

FOUNDATION INVESTIGATION REPORT
PROPOSED NON-STRUCTURAL CULVERT
REPLACEMENT/EXTENSION
HIGHWAY 26 FROM FORMER
ST. VINCENT/SYDENHAM
TOWNLINE TO MEAFORD

G.W.P. 167-91-00
Agreement # 3006-E-0002



I.E.
Group



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Appendix A Borehole Location Plan, Drawings 1-6

Appendix B Explanation of Terms Used in Report
Record of Borehole Sheets and Laboratory Test Results

Culvert Number	Borehole Logs	Grain Size Distribution Figures	Atterberg Limits Figures
02B	02B-1 to 3	02B.1, 3, 5	02B.2, 4, 6
03B	03B-1 to 3	03B.1, 3	03B.2, 4
05B	05B-1 to 4	05B.1, 3, 5, 7, 8	05B.2, 4, 6, 9
06B	06B-1 to 3	06B.1,3	06B.2,4
07B	07B-1 to 3	07B.1	07B.2
08B	08B-1 to 3	08B.1, 2, 4	08B.3, 5
09B	09B-1, 2, 4	09B.1, 3, 5	09B.2, 4, 6
10B	10B-1 to 3	10B.1, 3, 5	10B.2, 4, 6
11B	11B-1 to 3	11B.1, 3, 5	11B.2, 4, 6
12B	12B-1 to 3	12B.1, 3, 4	12B.2, 5
13B	13B-1 to 3	13B.1, 3, 4	13B.2, 5
14B	14B-1 to 3	14B.1, 2, 3, 4, 6	14B.5, 7
15B	15B-1 to 3	15B.1, 2, 3, 4	-
16B	16B-1 to 3	16B.1, 2, 3	-
17B	17B-1 to 3	17B.1, 2	-
18B	18B-1 to 3	18B.1, 2, 3	18B.4
19B	19B-1 to 3	19B.1, 2, 3	19B.4
20B	20B-1 to 3	20B.1, 2	20B.3
21B	21B-1 to 3	21B.1	21B.2

Appendix C Limitations of Report

Appendix D Site Photographs

PART A – FOUNDATION INVESTIGATION

1.0 INTRODUCTION

This report presents the results of a foundation investigation carried out in July and August 2007 by Infrastructure Engineering Group Inc. (IEG) on behalf of Stantec Consulting Ltd. (Stantec).

This assignment involves the rehabilitation of the pavement structure on Highway 26 from 0.3 km west of the former St. Vincent/Sydenham to 0.8 m west of the Town of Meaford west limit.

The project includes the replacement/extension of a single existing structural culvert, as well as many non-structural culvert extensions and replacements. The project also includes intersection improvements, construction of a new truck climbing lane, minor horizontal and vertical alignment improvements and electrical work.

Foundation investigation and recommendations are required for the design and construction of culvert replacements and extension as part of the improvement of Highway 26. A single structural culvert, nineteen (19) non-structural culverts, a swamp area, two high fill areas and a deep cut area are to be investigated.

This report covers the non-structural culvert sites listed in Table 1, with either culvert extensions or replacement as presented in the RFP documents, the 2004 Design Criteria (DC) and the Preliminary Design Report (PDR). The underside of the culvert is estimated from the top of culvert elevations shown on the plan and profiles included in the PDR with the assumption of the culvert top slab of approximately 250 mm above the obvert and the culvert base slab of approximately 250 mm below the invert of the concrete box culverts. The overfill height is also estimated from the PDR plan and profile. Table 1 was prepared by IEG along with data provided by Stantec.

Table 1 - Summary of location, structure type, dimensions

Culvert #	Chainage (m)	Existing Culvert Type and Size, W X H	Existing Overfill (m)	Recommended Replacement Culvert Type and Size	Length (m)	U/S Culvert Invert (m)	D/S Culvert Invert (m)
02B	10+800	1200 X 1067 Box	2.2	Replace with 975 mm diam. Pipe Culvert	19.58	326.32	326.23
03B	10+987	1540 X 925 Box	1.6	Extend Lt and Rt	18.78	326.68	326.53
05B	12+004	914 x 910 Box	1.6	Extend Lt and Rt	28.99	330.80	330.80
06B	12+542	914 X 910 Box	0.9	Extend Lt and Rt	18.26	331.68	331.64

Culvert #	Chainage (m)	Existing Culvert Type and Size, W X H	Existing Overfill (m)	Recommended Replacement Culvert Type and Size	Length (m)	U/S Culvert Invert (m)	D/S Culvert Invert (m)
07B	12+870 Rt	457 CSP	0.5	Replace with 600 mm diam. Pipe Culvert	26.765	322.31	321.04
08B	12+874 Lt	610 CSP	1.0	Replace with 600 mm diam. Pipe Culvert	26.76	321.74	320.20
09B	13+831	2150 x 1535 Box	4.6	Replace with 1800 mm diam. Pipe Culvert or Line Existing	33.09	267.04	266.87
10B	14+293	910 x 910 Box	0.9	Extend Lt and Rt	17.17	259.57	259.51
11B	14+991	1840 x 1220 Box	1.5	Extend Lt and Rt	20.81	239.91	239.72
12B	15+041	1540 x 1220 Box	1.5	Extend Lt and Rt	19.74	239.64	239.59
13B	15+434	910 x 910 Box	2.3	Extend Lt and Rt	21.38	234.99	234.90
14B	15+487	915 x 940 Box	1.9	Extend Lt and Rt	20.91	234.61	234.62
15B	16+692	910 x 910 Box	0.7	Extend Lt and Rt with Header and Gabion Walls	17.21	220.95	220.92
16B	16+998	910 x 910 Box	0.4	Extend Lt and Rt with Header and Gabion Walls	15.77	219.03	219.03
17B	17+412	920 x 630 Box	0.8	Extend Lt and Rt	16.37	214.81	214.71
18B	17+542	910 x 610 Box	1.0	Replace with 800 mm diam. Pipe Culvert	16.25	213.92	213.61
19B	18+470 Rt	470 CSP	0.6	Replace with 600 mm diam. Pipe Culvert	19.462	206.47	205.98
20B	18+866	920 x 910 Box	0.6	Extend Lt and Rt with Header and Gabion Walls	17.07	199.98	199.95
21B	19+838	920 x 940 Box	1.2	Extend Rt	23.13	184.74	184.54

The purpose of the investigation has been to obtain information about the subsurface conditions at the site by means of boreholes and, based on the findings, to provide geotechnical recommendations for the foundation elements. Partial or full replacement, or extension of the culverts may be required pending on the results of the drainage and hydrology study specified under Section 6.4 of the RFP document.

Culverts 7B and 8B are culverts crossing St. Vincent Township 11th Line on the south and north sides of Highway 26, respectively. Culvert 19B crosses St. Vincent Township Road between Concession 6 and 7, on the south side of Highway 26. The remaining culverts are culverts crossing Highway 26. Culvert 21B flows towards the south ditch of Ford Drive at Station 10+116.5 (Ford Drive). Based on the information provided in Plate 24 of the PDR prepared by Earth Tech Canada Inc., Culvert 18B flows from left to right, in a southerly direction.

Culvert 5B is a culvert extension on both the north (Lt) and south (Rt) sides located within the swamp area where a truck climbing lane will be added. Culvert 9B is located within a high fill area (>5m fill height) also within the truck climbing lane widening area. The embankment widening in the swamp area will be covered under a separate report, and the high fill/deep cut will also be covered in a separate report.

The existing culverts are described as box culverts in the PDR and the 2004 DC, and are described in the base plans provided by Stantec as either non-reinforced concrete open (NRFO) or reinforced concrete open (RFO).

The work presented herein was undertaken under MTO G.W.P. 167-91-00, Agreement No. 3006-E-0002.

Authorization to complete this assignment was given by Mr. Dan Green, P. Eng., of Stantec Consulting Ltd., the TPM Consultant who is completing this assignment for MTO under Agreement # 3006-E-0002.

2.0 SITE DESCRIPTION

2.1 Site Location

The nineteen (19) non-structural culverts are located on or beside Highway 26, approximately between 0.5 km and 9.5 km east of the west limit of this Contract (Station 10+300). The east limit of this Contract is located 0.3 km east of the former St. Vincent/Sydenham Township Boundary (Station 10+000). Photographs of the culvert sites are presented in Appendix D. Table 1 summarizes the locations, culvert types and dimensions of the existing and replacement culverts as recommended in the PDR and provided in the RFP documents. Locations of the individual non-structural culverts are illustrated in the Borehole Location Plan, Drawings 1 to 4 presented in Appendix A.

These non-structural culvert sites are generally located within drainage valleys, and surface water flow paths of equalizing culverts between wetlands severed by Highway 26. The overfill heights are approximately between 0.4 m and 4.6 m at the non-structural culvert sites.

The embankment slopes are typically 2.5H to 3H:1V and are grass covered. No signs of embankment slope instability were observed at the time of this foundation investigation. Site photographs were taken during the field work in 2007 and provided in Appendix D.

2.2 Physiography and Topography

Physiography for the area includes from west to east, part of a limestone plain, a till plain and a clay plain. Drumlins occur throughout the region, but were not observed in the project corridor. The underlying bedrock geology is dominated by Silurian sandstone, shale, dolostone and siltstone for one-third of the project area. The remainder of the project area has Ordovician shale, limestone, dolostone and siltstone.

Overall, the physiographic regions include, from west to east, the Bruce Peninsula (i.e., part of the Niagara Escarpment with shallower soils, more irregular rock types, and more water bodies as compared to further south) and the northern tip of the Bighead Valley (i.e., an indentation in the Niagara Escarpment that only touches the east end of the project corridor).

For most of this region, soils are brunisols and podzols (i.e. brown forest soils and grey-brown podzols) that have formed on calcareous till. The pH is neutral to alkaline. Slopes tend to be moderate.

Only two of the Niagara Escarpment Plan zoning designations, Escarpment Natural and Escarpment Rural Area, are located within the project limits within a relatively short section adjacent to the highway right-of-way (ROW). This section of the ROW includes the area where the westbound truck climbing lane is proposed.

The project limit also encroaches onto the plains forest of the Bayview Escarpment Area of Natural and Scientific Interest (ANSI) which was expanded in 1998 to include sections of land adjacent to the north side of Highway 26 (i.e. approximately 1 km of ROW in total), located 1 km east of the Sydenham/St. Vincent Township Line, and falls within the area of the westbound truck Climbing Lane. Much of this area has been disturbed and it is possible that the ANSI boundary extends to the highway simply to act as a buffer to the more sensitive ANSI features that are located further north.

3.0 INVESTIGATION PROCEDURES

3.1 Field Investigation

Between August 2 and 29, 2007, a Bombardier-mounted Diedrich drill rig and a truck-mounted CME 55 drill rig, supplied and operated by London Soil Test Ltd. of London, were used on site for drilling and Standard Penetration Testing (SPT, following the procedures of ASTM D 1586). Three (3) boreholes at each site were drilled and sampled to obtain data for foundation and

bedding design of the proposed replacement culverts. The boreholes were drilled to a minimum depth of 3.0 m (or deeper if required) below the culvert inverts to provide sufficient subsurface information for the evaluation of bearing resistances or support of bedding material for the proposed culverts.

The boreholes were advanced using continuous flight solid stem or hollow stem augers. Soil samples were retrieved at selected intervals throughout the depths of the boreholes in conjunction with Standard Penetration Tests (SPT). Samples were generally taken at intervals of depth of 0.75 m to the maximum depth of exploration.

The culvert borehole numbering system was established from the catchment area numbering system used in the Drainage Report of this project, as agreed with Stantec. A letter "A" or "B" was also added after the culvert numbers to delineate Part A or Part B of this assignment.

For the purpose of proper management of the Borehole Logs within gINT, the borehole logging software, a preceding 0 was added to the culverts numbered 1 to 9, with a letter "A" or "B" also added after the culvert numbers to delineate Part A or Part B of this assignment, and the last number being the borehole number at the culvert site, i.e., "02B-1" refers to Borehole 1 at the location of Culvert 2B, etc.

The boreholes were numbered 02 B-1 to 21B-3 for the subject culverts and the depths of sampling were as follows:

Table 2 - Ground Surface Elevations and Depth of Boreholes

Borehole Number	Ground Surface Elevation, m	Depth, m
02B-1	327.42	4.72
02B-2	329.84	5.79
02B-3	327.32	3.20
03B-1	327.23	3.43
03B-2	329.37	5.56
03B-3	327.44	3.35
05B-1	331.35	3.05
05B-2	333.03	7.32
05B-3	333.07	7.01
05B-4	331.17	4.27
06B-1	331.42	3.51
06B-2	333.80	5.03
06B-3	331.90	3.51
07B-1	322.32	3.51
07B-2	322.35	5.03

Borehole Number	Ground Surface Elevation, m	Depth, m
07B-3	322.21	3.51
08B-1	322.52	3.51
08B-2	322.48	5.03
08B-3	320.77	3.35
09B-1	266.93	6.40
09B-2	273.45	7.62
09B-4	268.55	4.72
10B-1	259.20	3.51
10B-2	261.66	4.80
10B-3	260.81	4.27
11B-1	240.92	4.27
11B-2	242.62	5.79
11B-3	241.17	4.27
12B-1	239.92	4.27
12B-2	242.43	5.18
12B-3	240.32	4.27
13B-1	235.21	4.27
13B-2	238.51	8.08
13B-3	235.51	3.51
14B-1	235.35	5.03
14B-2	237.78	6.55
14B-3	235.13	4.27
15B-1	222.03	4.27
15B-2	222.78	7.32
15B-3	222.80	5.03
16B-1	219.27	3.35
16B-2	220.50	5.79
16B-3	220.59	5.03
17B-1	214.91	3.51
17B-2	216.46	5.03
17B-3	216.51	5.03
18B-1	213.13	3.51
18B-2	215.66	5.49
18B-3	215.73	7.62
19B-1	206.50	3.96
19B-2	207.20	5.03

Borehole Number	Ground Surface Elevation, m	Depth, m
19B-3	207.25	4.80
20B-1	201.77	5.03
20B-2	201.75	5.59
20B-3	200.10	3.51
21B-1	186.37	4.27
21B-2	186.95	5.79
21B-3	185.47	4.27

Field pocket penetrometer testing was conducted on the retrieved SPT samples, where applicable, to determine the undrained shear strength of the cohesive soil deposits. These undrained shear strengths are used to supplement the properties of the cohesive soils. It is noted that the measured shear strength value would be slightly lower than the actual value due to sampling disturbance.

Seepage and water levels were noted in each borehole during and at the completion of drilling and sampling. All boreholes were grouted with a bentonite/cement mix at completion of sampling in accordance with Ontario Regulation 903.

Our field engineer, Mr. Ralph Billings, P. Eng., working under the direction of the project engineer, Mr. Eric Chung, P. Eng., supervised the fieldwork. Our field staff cleared the location of buried utilities and logged the boreholes. The soil samples obtained were placed in labeled containers and transported to our London Office for further examination and laboratory testing.

The stations, offsets and ground surface elevations at the as drilled borehole locations were surveyed by AGM London and provided to Infrastructure Engineering Group Inc. for the purpose of this report.

The results of the drilling, sampling, in-situ testing and groundwater observations are summarized on the Record of Borehole sheets and enclosed in Appendix B.

3.2 Laboratory Analysis

Geotechnical laboratory testing consisted of natural moisture content determinations and visual classifications of all retrieved soil samples. In addition, grain size analyses, Atterberg Limit tests and unit weight tests were performed on selected samples.

The results of the laboratory testing are presented on the Record of Borehole sheets and in the respective figures presented in Appendix B.

4.0 SUBSURFACE CONDITIONS

Reference is made to the respective appendix of each culvert site for the Record of Borehole sheets and Laboratory Test Results (Appendix B) for detailed subsurface soil and groundwater conditions encountered in the boreholes. The stratigraphic boundaries shown on the Record of Borehole sheets are inferred from non-continuous sampling and, consequently, represent transitions between soil types rather than exact planes of geological change. The soil profiles depicting the subsurface conditions on the respective Borehole Locations will vary between and beyond the borehole locations.

In general, boreholes put down on the existing shoulder encountered a 100 mm to 460 mm thick layer of shoulder gravel placed on a 0.76 m and 3.51 m of loose to compact mixed embankment fill. Boreholes put down near the existing ditches encountered 75 mm to 460 mm thick layer of topsoil, with localized near surface fill layers.

Boreholes 05B-1 and 05B-2 put down on the existing pavement within the swamp area penetrated a 150 mm thick layer of asphalt, underlain successively by a 0.56 m thick layer of granular fill and a 0.76 m thick layer of mixed fill. The mixed fill in Boreholes 05B-1 and 05B-2 is underlain by a 150 mm thick layer of buried asphalt which is in turn underlain by a 1.23 m thick layer of mixed embankment fill placed on top of a 1.21 m to 1.52 m thick layer of firm buried peat. Boreholes 05B-1 and 05B-4 penetrated a 2.74 m and 3.05 m thick layer of very soft, partially decomposed peat.

A 0.43 m and 0.30 m thick layer of firm, partially decomposed peat is present beneath the embankment fill of Boreholes 16B-2 and 18B-2.

The following is a summary of the general subsurface conditions encountered in the boreholes beneath the pavement, buried pavement, topsoil, peat, embankment fill and buried peat layers:

Culvert Sites	Borehole Number	General Subsurface Condition
02B	02B-1 to 3	Moist, Stiff to Hard Clayey Silt to Silty Clay Till with loose to compact wet silt layers
03B	03B-1 to 3	Moist, Loose to Very Dense Sand and Silt Till
05B	05B-1 to 4	Moist to Wet, Compact to Very Dense Sand and Silt Till, with Thin Moist, Firm to Stiff Upper Silty Clay Layer
06B	06B-1 to 3	Wet to Moist, Firm to Hard Silty Clay Till
07B	07B-1 to 3	Wet to Moist, Firm to Hard Silty Clay Till
08B	08B-1 to 3	Moist, Stiff to Hard Silty Clay Till
09B	09B-1, 2 and 4	Moist to Wet, Very Stiff to Hard Clayey Silt to Silty Clay Till
10B	10B-1 to 3	Moist, Very Stiff to Hard Clayey Silt to Silty Clay Till
11B	11B-1 to 3	Moist, Hard to Very Stiff Silty Clay Till
12B	12B-1 to 3	Wet to Moist, Loose to Very Dense Sand and SILT Till

Culvert Sites	Borehole Number	General Subsurface Condition
13B	13B-1 to 3	Wet to Moist, Firm to Hard Clayey Silt to Silty Clay Till, with Moist, Very Dense, Silty Sand and Gravel Layers
14B	14B-1 to 3	Moist, Very Dense Gravelly Silty Sand Till, Moist to Wet, Dense to Very Dense Sand and Gravel, to Moist, Very Stiff to Hard Clayey Silt Till
15B	15B-1 to 3	Moist to Saturated, Compact to Dense Sand, to Moist, Very Dense Sand and Silt Till
16B	16B-1 to 3	Saturated, Compact to Dense Silty Sand, to Wet to Moist, Dense to Very Dense Sand and Silt Till
17B	17B-1 to 3	Moist to Wet, Compact to Very Dense Silt Till
18B	18B-1 to 3	Moist to Wet, Loose to Very Dense Sand and Silt Till, changing to Wet, Very Stiff to Hard Silty Clay Till in Borehole 18B-1
19B	19B-1 to 3	Moist, Stiff to Hard Clayey Silt to Silty Clay Till, with Upper Saturated Sand and Moist Sandy Silt Layers in Borehole 19B-3
20B	20B-1 to 3	Moist, Very Stiff to Hard Clayey Silt to Silty Clay Till
21B	21B-1 to 3	Moist, Very Stiff to Hard Clayey Silt to Silty Clay Till

4.1 Detailed Subsurface Conditions

For the purpose of detailed description of the subsurface conditions, the boreholes are separated into the following five groups based on the major underlying soil types:

Section	Group	Major Subsurface Soil Type	Culvert Sites
4.2	1	Clayey Silt to Silty Clay Till	02B, 06B, 07B, 08B, 10B, 11B, 20B, 21B
4.3	2	Sand and Silt Till to Silt Till	03B, 12B, 17B
4.4	3	Sand, Silty Sand, Silty Sand Till, Sand and Silt Till, Clayey Silt to Silty Clay Till	13B, 14B, 15B, 16B, 18B, 19B
4.5	4	Swamp Area	05B
4.6	5	High Fill Area	09B

4.2 Group 1

The native soils in Boreholes 02B, 06B, 07B, 08B, 10B, 11B, 20B and 21B are mainly clayey silt to silty clay till. The following is a detailed description of the soil stratigraphy encountered for this group of boreholes.

4.2.1 Fill and Organic Soil

The boreholes at the shoulders generally encountered a 0.10 m to 0.76 m thick layer of granular fill (shoulder gravel). The shoulder gravel is underlain by a 1.37 m to 3.05 m thick layer of

mixed fill consisting of brown sand, gravel, silt and clayey silt fill materials with localized zones of organic inclusions.

The boreholes near the ends of the existing culverts generally encountered a 0.075 to 0.46 m thick layer of topsoil. Topsoil is not present in Boreholes 20B-1, and 21B-1.

The topsoil in Boreholes 07B-3 and 21B-3 is underlain by a 1.53 m and 1.07 m thick layer of granular or mixed fill, respectively.

The embankment fill in Borehole 20B-1 consists of a 1.52 m thick layer of granular material underlain by a 0.46 m thick layer of buried peat.

A 0.76 m thick layer of granular or mixed fill was encountered surficially in Borehole 21B-1.

Standard penetration tests taken in the fill and topsoil yielded “N”-values from 1 to 32 blows per 0.3 m, with an average of 11 blow per 300 mm, indicative of typically loose to compact compactness condition with localized very loose and dense zones. The measured natural moisture contents of the mixed fill ranged from 3 to 57%.

Five (5) grain size distribution analyses and three (3) Atterberg Limits determinations of the fill materials were carried out and the results are shown on the following figures of the corresponding culvert site in Appendix B, e.g. Figure C-02B.1 refers to the first figure of Culvert 02B, etc.

Table of Figures of Laboratory Test Results

Culvert Number	Grain Size Figure	Atterberg Limits Figure
02B	C-02B.1	C-02B.2
06B	-	-
07B	-	-
08B	C-08B.1	-
10B	C-10B.1	C-10B.2
11B	C-11B.1	C-11B.2
20B	C-20B.1	-
21B	-	-

The Atterberg Limits determinations carried out on the fill layers and yielded the following results:

	Minimum	Maximum	Average
Liquid Limit (W_L)	19	26	23.5
Plastic Limit (W_P)	15	18	16.3
Plasticity Index (I_P)	4	9	7.3

The unit weight of the fill was not determined due to the disturbance of the soil samples during sampling and sample retrieval.

The depth and bottom elevation of the topsoil, pavement, fill and buried peat layers are presented in the following table:

Borehole No.	Bottom of Topsoil, Pavement, Fill and Peat, m	Bottom Elevation of Topsoil, Pavement, Fill and Peat, m
02B-1	0.10	327.32
02B-2	3.05	326.79
02B-3	0.20	327.12
06B-1	0.15	331.27
06B-2	1.98	331.82
06B-3	0.15	331.75
07B-1	0.15	322.17
07B-2	1.52	320.83
07B-3	1.68	320.53
08B-1	0.30	322.22
08B-2	2.29	320.19
08B-3	0.20	320.57
10B-1	0.08	259.12
10B-2	2.74	258.92
10B-3	0.15	260.66
11B-1	0.08	240.84
11B-2	3.20	239.42
11B-3	0.15	241.02
20B-1	1.98	199.79
20B-2	2.13	199.62
20B-3	0.46	199.64
21B-1	0.76	185.61

Borehole No.	Bottom of Topsoil, Pavement, Fill and Peat, m	Bottom Elevation of Topsoil, Pavement, Fill and Peat, m
21B-2	0.76	186.19
21B-3	1.37	184.10

4.2.2 Clayey Silt to Silty Clay Till

The topsoil and fill layers are underlain by a major deposit of, brown to reddish brown, clayey silt to silty clay till which extends beyond the vertical limits of the boreholes. Silt seams, pockets and layers are present in Boreholes 10B-1, 10B-3 and 11B-1.

Standard penetration tests taken within the clayey silt to silty clay till yielded “N”-values of between 6 and over 100 blows per 0.3 m, with an average of 52 blows per 300 mm. The natural moisture contents were between 2 and 35% with an average of 11%.

Thirty-eight (38) grain size analyses and Thirty-eight (38) Atterberg Limits determinations were performed on the clayey silt to silty clay till and the results are plotted on the following figures of Appendix B:

Table of Figures of Laboratory Test Results

Culvert Number	Grain Size Figure	Atterberg Limits Figure
02B	C-02B.3	C-02B.4
06B	C-06B.3	C-06B.4
07B	C-07B.1	C-07B.2
08B	C-08B.2	C-08B.3
10B	C-10B.3	C-10B.4
11B	C-11B.3	C-11B.4
20B	C-20B.2	C-20B.3
21B	C-21B.1	C-21B.2

The Atterberg Limits determinations carried out on the clayey silt to silty clay till (CL-ML to CL) yielded the following results:

Atterberg Limits	Minimum	Maximum	Average
Liquid Limit (W_L)	19	28	22.9
Plastic Limit (W_P)	13	19	15.0
Plasticity Index (I_P)	5	11	7.9

Four (4) grain size distribution analyses and three (3) Atterberg Limits determinations were performed on the silt seams, pockets and layers within the clayey silt to silty clay till and the results are plotted on the following figures of Appendix B:

Culvert Number	Grain Size Figure	Atterberg Limits Figure
02B	C-02B.5	C-02B.6
10B	C-10B.5	C-10B.6
11B	C-11B.5	C-11B.6

The Atterberg Limits determinations carried out on the silt seams (ML), pockets and layers within the clayey silt to silty clay till yielded the following results:

Atterberg Limits	Minimum	Maximum	Average
Liquid Limit (W_L)	17	19	18.0
Plastic Limit (W_P)	14	16	15.0
Plasticity Index (I_P)	3	3	3.0

Undrained shear strength of the clayey silt to silty clay till as determined from field pocket penetrometer testing ranged from 87.5 to over 225 kPa, which generally increased with increasing depths.

Unit weight determinations carried out on the clayey silt to silty clay till yielded results of between 18.5 kN/m³ and 23.9 kN/m³, with an average of 22.1 kN/m³.

Based on the above field and laboratory test results, together with visual and tactile examination, the clayey silt to silty clay till deposit generally exhibited a very stiff to hard consistency with localized firm condition within the surface 0.5 m to 1.0 m of the deposit.

The clayey silt to silty clay deposit extends beyond the vertical limit of this group of boreholes at maximum depths of between 3.20 m and 5.79 m below the present ground surface (between Elevations 181.15 m and 328.77 m).

4.3 Group 2

The native soils in Boreholes 03B, 12B, 17B consist mainly of sand and silt till. The following is a detailed description of the soil stratigraphy encountered for this group of boreholes.

4.3.1 Fill and Topsoil

The boreholes at the shoulders generally encountered a 0.61 m and 1.01 m thick layer of granular fill (shoulder gravel). The shoulder gravel is underlain by a 1.53 m to 2.50 m thick layer of

mixed fill consisting of brown sand, gravel, silt and clayey silt fill materials with localized zones of organic inclusions.

The boreholes near the ends of the existing culverts generally encountered a 0.075 to 0.15 m thick layer of topsoil. Topsoil is not present in Boreholes 03B-3.

The topsoil in Boreholes 17B-3 is underlain by a 1.68 m thick layer of mixed fill.

The ground surface of Borehole 03B-3 is covered with a 1.07 m layer of mixed fill. The embankment fill in Borehole 20B-2 is underlain by a 0.46 m thick layer of buried topsoil.

Standard penetration tests taken in the fill and topsoil yielded “N”-values ranging from 3 to 24 blows per 0.3 m, with an average of 13 blows per 0.3 m, indicative of typically loose to compact compactness condition with localized very loose zones. The measured natural moisture contents of the mixed fill ranged from 8 to 43%.

Seven (7) grain size distribution analyses and four (4) Atterberg Limits determinations were carried out on the fill materials and test results are shown on the following figures of the corresponding culvert sites in Appendix B.

Table of Figures of Laboratory Test Results

Culvert Number	Grain Size Figure	Atterberg Limits Figure
03B	C-03B.1	C-03B.2
12B	C-12B.1	C-12B.2
17B	C-17B.1	-

The Atterberg Limits determinations carried out on the fill layers and yielded the following results:

Atterberg Limits	Minimum	Maximum	Average
Liquid Limit (W_L)	18	32	23.7
Plastic Limit (W_P)	16	20	17.3
Plasticity Index (I_P)	2	12	6.3

The unit weight of the fill was not determined due to the disturbance of the soil samples during sampling and sample retrieval.

The depths and bottom elevation of the topsoil, pavement, fill and buried peat layers are presented in the following table:

Borehole No.	Bottom of Topsoil, Pavement, Fill and Peat, m	Bottom Elevation of Topsoil, Pavement, Fill and Peat, m
03B-1	0.15	327.08
03B-2	3.05	326.32
03B-3	1.07	326.37
12B-1	0.15	239.77
12B-2	3.51	238.92
12B-3	0.075	240.24
17B-1	0.15	214.76
17B-2	2.44	214.02
17B-3	1.83	214.68

4.3.2 Sand and Silt Till

The topsoil and fill layers are underlain by a major deposit of reddish brown sand and silt till which extends beyond the vertical limits of the boreholes. Sand and gravel, and clayey silt layers are present in Boreholes 12B-2 and 12B-3 respectively.

Standard penetration tests taken within the sand and silt till yielded “N”-values of between 5 and over 100 blows per 0.3 m, with an average of 48 blows per 300 mm. The natural moisture contents were between 8 and 27% with an average of 15.2%.

Thirteen (13) grain size analyses and four (4) Atterberg Limits determinations were performed on the sand and silt till and the results are plotted on the following figures of Appendix B:

Table of Figures of Laboratory Test Results

Culvert Number	Grain Size Figure	Atterberg Limits Figure
03B	C-03B.3	C-03B.4
12B	C-12B.3	-
17B	C-17B.2	-

The Atterberg Limits determinations carried out on the sand and silt till (SM-ML) yielded the following results:

Atterberg Limits	Minimum	Maximum	Average
Liquid Limit (W_L)	16	20	18.0
Plastic Limit (W_P)	15	16	15.3
Plasticity Index (I_P)	1	4	2.8

A single grain size analysis and Atterberg Limits determination were performed on the clayey silt seams, pockets and layers within the sand and silt till and the results are plotted on the following figures of Appendix B:

Culvert Number	Grain Size Figure	Atterberg Limits Figure
12	C-12B.4	C-12B.5

A single Atterberg Limits determination carried out on the clayey silt pockets and layers within the sand and silt till yielded a liquid limit, plastic limit and plasticity index of 19%, 15% and 4% respectively.

Unit weight determinations carried out on the sand and silt till yielded results of between 20.1 kN/m³ and 21.6 kN/m³, with an average of 20.9 kN/m³.

Based on the above field and laboratory test results, together with visual and tactile examination, the sand and silt till generally exhibited a dense to very dense compactness condition, with near surface loose to compact zones.

The sand and silt till deposit extends beyond the vertical limit of this group of boreholes at maximum depths of between 3.35 m and 5.56 m below the present ground surface (between Elevations 211.41 m and 324.09 m).

4.4 Group 3

The native soils in Boreholes 13B, 14B, 15B, 16B, 18B and 19B consist of sand and silt till and clayey silt to silty clay till, with sand, silty sand, silty sand, and clayey silt to silty seams, pockets and layers. The following is a detailed description of the soil stratigraphy encountered for this group of boreholes.

4.4.1 Fill and Organic Soil

The boreholes put down on the existing shoulders generally encountered a 0.15 m to 3.66 m thick layer of brown granular fill (shoulder gravel). The shoulder gravel is generally underlain

by a 0.92 m to 5.03 m thick layer of mixed fill consisting of brown, sand, gravel, silt and clayey silt fill materials with localized zones of organic inclusions.

A 0.43 m and 0.30 m thick layer of firm, partially decomposed peat is present beneath the embankment fill of Boreholes 16B-2 and 18B-2.

The boreholes near the ends of the existing culverts generally encountered a 0.075 m to 0.15 m thick layer of topsoil. Topsoil is not present in Boreholes 15B-3, 16B-3, and 19B-3.

The topsoil in 14B-1 is underlain by a 1.98 m thick layer of granular fill.

The ground surface of Boreholes 15B-3, 16B-3 and 19 BRT-3 is covered with a 0.46 m, 1.52 and 0.3 m or granular fill or mixed fill.

Standard penetration tests taken within the fill layers yielded “N”-values of between 3 and 34 100 blows per 0.3 m, with an average of 11 blows per 0.3 m. The natural moisture contents were between 6 and 39% with an average of 18%.

Nine (9) grain size distribution analyses and two (2) Atterberg Limits determinations were performed and the results are plotted on the following figures of Appendix B.

Table of Figures of Laboratory Test Results

Culvert Number	Grain Size Figure	Atterberg Limits Figure
13B	C-13B.1	C-13B.2
14B	C-14B.1	-
15B	C-15B.1	-
16B	C-16B.1	-
18B	C-18B.1	-
19B	C-19B.1	-

The Atterberg Limits determinations carried out on the fill yielded the following results:

Atterberg Limits	Minimum	Maximum	Average
Liquid Limit (W_L)	22	31	26.5
Plastic Limit (W_P)	16	20	18.0
Plasticity Index (I_P)	6	11	8.5

The unit weight of the fill was not determined due to the disturbance of the soil samples during sampling and sample retrieval.

Based on the above field and laboratory test results, together with visual and tactile examination, the fill generally exhibited a loose to compact compactness condition with localized very loose to dense zones.

The depths and bottom elevations of the topsoil, pavement, fill and buried peat layers are presented in the following table:

Borehole No.	Bottom of Topsoil, Pavement, Fill and Peat, m	Bottom Elevation of Topsoil, Pavement, Fill and Peat, m
13B-1	0.15	235.06
13B-2	3.66	234.85
13B-3	0.075	235.43
14B-1	2.13	233.22
14B-2	3.35	234.43
14B-3	0.15	234.98
15B-1	0.15	221.88
15B-2	3.66	219.12
15B-3	0.46	222.34
16B-1	0.15	219.12
16B-2	3.05	217.45
16B-3	1.52	219.07
18B-1	0.15	212.98
18B-2	2.74	212.92
18B-3	0.075	215.65
19B-1	0.10	206.40
19B-2	1.68	205.52
19B-3	0.30	206.95

4.4.2 Gravelly Silty Sand Till

A 1.37 m thick layer of brown, gravelly sandy silt till is present beneath the topsoil in Borehole 14B-3.

A single standard penetration test carried out on the sand till yielded an “N”-value of 64 blows per 300 mm. A single moisture content determination yielded a result of 11%.

A single grain size distribution analysis was performed on the sand till and the results are presented in Figure C-14B.2.

These results indicate that the gravelly silty sand till is in a very dense compactness condition.

4.4.3 Sand, Silty Sand, Sand and Gravel to Sandy Silt

A 1.53 m to 4.57 m thick layer of brown to grey sand, silty sand, sand and gravel to sandy silt is present beneath the topsoil, fill and sand till layers in this Boreholes 13B-3, 14B-1, 14B-2, 14B3-3, 15B1, 15B-2, 15B-3, 16B-1 and 19B-3. A 0.61 m thick localized clay pockets is present within the sand and gravel deposit in Borehole 14B-2, at a depth of 3.35 m below the present ground surface.

Standard penetration tests taken within the fill layers yielded “N”-values of between 11 and over 100 blows per 0.3 m. The natural moisture contents were between 5 and 29%, with an average of 16%.

Eleven (11) grain size distribution analyses were performed and the results are plotted on the following figures of Appendix B.

Table of Figures of Laboratory Test Results

Culvert Number	Grain Size Figure	Atterberg Limits Figure
13B	C-13B.3	-
14B	C-14B.3	-
15B	C-15B.2 and 3	-
16B	C-16B.2	-
19B	C-19B.2	-

A single grain size distribution analysis was carried out on the silty clay pocket and the results presented in Figure 14B.4. A single Atterberg Limits determination, carried out on the silty clay pocket within the sand and gravel material in Borehole 14B-2, yielded a liquid limit, plastic limit and plasticity index of 27%, 18% and 9% respectively. Test results are presented in Figure C-14B.5

The unit weight of the cohesionless materials was not determined due to the disturbance of the soil samples during sampling and sample retrieval.

Based on the above field and laboratory test results, together with visual and tactile examination, the sand, silty sand, sand and gravel and sandy silt generally exhibited a compact to very dense compactness condition.

The sand to silty sand deposit in Boreholes 15B-1, 15B-3 extends beyond the vertical limit of the boreholes at maximum depths of between 4.27 m and 5.03 m below the present ground surface (Elevations 217.76 m and 217.77 m).

4.4.4 Sand and Silt Till

The topsoil, fill, buried peat, sand, silty sand, sand and gravel and sandy silt layers in Boreholes 15B-2, 16B-1, 16B-2, 16B-3, 18B-1, 18B-2, and 18B-3 is underlain by a 0.92 m to 7.55 m thick m layer of reddish brown sand and silt till., with embedded gravel.

Standard penetration tests taken within the sand and silt till yielded “N”-values of between 5 and over 100 blows per 0.3 m, with an average of 48 blows per 300 mm. The natural moisture contents were between 13 and 22% with an average of 17%.

Thirteen (13) grain size analyses were performed on the sand and silt till and the results are plotted on the following figures of Appendix B:

Table of Figures of Laboratory Test Results

Culvert Number	Grain Size Figure	Atterberg Limits Figure
15B	C-15B.4	-
16B	C-16B.3	-
18B	C-18B.2	-
19B	C-19B.2	-

The unit weight of the sand and silt till was not determined due to the disturbance of the soil samples during sampling and sample retrieval.

Based on the above field and laboratory test results, together with visual and tactile examination, the sand and silt till generally exhibited a dense to very dense compactness condition, with near surface as well as localized loose to compact zones.

The sand and silt till deposit in Boreholes 15B-2, 16B-1, 16B-2, 16B-3 and 18B-2 extends beyond the vertical limit of the boreholes at maximum depths of between 3.35 m and 7.32 m below the present ground surface (between Elevations 210.17 m and 215.92 m).

4.4.5 Clayey Silt to Silty Clay Till

The topsoil, fill, buried peat, sand, silty sand, sand and gravel and sandy silt layers in Boreholes 13B-1, 13B-2, 13B-3, 14B-1, 14B-2, 14B-3, 18B.1, 19B-1, 19B-2 and 19B-3 is underlain by a 0.45 m to 4.12 m thick layer of clayey silt to silty clay till deposit with embedded sand and gravel. The clayey silt to silty clay generally has a reddish brown colour.

Standard penetration tests taken within the clayey silt to silty clay till yielded “N”-values of between 11 and over 100 blows per 0.3 m, with an average of 51 blows per 300 mm. The natural moisture contents were between 7 and 20% with an average of 11%.

Ten (10) grain size distribution analyses and nine (9) Atterberg Limits determinations were performed on the clayey silt to silty clay till and the results are plotted on the following figures of Appendix B:

Table of Figures of Laboratory Test Results

Culvert Number	Grain Size Figure	Atterberg Limits Figure
13B	C-13B.4	C-13B.5
14B	C-14B.6	C-14B.7
18B	C-18B.3	C-18B.4
19B	C-19B.3	C-19B.4

The Atterberg Limits determinations carried out on the clayey silt to silty clay till (CL-ML to CL) yielded the following results:

Atterberg Limits	Minimum	Maximum	Average
Liquid Limit (W_L)	18	29	21.7
Plastic Limit (W_P)	11	21	15.5
Plasticity Index (I_p)	4	8	6.2

The undrained shear strength of the clayey silt to silty clay till as determined from field pocket penetrometer testing ranged from 175 kPa to over 225 kPa.

The unit weight determinations carried out on the clayey silt to silty clay till yielded results of between 20.7 kN/m³ and 23.0 kN/m³, with an average of 22.2 kN/m³.

Based on the above field and laboratory test results, together with visual and tactile examination, the clayey silt to silty clay till deposit generally exhibited hard consistency with stiff to very stiff zones within the upper 0.5 to 1.5 m of the stratum.

The clayey silt to silty clay deposit extends beyond the vertical limit of Boreholes 13B-1, 13B-2, 13B-3, 14B-1, 14B-2, 14B-3, 18B-1, 19B-1, 19B-2 and 19B-3, at maximum depths of between 3.51 m and 8.08 m below the present ground surface (between Elevations 202.17 m and 232.00).

4.4.6 Silty Clay

The sand and silt till layer in Borehole 18B-3 is underlain by a 0.92 m thick layer of grey silty clay. A single standard penetration test taken on the silty clay layer yielded a result of 5 blows per 0.3 m. A single moisture determination yielded a single value of 31%.

Based on the above field results, together with visual and tactile examination, the silty clay exhibited a firm consistency.

The silty clay extends beyond the vertical limit of the borehole at a maximum depth of 7.62 m below the present ground surface, at Elevation 208.11 m.

4.5 Group 4

Boreholes 05B-1 to 4 (also know as Boreholes SW-31A, 31, 32 and 33) were put down in the swamp area, within the truck climbing lane widening section. The area is generally underlain by embankment fill and organic peat deposit over a thin layer of native silty clay and then sand and silt till. The following is a detailed description of the soil stratigraphy encountered for this group of boreholes. A summarized soil profile is provided in Drawing 5.

4.5.1 Pavement, Fill, Buried Pavement and Peat

Boreholes 05B-2 and 05B-3 put down through the existing pavement penetrated a 0.2 m thick layer of asphalt followed by a 0.56 m and 0.76 m of granular fill and upper mixed fill, respectively. The mixed fill is underlain by a 0.15 m thick layer of buried asphalt which is underlain by a 1.23 m thick layer of lower mixed fill. The lower mixed fill is in turn underlain by a 1.21 m and 1.52 m thick layer of black to dark brown, fully decomposed peat.

Boreholes 05B-1 and 05B-4, put down near the existing ditch, penetrated a 2.74 m and 3.05 m thick layer of black, partially decomposed peat, with wood pieces. A 610 mm thick layer of sand and gravel is present within the peat deposit in Borehole 05B-4.

Two (2) grain size analyses and two (2) Atterberg Limits determinations were performed on the fill materials and the results are plotted on the following figures of Appendix B.

Table of Figures of Laboratory Test Results

Culvert Number	Grain Size Figure	Atterberg Limits Figure
05B	C-05B.1	C-05B.2

Atterberg Limits determinations on the fill materials yielded liquid limits, plastic limits and plasticity indices of 22% and 26%, 18% and 16%, 8% and 6%, respectively.

The unit weight of the fill and organic layers was not determined due to the disturbance of the soil samples during sampling and sample retrieval.

Standard penetration tests taken within the fill materials yielded “N”-values of between 12 and over 30 blows per 0.3 m. The measured natural moisture contents of the fill materials ranged from 7 to 23%, with an average of 12%

Three (3) grain size analyses and two (2) Atterberg Limits determinations were performed on the peat materials and the results are plotted on the following figures of Appendix B.

Table of Figures of Laboratory Test Results

Culvert Number	Grain Size Figure	Atterberg Limits Figure
05B	C-05B.3	C-05B.4

Atterberg Limits determinations on the peat materials yielded liquid limits, plastic limits and plasticity indices of 55% and 14%, 24% and 14%, 31% and 0%, respectively.

Organic content determinations were carried out on four (4) samples which yielded the following results:

Borehole	Sample	Depth, m	Organic Content, %	Peat Organic Content, %
05B-1	2	0.61	45.9	45.9
05B-2	4	3.05	60.1	60.1
05B-3	5	3.81	23.5	23.5
05B-4	3	1.22	15.9	15.9
			Minimum	15.9
			Maximum	60.1
			Average	36.90

Standard penetration tests taken within the peat materials yielded “N”-values of between 1 and over 18 blows per 0.3 m. The measured natural moisture contents of the fill materials ranged from 32 to 658%., with an average of 223%.

Field vane test carried out on the peat material yielded undrained shear strength of between 18.5 and 28 kPa, with an average of 25.1 kPa; sensitivities of between 1 and 3.7, and an average of 2.3.

Based on the above field and laboratory test results, together with visual and tactile examination, the fill material generally exhibited a compact compactness condition, and the peat material exhibited a soft to firm consistency. The peat material is classified as amorphous granular to fibrous.

The bottom depths and elevations of the peat deposit are presented in the following table:

Borehole No.	Bottom of Peat, m	Bottom Elevation of Peat, m
05B-1	2.74	328.61
05B-2	4.11	328.92
05B-3	4.42	328.65
05B-4	3.05	328.12

4.5.2 Silty Clay

The peat layer in all of the boreholes in the swamp area is underlain by a 0.31 m and 0.61 m thick layer of grey silty clay.

Standard penetration tests taken within the silty clay yielded “N”-values of between 8 and 11 blows per 0.3 m. Moisture content determinations of the silty clay samples yielded results of between 13 and 35%.

Two (2) grain size distribution analyses and two (2) Atterberg Limits determinations were performed on the peat materials and the results are presented on the following figures of Appendix B.

Table of Figures of Laboratory Test Results

Culvert Number	Grain Size Figure	Atterberg Limits Figure
05B	C-05B.5	C-05B.6

Atterberg Limits determinations on the silty clay layer yielded liquid limits, plastic limits and plasticity indices of 27 and 43%, 18 and 26%, and 9 and 17%, respectively, indicating a CL to CI classification.

The unit weight of the silty clay layer was not determined due to the disturbance of the soil samples during sampling and sample retrieval.

Based on the above field and laboratory test results, together with visual and tactile examination, the clayey silt to silty clay layer generally exhibited a stiff consistency.

The silty clay extends beyond the vertical limit of Borehole 05B-1 at a maximum depth of 3.05 m below the present ground surface at Elevation 328.30 m.

4.5.3 Sand and Silt Till

The silty clay layer in Boreholes 05B-2, 3 and 4 is in turn underlain by a 0.61 m to 2.39 m thick layer of sand and silt till with embedded gravel and a trace of clay. Occasional clayey silt seams and layers are present within the sand and silt till.

Standard penetration tests taken within the sand and silt till yielded “N”-values of between 15 and over 100 blows per 0.3 m, with an average of 60 blows per 0.3 m. The natural moisture contents were between 10 and 16% with an average of 13.0%.

A single grain size distribution analysis was performed on the sand and silt till and the results are plotted on Figure C-05B.7 of Appendix B.

Two (2) grain size distribution analyses and two (2) Atterberg Limits determination were performed on the clayey silt seams, pockets and layers within the sand and silt till and the results are plotted on the following figures of Appendix B:

Culvert Number	Grain Size Figure	Atterberg Limits Figure
05B	C-05B.8	C-05B.9

The Atterberg Limits determination carried out on the clayey silt seams and layers within the sand and silt till yielded liquid limits, plastic limits and plasticity indices of 21%, 15%, and 6%, respectively.

The unit weight of the sand and silt till layer was not determined due to the disturbance of the soil samples during sampling and sample retrieval.

Based on the above field and laboratory test results, together with visual and tactile examination, the sand and silt till generally exhibited a dense to very dense compactness condition, with near surface loose to compact zones.

The sand and silt till deposit extends beyond the vertical limit of Boreholes 15B-3 and 4 at maximum depths of between 7.01 m and 4.27 m below the present ground surface (between Elevations 326.06 m and 326.90 m), respectively.

4.5.4 Shale Bedrock

The sand and silt till in Borehole 05B-2 is underlain by weathered shale bedrock as evidenced by the shale fragments retrieved from the auger cuttings.

This borehole is terminated at a depth of 7.32 m due to auger refusal, at Elevation 325.71 m.

4.6 Group 5

Boreholes 09B-1, 2 and 4 were put down in the high fill area, within the truck climbing lane widening section. The area is generally underlain by embankment fill over native clayey silt to silty clay till. Additional boreholes (Boreholes 09B-3, 5, 6, 7, 8, 9 and 10) were put down for the high fill area covered in a separate report. The following is a detailed description of the soil stratigraphy encountered for this group of boreholes. A summarized soil profile is provided in Drawing 6.

4.6.1 Fill

Borehole 09B-2 put down on the existing shoulder penetrated a 0.3 m of granular fill underlain by a 5.03 m thick layer of mixed embankment fill.

The ground surface of Boreholes 09B-1 and 09B-2 is covered with a 0.15 m thick layer of topsoil.

Standard penetration tests taken within the fill layers yielded “N”-values of between 3 and 7 blows per 0.3 m, with an average of 5 blows per 0.3 m. The natural moisture contents were between 11 and 26% with an average of 20%.

Four (4) grain size distribution analyses and three (3) Atterberg Limits determinations were performed and the results are plotted on the following figures of Appendix B.

Table of Figures of Laboratory Test Results

Culvert Number	Grain Size Figure	Atterberg Limits Figure
09B	C-09B.1	C-09B.2

The Atterberg Limits determinations carried out on the fill yielded the following results:

Atterberg Limits	Minimum	Maximum	Average
Liquid Limit (W_L)	20	30	26.3
Plastic Limit (W_P)	14	18	16.3
Plasticity Index (I_P)	6	12	10.0

A single unit weight determination of the fill yielded a result of 18.6 kN/m^3 .

Based on the above field and laboratory test results, together with visual and tactile examination, the fill generally exhibited a very loose to loose compactness condition.

The depths and bottom elevations of the topsoil and embankment fill are presented in the following table:

Borehole No.	Bottom of Topsoil, Pavement, Fill and Peat, m	Bottom Elevation of Topsoil, Pavement, Fill and Peat, m
09B-1	0.15	266.78
09B-2	5.33	268.12
09B-3	0.15	268.40

4.6.2 Clayey Silt to Silty Clay Till

The topsoil and embankment fill are underlain by a major deposit of reddish brown clayey silt to silty clay till with embedded sand and gravel. Silt seams, pockets and layers are present within the clayey silt to silty clay till.

Standard penetration tests taken within the clayey silt to silty clay till yielded “N”-values of between 19 and over 100 blows per 0.3 m, with an average of 74 blows per 300 mm. The natural moisture contents were between 6 and 21% with an average of 12%.

Four (4) grain size analyses and four (4) Atterberg Limits determinations were performed on the clayey silt to silty clay till and the results are plotted on the following figures of Appendix B:

Table of Figures of Laboratory Test Results

Culvert Number	Grain Size Figure	Atterberg Limits Figure
09B	C-09B.3	C-09B.4

The Atterberg Limits determinations carried out on the clayey silt to silty clay till (CL-ML to CL) yielded the following results:

Atterberg Limits	Minimum	Maximum	Average
Liquid Limit (W_L)	18	32	22.0
Plastic Limit (W_P)	13	16	14.3
Plasticity Index (I_P)	4	16	7.8

Two (2) grain size distribution analyses and two (2) Atterberg Limits determinations were performed on the silt seams, pockets and layers within clayey silt to silty clay till and the results are plotted on the following figures of Appendix B:

Table of Figures of Laboratory Test Results

Culvert Number	Grain Size Figure	Atterberg Limits Figure
09B	09B.5	09B.6

The Atterberg Limits determinations carried out on the silt seams (ML), pockets and layers within the clayey silt to silty clay till yielded the following results:

Atterberg Limits	Minimum	Maximum	Average
Liquid Limit (W_L)	16	18	17.0
Plastic Limit (W_P)	13	14	13.5
Plasticity Index (I_P)	3	4	3.5

The undrained shear strength of the clayey silt to silty clay till as determined from field pocket penetrometer testing ranged from 100 to over 225 kPa, which generally increased with increasing depths.

Unit weight determinations carried out on the clayey silt to silty clay till yielded results of between 18.7 kN/m³ and 23.6 kN/m³, with an average of 21.1 kN/m³.

Based on the above field and laboratory test results, together with visual and tactile examination, the clayey silt to silty clay till deposit generally exhibited a hard consistency with localized very stiff consistency within the surface 0.5 m to 1.0 m of the deposit.

The clayey silt to silty clay deposit extends beyond the vertical limit of this group of boreholes at maximum depths of between 4.72 m and 7.62 m below the present ground surface (between Elevations 260.53 m and 265.83 m).

4.7 Groundwater

The groundwater condition was monitored during and upon completion of sampling. On completion of drilling, groundwater levels noted in the boreholes are summarized in the following table:

Borehole Number	Ground Surface Elevation, m	Groundwater Level, m	Groundwater Elevation, m
02B-1	327.42	BHD&O	
02B-2	329.84	BHD&O	
02B-3	327.32	BHD&O	
03B-1	327.23	BHD&O	
03B-2	329.37	BHD&O	
03B-3	327.44	BHD&O	
05B-1	331.35	0.30	331.05
05B-2	333.03	2.51	330.52
05B-3	333.07	2.60	330.48
05B-4	331.17	0.61	330.56
06B-1	331.42	BHD&O	
06B-2	333.80	3.35	330.45
06B-3	331.90	BHD&O	
07B-1	322.32	BHD&O	
07B-2	322.35	BHD&O	
07B-3	322.21	BHD&O	
08B-1	322.52	BHD&O	
08B-2	322.48	BHD&O	
08B-3	320.77	BHD&O	
09B-1	266.93	BHD&O	
09B-2	273.45	BHD&O	
09B-4	268.55	BHD&O	
10B-1	259.20	BHD&O	
10B-2	261.66	BHD&O	
10B-3	260.81	BHD&O	
11B-1	240.92	BHD&O	
11B-2	242.62	BHD&O	
11B-3	241.17	BHD&O	
12B-1	239.92	1.83	238.09
12B-2	242.43	4.57	237.86

Borehole Number	Ground Surface Elevation, m	Groundwater Level, m	Groundwater Elevation, m
12B-3	240.32	3.05	237.27
13B-1	235.21	BHD&O	
13B-2	238.51	BHD&O	
13B-3	235.51	BHD&O	
14B-1	235.35	3.07	232.28
14B-2	237.78	5.18	232.60
14B-3	235.13	2.74	232.39
15B-1	222.03	1.78	220.25
15B-2	222.78	1.83	220.95
15B-3	222.80	2.51	220.29
16B-1	219.27	0.73	218.54
16B-2	220.50	2.44	218.06
16B-3	220.59	1.91	218.68
17B-1	214.91	1.98	212.93
17B-2	216.46	2.54	213.92
17B-3	216.51	3.05	213.46
18B-1	213.13	3.35	209.78
18B-2	215.66	2.79	212.87
18B-3	215.73	0.30	215.43
19B-1	206.50	BHD&O	
19B-2	207.20	BHD&O	
19B-3	207.25	BHD&O	
20B-1	201.77	BHD&O	
20B-2	201.75	BHD&O	
20B-3	200.10	BHD&O	
21B-1	186.37	BHD&O	
21B-2	186.95	BHD&O	
21B-3	185.47	2.29	183.18

Note: BHD&O means borehole dry and open at completion

In general, the groundwater was encountered as perched conditions within the upper fill materials and in the wet to saturated sand to sand and gravel deposits. The observed groundwater table at the time of the field work represented the shallow groundwater condition at these culvert sites, and may not have stabilized for the short durations that the boreholes were kept open.

The brown to grey interface encountered in Boreholes 16B-1, 2 and 3 likely reflect a level of permanent saturation.

Groundwater levels within the swamp area could rise to above the ground surface under wet weather conditions.

The groundwater condition will fluctuate seasonally and in response to weather events.

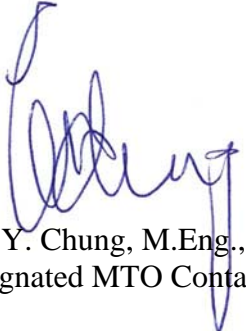
5.0 STATEMENT OF LIMITATION

We recommend that once the details of the proposed structure are finalized, our recommendations should be reviewed for their specific applicability.

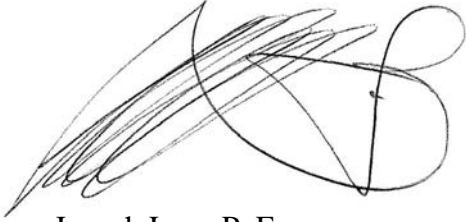
The Limitations of Report, as quoted in Appendix D, is an integral part of this report.


We trust that we have completed the assignment within the Terms of Reference for this project. If there are any questions concerning this report, please do not hesitate to contact our office.

Yours truly,
Infrastructure Engineering Group Inc.


