



Terraprobe

*Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing*

**FOUNDATION INVESTIGATION REPORT
MONTCALM CREEK BRIDGE REPLACEMENT
HIGHWAY 11, 6.8 KM WEST OF OPASATIKA
G.W.P. No. 5233-06-00, W.P. 5146-05-01, SITE 39W-058
GEOCRES No. 42G-36
MINISTRY OF TRANSPORTATION, ONTARIO
NORTHEASTERN REGION**

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Appendix B	Laboratory Test Results
Appendix C	Drawings titled “Borehole Locations and Soil Strata”



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GEOCRES No. 42G-36
PART 1: FACTUAL INFORMATION**

1 INTRODUCTION

This report presents the factual findings obtained from foundation investigations conducted at the Montcalm Creek Bridge site where a bridge replacement and a detour structure are proposed. The site is located on Highway 11, 6.8 km west of Opasatika in the Township of McCrea; District of Cochrane, Ontario.

The purpose of this investigation was to explore the subsurface conditions at this site and, based on the data obtained, to provide borehole location plans, records of boreholes, stratigraphic profiles, laboratory test results and descriptions of the subsurface conditions. Models of the subsurface conditions were developed from the data obtained.

Terraprobe conducted the investigation as a sub-consultant to McCormick Rankin, a Member of MMM Group Ltd., (MRC) under the Ministry of Transportation Ontario (MTO) Northeastern Region Assignment Number 5009-E-0020.

The results of a preliminary foundation investigation carried out at the site were presented in the following report:

- Preliminary Foundation Investigation & Design Report, Montcalm Creek Bridge Replacement, Highway 11, 6.8 km West of Opasatika, G.W.P. No. 5233-06-00, W.P. 5146-05-01, Site 39W-058, Geocres No. 42G-32, dated March 02, 2011.

This report contains information from the above referenced report as well as additional subsurface information that has been subsequently obtained.

A Pavement Design Report which addressed pavement widening and the detour pavement requirements at this site is reported under separate cover.

2 SITE DESCRIPTION & PHYSIOGRAPHY

Highway 11 crosses Montcalm Creek via an 11.5 m wide five span timber bridge measuring about 23 m in length. At this site Highway 11 is a two-lane highway with partially paved shoulders



carrying east and west bound traffic. An ONR (Ontario Northern Railway) track runs parallel to Highway 11 and is located approximately 45 m south of Highway 11 centreline.

Montcalm Creek flows from north to south meandering gently within a well-defined flood plain. The terrain is generally flat and within the flood plain area vegetation consists primarily of grass, shrubs and occasional small trees. Beyond the flood plain the area is vegetated with mature stands of deciduous and coniferous trees.

The study area is located in northeastern Ontario. Recent deposits consist of peat, gravel, sand, clay and till soils. The area is underlain by supracrustal rocks composed of metavolcanics, their intrusive equivalents and metasediments of Precambrian age.

3 SITE INVESTIGATION AND FIELD TESTING

The site investigation and field testing for this project was carried out in two phases. Four boreholes, designated as MC1 to MC4 inclusive were drilled at the preliminary design stage between July 20 and August 10, 2010. The preliminary work plan consisted of two boreholes (MC1 & MC2) drilled at the existing bridge site and two boreholes (MC3 & MC4) drilled at the site of the proposed detour structure. The second phase of the investigation was carried out between October 17 and November 04, 2011 and consisted of drilling and sampling six additional boreholes, designated MCD1 to MCD6 inclusive. Boreholes MCD1 and MCD2 were drilled at the existing bridge and boreholes MCD3 and MCD4 were drilled in the approaches to the existing bridge. Boreholes MCD5 and MCD6 were drilled in the approaches to the temporary bridge. The locations of the boreholes are shown on the attached Borehole Locations and Soil Strata Drawing in Appendix C.

A series of shallow boreholes were also drilled at the site for the design of the roadway pavements for the detour. The results of the shallow boreholes are presented in the Pavement Design Report.

Samples of the overburden soils were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT), as specified in ASTM Method D1586. In the cohesive deposits the undrained shear strength of the soil was measured using an MTO type field vane. Relatively undisturbed soil samples were also collected with thin-walled Shelby Tube samplers. The boreholes at the abutments were also advanced into bedrock using NQ size diamond coring techniques.

Ground water conditions in the open boreholes were observed throughout the drilling operations. The boreholes were also instrumented with standpipe piezometers consisting of 25 mm diameter PVC pipe with a slotted screen enclosed in sand to permit longer term ground water level monitoring. The locations and completion details of the piezometers are outlined in Table 3.1. The piezometers were decommissioned between April 26 and 30, 2012.

The drilling, sampling and coring operations were observed on a full time basis by a member of Terraprobe's technical staff who logged the boreholes and rock cores and prepared the recovered



soil and rock samples for transport to Terraprobe's Brampton laboratory for further examination and testing.

Table 3.1 – Piezometer Installation Details

Piezometer Location	Piezometer Details	
	Tip Depth/ Elevation (m)	Completion Details
MC1	19.8/216.6	Piezometer with 1.5 m slotted screen installed with filter sand to 16.8 m, bentonite seal from 16.8 m to 0.6 m and a concrete encased flush mount cover from 0.6 m to ground surface.
MC2	16.8/219.6	Piezometer with 1.5 m slotted screen installed with filter sand to 16.8 m, bentonite seal from 16.8 m to 0.6 m and a concrete encased flush mount cover from 0.6 m to ground surface.
MC3	18.3/217.0	Piezometer with 1.5 m slotted screen installed with filter sand to 16.2 m and bentonite seal from 16.2 m to ground surface.
MC4	16.8/218.8	Piezometer with 1.5 m slotted screen installed with filter sand to 14.6 m and bentonite seal from 14.6 m to ground surface.
MCD1	18.0/218.5	Piezometer with 3.0 m slotted screen installed with filter sand to 14.0 m, bentonite seal from 14.0 m to 13.1 m, drill cuttings from 13.1 m to 0.9 m and a concrete encased flush mount cover from 0.9 m to ground surface.
MCD2	17.1/219.4	Piezometer with 3.0 m slotted screen installed with filter sand to 13.4 m, bentonite seal from 13.4 m to 12.5 m, drill cuttings from 12.5 m to 0.9 m and a concrete encased flush mount cover from 0.9 m to ground surface.
MCD3	7.9/228.5	Piezometer with 3.0 m slotted screen installed with filter sand to 4.3 m, bentonite seal from 4.3 m to 0.6 m and a concrete encased flush mount cover from 0.6 m to ground surface.
MCD4	8.5/228.0	Piezometer with 3.0 m slotted screen installed with filter sand to 4.9 m, bentonite seal from 4.9 m to 4.3 m, drill cuttings from 4.3 m to 0.6 m and a concrete encased flush mount cover from 0.6 m to ground surface.
MCD5	8.8/226.9	Piezometer with 3.0 m slotted screen installed with filter sand to 5.2 m, bentonite seal from 5.2 m to 4.6 m, drill cuttings from 4.6 m to 0.3 m and bentonite seal from 0.3 m to ground surface.
MCD6	10.0/225.7	Piezometer with 3.0 m slotted screen installed with filter sand to 6.1 m, bentonite seal from 6.1 m to 5.5 m, drill cuttings from 5.5 m to 0.6 m and bentonite seal from 0.6 m to ground surface.

4 LABORATORY TESTING

The recovered soil samples were subjected to Visual Identification (VI) and water content determination. Selected samples were also subjected to a laboratory testing programme consisting of gradation analysis, Atterberg Limits tests, consolidation tests, unit weight and undrained shear strength testing with a laboratory vane. The results of this testing program are shown on the Record of Borehole sheets in Appendix A and on the figures in Appendix B.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

Reference is made to the Record of Borehole sheets in Appendix A. Details of the encountered soil and rock stratigraphy are presented in Appendix A and on the "Borehole Locations and Soil Strata"



drawings in Appendix C. The stratigraphic boundaries shown have been inferred from non-continuous samples and observations of drilling resistance and typically represent a transition from one soil or rock type to another. These boundaries should not be interpreted to represent exact planes of geological change. The subsurface conditions are confirmed at the borehole locations only, and will vary between and beyond the locations investigated. The following discussion has been simplified in terms of the major soil strata.

5.1 Existing Bridge Site (Boreholes MC1, MC2, MCD1, MCD2, MCD3 & MCD4)

In general, the site was underlain by flexible pavement (asphalt and sand and gravel), sand and silty sand fill, silty clay fill and deposits of silty clay to clayey silt, sandy silt till, clayey silt to silty clay till and cobbles and boulders. The overburden was underlain by bedrock consisting of igneous granitoid.

5.1.1 Flexible Pavement

A flexible pavement comprising of 130 mm to 200 mm thick of asphaltic concrete underlain by a layer of sand and gravel ranging in thickness from 150 mm to 410 mm was encountered. The granular fill extended to elevations ranging from 235.9 m to 236.2 m below ground surface.

The grain size distribution plot of a sample of the granular fill is presented in Figure B1-1. These results show a grain size distribution consisting of 50% gravel, 45% sand and 5% silt and clay size particles.

'N' values in the range of 27 to 36 blows for 0.3 m were determined in the Standard Penetration Testing carried out in the granular fill, inferring a compact to dense relative density. The water content of samples of the granular fill ranged from 3% to 5% by weight.

5.1.2 Fill – Sand to Silty Sand

Fill consisting of sand and silty sand with clay lumps was encountered beneath the pavement and to depths ranging from 1.9 m (Elev. 234.5 m) to 3.4 m (Elev. 233.1 m) below ground surface.

The grain size distribution plots of samples of the sand to silty sand fill are presented in Figure B1-2. These results show a grain size distribution consisting of 0-6% gravel, 81-88% sand and 6-19% silt and clay size particles.

N values in the range of 2 to 23 blows for 0.3 m were determined in the fill, indicating a very loose to compact relative density. The moisture content of samples of this fill ranged from about 5% to 28%.

5.1.3 Fill – Silty Clay

Fill consisting of silty clay and organics was encountered in borehole MC2 extending to a depth of 3.7 m (Elev. 232.7 m) below ground surface.



A single N value of 14 blows per 0.3m was determined in the silty clay fill, inferring a relatively stiff consistency. The moisture content of the sample of silty clay fill recovered from the penetration testing was 51%.

5.1.4 Silty Clay to Clayey Silt

A silty clay to clayey silt deposit was encountered beneath the fill and to depths ranging from 7.1 m (Elev. 229.4 m) to 7.5 m (Elev. 228.9 m) below ground surface.

The grain size distribution curves of samples of the silty clay to clayey silt are presented in Figures B1-3 and B1-4. These results show a grain size distribution consisting of 0-4% gravel, 4-24% sand, 36-62% silt and 21-60% clay size particles.

Samples were also subjected to Atterberg Limits tests and the results are shown on the plasticity chart, Figures B1-5 and B1-6. The index values from these tests are summarized below:

Liquid Limit:	19-38%
Plastic Limit:	13-21%
Plasticity Index:	6-17%
Natural Moisture Content:	12-30%

These values indicate that the deposit can be characterized as low plasticity silty clay to clayey silt.

The N values determined in the silty clay to clayey silt ranged from 4 to 24 blows for 0.3 m penetration. Field vane shear tests indicated undrained shear strengths ranging from 36 kPa to greater than 100 kPa. A laboratory vane test on a relatively undisturbed Shelby tube sample gave undrained shear strength of 72 kPa. Based on these results the silty clay to clayey silt was generally firm to stiff with some very stiff zones. The moisture content of samples of the silty clay to clayey silt ranged from 11% to 33% and the unit weight of a tested sample was 21.9 kN/m³.

A one dimensional consolidation test was carried out on a tube sample of the silty clay to clayey silt deposit from Borehole MCD4 and the results are presented on Figures B1-7 and B1-8. The consolidation characteristics listed in Table 5.1 were determined from the results of the consolidation testing.

Table 5.1 - Summary of Consolidation Testing on Silty Clay

Parameter	
Natural water content	14 %
Bulk Unit weight	21.9 kN/m ³
Dry Unit weight	19.2 kN/m ³
Compression index	0.114
Recompression index	0.015
Void ratio	0.40
Preconsolidation Pressure	70 kPa
Consolidation Coefficient	7.5 m ² /yr



5.1.5 Sandy Silt Till

A deposit of sandy silt till was encountered beneath the silty clay to clay silt. This deposit was fully penetrated in the deeper boreholes at depths ranging from 11.6 m to 11.7 m below ground surface or at elevations ranging from 224.8 m to 224.9 m. The approach boreholes were terminated in this deposit at depths of 8.7 m (Elev. 227.7 m) and 9.5 m (Elev. 227.0 m).

The results of grain size distribution tests carried out on samples obtained from this till deposit are shown in Figure B1-9. These results show grain size distributions consisting of 1-5% gravel, 25-32% sand, 55-65% silt and 4-13% clay size particles. The high penetration resistance and the resistance to auger advance observed in the boreholes were indications of the presence of cobbles and boulders in this soil matrix.

The N values in the sandy silt till ranged from 13 to more than 100 blows per 0.3 m penetration, indicating a compact to very dense relative density. The natural water content of samples from this stratum ranged from 7% to 12%.

5.1.6 Clayey Silt to Silty Clay Till

A clayey silt to silty clay till deposit was encountered beneath the sandy silt till in Boreholes MC1, MC2, MCD1 and MCD2. This till deposit extended to depths ranging from 17.7 m (Elev. 218.8 m) to 19.8 m (Elev. 216.7 m) below ground surface.

The grain size distribution plots of samples retrieved from this deposit are presented in Figure B1-10. These results show a grain size distribution consisting of 1-6% gravel, 18-34% sand, 45-61% silt and 17-26% clay size particles. Cobbles and boulders were also thought to have been encountered in the clayey silt to silty clay till.

The results of Atterberg Limits determinations on samples of the clayey silt to silty clay till are presented in Figure B1-11 and summarized below:

Liquid Limit:	19-23%
Plastic Limit:	12-14%
Plasticity Index:	6-11%
Natural Moisture Content:	9-11%

These values indicate that the clayey silt to silty clay till was of relatively low plasticity.

The N values in the clayey silt to silty clay till ranged from 34 to more than 100 blows for 0.3 m penetration indicating a hard consistency. The natural water content of samples of the clayey silt to silty clay till was in the range of 8% to 12%.

5.1.7 Cobbles and Boulders

In Boreholes MC1 and MCD2, a formation comprised of mostly cobbles and boulders was encountered overlying the bedrock surface. This stratum extended to depths ranging from 20.3 m (Elev. 216.2 m) to 22.0 m (Elev. 214.5 m) below ground surface.



A Standard Penetration test in this layer gave an 'N' value of more than 100 blows for 0.3 m penetration, which indicates that this deposit had a very dense relative density.

5.1.8 Bedrock

The overburden described above was underlain by igneous granitoid bedrock. Bedrock was proved by coring at the abutment locations and the bedrock depth and elevations to the top of bedrock are summarized in Table 5.2.

Table 5.2 – Depth to Bedrock

BH No.	Depth to Bedrock (m)	Top of Bedrock Elevation (m)
MC1	22.0	214.5
MC2	18.5	217.9
MCD1	18.0	218.5
MCD2	20.3	216.2

In Boreholes MC1, MC2 and MCD2, the bedrock is described as generally highly to moderately weathered at depths extending between 21.2 m (Elev. 215.2 m) and 24.5 m (Elev. 212.0 m). Below these depths the bedrock was described as slightly weathered to unweathered. In Borehole MCD1 the bedrock was described as unweathered and its colour is generally white to grey. Total core recovery in this bedrock ranged from 21% to 100%. The RQD values ranged widely from 0% to 84% but generally, most of the RQD values were below 50%. Based on these results the rock quality is considered to be very poor to poor with occasional zones of fair to good quality rock.

5.2 Detour Alignment (Boreholes MC3, MC4, MCD5 & MCD6)

The alignment is located in an area that has experienced previous construction due to the proximity to the ONR tracks and the highway. In general, the site was underlain by topsoil, fill consisting of sand and gravel and silty clay, and native deposits of clayey silt to silty clay, sandy silt till, clayey silt to silty clay till and cobbles and boulders. The overburden was underlain by bedrock consisting of granite. Boreholes drilled as part of the pavement investigation encountered discontinuous layers of peat beneath the fill.

5.2.1 Topsoil

Topsoil ranging from 130 mm to 150 mm thick was encountered at this site.

5.2.2 Fill – Sand and Gravel/Silty Clay/

A layer of sand and gravel fill approximately 0.4m thick was encountered beneath the topsoil in Borehole MCD5. The sand and gravel fill was underlain by silty clay fill to a depth of 1.4 m (Elev. 234.3 m) below ground surface. Silty clay fill was encountered to depths of 0.7 m (Elev. 235.0 m) to 1.4 m (Elev. 233.9 m) below ground surface in Boreholes MC3, MC4 and MCD6.



The grain size distribution curve of a sample of silty clay fill is shown in Figure B2-1. These results show a grain size distribution consisting of 0% gravel, 6% sand, 38% silt and 56% clay size particles.

A sample was also subjected to an Atterberg Limits test and the results are presented in Figure B2-2. The index values from these tests are summarized below:

Liquid Limit:	51%
Plastic Limit:	25%
Plasticity Index:	26%
In-situ Moisture Content:	29%

N values in the range of 5 to 11 blows for 0.3 m were determined in the fill, indicating a firm to stiff consistency. The moisture content of samples of this fill ranged from about 15% to 29%.

5.2.3 Clayey Silt to Silty Clay

Native clayey silt to silty clay deposits were encountered in all of the boreholes and to depths ranging from 6.4 m to 8.6 m below ground surface or to elevations ranging from 229.3 m to 227.1 m.

The grain size distribution plots of samples of the clayey silt to silty clay are presented in Figures B2-3 and B2-4. These results show a grain size distribution consisting of 0-4% gravel, 4-33% sand, 25-57% silt and 17-40% clay size particles.

Samples were also subjected to Atterberg Limits tests and the results are illustrated on the plasticity chart, Figures B2-5 and B2-6. The index values from these tests are summarized below:

Liquid Limit:	17-69%
Plastic Limit:	13-30%
Plasticity Index:	3-39%
Natural Moisture Content:	13-35%

These values indicate that the deposit generally consisted of low plasticity clayey silt to silty clay.

The N values determined in the clayey silt to silty clay ranged from 5 to 26 blows for 0.3 m penetration. A field vane shear test gave undrained shear strength of 52 kPa. These values indicate that the consistency of the clayey silt to silty clay was in the firm to very stiff range. The moisture content of samples of the clayey silt to silty clay ranged from 11% to 40%.

5.2.4 Sandy Silt Till

Sandy silt till was encountered across this site extending to depths ranging from 10.1 m to 15.7 m below ground surface or to elevations ranging from 219.9 m to 225.2 m. The approach boreholes were terminated in this deposit at depths of 9.2 m (Elevation 226.5 m) and 10.5 m (Elevation 225.2 m).



The results of grain size distribution tests conducted on samples of this till are illustrated in Figure B2-7. These results show grain size distributions of 2-5% gravel, 25-36% sand, 48-55% silt and 7-19% clay size particles. The high penetration resistance and the resistance to auger advance observed in the boreholes were indications of the presence of cobbles and boulders in this soil matrix.

The N values determined in the sandy silt till ranged from 13 to more than 100 blows per 0.3 m penetration indicating a compact to very dense relative density. The moisture content of samples from this stratum ranged from about 7 to 15%.

5.2.5 Clayey Silt to Silty Clay Till

Clayey silt to silty clay till was encountered beneath the sandy silt till in Borehole MC3 and to a depth of 15.5 m (Elev. 219.8 m) below ground surface.

The grain size distribution plots of samples of this till deposit are presented in Figure B2-8. These results show a grain size distribution consisting of 3-12% gravel, 25-27% sand, 46-58% silt and 12-17% clay size particles. The high penetration resistance and the resistance to auger advance observed in the boreholes were indications of the presence of cobbles and boulders in this soil matrix.

Samples of the clayey silt to silty clay till were also subjected to Atterberg Limits tests and the results are presented in Figure B2-9. The index values from these tests are summarized below:

Liquid Limit:	18-19%
Plastic Limit:	13-14%
Plasticity Index:	4-6%
Natural Moisture Content:	9%

These values indicate low plasticity clayey silt soils.

The N values determined in the clayey silt to silty clay till were more than 50 blows for 0.3 m penetration indicating a hard consistency. The moisture contents of samples of the clayey silt to silty clay till ranged from 9% to 11%.

5.2.6 Cobbles and Boulders

A stratum with frequent cobble and boulders was encountered in Boreholes MC3 and MC4 overlying the bedrock surface. This layer extended to depths ranging from 18.4 m to 19.0 m below ground surface or to elevations ranging from 216.3 m to 217.2 m. This stratum was inferred to have a very dense relative density.

