



THURBER ENGINEERING LTD.

**FOUNDATION INVESTIGATION AND DESIGN REPORT
HIGH FILL EMBANKMENTS AND DEEP CUTS
WOOLWICH GUELPH TOWNLINE TO 1.4 KM EAST OF WELLINGTON COUNTY ROAD 86
NEW HIGHWAY 7, KITCHENER TO GUELPH
G.W.P. 408-88-00**

GEOCRES No. 40P09-068

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Report

to

WSP

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TABLE OF CONTENTS

PART 1: FACTUAL INFORMATION

1	INTRODUCTION	1
2	SITE DESCRIPTION	1
3	SITE INVESTIGATIONS AND FIELD TESTING	2
4	LABORATORY TESTING.....	2
5	DESCRIPTION OF SUBSURFACE CONDITIONS	2
5.1	Highway 7: Station 32+300 – 32+500 (08-180, ML16 32+300, ML16 32+350, ML16 32+400, ML16 32+500) – Appendix A	3
5.1.1	Topsoil.....	3
5.1.2	Fill.....	3
5.1.3	Sandy Silt	3
5.1.4	Silty Sand to Sandy Silt Till.....	4
5.1.5	Groundwater Conditions.....	5
5.2	Highway 7: Station 32+800 – 33+050 (08-181, 08-182, 08-184, 08-185, 08-186, ML16 32+879, ML16 32+972,) – Appendix B	5
5.2.1	Topsoil.....	5
5.2.2	Fill.....	5
5.2.3	Sandy Silt	6
5.2.4	Sandy Clayey Silt Till.....	6
5.2.5	Sandy Silt Till.....	7
5.2.6	Groundwater Conditions.....	8
5.3	Highway 7: Station 33+400 – 33+600 (ML16 33+400, ML16 33+450, ML16 33+500, ML16 33+550, ML16 33+600) – Appendix C	8
5.3.1	Topsoil.....	8
5.3.2	Sand and Gravel	8
5.3.3	Silty Sand to Sandy Silt	9
5.3.4	Silty Clay	9
5.3.5	Sandy Silty Clay Till.....	10
5.3.6	Gravelly Sand.....	11
5.3.7	Silty Sand to Sandy Silt Till.....	11
5.3.8	Groundwater Conditions.....	12

5.4	Highway 7: Station 33+800 – 34+150 (08-202, ML16 33+800, ML16 33+850, ML16 33+900, ML16 33+950, ML16 34+000, ML16 34+050, ML16 34+100, ML16 34+150) – Appendix D	12
5.4.1	Topsoil.....	12
5.4.2	Sandy Silt	12
5.4.3	Sandy Silty Clay Till.....	12
5.4.4	Silty Sand to Sandy Silt Till.....	13
5.4.5	Silty Sand	14
5.4.6	Groundwater Conditions.....	15
5.5	Highway 7: Station 34+950 – 35+100 (08-210, 08-212) – Appendix E.....	15
5.5.1	Topsoil.....	15
5.5.2	Fill.....	15
5.5.3	Sandy Silt Till.....	16
5.5.4	Groundwater Conditions.....	17
5.6	Wellington County Road 86: Station 9+700 – 10+150 (CR16 09+700, CR16 09+750, CR16 09+800, CR16 09+850, CR16 09+900, CR16 10+100, CR16 10+158) – Appendix F	17
5.6.1	Fill.....	17
5.6.2	Sandy Silt Till.....	18
5.6.3	Groundwater Conditions.....	18
5.7	Wellington County Road 86 – N-E Ramp: Station 34+764 – 34+800 (CR16 34+764, CR16 34+800) – Appendix G	18
5.7.1	Topsoil.....	18
5.7.2	Sandy Silt	19
5.7.3	Silty Sand to Sandy Silt Till.....	19
5.7.4	Groundwater Conditions.....	19
5.8	Wellington County Road 86 – S-W Ramp: Station 35+250 – 35+400 (CR16 S-W01, CR16 S-W02, CR16 S-W03, CR16 S-W04) – Appendix H	19
5.8.1	Topsoil.....	19
5.8.2	Silty Sand	20
5.8.3	Silty Clay	20
5.8.4	Sandy Clayey Silt to Sandy Silty Clay Till.....	20
5.8.5	Groundwater Conditions.....	21



5.9	Wellington County Road 86 – E-N/S Ramp: Station 35+100 – 35+400 (CR16 E-NS01, CR16 E-NS03, CR16 E-NS06, CR16 E-NS07) – Appendix I	21
5.9.1	Topsoil	21
5.9.2	Clayey Silt to Silty Clay	21
5.9.3	Sandy Clayey Silt to Sandy Silty Clay Till.....	22
5.9.4	Groundwater Conditions.....	22
5.10	Highway 7: Station 36+000 – 36+250 (08-220) – Appendix J	23
5.10.1	Topsoil	23
5.10.2	Silty Sand to Sandy Silt Till.....	23
5.10.3	Groundwater Conditions.....	23
6	MISCELLANEOUS	24
PART 2: ENGINEERING DISCUSSION AND RECOMMENDATIONS		
7	GENERAL	26
7.1	Applicable Codes and Design Considerations.....	26
8	ENGINEERING AND ANALYSIS METHODOLOGY	27
8.1	General	27
8.2	Global Stability	28
8.3	Settlement.....	28
8.4	Seismic Considerations	29
9	DESIGN AND CONSTRUCTION CONSIDERATIONS	29
9.1	Fill Embankment	29
9.2	Deep Cuts	30
10	CONSTRUCTION CONCERNS	31
11	CLOSURE	31

Statement of Limitations and Conditions

Drawings 1 and 2 – Site Location Plans

Symbols, Abbreviations and Terms of Use on Records of Boreholes



APPENDICES

APPENDIX A. HIGHWAY 7: STATION 32+300 – 32+500 (08-180, ML16 32+300, ML16 32+350, ML16 32+400, ML16 32+500)

APPENDIX B. HIGHWAY 7: STATION 32+800 – 33+050 (08-181, 08-182, 08-184, 08-185, 08-186, ML16 32+879, ML16 32+972,)

APPENDIX C. HIGHWAY 7: STATION 33+400 – 33+600 (ML16 33+400, ML16 33+450, ML16 33+500, ML16 33+550, ML16 33+600)

APPENDIX D. HIGHWAY 7: STATION 33+800 – 34+150 (08-202, ML16 33+800, ML16 33+850, ML16 33+900, ML16 33+950, ML16 34+000, ML16 34+050, ML16 34+100, ML16 34+150)

APPENDIX E. HIGHWAY 7: STATION 34+950 – 35+100 (08-210, 08-212)

APPENDIX F. WELLINGTON COUNTY ROAD 86: STATION 9+700 – 10+150 (CR16 09+700, CR16 09+750, CR16 09+800, CR16 09+850, CR16 09+900, CR16 10+100, CR16 10+158)

APPENDIX G. WELLINGTON COUNTY ROAD 86 – N-E RAMP: STATION 34+764 – 34+800 (CR16 34+764, CR16 34+800)

APPENDIX H. WELLINGTON COUNTY ROAD 86 – S-W RAMP: STATION 35+250 – 35+400 (CR16 S-W01, CR16 S-W02, CR16 S-W03, CR16 S-W04)

APPENDIX I. WELLINGTON COUNTY ROAD 86 – E-N/S RAMP: STATION 35+100 – 35+400 (CR16 E-NS01, CR16 E-NS03, CR16 E-NS06, CR16 E-NS07)

APPENDIX J. HIGHWAY 7: STATION 36+000 – 36+250 (08-220)

APPENDIX K. GSC SEISMIC HAZARD CALCULATION

APPENDIX L. TABLES

Appendices A through J include:

- Record of Borehole Sheets
- Results of Laboratory Test
- Borehole Locations and Soil Strata Drawing(s)
- Results of Slope Stability Analyses



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PART 1: FACTUAL INFORMATION

1 INTRODUCTION

This section of the report presents the factual findings obtained from a foundation investigation completed for proposed high fill embankments of 4.5 m or greater in height and deep cuts from just east of Woolwich Guelph Townline to 1.4 km east of Wellington County Road 86 in the Guelph area as part of the new Highway 7 project. High fill embankments at Woodlawn Road interchange are addressed in a separate report. Thurber Engineering Limited (Thurber) carried out the current field investigation as a sub-consultant to WSP under Assignment No. 3014-E-0013.

The purpose of this investigation was to explore and supplement the previous investigation at the site and based on the data obtained, to prepare a borehole location plan, records of boreholes, stratigraphic profiles, laboratory test results, and a written description of the subsurface conditions.

Reference has been made to the following foundation report that was prepared by Thurber during the first phase of investigation:

- Preliminary Foundation Investigation and Design Report, High Fills and Deep Cuts, From East of Townline Road to Hanlon Expressway, Highway 7 New, Kitchener to Guelph, G.W.P. 408-88-00, GEOCRES No. 40P9-48, Report to Ministry of Transportation Ontario Southwestern Region, File 15-64-17, dated September 10, 2009

It is a condition of this report that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

2 SITE DESCRIPTION

The proposed new Highway 7 alignment is to the north of the existing Highway 7 alignment and traverses in an east-west direction. The length of this section of new Highway 7 is about 4.2 km and is just west of Woolwich Guelph Townline to 1.4 km east of Wellington County Road 86.

The area surrounding this section of new Highway 7 primarily consists of agricultural and undeveloped lands.



In general, the ground surface along the proposed new Highway 7 alignment is rising gently from west to east.

3 SITE INVESTIGATIONS AND FIELD TESTING

The foundation investigation was carried out at this site in two phases: the first phase, consisting of 10 boreholes, was carried out between May 2008 and December 2008 while the second phase, consisting of 36 boreholes, was conducted between November 2016 and December 2017. The investigation was completed using track mounted drill rigs. Prior to commencement of drilling, utility clearances were obtained in the vicinity of the borehole locations.

Soil samples were obtained at selected intervals using a split spoon sampler in conjunction with Standard Penetration Testing (SPT) in accordance with ASTM D 1586. The boreholes were advanced to sampled depths ranging from 2.9 m to 13.8 m and 4.8 m to 15.5 m, respectively.

Borehole drilling and sampling operations were supervised on a full-time basis by a member of Thurber's technical staff, who logged the boreholes and processed the recovered soil samples for transport to the laboratory for further examination and testing.

Piezometers of various diameters (19 mm and 25 mm) and slotted screen lengths (1.5 m and 3.0 m) were installed in selected boreholes to allow for measurements of the groundwater level. The piezometer installations are shown on the respective Record of Borehole sheets, provided in Appendix A through Appendix J.

Following completion of the field investigation, the boreholes and standpipe piezometers were decommissioned in general accordance with MECP requirements (O. Reg. 903 as amended).

The locations of the investigated high fill and deep cut areas are shown on Drawings 1 and 2 following the text of the report, while the approximate borehole locations are shown on the respective Borehole Locations and Soil Strata Drawings included in Appendix A through Appendix J. The coordinates and elevation of the boreholes are provided on these drawings and on the individual Record of Borehole sheets included in Appendix A through Appendix J. The borehole elevations and coordinates were provided by WSP.

4 LABORATORY TESTING

All recovered soil samples were subjected to further visual identification and to natural moisture content determination. Selected samples were also subjected to Atterberg Limit testing and grain size analysis. The results of these tests are summarized on the Record of Borehole sheets and laboratory figures included in Appendix A through Appendix J.

5 DESCRIPTION OF SUBSURFACE CONDITIONS

Details of the encountered soil stratigraphy are presented on the Record of Borehole sheets and the Borehole Location and Soil Strata drawings included in Appendix A through J. Summaries of the stratigraphy, based on the conditions encountered in the boreholes, is provided in the



following sections; however, the factual data presented on the Record of Borehole sheets takes precedence over this general description for interpretation of the site conditions.

The results of the in-situ tests (i.e., SPT) as presented in the record of borehole sheets are in the sections below are uncorrected. The boundaries between the soil deposits on the record of boreholes have been inferred from non-continuous sampling, and therefore, these boundaries represent transitions between soil types rather than exact planes of geological change. It must be recognized that the variation of stratigraphic boundaries will vary between and beyond borehole locations.

5.1 Highway 7: Station 32+300 – 32+500 (08-180, ML16 32+300, ML16 32+350, ML16 32+400, ML16 32+500) – Appendix A

5.1.1 Topsoil

Topsoil was encountered at ground surface in all boreholes except at Borehole 08-180. The topsoil thickness ranged from 150 mm to 300 mm.

5.1.2 Fill

Clayey silt fill containing occasional organics was encountered at ground surface in Borehole 08-180. The thickness of the clayey silt fill was 0.8 m with an underside depth of 0.8 m (Elevation 344.0 m).

An SPT N-Value of 7 blows was measured in the clayey silt fill indicating a firm consistency.

The recorded moisture content was 26 percent.

5.1.3 Sandy Silt

Native sandy silt with trace organics was encountered below the topsoil in Boreholes ML16 32+350, ML16 32+400 and ML16 32+500. The thickness of the sandy silt ranged from 0.5 m to 1.2 m with an underside depth ranging from 0.7 m to 1.4 m (Elevation 343.8 m to 341.5 m).

SPT N-Values in the sandy silt ranged from 5 blows to 16 blows indicating a loose to compact relative density.

Recorded moisture contents of the sandy silt ranged from 12 percent to 21 percent. The gradation analysis completed on one sample of the sandy silt is illustrated on Figure A1 of Appendix A. The results of the tests are summarized below and are presented on the corresponding Record of Borehole sheets in Appendix A.

Soil Particle	Percentage (%)
Gravel	0
Sand	32
Silt	50
Clay	18

5.1.4 Silty Sand to Sandy Silt Till

Silty sand to sandy silt till was encountered below the fill in Borehole 08-180, below the topsoil in Borehole ML16 32+300 and below the sandy silt in Boreholes ML16 32+350, ML16 32+400 and ML16 32+500. Cobbles were observed within the silty sand to sandy silt till. Boreholes 08-180, ML16 32+300, ML16 32+350, ML16 32+400 and ML16 32+500 were terminated within the silty sand to sandy silt till deposit at a depth of 4.8 m to 9.3 m below the ground surface (Elevation 334.9 m to 339.5 m). It should be noted that glacial tills are known to contain cobbles and boulders.

SPT N-Values in the silty sand to sandy silt till ranged from 12 blows to greater than 50 blows indicating a compact to very dense relative density.

Recorded moisture contents ranged from 4 percent to 42 percent. Atterberg limit testing was completed on one sample of clayey silt and sand within the sandy silt till deposit. The results are summarized on the Record of Borehole sheets in Appendix A and illustrated on Figure A2 in Appendix A. The laboratory results indicate the till is a clayey silt of low plasticity (CL-ML).

Parameter	Value
Liquid Limit	18
Plastic Limit	12
Plasticity Index	6

The gradation analyses completed on selected samples of the silty sand to sandy silt till are illustrated on Figure A3 of Appendix A. The results of the tests are summarized below and are presented on the corresponding Record of Borehole sheets in Appendix A.

Soil Particle	Percentage (%)
Gravel	0 to 18
Sand	32 to 42
Silt	35 to 52
Clay	10 to 17



5.1.5 Groundwater Conditions

Piezometers were installed in Boreholes ML16 32+350 and ML16 32+500 to monitor groundwater levels after completion of drilling. The measured groundwater levels are summarized in the table below.

Borehole	Date	Depth (m)	Elevation (m)
ML16 32+350	March 17, 2017	1.8	341.1
	May 2, 2018	0.6	342.3
ML16 32+500	March 17, 2017	1.6	342.2
	May 2, 2018	0.9	342.9

It should be noted that seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after periods of significant and/or prolonged precipitation and spring snow melts.

5.2 Highway 7: Station 32+800 – 33+050 (08-181, 08-182, 08-184, 08-185, 08-186, ML16 32+879, ML16 32+972,) – Appendix B

5.2.1 Topsoil

Topsoil was encountered at ground surface in Boreholes ML16 32+879 and ML16 32+972. The topsoil thickness ranged from 150 mm to 300 mm.

5.2.2 Fill

Fill: Sand and Gravel, Sand and Sandy Silt

Cohesionless fill consisting of sand and gravel, sand, and sandy silt was encountered at ground surface in Boreholes 08-184, 08-185, and 08-186. The sand fill varied in thickness from 1.1 m to 1.5 m (Elevation 334.7 m to 337.8 m). Occasional topsoil and asphalt fragments were noted in the cohesionless fill in Boreholes 08-185 and 08-186, respectively.

SPT N-Values in the sand fill ranged from 8 blows to 17 blows indicating a loose to compact relative density.

Recorded moisture contents ranged from 5 percent to 18 percent. The gradation analysis completed on one sample of the sand and gravel fill is illustrated on Figure B1 of Appendix B. The results of the test are summarized below and are presented on the corresponding Record of Borehole sheets in Appendix B.



Soil Particle	Percentage (%)
Gravel	50
Sand	41
Silt	9
Clay	

Fill: Clayey Silt

Clayey silt fill was encountered at ground surface in Boreholes 08-181 and 08-182. The clayey silt fill varied in thickness from 0.3 m to 0.6 m (Elevation 338.4 m to 344.0 m). Occasional rootlets were noted in the cohesive fill.

SPT N-Values in the clayey silt fill ranged from 7 blows to 31 blows indicating a firm to hard consistency.

Recorded moisture contents of the fill ranged from 19 percent to 24 percent.

5.2.3 Sandy Silt

Sandy silt was encountered below the topsoil in Boreholes ML16 32+879 and ML16 32+972. Cobbles were observed within the sandy silt. The sandy silt had a thickness of 0.5 m to 1.9 m with an underside depth of 0.7 m to 2.2 m (Elevation 341.1 m to 340.1 m). Trace organics and occasional cobbles were noted in the sandy silt.

SPT N-Values in the sandy silt ranged from 5 blows to 26 blows indicating a loose to compact relative density.

Recorded moisture contents in the sandy silt generally ranged from 7 percent to 9 percent.

5.2.4 Sandy Clayey Silt Till

A deposit of sandy clayey silt till was encountered below the fill in Boreholes 08-184 to 08-186. The thickness of the sandy clayey silt till ranged from 2.9 m to 5.6 m with an underside depth ranging from 4.2 m to 7.1 m (Elevation 334.7 m to 331.5 m). Cobbles were observed within the clayey silt till. It should be noted that glacial tills are known to contain cobbles and boulders.

SPT N-values in the sandy clayey silt till ranged from 4 blows to greater than 100 blows indicating a firm to hard consistency.

The recorded moisture contents ranged from 8 percent to 17 percent. Atterberg limit testing was completed on selected samples of the sandy clayey silt till deposit. The results are summarized on the Record of Borehole sheets in Appendix B and illustrated on Figure B2 in Appendix B. The laboratory results indicate the till is a clayey silt of low plasticity (CL-ML).



Parameter	Value
Liquid Limit	17 to 18
Plastic Limit	12 to 11
Plasticity Index	5 to 7

The gradation analyses completed on selected samples of the sandy clayey silt till are illustrated on Figure B3 of Appendix B. The results of the tests are summarized below and are presented on the corresponding Record of Borehole sheets in Appendix B.

Soil Particle	Percentage (%)
Gravel	1 to 4
Sand	30 to 35
Silt	48 to 49
Clay	15 to 18

5.2.5 Sandy Silt Till

Sandy silt till was encountered below the fill in Boreholes 08-181 and 08-182, below the sandy silt in Boreholes ML16 32+879 and ML16 32+972 and below the clayey silt till in Boreholes 08-184 to 08-186. Boreholes 08-181, 08-182, 08-184, 08-185, 08-186, ML16 32+879, and ML16 32+972 were terminated within sandy silt till deposit at a depth ranging from 7.8 m to 15.5 m below the ground surface (Elevation 325.3 m to 331.1 m). Cobbles were observed within the sandy silt till. It should be noted that glacial tills are known to contain cobbles and boulders.

SPT N-Values in the sandy silt till ranged from 8 blows to greater than 100 blows indicating a loose to very dense relative density.

Recorded moisture contents ranged from 6 percent to 18 percent. Atterberg limit testing was completed on two samples of the silty clay within the sandy silt till deposit. The results are summarized on the Record of Borehole sheets in Appendix B and illustrated on Figure B4 in Appendix B. The laboratory results indicate the till is silty clay of low plasticity (CL).

Parameter	Value
Liquid Limit	18 to 21
Plastic Limit	11 to 12
Plasticity Index	7 to 9



The gradation analyses completed on selected samples of the sandy silt till are illustrated on Figures B5 through B7 of Appendix B. The results of the tests are summarized below and are presented on the corresponding Record of Borehole sheets in Appendix B.

Soil Particle	Percentage (%)
Gravel	0 to 12
Sand	32 to 50
Silt	35 to 50
Clay	9 to 19

5.2.6 Groundwater Conditions

Piezometers were installed in Boreholes 08-181, 08-185, and ML16 32+972 to monitor groundwater levels after completion of drilling. The measured groundwater levels are summarized in the table below.

Borehole	Date	Depth (m)	Elevation (m)
08-181	January 9, 2009	2.5	336.5
	February 9, 2009	11.4	327.6
08-185	July 15, 2008	2.1	336.8
ML16 32+972	March 17, 2017	2.0	339.9
	May 2, 2018	1.8	340.0

It should be noted that seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after periods of significant and/or prolonged precipitation and spring snow melts.

5.3 Highway 7: Station 33+400 – 33+600 (ML16 33+400, ML16 33+450, ML16 33+500, ML16 33+550, ML16 33+600) – Appendix C

5.3.1 Topsoil

Topsoil was encountered at ground surface in all the boreholes at this location. The topsoil thickness ranged from 175 mm to 250 mm.

5.3.2 Sand and Gravel

Sand and gravel was encountered below the topsoil in Borehole ML15 33+500. The sand and gravel had a thickness of 2.0 m with an underside depth of 2.2 m (Elevation 323.2 m).

SPT N-Values in the fill ranged from 7 blows to 37 blows indicating loose to dense relative density.

Recorded moisture contents in the sand and gravel ranged from 1 percent to 20 percent. The gradation analyses completed on two samples of the sand and gravel fill are illustrated on Figure C1 of Appendix C. The results of the tests are summarized below and are presented on the corresponding Record of Borehole sheets in Appendix C.

Soil Particle	Percentage (%)
Gravel	38 to 45
Sand	37 to 44
Silt	18
Clay	

5.3.3 Silty Sand to Sandy Silt

Silty sand to sandy silt was encountered below the topsoil in all boreholes on this site, except for ML16 33+500. The silty sand to sandy silt was 0.5 m to 1.9 m thick with an underside depth of 0.7 m to 2.2 m (Elevation 322.6 m to 326.4 m). Occasional organics were noted in this deposit.

SPT N-Values in the silty sand to sandy silt ranged from 4 blows to 16 blows indicating a loose to compact relative density.

Recorded moisture contents ranged from 10 percent to 30 percent. The gradation analyses completed on three samples of the sandy silt are illustrated on Figure C2 of Appendix C. The results of the tests are summarized below and are presented on the corresponding Record of Borehole sheets in Appendix C.

Soil Particle	Percentage (%)
Gravel	0 to 14
Sand	37 to 42
Silt	36 to 53
Clay	10 to 18

5.3.4 Silty Clay

A deposit of silty clay was encountered below the sandy silt in Borehole ML16 33+450 and below the fill in Borehole ML16 33+500. The silty clay had a thickness of 0.8 m with an underside depth of 3.0 m (Elevation 322.4 m to 321.8 m) in both Boreholes.

SPT N-Values in the silty clay ranged from 10 blows to 19 blows indicating a stiff to very stiff consistency.

Recorded moisture contents in silty clay ranged from 7 percent to 18 percent. Atterberg limits testing was completed on one sample of the silty clay deposit. The results are summarized on



the Record of Borehole sheets in Appendix C and illustrated on Figure C3 in Appendix C. The laboratory results indicate that the deposit is a silty clay of low plasticity (CL).

Parameter	Value
Liquid Limit	27
Plastic Limit	15
Plasticity Index	12

The gradation analysis completed on one sample of the silty clay is illustrated on Figure C4 of Appendix C. The results of the tests are summarized below and are presented on the corresponding Record of Borehole sheets in Appendix C.

Soil Particle	Percentage (%)
Gravel	0
Sand	0
Silt	55
Clay	45

5.3.5 Sandy Silty Clay Till

A layer of sandy silty clay till was encountered within the silty sand till in Borehole ML16 33+550. The thickness of the silty clay till layer was 1.5 m with an underside depth of 5.6 m (Elevation 321.2 m). It should be noted that glacial tills are known to contain cobbles and boulders.

A SPT N-Value of 33 blows was recorded in the sandy silty clay till indicating a hard consistency.

The recorded moisture content of a sample of the sandy silty clay till was 11 percent. Atterberg limits testing was completed on one sample of the sandy silty clay till deposit. The results are summarized on the Record of Borehole sheets in Appendix C and illustrated on Figure C5 in Appendix C. The laboratory results indicate that the till is a silty clay of low plasticity (CL).

Parameter	Value
Liquid Limit	27
Plastic Limit	15
Plasticity Index	12

The gradation analysis completed on one sample of the sandy silty clay till is illustrated on Figure C6 of Appendix C. The results of the tests are summarized below and are presented on the corresponding Record of Borehole sheets in Appendix C.



Soil Particle	Percentage (%)
Gravel	6
Sand	37
Silt	35
Clay	22

5.3.6 Gravelly Sand

A deposit of gravelly sand was encountered below the sand and silt till layer in Borehole ML16 33+600 at a depth of 3.0 m (Elevation 324.9 m). This borehole was terminated in this deposit at a depth of 6.2 m (Elevation 321.7 m).

SPT N-Values in the gravelly sand ranged from 75 blows to 100 blows indicating a very dense relative density.

The recorded moisture content of the gravelly sand ranged from 7 percent to 10 percent.

5.3.7 Silty Sand to Sandy Silt Till

Silty sand to sandy silt till was encountered below the silty sand to sandy silt in Boreholes ML16 33+400, ML16 33+550 and ML16 33+600, and below the silty clay in Boreholes ML16 33+450 and ML16 33+500.

A gravelly sand zone was encountered within the silty sand till in Borehole ML16 33+400, at approximately 1.1 m depth (Elevation 324.2 m). Boreholes ML16 33+400, ML16 33+450, ML16 33+500 and ML16 33+550 were terminated within this deposit.

It should be noted that glacial tills are known to contain cobbles and boulders.

SPT N-Values in the silty sand to sandy silt till ranged from 13 blows to greater than 100 blows indicating a compact to very dense relative density.

Recorded moisture contents generally ranged from 5 percent to 15 percent. The gradation analyses completed on four samples of the silty sand to sandy silt till are illustrated on Figure C7 of Appendix C. The results of the tests are summarized below and are presented on the corresponding Record of Borehole sheets in Appendix C.

Soil Particle	Percentage (%) Silty Sand to Sandy Silt Till
Gravel	10 to 20
Sand	39 to 59
Silt and Clay	21
Silt	28 to 37
Clay	7 to 10

5.3.8 Groundwater Conditions

No piezometers were installed in the boreholes at this location. The water level was measured at depths ranging from 3.7 m to 5.8 m in the open boreholes upon completion of drilling.

5.4 Highway 7: Station 33+800 – 34+150 (08-202, ML16 33+800, ML16 33+850, ML16 33+900, ML16 33+950, ML16 34+000, ML16 34+050, ML16 34+100, ML16 34+150) – Appendix D

5.4.1 Topsoil

Topsoil was encountered at ground surface in Boreholes ML16 33+800 to ML16 33+950, ML16 34+000, ML16 34+050 and 08-202. The topsoil thickness ranged from 150 mm to 500 mm. A moisture content of 25 percent was recorded on a sample of the topsoil.

5.4.2 Sandy Silt

Native sandy silt was encountered at ground surface in Boreholes ML16 34+100 and ML16 34+150, and below the topsoil in Boreholes ML16 33+800 and ML16 33+900 to ML16 34+050. The thickness of the sandy silt was 0.5 m to 1.4 m with an underside depth ranging from 0.7 m to 1.4 m (Elevation 348.8 m to 337.8 m). Trace to occasional organics were noted in the deposit.

SPT N-Values in the sandy silt ranged from 5 blows to 14 blows indicating a loose to compact relative density.

Recorded moisture contents in the sandy silt ranged from 8 percent to 26 percent.

5.4.3 Sandy Silty Clay Till

A deposit of sandy silty clay till was encountered below the topsoil in Borehole ML16 33+850 and below the sandy silt till in Borehole ML16 33+900. The sandy silty clay till extended to a depth of 4.0 m (Elevation 339.8 m) in Borehole ML16 33+850. Borehole ML16 33+900 was terminated within the sandy silty clay till at a depth of 14.2 m (Elevation 335.0 m).

It should be noted that glacial tills are known to contain cobbles and boulders.

SPT N-Values ranged from 10 blows to 31 blows indicating a stiff to hard consistency.

The recorded moisture contents ranged from 8 percent to 34 percent. Atterberg limits testing was completed on two samples of the sandy silty clay till deposit. The results are summarized on the Record of Borehole sheets in Appendix D and illustrated on Figure D1 in Appendix D. The laboratory results indicate that the till is a silty clay of low plasticity (CL).

Parameter	Value
Liquid Limit	27 to 28
Plastic Limit	13
Plasticity Index	14 to 15

The gradation analyses completed on two samples of the sandy silty clay till are illustrated on Figure D2 of Appendix D. The results of the tests are summarized below and are presented on the corresponding Record of Borehole sheets in Appendix D.

Soil Particle	Percentage (%)
Gravel	0 to 1
Sand	24 to 31
Silt	36 to 44
Clay	32

5.4.4 Silty Sand to Sandy Silt Till

Silty sand to sandy silt till was encountered below the topsoil in Borehole 08-202, below the silty clay till in Borehole ML16 33+850, and below the sandy silt in Boreholes ML16 33+800 and ML16 33+900, ML16 33+950 and ML16 34+000 to ML16 34+150. Layers of clayey silt and sand and cobbles were encountered within the till deposit.

Where fully penetrated, the thickness of the silty sand to sandy silt till ranged from 4.2 m to 12.5 m with an underside depth of 5.6 m to 13.2 m (Elevation 339.1 m to 336.0 m). Boreholes ML16 33+850, 08-202, ML16 33+800, ML16 33+950, ML16 34+150, and ML16 34+050 were terminated within the silty sand to sandy silt till at depths ranging from 5.0 m to 9.4 m (Elevation 332.9 m to 343.3 m).

It should be noted that glacial tills are known to contain cobbles and boulders.

SPT N-Values ranged from 14 blows to greater than 100 blows indicating a compact to very dense relative density.

Recorded moisture contents generally ranged from 4 percent to 25 percent. Atterberg limit testing was completed on one sample of the clayey silt and sand within the sandy silt till deposit. The results are summarized on the Record of Borehole sheets in Appendix D and illustrated on Figure



D3 in Appendix D. The laboratory results indicate the layer within the sandy silt till is a clayey silty of low plasticity (CL-ML).

Parameter	Value
Liquid Limit	18
Plastic Limit	11
Plasticity Index	7

The gradation analyses completed on selected samples of sandy silt till and one sample within the sand and silt zone are illustrated on Figures D4 and D5 of Appendix D. The results of the tests are summarized below and are presented on the corresponding Record of Borehole sheets in Appendix D.

Soil Particle	Percentage (%) Silty Sand to Sandy Silt Till
Gravel	4 to 11
Sand	33 to 52
Silt	33 to 42
Clay	6 to 18

5.4.5 Silty Sand

A layer of silty sand was encountered in Boreholes ML16 34+000 and ML16 34+100 below the sand and silt till deposit at a depth of 5.6 m (Elevation 339.1 m) and 7.1 m (Elevation 338.8 m), respectively. Both boreholes were terminated in the silty sand at a depth of 6.6 m (Elevation 338.1 m), and 8.1 m (Elevation 337.8 m), respectively.

A SPT N-Value of 20 blows was obtained indicating a compact relative density.

The recorded moisture content of the silty sand was 9 percent and 16 percent. The gradation analysis completed on two samples of silty sand is illustrated on Figure D6 of Appendix D. The results of the test are summarized below and are presented on the corresponding Record of Borehole sheet in Appendix D.

Soil Particle	Percentage (%)
Gravel	0 to 20
Sand	63 to 70
Silt & Clay	17
Silt	25
Clay	5

5.4.6 Groundwater Conditions

Piezometers were installed in Boreholes ML16 33+900 and ML16 34+050 to monitor groundwater levels after completion of drilling. The measured groundwater levels are summarized in the table below.

Borehole	Date	Depth (m)	Elevation (m)
ML16 33+900	May 2, 2018	5.3	343.8
ML16 34+050	May 2, 2018	0.3	344.9

It should be noted that seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after periods of significant and/or prolonged precipitation and spring snow melts.

5.5 Highway 7: Station 34+950 – 35+100 (08-210, 08-212) – Appendix E

5.5.1 Topsoil

Topsoil with a thickness of 500 mm was encountered at ground surface in Borehole 08-210. A moisture content of 20 percent was recorded on a sample of the topsoil.

5.5.2 Fill

Sand and gravel fill was encountered at ground surface in Borehole 08-212. The sand and gravel fill, which contained a layer of silty sand fill at the base, had a thickness of 2.1 m and extended to Elevation 342.5 m.

SPT N-Values in the fill ranged from 23 blows to 38 blows indicating a compact to dense relative density.

Recorded moisture contents of the fill ranged from 3 percent to 11 percent. The gradation analysis completed on one sample of the sand and gravel fill and one sample of silty sand fill are illustrated on Figures E1 and E2 of Appendix E. The results of the tests are summarized below and are presented on the corresponding Record of Borehole sheets in Appendix E.



Soil Particle	Percentage (%) Sand and Gravel Fill	Percentage (%) Silty Sand Fill
Gravel	42	12
Sand	44	44
Silt	14	38
Clay		6

5.5.3 Sandy Silt Till

A deposit of sandy silt till was encountered below the topsoil in Borehole 08-210 and below the fill in Borehole 08-212. Cobbles and boulders were observed within the sandy silt till. A clayey zone was encountered within the sandy silt till at approximately 2.6 m depth (Elevation 345.0 m) in Borehole 08-210.

The boreholes were terminated within the sandy silt till at depths between 9.3 m and 7.5 m (Elevation 338.4 m and 337.2 m).

It should be noted that glacial tills are known to contain cobbles and boulders.

SPT N-Values in the sandy silt till ranged from 18 blows to greater than 100 blows indicating a compact to very dense relative density.

Recorded moisture contents ranged from 4 percent to 12 percent. Atterberg limit testing was completed on one sample of a clayey silt within the sandy silt till deposit. The results are summarized on the Record of Borehole sheets in Appendix E and illustrated on Figure E3 in Appendix E. The laboratory results indicate the till is a clayey silt of low plasticity (CL-ML).

Parameter	Value
Liquid Limit	19
Plastic Limit	12
Plasticity Index	7

The gradation analyses completed on five samples of sandy silt till are illustrated on Figure E4 of Appendix E. The results of the tests are summarized below and are presented on the corresponding Record of Borehole sheets in Appendix E.



Soil Particle	Percentage (%)
Gravel	1 to 9
Sand	29 to 32
Silt	46 to 56
Clay	10 to 18

5.5.4 Groundwater Conditions

A piezometer was installed in Borehole 08-212 to monitor groundwater levels after completion of drilling. The measured groundwater levels are summarized in the table below.

Borehole	Date	Depth (m)	Elevation (m)
08-212	May 21, 2008	Dry	-
	May 27, 2008	1.8	342.8
	June 18, 2008	2.1	342.5

It should be noted that seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after periods of significant and/or prolonged precipitation and spring snow melts.

5.6 Wellington County Road 86: Station 9+700 – 10+150 (CR16 09+700, CR16 09+750, CR16 09+800, CR16 09+850, CR16 09+900, CR16 10+100, CR16 10+158) – Appendix F

5.6.1 Fill

Cohesionless fill consisting of sand and gravel was encountered at ground surface in all seven boreholes at this location. Cobbles were observed within the fill. The cohesionless fill varied in thickness from 1.4 m to 4.0 m (Elevation 344.9 m to 336.9 m).

SPT N-Values in the fill ranged from 9 blows to greater than 69 blows indicating a loose to very dense relative density.

Recorded moisture contents ranged from 2 percent to 12 percent. The gradation analysis completed on one sample of the sand and gravel fill is illustrated on Figure F1 of Appendix F. The results of the tests are summarized below and are presented on the corresponding Record of Borehole sheets in Appendix F.

Soil Particle	Percentage (%)
Gravel	63
Sand	31
Silt	6
Clay	

5.6.2 Sandy Silt Till

A sandy silt till deposit was encountered below the fill in all boreholes. The boreholes were terminated in this deposit at depths ranging from 6.5 m to 9.6 m (Elevation 331.5 m to 338.3 m). Cobbles were noted in this deposit. It should be noted that glacial tills are known to contain cobbles and boulders.

SPT N-Values in the sandy silt till ranged from 6 blows to greater than 100 blows indicating a loose to very dense relative density.

Recorded moisture contents ranged from 6 percent to 19 percent. The gradation analyses completed on selected samples of the sandy silt till are illustrated on Figure F2 of Appendix F. The results of the tests are summarized below and are presented on the corresponding Record of Borehole sheets in Appendix F.

Soil Particle	Percentage (%)
Gravel	2 to 16
Sand	22 to 40
Silt	38 to 58
Clay	11 to 19

5.6.3 Groundwater Conditions

Piezometers were installed in Boreholes CR16 09+700, CR16 09+900 and CR16 10+100 to monitor groundwater levels after completion of drilling; however, all three piezometers were damaged after installation. The open boreholes were dry upon completion of drilling.

5.7 Wellington County Road 86 – N-E Ramp: Station 34+764 – 34+800 (CR16 34+764, CR16 34+800) – Appendix G

5.7.1 Topsoil

Topsoil ranging in thickness from 200 mm to 450 mm was encountered at ground surface in both boreholes at this location. A moisture content of 16 percent was recorded on a sample of the topsoil.



5.7.2 Sandy Silt

A layer of sandy silt was encountered below the topsoil in both borehole locations. The thickness of the sandy silt ranged from 1.0 m to 2.0 m with an underside depth of 1.4 m to 2.2 m (Elevation 345.8 m to 343.8 m). Occasional organics were noted in this layer.

SPT N-Values in the sandy silt ranged from 6 blows to 15 blows indicating a loose to compact relative density.

Recorded moisture contents of the sandy silt ranged from 11 percent to 21 percent.

5.7.3 Silty Sand to Sandy Silt Till

A silty sand to sandy silt till deposit was encountered below the sandy silt both borehole locations. The were terminated in this deposit at depths ranging from 6.5 m to 7.9 m (Elevation 338.1 m to 340.8 m). Cobbles were observed within this deposit. It should be noted that glacial tills are known to contain cobbles and boulders.

SPT N-Values ranged from 23 blows to greater than 100 blows indicating a compact to very dense relative density (typically very dense).

Recorded moisture contents ranged from 5 percent to 10 percent. The gradation analyses completed on selected samples of the silty sand to sandy silt till are illustrated on Figure G1 of Appendix G. The results of the tests are summarized below and are presented on the corresponding Record of Borehole sheets in Appendix G.

Soil Particle	Percentage (%)
Gravel	1 to 12
Sand	39 to 44
Silt	32 to 41
Clay	14 to 16

5.7.4 Groundwater Conditions

No piezometers were installed in either borehole at this location. The open boreholes were dry upon completion of drilling.

5.8 Wellington County Road 86 – S-W Ramp: Station 35+250 – 35+400 (CR16 S-W01, CR16 S-W02, CR16 S-W03, CR16 S-W04) – Appendix H

5.8.1 Topsoil

Topsoil ranging in thickness from 100 mm to 300 mm was encountered at ground surface at all borehole locations. A moisture content of 21 percent was recorded on a sample of the topsoil.



5.8.2 Silty Sand

A layer of silty sand was encountered below the topsoil in Borehole CR16 S-W03. The silty sand had a thickness of 1.1 m with an underside depth of 1.4 m (Elevation 340.4 m).

SPT N-Values in the silty sand ranged from 14 blows to 32 blows indicating a compact to dense relative density.

Recorded moisture contents of the silty sand ranged from 6 percent to 9 percent.

5.8.3 Silty Clay

Silty clay was encountered immediately below topsoil in Boreholes CR16 S-W01, CR16 S-W02 and CR16 S-W04. The thickness of the silty clay was 1.3 m with an underside depth of 1.4 m (Elevation 340.5 m to 339.9 m). Trace organics were noted in the silty clay.

SPT N-Values ranged from 4 blows to 6 blows indicating a firm consistency.

Recorded moisture contents of silty clay ranged from 12 percent to 28 percent.

5.8.4 Sandy Clayey Silt to Sandy Silty Clay Till

A deposit of sandy clayey silt to sandy silty clay till was encountered below the silty clay in Boreholes CR16 S-W01, CR16 S-W02, and CR16 S-W04, and below the silty and in Borehole CR16 S-W03. Occasional cobbles were encountered in the till and a layer of clayey sand, some silt, some gravel was encountered within the sandy silty clay till in Borehole CR16 S-W01. All boreholes were terminated in the sandy clayey silt to sandy silty clay till at a depth of 6.3 m to 12.6 m (Elevation 335.3 m to 332.1 m).

It should be noted that glacial tills are known to contain cobbles and boulders.

SPT N-Values in the till ranged from 12 blows to greater than 100 blows indicating a stiff to hard consistency.

The recorded moisture contents ranged from 4 percent to 25 percent. Atterberg limit testing was completed on selected samples of the till deposit. The results are summarized on the Record of Borehole sheets in Appendix H and illustrated on Figure H1 in Appendix H. The laboratory results indicate the till is a clayey silt to silty clay of low plasticity (CL-ML to CL).

Parameter	Value
Liquid Limit	18 to 25
Plastic Limit	12 to 13
Plasticity Index	6 to 12

The gradation analyses completed on selected samples of the till deposit and a sample of the clayey sand with the till deposit are illustrated on Figure H2 of Appendix H. The results of the



tests are summarized below and are presented on the corresponding Record of Borehole sheets in Appendix H.

Soil Particle	Percentage (%) Sandy Clayey Silt to Sandy Silty Clay Till	Percentage (%) Clayey Sand Layer
Gravel	0 to 8	15
Sand	20 to 33	38
Silt	41 to 51	32
Clay	17 to 29	15

5.8.5 Groundwater Conditions

A piezometer was installed in Borehole CR16 S-W03 to monitor groundwater levels after completion of drilling. The measured groundwater levels are summarized in the table below.

Borehole	Date	Depth (m)	Elevation (m)
CR16 S-W03	November 27, 2017	0.8	341.0

It should be noted that seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after periods of significant and/or prolonged precipitation and spring snow melts.

5.9 Wellington County Road 86 – E-N/S Ramp: Station 35+100 – 35+400 (CR16 E-NS01, CR16 E-NS03, CR16 E-NS06, CR16 E-NS07) – Appendix I

5.9.1 Topsoil

Topsoil ranging in thickness from 75 mm to 100 mm was encountered at ground surface in all the boreholes at this location.

5.9.2 Clayey Silt to Silty Clay

Clayey silt to silty clay was encountered immediately below the topsoil in all the boreholes at this location. The thickness of the clayey silt to silty clay was 0.6 m to 1.3 m with an underside depth of 0.7 m to 1.4 m (Elevation 347.8 m to 339.8 m). Occasional organics were noted in this layer.

SPT N-Values in the clayey silt to silty clay ranged from 6 blows to 12 blows indicating a firm to stiff consistency.

Recorded moisture contents ranged from 10 percent to 22 percent.



5.9.3 Sandy Clayey Silt to Sandy Silty Clay Till

A deposit of sandy clayey silt to sandy silty clay till was encountered below the clayey silt to silty clay in all the borehole locations. Occasional cobbles were encountered in the till and a layer of clayey sand-silty sand, some gravel was encountered within the sandy silty clay till in Borehole CR16 E-NS06. All boreholes were terminated in the till deposit at a depth of 6.3 m to 14.3 m (Elevation 338.7 m to 327.0 m).

It should be noted that glacial tills are known to contain cobbles and boulders.

SPT N-Values in the clayey silt till ranged from 14 blows to greater than 50 blows indicating a stiff to hard consistency.

The recorded moisture contents ranged from 6 percent to 14 percent. Atterberg limit testing was completed on selected samples of the sandy clayey silt to sandy silty clay till deposit. The results are summarized on the Record of Borehole sheets in Appendix I and illustrated on Figure I1 in Appendix I. The laboratory results indicate the till is a clayey silt to silty clay of low plasticity (CL-ML to CL).

Parameter	Value
Liquid Limit	15 to 25
Plastic Limit	11 to 13
Plasticity Index	4 to 13

The gradation analyses completed on selected samples of the sandy clayey silt to sandy silty clay till and a sample of the clayey sand-silty sand layer with the till deposit are illustrated on Figure I2 of Appendix I. The results of the tests are summarized below and are presented on the corresponding Record of Borehole sheets in Appendix I.

Soil Particle	Percentage (%) Clayey Silt to Silty Clay Till	Percentage (%) Clayey Sand-Silty Sand Layer
Gravel	0 to 7	14
Sand	26 to 42	40
Silt	33 to 54	33
Clay	15 to 25	13

5.9.4 Groundwater Conditions

A piezometer was installed in Borehole CR16 E-NS06 to monitor groundwater levels after completion of drilling. The measured groundwater levels are summarized in the table below.



Borehole	Date	Depth (m)	Elevation (m)
CR16 E-NS06	Nov 27, 2017	4.3	343.5
	May 2, 2018	1.5	346.3

It should be noted that seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after periods of significant and/or prolonged precipitation and spring snow melts.

5.10 Highway 7: Station 36+000 – 36+250 (08-220) – Appendix J

5.10.1 Topsoil

Topsoil was encountered at ground surface in Borehole 08-220 with a thickness of 450 mm. A moisture content of 2 percent was recorded on a sample of the topsoil.

5.10.2 Silty Sand to Sandy Silt Till

A layer of silty sand to sandy silt till was encountered in Borehole 08-220 below the topsoil. This borehole was terminated in the till deposit at a depth of 6.4 m (Elevation 335.3 m). It should be noted that glacial tills are known to contain cobbles and boulders.

SPT N-Values in the silty sand to sandy silt till ranged from 32 blows to greater than 100 blows indicating a dense to very dense relative density.

Recorded moisture contents ranged from 7 percent to 12 percent. The gradation analyses completed on two samples of the silty sand to sandy silt till are illustrated on Figure J1 of Appendix J. The results of the tests are summarized below and are presented on the corresponding Record of Borehole sheet in Appendix J.

Soil Particle	Percentage (%)
Gravel	4 to 9
Sand	32 to 44
Silt	40 to 47
Clay	7 to 17

5.10.3 Groundwater Conditions

A piezometer was installed in Borehole 08-220 to monitor groundwater levels after completion of drilling. The measured groundwater levels are summarized in the table below.



Borehole	Date	Depth (m)	Elevation (m)
08-220	April 23, 2009	0.5	341.2

It should be noted that seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after periods of significant and/or prolonged precipitation and spring snow melts.

6 MISCELLANEOUS

Borehole locations were selected relative to existing site features and anticipated high fill embankment and deep cut locations.

All-Terrain Drilling from Waterloo, Ontario, DBW Drilling from Ajax, Ontario, and Altech Drilling and Investigative Services Limited from Cambridge, Ontario supplied and operated the drill rig to carry out the drilling, sampling, in-situ testing, standpipe installation and borehole decommissioning. The field investigations were supervised by Messrs. Stephane Loranger, Luke Gilarski, Ligang Hao, Troy Mackinnon, Omar Ali, Bryan Lui, Justin Buis, Saeed Bastan, and George Azzopardi of Thurber. Overall supervision of the investigation program was conducted by Mr. Mark Farrant, P.Eng. and Ms. Nancy Berg, P.Eng.



Routine geotechnical laboratory testing was carried out by Thurber's geotechnical laboratory in Oakville, Ontario. Interpretation of the data and preparation of this report were carried out by Messrs. Michael Eastman, P.Eng., and Geoff Lay, P.Eng.. The report was reviewed by Messrs. Christopher Ng, P.Eng., and Jason Lee, P.Eng., a Designated Principal Contact for MTO Foundation Projects.

Thurber Engineering Ltd.
Report Prepared By:

Michael Eastman, P.Eng.
Associate, Geotechnical Engineer



Christopher Ng, P.Eng.
Associate, Senior Geotechnical Engineer



Jason Lee, P.Eng.,
Partner, Senior Geotechnical Engineer
Designated MTO Contact



**FOUNDATION INVESTIGATION AND DESIGN REPORT
HIGH FILL EMBANKMENTS AND DEEP CUTS
WOOLWICH GUELPH TOWNLINE TO 1.4 KM EAST OF WELLINGTON COUNTY
ROAD 86
NEW HIGHWAY 7, KITCHENER TO GUELPH
G.W.P. 408-88-00**

GEOCRES No. 40P09-068

PART 2: ENGINEERING DISCUSSION AND RECOMMENDATIONS

7 GENERAL

This section of the report provides an interpretation of the factual data from Part 1 of this report and presents foundation design recommendations to assist the project team in the design of the proposed high fill embankments and deep cuts from just east of Woolwich Guelph Townline to 1.4 km east of Wellington County Road 86. The discussion and recommendations presented in this report are based on the information provided by WSP and on the factual data obtained from the foundation investigations. Thurber Engineering Limited (Thurber) carried out the current field investigation as a sub-consultant to WSP under Assignment No. 3014-E-0013.

