20 is presented on Figure WB6-GS-3 and the respective Atterberg limits test results are presented on Figure WB6-PC-3. The sample contained 21% gravel, 49% sand, 22% silt and 8% clay sized particles. The liquid limit was 15 and the plastic limit was 12. The plasticity index computed was 3.

5.2.6.6 Groundwater

Groundwater observations were made in each borehole during and upon completion of auguring. Groundwater level in Borehole 20 was at 11.9 m (El. 274.7) below the existing ground surface upon completion of auguring.



5.2.7 North of North Approach

Boreholes 21 and 22 were drilled along Westchester Bourne near the area north of north approach to the underpass. The approximate locations of the boreholes advanced during current investigation are shown on DWG. No. WB-1. The stratigraphy profile is presented in DWG. No. WB-3.

The subsurface conditions encountered at this site can be categorized into 3 (three) zones as follows.

- Topsoil
- Clayey Silt, (Fill)
- Clayey Silt, Some Sand, Trace Gravel

Summarized descriptions of each layer are presented below.

5.2.7.1 Topsoil

A layer of topsoil with a thickness of 200 mm to 300 mm was encountered at the existing ground surface in Boreholes 21 and 22 (El. 285.6 and El. 284.9), which extends to El. 285.3 and El. 284.7.

5.2.7.2 Clayey Silt Fill

Clayey silt fill was encountered in Borehole 21 at 0.3 m (El. 285.3) and extends to 1.5 m (El. 284.1) below the existing ground surface, respectively. Asphalt debris was encountered within the clayey silt fill.

The SPT “N”-values recorded in the fill were 7 and 14 blows, indicating firm to stiff consistency. The fill layer may be encountered between and beyond borehole locations. Moisture content determinations of the fill were 14.6% and 19.4%.

5.2.7.3 Clayey Silt, Some Sand, Trace Gravel

This clayey silt layer was encountered following the topsoil in Borehole 22 at El. 284.7. In Borehole 21, the clayey silt layer was encountered following the clayey silt fill at El. 284.1. This layer extends to the termination depth of the Boreholes 21 and 22 at 15.8 m (El. 269.8 and EL. 269.1) below the existing ground surface. The clayey silt layer in Borehole 21 is interbedded with a 1.3 m thick silt layer from a depth of 13.7 m to 15.0 m (El. 271.9 to El. 270.6).



The SPT “N”-values recorded generally ranged between 10 blows and 26 blows, with the exception of one SPT value of 45 blows below the silt layer in Borehole 21, indicating stiff to very stiff consistency. Moisture content determinations of the samples from clayey silt layer ranged from 5.2% to 19.5%, with an average value of 14.4%.

The grain size distribution results of seven (7) representative samples from the clayey silt layer are presented on Figure WB7-GS-1. Atterberg limits test results of seven (7) representative samples are presented on Figure WB7-PC-1. These samples contained 1% to 5% gravel, 3% to 19% sand, 54% to 77% silt and 19% to 26% clay. The liquid limits of the clayey silt samples vary between 21 and 23 and the plastic limits determined vary between 13 and 16. The values of plasticity index computed range between 6 and 10. Based on the results of Atterberg limit tests, the soil may be classified as clayey silt of low plasticity (CL/CL-ML) in the USCS.

One SPT “N”-value of 37 blows was recorded in the silt layer, indicating dense state of compaction. The moisture content of the silt sample was 18.8%.

The grain size analysis performed on one sample from the silt layer encountered in Borehole 21 is presented on Figure WB7-GS-2. The sample contained 6% sand, 89% silt and 5% clay sized particles. Moisture content determination of the silt sample was 18.8%.

5.2.7.4 Groundwater

Groundwater observations were made in both boreholes during and upon completion of auguring. Groundwater level upon completion of auguring of Borehole 21 was observed at 13.4 m (El. 272.2) below the existing ground surface. However, groundwater was not encountered during or upon completion of Borehole 22.

5.2.8 Existing N/S-W Ramp from Westchester Bourne to Highway 401 West

Boreholes 23 to 25 were drilled along the existing N/S-W Ramp from Westchester Bourne to Highway 401 west. The approximate locations of the boreholes advanced during current investigation are shown on DWG. No. WB-1. The stratigraphy profile is presented in DWG. No. WB-3.



The subsurface conditions encountered at this site can be categorized into 2 (two) zones as follows.

- Silty Sand with Gravel (Fill)
- Clayey Silt, trace/some sand, trace gravel

Summarized descriptions of each layer are presented below.

5.2.8.1 Silty Sand with Gravel (Fill)

Silty sand fill was encountered immediately below the existing ground surface (El. 285.9 to El. 283.2) in Boreholes 23, 24 and 25. The depth of the fill extends to 0.8 m to 1.5 m (El. 284.4 to El. 281.5) below the existing ground surface in all three boreholes.

The SPT “N”-values recorded in the pavement fill varied from 24 to 42 blows, indicating compact to dense state of compaction. The fill layer may be encountered between and beyond borehole locations. Moisture content determinations of the fill ranged between 2.7% and 3.1%.

5.2.8.2 Clayey Silt, Trace/Some Sand, Trace Gravel

Clayey silt was encountered below silty sand fill in Boreholes 23, 24 and 25 at 0.8 m to 1.5 m (El. 281.5 to El. 284.4) below the existing ground surface. This deposit extends to the termination depth of 12.8 m (El. 273.1 to El. 269.5) below the existing ground surface in all three boreholes.

The SPT “N”-values recorded ranged between 5 and 20, indicating firm to very stiff consistency. Moisture content determinations of the samples from clayey silt layer ranged from 8.6% to 24.0%.

The grain size distribution results of eight (8) representative samples from clayey silt are presented on Figure WB8-GS-1 and a total of nine (9) Atterberg limits test results are presented on Figure WB8-PC-1A/B. These samples contained 0 to 7% gravel, 1% to 22% sand, 52% to 63% silt and 22% to 36% clay sized particles. The liquid limits of the clayey silt samples were between 21 and 32 and the plastic limits were between 13 and 18, respectively. The values of plasticity index computed were between 7 and 14. Based on the results of Atterberg limit tests, the soil may be classified as clayey silt of low plasticity (CL/CL-ML) in the USCS.



5.2.8.3 Groundwater

Groundwater observations were made in each borehole during and upon completion of auguring. Groundwater was first observed in Borehole 23 at 1.5 m (El. 280.8) below the existing ground surface during auguring. Groundwater was not observed in the three of the boreholes upon completion of auguring in the three boreholes.

5.2.9 Future N/S-E Ramp from Westchester Bourne to Highway 401 East

Boreholes 26 to 28 were drilled along the proposed alignment of future N/S-E ramp from Westchester Bourne to Highway 401 east. The approximate locations of the boreholes advanced during current investigation are shown on DWG. No. WB-1. The stratigraphy profile is presented on DWG. No. WB-3. The subsurface conditions encountered at this site can be categorized into 2 (two) zones as follows.

- Fill
- Clayey Silt, with/some sand, trace gravel

Summarized descriptions of each layer are presented below.

5.2.9.1 Fill

The composition of the fill along the site varied from silty sand to clayey silt.

5.2.9.1.1 *Silty Sand with Gravel (Fill)*

Fill comprised of silty sand with gravel layer was encountered immediately at the existing ground surface in Boreholes 26, 27 and 28 (El. 283.5 to El. 283.3) and extends to 0.8 m to 1.4 m (El. 282.7 to El. 281.9) below the existing ground surface.

The SPT “N”-values recorded in the fill widely varied from 7 to 45 blows, indicating loose to dense state of compaction. The fill layer may be encountered between and beyond borehole locations. Moisture content determinations of the fill ranged between 3.2% and 3.9%.

5.2.9.1.2 *Clayey Silt (Fill)*

Clayey silt fill was encountered in Boreholes 26 to 28. This layer was encountered at 0.8 m to 1.4 m (El. 282.7 and El. 281.9) and extends to 1.5 m to 2.3 m (El. 282.0 to El. 281.0) below the existing ground surface. The SPT “N”-values recorded in the clayey silt fill widely varied from 2 to



22 blows, indicating soft to very stiff consistency. Moisture content determinations of the clayey silt fill samples ranged between 10.5% and 20.5%.

5.2.9.2 Clayey Silt, With/Some Sand, Trace Gravel

Clayey silt was encountered below silty sand/sandy silt fill in Boreholes 26 to 28 at 0.8 m to 1.4 m (El. 282.7 and El. 281.9). This layer extends to 12.8 m (El. 270.7 to El. 270.5) below the existing ground surface to the termination depth of the boreholes.

The SPT "N"-values recorded ranged between 2 and 27, indicating soft to very stiff consistency. Moisture content determinations of the samples from clayey silt layer ranged from 10.5% and 20.5.

The grain size distribution results of eight (10) representative samples from clayey silt are presented on Figure WB9-GS-1A/B and a total of ten (10) Atterberg limits test results are presented on Figure WB9-PC-1A/B. These samples contained 1 to 9% gravel, 17% to 23% sand, 51% to 58% silt and 19% to 25% clay sized particles. The liquid limits of the clayey silt samples were between 21 and 24 and the plastic limits were between 13 and 14, respectively. The values of plasticity index computed range between 8 and 10. Based on the results of Atterberg limit tests, the soil may be classified as clayey silt of low plasticity (CL) in the USCS.

5.2.9.3 Groundwater

Groundwater observations were made in each borehole during and upon completion of auguring. Groundwater level recorded in Boreholes 26 and 27 upon completion of auguring were at 11.6 m (El. 271.9) and 12.3 m (El. 271.1) below the existing ground surface, respectively. Groundwater was not encountered in Borehole 28 during and upon completion of auguring.



5.3 Chemical Analysis

A summary of the chemical test results provided by SGS are presented in Tables 5.3a and 5.3b. The details of the test results provided by SGS are also presented in Appendix B.

Table 5.3a – Soil Chemical Analysis Results

Borehole ID	Sample	Depth (m)	Soil Type	Corrosivity Index	Soil Redox Potential (mV)	Sulphide (%)	pH
C-1	SS 3	1.5 - 2.1	Clayey Silt	17.5	210	0.07	8.71
C-2	SS 4	2.3 - 2.9	Clayey Silt	14.5	148	0.05	8.42
N-2	SS 5	3.1 - 3.7	Clayey Silt	4	246	<0.02	8.81
N-3	SS 8	5.3 - 5.9	Clayey Silt	7.5	119	0.09	8.53
S-2	SS 6	3.8 - 4.6	Clayey Silt	3	235	<0.02	8.32
S-3	SS 9	6.1 - 6.7	Clayey Silt	7.5	217	0.05	8.52

Table 5.3b – Soil Chemical Analysis Results

Borehole ID	Sample	Depth (m)	Soil Type	Resistivity (Ohm-cm)	Conductivity (uS/cm)	Sulphate (µg/g)	Chloride (µg/g)
C-1	SS 3	1.5 - 2.1	Clayey Silt	401	2490	130	1200
C-2	SS 4	2.3 - 2.9	Clayey Silt	582	1720	85	870
N-2	SS 5	3.1 - 3.7	Clayey Silt	4610	217	20	50
N-3	SS 8	5.3 - 5.9	Clayey Silt	3430	291	92	70
S-2	SS 6	3.8 - 4.6	Clayey Silt	2460	407	17	200
S-3	SS 9	6.1 - 6.7	Clayey Silt	3730	268	130	12



6. CLOSURE

Mr. Akbar Hossain and Mr. Mahad Mohamed carried out the field investigations under the supervision of Mr. Nazibur Rahman, P.Eng., Senior Engineer. Landshark Drilling Inc. of Brantford, Ontario supplied the drilling equipment for the subsurface exploration. Traffic control services were provided by Almon Equipment Inc. of Toronto, Ontario. Surveying of borehole locations were carried out by WSP. The laboratory testing of the selected samples was carried out in the PML laboratory in Toronto. Chemical corrosivity tests were conducted by SGS Canada Inc., of Toronto, Ontario.

This report was prepared by Mr. Keshav K. Amatya, MEng. P.Eng. with the assistance of Ms. Natasha Leong-Sem, B.Eng., EIT, Geotechnical Services and reviewed by Mr. Nazibur Rahman, P.Eng., Project Engineer and Mr. Mark Vasavithasan, M.Sc.Eng., P.Eng., Senior Engineer, Geotechnical Services. Mr. R. Ng, MBA, PhD, P.Eng., MTO Designated Principal Contact, conducted an independent review of the report.

Yours very truly,

Peto MacCallum Ltd.

Natasha Leong-Sem, B.Eng., EIT
Project Supervisor, Geotechnical Services



Nazibur Rahman, P.Eng.
Senior Engineer, Geotechnical Services

NL/NR/RN:nl-nr



Keshav K. Amatya, MEng, P.Eng.
Project Engineer, Geotechnical Services



Robert Ng, MBA, PhD, P.Eng.
Foundation Project Manager and
MTO Designated Principal Contact

NOTES & REFERENCES

NOTES:

1.
- THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BOREHOLE LOCATIONS. BETWEEN BOREHOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCES.

2.
- COORDINATES AND GROUND SURFACE ELEVATIONS AT THE DRILLED BOREHOLE LOCATIONS WERE SURVEYED BY J. D. BARNES, AND PROVIDED BY WSP GROUP LIMITED VIA E-MAIL DATED DECEMBER 12, 2018.

REFERENCES:

THESE DRAWINGS WERE REPRODUCED FROM THE COMPOSITE OF BELOW MENTIONED DRAWINGS RECEIVED FROM **WSP GROUP LIMITED**:

1.
- 3053-New Construction (Westchester).dwg, Dated April 2018
2.
- 3053-Alignment (Wes).dwg, Dated April 2018
3.
- 3053-Base (Wes).dwg, Dated April 2018

LEGEND



BOREHOLE LOCATION



PROPOSED GUIDE RAIL INSTALLATION



PROPOSED PROPERTY REQUEST



PROPOSED PROPERTY LIMITS



PROPOSED FUTURE PROPERTY LIMITS

N



BLOWS / 0.3 m (STANDARD PENETRATION TEST, 475 J/BLOW)



WATER LEVEL AT TIME OF INVESTIGATION: OCTOBER 2018 - NOVEMBER 2018

*

WATER LEVEL COULD NOT BE ESTABLISHED

DRY

WATER LEVEL NOT ENCOUNTERED UPON COMPLETION OF DRILLING



Dec. 2019

WATER LEVEL IN PIEZOMETER



PIEZOMETER

BOREHOLE LOCATION COORDINATES & ELEVATIONS

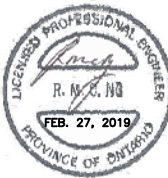
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N-1	4 757 445.875	418 669.305	42.948303	-81.104572	284.361
N-2	4 757 429.976	418 657.157	42.948161	-81.104724	283.886
N-3	4 757 439.137	418 674.495	42.948241	-81.104510	284.318
C-1	4 757 386.417	418 677.002	42.947766	-81.104490	280.788
C-2	4 757 376.089	418 660.134	42.947676	-81.104699	280.612
S-1	4 757 316.522	418 694.371	42.947135	-81.104292	282.235
S-2	4 757 344.739	418 692.531	42.947389	-81.104308	282.547
S-3	4 757 331.770	418 676.397	42.947275	-81.104509	282.520
1	4 757 172.378	418 396.303	42.945882	-81.107972	277.407
2	4 757 210.093	418 498.707	42.946206	-81.106710	277.512
3	4 757 188.002	418 544.823	42.946000	-81.106150	281.290
4	4 757 182.498	418 612.992	42.945941	-81.105316	282.586
5	4 757 186.187	418 686.001	42.945963	-81.104421	281.385
6	4 757 195.463	418 655.766	42.946051	-81.104789	281.197
7	4 757 224.569	418 636.865	42.946316	-81.105015	281.577
8	4 757 214.693	418 583.642	42.946235	-81.105669	282.330
9	4 757 292.203	418 633.008	42.946925	-81.105048	282.357
10	4 757 290.583	418 595.020	42.946916	-81.105514	279.345
11	4 757 271.083	418 711.128	42.946725	-81.104267	281.671
12	4 757 209.883	418 711.128	42.946173	-81.104108	280.680
13	4 757 126.81	418 736.086	42.945421	-81.103819	279.002
14	4 757 570.791	418 817.975	42.949405	-81.102726	283.969
15	4 757 569.826	418 763.276	42.949404	-81.103396	284.937
16	4 757 563.073	418 730.867	42.949348	-81.103794	286.269
17	4 757 538.455	418 780.514	42.949119	-81.103191	285.126
18	4 757 498.099	418 780.086	42.948756	-81.103205	283.954
19	4 757 483.905	418 721.383	42.948637	-81.103927	286.087
20	4 757 538.774	418 719.049	42.949131	-81.103944	286.642
21	4 757 554.297	418 644.786	42.949282	-81.104851	285.606
22	4 757 516.260	418 652.574	42.948939	-81.104763	284.926
23	4 757 431.334	418 564.296	42.948187	-81.105862	282.264
24	4 757 471.185	418 568.619	42.948545	-81.105801	283.723
25	4 757 525.884	418 576.552	42.949037	-81.105692	285.859
26	4 757 350.342	418 887.796	42.947410	-81.101915	283.544
27	4 757 399.948	418 908.720	42.947854	-81.101649	283.421
28	4 757 438.061	418 924.700	42.948194	-81.101445	283.292

REVISIONS

REVISIONS

DRAWING

PML **Peto MacCallum Ltd.**
CONSULTING ENGINEERS



GEOCRES NO. 40114-187

DRAWN NL 2/27/2019

CHECKED NR / MV 2/27/2019

APPROVED RN 2/27/2019

WESTCHESTER BOURNE UNDERPASS

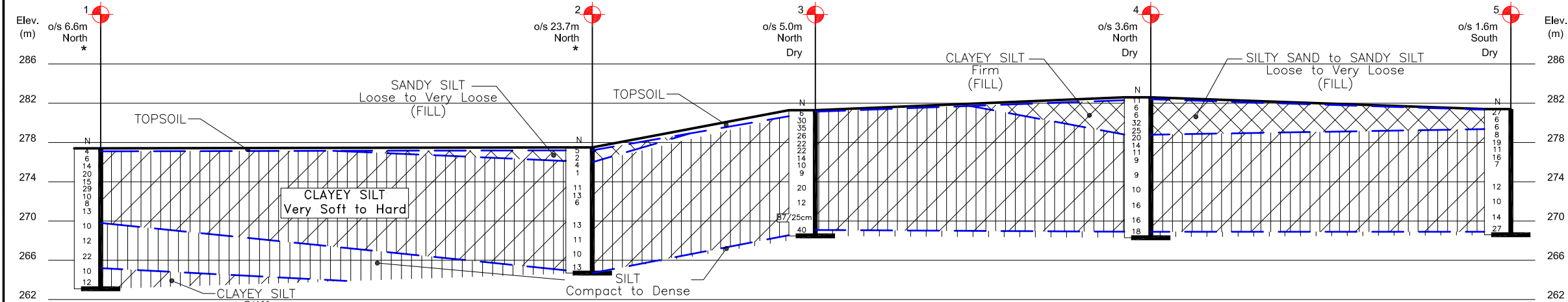
TITLE
NOTES & REFERENCES, LEGEND, AND
BOREHOLE LOCATIONS AND ELEVATIONS

Plot Date: 2/27/2019

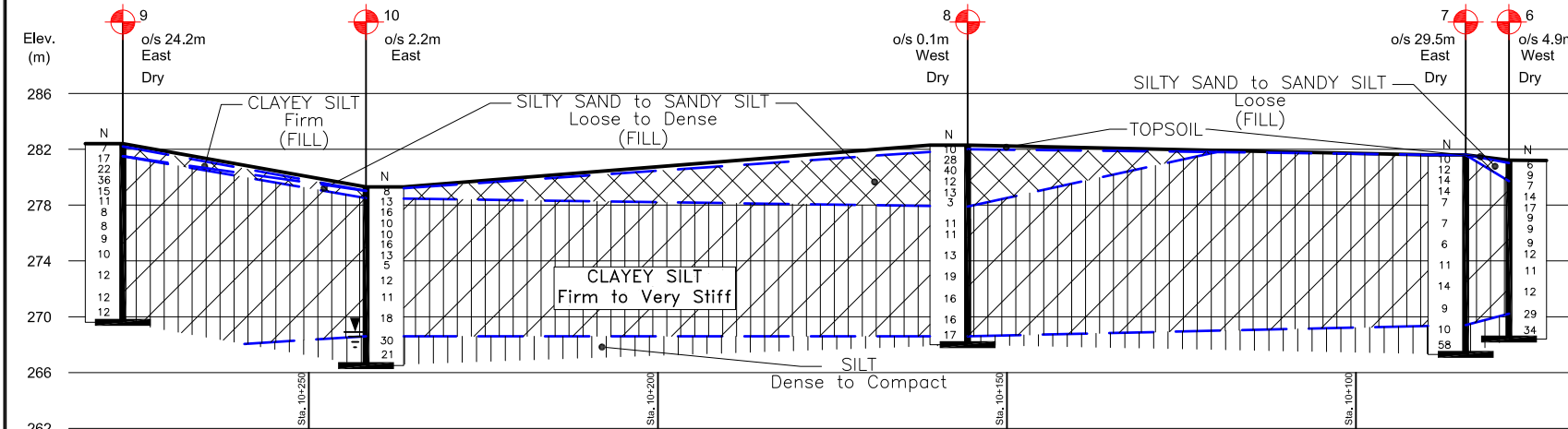


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WB-A

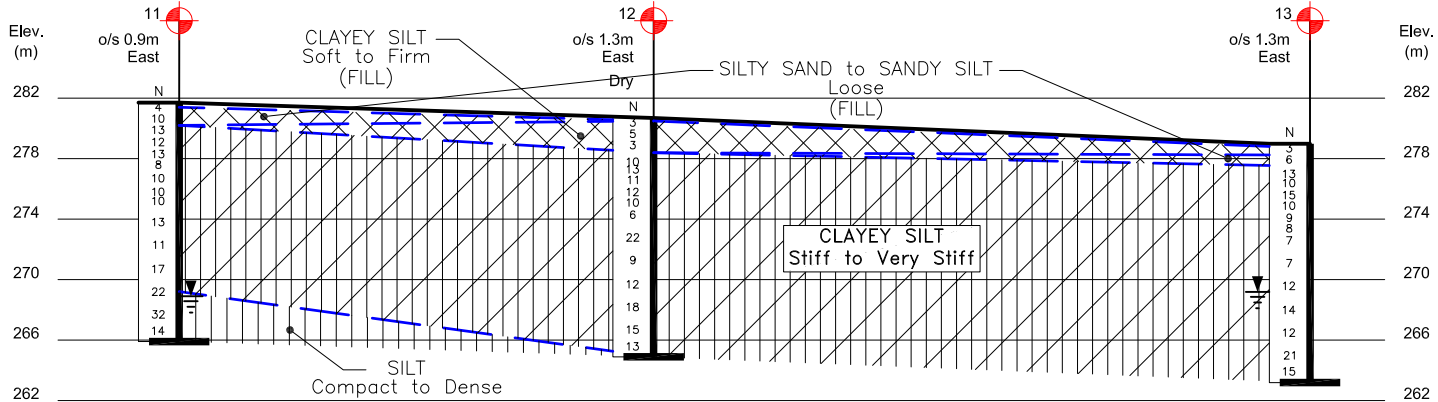
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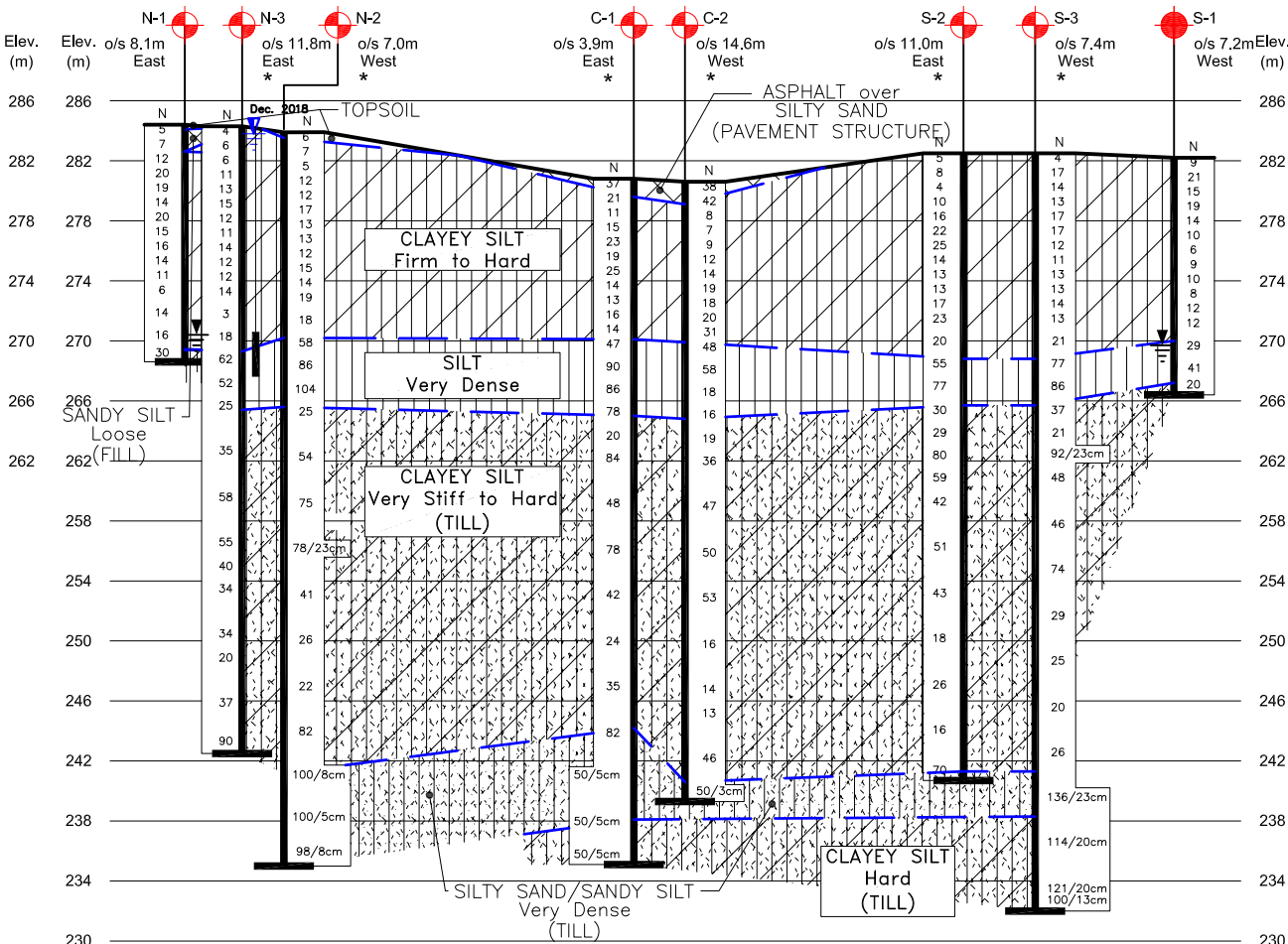
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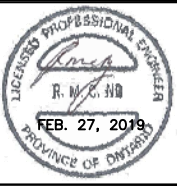
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PROFILE ALONG PROPOSED C/L WESTCHESTER BOURNE UNDERPASS

- NOTES:
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 2. THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION.
 3. DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.

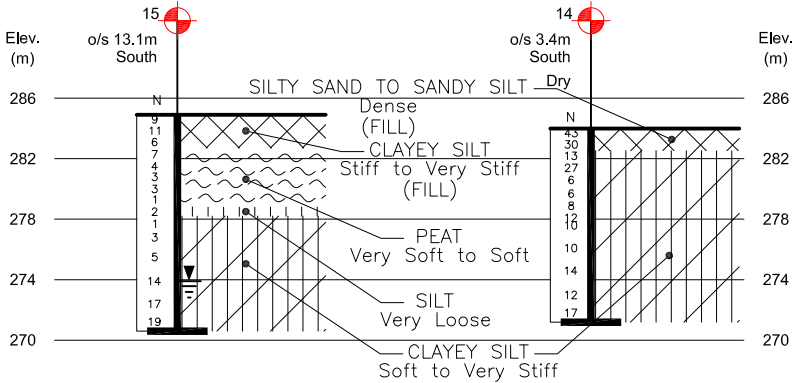
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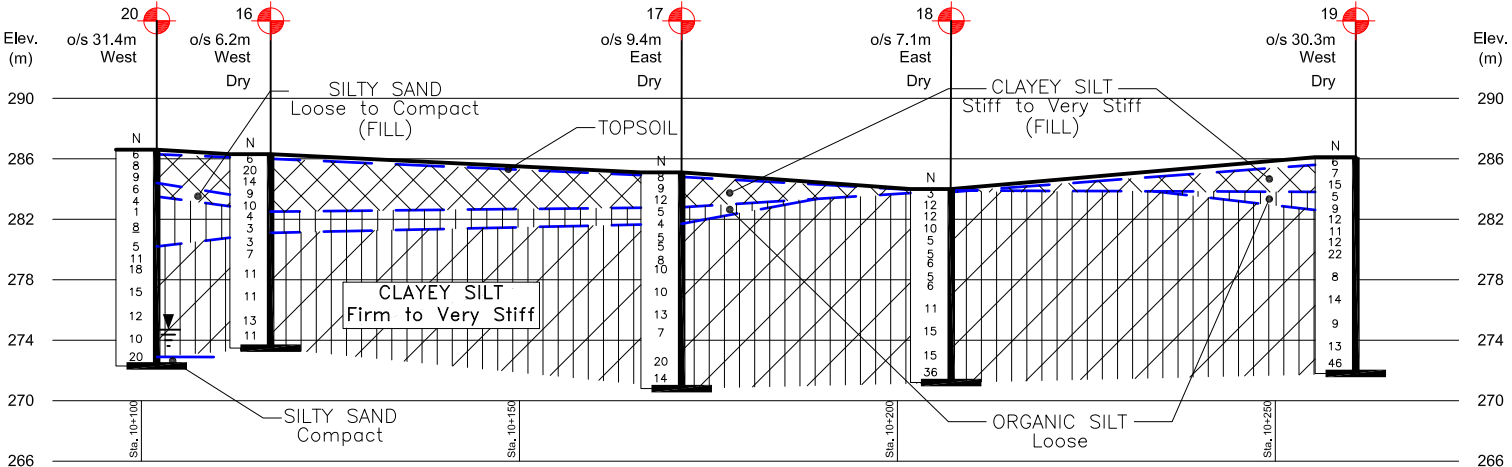
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WESTCHESTER BOURNE
TITLE
SOIL STRATIGRAPHY
SITE 19-375
LONDON, ONTARIO

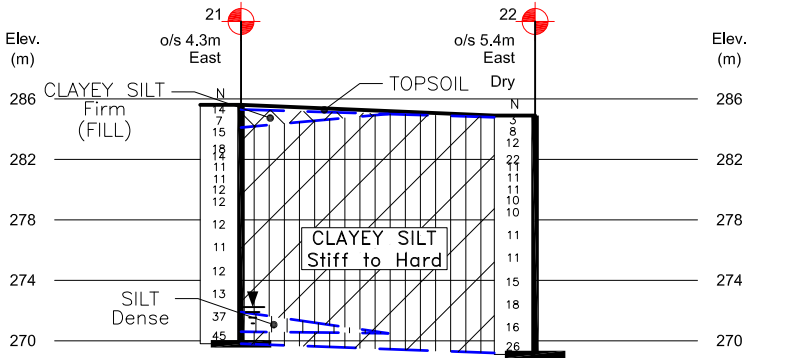
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Sheet No.



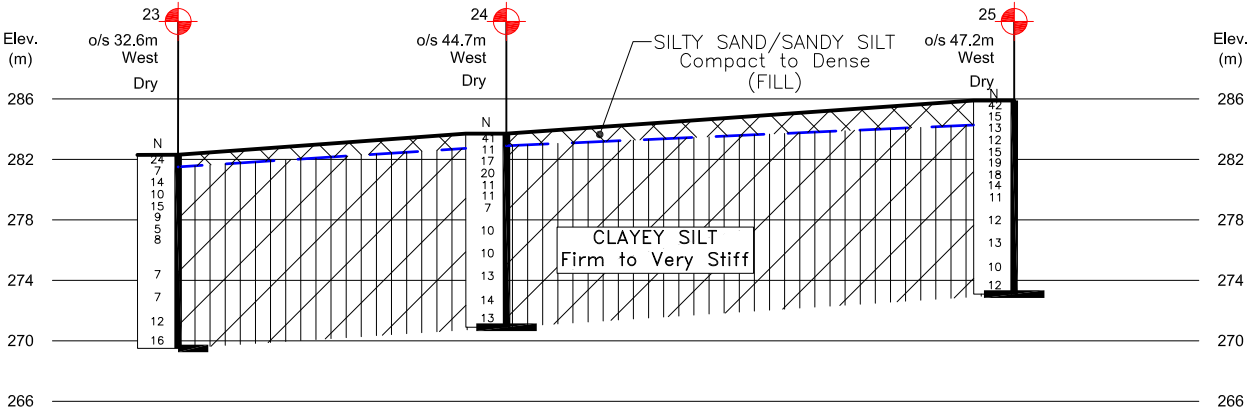
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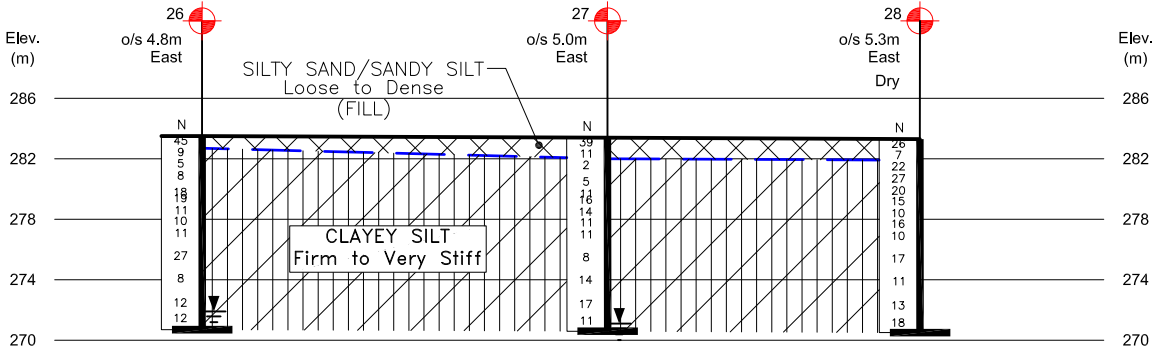
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PROFILE ALONG PROPOSED C/L WESTCHESTER BOURNE



PROFILE ALONG EXISTING N/S - E

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REVISIONS		REVISIONS	DRAWING	
			Reference WSP Ltd. Drawing: 3053-New Construction Westchester).dwg, dated April 2018.	
			SCALE (HORIZ) 5m 0 5 10 15 20m SCALE (VERT) 2.5m 0 5 10m	

GEOCRES NO. 40114-187

DRAWN: NL 2/27/2019

CHECKED: NR / MV 2/27/2019

APPROVED: RN 2/27/2019

WESTCHESTER BOURNE

TITLE: SOIL STRATIGRAPHY

SITE 19-375 LONDON, ONTARIO

Plot Date: 2/27/2019

Dwg. No. WB-3

Sheet No.

EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS \bar{N} .

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

COMPOSITION: SECONDARY SOIL COMPONENTS ARE DESCRIBED ON THE BASIS OF PERCENTAGE BY MASS OF THE WHOLE SAMPLE AS FOLLOWS:

PERCENT BY MASS	0 - 10	10 - 20	20 - 30	30 - 40	> 40
	TRACE	SOME	WITH	ADJECTIVE (SILTY)	AND (AND SILT)

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH (c_u) AS FOLLOWS:

c_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	> 200
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

N (BLOWS/0.3m)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND / OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm* IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (R Q D), FOR MODIFIED RECOVERY, IS:

R Q D (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

JOINTING AND BEDDING:

SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	> 3m
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

S S SPLIT SPOON	T P THINWALL PISTON
W S WASH SAMPLE	O S OSTERBERG SAMPLE
S T SLOTTED TUBE SAMPLE	R C ROCK CORE
B S BLOCK SAMPLE	P H T W ADVANCED HYDRAULICALLY
C S CHUNK SAMPLE	P M T W ADVANCED MANUALLY
T W THINWALL OPEN	F S FOIL SAMPLE
F V FIELD VANE	

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
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa ⁻¹	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
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'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_i	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m ³	DENSITY OF SOLID PARTICLES	n	1, %	POROSITY	e_{max}	1, %	VOID RATIO IN LOOSEST STATE
γ_s	kN/m ³	UNIT WEIGHT OF SOLID PARTICLES	w	1, %	WATER CONTENT	e_{min}	1, %	VOID RATIO IN DENSEST STATE
ρ_w	kg/m ³	DENSITY OF WATER	S_r	%	DEGREE OF SATURATION	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
γ_w	kN/m ³	UNIT WEIGHT OF WATER	w_L	%	LIQUID LIMIT	D	mm	GRAIN DIAMETER
ρ	kg/m ³	DENSITY OF SOIL	w_p	%	PLASTIC LIMIT	D_n	mm	n PERCENT - DIAMETER
γ	kN/m ³	UNIT WEIGHT OF SOIL	w_s	%	SHRINKAGE LIMIT	C_u	1	UNIFORMITY COEFFICIENT
ρ_d	kg/m ³	DENSITY OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	h	m	HYDRAULIC HEAD OR POTENTIAL
γ_d	kN/m ³	UNIT WEIGHT OF DRY SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	q	m ³ /s	RATE OF DISCHARGE
ρ_{sat}	kg/m ³	DENSITY OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	v	m/s	DISCHARGE VELOCITY
γ_{sat}	kN/m ³	UNIT WEIGHT OF SATURATED SOIL	DTPL		DRIER THAN PLASTIC LIMIT	i	1	HYDRAULIC GRADIENT
ρ'	kg/m ³	DENSITY OF SUBMERGED SOIL	APL		ABOUT PLASTIC LIMIT	k	m/s	HYDRAULIC CONDUCTIVITY
γ'	kN/m ³	UNIT WEIGHT OF SUBMERGED SOIL	WTP		WETTER THAN PLASTIC LIMIT	j	kN/m ³	SEEPAGE FORCE
e	1, %	VOID RATIO						

RECORD OF BOREHOLE No C-1

1 OF 4

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 386.417 N; 418 677.002 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
 DATUM Geodetic DATE 2018.11.15 - 2018.11.20 LATITUDE 42.947761 LONGITUDE -81.104485 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
280.8	GROUND													
0.0	150 mm ASPHALT over SILTY SAND, with gravel		1	SS	37		280							
	Dense to compact, Brown, Moist to wet (PAVEMENT STRUCTURE)		2	SS	21									
279.6	CLAYEY SILT, some sand, trace/some gravel						279							
1.2	Stiff to very stiff, Grey, Moist to wet		3	SS	11									
			4	SS	15		278							4 16 58 22
			5	SS	23									
			6	SS	19		277							
			7	SS	25									
			8	SS	14		276							
			9	SS	13		275							17 17 47 19
			10	SS	16		274							
							273							
							272							
			11	SS	14		271							
270.1	SILT, some sand, trace clay		12	SS	47		270							0 11 88 1
10.7	Very dense, Grey, Moist to wet						269							
			13	SS	90		268							
			14	SS	86		267							
265.8							266							

Continued Next Page

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

RECORD OF BOREHOLE No C-1

2 OF 4

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 386.417 N; 418 677.002 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
 DATUM Geodetic DATE 2018.11.15 - 2018.11.20 LATITUDE 42.947761 LONGITUDE -81.104485 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
265.8 15.0	SILT, trace sand, trace clay Very dense, Grey, Wet		15	SS	78		265							0 1 94 5
265.0 15.8	CLAYEY SILT, some sand, trace gravel Very stiff to hard, Grey, Moist (TILL)		16	SS	20		264							
							263							
	SANDY SILT		17	SS	84		262							
							261							
							260							
			18	SS	48		259							
							258							
							257							
			19	SS	78		256							6 17 56 21
							255							
							254							
			20	SS	42		253							
							252							
250.8							251							

Continued Next Page

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

RECORD OF BOREHOLE No C-1

3 OF 4

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 386.417 N; 418 677.002 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
 DATUM Geodetic DATE 2018.11.15 - 2018.11.20 LATITUDE 42.947761 LONGITUDE -81.104485 CHECKED BY N.R.

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 (%)		
250.8 30.0	CLAYEY SILT, some sand, trace gravel Very stiff to hard, Grey, Moist (TILL)		21	SS	24		250										
							249										
							248										
				22	SS	35		247									
							246										
						245											
244.2 36.6	SANDY SILT, trace clay Very dense, Grey, Moist to wet (TILL)		23	SS	82		244										
							243										
							242										
				24	SS	50/5cm		241									
							240										
						239											
238.1 42.7	CLAYEY SILT, some sand, trace gravel Hard, Grey, Moist (TILL)		25	SS	50/5cm		238										
							237										
235.8							236										

Continued Next Page

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

RECORD OF BOREHOLE No C-1

4 OF 4

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 386.417 N; 418 677.002 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
 DATUM Geodetic DATE 2018.11.15 - 2018.11.20 LATITUDE 42.947761 LONGITUDE -81.104485 CHECKED BY N.R.

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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					W _p — W — W _L 20 40 60						
235.8 45.0	CLAYEY SILT, trace sand Hard, Grey, Moist (TILL)																
235.1 45.7	End of borehole		26	SS	50/5cm											0 7 60 33	
NOTES: 1. Borehole was charged with drilling mud below a depth of 3.7 m, thus groundwater level could not be established upon completion of drilling. 2. No cave-in was noted in the borehole upon extraction of hollow stem augers																	

RECORD OF BOREHOLE No C-2

1 OF 3

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 376.089 N; 418 660.134 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
DATUM Geodetic DATE 2018.11.21 - 2018.11.23 LATITUDE 42.947671 LONGITUDE -81.104694 CHECKED BY N.R.

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				W _P	W	W _L		GR	SA	SI	CL		
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE	WATER CONTENT (%)									
								20	40	60	80	100	20	40		60					
280.6	GROUND																				
0.0	150 mm ASPHALT over SILTY SAND, with gravel		1	SS	38																
	Dense, Brown, Moist																				
	(PAVEMENT STRUCTURE)		2	SS	42																
279.1	CLAYEY SILT, some sand, trace gravel		3	SS	8												3	17			
1.5	Firm to hard, Grey, Moist to wet		4	SS	7																
			5	SS	9																
			6	SS	12												4	18			
			7	SS	14																
			8	SS	19																
			9	SS	18																
			10	SS	20																
			11	SS	31																
269.9	SILT, some sand, trace clay		12	SS	48												0	12			
10.7	Dense to compact, Grey, Wet																				
			13	SS	58																
			14	SS	18																
265.6																					

Continued Next Page

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

RECORD OF BOREHOLE No C-2

2 OF 3

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 376.089 N; 418 660.134 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
DATUM Geodetic DATE 2018.11.21 - 2018.11.23 LATITUDE 42.947671 LONGITUDE -81.104694 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
265.6 15.0	SILT, some sand, trace clay Compact, Grey, Wet		15	SS	16		265							
264.8 15.8	CLAYEY SILT, trace/some sand, trace/some gravel Very stiff to hard, Grey, Moist (TILL)		16	SS	19		264							0 0 55 45
	SILTY SAND, trace clay, trace gravel		17	SS	36		262							4 73 19 4
			18	SS	47		259							
			19	SS	50		256							
			20	SS	53		253							13 19 53 15
250.6							251							

Continued Next Page

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

RECORD OF BOREHOLE No C-2

3 OF 3

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 376.089 N; 418 660.134 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
DATUM Geodetic DATE 2018.11.21 - 2018.11.23 LATITUDE 42.947671 LONGITUDE -81.104694 CHECKED BY N.R.

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								WATER CONTENT (%)			
250.6 30.0	CLAYEY SILT, trace/some sand, trace/some gravel Stiff to hard, Grey, Moist to wet (TILL)						20	40	60	80	100								
			21	SS	16														
			22	SS	14														
			23	SS	13														

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RECORD OF BOREHOLE No N-1

1 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 445.875 N; 418 669.305 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
DATUM Geodetic DATE 2018.11.07 LATITUDE 42.948297 LONGITUDE -81.104567 CHECKED BY N.R.

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 (%)			
284.4	GROUND						20	40	60	80	100	20	40	60		GR SA SI CL		
0.0	TOPSOIL						284											
284.1	SANDY SILT, trace gravel Loose, Brown, Moist to wet (FILL)		1	SS	5									○				
0.3														○				
		2	SS	7										○				
					283													
														○				
282.6	CLAYEY SILT, some/with sand, trace gravel		3	SS	12												○	
1.8	Stiff to very stiff, Brown to grey, Moist																	
																	○	
			4	SS	20												○	
							282											
			5	SS	19													
							281											4 24 53 19
			6	SS	14										4 16 58 22			
						280												
			7	SS	20									○				
						279								○				
			8	SS	15													
			9	SS	16										8 18 53 21			
					278													
					277													
		10	SS	14									○					
					276													
		11	SS	11									○					
					275													
					274													
		12	SS	6									○					
					273													
		13	SS	14									○					
					272													
					271													
		14	SS	16											4 24 46 26			
269.4																		

Continued Next Page

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

RECORD OF BOREHOLE No N-1

2 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 445.875 N; 418 669.305 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
DATUM Geodetic DATE 2018.11.07 LATITUDE 42.948297 LONGITUDE -81.104567 CHECKED BY N.R.

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
269.4								20	40	60	80	100					
15.0	SILT, some sand, trace gravel																
	Dense, Grey, Wet		15	SS	30		269										
268.6																	
15.8	End of borehole																
	<div><div>▼</div><div>Groundwater level measured upon completion of drilling</div></div> <div>NOTE: Upon extraction of hollow stem augers, borehole caved-in at a depth of 14.6 m.</div>																

RECORD OF BOREHOLE No N-2

1 OF 4

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 429.976 N; 418 657.157 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
 DATUM Geodetic DATE 2018.11.09 - 2018.11.14 LATITUDE 42.948156 LONGITUDE -81.104719 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
283.9 0.0 283.6 0.3	GROUND TOPSOIL													
			1	SS	6		283							
			2	SS	7									
			3	SS	5		282							
			4	SS	12		281							
			5	SS	12									
			6	SS	17		280							
			7	SS	13		279							
			8	SS	13		278							
			9	SS	12									
							277							
			10	SS	15		276							
							275							
			11	SS	14		274							
							273							
			12	SS	19									
							272							
			13	SS	18		271							
							270							
			14	SS	58									
							269							

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

RECORD OF BOREHOLE No N-2

2 OF 4

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 429.976 N; 418 657.157 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
DATUM Geodetic DATE 2018.11.09 - 2018.11.14 LATITUDE 42.948156 LONGITUDE -81.104719 CHECKED BY N.R.

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							WATER CONTENT (%)			
								○ UNCONFINED	+ FIELD VANE							● QUICK TRIAXIAL	× LAB VANE	
268.9 15.0	SILT, some sand, trace clay Very dense, Grey, Wet						268								0 11 85 4			
			15	SS	86													
							267											
			16	SS	104													
							266											
265.6 18.3	CLAYEY SILT, some sand, trace gravel Very stiff to hard, Grey, Moist (TILL)						265											
			17	SS	25													
							264											
							263											
							262								2 18 60 20			
			18	SS	54													
							261											
							260											
							259											
			19	SS	75													
							258											
							257											
							256											
			20	SS	78/23cm													
							255											
253.9							254											

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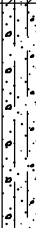
+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No N-2

3 OF 4

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 429.976 N; 418 657.157 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
DATUM Geodetic DATE 2018.11.09 - 2018.11.14 LATITUDE 42.948156 LONGITUDE -81.104719 CHECKED BY N.R.

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)		
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE								
253.9 30.0	CLAYEY SILT, some sand, trace gravel Very stiff to hard, Grey, Moist (TILL)		21	SS	41														
			22	SS	26											2 20 57 21			
			23	SS	22														
			24	SS	82											8 12 65 15			
241.2 42.7	SANDY SILT, some/trace gravel Very dense, Grey, Moist (TILL)		25	SS	100/8cm														
238.9																			

Continued Next Page

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

RECORD OF BOREHOLE No N-2

4 OF 4

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 429.976 N; 418 657.157 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
DATUM Geodetic DATE 2018.11.09 - 2018.11.14 LATITUDE 42.948156 LONGITUDE -81.104719 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
238.9 45.0	SANDY SILT, some/trace gravel Very dense, Grey, Moist (TILL)		26	SS	100/5cm		238							
235.3 48.6	CLAYEY SILT, some sand, trace gravel		27	SS	98/8cm		235							
235.0 48.9	Hard, Grey, Moist (TILL) End of borehole													
NOTES: 1. Borehole was charged with drilling mud below a depth of 3.7 m, thus groundwater level could not be established upon completion of drilling. 2. No cave-in was noted in the borehole upon extraction of hollow stem augers														

RECORD OF BOREHOLE No N-3

1 OF 4

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 439.137 N; 418 674.495 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
DATUM Geodetic DATE 2018.11.07 - 2018.11.09 LATITUDE 42.948236 LONGITUDE -81.104505 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
284.3 0.0	GROUND													
		firm	1	SS	4		284							
			2	SS	6									
							283							
			3	SS	6									
	CLAYEY SILT, some/with sand, trace/some gravel						282							
	Firm to stiff, Brown to grey, Moist		4	SS	11									
							281							11 23 48 18
			5	SS	13									
							280							
			6	SS	15									
							279							8 14 57 21
			7	SS	12									
							278							
			8	SS	11									
							277							
			9	SS	14									
							276							10 16 52 22
							275							
			10	SS	12									
							274							
			11	SS	12									
							273							
			12	SS	14									
							272							4 18 52 26
			13	SS	3									
							271							
			14	SS	18									
							270							
269.3														

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

RECORD OF BOREHOLE No N-3

2 OF 4

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 439.137 N; 418 674.495 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
DATUM Geodetic DATE 2018.11.07 - 2018.11.09 LATITUDE 42.948236 LONGITUDE -81.104505 CHECKED BY N.R.

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 (%)			GR	SA	SI	CL			
269.3 15.0	SILT, trace sand, trace clay Very dense to compact, Grey, Wet							20	40	60	80	100	20	40	60	0	8	88	4				
			15	SS	62																		
			16	SS	52																		

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

RECORD OF BOREHOLE No N-3

3 OF 4

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 439.137 N; 418 674.495 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
DATUM Geodetic DATE 2018.11.07 - 2018.11.09 LATITUDE 42.948236 LONGITUDE -81.104505 CHECKED BY N.R.

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								WATER CONTENT (%)			GR	SA	SI	CL
																○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE					
254.3 30.0	CLAYEY SILT, some sand, trace gravel Hard, Grey, Moist (TILL)															5	21	59	15			
			22	SS	34									○								
				23	SS		34							○								
				24	SS		20							○								
								</														

Continued Next Page

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

RECORD OF BOREHOLE No N-3

4 OF 4

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 439.137 N; 418 674.495 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
 DATUM Geodetic DATE 2018.11.07 - 2018.11.09 LATITUDE 42.948236 LONGITUDE -81.104505 CHECKED BY N.R.

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40						60	80	100			
239.3	<p><u>Piezometer Readings:</u></p> <table border="1"> <thead> <tr> <th>Date</th> <th>Depth (m)</th> <th>Elev.</th> </tr> </thead> <tbody> <tr> <td>Dec.24/18</td> <td>0.50</td> <td>283.8</td> </tr> </tbody> </table> <p><u>Piezometer Legend</u></p> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 20px; height: 10px; margin-right: 5px;"></div> <div>PVC Pipe Stick-up</div> </div> <div style="display: flex; align-items: center;"> <div style="background-color: black; width: 20px; height: 10px; margin-right: 5px;"></div> <div>Bentonite Seal</div> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 20px; height: 10px; background: repeating-linear-gradient(45deg, transparent, transparent 2px, black 2px, black 4px); margin-right: 5px;"></div> <div>Filter Sand</div> </div> <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; width: 20px; height: 10px; background: repeating-linear-gradient(-45deg, transparent, transparent 2px, black 2px, black 4px); margin-right: 5px;"></div> <div>Screen</div> </div>	Date	Depth (m)	Elev.	Dec.24/18	0.50	283.8													
Date	Depth (m)	Elev.																		
Dec.24/18	0.50	283.8																		

ONTARIO MTO 18KF037A.GPJ ONTARIO MTO.GDT 2/5/19

RECORD OF BOREHOLE No S-1

1 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 316.522 N; 418 694.371 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
DATUM Geodetic DATE 2018.10.18 LATITUDE 42.947129 LONGITUDE -81.104286 CHECKED BY N.R.

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED		+ FIELD VANE								○		
								● QUICK TRIAXIAL		× LAB VANE								○		
282.2	GROUND		1	SS	9		282							○			12 15 50 23			
0.0	TOPSOIL														○					
281.9	CLAYEY SILT, some sand, trace/some gravel Very stiff to firm, Brown to grey, Moist		2	SS	21		281									○				
0.3																○				
			3	SS	15		280											○		
			4	SS	19		279											○		
			5	SS	14		278											○		
			6	SS	10		277											○		
			7	SS	6		276											○		
			8	SS	9		275											○		
			9	SS	10		274											○		
			10	SS	8		273											○		
	11	SS	12	272										○						
	12	SS	12	271										○						
270.0	SILT, trace sand, trace clay		13	SS	29	▼	270							○			0 2 94 4			
12.2	Compact to dense, Grey, Wet						269													
			14	SS	41		268								○					
267.2																				

Continued Next Page

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

RECORD OF BOREHOLE No S-1

2 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 316.522 N; 418 694.371 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.10.18 LATITUDE 42.947129 LONGITUDE -81.104286 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE		WATER CONTENT (%) w _p w w _L				
267.2 15.0	CLAYEY SILT, some sand, trace gravel Very stiff, Grey, Moist (TILL)						267							
266.4 15.8			15	SS	20									
End of borehole														
	Groundwater level measured upon completion of drilling NOTE: Upon extraction of hollow stem augers, borehole caved-in at a depth of 13.0 m.													

RECORD OF BOREHOLE No S-2

1 OF 3

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 344.739 N; 418 692.531 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
DATUM Geodetic DATE 2018.10.11 - 2018.10.12 LATITUDE 42.947384 LONGITUDE -81.104303 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
282.5	GROUND													
0.0	TOPSOIL													
282.2														
0.3														
		firm	1	SS	5		282							
			2	SS	8									
			3	SS	4		281							
	CLAYEY SILT, some sand, trace gravel													
	Stiff to very stiff, Brown to grey, Moist		4	SS	10		280							
			5	SS	16		279							
			6	SS	22									
			7	SS	25		278							
			8	SS	14		277							
			9	SS	13		276							
			10	SS	13		275							
			11	SS	17		273							
			12	SS	23		272							
			13	SS	20		270							
268.8							269							
13.7	SILT, trace sand, trace clay		14	SS	55									
	Very dense, Grey, Moist						268							
267.5														

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

RECORD OF BOREHOLE No S-2

2 OF 3

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 344.739 N; 418 692.531 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
DATUM Geodetic DATE 2018.10.11 - 2018.10.12 LATITUDE 42.947384 LONGITUDE -81.104303 CHECKED BY N.R.

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)		
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE								
267.5 15.0	SILT, trace sand, trace clay Very dense, Grey, Moist		15	SS	77											0 3 92 5			
265.7 16.8	CLAYEY SILT, some sand, trace gravel Hard, Grey, Moist (TILL) — — — — — SILTY SAND, with gravel — — — — —		16	SS	30														
			17	SS	29														
			18	SS	80														
			19	SS	59														
			20	SS	42														
			21	SS	51											4 16 56 24			
			22	SS	43														
252.5																			

Continued Next Page

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

RECORD OF BOREHOLE No S-2

3 OF 3

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 344.739 N; 418 692.531 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
DATUM Geodetic DATE 2018.10.11 - 2018.10.12 LATITUDE 42.947384 LONGITUDE -81.104303 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
252.5	CLAYEY SILT, some/with sand, trace gravel						252							2 24 52 22
30.0	Very stiff to hard, Grey, Moist (TILL)						251							
			23	SS	18		250							
							249							
							248							
			24	SS	26		247							
							246							
							245							
			25	SS	16		244							
							243							
							242							
241.3	SANDY SILT, some clay, trace gravel						241							3 16 68 13
41.2	Very dense, Grey, Wet (TILL)		26	SS	70									
240.7	End of borehole													
41.8														
NOTES: 1. Borehole was charged with drilling water below a depth of 3.1 m, thus groundwater level could not be established upon completion of drilling. 2. No Cave-in was noted upon extraction of hollow stem augers.														

ONTARIO MTO 18KF037A.GPJ ONTARIO MTO.GDT 2/5/19

RECORD OF BOREHOLE No S-3

1 OF 4

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 331.770 N; 418 676.397 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
DATUM Geodetic DATE 2018.10.12 - 2018.10.15 LATITUDE 42.947269 LONGITUDE -81.104503 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
282.5	GROUND													
0.0	TOPSOIL													
282.2			1	SS	4		282							
0.3			2	SS	17									
	CLAYEY SILT, some sand, trace gravel		3	SS	14		281							
	Stiff to very stiff, Brown to grey, Moist		4	SS	13		280							
			5	SS	17		279							
			6	SS	17		278							
			7	SS	12		277							
			8	SS	11		276							
			9	SS	13		275							
			10	SS	13		274							
			11	SS	14		273							
			12	SS	13		272							
			13	SS	21		271							
			14	SS	77		270							
268.8	SILT, trace sand, trace clay						269							
13.7	Very dense, Grey, Wet						268							
267.5														

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

RECORD OF BOREHOLE No S-3

2 OF 4

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 331.770 N; 418 676.397 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
DATUM Geodetic DATE 2018.10.12 - 2018.10.15 LATITUDE 42.947269 LONGITUDE -81.104503 CHECKED BY N.R.

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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				WATER CONTENT (%) W _P W W _L				GR	SA	SI	CL
267.5 15.0	SILT, trace sand, trace clay Very dense, Grey, Wet		15	SS	86		267												
265.7 16.8	CLAYEY SILT, some sand, trace gravel Very stiff to hard, Grey, Moist to wet (TILL)		16	SS	37		266												
			17	SS	21		265												
	SANDY SILT, trace clay		18	SS	92/23cm		264												
			19	SS	48		263												
			20	SS	46		262												
			21	SS	74		261												
							260												
							259												
							258												
							257												
							256												
							255												
							254												
							253												

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

RECORD OF BOREHOLE No S-3

3 OF 4

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 331.770 N; 418 676.397 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
DATUM Geodetic DATE 2018.10.12 - 2018.10.15 LATITUDE 42.947269 LONGITUDE -81.104503 CHECKED BY N.R.

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				GR	SA	SI	CL
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	WATER CONTENT (%)										
252.5 30.0	CLAYEY SILT, some sand, trace gravel Very stiff, Grey, Moist (TILL)																		
			22	SS	29														
				23	SS	25													
				24	SS	20													

Continued Next Page

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

RECORD OF BOREHOLE No S-3

4 OF 4

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 331.770 N; 418 676.397 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
DATUM Geodetic DATE 2018.10.12 - 2018.10.15 LATITUDE 42.947269 LONGITUDE -81.104503 CHECKED BY N.R.

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					W _p	W	W _L		
							20	40	60	80	100						
237.5 45.0	CLAYEY SILT, some sand, trace gravel Hard, Grey, Moist (TILL)																
			27	SS	114/20cm												
			28	SS	121/20cm												
232.0 50.5	End of borehole		29	SS	100/13cm												
	NOTES: 1. Borehole was charged with drilling water below a depth of 3.7 m, thus groundwater level could not be established upon completion of drilling. 2. No Cave-in was noted upon extraction of hollow stem augers.																

RECORD OF BOREHOLE No 1

1 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 172.378 N; 418 396.303 E ORIGINATED BY M.M.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
DATUM Geodetic DATE 2018.10.05 LATITUDE 42.945877 LONGITUDE -81.107967 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
277.4 0.0 277.1 0.3	GROUND TOPSOIL													
			1	SS	4		277							
			2	SS	6									
			3	SS	14		276							
			4	SS	20		275							
			5	SS	15		274							
			6	SS	29		273							
			7	SS	10									
			8	SS	8		272							
			9	SS	13		271							
							270							
269.8 7.6	SILT, trace clay, trace sand Compact, Grey, Wet		10	SS	10		269							
			11	SS	12		268							
			12	SS	22		267							
265.2 12.2	CLAYEY SILT, some sand, trace gravel Stiff, Grey, Dry to wet		13	SS	10		265							
			14	SS	12		264							
263.1 14.3	End of borehole													

Continued Next Page

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

RECORD OF BOREHOLE No 1

2 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 172.378 N; 418 396.303 E ORIGINATED BY M.M.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
 DATUM Geodetic DATE 2018.10.05 LATITUDE 42.945877 LONGITUDE -81.107967 CHECKED BY N.R.

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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					W _p — W — W _L 20 40 60						
262.4	NOTES: 1. Groundwater was not encountered during drilling. 2. Borehole was charged with drilling mud below a depth of 13.1 m, thus groundwater level could not be established upon completion of drilling. 3. Upon extraction of hollow stem augers, borehole caved in at a depth of 12.2 m.																

RECORD OF BOREHOLE No 2

1 OF 1

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 210.093 N; 418 498.707 E ORIGINATED BY M.M.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers + Mud Rotary COMPILED BY K.A.
 DATUM Geodetic DATE 2018.10.05 LATITUDE 42.946201 LONGITUDE -81.106705 CHECKED BY N.R.

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									WATER CONTENT (%)			GR	SA	SI	CL			
								○ UNCONFINED + FIELD VANE																		
								● QUICK TRIAXIAL × LAB VANE																		
277.5	GROUND						20	40	60	80	100															
0.0	TOPSOIL																									
277.2	SANDY SILT, trace clay, trace gravel Loose to very loose, Dark brown to brown, Moist (FILL)		1	SS	5		277																			
0.3																										
		2	SS	2	276																					
276.0																										
1.5	soft to very soft _____ CLAYEY SILT, some sand, trace gravel Firm to stiff, Brown to grey, Moist		3	SS	4		275																			
				4	SS		1	274																		
				5	SS		11	273																		
				6	SS		13	272																		
						TW		271																		

RECORD OF BOREHOLE No 3

1 OF 1

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 188.002 N; 418 544.823 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.10.04 LATITUDE 42.945995 LONGITUDE -81.106144 CHECKED BY N.R.

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				GR	SA	SI	CL
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	WATER CONTENT (%)											
281.3	GROUND							20	40	60	80	100		20	40	60				
281.2	TOPSOIL							20	40	60	80	100								
0.2																				

RECORD OF BOREHOLE No 4

1 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 182.498 N; 418 612.992 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
DATUM Geodetic DATE 2018.10.01 LATITUDE 42.945935 LONGITUDE -81.10531 CHECKED BY N.R.

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												
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE	WATER CONTENT (%)								
282.6	GROUND						20	40	60	80	100									
282.4	TOPSOIL						20	40	60	80	100									
0.2	SILTY SAND TO SANDY SILT, with gravel		1	SS	11															
	Loose to compact, Brown, Moist																			
	(FILL)		2	SS	6															
	CLAYEY SILT, some/with sand, trace/some gravel		3	SS	6															
	Firm, Brown, Moist																			
	asphalt debris		4	SS	32															
	(FILL)																			
			5	SS	25															
278.8	CLAYEY SILT, some/with sand, trace gravel		6	SS	20															
3.8	Stiff to very stiff, Brown to grey, Moist to wet		7	SS	14													3 23 54 20		
			8	SS	11															
			9	SS	9													2 17 56 25		
			10	SS	9															
			11	SS	10													9 16 52 23		
			12	SS	16															
			13	SS	16															
268.9	SILT, some clay, trace sand																			
13.7	Compact, Grey, Wet		14	SS	18													0 2 86 12		
268.3	End of borehole																			
14.3																				

Continued Next Page

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

RECORD OF BOREHOLE No 4

2 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 182.498 N; 418 612.992 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.10.01 LATITUDE 42.945935 LONGITUDE -81.10531 CHECKED BY N.R.

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			20	40	60	80	100	W _p	W	W _L		
267.6	NOTES: 1. Groundwater was not encountered during or upon completion of drilling. 2. No cave-in was noted in the borehole upon extraction of hollow stem augers																

RECORD OF BOREHOLE No 5

1 OF 1

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 186.187 N; 418 686.001 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
DATUM Geodetic DATE 2018.10.02 LATITUDE 42.945958 LONGITUDE -81.104415 CHECKED BY N.R.

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									WATER CONTENT (%)			GR	SA	SI	CL			
								○ UNCONFINED + FIELD VANE																		
								● QUICK TRIAXIAL × LAB VANE																		
281.4	GROUND						20	40	60	80	100															
281.3	TOPSOIL						20	40	60	80	100															
0.2	asphalt debris		1	SS	27																					
	CLAYEY SILT, some sand, trace gravel, organic inclusions																									
	Firm, Brown, Moist (FILL)		2	SS	6																					
279.4			3	SS	6																					
2.0	CLAYEY SILT, some sand, trace gravel																									
	Stiff to very stiff, Brown to grey, Moist																									
			4	SS	8																					
			5	SS	19																					
			6	SS	11																					
			7	SS	16																					
			8	SS	7																					
				TW																						
			9	SS	12																					
			10	SS	10																					
			11	SS	14																					
268.9			12	SS	27																					
12.5	SILT, trace clay, trace gravel																									
268.6	Compact, Grey, Wet																									
12.8	End of Borehole																									
NOTES: 1. Groundwater was not encountered during or upon completion of drilling. 2. Upon extraction of hollow stem augers, borehole caved in at a depth of 8.5 m.																										

ONTARIO MTO 18KF037A.GPJ ONTARIO MTO.GDT 2/5/19

RECORD OF BOREHOLE No 6

1 OF 1

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 195.463 N; 418 655.766 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.10.02 LATITUDE 42.946046 LONGITUDE -81.104784 CHECKED BY N.R.

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									WATER CONTENT (%)			GR	SA	SI	CL
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE															
281.2	GROUND					▽																	
281.0	TOPSOIL																						
0.2	SILTY SAND TO SANDY SILT, trace clay			1	SS		6	281															
	Loose, Brown, Moist																						
	(FILL)		2	SS	9		280																
279.7	CLAYEY SILT, some sand Stiff, Brown to grey, Moist																						
1.5			3	SS	7		279																
			4	SS	14		278																
			5	SS	17		277																
			6	SS	9		276																
			7	SS	9		275																
			8	SS	9		274																
			9	SS	12		273																
			10	SS	11	272																	
			11	SS	12	271																	
			12	SS	29	270																	
270.2	SILT, trace sand, trace clay																						
11.0	Dense, Grey, Wet																						
			13	SS	34	269																	
268.4	End of Borehole																						
12.8	Groundwater level observed during drilling																						
NOTES: 1. Groundwater was not encountered upon completion of drilling. 2. Upon extraction of hollow stem augers, borehole caved in at a depth of 10.7 m.																							

ONTARIO MTO 18KF037A.GPJ ONTARIO MTO.GDT 3/1/19

RECORD OF BOREHOLE No 7

1 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 224.569 N; 418 636.865 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.10.01 LATITUDE 42.94631 LONGITUDE -81.105009 CHECKED BY N.R.

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									WATER CONTENT (%)			GR	SA	SI	CL
281.6 0.0	GROUND CLAYEY SILT, some sand, trace gravel Stiff to firm, Brown to grey, Moist							20	40	60	80	100											
			1	SS	10		281								○						3 17 56 24		
			2	SS	12		280								○								
			3	SS	14		279								○								
			4	SS	14		278								○								
			5	SS	7		277								○								
			6	SS	7		276								○								
			7	SS	6		275								○								
			8	SS	11		274								○								
			9	SS	14		273								○								
			10	SS	9		272								○								
269.4 12.2	SILT, trace clay, trace sand Compact, to very dense, Grey, Wet		11	SS	10		269							○						0 2 92 6			
					268								○										
					12	SS	58								○								
267.3 14.3	End of borehole																						

Continued Next Page

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

RECORD OF BOREHOLE No 7

2 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 224.569 N; 418 636.865 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.10.01 LATITUDE 42.94631 LONGITUDE -81.105009 CHECKED BY N.R.

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			20	40	60	80	100	W _p	W	W _L		
266.6	NOTES: 1. Groundwater was not encountered during or upon completion of drilling. 2. Upon extraction of hollow stem augers, borehole caved-in at a depth of 12.2 m.																

RECORD OF BOREHOLE No 8

1 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 214.693 N; 418 583.642 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.10.04 LATITUDE 42.946229 LONGITUDE -81.105663 CHECKED BY N.R.

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 (%)		
								20	40	60	80	100						20	40	60
282.3	GROUND																			
0.0	TOPSOIL																			
282.0	SILTY SAND TO SANDY SILT, some gravel, asphalt debris Compact to dense, Brown, Moist (FILL) very loose		1	SS	10															
0.3			2	SS	28															
			3	SS	40															
			4	SS	12															
		5	SS	13																
	6	SS	3																	
277.9	CLAYEY SILT, trace sand, trace gravel																			
4.4	Stiff to very stiff, Grey, Moist		7	SS	11															
			8	SS	11															
			9	SS	13															
			10	SS	19															
			11	SS	16															
	12	SS	16																	
268.6	SILT, trace clay, some sand																			
13.7	Compact, Grey, Wet		13	SS	17															
268.0	End of borehole																			
14.3																				

Continued Next Page

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

RECORD OF BOREHOLE No 8

2 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 214.693 N; 418 583.642 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.10.04 LATITUDE 42.946229 LONGITUDE -81.105663 CHECKED BY N.R.

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					W _p	W	W _L			
267.3	NOTES: 1. Groundwater was not encountered during or upon completion of drilling. 2. Upon extraction of hollow stem augers, borehole caved-in at a depth of 13.1 m.																	