5.2.7 Bedrock

The overburden was underlain by igneous granite bedrock. Bedrock was proved by coring in both abutment boreholes and the bedrock depths and top of bedrock elevations are summarized in Table 5.3.



Table 5.3 – Depth to Bedrock

BH No.	Depth to Bedrock (m)	Top of Bedrock Elevation (m)
MC3	19.0	216.3
MC4	18.4	217.2

In Borehole MC3 the bedrock has been described as moderately weathered to a depth of 19.9 m (Elev. 215.4 m) and is unweathered below. In Borehole MC4 the bedrock was slightly weathered. The colour of the bedrock was white to grey. Total core recovery in the bedrock ranged from 89% to 100%. RQD values ranged from 0% to 70% but generally, the recorded RQD values ranged from 32% to 70%. Based on these results, the rock quality was considered to be generally poor to fair with occasional zones of very poor rock.

5.3 Water Levels

Standpipe piezometers were installed in the boreholes and the water level readings were measured on separate visits made after the completion of drilling. The water level records are presented in Table 5.4.

Table 5.4 – Water Level Measurements

Borehole	Date	Water Levels	
		Depth (m)	Elevation (m)
Existing Bridge Site			
MC1	August 06, 2010	1.6	234.9
	August 10, 2010	1.6	234.9
	September 03, 2010	1.6	234.9
	April 26, 2012	1.3	235.2
MC2	August 06, 2010	1.4	235.0
	August 10, 2010	1.5	234.9
	September 03, 2010	1.5	234.9
	April 26, 2012	1.3	235.1
MCD1	November 08, 2011	1.4	235.1
	December 13, 2011	1.3	235.2
	April 26, 2012	1.1	235.4
MCD2	November 08, 2011	0.6	235.9
	December 13, 2011	0.8	235.7
	April 26, 2012	0.4 (frozen)	236.1
MCD3	November 03, 2011	1.4	235.0
	November 08, 2011	1.3	235.1
	December 13, 2011	1.2	235.2
	April 26, 2012	Damaged	
MCD4	November 03, 2011	1.5	235.0
	November 08, 2011	1.3	235.2
	December 13, 2011	1.2	235.3
Detour Alignment			
MC3	August 10, 2010	0.5	234.8
	September 03, 2010	0.5	234.8
	April 26, 2012	Damaged	-
MC4	August 10, 2010	0.4	235.2
	August 31, 2010	1.6	234.0
	September 01, 2010	1.6	234.0
	April 26, 2012	0.3	235.3



MCD5	November 03, 2011	0.8	234.9
	November 08, 2011	0.8	234.9
	December 13, 2011	0.5	235.2
	April 26, 2012	0.4	235.3
MCD6	November 03, 2011	0.5	235.2
	November 08, 2011	0.2	235.5
	December 13, 2011	0.4	235.3
	April 26, 2012	0.4	235.3

The free water level in the creek was recorded at Elevation 234.4 m in August, 2010 indicating that the ground water table exists just below the ground surface in the flood plain area.

At the existing bridge the piezometric head was estimated to range between Elevation ± 234.9 m and Elevation ± 235.7 m. Along the detour alignment the recorded water levels ranged between Elevations ± 234.0 and ± 235.3 m.

All groundwater observations at this site were short term and the levels are expected to fluctuate seasonally and with precipitation conditions. The ground water level may also be affected by the free water level in the creek.

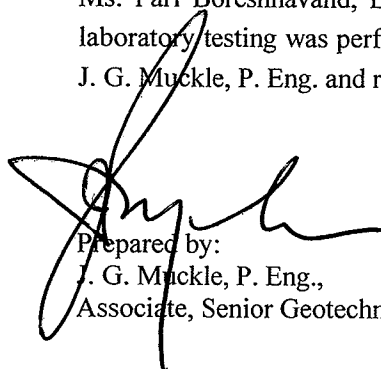
5.4 Miscellaneous

The borehole locations were marked in the field by surveyors from MRC who also provided Terraprobe with their coordinates and geodetic elevations. Terraprobe obtained utility clearances and permits prior to drilling.

The drilling, sampling and in-situ testing operations, piezometer installation and decommissioning were conducted with a track mounted drill rig owned and operated by Landcore Drilling of Chelmsford, Ontario.

The boreholes were advanced using hollow-stem augers and casing and washboring methods. Rock cores were retrieved by NQ size diamond coring techniques.

Ms. Pari Boreshnavand, E.I.T., and Mr. Phil Khuu, B.A.T., carried out the field work and the laboratory testing was performed at Terraprobe's Brampton laboratory. The report was written by J. G. Muckle, P. Eng. and reviewed by Michael Tanos, P. Eng.


Prepared by:
J. G. Muckle, P. Eng.,
Associate, Senior Geotechnical Engineer

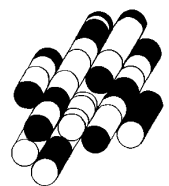


Report Reviewed by:
Michael Tanos, P. Eng.,
Review Principal



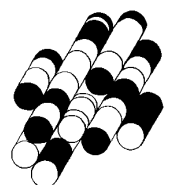
APPENDICES

TERRAPROBE INC.



APPENDIX A

TERRAPROBE INC.



RECORD OF BOREHOLE No MCD1

1 of 2

METRIC

G.W.P. 5233-06-00 LOCATION Coords: E:381087.5 N:5489894.5 ORIGINATED BY PB
DIST - HWY Hwy 11 BOREHOLE TYPE HOLLOW STEM AUGERS / WASH BORING COMPILED BY DB
DATUM GEODETIC DATE 10.27.11 CHECKED BY HA

SOIL PROFILE						SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	SPT 'N' VALUE	SHEAR STRENGTH (kPa)					WATER CONTENT (%)									
						20	40			60	80	100	W _P	W	W _L					
						○ UNCONFINED ● QUICK TRIAXIAL					+ FIELD VANE x LAB VANE									
236.5	GROUND SURFACE																			
236.3	180mm ASPHALTIC CONCRETE		1A	AS																
236.0	330mm FILL - sand and gravel, trace silt, brown, damp		1B																	
235.1	FILL, sand, trace silt, trace gravel; compact, brown, damp		2	SS	22															
235.1	FILL, silty sand, frequent clay lumps, trace organics; loose to compact, brown, moist		3	SS	16															
234.1			4	SS	6															
233.1			5	SS	3															
233.1	SILTY CLAY, sandy, trace gravel, firm to very stiff, grey, moist		6	ST																
232.1			7	AS	-															
231.1			8	AS	-															
230.1			9	SS	18															
229.4																				
229.4	SANDY SILT, trace to some clay, trace gravel, occasional cobbles and boulders, dense to very dense, grey, moist (GLACIAL TILL)		10	SS	32															
227.1			11	SS	100 / 150mm															
226.1			12	SS	136															
224.8																				
224.8	CLAYEY SILT to SILTY CLAY, sandy, trace gravel, occasional cobbles and boulders, hard, grey, moist (GLACIAL TILL)		13	SS	186 / 200mm															
223.1			14	SS	53															
222.1																				

Continued Next Page

+³, X³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

library: library - mto gis gis report: mto-terraprobe soil path: \\pdcserver11-project files\11-geotechnical\2010\11-10-5001 to 5009\11-10-5076\gint11-10-5076 montcalm bridge.gpj

RECORD OF BOREHOLE No MCD1

2 of 2

METRIC

G.W.P. 5233-06-00 LOCATION Coords: E:381087.5 N:5489894.5 ORIGINATED BY PB
 DIST - HWY Hwy 11 BOREHOLE TYPE HOLLOW STEM AUGERS / WASH BORING COMPILED BY DB
 DATUM GEODETIC DATE 10.27.11 CHECKED BY HA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	SPT 'N' VALUE			20 40 60 80 100							W _p W W _L		
								SHEAR STRENGTH (kPa)							WATER CONTENT (%)		
								○ UNCONFINED ● QUICK TRIAXIAL		+ FIELD VANE X LAB VANE							
	(continued)																
	CLAYEY SILT to SILTY CLAY, sandy, trace gravel, occasional cobbles and boulders, hard, grey, moist (GLACIAL TILL) (continued)																

END OF BOREHOLE

Borehole was filled with drill water
upon completion of drilling.


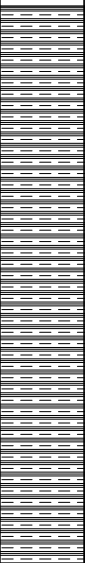
25mm piezometer installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
November 8, 2011	1.4	235.1
December 13, 2011	1.3	235.2
April 26, 2012	1.1	235.4


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Y:\1-Project Files\11-Geotechnical\2010\11-10-5001 to 5099\11-10-5076\A Dwg, Log\AutoCAD\11-10-5076 CORE.dwg, DB

CORE LOG													 Terraprobe							
ProjectCrow Creek Bridge Replacement				OrientationVertical			Ground Elevation236.5m			DatumGeodetic				Borehole No.MCD1						
LocationHwy 11, Township of McCrea, Ontario				Date StartedNovember 2, 2011			CompletedNovember 2, 2011			Logged ByB.R.				Sheet 1 of 1						
ClientMTO				Drilling AgencyLandcore Drilling			Drill TypeCME55			Core Barrel & Bit DesignNQ				Project No.11-10-5076						
ELEVATION (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	Joint Characteristics							WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN NO. CORE RECOVERY %	R Q D %	CORE SIZE/CASING	MPa UNCONFINED COMPRESSIVE STRENGTH	UNIT WEIGHT (kN/m³)		
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERTURE										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19		
219.5	17.0		Overburden, see Borehole Log MCD1																	
218.5	18.0		BEDROCK – Granitic Gneiss (biotite–quartz–feldspar gneiss to hornblende–quartz–feldspar gneiss) unweathered, massive, white to grey, medium to high strength, medium to coarse grained.	2	CC	DV	VC	SP	SA	0 to 1				#1 TCR 95 SCR 32	32	NQ				
217.5	19.0			2	CC	DV	VC	SP	O	0 to 1						#2 TCR 91 SCR 83	57	NQ		
216.5	20.0			2	CC	DV	C	SP	O	0 to 1						#3 TCR 100 SCR 100	74	NQ		
215.5	21.0		End of Core Log																	
214.8	21.7																			
214.5	22.0																			
213.5	23.0																			
212.5	24.0																			
211.5	25.0																			
210.5	26.0																			
209.5	27.0																			
208.4	28.0																			
207.3	29.0																			

Remarks:

LEGEND:

 Bedrock

RECORD OF BOREHOLE No MCD2

1 of 2

METRIC

G.W.P. 5233-06-00 LOCATION Coords: E:381058.3 N:5489913.2 ORIGINATED BY PB
DIST - HWY Hwy 11 BOREHOLE TYPE HOLLOW STEM AUGERS / WASH BORING COMPILED BY DB
DATUM GEODETIC DATE 11.2.11 CHECKED BY HA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	SPT 'N' VALUE			SHEAR STRENGTH (kPa)							WATER CONTENT (%)		
								20	40	60	80	100			W _p	W	W _L
236.5	GROUND SURFACE																
236.4	150mm ASPHALTIC CONCRETE		1A	AS													
0.2	410mm FILL - sand and gravel, trace silt, brown, damp		1B														
235.9	FILL, sand, trace silt, trace gravel; compact, brown, wet		2	SS	16									6 85 (9)			
0.6																	
			3	SS	11												
234.4																	
2.1	Trace rootlets, occasional peat inclusions		4	AS													
233.2			5	SS	7									0 4 41 55			
3.4	SILTY CLAY to CLAYEY SILT, some sand to sandy, trace gravel, firm to very stiff, grey, moist		6	SS	5												
			7	SS	4												
			8	SS	13									Nov.2			
														Nov.3			
			9	SS	16												
														2 17 52 29			
229.4																	
7.1	SANDY SILT, trace clay, trace gravel, occasional cobbles and boulders, compact to very dense, grey, moist (GLACIAL TILL)		10	SS	27									1 32 58 9			
			11	SS	100 / 150mm												
			12	SS	167 / 200mm												
224.8																	
11.7	CLAYEY SILT to SILTY CLAY, some sand to sandy, trace gravel, occasional cobbles and boulders, hard, grey, moist (GLACIAL TILL)		13	SS	96									Commence casing and washboring			
			14	SS	87									1 28 50 21			

Continued Next Page

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

library: library - mto gis gis report: mto-terraprobe soil path: \pdc\server11-10-5076\gint11-10-5076 montcalm bridge.gpj

RECORD OF BOREHOLE No MCD2

2 of 2

METRIC

G.W.P. 5233-06-00 LOCATION Coords: E:381058.3 N:5489913.2 ORIGINATED BY PB
DIST - HWY Hwy 11 BOREHOLE TYPE HOLLOW STEM AUGERS / WASH BORING COMPILED BY DB
DATUM GEODETIC DATE 11.2.11 CHECKED BY HA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	SPT 'N' VALUE			20 40 60 80 100									
								SHEAR STRENGTH (kPa)									
								○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE x LAB VANE									
							WATER CONTENT (%)										
	(continued)																
218.8 17.7	CLAYEY SILT to SILTY CLAY, some sand to sandy, trace gravel, occasional cobbles and boulders, hard, grey, moist (GLACIAL TILL) (continued)		15	SS	52												
			16	SS	123 / 225mm												
216.2 20.3	COBBLES and BOULDERS, inferred very dense, grey																
			1	RUN													
			2	RUN													
210.2	For details see rock core log mcd2 (BEDROCK)																
			3	RUN													
			4	RUN													
			5	RUN													
			6	RUN													

END OF BOREHOLE

Borehole was filled with drill water upon completion of drilling.

25mm piezometer installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
November 8, 2011	0.6	235.9
December 13, 2011	0.8	235.7
April 26, 2012	0.4	236.1

Terraprobe

[illegible]

Bedrock

RECORD OF BOREHOLE No MCD3

1 of 1

METRIC

G.W.P. 5233-06-00 LOCATION Coords: E:381033.2 N:5489910.4 ORIGINATED BY PB
DIST - HWY Hwy 11 BOREHOLE TYPE HOLLOW STEM AUGERS COMPILED BY DB
DATUM GEODETIC DATE 10.17.11 CHECKED BY HA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	SPT 'N' VALUE			SHEAR STRENGTH (kPa)													
								20 40 60 80 100													
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					w _p w w _L WATER CONTENT (%)									
							20 40 60 80 100					10 20 30									
236.4	GROUND SURFACE																				
236.1	130mm ASPHALTIC CONCRETE			1A	AS																
0.3	180mm FILL - sand and gravel, trace silt, brown, damp			1B																	
	FILL, sand, trace silt, trace gravel; loose to compact, brown, wet			2	SS	20															
234.5	Occasional peat inclusions			3A	SS	7															
1.9				3B																	
233.8	SILTY CLAY to CLAYEY SILT, trace to some sand, trace gravel, firm to stiff, grey, moist			4	SS	7															
2.6				5	SS	6															
				6	AS																
				7	AS																
				8	SS	14															
				9	SS	10															
				10	ST																
228.9	SANDY SILT, trace clay, trace gravel, occasional cobbles and boulders, compact to very dense, grey, moist (GLACIAL TILL)			11	SS	26															
7.5				12	SS	100 / 50mm															
227.7																					

END OF BOREHOLE

Auger refusal

Unstabilized water level measured at 7.0m and borehole caved to 7.9m below grade upon completion of drilling

25mm piezometer installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
November 3, 2011	1.4	235.0
November 8, 2011	1.3	235.1
December 13, 2011	1.2	235.2
April 26, 2012	n/a (damaged)	n/a

RECORD OF BOREHOLE No MCD4

1 of 1

METRIC

G.W.P. 5233-06-00 LOCATION Coords: E:381110.4 N:5489889.2 ORIGINATED BY PB
DIST - HWY Hwy 11 BOREHOLE TYPE HOLLOW STEM AUGERS COMPILED BY DB
DATUM GEODETIC DATE 10.18.11 CHECKED BY HA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	SPT 'N' VALUE			20 40 60 80 100									
								SHEAR STRENGTH (kPa)									
								○ UNCONFINED	● QUICK TRIAXIAL	+ FIELD VANE	× LAB VANE	WATER CONTENT (%)					
236.5	GROUND SURFACE															GR SA SI CL	
236.3	170mm ASPHALTIC CONCRETE		1A														
236.2	150mm FILL - sand and gravel, trace silt, brown, damp		1B	AS													
236.2	FILL, sand, some silt, trace gravel; compact, brown, damp		2	SS	15												
	...at 1.5m, wet		3	SS	12											0 81 (19)	
234.4	Trace organics															0 23 53 24	
234.4			4	SS	12												
233.2			5	SS	6												
233.2	CLAYEY SILT to SILTY CLAY, some sand to sandy, trace gravel, firm to very stiff, grey, moist		6	AS													
			7	ST											21.9	4 20 53 23	
			8	AS													
			9	SS	16												
229.4																	
229.4	SANDY SILT, trace clay, trace gravel, occasional cobbles and boulders, compact to very dense, grey, moist (GLACIAL TILL)		10	SS	13											5 30 58 7	
227.0			11	SS	194 / 225mm												
227.0																	

END OF BOREHOLE

Auger refusal

Unstabilized water level measured at 7.0m and borehole caved to 8.5m below grade upon completion of drilling

25mm piezometer installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
November 3, 2011	1.5	235.0
November 8, 2011	1.3	235.2
December 13, 2011	1.2	235.3

RECORD OF BOREHOLE No MCD5

1 of 1

METRIC

G.W.P.	5233-06-00	LOCATION	Coords: E:381029.9 N:5489898.5	ORIGINATED BY	PB
DIST	-	HWY	Hwy 11	BOREHOLE TYPE	HOLLOW STEM AUGERS
DATUM	GEODETIC	DATE	10.25.11	CHECKED BY	HA
				COMPILED BY	DB

[illegible]

END OF BOREHOLE

Auger refusal

Borehole was dry and caved to 7.3m below grade upon completion of drilling.

25mm piezometer installed.