This foundation investigation and design report with the interpretation and recommendations are intended for the use of the Ministry of Transportation and shall not be used or relied upon for any other purposes or by any other parties including the construction or design-build contractor. The construction or design-build contractor must make their own interpretation based on the factual data in Part 1 of the report. Where comments are made on construction, they are provided only to highlight those aspects which could affect the design of the project. Contractors must make their own interpretation of the subsurface information provided as it may affect equipment selection, proposed construction methods and scheduling.

7.1 Applicable Codes and Design Considerations

The geotechnical assessment presented below has been prepared based on the available data regarding the proposed high fill embankments and deep cuts and existing ground conditions and in accordance with the Canadian Highway Bridge Design Code (CHBDC), version CSA S6-14.

As per Section 6.5.3.2 of the CHBDC S6-14, the degree of site prediction model understanding is considered *Typical* based on the current information.



8 ENGINEERING AND ANALYSIS METHODOLOGY

8.1 General

The subsurface conditions were investigated to assess the stability of the proposed embankment foundations and cut slopes, potential settlement issues under the embankments and anticipated construction concerns. Analyses were carried out at the critical sections based on embankment heights, gradient of cut slopes, and subsurface conditions. Geotechnical factors governing design of high fill embankments and deep cuts include the following:

- Thickness, extent, and engineering properties of the foundation soils.
- Depth of refusal materials.
- Embankment material type.
- Embankment/earth cut geometry including embankment height/cut depth, gradient of side slopes, and requirements for stabilizing berms.
- Temporary and long-term drainage requirements and erosion control for cut slopes.
- Construction and post-construction settlement of embankments.
- Staging of construction.

The foundation design recommendations were developed based on assumptions that are consistent with MTO's standard highway design practices:

- In accordance with OPSS.PROV 206, peat, topsoil, organic deposits, and other deleterious materials will be stripped prior to constructing embankments.
- Benching of the existing slope will be carried out in accordance with OPSD 208.010 where new fill is placed against an existing embankment slope or on a sloping ground surface steeper than 3H:1V.
- The embankments will be constructed using granular fill meeting the specifications of OPSS.PROV 1010 Granular B Type I, Type II, or Select Subgrade Material (SSM).
- High fills and deep cuts will be constructed with side slopes of 2H:1V or flatter.
- A 2 m wide mid-height berm will be incorporated into the overall slope profile for every successive 8 m of embankment fill and 6 m of deep cut.
- Permanent drainage and erosion protection will be provided for all earth cuts and embankment slopes.



8.2 Global Stability

Stability analyses were carried out to assess the global stability of the high fills and deep cuts at the critical embankment sections. The stability analyses were carried out utilizing the commercially available slope stability program Slide2 (Version 9) developed by Rocscience Inc. using Morgenstern Price method of slices.

For the purposes of analysis, it was assumed that the embankments would be constructed with either OPSS.PROV1010 Granular B Type I or Type II, or SSM. It was also assumed that all high fills and deep cuts will be constructed with side slopes of 2H:1V or flatter.

In accordance with the 2014 CHBDC, a minimum factor of safety of 1.3 and 1.5 is considered acceptable for short-term (temporary) and long-term (permanent) conditions, respectively. In addition, a minimum factor of safety of 1.0 is considered appropriate for seismic conditions.

The analyses under seismic loading were performed using a pseudo-static slope stability analysis. Horizontal seismic coefficient, k_h of 0.049 g (one-half of the corresponding site peak ground acceleration in accordance with Section 4.6.7 of CHBDC, for a site Class D) was taken for the seismic stability analysis. It should be noted that horizontal seismic coefficient was determined from the peak ground acceleration (PGA) for the site, obtained from the 2015 National Building Code Seismic Hazard Calculation for Site Class C (refer to Appendix K), but amplified by a factor of 1.29 for Site Class D.

The input parameters and soil model used in the stability analyses, including soil stratigraphy, engineering properties, groundwater conditions and model geometry for selected analyses are shown in Appendix A through Appendix J. The material properties used in the analyses were determined from in-situ and laboratory testing, and/or through soil index correlations from published literature.

The results of the stability analysis are provided in Table 1 in Appendix K. In summary, high fills comprised of Granular B Type I or Type II, or SSM, and deep cuts through the native soils may be constructed with side slopes of 2H:1V.

8.3 Settlement

Settlement analyses were carried out using the commercially available settlement program Settle3 (Version 5.0) developed by Rocscience Inc. The material properties used in the analyses were determined from in-situ and laboratory testing, and/or soil index correlations from published literature.

For analysis, self-compression of the compacted fill is assumed to be 0.5 percent of the fill height.



In accordance with the MTO's Embankment Settlement Criteria for Design (July 2, 2010), the maximum permissible post-construction total settlement for new embankments is 100 mm or less within 20 years following paving.

The modelling of settlements for the high fill embankments have been carried out based on the results of the field and laboratory program, as well as engineering experiences with other high fill embankments on similar soil conditions. However, it should be noted that the estimated settlements may differ from the magnitude of settlement observed during and/or after construction due to variability of the soil thickness and characteristics along the high fill embankments. Therefore, the results of the settlement analyses should be considered as a likely response of the foundation soils due to embankment loads.

A summary of the results of the settlement analyses at the critical sections along the proposed Highway 7, Wellington County Road 86, and associated interchange ramps is presented in Table 2 in Appendix L.

The results of the settlement analyses indicate that the estimated settlement of the foundation soils is within the MTO settlement guidelines and as such, waiting periods are not required prior to paving.

8.4 Seismic Considerations

In accordance with Table 4.1 of the 2014 CHBDC, this site is classified as a Seismic Site Class D based on the energy-corrected penetration resistance, \bar{N}_{60} . The peak ground acceleration, PGA, for a 2,475-year return period earthquake at this site is 0.076 g as per the National Building Code of Canada (NBCC) for Site Class C before modification for site-specific classification.

9 DESIGN AND CONSTRUCTION CONSIDERATIONS

9.1 Fill Embankment

As indicated in Section 8.1, embankments constructed with OPSS.PROV 1010 Granular B Type I or Type II, or SSM may be constructed with side slopes inclined at 2H:1V or flatter. In addition, for every successive 8 m of embankment, a 2 m wide mid-height bench should be incorporated into the embankment slope. Mid-height benches should maintain a 2 percent slope to shed surface runoffs.

The subgrade must be adequately prepared prior to fill placement. All vegetation, topsoil, organics, soft/loosened or wet soils should be sub-excavated. All subgrade surfaces should be inspected and any soft spots sub-excavated and replaced with suitable compacted granular materials prior to placing the new embankment fill. The subgrade preparation and placement and compaction of the granular fill must be carried out in the dry.



Embankment construction should be carried out in accordance with OPSS.PROV 206 and OPSS.PROV 501 requirements.

To prevent surface runoff from eroding and gulying the embankment side slopes, consideration should be given to installing an asphalt barrier curb in accordance with OPSD 601.010.

It is recommended that a vegetative cover to provided on all exposed slope surfaces in accordance with OPSS.PROV 803.

Where embankment fill is placed against existing embankment slopes or earth cuts, benching of the existing slope should be carried out in accordance with OPSD 208.010.

9.2 Deep Cuts

As indicated in Section 8.1, deep cuts should be constructed with side slopes of 2H:1V or flatter. In addition, 2 m wide mid-height benches are to be incorporated along the length of deep cut for every 6 m of cut. Mid-height benches should maintain a 2 percent slope to shed surface runoffs.

Areas where the final subgrade is revealed to be disturbed, softened, organic and/or contain deleterious materials should be sub-excavated and backfilled with compacted granular fill. Geogrid and/or geotextile may be required to allow placement of granular fill above the soft subgrade. Prior to backfilling, the subgrade should be inspected and approved by qualified geotechnical personnel.

To maintain a relatively dry, stable excavation during construction, temporary drainage consisting of ditching on both sides of the highway should be provided to remove water originating from below the natural groundwater table, from seepage from within water-bearing soils (as such silty sands and sandy silts) along the cut slopes, and from precipitation runoffs. It is important that construction be sequenced in such a way as to promote positive drainage away from the cut and avoid ponding of water within the excavation.

Permanent drainage of the cuts should also be provided. Roadside ditches are expected to provide an adequate level of surface drainage. Interceptor ditches should be constructed at the top of the cut slopes as per OPSD 200.020.

In accordance with OPSS.PROV 803, vegetation cover should be established on all cut slopes to protect against surficial erosion. Where required, granular sheeting with a minimum thickness of 0.5 m should be placed in accordance with OPSS.PROV 511 on the cut slope faces to provide protection against surficial erosion and instability.



10 CONSTRUCTION CONCERNS

Potential construction concerns include, but are not necessarily limited to:

- Confirmation is required that all peat, topsoil, and organic deposits within the proposed embankment footprint are stripped and replaced with approved backfill.
- Trafficability of construction equipment may be difficult in areas of soft, loosened, and/or saturated subgrade. Disturbance of the subgrade by construction traffic should be minimized, which may require adjustments to construction operations. In addition, provisions for adequate drainage will be critical to maintain stable subgrade.
- Cobbles and boulders may be encountered during construction and during excavation of cut slopes. Provisions must be made for the removal of cobbles and boulders.

Achieving the target performance is largely dependent on good workmanship and quality control during construction. Subgrade inspection should be carried out by qualified geotechnical personnel to confirm subgrade conditions are consistent with the construction specifications. In addition, the material used as fill as well as the density of the fill should be verified to conform with the material and construction specifications, respectively.



11 CLOSURE

Engineering analysis and preparation of this report were carried out by Messrs. Michael Eastman, P.Eng., Geoff Lay, P.Eng., and Ali Rajaei, P.Eng. The report was reviewed by Messrs. Christopher Ng, P.Eng., and Jason Lee, P.Eng., the Designated Principal Contact for MTO Foundation Projects.

Thurber Engineering Ltd.
Report Prepared By:

Michael Eastman, P.Eng.
Associate, Geotechnical Engineer

Ali Rajaei, P.Eng.
Geotechnical Engineer



Christopher Ng, P.Eng.
Associate, Senior Geotechnical Engineer



Jason Lee, P.Eng.
Partner, Senior Geotechnical Engineer
Designated MTO Contact

STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

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5. INTERPRETATION OF THE REPORT


- a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.
- c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.
- d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

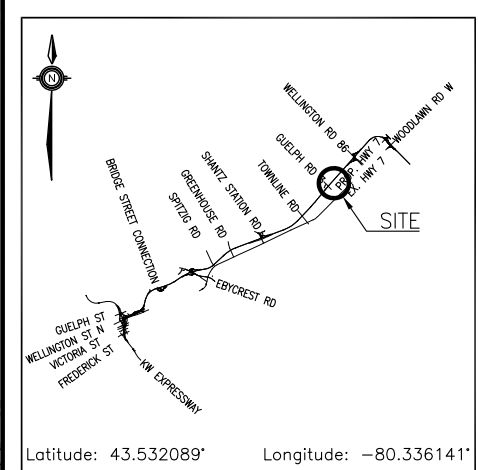
6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

CONT No
WP No
HIGHWAY 7 HIGH FILL/DEEP CUT SITE LOCATION PLAN




KEYPLAN

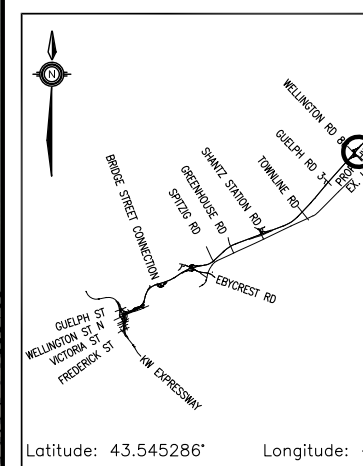
[illegible]

- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- 3) Coordinate system is MTM NAD 83 Zone 10.

GEOCRES No. 40P09-068

REV	REVISIONS		DESCRIPTION				DATE
	DATE	BY	CODE	LOAD	STRUCT	DWG	
DESIGN		CHK					FEB 2022
DRAWN	MC	CHK	SITE			1	

CONT No
WP No
HIGHWAY 7 HIGH FILL/DEEP CUT SITE LOCATION PLAN

KEYPLAN

[illegible]

-NOTES-

- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
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- 3) Coordinate system is MTM NAD 83 Zone 10.

GEOCRES No. 40P09-068

[illegible]

SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

1. TEXTURAL CLASSIFICATION OF SOILS

CLASSIFICATION	PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	Greater than 200mm	same
Cobbles	75 to 200mm	same
Gravel	4.75 to 75mm	5 to 75mm
Sand	0.075 to 4.75mm	Not visible particles to 5mm
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to the naked eye
Clay	Less than 0.002mm	Plastic particles, not visible to the naked eye

2. COARSE GRAIN SOIL DESCRIPTION (50% greater than 0.075mm)

TERMINOLOGY	PROPORTION
Trace or Occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)	APPROXIMATE SPT ⁽¹⁾ 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction

- 1) Laboratory Triaxial Testing
- 2) Field Insitu Vane Testing
- 3) Laboratory Vane Testing
- 4) SPT value
- 5) Pocket Penetrometer



4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	SPT "N" VALUE
Very Loose	Less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

5. LEGEND FOR RECORDS OF BOREHOLES

SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE	SS Split Spoon Sample	WS Wash Sample	AS Auger (Grab) Sample
	TW Thin Wall Shelby Tube Sample	TP Thin Wall Piston Sample	
	PH Sampler Advanced by Hydraulic Pressure	PM Sampler Advanced by Manual Pressure	
	WH Sampler Advanced by Self Static Weight	RC Rock Core	SC Soil Core

$$\text{Sensitivity} = \frac{\text{Undisturbed Shear Strength}}{\text{Remoulded Shear Strength}}$$

 Water Level
 Shear Strength Determination by Pocket Penetrometer

- (1) SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.
- (2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

UNIFIED SOILS CLASSIFICATION

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS W _L < 50%	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. (W _L < 30%).
		CI	Inorganic clays of medium plasticity, silty clays. (30% < W _L < 50%).
		OL	Organic silts and organic silty-clays of low plasticity.
	SILTS AND CLAYS W _L > 50%	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.
CLAY SHALE			
SANDSTONE			
SILTSTONE			
CLAYSTONE			
COAL			



Appendix A.

Highway 7: Station 32+300 – 32+500 (08-180, ML16 32+300, ML16 32+350, ML16 32+400, ML16 32+500)

RECORD OF BOREHOLE No 08-180

1 OF 1

METRIC

GWP# 408-88-00 LOCATION N 4 821 035.0 E 236 635.2 ORIGINATED BY LG
 DIST HWY 7 - New BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2008.12.01 - 2008.12.01 LATITUDE LONGITUDE CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)				
								20 40 60 80 100	○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				W _P W W _L			
344.8	GROUND SURFACE															
0.0	Clayey SILT , trace sand, trace gravel, occasional organics Firm Brown Moist (FILL)		1	SS	7								○			
344.0																
0.8	Sandy SILT , some clay, trace gravel Compact to Very Dense Brown to Grey Moist (TILL)		2	SS	24		344						○			
			3	SS	22		343						○			1 42 45 12
			4	SS	100/ 0.275		342									
			5	SS	100/ 0.200		341						○			1 40 45 14
			6	SS	100/ 0.125		340						○			
			7	SS	75/ 0.150		339						○			
			8	SS	100/ 0.150		338									
	Layer of clayey silt and sand															
			9	SS	100/ 0.200		337						H			0 40 46 14
							336									
335.4																
9.3	END OF BOREHOLE AT 9.3m. BOREHOLE BACKFILLED WITH HOLEPLUG TO SURFACE.				0.200											

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+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No ML16 32+300 1 OF 1 METRIC

GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 820 922.3 E 236 540.9 ORIGINATED BY TM
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.12.08 - 2016.12.08 LATITUDE 43.525106 LONGITUDE -80.344423 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
341.2	GROUND SURFACE							20	40	60	80	100	PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	
0.0	TOPSOIL: (300mm)															
340.9																
0.3	Sandy SILT , some clay, trace gravel, trace organics Compact to Very Dense Brown Moist (TILL)		1	SS	12		341									
			2	SS	38		340									
			3	SS	28											
			4	SS	50		339									
			5	SS	100/ 250		338									
							337									
336.4			6	SS	100/ 250											
4.8	END OF BOREHOLE AT 4.8m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.															

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RECORD OF BOREHOLE No ML16 32+350 1 OF 1 METRIC

GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 820 960.6 E 236 573.8 ORIGINATED BY TM
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.12.08 - 2016.12.08 LATITUDE 43.525454 LONGITUDE -80.344021 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
342.9	GROUND SURFACE							20	40	60	80	100							
0.0	TOPSOIL: (300mm)																		
342.6																			
0.3	Sandy SILT , some clay, trace gravel, trace organics Loose to Compact Brown Moist		1	SS	5														
			2	SS	16														
341.5																			
1.4	Silty SAND , some clay, some gravel, occasional cobbles Dense to Very Dense Brown to Grey Moist to Wet (TILL)		3	SS	38														
			4	SS	63														
			5	SS	100/ 0.200														
			6	SS	39														
			7	SS	32														

+³, ×³: Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No ML16 32+400 1 OF 1 METRIC

GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 820 998.7 E 236 603.8 ORIGINATED BY TM
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.12.08 - 2016.12.08 LATITUDE 43.525799 LONGITUDE -80.343654 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							WATER CONTENT (%) W _P W W _L			
344.5	GROUND SURFACE							20	40	60	80	100						
0.0	TOPSOIL: (150mm)																	
0.2	Sandy SILT , some clay, trace gravel, trace organics		1	SS	8		344											
343.8	Loose																	
0.7	Brown																	
	Moist																	
	Silty SAND , some clay, trace gravel, occasional cobbles		2	SS	31													
	Compact to Very Dense																	
	Brown						343											
	Moist																	
	(TILL)		3	SS	23													
			4	SS	88		342											6 42 37 15
			5	SS	100/ 0.200		341											
							340											
			6	SS	100/ 0.275													
339.5																		
5.0	END OF BOREHOLE AT 5.0m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.																	

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RECORD OF BOREHOLE No ML16 32+500 1 OF 1 METRIC

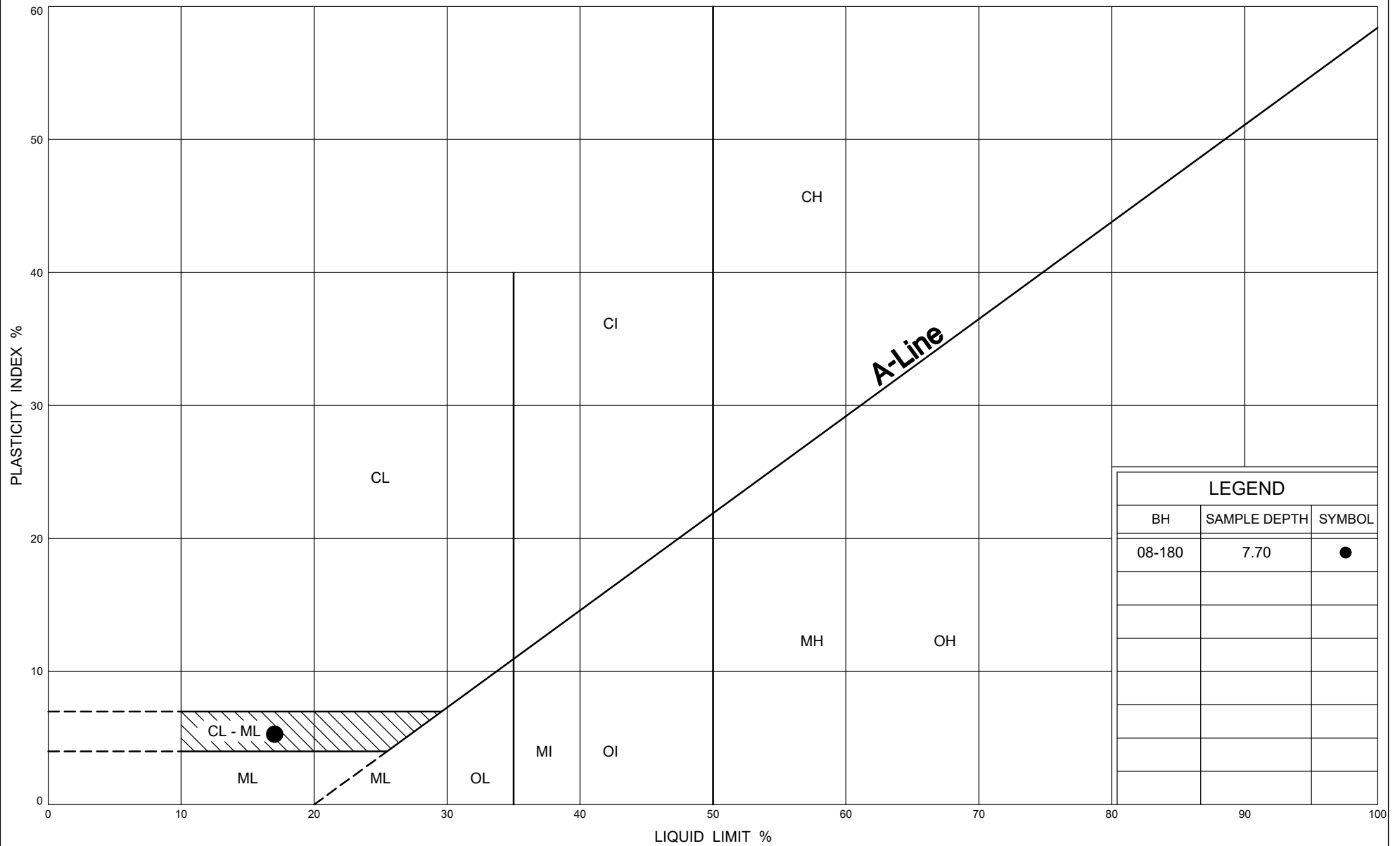
GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 821 076.4 E 236 665.7 ORIGINATED BY TM
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.12.08 - 2016.12.08 LATITUDE 43.526504 LONGITUDE -80.342898 CHECKED BY JPL

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	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)								
343.8	GROUND SURFACE							20	40	60	80	100	W _P	W	W _L	kN/m ³	GR	SA	SI	CL
0.0	TOPSOIL: (150mm)							20	40	60	80	100								
0.2	Sandy SILT , some clay, trace gravel, trace organics, occasional cobbles Loose to Compact Brown Moist		1	SS	13		343							○						
			2	SS	7									○						
342.3																				
1.4	Sandy SILT , some clay, trace gravel, trace organics, occasional cobbles Compact to Very Dense Brown to Grey Moist to Wet (TILL)		3	SS	27		342							○						
			4	SS	48		341							○						
			5	SS	100/ 0.275		340							○						7 38 39 16
			6	SS	100/ 0.275		339							○						
							338													
			7	SS	63		337							○						9 37 37 17
336.0			8	SS	100/ 0.150									○						
7.8	END OF BOREHOLE AT 7.8m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.5m slotted screen.																			
WATER LEVEL READINGS																				
DATE DEPTH(m) ELEV.(m)																				
2017.03.17 1.6 342.2																				
2018.05.02 0.9 342.9																				

+³, ×³: Numbers refer to
Sensitivity 20
15 10 5 10 (%) STRAIN AT FAILURE



FIG No A1
GWP 408-88-00



LEGEND

BH	SAMPLE DEPTH	SYMBOL
08-180	7.70	●

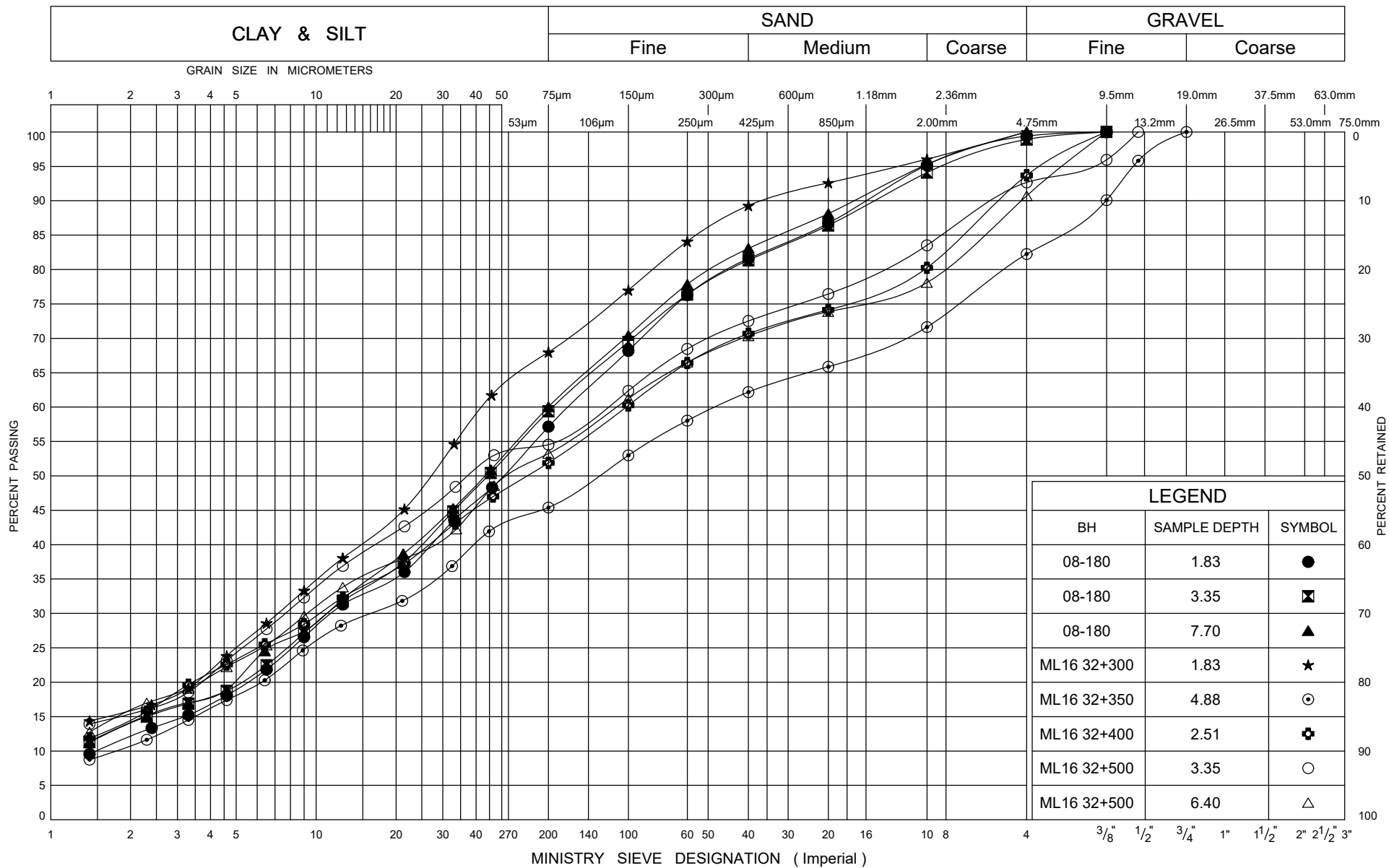


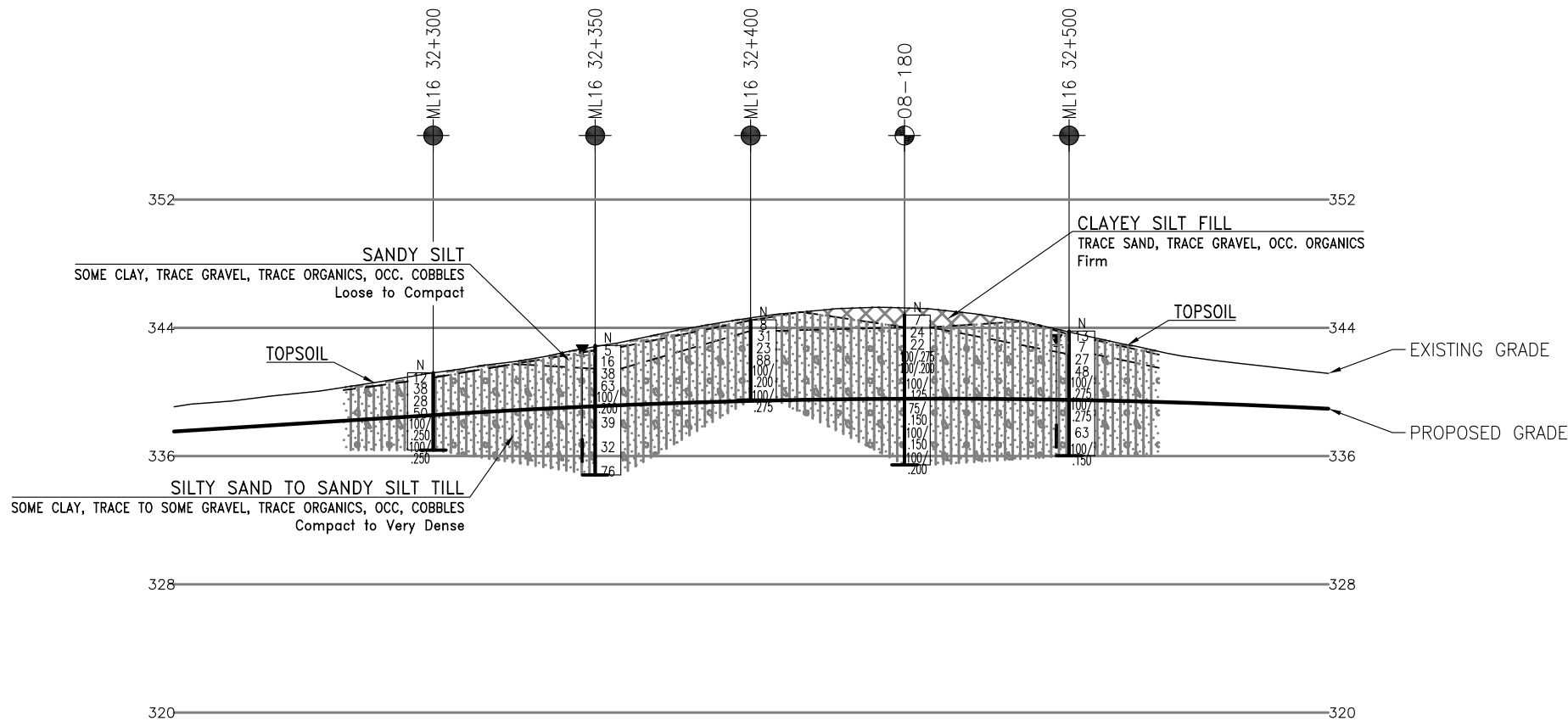
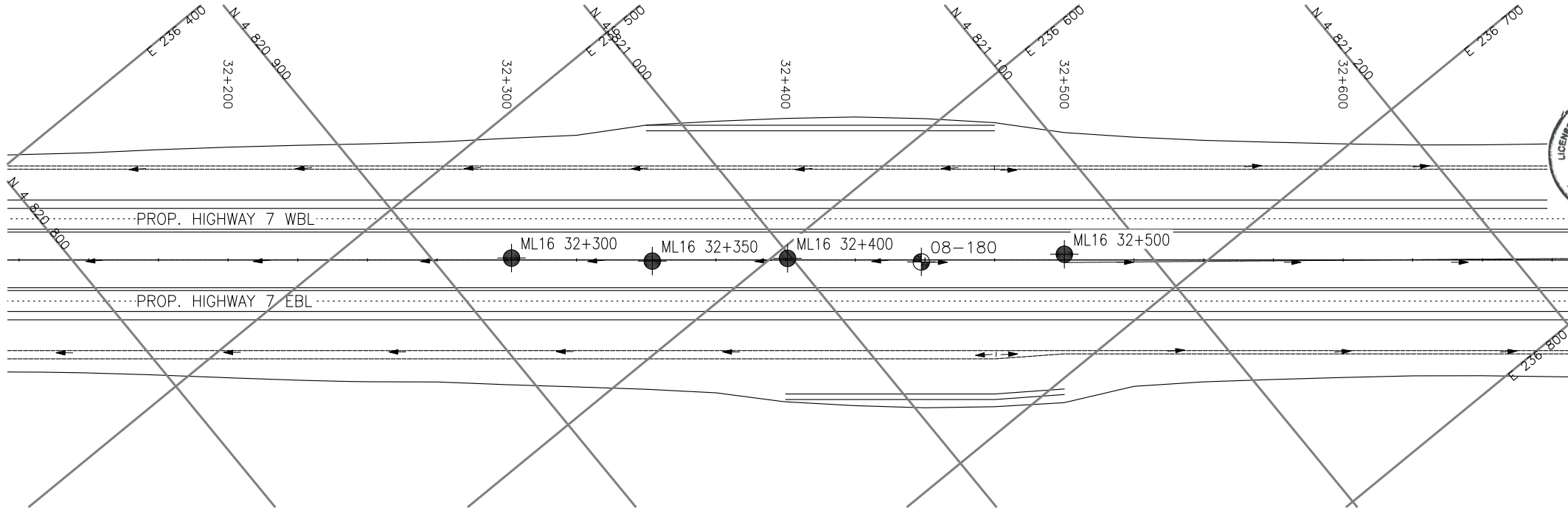
Ministry of
Transportation

PLASTICITY CHART
Sandy SILT TILL
(Clayey SILT and SAND Layer)

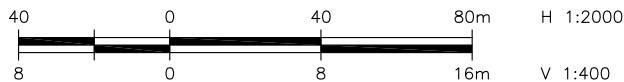
FIG No A2

GWP 408-88-00





PROFILE ALONG PROPOSED HIGHWAY 7



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

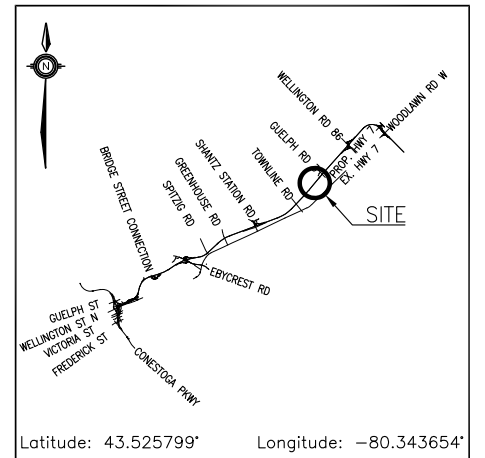


CONT No
GWP No 408-88-00

HIGHWAY 7
MAINLINE CUT
32+300 TO 32+500
BOREHOLE LOCATIONS AND SOIL STRATA



THURBER ENGINEERING LTD.



Latitude: 43.525799° Longitude: -80.343654°

KEYPLAN

LEGEND

	Borehole (Current Investigation)
	Borehole (2008 Investigation)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
ML16 32+300	341.2	4 820 922.3	236 540.9
ML16 32+350	342.9	4 820 960.6	236 573.8
ML16 32+400	344.5	4 820 998.7	236 603.8
ML16 32+500	343.8	4 821 076.4	236 665.7
08-180	344.8	4 821 035.0	236 635.2

-NOTES-

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- Coordinate system is MTM NAD 83 Zone 10.

GEOCRES No. 40P09-068

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	MKE	CHK	PKC
DRAWN	MFA	CHK	MKE
LOAD	DATE	FEB 2024	
STRUCT	DWG	1	

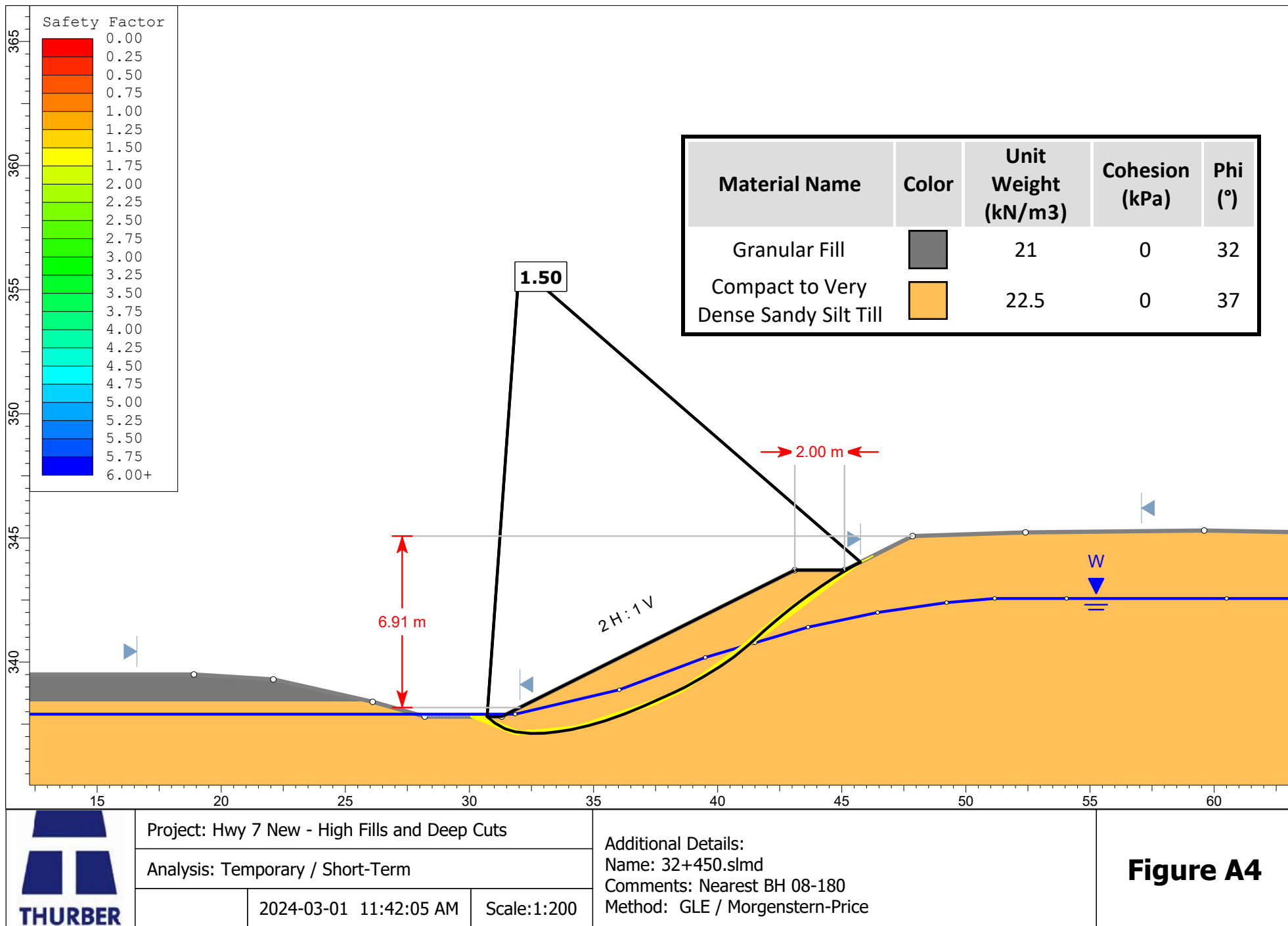
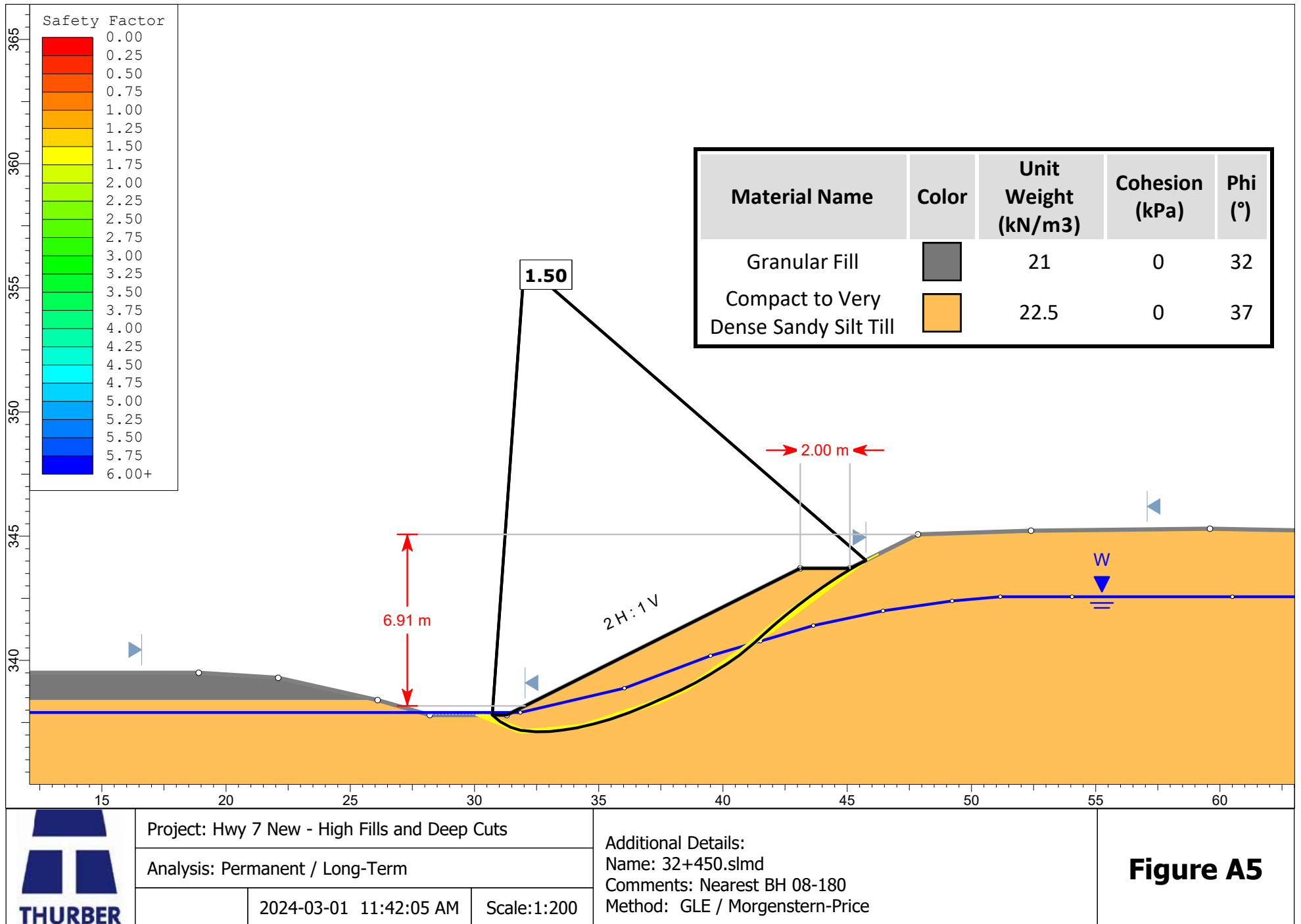
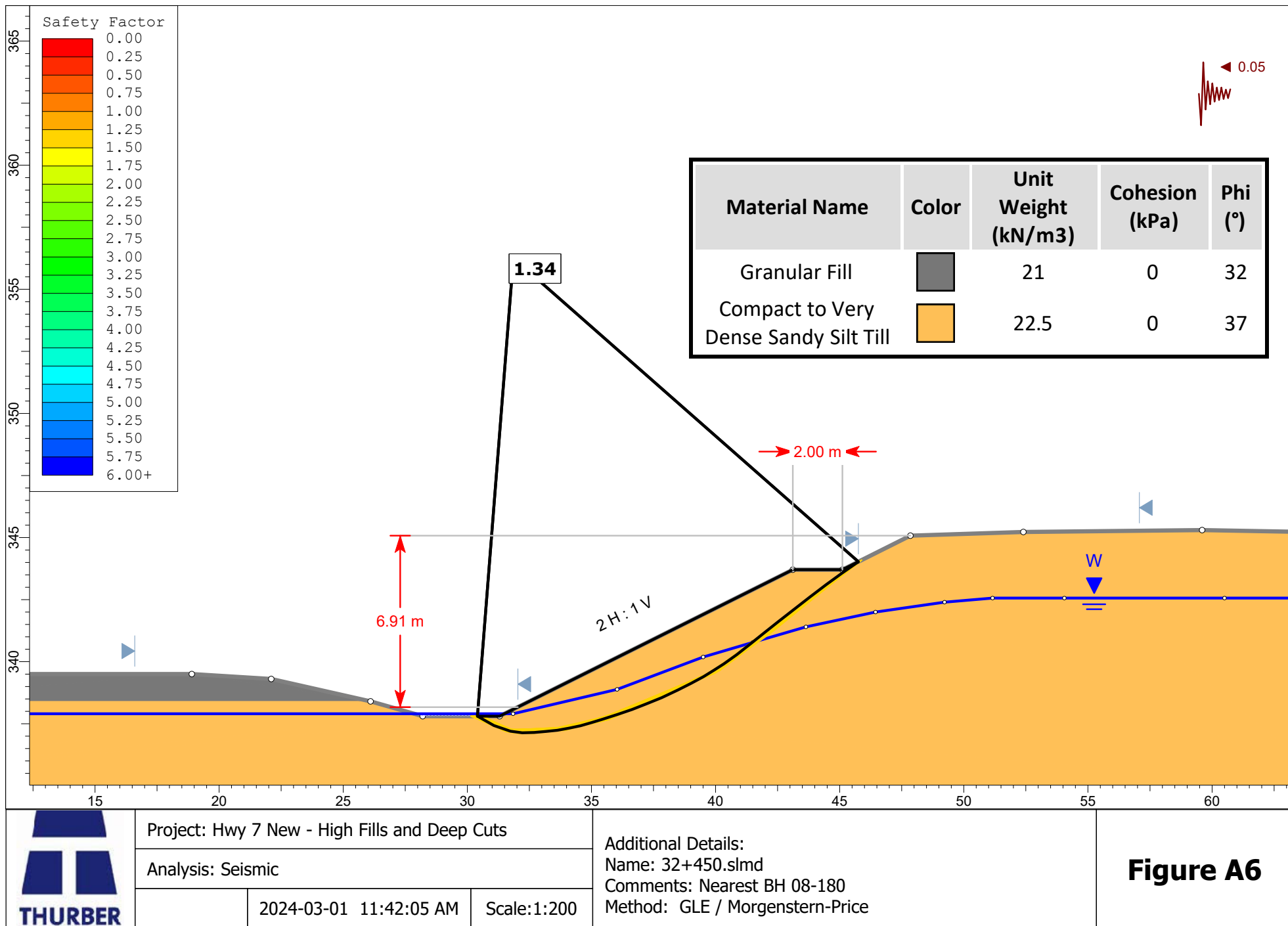


Figure A4







Appendix B.