RECORD OF BOREHOLE No 9

1 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 292.203 N; 418 633.008 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
DATUM Geodetic DATE 2018.10.17 LATITUDE 42.94692 LONGITUDE -81.105043 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
282.4	GROUND													
282.2	TOPSOIL													
0.2	CLAYEY SILT, some sand, trace gravel Firm, Brown, Moist (FILL)		1	SS	7		282							
281.5	CLAYEY SILT, some sand, trace gravel Stiff to very stiff, Brown to grey, Moist		2	SS	17		281							
0.9			3	SS	22		280							
			4	SS	36		279							
			5	SS	15		278							
			6	SS	11		277							
			7	SS	8		276							
			8	SS	8		275							
			9	SS	9		274							
			10	SS	10		273							
			11	SS	12		272							
			12	SS	12		271							
			13	SS	12		270							
269.6	End of borehole													
12.8														

Continued Next Page

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

RECORD OF BOREHOLE No 9

2 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 292.203 N; 418 633.008 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.10.17 LATITUDE 42.94692 LONGITUDE -81.105043 CHECKED BY N.R.

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			20	40	60	80	100	W _p	W	W _L		
267.4	NOTES: 1. Groundwater was not encountered during or upon completion of drilling. 2. Upon extraction of hollow stem augers, borehole caved-in at a depth of 11.6 m.																

ONTARIO MTO 18KF037A.GPJ ONTARIO MTO.GDT 2/5/19

METRIC

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

RECORD OF BOREHOLE No 11

1 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 271.083 N; 418 697.100 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.10.18 LATITUDE 42.94672 LONGITUDE -81.104262 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
281.7	GROUND													
0.0	TOPSOIL													
281.4														
0.3	SILTY SAND TO SANDY SILT, trace gravel		1	SS	4		281							
	Loose, Brown, Moist (FILL)		2	SS	10									
280.2							280							
1.5	CLAYEY SILT, some sand, trace gravel		3	SS	13									
	Stiff to very stiff, Brown to grey, Moist		4	SS	12		279							
			5	SS	13		278							
			6	SS	8		277							
			7	SS	10		276							
			8	SS	10		275							
			9	SS	10		274							
			10	SS	13		273							
			11	SS	11		272							
			12	SS	17		271							
			13	SS	22		270							
269.2							269							
12.5	SILT, trace clay, trace sand						268							
	Compact to dense, Grey, Moist to wet		14	SS	32		267							
266.7														

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

RECORD OF BOREHOLE No 11

2 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 271.083 N; 418 697.100 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.10.18 LATITUDE 42.94672 LONGITUDE -81.104262 CHECKED BY N.R.

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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE										
266.7 15.0	SILT, trace clay, trace sand Compact, Grey, Wet		15	SS	14		266											
265.9 15.8	End of borehole																	
	<div>▼ Groundwater level measured upon completion of drilling</div> <div>NOTE: Upon extraction of hollow stem augers, borehole caved-in at a depth of 13.7 m.</div>																	

RECORD OF BOREHOLE No 12

1 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 209.883 N; 418 711.128 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.10.03 LATITUDE 42.946167 LONGITUDE -81.104103 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
280.7	GROUND													
280.5	TOPSOIL													
0.2	CLAYEY SILT, some sand, trace gravel		1	SS	3		280							
	Soft to firm, Brown, Moist (FILL)		2	SS	5									
			3	SS	3		279							
278.4	CLAYEY SILT, trace/some sand, trace gravel													
2.3	Stiff to very stiff, Brown to grey, Moist		4	SS	10		278							
			5	SS	13									
			6	SS	11		277							
			7	SS	12									
			8	SS	10		276							
			9	SS	6									
			10	SS	22		275							
			11	SS	9		274							
			12	SS	12		273							
			13	SS	18		272							
			14	SS	15		271							
							270							
							269							
							268							
							267							
265.7							266							

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

RECORD OF BOREHOLE No 12

2 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 209.883 N; 418 711.128 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.10.03 LATITUDE 42.946167 LONGITUDE -81.104103 CHECKED BY N.R.

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			20	40	60	80	100	W _p	W	W _L		
265.7 15.0	CLAYEY SILT, some sand, trace gravel Stiff, Grey, Moist		15	SS	13												
264.9 15.8	End of borehole																
NOTES: 1. Groundwater was not encountered during or upon completion of drilling. 2. Upon extraction of hollow stem augers, borehole caved-in at a depth of 13.7 m.																	

RECORD OF BOREHOLE No 13

1 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 126.810 N; 418 736.086 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
DATUM Geodetic DATE 2018.10.03 LATITUDE 42.945416 LONGITUDE -81.103814 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
279.0	GROUND													
0.0	TOPSOIL													
278.7														
0.3	CLAYEY SILT, some sand, trace gravel		1	SS	3									
	SILTY SAND TO SANDY SILT, trace clay, trace gravel Loose, Brown, Moist (FILL)		2	SS	6		278							
277.5														
1.5	CLAYEY SILT, some sand, trace gravel													
	Stiff to very stiff, Brown to grey, Moist		3	SS	13		277							
			4	SS	10		276							
			5	SS	15									
			6	SS	10		275							
			7	SS	9		274							
			8	SS	8		273							
			9	SS	7		272							
			VANE											
			10	SS	7		271							
							270							
			11	SS	12		269							
			12	SS	14		268							
			13	SS	12		267							
							266							
			14	SS	21		265							
264.0														

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


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

RECORD OF BOREHOLE No 13

2 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 126.810 N; 418 736.086 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.10.03 LATITUDE 42.945416 LONGITUDE -81.103814 CHECKED BY N.R.

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
264.0 15.0	CLAYEY SILT, some sand, trace gravel Very stiff, Grey, Moist		15	SS	15												
263.2 15.8	End of borehole																
	<div> Groundwater level observed during drilling</div> <div> Groundwater level measured upon completion of drilling</div> <div>NOTE: Upon extraction of hollow stem augers, borehole caved-in at a depth of 10.7 m.</div>																

RECORD OF BOREHOLE No 14

1 OF 1

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 570.791 N; 418 817.975 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.11.01 LATITUDE 42.949399 LONGITUDE -81.10272 CHECKED BY N.R.

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										WATER CONTENT (%)		
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE	20						40	60	80
284.0	GROUND TOPSOIL																			
283.8	0.3	SILTY SAND TO SANDY SILT, with gravel		1	SS	43														
		Dense, Brown, Moist																		
		(FILL)		2	SS	30														
282.5	1.5			3	SS	13														
		stiff to very stiff																		
				4	SS	27														
		CLAYEY SILT, some sand, trace gravel		5	SS	6														
		Firm to stiff, Grey, Moist																		
				6	SS	6														
				7	SS	8														
				8	SS	12														
				9	SS	10														
				10	SS	10														

RECORD OF BOREHOLE No 15

1 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 569.826 N; 418 763.276 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
DATUM Geodetic DATE 2018.11.01 LATITUDE 42.949399 LONGITUDE -81.103391 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
284.9 0.0	GROUND CLAYEY SILT, some sand, trace gravel Firm to stiff, Brown to dark grey, Moist		1	SS	9		284							
	with sand, some gravel asphalt and wood debris (FILL)		2	SS	11									
			3	SS	6		283							
282.7 2.2	asphalt and wood debris		4	SS	7		282						91.7	
	PEAT		5	SS	4								80.8	
	Very soft to soft, Black, Wet		6	SS	3		281						205.5	
			7	SS	3		280						454.6	
			8	SS	1		279						199.4	
278.8 6.1	SILT, some sand, some clay		9A	SS	2									0 15 76 9
278.2 6.7	Very loose, Grey, Wet		VANE				278							
	CLAYEY SILT, trace to some sand, trace gravel		9B	SS	1									
	Soft to firm, Grey, Moist		10	SS	3		277							0 1 77 22
			VANE				276							
			11	SS	5		275							
			VANE				274							5 19 53 23
			12	SS	14		273							
			13	SS	17		272							
			14	SS	19		271							4 21 53 22
270.6 14.3	End of borehole													

Continued Next Page


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

RECORD OF BOREHOLE No 15

2 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 569.826 N; 418 763.276 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.11.01 LATITUDE 42.949399 LONGITUDE -81.103391 CHECKED BY N.R.

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			20	40	60	80	100	W _p	W	W _L		
269.9	 Groundwater measured upon completion of drilling. NOTE: Upon extraction of hollow stem augers, borehole caved in at a depth of 11.0 m.																

ONTARIO MTO 18KF037A.GPJ ONTARIO MTO.GDT 2/5/19

METRIC

SOIL PROFILE					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES	GROUND WATER CONDITIONS	DYNAMIC CONE PENETRATION RESISTANCE PLOT
			NUMBER	TYPE	"N" VALUES
286.3	GROUND TOPSOIL, asphalt debris				
0.0					
286.0					
0.3	CLAYEY SILT, with/some sand, some/trace gravel, asphalt debris		1	SS	6
	Firm to very stiff, Brown, Moist to wet		2	SS	20
			3	SS	14
			4	SS	9
	SILTY SAND, with gravel Compact, Brown, Moist (FILL)		5	SS	10
282.5	ORGANIC SILT Black, Moist		6	SS	4
3.8	SILT, some clay, trace gravel Very loose, Grey, Moist		7	SS	3
281.1	soft to firm		VANE		
5.2			8	SS	3
			9	SS	7
	CLAYEY SILT, with sand, trace gravel Stiff, Grey, Moist		VANE		
			10	SS	11
			11	SS	11
			12	SS	13
			13	SS	11
273.5	End of borehole				
12.8	NOTES: 1. Groundwater was not encountered during or upon completion of drilling. 2. No cave-in was noted in the borehole upon extraction of hollow stem augers.				

ONTARIO MTO 18KF037A.GPJ ONTARIO MTO.GDT 2/5/19

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

RECORD OF BOREHOLE No 17

1 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 7575 38.455 N; 418 780.514 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
DATUM Geodetic DATE 2018.11.05 LATITUDE 42.949114 LONGITUDE -81.103186 CHECKED BY N.R.

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									WATER CONTENT (%)	
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE							
285.1 0.0	GROUND TOPSOIL																	
284.8 0.3	CLAYEY SILT, with/some sand, some gravel		1	SS	8													
	Stiff, Brown to grey, Moist																	
	(FILL)		2	SS	9													
			3	SS	12													
282.8 2.3	SILT, trace sand																	
	Loose, Grey, Moist		4	SS	5													
	ORGANIC SILT																	
281.7 3.4	Black, Moist		5	SS	4													
	CLAYEY SILT, trace/some sand, trace gravel																	
	Firm to stiff, Grey, Wet																	
				VANE														
			6	SS	5													
			7	SS	5													
			8	SS	8													
			9	SS	10													
			10	SS	10													
			12	SS	13													
			11	SS	7													
			13	SS	20													

Continued Next Page

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

RECORD OF BOREHOLE No 17

2 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 7575 38.455 N; 418 780.514 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.11.05 LATITUDE 42.949114 LONGITUDE -81.103186 CHECKED BY N.R.

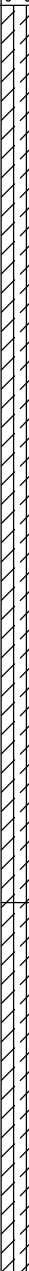
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT			LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)					
							20	40	60	80	100							
270.1	NOTES: 1. Groundwater was not encountered during or upon completion of drilling. 2. Upon extraction of hollow stem augers, borehole caved-in at a depth of 11.9 m.																	

RECORD OF BOREHOLE No 18

1 OF 1

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 498.099 N; 418 780.086 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.11.05 LATITUDE 42.948751 LONGITUDE -81.103199 CHECKED BY N.R.

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 ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE	20	40	60	80	100			20	40	60		
284.0	GROUND		1	SS	3		283							○				7 21 50 22			
283.8	TOPSOIL		2	SS	12											○					
0.2	CLAYEY SILT, some sand, trace gravel Soft to firm, Brown to grey, Moist		3	SS	12											○					
			4	SS	10											⊞					
			5	SS	5											○					
			6	SS	5											○					
			7	SS	6											○					
				VANE															⊞		
			8	SS	5											⊞					
			9	SS	6											○					
			10	SS	11											○					

RECORD OF BOREHOLE No 19

1 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 483.905 N; 418 721.383 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
DATUM Geodetic DATE 2018.11.05 LATITUDE 42.948632 LONGITUDE -81.103921 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
286.1	GROUND													
0.0	TOPSOIL													
285.8			1	SS	6		286							
0.3	CLAYEY SILT, some sand, trace gravel													
	Stiff, Brown to grey, Moist		2	SS	7		285							
	asphalt debris													
	(FILL)		3	SS	15		284							
283.8														
2.3	ORGANIC SILT		4	SS	5		283							
	Dark brown, Moist		5	SS	9									
282.3														
3.8	CLAYEY SILT, some sand, trace gravel		6	SS	12		282							
	Stiff to very stiff, Brown to grey, Moist		7	SS	11		281							6 21 52 21
			8	SS	12		280							
			9	SS	22		279							
			10	SS	8		278							3 21 56 20
			11	SS	14		277							
			12	SS	9		276							
			13	SS	13		275							1 11 62 26
			14	AS	46		274							
271.8	End of borehole						273							5 23 50 22
14.3							272							

Continued Next Page

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

RECORD OF BOREHOLE No 19

2 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 483.905 N; 418 721.383 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.11.05 LATITUDE 42.948632 LONGITUDE -81.103921 CHECKED BY N.R.

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					W _p	W	W _L		
							20	40	60	80	100						
271.1	NOTES: 1. Groundwater was not encountered during or upon completion of drilling. 2. Upon extraction of hollow stem augers, borehole caved-in at a depth of 13.1 m.																

RECORD OF BOREHOLE No 20

1 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 538.774 N; 418 719.049 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
DATUM Geodetic DATE 2018.11.02 LATITUDE 42.949126 LONGITUDE -81.103939 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p	W	W _L		WATER CONTENT (%)	GR	SA	SI	CL	
286.6	GROUND							20	40	60	80	100										
0.0	TOPSOIL																					
286.3	CLAYEY SILT, with/some sand, some gravel, asphalt and wood debris Firm, Brown to grey, Moist		1	SS	6		286								○					0 12 70 18		
			2	SS	8		285									○						
			3	SS	9		284										○					
			4	SS	6		283											○				
283.5	SILTY SAND, with gravel Loose, Brown, Wet (FILL)						282														5 17 55 23	
3.1			ORGANIC SILT	5	SS		4	281														
			Black, Wet	6	SS		1	280														
								279														
	7	SS		8	278																	
			8		-		277														3 19 55 23	
							276															
							275															
							274															
280.2	CLAYEY SILT, some sand, trace gravel Stiff to very stiff, Grey, Moist		9A	SS	5		273														21 49 22 8	
6.4							272															
			9B	SS	11	271																
							270															
			10	SS	18		269								○							
						268																
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			11	SS	15		265								○							
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+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No 20

2 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 538.774 N; 418 719.049 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.11.02 LATITUDE 42.949126 LONGITUDE -81.103939 CHECKED BY N.R.

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			20	40	60	80	100	W _p	W	W _L		
271.6	 Groundwater measured upon completion of drilling. NOTE: Upon extraction of hollow stem augers, borehole caved in at a depth of 13.1 m.																

ONTARIO MTO 18KF037A.GPJ ONTARIO MTO.GDT 2/5/19

RECORD OF BOREHOLE No 21

1 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 554.297 N; 418 644.786 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.11.06 LATITUDE 42.949277 LONGITUDE -81.104845 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
285.6	GROUND													
0.0	TOPSOIL													
285.3														
0.3	asphalt debris		1	SS	14		285							
	CLAYEY SILT, with sand, trace gravel, Firm, Brown, Moist (FILL)		2	SS	7									
284.1							284							
1.5	CLAYEY SILT, some sand, trace gravel Stiff to very stiff, Brown, Moist		3	SS	15									
			4	SS	18		283							4 17 57 22
			5	SS	14		282							
			6	SS	11		281							
			7	SS	11		280							
			8	SS	12		279							3 19 56 22
			9	SS	12		278							
			10	SS	12		277							
			11	SS	11		276							
			12	SS	12		275							3 14 58 25
			13	SS	13		274							
							273							
							272							
271.9	SILT, trace clay, trace sand Dense, Grey, Moist to wet		14	SS	37		271							0 6 89 5
13.7														
270.6														

Continued Next Page



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

RECORD OF BOREHOLE No 21

2 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 554.297 N; 418 644.786 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.11.06 LATITUDE 42.949277 LONGITUDE -81.104845 CHECKED BY N.R.

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
270.6 15.0	CLAYEY SILT, with sand							20	40	60	80	100					
	Hard, Grey, Wet		15	SS	45		270										
269.8 15.8	End of borehole																
	<div> Groundwater level measured upon completion of drilling</div> <div>NOTE: Upon extraction of hollow stem augers, borehole caved-in at a depth of 14.6 m.</div>																

RECORD OF BOREHOLE No 22

1 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 516.260 N; 418 652.574 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.11.06 LATITUDE 42.948933 LONGITUDE -81.104758 CHECKED BY N.R.

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									WATER CONTENT (%)																																						
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE																																												
								20	40	60	80						100	20	40	60																																			
284.9	GROUND		1	SS	3		284									5 18 55 22																																							
284.7	TOPSOIL		2	SS	8				283																																														
0.2			3	SS	12						282																																												
			4	SS	22								281																																										
			5	SS	11												280																																						
			6	SS	11															279																																			
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			8	SS	10																					277																													
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+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No 22

2 OF 2

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 516.260 N; 418 652.574 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
DATUM Geodetic DATE 2018.11.06 LATITUDE 42.948933 LONGITUDE -81.104758 CHECKED BY N.R.

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			20	40	60	80	100	W _p	W	W _L		
269.9 15.0	CLAYEY SILT, trace sand, trace gravel																
	Very stiff, Grey, Moist		15	SS	26												1 3 77 19
269.1 15.8	End of borehole																
NOTES: 1. Groundwater was not encountered during or upon completion of drilling. 2. Upon extraction of hollow stem augers, borehole caved-in at a depth of 13.7 m.																	

RECORD OF BOREHOLE No 23

1 OF 1

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 431.334 N; 418 564.296 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.10.22 LATITUDE 42.948182 LONGITUDE -81.105856 CHECKED BY N.R.

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									WATER CONTENT (%)			GR	SA	SI	CL
								20 40 60 80 100									20 40 60						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE															
282.3	GROUND																						
0.0	SILTY SAND, with gravel		1	SS	24	▽	282																
281.5	Compact, Brown, Moist (FILL)						281																
0.8	CLAYEY SILT, some sand, trace gravel Firm to very stiff, Brown to grey, Moist		2	SS	7		280																
			3	SS	14																		
			4	SS	10																		
			5	SS	15																		
			6	SS	9																		
			7	SS	5																		
			8	SS	8																		
			9	SS	7																		
			10	SS	7																		
			11	SS	12																		
	12	SS	16			270																	
269.5	End of borehole																						
12.8	▽ Groundwater level measured during drilling																						
NOTES: 1. Groundwater level was not encountered upon completion of drilling. 2. Upon extraction of hollow stem augers, borehole caved-in at a depth of 11.3 m.																							

ONTARIO MTO 18KF037A.GPJ ONTARIO MTO.GDT 2/5/19

RECORD OF BOREHOLE No 24

1 OF 1

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 471.185 N; 418 568.619 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.10.22 LATITUDE 42.94854 LONGITUDE -81.105795 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
283.7 0.0	GROUND SILTY SAND, with gravel Dense, Brown, Moist (FILL)		1	SS	41		283							
282.9 0.8	CLAYEY SILT, some sand, trace gravel Stiff to very stiff, Brown to grey, Moist		2	SS	11		282							
			3	SS	17		282							
			4	SS	20		281							
			5	SS	11		280							
			6	SS	11		279							
			7	SS	7		278							
			8	SS	10		277							
			9	SS	10		276							
			10	SS	13		275							
			11	SS	14		274							
			12	SS	13		273							
270.9 12.8	End of borehole						272							
	NOTES: 1. Groundwater was not encountered during or upon completion of drilling. 2. Upon extraction of hollow stem augers, borehole caved in at a depth of 11.3 m.						271							

ONTARIO MTO 18KF037A.GPJ ONTARIO MTO.GDT 2/5/19

RECORD OF BOREHOLE No 25

1 OF 1

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 525.884 N; 418 576.552 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
DATUM Geodetic DATE 2018.10.22 LATITUDE 42.949031 LONGITUDE -81.105687 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
285.9	GROUND													
0.0	SILTY SAND, with gravel		1	SS	42		285							
	Dense to compact, Brown, Moist (FILL)		2	SS	15									
284.4														
1.5	CLAYEY SILT, trace to some sand, trace gravel		3	SS	13		284							
	Stiff to very stiff, Brown to grey, Moist		4	SS	12									
			5	SS	15		283							
			6	SS	19									
			7	SS	18		282							
			8	SS	14									
			9	SS	11		281							
			10	SS	12		280							
			11	SS	13		279							
			12	SS	10		278							
							277							
							276							
			13	SS	12		275							
							274							
273.1	End of borehole													
12.8														
	NOTES: 1. Groundwater was not encountered during or upon completion of drilling. 2. Upon extraction of hollow stem augers, borehole caved in at a depth of 11.4 m.													


ONTARIO MTO 18KF037A.GPJ ONTARIO MTO.GDT 2/5/19

RECORD OF BOREHOLE No 26

1 OF 1

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 350.342 N; 418 887.796 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
DATUM Geodetic DATE 2018.10.19 LATITUDE 42.947405 LONGITUDE -81.10191 CHECKED BY N.R.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
283.5 0.0	GROUND SILTY SAND, with gravel Dense, Brown, Dry (FILL)		1	SS	45		283							
282.7 0.8	CLAYEY SILT, with some organic inclusions with some sand, trace gravel Firm to stiff, Brown to grey, Moist		2	SS	9		282							
			3	SS	5									
			4	SS	8		281							6 21 53 20
			5	SS	18		280							
			6	SS	19									
			7	SS	11		279							
			8	SS	10		278							
			9	SS	11		277							2 18 56 24
			10	SS	27		276							
			11	SS	8		274							
			12	SS	12		273							4 23 51 22
			13	SS	12		271							
270.7 12.8	End of borehole													
	 Groundwater level measured upon completion of drilling NOTES: 1. No cave-in was noted in the borehole upon extraction of hollow stem augers													

ONTARIO MTO 18KF037A.GPJ ONTARIO MTO.GDT 2/5/19

RECORD OF BOREHOLE No 27

1 OF 1

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 399.948 N; 418 908.720 E ORIGINATED BY A.H.
DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
DATUM Geodetic DATE 2018.10.19 LATITUDE 42.947848 LONGITUDE -81.101643 CHECKED BY N.R.

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									WATER CONTENT (%)			
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE									
283.4 0.0	GROUND SILTY SAND, with gravel Dense to compact, Brown, Dry (FILL)		1	SS	39															
			2	SS	11															
282.0 1.4			3	SS	2															
			4	SS	5															
			5	SS	11															
			6	SS	16															
			7	SS	14															
			8	SS	11															
			9	SS	11															
			10	SS	8															
			11	SS	14															
			12	SS	17															
			13	SS	11															
270.6 12.8	End of borehole																			
	<div>Groundwater level measured upon completion of drilling</div> <div>NOTE: 1. No cave-in was noted in the borehole upon extraction of hollow stem augers</div>																			

ONTARIO MTO 18KF037A.GPJ ONTARIO MTO.GDT 2/5/19

RECORD OF BOREHOLE No 28

1 OF 1

METRIC

G.W.P. 3016-E-0009-013 LOCATION Coords: 4 757 438.061 N; 418 924.700 E ORIGINATED BY A.H.
 DIST West Region HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY K.A.
 DATUM Geodetic DATE 2018.10.19 LATITUDE 42.948189 LONGITUDE -81.10144 CHECKED BY N.R.

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											
						20	40	60	80	100	WATER CONTENT (%)								
283.3 0.0	GROUND SILTY SAND, with gravel		1	SS	26		283											9 18 54 19	
	Compact to loose, Brown, Dry (FILL)		2	SS	7		282												
281.9 1.4	CLAYEY SILT, some sand, trace gravel		3	SS	22		281												
	Very stiff to stiff, Brown to grey, Moist to wet		4	SS	27		280												
			5	SS	20		279												
			6	SS	15		278												
			7	SS	10		277												
			8	SS	16		276												
			9	SS	10		275												
			10	SS	17		274												
			11	SS	11		273												
			12	SS	13		272												
			13	SS	18		271												
270.5 12.8	End of borehole																		
NOTES:																			
1. Groundwater was not encountered during or upon completion of drilling.																			
2. No cave-in was noted in the borehole upon extraction of hollow stem augers																			

ONTARIO MTO 18KF037A.GPJ ONTARIO MTO.GDT 2/5/19



APPENDIX A

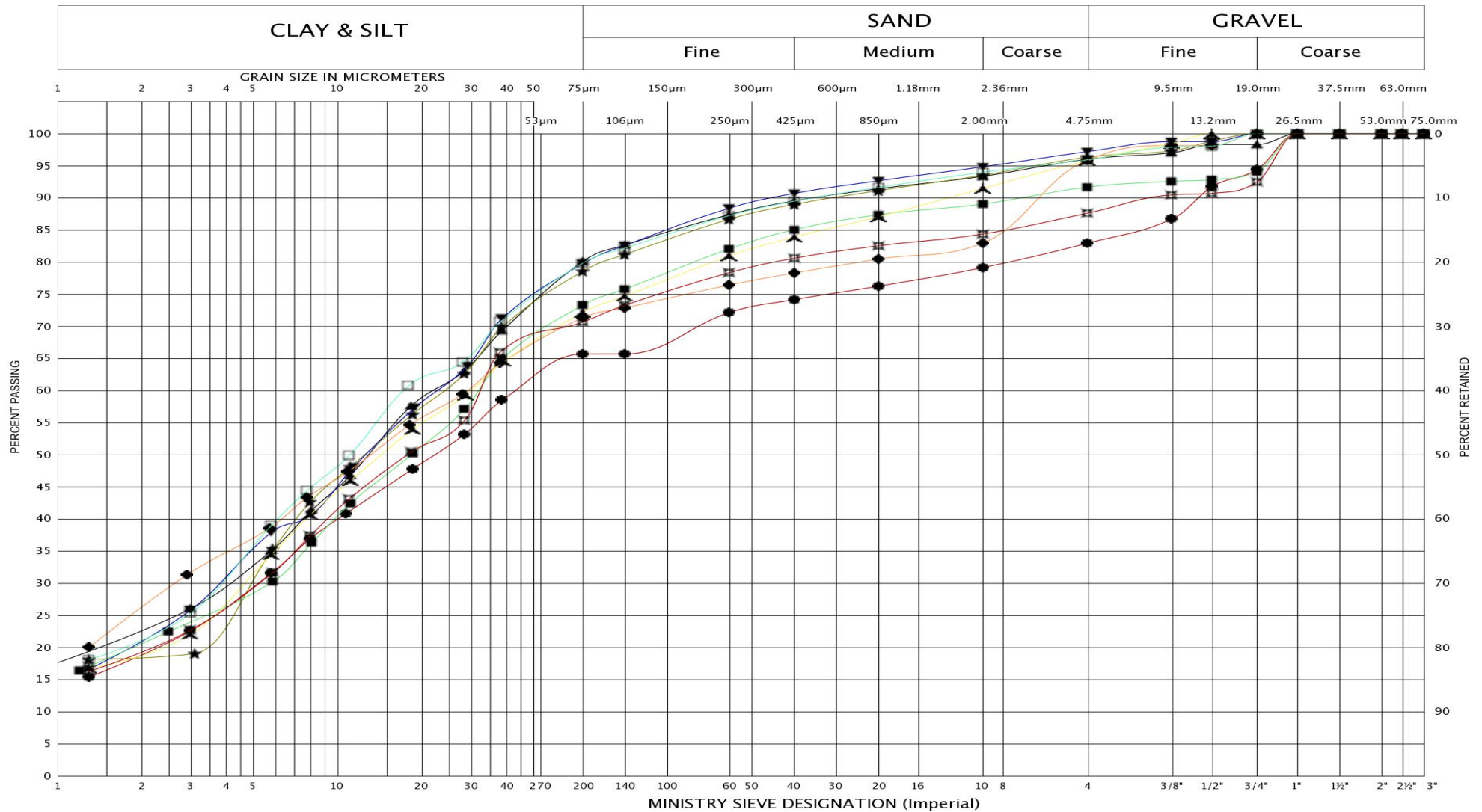
Grain Size Distribution Charts

Figures WB1-GS-1A/B, WB1-GS-2
Figures WB1-GS-3A/B, WB1-GS-4
Figures WB1-GS-5, WB2-GS-1, WB2-GS-2
Figures WB3-GS-1A/B, WB3-GS-2
Figures WB4-GS-1, WB4-GS-2
Figures WB5-GS-1, WB5-GS-2
Figures WB6-GS-1, WB6-GS-2A/B, WB6-GS-3
Figures WB7-GS-1, WB7-GS-2
Figures WB8-GS-1, WB9-GS-1A/B

Plasticity Charts

Figures WB1-PC-1A/B/C, WB1-PC-2A/B
Figures WB2-PC-1A/B, WB3-PC-1A/B
Figures WB4-PC-1A/B, WB5-PC-1
Figures WB6-PC-1, WB6-PC-2A/B, WB6-PC-3
Figures WB7-PC-1, WB8-PC-1A/B
Figures WB9-PC-1A/B

UNIFIED SOIL CLASSIFICATION SYSTEM



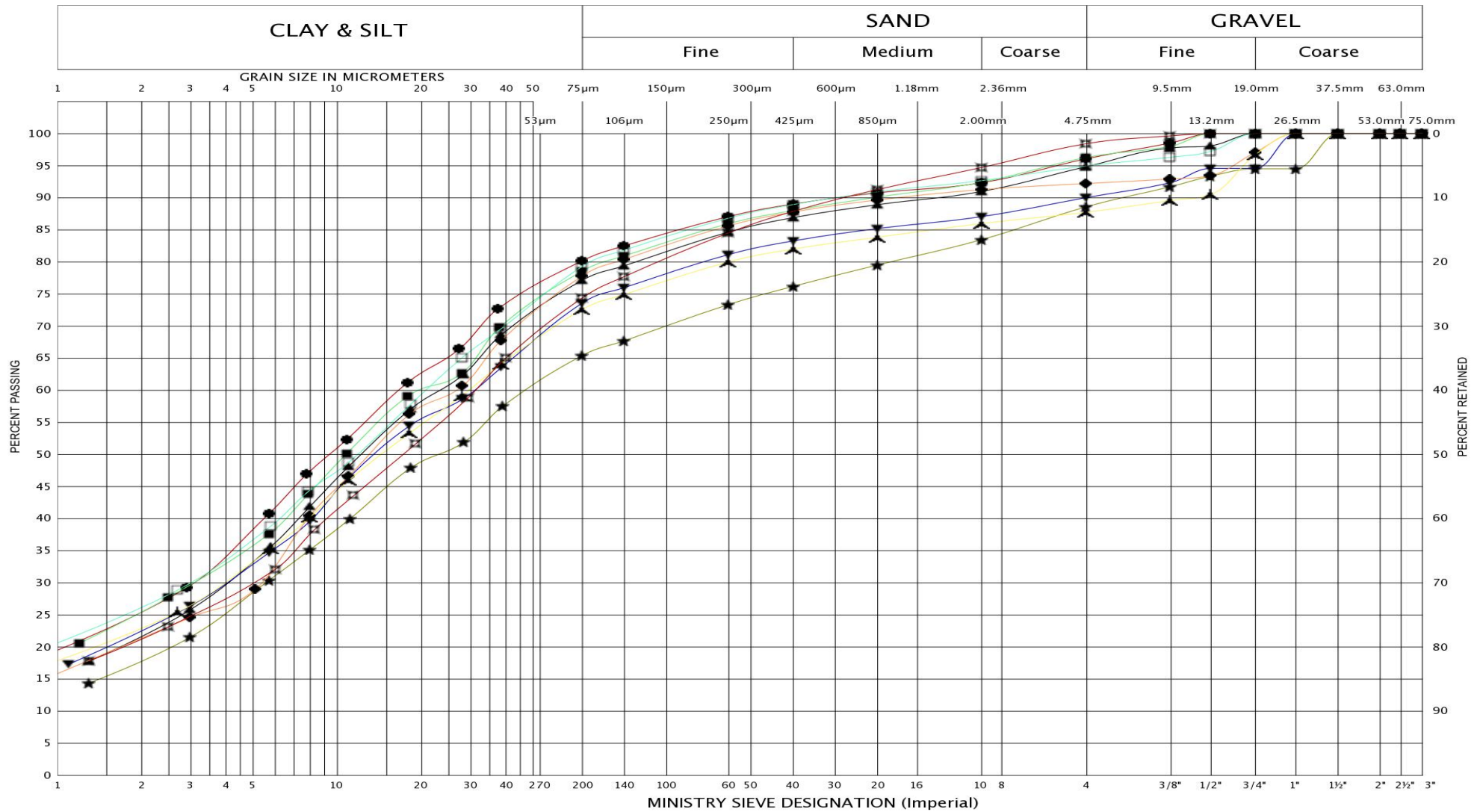
LEGEND	BH	C-1	N-1	N-1	C-1	N-1	N-1	C-2	C-2	N-2
	SAMPLE	4	5	6	8	9	14	3	6	6
	SYMBOL	▲	△	□	●	■	◆	▼	★	⊠



GRAIN SIZE DISTRIBUTION
CLAYEY SILT

FIG No.: WB1-GS-1A
HWY : 401
GWP 3016-E-0009-013

UNIFIED SOIL CLASSIFICATION SYSTEM



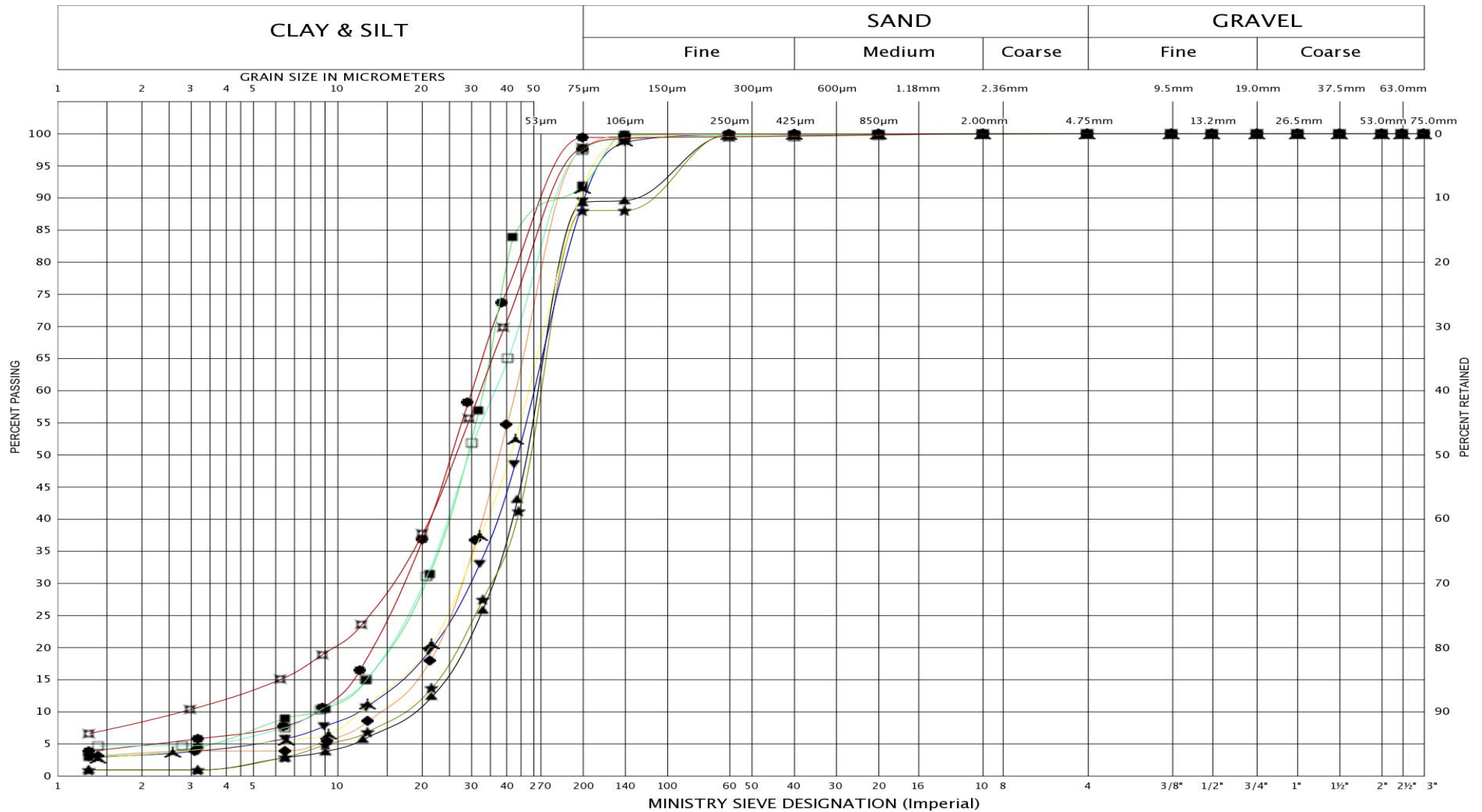
LEGEND	BH	S-1	S-1	N-2	N-2	S-2	N-3	N-3	N-3	N-3
	SAMPLE	7	11	9	12	24	5	7	10	13
	SYMBOL	▲	◻	▲	●	⊠	★	◆	▼	■