Eric Y. Chung, M.Eng., P.Eng.
Designated MTO Contact




Joseph Law, P. Eng.
Project Manager


Tom O'Dwyer, P. Eng.
Quality Review Engineer



Ministry of Transportation/Stantec Consulting Ltd.
G.W.P. 167-91-00 - Rehabilitation of Highway 26
From Former St. Vincent/Sydenham Townline to Meaford
Agreement # 3006-E-0002

07-6-IEG-B-NSCR
Final Report
Appendix A
May 28, 2010

Appendix A

Drawings 1 to 4
Borehole Location Plans

Drawing 5
Plan & Profile - Culvert 05B

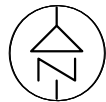
Drawing 6
Plan & Profile - Culvert 09B

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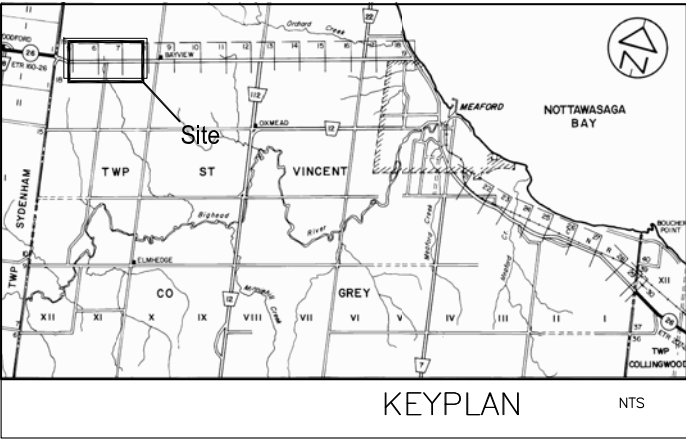
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WP No GWP 167-91-00



NON-STRUCTURAL CULVERT REPLACEMENT
Highway 26 - Part B
BOREHOLE LOCATION PLAN

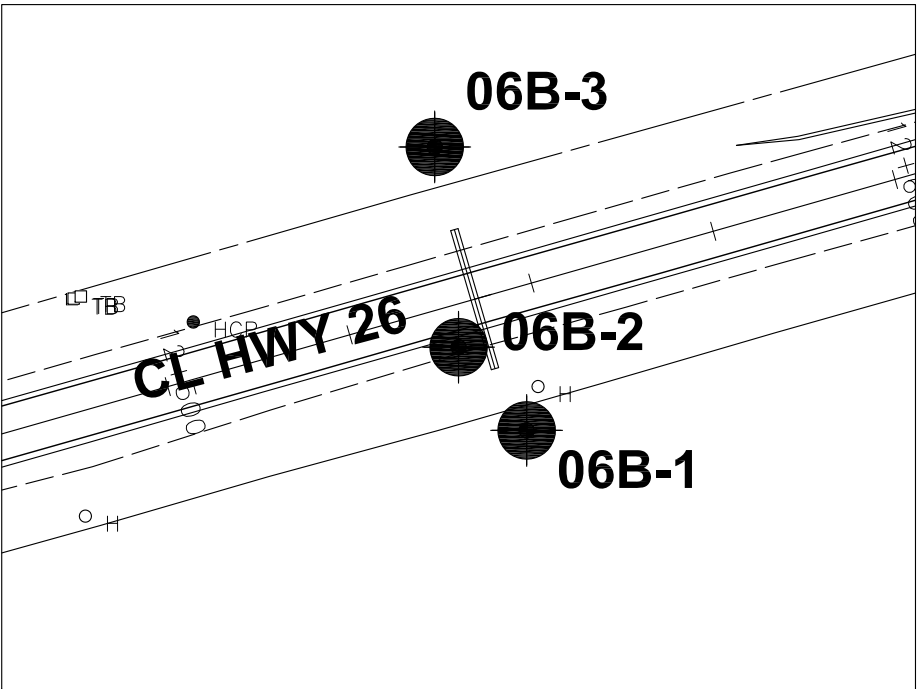
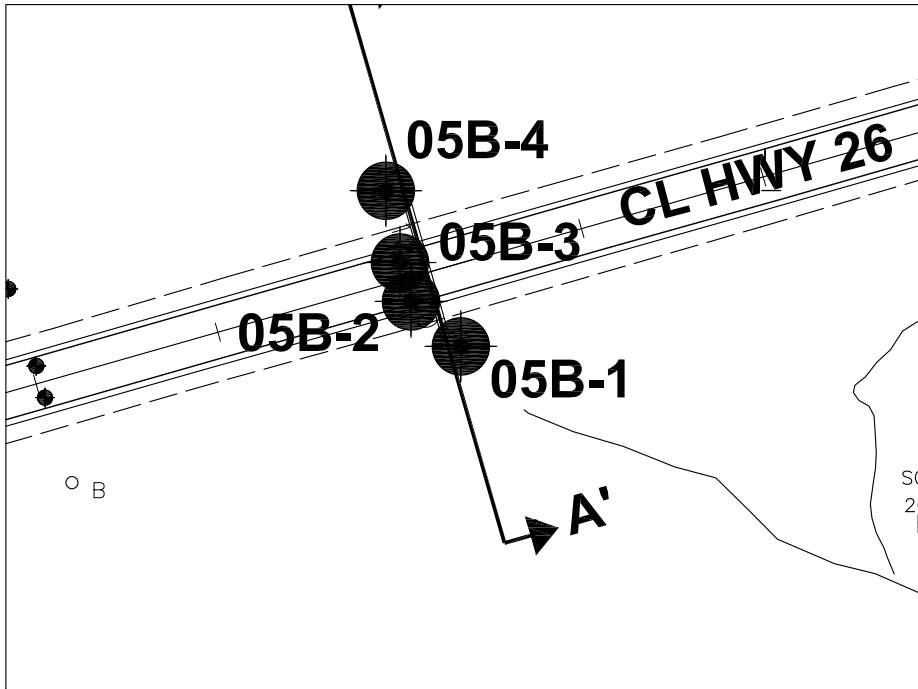
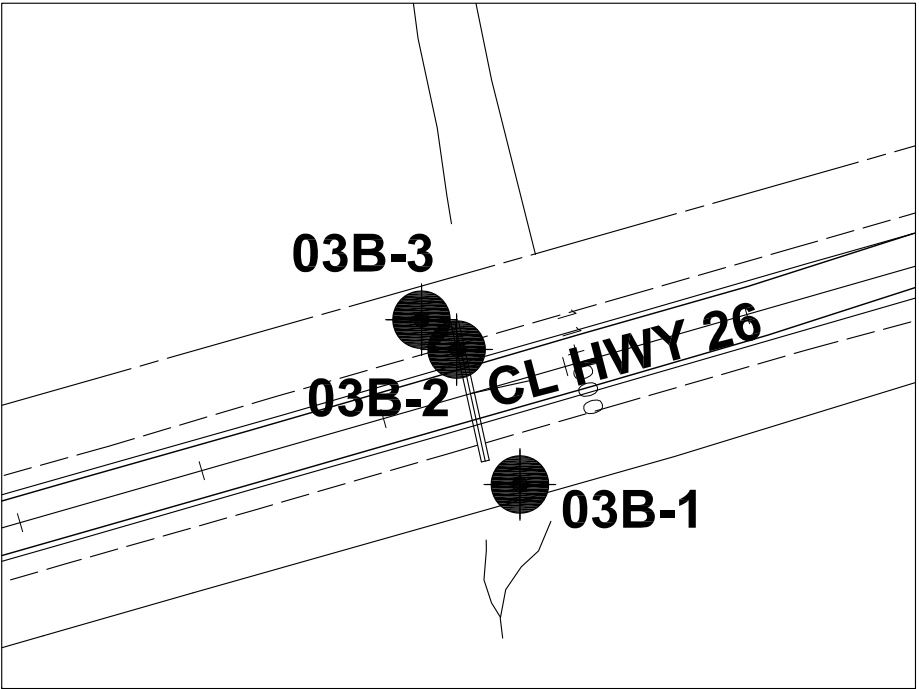
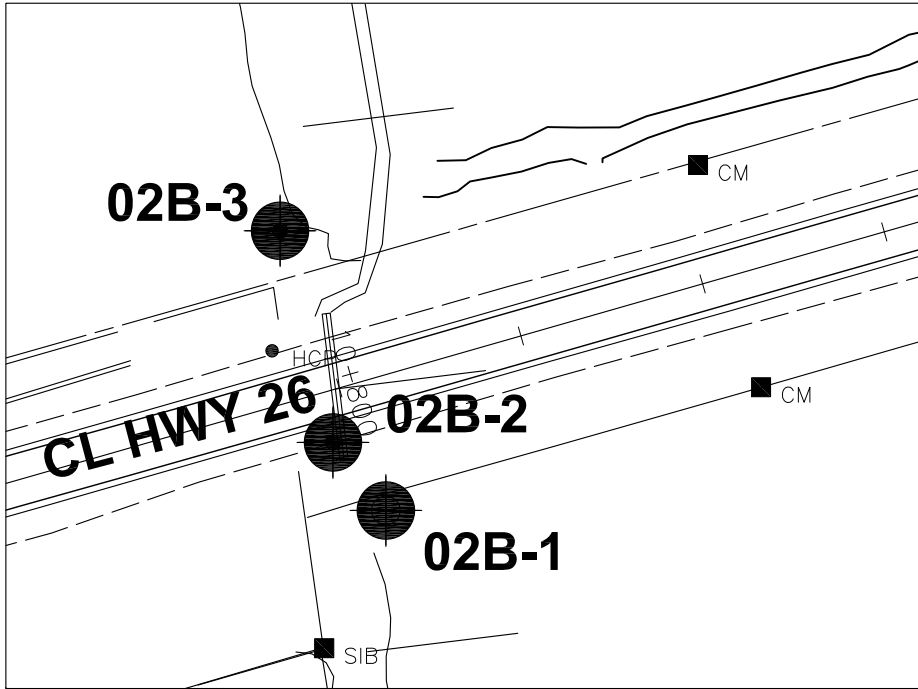
SHEET
1

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LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- Blows/0.3m (Std Pen Test, 475 J/blow)
- Blows/0.3m (60° Cone, 475 J/blow)
- W L at time of investigation
- Standpipe



NOTES
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BOREHOLE NO.	ELEV.	UTM CO-ORDINATES		BOREHOLE NO.	ELEV.	UTM CO-ORDINATES		BOREHOLE NO.	ELEV.	UTM CO-ORDINATES		BOREHOLE NO.	ELEV.	UTM CO-ORDINATES	
		NORTH	EAST			NORTH	EAST			NORTH	EAST			NORTH	EAST
02B-1	327.42	4940233	208320	03B-1	327.23	4940289	208500	05B-1	331.35	4940570	209476	06B-1	331.42	4940710	209996
02B-2	329.84	4940242	208313	03B-2	329.37	4940307	208492	05B-2	333.03	4940576	209469	06B-2	333.80	4940721	209987
02B-3	327.32	4940270	208306	03B-3	327.44	4940310	208487	05B-3	333.07	4940581	209468	06B-3	331.90	4940747	209984
								05B-4	331.17	4940591	209466				

REVISIONS			DISCRIPTION
	DATE	BY	
	14/05/10	J.L.	Final Report
	20/11/09	J.L.	Draft Report

MTO GEOCREs No. 41A-216			
HWY No.	HWY 26		DIST Owen Sound
SUBM'D J.L.	CHECKED E.C.	DATE 15/01/09	SITE 2B, 3B, 5B, 6B
DRAWN J.L.	CHECKED J.L.	APPROVED E.C.	DWG 1

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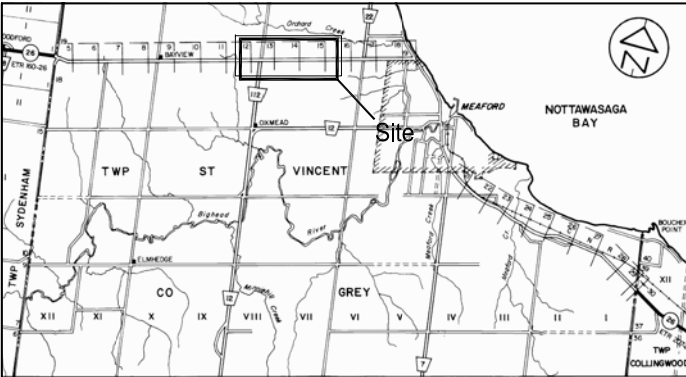
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NON-STRUCTURAL CULVERT REPLACEMENT
Highway 26 - Part B
BOREHOLE LOCATION PLAN

SHEET
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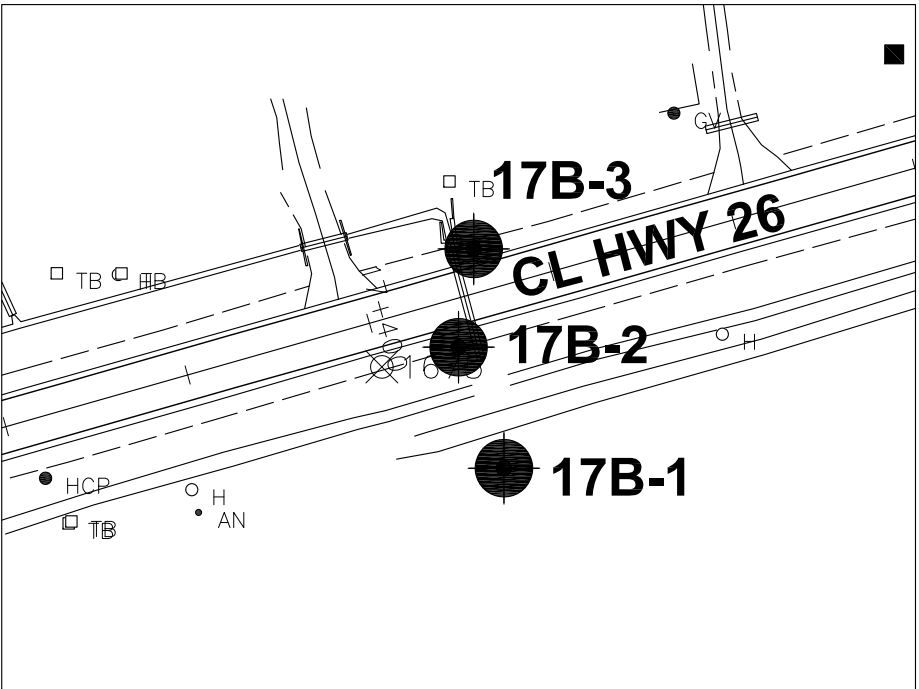
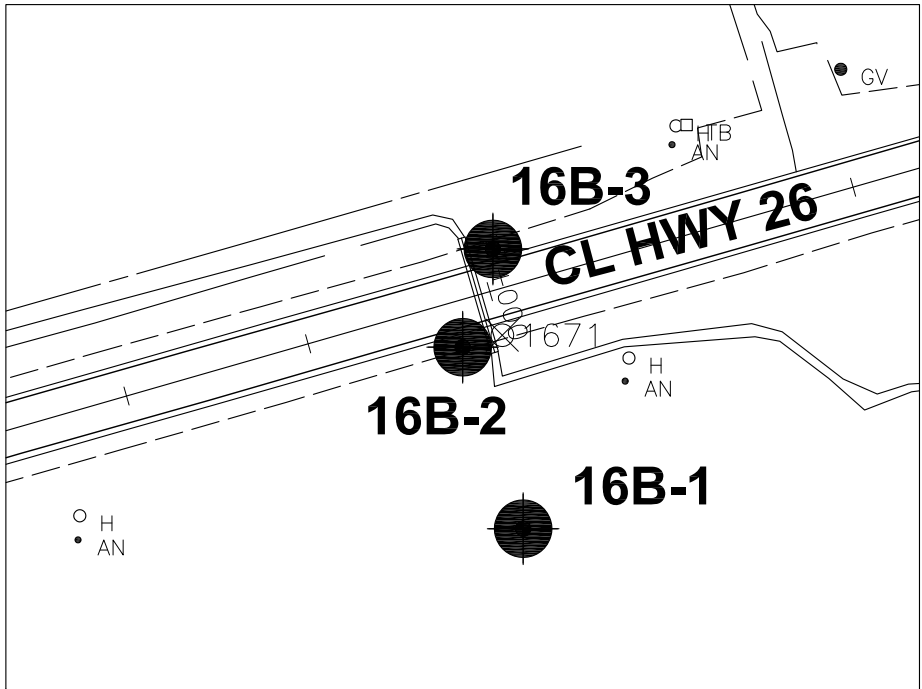
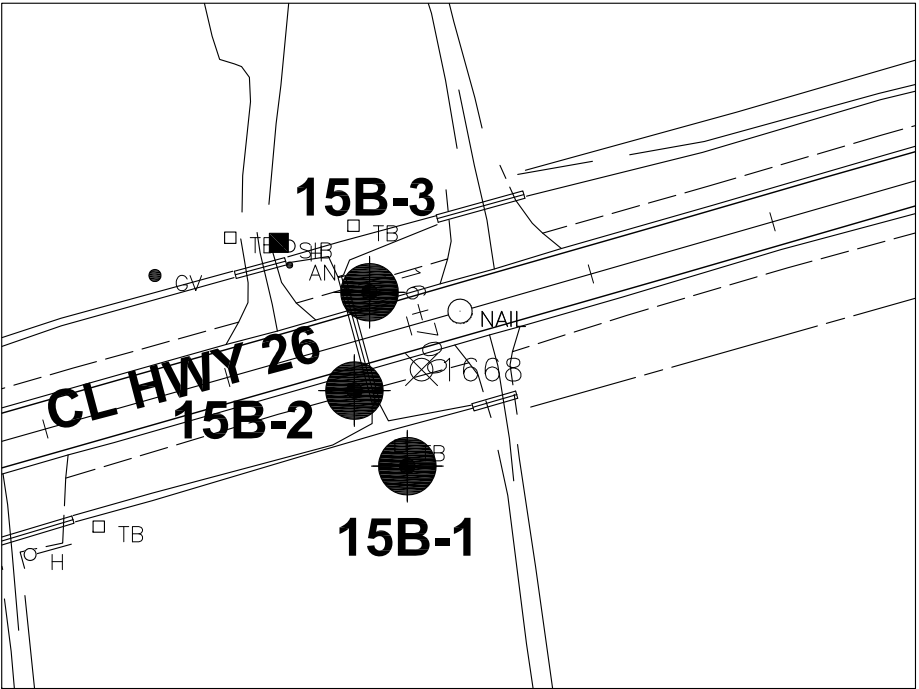
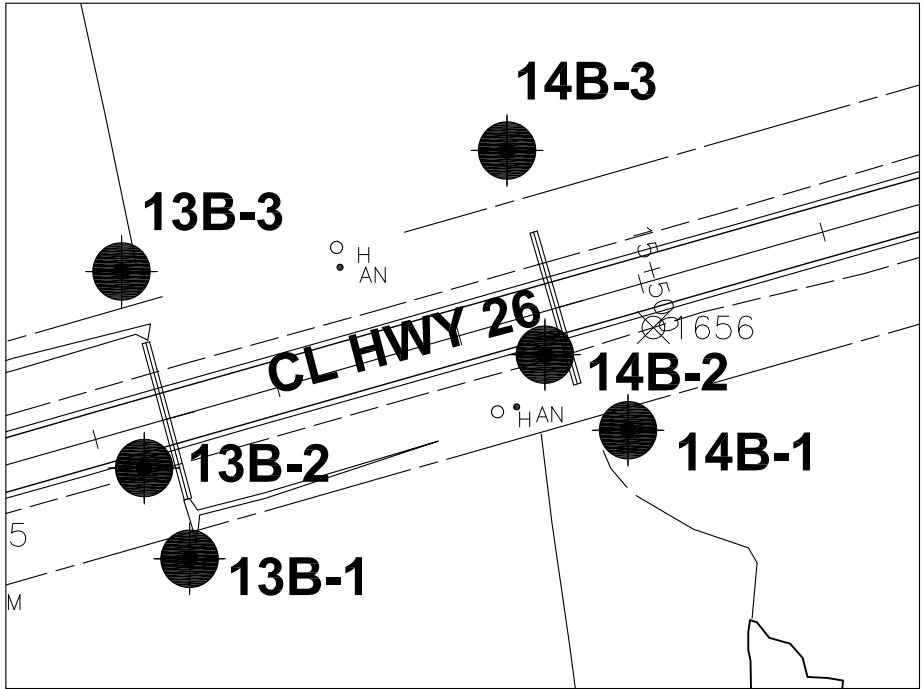


KEYPLAN

NTS

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- Blows/0.3m (Std Pen Test, 475 J/blow)
- Blows/0.3m (60° Cone, 475 J/blow)
- W L at time of investigation
- Standpipe



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		NORTH	EAST			NORTH	EAST			NORTH	EAST			NORTH	EAST			NORTH	EAST
13B-1	235.21	4941498	212775	14B-1	235.35	4941515	212833	15B-1	222.03	4941843	213989	16B-1	219.27	4941913	214282	17B-1	214.91	4942035	214680
13B-2	238.51	4941510	212769	14B-2	237.78	4941525	212822	15B-2	222.78	4941866	213984	16B-2	220.50	4941937	214274	17B-2	216.46	4942051	214674
13B-3	235.51	4941536	212766	14B-3	235.13	4941552	212817	15B-3	222.80	4941853	213982	16B-3	220.59	4941950	214278	17B-2	216.51	4942064	214676

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	20/11/09	J.L.	Draft Report
DATE	BY	DISCRIPTION	

MT0 GEOCRES No. 41A-216

HWY No.	HWY 26		DIST	Owen Sound
SUBM'D	J.L.	CHECKED E.C.	DATE 15/01/09	SITE 13B, 14B, 15B, 16B, 17B
DRAWN	J.L.	CHECKED J.L.	APPROVED E.C.	DWG 3

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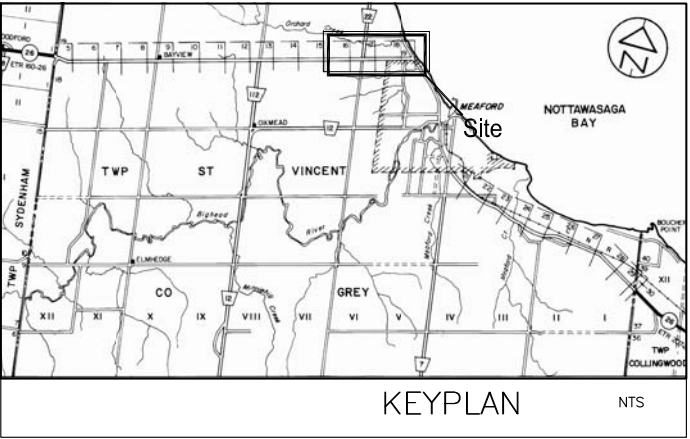
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WP No GWP 167-91-00

NON-STRUCTURAL CULVERT REPLACEMENT
Highway 26 - Part B
BOREHOLE LOCATION PLAN

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SHEET
4



LEGEND

Bore Hole

Dynamic Cone Penetration Test (Cone)

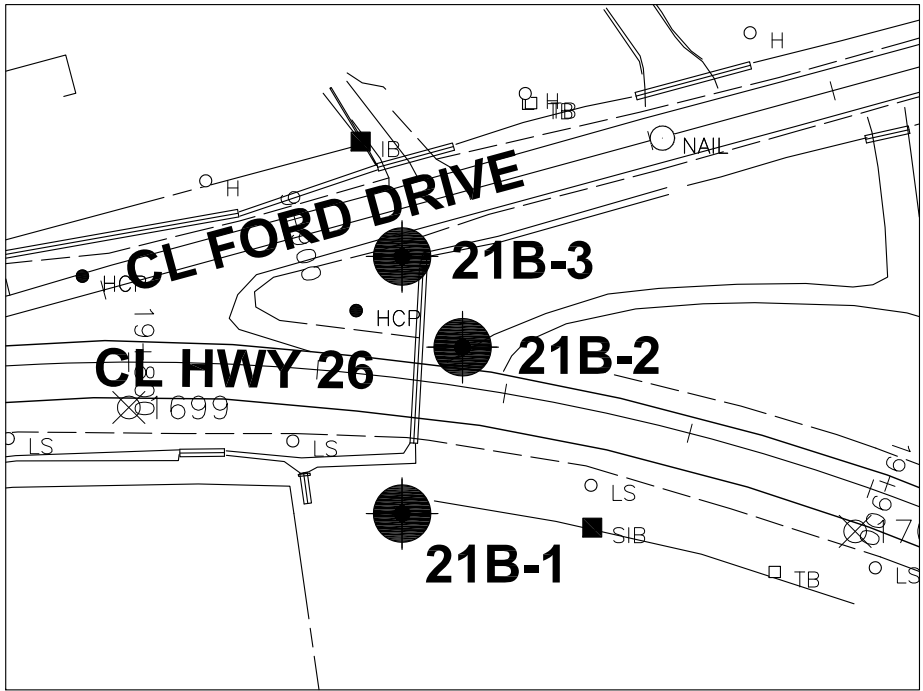
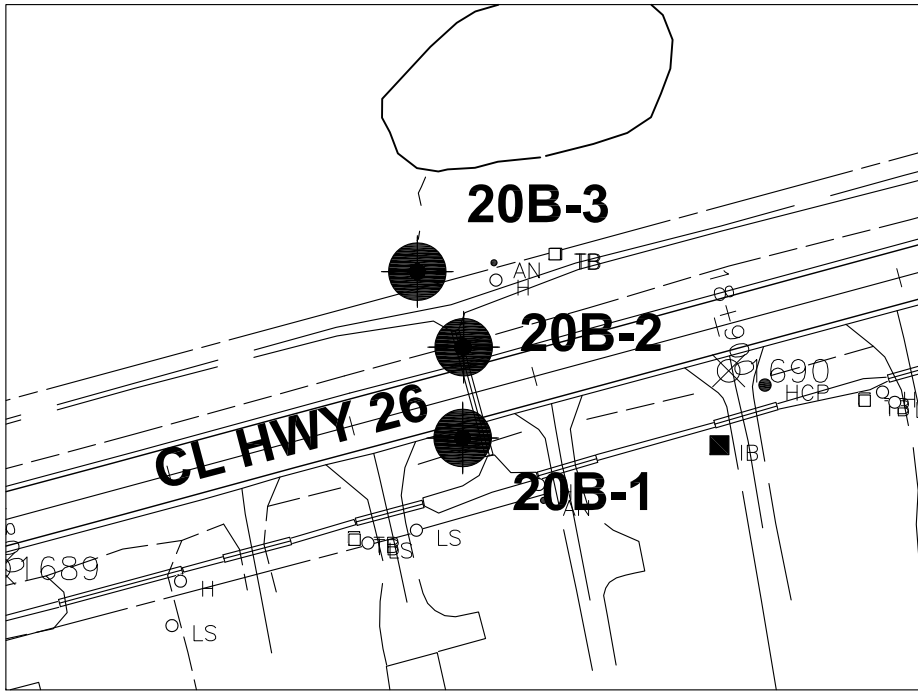
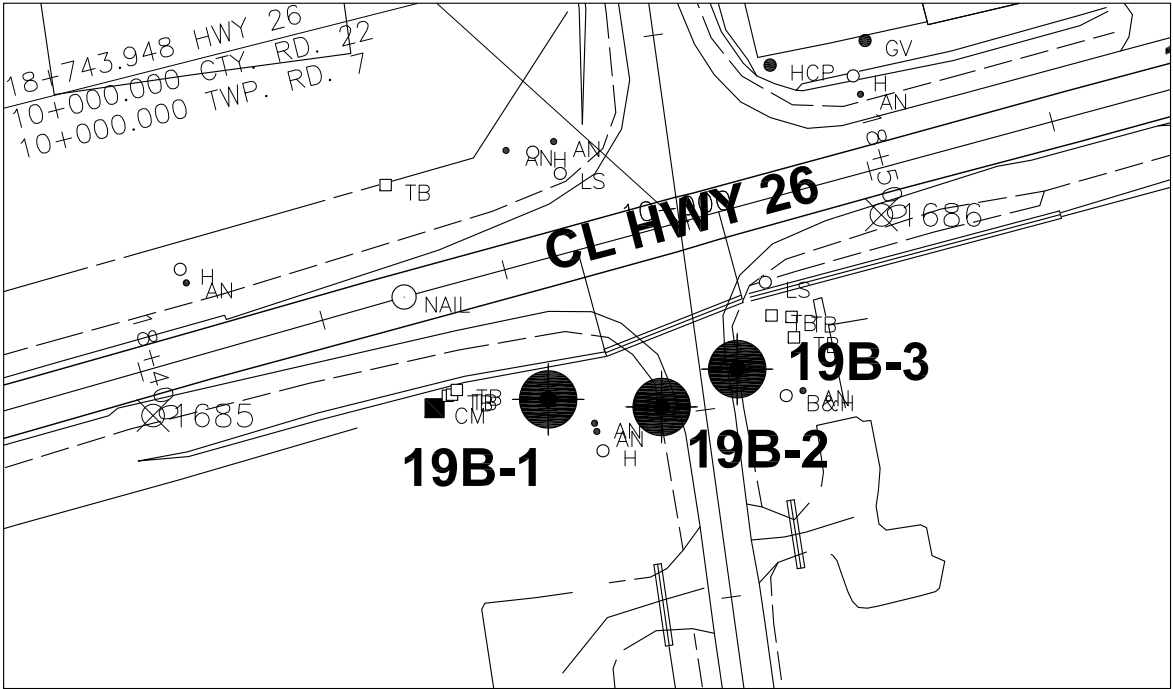
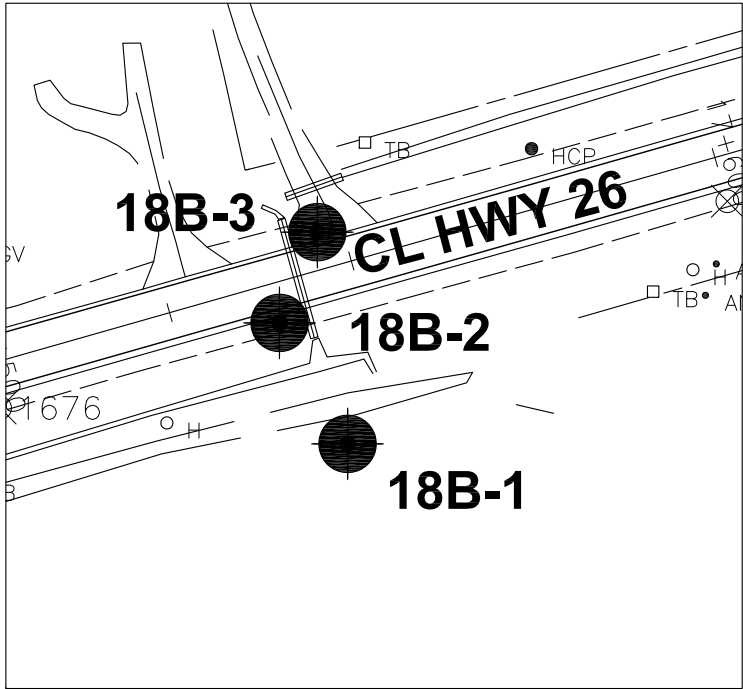
Bore Hole & Cone

Blows/0.3m (Std Pen Test, 475 J/blow)

Blows/0.3m (60° Cone, 475 J/blow)

W L at time of investigation

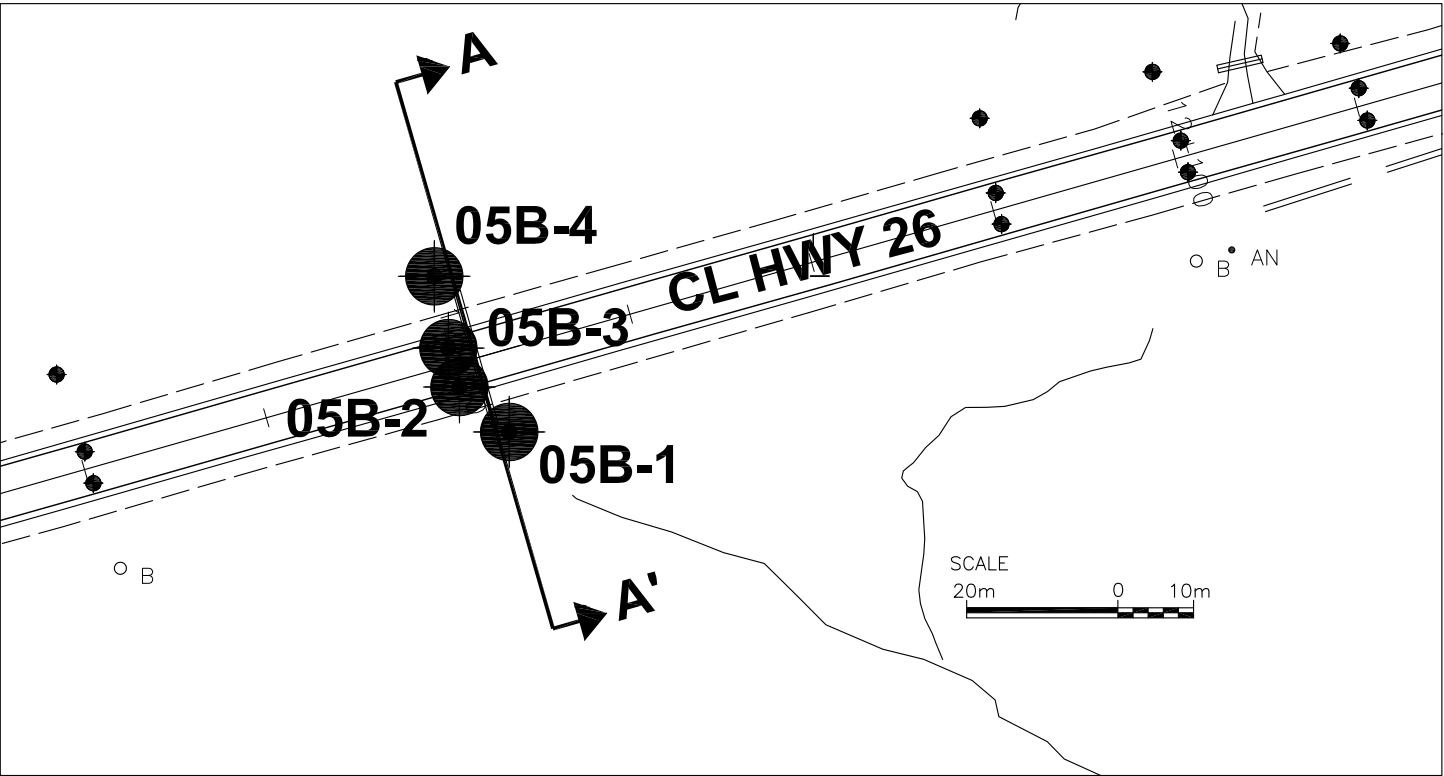
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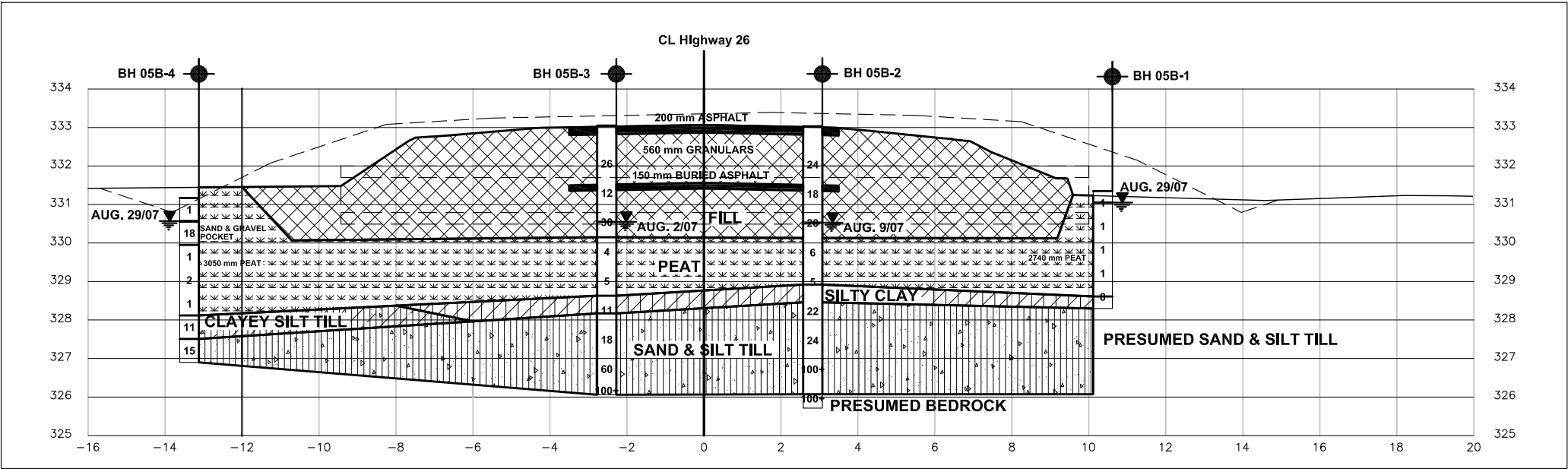
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		NORTH	EAST			NORTH	EAST			NORTH	EAST			NORTH	EAST
18B-1	213.12	4942071	214806	19B-1	206.50	4942324	215678	20B-1	201.77	4942444	216073	21B-1	186.37	4942665	217013
18B-2	215.66	4942087	214797	19B-2	207.20	4942323	215693	20B-2	201.75	4942456	216073	21B-2	186.95	4942687	217021
18B-3	215.73	4942099	214802	19B-3	207.25	4942328	215703	20B-3	200.10	4942466	216067	21B-3	185.47	4942699	217013

REVISIONS					
	14/05/10	J.L.	Final Report		
	20/11/09	J.L.	Draft Report		
	DATE	BY	DISCRIPTION		
MTO GEOCRES No. 41A-216					
HWY No.		HWY 26		DIST	Owen Sound
SUBM'D	J.L.	CHECKED E.C.	DATE 15/01/09	SITE	18B, 19B, 19BRT, 20B, 21B
DRAWN	J.L.	CHECKED J.L.	APPROVED E.C.	DWG	4



BOREHOLE LOCATION PLAN



PROFILE A-A'
CENTRELINE OF CULVERT

SCALE
5m 0 2m
Horizontal and Vertical

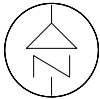
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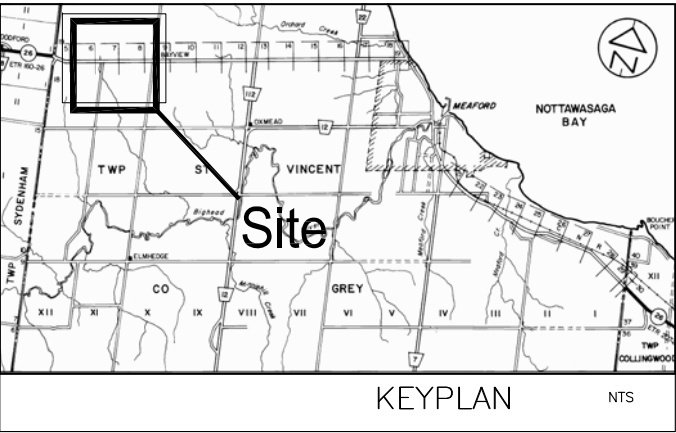
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WP No GWP 167-91-00

NON-STRUCTURAL CULVERT
Highway 26 - Part B
PLAN AND PROFILE - 05B

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SHEET
5



LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- Blows/0.3m (Std Pen Test, 475 J/blow)
- Blows/0.3m (60° Cone, 475 J/blow)
- W L at time of investigation
- Standpipe

NOTES

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- THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BOREHOLE LOCATIONS. BETWEEN BOREHOLES AND BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE.
- THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION.

BOREHOLE NO.	ELEV.	UTM CO-ORDINATES NORTH	EAST
05B-1	331.35	4940570	209476
05B-2	333.03	4940576	209469
05B-3	333.07	4940581	209468
05B-4	331.18	4940591	209466

REVISIONS	DATE	BY	DISCRPTION
14/05/10	J.L.	Final	
05/12/09	J.L.	Draft	
MTO GEOCRES No. 41A-216			
HWY No.	HWY 26	DIST	Owen Sound
SUBM'D	J.L.	CHECKED E.C.	DATE 24/08/08
DRAWN	J.L.	CHECKED J.L.	APPROVED E.C.
SITE	CULVERT 05B	DWG	5

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UNLESS OTHERWISE SHOWN

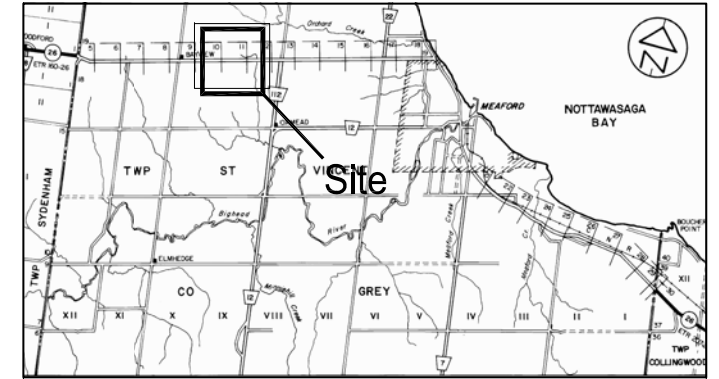
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NON-STRUCTURAL CULVERT
Highway 26 - Part B
PLAN AND PROFILE - 09B

SHEET
6

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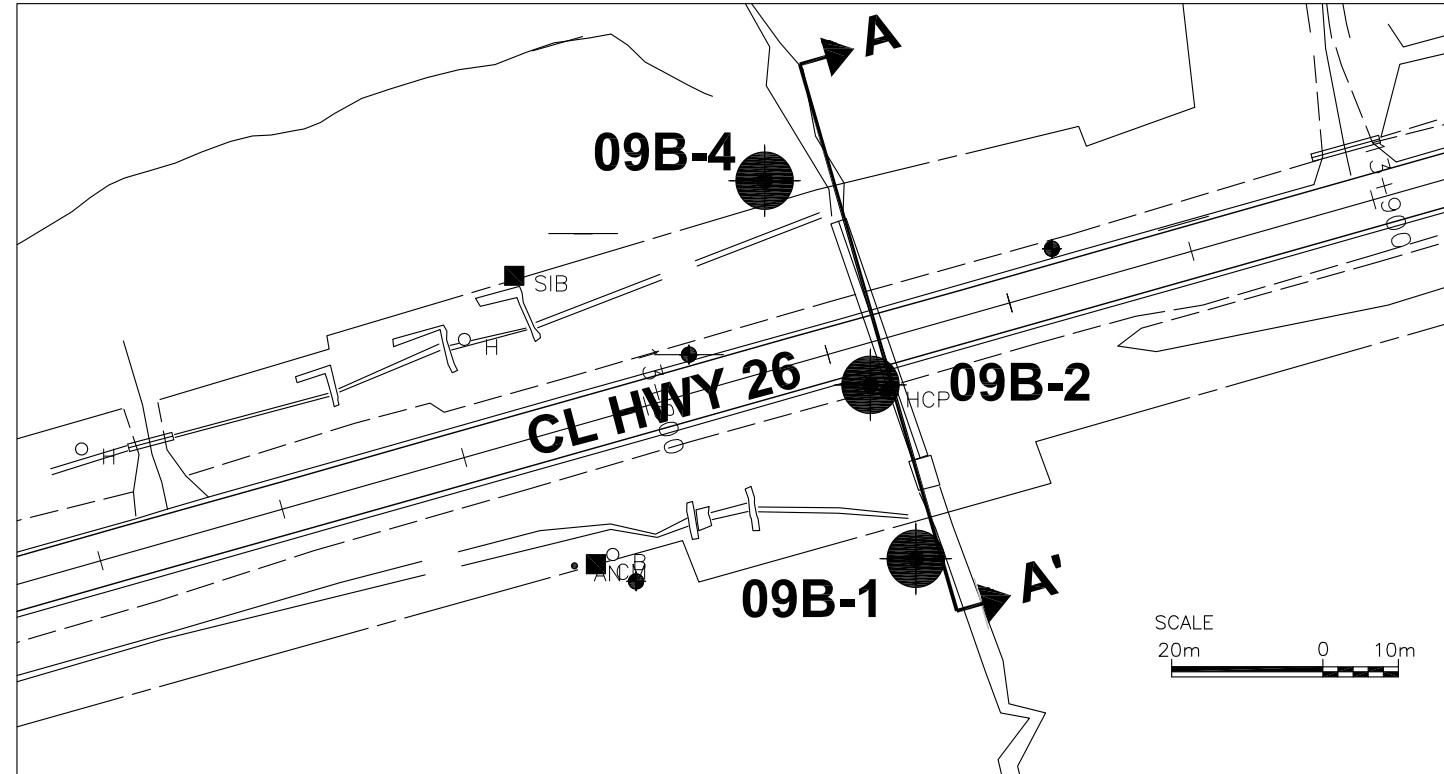


KEYPLAN

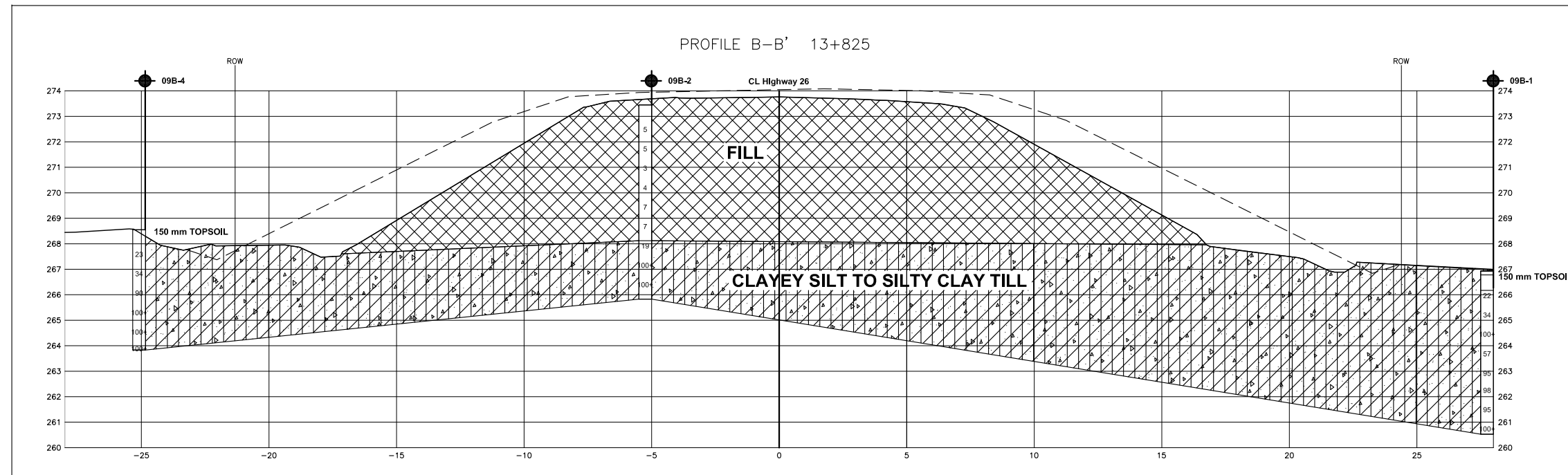
NTS

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- Blows/0.3m (Std Pen Test, 475 J/blow)
- Blows/0.3m (60° Cone, 475 J/blow)
- W L at time of investigation
- Standpipe



BOREHOLE LOCATION PLAN



PROFILE A-A'
CENTRELINE OF CULVERT

SCALE
5m 0 2m
Horizontal and Vertical

REVISIONS	DATE	BY	DISCRIPTION
	DATE	BY	DISCRIPTION
	14/05/10	J.L.	Final
	05/12/09	J.L.	Draft

MTO GEOCRES No. 41A-216			
HWY No.	HWY 26		DIST Owen Sound
SUBM'D J.L.	CHECKED E.C.	DATE 24/08/08	SITE CULVERT 09B
DRAWN J.L.	CHECKED J.L.	APPROVED E.C.	DWG 6

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BOREHOLE NO.	ELEV.	UTM CO-ORDINATES	
		NORTH	EAST
05B-1	331.35	4940570	209476
05B-2	333.03	4940576	209469
05B-3	333.07	4940581	209468
05B-4	331.18	4940591	209466

Appendix B
Explanation of Terms Used in Report
Record of Borehole Sheet - Boreholes SW-01 to 66

Laboratory Test Results

Culvert Number	Borehole Logs	Grain Size Distribution Figures	Atterberg Limits Figures
02B	02B-1 to 3	02B.1, 3, 5	02B.2, 4, 6
03B	03B-1 to 3	03B.1, 3	03B.2, 4
05B	05B-1 to 4	05B.1, 3, 5, 7, 8	05B.2, 4, 6, 9
06B	06B-1 to 3	06B.1,3	06B.2,4
07B	07B-1 to 3	07B.1	07B.2
08B	08B-1 to 3	08B.1, 2, 4	08B.3, 5
09B	09B-1, 2, 4	09B.1, 3, 5	09B.2, 4, 6
10B	10B-1 to 3	10B.1, 3, 5	10B.2, 4, 6
11B	11B-1 to 3	11B.1, 3, 5	11B.2, 4, 6
12B	12B-1 to 3	12B.1, 3, 4	12B.2, 5
13B	13B-1 to 3	13B.1, 3, 4	13B.2, 5
14B	14B-1 to 3	14B.1, 2, 3, 4, 6	14B.5, 7
15B	15B-1 to 3	15B.1, 2, 3, 4	-
16B	16B-1 to 3	16B.1, 2, 3	-
17B	17B-1 to 3	17B.1, 2	-
18B	18B-1 to 3	18B.1, 2, 3	18B.4
19B	19B-1 to 3	19B.1, 2, 3	19B.4
20B	20B-1 to 3	20B.1, 2	20B.3
21B	21B-1 to 3	21B.1	21B.2
02B	02B-1 to 3	02B.1, 3, 5	02B.2, 4, 6

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 1" 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.

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:

RQD (%)	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

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'_{vo}	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_c	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = $\frac{c_u}{\tau_c}$

PHYSICAL PROPERTIES OF SOIL


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

RECORD OF BOREHOLE No 02B-1

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4940233, Easting - 208320 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 21.8.07 - 21.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE						
327.42 0.00	Ground 100 mm TOPSOIL.														
326.66 0.76			1	SPT	10										0 3 82 14 (97)
326.20 1.22			2	SPT	18										14 20 40 26 (66)
	Clayey SILT to Silty CLAY TILL, CL to CL-ML Reddish brown, moist, stiff to hard, with embedded gravel, occasional silt seams and layers.		3	SPT	56										
			4	SPT	100+										
			5	SPT	100+										
322.70 4.72		End of Borehole.	6	SPT	100+										Borehole dry and open @ completion.

+³, ×³: Numbers refer to Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 02B-2

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4940242, Easting - 208313 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 16.8.07 - 16.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)			
								○ UNCONFINED	● QUICK TRIAXIAL	+ FIELD VANE						× LAB VANE			
329.84 0.00	Ground																		
329.23 0.61	610 Granular FILL.																		
	FILL Reddish brown, moist to wet, loose to compact, consisting of mix gravel, sand, silt and clay, with organic stained pockets		1	SPT	18		329												
			2	SPT	5		328							12 32 43 13 (57)					
			3	SPT	16		327												
326.79 3.05	Clayey SILT to Silty CLAY TILL, CL to CL-ML Reddish brown, moist, very stiff to hard, with embedded sand and gravel, occasional silt seams and layers.		4	SPT	18		326							0 35 48 17 (65)					
			5	SPT	18		325												
			6	SPT	78									15 33 36 15 (52)					
			7	SPT	70														
324.05 5.79	End of Borehole.												23.7	Borehole dry and open @ completion.					

JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

RECORD OF BOREHOLE No 02B-3

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4940270, Easting - 208306 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 21.8.07 - 21.8.07 CHECKED BY JL

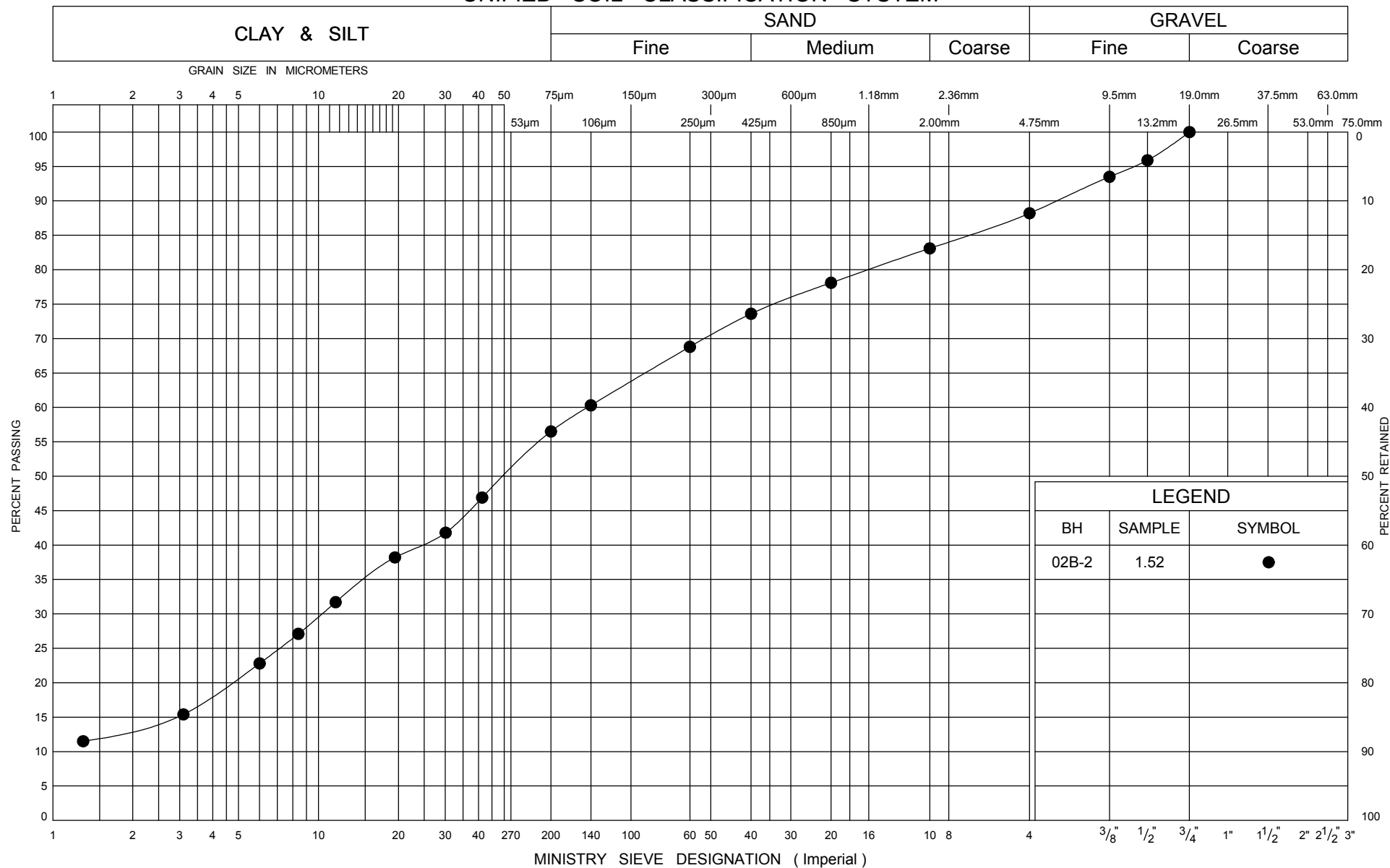
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			STANDARD 20 40 60 80 100	DYN. CONE 20 40 60 80 100					
327.32 0.00	Ground													
326.56 0.76	200 mm TOPSOIL. loose silt layer Clayey SILT to Silty CLAY TILL, CL to CL-ML Reddish brown, moist, very stiff to hard, with embedded sand and gravel, occasional silt seams and layers.		1	SPT	6		327						19.4	3 16 63 18 (81)
326.10 1.22			2	SPT	22		326							
			3	SPT	55		325							10 32 42 17 (59)
324.12 3.20			4	SPT	100+									Sampler refusal @ 3.20 m. Borehole dry and open @ completion.

JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

UNIFIED SOIL CLASSIFICATION SYSTEM



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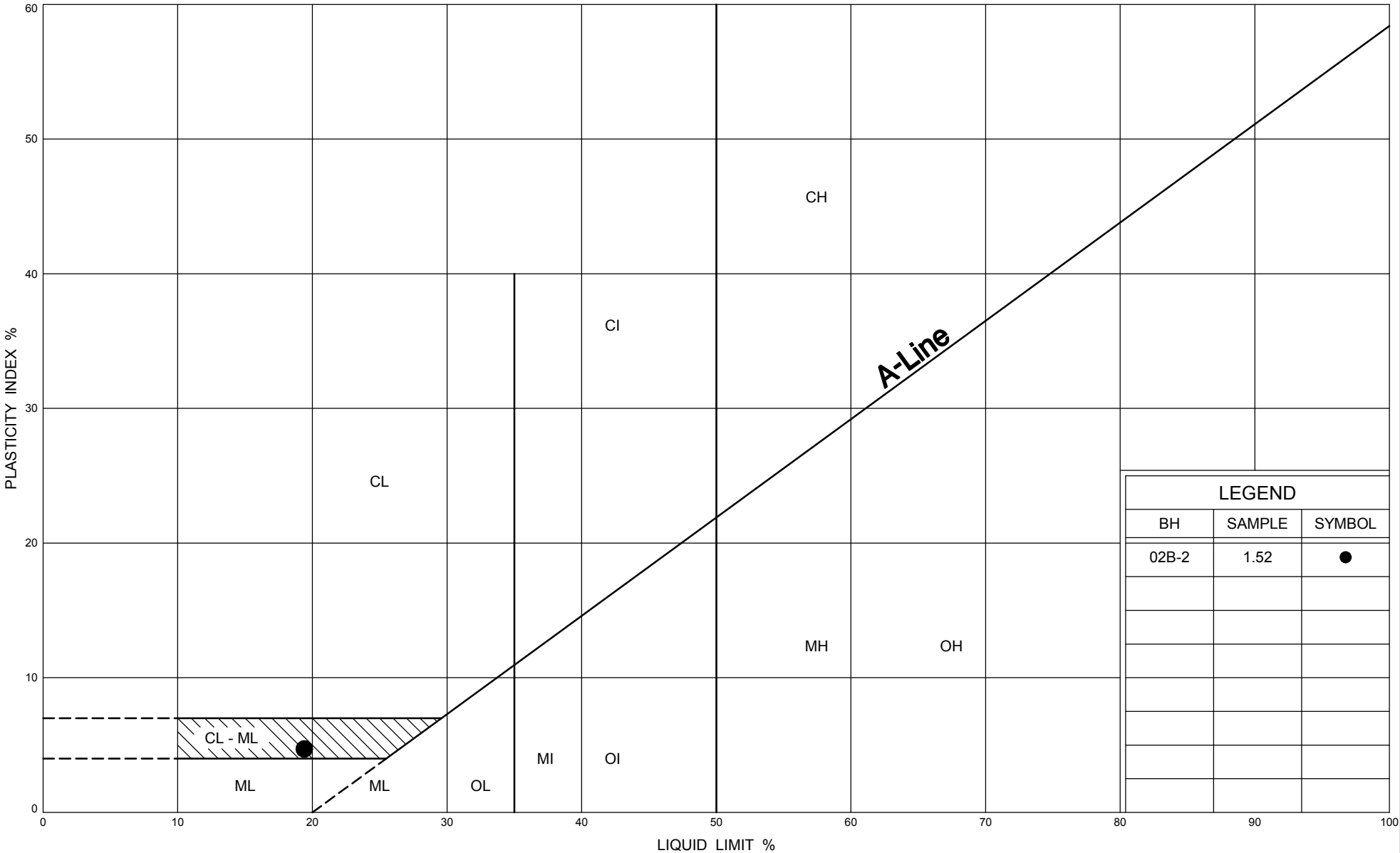
GRAIN SIZE DISTRIBUTION

FILL

FIG No C-02B.1

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford



LEGEND		
BH	SAMPLE	SYMBOL
02B-2	1.52	●



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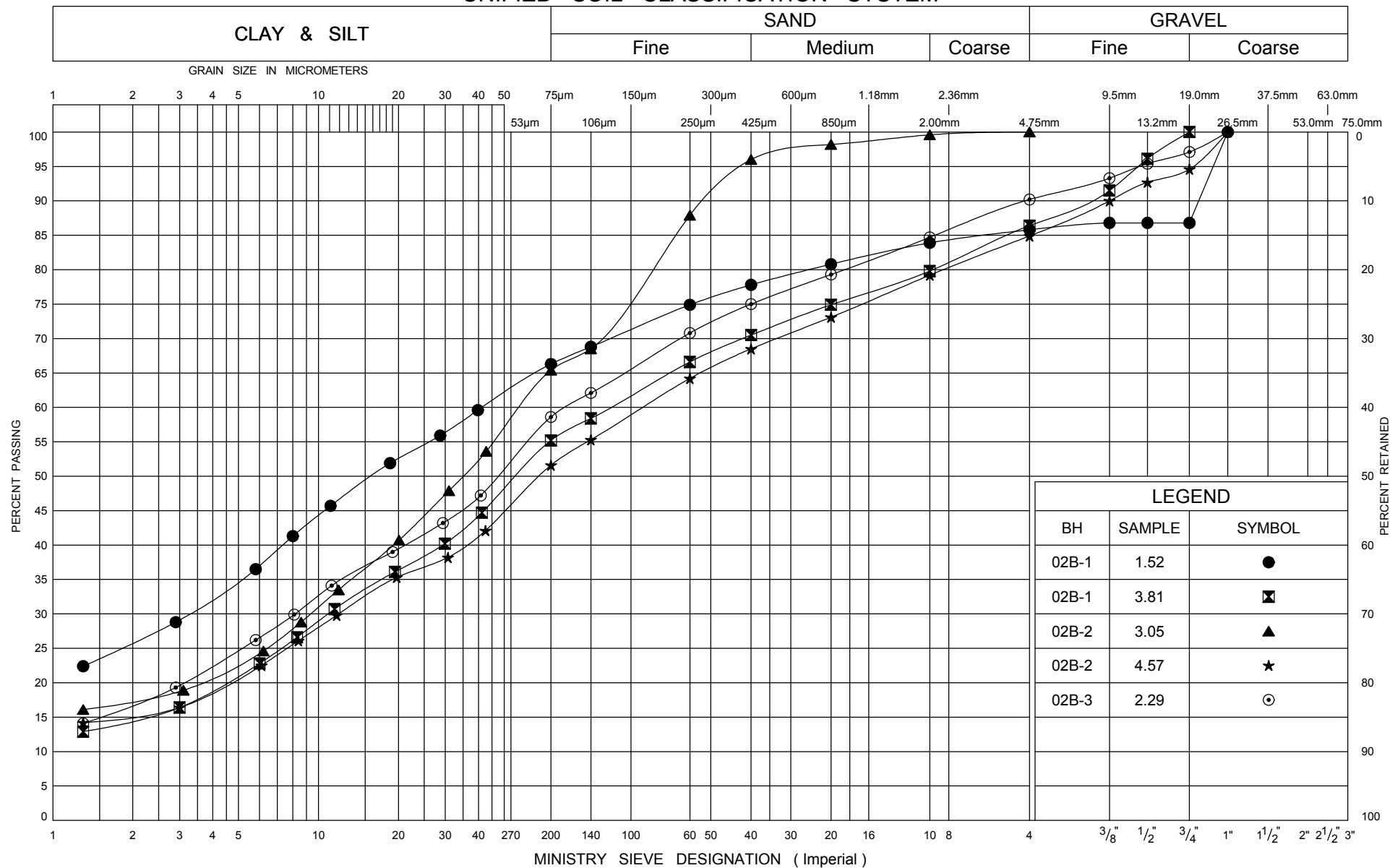
PLASTICITY CHART
FILL

FIG No C- 02B.2

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

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GRAIN SIZE DISTRIBUTION
CLAYEY SILT TO SILTY CLAY TILL, CL-ML TO CL

FIG No C-02B.3

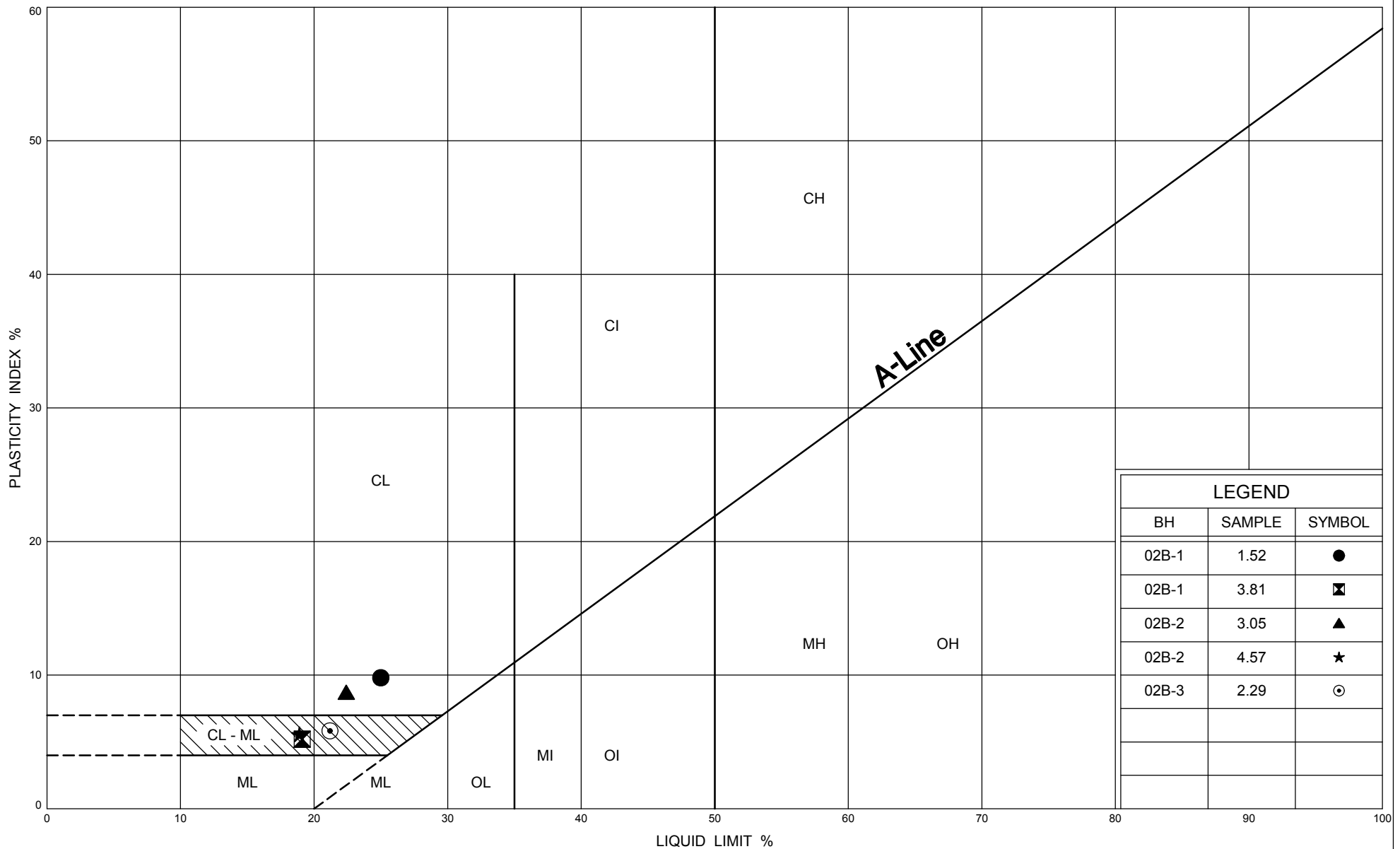
GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford



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PLASTICITY CHART CLAYEY SILT TO SILTY CLAY TILL, CL-ML TO CL

FIG No C- 02B.4

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford



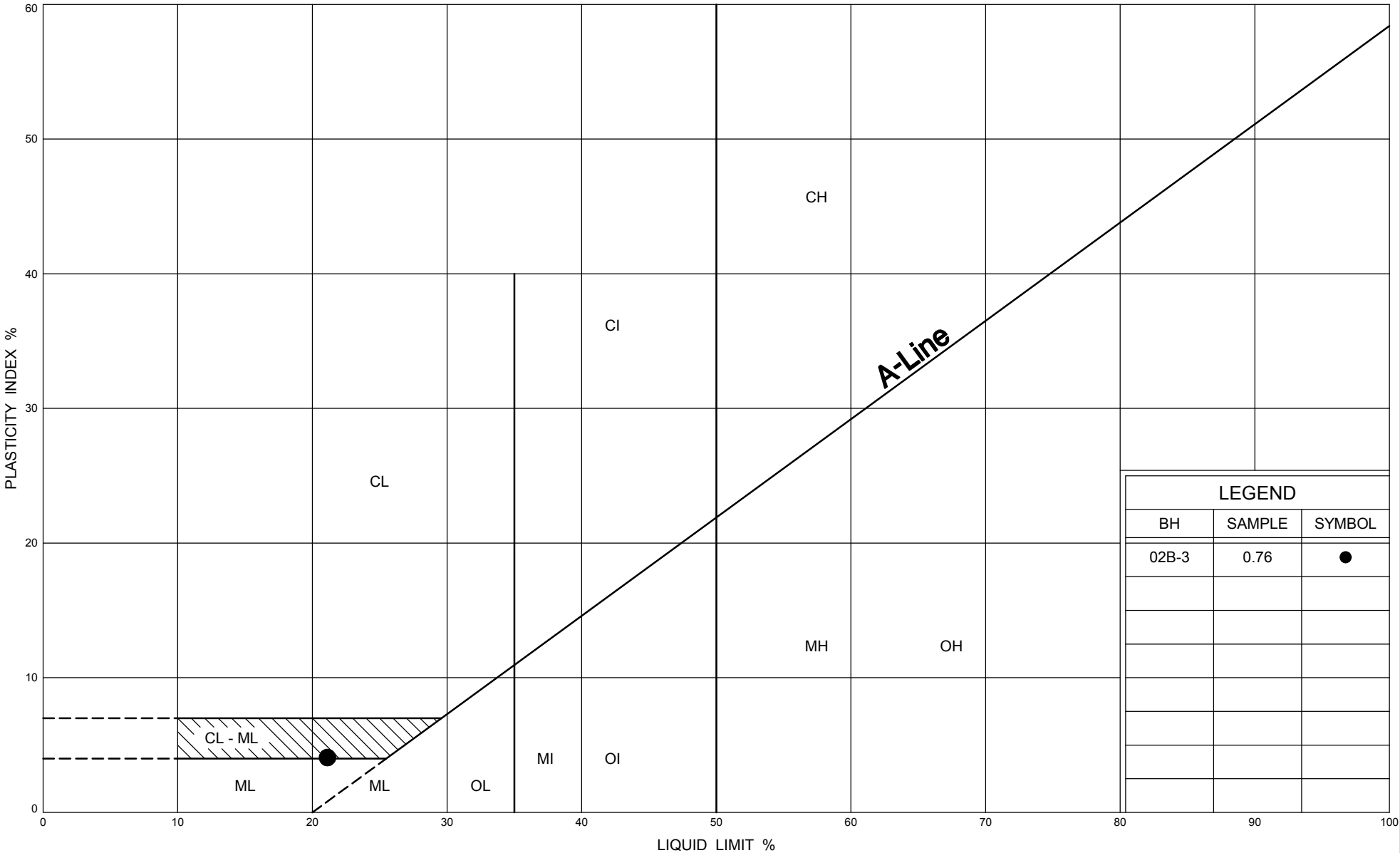
GRAIN SIZE DISTRIBUTION

SILT LAYER, ML

Hwy 26 - Sydenham Townline to Meaford

ONTARIO MOT PLASTICITY CHART SMALL CULVE 07-6-JEGIB.GPJ ONTARIO MOT.GDT 17/11/09

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PLASTICITY CHART
SILT LAYER, ML

FIG No C- 02B.6

GWP 167-91-00

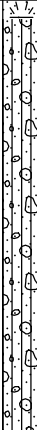
Hwy 26 - Sydenham Townline to Meaford

RECORD OF BOREHOLE No 03B-1

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4940289, Easting - 208500 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 21.8.07 - 21.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		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 (%)					
327.23 0.00	Ground 150 mm TOPSOIL.														
			1	SPT	36										
			2	SPT	17										
			3	SPT	100+										
			4	SPT	73										
323.80 3.43	End of Borehole.														