Highway 7: Station 32+800 – 33+050 (08-181, 08-182, 08-184, 08-185, 08-186, ML16 32+879, ML16 32+972,)

METRIC

[illegible]

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No 08-181

2 OF 2

METRIC

GWP# 408-88-00 LOCATION N 4 821 326.6 E 236 873.7 ORIGINATED BY LG
DIST HWY 7 - New BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2008.11.28 - 2008.11.28 LATITUDE LONGITUDE CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
							20	40	60	80	100	20	40	60			
Continued From Previous Page																	
	Sandy SILT, trace gravel, trace to Loose to Very Dense Grey Moist to Wet (TILL)		10	SS	100/ 0.125												
			11	SS	50/ 0.25												
325.3			12	SS	50/ 0.75												
13.8	END OF BOREHOLE AT 13.8m. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2009.01.09 2.5 336.5 2009.02.09 11.4 327.6																

RECORD OF BOREHOLE No 08-182

1 OF 2

METRIC

GWP# 408-88-00 LOCATION N 4 821 410.3 E 236 943.4 ORIGINATED BY LG
 DIST HWY 7 - New BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2008.11.27 - 2008.11.27 LATITUDE LONGITUDE CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
344.3	GROUND SURFACE													
0.0	Clayey SILT , some sand, trace gravel, occasional rootlets		1	SS	7									
344.0	Firm													
0.3	Dark Brown Moist (FILL)													
	Sandy SILT , trace gravel, trace to some clay		2	SS	25									
	Compact to Very Dense													
	Brown to Grey													
	Moist to Wet (TILL)		3	SS	20									2 50 39 9
	Layer of silty sand till													
			4	SS	83									
			5	SS	100/ 0.150									
			6	SS	50/ 0.25									

Continued Next Page

+³, ×³: Numbers refer to Sensitivity
 20
 15
 10
 (%) STRAIN AT FAILURE

METRIC

[illegible]

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No 08-184

1 OF 1

METRIC

GWP# 408-88-00 LOCATION N 4 821 505.8 E 236 976.1 ORIGINATED BY SLL
 DIST HWY 7 - New BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.06.09 - 2008.06.09 LATITUDE LONGITUDE CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
336.1	GROUND SURFACE							20 40 60 80 100						
0.0	SAND , trace silt Brown Moist (FILL)		1	AS	-		336							
335.4														
0.7	Sandy SILT , trace gravel, occasional topsoil staining Loose Brown Moist (FILL)		1	SS	8		335							
334.7														
1.4	Sandy Clayey SILT , trace gravel Stiff Brown Moist (TILL)		2	SS	8		334							
			3	SS	12		333							1 35 49 15
			4	SS	9		332							
331.8														
4.3	Sandy SILT , trace to some clay, trace gravel, occasional cobbles Very Dense Grey Moist (TILL)		5	SS	100/ 250		331							2 41 44 13
			6	SS	100/ .150		330							4 39 44 13
							329							
328.3			7	SS	100/ .150									
7.8	END OF BOREHOLE AT 7.77 m. BOREHOLE OPEN TO 7.62 m AND WATER LEVEL AT 6.25 m ON COMPLETION. BOREHOLE BACKFILLED WITH HOLEPLUG TO 5.5m, BENTONITE BENSEAL AND AUGER CUTTINGS TO 0.6m, HOLEPLUG TO 0.3m AND AUGER CUTTING TO SURFACE													

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 08-185

1 OF 1

METRIC

GWP# 408-88-00 LOCATION N 4 821 467.3 E 236 995.3 ORIGINATED BY SLL
 DIST HWY 7 - New BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.06.10 - 2008.06.10 LATITUDE LONGITUDE CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
338.9	GROUND SURFACE							20	40	60	80	100							
0.0	SAND and GRAVEL trace silt Compact Brown Moist (FILL)		1	AS	-														
337.8	Occasional topsoil						338												
1.1	Sandy Clayey SILT , trace gravel Stiff to Hard Brown to Grey Moist (TILL) Occasional cobbles		2	SS	17														
			3	SS	11		337												
			4	SS	31		336												
			5	SS	47														
							335												
334.7																			
4.2	Sandy SILT , trace to some clay, trace gravel, occasional cobbles Very Dense Grey Moist (TILL)		6	SS	100/ 200		334												
							333												
			7	SS	100/ 125														
							332												
331.1			8	SS	100/ 225														
7.8	END OF BOREHOLE AT 7.85 m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.																		
	WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2008.07.15 2.1 336.8																		

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+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 08-186

1 OF 2

METRIC

GWP# 408-88-00 LOCATION N 4 821 449.4 E 237 033.0 ORIGINATED BY SLL
 DIST HWY 7 - New BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.06.09 - 2008.06.09 LATITUDE LONGITUDE CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)					GR	SA	SI	CL
338.6	GROUND SURFACE							20	40	60	80	100								
0.0	SAND and GRAVEL some asphalt fragments, trace silt Compact Brown Moist (FILL)		1	AS	-		338							○						50 41 9 (SI+CL)
			2	SS	12									○						
337.1																				
1.5	Sandy Clayey SILT , trace gravel Firm to Hard Brown to Grey Moist (TILL)		3	SS	4		337							○						
			4	SS	13		336							⦿						2 35 48 15
			5	SS	17		335							○						
			6	SS	86		334							○						
			7	SS	100/ 250		333							○						4 30 48 18
							332													
331.5							331							○						3 46 38 13
7.1	Sandy SILT , some clay, trace gravel Very Dense Grey Moist (TILL)		8	SS	100/ .125		330													
			9	SS	100/ 250									○						3 35 47 15
329.1																				
9.5	END OF BOREHOLE AT 9.55 m. BOREHOLE OPEN TO 9.55 m AND DRY ON COMPLETION																			

Continued Next Page

+³, ×³: Numbers refer to Sensitivity
 20
 15
 10
 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 08-186

2 OF 2

METRIC

GWP# 408-88-00 LOCATION N 4 821 449.4 E 237 033.0 ORIGINATED BY SLL
DIST HWY 7 - New BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
DATUM Geodetic DATE 2008.06.09 - 2008.06.09 LATITUDE LONGITUDE CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
	Continued From Previous Page BOREHOLE BACKFILLED WITH HOLE PLUG TO 8.5m, THEN BENTONITE BENSEAL MIXED WITH AUGER CUTTING TO SURFACE.																

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RECORD OF BOREHOLE No ML16 32+879 1 OF 2 METRIC

GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 821 369.7 E 236 907.2 ORIGINATED BY TM
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.12.08 - 2016.12.13 LATITUDE 43.529166 LONGITUDE -80.339948 CHECKED BY JPL

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	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				W _P	W	W _L		
342.3	GROUND SURFACE							20	40	60	80	100				
0.0	TOPSOIL: (300mm)															
342.0																
0.3	Sandy SILT , some clay, trace gravel, trace organics, occasional cobbles Loose to Compact Brown Moist		1	SS	5		342									
			2	SS	20											
								341								
				3	SS	26										
340.1																
2.2	Sandy SILT , some clay, trace to some gravel, occasional cobbles Very Dense Brown to Grey Moist to Wet (TILL)		4	SS	71		340									
				5	SS	95		339								
								338								
				6	SS	77										
								337								
				7	SS	100/ .225		336								
								335								
			8	SS	100/ .275											
							334									
			9	SS	94		333									

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity 20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No ML16 32+879 2 OF 2 METRIC

GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 821 369.7 E 236 907.2 ORIGINATED BY TM
DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
DATUM Geodetic DATE 2016.12.08 - 2016.12.13 LATITUDE 43.529166 LONGITUDE -80.339948 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)		
								20 40 60 80 100									20 40 60		
Continued From Previous Page																			
326.9 																			

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RECORD OF BOREHOLE No ML16 32+972 1 OF 2 METRIC

GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 821 438.0 E 236 969.1 ORIGINATED BY TM
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.12.09 - 2016.12.09 LATITUDE 43.529786 LONGITUDE -80.339190 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE										WATER CONTENT (%) PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT w _p w w _L	
341.8	GROUND SURFACE							20	40	60	80	100	20	40	60				
0.0	TOPSOIL: (150mm)																		
0.2	Sandy SILT, some clay, trace gravel, trace organics Loose Brown Moist		1	SS	5									○					
341.1																			
0.7	Sandy SILT, some clay, trace to some gravel, occasional cobbles Compact to Very Dense Brown to Grey Moist (TILL)		2	SS	23		341							○					
	</																		

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity 20
15 10 5
(%) STRAIN AT FAILURE

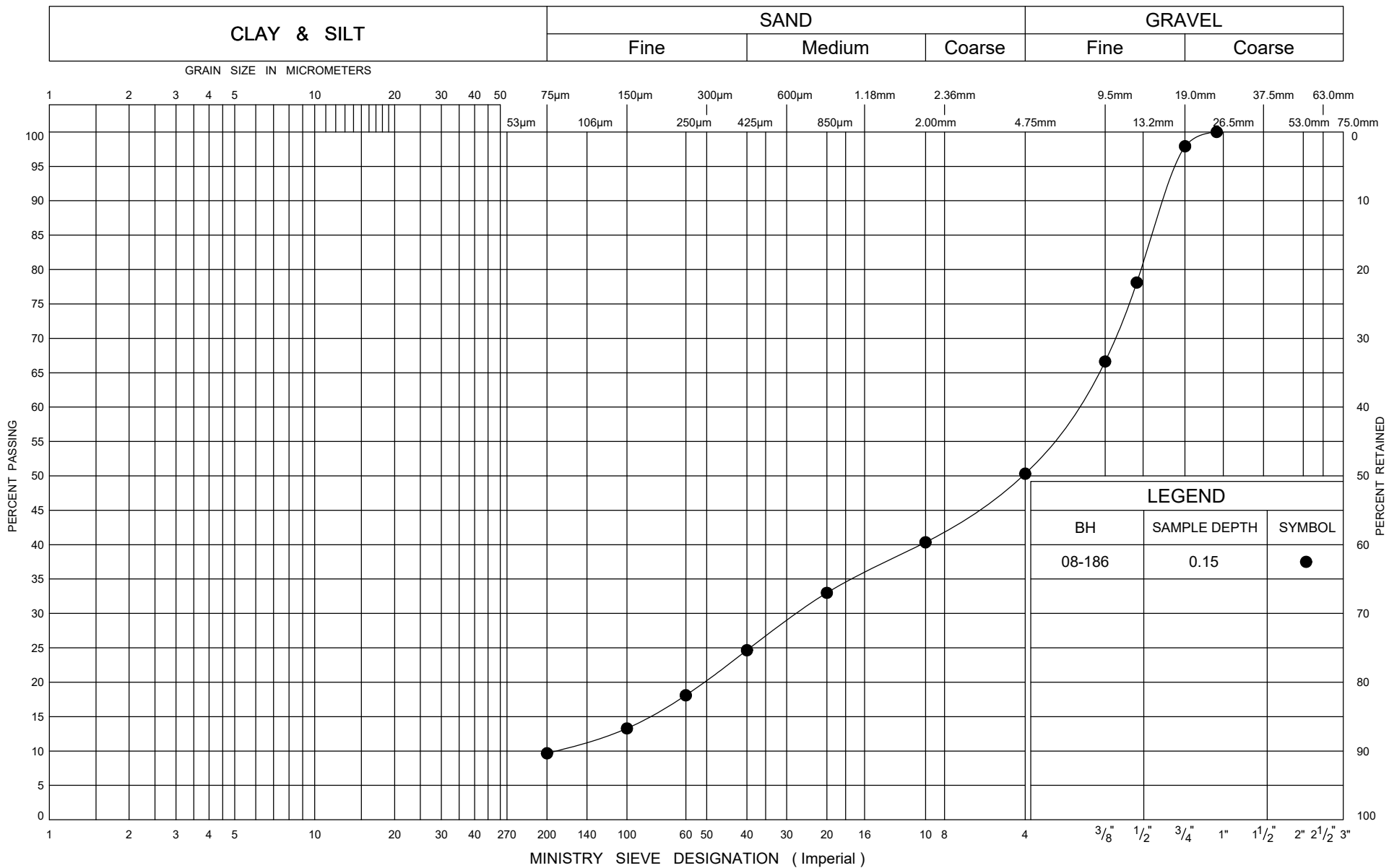
RECORD OF BOREHOLE No ML16 32+972 2 OF 2 METRIC

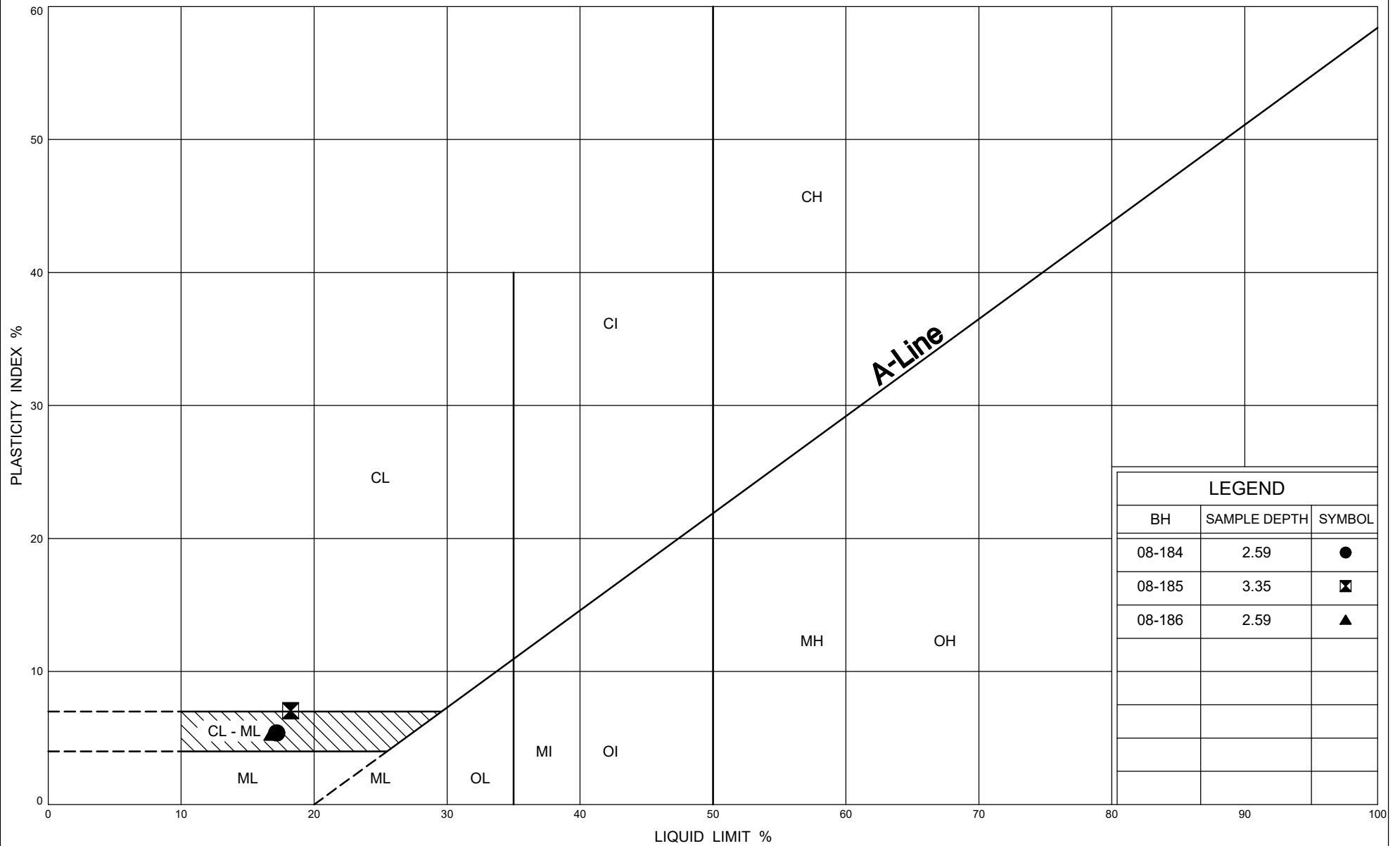
GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 821 438.0 E 236 969.1 ORIGINATED BY TM
DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
DATUM Geodetic DATE 2016.12.09 - 2016.12.09 LATITUDE 43.529786 LONGITUDE -80.339190 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
330.9	Continued From Previous Page Sandy SILT , some clay, trace to some gravel, occasional cobbles Compact to Very Dense Brown to Grey Wet (TILL)		10	SS	100/ 250		331										
10.9	END OF BOREHOLE AT 10.9m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.5m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2017.03.17 2.0 339.9 2018.05.02 1.8 340.0																

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ONTARIO MOT GRAIN SIZE 3 MTO-11375(GINTDATA)\GPJ_ONTARIO MOT.GDT 3/24/20





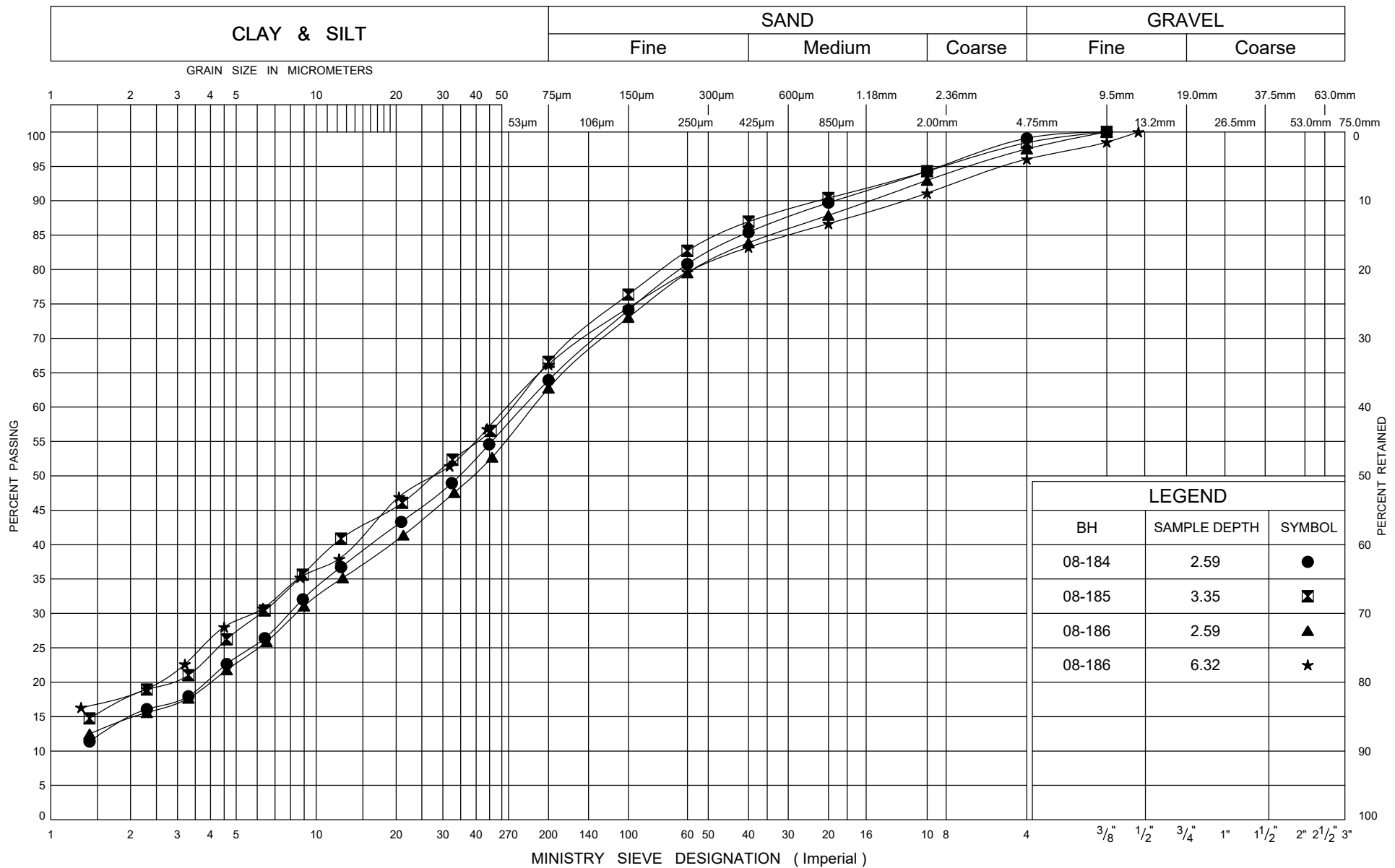
Ministry of
Transportation

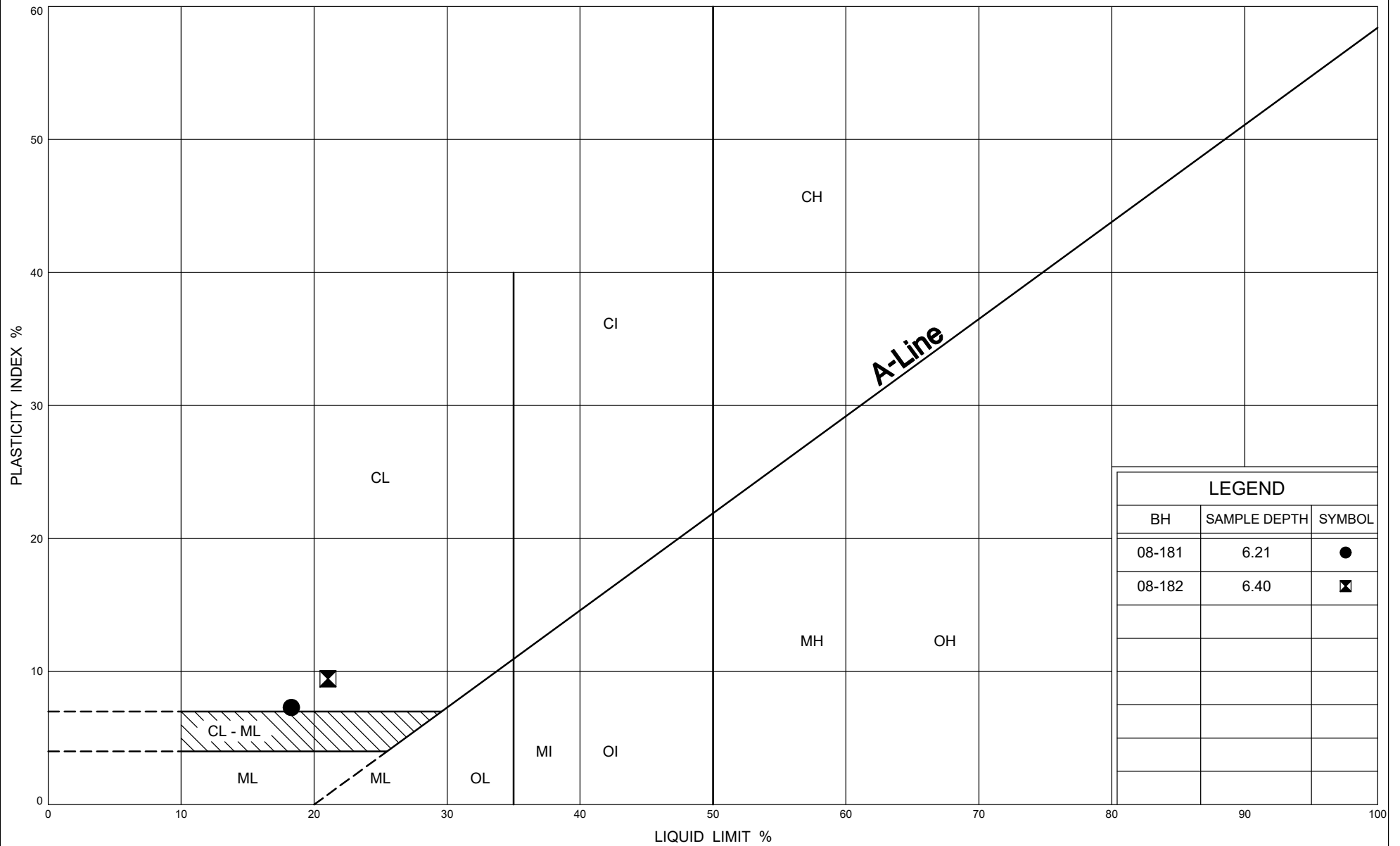
PLASTICITY CHART

Sandy Clayey SILT TILL

FIG No B2

GWP 408-88-00





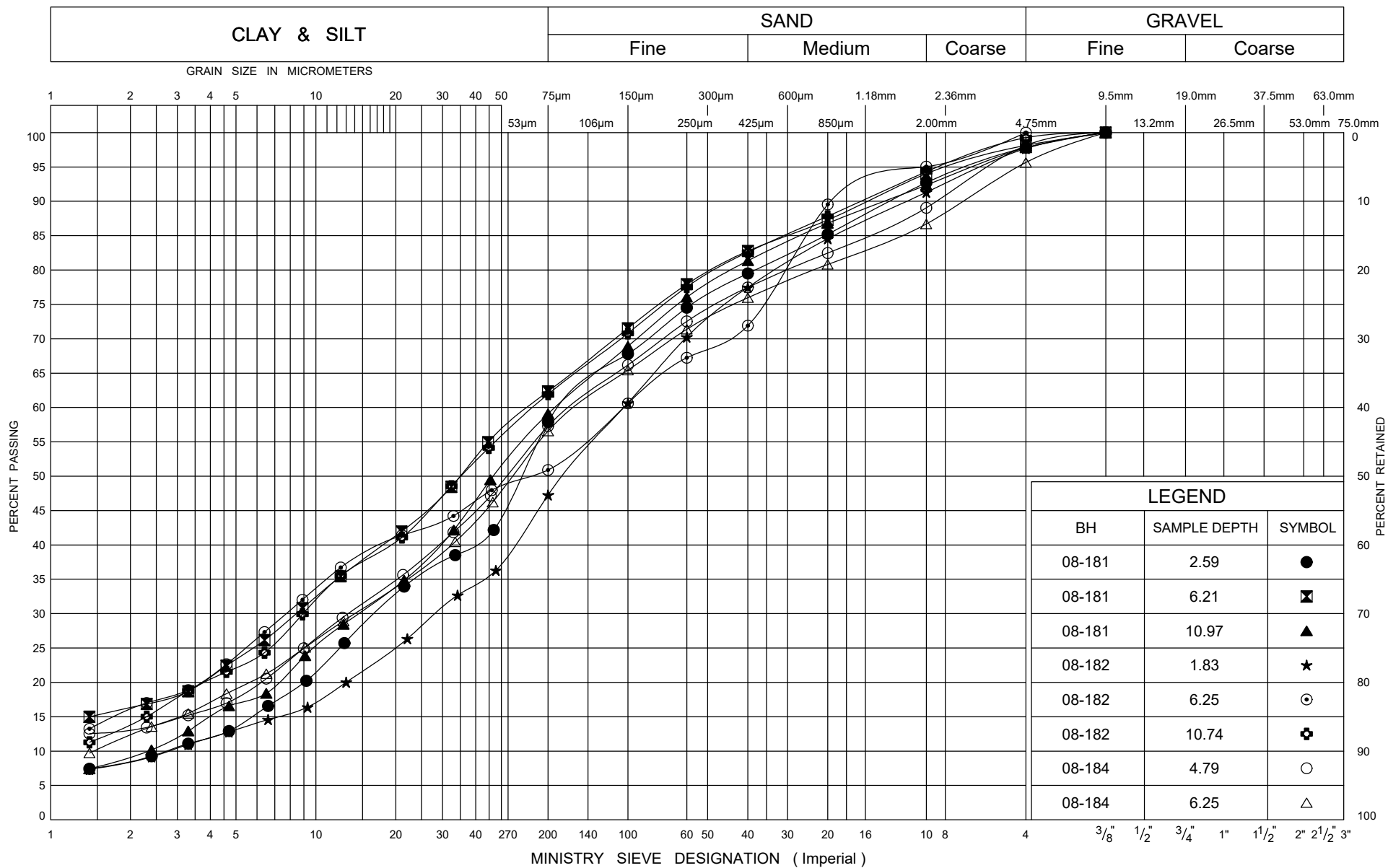
Ministry of
Transportation

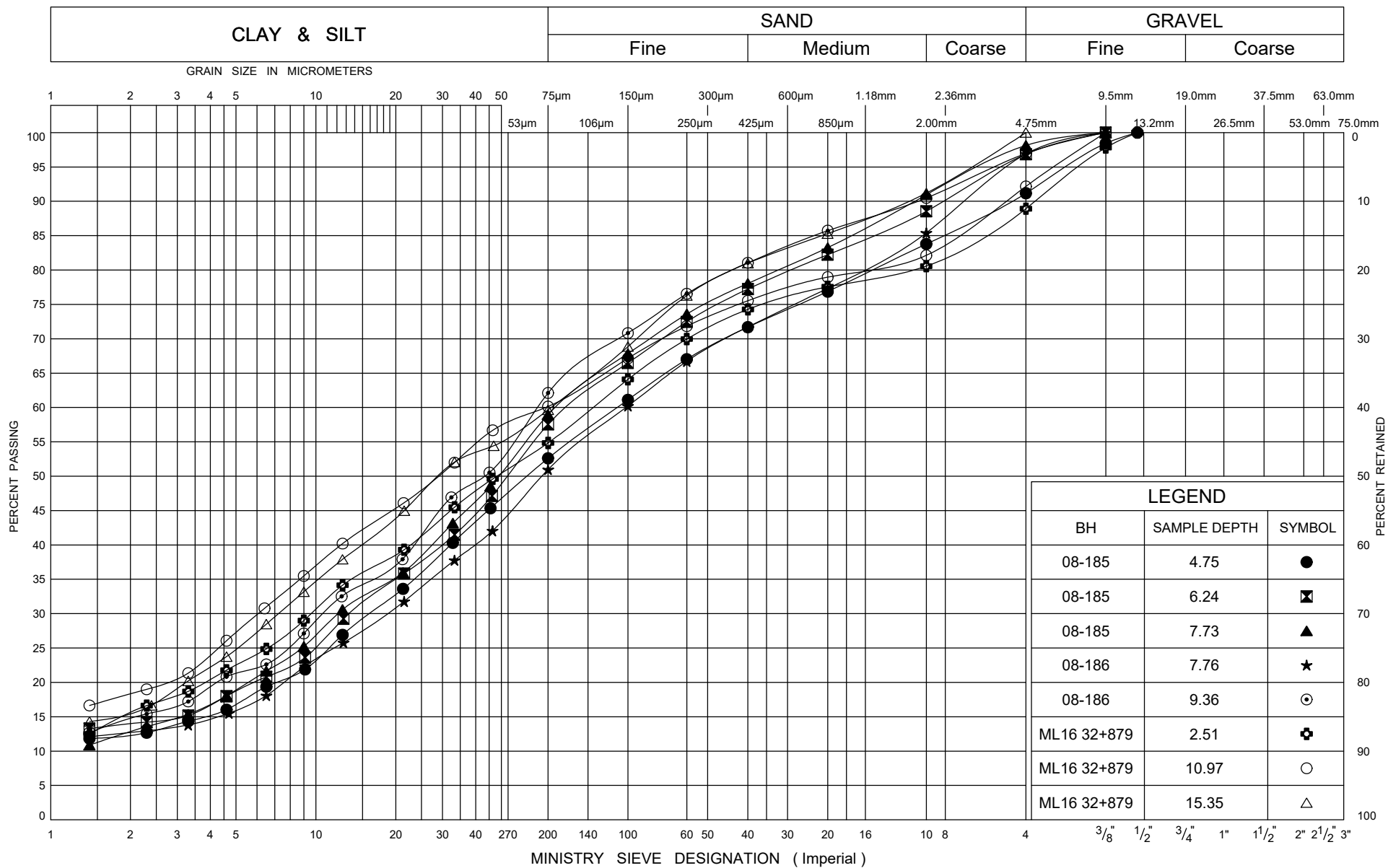
PLASTICITY CHART

Sandy SILT TILL
(Silty CLAY Layer)

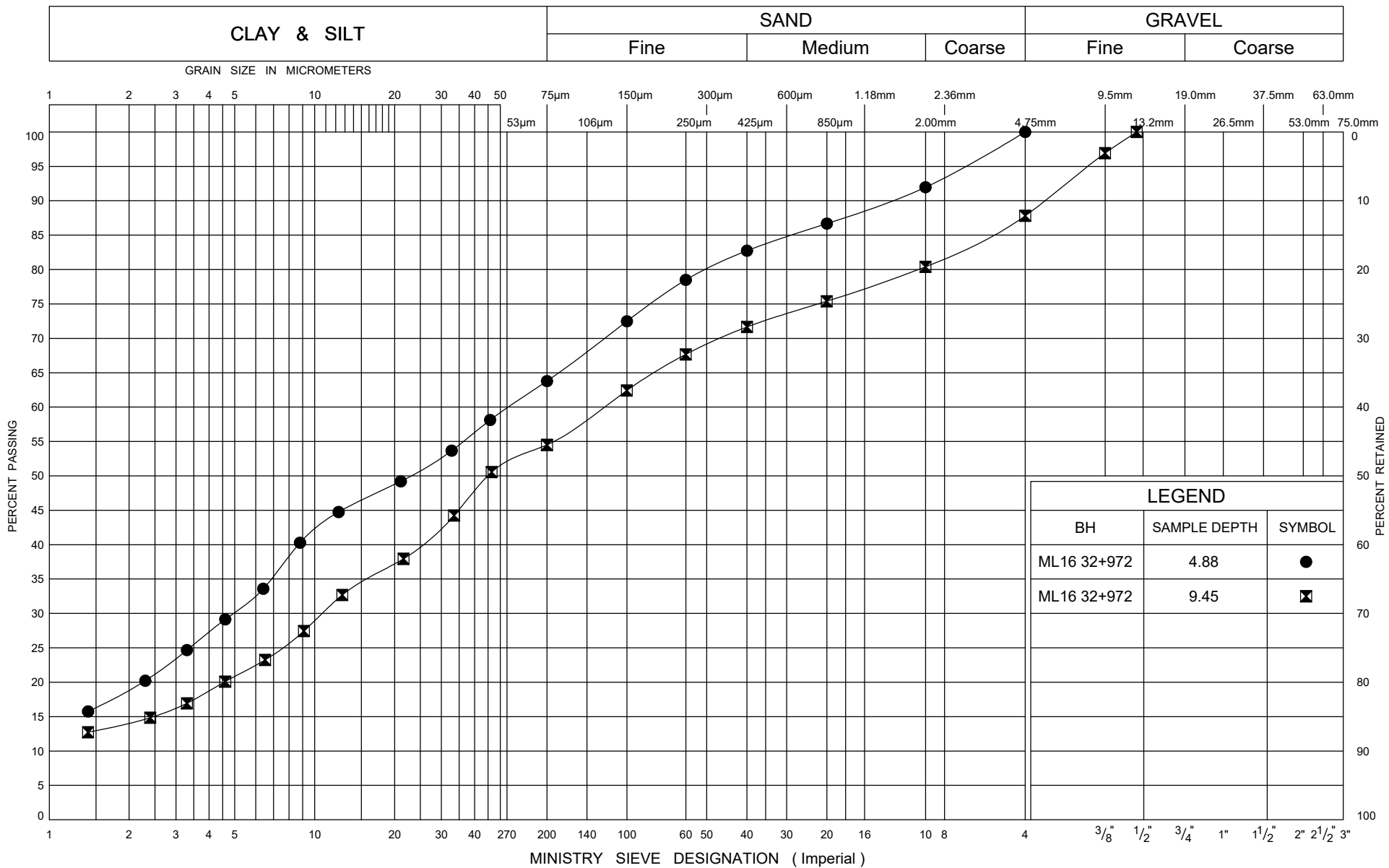
FIG No B4

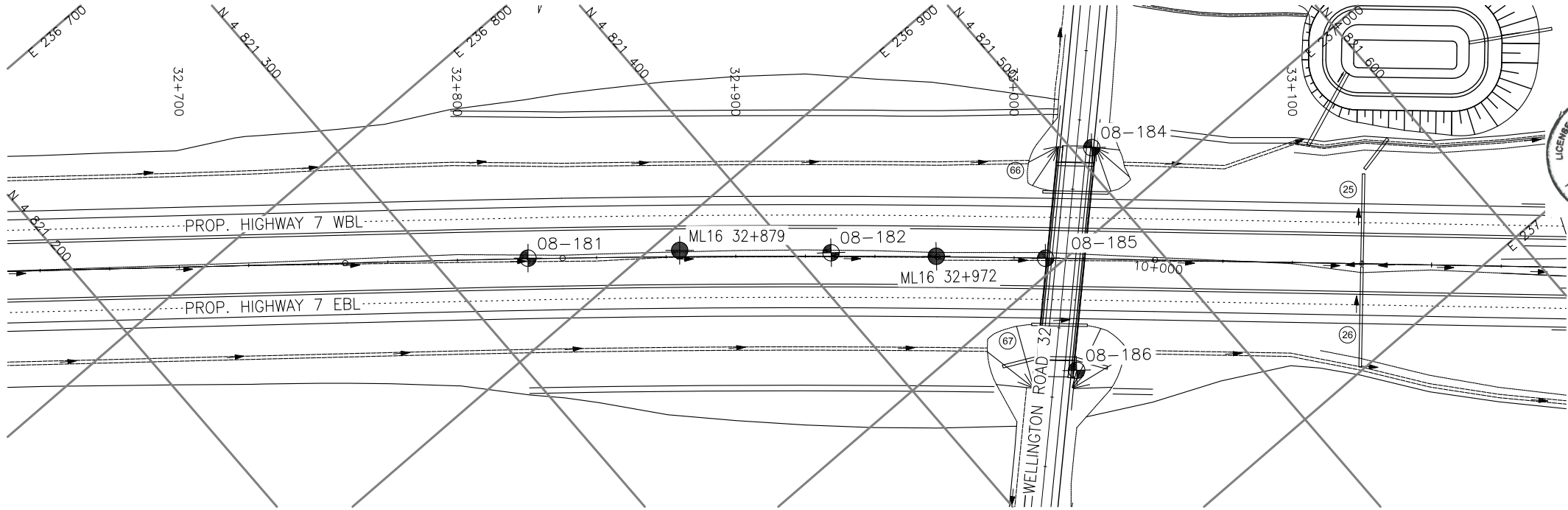
GWP 408-88-00



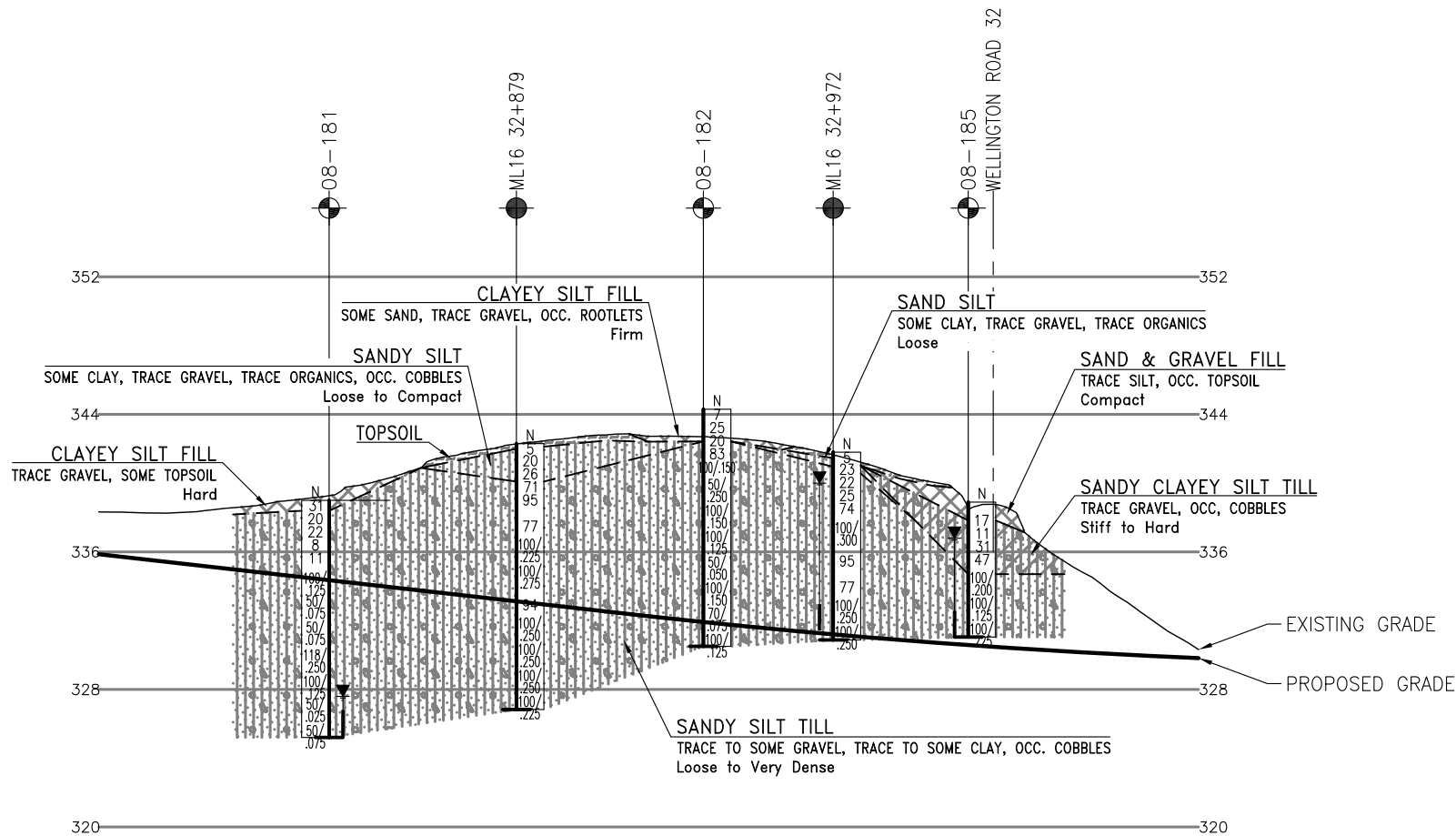
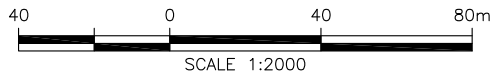


ONTARIO MOT GRAIN SIZE 3 MTO-11375(GINTDATA)\GPJ_ONTARIO MOT.GDT 3/24/20





PLAN



PROFILE ALONG PROPOSED HIGHWAY 7

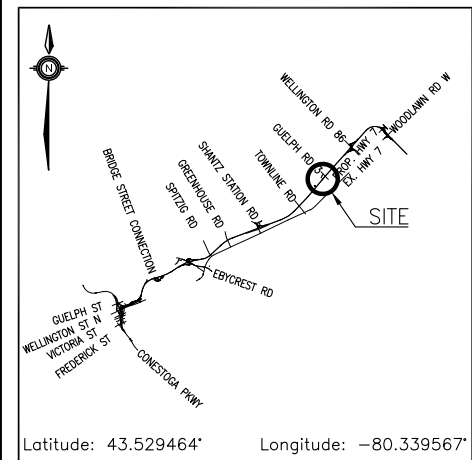


METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN



CONT No
GWP No 408-88-00

HIGHWAY 7
MAINLINE CUT
32+800 TO 33+050
BOREHOLE LOCATIONS AND SOIL STRATA



KEYPLAN

LEGEND

	Borehole (Current Investigation)
	Borehole (2008 Investigation)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

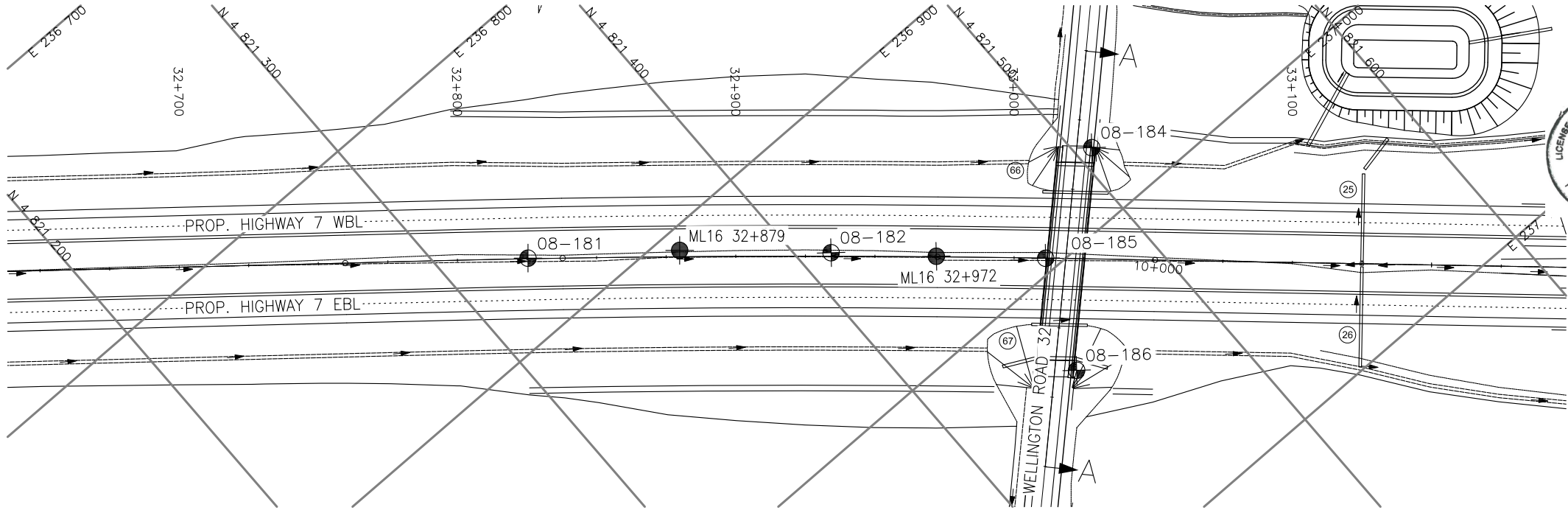
NO	ELEVATION	NORTHING	EASTING
ML16 32+879	342.3	4 821 369.7	236 907.2
ML16 32+972	341.8	4 821 438.0	236 969.1
08-181	339.0	4 821 326.6	236 873.7
08-182	344.3	4 821 410.3	236 943.4
08-184	336.1	4 821 505.8	236 976.1
08-185	338.9	4 821 467.3	236 995.3
08-186	338.6	4 821 449.4	237 033.0

-NOTES-

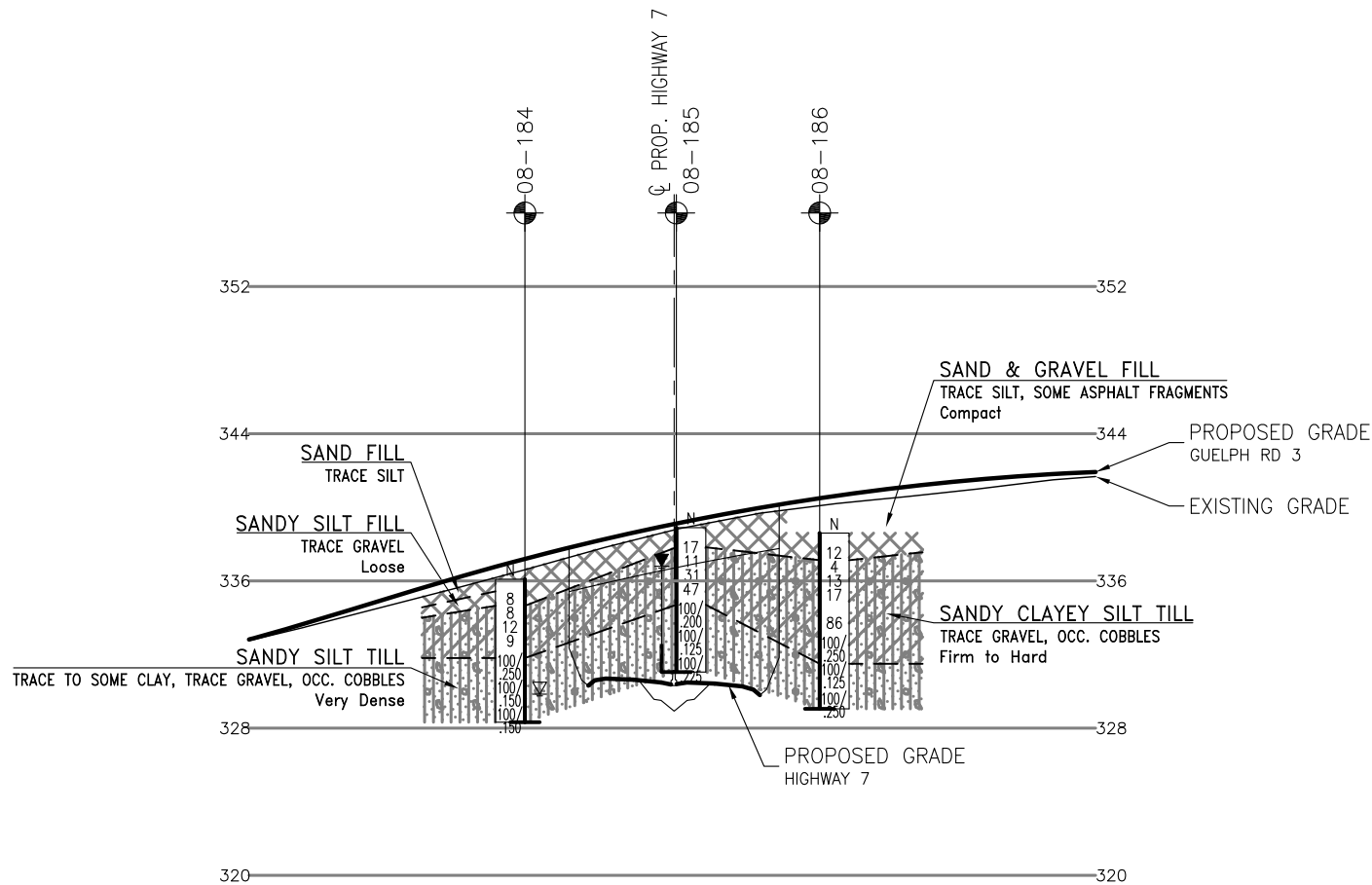
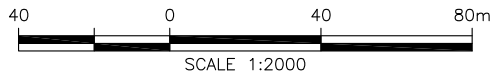
- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- Coordinate system is MTM NAD 83 Zone 10.