GRAIN SIZE DISTRIBUTION
CLAYEY SILT

FIG No.: WB1-GS-1B
HWY : 401
GWP 3016-E-0009-013

UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND	BH	C-1	C-1	C-2	N-2	N-3	S-1	S-2	S-2	S-3
	SAMPLE	15A	12	12	15	15	13	14	15	14
	SYMBOL	●	▲	★	▼	■	◆	▲	□	⊠



GRAIN SIZE DISTRIBUTION

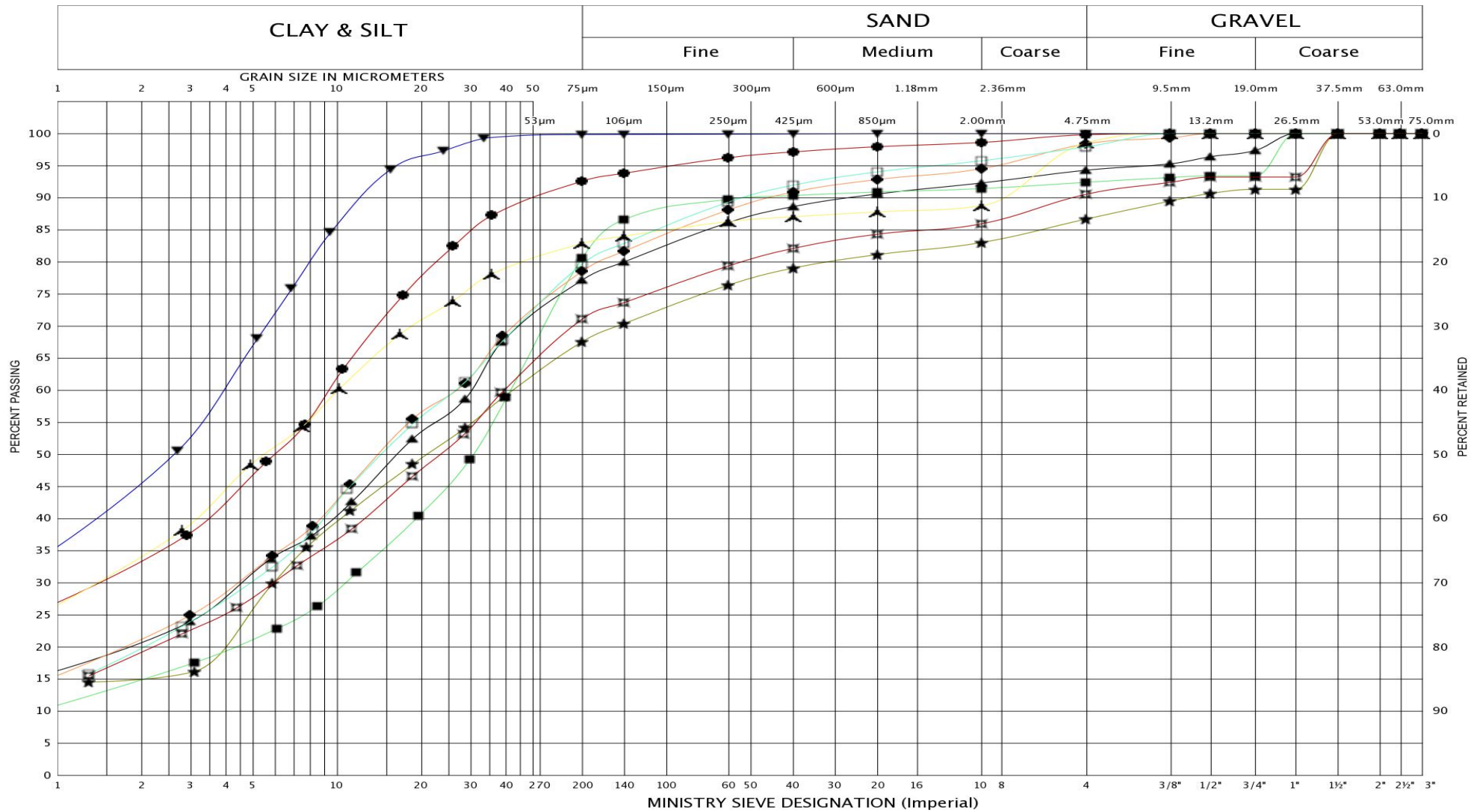
SILT

FIG No.: WB1-GS-2

HWY : 401

GWP 3016-E-0009-013

UNIFIED SOIL CLASSIFICATION SYSTEM



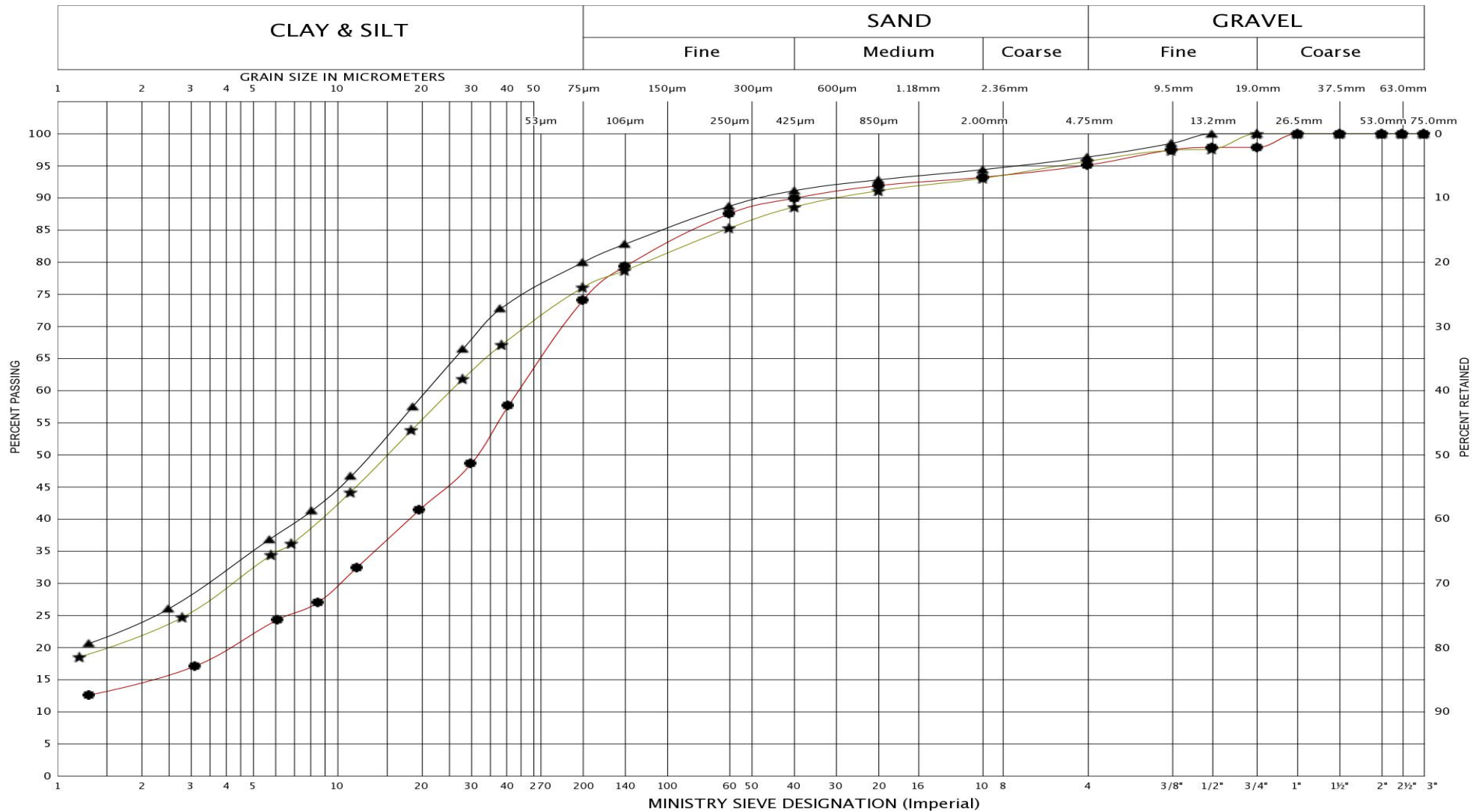
LEGEND	BH	C-1	C-1	C-2	C-2	N-2	N-2	N-2	N-2	N-3
	SAMPLE	26	19	20	16	24	22	27	18	18(2)
	SYMBOL	●	▲	★	▼	■	◆	▲	□	⊠



GRAIN SIZE DISTRIBUTION
CLAYEY SILT TILL

FIG No.: WB1-GS-3A
HWY : 401
GWP 3016-E-0009-013

UNIFIED SOIL CLASSIFICATION SYSTEM



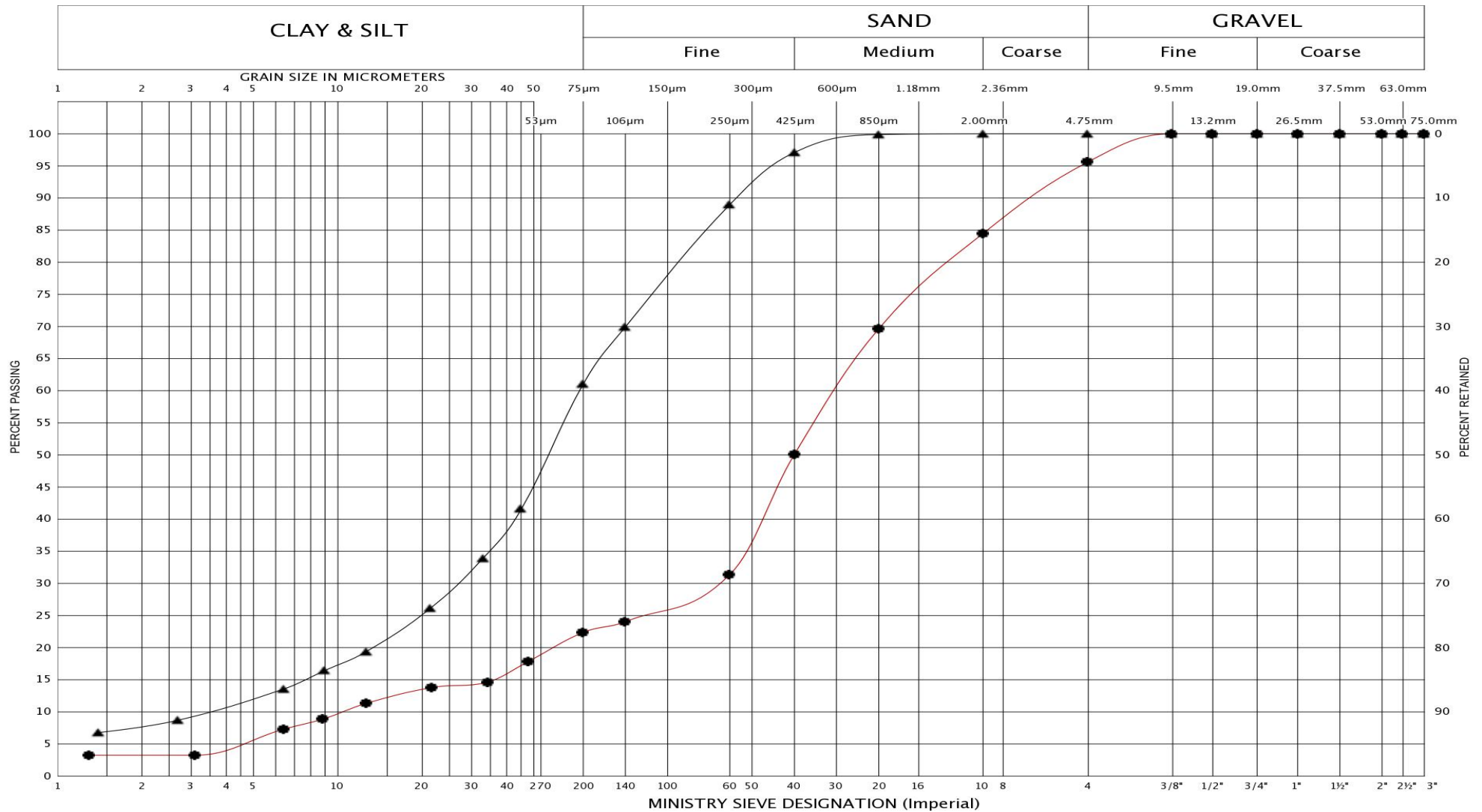
LEGEND	BH	N-3	S-2	S-3
	SAMPLE	24	21	20
	SYMBOL	●	▲	★



GRAIN SIZE DISTRIBUTION
CLAYEY SILT TILL

FIG No.: WB1-GS-3B
HWY : 401
GWP 3016-E-0009-013

UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND	BH	C-2	S-3
	SAMPLE	17	18
	SYMBOL	●	▲



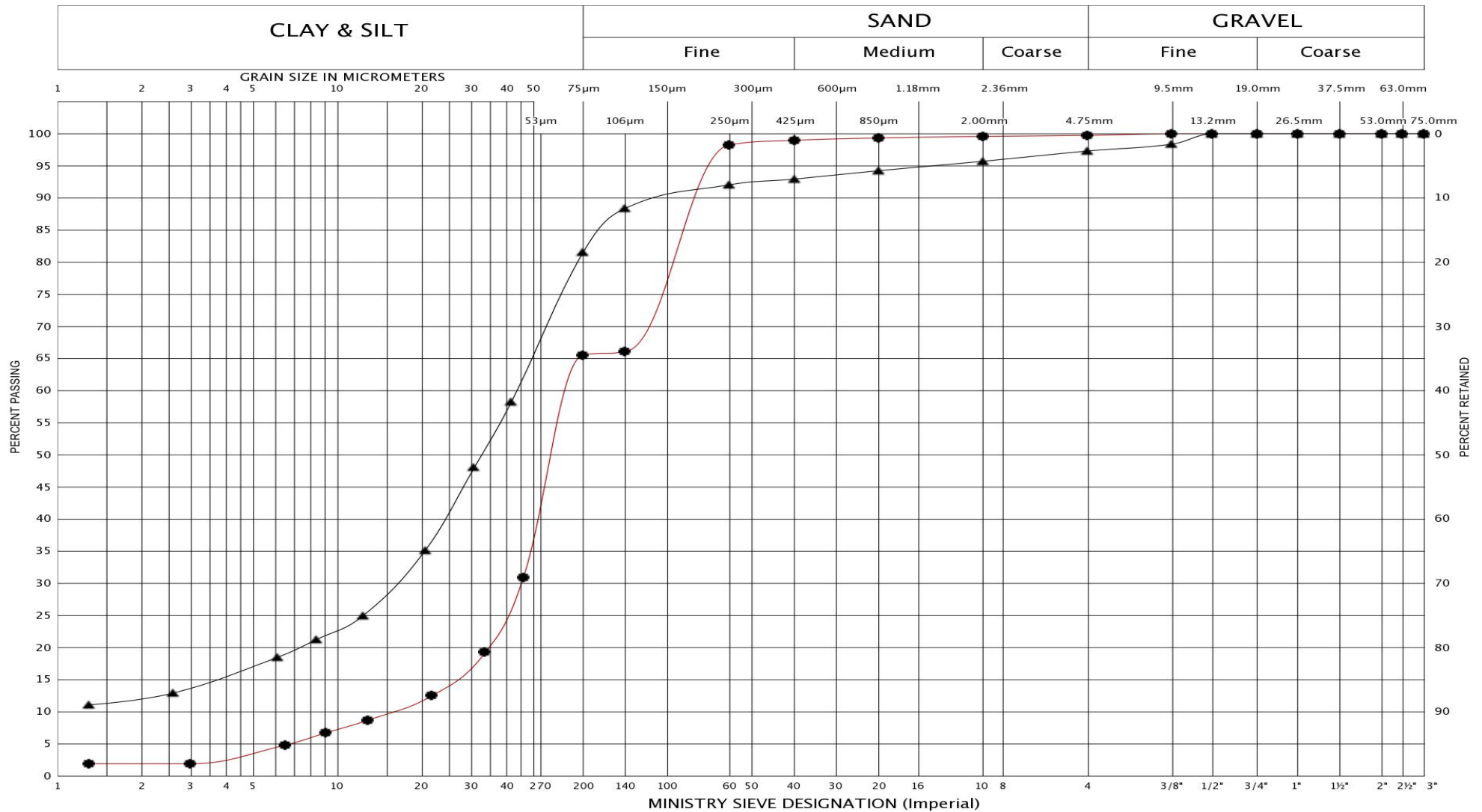
GRAIN SIZE DISTRIBUTION
SANDY SILT/SILTY SAND Seam

FIG No.: WB1-GS-4

HWY : 401

GWP 3016-E-0009-013

UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND	BH	C-1	S-2
	SAMPLE	23	26
	SYMBOL	●	▲