WATER LEVEL READINGS

<u>Date</u>	<u>Water Depth (m)</u>	<u>Elevation (m)</u>
November 3, 2011	0.8	234.9
November 8, 2011	0.8	234.9
December 13, 2011	0.5	235.2
April 26, 2012	0.4	235.3

library: library - mto gint.glb **report:** mto-terraprobe soil **path:** \\pdcs\server1\project files\11-geotechnical\2010\11-10-5001 to 5099\11-10-5076\gint\11-10-5076 montcalm bridge.gpj

RECORD OF BOREHOLE No MCD6

1 of 1

METRIC

G.W.P. 5233-06-00 LOCATION Coords: E:381107.1 N:5489877.4 ORIGINATED BY PB
DIST - HWY Hwy 11 BOREHOLE TYPE HOLLOW STEM AUGERS COMPILED BY DB
DATUM GEODETIC DATE 10.25.11 CHECKED BY HA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	SPT 'N' VALUE			20 40 60 80 100									
								SHEAR STRENGTH (kPa)									
								○ UNCONFINED	● QUICK TRIAXIAL	+ FIELD VANE	× LAB VANE	WATER CONTENT (%)					
235.7	GROUND SURFACE																
235.6 0.2	150mm TOPSOIL		1	SS	11								○				
235.0 0.7	FILL, silty clay, sandy, trace gravel, trace organics; stiff, grey, moist Occasional peat inclusions		2	SS	7										○		
233.9 1.8	CLAYEY SILT to SILTY CLAY, some sand to sandy, trace gravel, firm to very stiff, grey, moist		3	SS	6										○		
			4	SS	7								○			2 33 48 17	
			5	SS	7								○				
			6	SS	6								○			1 23 55 21	
			7	SS	18								○				
			8	SS	10								○			4 25 48 23	
			9	SS	8								○				
227.1 8.6	SANDY SILT, some clay, trace gravel, occasional cobbles and boulders, very dense, grey, damp (GLACIAL TILL)		10	SS	100 / 150mm								○				
225.2			11	SS	147								○			2 25 54 19	

END OF BOREHOLE
Auger refusal

Unstabilized water level measured at
5.5m and borehole caved to 7.0m
below grade upon completion of
drilling

25mm piezometer installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
November 3, 2011	0.5	235.2
November 8, 2011	0.2	235.5
December 13, 2011	0.4	235.3
April 26, 2012	0.4	235.3

RECORD OF BOREHOLE No MC-1

1 OF 2

METRIC

W.P. 5233-06-00 LOCATION Coords: N:5489903.6 E:381055.6 ORIGINATED BY PK
 DIST HWY Hwy 11 BOREHOLE TYPE Hollow Stem Augers / Casing and Washboring / NQ Coring COMPILED BY DB
 DATUM Geodetic DATE 7.21.10 - 7.22.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)					
												○ UNCONFINED ● QUICK TRIAXIAL						+ FIELD VANE × LAB VANE					
236.5	Ground Surface							20	40	60	80	100					GR	SA	SI	CL			
236.3	200mm ASPHALT																						
0.2	360mm FILL - Sand and Gravel, trace silt, dense, brown, damp		1	SS	36									○				50	45	(5)			
235.9	FILL - Sand, some silt, compact, brown, moist to wet		2	SS	23									○									
0.6			3	SS	18										○			0	87	(13)			
234.4	trace rootlets, frequent silt inclusions ---- SILTY CLAY TO CLAYEY SILT sandy, firm to very stiff, grey, moist		4	SS	8											○							
2.1			5	SS	6											○							
			6	SS	8											○							
			7	SS	6												○						
			8	SS	12												○						
			9	SS	16												○						
229.4	SANDY SILT trace clay, trace gravel, occasional cobbles and boulders, compact to very dense, grey, damp to moist (GLACIAL TILL)		10	SS	26											○			3	30	63	4	
7.1																							
			11	SS	100/ 13cm												○						
			12	SS	100/ 8cm													○					
224.9	CLAYEY SILT TO SILTY CLAY some sand to sandy, trace gravel, occasional cobbles and boulders, hard, grey, damp to moist (GLACIAL TILL)		13	SS	62												○			1	18	61	20
11.6																							
			14	SS	137													○					
				</																			

Continued Next Page

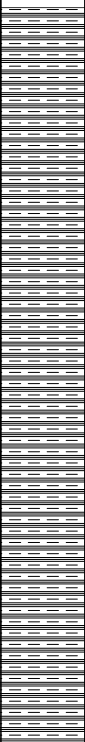
+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE


ON_MOT_OLD 1-10-5076 CROW MONTCALM BRIDGE RPL - ORIGINAL.GPJ ON_MOT_GDT 5/22/12

METRIC

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

Terraprobe

ELEVATION (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	Joint Characteristics							WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN NO. CORE RECOVERY %	R Q D %	CORE SIZE/CASING	MPa UNCONFINED COMPRESSIVE STRENGTH	UNIT WEIGHT (KN/m³)		
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERTURE										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19		
215.5 214.5 213.5 212.5 211.5 210.6	21.0		Overburden, see Borehole Log MC-1																	
	22.0		BEDROCK – GRANITE	2	CC	DV	VC	SP	SA	0 to 1					#1 TCR 21 SCR 0	0	NQ			
	23.0		Unweathered below 24.5m, massive, white to grey, medium to high strength. Highly weathered from 22.0m to 22.3m. Moderately to slightly weathered from 22.3m to 24.5m. Highly fractured zones from 22.0m to 22.4m and 25.4m to 25.7m.	2		CC	DV	VC	SP	O	0 to 3				#2 TCR 72 SCR 41	18	NQ			
						CC	DV	C	SP	O	0 to 1									
	24.0				2		CC	DV	C	SP	O	0 to 1				#3 TCR 98 SCR 56	43	NQ		
	25.0						CC	DV	VC	SP	O									
							CC	DV	C	SP	O									
	25.9				End of Core Log															

Remarks:	<div style="text-align: right;"><u>LEGEND:</u></div>  Bedrock
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RECORD OF BOREHOLE No MC-2

1 OF 2

METRIC

W.P. 5233-06-00 LOCATION Coords: N:5489904.1 E:381090.2 ORIGINATED BY PK
DIST HWY Hwy 11 BOREHOLE TYPE Hollow Stem Augers / Casing and Washboring / NQ Coring COMPILED BY DB
DATUM Geodetic DATE 7.20.10 - 7.21.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
								20 40 60 80 100							
								○ UNCONFINED + FIELD VANE							
								● QUICK TRIAXIAL × LAB VANE							
236.4	Ground Surface														
236.2	200mm ASPHALT														
0.2 235.9 0.5	310mm FILL - Sand and Gravel, trace silt, compact, brown, dry		1	SS	27		236								
	FILL - Sand, trace silt, trace gravel, compact, damp		2	SS	16										6 88 (6)
	----- loose, wet		3	SS	4		235								
234.3															
2.1	FILL - Silty Sand, frequent clay lumps, very loose, grey, wet		4	SS	2		234								
233.5															
2.9	FILL - Silty Clay and Organics, sandy, stiff, grey, moist		5	SS	14		233								
232.7															
3.7	SILTY CLAY some sand, trace gravel, firm to very stiff, grey, moist		6	SS	6										1 12 62 25
			7	SS	9		232								
			8	SS	21		231								
			9	SS	24		230								
229.3															
7.1	SANDY SILT trace to some clay, trace gravel, occasional cobbles and boulders, compact to very dense, grey, damp to moist (GLACIAL TILL)		10	SS	28		229								
			11	SS	100/ 8cm		228								
							227								1 32 55 12 commence casing and washboring
							226								
			12	SS	175/ 25cm		225								
224.8															
11.6	CLAYEY SILT TO SILTY CLAY sandy, trace gravel, hard, grey, damp to moist (GLACIAL TILL)		13	SS	34		224								6 25 45 24
							223								
			14	SS	51		222								

Continued Next Page

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

ONL_MOT_OLD 1-10-5076 CROW MONTCALM BRIDGE RPL - ORIGINAL.GPJ ON_MOT.GDT 5/22/12

2 OF 2

METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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							20	40	60	80	100		10	20	30																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
			15	SS	49									○																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									

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

Terraprobe

Remarks:

LEGEND:

Bedrock

RECORD OF BOREHOLE No MC-3

1 OF 2

METRIC

W.P. 5233-06-00 LOCATION Coords: N:5489892.0 E:381057.3 ORIGINATED BY PK
DIST HWY Hwy 11 BOREHOLE TYPE Hollow Stem Augers / Casing and Washboring / NQ Coring COMPILED BY DB
DATUM Geodetic DATE 8.7.10 - 8.8.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)					
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL						× LAB VANE					
235.3	Ground Surface							20	40	60	80	100	10			20	30	GR	SA	SI	CL
235.2	130mm TOPSOIL																				
0.1																					
	FILL - Silty Clay, trace sand, trace organics, firm, brown, moist		1	SS	5																
			2	SS	5											0	6	38	56		
233.9																					
1.4	CLAYEY SILT TO SILTY CLAY sandy, trace gravel, stiff, grey, moist		3	SS	9																
			4	SS	8																
			5	SS	8											1	24	57	18		
			6	SS	10																
			7	SS	14																
			8	SS	14																
			9	SS	8											2	22	50	26		
228.2																					
7.1	SANDY SILT some clay, trace gravel, frequent cobbles, compact to very dense, damp to moist (GLACIAL TILL)		10	SS	13																
			11	SS	100/ 13cm											5	36	48	11		
225.2																					
10.1	CLAYEY SILT TO SILTY CLAY sandy, trace to some gravel, frequent cobbles and boulders below 15.7m, hard, grey, damp to moist (GLACIAL TILL)		12	SS	152																
			13	SS	169											3	27	58	12		
			14	SS	89																

Continued Next Page

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

ON_MOT_OLD 1-10-5076 CROW MONTCALM BRIDGE RPL - ORIGINAL.GPJ ON_MOT.GDT 5/22/12

RECORD OF BOREHOLE No MC-3

2 OF 2

METRIC

W.P. 5233-06-00 LOCATION Coords: N:5489892.0 E:381057.3 ORIGINATED BY PK
 DIST HWY Hwy 11 BOREHOLE TYPE Hollow Stem Augers / Casing and Washboring / NQ Coring COMPILED BY DB
 DATUM Geodetic DATE 8.7.10 - 8.8.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE											
							20	40	60	80	100								
219.8	COBBLES AND BOULDERS inferred very dense, grey, moist															Commence NQ Coring			
15.5			15	WS	-														
			16	WS	-														
			17	WS	-														
216.3	BEDROCK - GRANITE unweathered below 19.9m, massive, white to grey, medium to high strength.		1	RUN	NQ											RUN#1 TCR=100% SCR=99% RQD=32%			
19.0			2	RUN	NQ											RUN#2 TCR=94% SCR=86% RQD=49%			
			3	RUN	NQ											RUN#3 TCR=100% SCR=80% RQD=70%			
213.1	End of Borehole																		
22.3	Borehole filled with drill water upon completion of drilling. Continous soil core sample collected from 15.2m to 19.0m. Unable to push vane beyond 7.0m. Piezometer installation consists of a 25mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen. Water Level Readings: Date Depth(m) Elevation(m) Aug.10.10 0.5 234.8 Sep.03.10 0.5 234.8 Apr.26. 12 Damaged																		

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

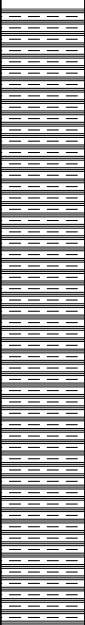


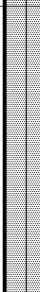

ONL_MOT_OLD 1-10-5076 CROW MONTCALM BRIDGE RPL - ORIGINAL.GPJ ON_MOT.GDT 5/22/12

CORE LOG



Terraprobe

Project	Montcalm Creek Bridge Replacement	Orientation	Vertical	Ground Elevation	235.3m	Datum	Geodetic	Borehole No.	MC-3
Location	Hwy 11, Township of McCrea, Ontario	Date Started	August 8, 2010	Completed	August 8, 2010	Logged By	A.W.	Sheet	1 of 1
Client	MTO	Drilling Agency	Landcore Drilling	Drill Type	CME55	Core Barrel & Bit Design	NQ	Project No.	1-10-5076

ELEVATION (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	Joint Characteristics								WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN NO. CORE RECOVERY %	R Q D %	CORE SIZE/CASING	MPa UNCONFINED COMPRESSIVE STRENGTH	UNIT WEIGHT (KN/m³)
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERTURE									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
217.3 216.3 215.3 214.3 213.3 213.0	18.0		Overburden, see Borehole Log MC-3																
	19.0		<u>BEDROCK – GRANITE</u> Unweathered below 19.9m, massive, white to grey, medium to high strength. Moderately to slightly weathered from 19.0m to 19.9m. Slightly rubbilized zone from 21.5m to 21.6m. Weathered zones are typically slightly friable and pitted.	1	C	F	C	RP	S	0 to 1					#1 TCR 100 SCR 99	32	NQ		
	20.0			2	CC	DV	C	RP	SA	0 to 1				#2 TCR 94 SCR 86	49	NQ			
	21.0				CC	DV	C	RP	O										
	22.0			1	C	D	C	RP	T	0 to 1				#3 TCR 100 SCR 80	70	NQ			
	22.3																		
				End of Core Log															

Remarks:	<div>LEGEND: Bedrock</div>
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RECORD OF BOREHOLE No MC-4

1 OF 2

METRIC

W.P. 5233-06-00 LOCATION Coords: N:5489882.6 E:381079.1 ORIGINATED BY PK
DIST HWY Hwy 11 BOREHOLE TYPE Hollow Stem Augers / Casing and Washboring / NQ Coring COMPILED BY DB
DATUM Geodetic DATE 8.9.10 - 8.10.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL						× LAB VANE		
235.6	Ground Surface																	
235.5	150mm TOPSOIL																	
0.2	FILL - Silty Clay, trace sand, trace organics, stiff, brown, moist		1	SS	10													
234.9																		
0.7	SILTY CLAY some sand to sandy, trace gravel, stiff to very stiff, grey, moist		2	SS	12													
			3	SS	11													
			4	SS	13													
			5	SS	9													
			6	SS	9													
			7	SS	26													
			8	SS	24													
			9	SS	16													
228.5	compact		10	SS	20													
7.1	----																	
	SANDY SILT trace clay, trace gravel, frequent cobbles and boulders below 13.7m, very dense, grey, damp to moist (GLACIAL TILL)		11	SS	100/ 15cm													
			12	SS	100/ 10cm													
			13	SS	155/ 25cm													
			14	SS	100/ 8cm													

Continued Next Page

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

ONL_MOT_OLD 1-10-5076 CROW MONTCALM BRIDGE RPL - ORIGINAL.GPJ ON_MOT_GDT 5/22/12

RECORD OF BOREHOLE No MC-4

2 OF 2

METRIC

W.P. 5233-06-00 LOCATION Coords: N:5489882.6 E:381079.1 ORIGINATED BY PK
DIST HWY Hwy 11 BOREHOLE TYPE Hollow Stem Augers / Casing and Washboring / NQ Coring COMPILED BY DB
DATUM Geodetic DATE 8.9.10 - 8.10.10 CHECKED BY RA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
							20 40 60 80 100													
219.9			15	SS	100/ 13cm										○					
15.7	COBBLES AND BOULDERS inferred very dense, grey, dry																Aug.09 Aug.10			
217.2	BEDROCK - GRANITE slightly weathered, massive, white to grey, high strength.																			
18.4		1	RUN	NQ													RUN#1 TCR=96% SCR=58% RQD=16%			
		2	RUN	NQ													RUN#2 TCR=89% SCR=63% RQD=56%			
		3	RUN	NQ													RUN#3 TCR=100% SCR=77% RQD=0%			
213.8	End of Borehole																			
21.8	Borehole filled with drill water upon completion of drilling. Piezometer installation consists of a 25mm diameter, Schedule 40 PVC pipe with a 1.52m slotted screen. Water Level Readings: Date Depth(m) Elevation(m) Aug.10.10 0.4 235.2 Aug.31.10 1.6 234.0 Sep.01.10 1.6 234.0 Apr.26. 12 0.3 235.3																			

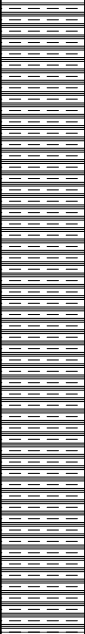
ON_MOT_OLD 1-10-5076 CROW MONTCALM BRIDGE RPL - ORIGINAL.GPJ ON_MOT.GDT 5/22/12

CORE LOG



Terraprobe

Project	Montcalm Creek Bridge Replacement	Orientation	Vertical	Ground Elevation	235.6m	Datum	Geodetic	Borehole No.	MC-4
Location	Hwy 11, Township of McCrea, Ontario	Date Started	August 10, 2010	Completed	August 10, 2010	Logged By	A.W.	Sheet	1 of 1
Client	MTO	Drilling Agency	Landcore Drilling	Drill Type	CME55	Core Barrel & Bit Design	NQ	Project No.	1-10-5076

ELEVATION (m)	DEPTH (m)	SYMBOL	GENERAL DESCRIPTION	Joint Characteristics							WEATHERING	STRENGTH	FRACTURE FREQUENCY	RUN NO.	CORE RECOVERY %	R Q D %	CORE SIZE/CASING	MPa UNCONFINED COMPRESSIVE STRENGTH	UNIT WEIGHT (KN/m³)
				No. OF SETS	JOINT TYPE	ORIENTATION	SPACING	ROUGHNESS	FILLING	APERTURE									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
217.6	18.0		Overburden, see Borehole Log MC-4																
217.2	18.4		<u>BEDROCK – GRANITE</u> Slightly weathered, massive, white to grey, high strength.	2	CC	FV	C	RP	SA	0 to 1					#1 TCR 96 SCR 58	16	NQ		
216.6	19.0			Highly fractured zones from 20.0m to 20.5m.	2	CC	FV	VC	RP	O	0 to 1				#2 TCR 89 SCR 63	56	NQ		
215.6	20.0				CC	FV	C	RP	O										
214.6	21.0			2	CC	FV	C	RP	O	0 to 1					#3 TCR 100 SCR 77	0	NQ		
213.8	21.8		End of Core Log																

Remarks:

LEGEND:

 Bedrock

Foundation Investigation Report
Montcalm Creek Bridge Replacement
G.W.P. No.: 5233-06-00; W.P. 5146-05-01



Bedrock Core Sample
Borehole: MC-1
Runs: 1, 2 & 3
Depth: 21.0m – 25.9m

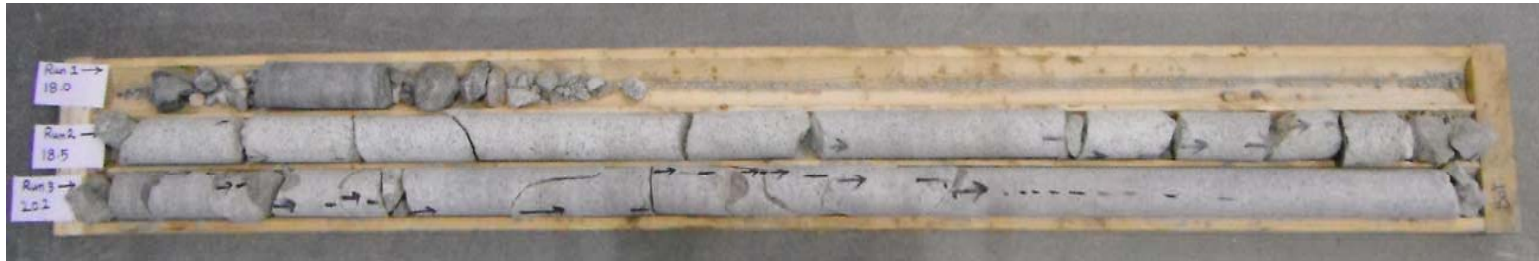


Foundation Investigation Report
Montcalm Creek Bridge Replacement
G.W.P. No.: 5233-06-00; W.P. 5146-05-01



Bedrock Core Sample
Borehole: MC-2
Runs: 1, 2 & 3
Depth: 18.5m – 22.0m





Bedrock Core Sample

Borehole: MCD-1; Runs: 1 to 3; Depth: 18.0m – 21.7m



Soil/Bedrock Core Sample

Borehole: MCD-2; Runs: 1 to 6; Depth: 17.7m – 26.3m



Foundation Investigation Report
Montcalm Creek Bridge Replacement
G.W.P. No.: 5233-06-00; W.P. 5146-05-01



Bedrock Core Sample
Borehole: MC-3
Runs: 1, 2 & 3
Depth: 19.0m – 22.3m



Foundation Investigation Report
Montcalm Creek Bridge Replacement
G.W.P. No.: 5233-06-00; W.P. 5146-05-01