GEOCRES No. 40P09-068

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	MKE	CHK	PKC
DRAWN	MFA	CHK	MKE
LOAD			
STRUCT			
DWG			



PLAN



PROFILE ALONG WELLINGTON ROAD 32



H 1:2000
V 1:400

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



CONT No
GWP No 408-88-00

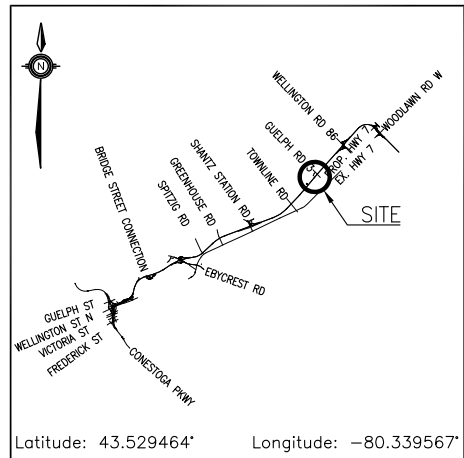
HIGHWAY 7
MAINLINE CUT
32+800 TO 33+050
BOREHOLE LOCATIONS AND SOIL STRATA



SHEET



THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

- Borehole (Current Investigation)
- Borehole (2008 Investigation)
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- Water Level
- Head Artesian Water
- Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

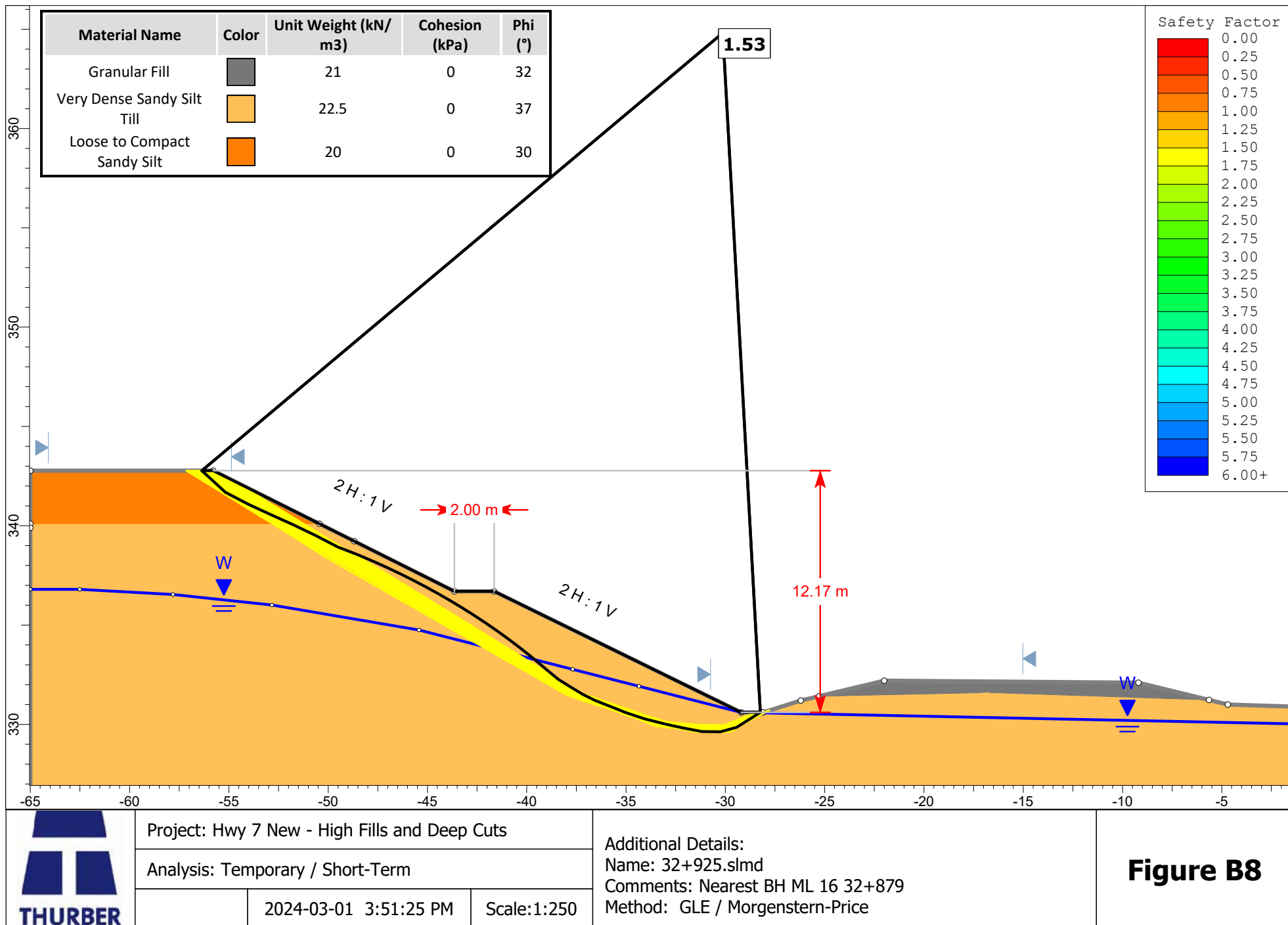
NO	ELEVATION	NORTHING	EASTING
ML16 32+879	342.3	4 821 369.7	236 907.2
ML16 32+972	341.8	4 821 438.0	236 969.1
08-181	339.0	4 821 326.6	236 873.7
08-182	344.3	4 821 410.3	236 943.4
08-184	336.1	4 821 505.8	236 976.1
08-185	338.9	4 821 467.3	236 995.3
08-186	338.6	4 821 449.4	237 033.0

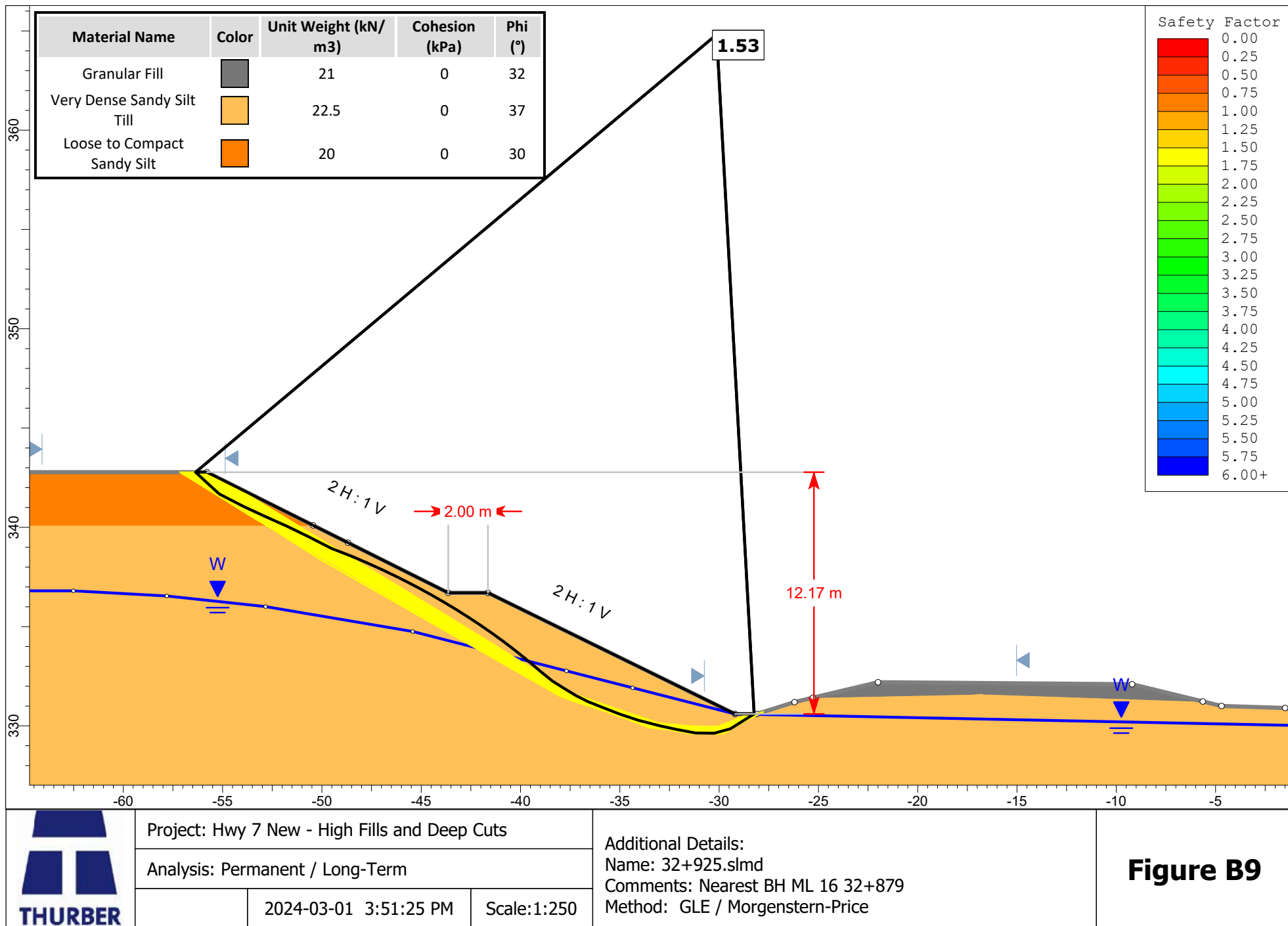
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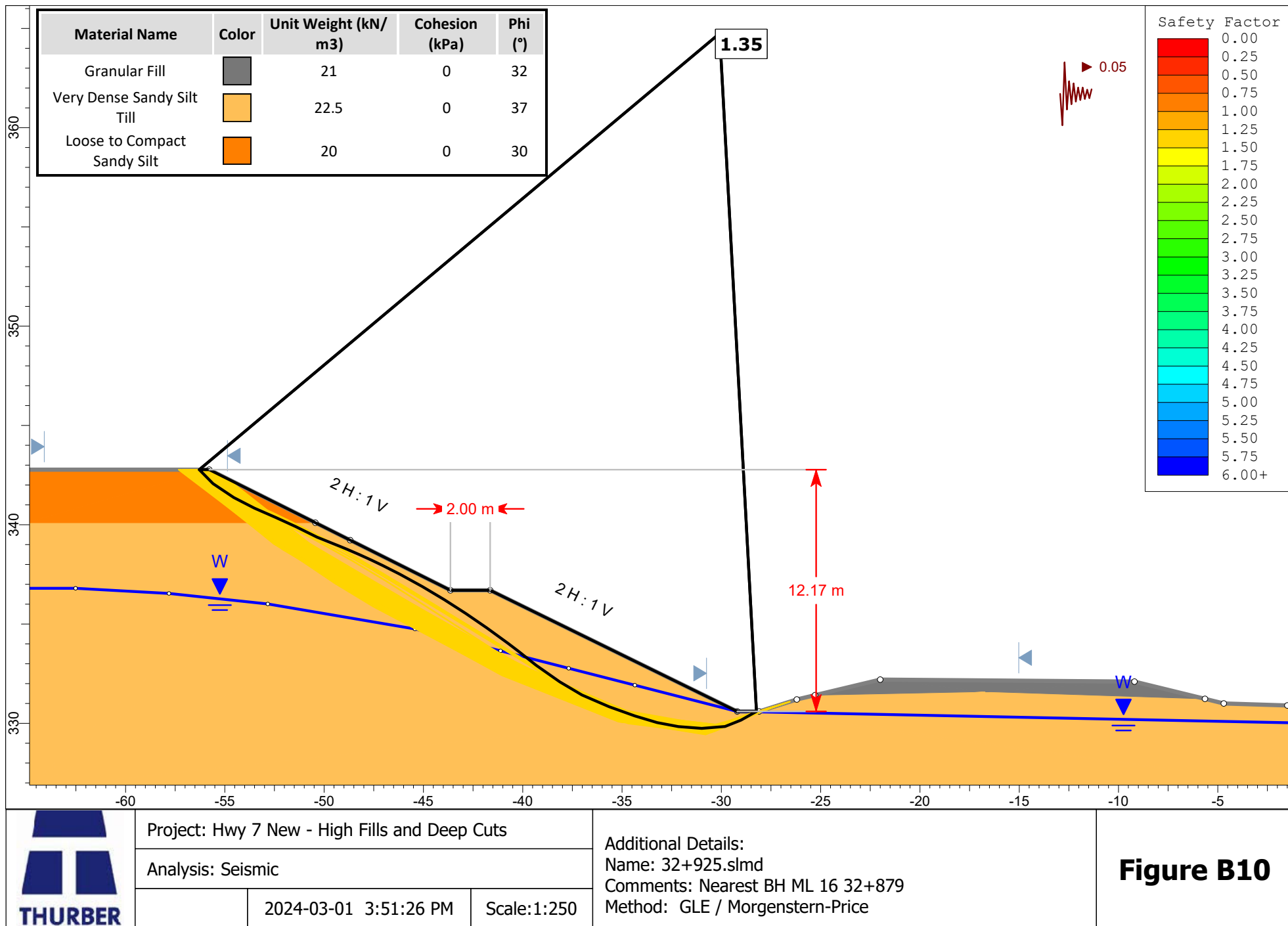
- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- Coordinate system is MTM NAD 83 Zone 10.

GEOCRES No. 40P09-068

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	MKE	CHK	PKC
DRAWN	MFA	CHK	MKE
LOAD	DATE	FEB 2024	
STRUCT	DWG	2	









Appendix C.

**Highway 7: Station 33+400 – 33+600 (ML16 33+400, ML16 33+450, ML16 33+500,
ML16 33+550, ML16 33+600)**

RECORD OF BOREHOLE No ML16 33+400 1 OF 1 METRIC

GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 821 757.9 E 237 255.5 ORIGINATED BY OA
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.12.04 - 2017.12.04 LATITUDE 43.532691 LONGITUDE -80.335688 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
325.3	GROUND SURFACE							20	40	60	80	100							
0.0	TOPSOIL: (175mm)																		
0.2	Silty SAND , some gravel, some clay, occasional organics		1	SS	7		325												
324.7	Loose Brown Moist																		
0.7	Silty SAND , some gravel, trace to some clay Compact to Very Dense Brown to Grey Moist to Wet (TILL)		2	SS	17		324												20 59 21 (SI+CL)
			3	SS	16		323												
			4	SS	23		322												
			5	SS	36		321												
			6	SS	93		320												18 44 28 10
319.2			7	SS	100/														
6.2	END OF BOREHOLE AT 6.2m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.				0.100														

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1 OF 1

ORIGINATED BY OA

COMPILED BY MP

CHECKED BY JPL

+³, ×³: Numbers refer to Sensitivity

RECORD OF BOREHOLE No ML16 33+500 1 OF 1 METRIC

GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 821 832.2 E 237 321.3 ORIGINATED BY OA
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.12.04 - 2017.12.04 LATITUDE 43.533367 LONGITUDE -80.334882 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
325.4	GROUND SURFACE							20	40	60	80	100							
0.0	TOPSOIL: (200mm)																		
0.2	SAND and GRAVEL, some silt, trace clay Dense Brown to Grey Dry to Moist		1	SS	7		325												
			2	SS	37		324												
			3	SS	32														38 44 18 (SI+CL)
323.2																			
2.2	Silty CLAY Stiff Brown Moist		4	SS	10			323											
322.4	Silty SAND, some gravel, trace clay Very Dense Brown to Grey Wet (TILL)		5	SS	53		322												
																			10 51 32 7
							321												
			6	SS	100/ 0.275														
							320												
319.2																			

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RECORD OF BOREHOLE No ML16 33+550 1 OF 1 METRIC

GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 821 868.4 E 237 355.3 ORIGINATED BY OA
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.12.06 - 2017.12.06 LATITUDE 43.533695 LONGITUDE -80.334467 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							WATER CONTENT (%) PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT w _p w w _L			
326.9	GROUND SURFACE							20	40	60	80	100						
0.0 326.6	TOPSOIL: (250mm)																	
0.3	Silty SAND , some gravel, some clay, occasional organics Loose Brown Moist		1	SS	6		326							○				
			2	SS	9									○				
325.4																		
1.4	Silty SAND , some gravel, trace clay Dense Brown Moist (TILL)		3	SS	40		325							○				
			4	SS	37		324							○				
			5	SS	41									○				
322.7							323											
4.1	Sandy Silty CLAY , trace gravel Hard Brown Moist (TILL)		6	SS	33		322							○				6 37 35 22
321.2																		
5.6	Silty SAND , some gravel, trace clay Dense Brown Wet (TILL)		7	SS	35		321							○				
320.2																		
6.7	END OF BOREHOLE AT 6.7m. WATER LEVEL AT 5.5m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.																	

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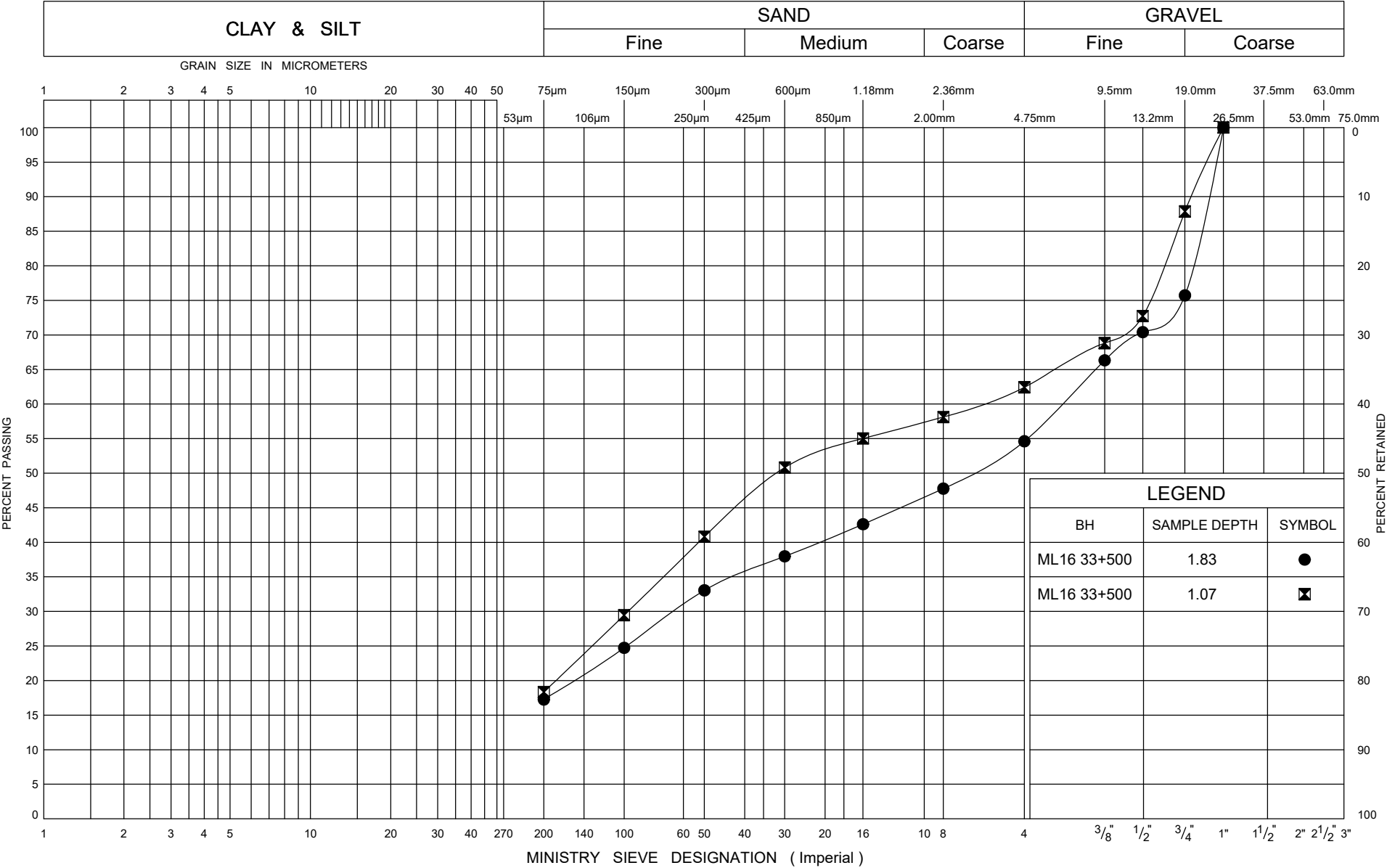
RECORD OF BOREHOLE No ML16 33+600 1 OF 1 METRIC

GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 821 905.8 E 237 388.1 ORIGINATED BY OA
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP
 DATUM Geodetic DATE 2017.12.04 - 2017.12.04 LATITUDE 43.534034 LONGITUDE -80.334065 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							WATER CONTENT (%) W _P W W _L			
327.9	GROUND SURFACE							20	40	60	80	100		20	40	60		
0.0	TOPSOIL: (200mm)																	
0.2	Sandy SILT , some clay, trace gravel, occasional organics Loose Brown Moist		1	SS	5		327								○			3 42 37 18
															○			
			2	SS	7													
326.4																		
1.4	Silty SAND , some clay, some gravel Compact Brown Moist (TILL)						326								○			14 39 37 10
			3	SS	13													
			4	SS	24		325								○			
324.9																		
3.0	Gravelly SAND , some silt Very Dense Brown Moist						324											
			5	SS	75										○			
							323											
			6	SS	100/ 0.100		322											
321.7															○			
6.2	END OF BOREHOLE AT 6.2m. WATER LEVEL AT 5.8m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE AND AUGER CUTTINGS TO SURFACE.		7	SS	100/ 0.100													

+³, ×³: Numbers refer to Sensitivity 20 15 10 5 0 (%) STRAIN AT FAILURE

ONTARIO MOT GRAIN SIZE 3 MTO-11375(GINTDATA)\GPJ_ONTARIO MOT.GDT 7/21/23

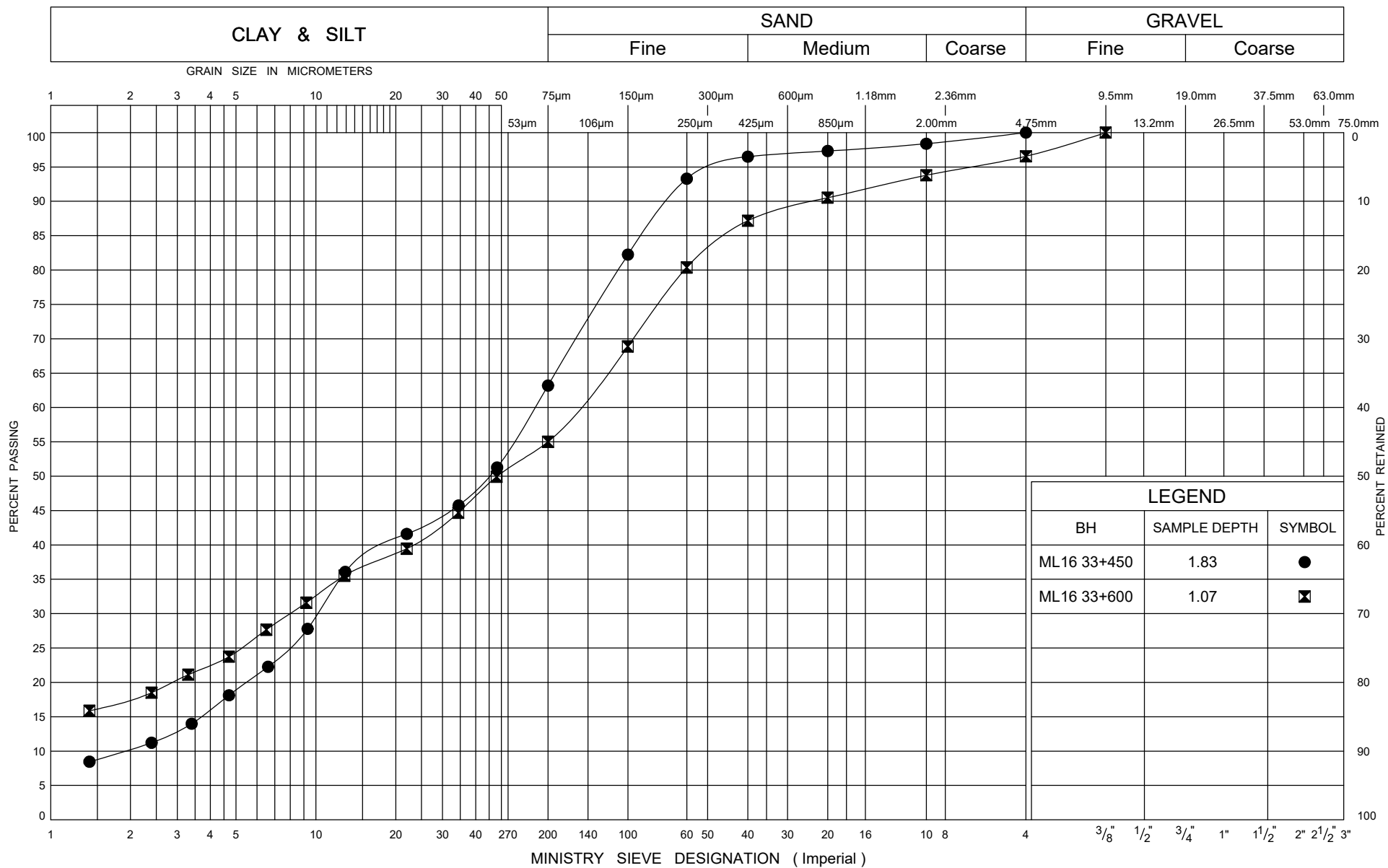


Ministry of
Transportation

GRAIN SIZE DISTRIBUTION
SAND and GRAVEL

FIG No C1

GWP 408-88-00



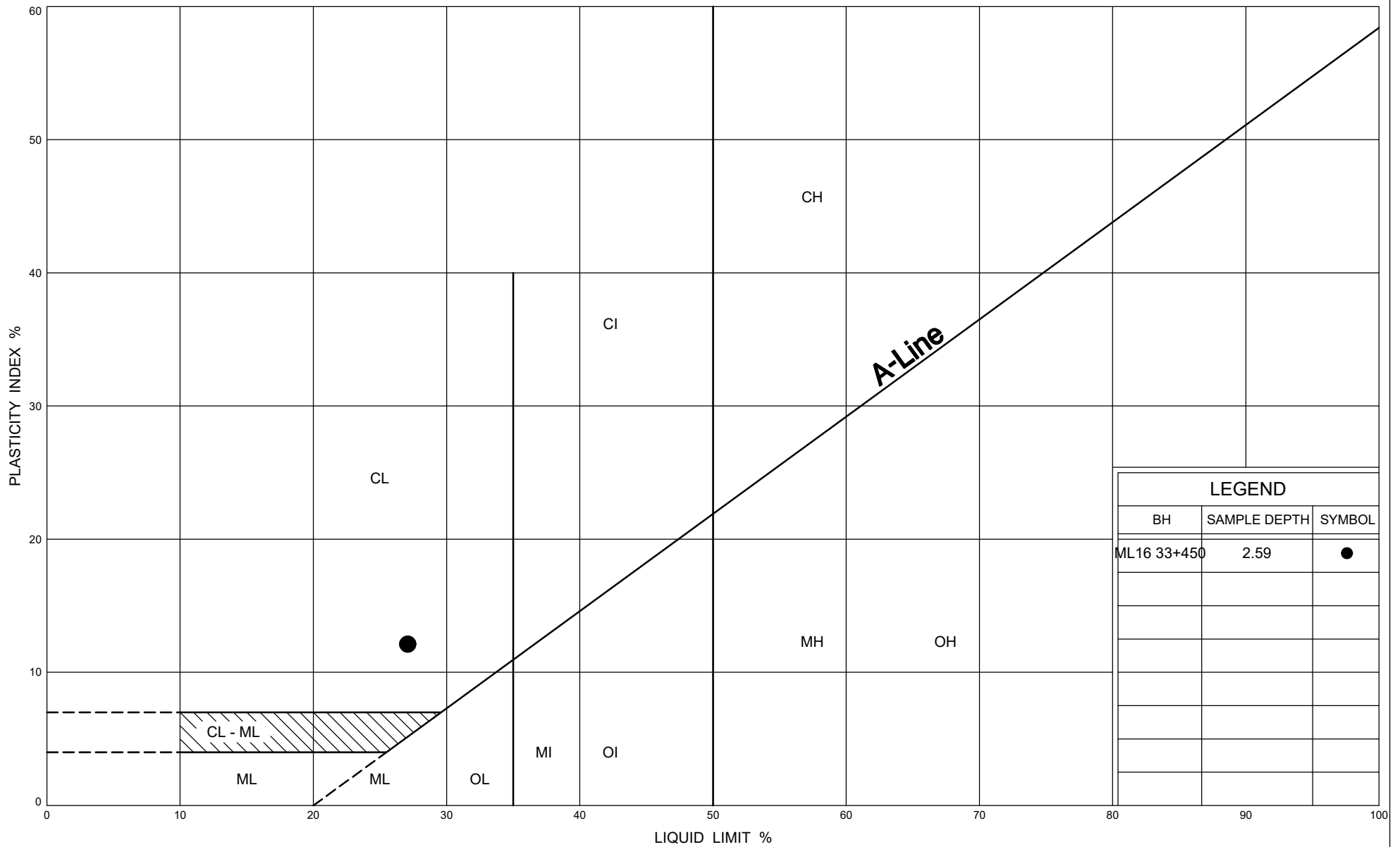




FIG No C4

GWP 408-88-00

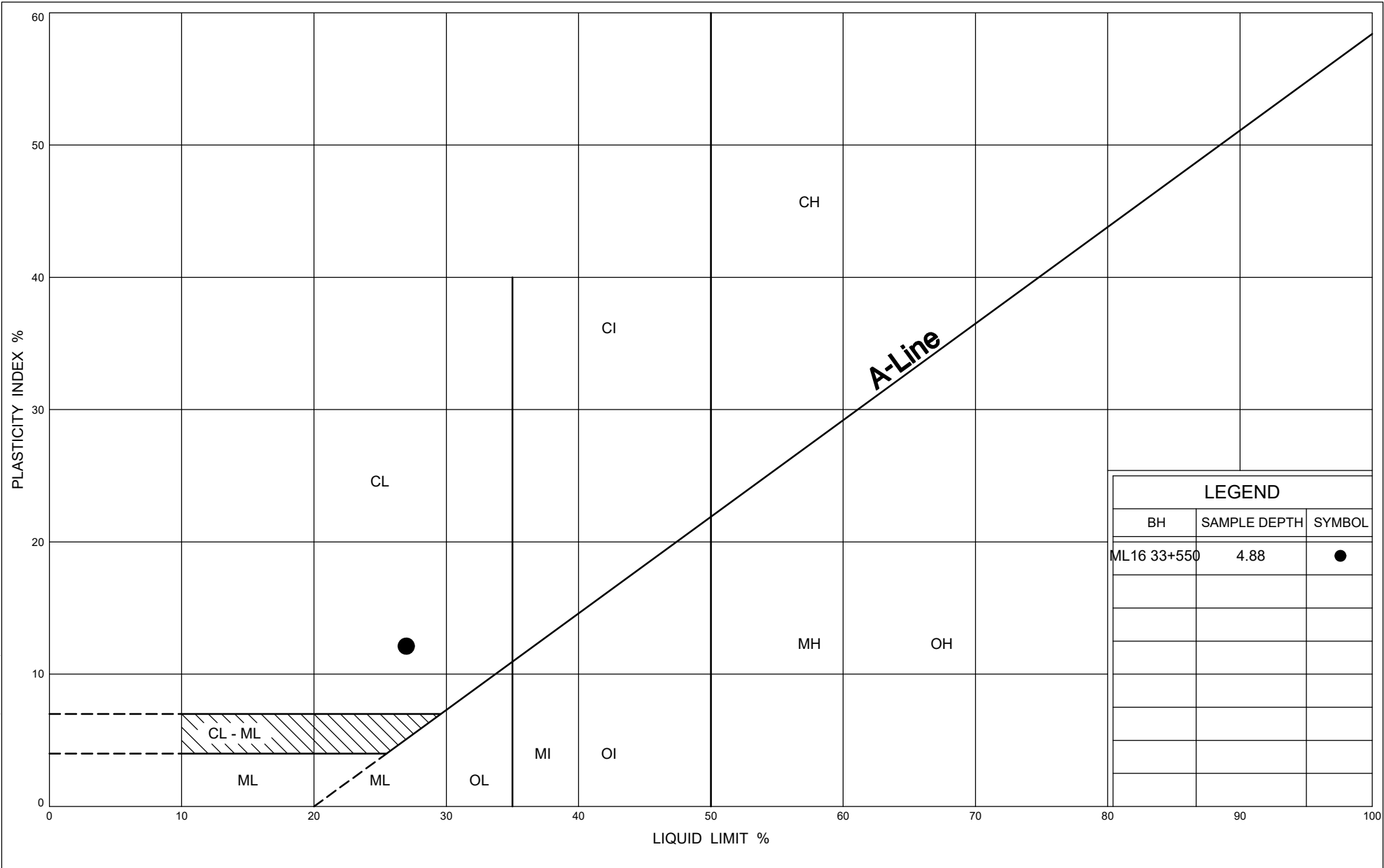
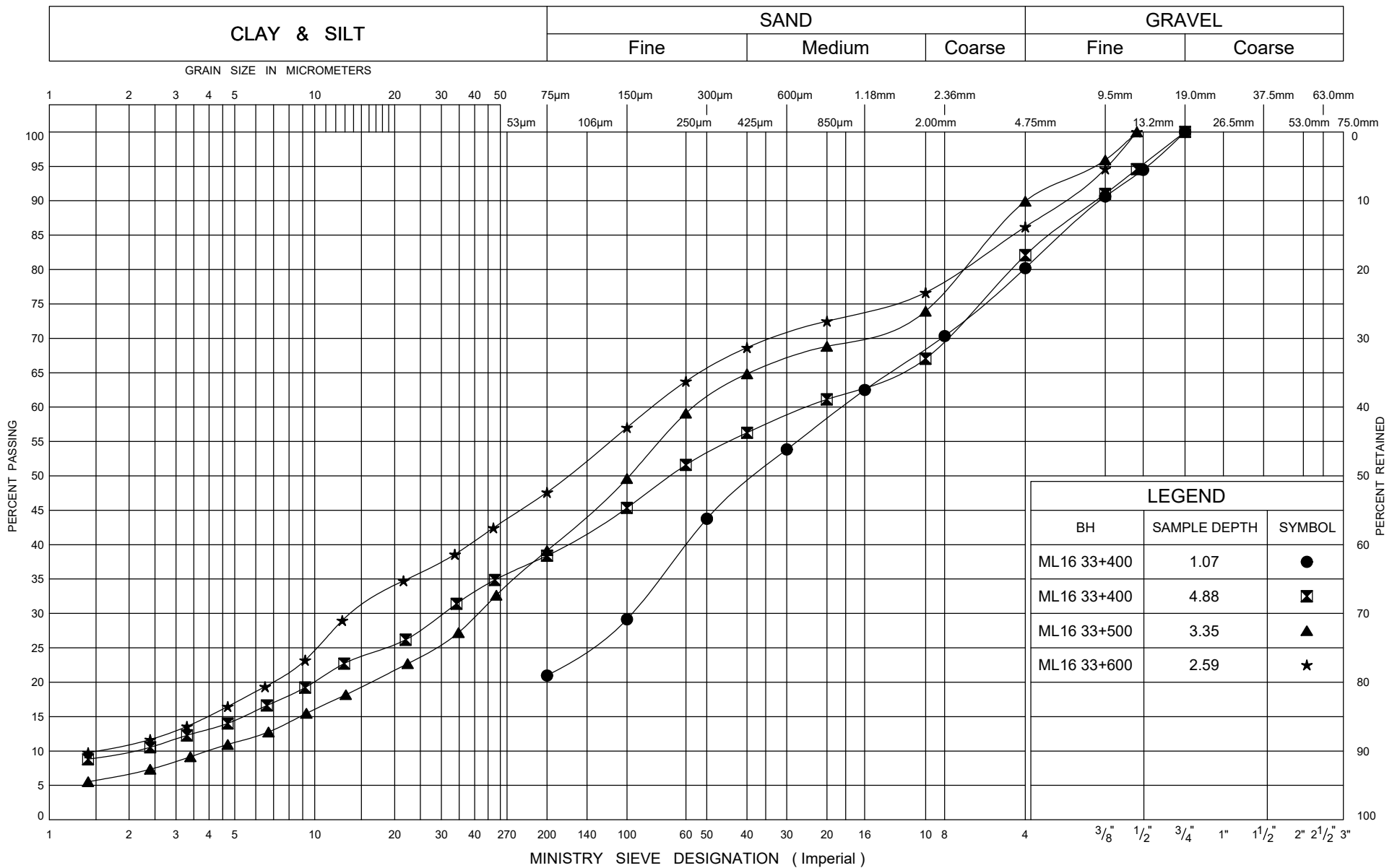
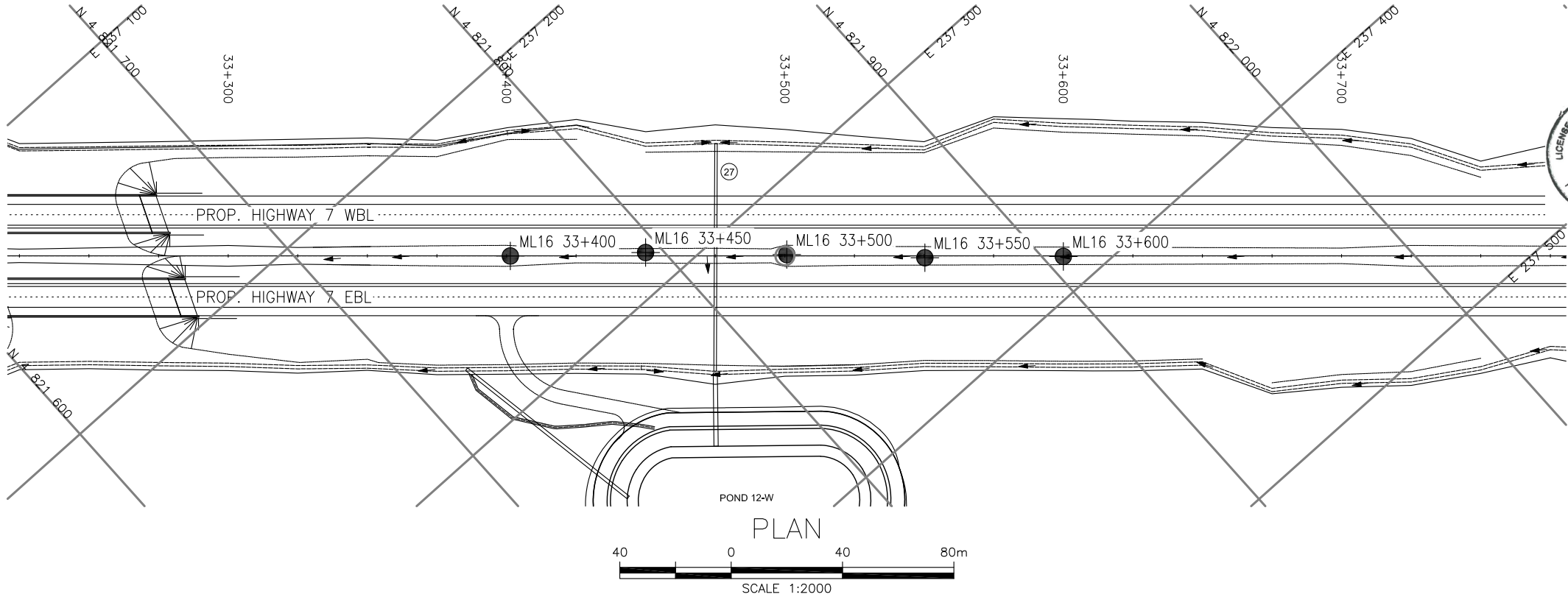




FIG No C6
GWP 408-88-00





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

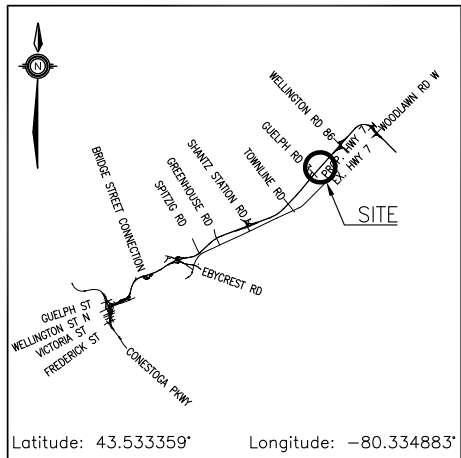


CONT No
GWP No 408-88-00

HIGHWAY 7
MAINLINE FILL
33+400 TO 33+600
BOREHOLE LOCATIONS AND SOIL STRATA



THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

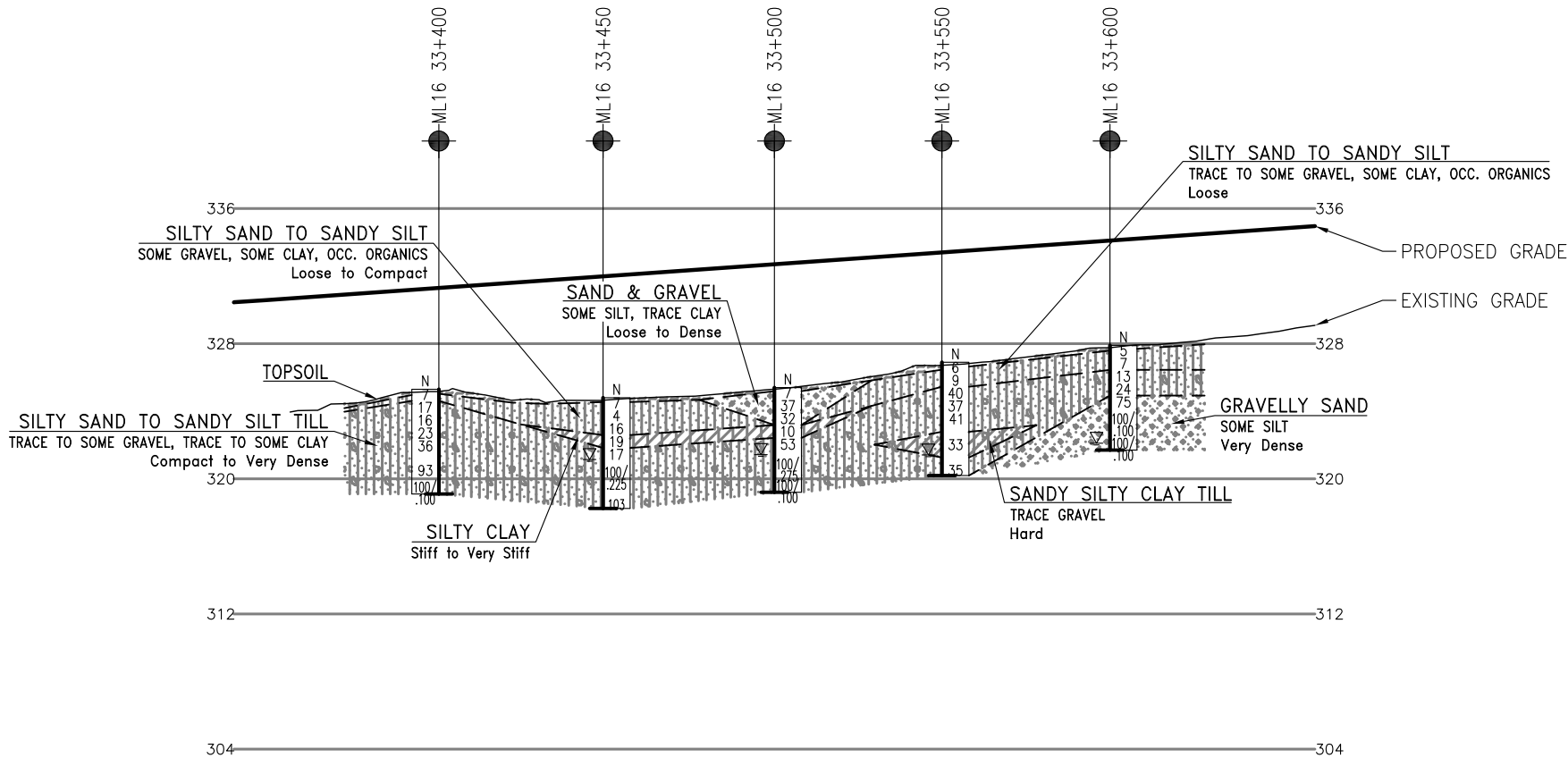
	Borehole (Current Investigation)
	Borehole (2008 Investigation)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
ML16 33+400	325.3	4 821 757.9	237 255.5
ML16 33+450	324.8	4 821 794.9	237 287.0
ML16 33+500	325.4	4 821 832.2	237 321.3
ML16 33+550	326.9	4 821 868.4	237 355.3
ML16 33+600	327.9	4 821 905.8	237 388.1

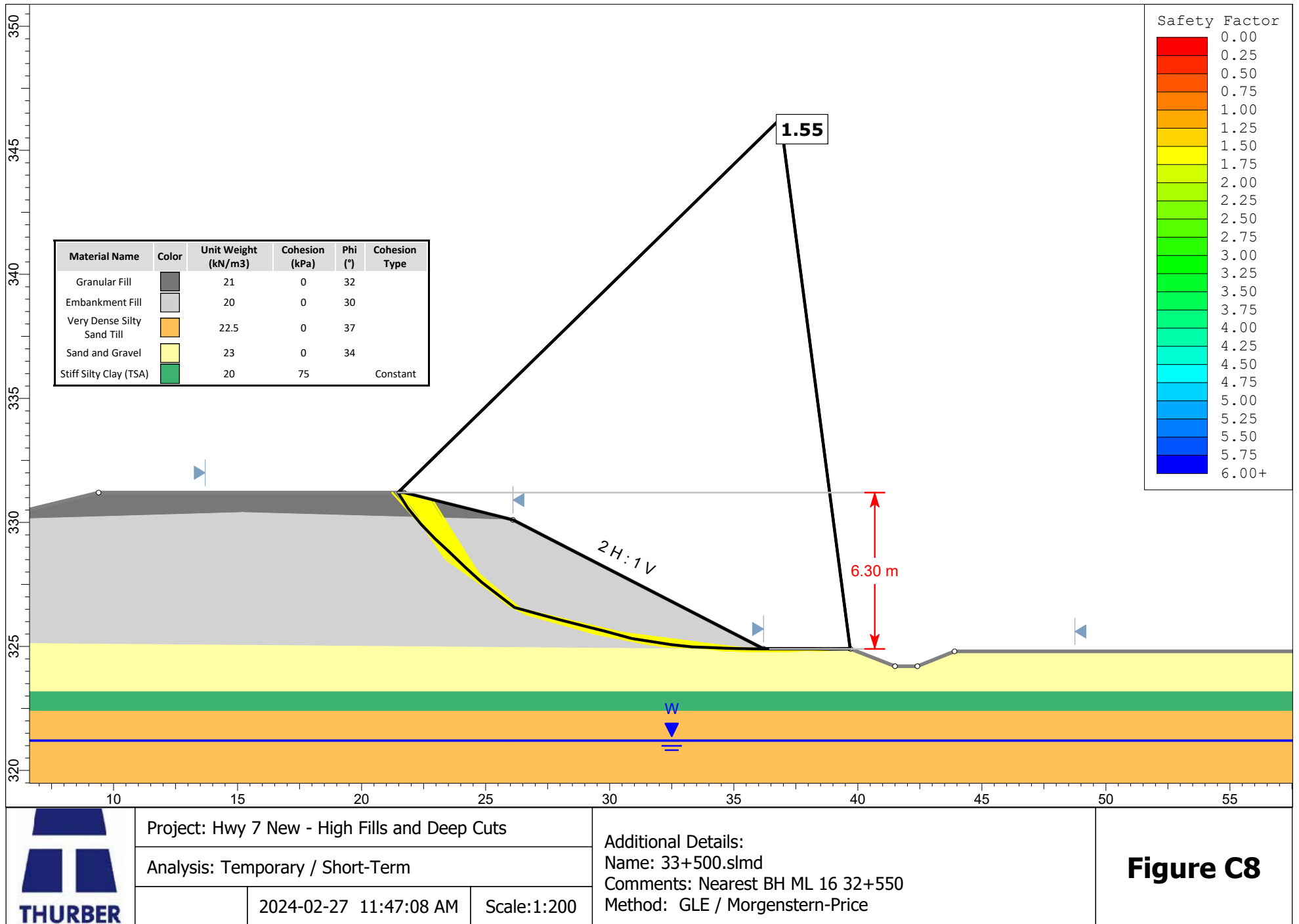
-NOTES-

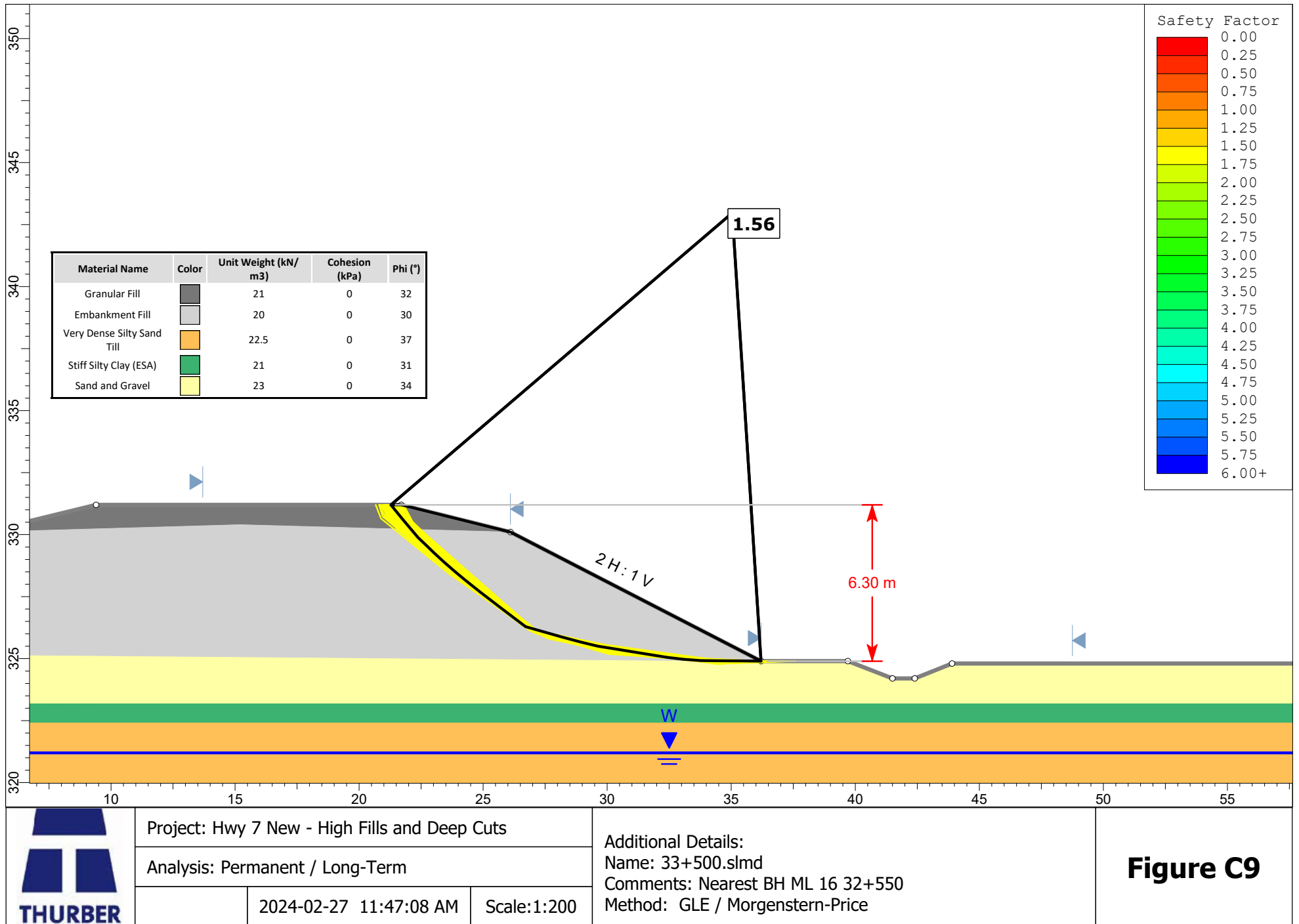
- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- Coordinate system is MTM NAD 83 Zone 10.