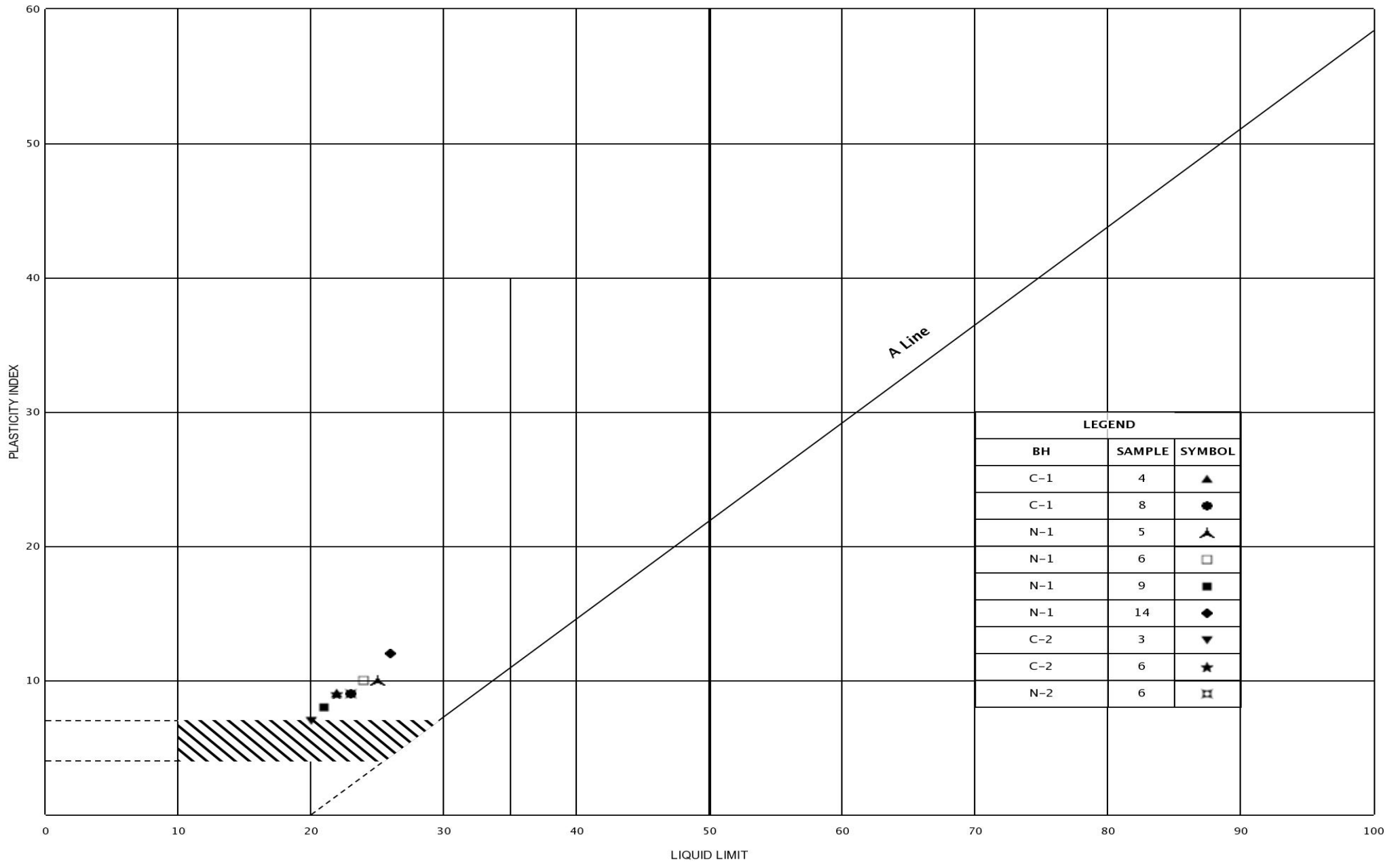


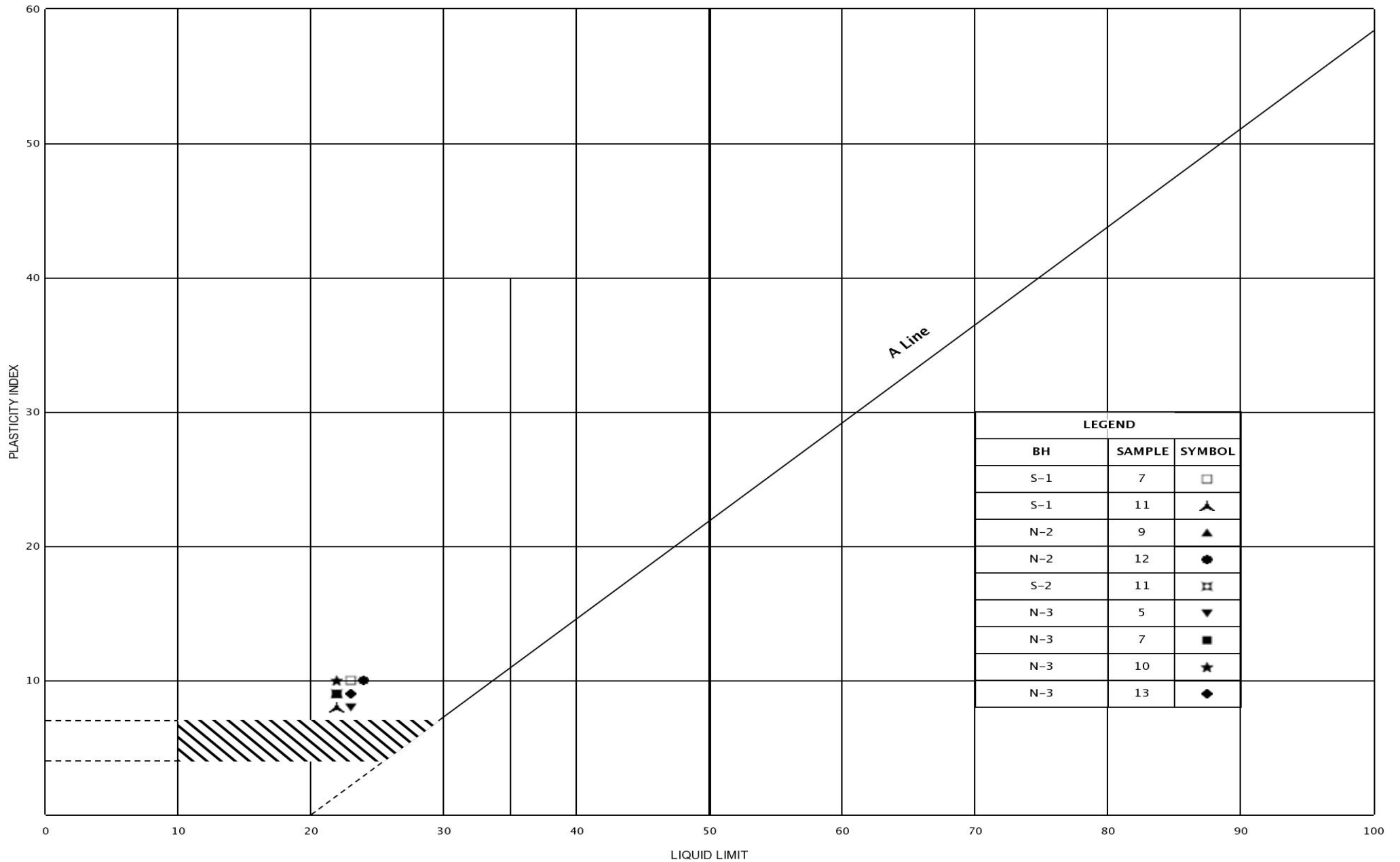
GRAIN SIZE DISTRIBUTION
SANDY SILT TILL

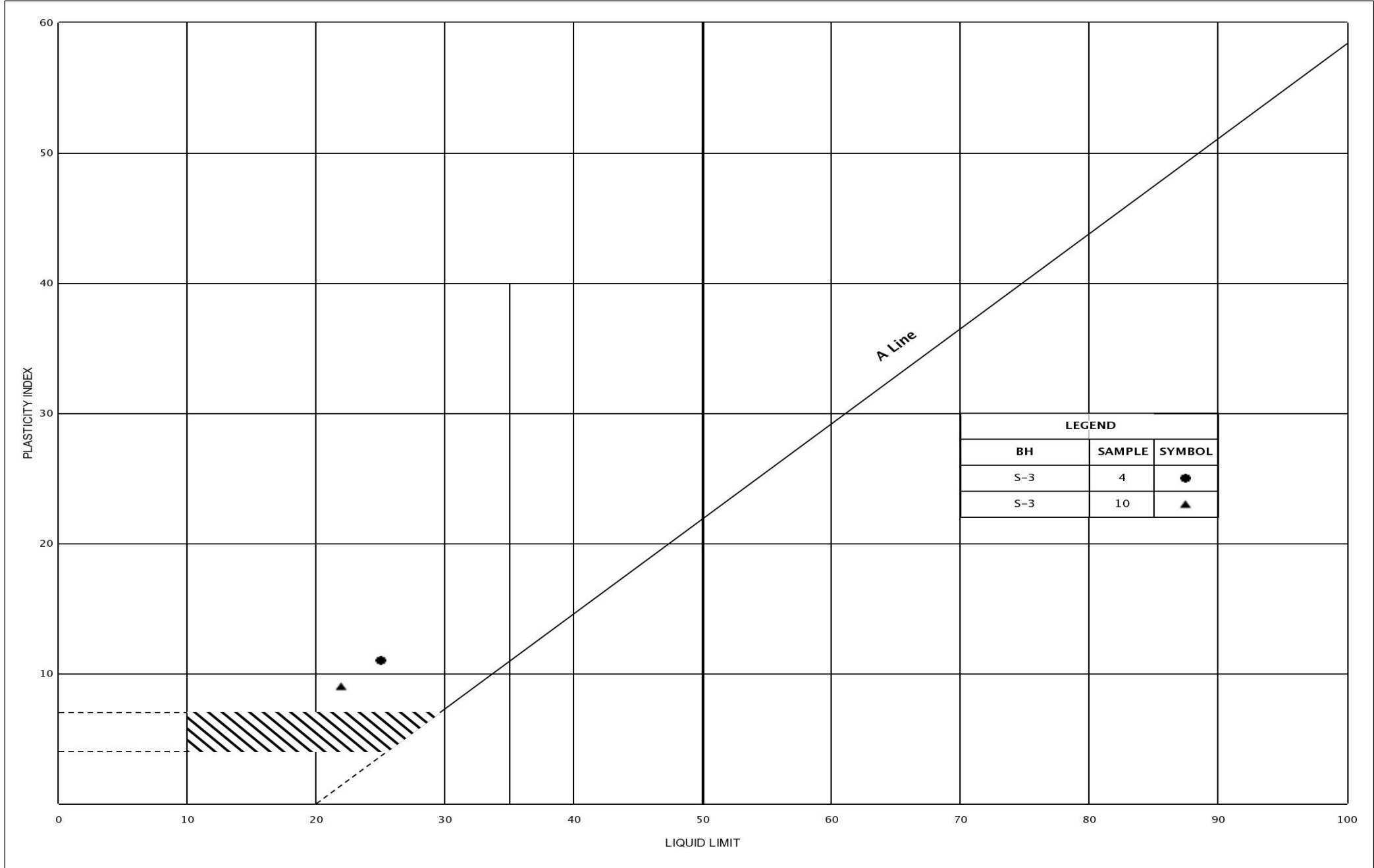
FIG No.: WB1-GS-5

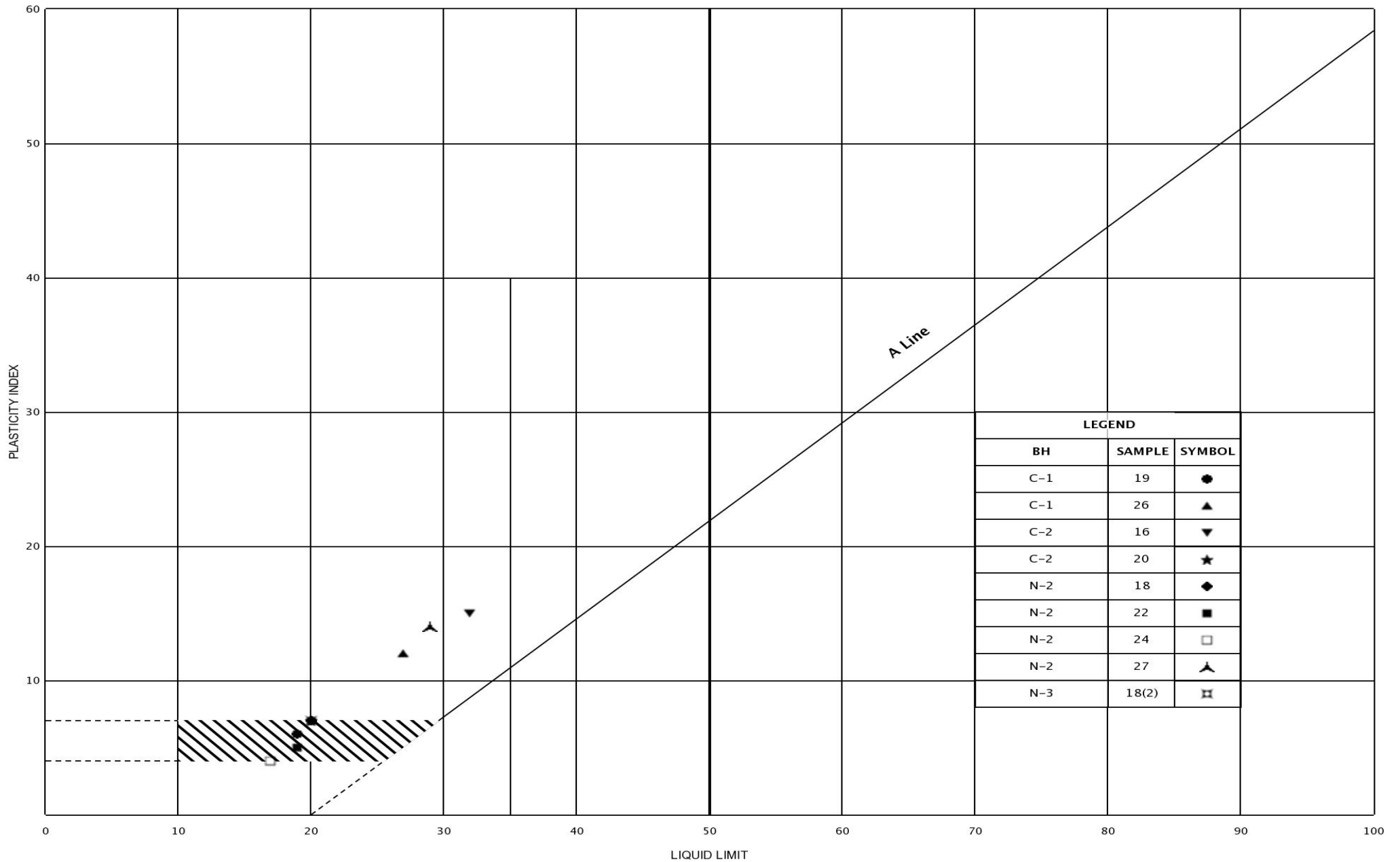
HWY : 401

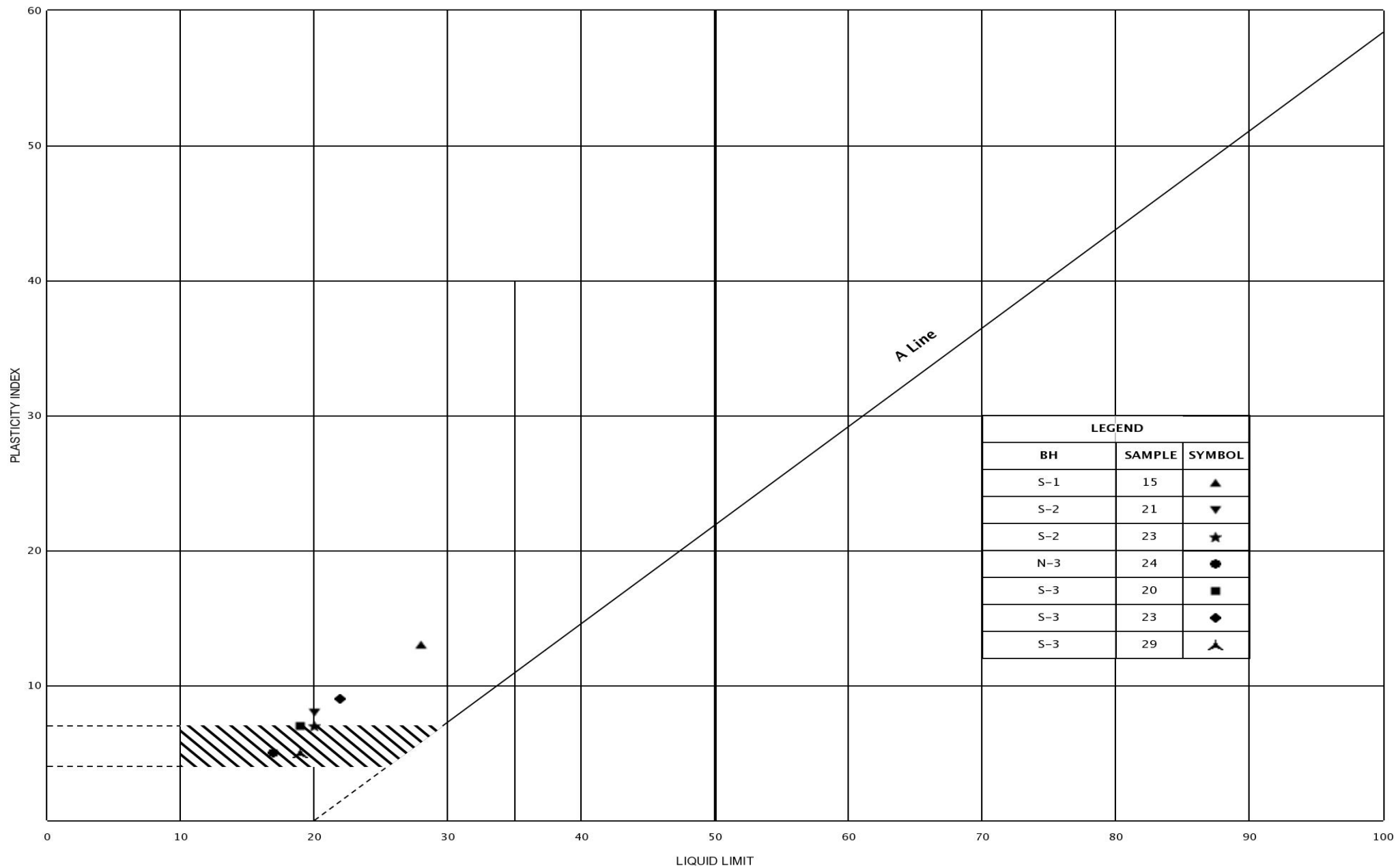
GWP 3016-E-0009-013



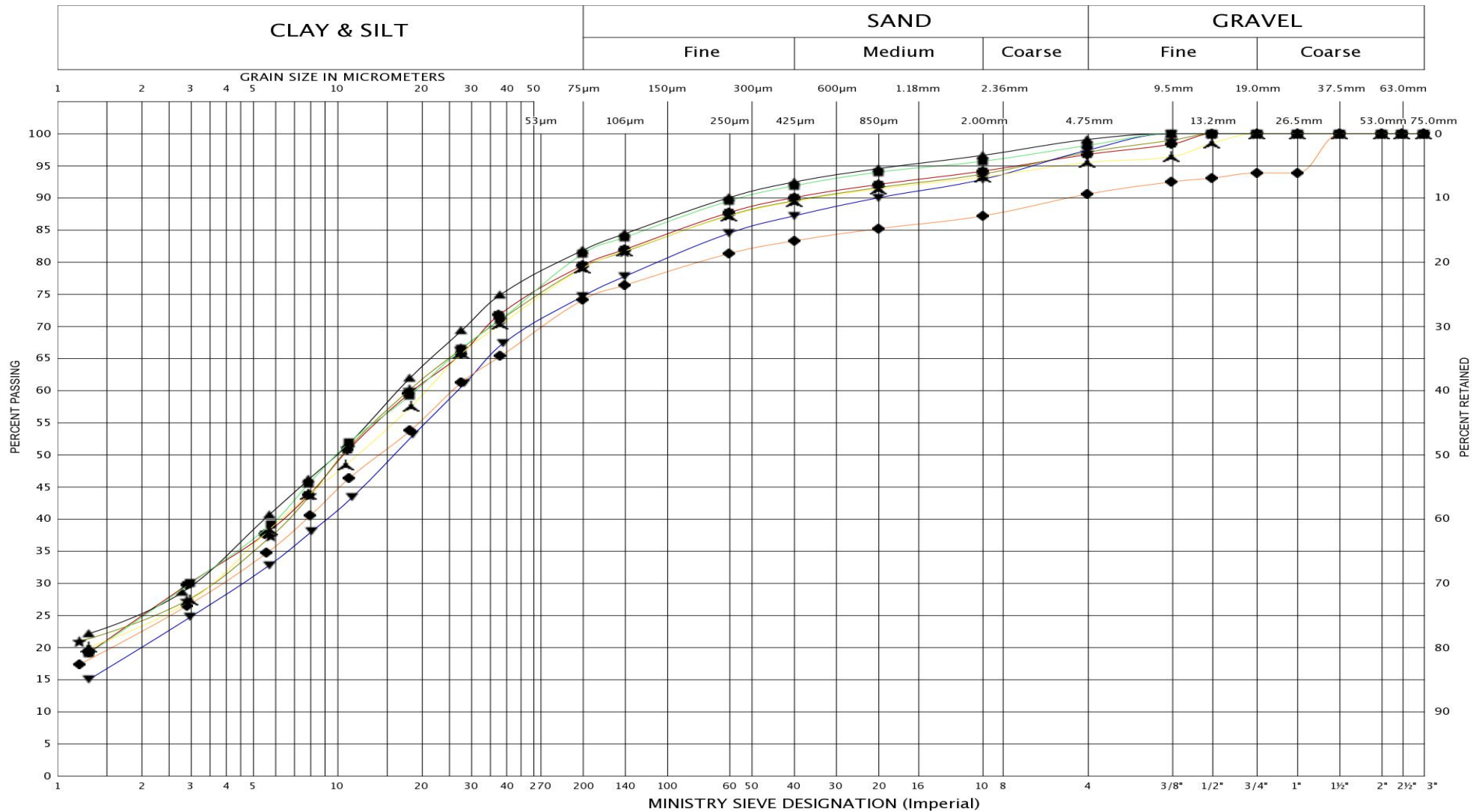








UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND	BH	2	3	3	4	4	4	5
	SAMPLE	7	5	8	7	9	11	9
	SYMBOL	●	▲	★	▼	■	◆	▲



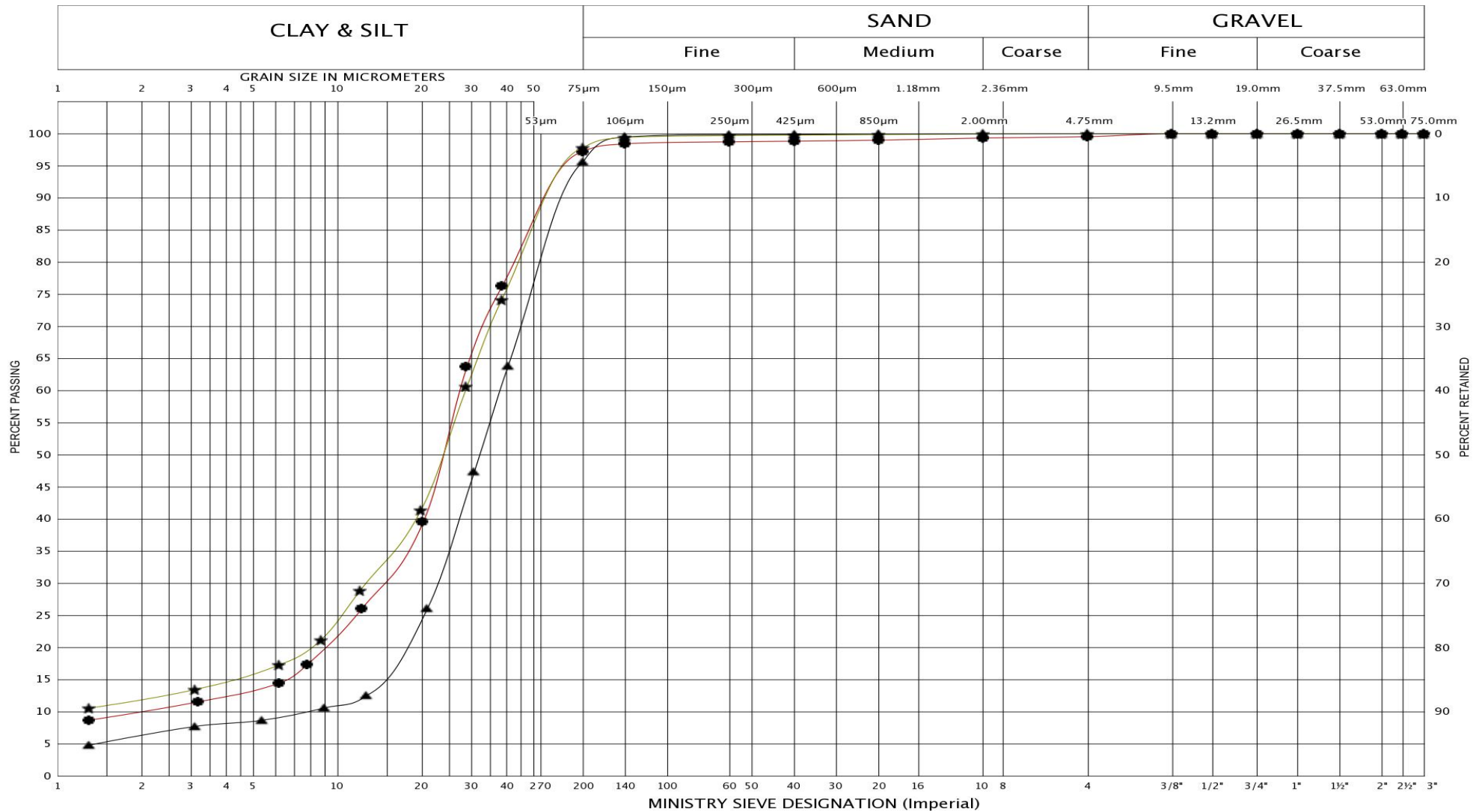
GRAIN SIZE DISTRIBUTION
CLAYEY SILT

FIG No.: WB2-GS-1

HWY : 401

GWP 3016-E-0009-013

UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND	BH	1	3	4
	SAMPLE	10	13	14
	SYMBOL	●	▲	★



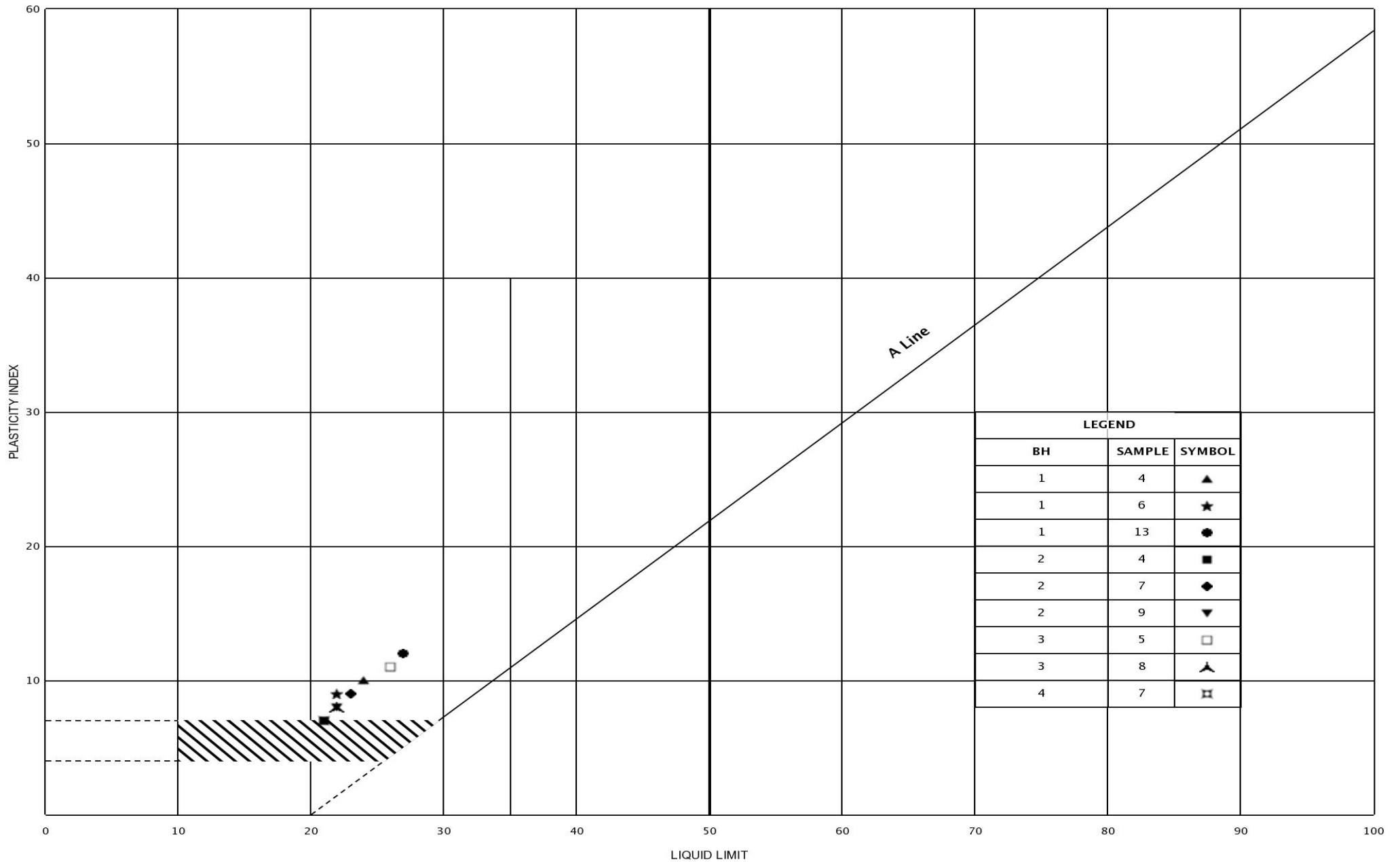
GRAIN SIZE DISTRIBUTION

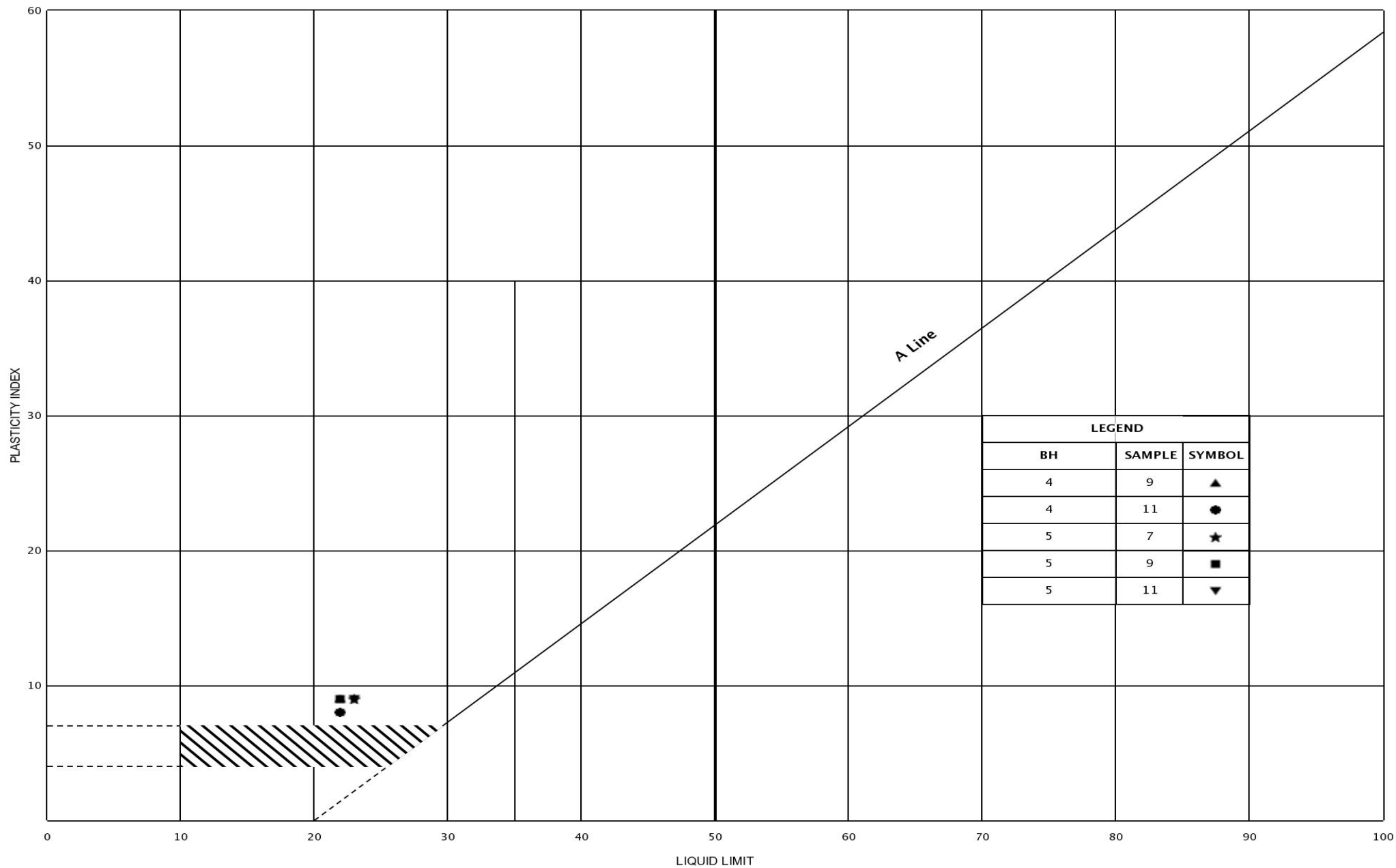
SILT

FIG No.: WB2-GS-2

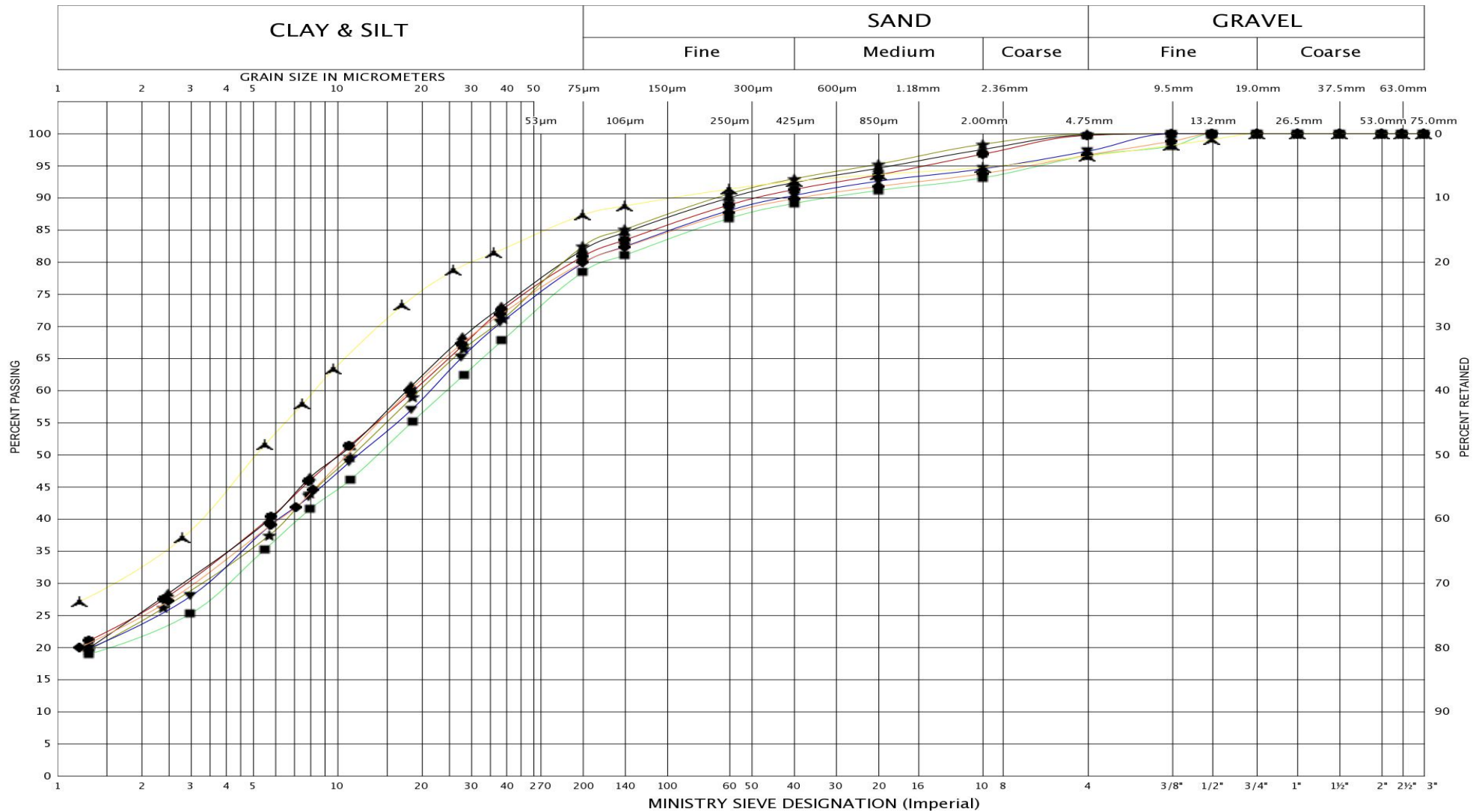
HWY : 401

GWP 3016-E-0009-013





UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND	BH	6	6	6	7	7	7	8
	SAMPLE	5	8	10	4	6	8	10
	SYMBOL	●	★	▲	▼	◆	■	▲



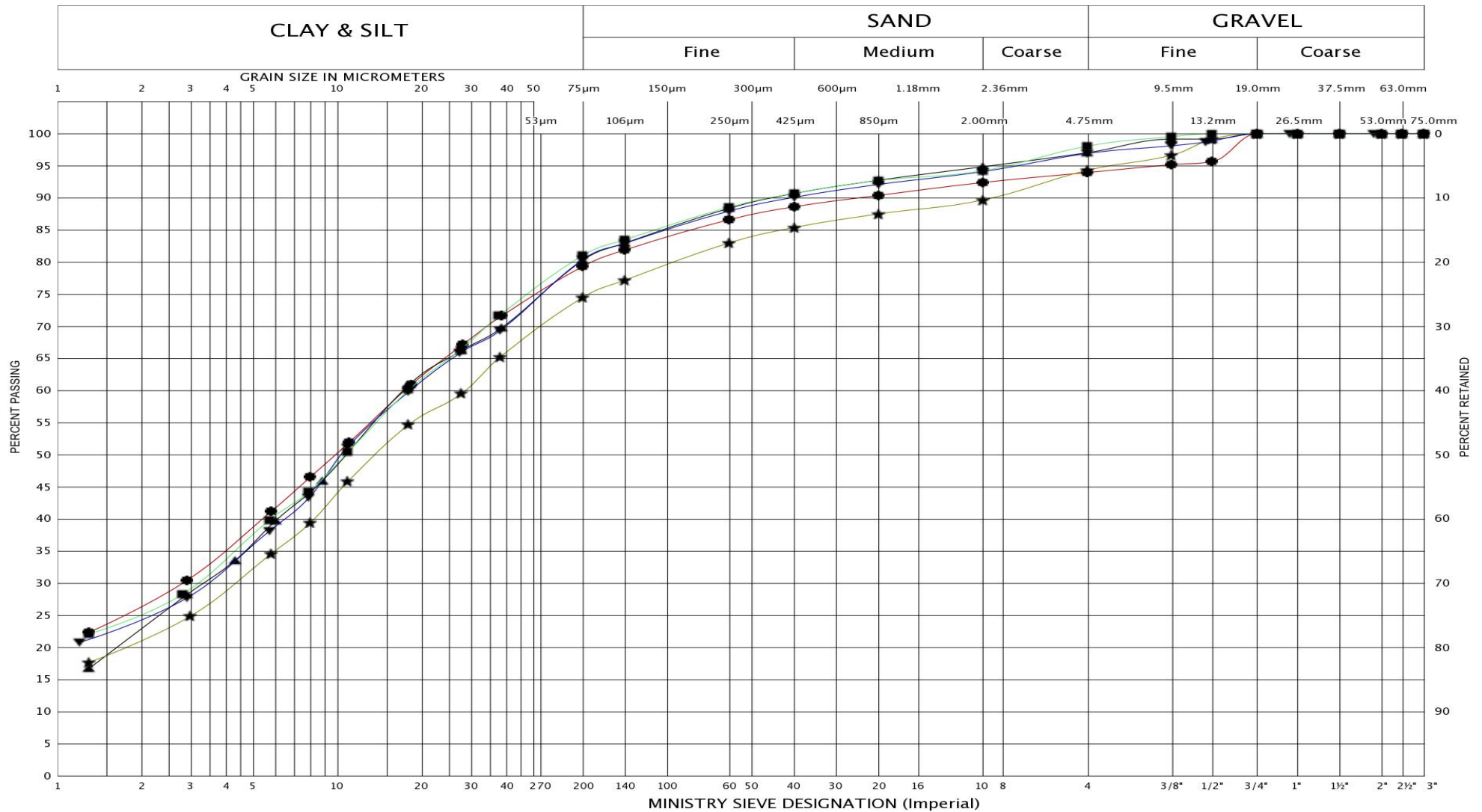
GRAIN SIZE DISTRIBUTION
CLAYEY SILT

FIG No.: WB3-GS-1A

HWY : 401

GWP 3016-E-0009-013

UNIFIED SOIL CLASSIFICATION SYSTEM



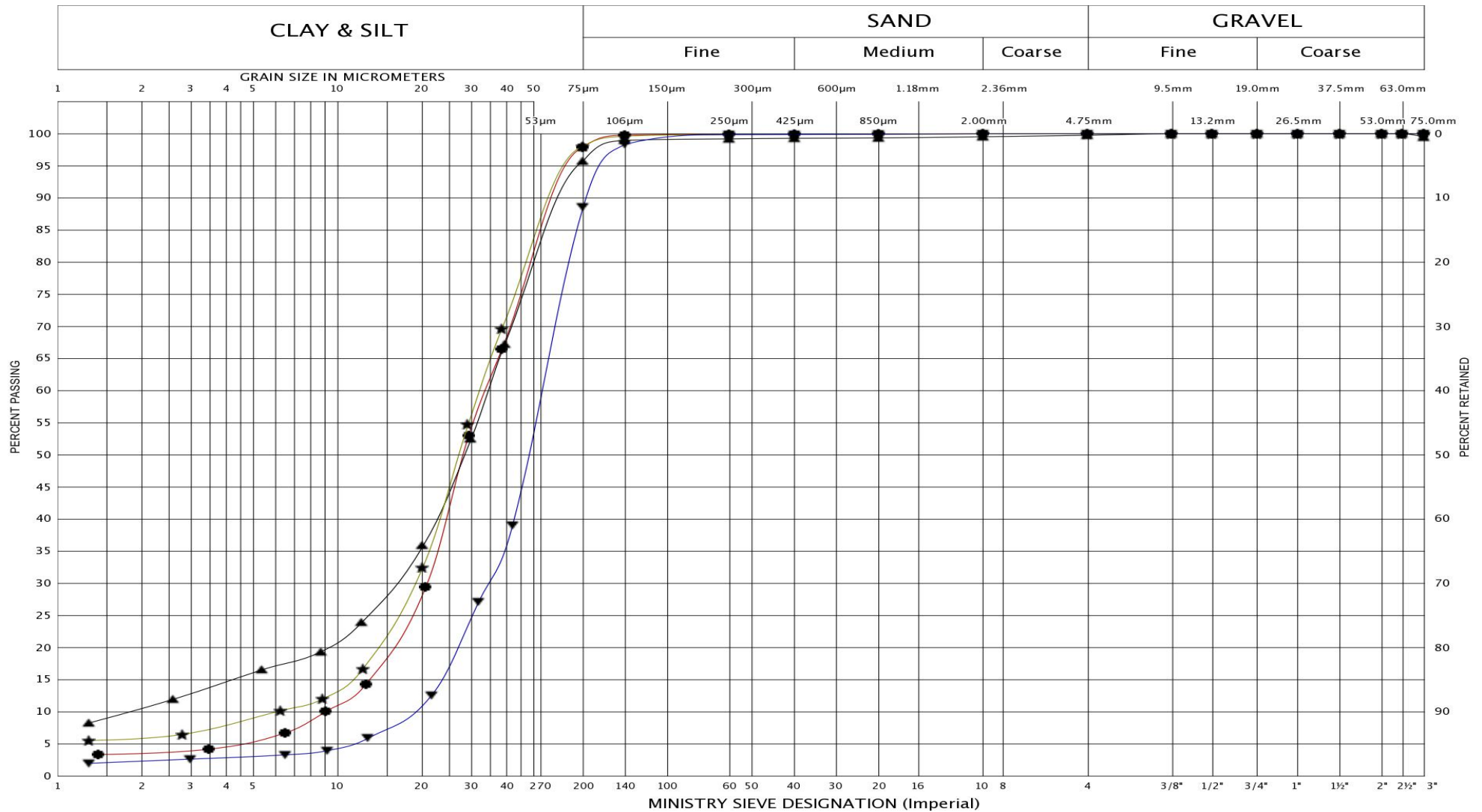
LEGEND	BH	9	9	9	9	10
	SAMPLE	5	8	10	12	8
	SYMBOL	★	■	▼	▲	◆



GRAIN SIZE DISTRIBUTION
CLAYEY SILT

FIG No.: WB3-GS-1B
HWY : 401
GWP 3016-E-0009-013

UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND	BH	6	7	8	10
	SAMPLE	13	12	13	13
	SYMBOL	▲	★	▼	●