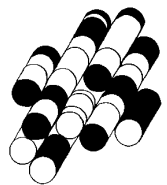


Bedrock Core Sample
Borehole: MC-4
Runs: 1, 2 & 3
Depth: 18.4m – 21.8m

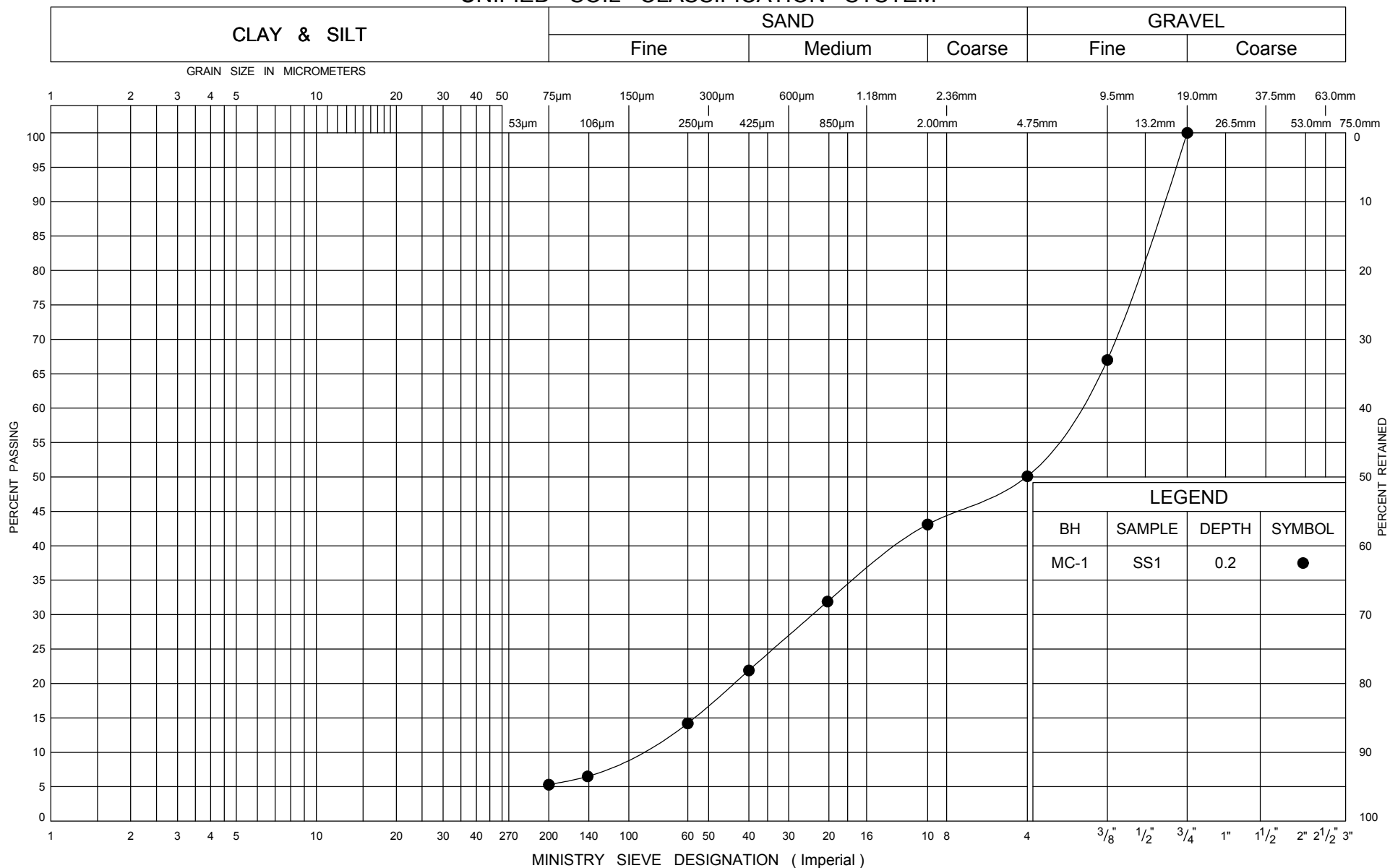


APPENDIX B

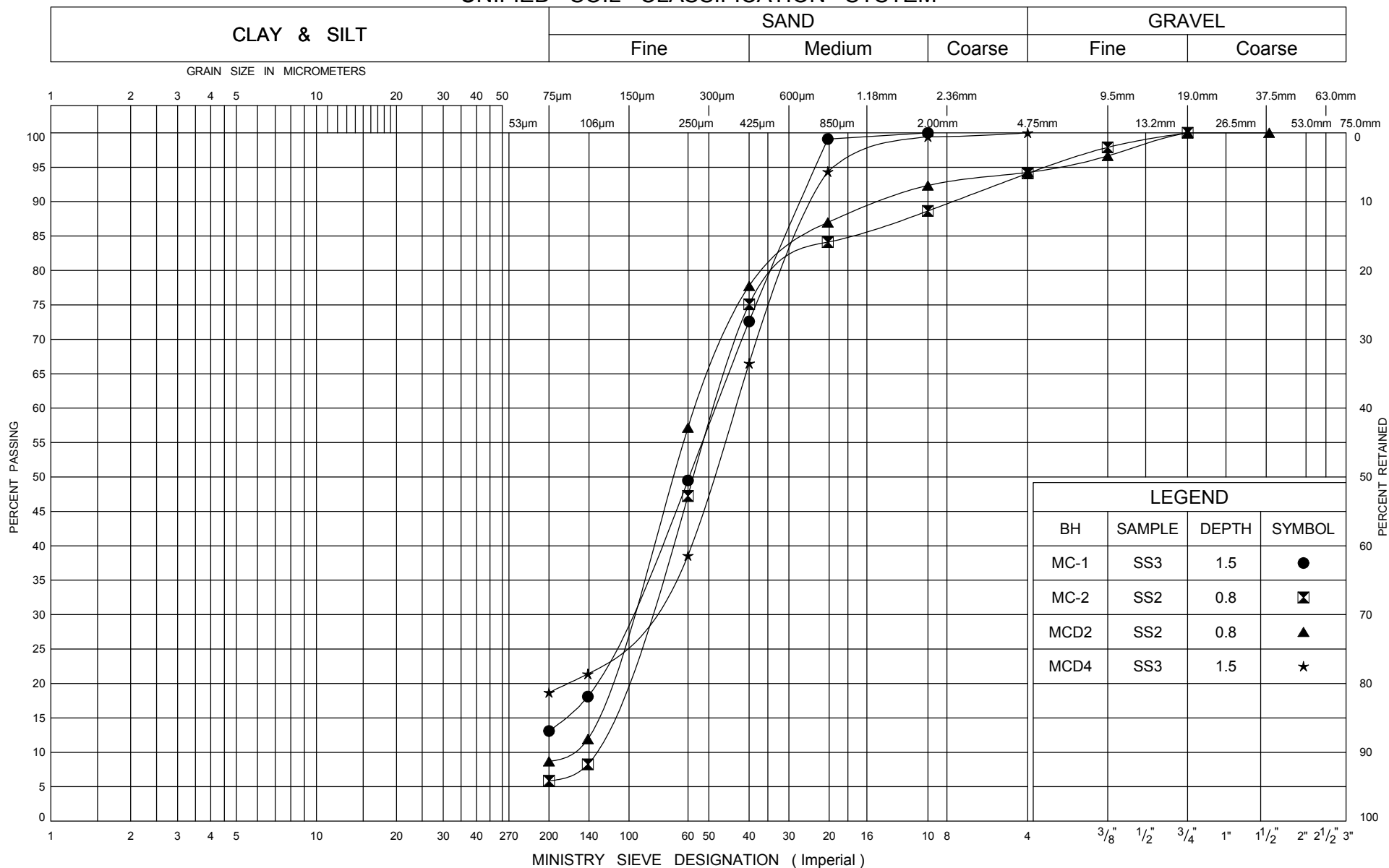
TERRAPROBE INC.



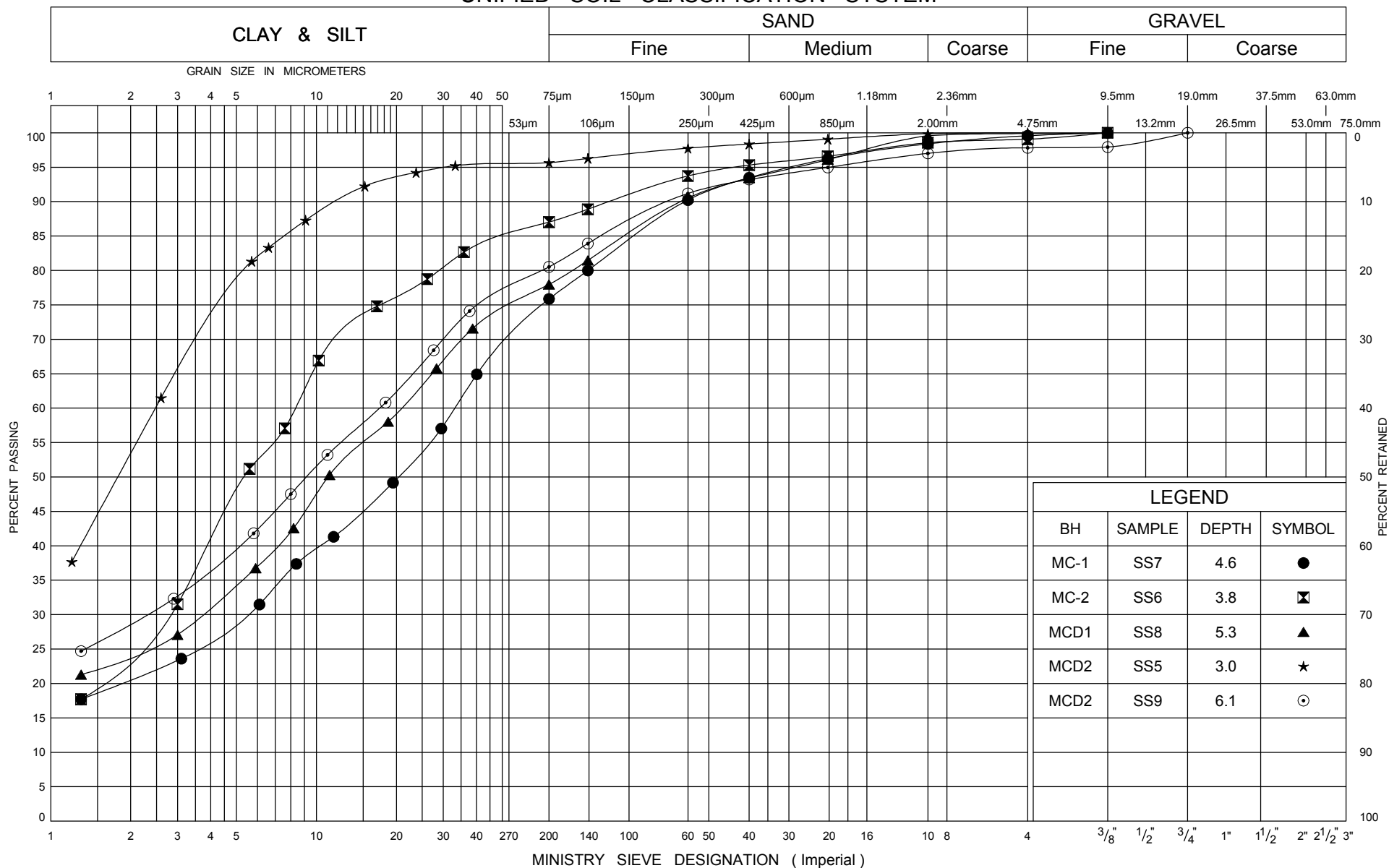
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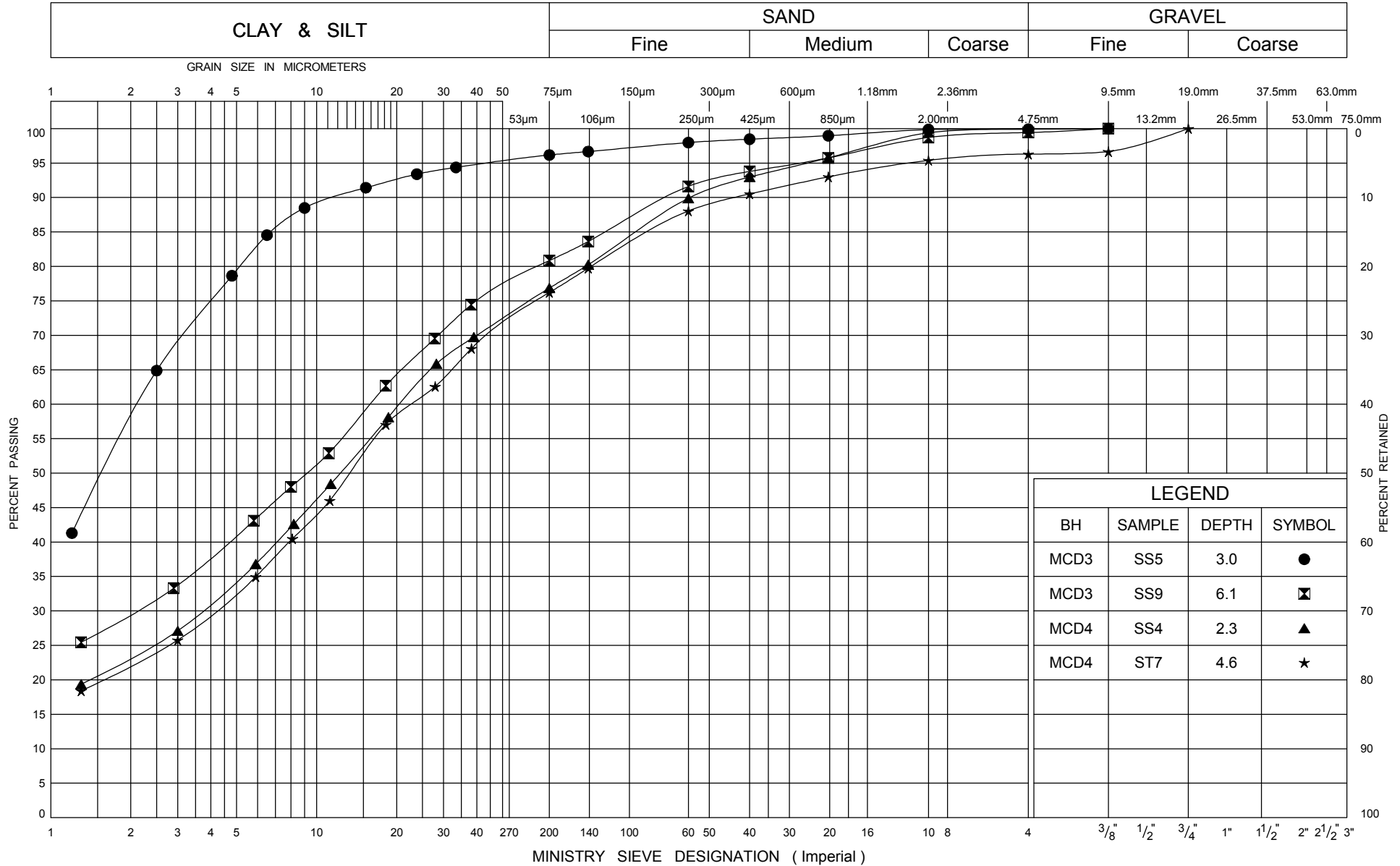
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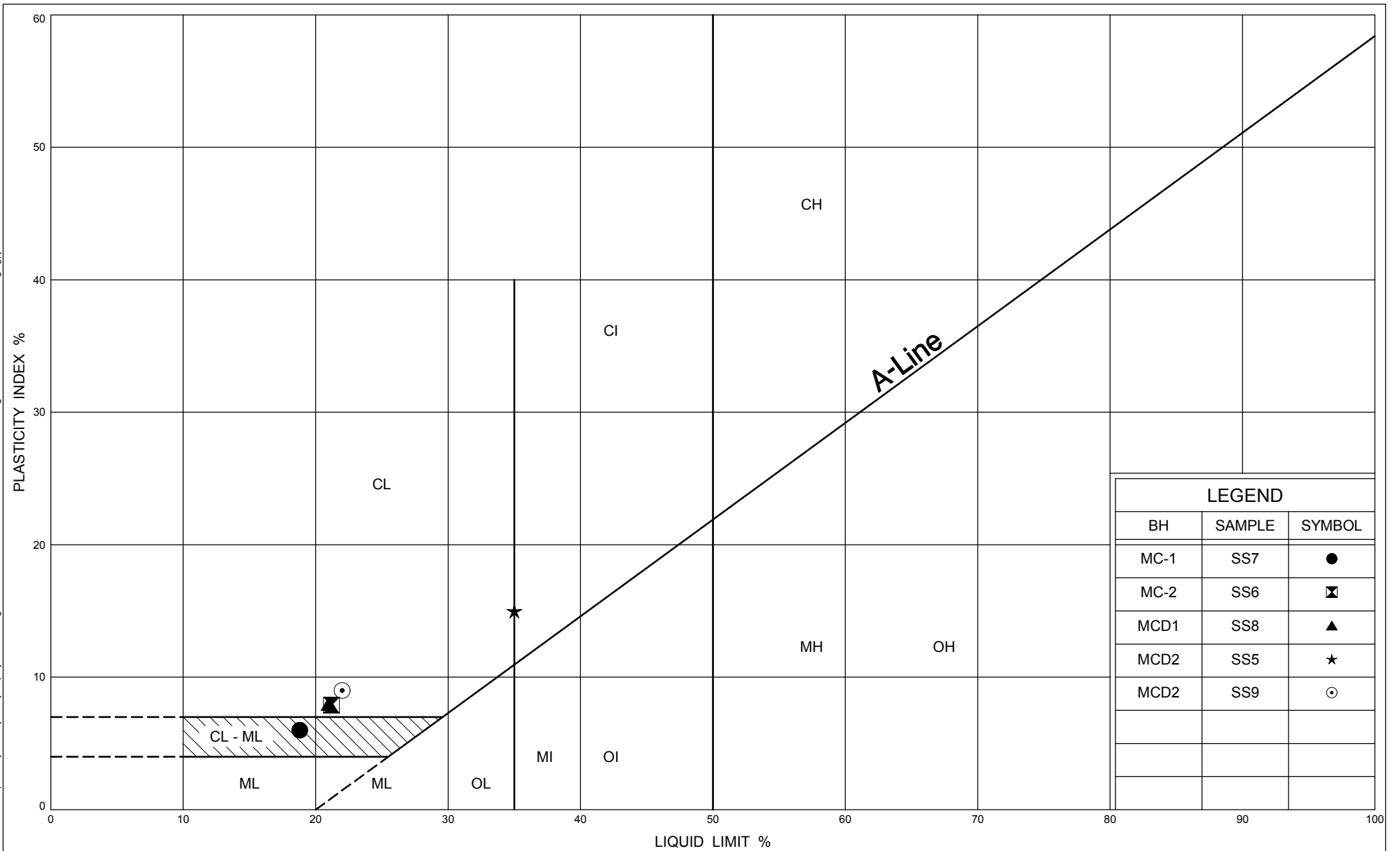