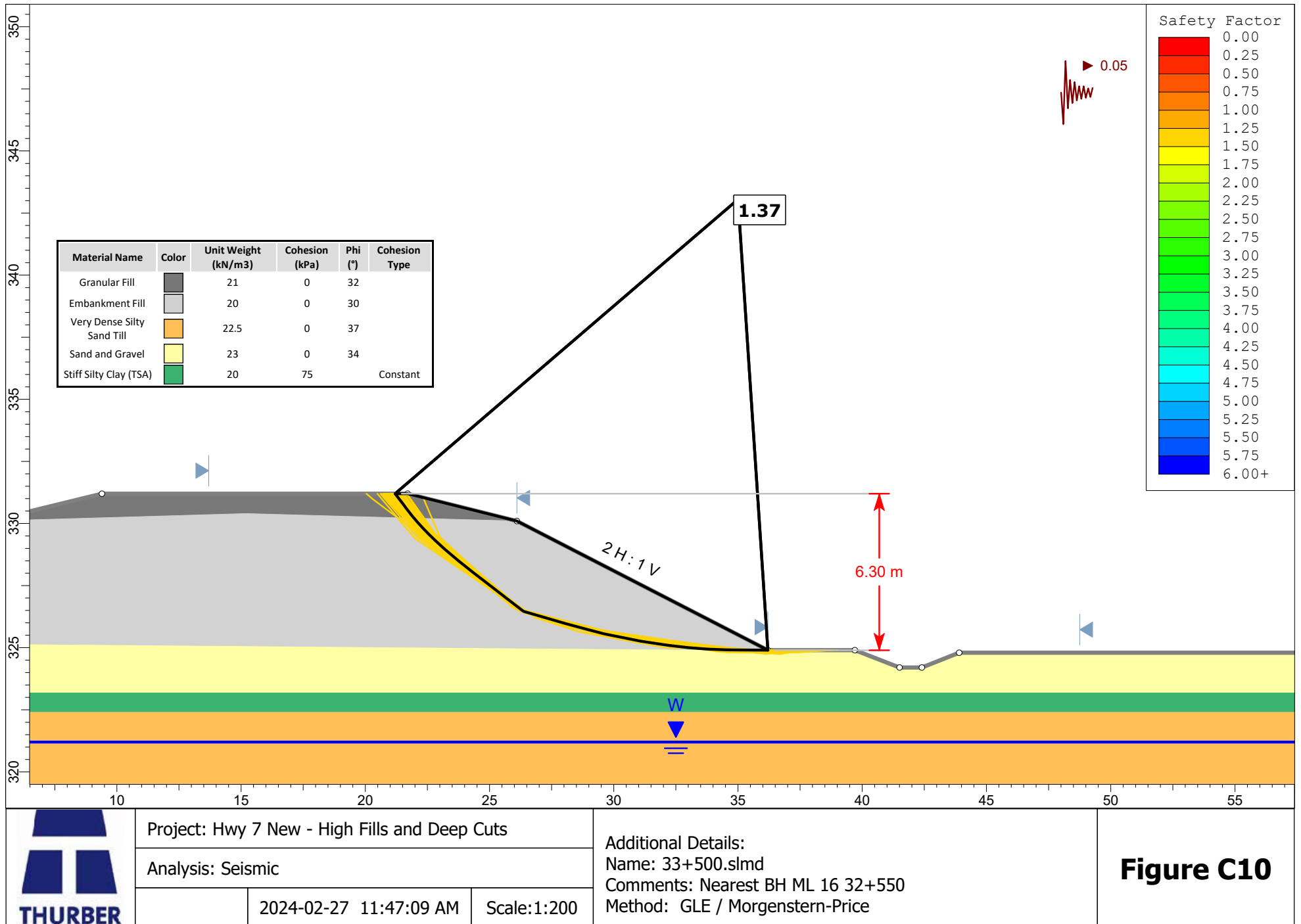
GEOCRES No. 40P09-068



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	MKE	CHK	PKC
DRAWN	MFA	CHK	MKE
SITE	STRUCT	DWG	1









Appendix D.

Highway 7: Station 33+800 – 34+150 (08-202, ML16 33+800, ML16 33+850, ML16 33+900, ML16 33+950, ML16 34+000, ML16 34+050, ML16 34+100, ML16 34+150)

RECORD OF BOREHOLE No 08-202

1 OF 1

METRIC

GWP# 408-88-00 LOCATION N 4 822 264.1 E 237 718.0 ORIGINATED BY LH
 DIST HWY 7 - New BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2008.11.28 - 2008.11.28 LATITUDE LONGITUDE CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
345.5	GROUND SURFACE							20	40	60	80	100	PLASTIC LIMIT W P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W L	
0.0	TOPSOIL (500mm)		1	SS	8											
345.0							345									
0.5	Sandy SILT , trace to some clay, trace gravel, occasional organics, rootlets, occasional cobbles Compact to Very Dense Brown to Grey Moist to Wet (TILL)		2	SS	23											
							344									
			3	SS	60											
			4	SS	100/ 0.150		343									
	Layer of clayey silt		5	SS	55		342									5 42 39 14
							341									
			6	SS	100/ 0.150											
							340									
			7	SS	100/ 0.075		339									7 43 38 12
							338									
337.7			8	SS	100/0.125											
7.7	END OF BOREHOLE AT 7.7m. BOREHOLE BACKFILLED WITH BENTONITE AND AUGER CUTTINGS TO SURFACE.															

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RECORD OF BOREHOLE No ML16 33+800

1 OF 1

METRIC

GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 822 054.4 E 237 520.7 ORIGINATED BY JB
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.11.21 - 2016.11.21 LATITUDE 43.535384 LONGITUDE -80.332443 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT						UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE								
339.2	GROUND SURFACE							20	40	60	80	100	PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	
0.0	TOPSOIL: (150mm)												W P	W	W L	
0.2	Sandy SILT , some clay, trace gravel, trace organics Loose to Compact Brown Moist		1	SS	8		339							○		
			2	SS	12									○		
							338							○		
337.8																
1.4	Sandy SILT , some clay, trace to some gravel Compact to Very Dense Brown Moist (TILL)		3	SS	24									○		
			4	SS	53		337							○		
			5	SS	74		336							○		
							335									
			6	SS	103/ 0.250											
							334									
	Auger grinding at 5.8m															
332.9			7	SS	113/ 0.200		333							○		
6.3	END OF BOREHOLE AT 6.3m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH AUGER CUTTINGS TO SURFACE.				0.200											

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RECORD OF BOREHOLE No ML16 33+850

1 OF 2

METRIC

GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 822 087.6 E 237 555.9 ORIGINATED BY JB
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.11.21 - 2016.11.21 LATITUDE 43.535686 LONGITUDE -80.332012 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								20 40 60 80 100		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			
343.8	GROUND SURFACE												
0.0	TOPSOIL: (150mm)												
0.2	Sandy Silty CLAY , trace gravel Stiff to Hard Brown Moist (TILL)		1	SS	10								
			2	SS	19								
			3	SS	15								
			4	SS	30								
			5	SS	31								
339.8													
4.0	Sandy SILT , some clay, trace gravel Very Dense Brown Moist (TILL)		6	SS	70								
			7	SS	58								
			8	SS	102								
334.4			9	SS	106/								
9.4	END OF BOREHOLE AT 9.4m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH				0.250								

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No ML16 33+850

2 OF 2

METRIC

GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 822 087.6 E 237 555.9 ORIGINATED BY JB
DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
DATUM Geodetic DATE 2016.11.21 - 2016.11.21 LATITUDE 43.535686 LONGITUDE -80.332012 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
	Continued From Previous Page AUGER CUTTINGS TO SURFACE.													

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RECORD OF BOREHOLE No ML16 33+900

1 OF 2

METRIC

GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 822 126.1 E 237 589.2 ORIGINATED BY JB
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.11.22 - 2016.11.23 LATITUDE 43.536036 LONGITUDE -80.331604 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								20 40 60 80 100					
349.1	GROUND SURFACE												
0.0	TOPSOIL: (150mm)												
0.2	Sandy SILT , some clay, trace gravel, trace organics		1	SS	7								
348.5	Loose Brown												
0.7	Moist												
	Sandy SILT , some clay, trace gravel, occasional cobbles Compact to Very Dense Brown to Grey Moist to Wet (TILL)		2	SS	28								
			3	SS	51								
			4	SS	23								
			5	SS	52								
			6	SS	102								
			7	SS	37								
			8	SS	36								
			9	SS	113								
	</												

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No ML16 33+900

2 OF 2

METRIC

GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 822 126.1 E 237 589.2 ORIGINATED BY JB
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.11.22 - 2016.11.23 LATITUDE 43.536036 LONGITUDE -80.331604 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED	+ FIELD VANE								
								● QUICK TRIAXIAL	× LAB VANE								
	Continued From Previous Page						20	40	60	80	100						
	Sandy SILT , some clay, trace gravel, occasional cobbles Compact to Very Dense Grey Wet (TILL)		10	SS	100												
			11	SS	101												
336.0																	
13.2	Sandy Silty CLAY , trace gravel Very Stiff Grey Moist (TILL)		12	SS	24												
335.0																1 31 36 32	
14.2	END OF BOREHOLE AT 14.2m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 3.0m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2018.05.02 5.3 343.8																

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RECORD OF BOREHOLE No ML16 33+950

1 OF 1

METRIC

GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 822 166.6 E 237 622.6 ORIGINATED BY JB
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.11.23 - 2016.11.23 LATITUDE 43.536403 LONGITUDE -80.331196 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)						
								20 40 60 80 100				W P W W L						
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
349.4	GROUND SURFACE																	
0.0	TOPSOIL: (200mm)																	
0.2	Sandy SILT , some clay, trace gravel, trace organics		1	SS	5		349						○			4 40 41 15		
348.8	Loose Brown																	
0.7	Moist																	
	Sandy SILT , some clay, trace gravel Compact to Very Dense		2	SS	28		348						○					
	Brown																	
	Moist																	
	(TILL)		3	SS	34								○					
			4	SS	33		347						○					
			5	SS	106		346						○			6 38 42 14		
							345											
			6	SS	132								○					
							344											
343.2			7	SS	98/													
6.2	END OF BOREHOLE AT 6.2m. BOREHOLE DRY UPON COMPLETION.				.100													

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RECORD OF BOREHOLE No ML16 34+000

1 OF 1

METRIC

GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 822 202.7 E 237 654.7 ORIGINATED BY TM
DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
DATUM Geodetic DATE 2016.12.01 - 2016.12.01 LATITUDE 43.536731 LONGITUDE -80.330803 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT						UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							
								20 40 60 80 100							
344.7	GROUND SURFACE														
0.0	TOPSOIL: (200mm)														
0.2	Sandy SILT , trace clay, trace gravel, trace organics Loose to Compact Brown Moist		1	SS	5		344								
			2	SS	13										
343.3															
1.4	Silty SAND , trace clay Loose to Compact Brown Moist (TILL)		3	SS	22		343								
			4	SS	21		342								0 52 42 6
			5	SS	21										
							341								
			6	SS	24		340								
339.1															
5.6	Silty SAND , trace clay Compact Brown Moist		7	SS	20		339								0 70 25 5
338.1															
6.6	END OF BOREHOLE AT 6.6m. BOREHOLE CAVED TO 4.7m AND WATER LEVEL AT 5.9m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.														

ONTMT452 2020LIBRARY(MTO) - COPY.GLB MTO-11375(GINTDATA).GPJ 7/28/23

RECORD OF BOREHOLE No ML16 34+050

1 OF 1

METRIC

GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 822 237.4 E 237 684.0 ORIGINATED BY TM
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.12.01 - 2016.12.01 LATITUDE 43.537046 LONGITUDE -80.330445 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										
345.2	GROUND SURFACE							20	40	60	80	100						
0.0	TOPSOIL: (150mm)																	
0.2	Sandy SILT , some clay, trace gravel, occasional organics		1	SS	14													
344.5	Compact Brown																	
0.7	Moist																	
	Sandy SILT , some clay, trace gravel, occasional cobbles Compact to Very Dense Brown Moist to Wet (TILL)		2	SS	36													
			3	SS	24													
			4	SS	68													
			5	SS	110/ 0.225													
			6	SS	100/ 0.250													
340.2																		
5.0	END OF BOREHOLE AT 5.0m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.5m slotted screen.																	
	WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2018.05.02 0.3 344.9																	

ONTMT452 2020LIBRARY(MTO) - COPY.GLB MTO-11375(GINTDATA).GPJ 7/28/23

RECORD OF BOREHOLE No ML16 34+100

1 OF 1

METRIC

GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 822 279.1 E 237 720.5 ORIGINATED BY TM
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.12.01 - 2016.12.01 LATITUDE 43.537424 LONGITUDE -80.329999 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
345.9	GROUND SURFACE							20	40	60	80	100							
0.0	Sandy SILT , some clay, trace gravel, trace organics Loose Brown Moist		1	SS	5														
345.2																			
0.7	Silty SAND , some clay, some gravel, occasional cobbles Compact to Very Dense Brown Moist (TILL)		2	SS	20		345												
			3	SS	20		344												
			4	SS	14		343												11 41 33 15
			5	SS	37		342												
							341												
			6	SS	74		340												
							339												
338.8																			
7.1	Silty SAND , some gravel Dense Brown Wet		8	SS	40		338												20 63 17 (SI+CL)
337.8																			
8.1	END OF BOREHOLE AT 8.1m. BOREHOLE CAVED TO 7.5m AND WATER LEVEL AT 7.5m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE AND AUGER CUTTINGS TO SURFACE.																		

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No ML16 34+150

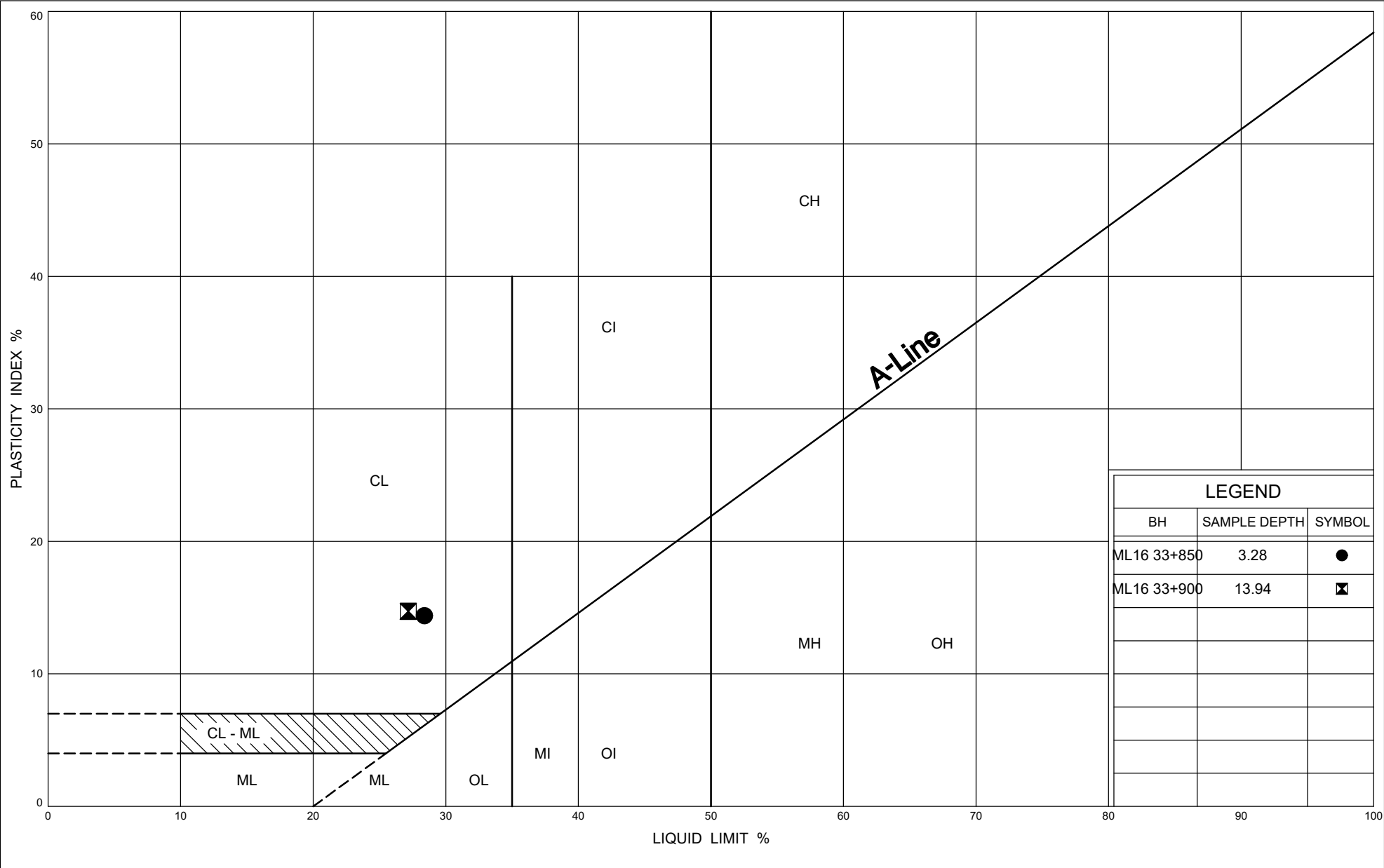
1 OF 1

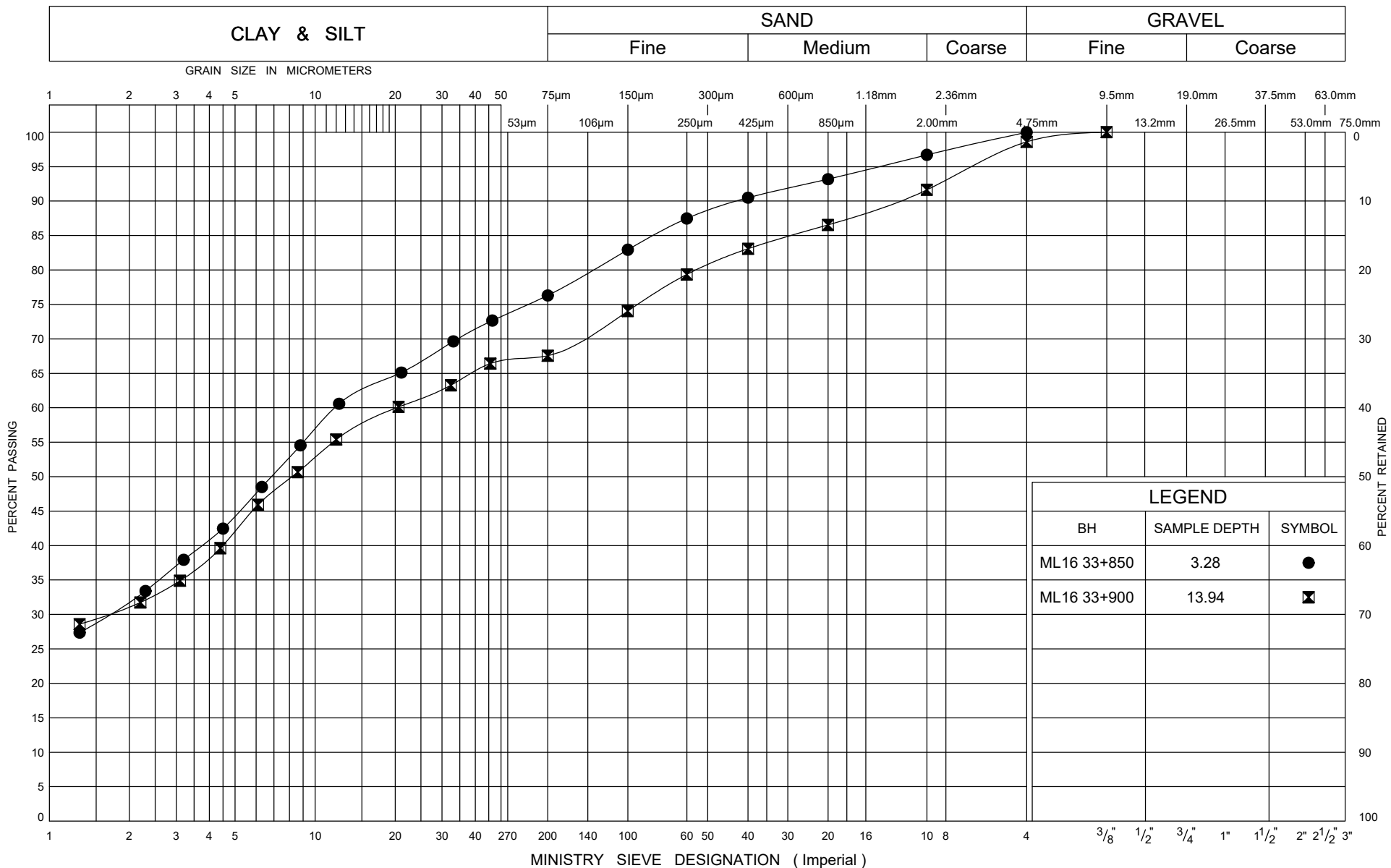
METRIC

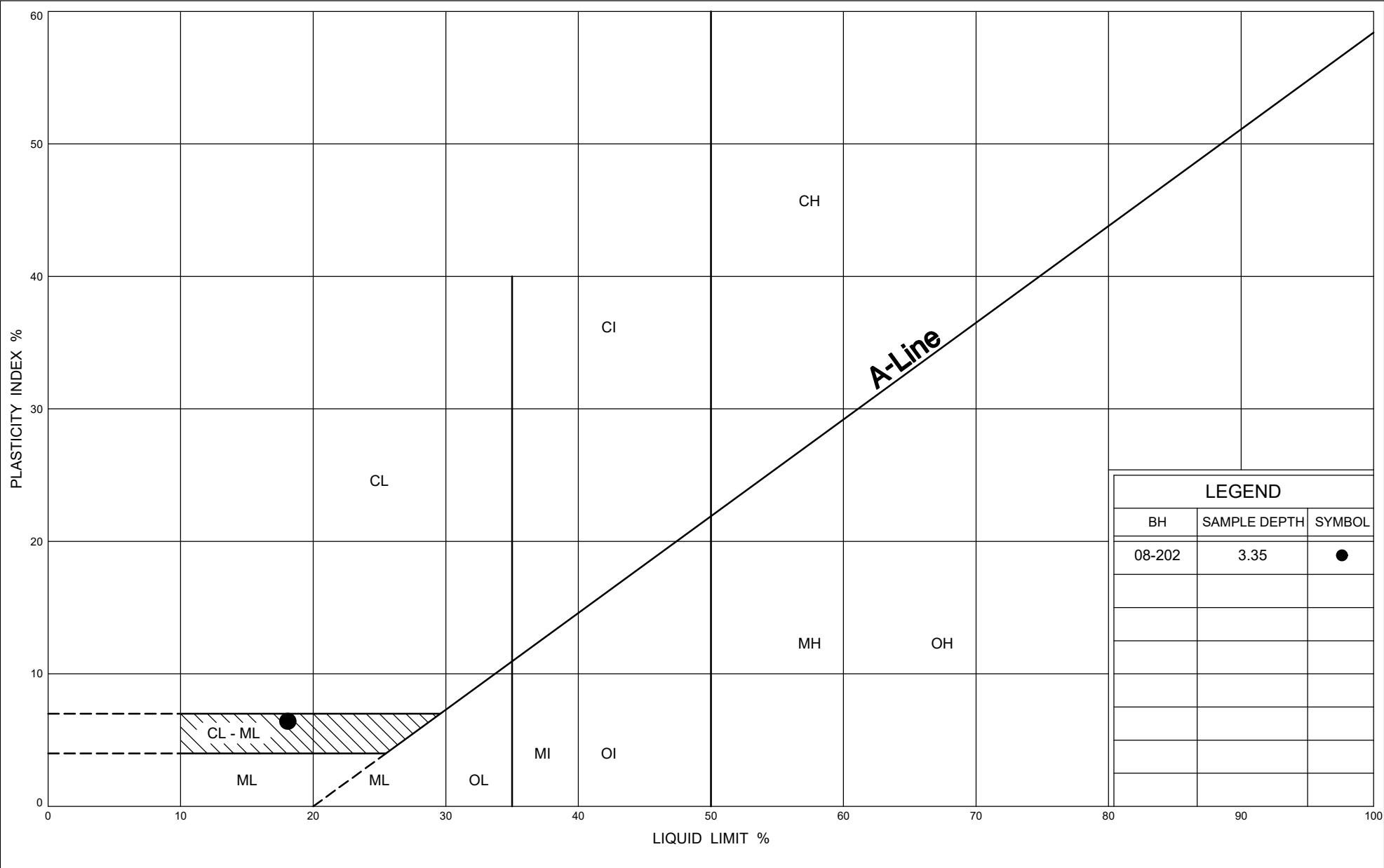
GWP# 408-88-00 LOCATION Mainline, MTM NAD 83 Zone 10: N 4 822 317.1 E 237 756.1 ORIGINATED BY TM
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.12.01 - 2016.12.01 LATITUDE 43.537770 LONGITUDE -80.329563 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
345.5	GROUND SURFACE							20	40	60	80	100					
0.0	Sandy SILT , some clay, trace gravel, trace organics Loose Brown Moist		1	SS	7		345							○			
			2	SS	6									○			
344.1							344							○			
1.4	Sandy SILT , some clay, trace gravel, occasional cobbles Compact to Very Dense Brown Moist (TILL)		3	SS	30		343							○			
			4	SS	35									○			
			5	SS	29		342							○			
							341							○			
			6	SS	42		340										
340.0			7	SS	100/												
5.5	END OF BOREHOLE AT 5.5m ON AUGER REFUSAL. BOREHOLE DRY UPON COMPLETION.				0.050												

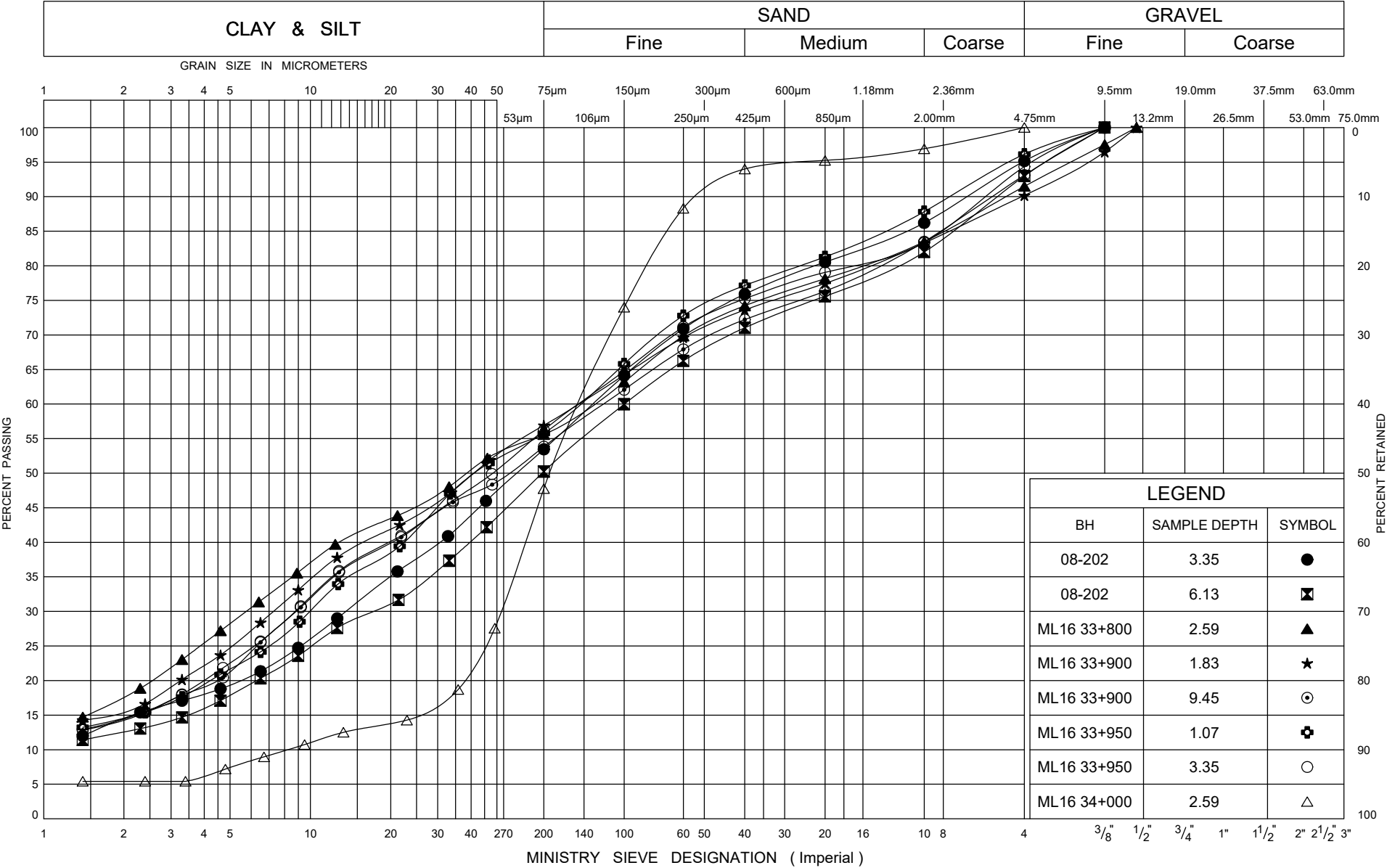
ONTMT452 2020LIBRARY(MTO) - COPY.GLB MTO-11375(GINTDATA).GPJ 7/28/23







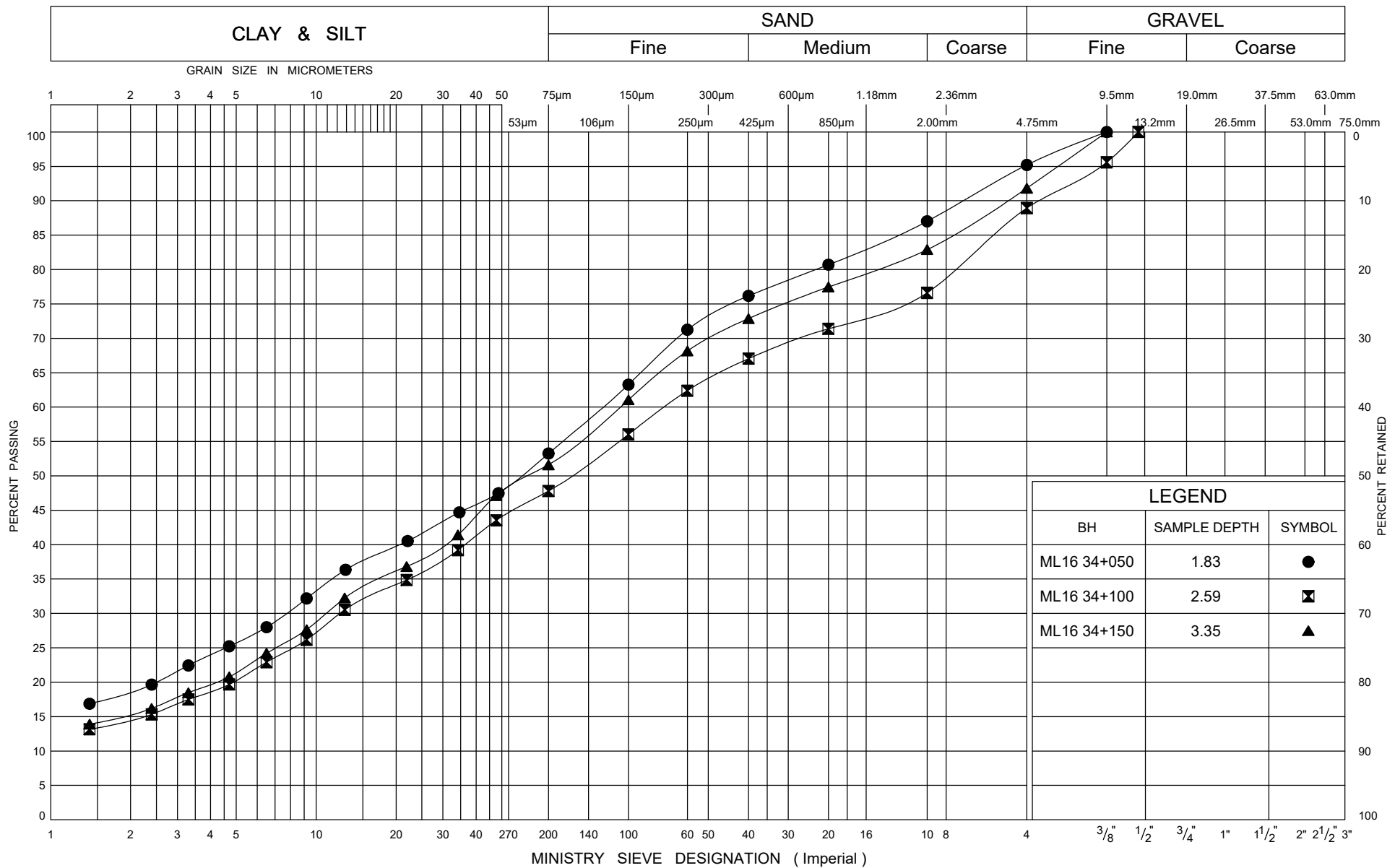
ONTARIO MOT GRAIN SIZE 3 MTO-11375(GINTDATA)\GPJ_ONTARIO MOT.GDT 7/21/23

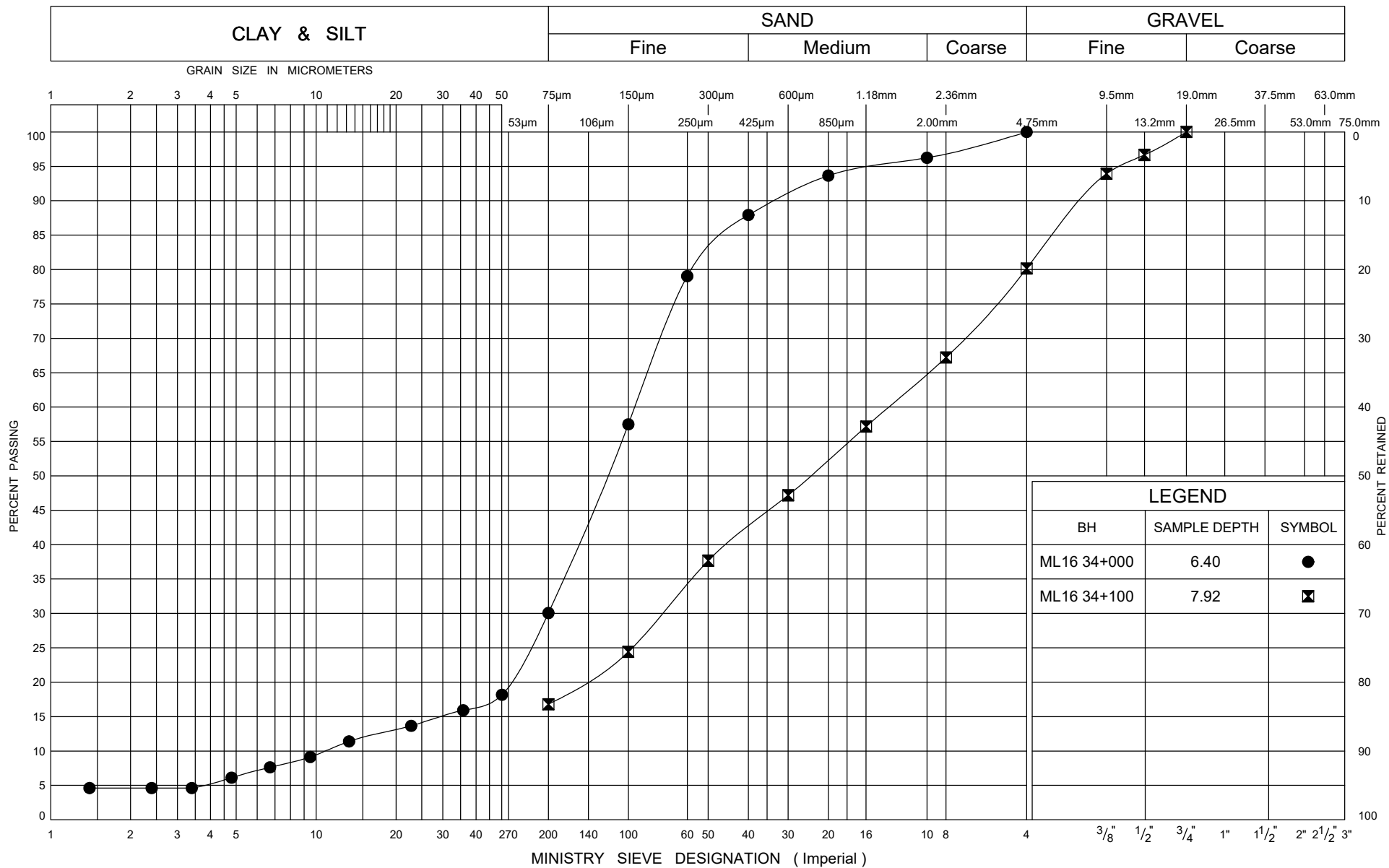


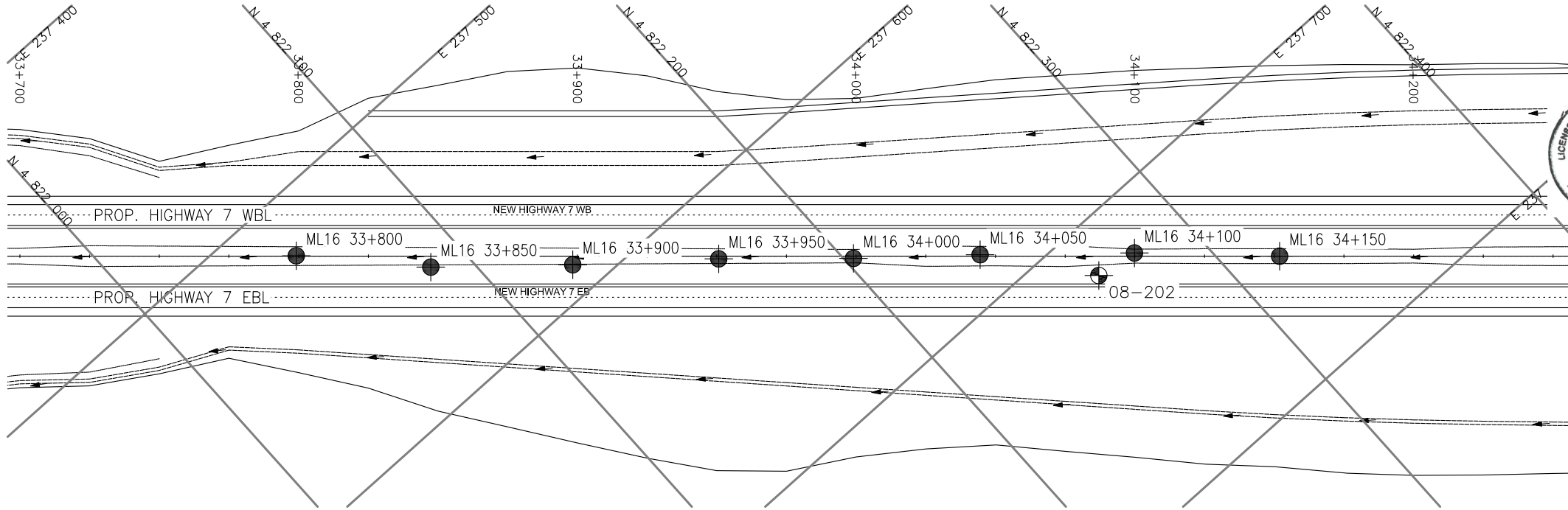
GRAIN SIZE DISTRIBUTION
Silty SAND to Sandy SILT TILL

FIG No D4
GWP 408-88-00

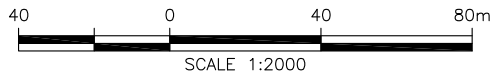
ONTARIO MOT GRAIN SIZE 3 MTO-11375(GINTDATA)\GPJ_ONTARIO MOT.GDT 7/21/23



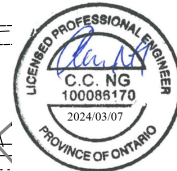




PLAN



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



CONT No
GWP No 408-88-00

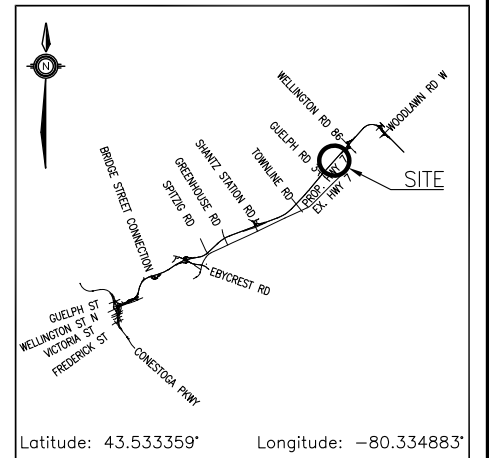
HIGHWAY 7
MAINLINE CUT
33+800 TO 34+150
BOREHOLE LOCATIONS AND SOIL STRATA



SHEET



THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

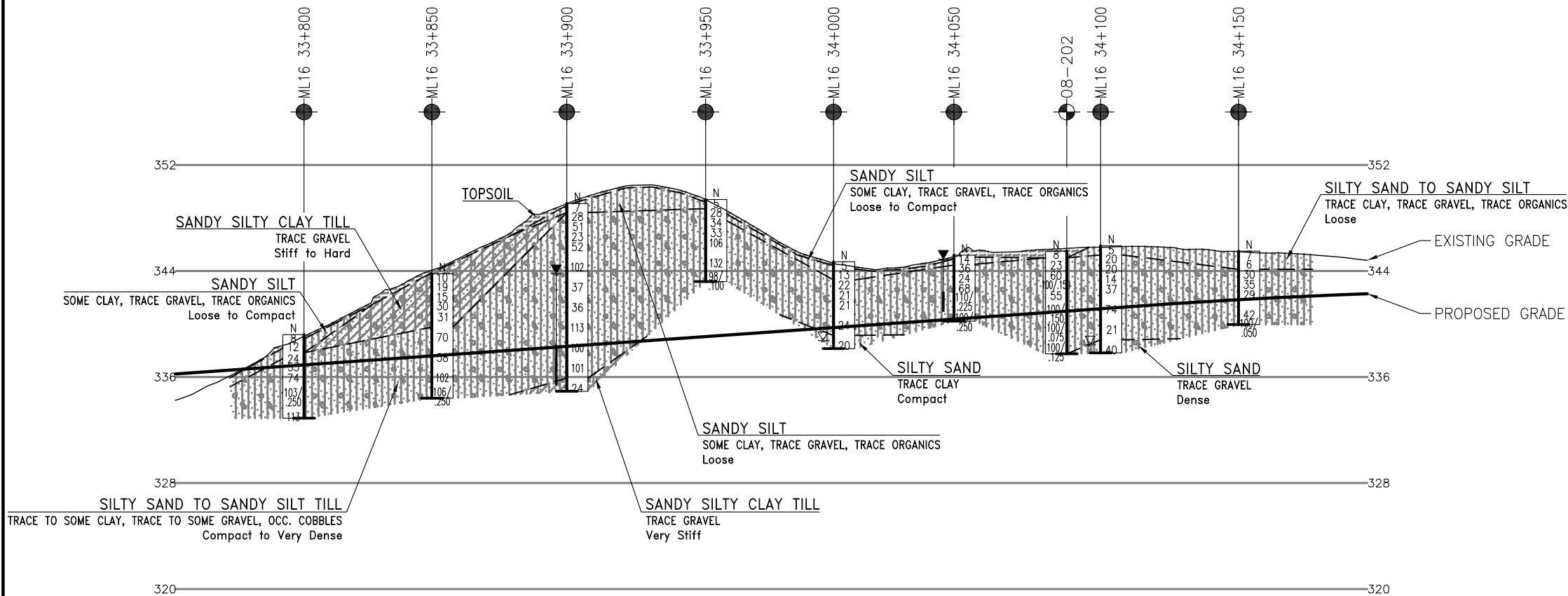
	Borehole (Current Investigation)
	Borehole (2008 Investigation)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
ML16 33+800	339.2	4 822 054.4	237 520.7
ML16 33+850	343.8	4 822 087.6	237 555.9
ML16 33+900	349.1	4 822 126.1	237 589.2
ML16 33+950	349.4	4 822 166.6	237 622.6
ML16 34+000	344.7	4 822 202.7	237 654.7
ML16 34+050	345.2	4 822 237.4	237 684.0
ML16 34+100	345.9	4 822 279.1	237 720.5
ML16 34+150	345.5	4 822 317.1	237 756.1
08-202	345.5	4 822 264.1	237 718.0

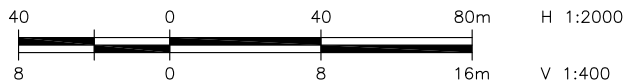
NOTES

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- Coordinate system is MTM NAD 83 Zone 10.