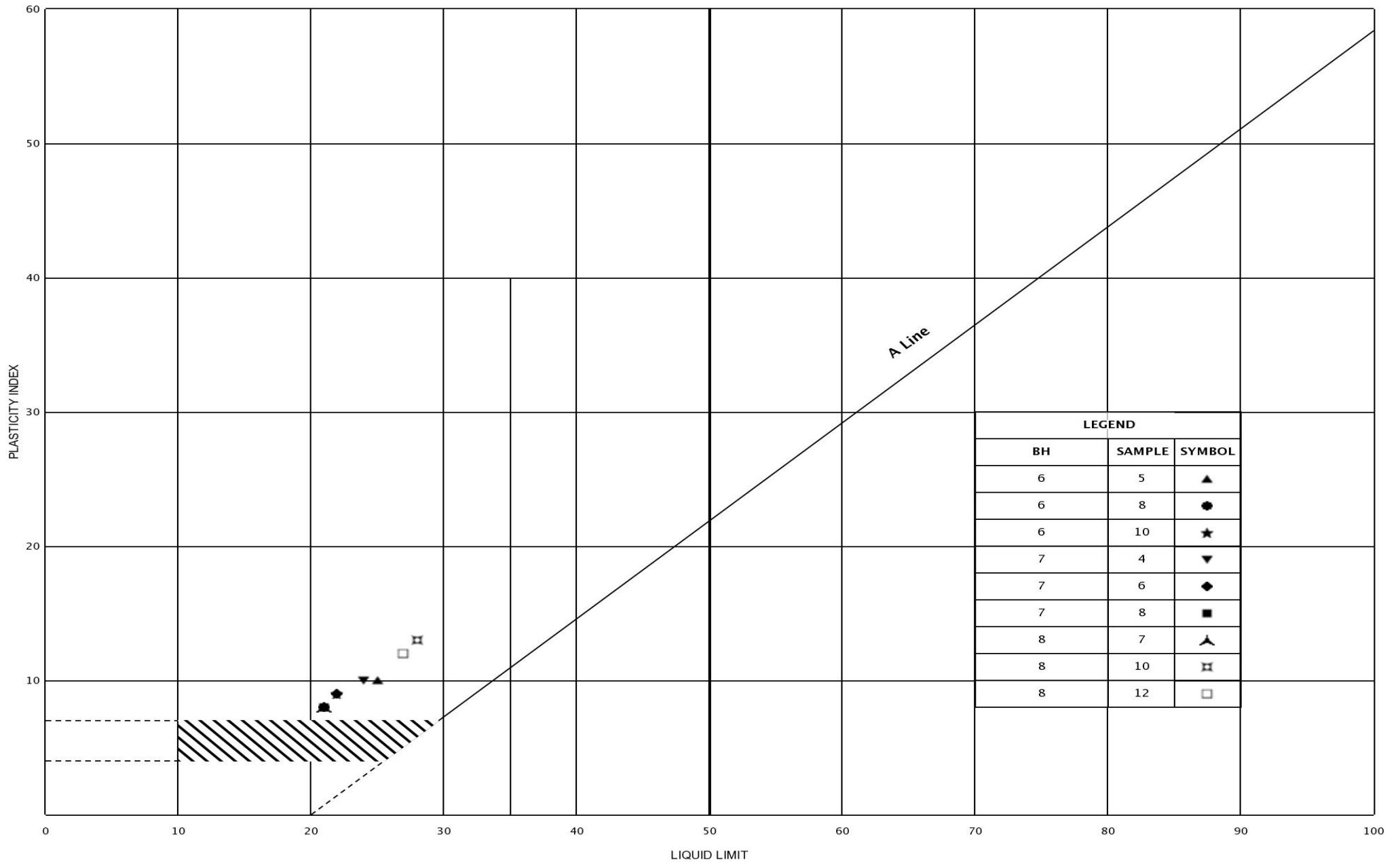
GRAIN SIZE DISTRIBUTION

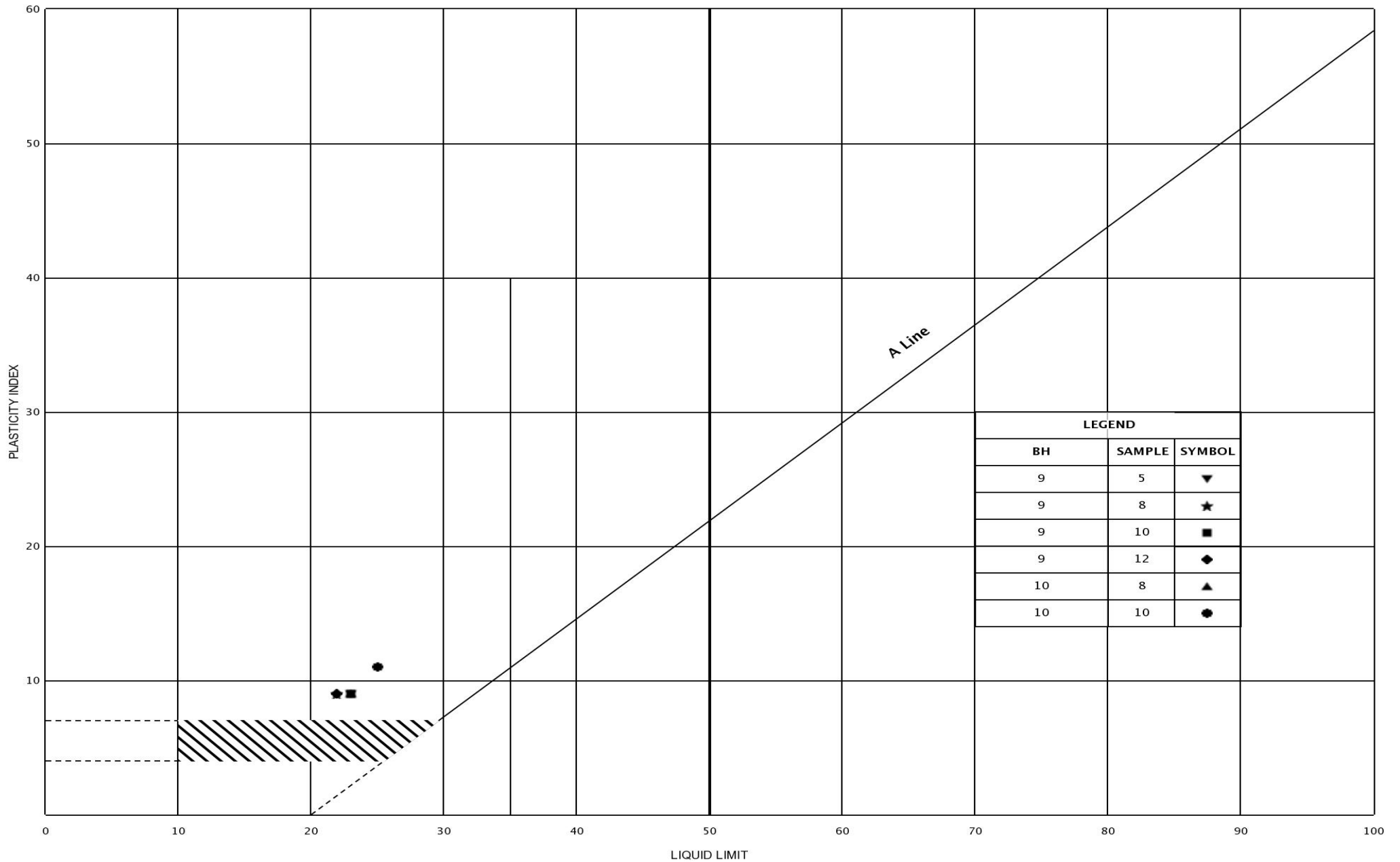
SILT

FIG No.: WB3-GS-2

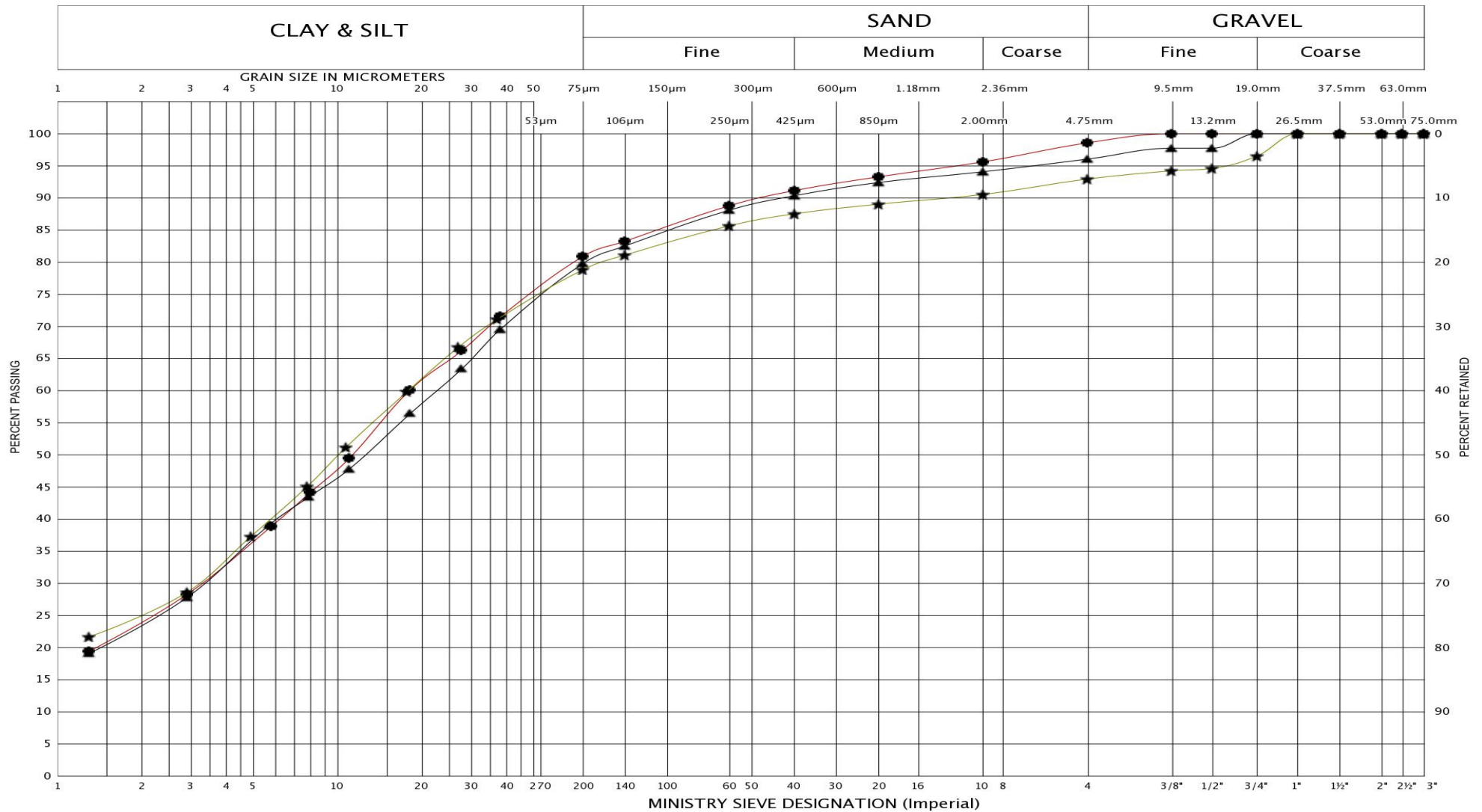
HWY : 401

GWP 3016-E-0009-013





UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND	BH	11	12	13
	SAMPLE	8	11	11
	SYMBOL	●	▲	★



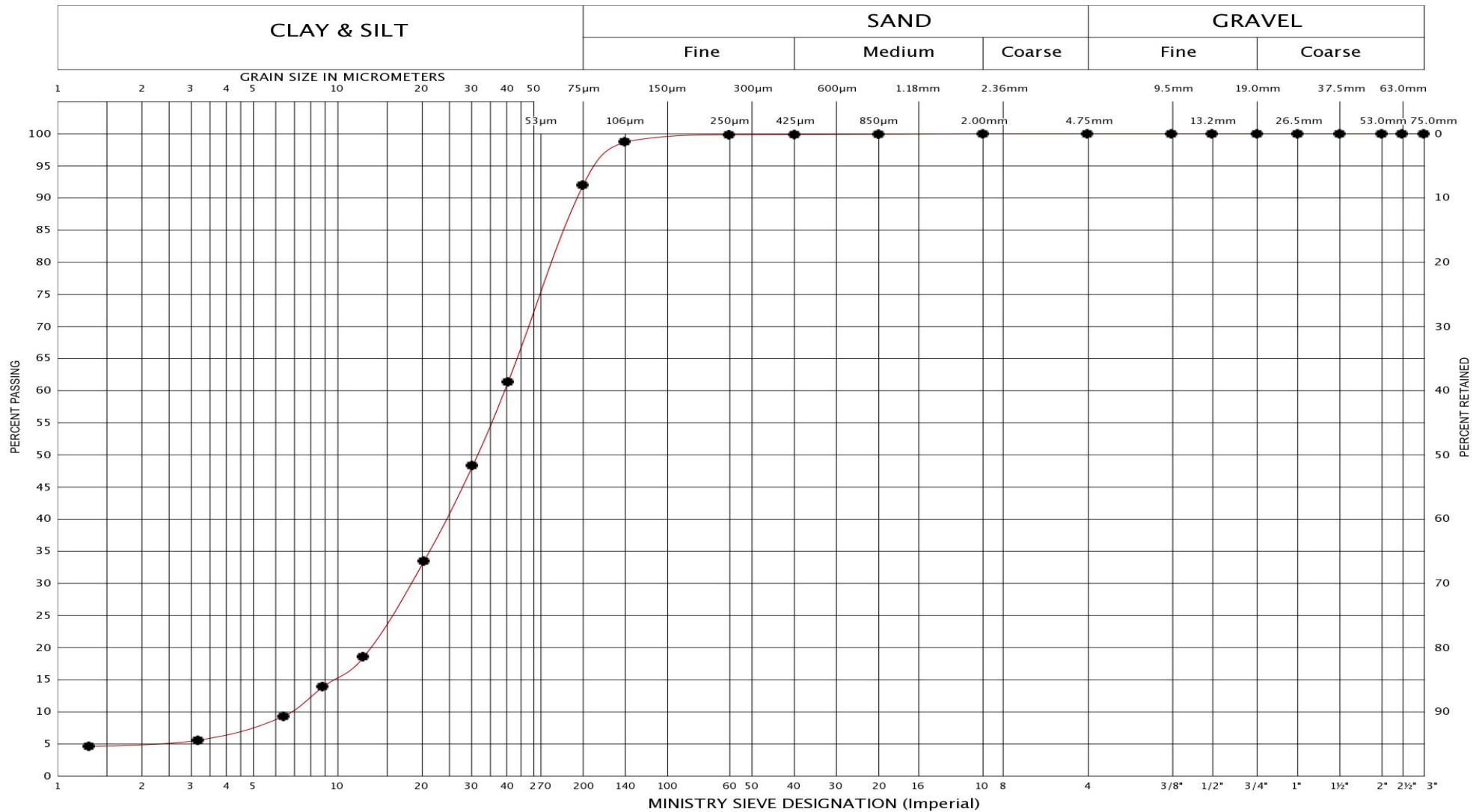
GRAIN SIZE DISTRIBUTION
CLAYEY SILT

FIG No.: WB4-GS-1

HWY : 401

GWP 3016-E-0009-013

UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND	BH	11
	SAMPLE	14
	SYMBOL	•



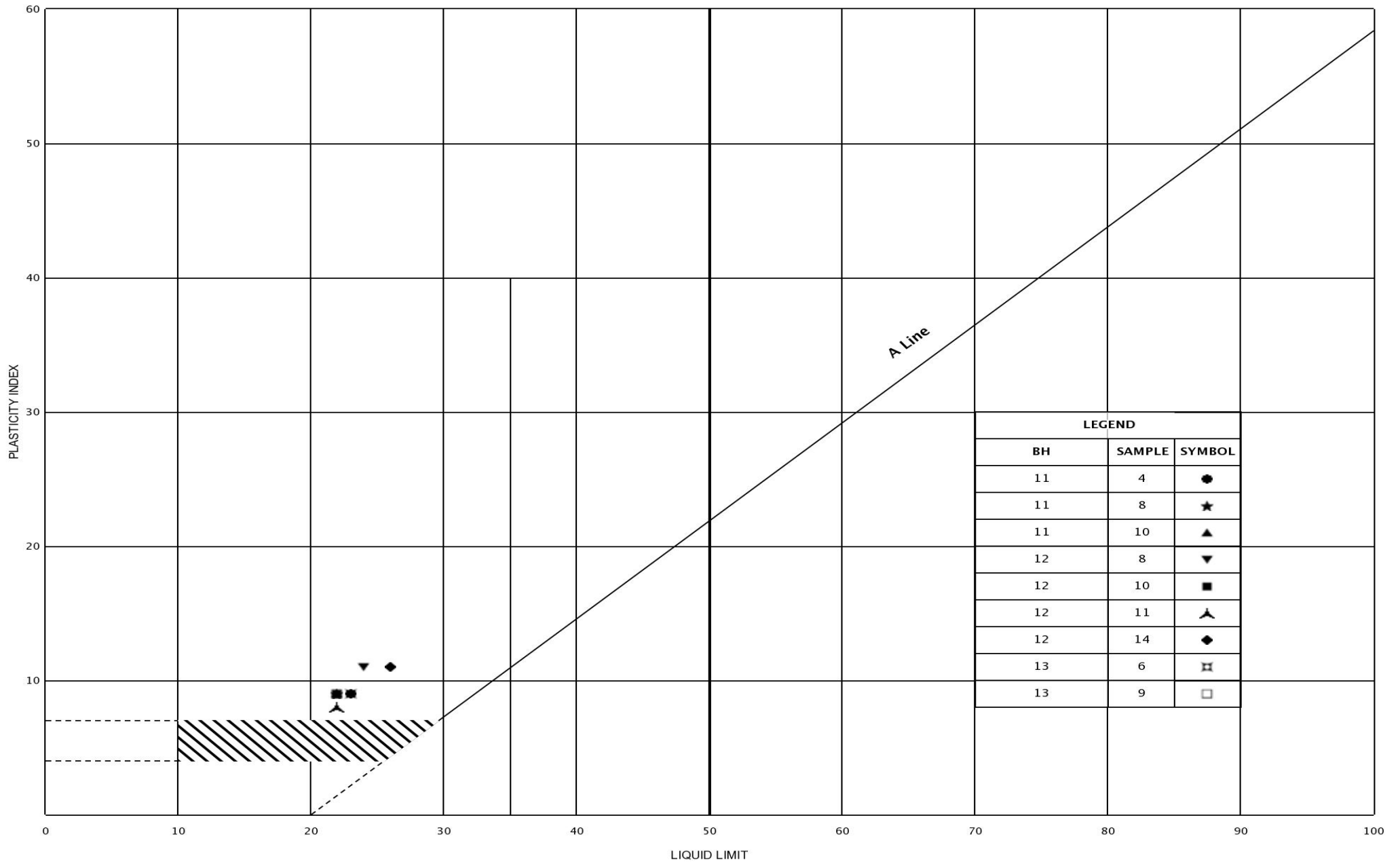
GRAIN SIZE DISTRIBUTION

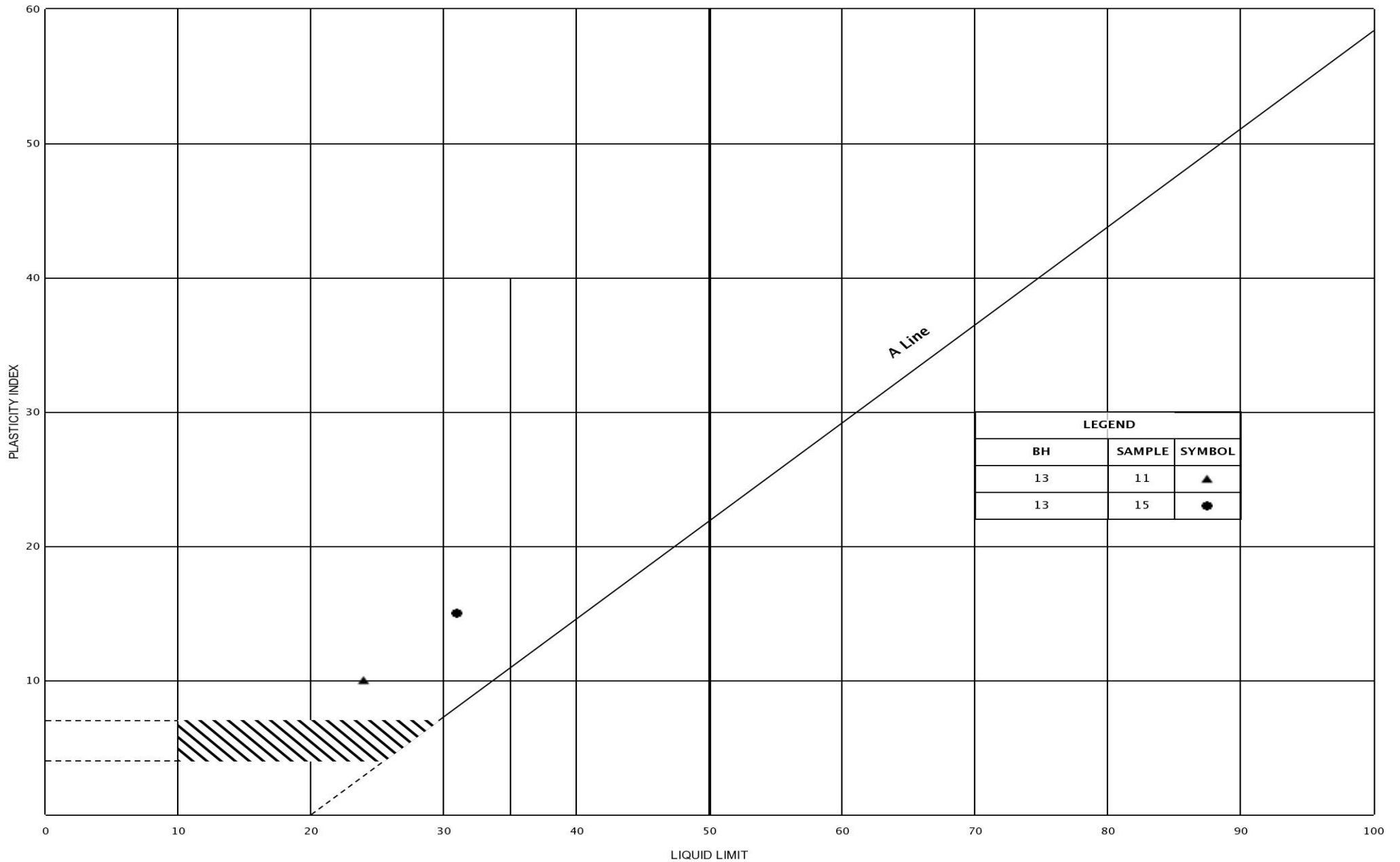
SILT

FIG No.: WB4-GS-2

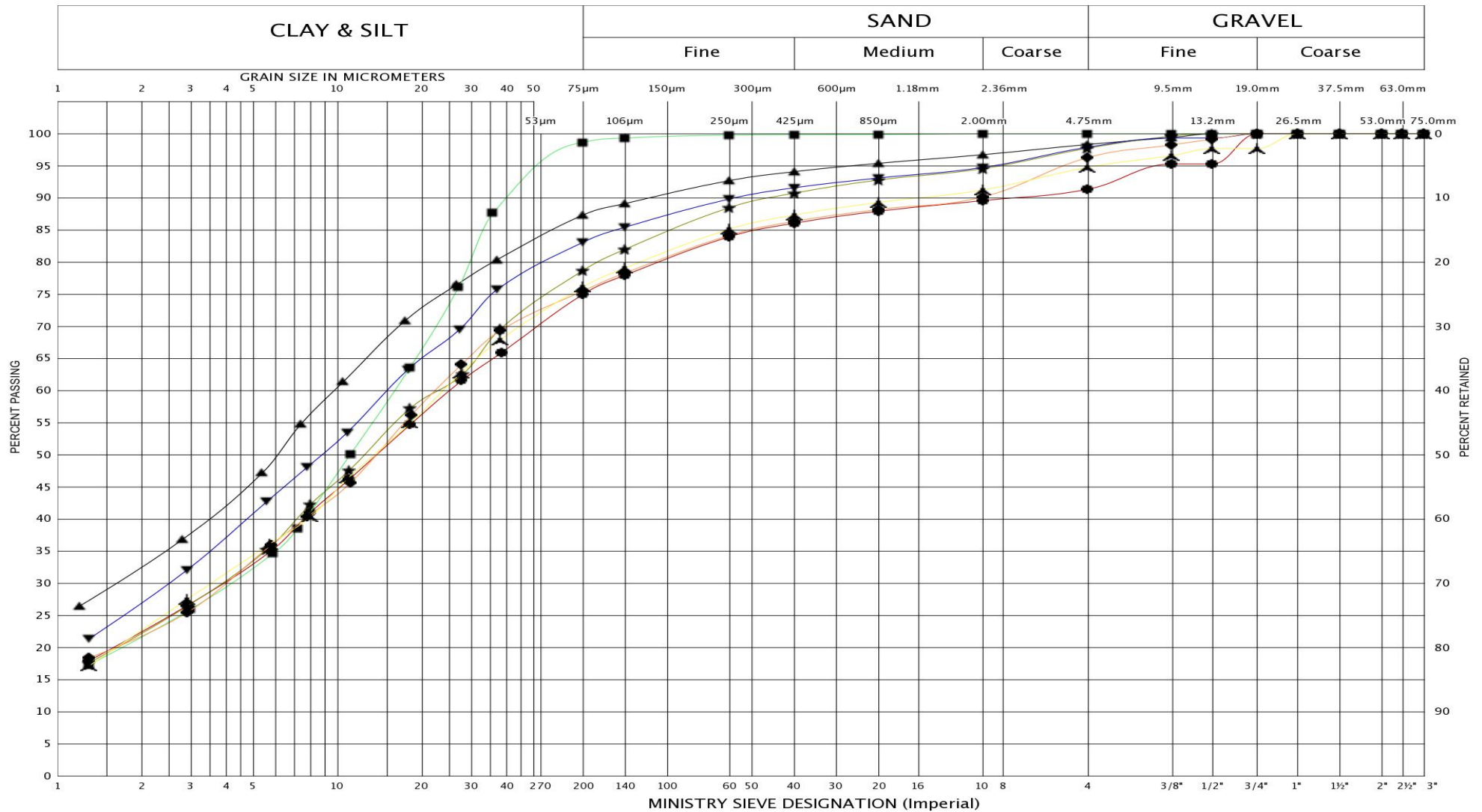
HWY : 401

GWP 3016-E-0009-013





UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND	BH	14	14	14	14	15	15	15
	SAMPLE	6	8	10	12	10	12	14
	SYMBOL	★	●	▼	▲	■	△	◆



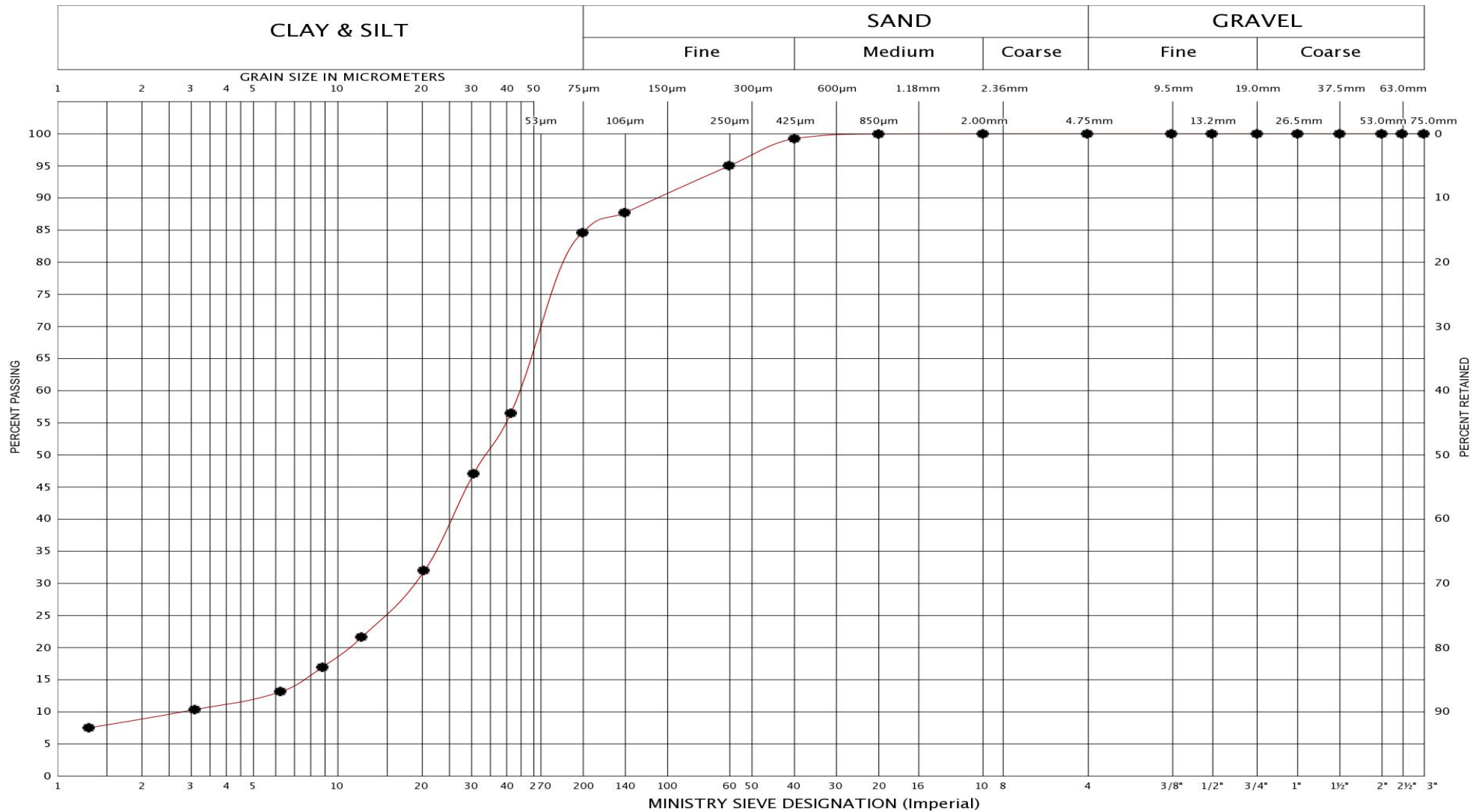
GRAIN SIZE DISTRIBUTION
CLAYEY SILT

FIG No.: WB5-GS-1

HWY : 401

GWP 3016-E-0009-013

UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND	BH	15
	SAMPLE	9A
	SYMBOL	•



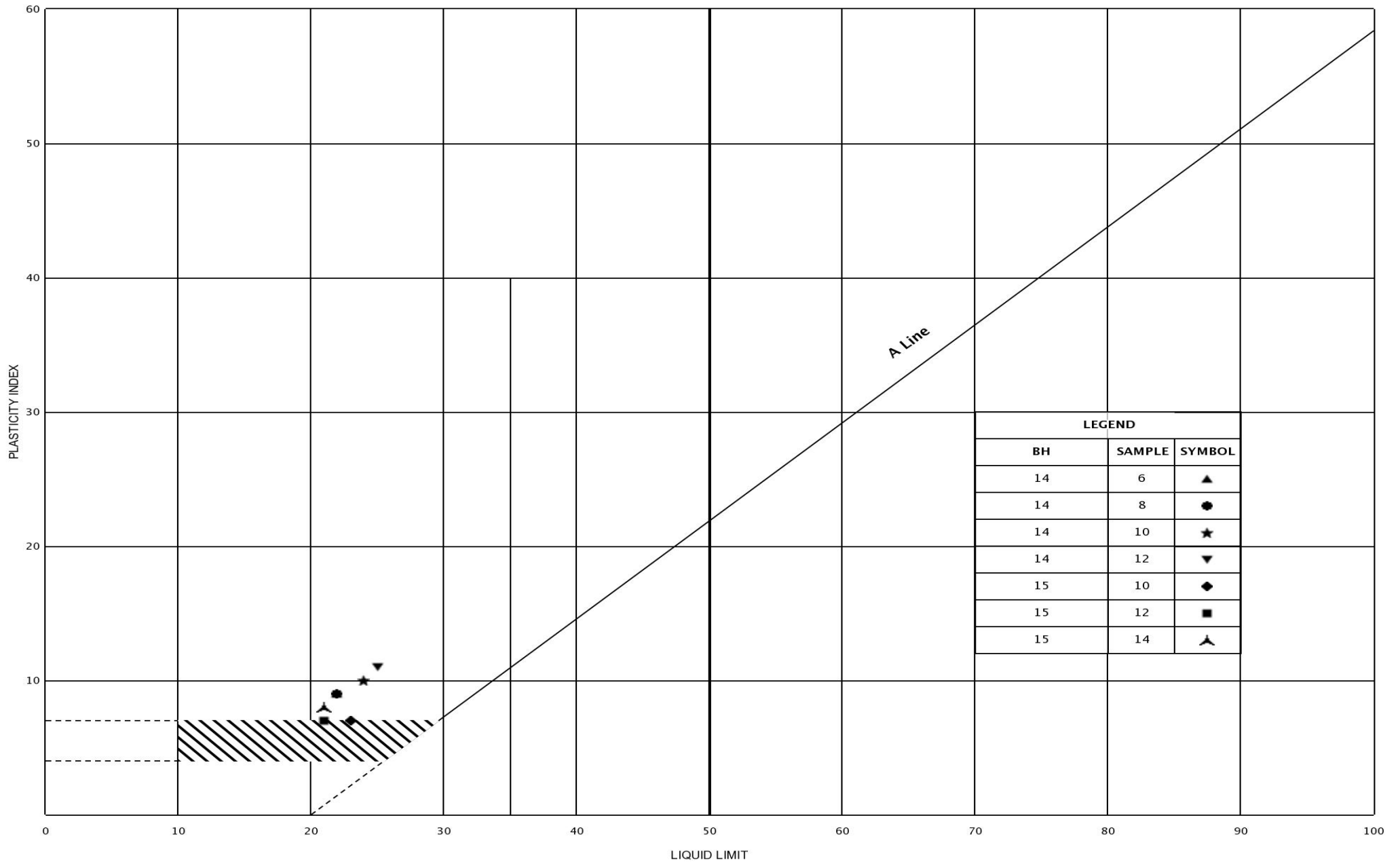
GRAIN SIZE DISTRIBUTION

SILT

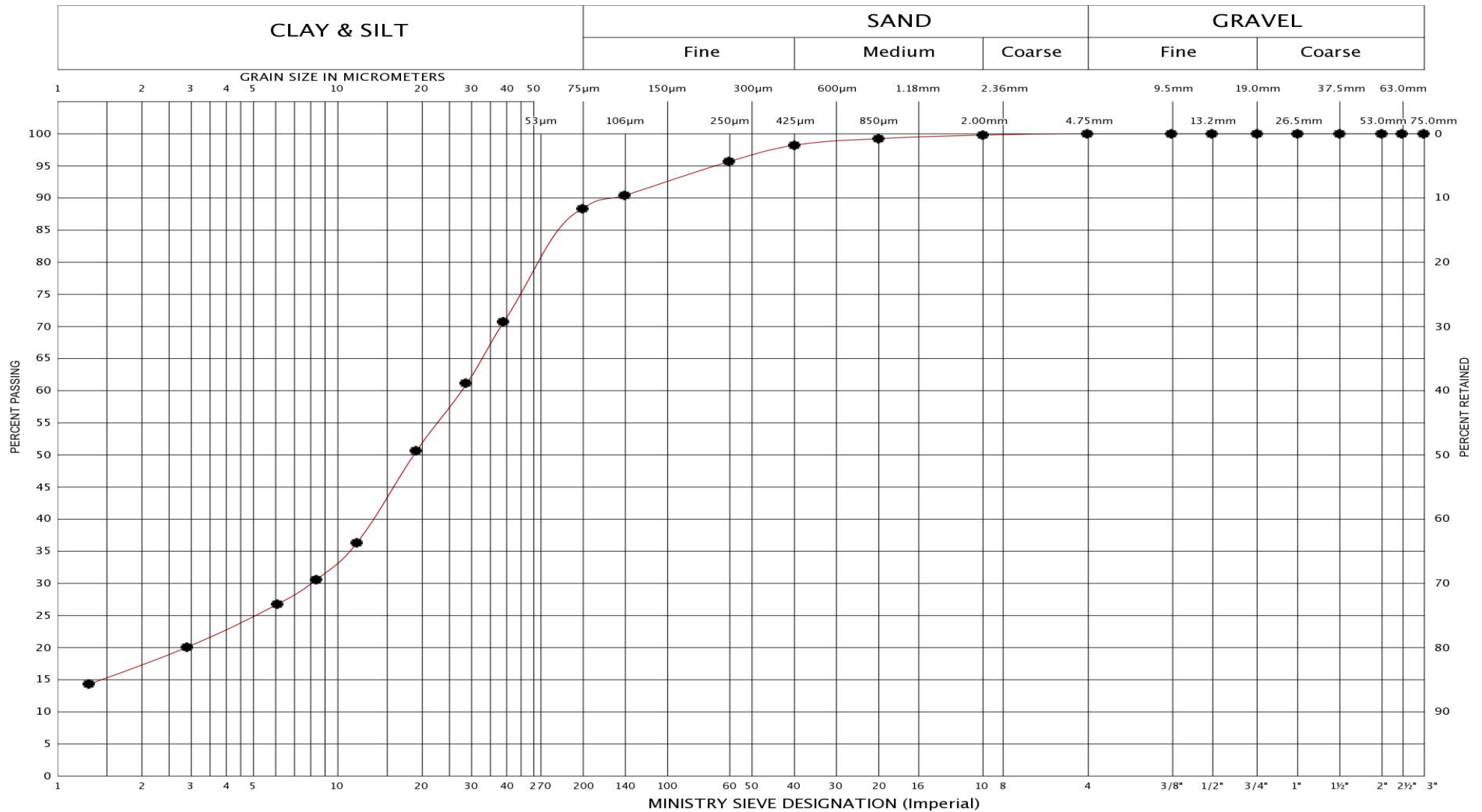
FIG No.: WB5-GS-2

HWY : 401

GWP 3016-E-0009-013



UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND	BH	20
	SAMPLE	6
	SYMBOL	•