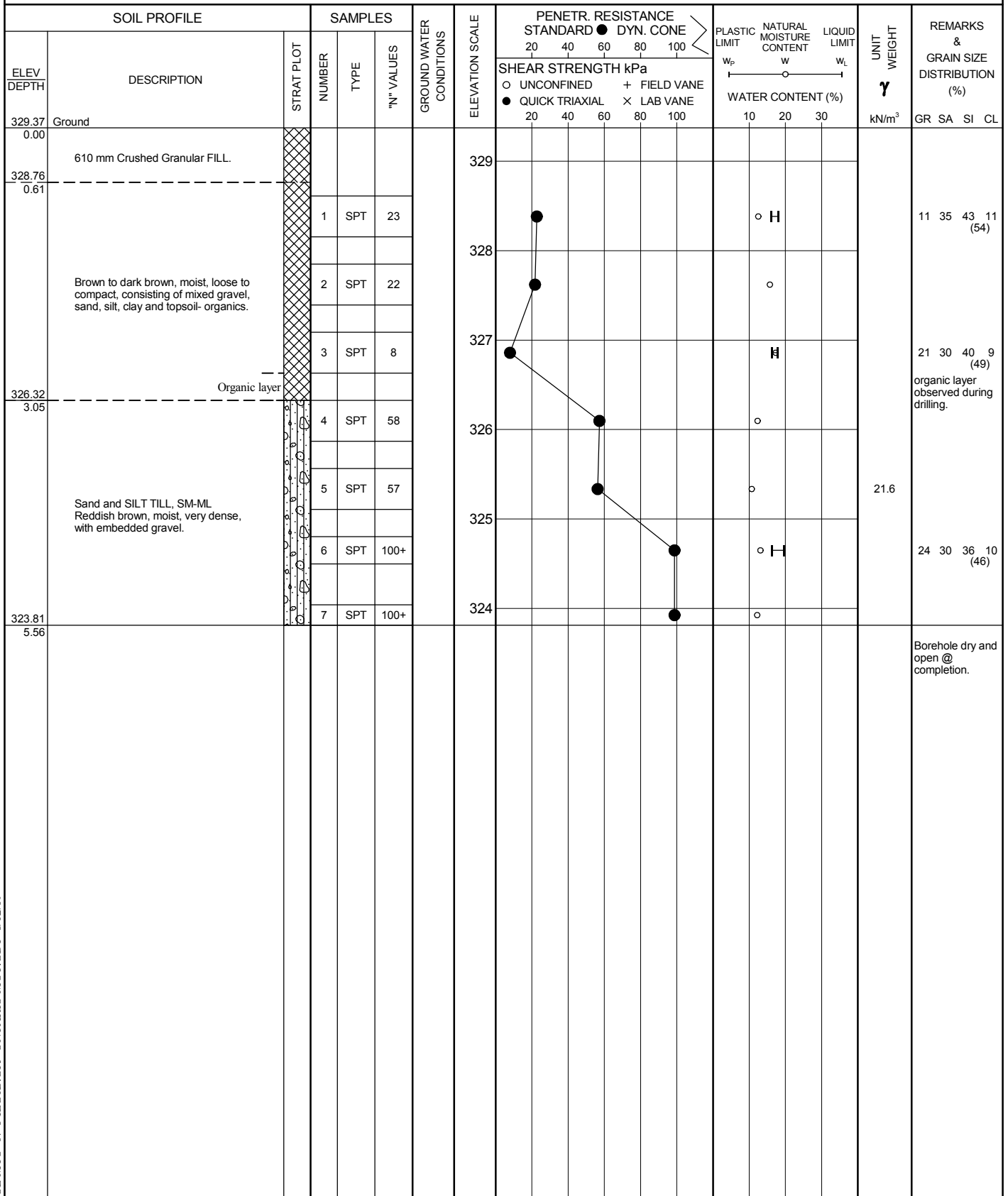
JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

RECORD OF BOREHOLE No 03B-2

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4940307, Easting - 208492 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 16.8.07 - 16.8.07 CHECKED BY JL



JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 03B-3

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4940310, Easting - 208487 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 2.8.07 - 2.8.07 CHECKED BY JL

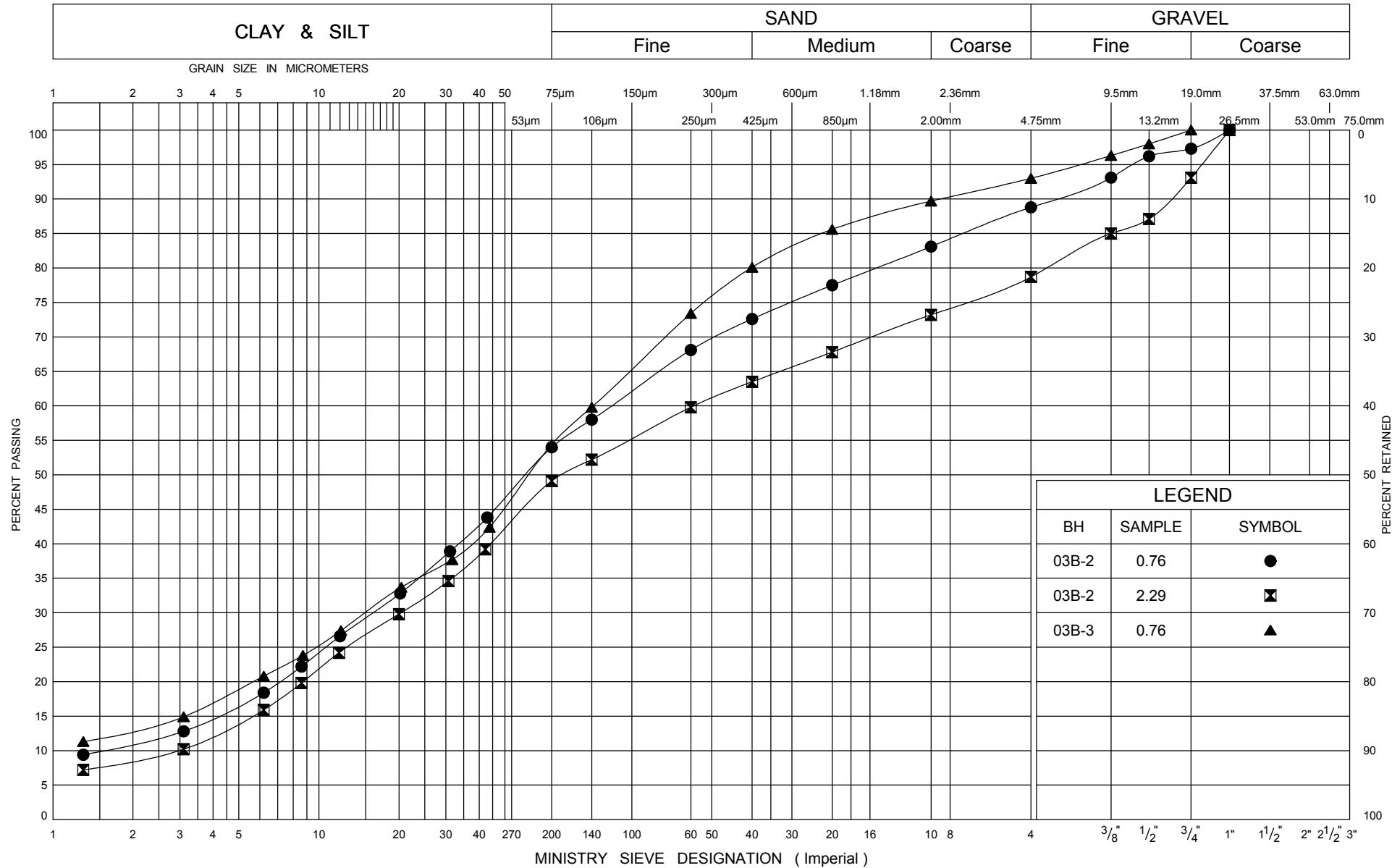
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED	+	● QUICK TRIAXIAL						×		
327.44 0.00	Ground						20	40	60	80	100	10	20	30		GR SA SI CL		
326.37 1.07	FILL Black to dark brown, moist, consisting mainly of topsoil and mixed silt, sand some clay and trace gravel.		1	SPT	7											7 39 41 13 (54)		
	Sand and SILT TILL, SM-ML Reddish brown, moist, loose to dense, with embedded gravel.		2	SPT	20													
			3	SPT	17											23 29 39 9 (48)		
			4	SPT	30													
324.09 3.35	End of borehole.															Borehole dry and open @ completion.		

JOE MTO 07-6-IEG1B.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

FILL

FIG No C-03B.1

GWP 167-91-00

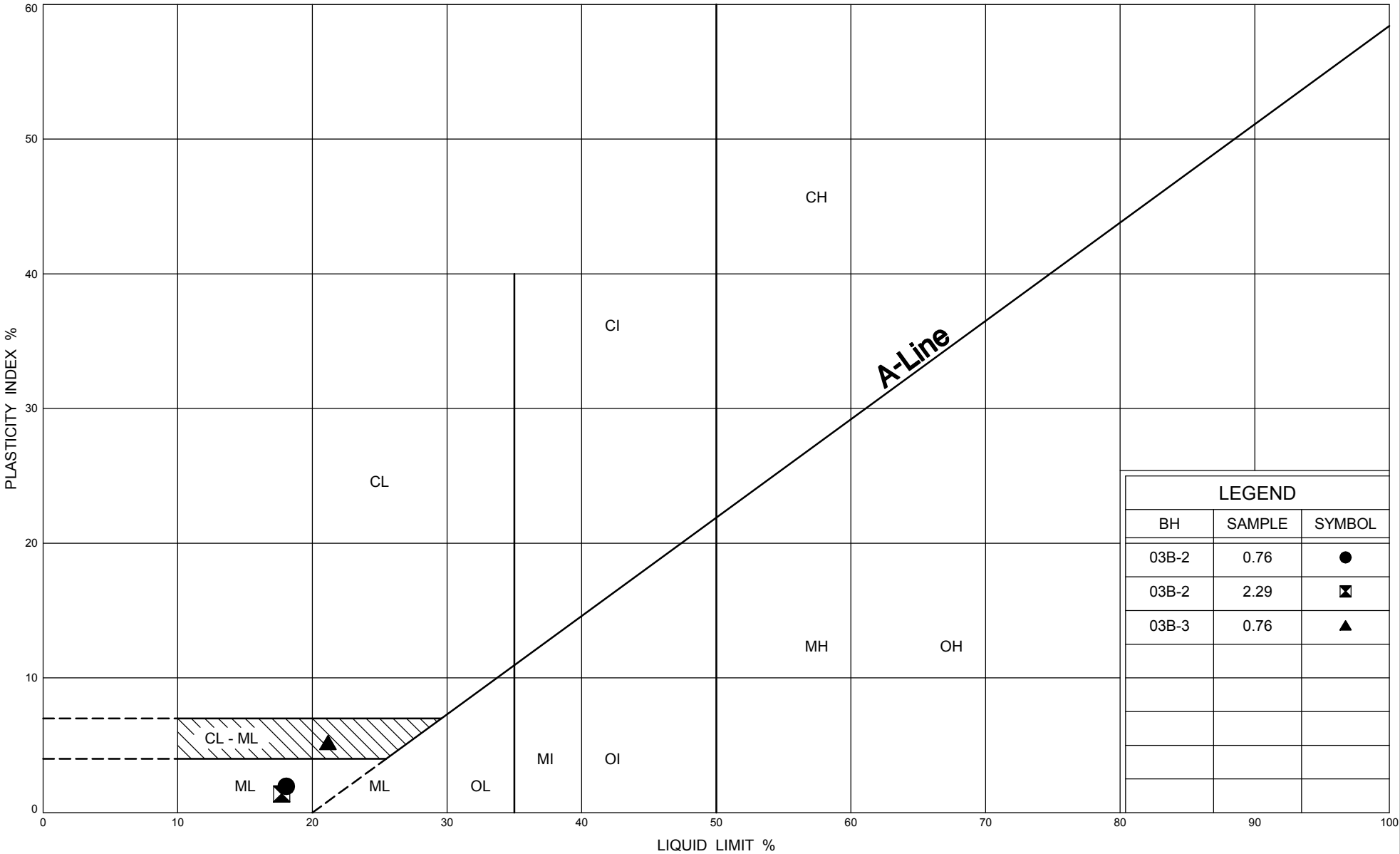
Hwy 26 - Sydenham Townline to Meaford

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ONTARIO MOT PLASTICITY CHART SMALL CULVE 07-6-JEGIB.GPJ ONTARIO MOT.GDT 17/11/09

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LEGEND		
BH	SAMPLE	SYMBOL
03B-2	0.76	●
03B-2	2.29	⊠
03B-3	0.76	▲



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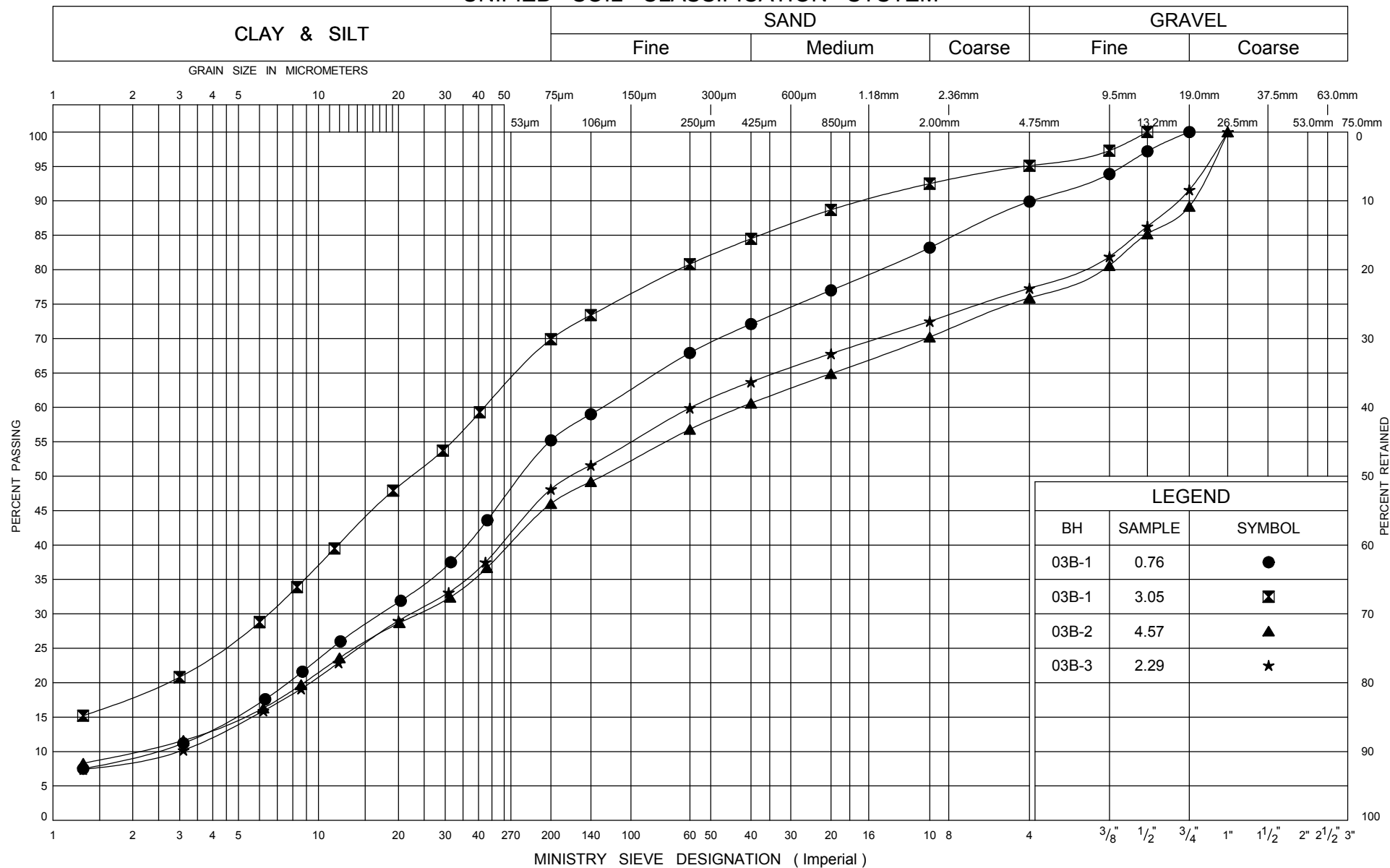
PLASTICITY CHART
FILL

FIG No C- 03B.2

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

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GRAIN SIZE DISTRIBUTION SAND AND SILT TILL, SM-ML

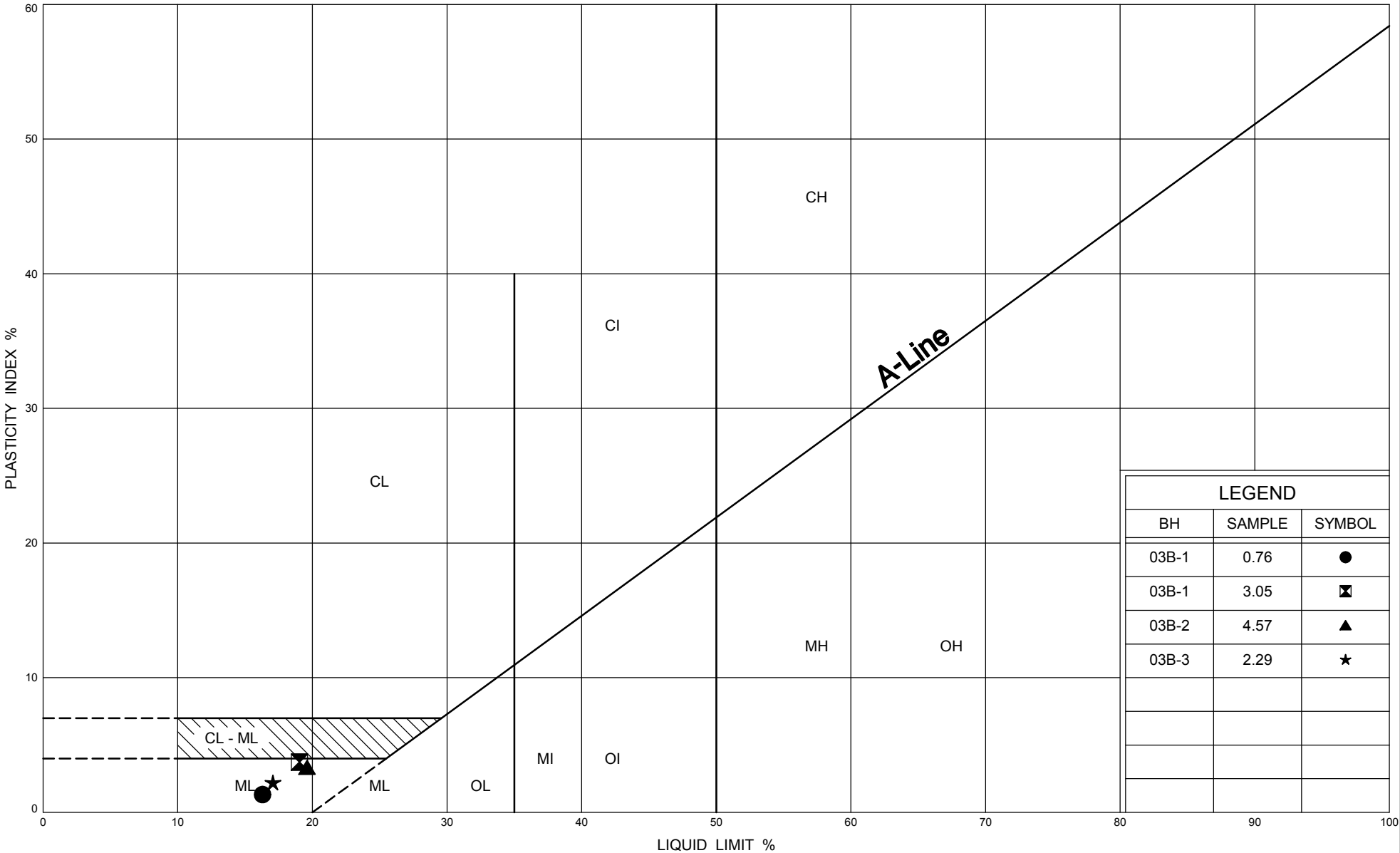
FIG No C-03B.3

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

ONTARIO MOT PLASTICITY CHART SMALL CULVE 07-6-JEGIB.GPJ ONTARIO MOT.GDT 17/11/09

Oct 75, FF - S - 21



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PLASTICITY CHART
SAND AND SILT TILL, SM-ML

FIG No C- 03B.4

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

METRIC

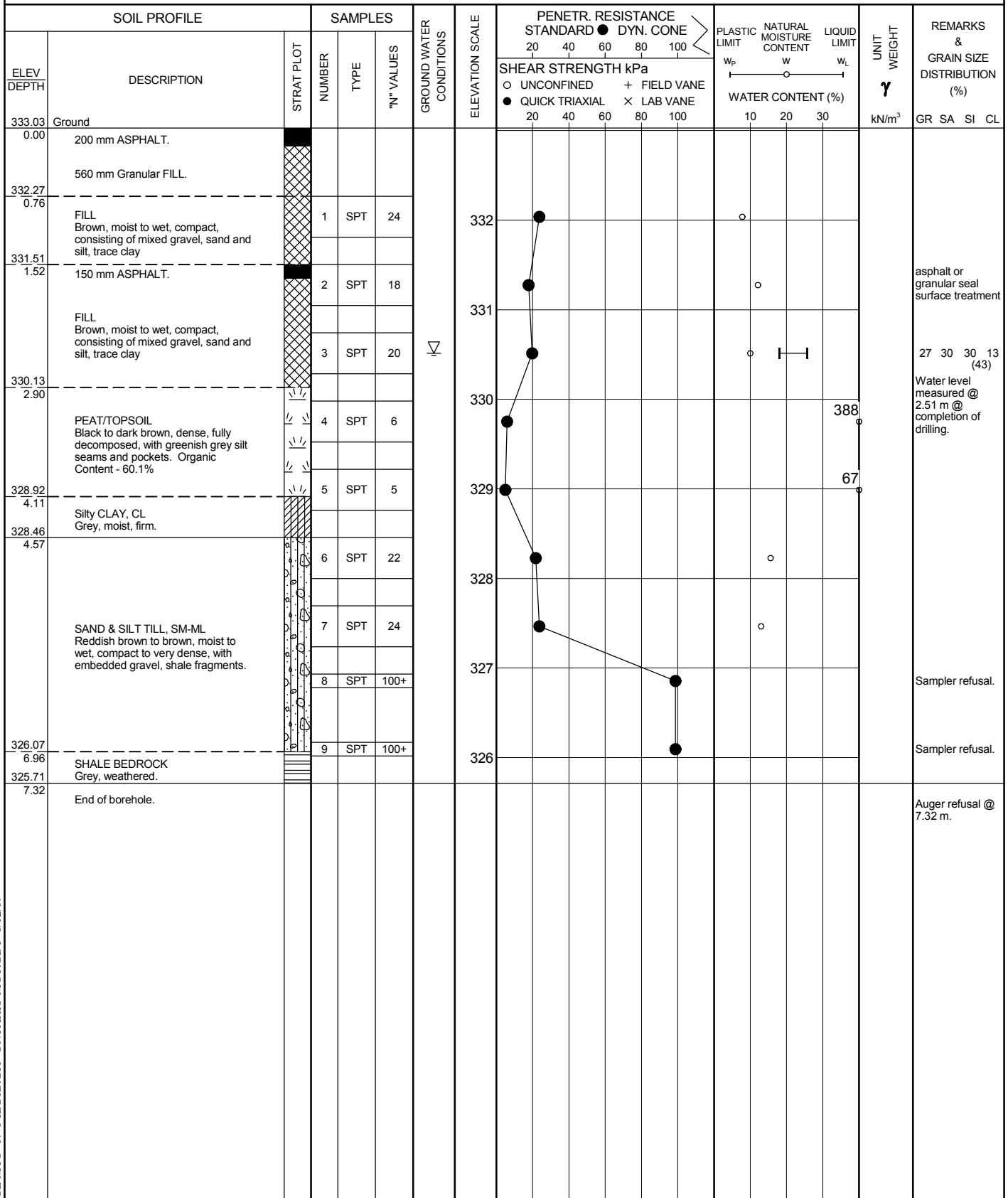
+ ³, × ³: Numbers refer to Sensitivity ○ ¹⁵⁰ UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 05B-2

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4940576, Easting - 209469 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 8.9.07 - 8.9.07 CHECKED BY JL



+ 3, X 3: Numbers refer to Sensitivity

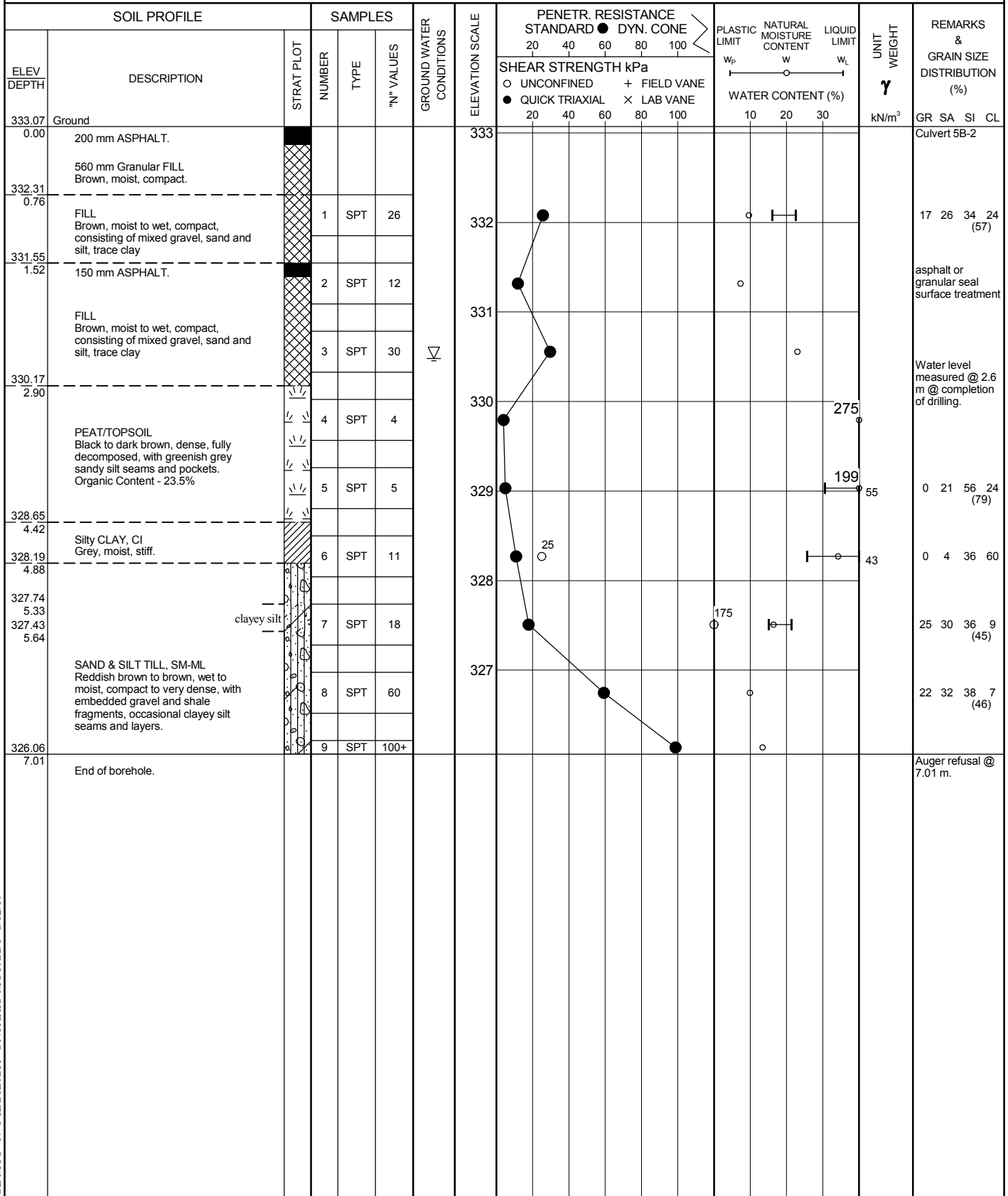
○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 05B-3

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4940581, Easting - 209468 ORIGINATED BY RB
DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
DATUM Geodetic DATE 8.2.07 - 8.2.07 CHECKED BY JL



JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 05B-4

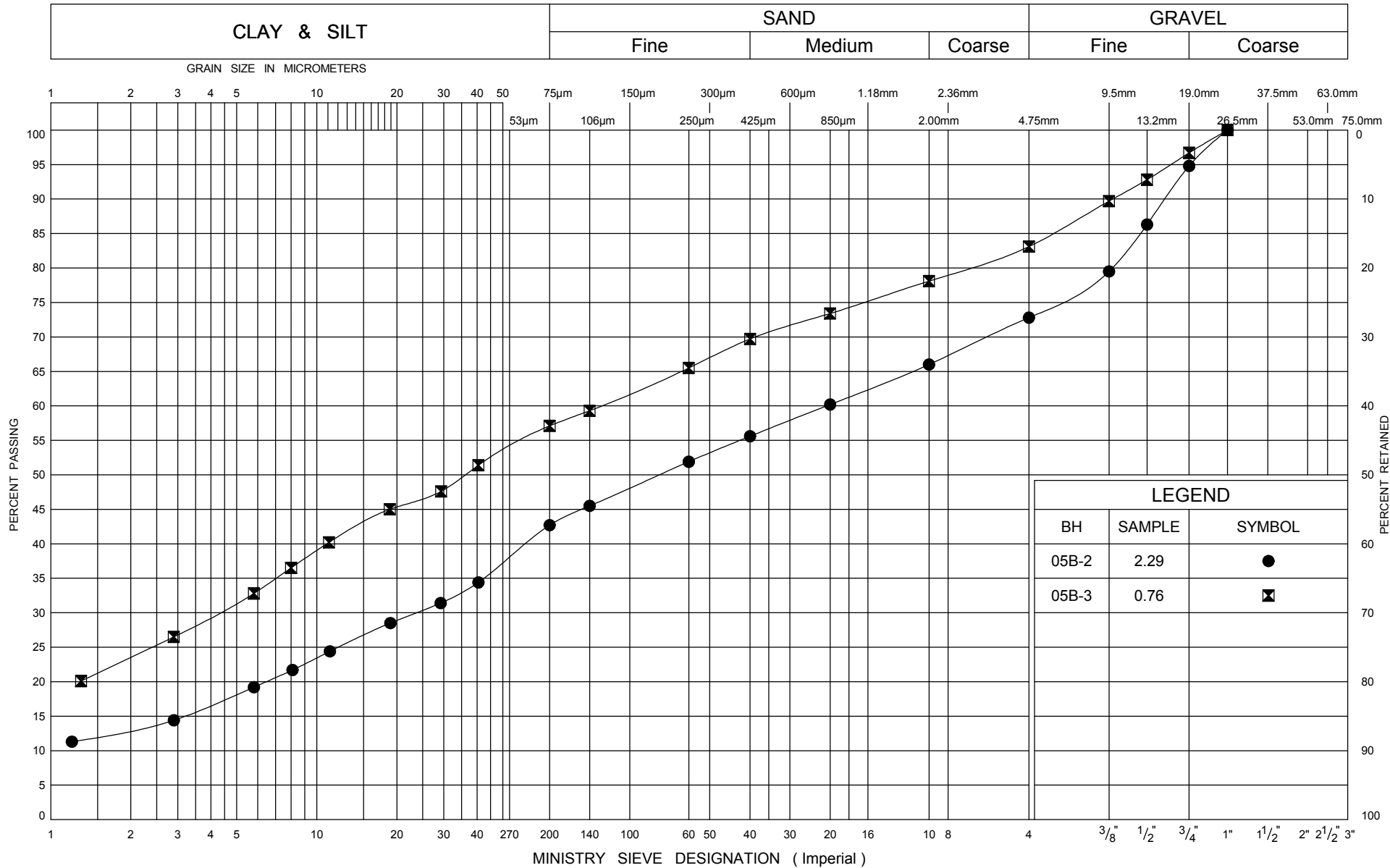
1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4940591, Easting - 209466 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE Hand Drilling COMPILED BY NN
 DATUM Geodetic DATE 29.8.07 - 29.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										
								○ UNCONFINED	+ FIELD VANE									
								● QUICK TRIAXIAL	× LAB VANE									
															WATER CONTENT (%)			
331.17 0.00	Ground							20	40	60	80	100	10	20	30		GR SA SI CL	
330.56 0.61	sand and gravel layer PEAT Black, very loose, partially decomposed, wood pieces, interbedded with greenish grey organic sand and silt, and gravel layers. Organic Content - 15.9%		1	SPT	1		331										Culvert 5B-3	
			2	SPT	18													Water level measured @ 0.61 m @ completion of drilling.
329.95 1.22			3	SPT	1		330											
			4	SPT	2		329											10 45 39 6 (46)
			5	SPT	1													
328.12 3.05	SAND & SILT TILL, SM-ML Grey, moist, compact, shale fragments, with embedded gravel, clayey silt seams and layers.		6	SPT	11		328										15 38 36 11 (47)	
			7	SPT	15													
326.90 4.27	End of borehole due to excessive cave-in.																Hand drilling terminated due to excessive cave-in. 31.75 Kg (70 lb.) hammer used for driving sampler. N-values corrected for standard 63.5 Kg (140 lb.) hammer.	

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

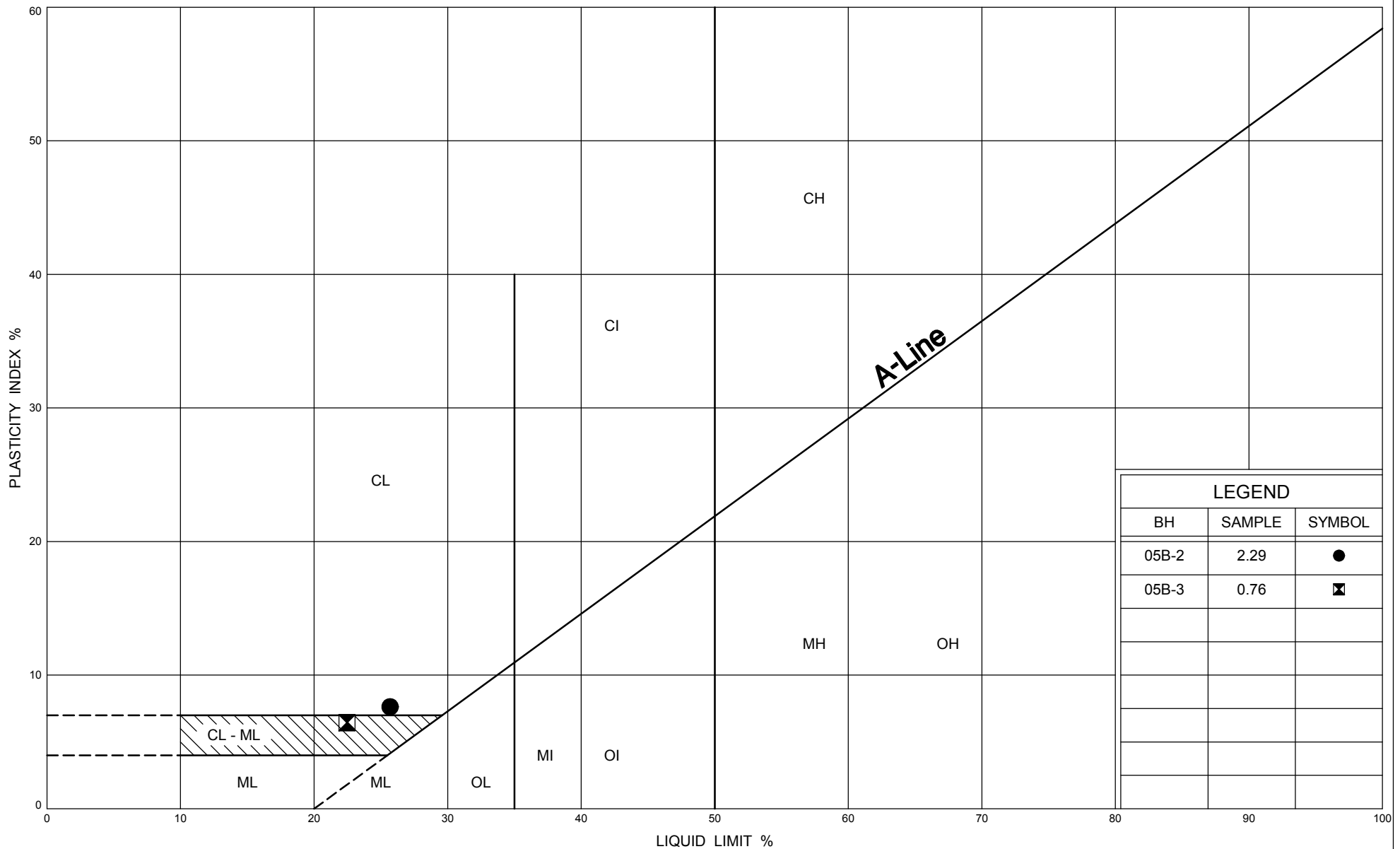
GRAIN SIZE DISTRIBUTION

FILL

FIG No C-05B.1

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford



LEGEND		
BH	SAMPLE	SYMBOL
05B-2	2.29	●
05B-3	0.76	⊠



Ministry of
Transportation

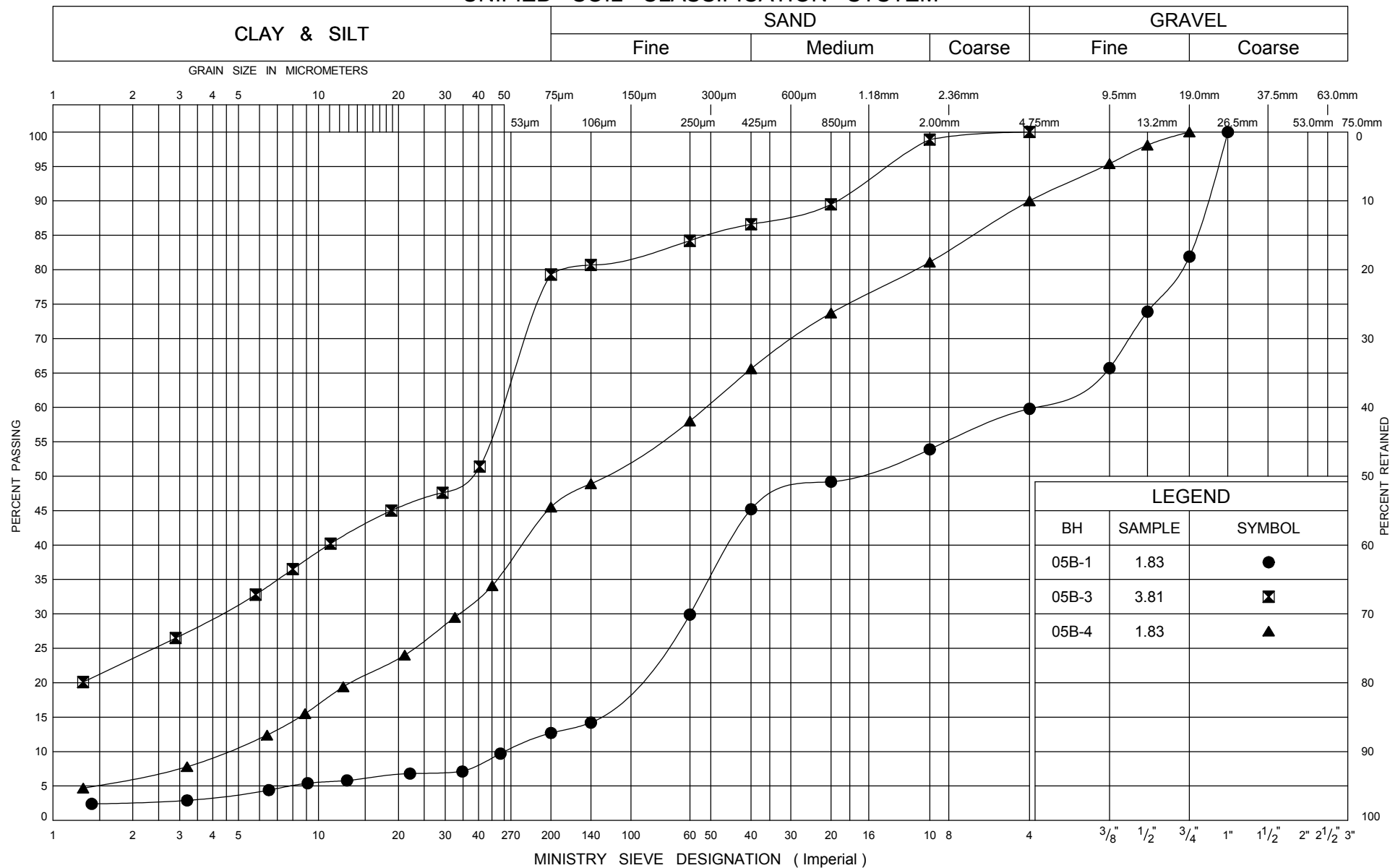
PLASTICITY CHART FILL

FIG No C- 05B.2

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

PEAT

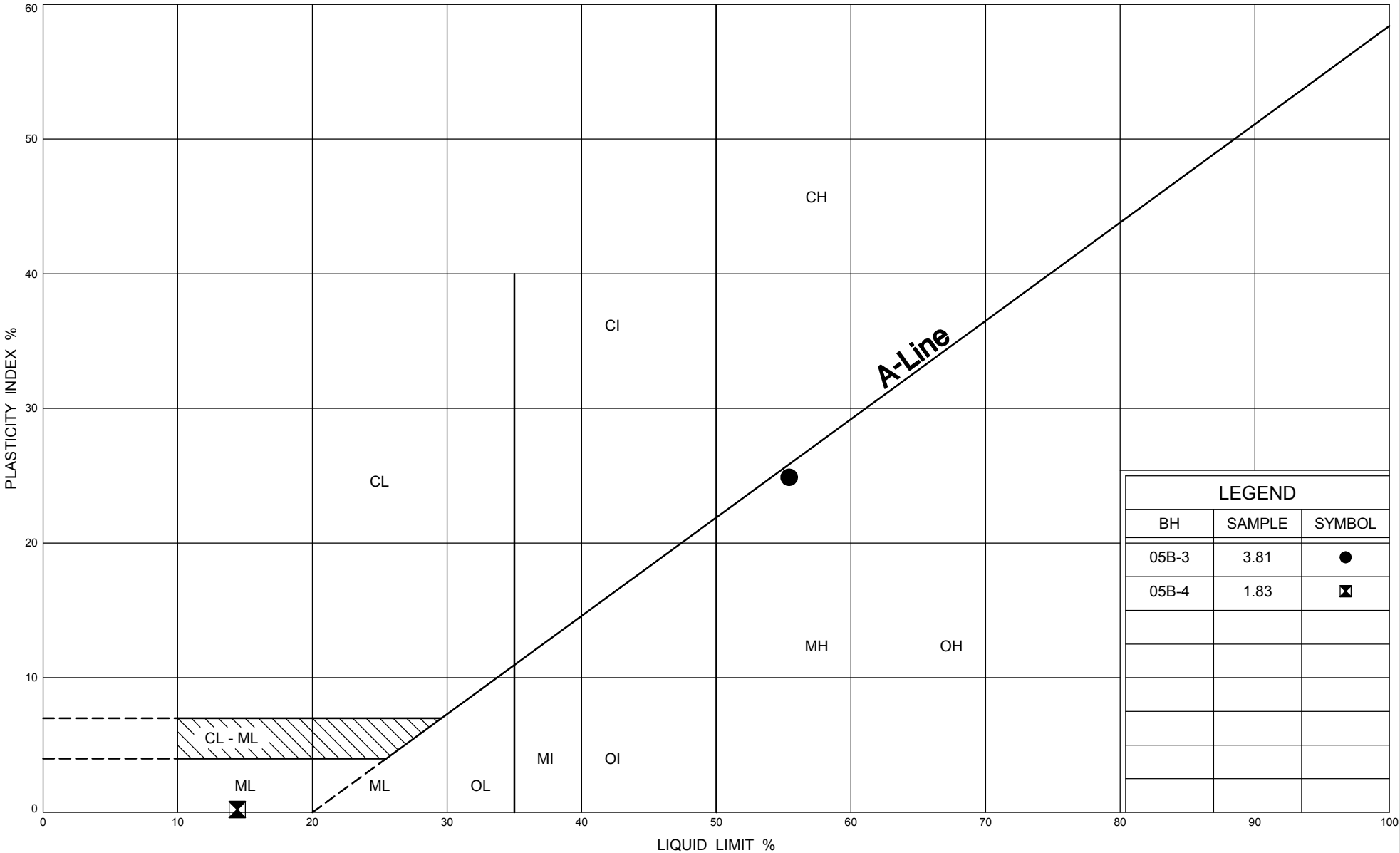
FIG No C-05B.3

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford


 Ministry of
Transportation

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Transportation

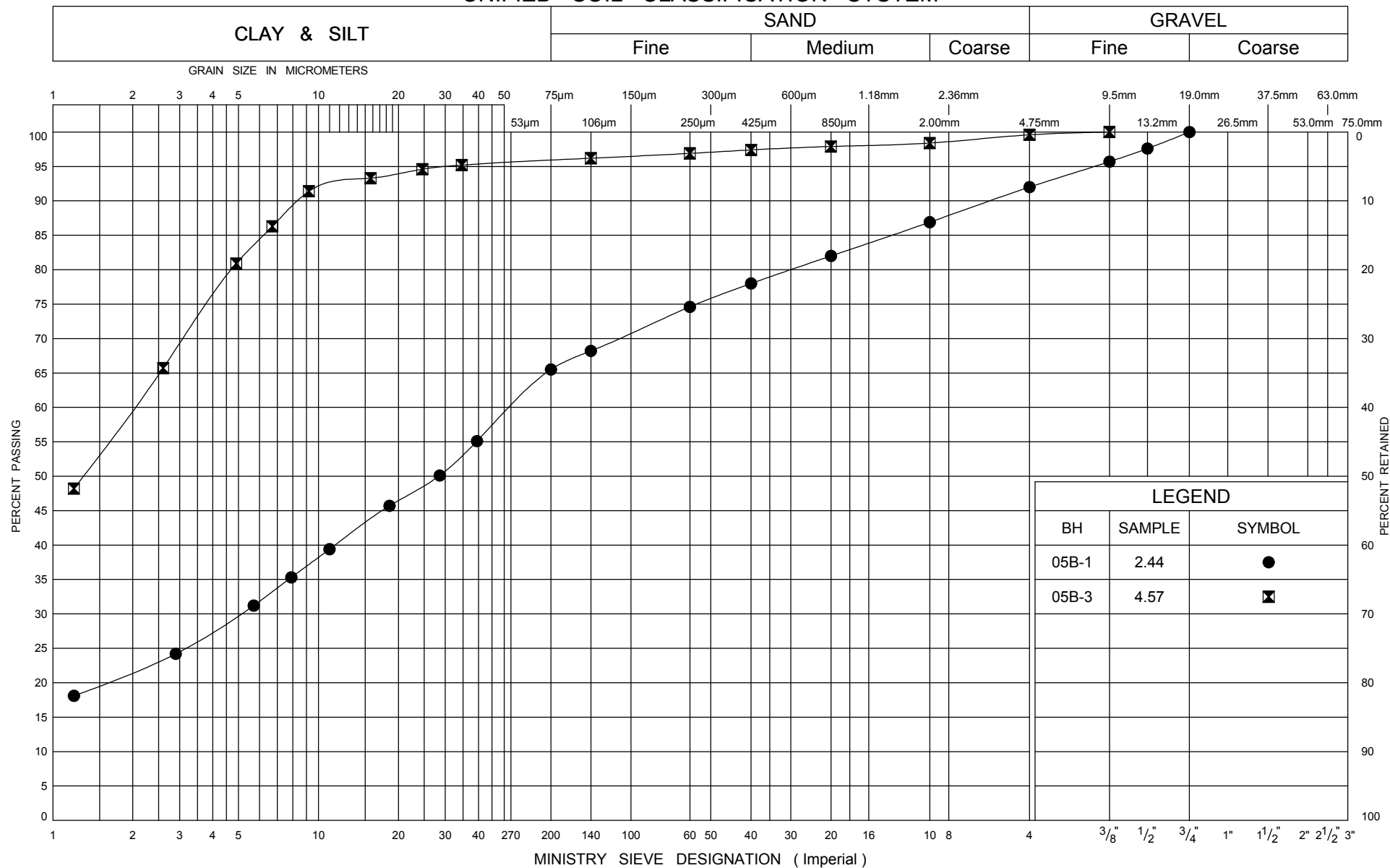
PLASTICITY CHART
PEAT

FIG No C- 05B.4

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

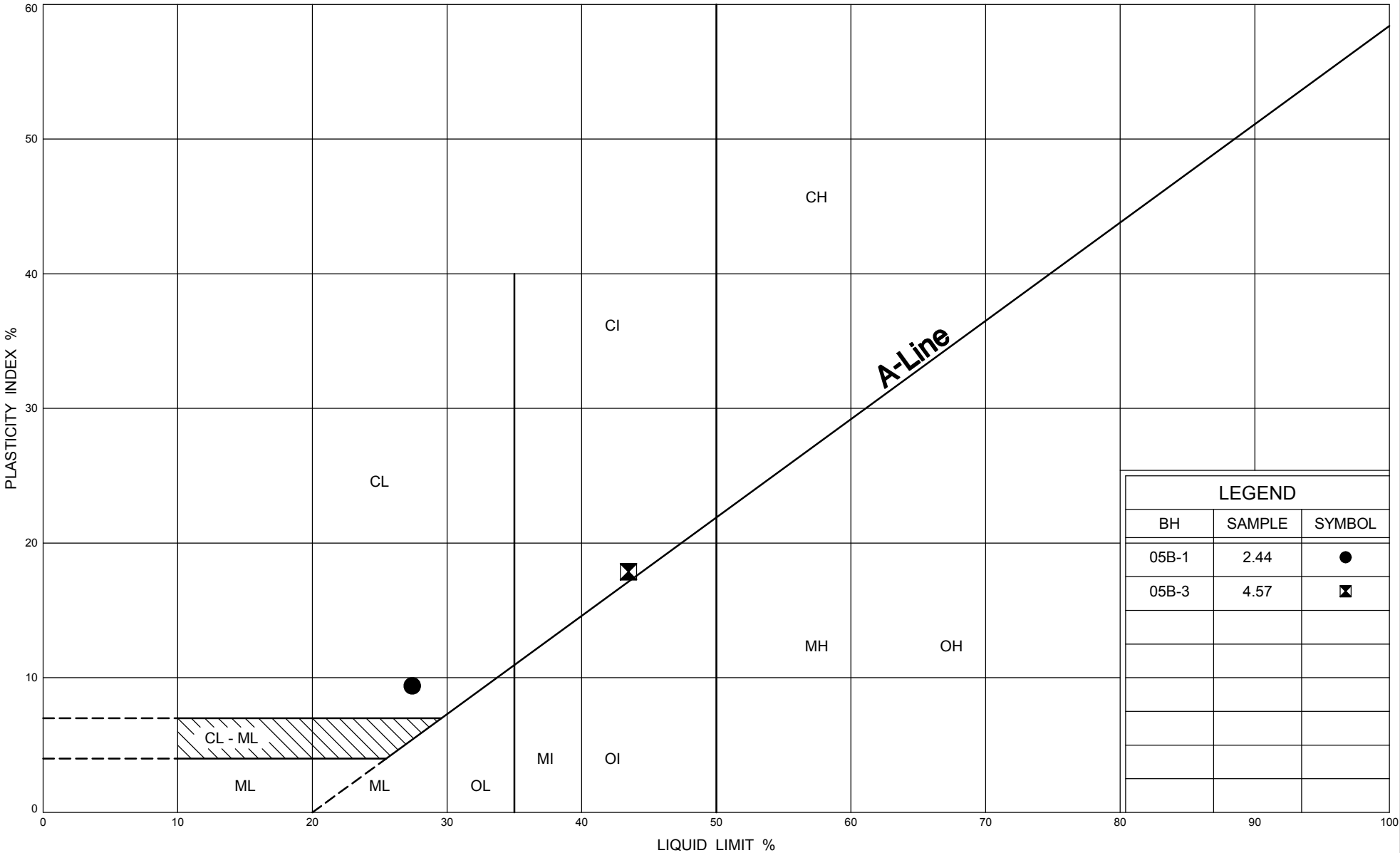
GRAIN SIZE DISTRIBUTION

SILTY CLAY, CL to CI

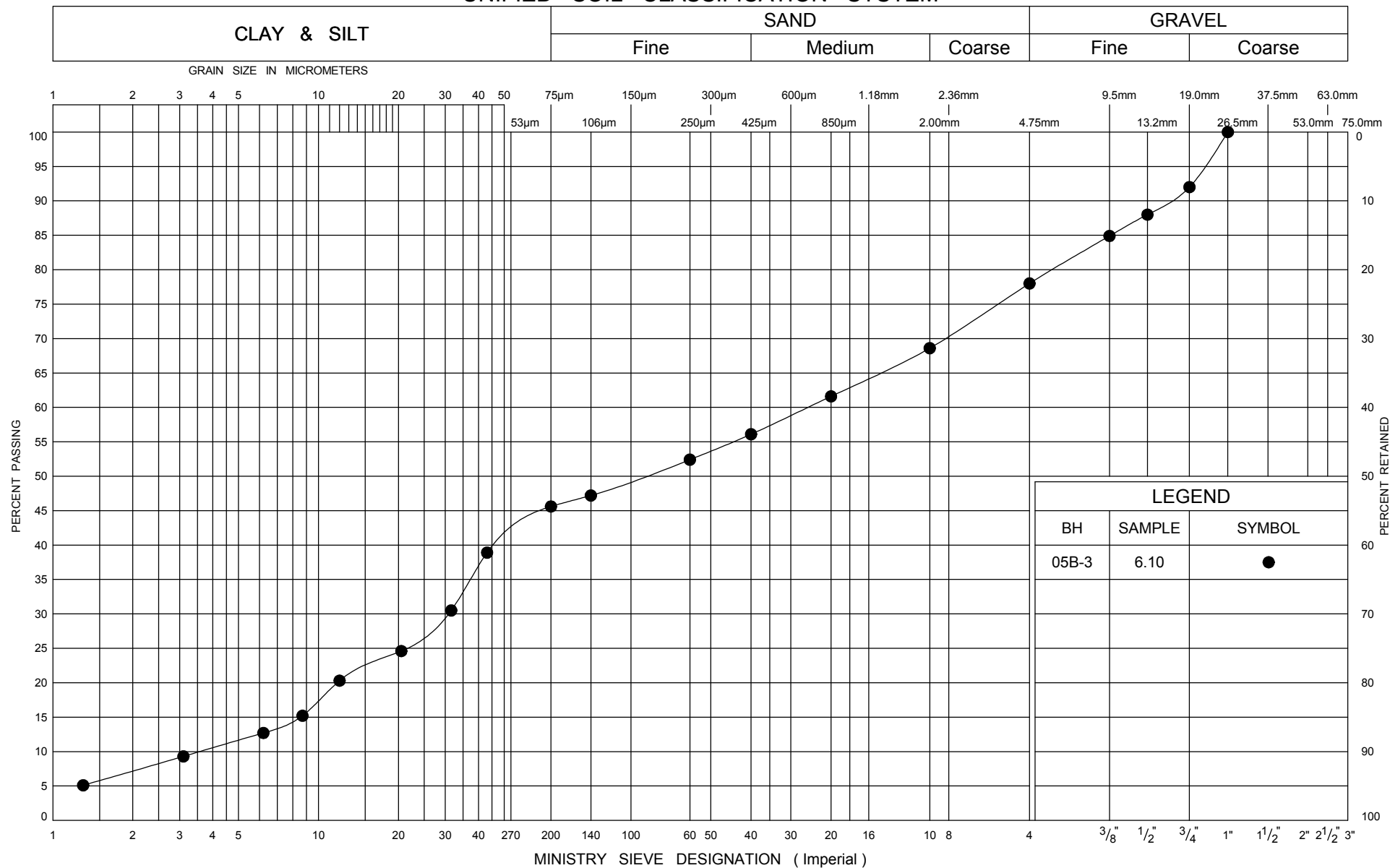
FIG No C-05B.5

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford



UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

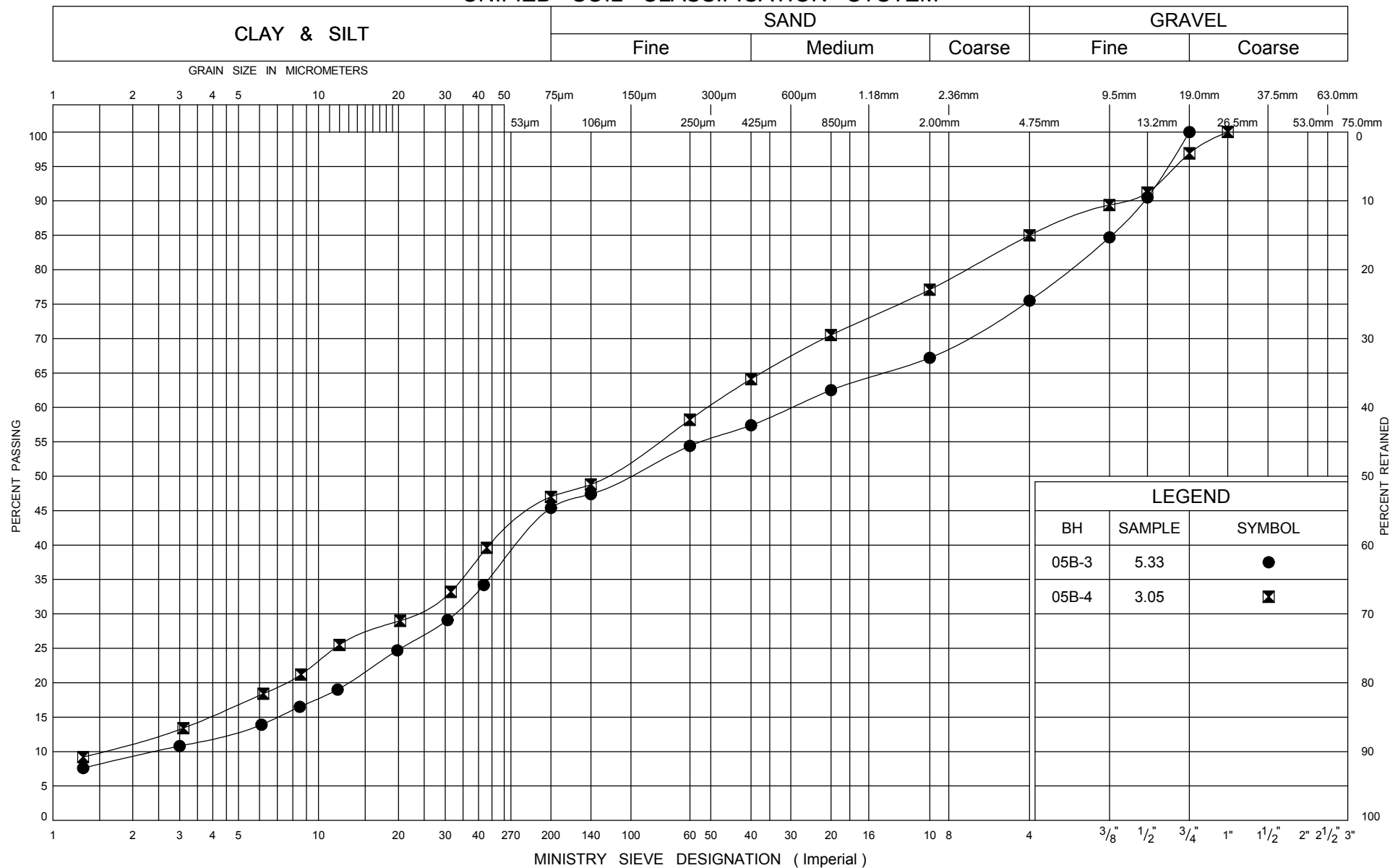
GRAIN SIZE DISTRIBUTION
SAND AND SILT TILL, SM-ML

FIG No C-05B.7

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

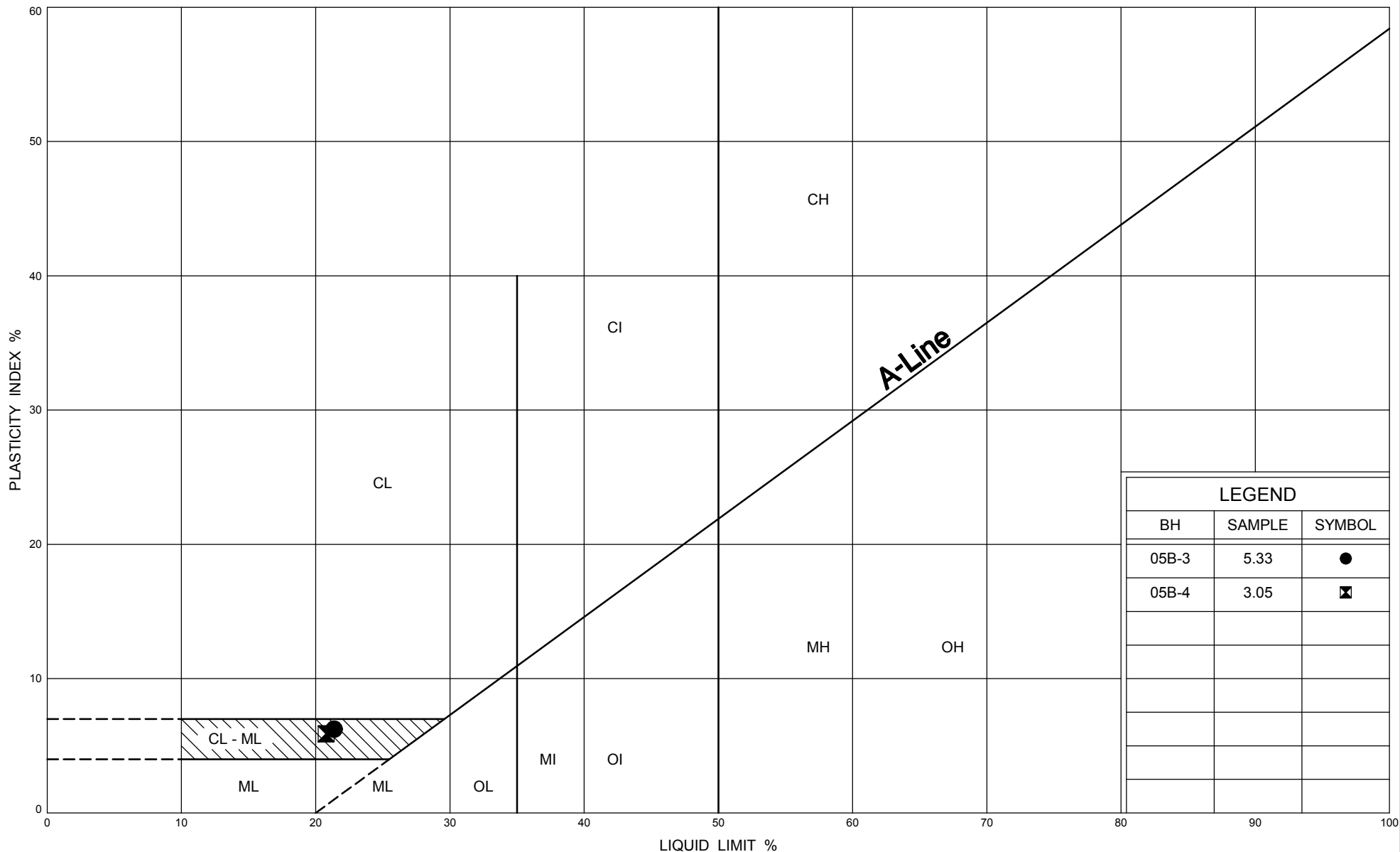
GRAIN SIZE DISTRIBUTION

CLAYEY SILT SEAMS AND LAYERS, CL-ML

FIG No C-05B.8

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford



LEGEND		
BH	SAMPLE	SYMBOL
05B-3	5.33	●
05B-4	3.05	☒



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PLASTICITY CHART CLAYEY SILT SEAMS AND LAYERS, CL-ML

FIG No C- 05B.9

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

RECORD OF BOREHOLE No 06B-1

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4940710, Easting - 209996 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 16.8.07 - 16.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		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			STANDARD 20 40 60 80 100	DYN. CONE 20 40 60 80 100					
331.42 0.00	Ground 150 mm TOPSOIL.													
			1	SPT	31		331			225+				
			2	SPT	40		330			225+				26 28 32 14 (46)
			3	SPT	47		329			225+				
327.91 3.51	End of Borehole.		4	SPT	49		328			225+				6 27 42 25 (67)
														Borehole dry and open @ completion.