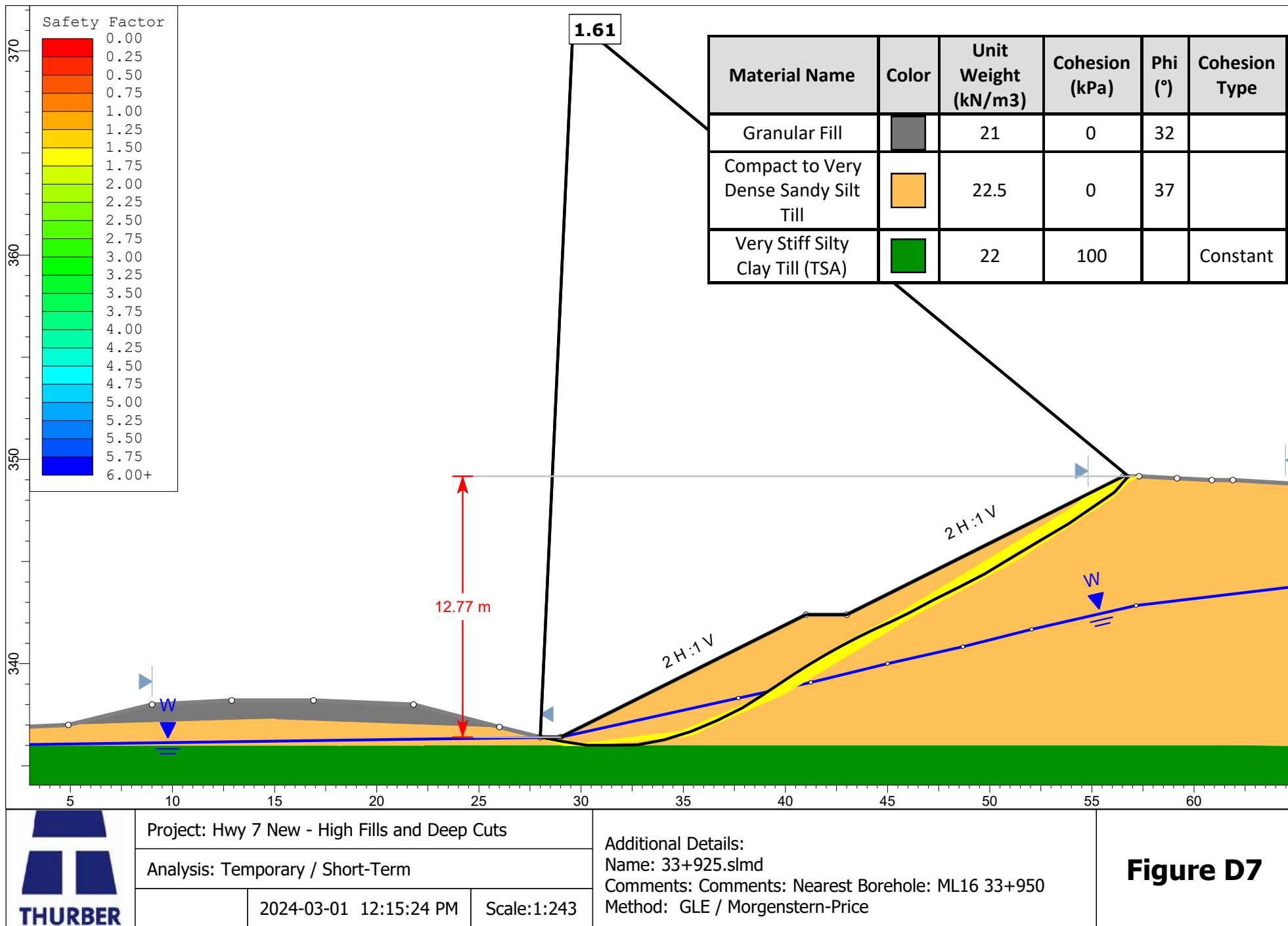
GEOCRES No. 40P09-068

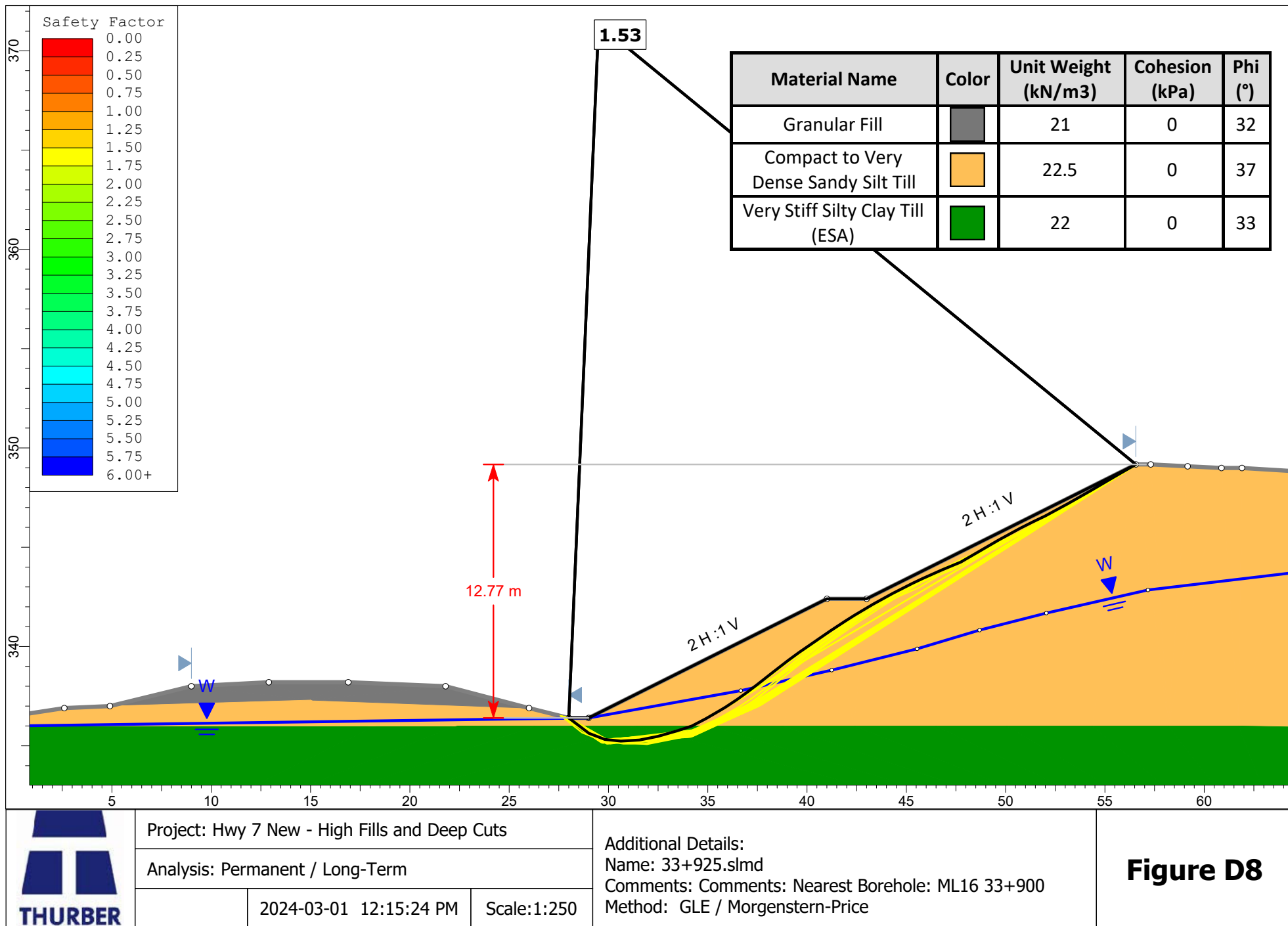


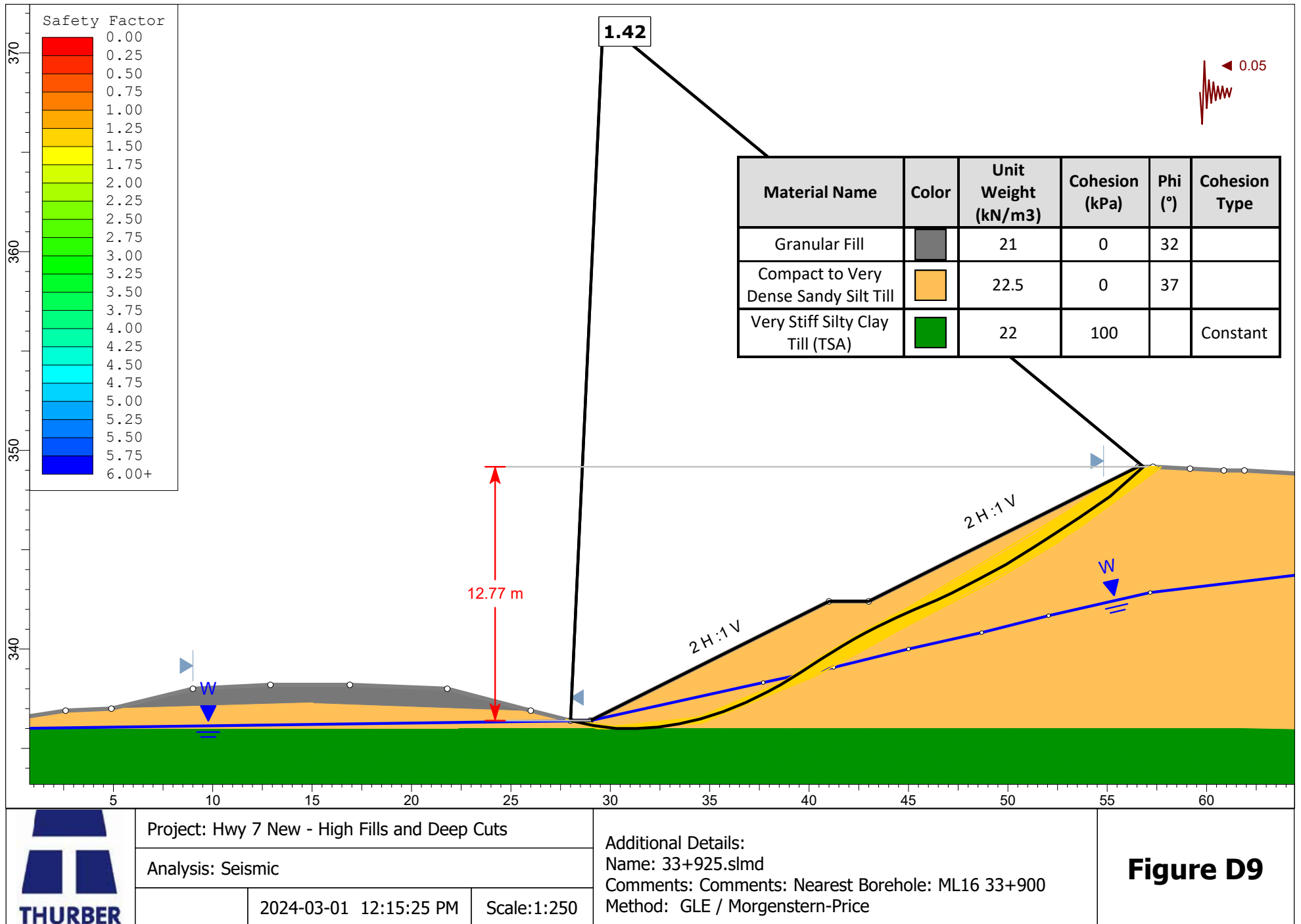
PROFILE ALONG PROPOSED HIGHWAY 7



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	MKE	CHK	PKC
DRAWN	MFA	CHK	MKE
LOAD	DATE	FEB 2024	
STRUCT	DWG	1	









Appendix E.

Highway 7: Station 34+950 – 35+100 (08-210, 08-212)

RECORD OF BOREHOLE No 08-210

1 OF 2

METRIC

GWP# 408-88-00 LOCATION N 4 822 888.3 E 238 314.2 ORIGINATED BY LH
DIST HWY 7 - New BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2008.11.27 - 2008.11.27 LATITUDE LONGITUDE CHECKED BY MEF

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									
347.6	GROUND SURFACE							20	40	60	80	100					
0.0	TOPSOIL: (500mm)		1	SS	8												
347.2																	
0.5	Sandy SILT , trace to some clay, trace gravel, occasional organics, occasional cobbles Compact to Very Dense Brown to Grey Moist to Wet (TILL)		2	SS	50/ 0.025		347										
			3	SS	23		346										
	Layer of sandy clayey silt		4	SS	100/ 0.050		345										6 31 50 13
			5	SS	100/ 0.050		344										
	Occasional cobbles and boulders		6	SS	100/ 0.075		343										
							342										
			7	SS	100/ 0.125		341										2 31 55 12
			8	SS	100/ 0.125		340										
							339										
338.4			9	SS	100/ 0.125												1 32 49 18
9.3	END OF BOREHOLE AT 9.3m. BOREHOLE OPEN AND DRY UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE AND AUGER				0.125												

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 08-210

2 OF 2

METRIC

GWP# 408-88-00 LOCATION N 4 822 888.3 E 238 314.2 ORIGINATED BY LH
DIST HWY 7 - New BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2008.11.27 - 2008.11.27 LATITUDE LONGITUDE CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
	Continued From Previous Page CUTTINGS TO THE SURFACE.							20 40 60 80 100						




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RECORD OF BOREHOLE No 08-212

1 OF 1

METRIC

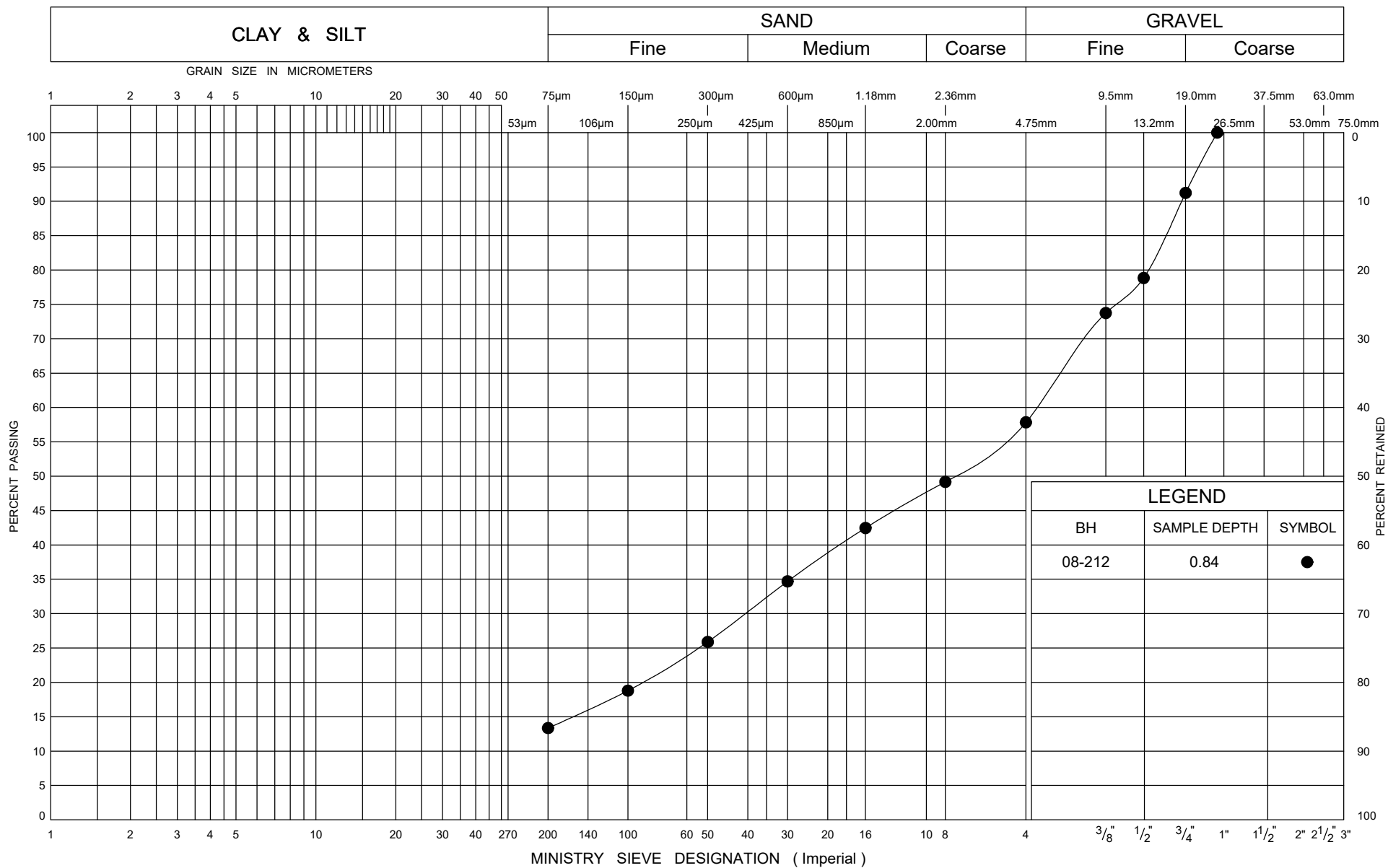
GWP# 408-88-00 LOCATION N 4 823 000.4 E 238 375.5 ORIGINATED BY SLL
 DIST HWY 7 - New BOREHOLE TYPE Hollow Stem Augers COMPILED BY WM
 DATUM Geodetic DATE 2008.05.21 - 2008.05.21 LATITUDE LONGITUDE CHECKED BY RPR

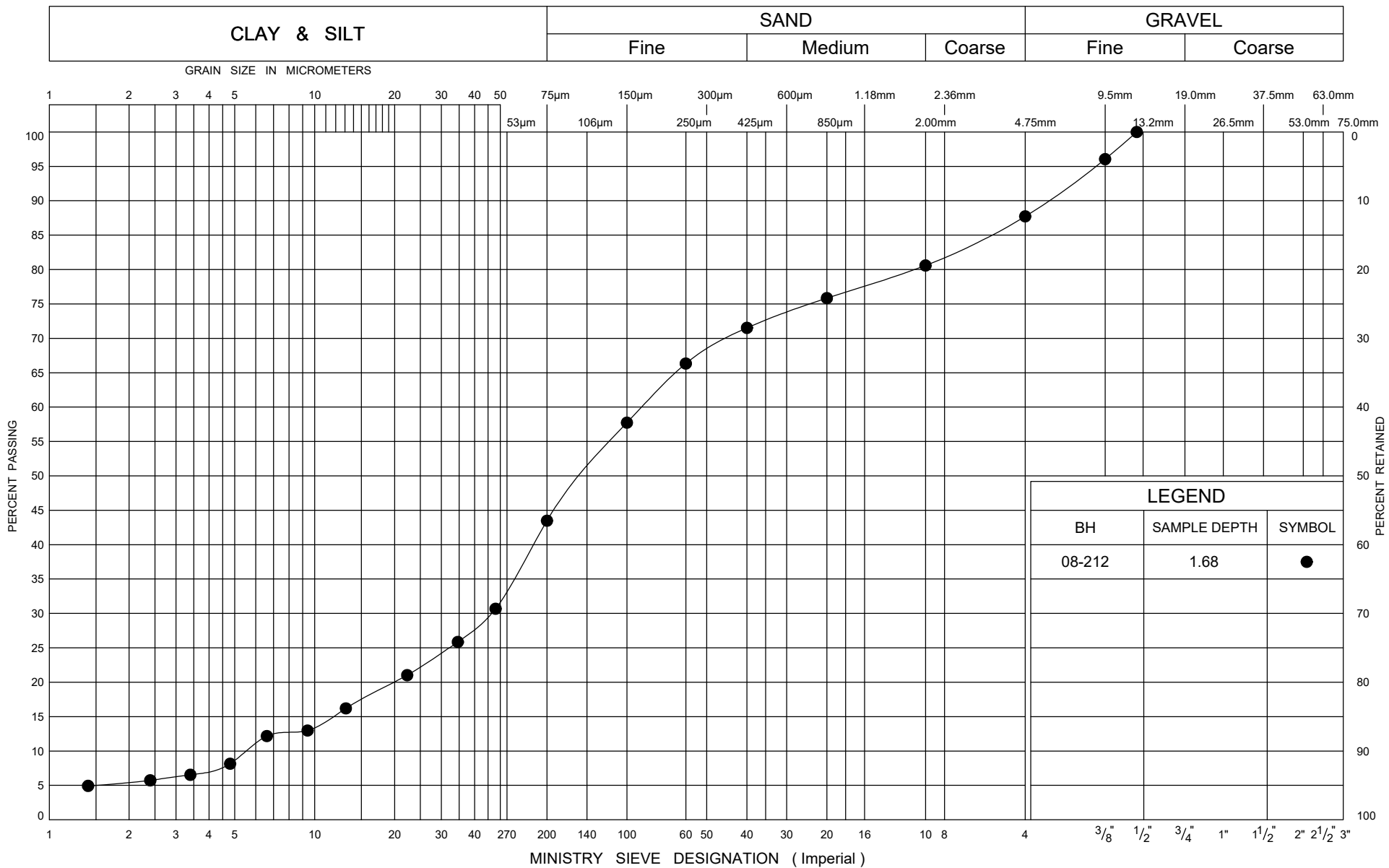
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)								
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa														
344.6	GROUND SURFACE							20	40	60	80	100										
0.0	SAND and GRAVEL Compact to Dense Brown Moist (FILL)		1	AS	-																	
			1	SS	38																	
			2	SS	23																	
342.5	Layer of silty sand fill Trace topsoil																					
2.1	Sandy SILT , trace to some clay, trace gravel Compact to Hard Brown to Grey Moist (TILL)		3	SS	18																	
			4	SS	21																	
			5	SS	100/ .125																	
			6	SS	100/ .125																	
337.2			7	SS	100/ .150																	
7.5	END OF BOREHOLE AT 7.5m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2008.05.21 Dry - 2008.05.27 1.8 342.8 2008.06.18 2.1 342.5																					

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE





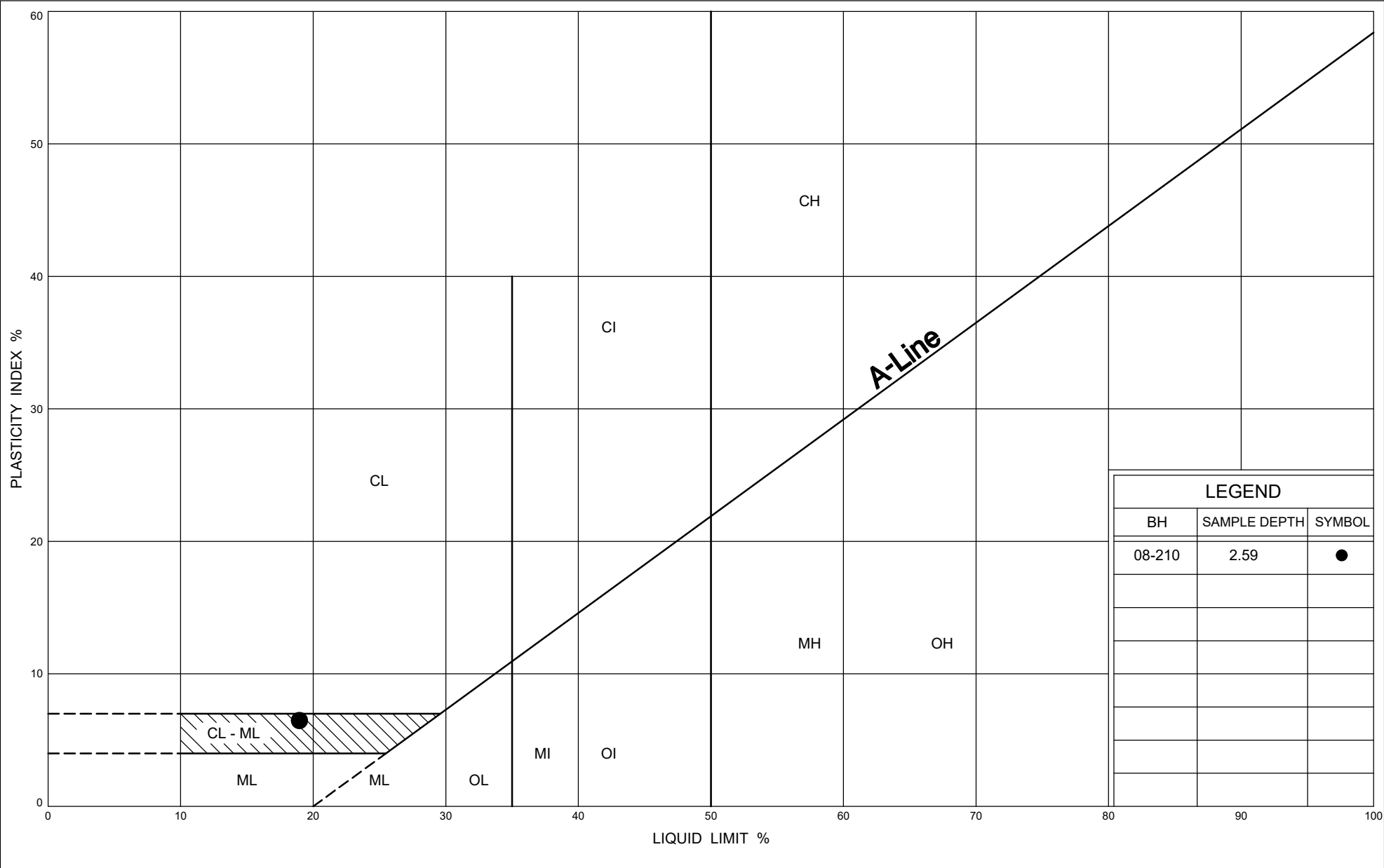
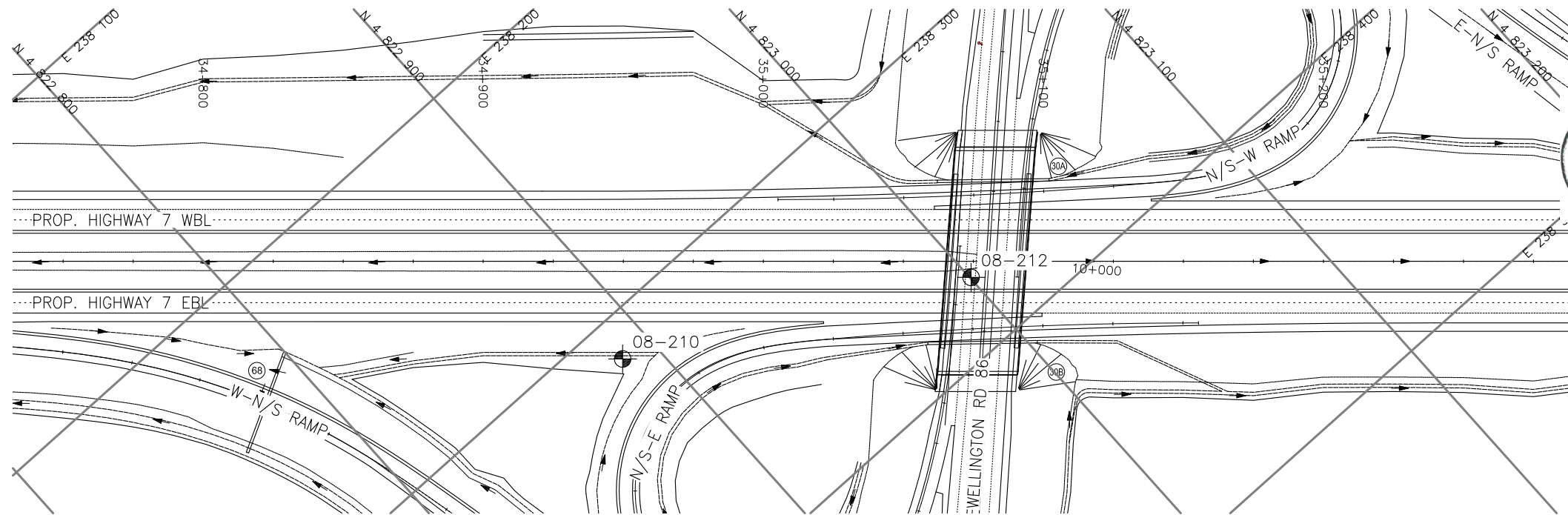
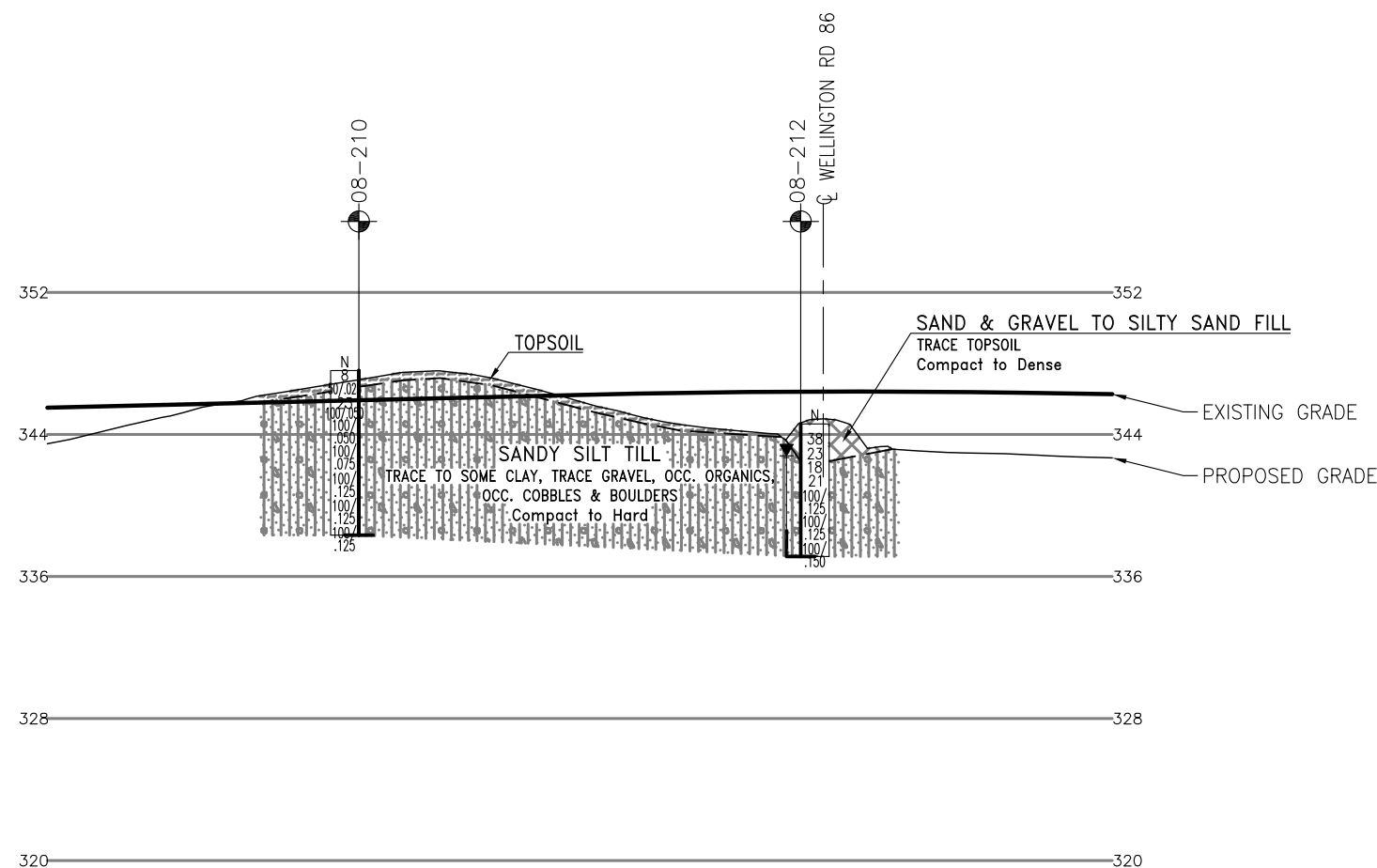




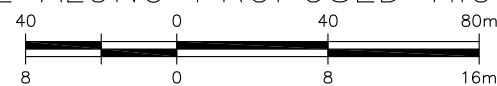
FIG No E4
GWP 408-88-00



PLAN



PROFILE ALONG PROPOSED HIGHWAY 7



H 1:2000

V 1:400

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

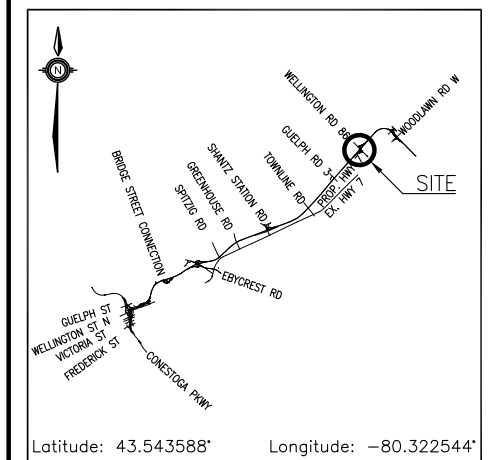


CONT No
GWP No 408-88-00

HIGHWAY 7
MAINLINE CUT
34+950 TO 35+100
BOREHOLE LOCATIONS AND SOIL STRATA



THURBER ENGINEERING LTD.








Latitude: 43.543588°

Longitude: -80.322544°

KEYPLAN

LEGEND

	Borehole (Current Investigation)
	Borehole (2008 Investigation)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

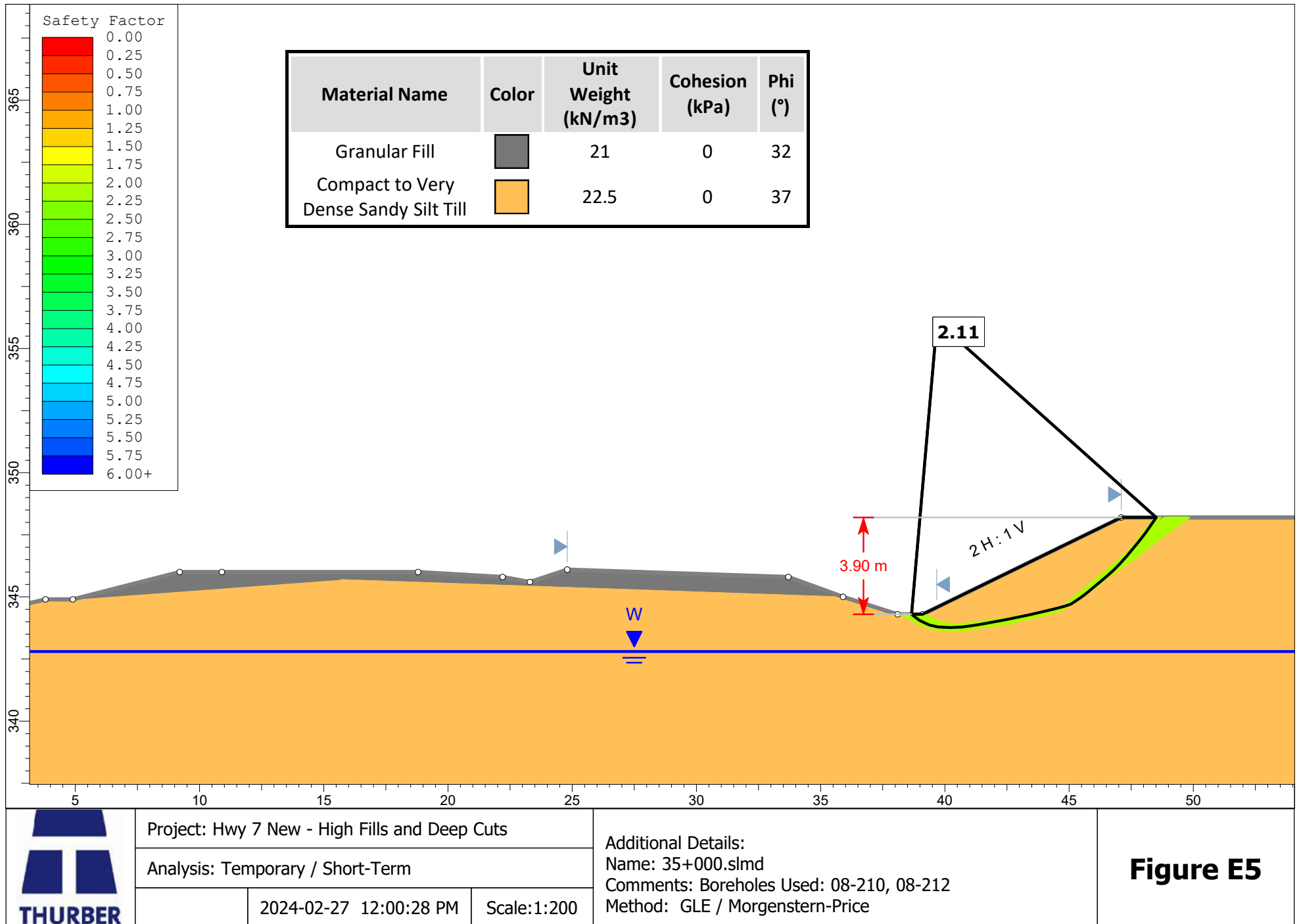
NO	ELEVATION	NORTHING	EASTING
08-210	347.6	4 822 888.3	238 314.2
08-212	344.6	4 823 000.4	238 375.5

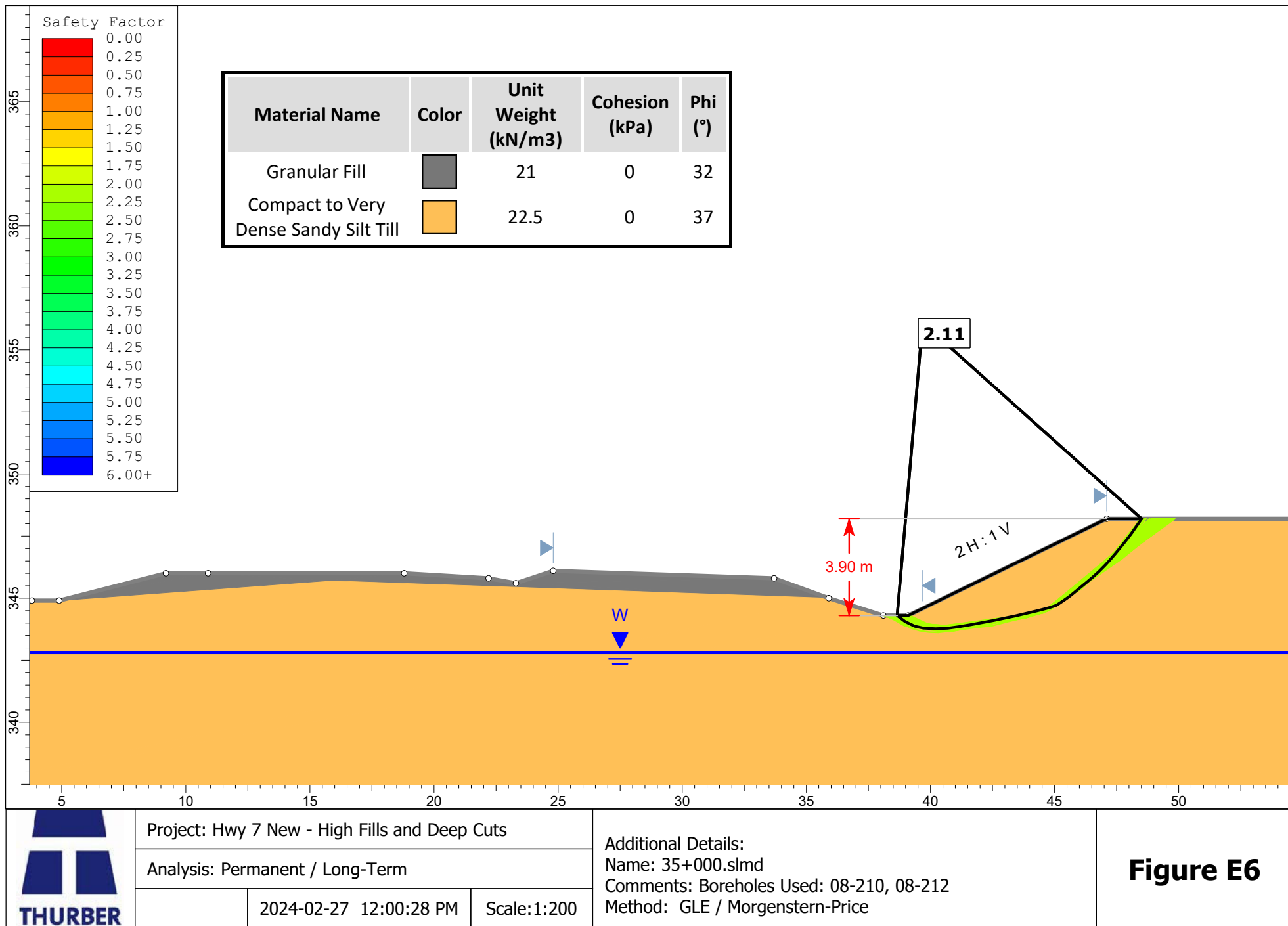
-NOTES-

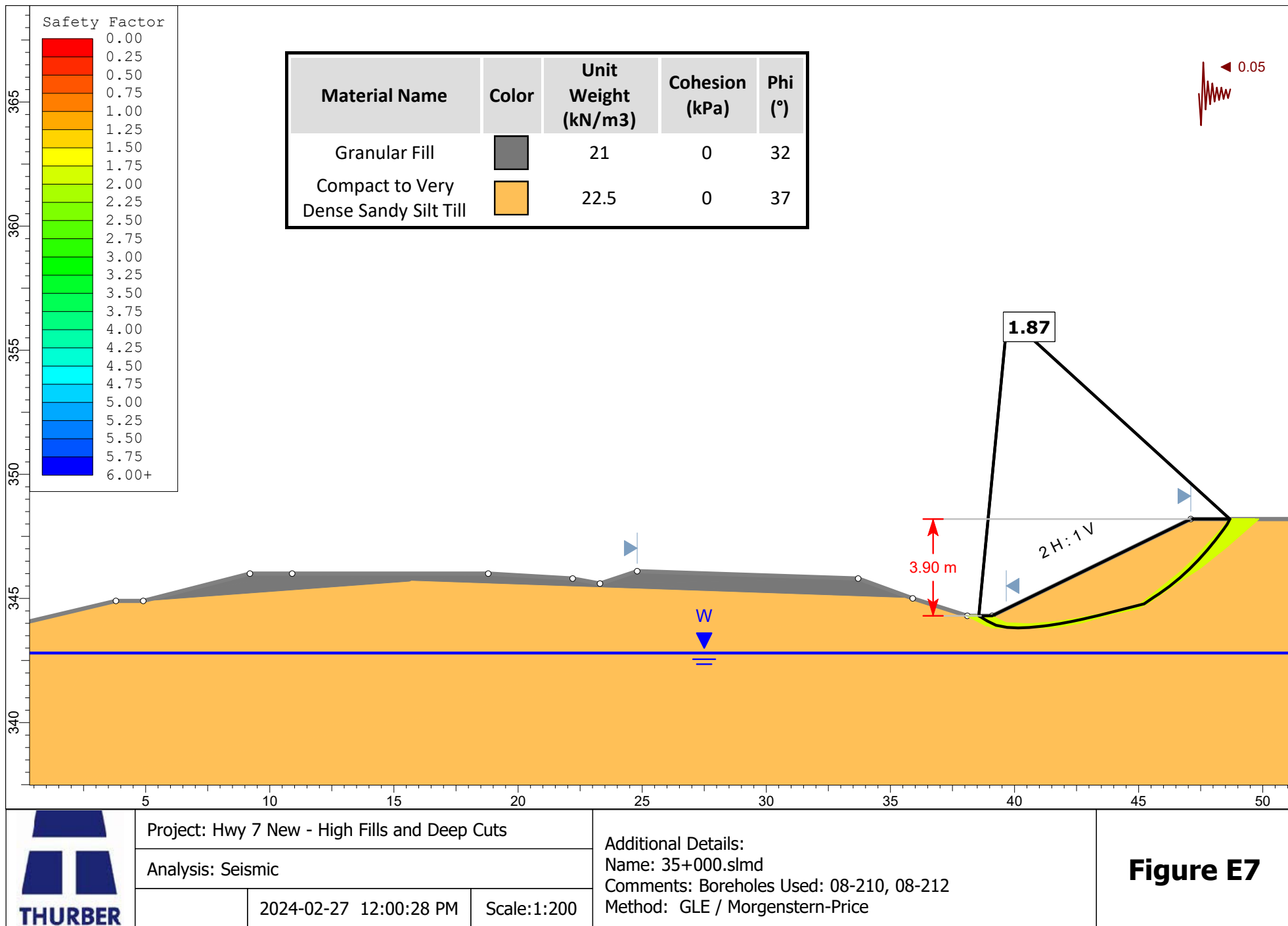
- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- 3) Coordinate system is MTM NAD 83 Zone 10.

GEOCRES No. 40P09-068

[illegible]









Appendix F.


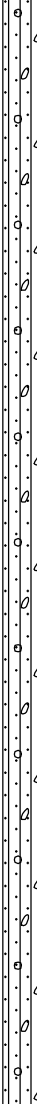
**Wellington County Road 86: Station 9+700 – 10+150 (CR16 09+700, CR16 09+750,
CR16 09+800, CR16 09+850, CR16 09+900, CR16 10+100, CR16 10+158)**

RECORD OF BOREHOLE No CR16 09+700

1 OF 2

METRIC

GWP# 408-88-00 LOCATION Wellington County Road 86, MTM NAD 83 Zone 10: N 4 823 230.5 E 238 172.9 ORIGINATED BY TM
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.12.06 - 2016.12.06 LATITUDE 43.546028 LONGITUDE -80.324518 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100						
341.1	GROUND SURFACE													
0.0	SAND and GRAVEL , trace silt, occasional cobbles Loose to Very Dense Brown Moist (FILL)		1	SS	59									
			2	SS	33									
			3	SS	9									
339.0														
2.1	Sandy SILT , some clay, trace gravel Compact to Very Dense Brown to Grey Moist (TILL)		4	SS	17									
			5	SS	17									
			6	SS	59									
			7	SS	60									
			8	SS	77									
331.5			9	SS	98									
9.6	END OF BOREHOLE AT 9.6m. OPEN BOREHOLE DRY UPON													

Continued Next Page

+³, ×³: Numbers refer to Sensitivity 20 15 10 5 0 (%) STRAIN AT FAILURE

2 OF 2

[illegible]

RECORD OF BOREHOLE No CR16 09+750

1 OF 1

METRIC

GWP# 408-88-00 LOCATION Wellington County Road 86, MTM NAD 83 Zone 10: N 4 823 194.7 E 238 207.9 ORIGINATED BY TM
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.12.06 - 2016.12.06 LATITUDE 43.545709 LONGITUDE -80.324081 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		WATER CONTENT (%)		
341.0	GROUND SURFACE													
0.0	SAND and GRAVEL , trace silt, occasional cobbles Compact to Very Dense Brown to Grey Moist (FILL)		1	SS	45									
			2	SS	69		340							
			3	SS	18		339							
			4	SS	30		338							
			5	SS	45									
336.9							337							
4.0	Sandy SILT , some clay, trace gravel, occasional cobbles Dense to Very Dense Grey Moist (TILL)		6	SS	34		336							10 35 41 14
							335							
334.4			7	SS	72									
6.6	END OF BOREHOLE AT 6.6m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE AND AUGER CUTTINGS TO SURFACE.													

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No CR16 09+800

1 OF 1

METRIC

GWP# 408-88-00 LOCATION Wellington County Road 86, MTM NAD 83 Zone 10: N 4 823 159.0 E 238 242.8 ORIGINATED BY TM
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.12.05 - 2016.12.05 LATITUDE 43.545390 LONGITUDE -80.323644 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)						
								20 40 60 80 100	W P W W L									
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE												
341.1	GROUND SURFACE																	
0.0	SAND and GRAVEL, trace silt, occasional cobbles Compact to Very Dense Brown Moist (FILL)		1	SS	53		341											
			2	SS	31		340											
			3	SS	11													
339.0							339											
2.1	Sandy SILT, some clay, trace gravel, occasional cobbles Loose to Very Dense Brown to Grey Moist (TILL)		4	SS	6													
			5	SS	9		338											
							337											
			6	SS	50													
							336											
							335											
334.6			7	SS	100													
6.5	END OF BOREHOLE AT 6.5m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE AND AUGER CUTTINGS TO SURFACE.																	

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No CR16 09+850

1 OF 2

METRIC

GWP# 408-88-00 LOCATION Wellington County Road 86, MTM NAD 83 Zone 10: N 4 823 123.2 E 238 277.8 ORIGINATED BY TM
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.12.06 - 2016.12.06 LATITUDE 43.545072 LONGITUDE -80.323208 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				W P W W L				GR SA SI CL			
341.3	GROUND SURFACE							20	40	60	80	100							
0.0	SAND and GRAVEL , trace to some silt, trace clay Dense to Compact Brown to Grey Moist (FILL)		1	SS	43		341							○					
			2	SS	41									○					
			3	SS	11		340							○					
			4	SS	33		339							○					
338.4																			
2.9	Sandy SILT , some gravel, some clay Compact to Very Dense Brown to Grey Wet (TILL)		5	SS	30		338							○					
							337												
			6	SS	25		336							○					
			7	SS	100/ .100		335												
							334												
			8	SS	100/ 250									○					
							333												
332.1			9	SS	100/														
9.3	END OF BOREHOLE AT 9.3m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE AND AUGER				.125														

Continued Next Page

+³, ×³: Numbers refer to Sensitivity
 20
 15 10 5
 (%) STRAIN AT FAILURE

METRIC

[illegible]

RECORD OF BOREHOLE No CR16 09+900

1 OF 1

METRIC

GWP# 408-88-00 LOCATION Wellington County Road 86, MTM NAD 83 Zone 10: N 4 823 087.5 E 238 312.7 ORIGINATED BY TM
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.12.05 - 2016.12.05 LATITUDE 43.544753 LONGITUDE -80.322771 CHECKED BY JPL

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 (%)			
342.1	GROUND SURFACE							20	40	60	80	100					GR	SA	SI	CL
0.0	SAND and GRAVEL , trace silt, occasional cobbles, trace organics Compact Brown Moist (FILL)		1	SS	16		342													
			2	SS	19		341													63 31 6 (SI+CL)
340.7																				
1.4	Sandy SILT , some clay, trace gravel Loose to Very Dense Brown to Grey Moist (TILL)		3	SS	7		340													
			4	SS	7															
			5	SS	19		339													
							338													
			6	SS	68		337													7 35 39 19
			7	SS	78		336													
							335													
334.1			8	SS	100															6 22 58 14
8.0	END OF BOREHOLE AT 8.0m. OPEN BOREHOLE DRY UPON COMPLETION OF DRILLING. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.5m slotted screen. NOTE: 1. Piezometer was noted to be damaged on December 18, 2017 and therefore, no water level measurements were taken.																			