UNIFIED SOIL CLASSIFICATION SYSTEM



UNIFIED SOIL CLASSIFICATION SYSTEM





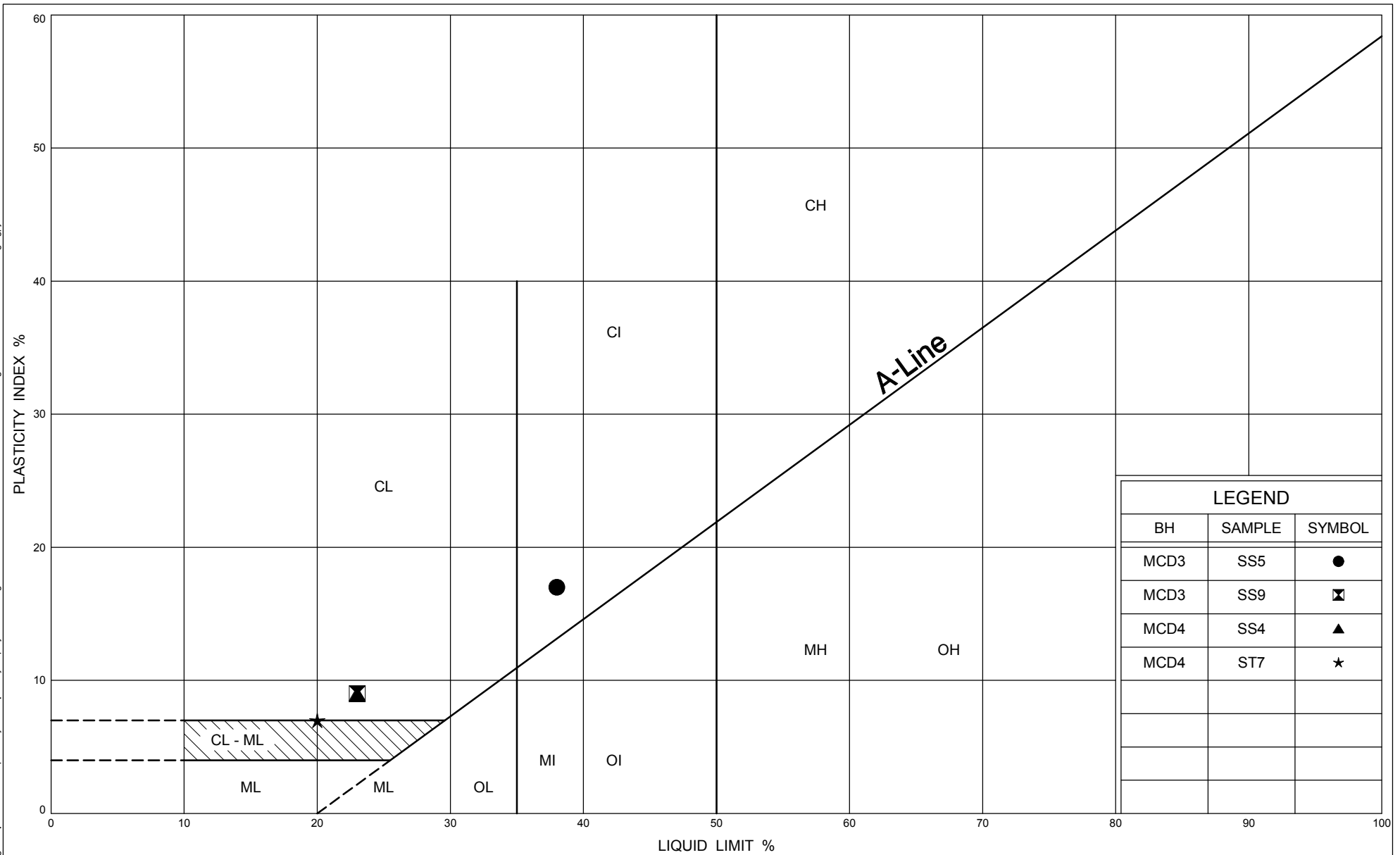
Ministry of
Transportation

PLASTICITY CHART SILTY CLAY TO CLAYEY SILT

FIG No B1-5

G W P 5233-06-00

Montcalm Bridge Replacement



Ministry of
Transportation

PLASTICITY CHART

SILTY CLAY TO CLAYEY SILT

FIG No B1-6

G W P 5233-06-00

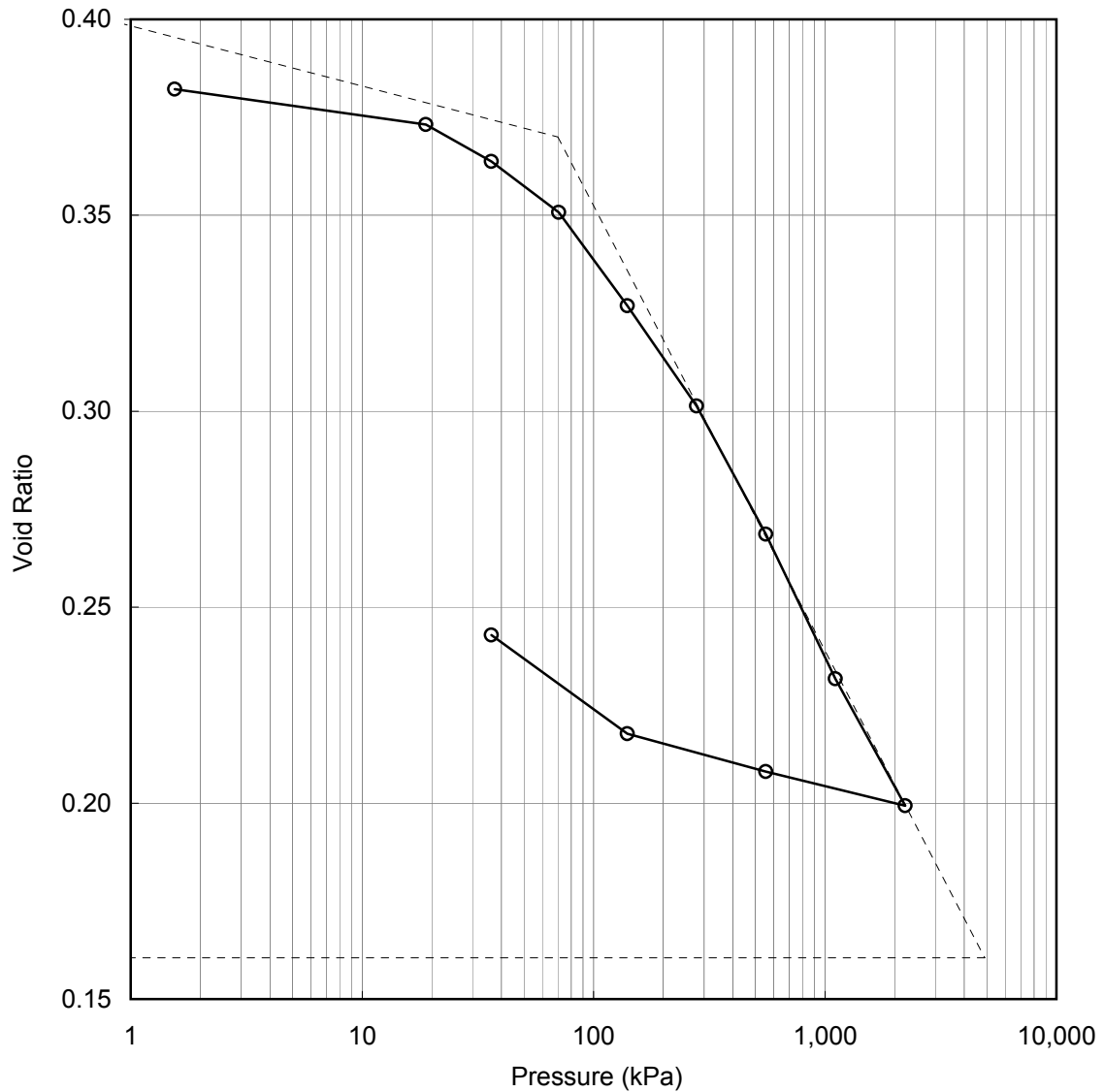
Montcalm Bridge Replacement

CONSOLIDATION TEST

FIG No B1-7

MONTCLAM BRIDGE, BH MCD4, SAMPLE Sa7
SILTY CLAY

e vs Pressure



Soil Type : Silty Clay

$e_o =$	0.40	$\omega_L =$	-	$Po' =$	0 kPa
$\omega =$	14%	$\omega_P =$	-	$Pc' =$	70 kPa
$\gamma =$	21.9 kN/m ³	$PI =$	-	$Cc =$	0.114
$G_s =$	2.71			$Cr =$	0.015

Project No. : 11-10-5076
Date : February 2012



Terraprobe Inc.

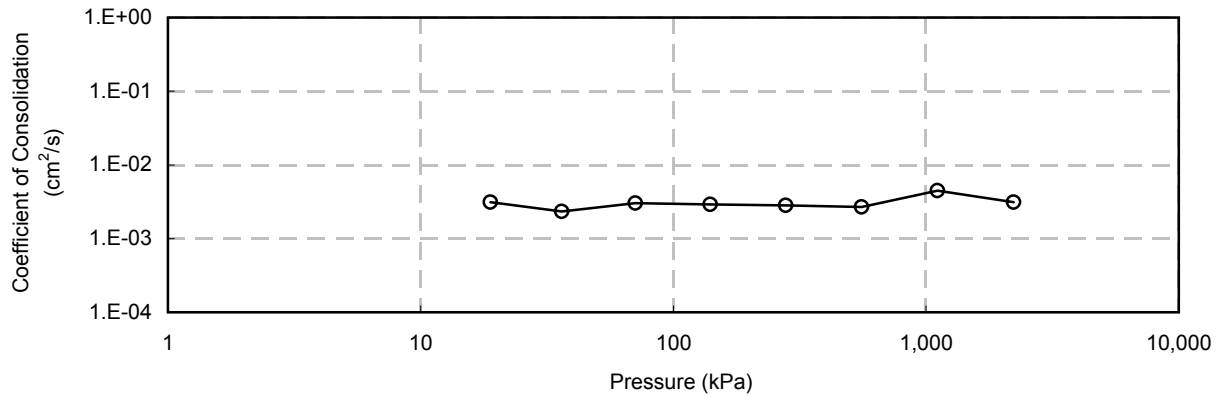
Prepared By : MD
Checked By : JC

CONSOLIDATION TEST

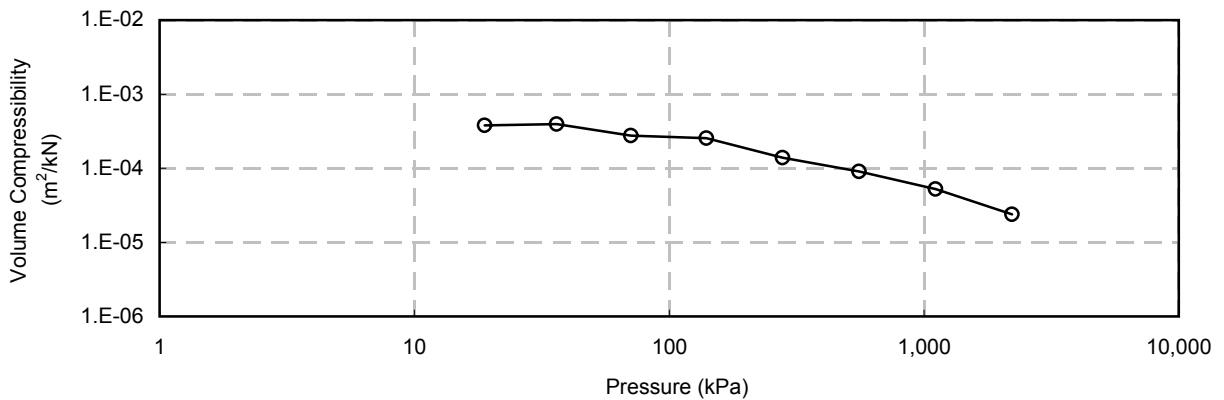
FIG No B1-8

MONTCLAM BRIDGE, BH MCD4, SAMPLE Sa7
SILTY CLAY

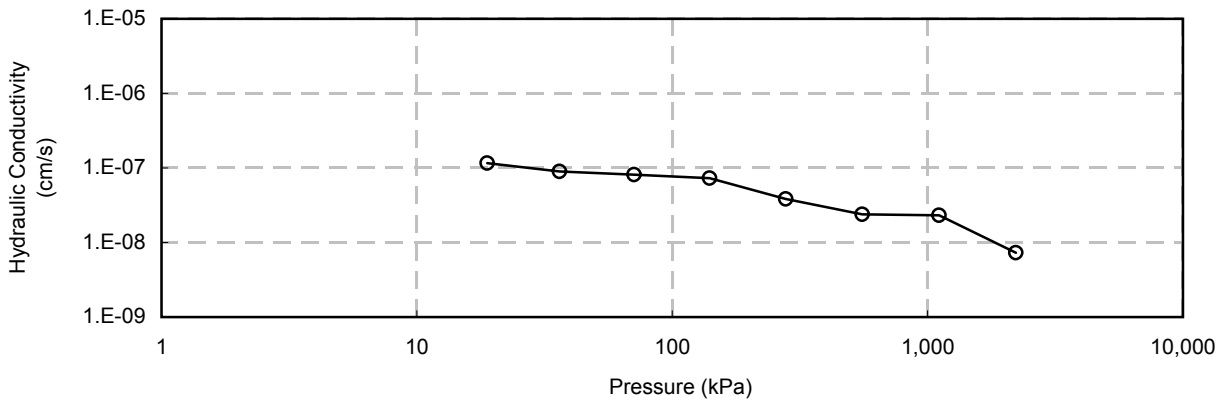
Cv vs Pressure



mv vs Pressure



k vs Pressure



Project No. : 11-10-5076
Date : February 2012

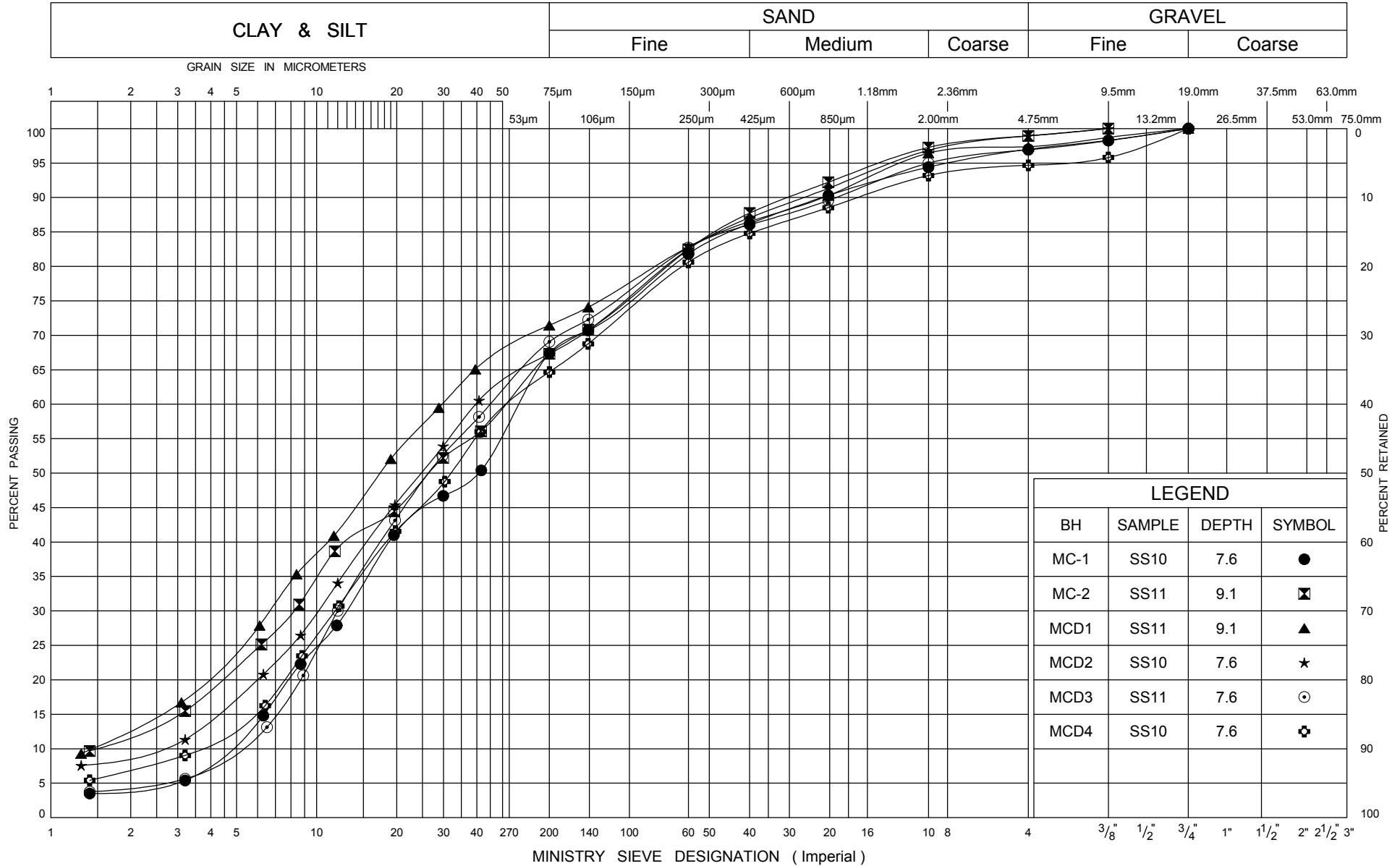


Terraprobe Inc.

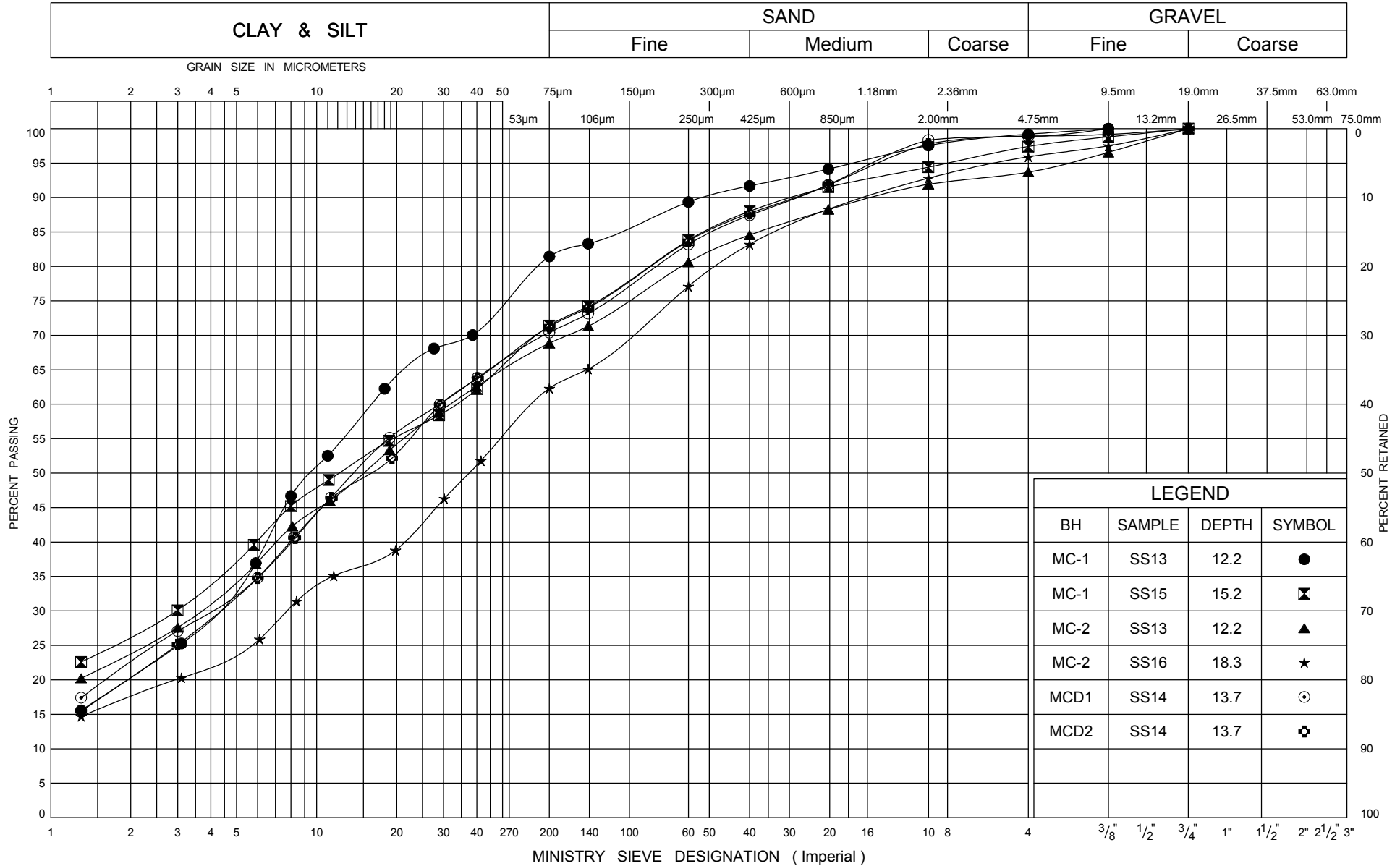
Prepared By : MD
Checked By : JC

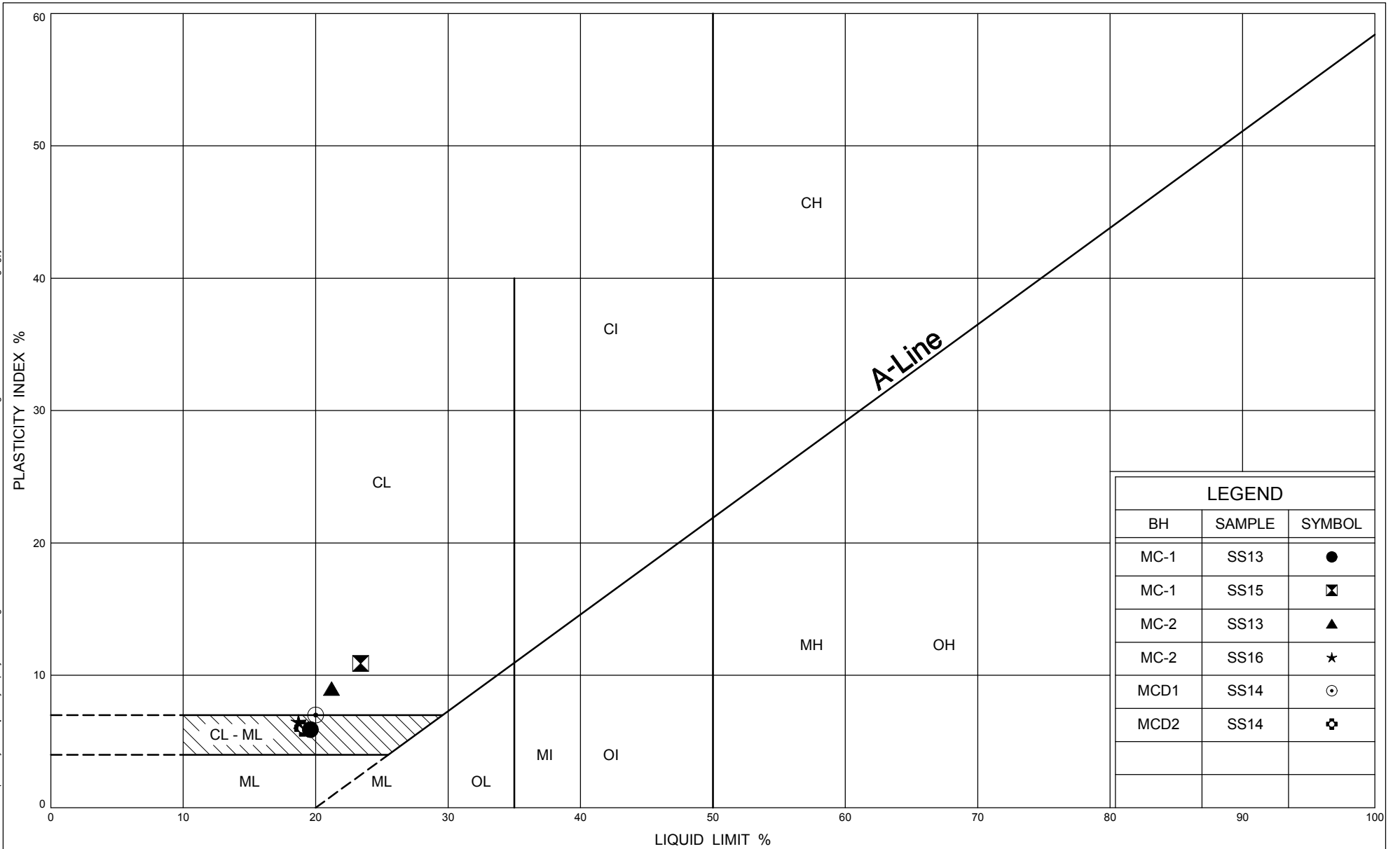
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UNIFIED SOIL CLASSIFICATION SYSTEM