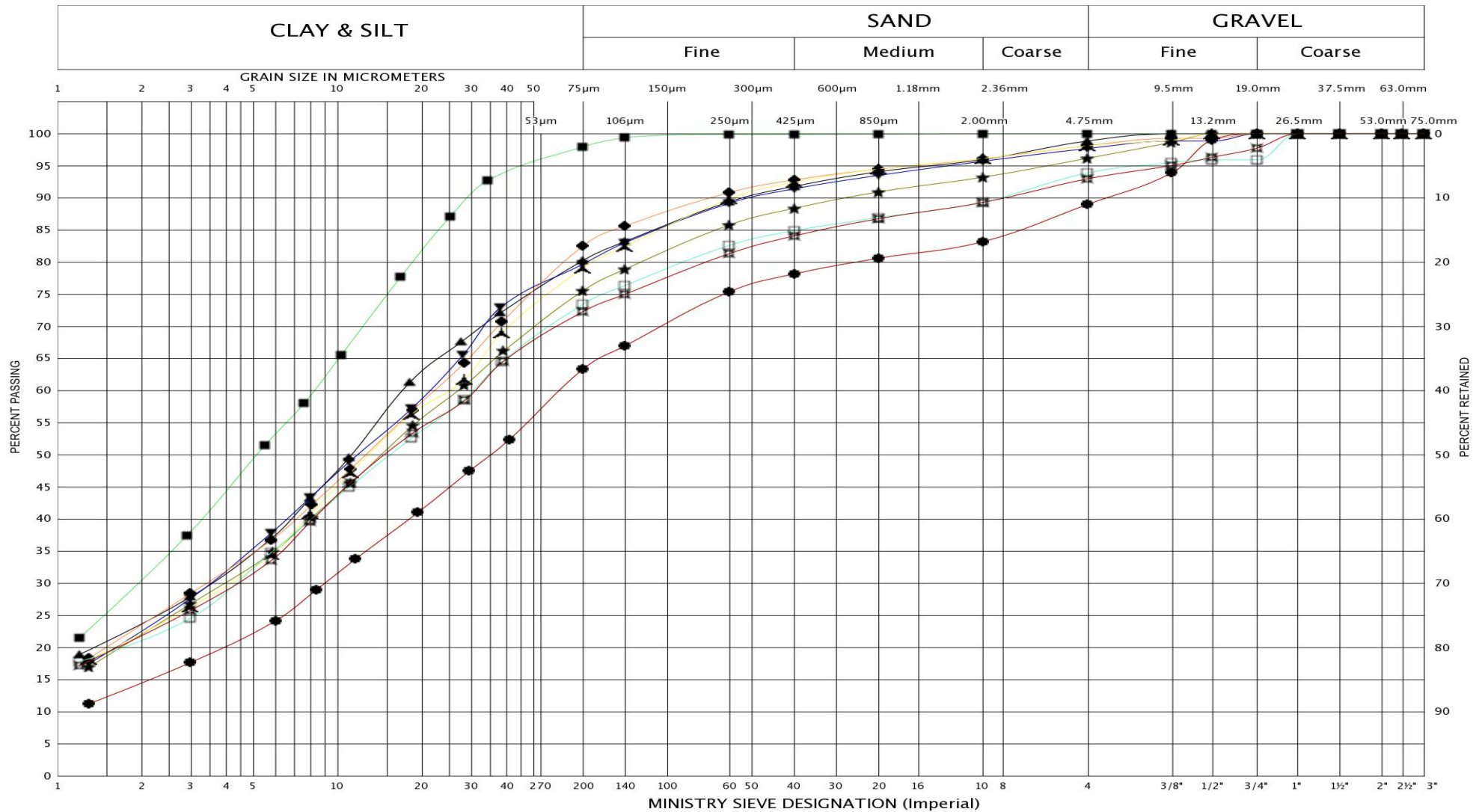
GRAIN SIZE DISTRIBUTION
ORGANIC SILT

FIG No.: WB6-GS-1

HWY : 401

GWP 3016-E-0009-013

UNIFIED SOIL CLASSIFICATION SYSTEM



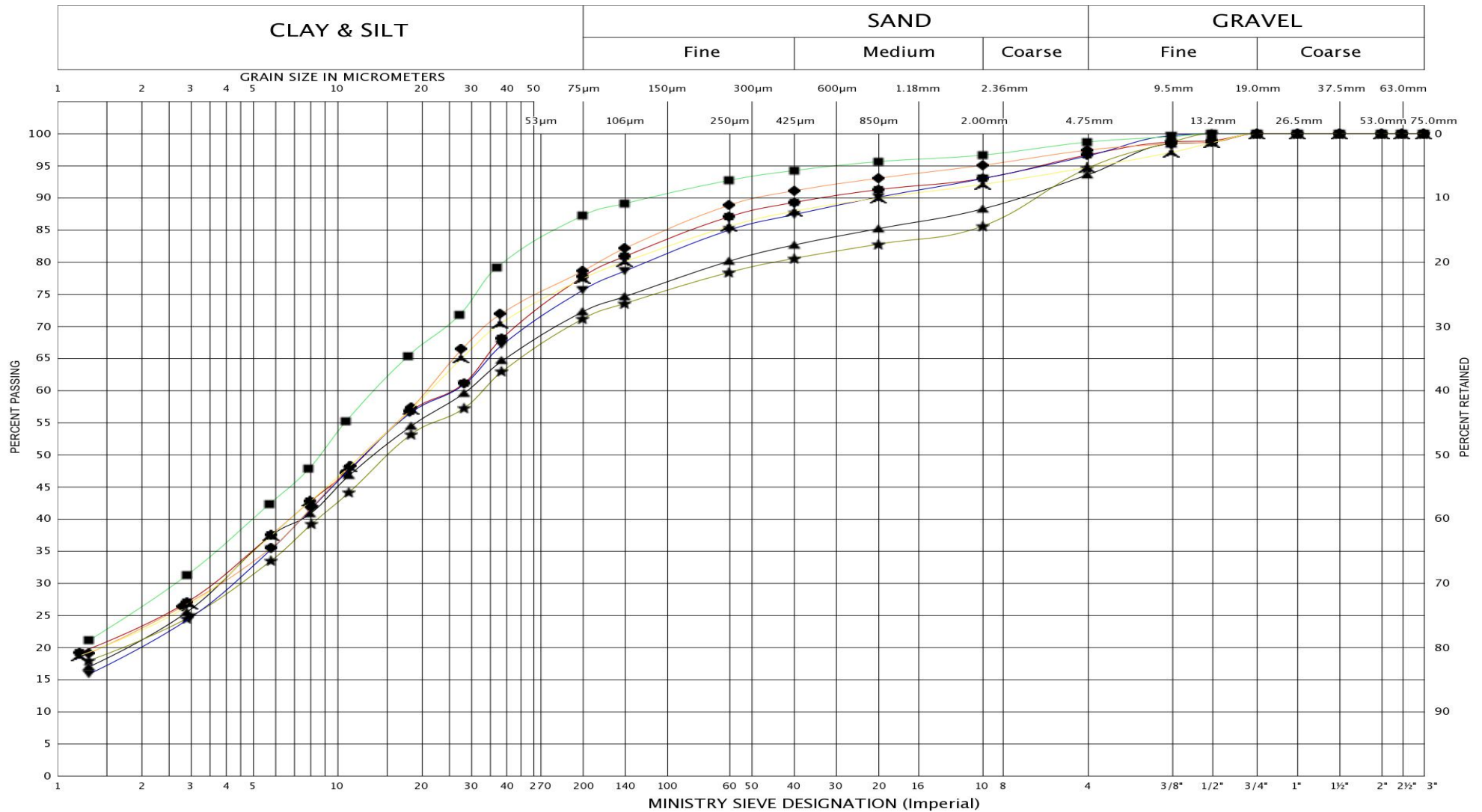
LEGEND	BH	16	16	16	17	17	17	17	18	18
	SAMPLE	8	10	12	6	9	11	14	4	8
	SYMBOL	●	★	▲	◆	■	△	▽	⊠	□



GRAIN SIZE DISTRIBUTION
CLAYEY SILT

FIG No.: WB6-GS-2A
HWY : 401
GWP 3016-E-0009-013

UNIFIED SOIL CLASSIFICATION SYSTEM



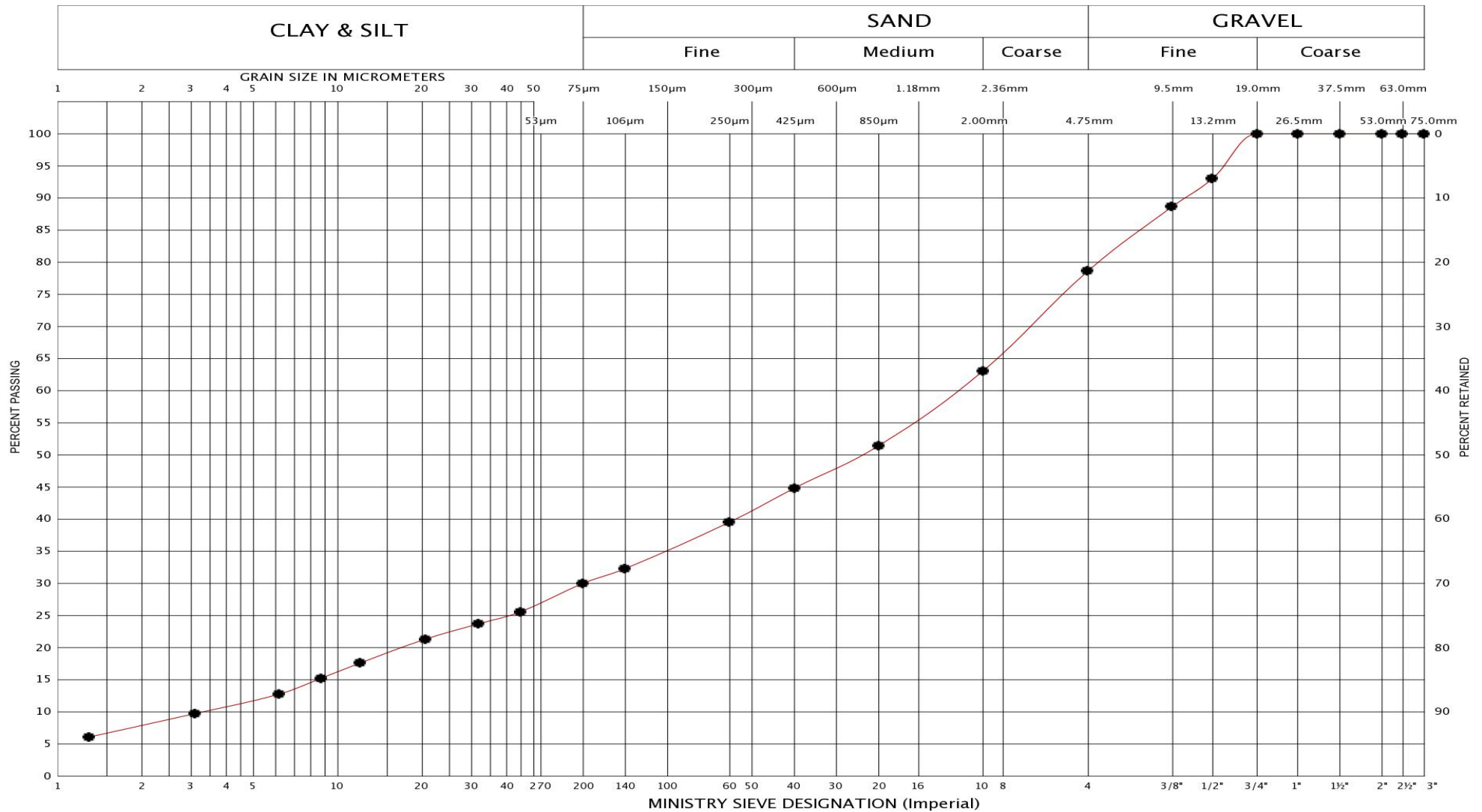
LEGEND	BH	18	19	19	19	19	20	20
	SAMPLE	12	7	10	12	14	9	12
	SYMBOL	●	▲	▼	■	★	▲	◆



GRAIN SIZE DISTRIBUTION
CLAYEY SILT

FIG No.: WB6-GS-2B
HWY : 401
GWP 3016-E-0009-013

UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND	BH	20
	SAMPLE	14
	SYMBOL	•

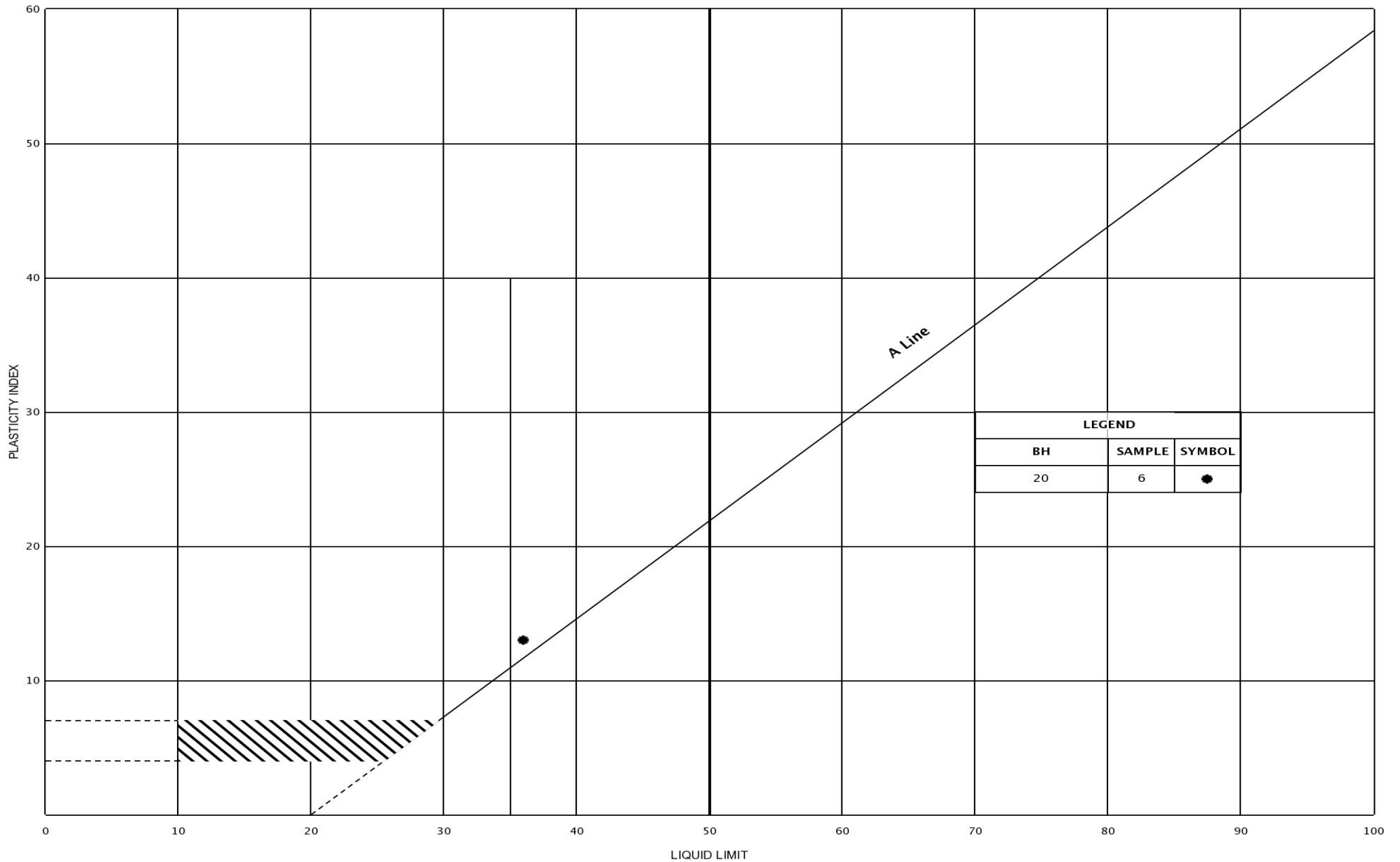


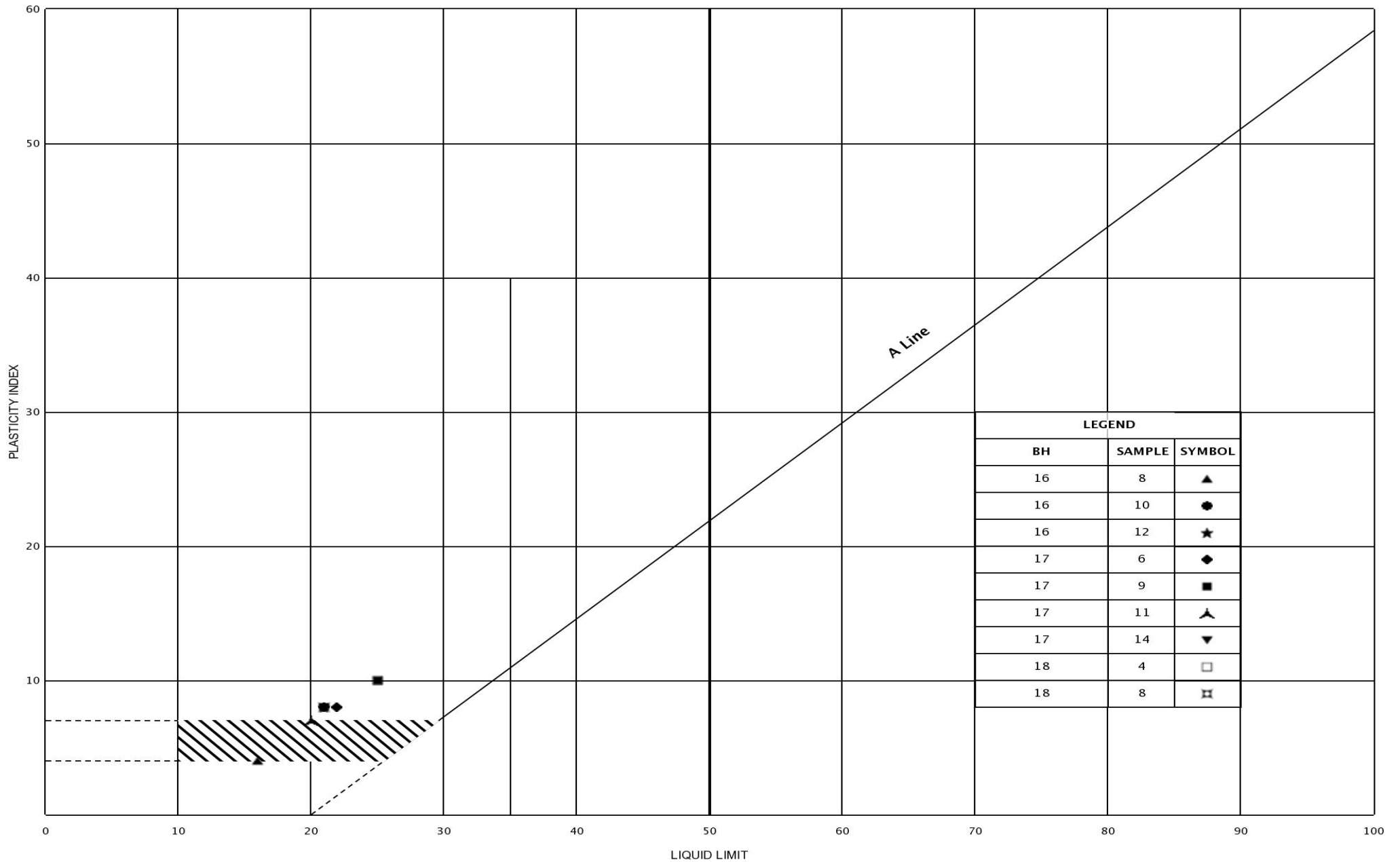
GRAIN SIZE DISTRIBUTION
SILTY SAND

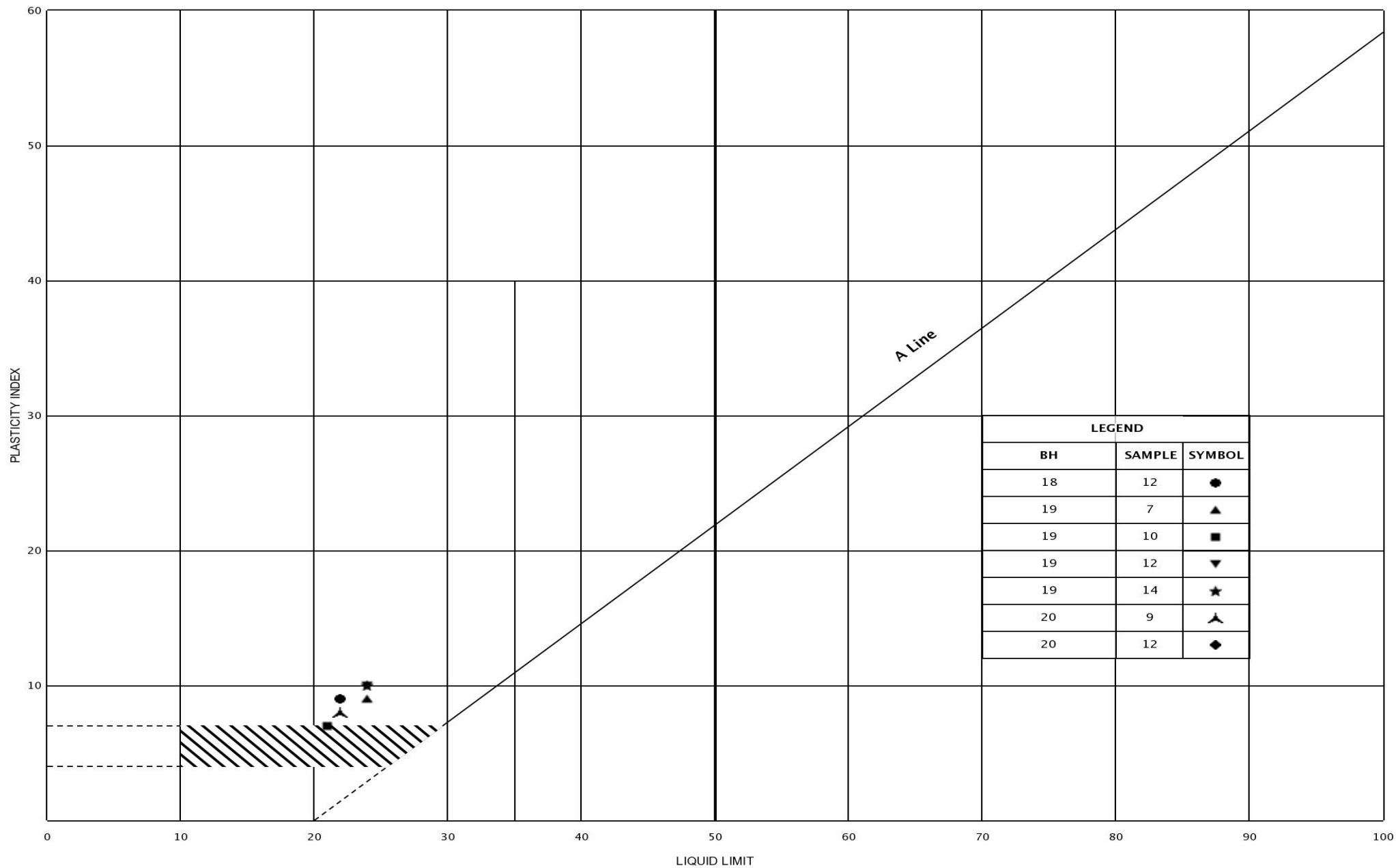
FIG No.: WB6-GS-3

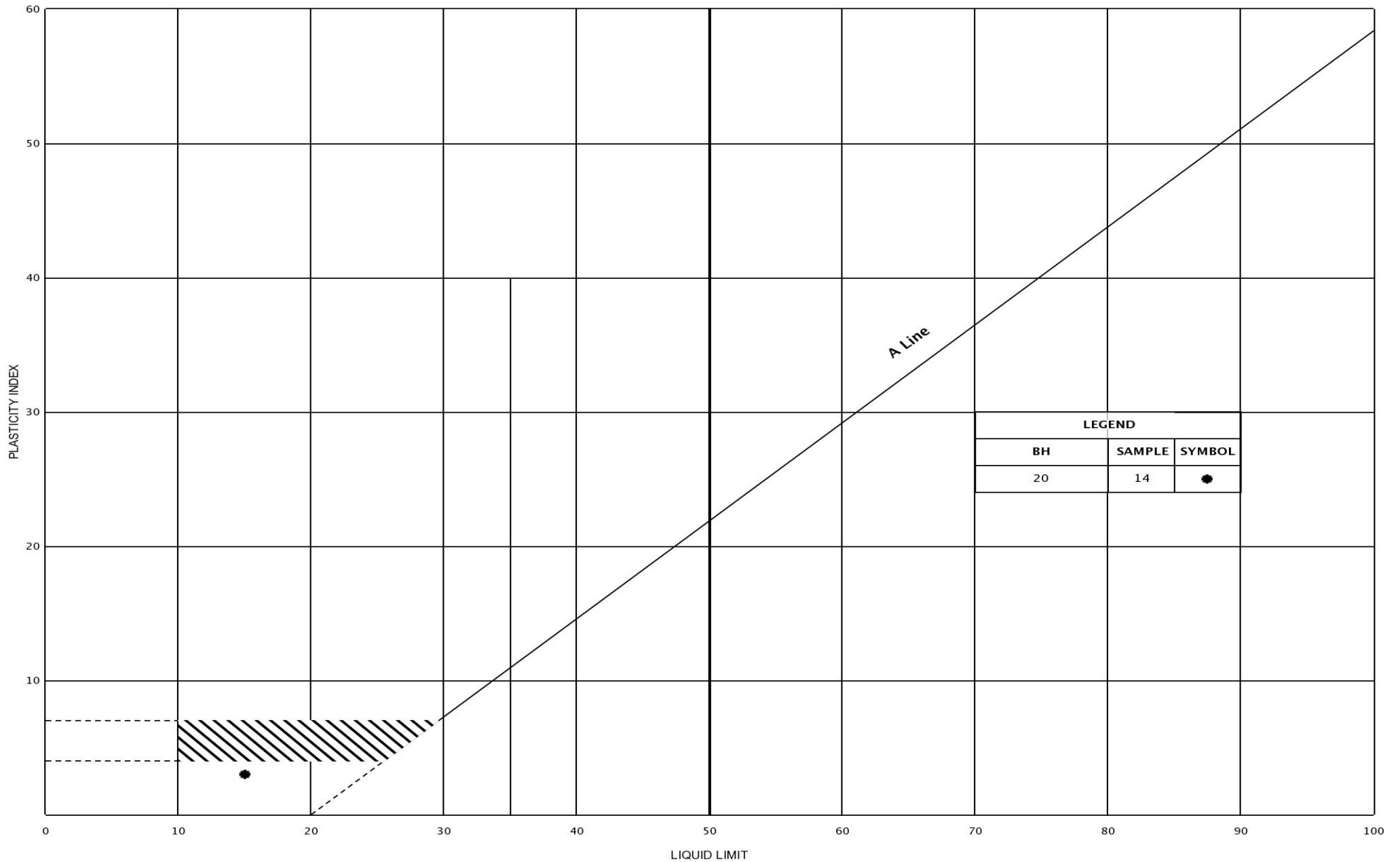
HWY : 401

GWP 3016-E-0009-013

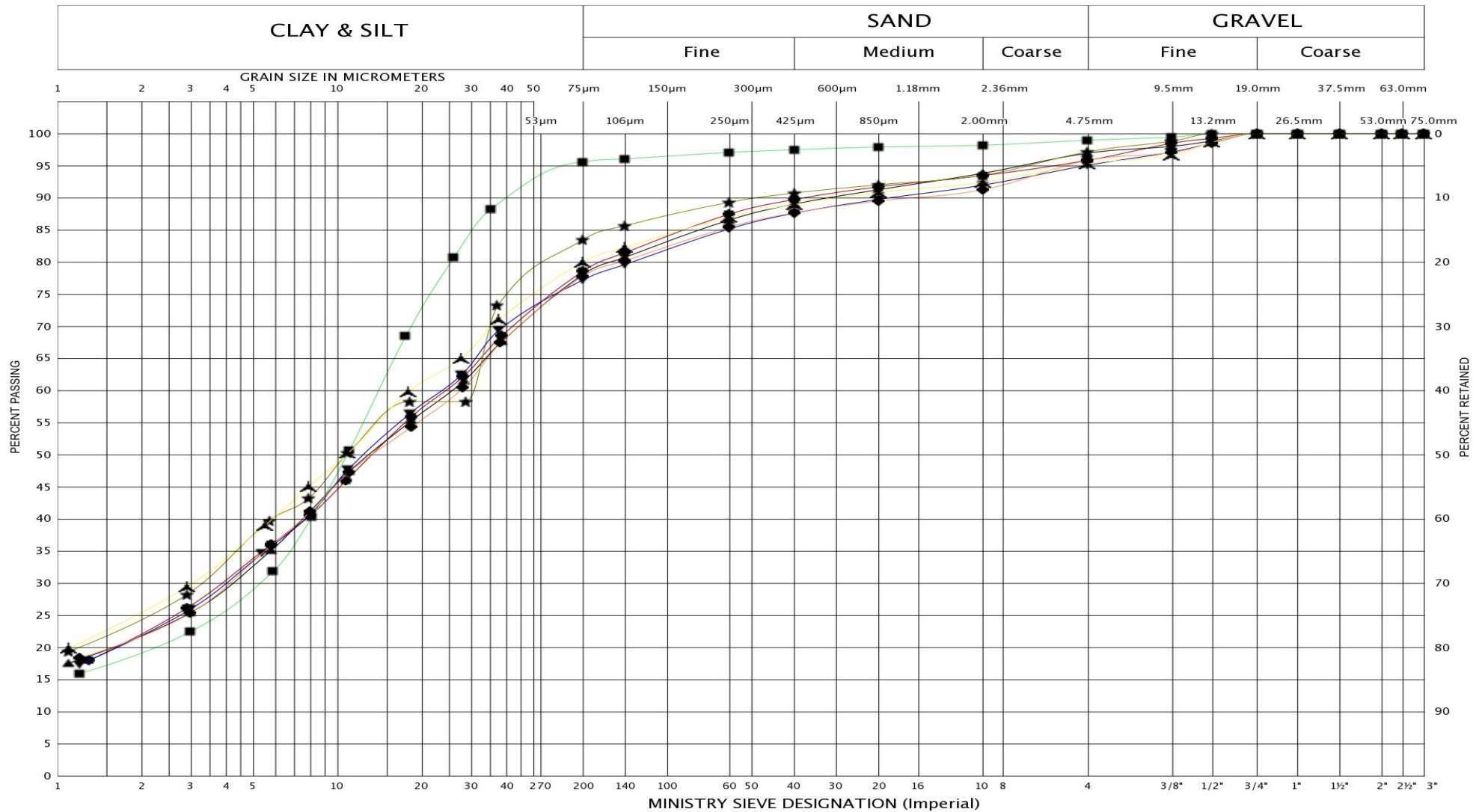








UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND	BH	21	21	21	22	22	22	22
	SAMPLE	4	9	12	5	9	12	15
	SYMBOL	●	▲	★	▼	◆	▲	■



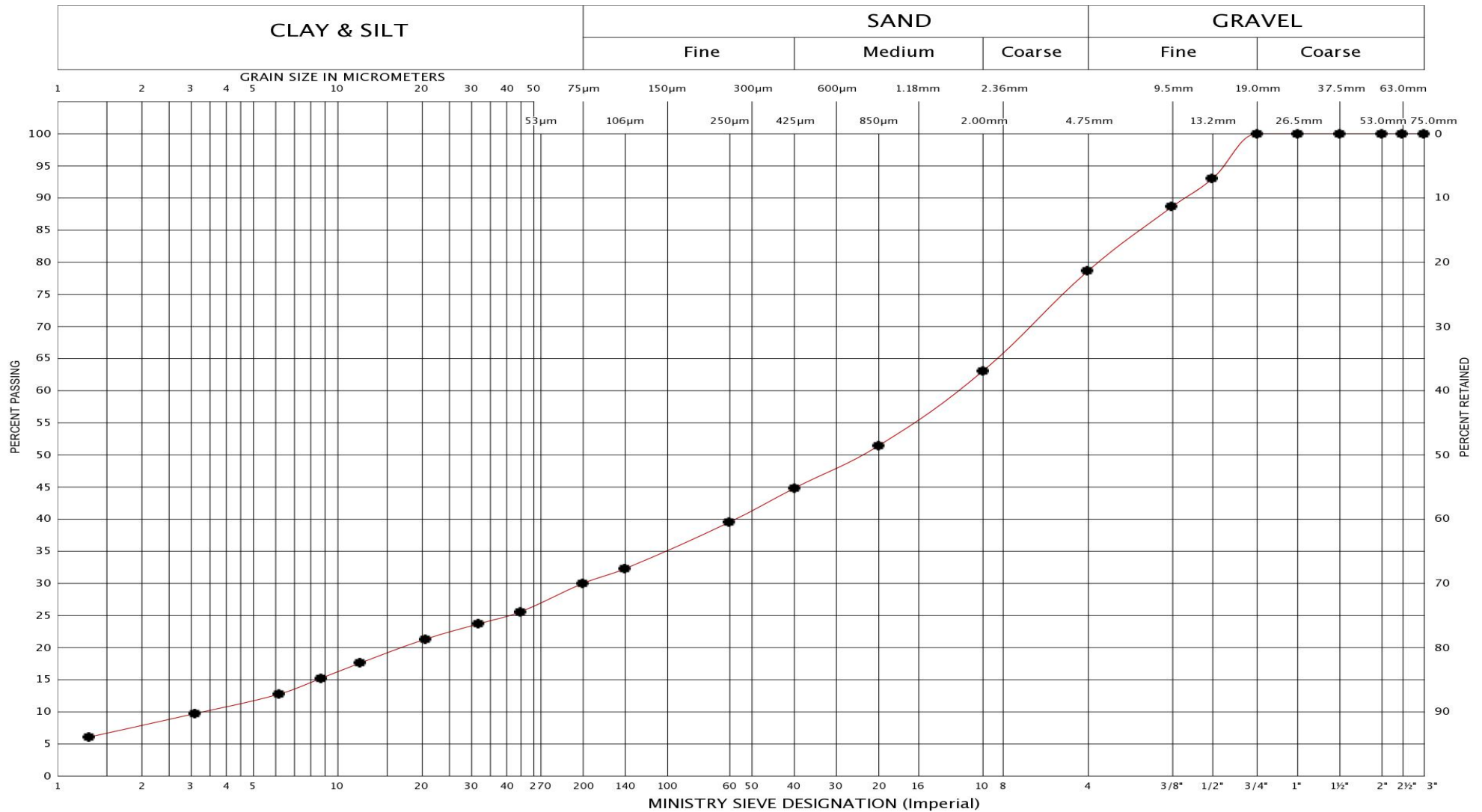
GRAIN SIZE DISTRIBUTION
CLAYEY SILT

FIG No.: WB7-GS-1

HWY : 401

GWP 3016-E-0009-013

UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND	BH	20
	SAMPLE	14
	SYMBOL	•