JOE MTO 07-6-IEG1B.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

METRIC

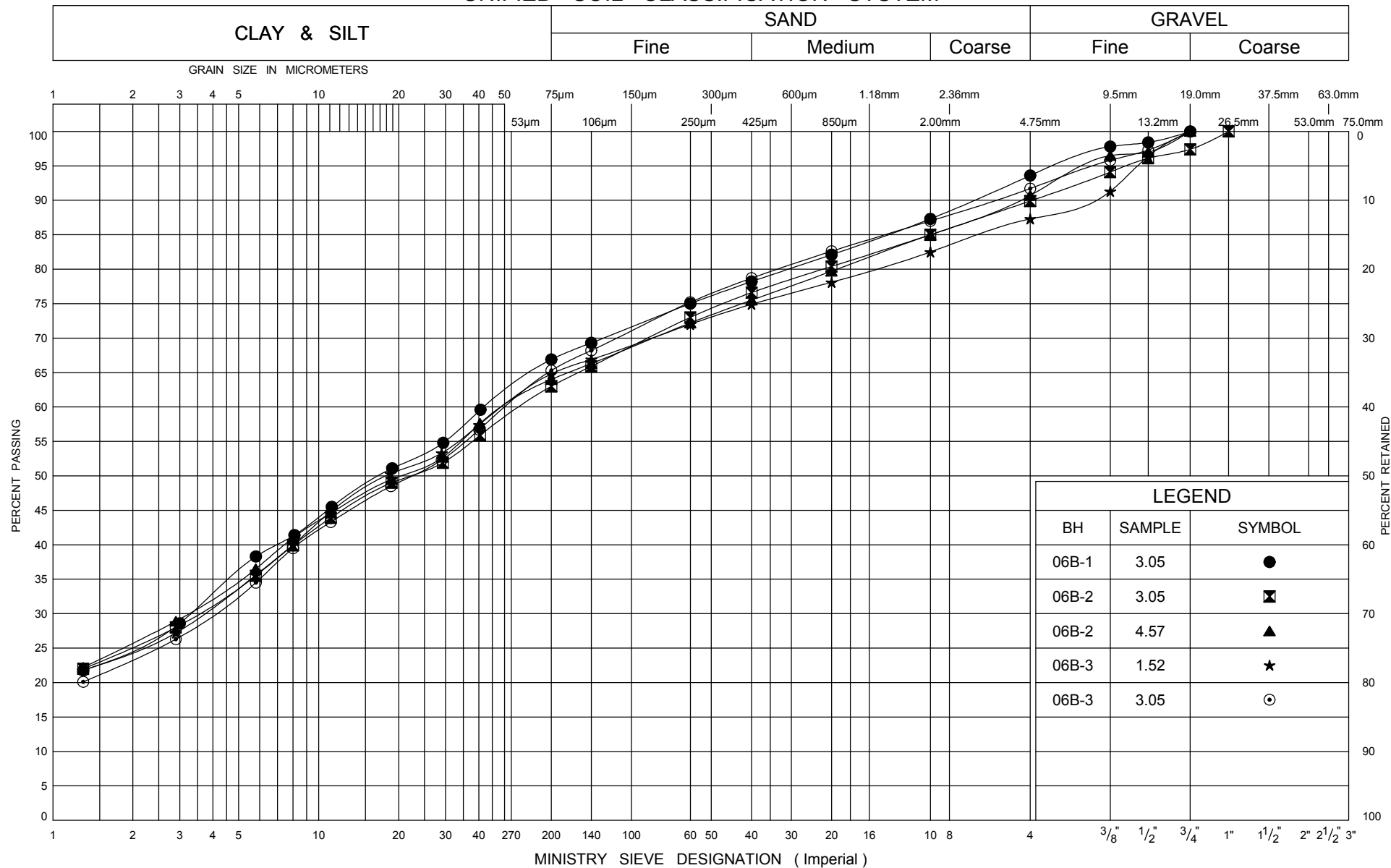
+ ³, × ³: Numbers refer to Sensitivity

METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD DYN. CONE	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	WATER CONTENT (%)		GR SA SI CL
								20 40 60 80 100		○ QUICK TRIAXIAL × LAB VANE			
331.90 0.00	Ground 150 mm TOPSOIL.	[Strat. Plot]											
			1	SPT	50		331	●		○			
			2	SPT	100+		330	●		○	—		13 23 40 2 (65)
			3	SPT	55		329	●		○			
			4	SPT	38		328	●		○	—		8 26 42 2 (65)

○ ¹⁵⁰ UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

GRAIN SIZE DISTRIBUTION

SILTY CLAY TILL, CL

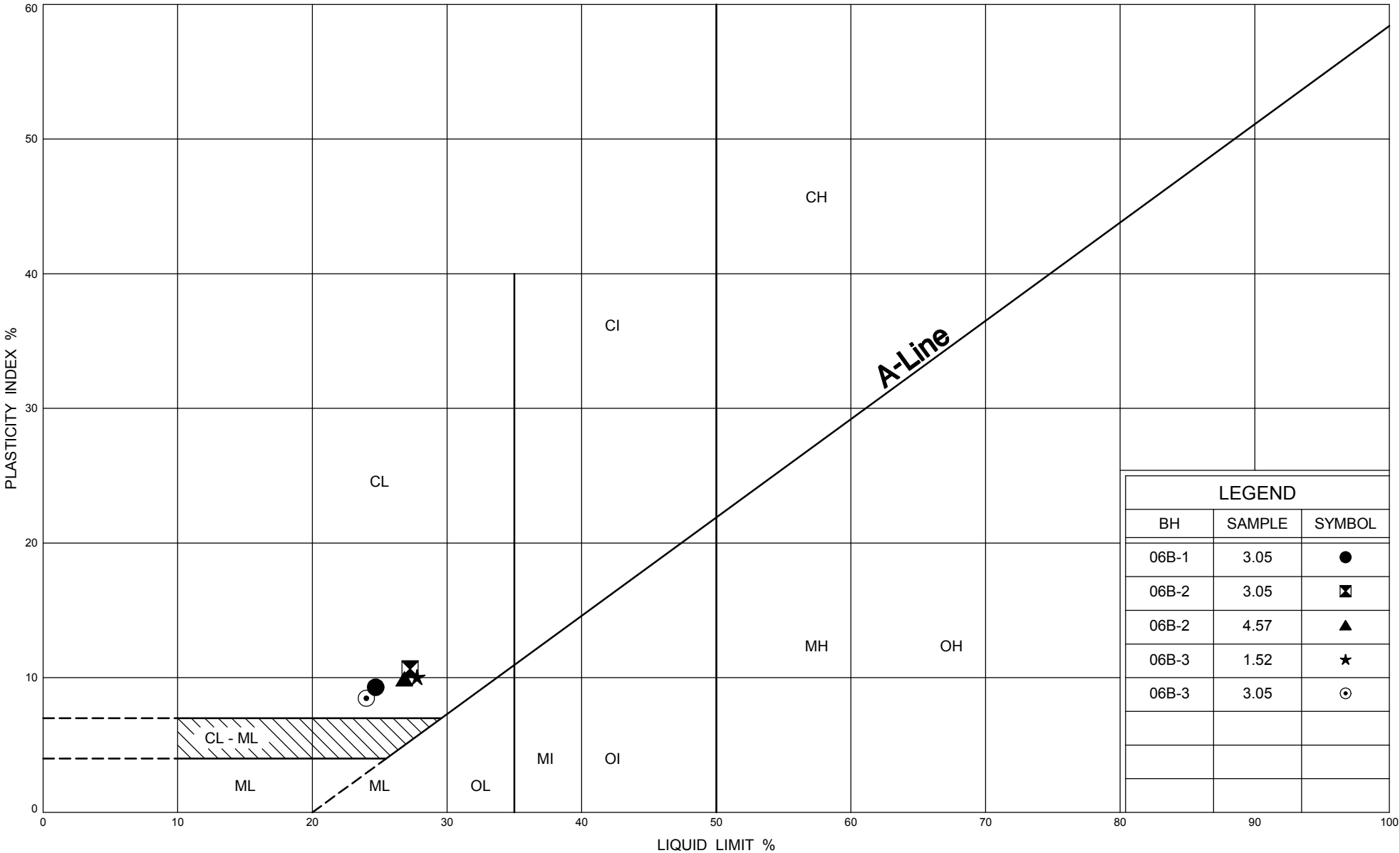
FIG No C-06B.1

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

ONTARIO MOT PLASTICITY CHART SMALL CULVE 07-6-JEGIB.GPJ ONTARIO MOT.GDT 18/11/09

Oct 75, FF - S - 21



Ministry of
Transportation

Ontario

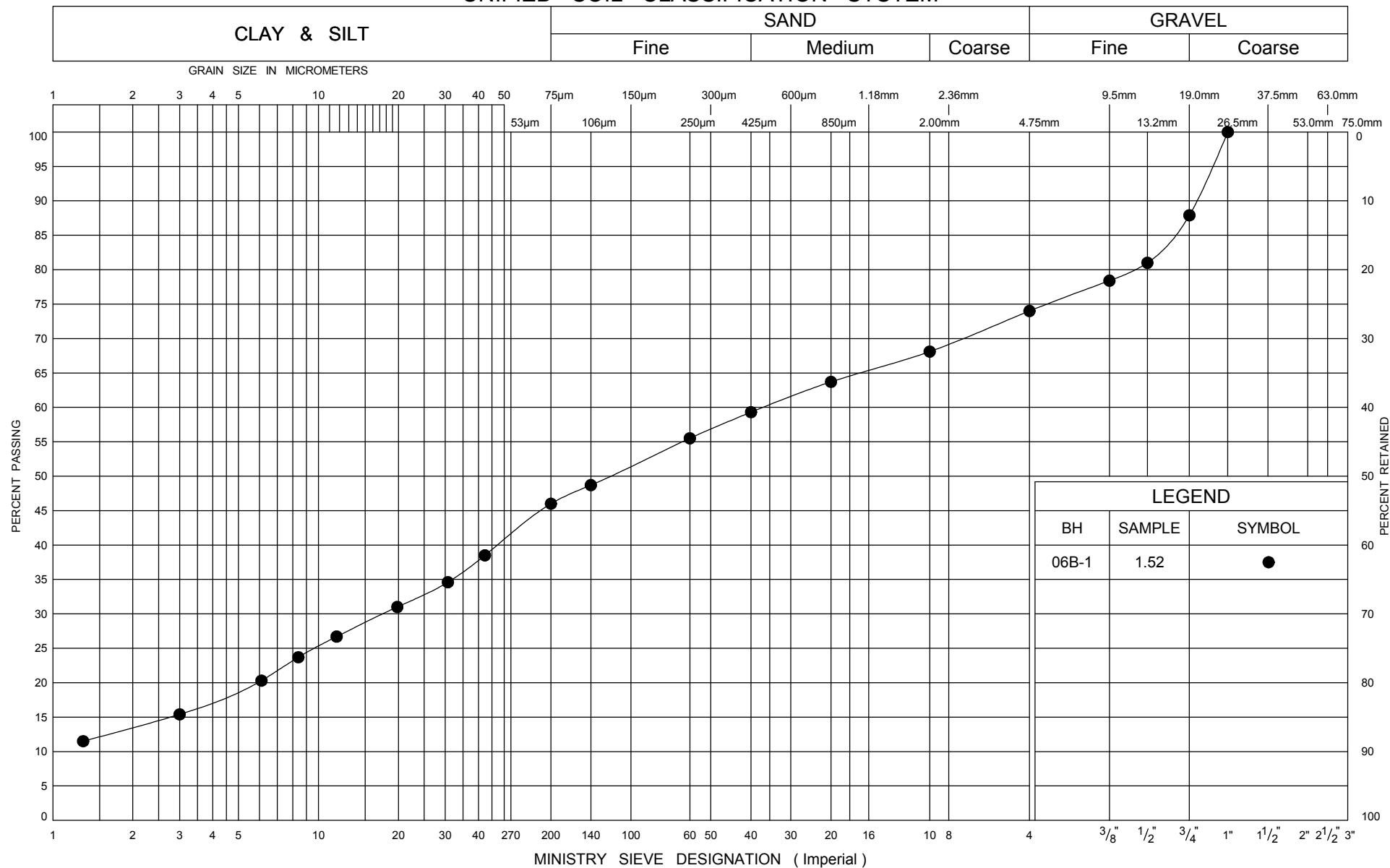
PLASTICITY CHART
SILTY CLAY TILL, CL

FIG No C- 06B.2

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

GRAIN SIZE DISTRIBUTION

CLAYEY SILT LAYER, CL-ML

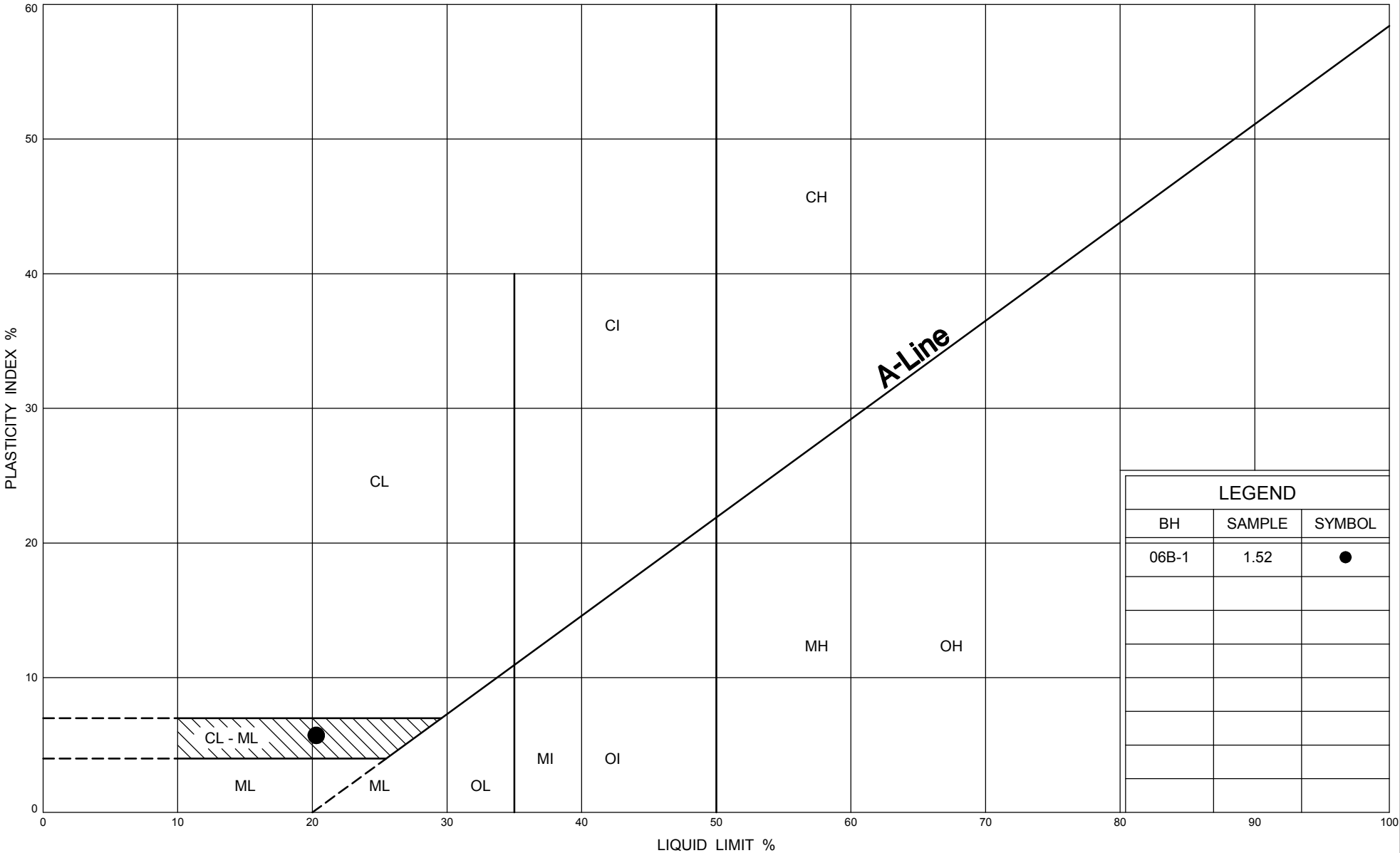
FIG No C-06B.3

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

ONTARIO MOT PLASTICITY CHART SMALL CULVE 07-6-JEGIB.GPJ ONTARIO MOT.GDT 18/11/09

Oct 75, FF - S - 21



Ministry of
Transportation

PLASTICITY CHART
CLAYEY SILT LAYER, CL-ML

FIG No C- 06B.4

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

METRIC

+ ³, × ³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No 07B-2

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4940806, Easting - 210314 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 23.8.07 - 23.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE						
								● QUICK TRIAXIAL	× LAB VANE						
322.35 0.00	Ground														
	150 mm Granular FILL.														
	FILL Brown to dark brown, moist, loose, consisting of mixed sand, silt, some clay, gravel and organics.		1	SPT	4		322						44		
320.83 1.52			2	SPT	8		321							12 39 32 17 (49)	
			3	SPT	18		320								
	Silty CLAY TILL, CL Reddish brown, wet to moist, firm to hard, with embedded sand and gravel, occasional sandy layers.		4	SPT	52		319							12 26 39 23 (63)	
			5	SPT	53		318								
317.32 5.03	End of Borehole.		6	SPT	44								22.6	5 30 41 24 (65)	
														Borehole dry and open @ completion.	

JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, x 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 07B-3

1 OF 1

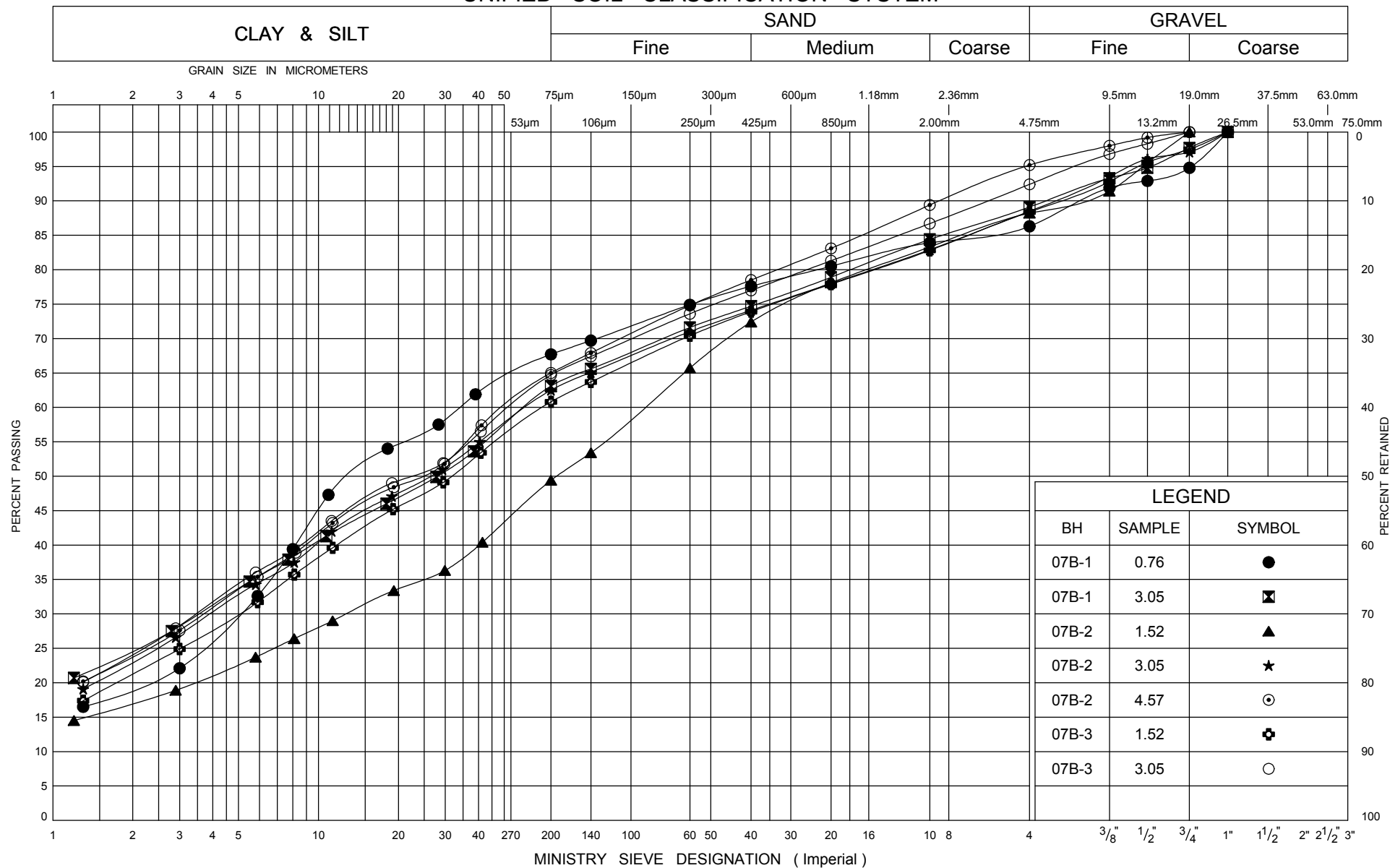
METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4940806, Easting - 210316 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 23.8.07 - 23.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE						
								● QUICK TRIAXIAL	× LAB VANE						
322.21 0.00	Ground														
	150 mm TOPSOIL.														
320.53 1.68			1	SPT	4										
	FILL Brown, moist, loose, consisting of mixed sand, silt and clay, trace organics.														
			2	SPT	19										
	Silty CLAY TILL, CL Reddish brown, moist, very stiff to hard, with embedded sand and gravel, occasional sandy layers.		3	SPT	30										
318.70 3.51			4	SPT	34										
	End of Borehole.													Borehole dry and open @ completion.	

JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

UNIFIED SOIL CLASSIFICATION SYSTEM



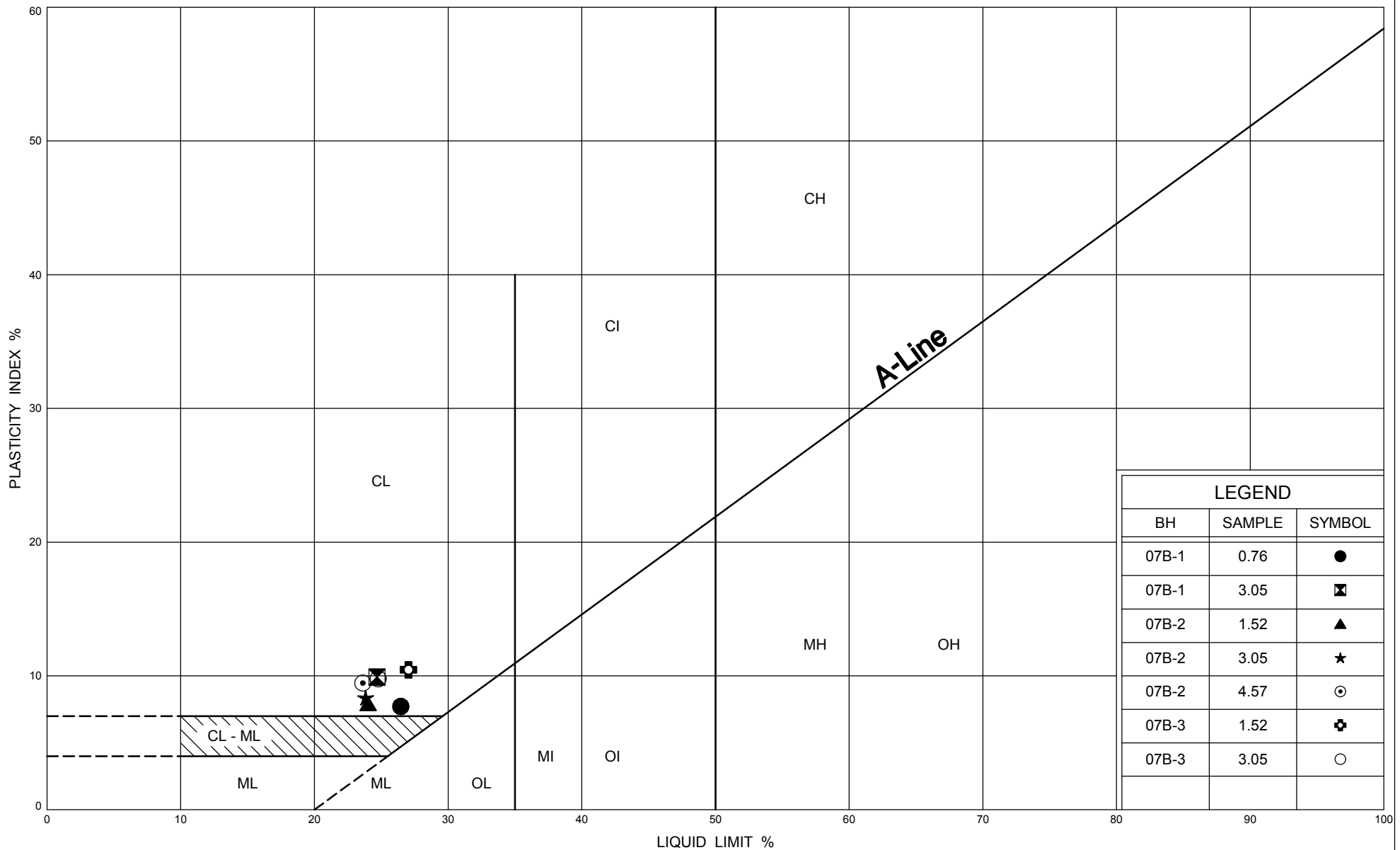
Ministry of
Transportation

GRAIN SIZE DISTRIBUTION
SILTY CLAY TILL, CL

FIG No C-07B.1

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford



Ministry of
Transportation

Ontario

PLASTICITY CHART SILTY CLAY TILL, CL

FIG No C- 07B.2

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

RECORD OF BOREHOLE No 08B-1

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4940833, Easting - 210295 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 23.8.07 - 23.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		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			STANDARD 20 40 60 80 100	DYN. CONE 20 40 60 80 100					
322.52 0.00 322.22 0.30	Ground 300 mm TOPSOIL Silty CLAY TILL, CL Reddish brown, moist, hard, with embedded sand and gravel, occasional clayey silt layers.													
			1	SPT	34		322	40	60		18	28		7 27 40 26 (66)
			2	SPT	68		321	60	80		18	28		
			3	SPT	77		320	80	100		18	28		10 28 38 24 (62)
			4	SPT	35						18	28		
319.01 3.51	End of Borehole.													Borehole dry and open @ completion.

JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

RECORD OF BOREHOLE No 08B-2

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4940838, Easting - 210310 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 23.8.07 - 23.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		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						
										WATER CONTENT (%)					
322.48 0.00	Ground													GR SA SI CL	
320.19 2.29	200 mm Granular FILL FILL Brown, moist, loose to compact, consisting of gravel, sand some silt and trace clay.													43 42 12 3 (15)	
			1	SPT	13										
			2	SPT	9										
317.45 5.03	Silty CLAY TILL, CL Reddish brown, moist, hard to very stiff, with embedded sand and gravel, occasional clayey silt layers.		3	SPT	31									19 33 31 16 (48)	
			4	SPT	48										
			5	SPT	53										
317.45 5.03	End of Borehole.		6	SPT	15									16 27 37 20 (57)	
														Borehole dry and open @ completion.	

JOE MTO 07-6-IEG1B.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 08B-3

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4940840, Easting - 210316 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 23.8.07 - 23.8.07 CHECKED BY JL

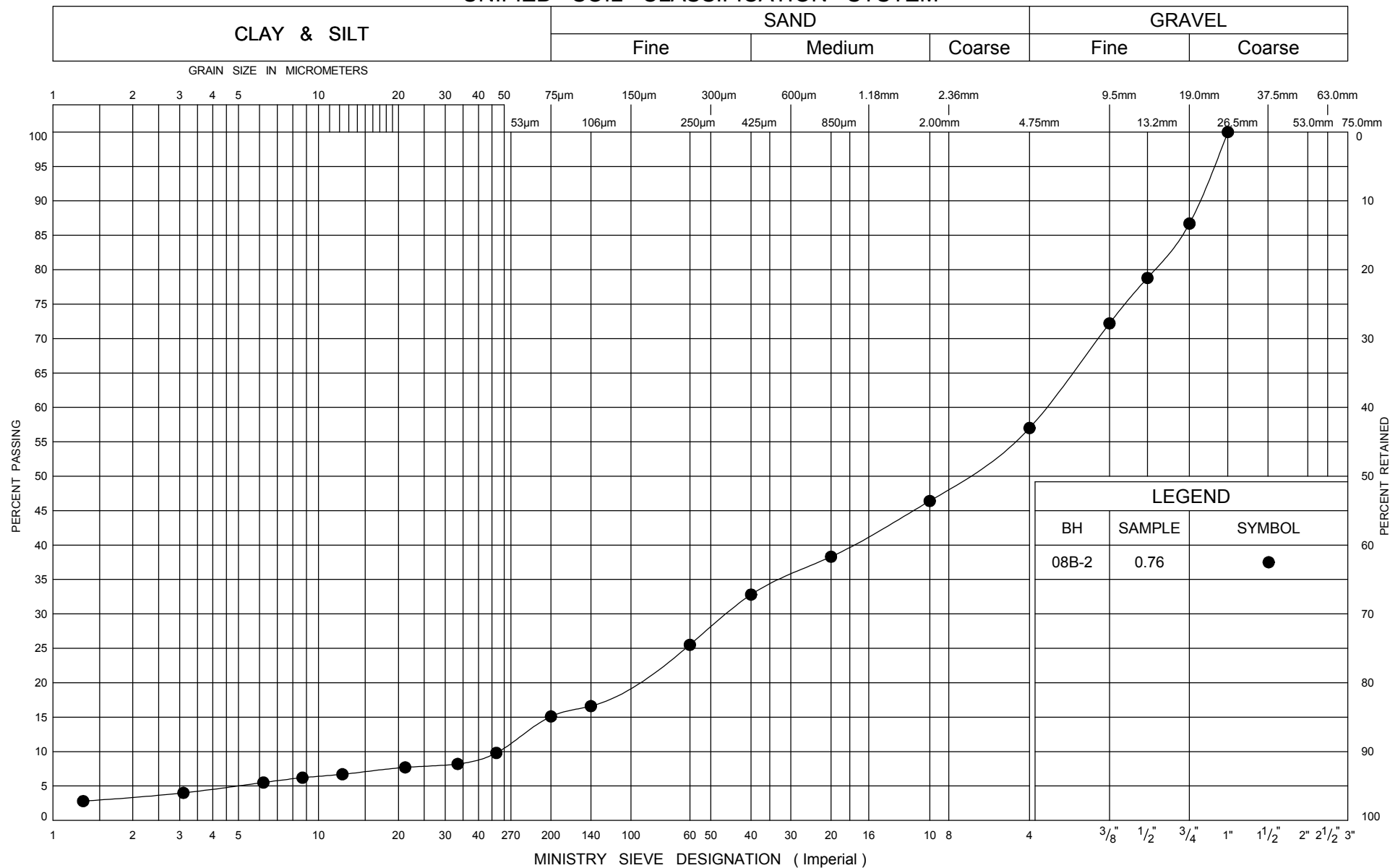
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			STANDARD 20 40 60 80 100	DYN. CONE 20 40 60 80 100					
320.77 0.00	Ground													
	200 mm TOPSOIL													
	Silty CLAY TILL, CL Reddish brown, moist, stiff to hard, with embedded sand and gravel, frequent clayey silt layers.		1	SPT	13		320						21.3	15 33 37 15 (52)
			2	SPT	36		319							
			3	SPT	44		318							
			4	SPT	50									
317.42 3.35	End of Borehole.													Borehole dry and open @ completion.

JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

Ontario

GRAIN SIZE DISTRIBUTION

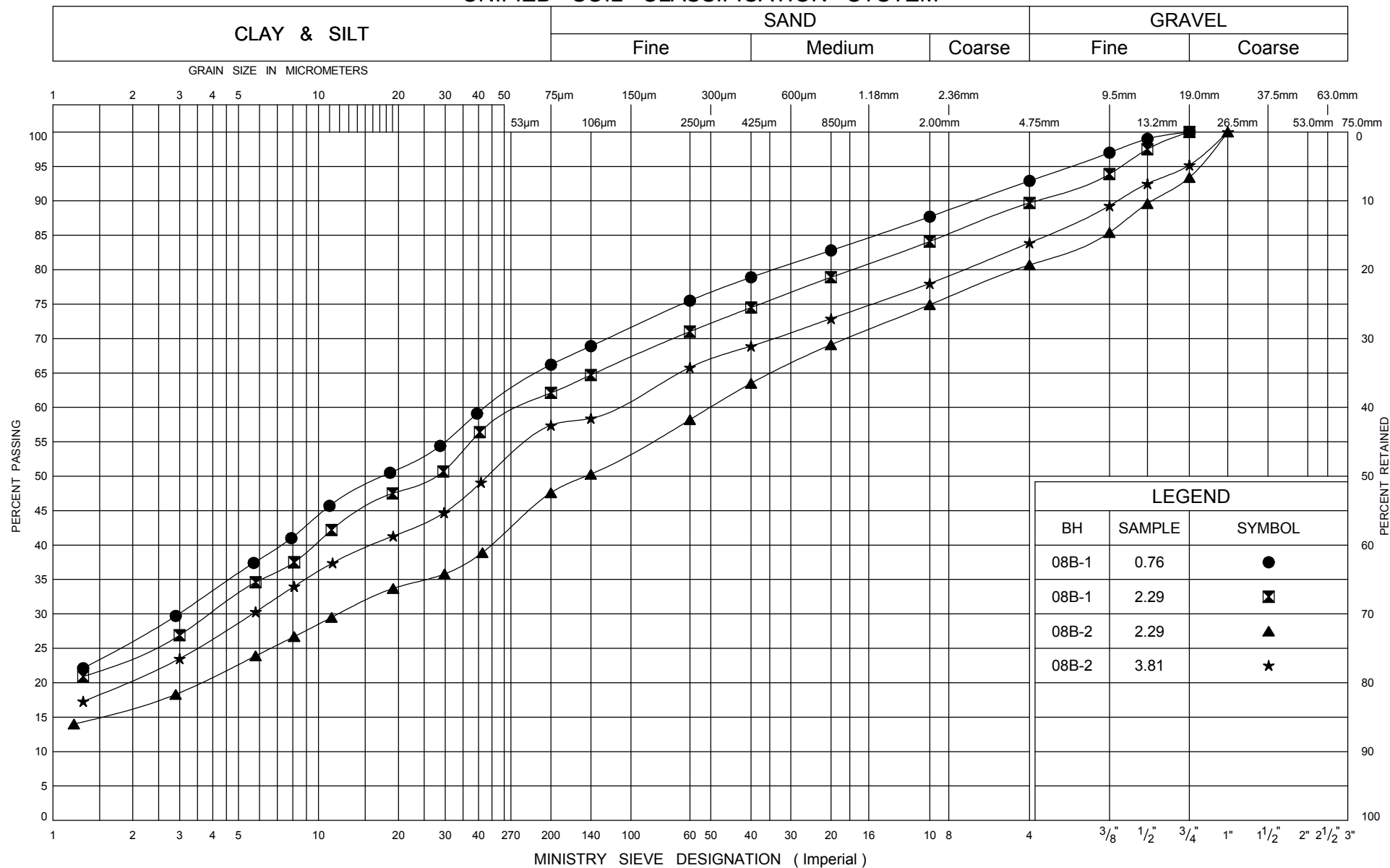
FILL

FIG No C-08B.1

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

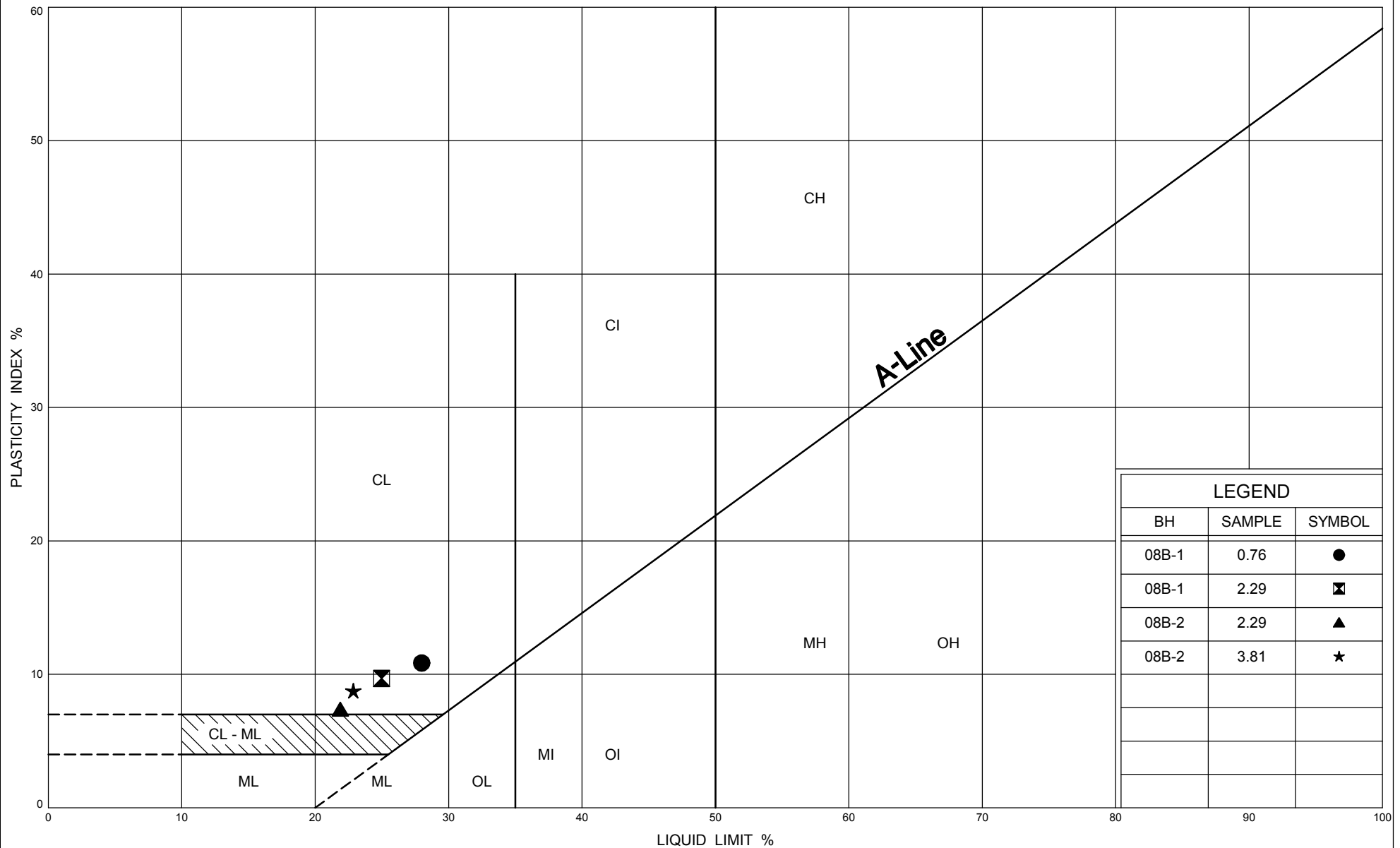
GRAIN SIZE DISTRIBUTION

SILTY CLAY TILL, CL

FIG No C-08B.2

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford



Ministry of
Transportation

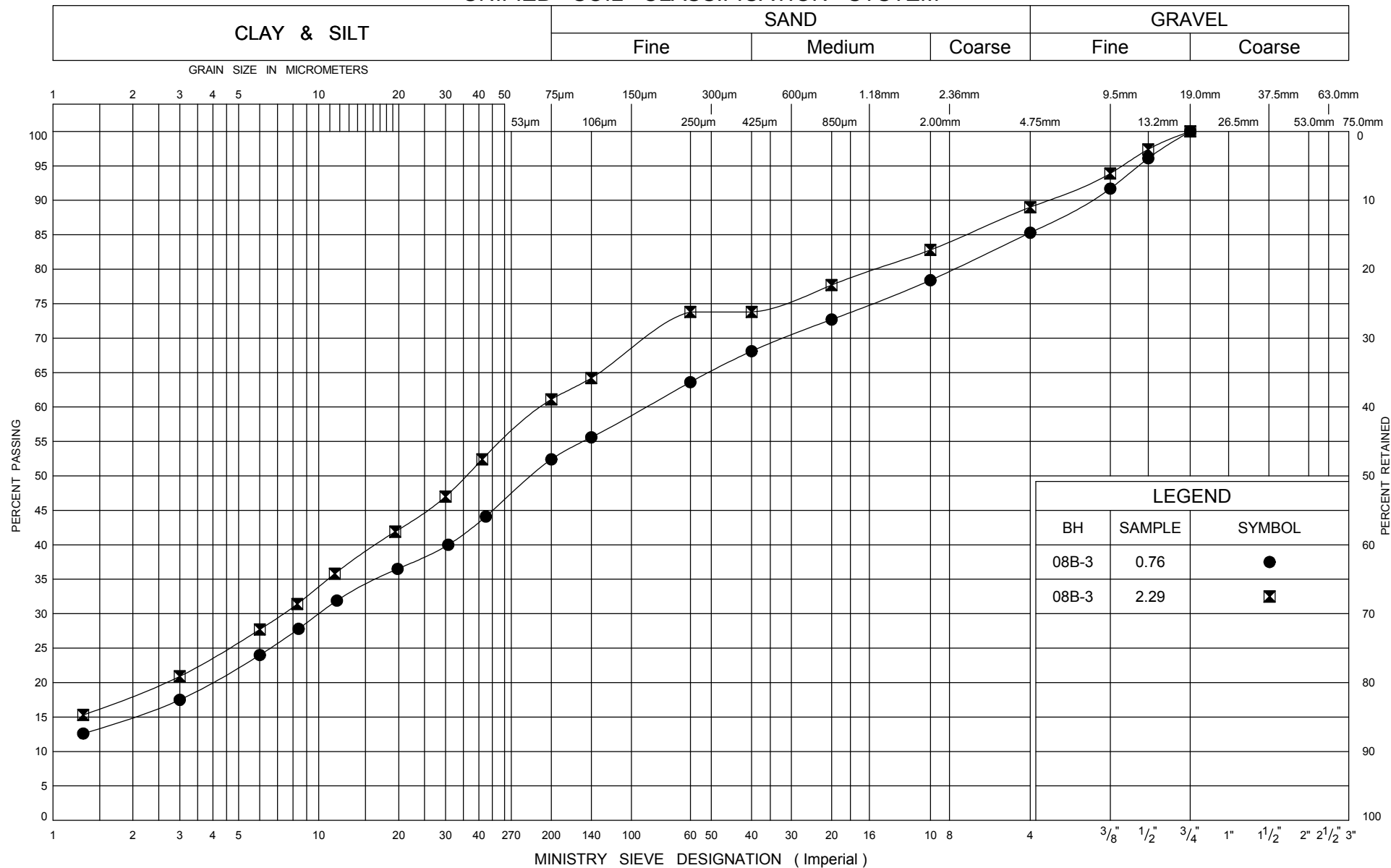
PLASTICITY CHART SILTY CLAY TILL, CL

FIG No C- 08B.3

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM



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Ontario

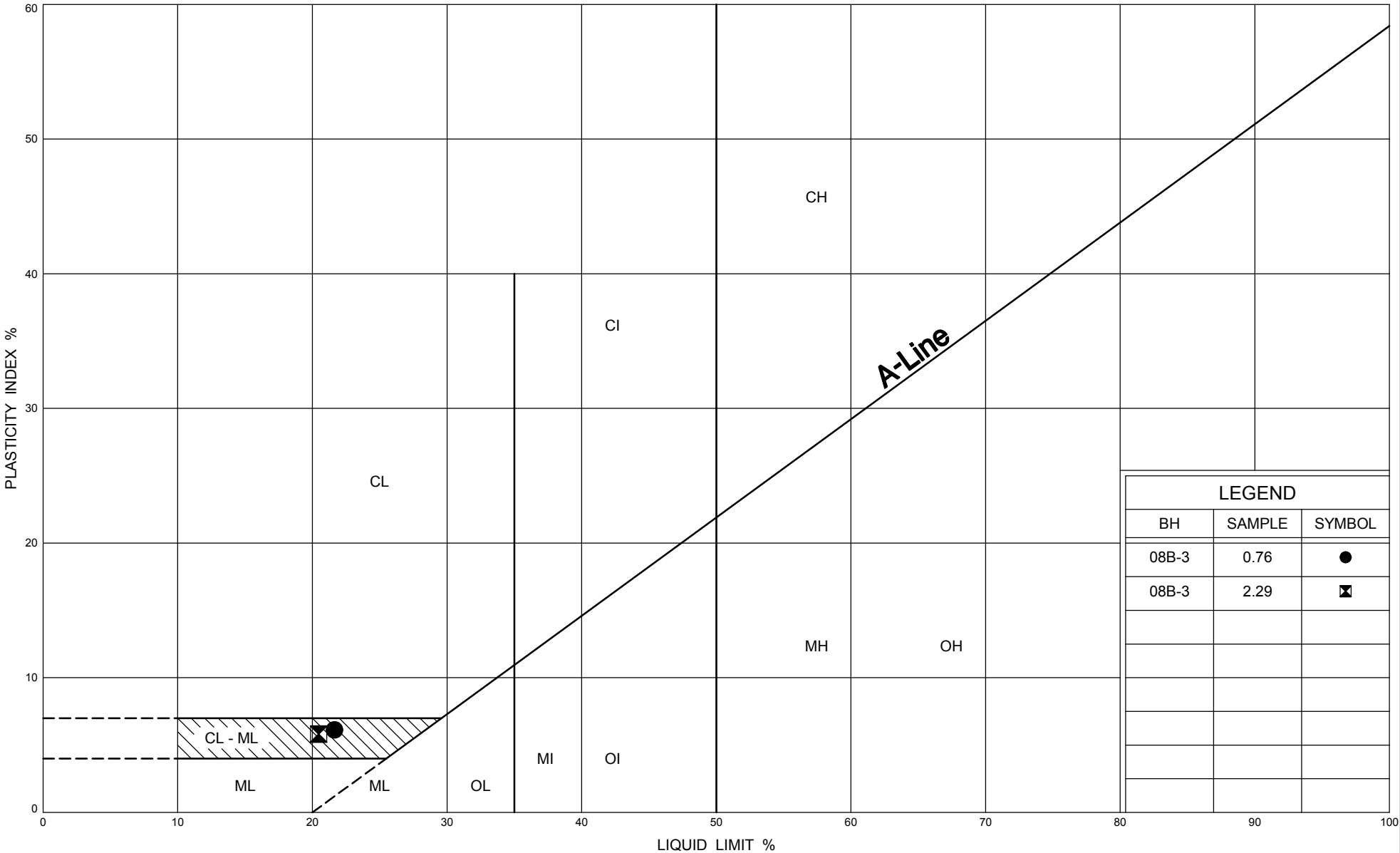
GRAIN SIZE DISTRIBUTION

CLAYEY SILT LAYERS, CL-ML

FIG No C-08B.4

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford



Ministry of
Transportation

PLASTICITY CHART
CLAYEY SILT LAYERS, CL-ML

FIG No C- 08B.5

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

RECORD OF BOREHOLE No 09B-1

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4941050, Easting - 211235 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 22.8.07 - 22.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		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			STANDARD 20 40 60 80 100	DYN. CONE 20 40 60 80 100					
266.93 0.00	Ground 150mm TOPSOIL													
	Clayey SILT to Silty CLAY TILL, CL-ML to CL Reddish brown, moist, very stiff to hard, with embedded sand and gravel, silt seams pockets and layers, occasional cobble layers.		1	SPT	22		266	●		○	175			
			2	SPT	34		265	●		○	225+			13 22 49 16 (65)
			3	SPT	100+					○	225+			
			4	SPT	57		264	●		○	225+			2 20 58 21 (79)
			5	SPT	95		263	●		○	225+			
			6	SPT	98		262	●		○	225+			7 24 49 20 (69)
			7	SPT	95					○	225+			
			8	SPT	100+		261	●		○	225+			
260.53 6.40	End of Borehole.												23.6	Borehole dry and open @ completion.

JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

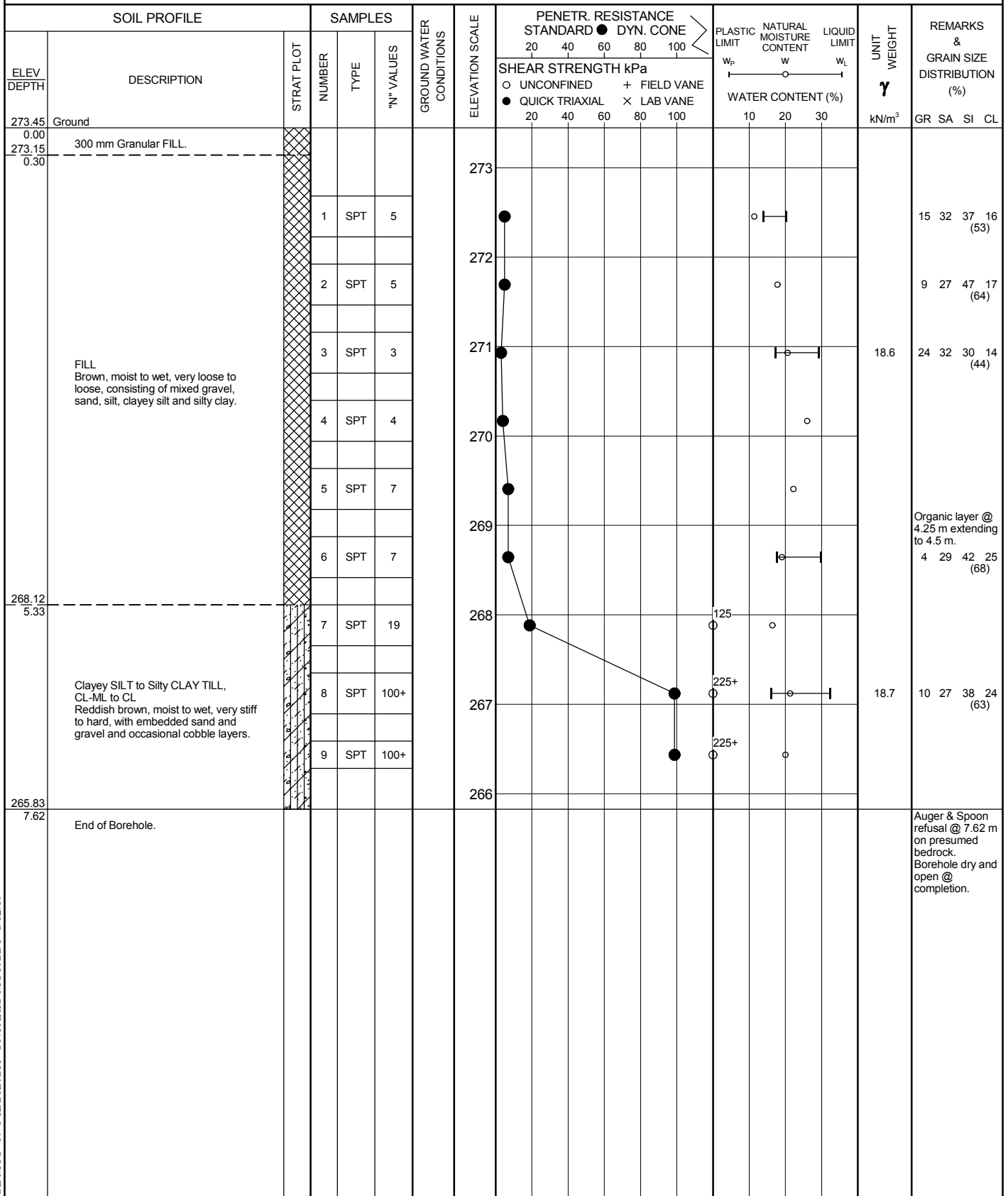
○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 09B-2

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4941073, Easting - 211229 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 20.8.07 - 20.8.07 CHECKED BY JL



JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to Sensitivity

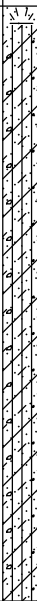
○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 09B-4

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4941100, Easting - 211215 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 22.8.07 - 22.8.07 CHECKED BY JL

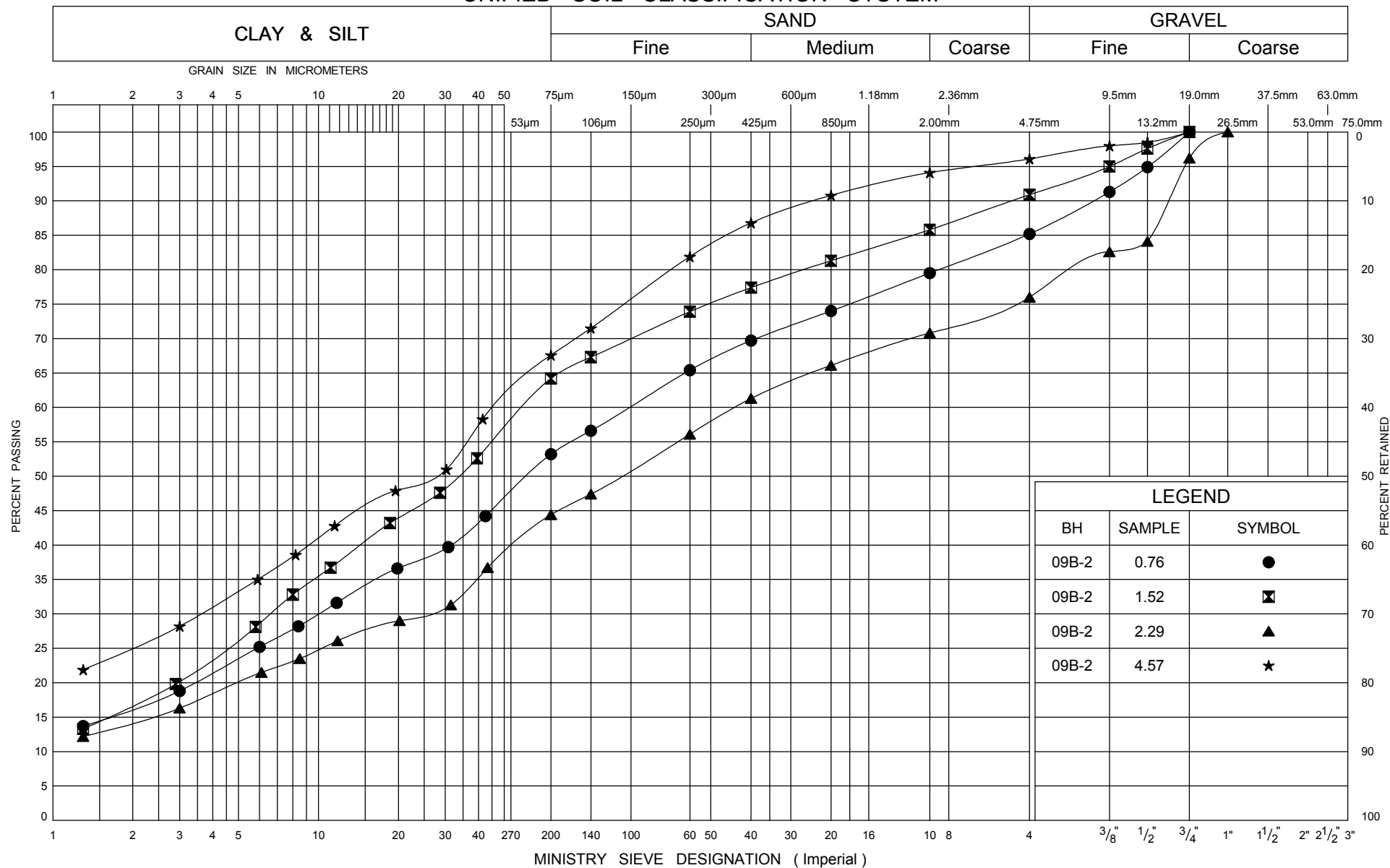
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE						
								● QUICK TRIAXIAL	× LAB VANE						
						20 40 60 80 100	20 40 60 80 100	10 20 30							
268.55 0.00	Ground 150mm TOPSOIL.		1	SPT	23		268			150			22.2	2 27 56 14 (71)	
	Clayey SILT to Silty CLAY TILL, CL-ML to CL Reddish brown, moist, very stiff to hard, with embedded sand and gravel, and occasional cobble layers, interbedded with silt seams, pockets and layers.		2	SPT	34		267			225+			19.8		
			3	SPT	90		266			225+					
			4	SPT	100+		265			225+			2 37 51 10 (61)		
			5	SPT	100+		264			225+					
263.83 4.72			End of Borehole.	6	SPT		100+	264			225+				Spoon and auger refusal @ 4.72 m. Borehole dry and open @ completion.

JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

Ontario

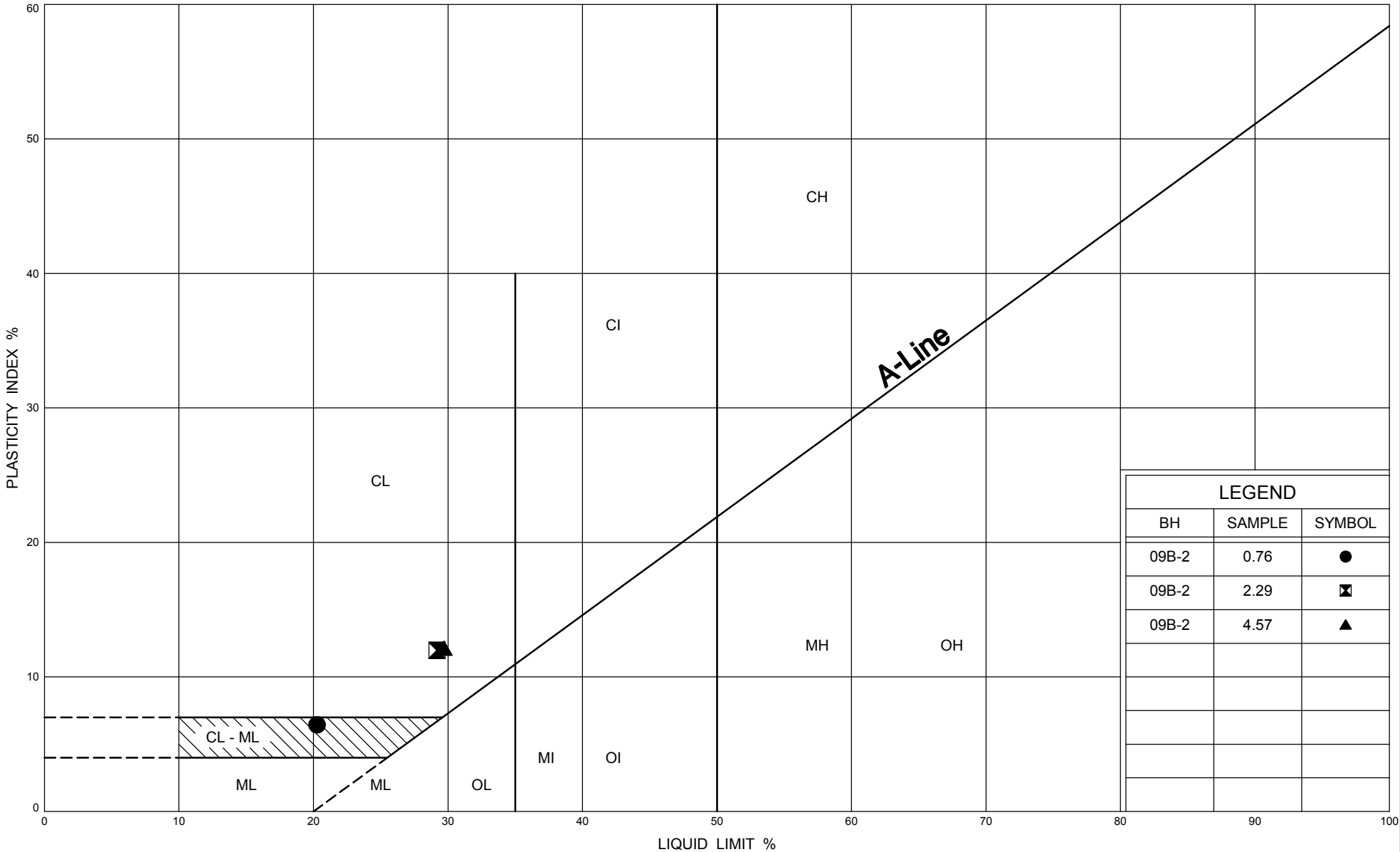
GRAIN SIZE DISTRIBUTION

FILL

FIG No C-09B.1

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford



Ministry of
Transportation

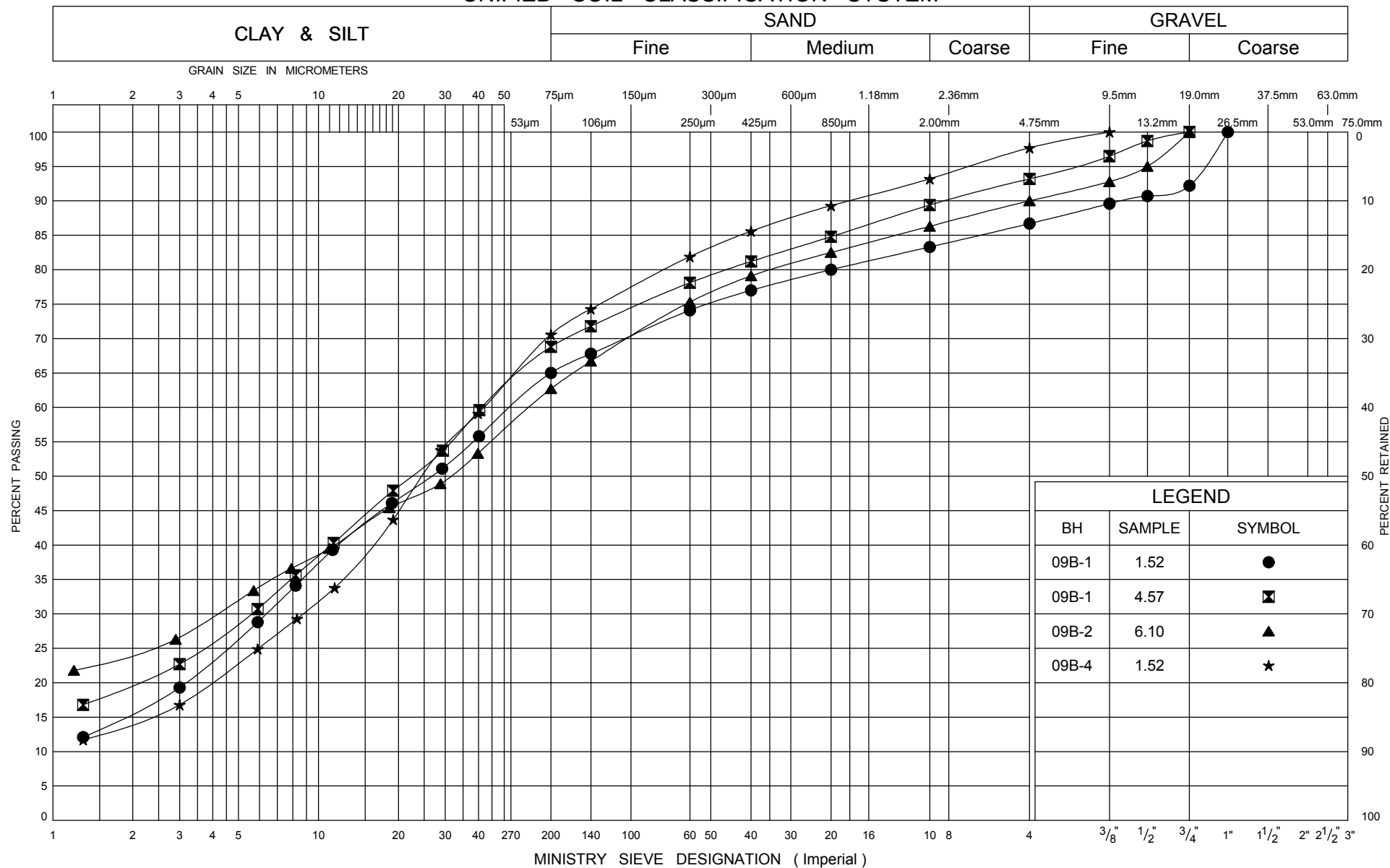
PLASTICITY CHART
FILL

FIG No C- 09B.2

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

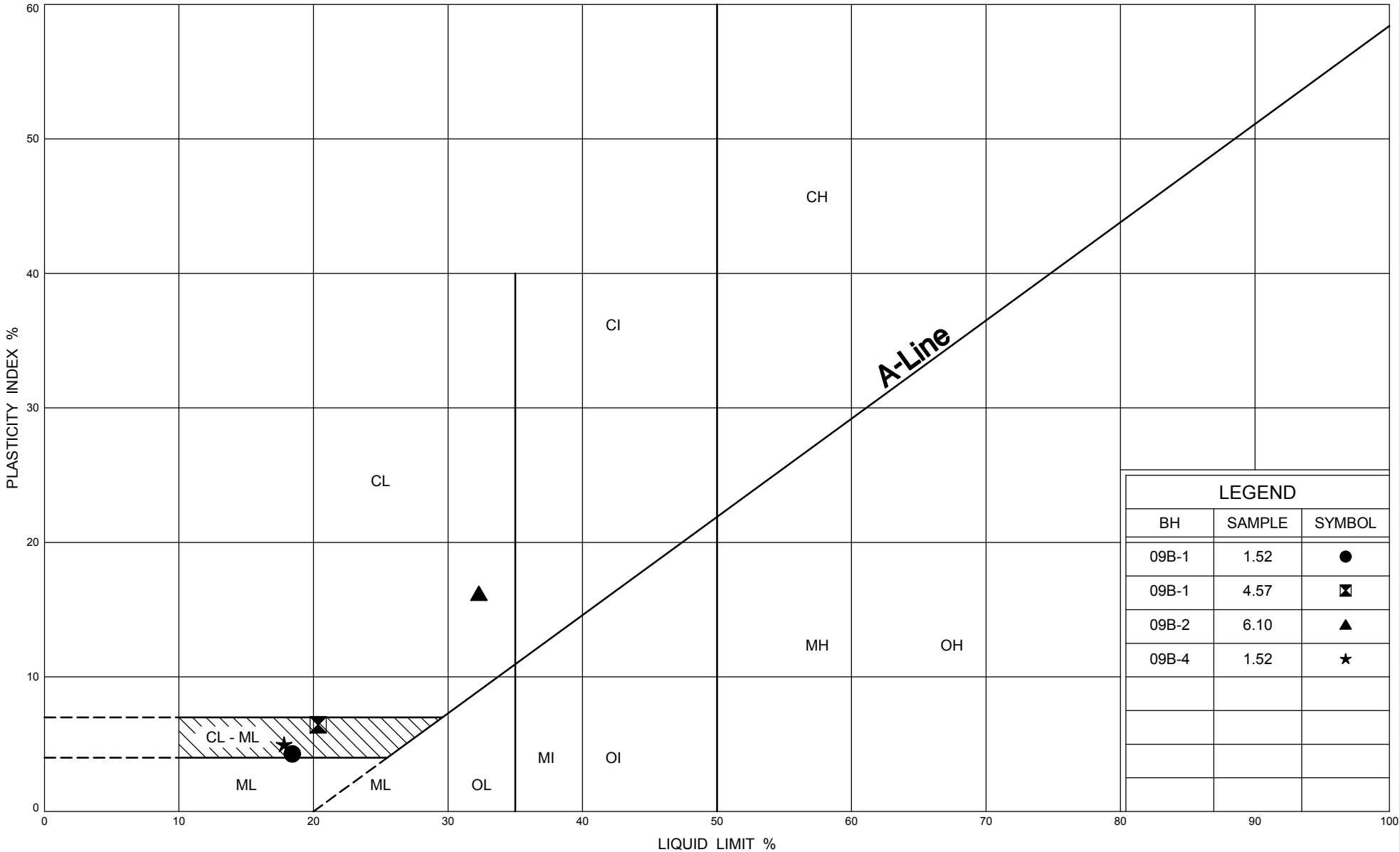
Ontario

GRAIN SIZE DISTRIBUTION
CLAYEY SILT TO SILTY CLAY TILL, CL-ML TO CL

FIG No C-09B.3

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford



Ministry of
Transportation

PLASTICITY CHART
CLAYEY SILT TO SILTY CLAY TILL, CL-ML TO CL

FIG No C- 09B.4

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

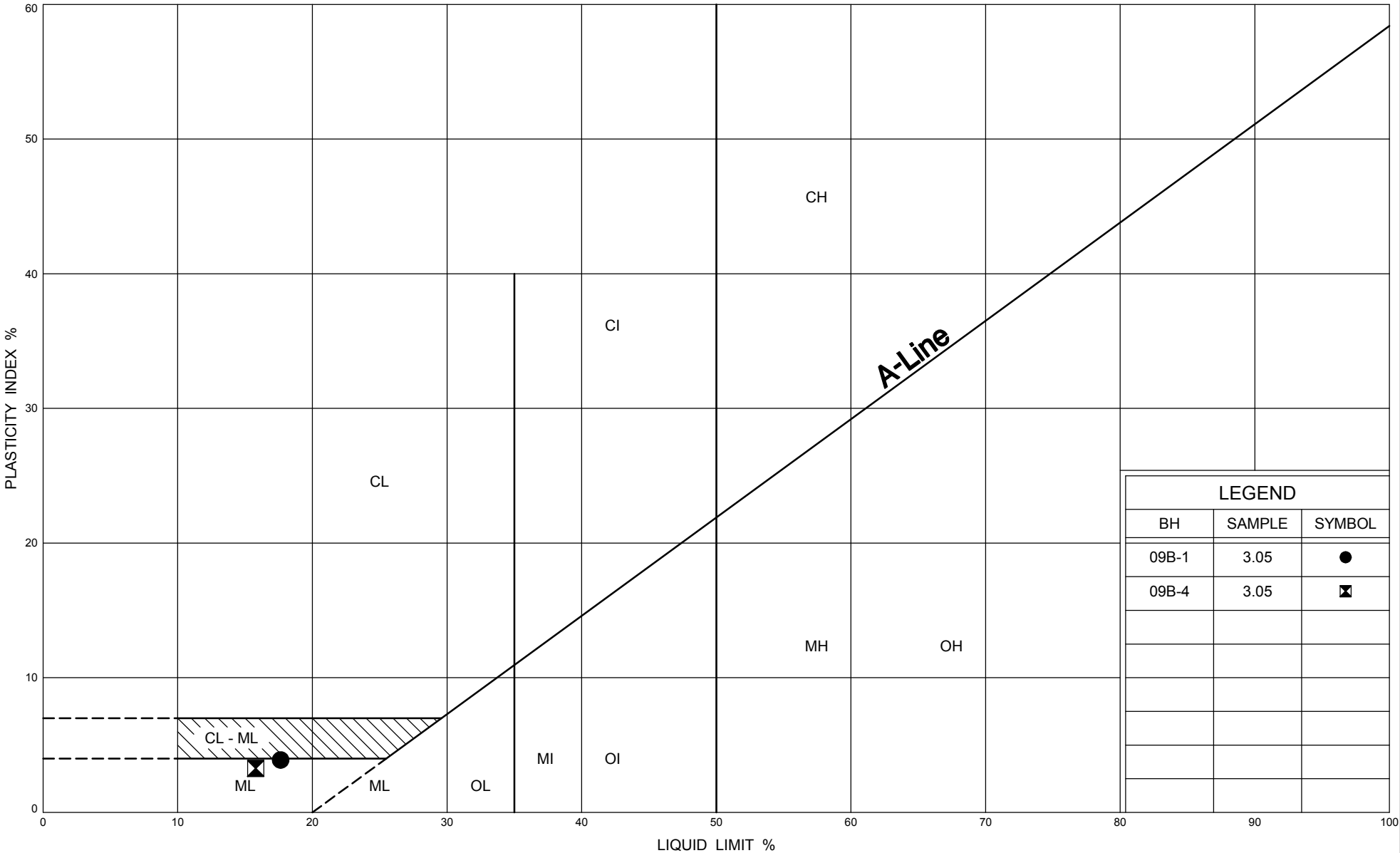


GRAIN SIZE DISTRIBUTION
SILT SEAMS, POCKETS AND LAYERS, ML

Hwy 26 - Sydenham Townline to Meaford

ONTARIO MOT PLASTICITY CHART SMALL CULVE 07-6-JEGIB.GPJ ONTARIO MOT.GDT 19/11/09

Oct 75, FF - S - 21



LEGEND		
BH	SAMPLE	SYMBOL
09B-1	3.05	●
09B-4	3.05	⊠

1 OF 1

METRIC

W.P.	GWP 167-91-00	LOCATION	Northing - 4941185, Easting - 211678	ORIGINATED BY	RB
DIST	Owen Sound HWY 26	BOREHOLE TYPE	S/S Augering, 110 mm dia.	COMPILED BY	NN
DATUM	Geodetic	DATE	28.8.07 - 28.8.07	CHECKED BY	JL