UNIFIED SOIL CLASSIFICATION SYSTEM





Ministry of
Transportation

PLASTICITY CHART

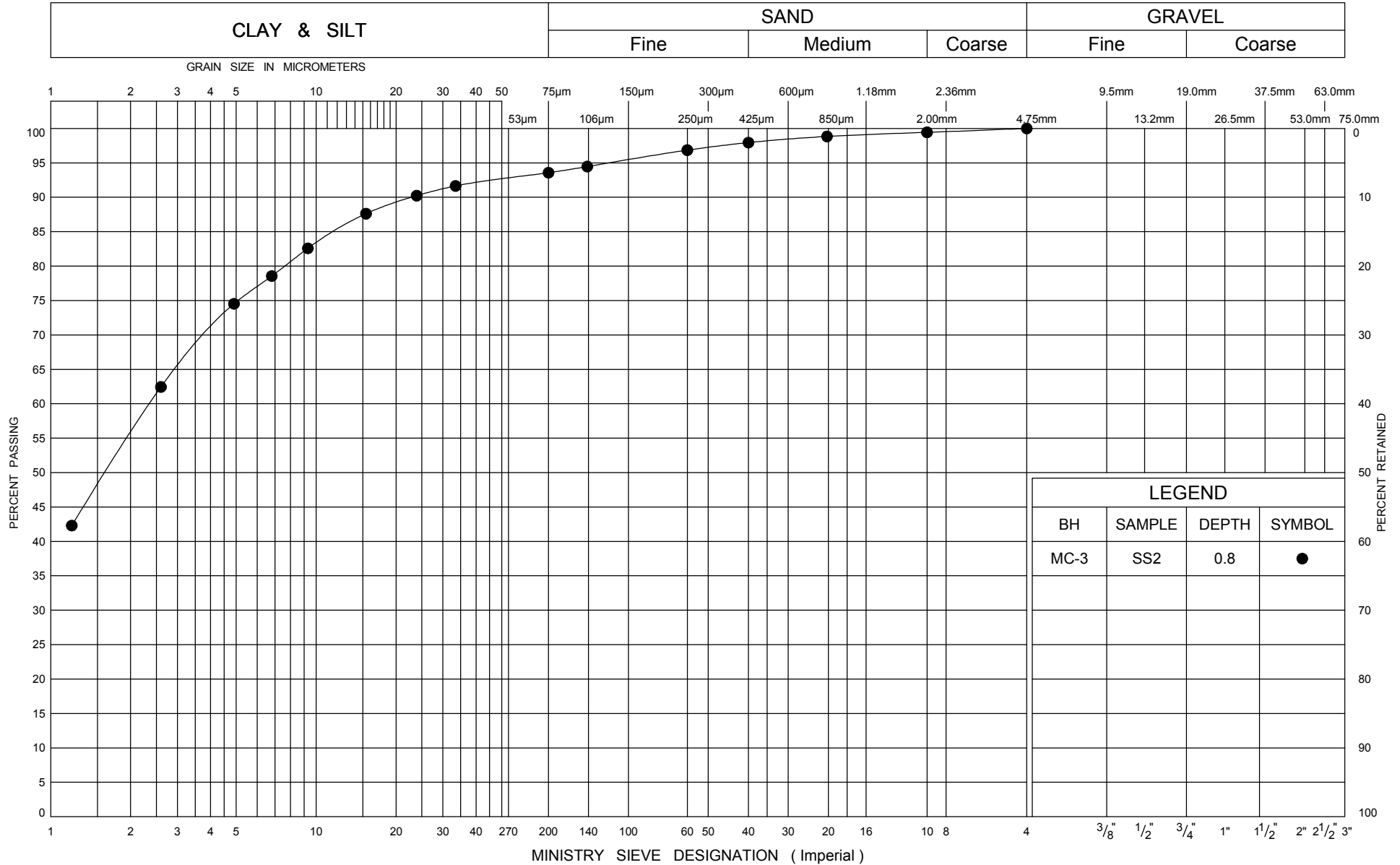
CLAYEY SILT TO SILTY CLAY TILL

FIG No B1-11

G W P 5233-06-00

Montcalm Bridge Replacement

UNIFIED SOIL CLASSIFICATION SYSTEM



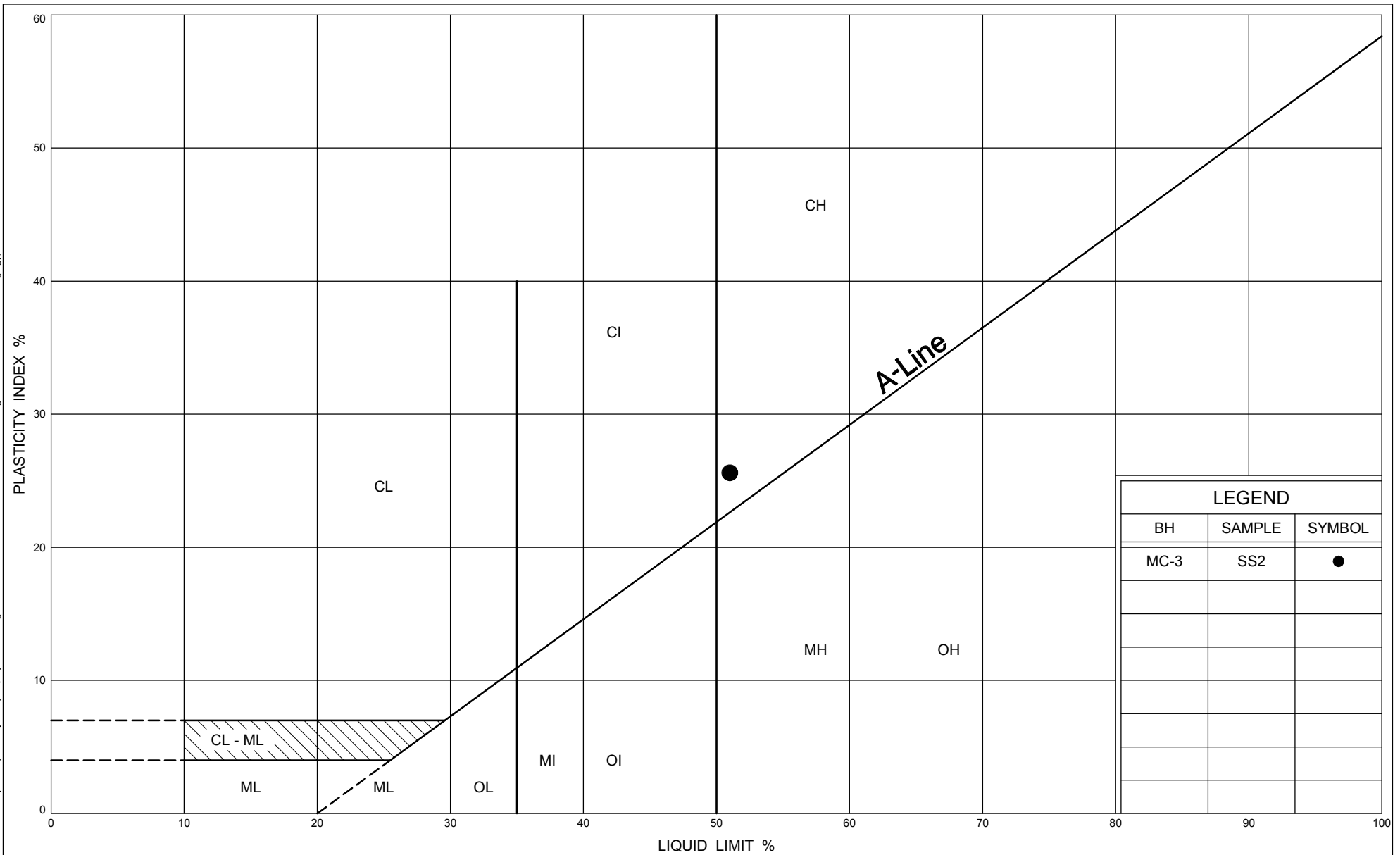
Ministry of
Transportation

GRAIN SIZE DISTRIBUTION FILL - SILTY CLAY

FIG No B2-1

G W P 5233-06-00

Montcalm Bridge Replacement



Ministry of
Transportation

PLASTICITY CHART

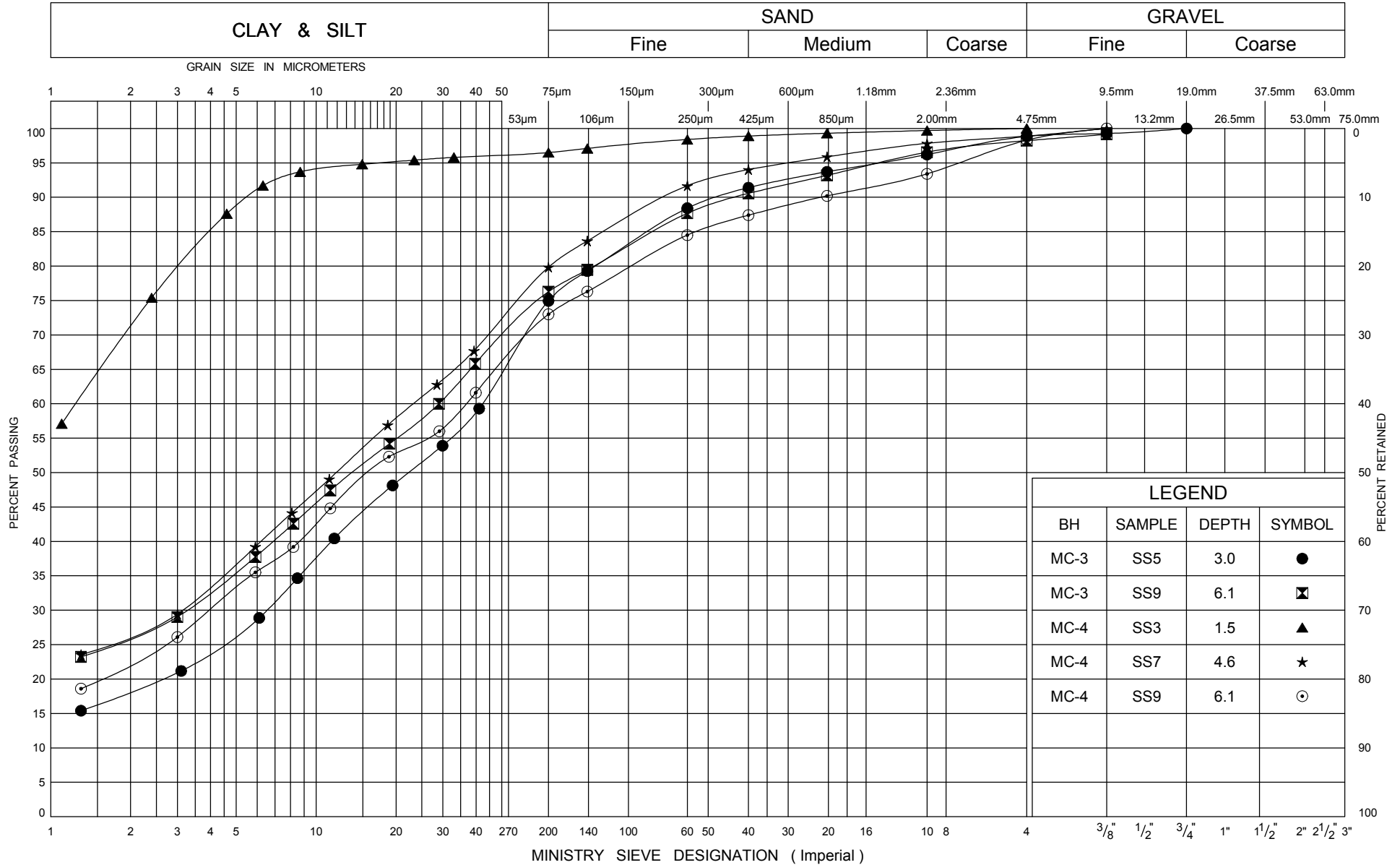
FILL - SILTY CLAY

FIG No B2-2

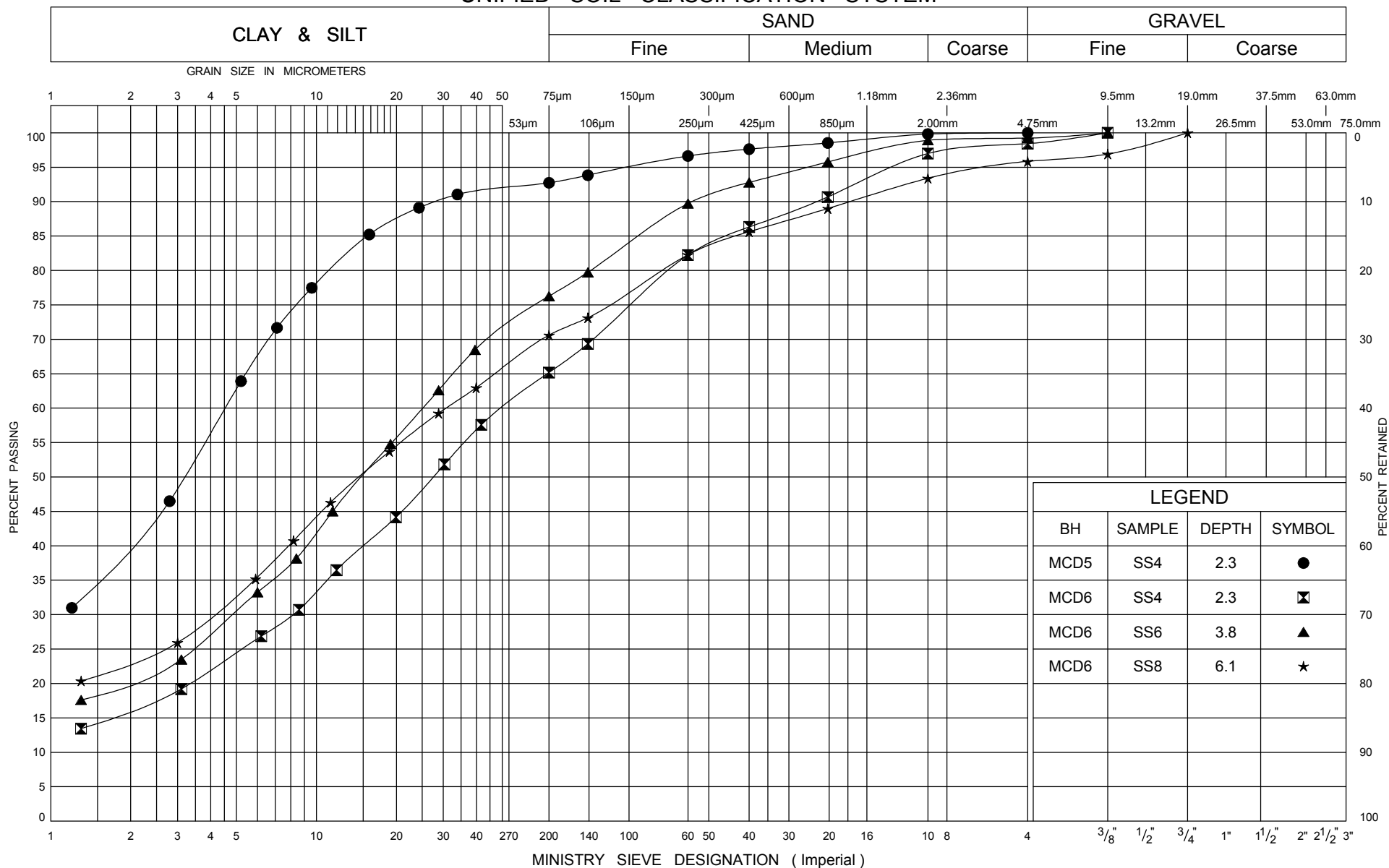
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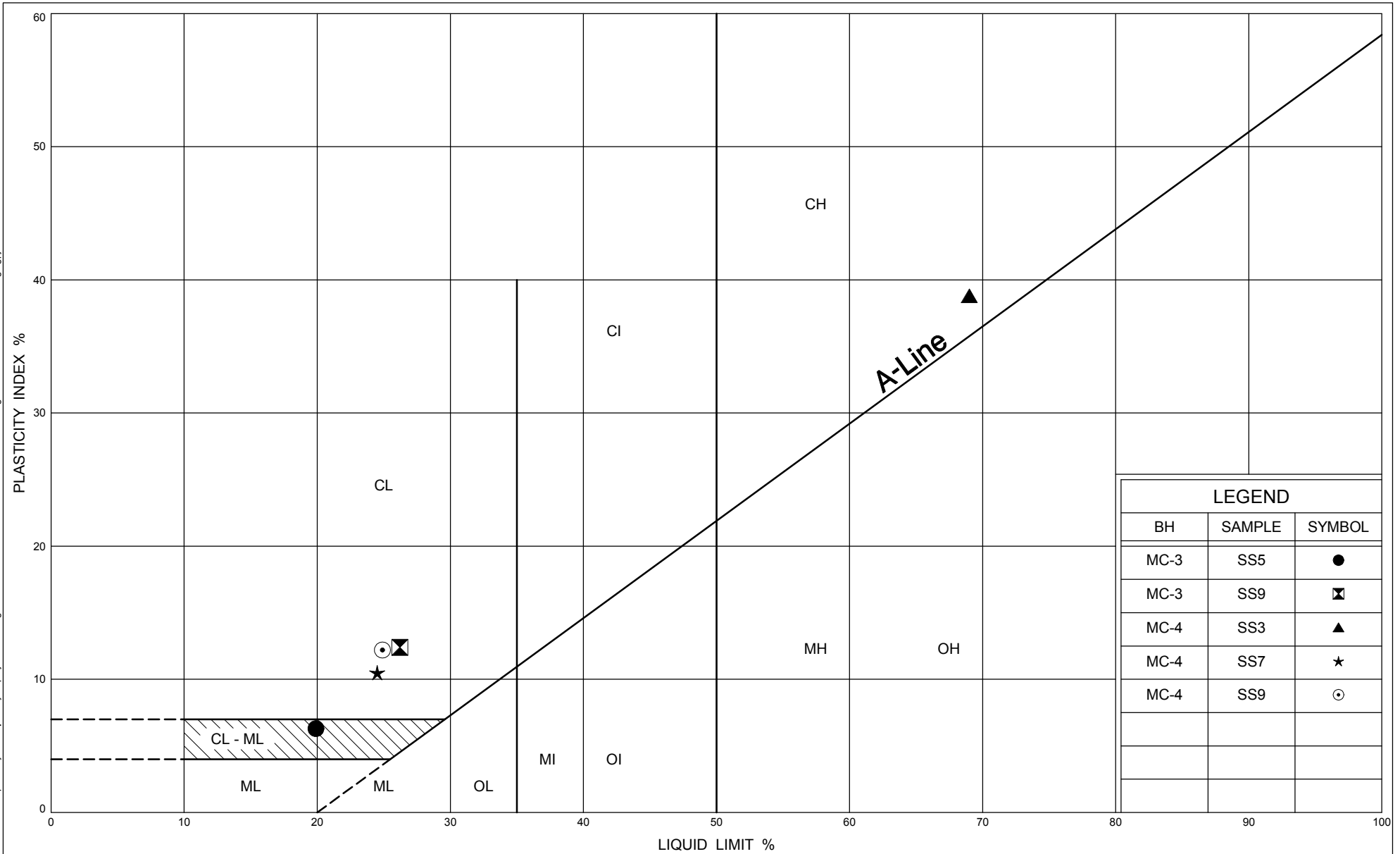
Montcalm Bridge Replacement