+³, ×³: Numbers refer to
Sensitivity 20
15 10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No CR16 10+100

1 OF 1

METRIC

GWP# 408-88-00 LOCATION Wellington County Road 86, MTM NAD 83 Zone 10: N 4 822 944.5 E 238 452.6 ORIGINATED BY JB
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.12.02 - 2016.12.02 LATITUDE 43.543479 LONGITUDE -80.321023 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								20 40 60 80 100					
345.6	GROUND SURFACE												
0.0	SAND and GRAVEL Compact to Dense Brown Moist (FILL)		1	SS	29								
			2	SS	21								
			3	SS	48								
343.6													
2.0	Sandy SILT , some clay, trace gravel Compact to Very Dense Brown to Grey Moist (TILL)		4	SS	10								
			5	SS	14								
				6	SS	91							
				7	SS	81/ 0.175							

+³, ×³: Numbers refer to
Sensitivity 20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No CR16 10+158

1 OF 1

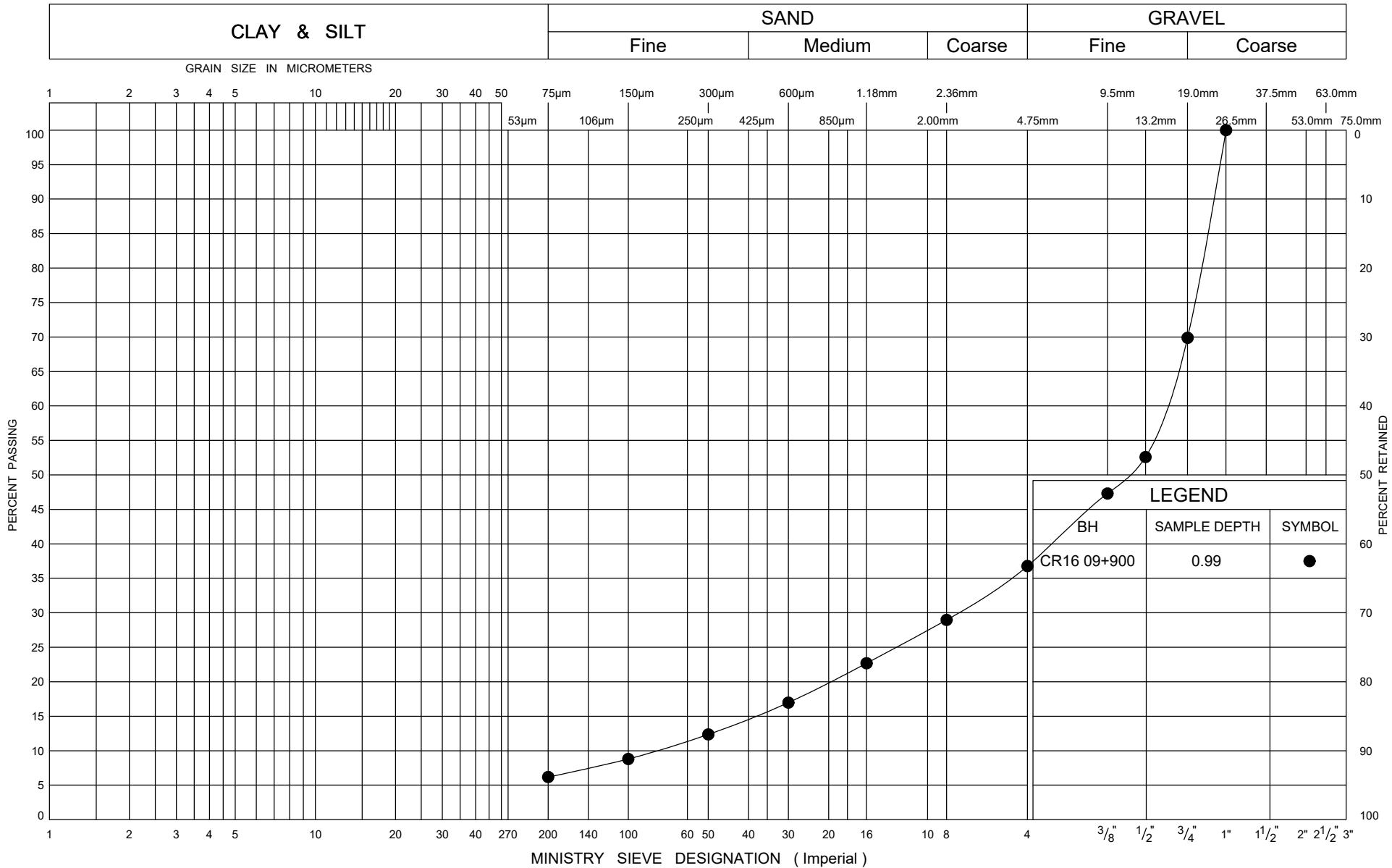
METRIC

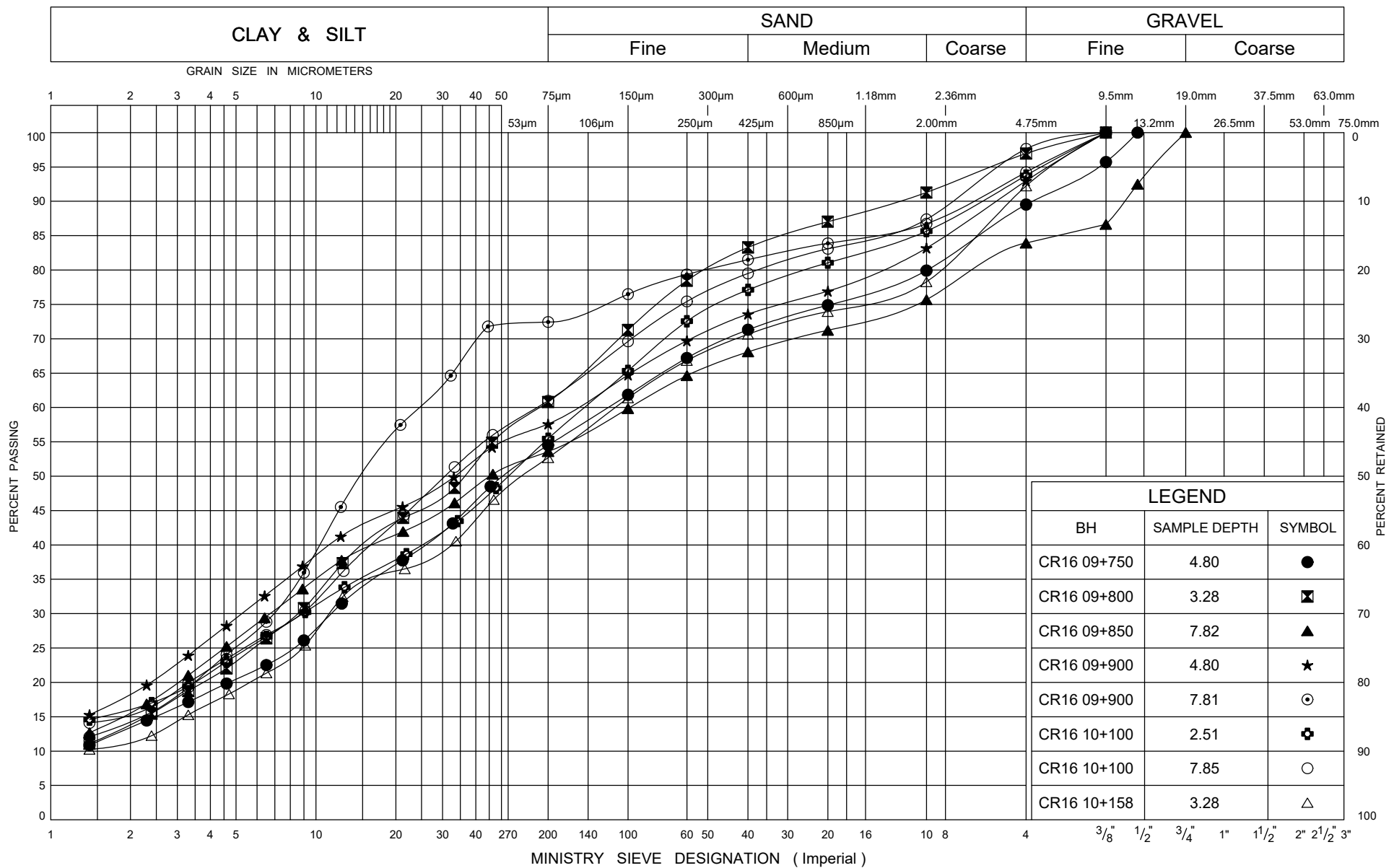
GWP# 408-88-00 LOCATION Wellington County Road 86, MTM NAD 83 Zone 10: N 4 822 908.7 E 238 487.5 ORIGINATED BY TM
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.12.07 - 2016.12.07 LATITUDE 43.543160 LONGITUDE -80.320586 CHECKED BY JPL

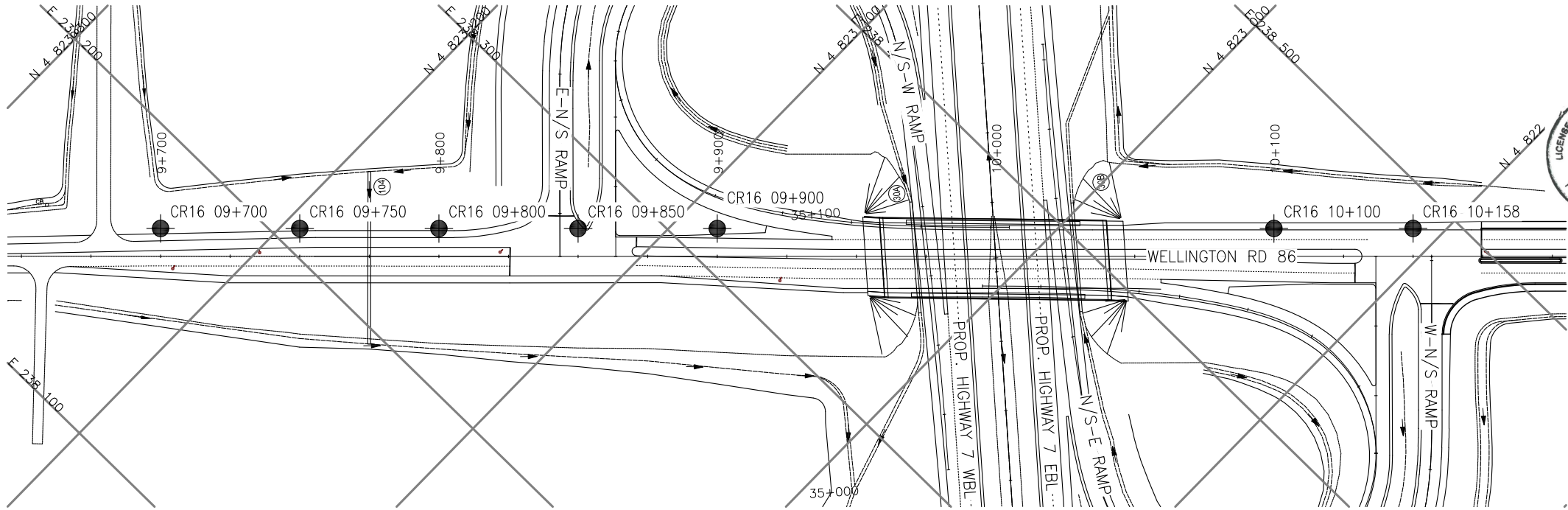
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						PLASTIC LIMIT W _P NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L			
346.3	GROUND SURFACE							20	40	60	80	100					
0.0	SAND and GRAVEL , trace silt, occasional cobbles Compact to Dense Brown Moist (FILL)		1	SS	43		346										
			2	SS	20												
344.9							345										
1.4	Sandy SILT , some clay, trace gravel Compact to Very Dense Brown Moist (TILL)		3	SS	35												
			4	SS	33		344										
			5	SS	13		343										
			6	SS	100/ .275		342										
			7	SS	100/ .075		341										
			8	SS	98/ .060		340										
338.3							339										
8.0	END OF BOREHOLE AT 8.0m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE AND AUGER CUTTINGS TO SURFACE.																

ONTMT452 2020LIBRARY(MTO) - COPY.GLB MTO-11375(GINTDATA).GPJ 3/5/24

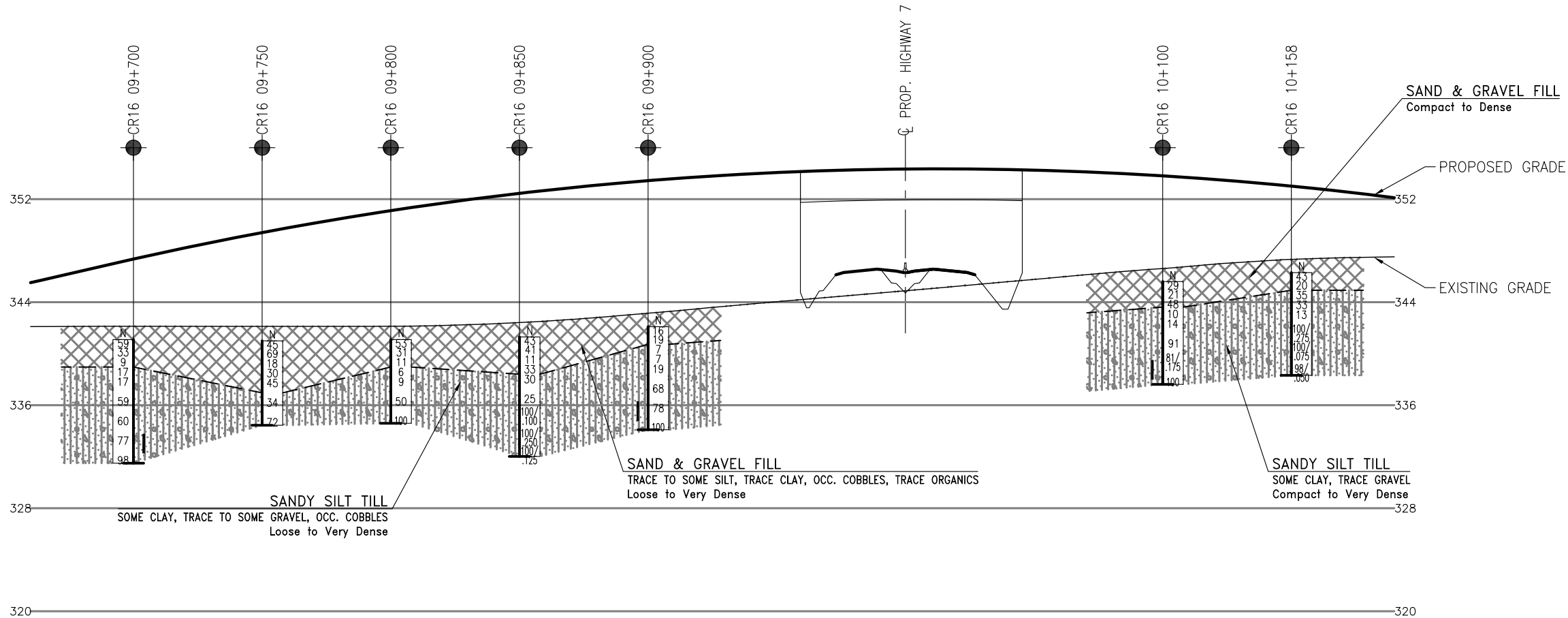
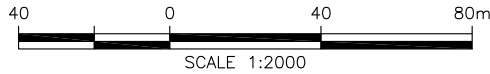
ONTARIO MOT GRAIN SIZE 3 MTO-11375(GINTDATA)\GPJ_ONTARIO MOT.GDT 3/24/20







PLAN



PROFILE ALONG WELLINGTON COUNTY ROAD 86



H 1:2000
V 1:400

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

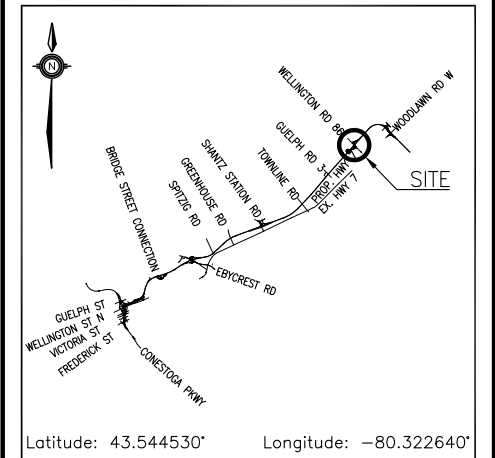


CONT No
GWP No 408-88-00

WELLINGTON COUNTY ROAD 86 FILL
9+700 TO 10+150
BOREHOLE LOCATIONS AND SOIL STRATA



THURBER ENGINEERING LTD.



Latitude: 43.544530° Longitude: -80.322640°

KEYPLAN

LEGEND

	Borehole (Current Investigation)
	Borehole (2008 Investigation)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

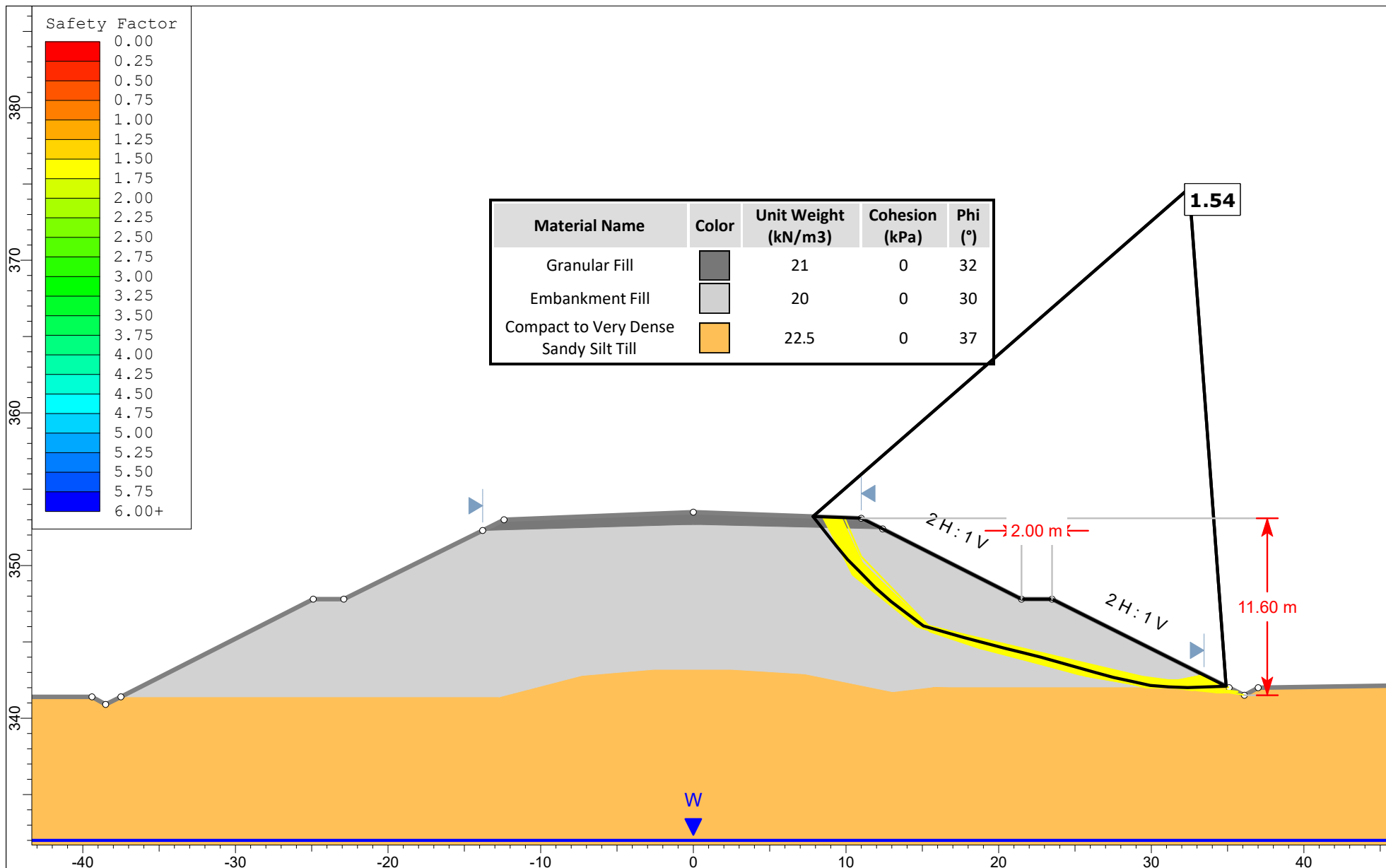
NO	ELEVATION	NORTHING	EASTING
CR16 09+700	341.1	4 823 230.5	238 172.9
CR16 09+750	341.0	4 823 194.7	238 207.9
CR16 09+800	341.1	4 823 159.0	238 242.8
CR16 09+850	341.3	4 823 123.2	238 277.8
CR16 09+900	342.1	4 823 087.5	238 312.7
CR16 10+100	345.6	4 822 944.5	238 452.6
CR16 10+158	346.3	4 822 908.7	238 487.5

NOTES

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- Coordinate system is MTM NAD 83 Zone 10.

GEOCRES No. 40P09-068

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	MKE	CHK	PKC
DRAWN	MFA	CHK	MKE
LOAD	DATE	FEB 2024	
STRUCT	DWG	1	



Project: Hwy 7 New - High Fills and Deep Cuts

Analysis: Temporary / Short-Term

2024-03-04 11:37:15 AM

Scale: 1:350

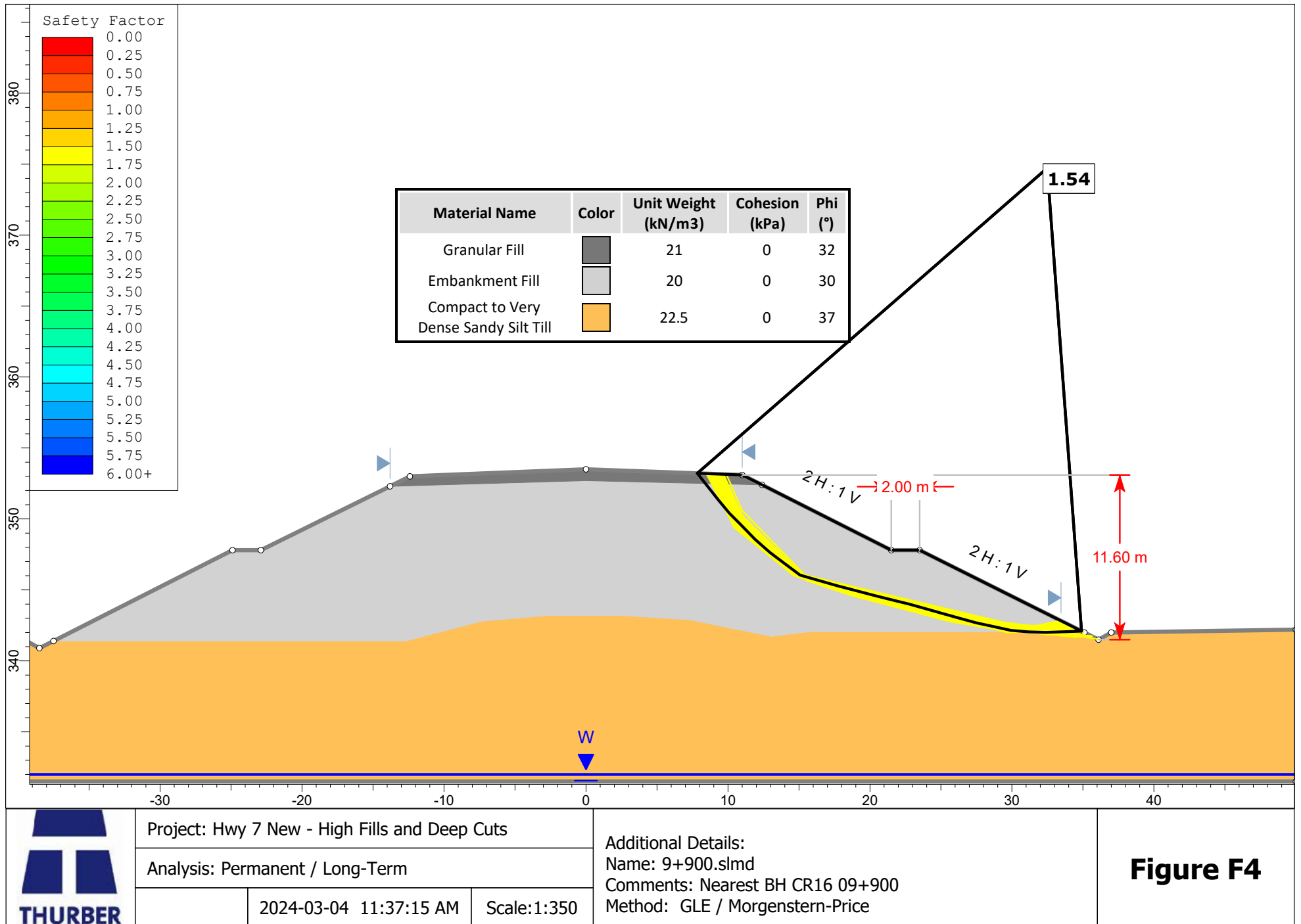
Additional Details:

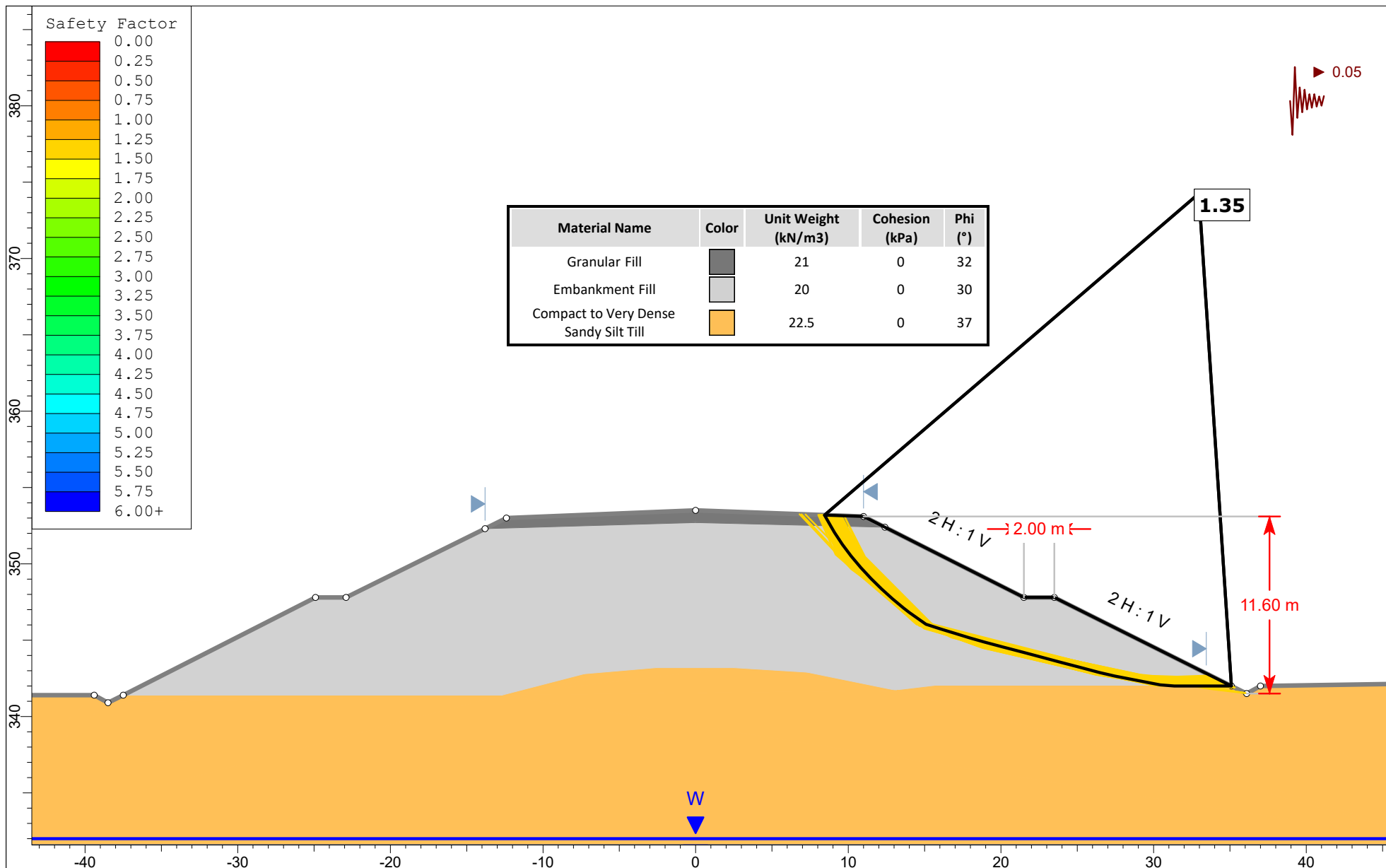
Name: 9+900.slmd

Comments: Nearest BH CR16 09+900

Method: GLE / Morgenstern-Price

Figure F3





Project: Hwy 7 New - High Fills and Deep Cuts

Analysis: Seismic

2024-03-04 11:37:15 AM

Scale: 1:350

Additional Details:

Name: 9+900.slmd

Comments: Nearest BH CR16 09+900

Method: GLE / Morgenstern-Price

Figure F5



Appendix G.

**Wellington County Road 86 – N-E Ramp: Station 34+764 – 34+800 (CR16 34+764,
CR16 34+800)**

RECORD OF BOREHOLE No CR16 34+764 1 OF 1 METRIC

GWP# 408-88-00 LOCATION Wellington County Road 86, MTM NAD 83 Zone 10: N 4 822 940.2 E 238 419.4 ORIGINATED BY JB
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.12.02 - 2016.12.02 LATITUDE 43.543437 LONGITUDE -80.321432 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
346.0	GROUND SURFACE							20	40	60	80	100					
0.0	TOPSOIL: (200mm)							20	40	60	80	100					
0.2	Sandy SILT , some clay, trace gravel, occasional organics Loose to Compact Brown Moist		1	SS	6												
			2	SS	15		345										
			3	SS	9		344										
343.8																	
2.2	Sandy SILT , some clay, trace gravel, occasional cobbles Very Dense Brown to Grey Moist (TILL)		4	SS	64		343										6 40 38 16
			5	SS	95/0.175												
							342										
			6	SS	100/ 0.175		341										
							340										1 44 41 14
							339										
338.1			8	SS	76/ 0.150												
7.9	END OF BOREHOLE AT 7.9m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH AUGER CUTTINGS TO SURFACE.																

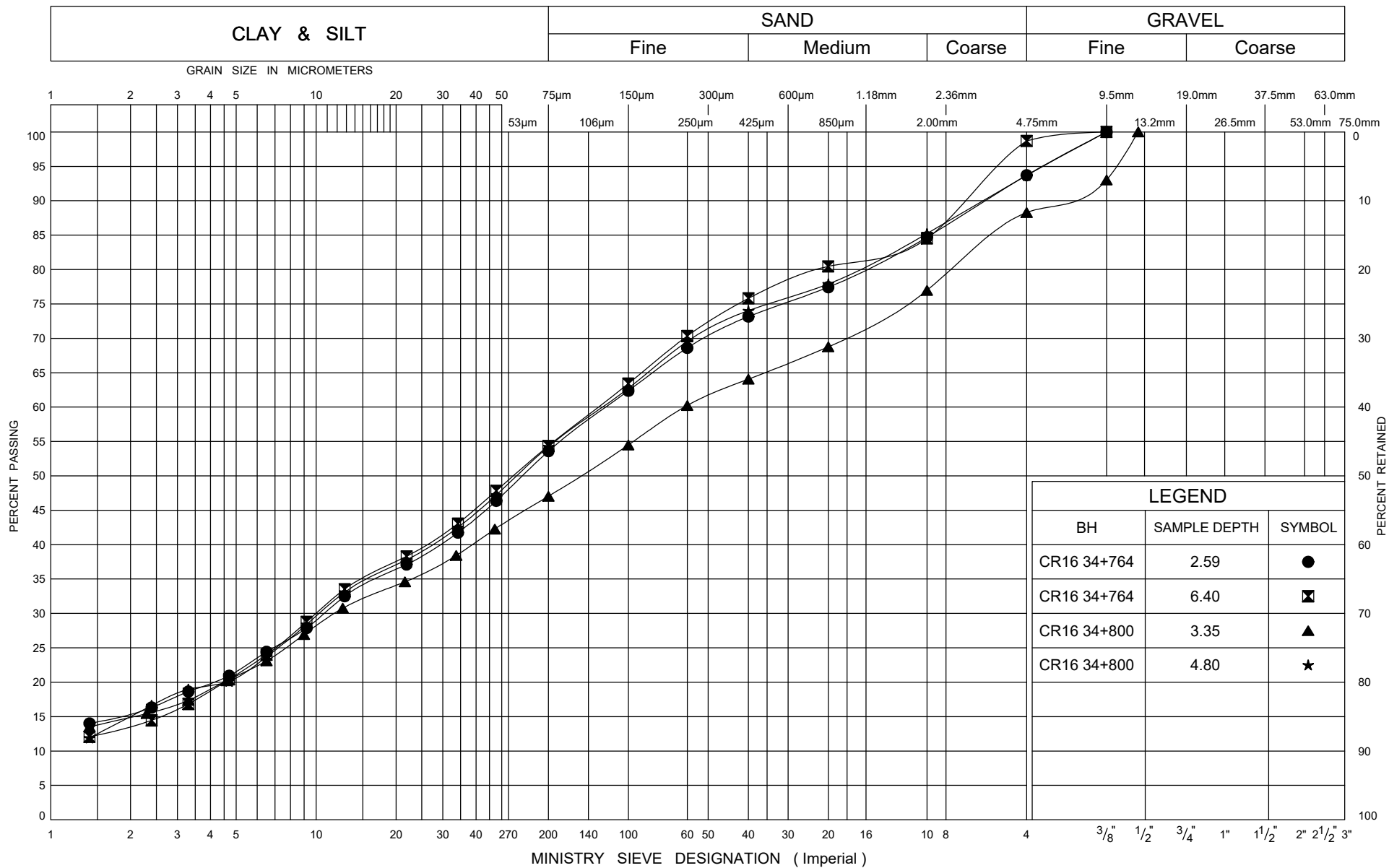
ONTMT452 2020LIBRARY(MTO) - COPY.GLB MTO-11375(GINTDATA).GPJ 7/21/23

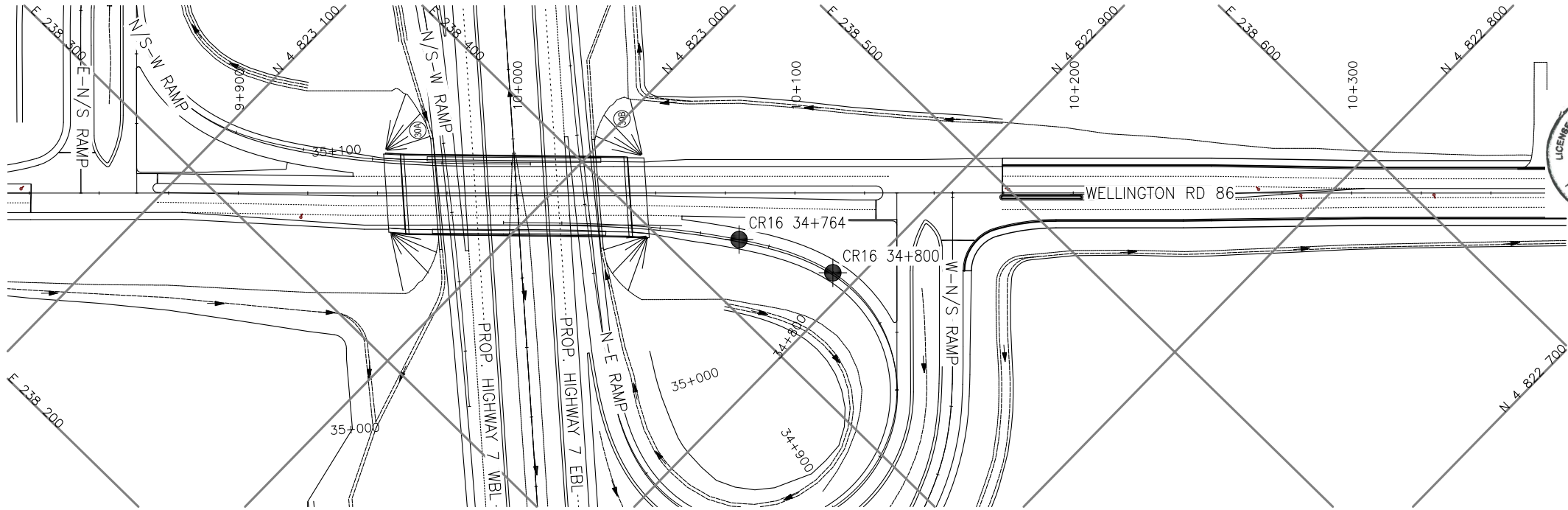
RECORD OF BOREHOLE No CR16 34+800 1 OF 1 METRIC

GWP# 408-88-00 LOCATION Wellington County Road 86, MTM NAD 83 Zone 10: N 4 822 907.7 E 238 434.5 ORIGINATED BY JB
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2016.12.02 - 2016.12.02 LATITUDE 43.543146 LONGITUDE -80.321242 CHECKED BY JPL

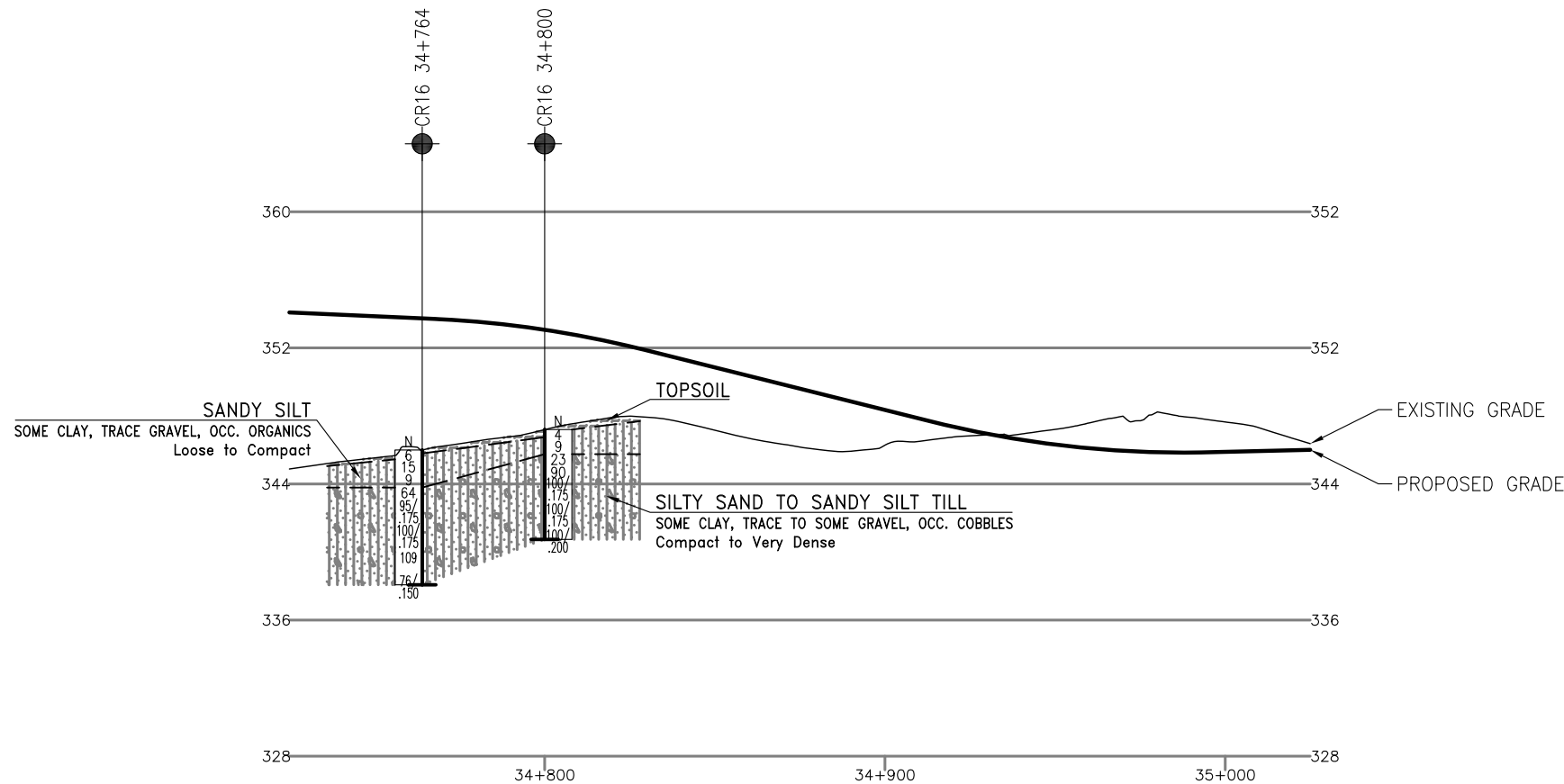
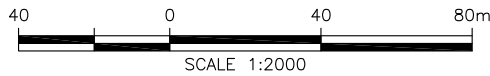
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						WATER CONTENT (%)					
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						w _P w w _L					
347.2	GROUND SURFACE							20	40	60	80	100							
0.0	TOPSOIL: (450mm)		1	SS	4		347												
346.8																			
0.4	Sandy SILT , some clay, trace gravel, occasional organics Loose Brown Moist		2	SS	9		346												
345.8																			
1.4	Silty SAND to Sandy SILT , some clay, trace to some gravel Compact to Very Dense Brown Moist (TILL)		3	SS	23		345												
			4	SS	90		344												
			5	SS	100/ 0.175		343												
			6	SS	100/ 0.175		342												
			7	SS	100/ 0.200		341												
340.8	END OF BOREHOLE AT 6.50m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH AUGER CUTTINGS TO SURFACE.																		
6.5																			

ONTMT452 2020LIBRARY(MTO) - COPY.GLB MTO-11375(GINTDATA).GPJ 7/21/23





PLAN



PROFILE ALONG PROPOSED N-E RAMP



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



CONT No
GWP No 408-88-00



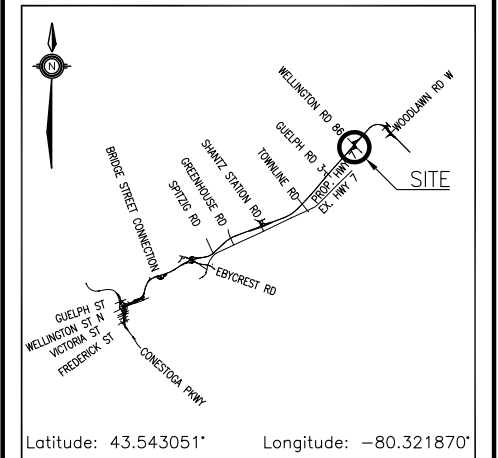
WELLINGTON COUNTY ROAD 86
N-E RAMP FILL
BOREHOLE LOCATIONS AND SOIL STRATA



SHEET



THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

	Borehole (Current Investigation)
	Borehole (2008 Investigation)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

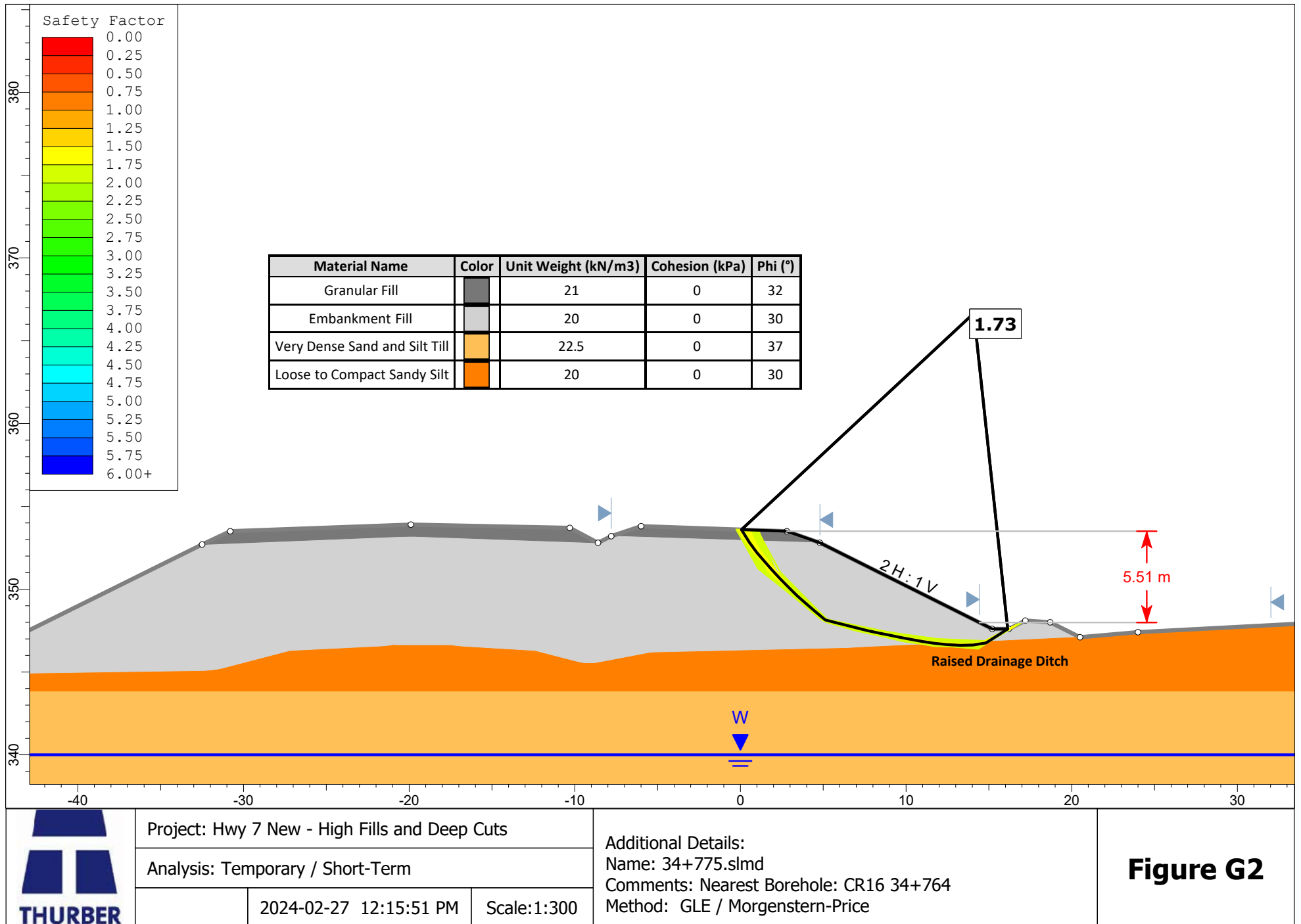
NO	ELEVATION	NORTHING	EASTING
CR16 34+764	346.0	4 822 940.2	238 419.4
CR16 34+800	347.2	4 822 907.7	238 434.5

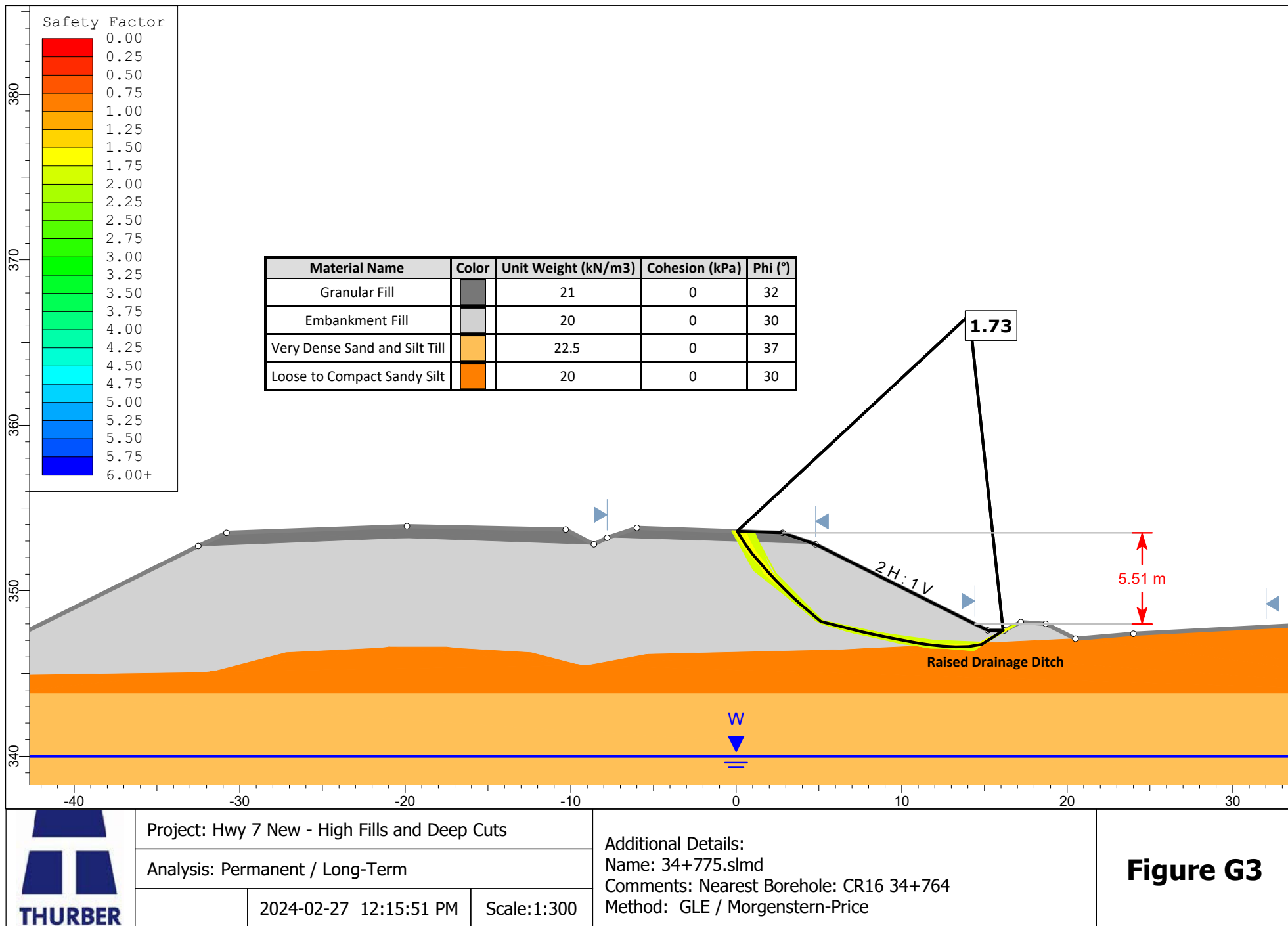
-NOTES-

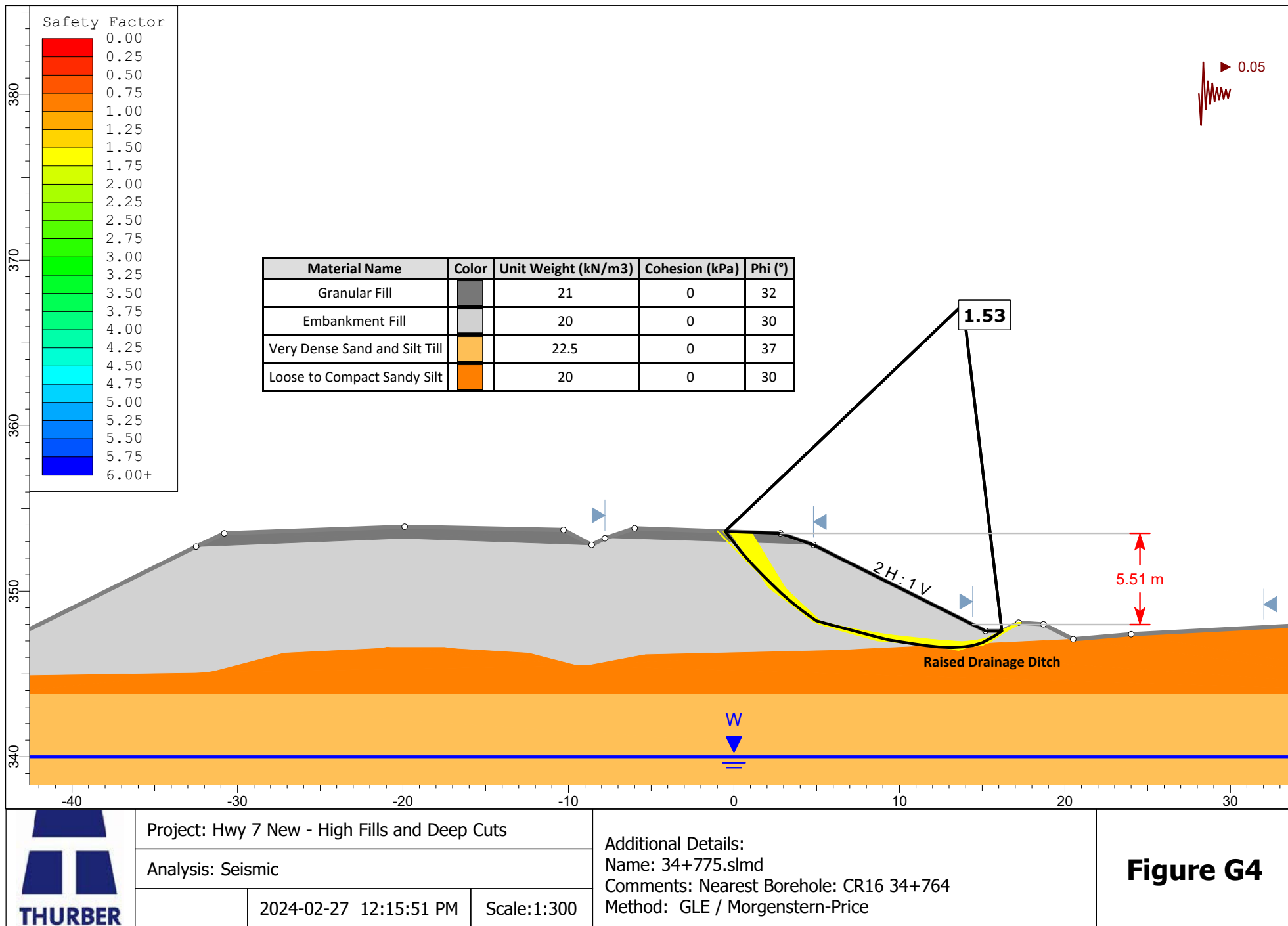
- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- Coordinate system is MTM NAD 83 Zone 10.