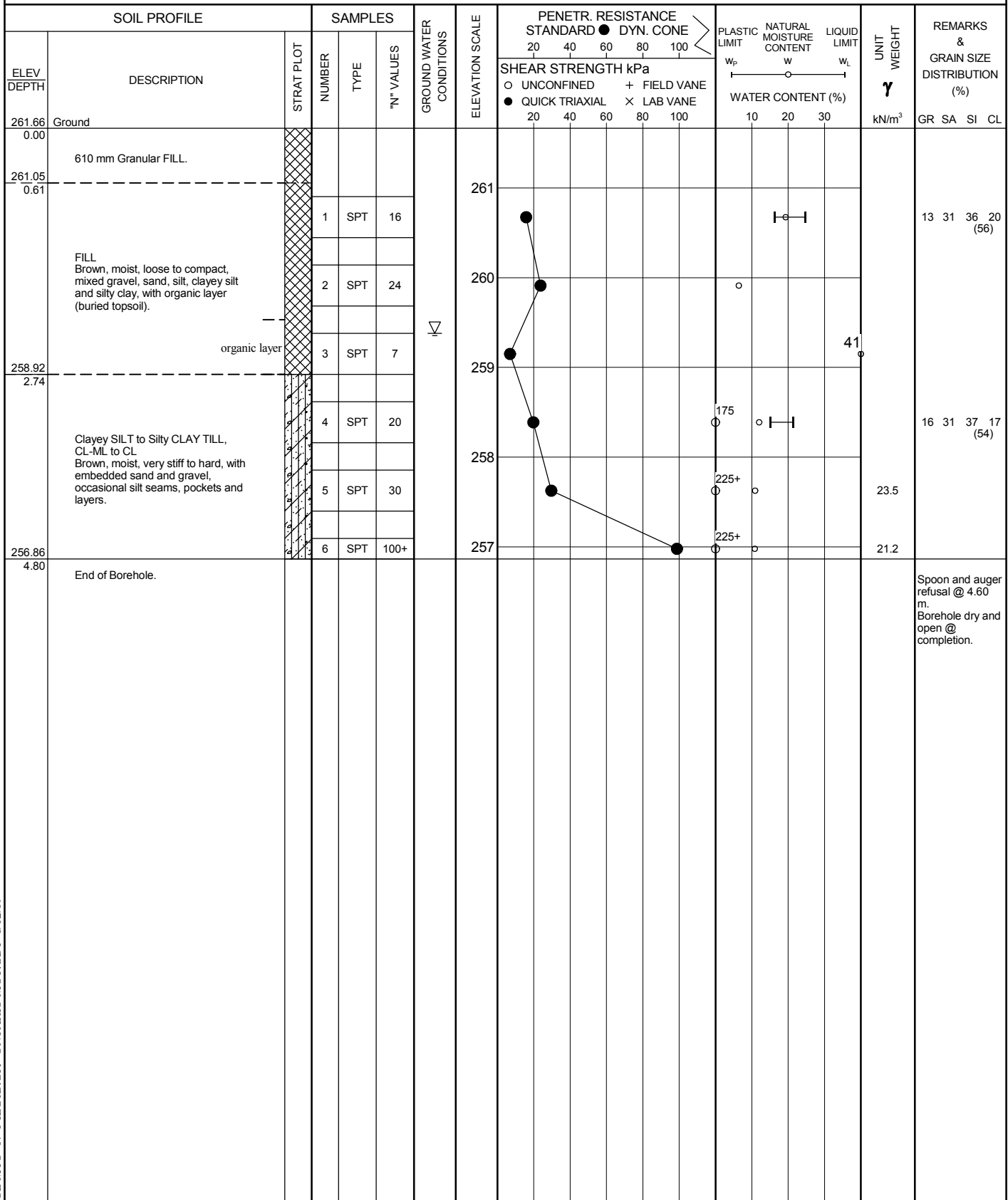
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE						
259.20	Ground							● QUICK TRIAXIAL	× LAB VANE						
0.00	75 mm TOPSOIL.		1	SPT	20		259			225+				18 31 39 12 (51)	
	Clayey SILT to Silty CLAY TILL, CL-ML to CL Brown, moist, very stiff to hard, with embedded sand and gravel, occasional silt seams, pockets and layers.		2	SPT	26		258			225+					
			3	SPT	80		257			225+				5 29 42 24 (66)	
			4	SPT	92		256			225+					
255.69			End of Borehole.											Borehole dry and open @ completion.	
3.51															

RECORD OF BOREHOLE No 10B-2

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4941198, Easting - 211674 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 16.8.07 - 16.8.07 CHECKED BY JL



JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

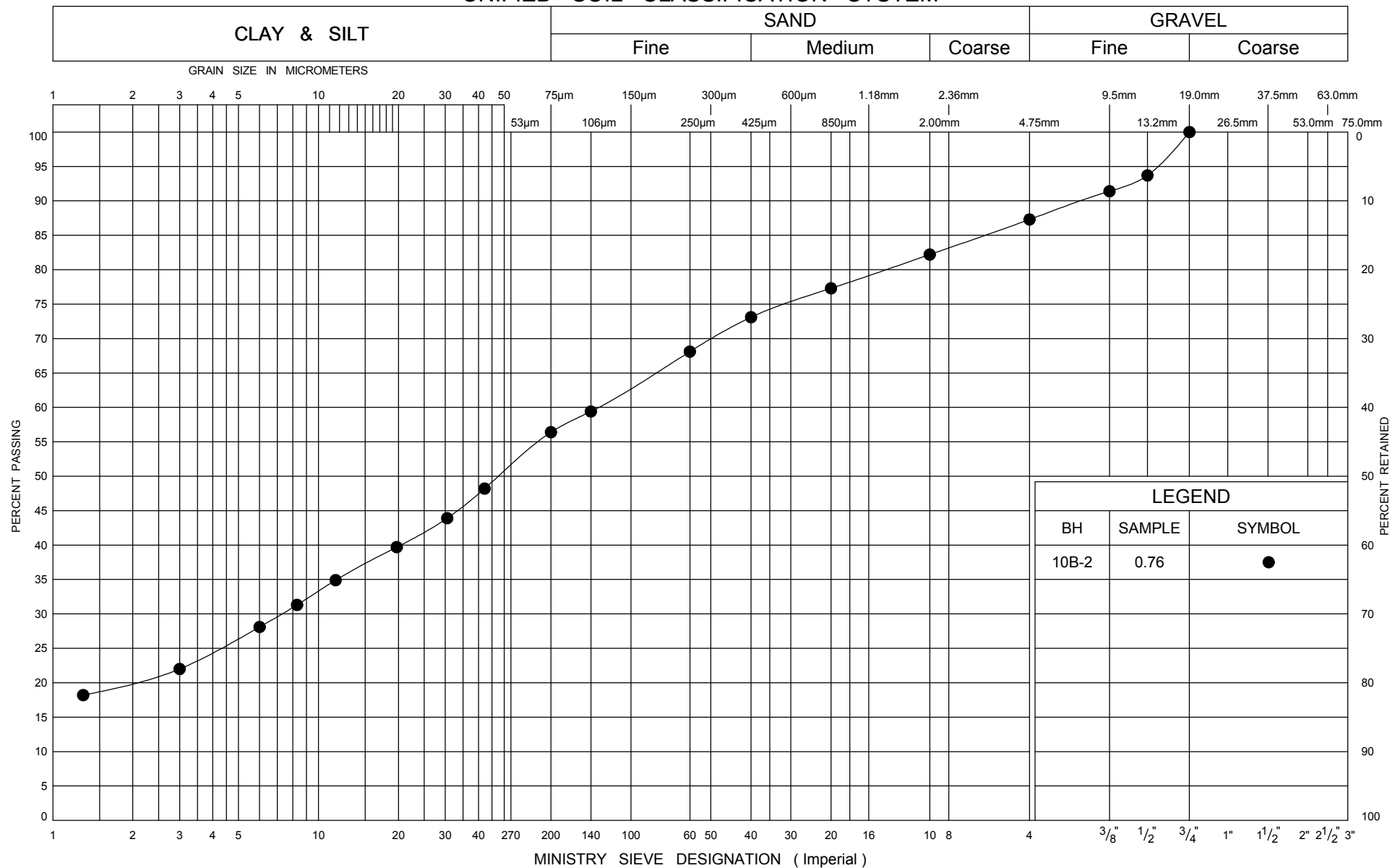
1 OF 1

METRIC

W.P.	GWP 167-91-00	LOCATION	Northing - 4941224, Easting - 211668	ORIGINATED BY	RB
DIST	Owen Sound HWY 26	BOREHOLE TYPE	S/S Augering, 110 mm dia.	COMPILED BY	NN
DATUM	Geodetic	DATE	28.8.07 - 28.8.07	CHECKED BY	JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL						× LAB VANE		
260.81 0.00	Ground 150 mm TOPSOIL.																	
	Clayey SILT to Silty CLAY TILL, CL-ML to CL Brown, moist, very stiff to hard, with embedded sand and gravel, occasional silt seams, pockets and layers.		1	SPT	16													
			2	SPT	20													
			3	SPT	29													
			4	SPT	100+													
			5	SPT	100+													
256.54 4.27	End of Borehole.														Borehole dry and open @ completion.			

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

Ontario

GRAIN SIZE DISTRIBUTION

FILL

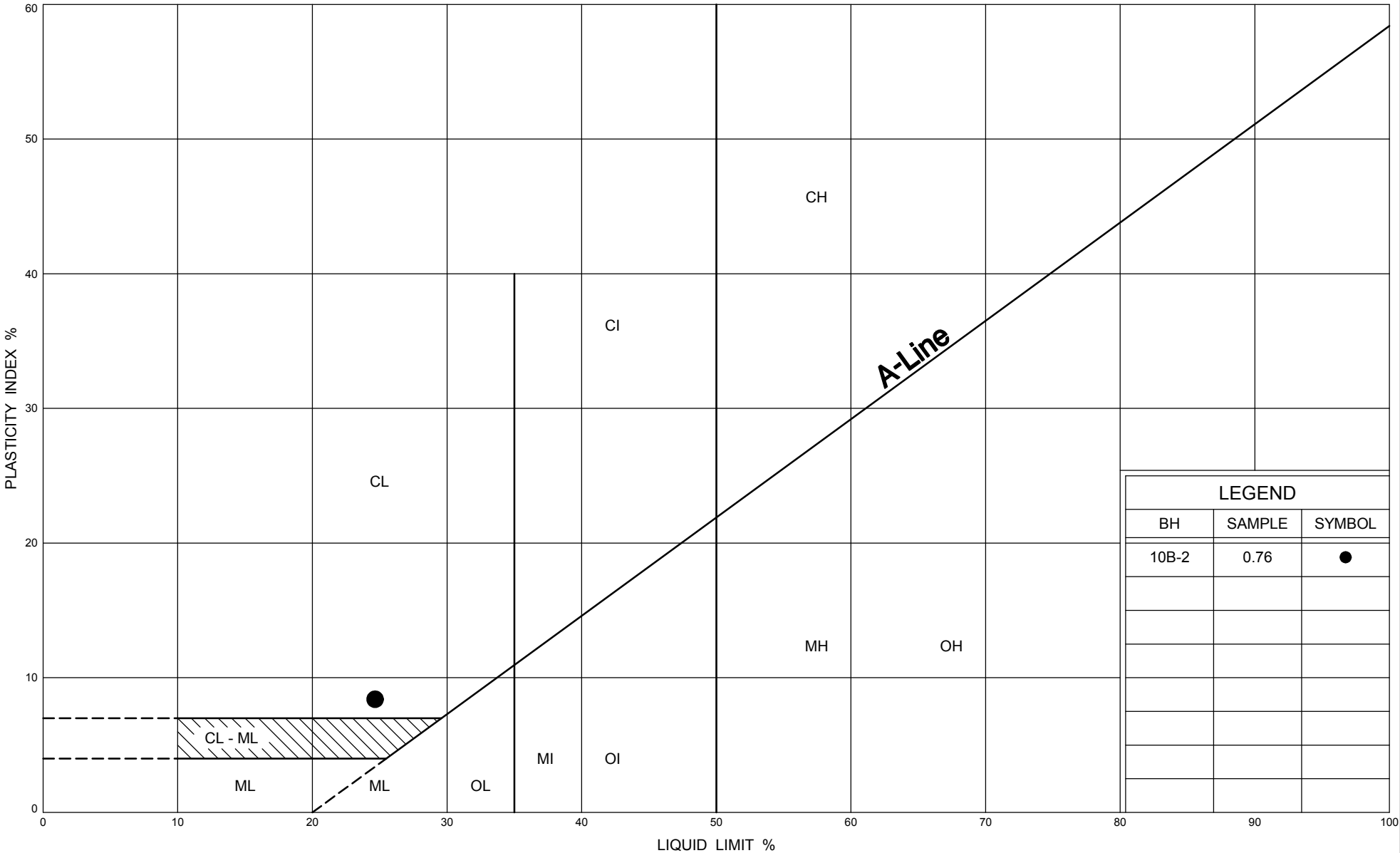
FIG No C- 10B.1

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

ONTARIO MOT PLASTICITY CHART SMALL CULVE 07-6-JEGIB.GPJ ONTARIO MOT.GDT 19/11/09

Oct 75, FF - S - 21



LEGEND		
BH	SAMPLE	SYMBOL
10B-2	0.76	●



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Transportation

Ontario

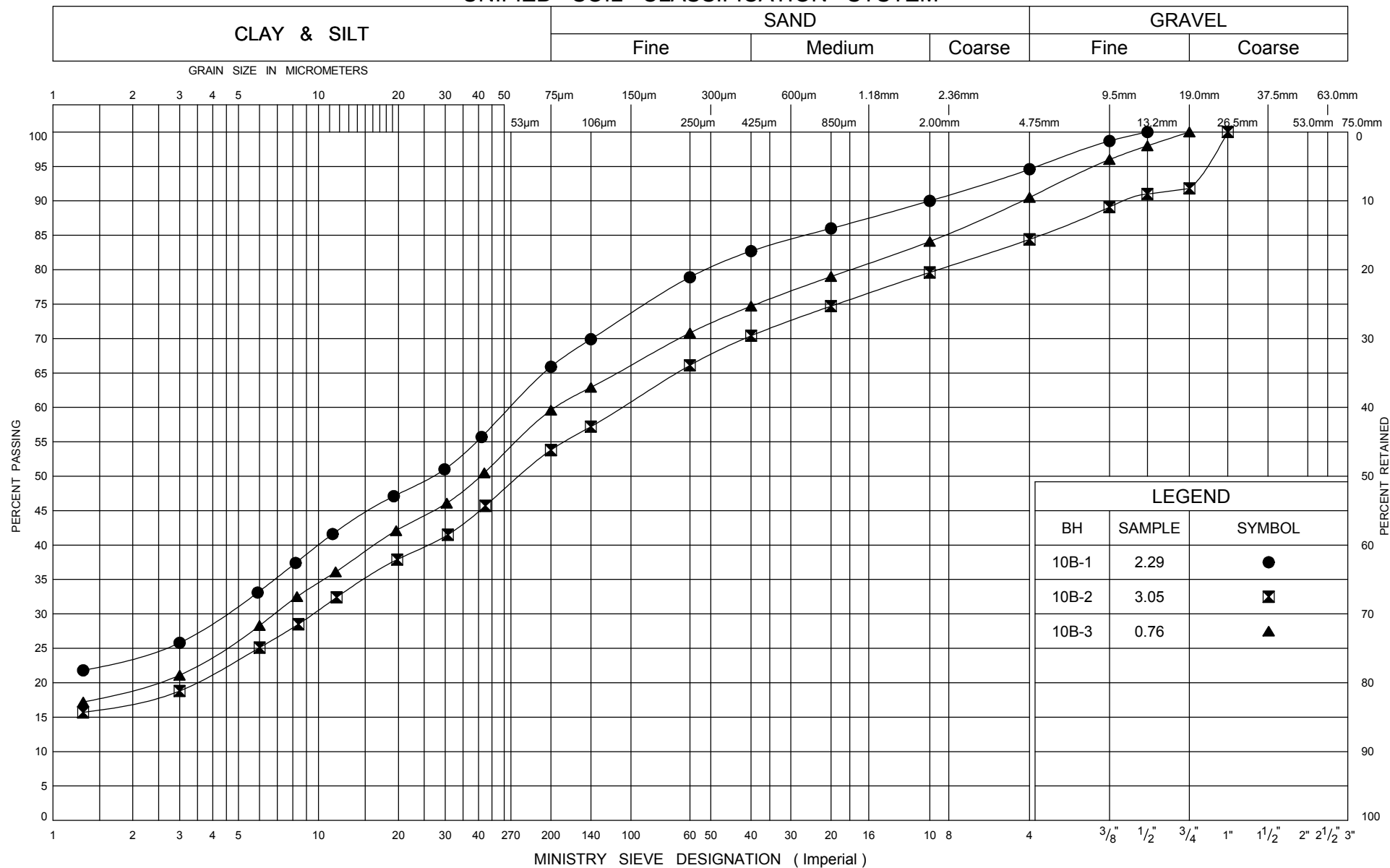
PLASTICITY CHART
FILL

FIG No C- 10B.2

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION
CLAYEY SILT TO SILTY CLAY, CL-ML TO CL

FIG No C- 10B.3

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

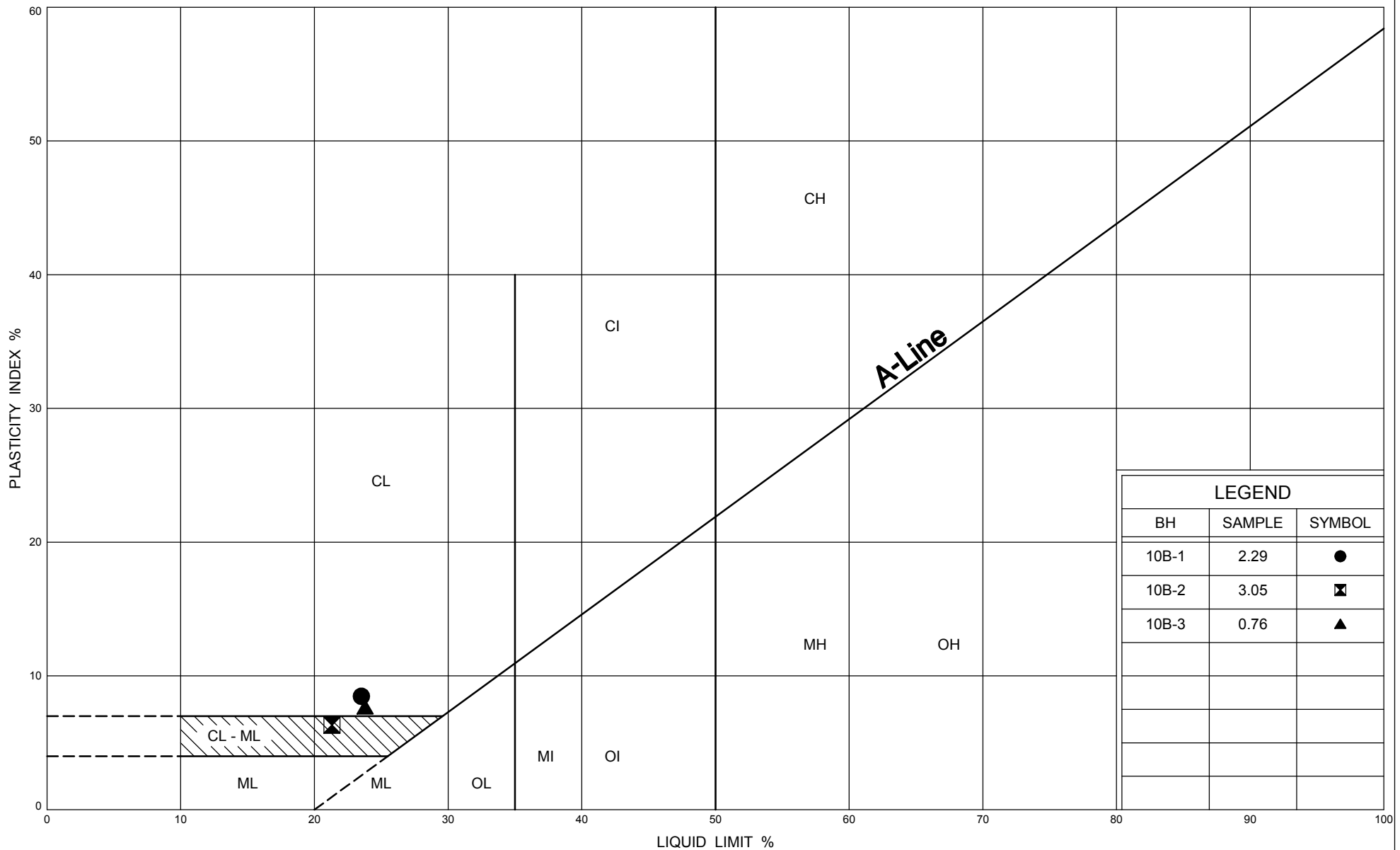


Ministry of
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Ontario

ONTARIO MOT PLASTICITY CHART SMALL CULVE 07-6-JEGIB.GPJ ONTARIO MOT.GDT 19/11/09

Oct 75, FF - S - 21



Ministry of
Transportation

Ontario

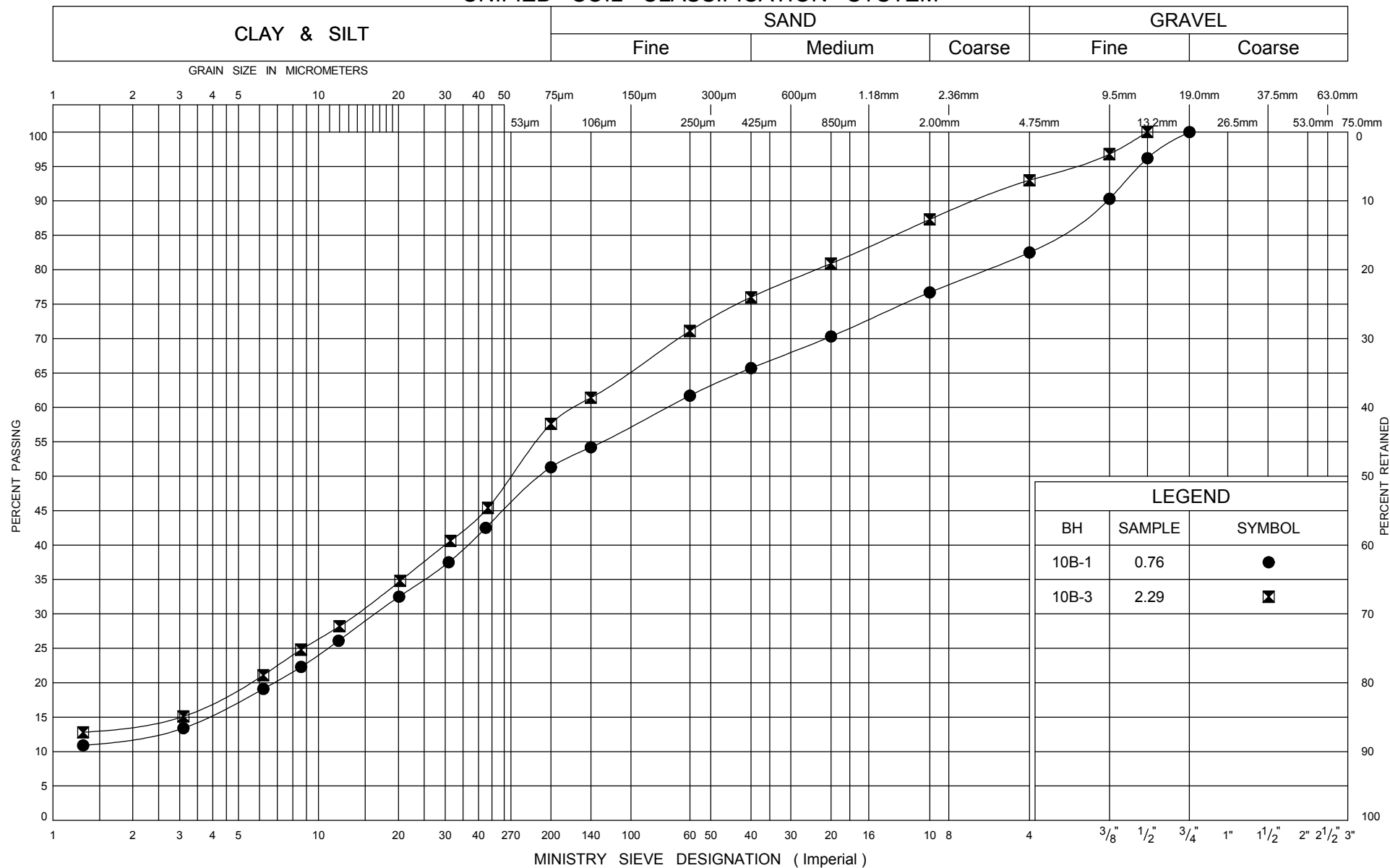
PLASTICITY CHART
CLAYEY SILT TO SILTY CLAY, CL-ML TO CL

FIG No C- 10B.4

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM



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Transportation

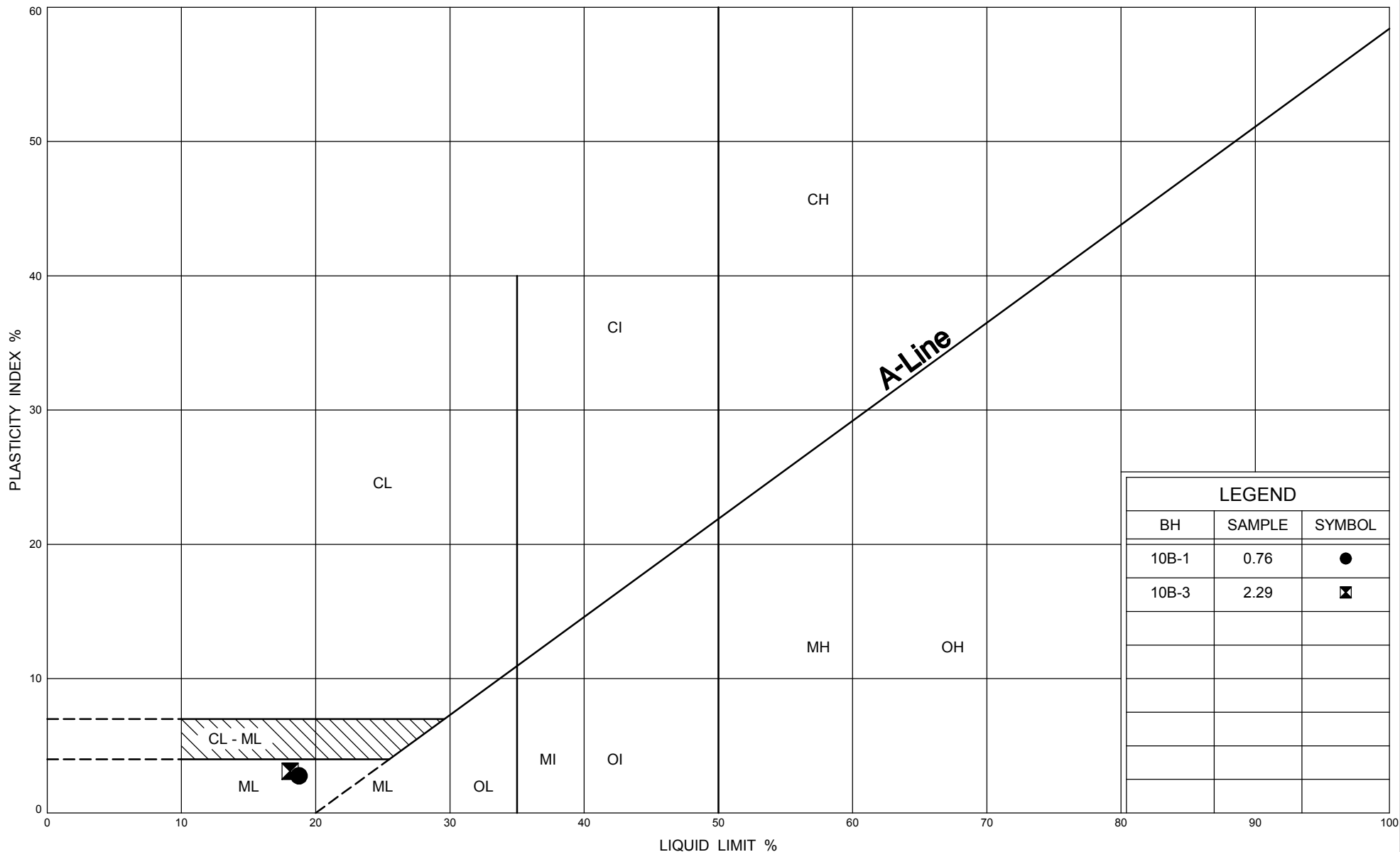
GRAIN SIZE DISTRIBUTION

SILT SEAMS, POCKETS AND LAYERS, ML

FIG No C- 10B.5

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford



Ministry of
Transportation

PLASTICITY CHART SILT SEAMS, POCKETS AND LAYERS, ML

FIG No C- 10B.6

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

RECORD OF BOREHOLE No 11B-1

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4941374, Easting - 212351 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 27.8.07 - 27.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		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			STANDARD 20 40 60 80 100	DYN. CONE 20 40 60 80 100					
240.92 0.00	Ground 75 mm TOPSOIL.													
			1	SPT	78		240							
			2	SPT	35		239							6 34 33 27 (60)
			3	SPT	23		238							
			4	SPT	36		237							8 25 53 14 (67)
236.65 4.27	End of Borehole.		5	SPT	39									Borehole dry and open @ completion.

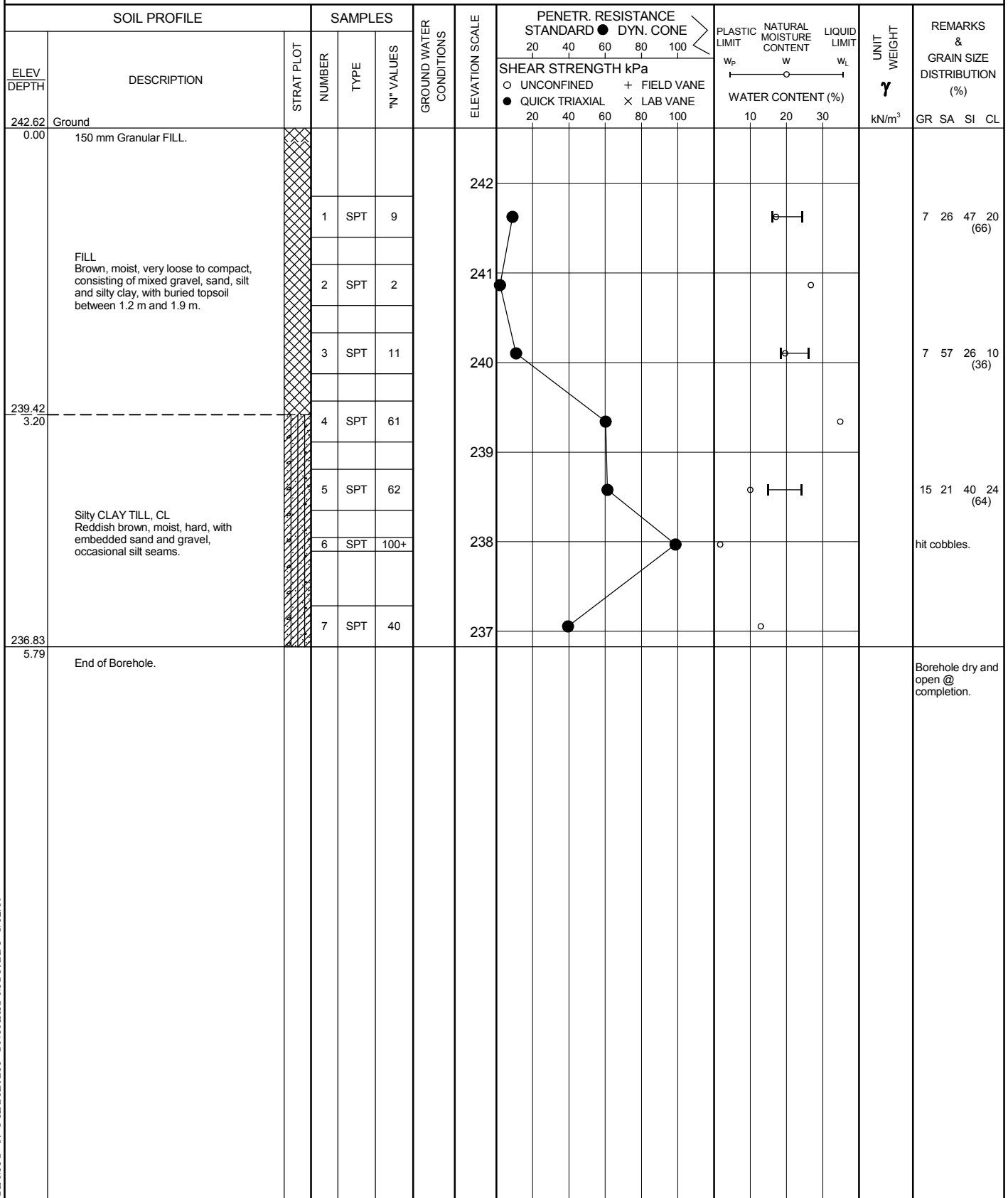
JOE MTO 07-6-IEG1B.GPJ ONTARIO MOT.GDT 8/12/09

RECORD OF BOREHOLE No 11B-2

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4941388, Easting - 212345 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 15.8.07 - 15.8.07 CHECKED BY JL



JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 11B-3

1 OF 1

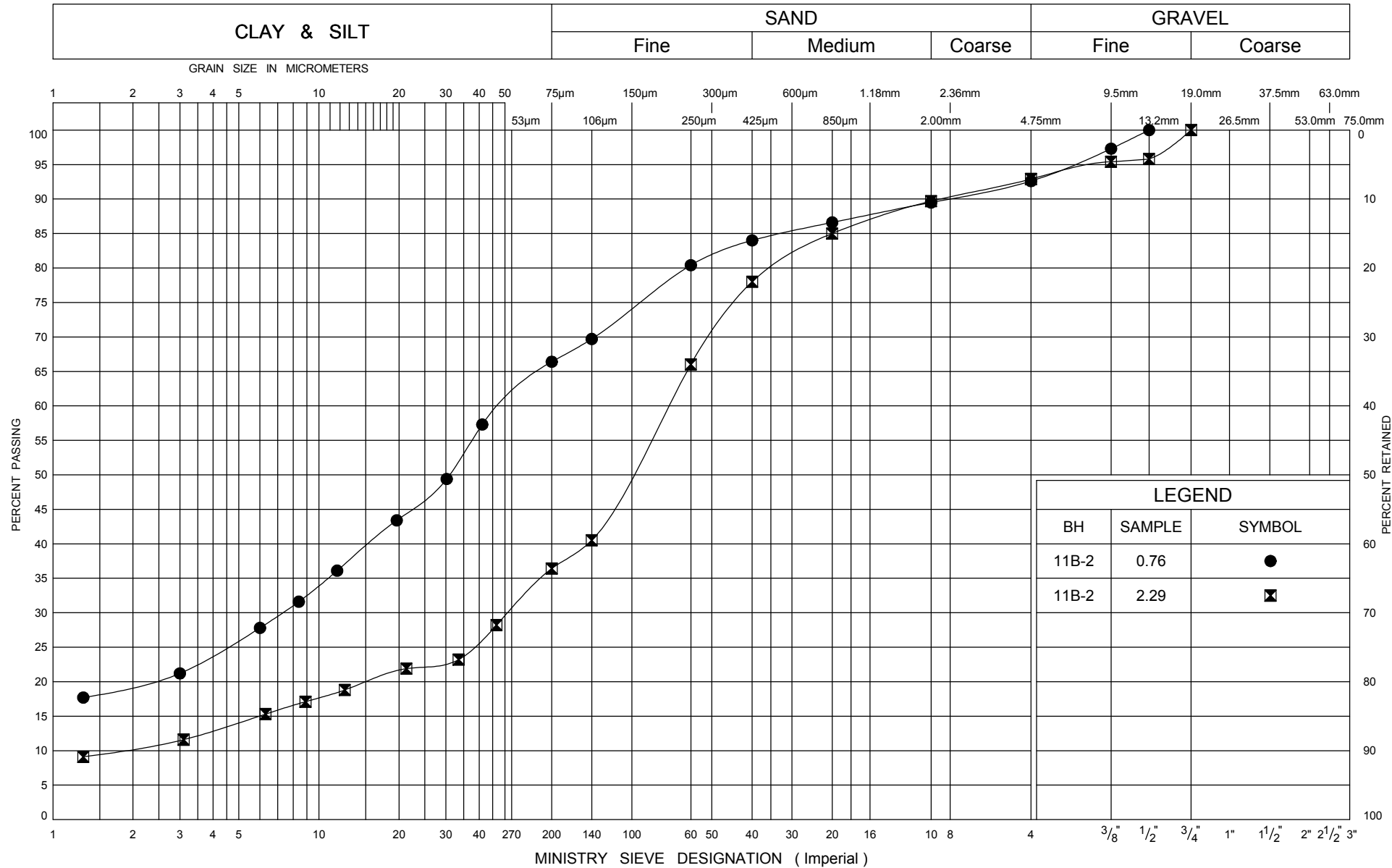
METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4941417, Easting - 212336 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 27.8.07 - 27.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		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			STANDARD 20 40 60 80 100	DYN. CONE 20 40 60 80 100					
241.17 0.00	Ground 150 mm TOPSOIL.						241							
			1	SPT	100+		240							hit cobbles, no recovery.
			2	SPT	35		239							7 25 43 25 (68)
			3	SPT	42		238							
			4	SPT	44		237							
236.90 4.27	End of Borehole.		5	SPT	53									Borehole dry and open @ completion.

JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

FILL

FIG No C- 11B.1

GWP 167-91-00

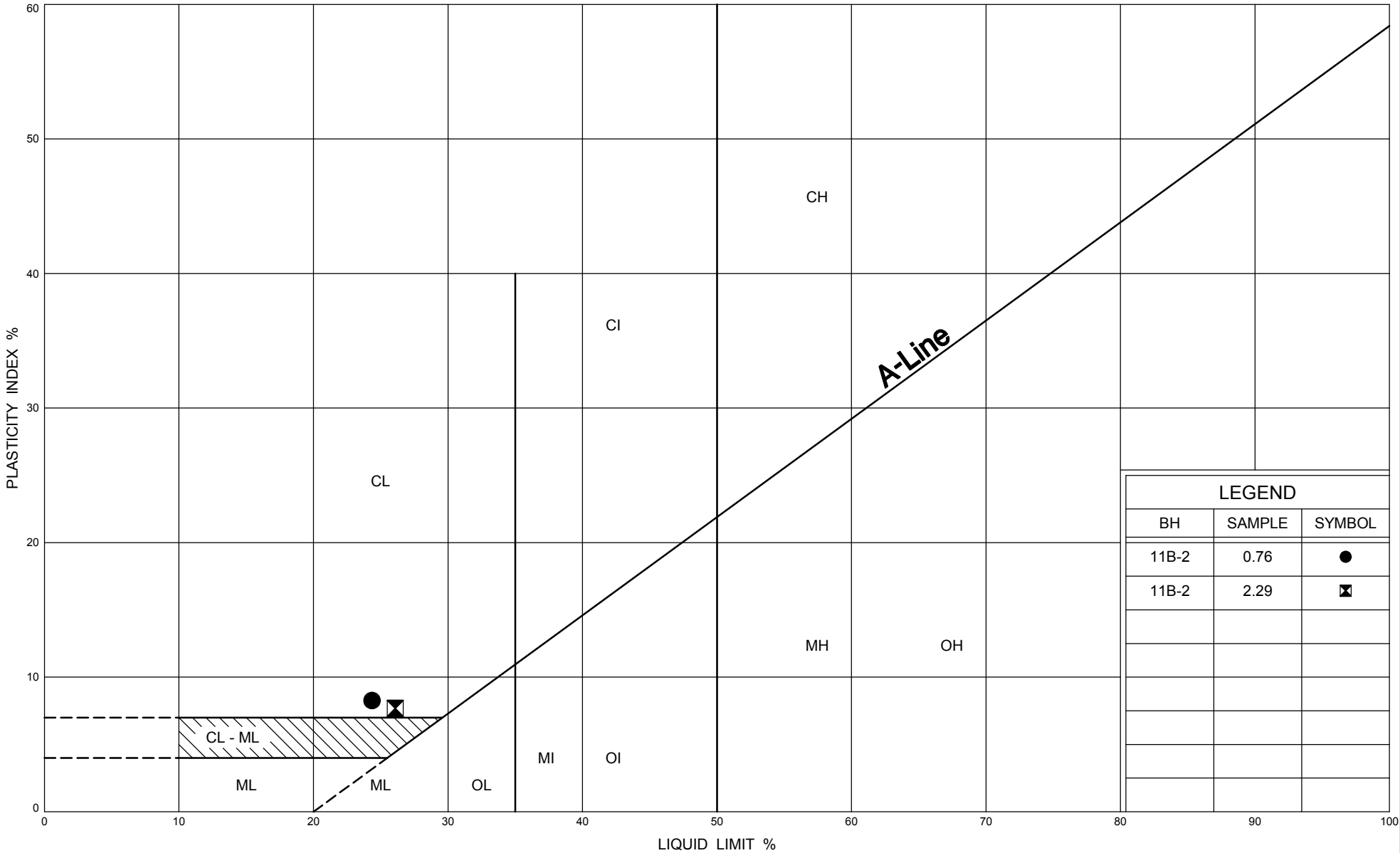
Hwy 26 - Sydenham Townline to Meaford


 Ministry of
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Ontario

ONTARIO MOT PLASTICITY CHART SMALL CULVE 07-6-JEGIB.GPJ ONTARIO MOT.GDT 19/11/09

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Ministry of
Transportation

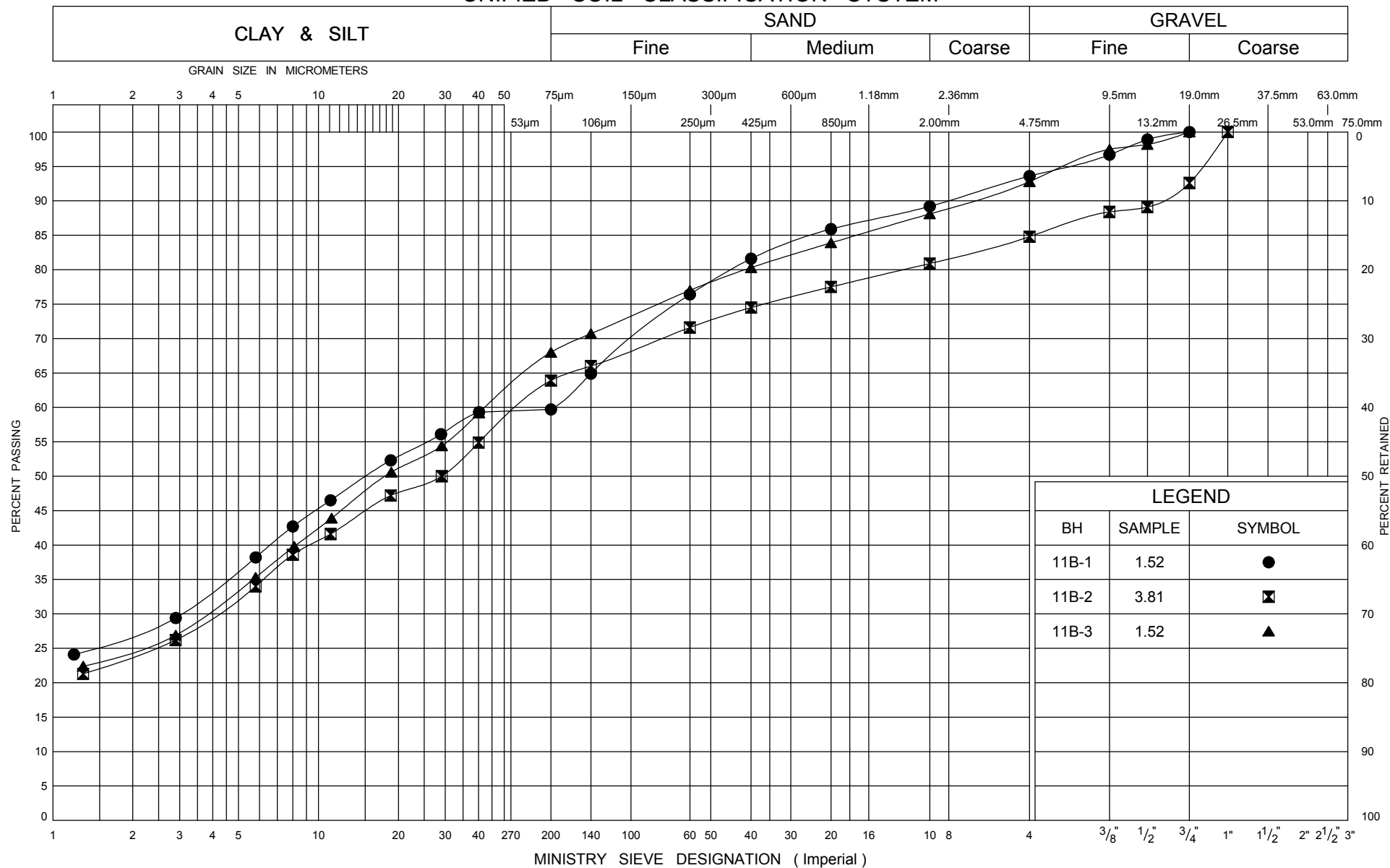
PLASTICITY CHART
FILL

FIG No C- 11B.2

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

GRAIN SIZE DISTRIBUTION

SILTY CLAY TILL, CL

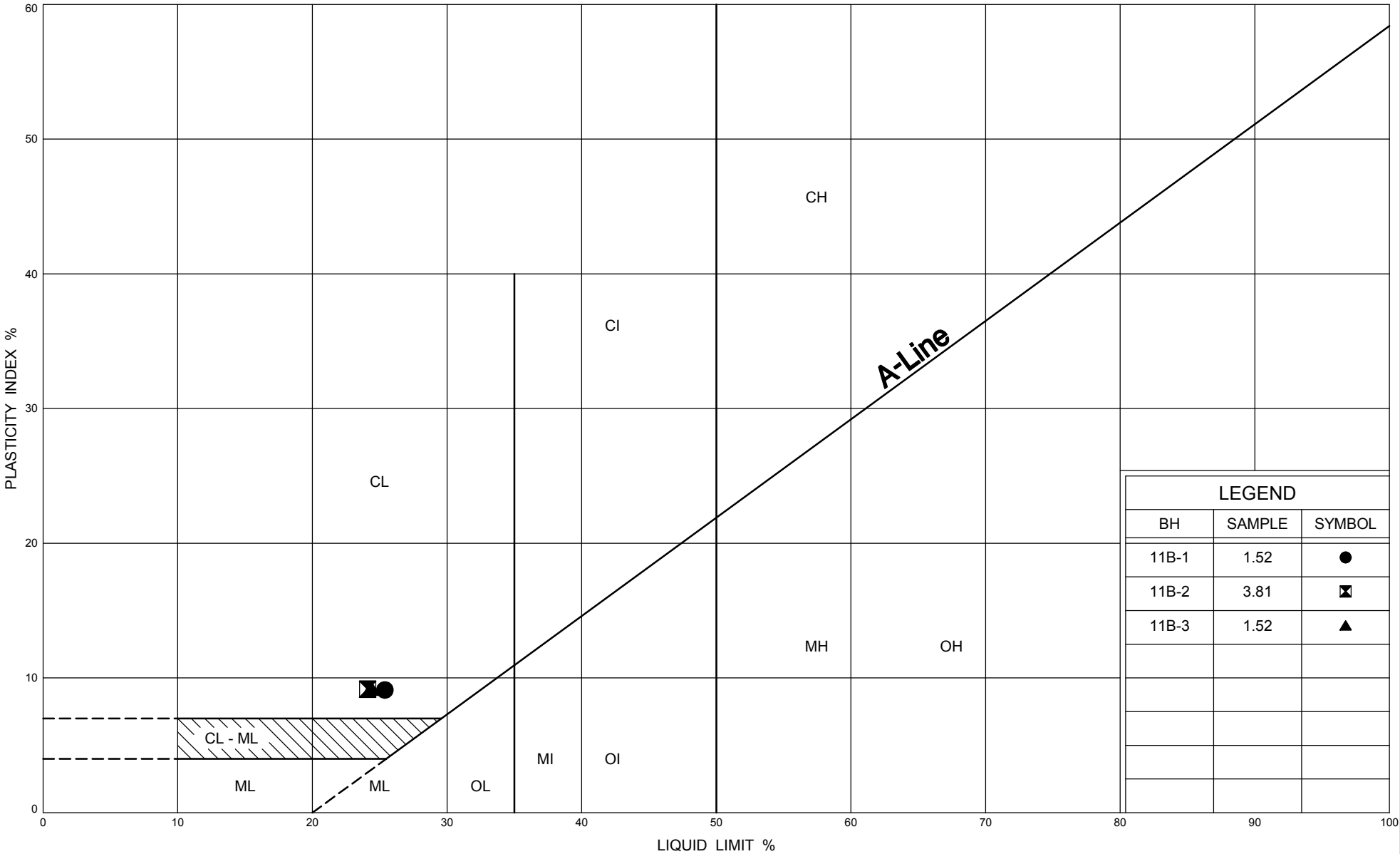
FIG No C- 11B.3

GWP 167-91-00

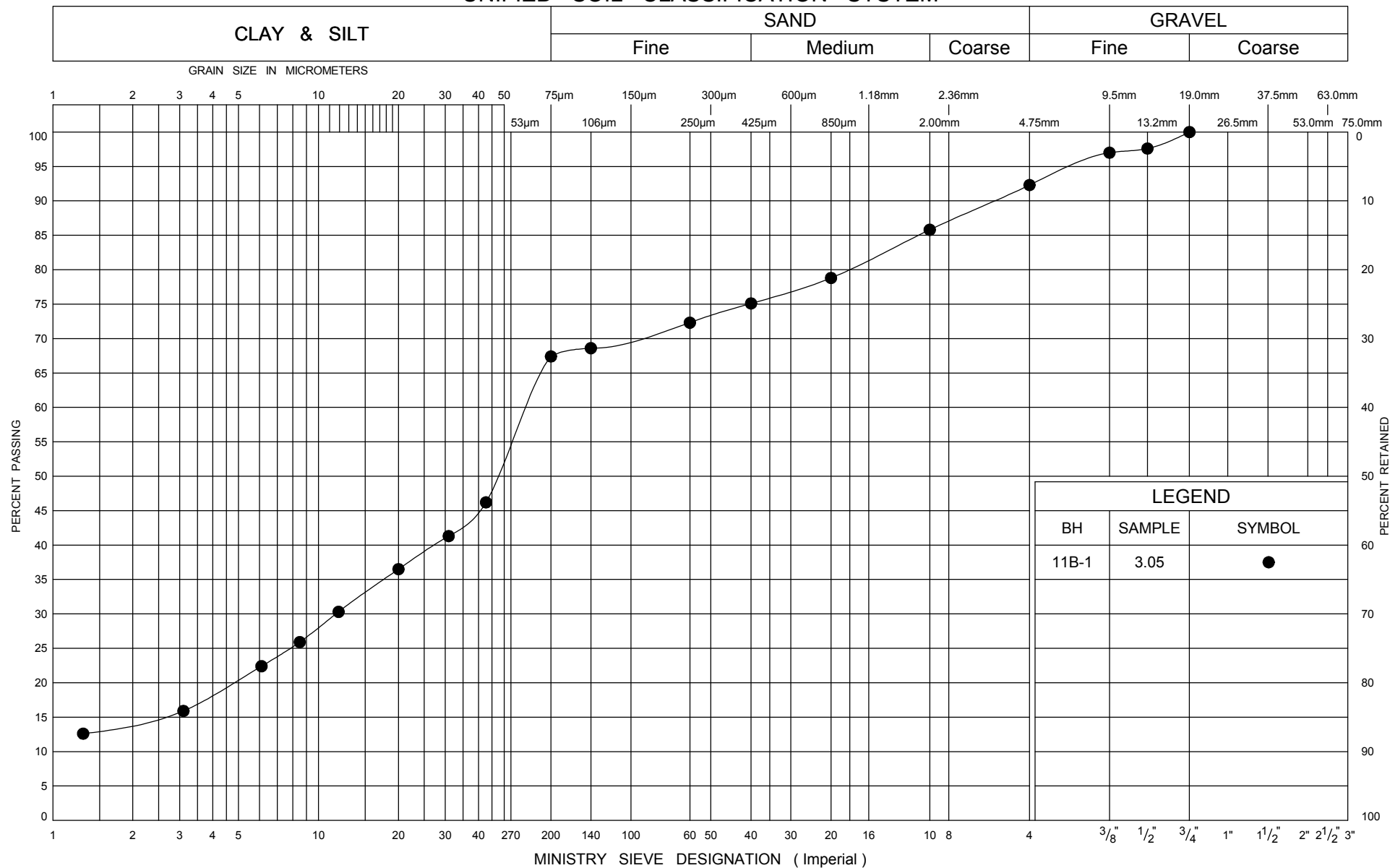
Hwy 26 - Sydenham Townline to Meaford

ONTARIO MOT PLASTICITY CHART SMALL CULVE 07-6-JEGIB.GPJ ONTARIO MOT.GDT 19/11/09

Oct 75, FF - S - 21



UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

Ontario

GRAIN SIZE DISTRIBUTION

SILT LSEAMS, POCKETS AND LAYERS, ML

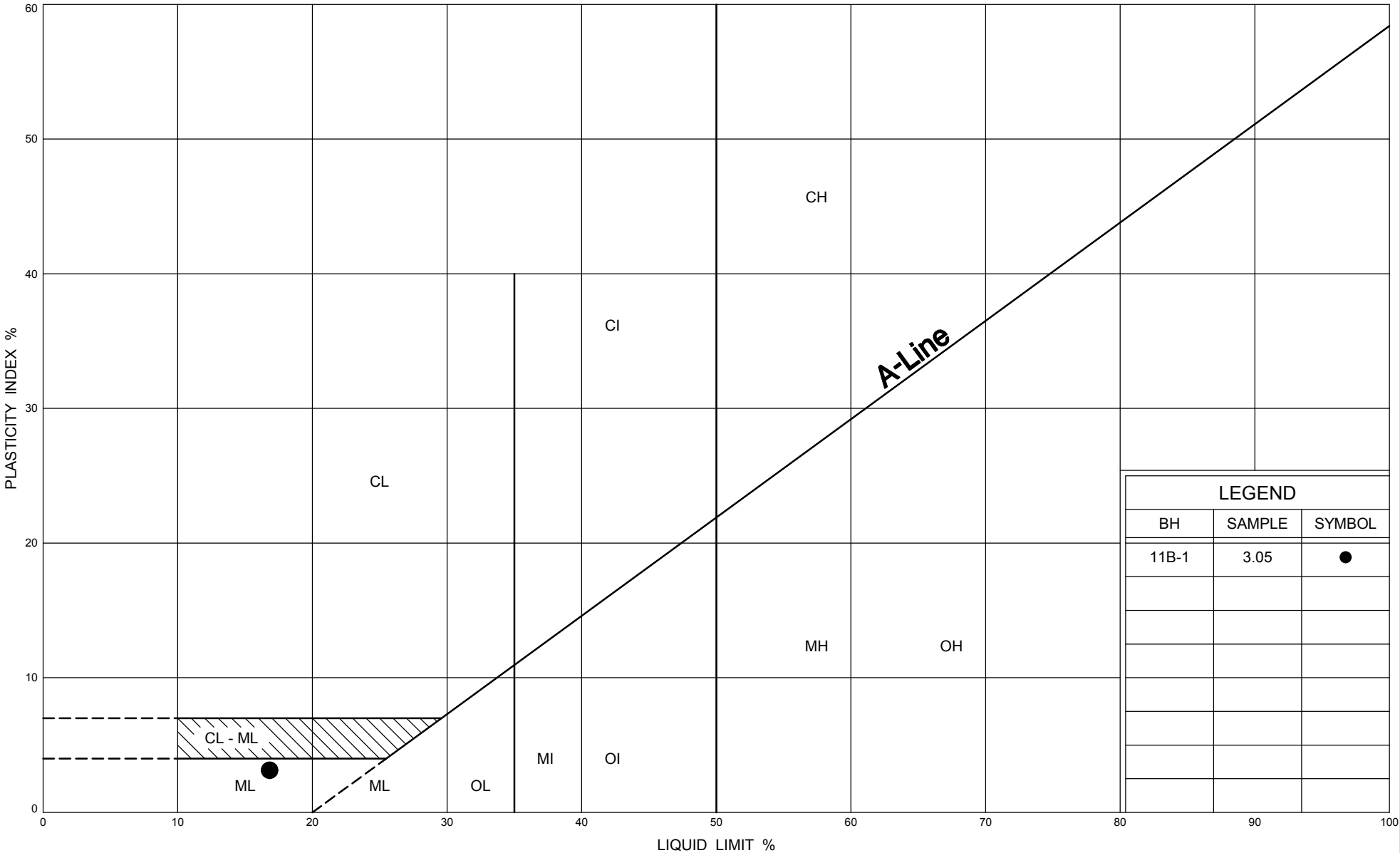
FIG No C- 11B.5

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

ONTARIO MOT PLASTICITY CHART SMALL CULVE 07-6-JEGIB.GPJ ONTARIO MOT.GDT 19/11/09

Oct 75, FF - S - 21



LEGEND		
BH	SAMPLE	SYMBOL
11B-1	3.05	●

RECORD OF BOREHOLE No 12B-1

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4941390, Easting - 212402 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 27.8.07 - 27.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		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			STANDARD 20 40 60 80 100	DYN. CONE 20 40 60 80 100					
239.92 0.00	Ground 150 mm TOPSOIL.													
			1	SPT	5		239							18 55 18 9 (27)
			2	SPT	27		238							Water level @ 1.83 m @ completion.
			3	SPT	51		237							22 45 26 7 (33)
			4	SPT	87		236							
235.65 4.27	End of Borehole.		5	SPT	40									

JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

RECORD OF BOREHOLE No 12B-2

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4941402, Easting - 212394 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 15.8.07 - 15.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE						
								● QUICK TRIAXIAL	× LAB VANE						
242.43 0.00	Ground														
241.42 1.01	Granular FILL Brown, moist, compact.		1	SPT	24		242								
	FILL Brown, moist, loose, consisting of mixed gravel, sand, silt, and silty clay.		2	SPT	6		241							3 36 40 21 (61)	
			3	SPT	5		240								
			4	SPT	6		239							9 64 19 8 (27)	
238.92 3.51		SAND & SILT TILL, SM-ML Brown, wet to moist, compact to very dense, with embedded gravel, sand and gravel layer.		5	SPT	29		238							
237.86 4.57		— sand and gravel layer	6	SPT	100+									Water level @ 4.57 m.	
237.25 5.18	End of Borehole.													Auger refusal @ 5.18 m @ completion.	