UNIFIED SOIL CLASSIFICATION SYSTEM



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Ministry of
Transportation

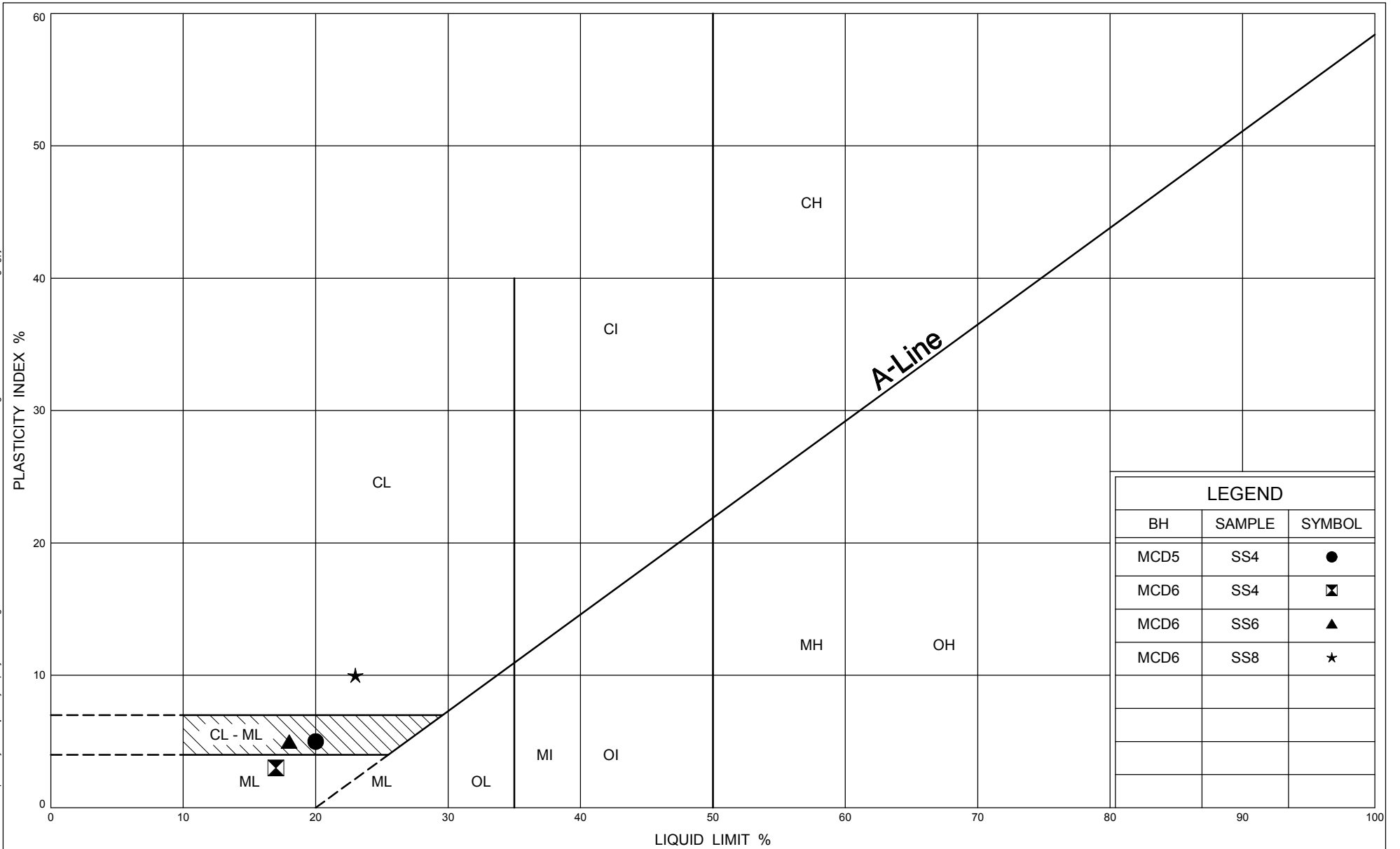
PLASTICITY CHART

CLAYEY SILT TO SILTY CLAY

FIG No B2-5

G W P 5233-06-00

Montcalm Bridge Replacement



Ministry of
Transportation

PLASTICITY CHART

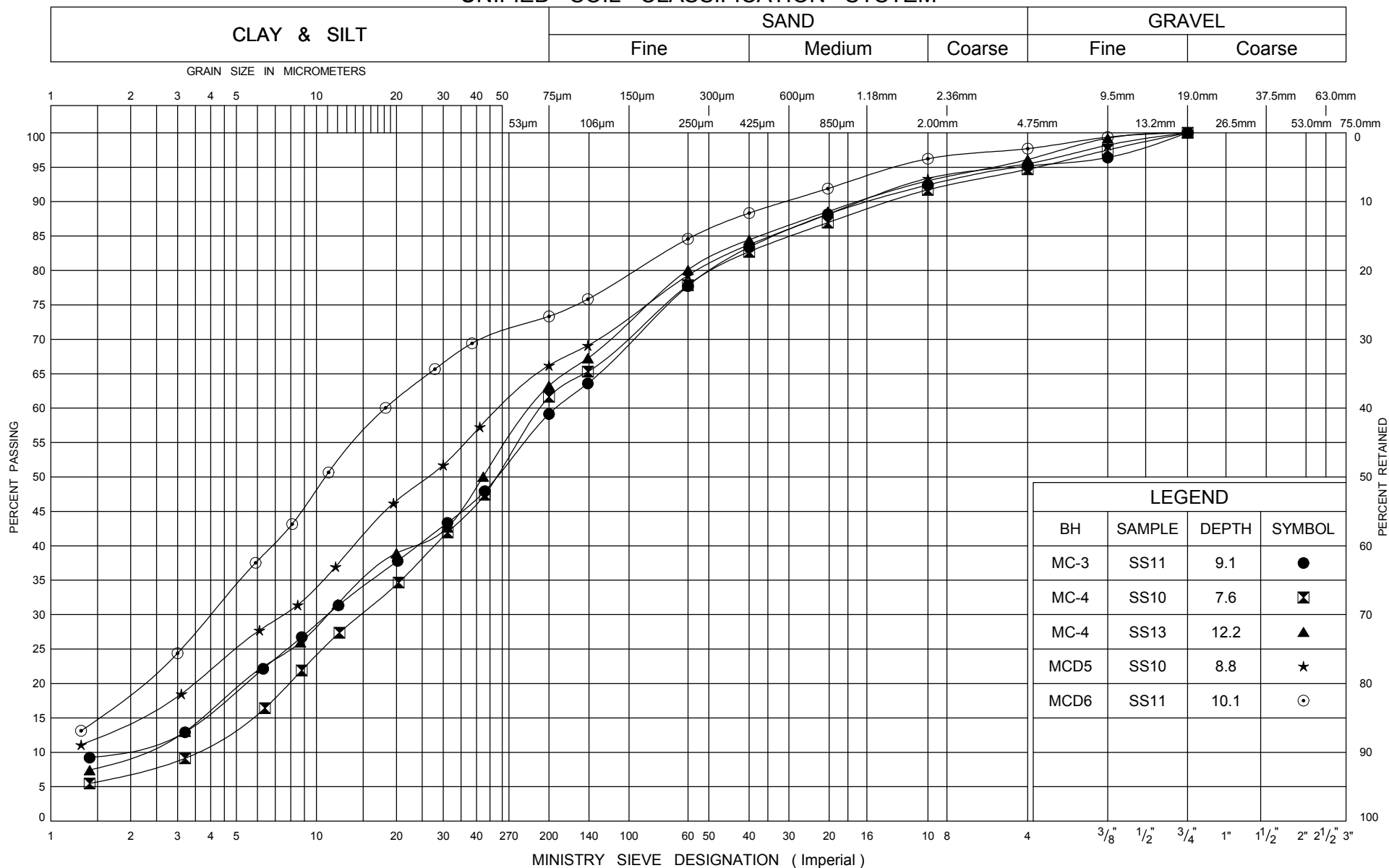
CLAYEY SILT TO SILTY CLAY

FIG No B2-6

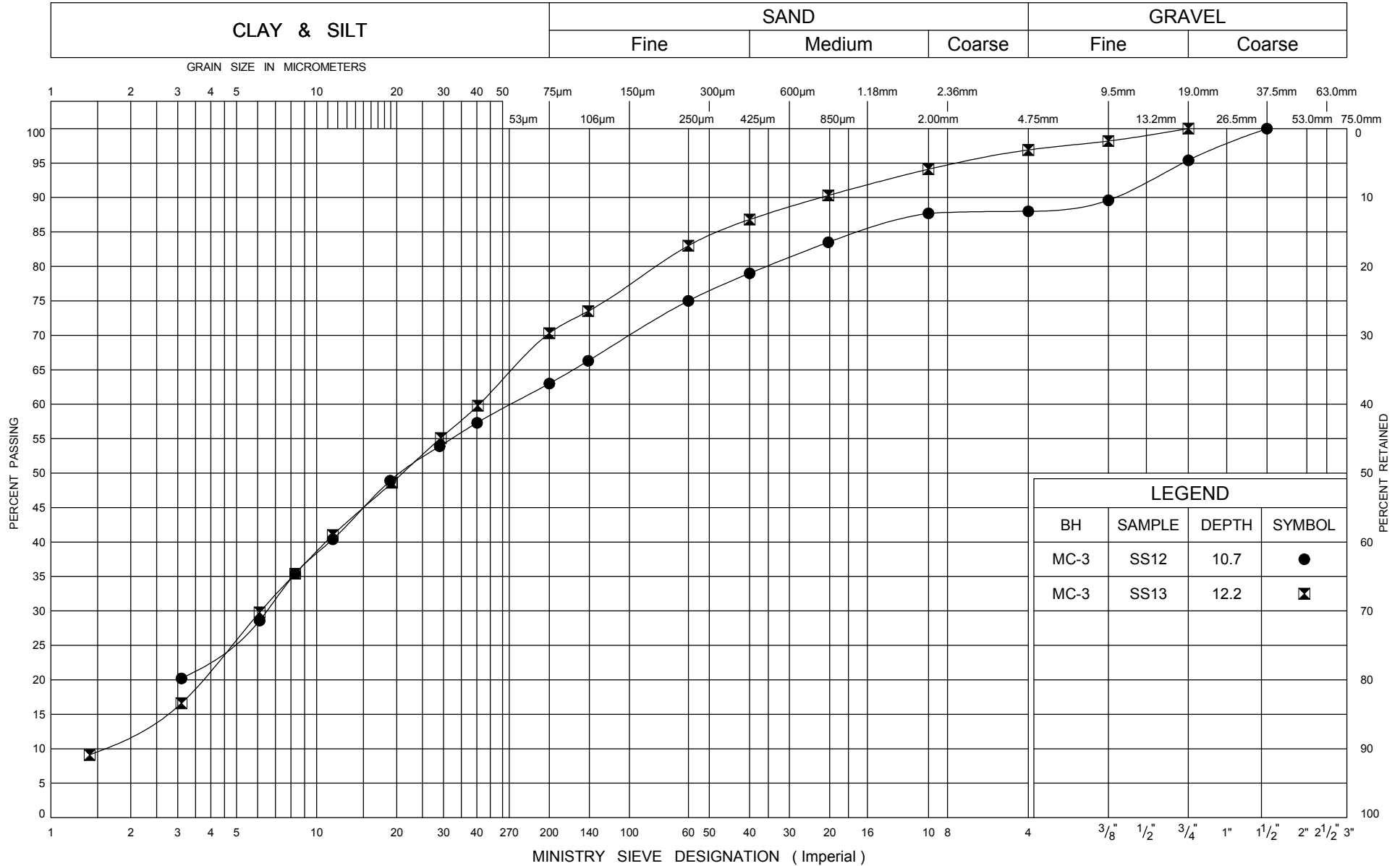
G W P 5233-06-00

Montcalm Bridge Replacement

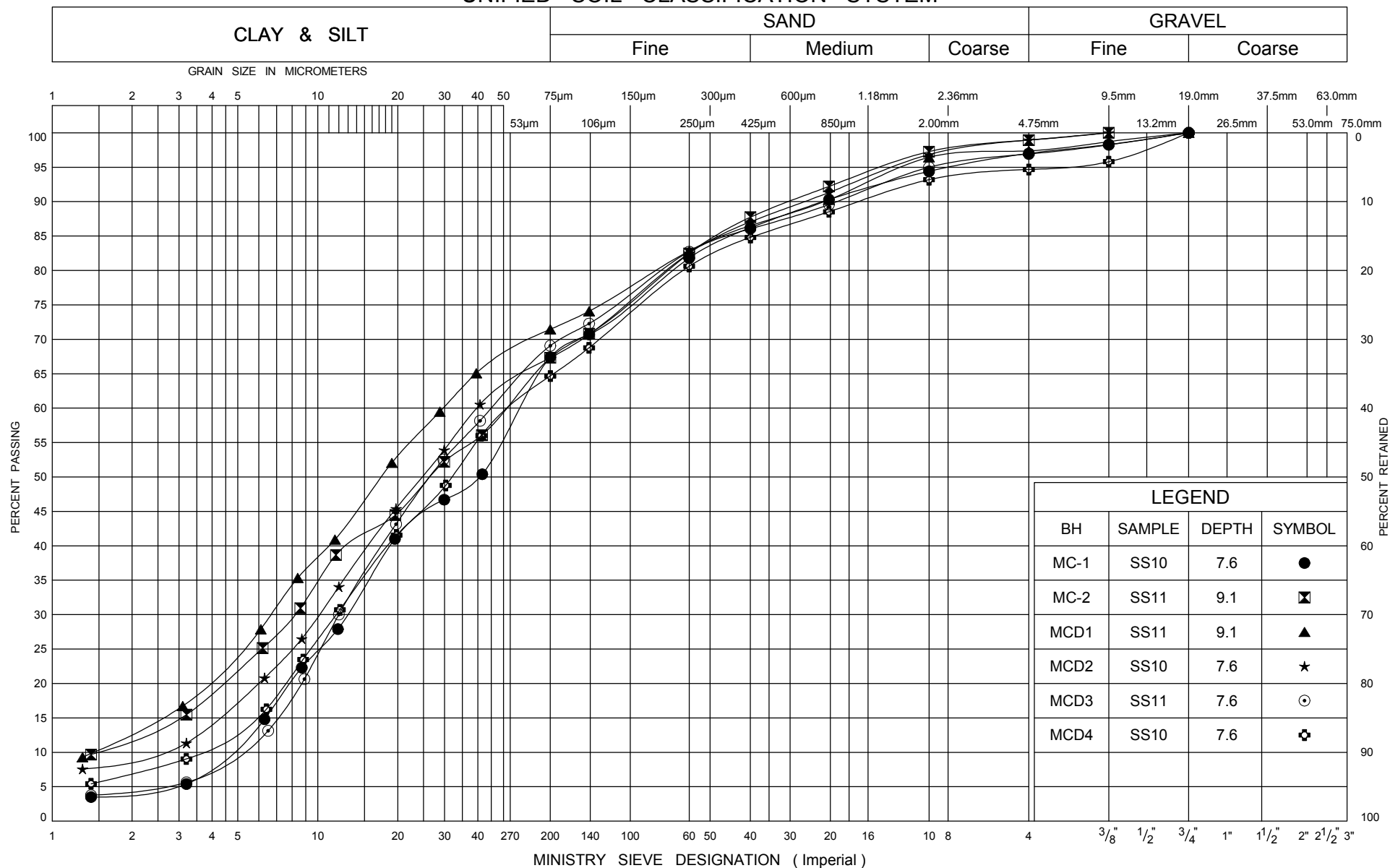
UNIFIED SOIL CLASSIFICATION SYSTEM



UNIFIED SOIL CLASSIFICATION SYSTEM

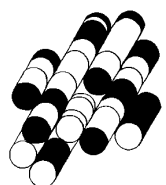


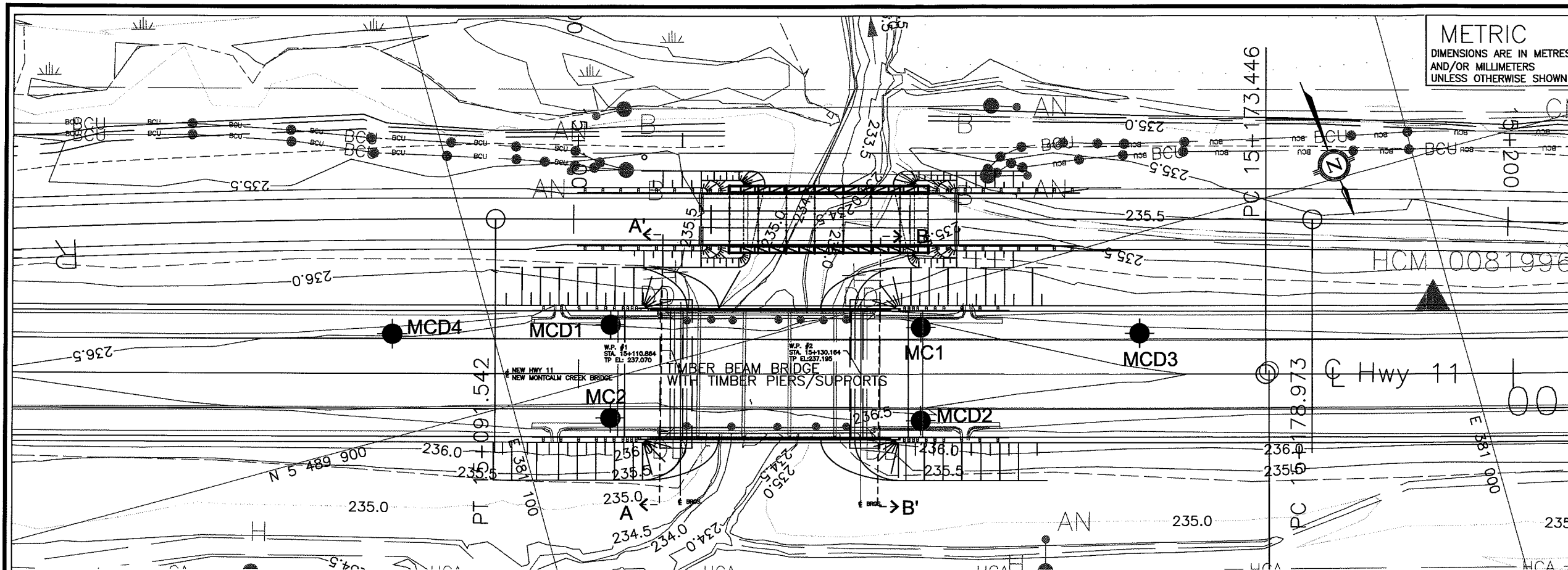
UNIFIED SOIL CLASSIFICATION SYSTEM



APPENDIX C

TERRAPROBE INC.





CONT No
GWP No 5233-06-00

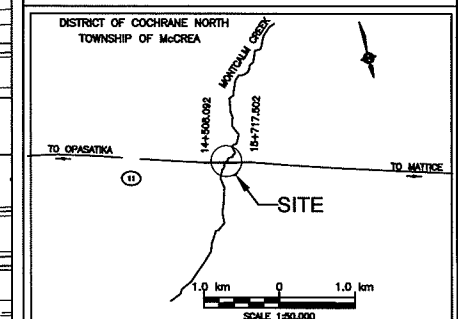
MONTCALM CREEK BRIDGE
BOREHOLE LOCATION AND SOIL STRATA

SHEET
1 OF 4

McCORMICK RANKIN CORPORATION

MRC

Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials Engineering, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 798-2650