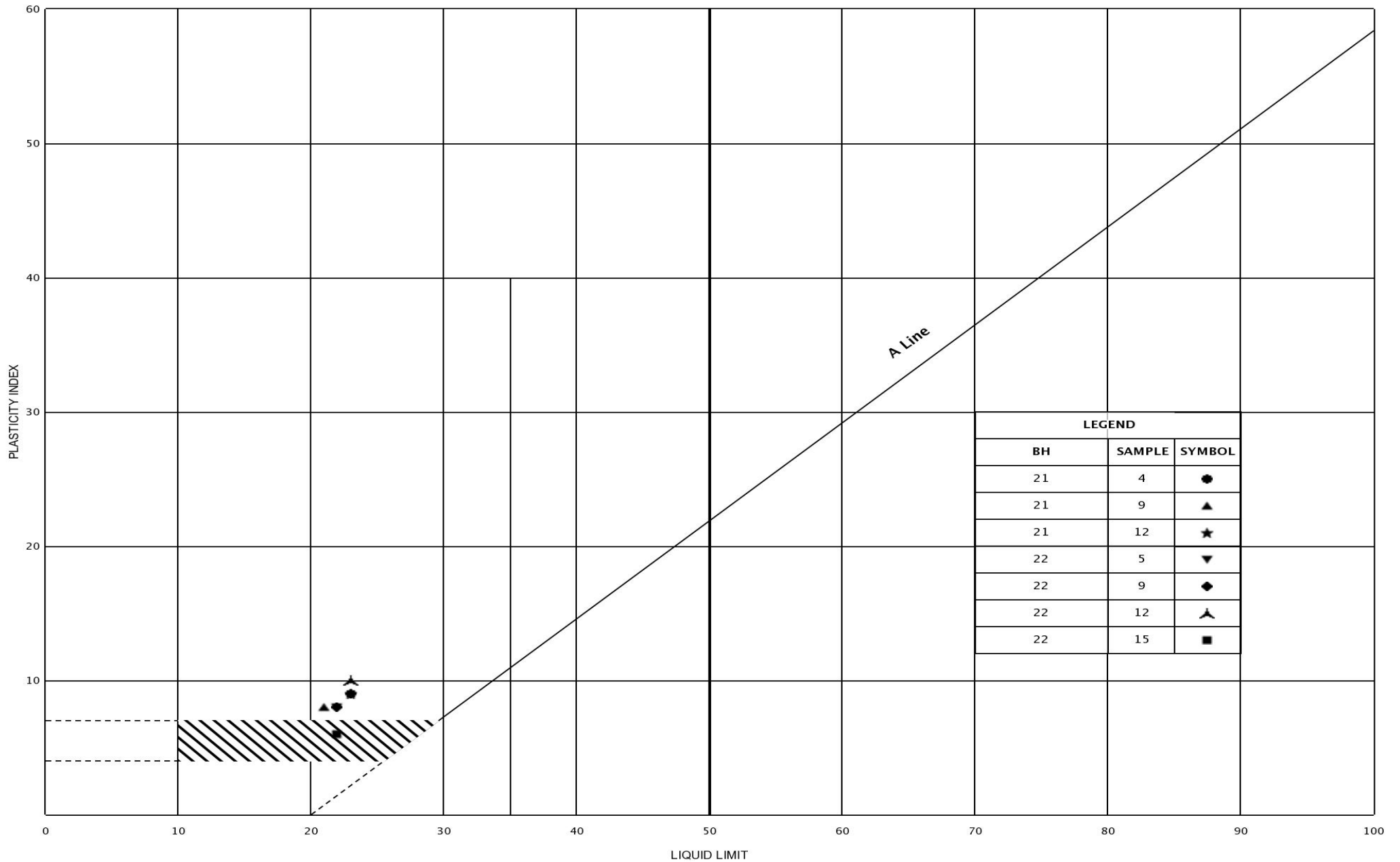
GRAIN SIZE DISTRIBUTION

SILT

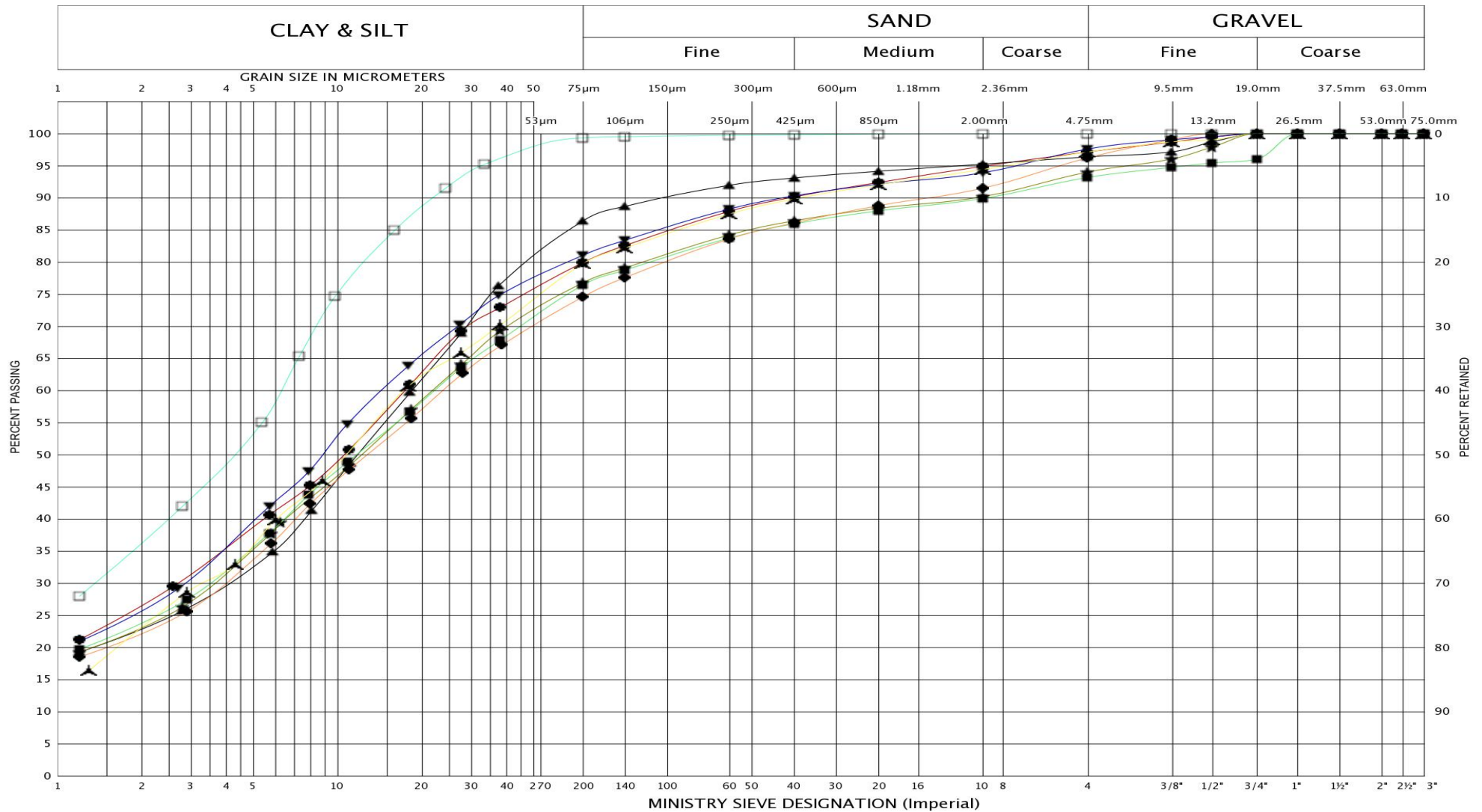
FIG No.: WB7-GS-2

HWY : 401

GWP 3016-E-0009-013



UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND	BH	23	23	23	24	24	24	25	25
	SAMPLE	5	8	11	5	9	12	4	10
	SYMBOL	▲	●	★	◆	■	▼	□	△

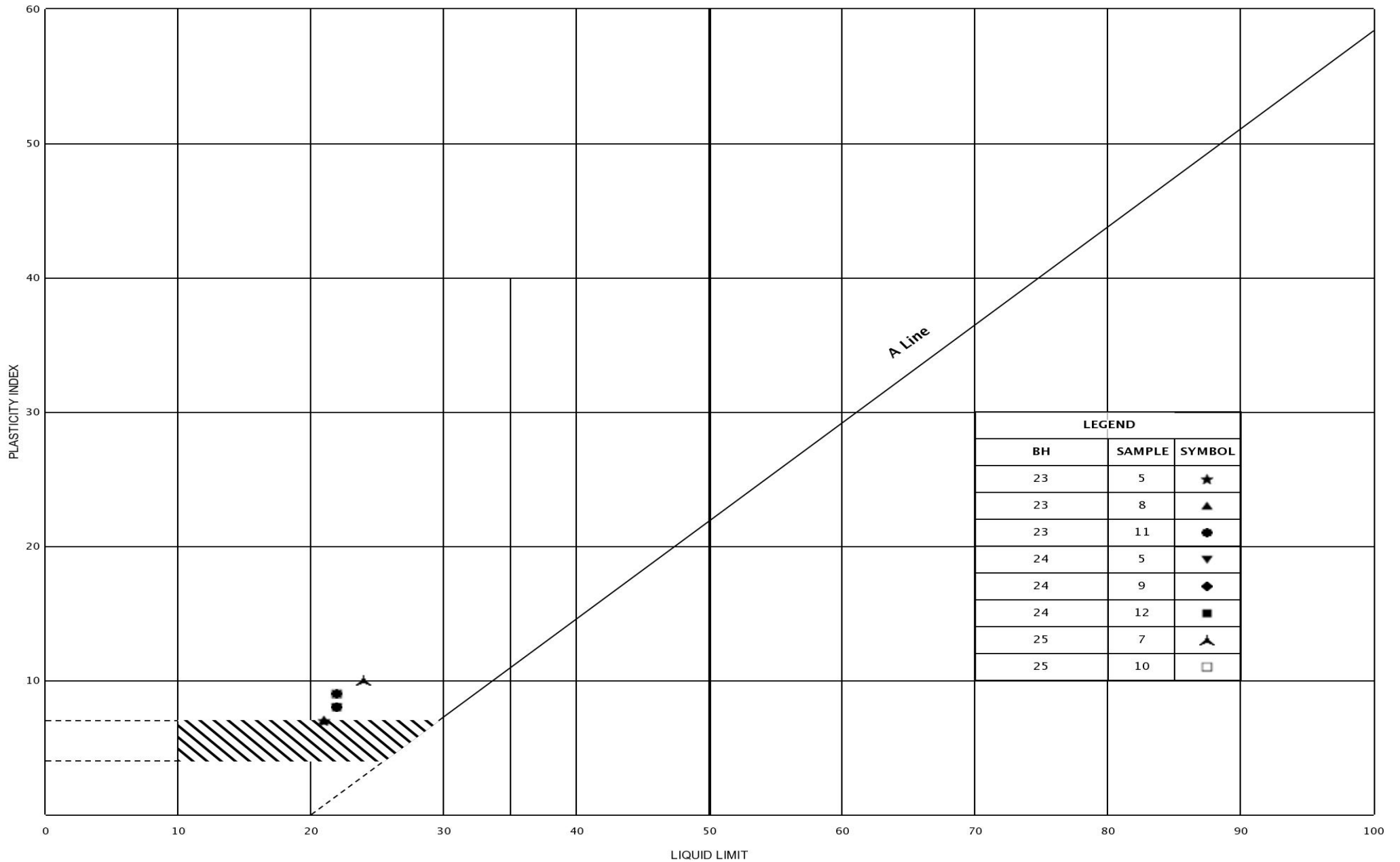


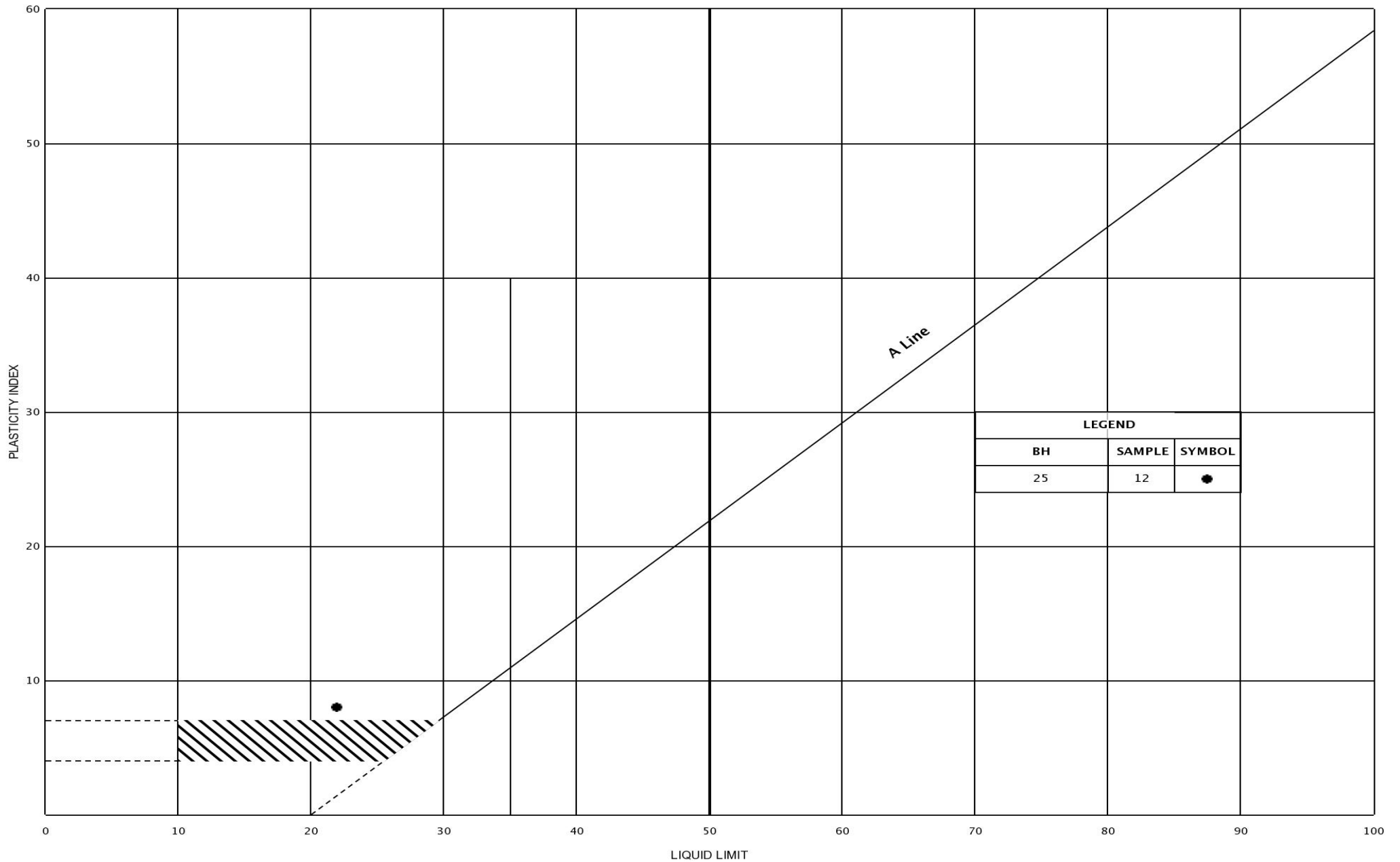
GRAIN SIZE DISTRIBUTION
CLAYEY SILT

FIG No.: WB8-GS-1

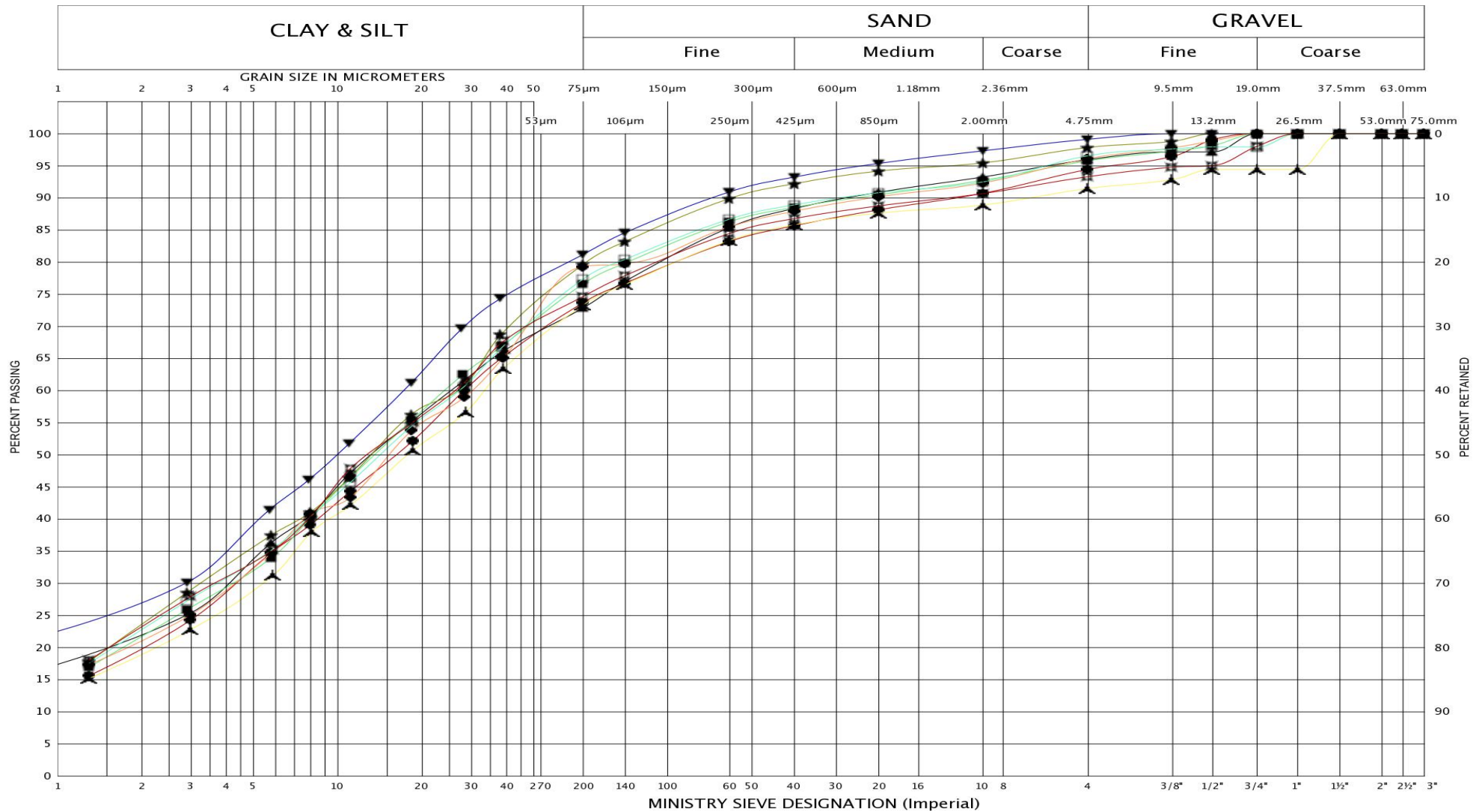
HWY : 401

GWP 3016-E-0009-013





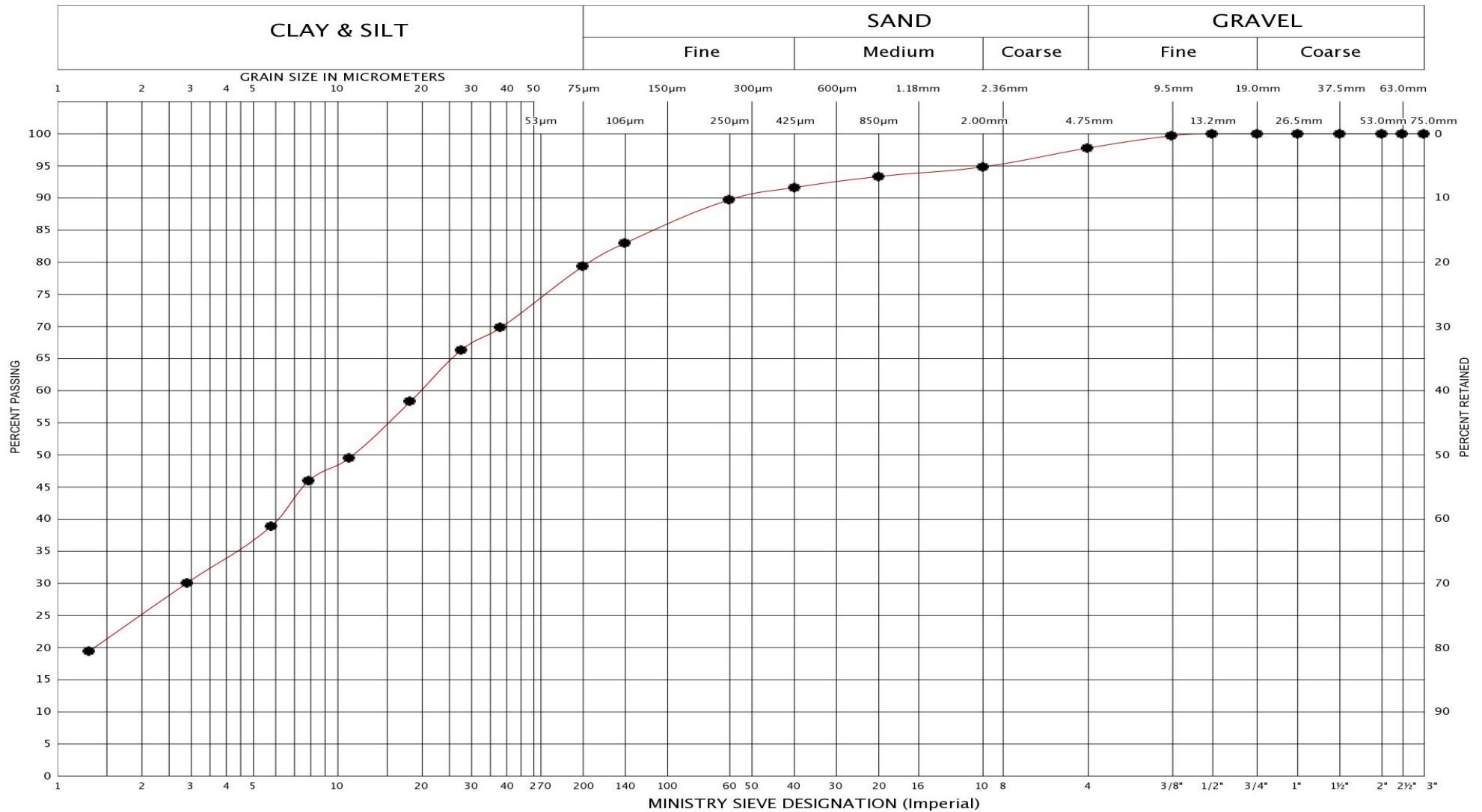
UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION
CLAYEY SILT

FIG No.: WB9-GS-1A
HWY : 401
GWP 3016-E-0009-013

UNIFIED SOIL CLASSIFICATION SYSTEM

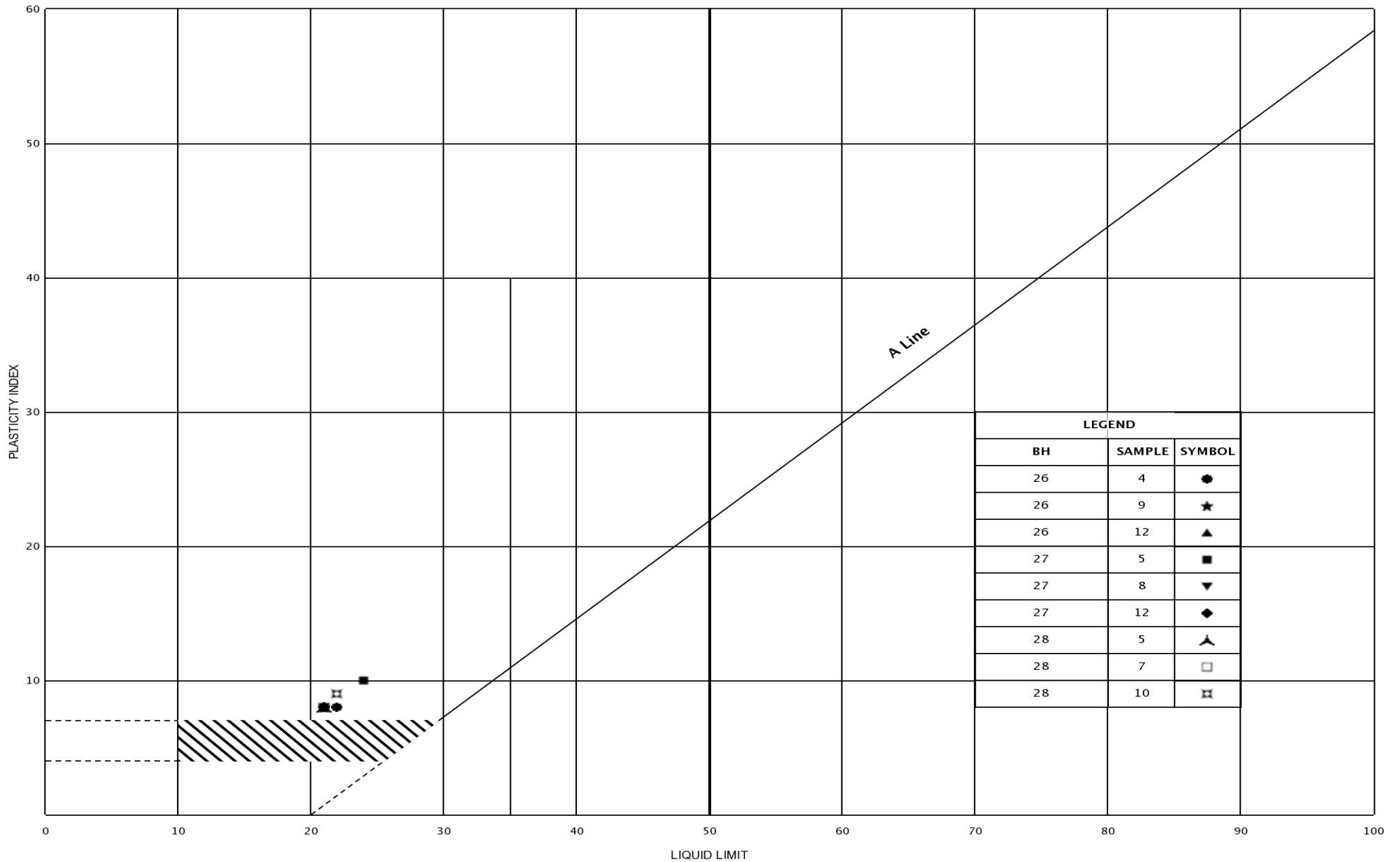


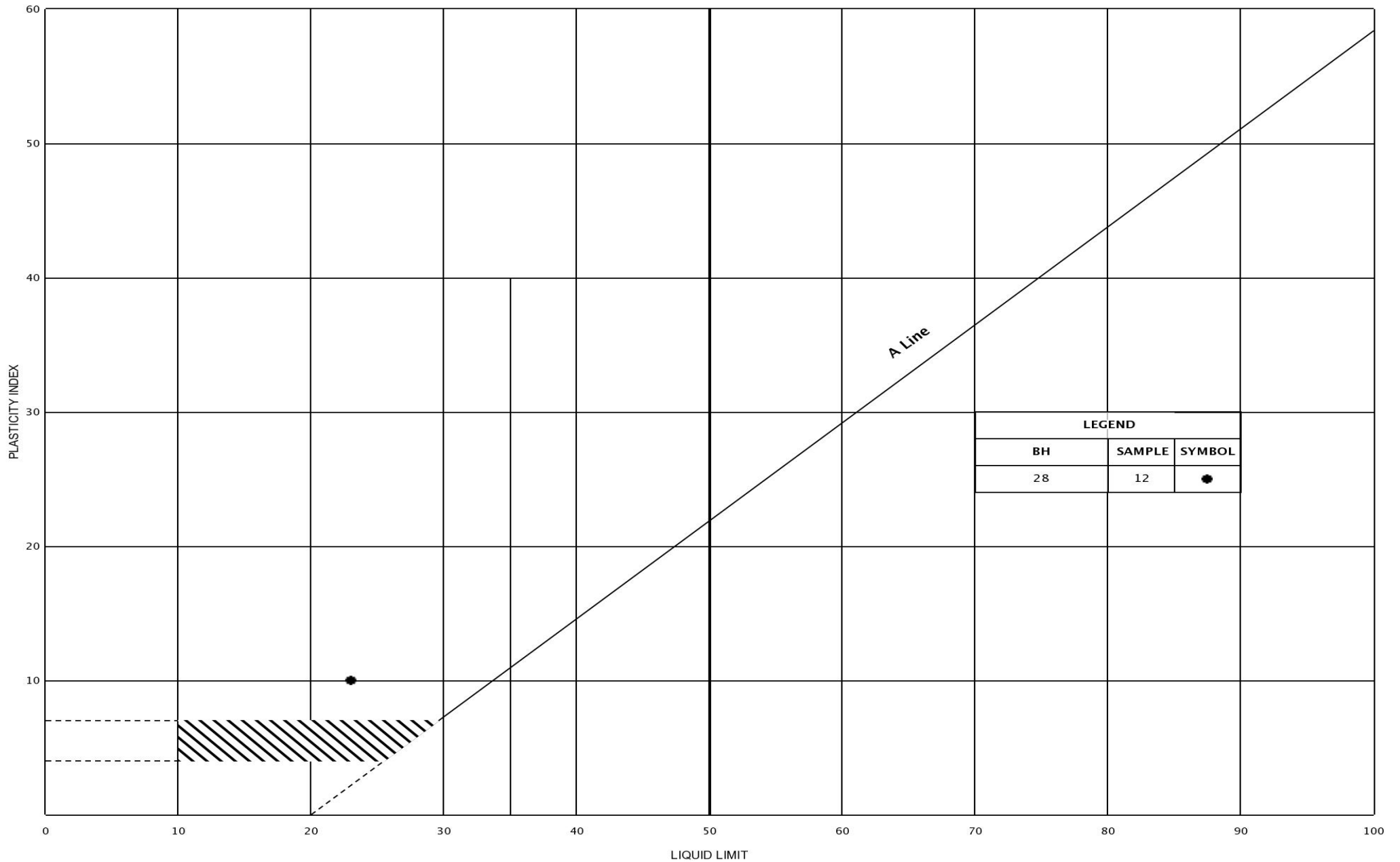
LEGEND	BH	28
	SAMPLE	12
	SYMBOL	•



GRAIN SIZE DISTRIBUTION
CLAYEY SILT

FIG No.:	WB9-GS-1B
HWY :	401
GWP	3016-E-0009-013







APPENDIX B

Results of Chemical Tests Provided by SGS Canada Inc.



FINAL REPORT

CA14025-DEC18 R1

18KF037A, Westchester Bourne Underpass

Prepared for

Peto MacCallum Ltd

First Page

CLIENT DETAILS

Client Peto MacCallum Ltd

Address 165 Cartwright Ave
Toronto, ON
M6A 1V5, Canada

Contact Nazibur Rahman

Telephone 416-785-5110

Facsimile 416-785-5120

Email nrahman@petomacallum.com

Project 18KF037A, Westchester Bourne Underpass

Order Number

Samples Soil (6)

LABORATORY DETAILS

Project Specialist Rob Irwin B.Sc., C.Chem

Laboratory SGS Canada Inc.

Address 185 Concession St., Lakefield ON, K0L 2H0

Telephone 2361

Facsimile 705-652-6365

Email

SGS Reference CA14025-DEC18

Received 12/03/2018

Approved 12/11/2018

Report Number CA14025-DEC18 R1

Date Reported 12/11/2018

COMMENTS

Temperature of Sample upon Receipt: 5 degrees C

Cooling Agent Present: yes

Custody Seal Present: no

Chain of Custody Number: 004115

Corrosivity Index is based on the American Water Works Corrosivity Scale according to AWWA C-105. An index greater than 10 indicates the soil matrix may be corrosive to cast iron alloys.

SIGNATORIES

Rob Irwin B.Sc., C.Chem





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FINAL REPORT

CA14025-DEC18 R1

Client: Peto MacCallum Ltd

Project: 18KF037A, Westchester Bourne Underpass

Project Manager: Nazibur Rahman

Samplers: K. Amatya

PACKAGE: - Corrosivity Index (SOIL)

Sample Number	5	6	7	8	9	10
Sample Name	C-1, SS #3 (5'-7')	C-2, SS #4 (7.5'-9.5')	N-2, SS #5 (10'-12')	N-3, SS #8 (17.5'-19.5')	S-2, SS #6 (12.5'-14.5')	S-3, SS #9 (20'-22')
Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil
Sample Date	03/12/2018	03/12/2018	03/12/2018	03/12/2018	03/12/2018	03/12/2018

Parameter	Units	RL		Result	Result	Result	Result	Result	Result
Corrosivity Index									
Corrosivity Index	none	1		17.5	14.5	4.0	7.5	3.0	7.5
Soil Redox Potential	mV	-		210	148	246	119	235	217
Sulphide	%	0.02		0.07	0.05	< 0.02	0.09	< 0.02	0.05
pH	pH Units	0.05		8.71	8.42	8.81	8.53	8.32	8.52
Resistivity (calculated)	ohms.cm	-9999		401	582	4610	3430	2460	3730

PACKAGE: - General Chemistry (SOIL)

Sample Number	5	6	7	8	9	10
Sample Name	C-1, SS #3 (5'-7')	C-2, SS #4 (7.5'-9.5')	N-2, SS #5 (10'-12')	N-3, SS #8 (17.5'-19.5')	S-2, SS #6 (12.5'-14.5')	S-3, SS #9 (20'-22')
Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil
Sample Date	03/12/2018	03/12/2018	03/12/2018	03/12/2018	03/12/2018	03/12/2018

Parameter	Units	RL		Result	Result	Result	Result	Result	Result
General Chemistry									
Conductivity	uS/cm	2		2490	1720	217	291	407	268

PACKAGE: - Metals and Inorganics (SOIL)

Sample Number	5	6	7	8	9	10
Sample Name	C-1, SS #3 (5'-7')	C-2, SS #4 (7.5'-9.5')	N-2, SS #5 (10'-12')	N-3, SS #8 (17.5'-19.5')	S-2, SS #6 (12.5'-14.5')	S-3, SS #9 (20'-22')
Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil
Sample Date	03/12/2018	03/12/2018	03/12/2018	03/12/2018	03/12/2018	03/12/2018

Parameter	Units	RL		Result	Result	Result	Result	Result	Result
Metals and Inorganics									
Moisture Content	%	0.1		12.6	12.5	12.3	13.7	14.6	12.3



FINAL REPORT

CA14025-DEC18 R1

Client: Peto MacCallum Ltd

Project: 18KF037A, Westchester Bourne Underpass

Project Manager: Nazibur Rahman

Samplers: K. Amatya

PACKAGE: - Metals and Inorganics (SOIL)

Sample Number	5	6	7	8	9	10
Sample Name	C-1, SS #3 (5'-7')	C-2, SS #4 (7.5'-9.5')	N-2, SS #5 (10'-12')	N-3, SS #8 (17.5'-19.5')	S-2, SS #6 (12.5'-14.5')	S-3, SS #9 (20'-22')
Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil
Sample Date	03/12/2018	03/12/2018	03/12/2018	03/12/2018	03/12/2018	03/12/2018

Parameter	Units	RL		Result	Result	Result	Result	Result	Result
Metals and Inorganics (continued)									
Sulphate	µg/g	0.4		130	85	20	92	17	130

PACKAGE: - Other (ORP) (SOIL)

Sample Number	5	6	7	8	9	10
Sample Name	C-1, SS #3 (5'-7')	C-2, SS #4 (7.5'-9.5')	N-2, SS #5 (10'-12')	N-3, SS #8 (17.5'-19.5')	S-2, SS #6 (12.5'-14.5')	S-3, SS #9 (20'-22')
Sample Matrix	Soil	Soil	Soil	Soil	Soil	Soil
Sample Date	03/12/2018	03/12/2018	03/12/2018	03/12/2018	03/12/2018	03/12/2018

Parameter	Units	RL		Result	Result	Result	Result	Result	Result
Other (ORP)									
Chloride	µg/g	0.4		1200	870	50	70	200	12



FINAL REPORT

CA14025-DEC18 R1

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-IENVIIC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chloride	DIO0050-DEC18	µg/g	0.4	<0.4	3	20	100	80	120	119	75	125
Sulphate	DIO0050-DEC18	µg/g	0.4	<0.4	1	20	96	80	120	92	75	125

Carbon/Sulphur

Method: ASTM E1915-07A | Internal ref.: ME-CA-IENVIARD-LAK-AN-020

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Sulphide	ECS0007-DEC18	%	0.02	<0.02	20	20	106	80	120			

Conductivity

Method: SM 2510 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0115-DEC18	uS/cm	2	< 0.002	1	10	101	90	110	NA		



FINAL REPORT

CA14025-DEC18 R1

QC SUMMARY

pH
Method: SM 4500 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0115-DEC18	pH Units	0.05	NA	0		100			NA		

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates 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.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS Insufficient sample for analysis.

RL Reporting Limit.

↑ Reporting limit raised.

↓ Reporting limit lowered.

NA The sample was not analysed for this analyte

ND Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

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-- End of Analytical Report --