+ 3, × 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 12B-3

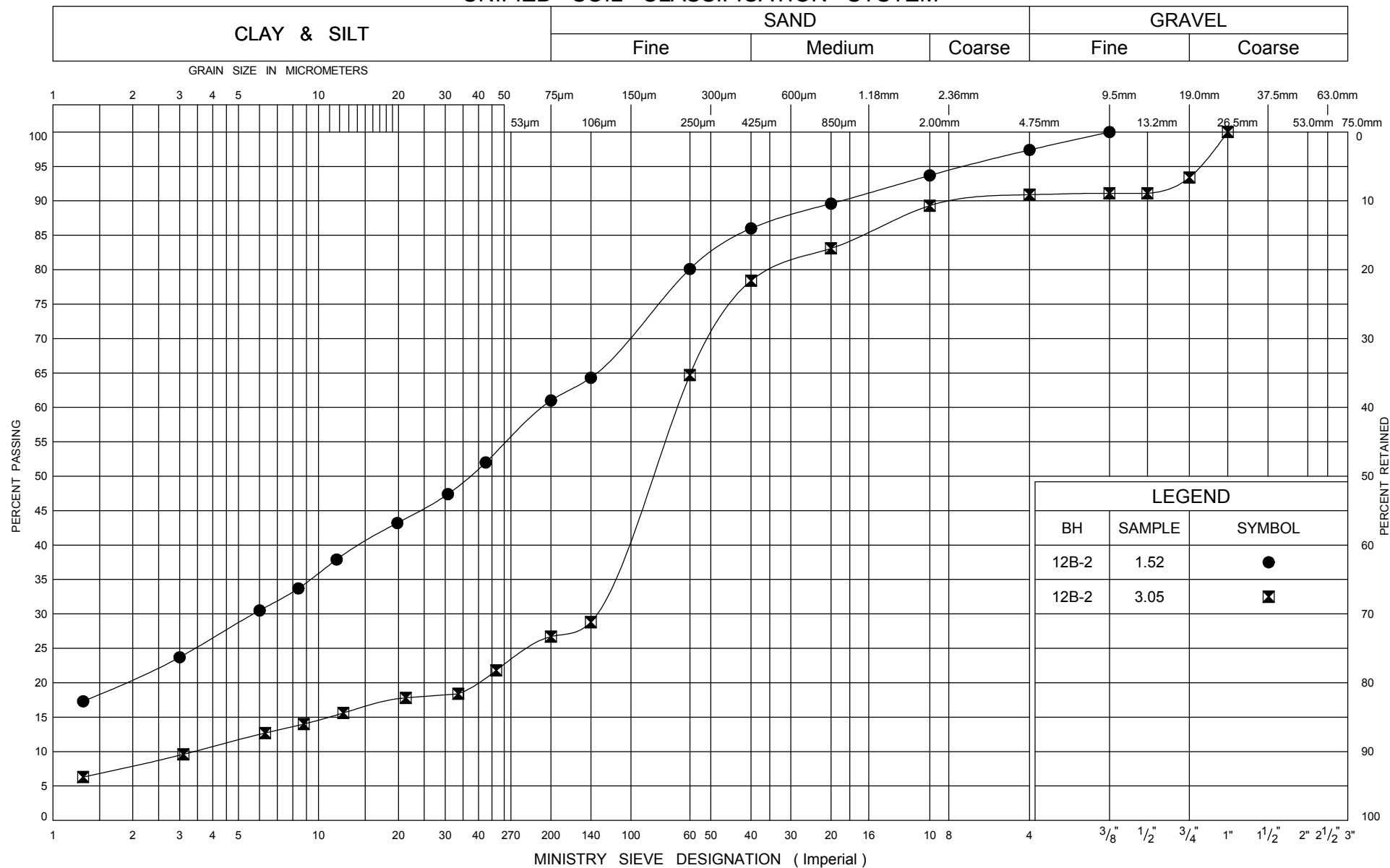
1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4941429, Easting - 212385 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 27.8.07 - 27.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		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			STANDARD 20 40 60 80 100	DYN. CONE 20 40 60 80 100					
240.32 0.00	Ground 75 mm TOPSOIL.													
			1	SPT	17		240							
			2	SPT	29		239							
			3	SPT	80+		238							
			4	SPT	100+		237							
			5	SPT	100+									
236.05 4.27	End of Borehole.													

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

FILL

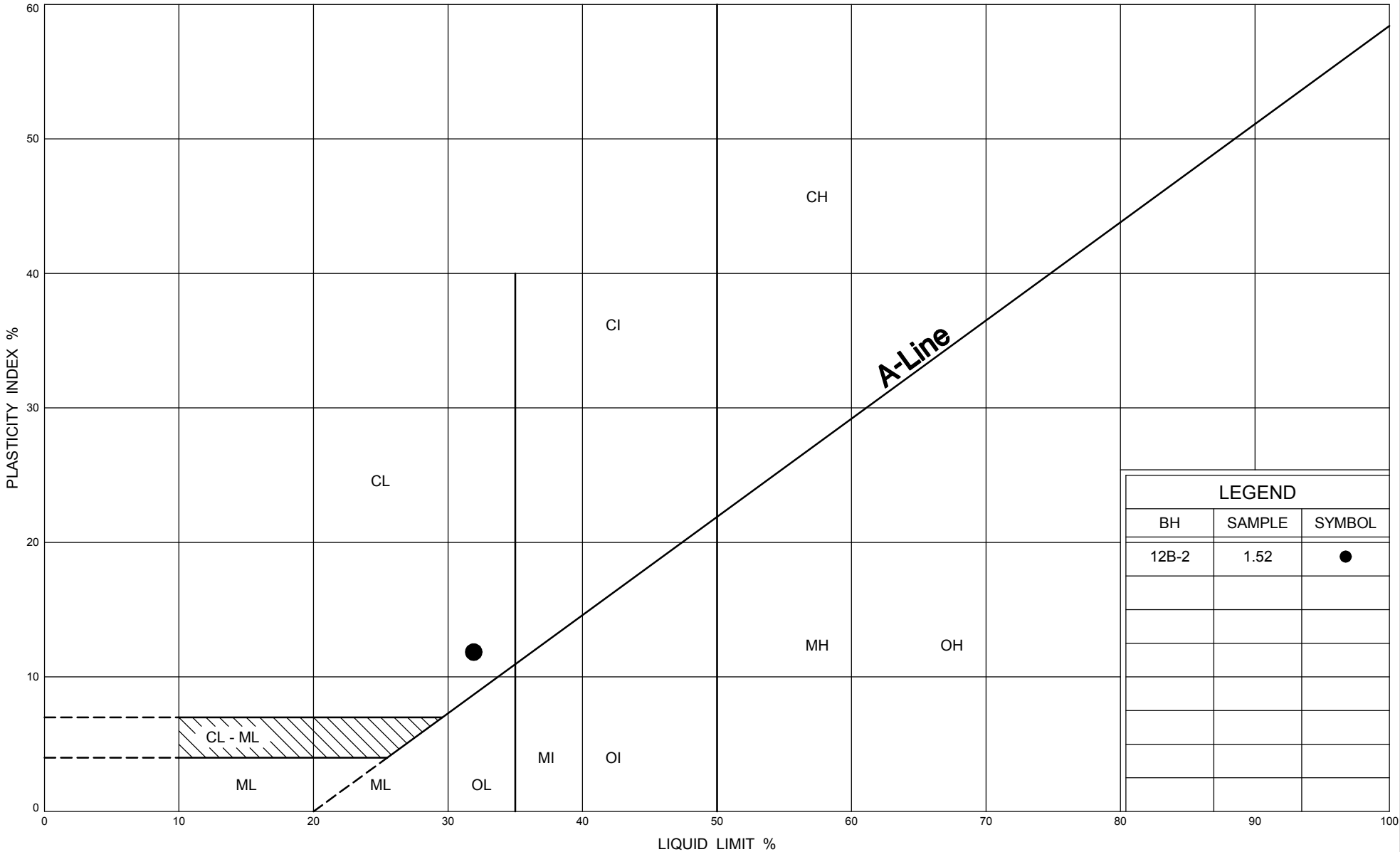
FIG No C- 12B.1

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

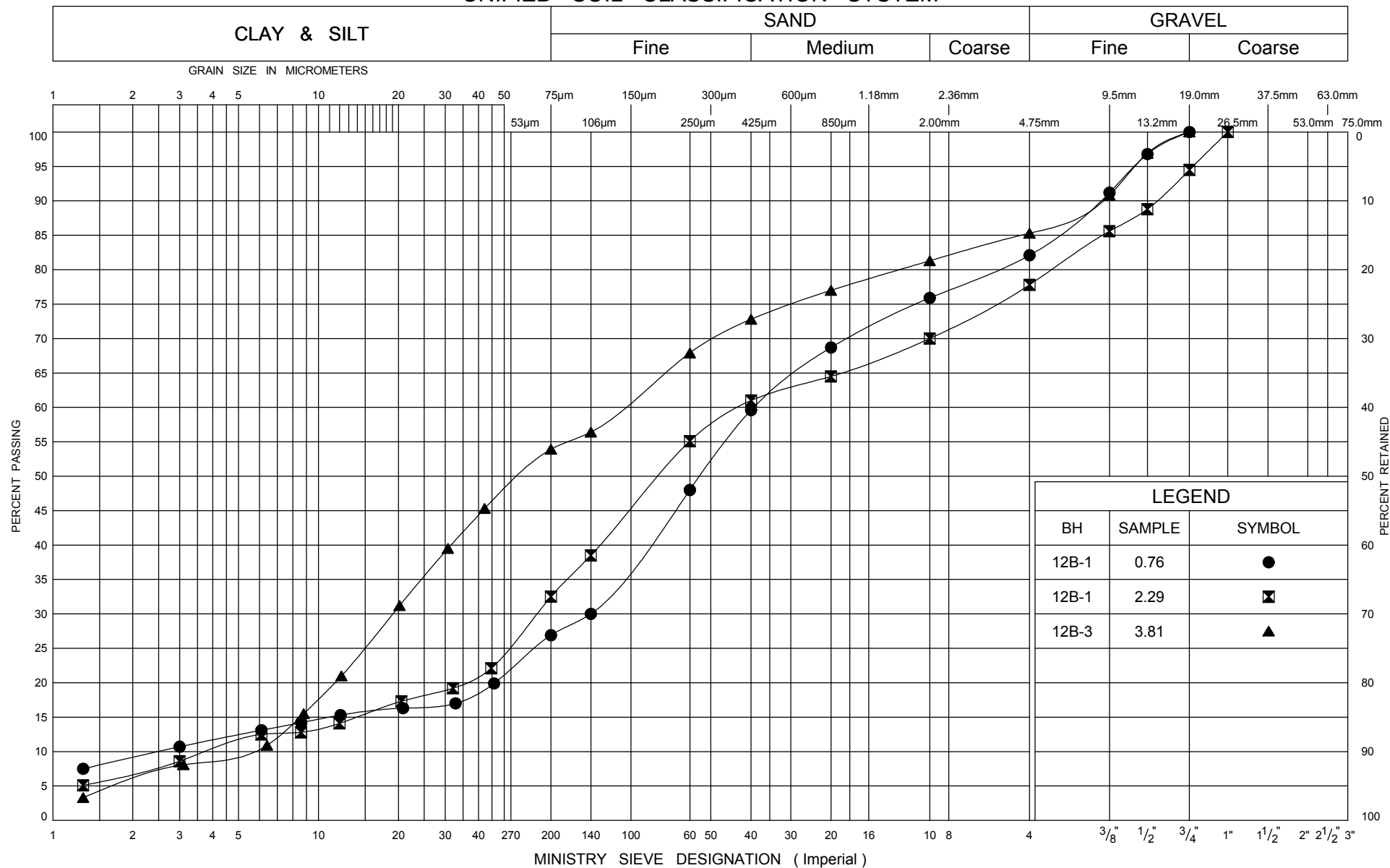

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LEGEND		
BH	SAMPLE	SYMBOL
12B-2	1.52	●

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

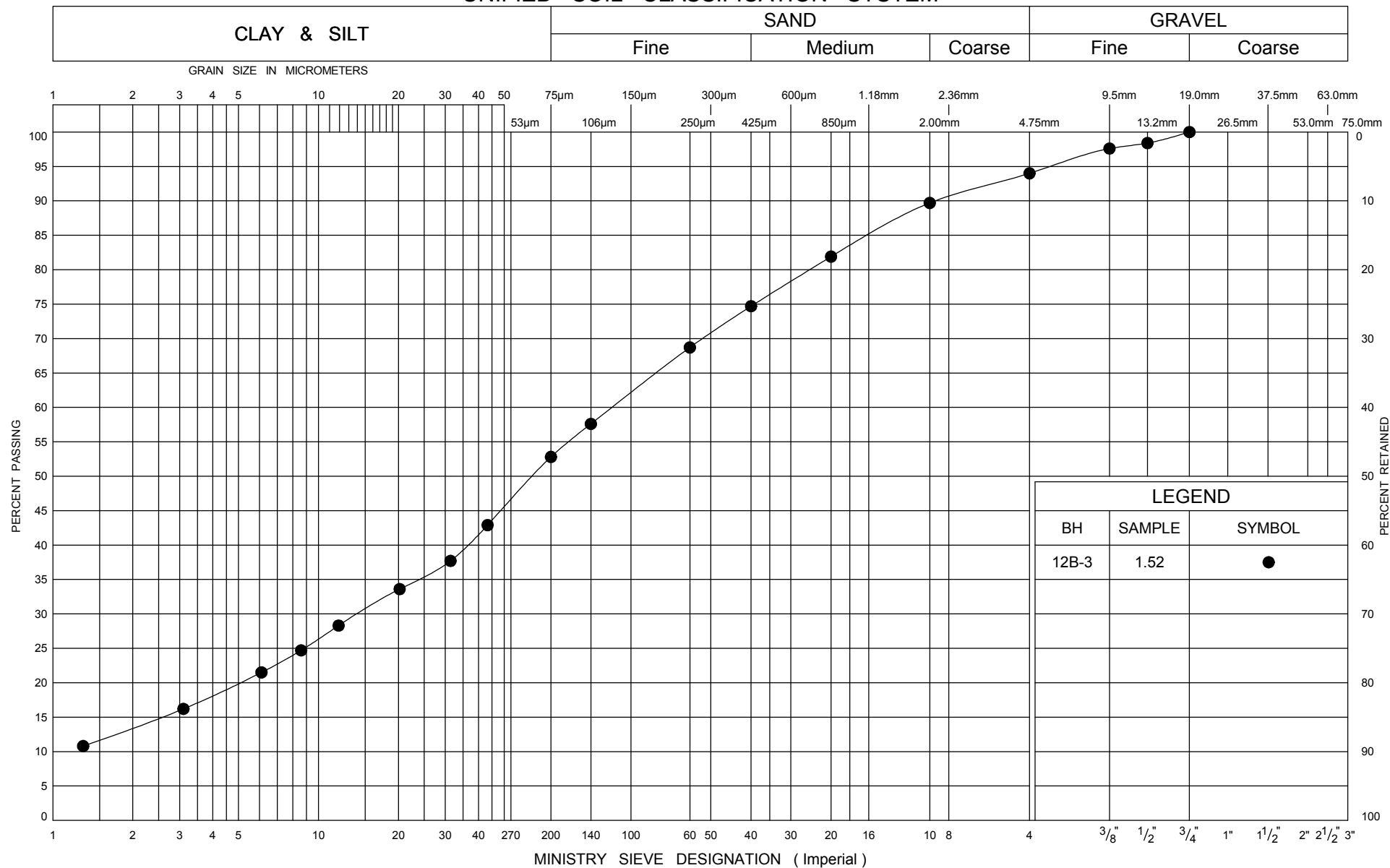
GRAIN SIZE DISTRIBUTION SAND AND SILT TILL, SM-ML

FIG No C- 12B.3

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

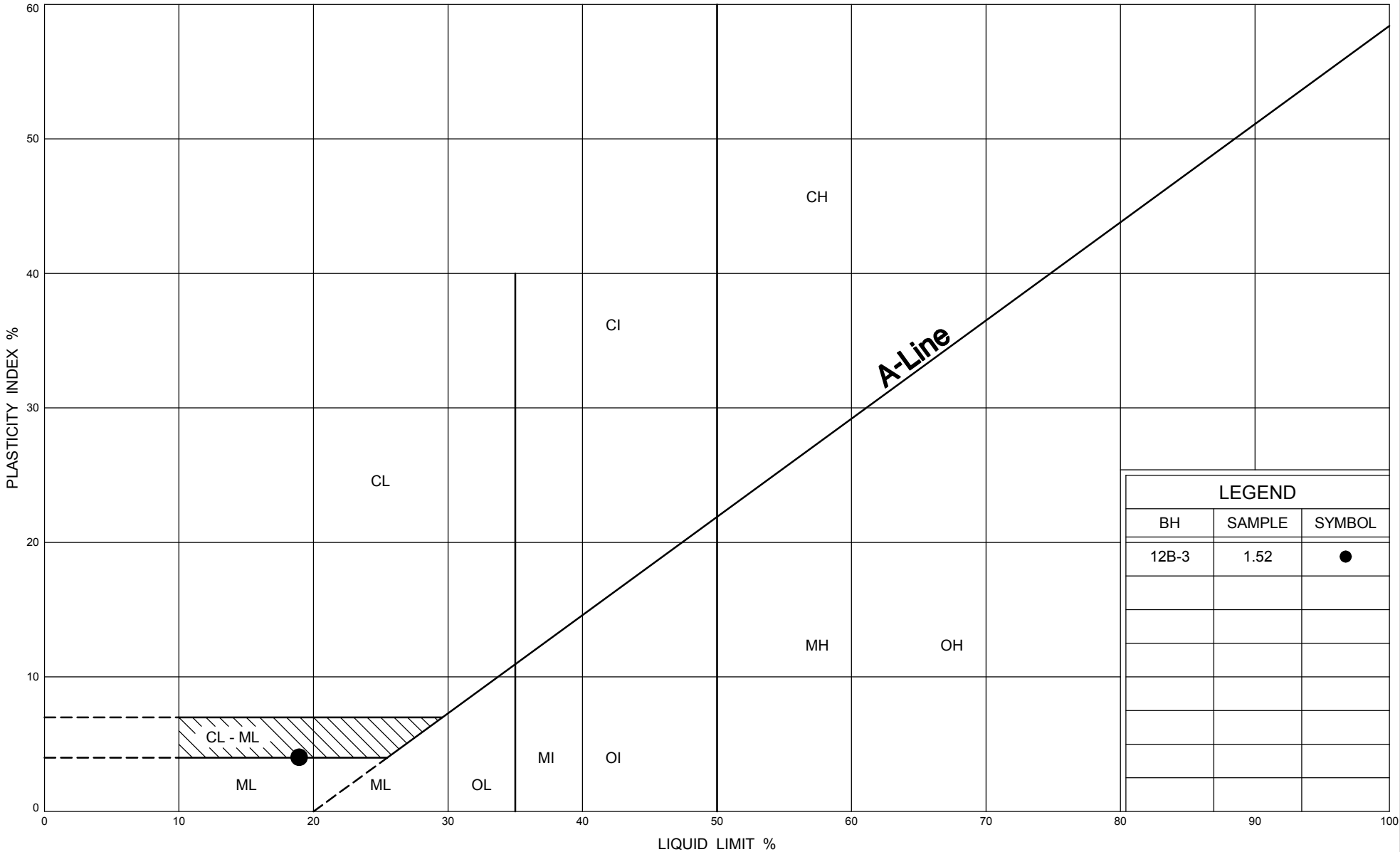
GRAIN SIZE DISTRIBUTION

CLAYEY SILT LAYERS, CL-ML

FIG No C- 12B.4

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford



LEGEND		
BH	SAMPLE	SYMBOL
12B-3	1.52	●



Ministry of
Transportation

PLASTICITY CHART
CLAYEY SILT LAYERS, CL-ML

FIG No C- 12B.5

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

RECORD OF BOREHOLE No 13B-1

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4941498, Easting - 212775 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 23.8.07 - 23.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		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			STANDARD 20 40 60 80 100	DYN. CONE 20 40 60 80 100					
235.21 0.00	Ground 150 mm TOPSOIL.													
			1	SPT	11					175				13 30 36 22 (57)
			2	SPT	22									
	Clayey SILT to Silty CLAY TILL, CL-ML to CL Reddish brown, moist, stiff to hard, with embedded sand and gravel.		3	SPT	+100									hit cobbles
			4	SPT	35									5 23 51 21 (72)
			5	SPT	39									
230.94 4.27	End of Borehole.												23.0	Borehole dry and open @ completion.

JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 13B-2

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4941510, Easting - 212769 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 20.8.07 - 20.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		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			STANDARD 20 40 60 80 100	DYN. CONE 20 40 60 80 100					
238.51 0.00	Ground 150 mm Granular FILL													
			1	SPT	19		238							20 33 35 12 (47)
			2	SPT	13		237							
			3	SPT	7		236							
			4	SPT	3		235							25 33 30 11 (42)
234.85 3.66			5	SPT	6		234	62.5						18 33 28 21 (49)
			6	SPT	5		233	50						25 35 27 13 (40)
			7	SPT	35		232							
			8	SPT	35		231							
			9	SPT	36									
			10	SPT	24									
230.43 8.08	End of Borehole.													Borehole dry and open @ completion.

JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 13B-3

1 OF 1

METRIC

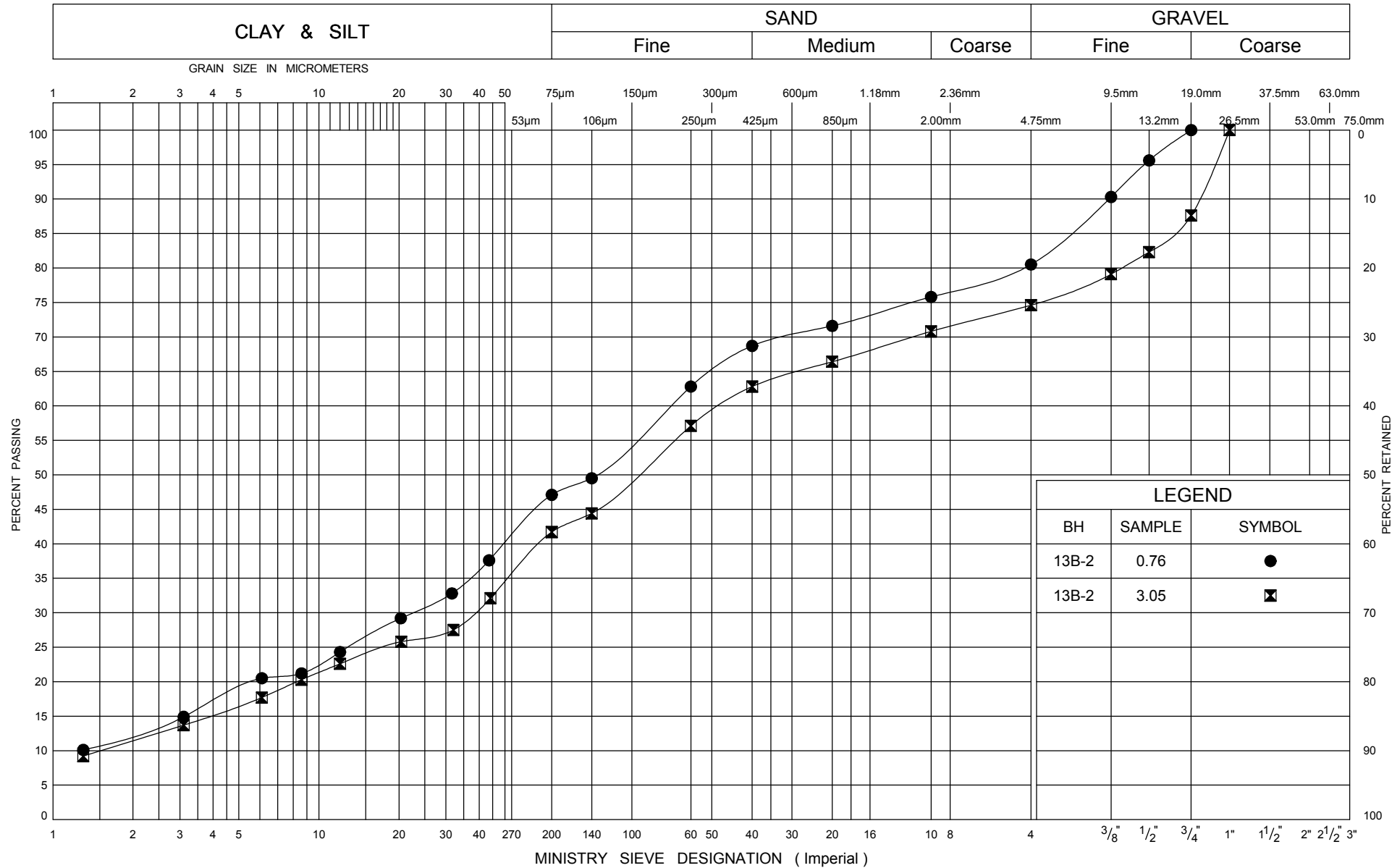
W.P. GWP 167-91-00 LOCATION Northing - 4941536, Easting - 212766 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 27.8.07 - 27.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		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			STANDARD 20 40 60 80 100	DYN. CONE 20 40 60 80 100					
235.51 0.00	Ground 75 mm TOPSOIL. Sandy SILT, ML Dark brown, moist, some gravel.													
235.05 0.46	Silty SAND & GRAVEL, SM-GM Brown, moist, very dense.		1	SPT	100+		235							
233.07 2.44			2	SPT	68		234							
232.00 3.51			3	SPT	100+		233							
	Clayey SILT to Silty CLAY TILL, CL-ML to CL Reddish brown, moist, hard, with embedded sand and gravel.													
			4	SPT	100+									
	End of Borehole.													

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

FILL

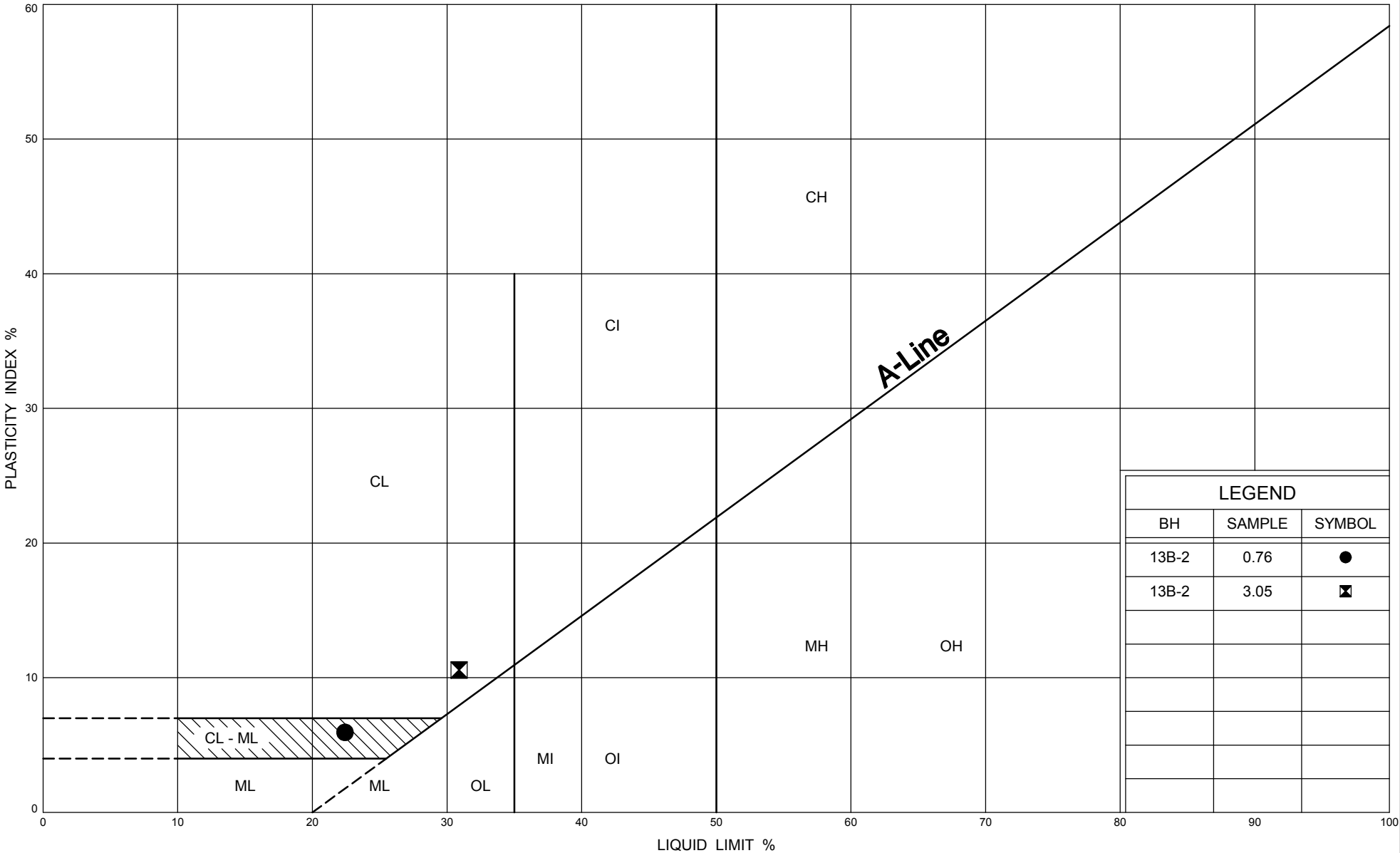
FIG No C- 13B.1

GWP 167-91-00

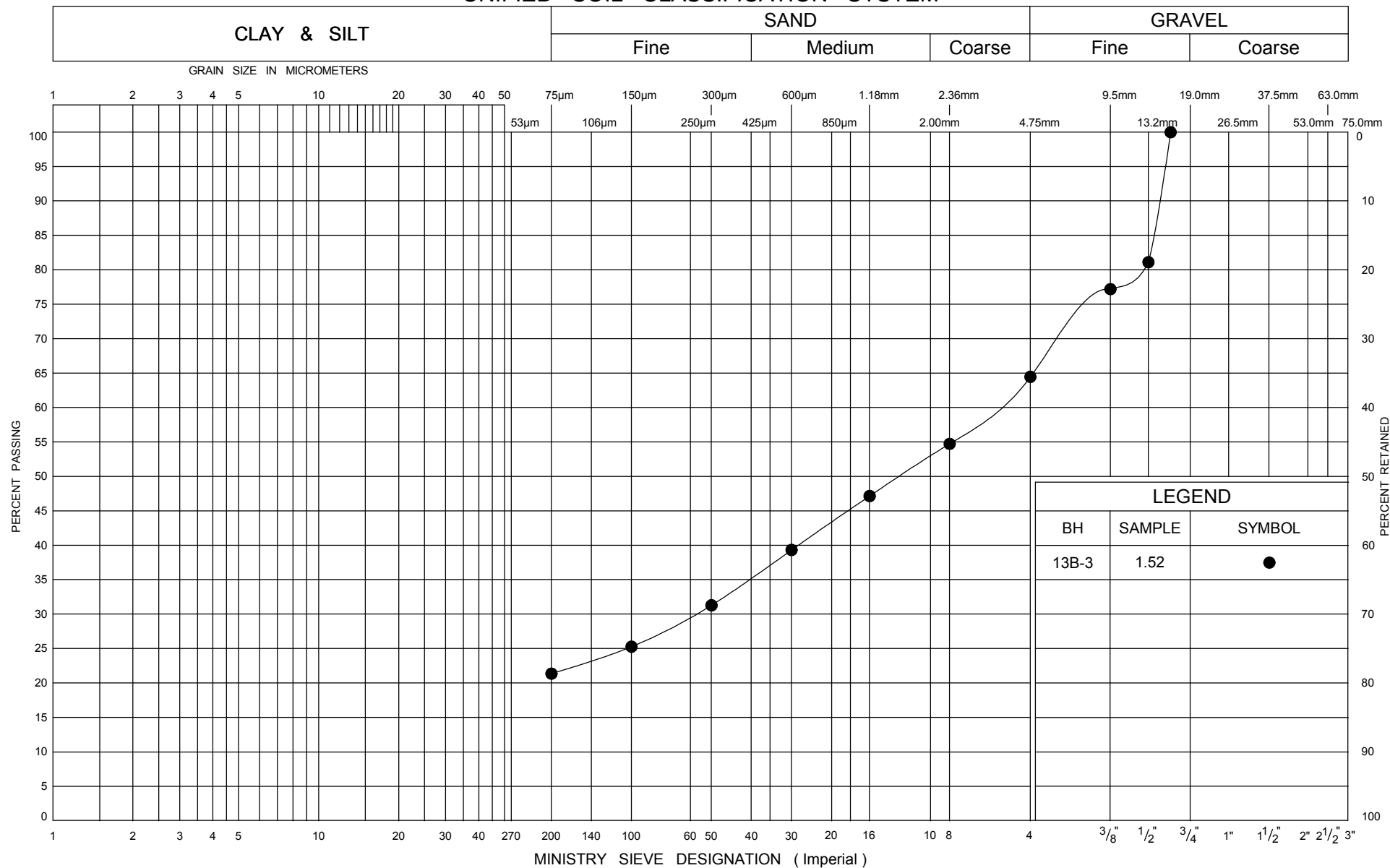
Hwy 26 - Sydenham Townline to Meaford


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GRAIN SIZE DISTRIBUTION

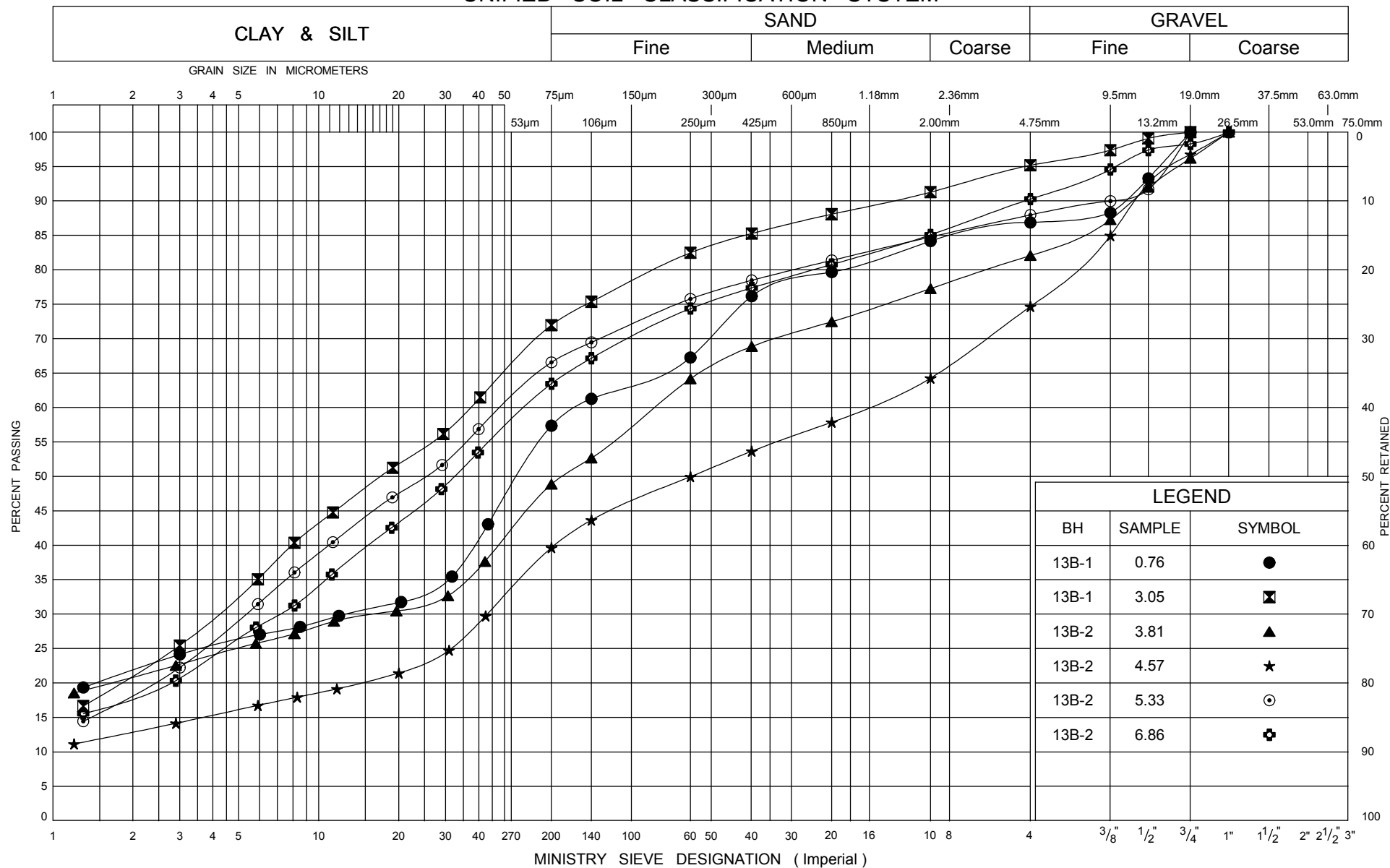
SILTY SAND AND GRAVEL. SM-GM

FIG No C- 13B.3

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

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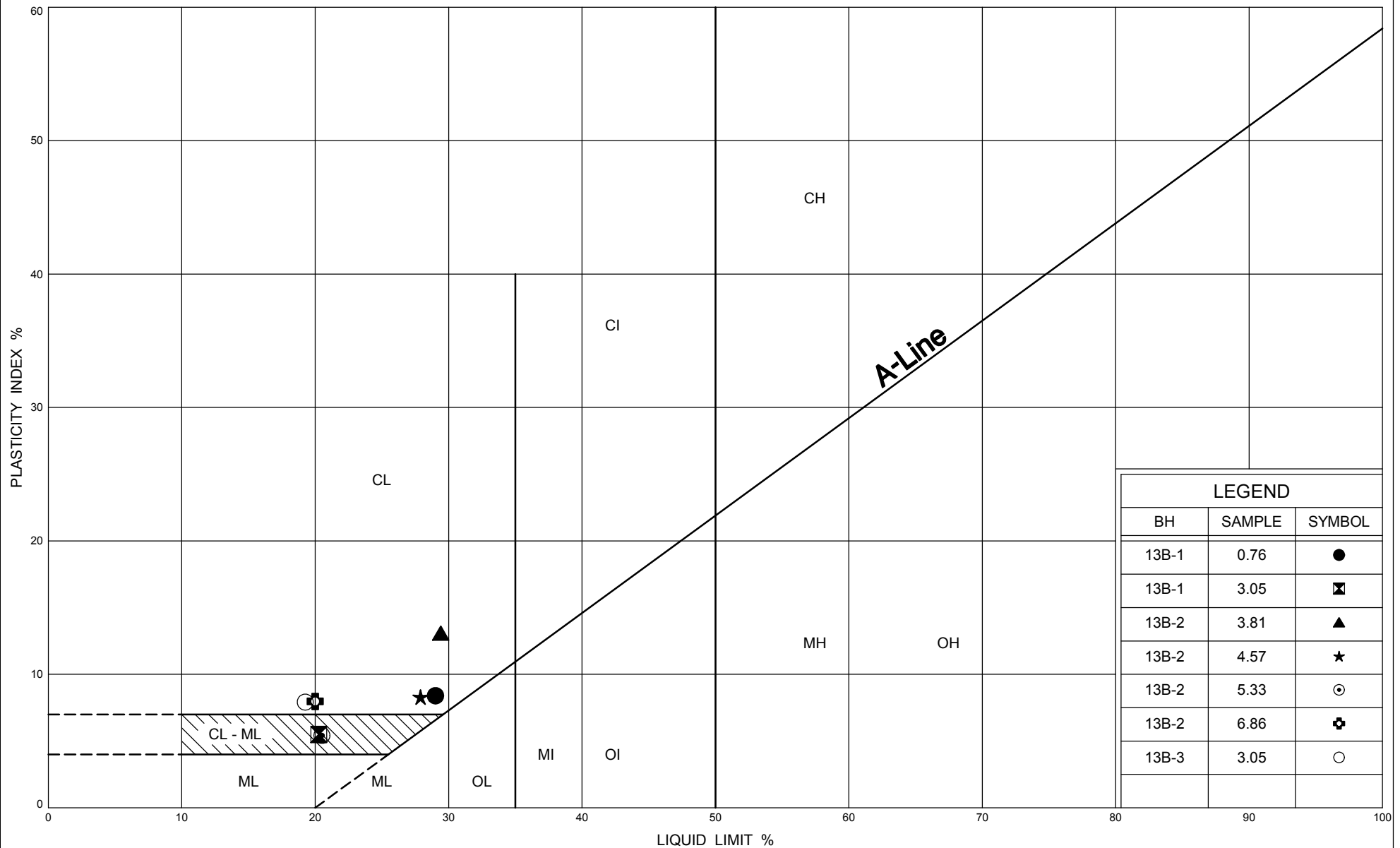
Ontario

GRAIN SIZE DISTRIBUTION
CLAYEY SILT TO SILTY CLAY TILL, CL-ML TO CL

FIG No C- 13B.4

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford



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PLASTICITY CHART CLAYEY SILT TO SILTY CLAY, CL-ML TO CL

FIG No C- 13B.5

GWP 167-91-00

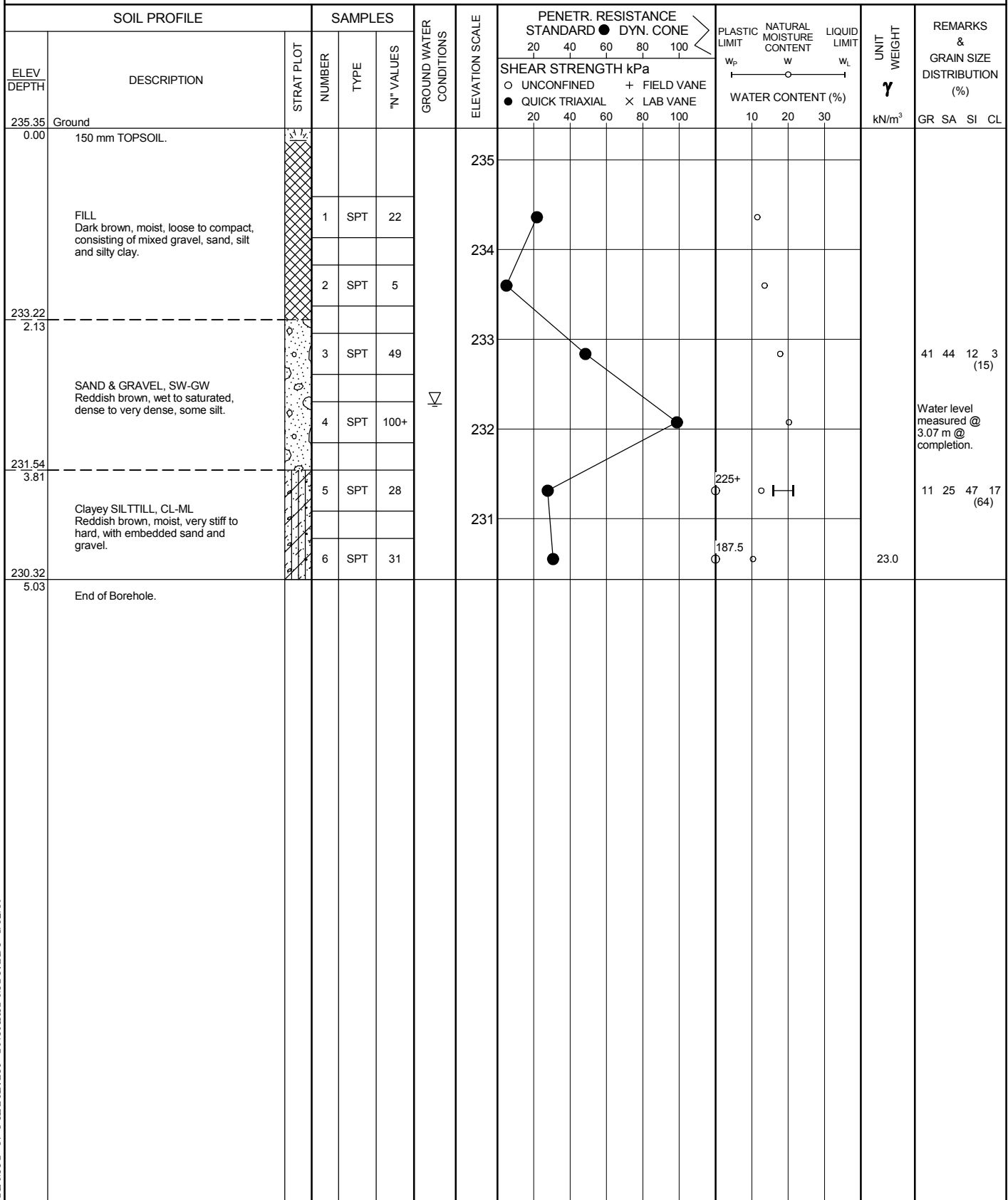
Hwy 26 - Sydenham Townline to Meaford

RECORD OF BOREHOLE No 14B-1

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4941515, Easting - 212833 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 22.8.07 - 22.8.07 CHECKED BY JL



JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

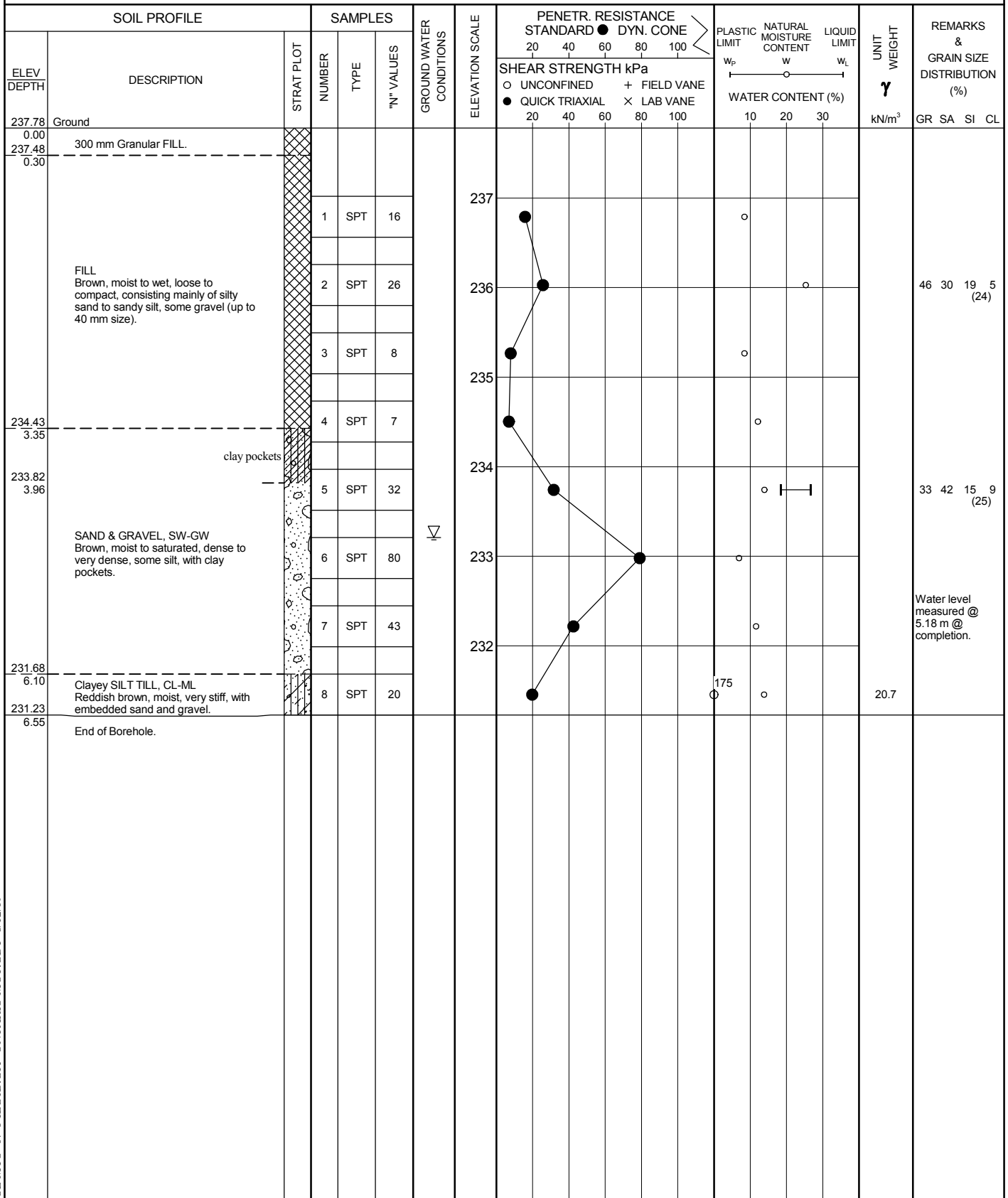
○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 14B-2

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4941525, Easting - 212822 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 20.8.07 - 20.8.07 CHECKED BY JL



JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 14B-3

1 OF 1

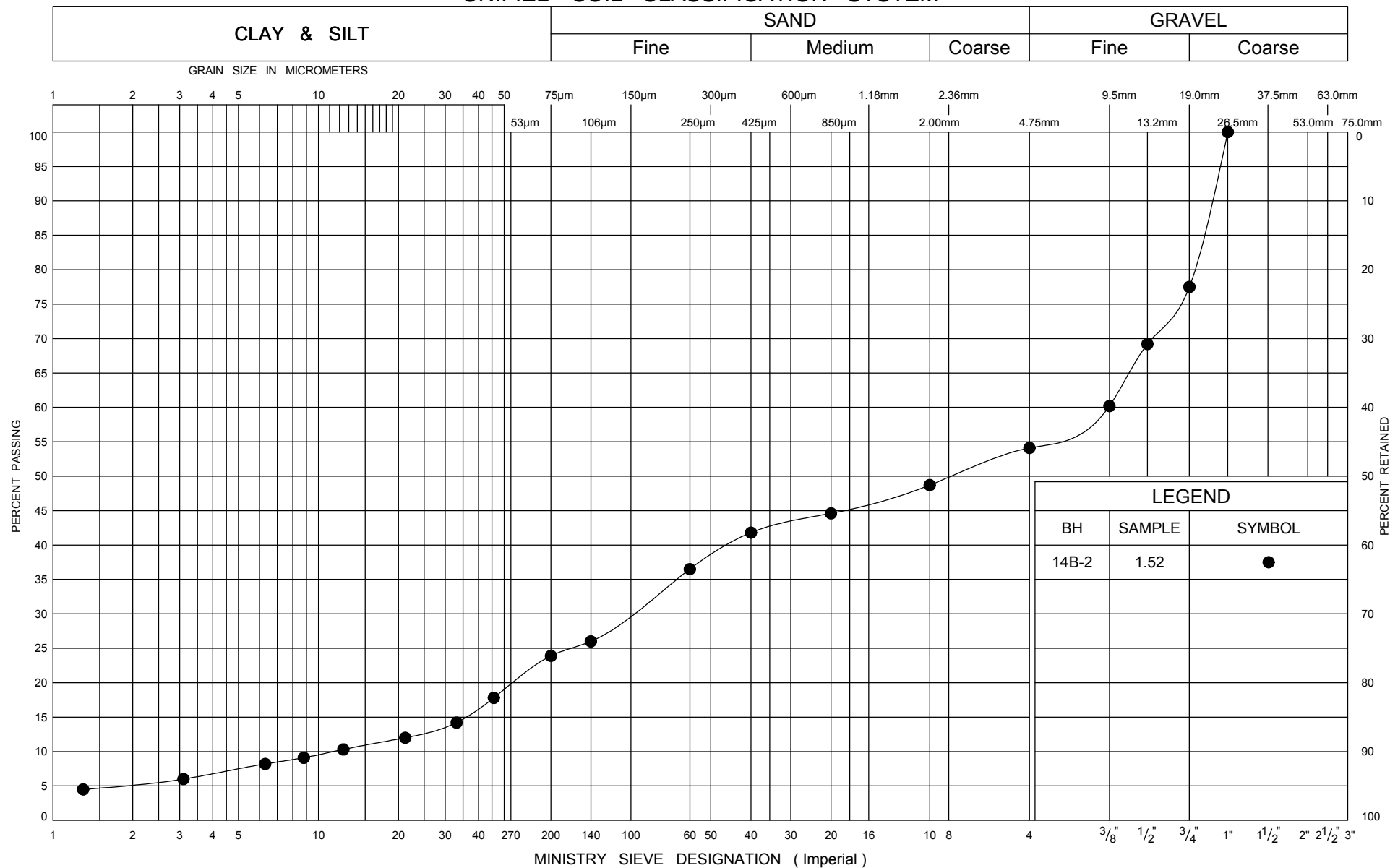
METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4941552, Easting - 212817 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 27.8.07 - 27.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE			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 (%)										
235.13	Ground						235										
0.00	150 mm TOPSOIL.																
	Gravelly Silty SAND TILL, SM Reddish brown, moist, very dense, clayey pockets.		1	SPT	64		234								20 37 20 23 sample not (44) sufficient for Atterberg limits		
233.61			2	SPT	33												
1.52							233										
	SAND & GRAVEL, SW-GW Brown, moist to saturated, dense to very dense, some silt.		3	SPT	62										Water level measured @ 2.74 m @ completion.		
			4	SPT	40		232										
231.32																	
3.81	Clayey SILT to TILL, CL-ML Reddish brown, moist, hard, with embedded sand and gravel.		5	SPT	44		231								16 25 44 15 (59)		
230.86																	
4.27	End of Borehole.																

JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

UNIFIED SOIL CLASSIFICATION SYSTEM



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GRAIN SIZE DISTRIBUTION

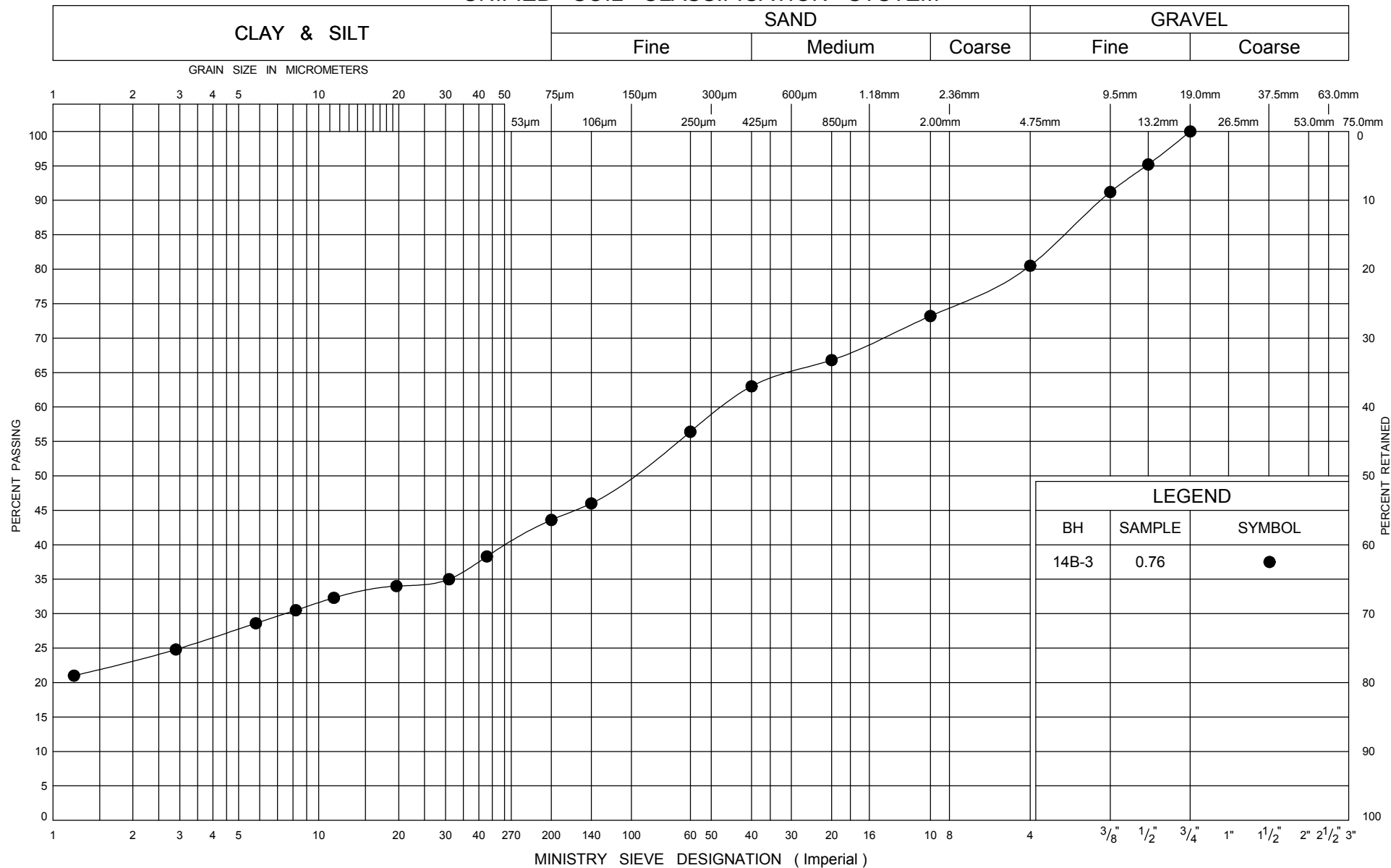
FILL

FIG No C- 14B.1

GWP 167-91-00

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UNIFIED SOIL CLASSIFICATION SYSTEM



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GRAIN SIZE DISTRIBUTION

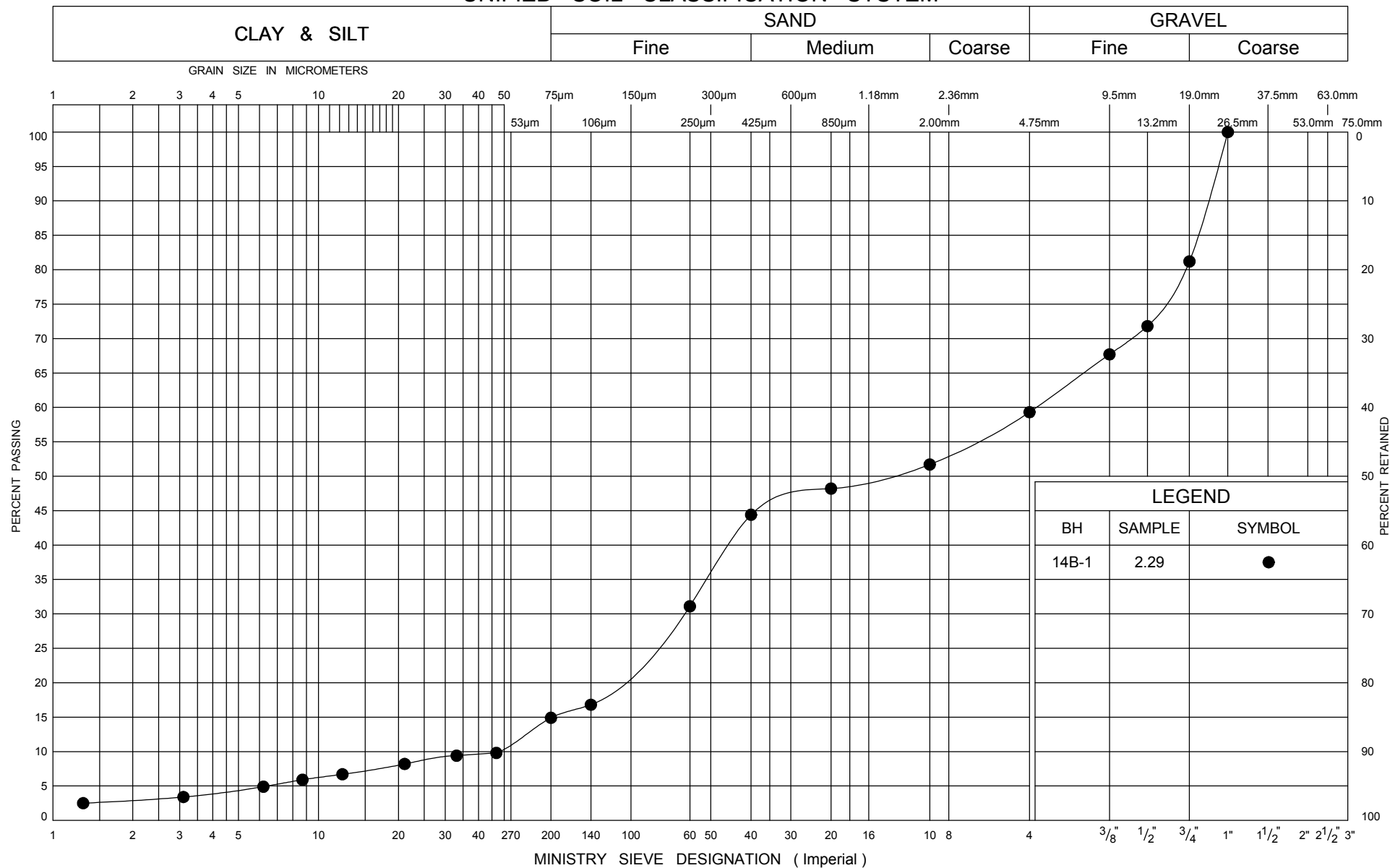
GRAVELLY SILTY SAND TILL, SM

FIG No C- 14B.2

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

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GRAIN SIZE DISTRIBUTION

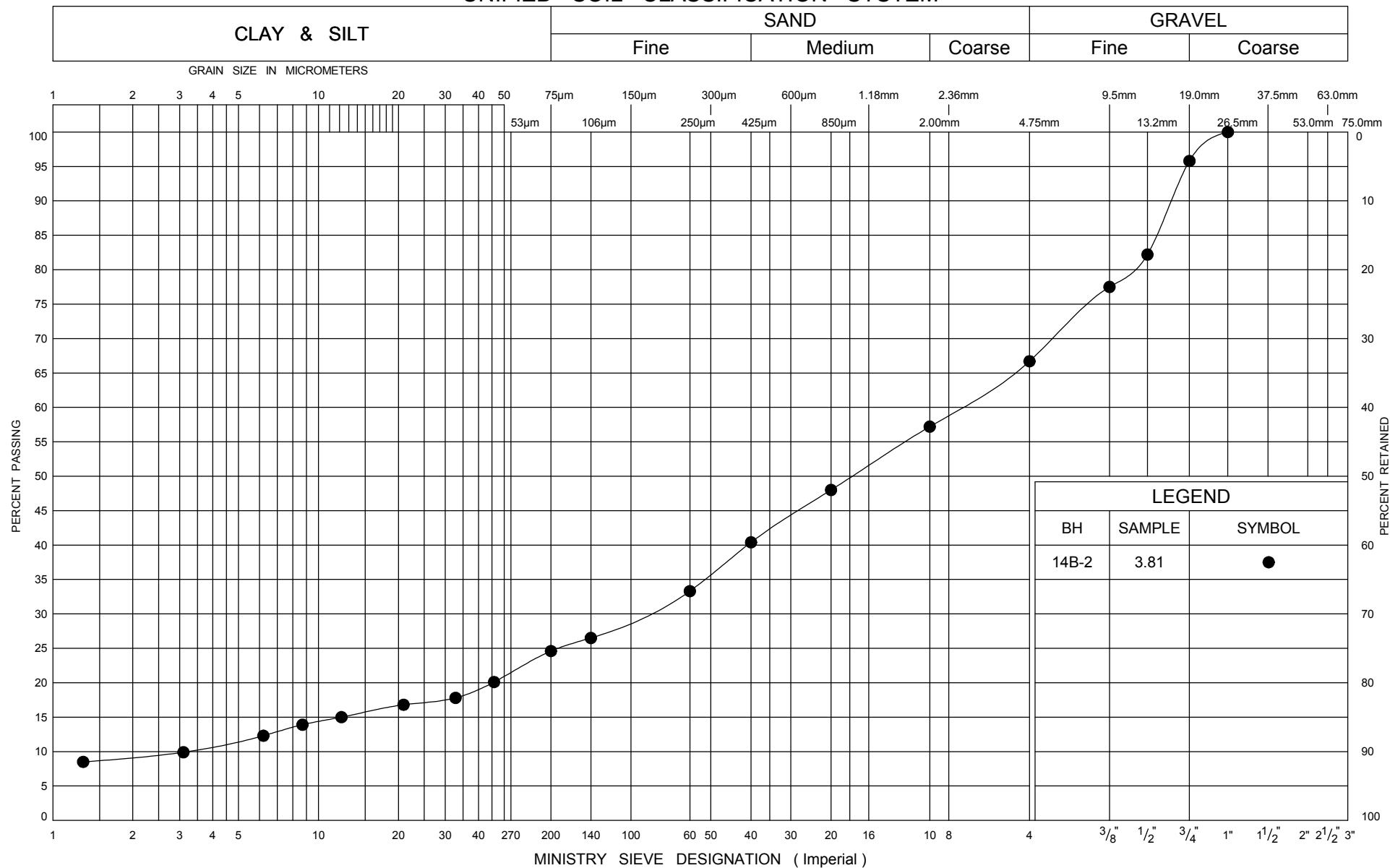
SAND & GRAVEL, SW-GW

FIG No C- 14B.3

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

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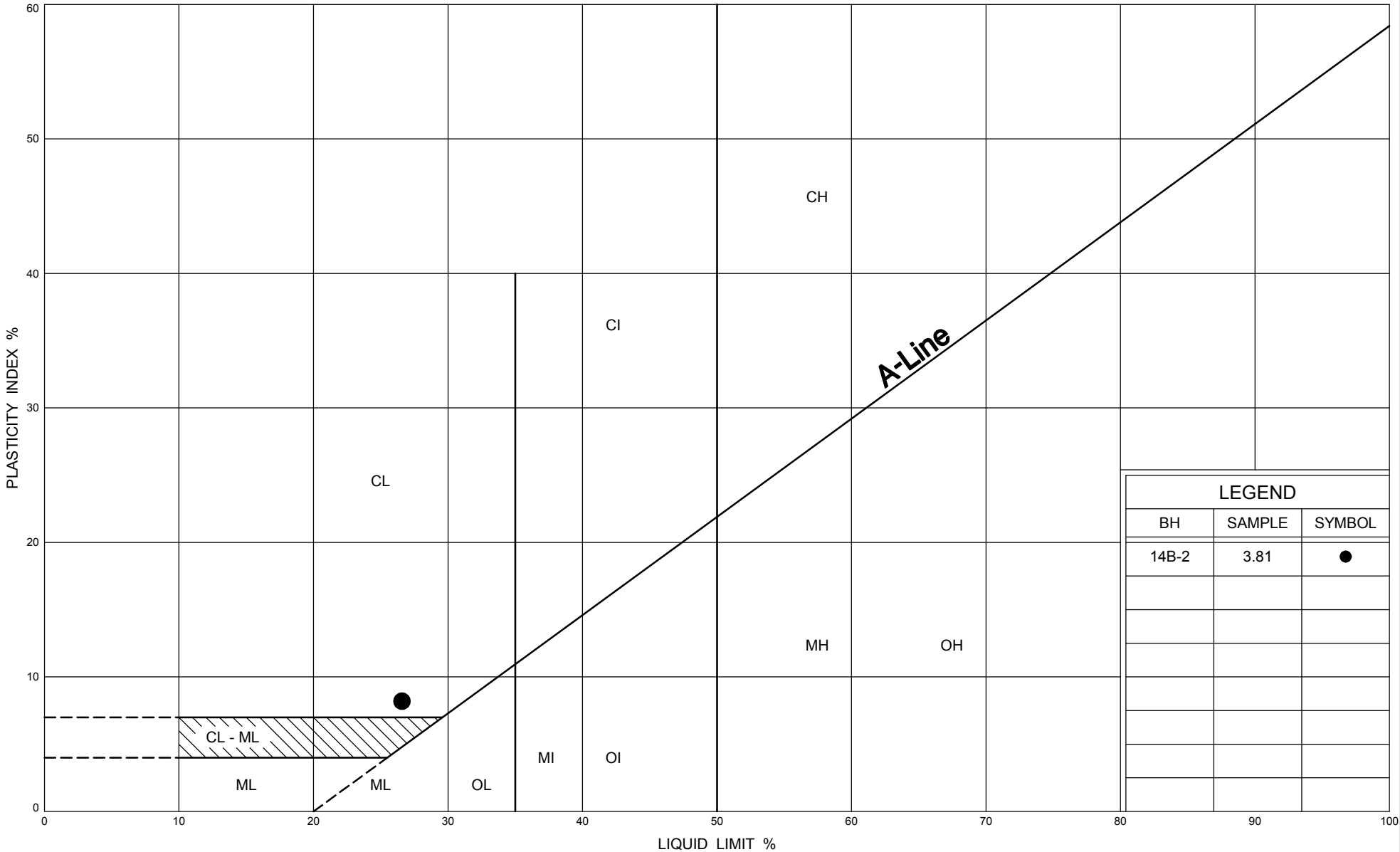
GRAIN SIZE DISTRIBUTION