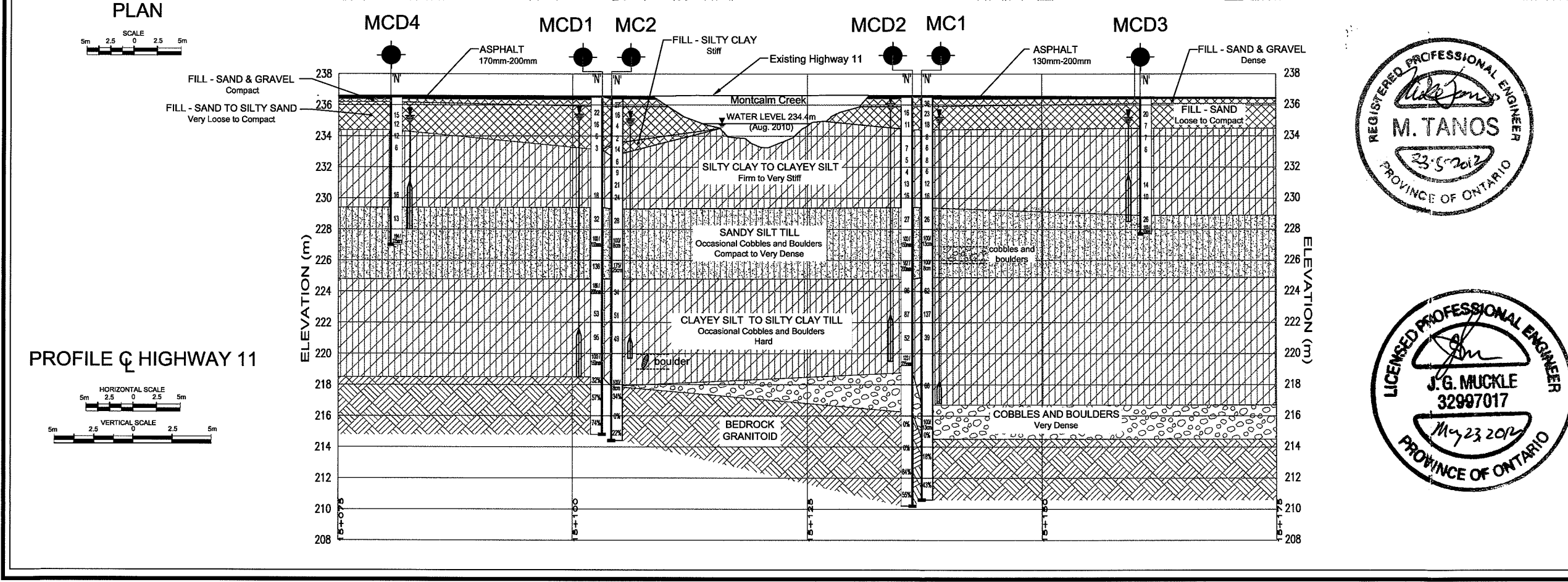


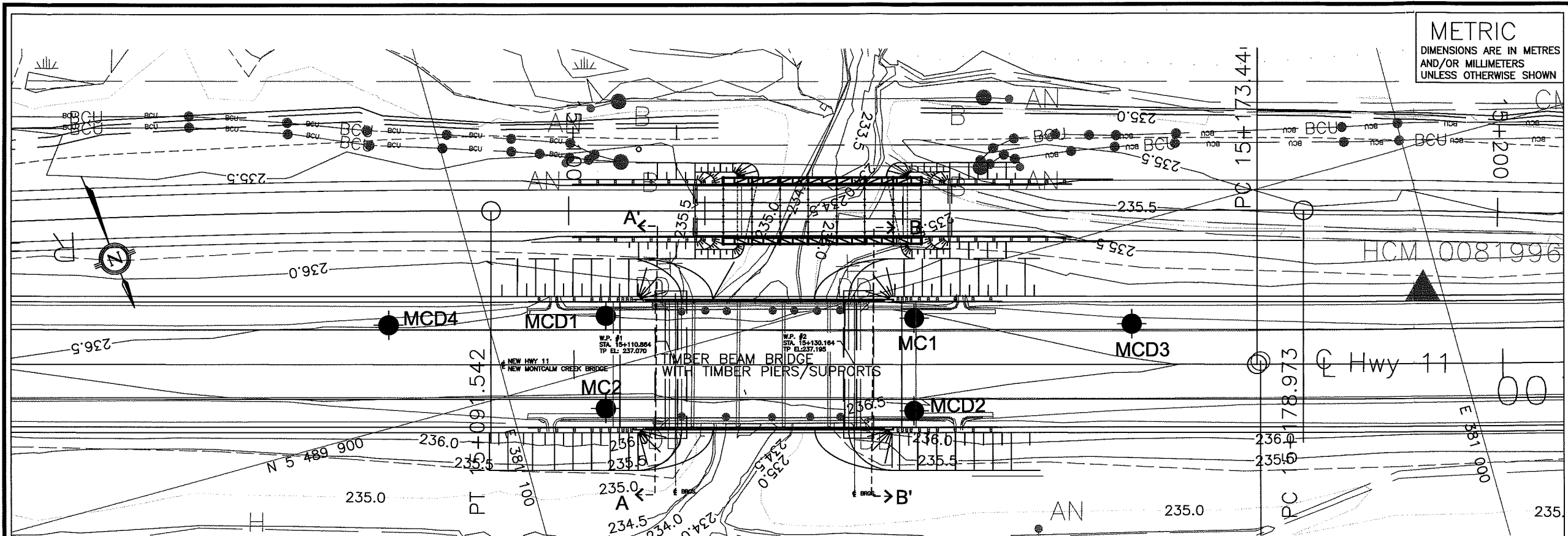
- LEGEND**
- Bore Hole
 - ⊕ Dynamic Cone Penetration Test
 - Bore Hole And Cone
 - 'N' Blows/0.3m (Std Pen Test, 475 J/blow)
 - CONE Blows/0.3m (60' Cone, 475 J/blow)
 - ↓ WL at Time of Investigation
 - ↑ WL in Piezometer
 - 90% Rock Quality Designation
 - A/R Auger Refusal

No	ELEV.	COORDINATES	
		NORTHING	EASTING
MC1	236.5	5 489 903.6	381 055.6
MC2	236.4	5 489 904.1	381 090.2
MCD1	236.5	5 489 894.5	381 087.5
MCD2	236.5	5 489 913.2	381 058.3
MCD3	236.4	5 489 910.4	381 033.2
MCD4	236.5	5 489 889.2	381 110.4

NOTE
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.
This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

REVISIONS			
DATE	BY	DESCRIPTION	
DESIGN G.M	CODE CHBDC2006	LOAD	DATE MAY 2012
DRAWN K.C	CHK G.M	STRUCT 39W-058	GEOCRES 42G-36





METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETERS
UNLESS OTHERWISE SHOWN

CONT No
GWP No 5233-06-00

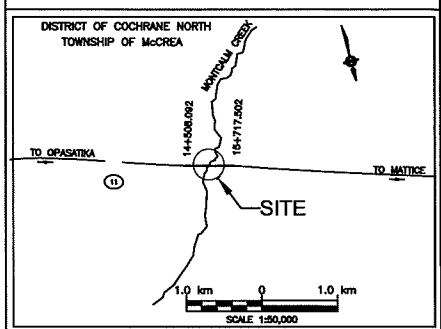
MONTCALM CREEK BRIDGE
BOREHOLE LOCATION AND SOIL STRATA

MCCORMICK RANKIN CORPORATION

MRC

SHEET
2 OF 4

Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials Engineering, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650



KEY PLAN

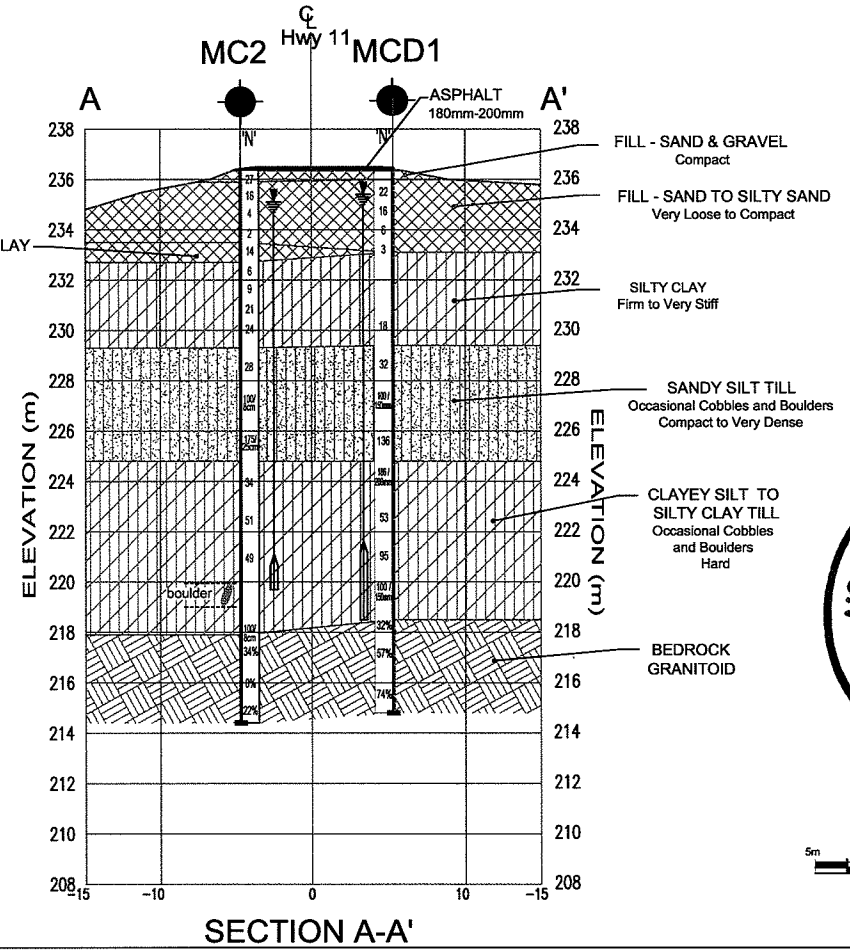
LEGEND

- Bore Hole
- Dynamic Cone Penetration Test
- Bore Hole And Cone
- 'N' Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60' Cone, 475 J/blow)
- WL at Time of Investigation
- WL in Piezometer
- Piezometer
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- A/R Auger Refusal

No	ELEV.	COORDINATES	
		NORTHING	EASTING
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MC2	236.4	5 489 904.1	381 090.2
MCD1	236.5	5 489 894.5	381 087.5
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REVISIONS				
DATE	BY	DESCRIPTION		
DESIGN G.M	CODE CHBDC2006	LOAD	DATE MAY 2012	
DRAWN K.C	CHK G.M	STRUCT 39W-058	GEORES 42G-36	



PLAN

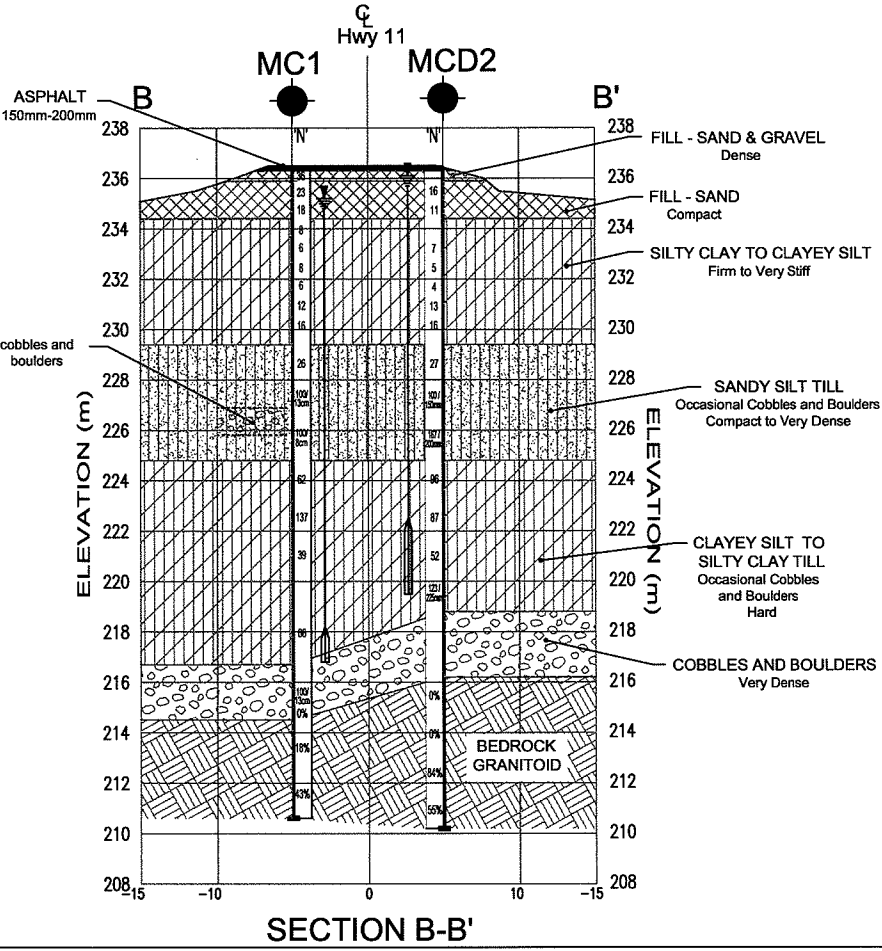
5m 2.5 0 2.5 5m

REGISTERED PROFESSIONAL ENGINEER
M. TANOS
23-5-2012
PROVINCE OF ONTARIO

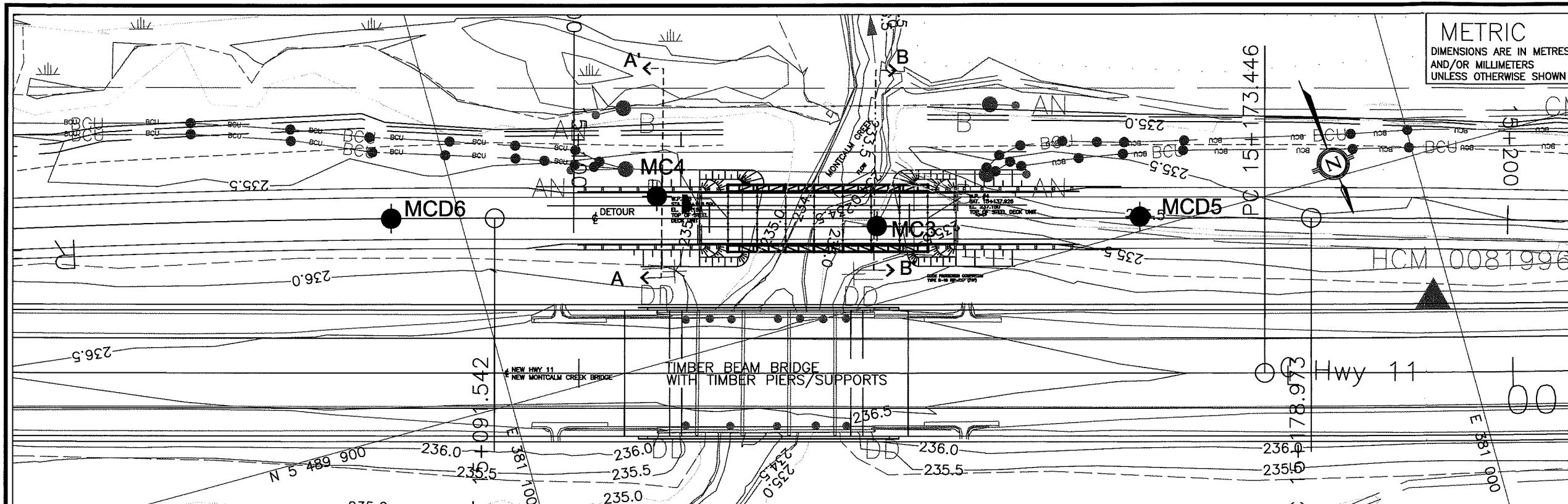
LICENSED PROFESSIONAL ENGINEER
J. G. MUCKLE
32997017
MAY 23, 2012
PROVINCE OF ONTARIO

HORIZONTAL SCALE
5m 2.5 0 2.5 5m

VERTICAL SCALE
5m 2.5 0 2.5 5m



SECTION B-B'



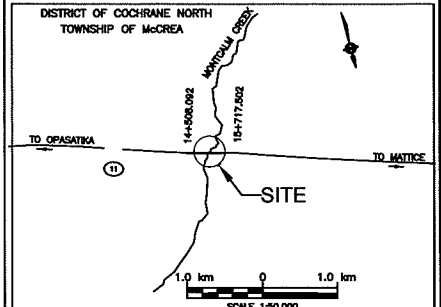
METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETERS
UNLESS OTHERWISE SHOWN

CONT No
GWP No 5233-06-00

MONTCALM CREEK DETOUR
BOREHOLE LOCATION AND SOIL STRATA

McCORMICK RANKIN CORPORATION
MRC

Terraprobe Inc.
Consulting Geotechnical & Environmental Engineering
Construction Materials, Inspection & Testing
11 Indell Lane - Brampton Ontario L6T 3Y3 (905) 796-2650



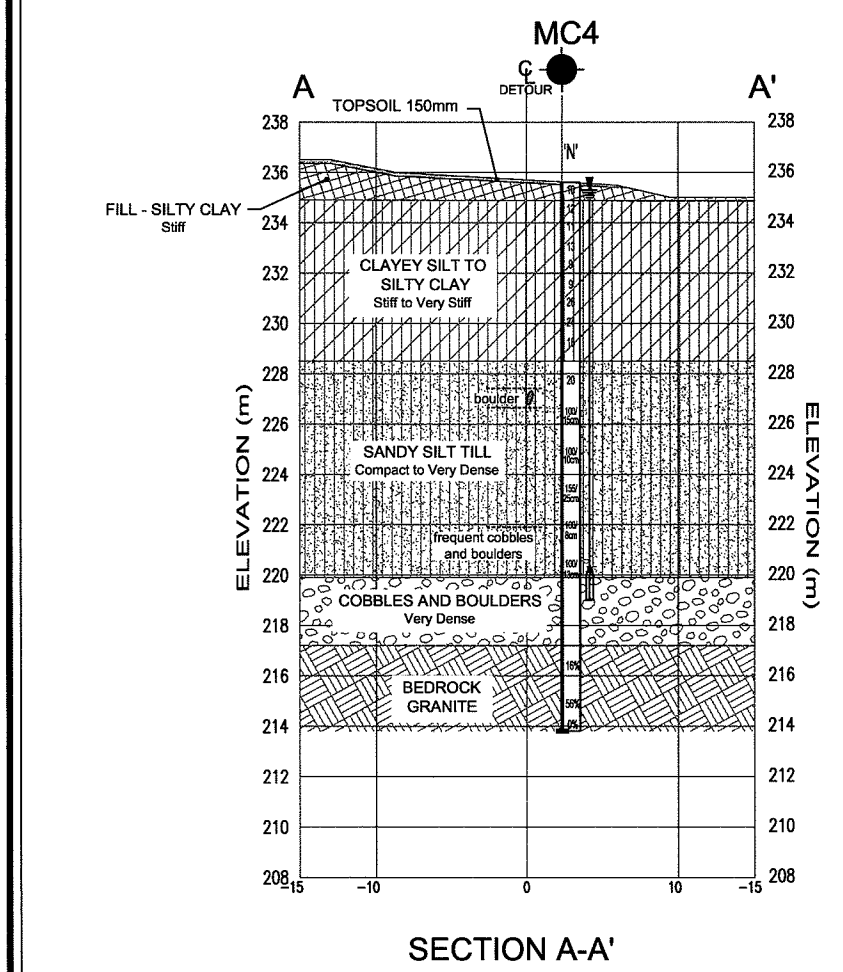
KEY PLAN

- LEGEND**
- Bore Hole
 - Dynamic Cone Penetration Test
 - Bore Hole And Cone
 - 'N' Blows/0.3m (Std Pen Test, 475 J/blow)
 - CONE Blows/0.3m (60' Cone, 475 J/blow)
 - WL at Time of Investigation
 - WL in Piezometer
 - Piezometer
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 - A/R Auger Refusal

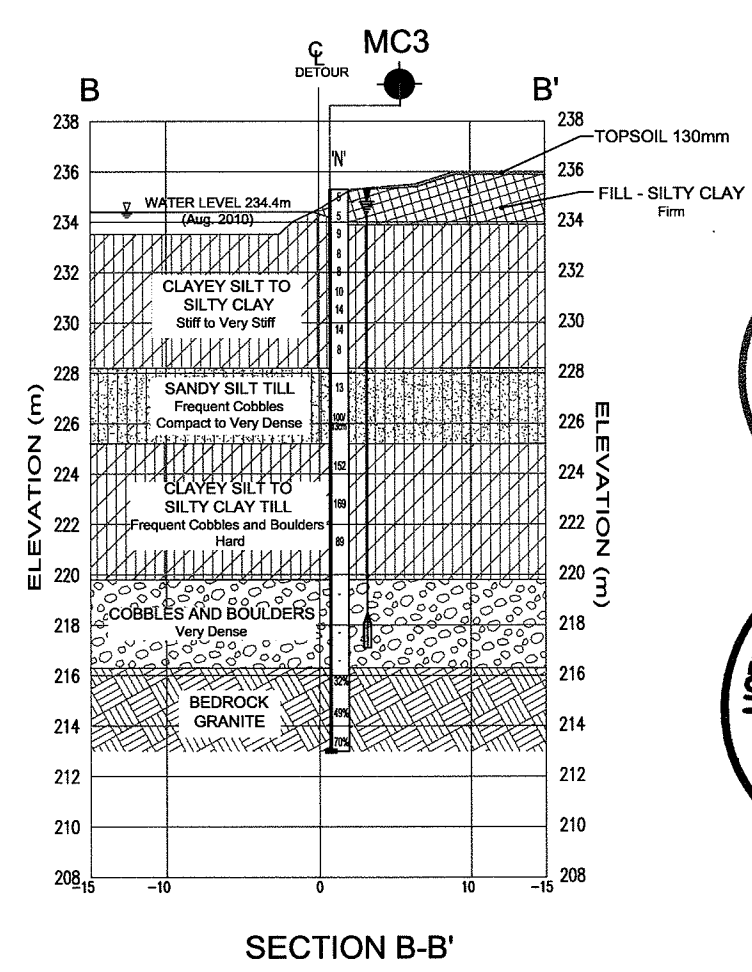
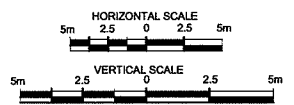
No	ELEV.	COORDINATES	
		NORTHING	EASTING
MC3	235.3	5 489 892.0	381 057.3
MC4	235.6	5 489 882.6	381 079.1
MCD5	235.7	5 489 898.5	381 029.9
MCD6	235.7	5 489 877.4	381 107.1

NOTE
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REVISIONS	DATE	BY	DESCRIPTION
DESIGN	G.M.	CODE	CHBDC2006
DRAWN	K.C.	CHK	G.M.
		STRUCT	39W-058
			GEORES 42G-38



PROFILE C DETOUR ALIGNMENT



SECTION B-B'