CLAY POCKETS WITHIN SAND AND GRAVEL, CL

FIG No C- 14B.4

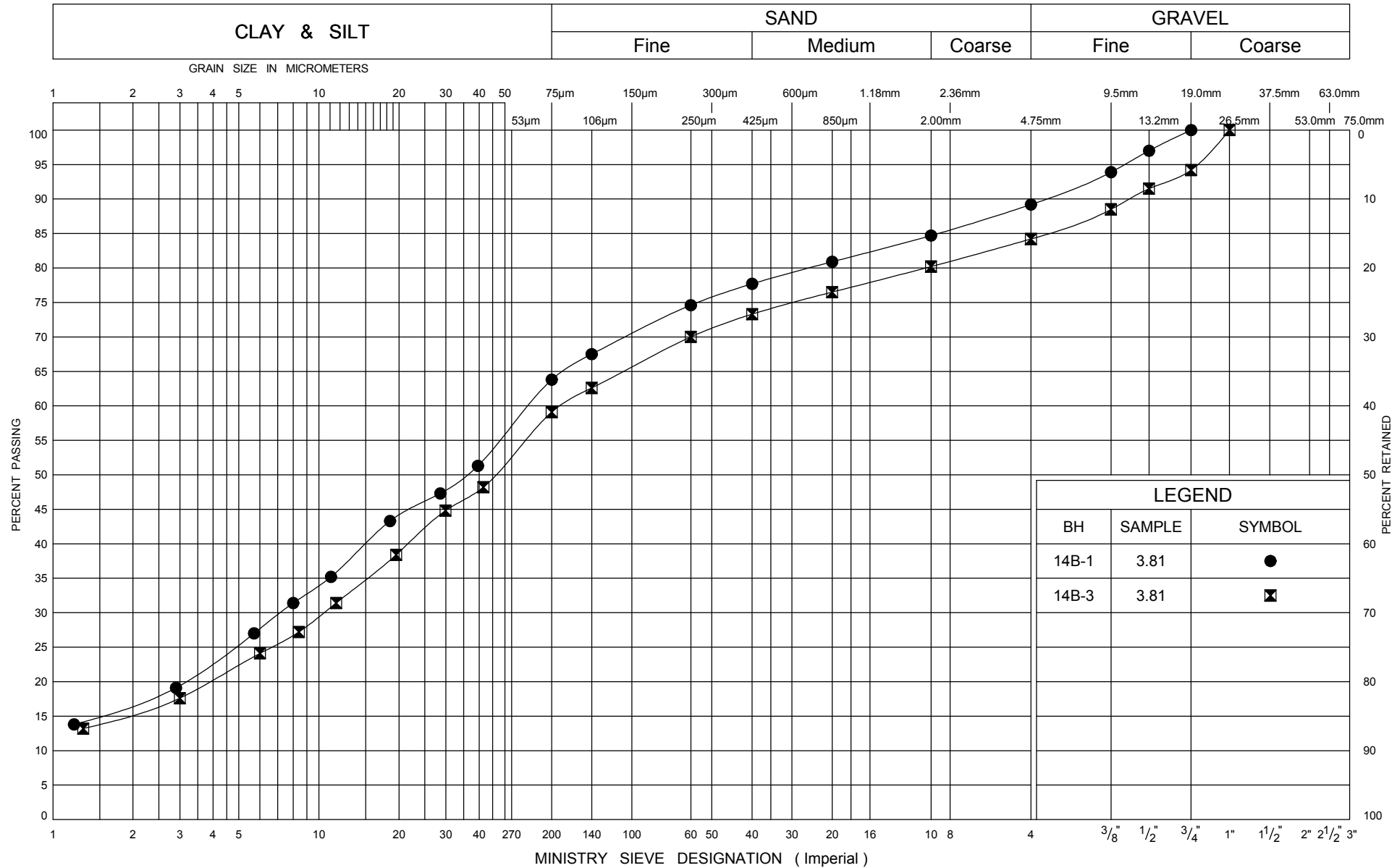
GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford



LEGEND		
BH	SAMPLE	SYMBOL
14B-2	3.81	●

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GRAIN SIZE DISTRIBUTION

CLAYEY SILT TILL, CL-ML

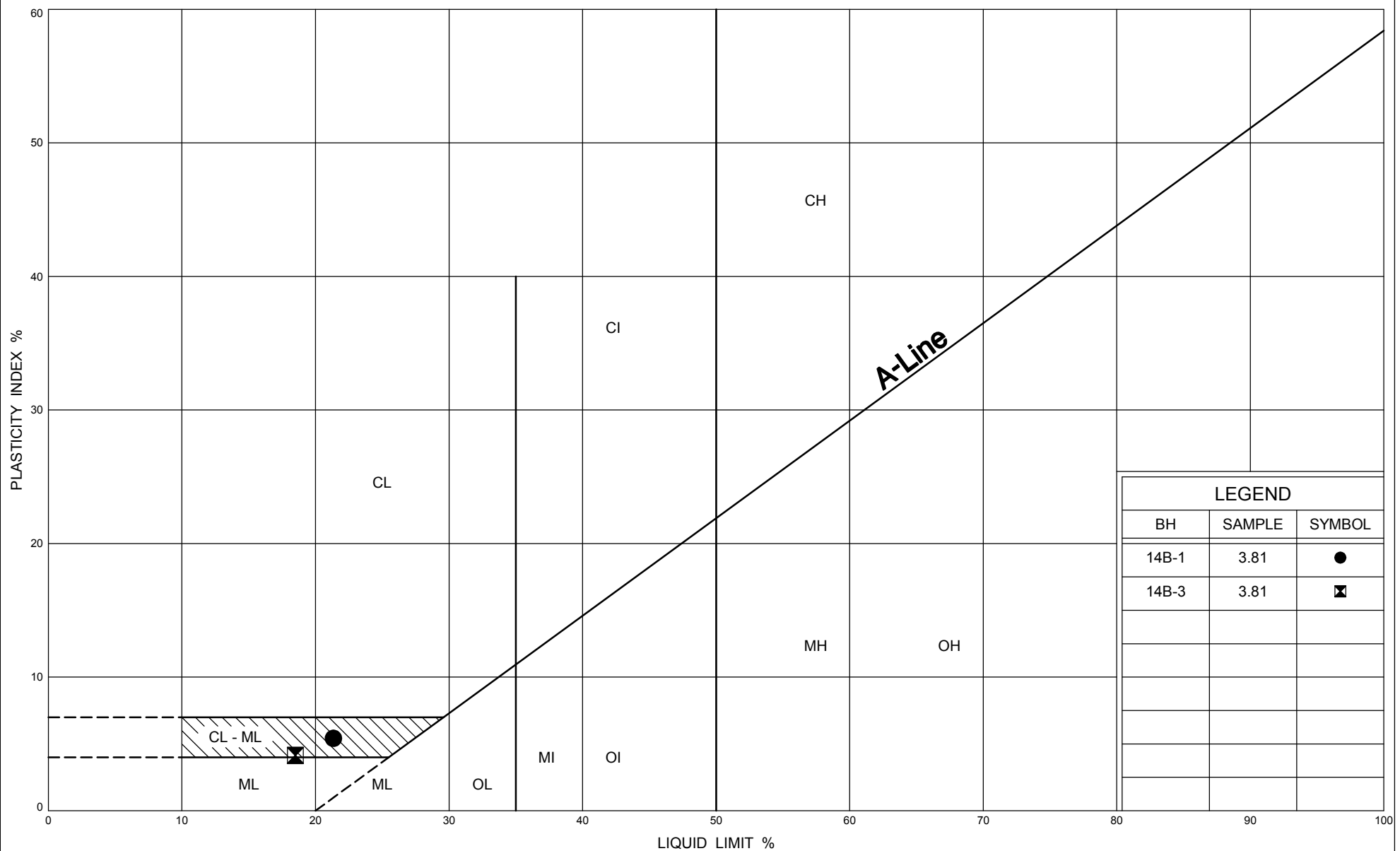
FIG No C- 14B.6

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

ONTARIO MOT PLASTICITY CHART SMALL CULVE 07-6-JEGIB.GPJ ONTARIO MOT.GDT 19/11/09

Oct 75, FF - S - 21



LEGEND		
BH	SAMPLE	SYMBOL
14B-1	3.81	●
14B-3	3.81	⊠



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PLASTICITY CHART
CLAYEY SILT TILL, CL-ML

FIG No C- 14B.7

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

RECORD OF BOREHOLE No 15B-1

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4941843, Easting - 213989 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 20.8.07 - 20.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE			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	● QUICK TRIAXIAL	+ FIELD VANE						× LAB VANE		
222.03 0.00	Ground						20	40	60	80	100	10	20	30	GR	SA	SI	CL
220.81 1.22	150 mm TOPSOIL.		1	SPT	48	▽	221								49	41	(10)	
	2		SPT	20	220													
	3		SPT	11	219													
	SAND, SP Dark brown to brown, moist to saturated, dense to compact, trace to some gravel, with occasional gravel and gravelly layers.		4	SPT	15		218											
							219											
			5	SPT	22		218											
217.76 4.27	End of Borehole.																	

JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 15B-2

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4941866, Easting - 213984 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 20.8.07 - 20.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		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			STANDARD 20 40 60 80 100	DYN. CONE 20 40 60 80 100					
222.78 0.00	Ground													
	FILL Light brown, moist to saturated, loose to compact consisting of sand to sand and gravel, trace to some silt.		1	SPT	11	▽	222							53 35 (12)
			2	SPT	5		221							Water level @ 1.83 m.
			3	SPT	9		220							
			4	SPT	6		219							1 88 9 2 (11)
219.12 3.66	SAND, SP Brown and grey, saturated to moist, compact, trace to some silt, trace gravel.		5	SPT	15		218							8 78 12 2 (14)
			6	SPT	23		217							
			7	SPT	11		216							0 23 69 8 (77)
216.38 6.40			8	SPT	17									
215.46 7.32	SAND & SILT TILL, SM-ML Brown, moist, compact to very dense, with embedded gravel.		9	SPT	100+									
	End of Borehole.													

JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 15B-3

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4941853, Easting - 213982 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 15.8.07 - 15.8.07 CHECKED BY JL

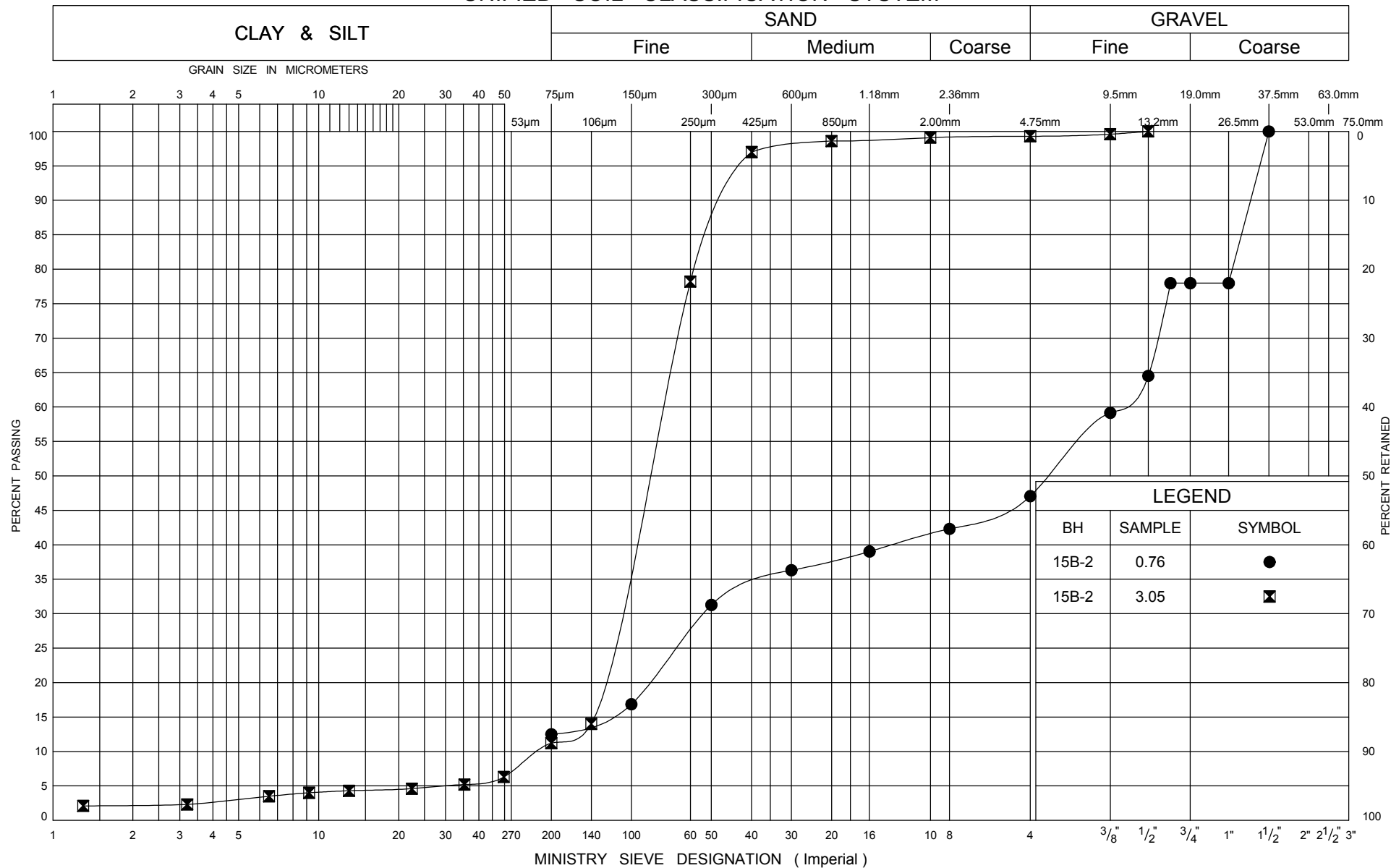
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED	● QUICK TRIAXIAL	+						×	
										FIELD VANE						LAB VANE	
222.80 0.00	Ground						20	40	60	80	100						
222.34 0.46	FILL Brown crushed granulars.																
221.43 1.37	SAND, SP Brown, moist to saturated, compact to dense, occasional gravel and silty layers.	gravel layer	1	SPT	31		222								56 31 (13)	Water level @ 2.51 m.	
							221								5 58 28 9 (37)		
							220										
							219										
							218										
217.77 5.03	End of Borehole.																

JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

FILL

FIG No C- 15B.1

GWP 167-91-00

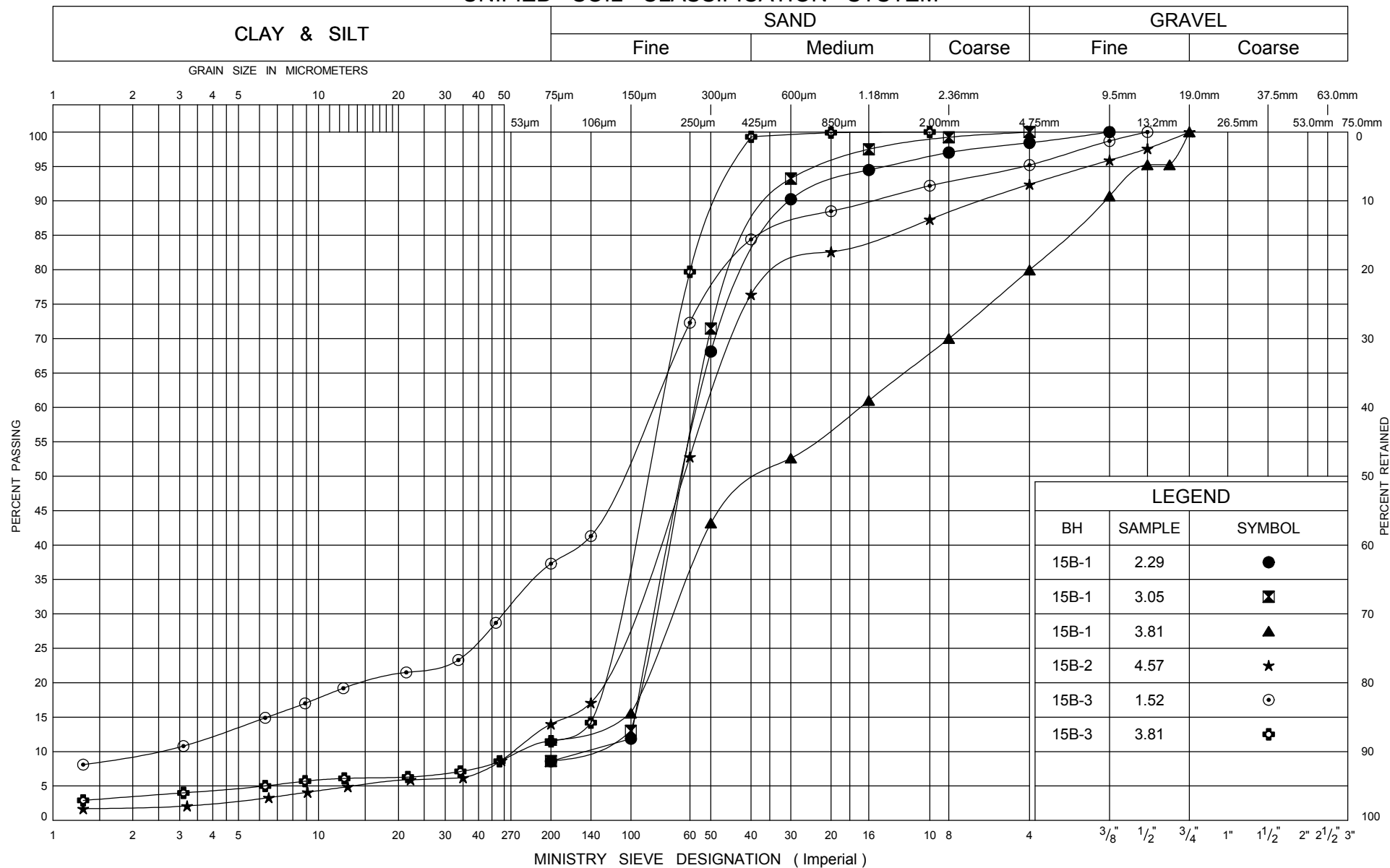
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GRAIN SIZE DISTRIBUTION

SAND, SP

FIG No C- 15B.2

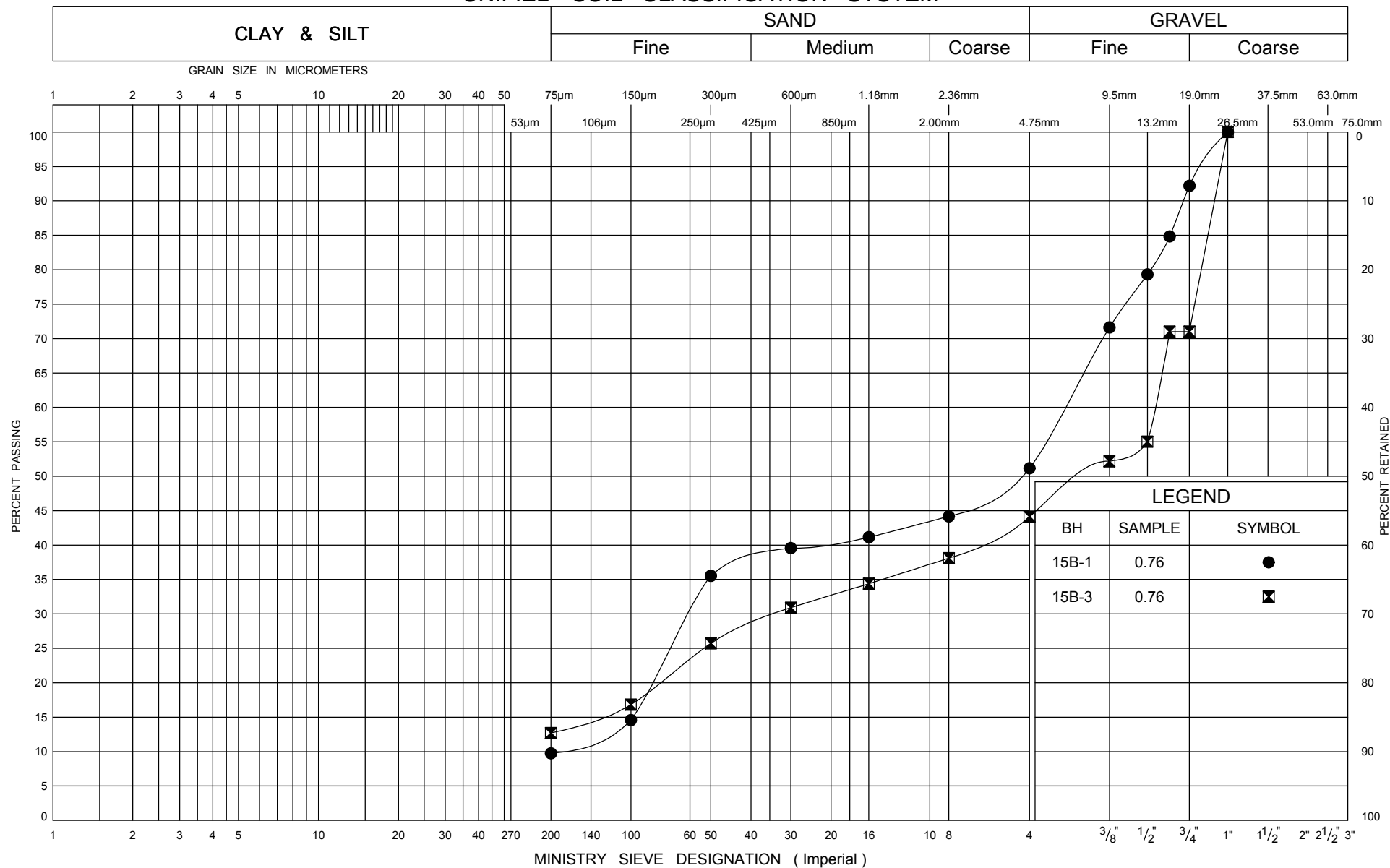
GWP 167-91-00

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GRAIN SIZE DISTRIBUTION

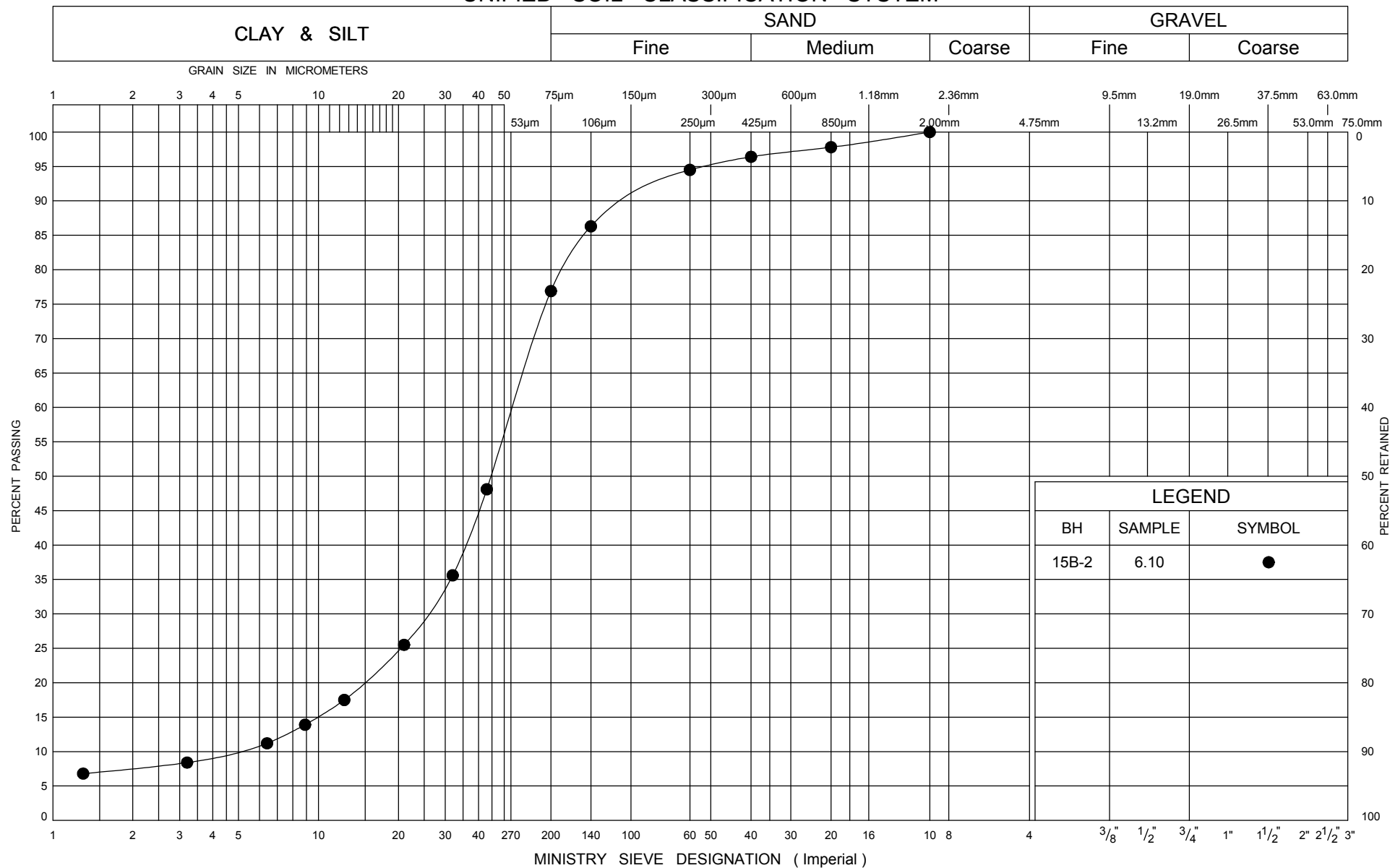
GRAVEL LAYERS, GP

FIG No C- 15B.3

GWP 167-91-00

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GRAIN SIZE DISTRIBUTION

SAND AND SILT TILL, SM-ML

FIG No C- 15B.4

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

METRIC

+ ³, × ³: Numbers refer to Sensitivity ○ ¹⁵⁰ UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 16B-2

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4941937, Easting - 214274 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 20.8.07 - 20.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		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			STANDARD 20 40 60 80 100	DYN. CONE 20 40 60 80 100					
220.50 0.00	Ground													
	FILL Brown, moist, dense, consisting of crushed granulars.		1	SPT	34		220							44 40 (16)
218.98 1.52	FILL Grey, wet, very loose to loose, consisting of mainly sand and silt, trace organics and gravel.		2	SPT	3		219							
217.91 2.59	PEAT Black, wet, soft, partially decomposed.		3	SPT	4		218							Water level @ 2.44 m.
217.45 3.05			4	SPT	6		217							
	SAND & SILT TILL, SM-ML Grey, wet to moist, loose to very dense.		5	SPT	41		216							0 18 74 8 (81)
			6	SPT	50		215							
214.71 5.79	End of Borehole.		7	SPT	33									

JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+³, X³: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 16B-3

1 OF 1

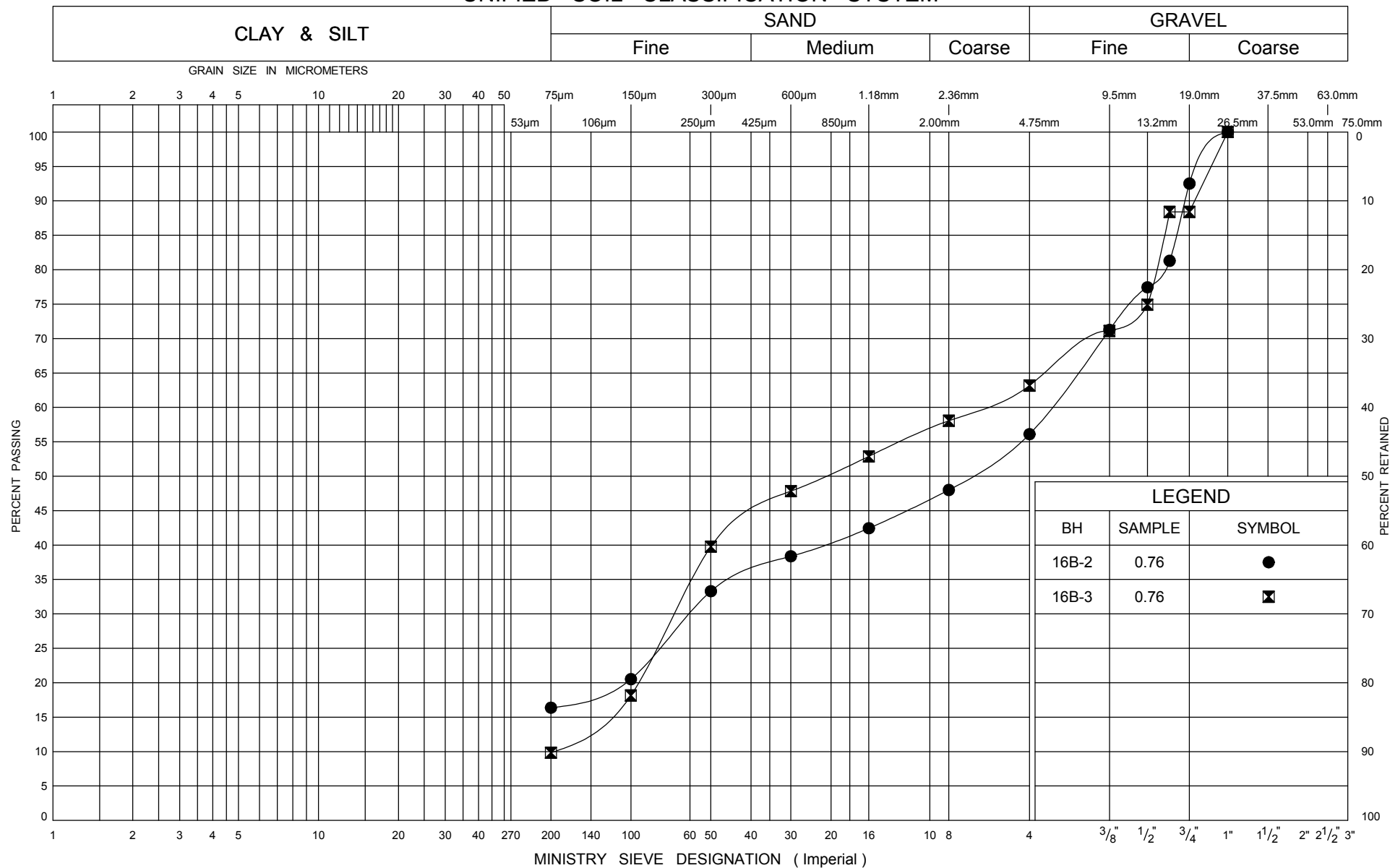
METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4941950, Easting - 214278 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 20.8.07 - 20.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE			PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL						× LAB VANE	WATER CONTENT (%)		
								20	40	60						80	100		
220.59	Ground																		
0.00																			
220.29	300 mm Granular FILL.																		
0.30																			
	FILL Dark brown, moist to wet, loose, consisting of mixed gravel and sand, with organic staining and inclusions, trace to some silt.		1	SPT	9		220								37 53 (10)				
219.07			2	SPT	16		219								2 46 49 3 (52) Water level @ 1.91 m				
1.52			3	SPT	27		218												
			4	SPT	24		217												
	SAND & SILT TILL, SM-ML Grey, wet, compact to very dense, trace gravel.		5	SPT	39		216								9 35 47 9 (55)				
			6	SPT	60														
215.56																			
5.03	End of Borehole.																		

JOE MTO 07-6-IEG1B.GPJ ONTARIO MOT.GDT 8/12/09

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

FILL

FIG No C- 16B.1

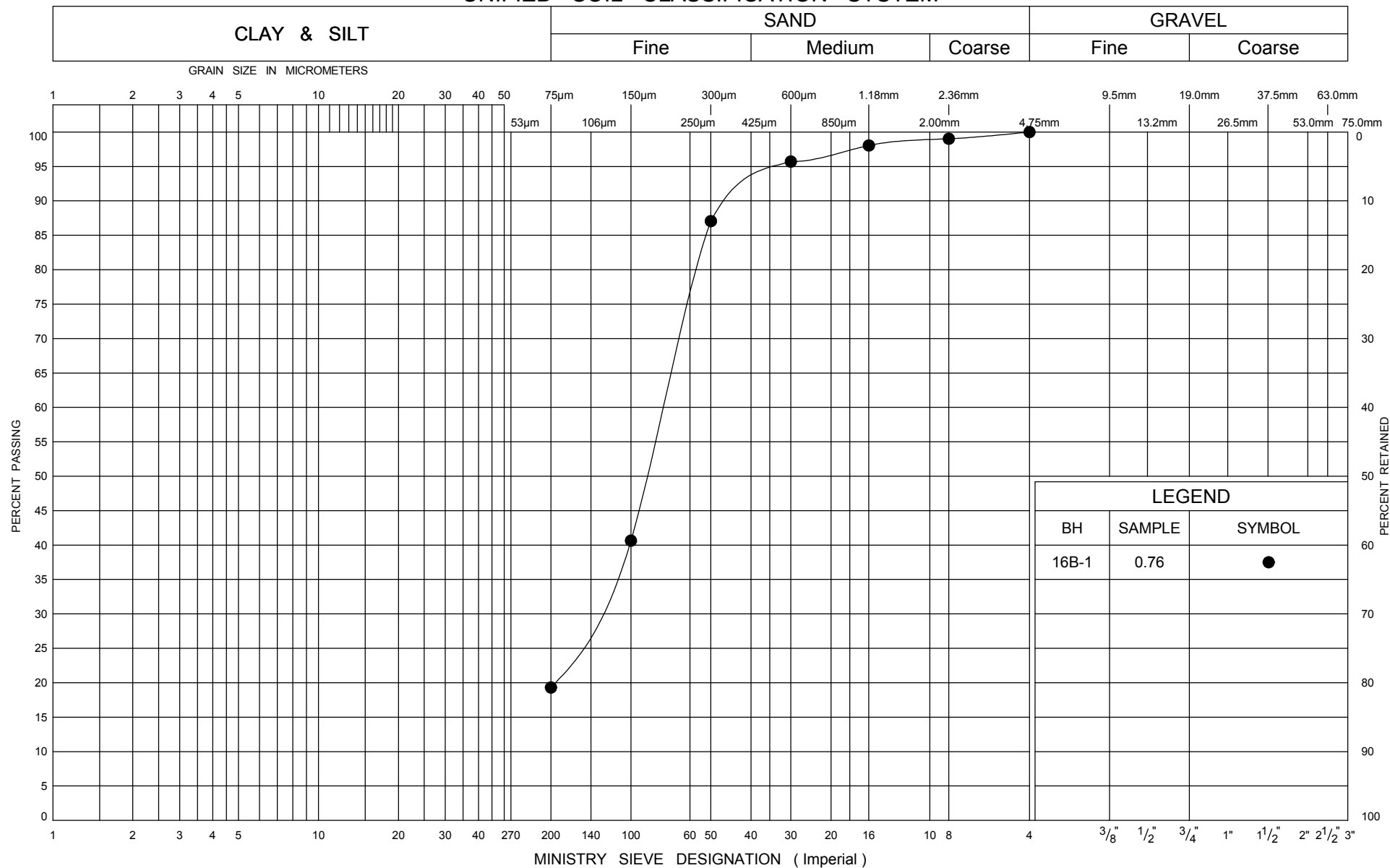
GWP 167-91-00

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GRAIN SIZE DISTRIBUTION

SILTY SAND, SM

FIG No C- 16B.2

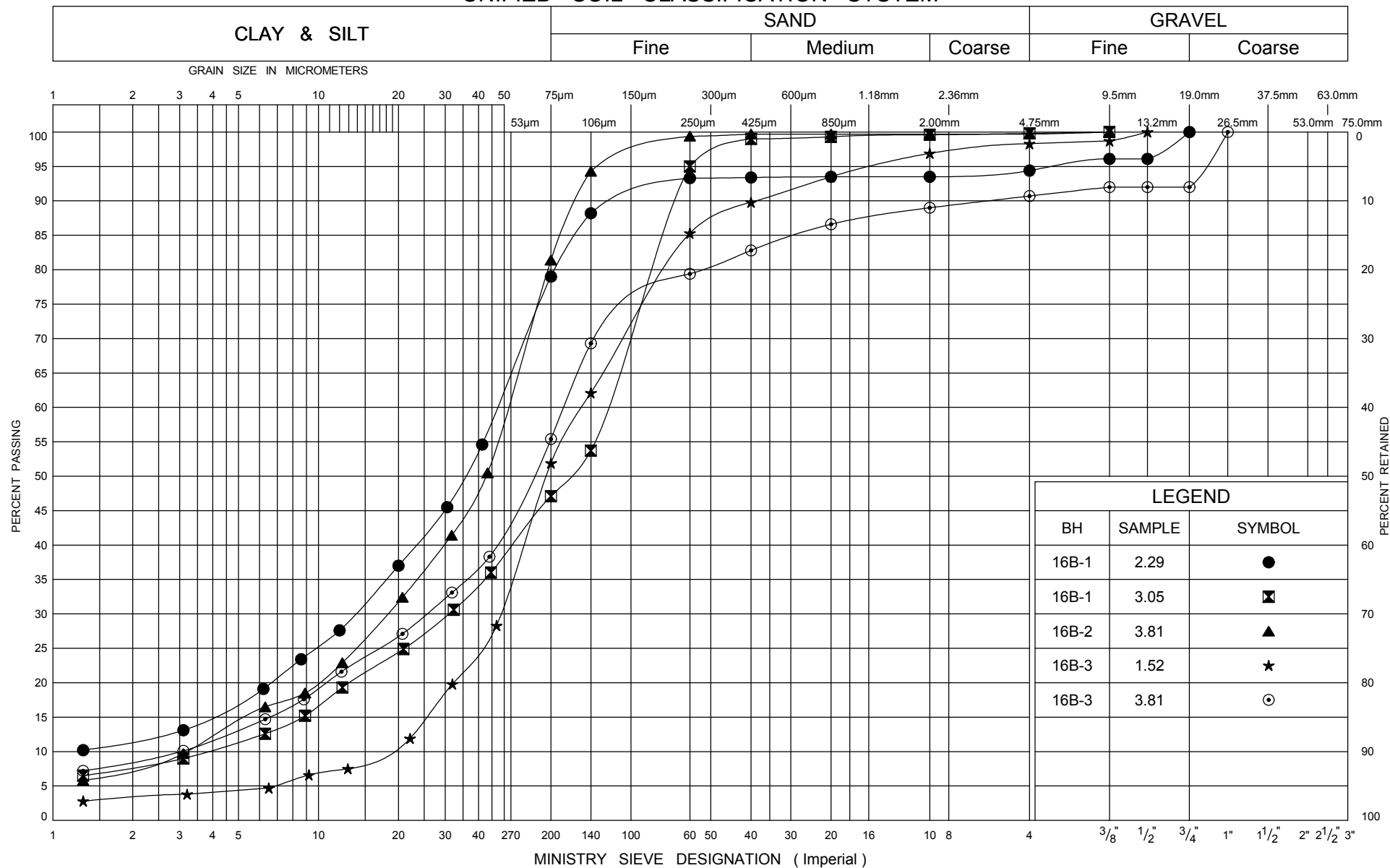
GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford


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UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

SAND & SILT TILL, SM-ML

FIG No C- 16B.3

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford



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RECORD OF BOREHOLE No 17B-1

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4942035, Easting - 214680 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 16.8.07 - 16.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE			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								
214.91 0.00	Ground 150 mm TOPSOIL.					▽												
			1	SPT	37		214									0 30 62 8 (70)		
	SILT TILL, ML Grey, moist to wet, dense to very dense, trace sand to sandy.		2	SPT	70		213									Water level @ 1.98 m.		
			3	SPT	66										0 27 65 8 (73)			
211.40 3.51	End of Borehole.		4	SPT	57	212									0 5 85 10 (95)			

JOE MTO 07-6-IEG1B.GPJ ONTARIO MOT.GDT 8/12/09

RECORD OF BOREHOLE No 17B-2

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4942051, Easting - 214674 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 15.8.07 - 15.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		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	● QUICK TRIAXIAL						+ FIELD VANE	× LAB VANE	WATER CONTENT (%)
216.46 0.00	Ground						20	40	60	80	100	10	20	30			
215.55 0.91	FILL Brown, moist, compact, consisting of crushed granulars.		1	SPT	19												
	FILL Grey, saturated, very loose, consisting of sand and silt, with organic inclusions.		2	SPT	3												
214.02 2.44			3	SPT	20												
			4	SPT	30												
	SILT TILL, ML Grey, moist to wet, compact to dense, trace sand to sandy.		5	SPT	46												
			6	SPT	14												
211.43 5.03	End of Borehole.																

JOE MTO 07-6-IEG1B.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 17B-3

1 OF 1

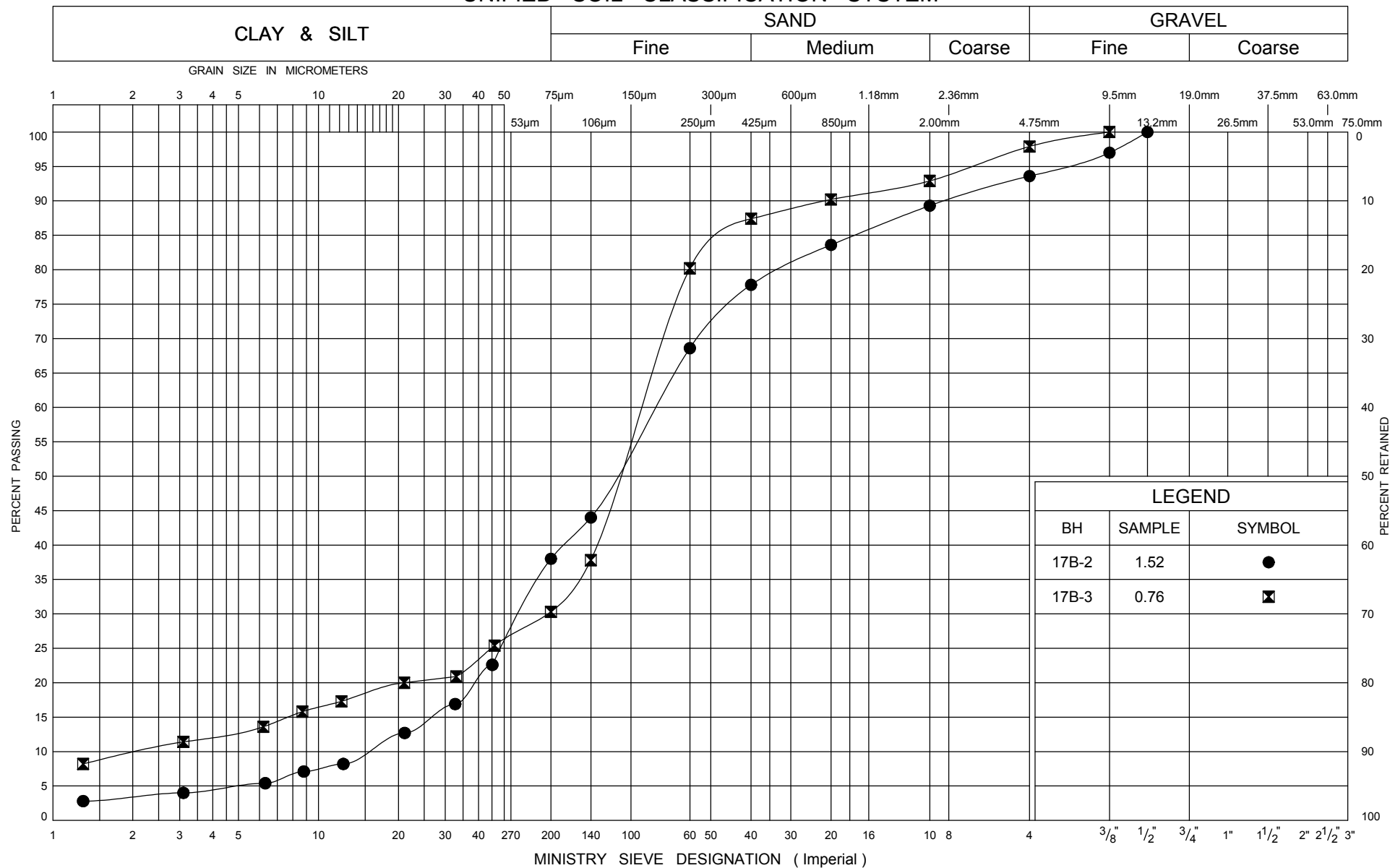
METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4942064, Easting - 214676 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 16.8.07 - 16.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		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			STANDARD 20 40 60 80 100	DYN. CONE 20 40 60 80 100					
216.51 0.00	Ground													
	150 mm TOPSOIL.													
	FILL Dark brown to black, moist, compact, consisting of mixed gravel, sand, silt and organics.		1	SPT	28		216				o			2 68 21 10 (30)
214.68 1.83			2	SPT	28		215				o			
			3	SPT	47		214				o			0 5 88 7 (95)
	SILT TILL, ML Grey, moist to wet, compact to dense, trace sand to sandy.		4	SPT	47		213				o			Water level @ 3.05 m.
			5	SPT	40		212				o			0 24 71 5 (77)
211.48 5.03	End of Borehole.		6	SPT	37						o			

JOE MTO 07-6-IEG1B.GPJ ONTARIO MOT.GDT 8/12/09

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

FILL

FIG No C- 17B.1

GWP 167-91-00

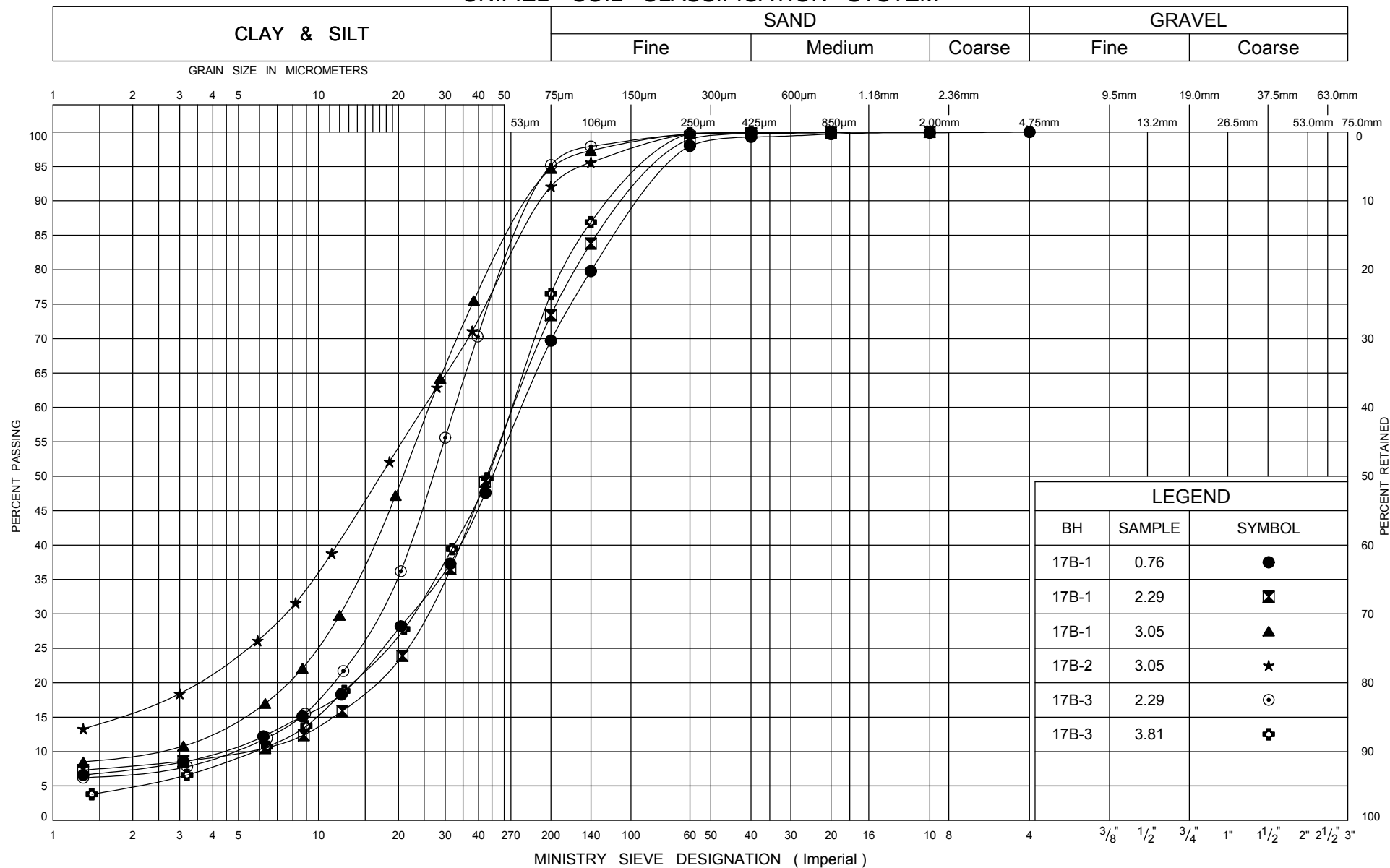
Hwy 26 - Sydenham Townline to Meaford



Ministry of
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Ontario

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

SILT TILL, ML

FIG No C- 17B.2

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford



Ministry of
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Ontario

RECORD OF BOREHOLE No 18B-1

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4942071, Easting - 214806 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 20.8.07 - 20.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)	
								○ UNCONFINED	+ FIELD VANE							
								● QUICK TRIAXIAL	× LAB VANE							
213.13 0.00	Ground						213									
	150 mm TOPSOIL															
	SAND & SILT TILL, SM-ML Grey and brown, moist to wet, dense to very dense.		1	SPT	35		212							0 43 54 3 (57)		
			2	SPT	75											
210.84 2.29			3	SPT	23		211							0 2 74 24 (98)		
	Clayey SILT TILL, CL-ML Grey and brown, wet, very stiff to hard, trace sand.															
209.62 3.51	End of Borehole.		4	SPT	45		210							Water level @ 3.35 m.		

JOE MTO 07-6-IEG1B.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 18B-2

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4942087, Easting - 214797 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 15.8.07 - 15.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE						
								● QUICK TRIAXIAL	× LAB VANE						
215.66 0.00	Ground						20 40 60 80 100	10 20 30							
	FILL Brown, moist to wet, compact, consisting of granulars.		1	SPT	18		215								
214.14 1.52	FILL Brown, moist to saturated, very loose, consisting of mixed gravel, sand, silt and clay.		2	SPT	3		214							8 67 21 5 (26)	
213.22 2.44	PEAT Black, wet, firm, partially decomposed.		3	SPT	5		213							Water level @ 2.79 m.	
212.92 2.74			4	SPT	100+									2 24 70 5 (75)	
	SAND & SILT TILL, SM-ML Grey, moist to wet, very dense to dense.		5	SPT	100+		212								
			6	SPT	43		211							0 13 80 7 (87)	
210.17 5.49	End of Borehole.		7	SPT	100+										

JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 18B-3

1 OF 1

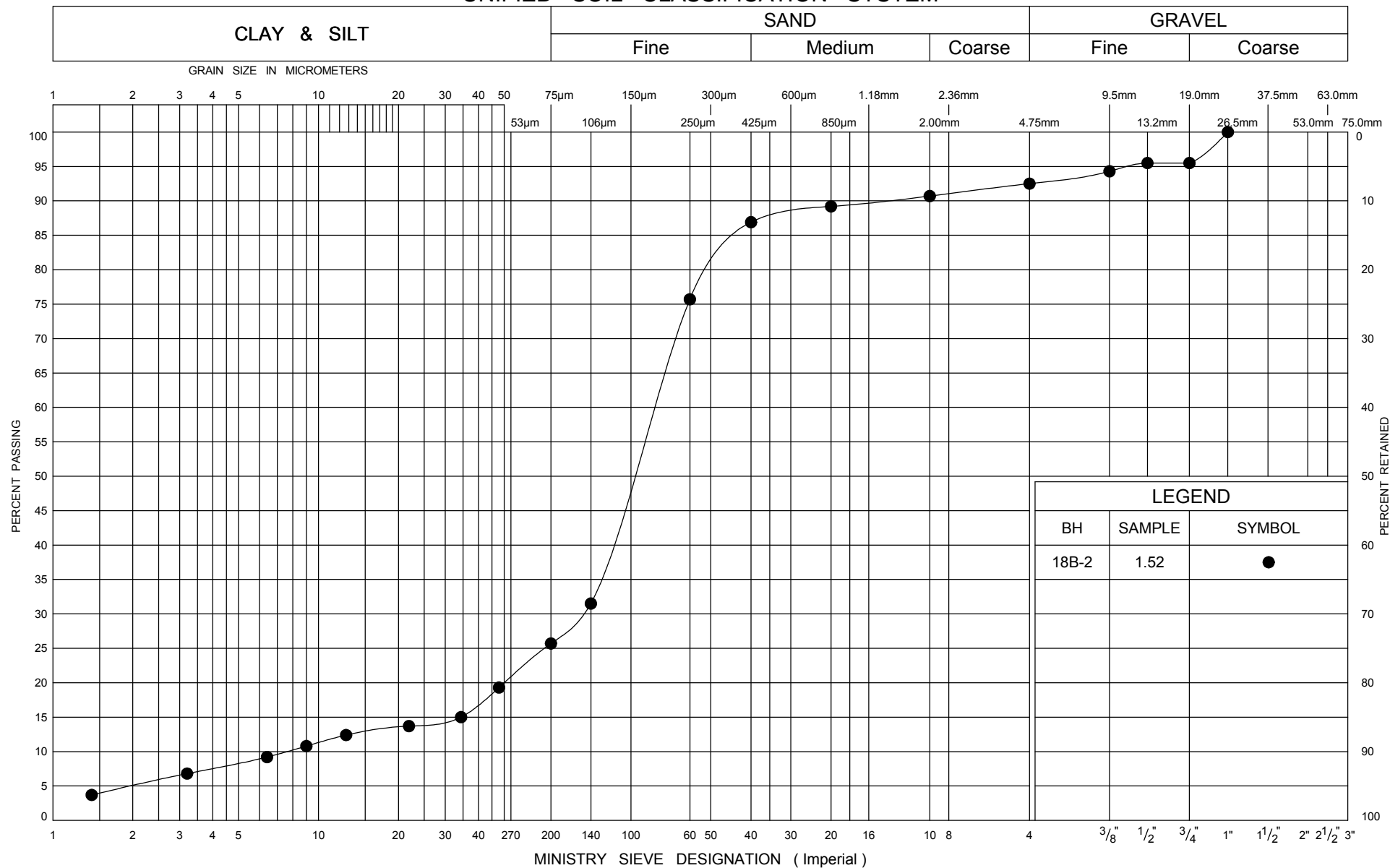
METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4942099, Easting - 214802 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 16.8.07 - 16.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		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			STANDARD 20 40 60 80 100	DYN. CONE 20 40 60 80 100					
215.73 0.00	Ground 75 mm TOPSOIL.													
			1	SPT	5		215							Water level @ 0.3 m.
			2	SPT	13		214							0 79 14 7 (21)
			3	SPT	63		213							1 64 29 5 (34)
			4	SPT	73		212							0 74 24 3 (26)
	SAND & SILT TILL, SM-ML Wet to moist, loose to very dense, occasional silty clay layers.		5	SPT	23		211							0 23 69 8 (77)
			6	SPT	69		210							
			7	SPT	23		209							
			8	SPT	11									
			9	SPT	5									
208.11 7.62	End of Borehole.													

JOE MTO 07-6-IEG1B.GPJ ONTARIO MOT.GDT 8/12/09

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

FILL

FIG No C- 18B.1

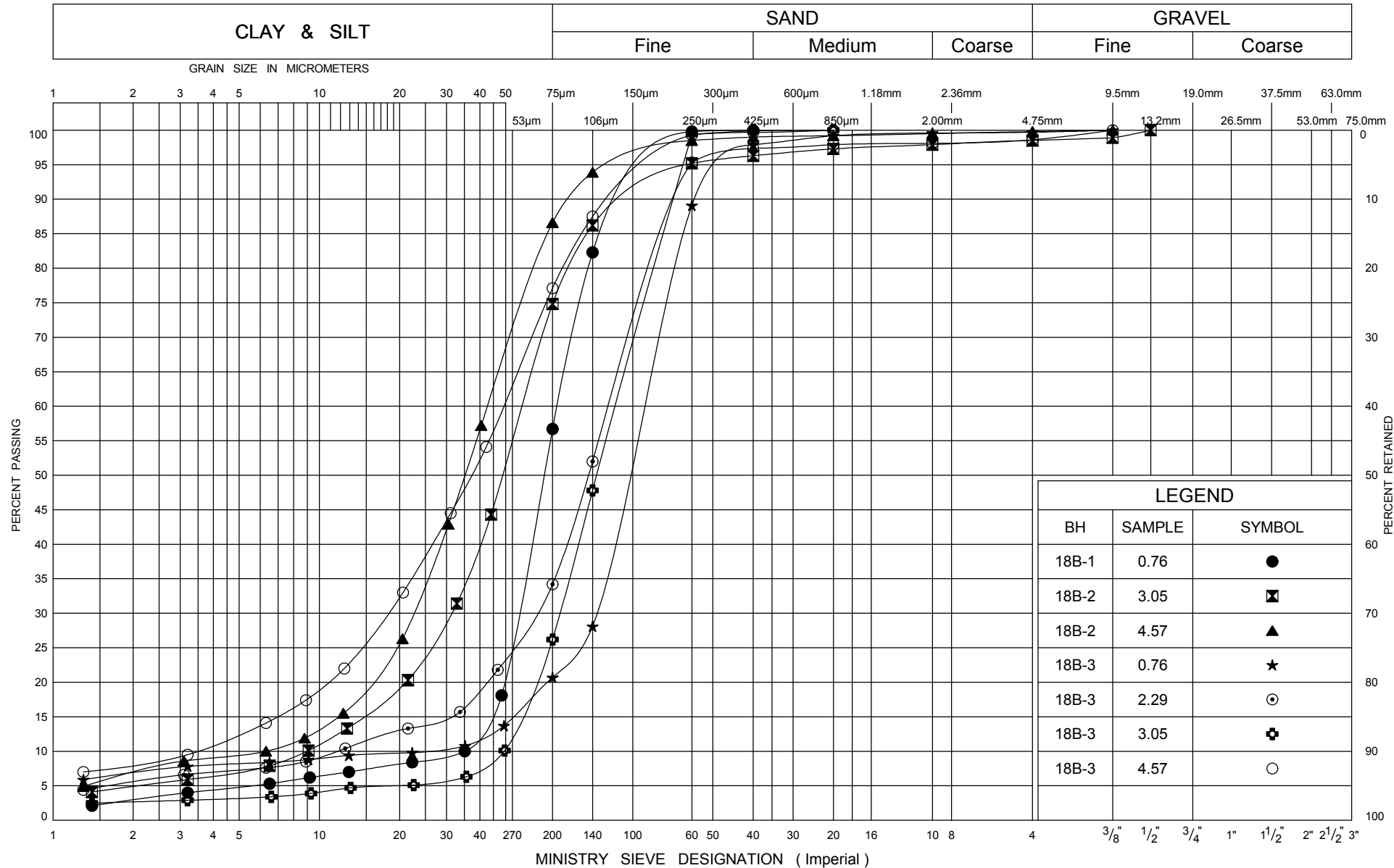
GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford


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UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

GRAIN SIZE DISTRIBUTION

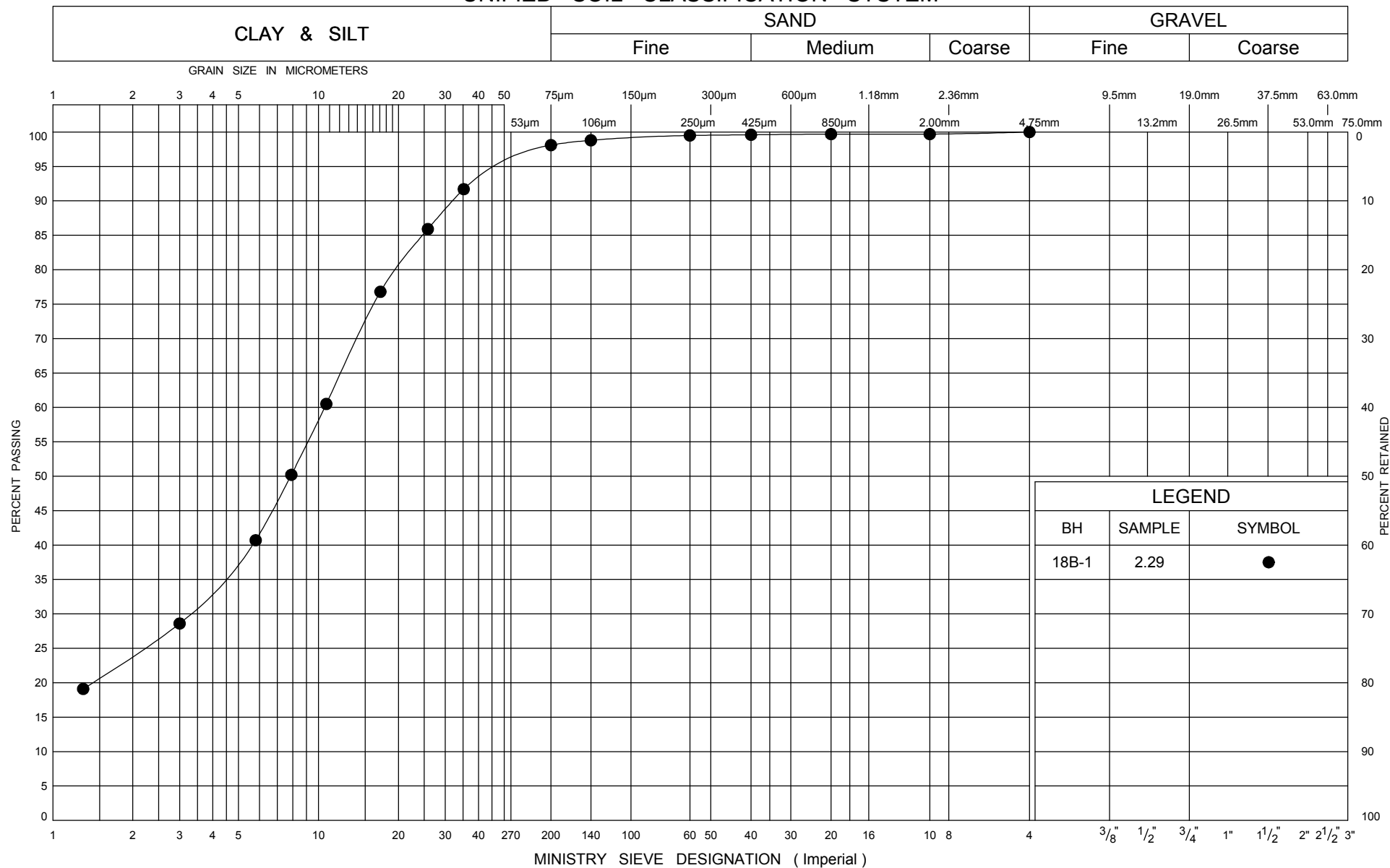
SAND & SILT TILL, SM-ML

FIG No C- 18B.2

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM



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GRAIN SIZE DISTRIBUTION

CLAYEY SILT TILL, CL-ML

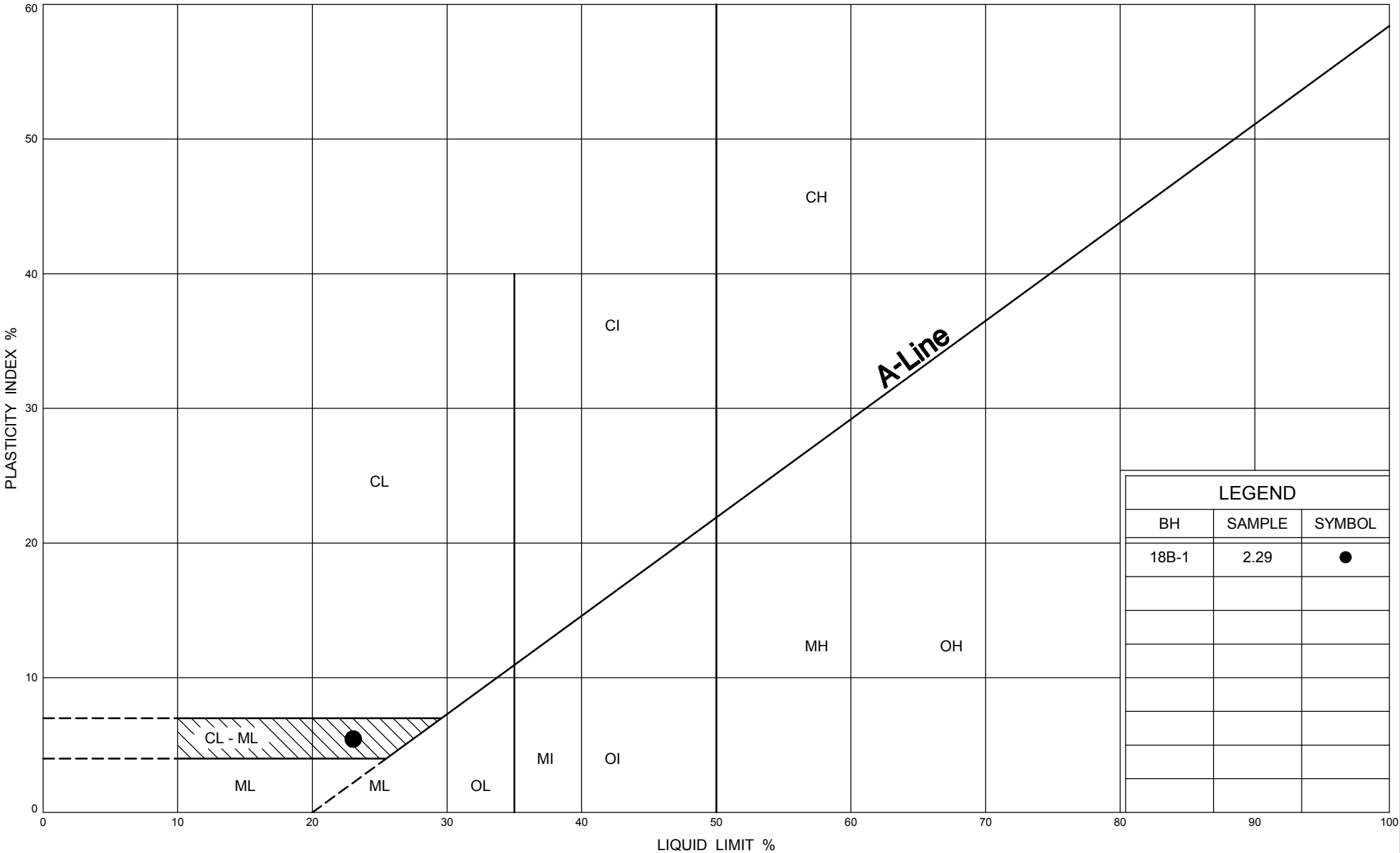
FIG No C- 18B.3

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

ONTARIO MOT PLASTICITY CHART SMALL CULVE 07-6-JEGIB.GPJ ONTARIO MOT.GDT 20/11/09

Oct 75, FF - S - 21



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Ontario

PLASTICITY CHART
CLAYEY SILT TILL, CL-ML

FIG No C- 18B.4

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

RECORD OF BOREHOLE No 19B-1

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4942324, Easting - 215678 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 22.8.07 - 22.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		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			STANDARD 20 40 60 80 100	DYN. CONE 20 40 60 80 100					
206.50 0.00	Ground 100 mm TOPSOIL.													
			1	SPT	24		206							9 28 45 19 (63)
			2	SPT	23		205							
			3	SPT	42		204							35 25 27 13 (41)
			4	SPT	53		203							
202.54 3.96	End of Borehole.		5	SPT	100+									Borehole dry and open @ completion.

JOE MTO 07-6-IEG1B.GPJ ONTARIO MOT.GDT 8/12/09

RECORD OF BOREHOLE No 19B-2

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4942323, Easting - 215693 ORIGINATED BY RB
DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
DATUM Geodetic DATE 22.8.07 - 22.8.07 CHECKED BY JL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE		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			STANDARD 20 40 60 80 100	DYN. CONE 20 40 60 80 100					
207.20 0.00	Ground													
206.74 0.46	460 mm Crushed Granular FILL.						207							
	FILL Brown, moist, consisting mainly of sand, some silt and gravel.		1	SPT	6		206							12 71 13 4 (17)
205.52 1.68			2	SPT	13		205							
			3	SPT	45		204							18 27 39 15 (54)
	Clayey SILT to Silty CLAY TILL, CL-ML to CL Brown, moist, stiff to hard, with embedded sand and gravel.		4	SPT	68		203							
			5	SPT	75									
			6	SPT	45									
202.17 5.03	End of Borehole.													Borehole dry and open @ completion.

JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 19B-3

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4942328, Easting - 215703 ORIGINATED BY RB
DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
DATUM Geodetic DATE 22.8.07 - 22.8.07 CHECKED BY JL

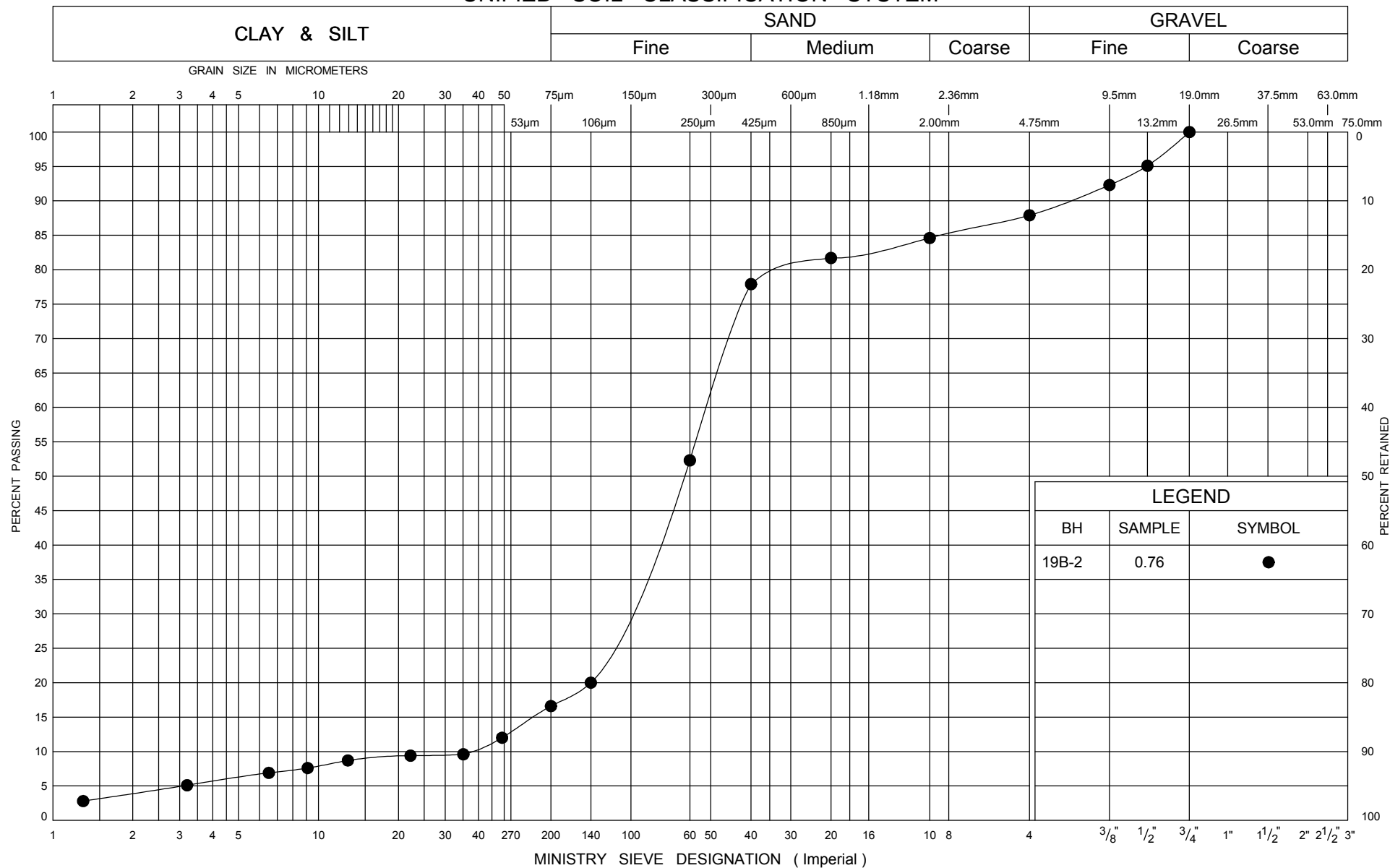
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE						
								● QUICK TRIAXIAL	× LAB VANE						
207.25 0.00	Ground													GR SA SI CL	
206.95 0.30	300 mm Crushed Granular FILL.						207								
206.03 1.22	Fine SAND, SP Brown, moist to wet, compact, trace gravel and silt.		1	SPT	11		206							7 24 58 11 (69)	
205.42 1.83	Sandy SILT, ML Brown, moist, compact.		2	SPT	18		205								
	Clayey SILT to Silty CLAY TILL, CL-ML to CL Brown, moist, very stiff to hard, with embedded sand and gravel, frequent large gravel pieces (up to 40 mm), occasional cobbles.		3	SPT	45		204							20 34 32 14 (46)	
		4	SPT	90		203									
		5	SPT	28											
		6	SPT	100+											
202.45 4.80	End of Borehole.													Borehole dry and open @ completion.	

JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, × 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

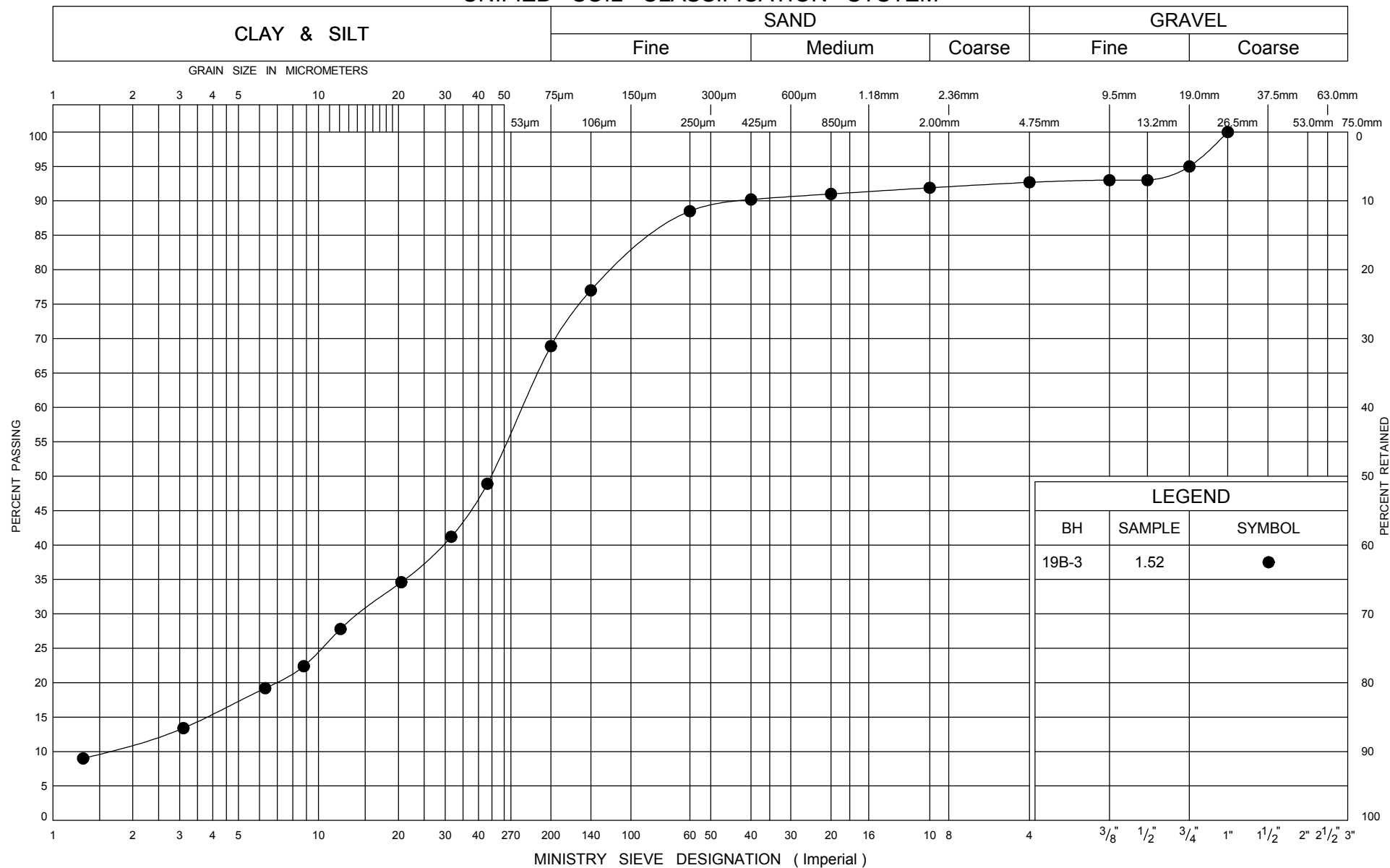
FILL

FIG No C- 19B.1

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

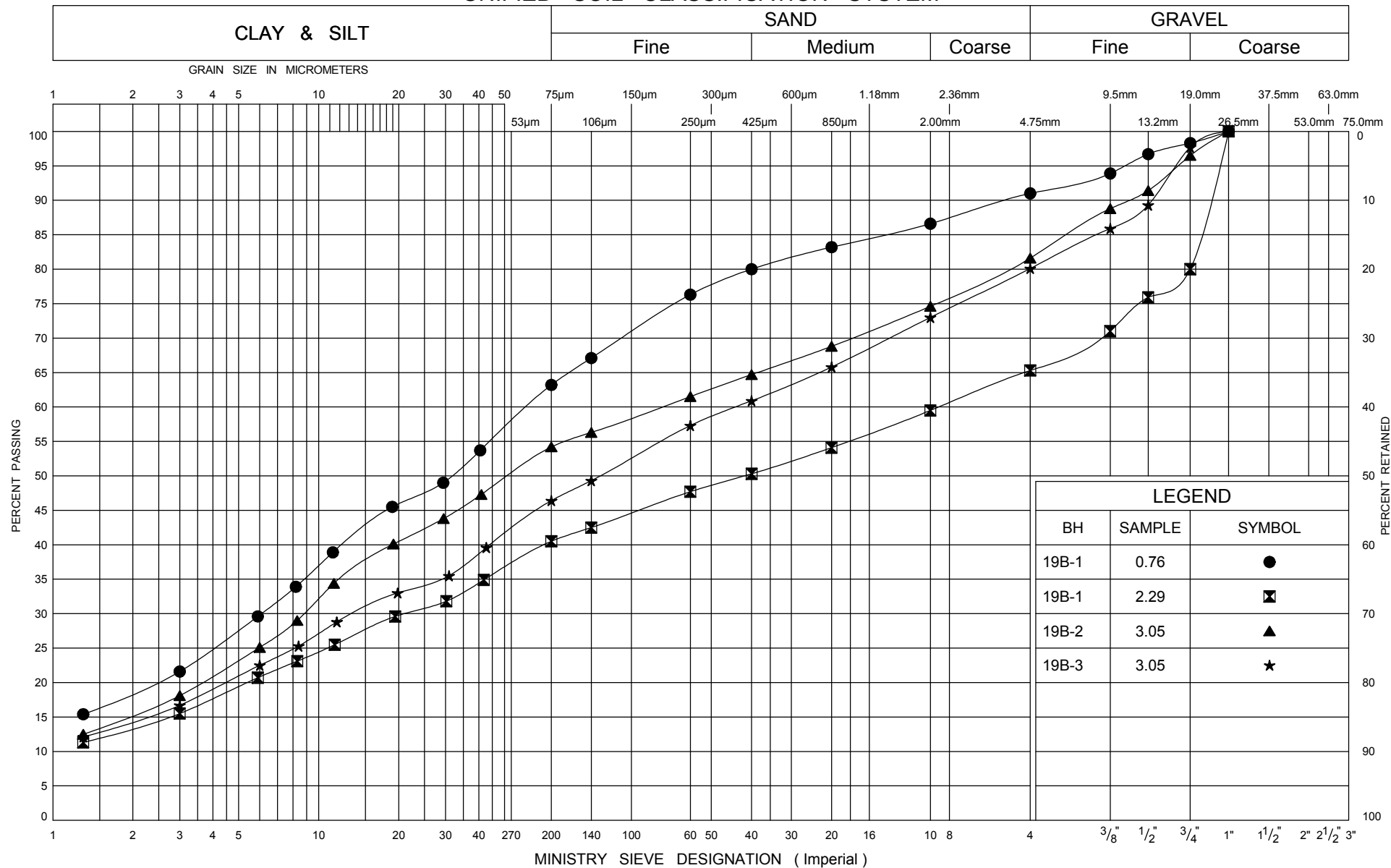
SANDY SILT, ML

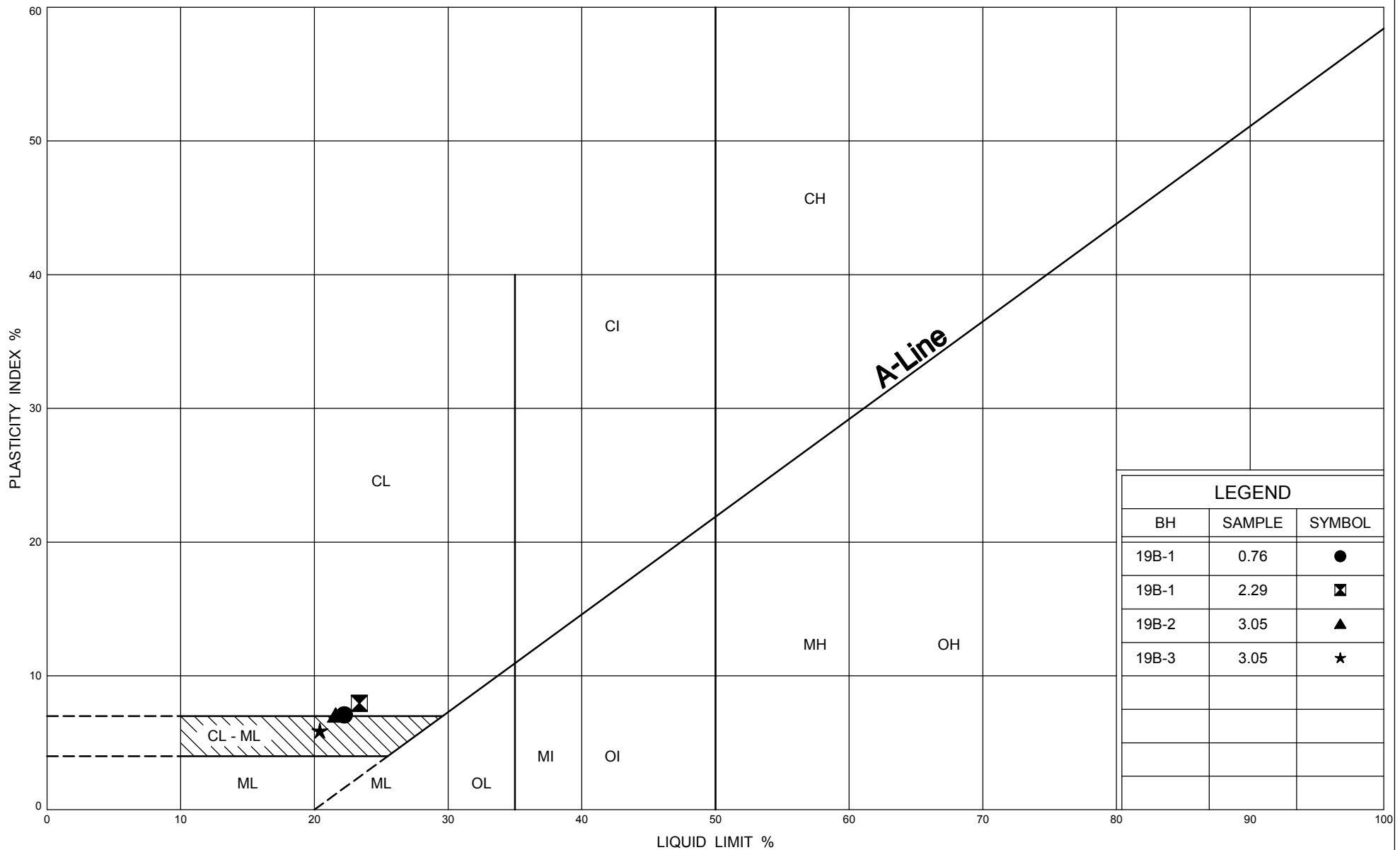
FIG No C- 19B.2

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

UNIFIED SOIL CLASSIFICATION SYSTEM





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PLASTICITY CHART CLAYEY SILT TO SILTY CLAY TILL, CL-ML TO CL

FIG No C- 19B.4

GWP 167-91-00

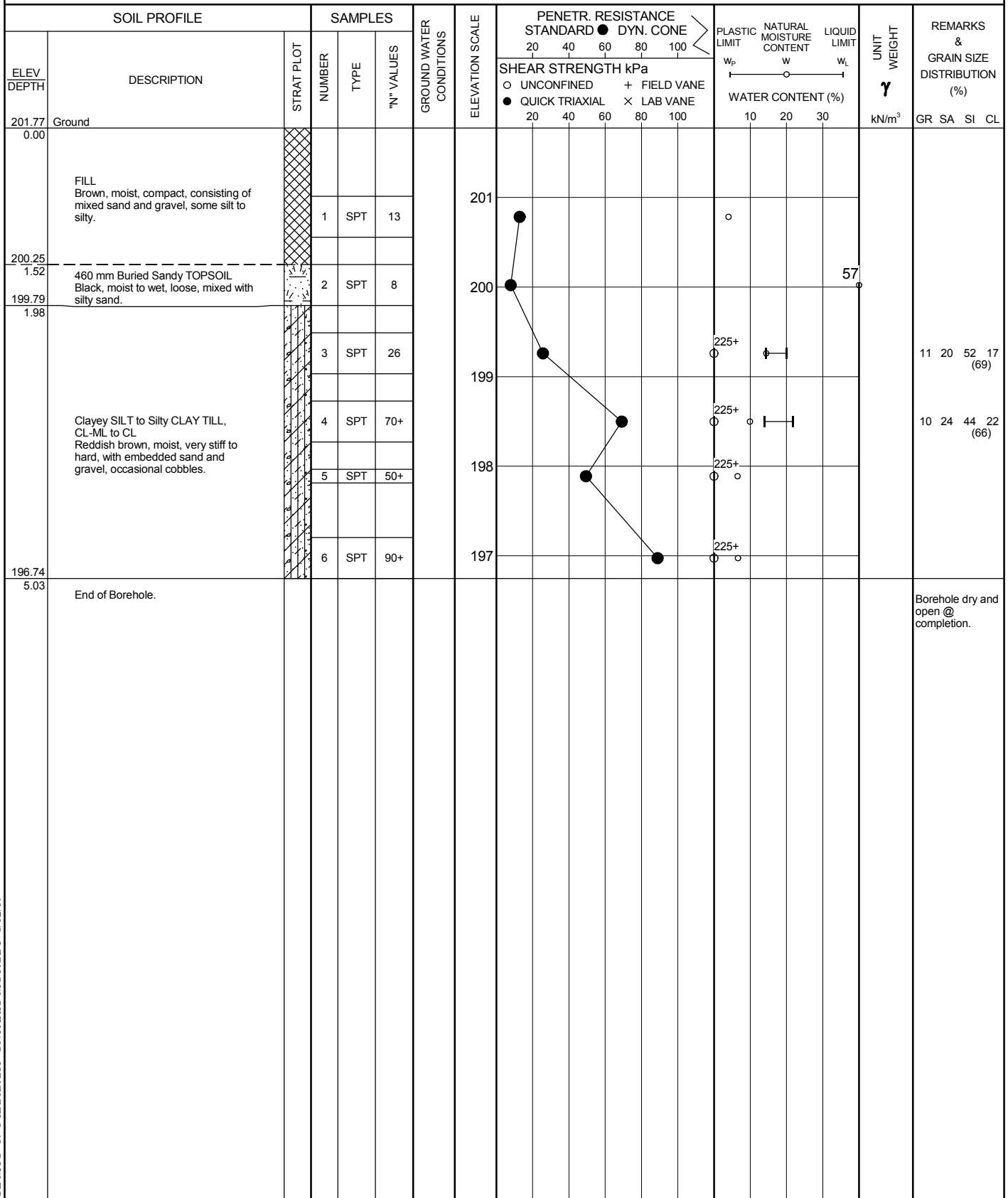
Hwy 26 - Sydenham Townline to Meaford

RECORD OF BOREHOLE No 20B-1

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4942444, Easting - 216073 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 21.8.07 - 21.8.07 CHECKED BY JL



JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

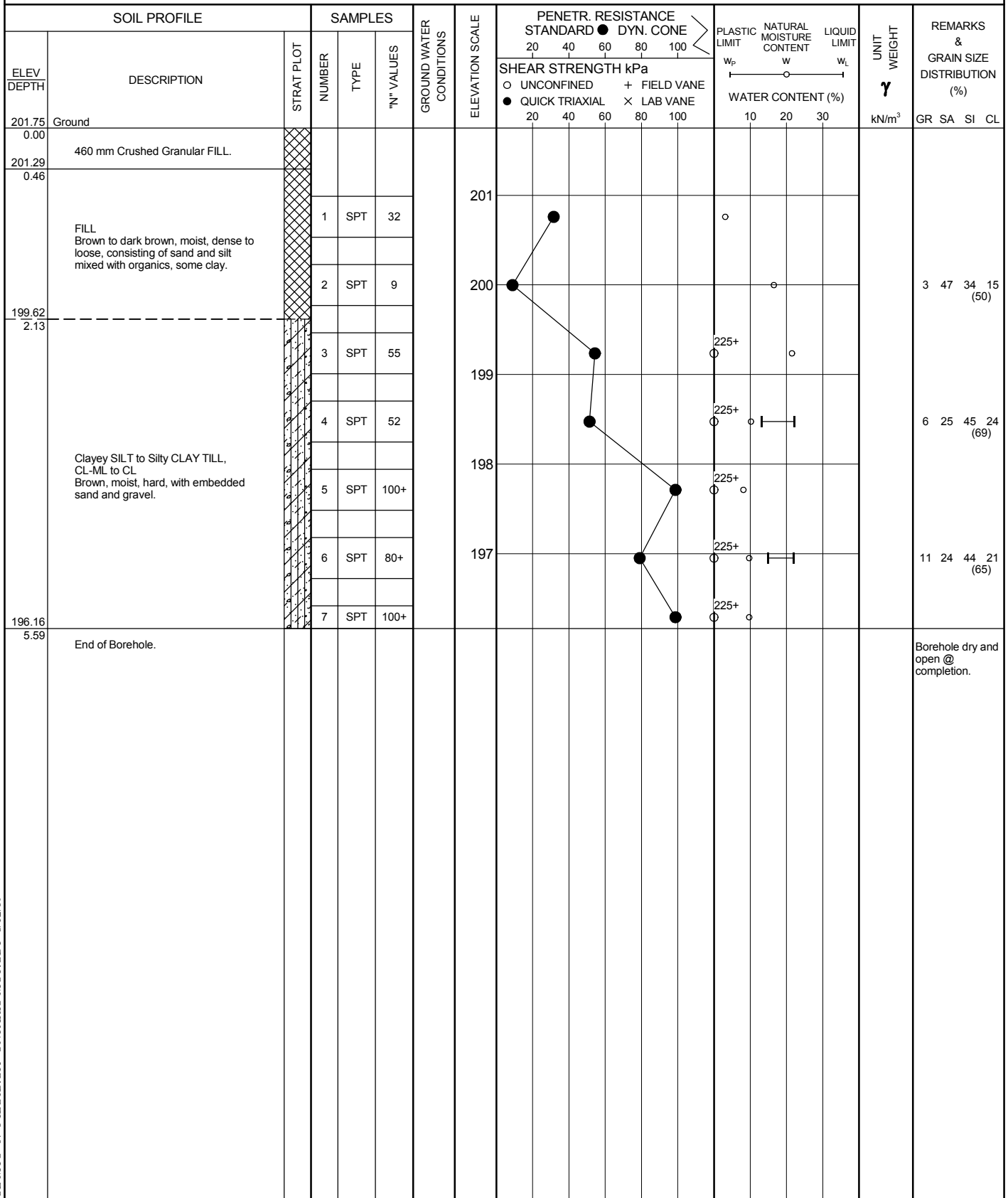
○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 20B-2

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4942456, Easting - 216073 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 21.8.07 - 21.8.07 CHECKED BY JL



JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to Sensitivity

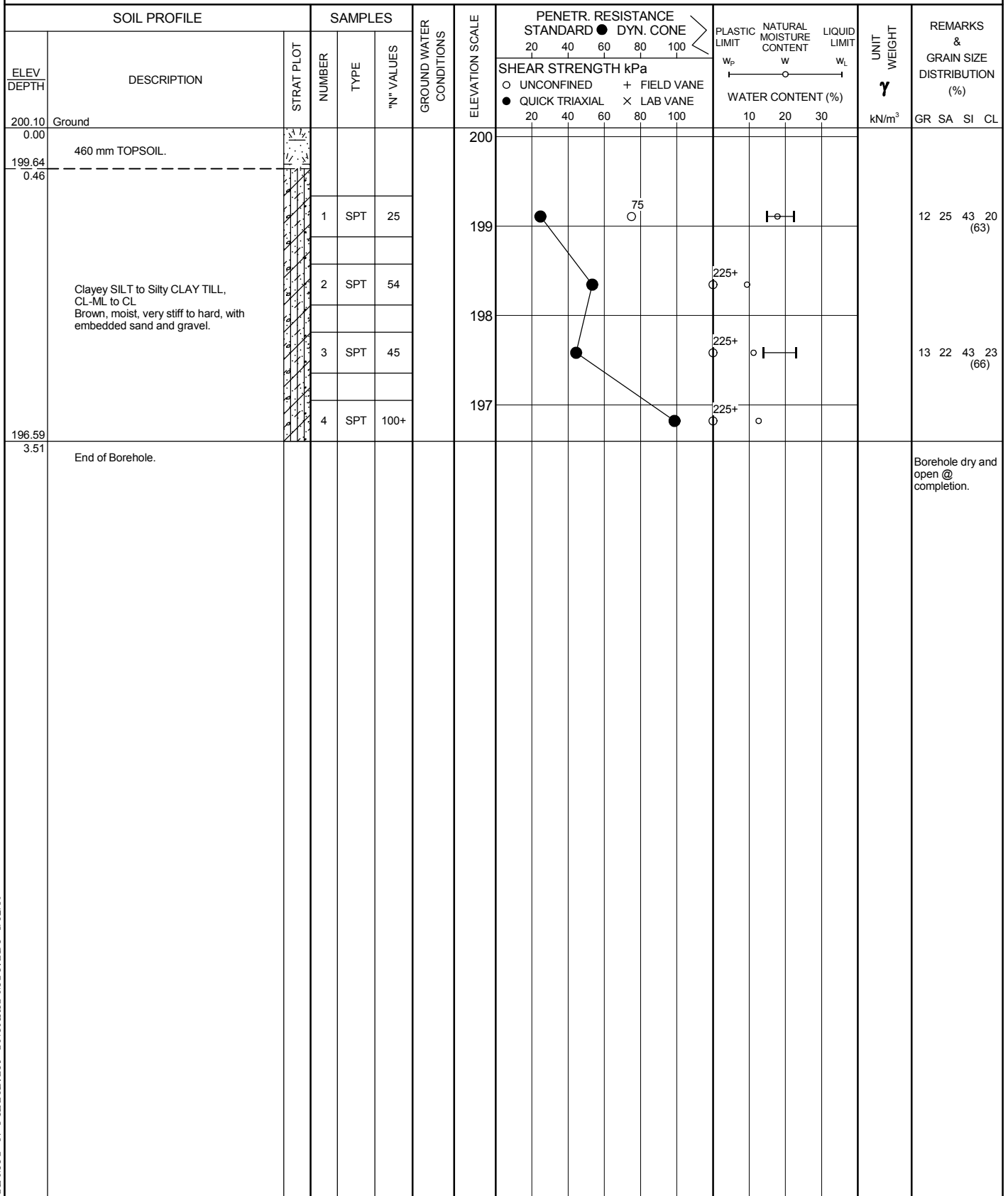
○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 20B-3

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4942466, Easting - 216067 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 21.8.07 - 21.8.07 CHECKED BY JL

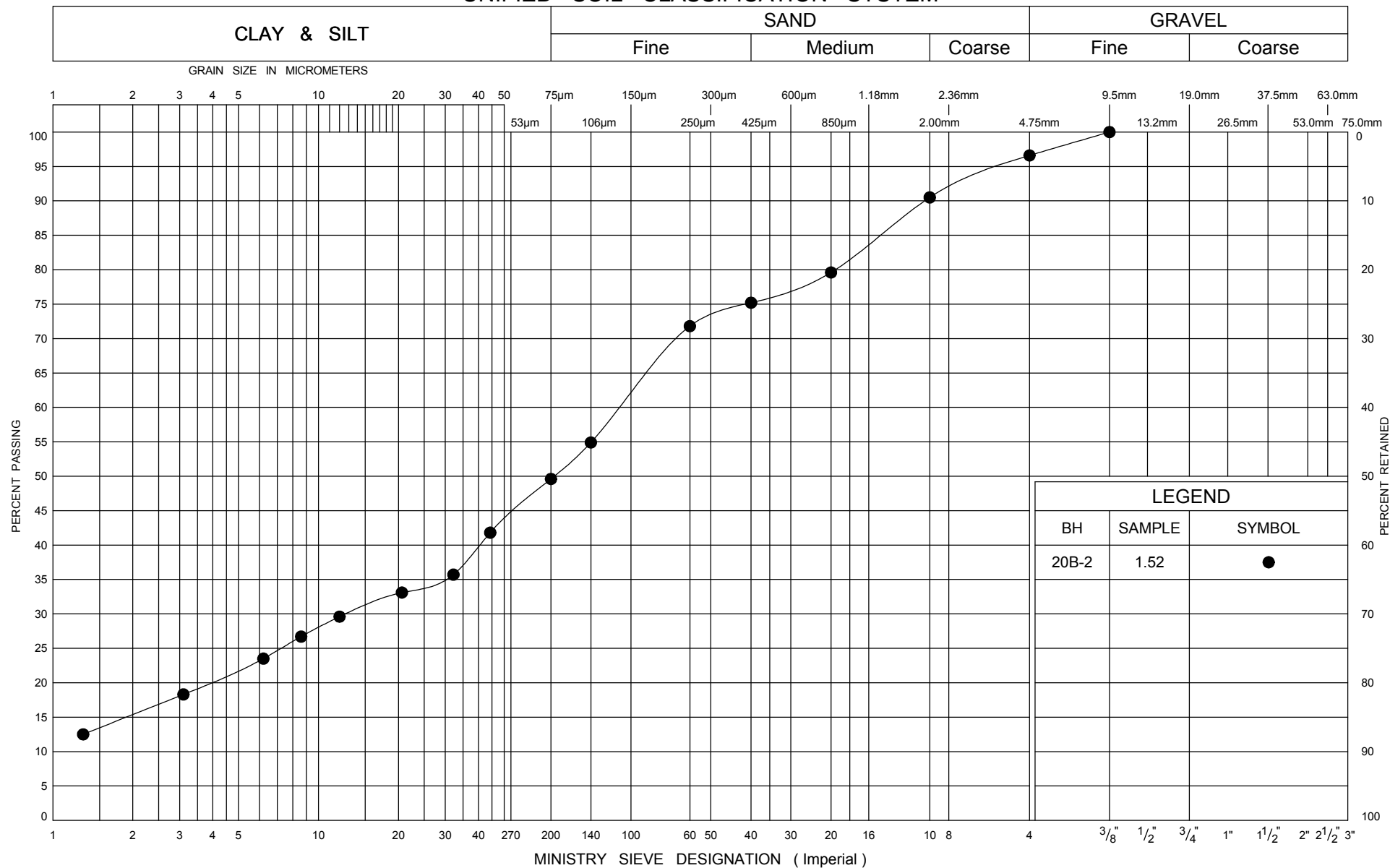


JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

FILL

FIG No C- 20B.1

GWP 167-91-00

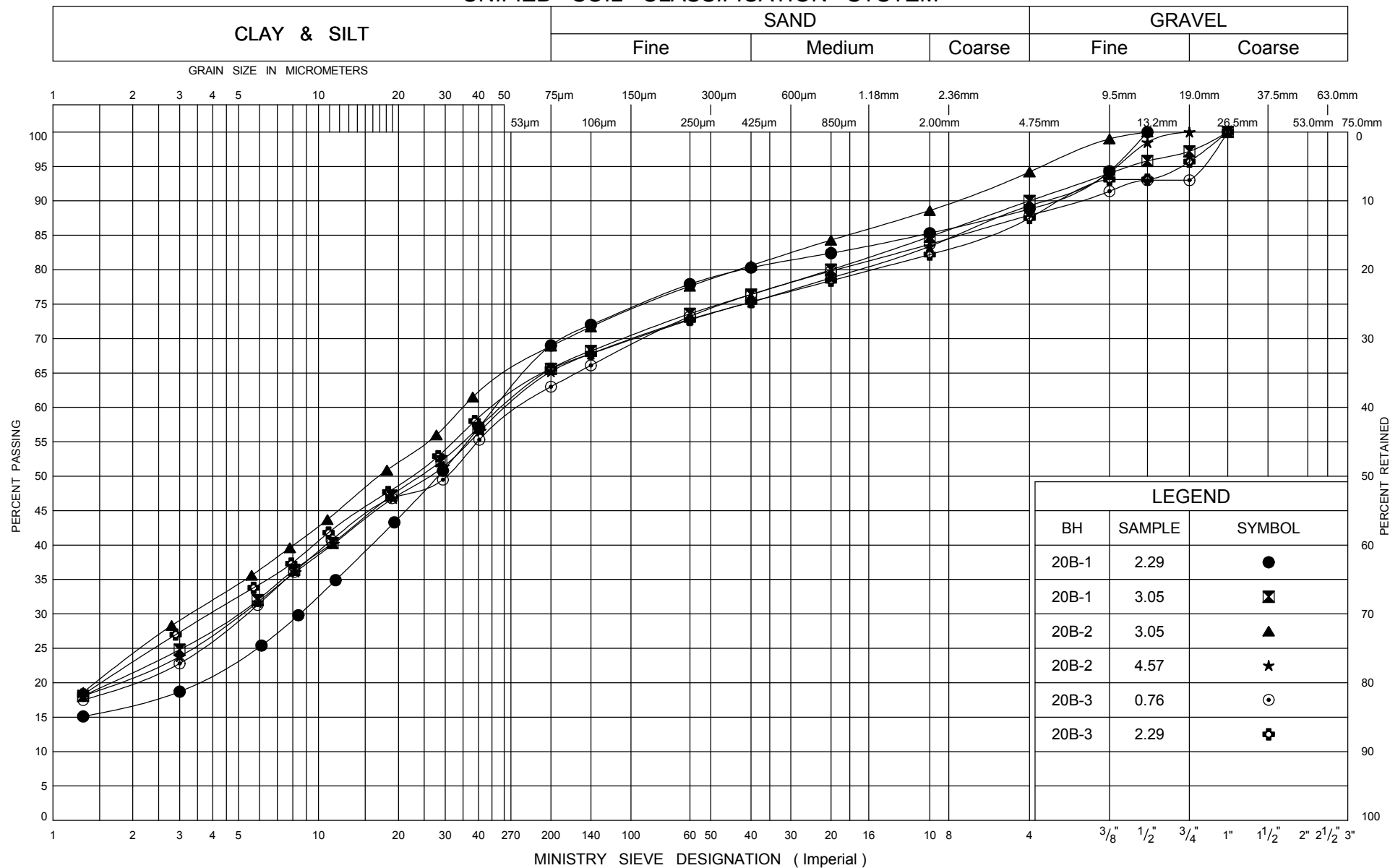
Hwy 26 - Sydenham Townline to Meaford



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Ministry of
Transportation

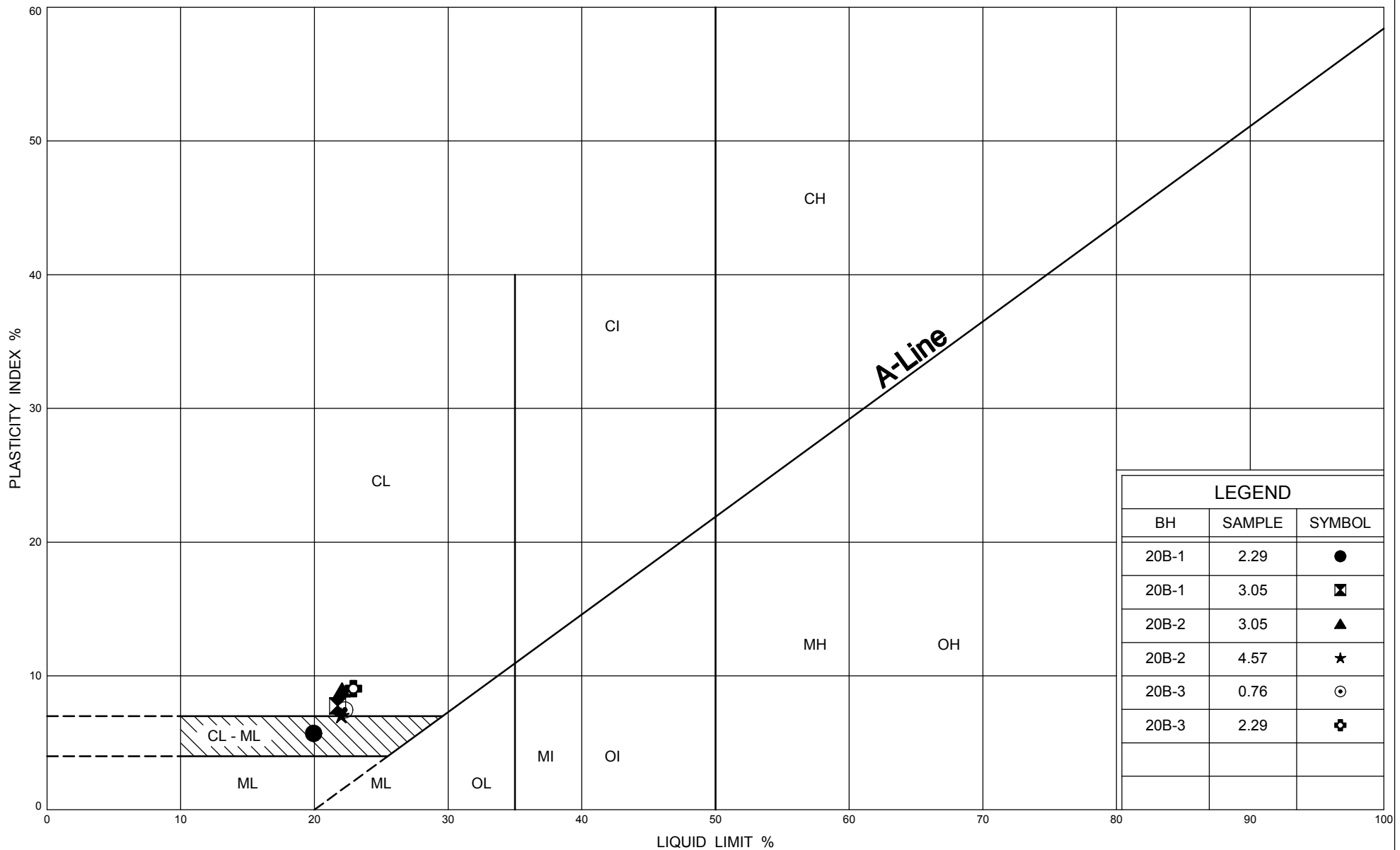
Ontario

GRAIN SIZE DISTRIBUTION
CLAYEY SILT TO SILTY CLAY TILL, CL-ML TO CL

FIG No C- 20B.2

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford



Ministry of
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Ontario

PLASTICITY CHART CLAYEY SILT TO SILTY CLAY TILL, CL-ML TO CL

FIG No C- 20B.3

GWP 167-91-00

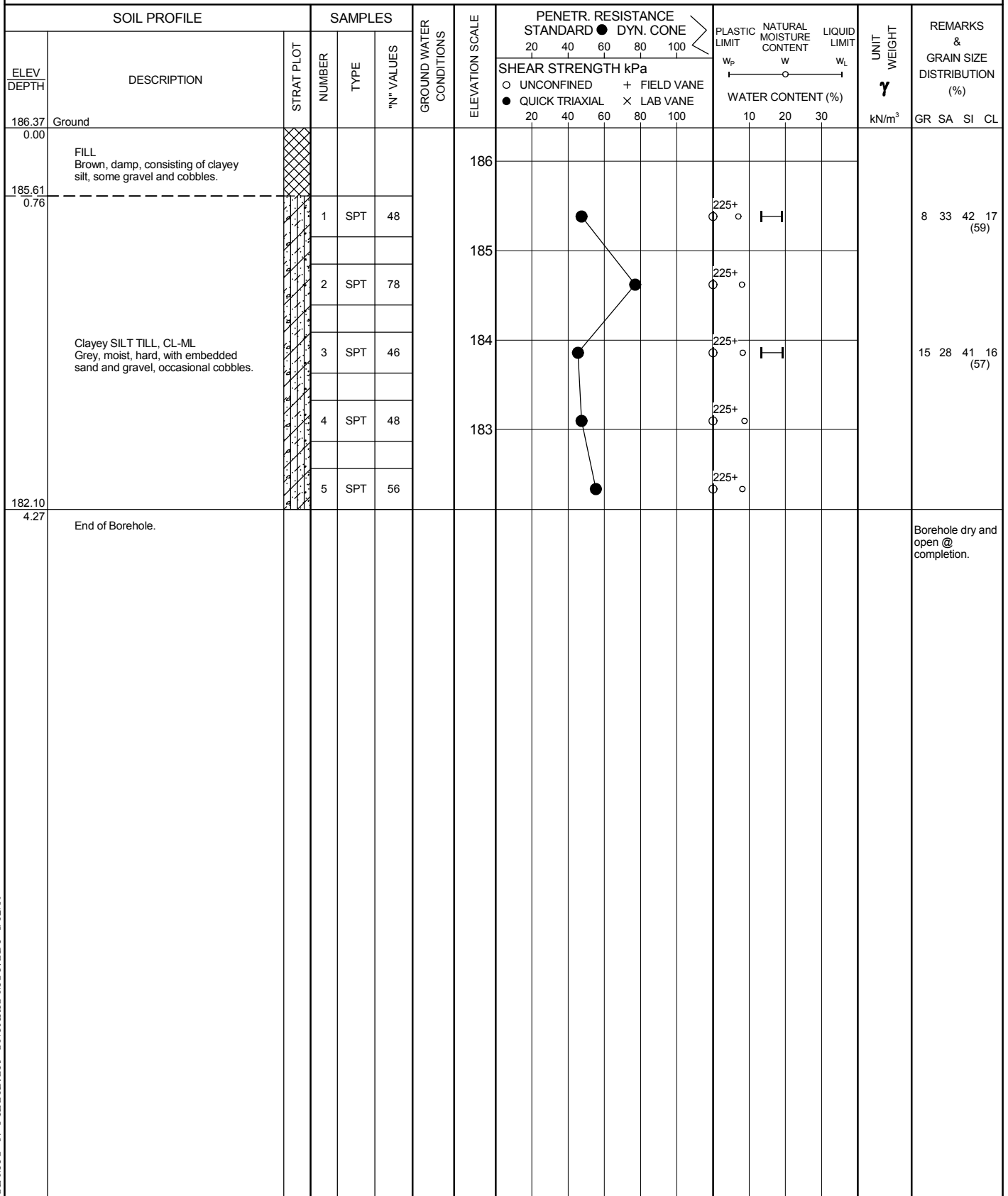
Hwy 26 - Sydenham Townline to Meaford

RECORD OF BOREHOLE No 21B-1

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4942665, Easting - 217013 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 21.8.07 - 21.8.07 CHECKED BY JL

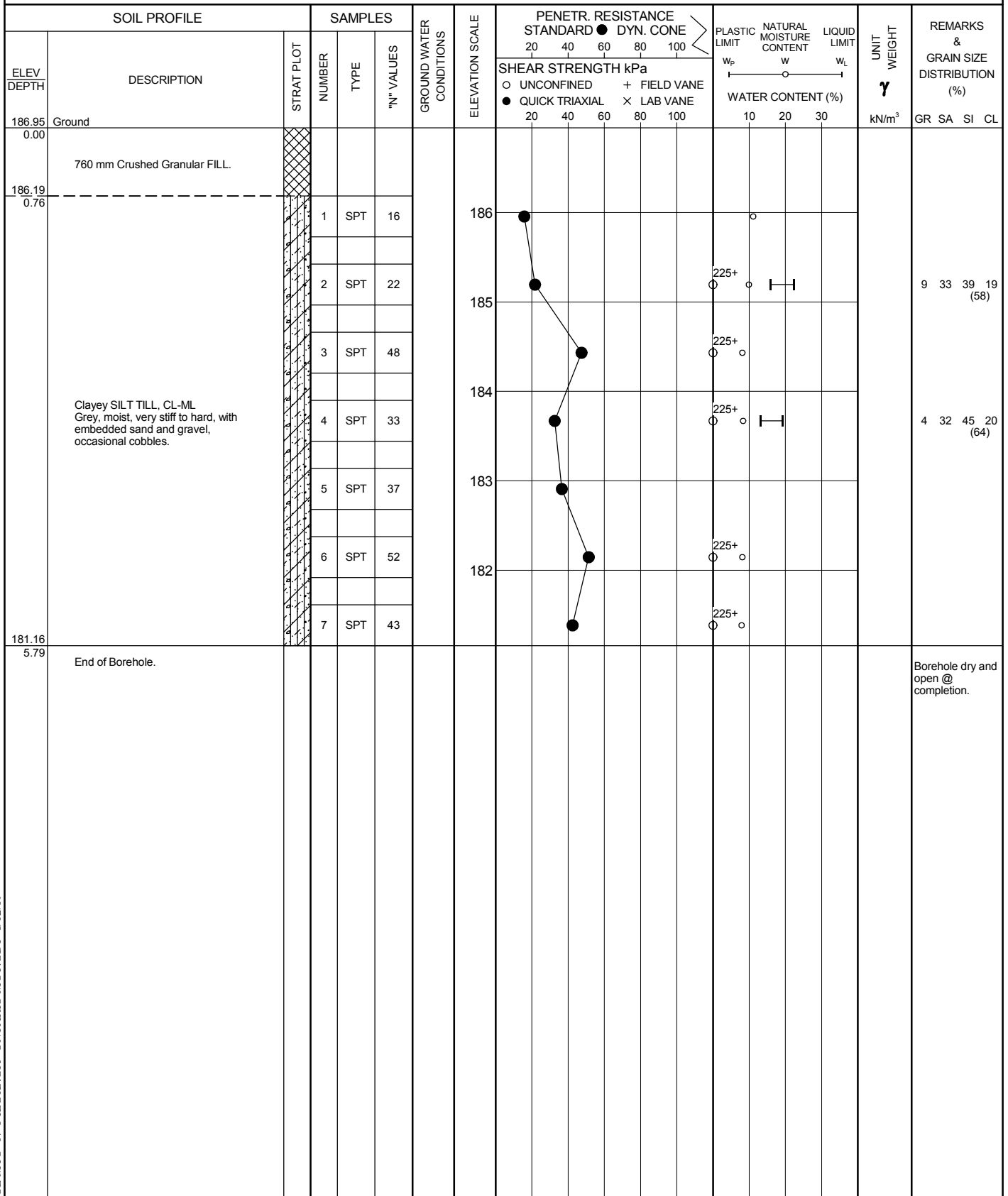


RECORD OF BOREHOLE No 21B-2

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4942687, Easting - 217021 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 21.8.07 - 21.8.07 CHECKED BY JL



JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, X 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

RECORD OF BOREHOLE No 21B-3

1 OF 1

METRIC

W.P. GWP 167-91-00 LOCATION Northing - 4942699, Easting - 217013 ORIGINATED BY RB
 DIST Owen Sound HWY 26 BOREHOLE TYPE S/S Augering, 110 mm dia. COMPILED BY NN
 DATUM Geodetic DATE 21.8.07 - 21.8.07 CHECKED BY JL

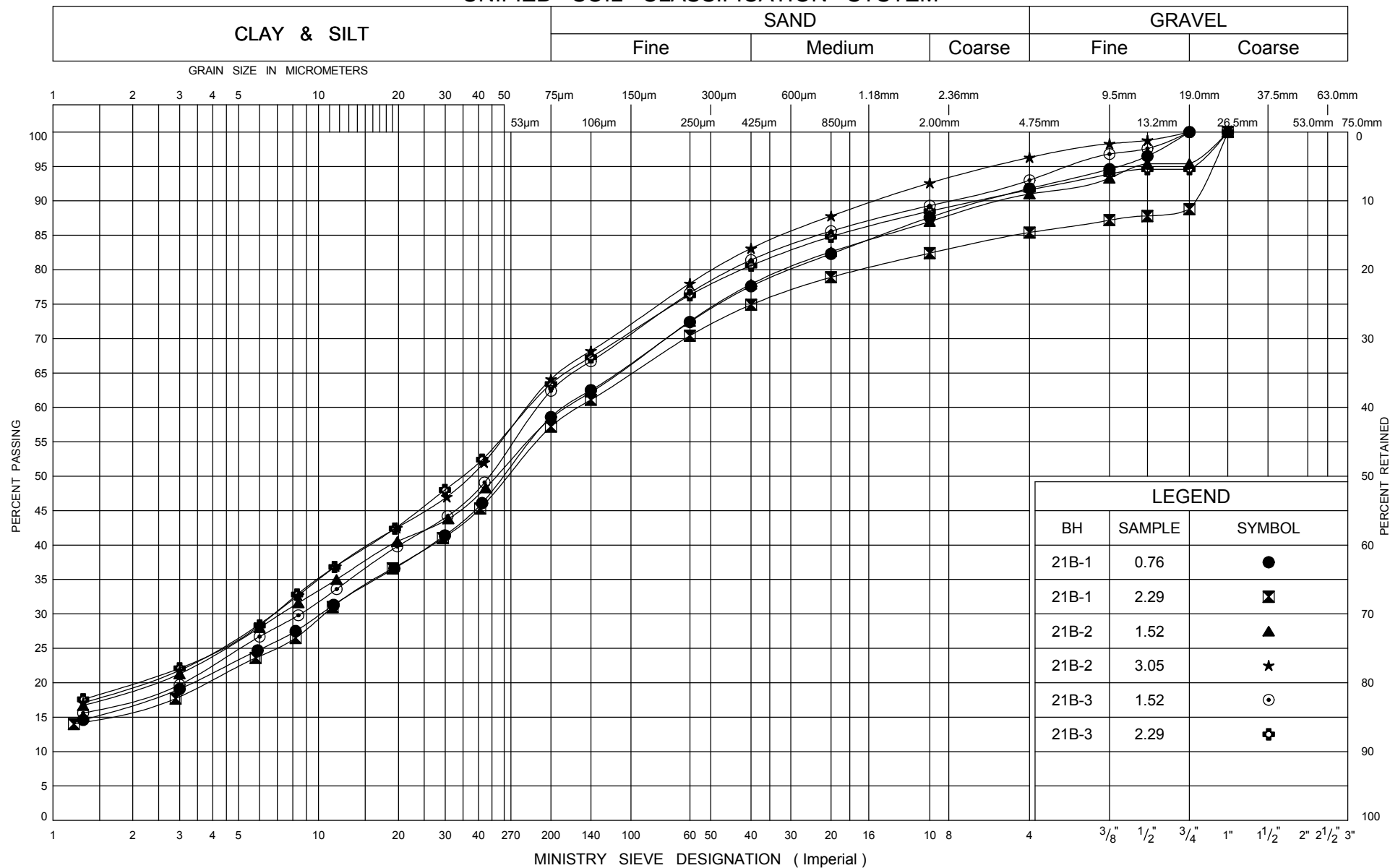
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	PENETR. RESISTANCE STANDARD ● DYN. CONE		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE						
						● QUICK TRIAXIAL		× LAB VANE							
185.47	Ground														
0.00															
185.17	300 mm TOPSOIL.														
0.30															
	FILL Brown, wet, very loose, consisting of mixed gravel, sand and silt.		1	SPT	1		185								
184.10															
1.37			2	SPT	38		184			225+				7 31 45 18 (62)	
	Clayey SILT TILL, CL-ML Grey, moist, hard, with embedded sand and gravel, occasional cobbles.		3	SPT	35		183			225+				8 28 43 20 (63)	
			4	SPT	100+		182			225+					
181.20			5	SPT	40										
4.27	End of Borehole.													Borehole dry and open @ completion.	

JOE MTO 07-6-IEGIB.GPJ ONTARIO MOT.GDT 8/12/09

+ 3, × 3: Numbers refer to
Sensitivity

○ 150 UNCONFINED SHEAR STRENGTH INFERRED FROM POCKET PENETROMETER READINGS

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION
CLAYEY SILT TILL, CL-ML

FIG No C- 21B.1

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

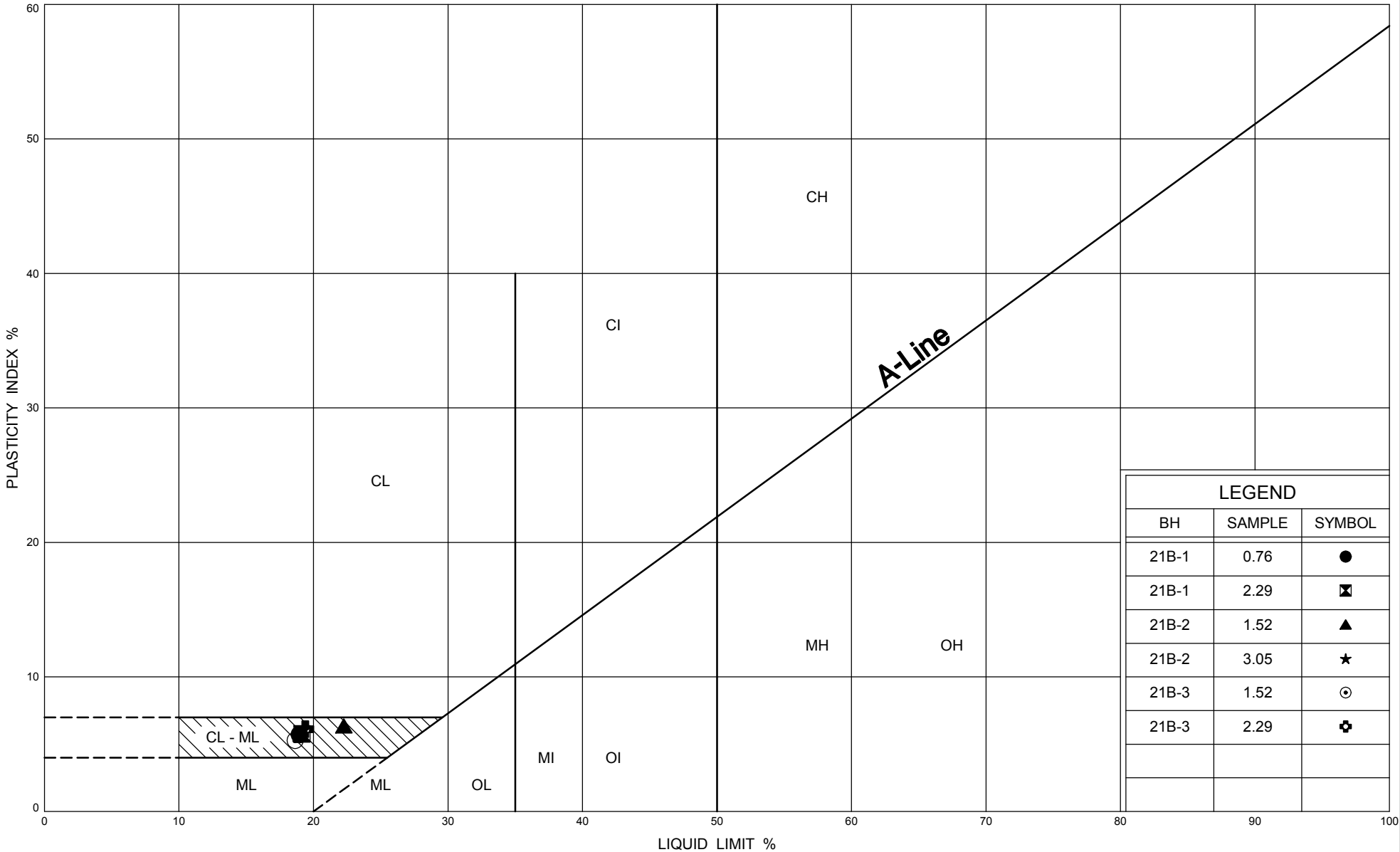


Ministry of
Transportation

Ontario

ONTARIO MOT PLASTICITY CHART SMALL CULVE 07-6-JEGIB.GPJ ONTARIO MOT.GDT 21/11/09

Oct 75, FF - S - 21



Ministry of
Transportation

Ontario

PLASTICITY CHART
CLAYEY SILT TILL, CL-ML

FIG No C- 21B.2

GWP 167-91-00

Hwy 26 - Sydenham Townline to Meaford

Ministry of Transportation/Stantec Consulting Ltd.
G.W.P. 167-91-00 - Rehabilitation of Highway 26
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Appendix C

Limitations of Report

APPENDIX C

LIMITATIONS OF REPORT

The conclusions and recommendations given in this report are based on information determined at the testhole locations. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the testhole locations, and conditions may become apparent during construction which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the Soils Engineer be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the testholes.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of testholes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusion as to how the subsurface conditions may affect their work.

The benchmark and elevations mentioned in this report were obtained strictly for use in the geotechnical design of the project and by this office only, and should not be used by any other parties for any other purposes.

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

This report does not reflect the environmental issues or concerns unless otherwise stated in the report.

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

Ministry of Transportation/Stantec Consulting Ltd.
G.W.P. 167-91-00 - Rehabilitation of Highway 26
From Former St. Vincent/Sydenham Townline to Meaford
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Appendix D

Site Photographs



Culvert 2B Inlet



Culvert 2B Outlet



Culvert 3B, Inlet



Culvert 3B, Outlet



Culvert 5B Inlet



Culvert 5B Outlet



Culvert 6B, Inlet



Culvert 6B, Outlet



Culvert 7B Inlet



Culvert 7B Outlet



Culvert 8B, Inlet



Culvert 8B, Outlet



Culvert 9B Inlet



Culvert 9B Outlet



Culvert 10B, Inlet



Culvert 10B, Outlet



Culvert 11B Inlet



Culvert 11B Outlet



Culvert 12B, Inlet



Culvert 12B, Outlet



Culvert 13B Inlet



Culvert 13B Outlet



Culvert 14B, Inlet



Culvert 14B, Outlet



Culvert 15B Inlet



Culvert 15B Outlet



Culvert 16B, Inlet



Culvert 16B, Outlet



Culvert 17B Inlet



Culvert 17B Outlet



Culvert 18B, Inlet



Culvert 18B, Outlet



Culvert 19 Inlet



Culvert 19B Outlet



Culvert 20B, Inlet



Culvert 20, Outlet



Culvert 21B Inlet



Culvert 21B Outlet