GEOCRES No. 40P09-068

REVISIONS		DATE	BY	DESCRIPTION
DESIGN	MKE	CHK	PKC	CODE
DRAWN	MFA	CHK	MKE	SITE
		LOAD	DATE	FEB 2024
		STRUCT	DWG	1









Appendix H.

**Wellington County Road 86 – S-W Ramp: Station 35+250 – 35+400 (CR16 S-W01,
CR16 S-W02, CR16 S-W03, CR16 S-W04)**

RECORD OF BOREHOLE No CR16 S-W01 1 OF 2 METRIC

GWP# 408-88-00 LOCATION Wellington County Road 86 S-W Ramp, MTM NAD 83 Zone 10: N 4 823 078.3 E 238 335 000 ORIGINATED BY OA
 DIST HWY 7 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2017.06.22 - 2017.06.22 LATITUDE 43.544673 LONGITUDE -80.322482 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)									
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa															
341.9	GROUND SURFACE							20	40	60	80	100											
0.0	TOPSOIL: (100mm)							20	40	60	80	100											
0.1	Silty CLAY , trace sand, trace gravel, trace organics Firm Dark Brown to Brown Moist		1	SS	6		341																
			2	SS	6																		
340.5																							
1.4	Sandy Silty CLAY , trace to some gravel Very Stiff to Hard Brown to Grey Moist (TILL) Layer of clayey sand at a depth of 1.8m		3	SS	49		340											15	38	32	15		
			4	SS	23																		
			5	SS	100/ 0.225		339																
							338																
			6	SS	90/ 0.275		337																
			7	SS	90/ 0.225		336													8	26	44	22
							335																
			8	SS	91		334																
			9	SS	75/ 0.275		333																
							332																

Continued Next Page


+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No CR16 S-W01 2 OF 2 METRIC

GWP# 408-88-00 LOCATION Wellington County Road 86 S-W Ramp, MTM NAD 83 Zone 10: N 4 823 078.3 E 238 335 000 ORIGINATED BY OA
DIST HWY 7 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
DATUM Geodetic DATE 2017.06.22 - 2017.06.22 LATITUDE 43.544673 LONGITUDE -80.322482 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
	Continued From Previous Page							20	40	60	80	100					
	Sandy Silty CLAY , trace to some gravel Very Stiff to Hard Brown to Grey Moist (TILL)		10	SS	101/ 0.225		331								○		
							330										
329.3			11	SS	90/ 0.275										○		
12.6	END OF BOREHOLE AT 12.6m. WATER LEVEL AT 7.6m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.																

RECORD OF BOREHOLE No CR16 S-W02 1 OF 2 METRIC

GWP# 408-88-00 LOCATION Wellington County Road 86 S-W Ramp, MTM NAD 83 Zone 10: N 4 823 117.2 E 238 314 ORIGINATED BY OA
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2017.06.21 - 2017.06.21 LATITUDE 43.545021 LONGITUDE -80.322747 CHECKED BY JPL

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 (%)
341.4	GROUND SURFACE							20	40	60	80	100					
0.0	TOPSOIL: (100mm)							○ UNCONFINED	+	FIELD VANE	● QUICK TRIAXIAL	×	LAB VANE				
0.1	Silty CLAY , trace to some sand, trace gravel Firm Dark Brown to Brown Moist		1	SS	4		341							○			
			2	SS	4									○			
339.9							340										
1.4	Sandy Silty CLAY , trace gravel, occasional cobbles Very Stiff to Hard Brown to Grey Moist (TILL)		3	SS	24									○			
			4	SS	32		339							○			
			5	SS	58/ 0.275		338							○			
			6	SS	75/ 0.275		337							○			
							336										
			7	SS	78/ 0.225		335							○			
							334										
			8	SS	75/ 0.225		333							○			
			9	SS	50/ 0.100		332							○			

Continued Next Page

+³, ×³: Numbers refer to Sensitivity
 20
 15
 10
 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No CR16 S-W02 2 OF 2 METRIC

GWP# 408-88-00 LOCATION Wellington County Road 86 S-W Ramp, MTM NAD 83 Zone 10: N 4 823 117.2 E 238 314 ORIGINATED BY OA
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2017.06.21 - 2017.06.21 LATITUDE 43.545021 LONGITUDE -80.322747 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									
	Continued From Previous Page							20	40	60	80	100					
330.3	Sandy Silty CLAY , trace gravel, occasional cobbles Very Stiff to Hard Brown to Grey Moist (TILL)		10	SS	93/ 0.275		331										
11.1	END OF BOREHOLE AT 11.1m BOREHOLE DRY UPON COMPLETION BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.																

RECORD OF BOREHOLE No CR16 S-W03 1 OF 2 METRIC

GWP# 408-88-00 LOCATION Wellington County Road 86 S-W Ramp, MTM NAD 83 Zone 10: N 4 823 162.5 E 238 330 ORIGINATED BY OA
 DIST HWY 7 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2017.06.22 - 2017.06.22 LATITUDE 43.545431 LONGITUDE -80.322462 CHECKED BY JPL

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								
341.8	GROUND SURFACE							20	40	60	80	100				
0.0	TOPSOIL: (300mm)							20	40	60	80	100				
341.5			1	SS	14											
0.3	Silty SAND , some gravel Compact Brown Moist															
			2	SS	32											
340.4																
1.4	Sandy Silty CLAY , trace gravel Stiff to Hard Brown to Grey Moist (TILL)		3	SS	23											
			4	SS	50											
			5	SS	52											
			6	SS	37											
			7	SS	12											
334.7																
7.2	Sandy Clayey SILT , trace gravel Hard Grey Moist (TILL)		8	SS	95											
			9	SS	85											
332.1																
9.7	END OF BOREHOLE AT 9.8m.															

Continued Next Page

+³, ×³: Numbers refer to Sensitivity 20 15 10 5 0 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No CR16 S-W03 2 OF 2 METRIC

GWP# 408-88-00 LOCATION Wellington County Road 86 S-W Ramp, MTM NAD 83 Zone 10: N 4 823 162.5 E 238 330 000 ORIGINATED BY OA
 DIST HWY 7 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2017.06.22 - 2017.06.22 LATITUDE 43.545431 LONGITUDE -80.322462 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%)				
							20	40	60	80	100	20	40	60			
	Continued From Previous Page Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 1.5m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2017.11.27 0.8 341.0																

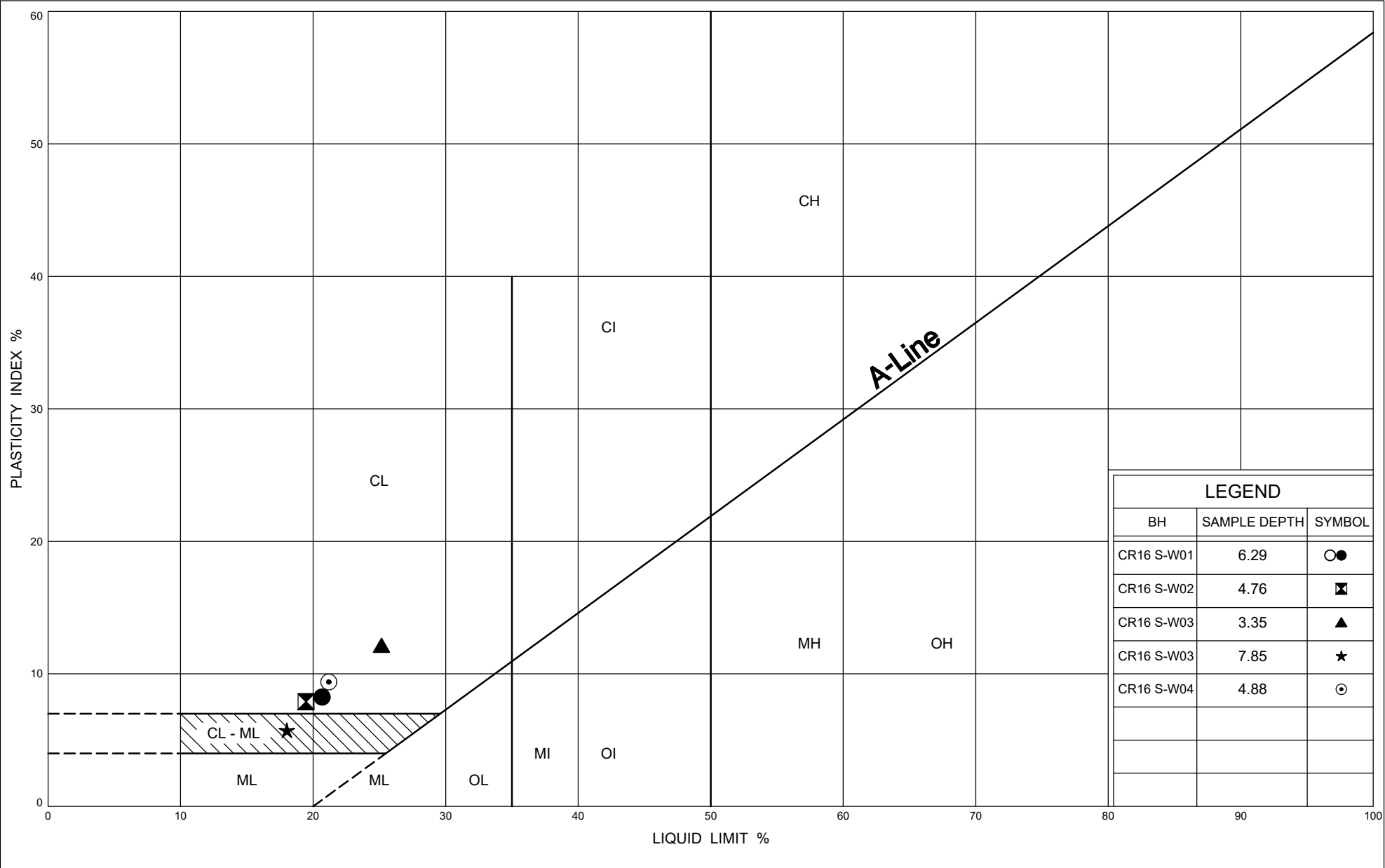
RECORD OF BOREHOLE No CR16 S-W04 1 OF 1 METRIC

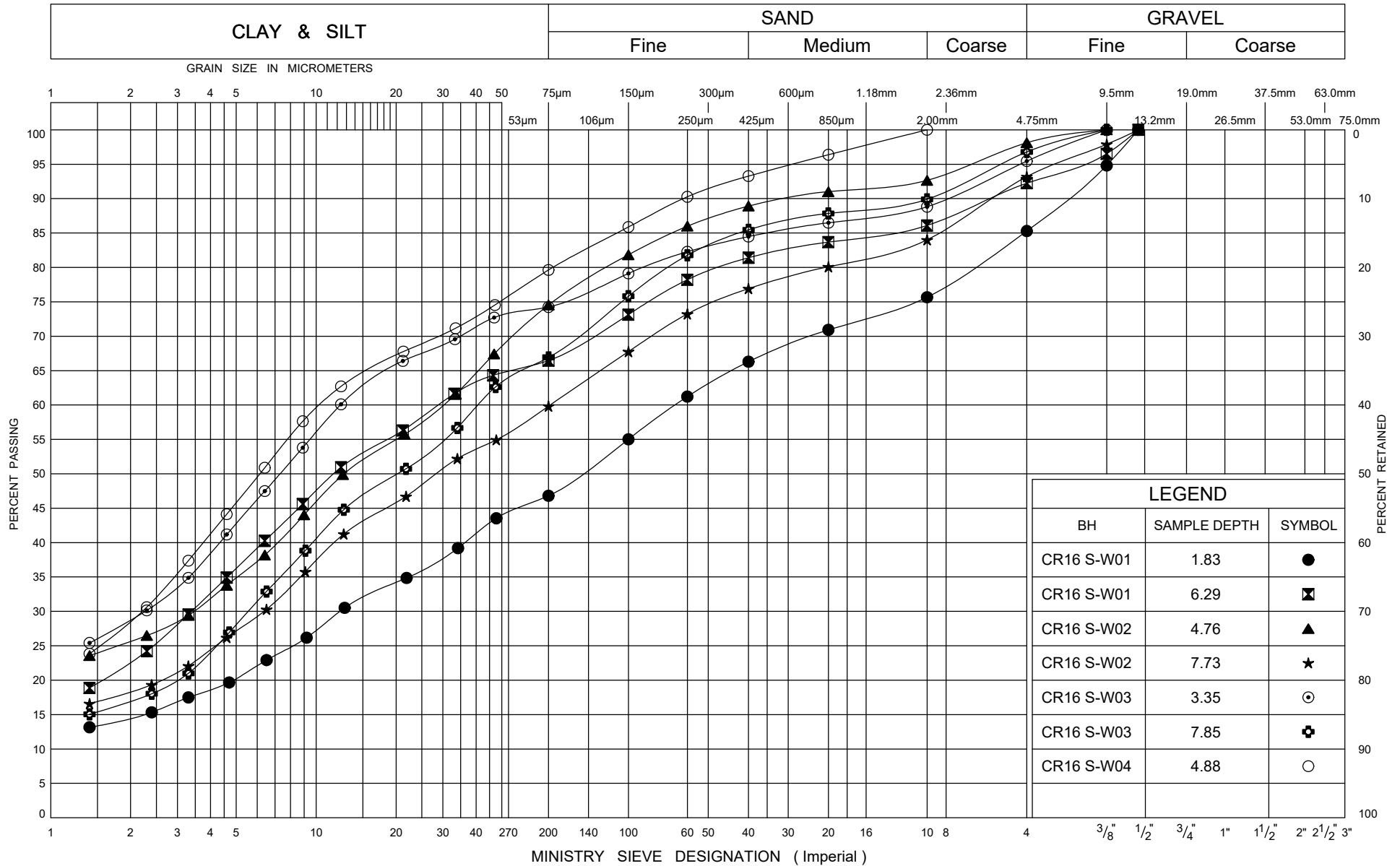
GWP# 408-88-00 LOCATION Wellington County Road 86 S-W Ramp, MTM NAD 83 Zone 10: N 4 823 165.6 E 238 386 ORIGINATED BY OA
 DIST HWY 7 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2017.06.26 - 2017.06.26 LATITUDE 43.545463 LONGITUDE -80.321871 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
341.8	GROUND SURFACE							20	40	60	80	100	PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	
0.0	TOPSOIL: (100mm)															
0.1	Silty CLAY , some sand, some gravel Firm Dark Brown to Brown Moist		1	SS	5		341									
			2	SS	5											
340.4																
1.4	Silty CLAY , some sand, trace gravel Very Stiff to Hard Brown to Grey Moist (TILL)		3	SS	19		340									
			4	SS	15		339									
			5	SS	87/ 0.250		338									
			6	SS	53		337									0 20 51 29
							336									
335.5			7	SS	96/ 0.200											
6.3	END OF BOREHOLE AT 6.3m. WATER LEVEL AT 2.3m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.															

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE



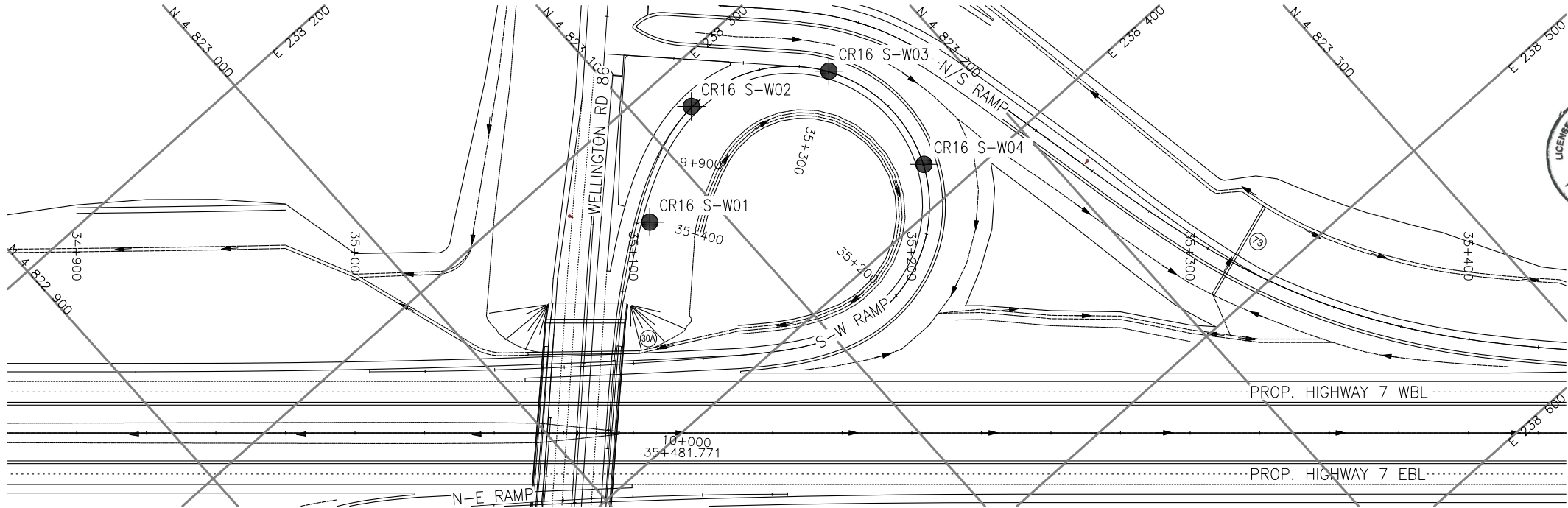


Ministry of
Transportation

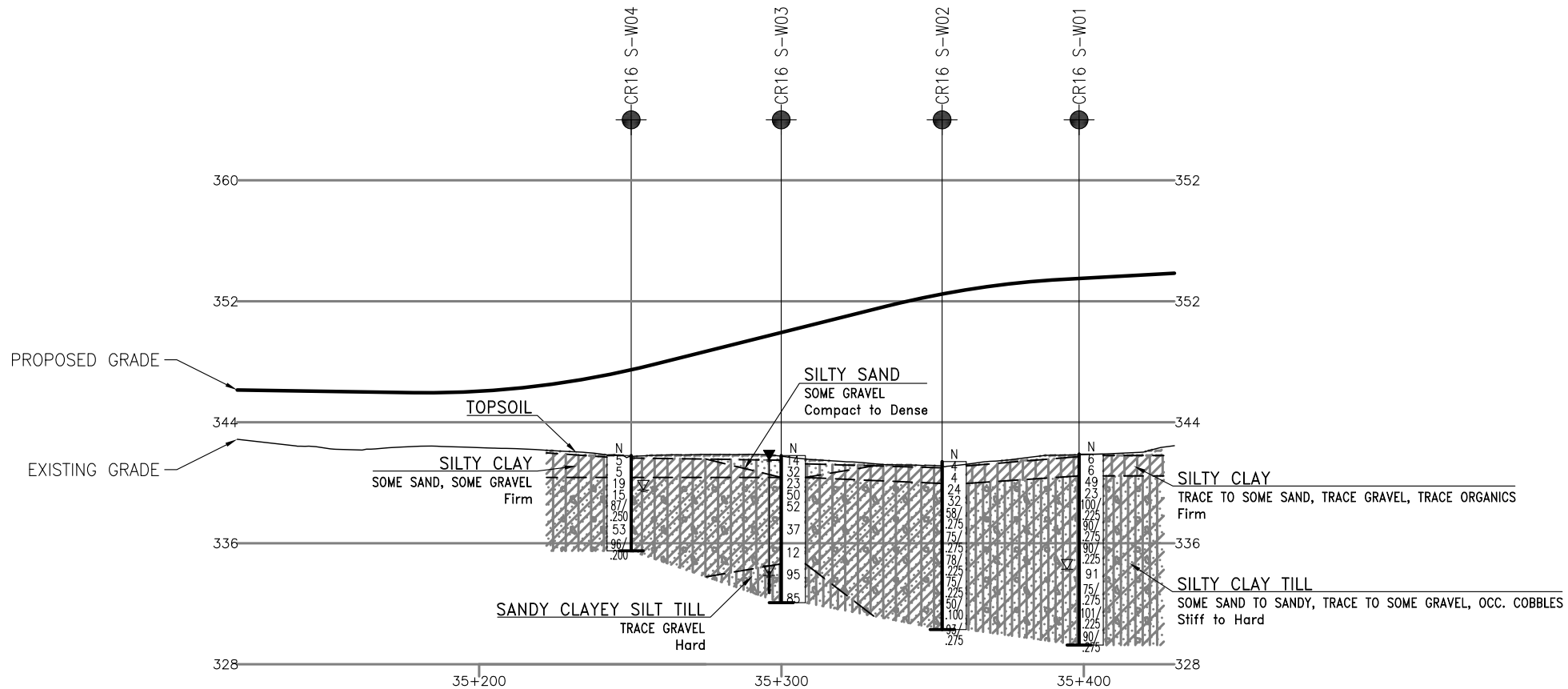
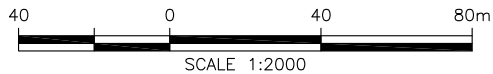
GRAIN SIZE DISTRIBUTION Sandy Clayey Silt to Sandy Silty CLAY TILL and Clayey Sand Layer

FIG No H2

GWP 408-88-00



PLAN



PROFILE ALONG PROPOSED S-W RAMP

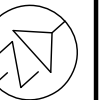


METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN



CONT No
GWP No 408-88-00

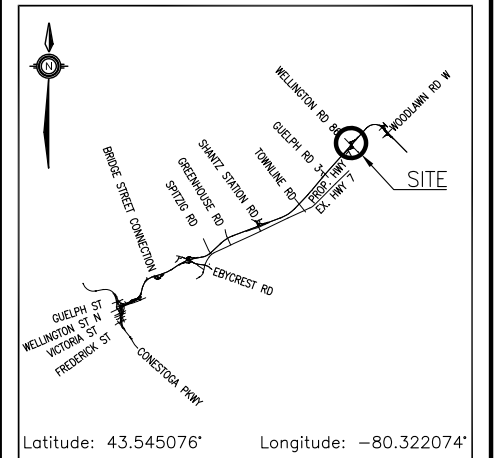
WELLINGTON COUNTY ROAD 86
S-W RAMP FILL
BOREHOLE LOCATIONS AND SOIL STRATA



SHEET



THURBER ENGINEERING LTD.



Latitude: 43.545076° Longitude: -80.322074°

KEYPLAN

LEGEND

	Borehole (Current Investigation)
	Borehole (2008 Investigation)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

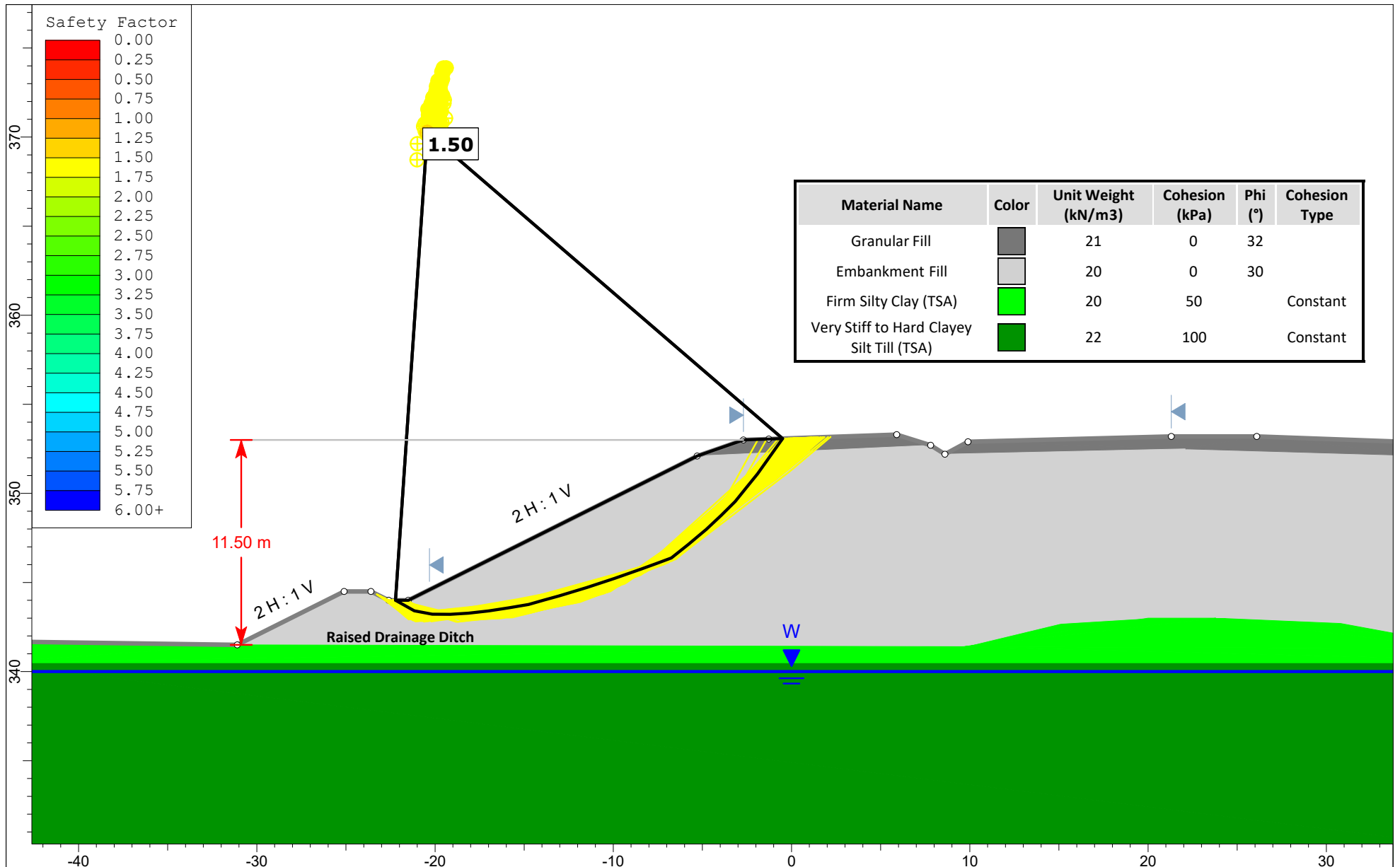
NO	ELEVATION	NORTHING	EASTING
CR16 S-W01	341.9	4 823 078.3	238 335.9
CR16 S-W02	341.4	4 823 117.2	238 314.9
CR16 S-W03	341.8	4 823 162.5	238 338.5
CR16 S-W04	341.8	4 823 165.6	238 386.2

-NOTES-

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- Coordinate system is MTM NAD 83 Zone 10.

GEOCRES No. 40P09-068

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	MKE	CHK	PKC
DRAWN	MFA	CHK	MKE
LOAD			
STRUCT			
DWG	1		



Project: Hwy 7 New - High Fills and Deep Cuts

Analysis: Temporary / Short-Term

2024-02-27 12:24:14 PM

Scale: 1:300

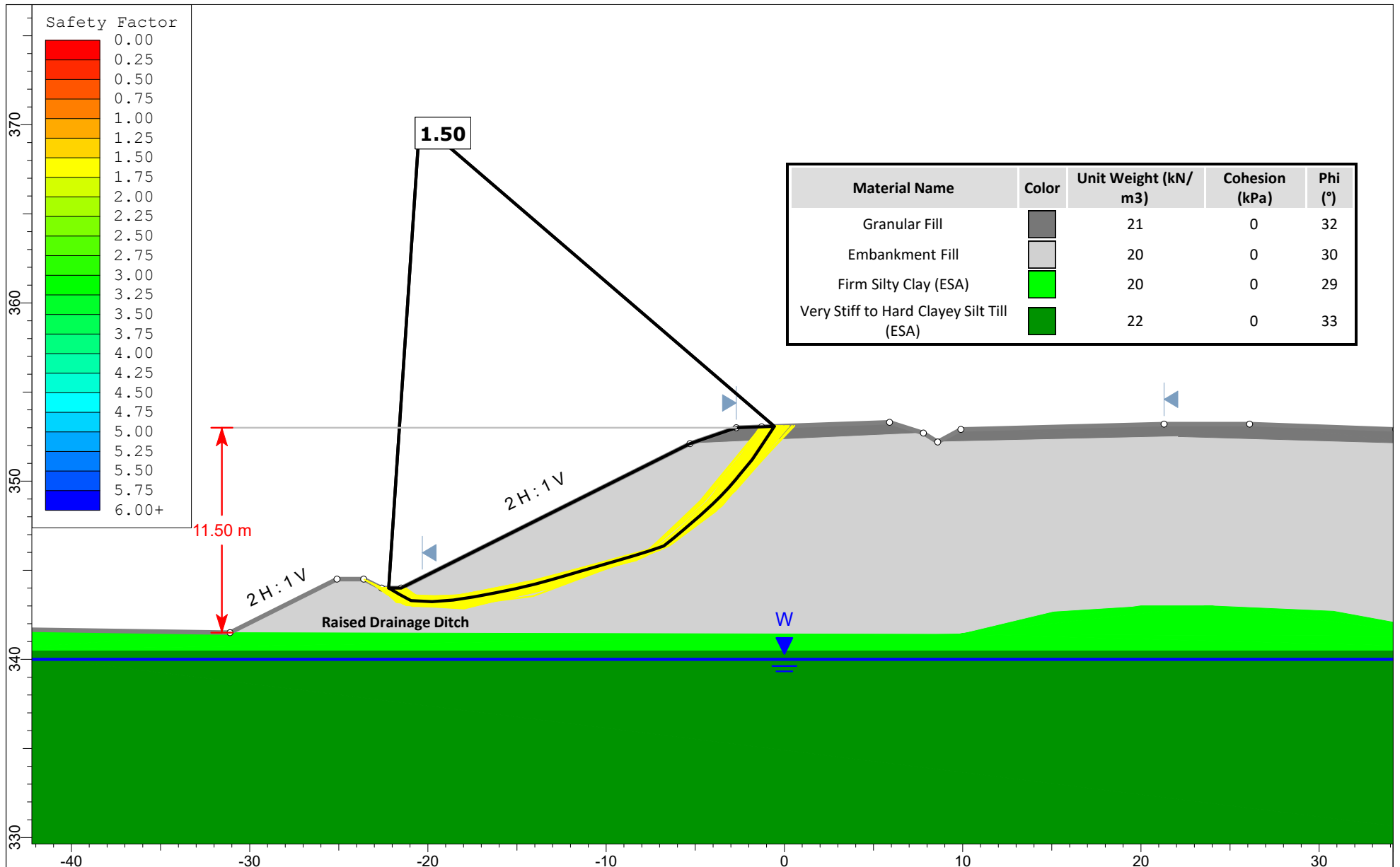
Additional Details:

Name: 35+375.slmd

Comments: Nearest Borehole: CR16 S-W01

Method: GLE / Morgenstern-Price

Figure H3



Project: Hwy 7 New - High Fills and Deep Cuts

Analysis: Permanent / Long-Term

2024-02-27 12:24:14 PM

Scale: 1:300

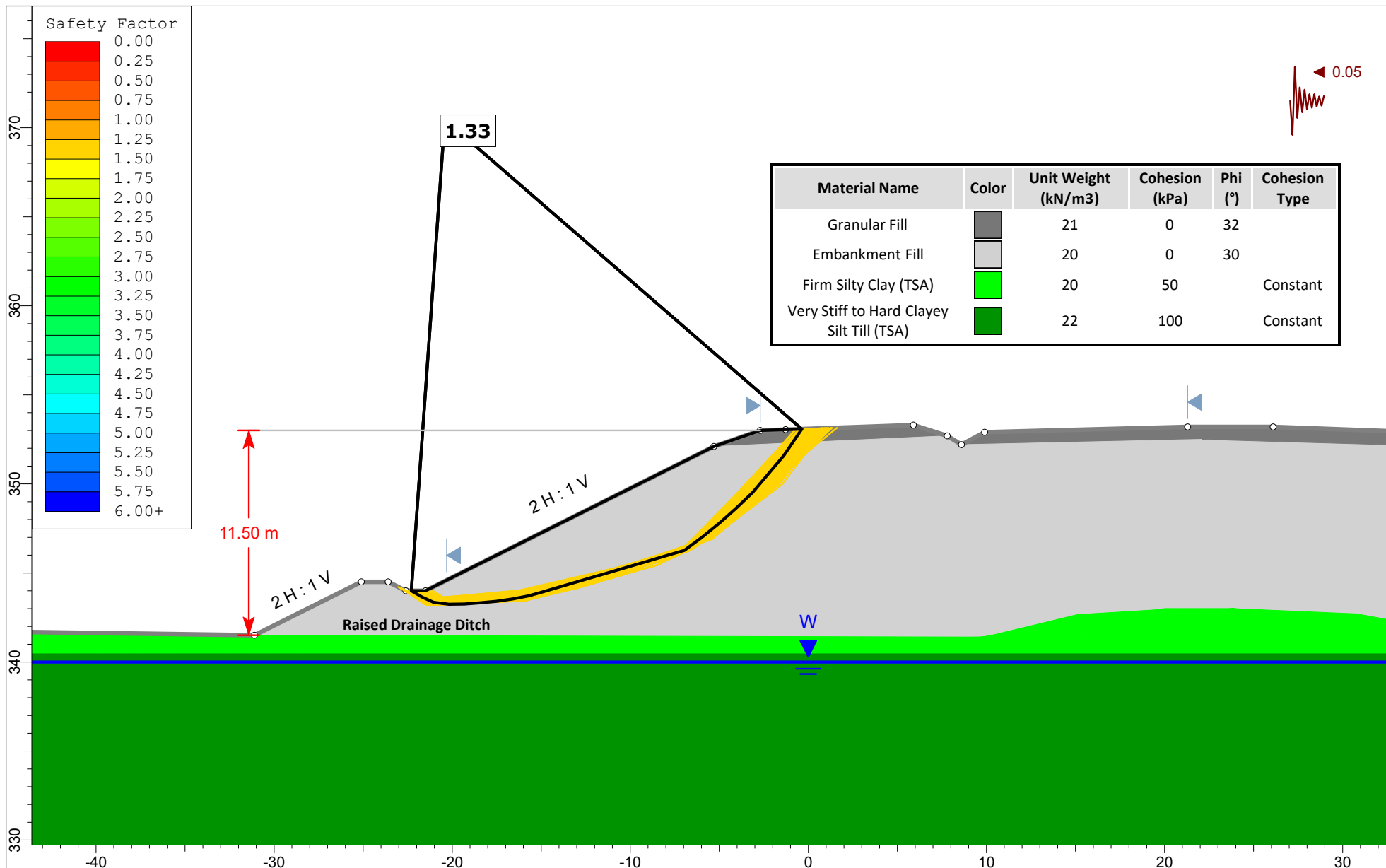
Additional Details:

Name: 35+375.slmd

Comments: Nearest Borehole: CR16 S-W01

Method: GLE / Morgenstern-Price

Figure H4



Project: Hwy 7 New - High Fills and Deep Cuts

Analysis: Seismic

2024-02-27 12:24:14 PM

Scale: 1:300

Additional Details:

Name: 35+375.slmd

Comments: Nearest Borehole: CR16 S-W01

Method: GLE / Morgenstern-Price

Figure H5



Appendix I.

Wellington County Road 86 – E-N/S Ramp: Station 35+100 – 35+400 (CR16 E-NS01, CR16 E-NS03, CR16 E-NS06, CR16 E-NS07)

RECORD OF BOREHOLE No CR16 E-NS01 1 OF 2 METRIC

GWP# 408-88-00 LOCATION Wellington County Road 86 E-NS Ramp, MTM NAD 83 Zone 10: N 4 823 149.3 E 238 208 208 ORIGINATED BY OA
 DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2017.06.21 - 2017.06.21 LATITUDE 43.545308 LONGITUDE -80.322970 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						WATER CONTENT (%) W P W W L				
341.3	GROUND SURFACE							20	40	60	80	100						
0.0	TOPSOIL: (75mm)							20	40	60	80	100						
0.1	Silty CLAY , trace sand, trace gravel, occasional organics Firm to Stiff Brown Moist		1	SS	6		341											
			2	SS	11		340											
339.8																		
1.4	Sandy Clayey SILT , trace gravel, occasional cobbles Stiff to Hard Grey Moist (TILL)		3	SS	43		339											
			4	SS	14													
			5	SS	32		338											
			6	SS	100		337											
			7	SS	100/ .150		336											
			8	SS	100/ .150		335											
							334											
			9	SS	100/ .250		333											
							332											

Continued Next Page

+³, X³: Numbers refer to Sensitivity
 20
 15
 10
 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No CR16 E-NS01 2 OF 2 METRIC

GWP# 408-88-00 LOCATION Wellington County Road 86 E-NS Ramp, MTM NAD 83 Zone 10: N 4 823 149.3 E 238 200 000 ORIGINATED BY OA
DIST HWY 7 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
DATUM Geodetic DATE 2017.06.21 - 2017.06.21 LATITUDE 43.545308 LONGITUDE -80.322970 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								20 40 60 80 100					
								20 40 60 80 100					
	Continued From Previous Page												
	Sandy Clayey SILT , trace gravel, occasional cobbles Stiff to Hard Grey Moist (TILL)		10	SS	100/ .225								2 26 54 18
			11	SS	100/ .225								
			12	SS	72								
327.0													
14.3	END OF BOREHOLE AT 14.3m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.												

ONTMT452 2020LIBRARY(MTO) - COPY.GLB MTO-11375(GINTDATA).GPJ 7/28/23

RECORD OF BOREHOLE No CR16 E-NS03

1 OF 1

METRIC

GWP# 408-88-00 LOCATION Wellington County Road 86 E-NS Ramp, MTM NAD 83 Zone 10: N 4 823 197.9 E 238 308 308
 DIST HWY 7 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2017.06.22 - 2017.06.22 LATITUDE 43.545753 LONGITUDE -80.321958 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT							UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										
								○ UNCONFINED		+ FIELD VANE								
342.5	GROUND SURFACE						20	40	60	80	100							
0.0	TOPSOIL: (100mm)																	
0.1	Clayey SILT , trace sand, trace gravel, trace organics Very Stiff Brown Moist		1	SS	8								○					
			2	SS	12								○					
341.1																		
1.4	Sandy Clayey SILT , trace gravel Very Stiff to Hard Brown to Grey Moist (TILL)		3	SS	16								○					
			4	SS	29								○					
			5	SS	82/ 0.225								○ H					2 37 42 19
			6	SS	64/ 0.275								○					
336.2			7	SS	58/ 0.225								○					
6.3	END OF BOREHOLE AT 6.3m. BOREHOLE DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.				0.225													

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RECORD OF BOREHOLE No CR16 E-NS06

1 OF 2

METRIC

GWP# 408-88-00 LOCATION Wellington County Road 86 E-NS Ramp, MTM NAD 83 Zone 10: N 4 823 242.5 E 238 502.1 ORIGINATED BY OA
 DIST HWY 7 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2017.06.26 - 2017.06.26 LATITUDE 43.546167 LONGITUDE -80.320179 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)								
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				W _P W W _L				GR	SA	SI	CL					
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				WATER CONTENT (%)												
347.7	GROUND SURFACE							20	40	60	80	100												
0.0	TOPSOIL: (75mm) Clayey SILT , trace sand, trace gravel, trace organics Stiff Brown Moist		1	SS	10									○										
0.1			2	SS	10										○									
346.3	Sandy Clayey SILT , trace to some gravel Very Stiff to Hard Brown to Grey Moist (TILL) Layer of clayey sand - silty sand		3	SS	26									○										
1.4			4	SS	81									○						14	40	33	13	
			5	SS	80/ 0.275										○									
			6	SS	83										○									
			7	SS	42										○									
			8	SS	44										○									

Continued Next Page

+³, ×³: Numbers refer to Sensitivity
 20
 15
 10
 (%) STRAIN AT FAILURE

2 OF 2

METRIC

[illegible]

RECORD OF BOREHOLE No CR16 E-NS07

1 OF 2

METRIC

GWP# 408-88-00 LOCATION Wellington County Road 86 E-NS Ramp, MTM NAD 83 Zone 10: N 4 823 270.5 E 238 501 501 ORIGINATED BY OA
 DIST HWY 7 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2017.06.26 - 2017.06.26 LATITUDE 43.546423 LONGITUDE -80.319695 CHECKED BY JPL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL LIMIT MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE			W P W W L WATER CONTENT (%)				
348.5	GROUND SURFACE														
0.0	TOPSOIL: (100mm)														
0.1	Silty CLAY , trace sand, trace gravel, occasional organics Stiff Brown		1	SS	9		348								
347.8	Moist														
0.7	Sandy Clayey SILT , trace gravel, occasional cobbles Very Stiff to Hard Brown to Grey Moist (TILL)		2	SS	18		347								
			3	SS	22										0 42 43 15
			4	SS	68		346								
			5	SS	98		345								
							344								
			6	SS	65/ 0.225										
							343								
			7	SS	98/ 0.200		342								
341.5							341								
7.0	Sandy Silty CLAY , trace gravel Hard to Stiff Grey Moist (TILL)														
			8	SS	35		340								7 32 36 25
							339								
338.7			9	SS	14										
9.8	END OF BOREHOLE AT 9.8m.														

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

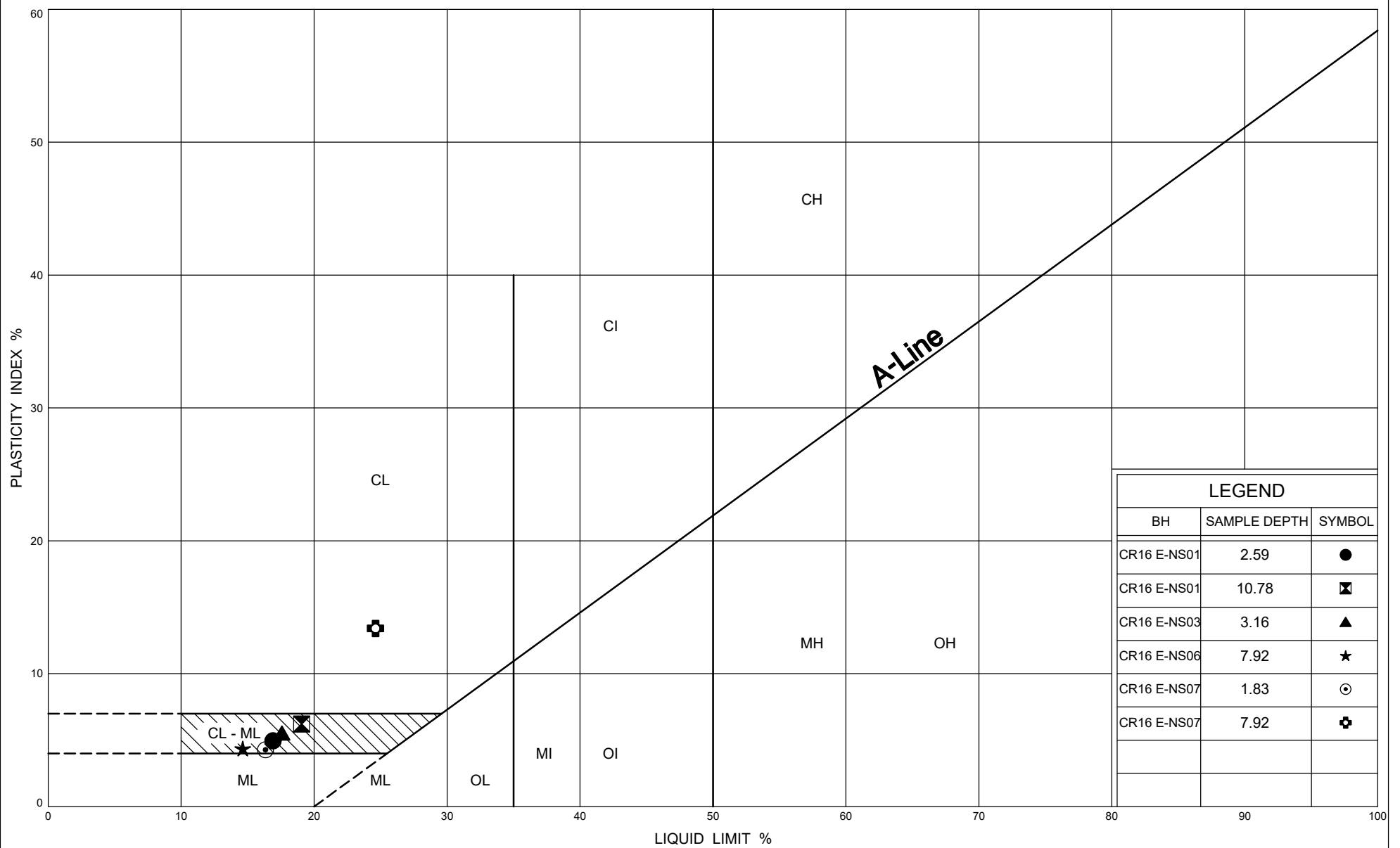
20
15
10

(%) STRAIN AT FAILURE

2 OF 2

GWP#	408-88-00	LOCATION	Wellington County Road 86 E-NS Ramp, MTM NAD 83 Zone 10: N 4 823 270.5 E 238 560			ORIGINATED BY	OA
DIST	HWY 7	BOREHOLE TYPE	Solid Stem Augers			COMPILED BY	MFA
DATUM	Geodetic	DATE	2017.06.26 - 2017.06.26	LATITUDE	43.546423	LONGITUDE	-80.319695
						CHECKED BY	JPL

[illegible]



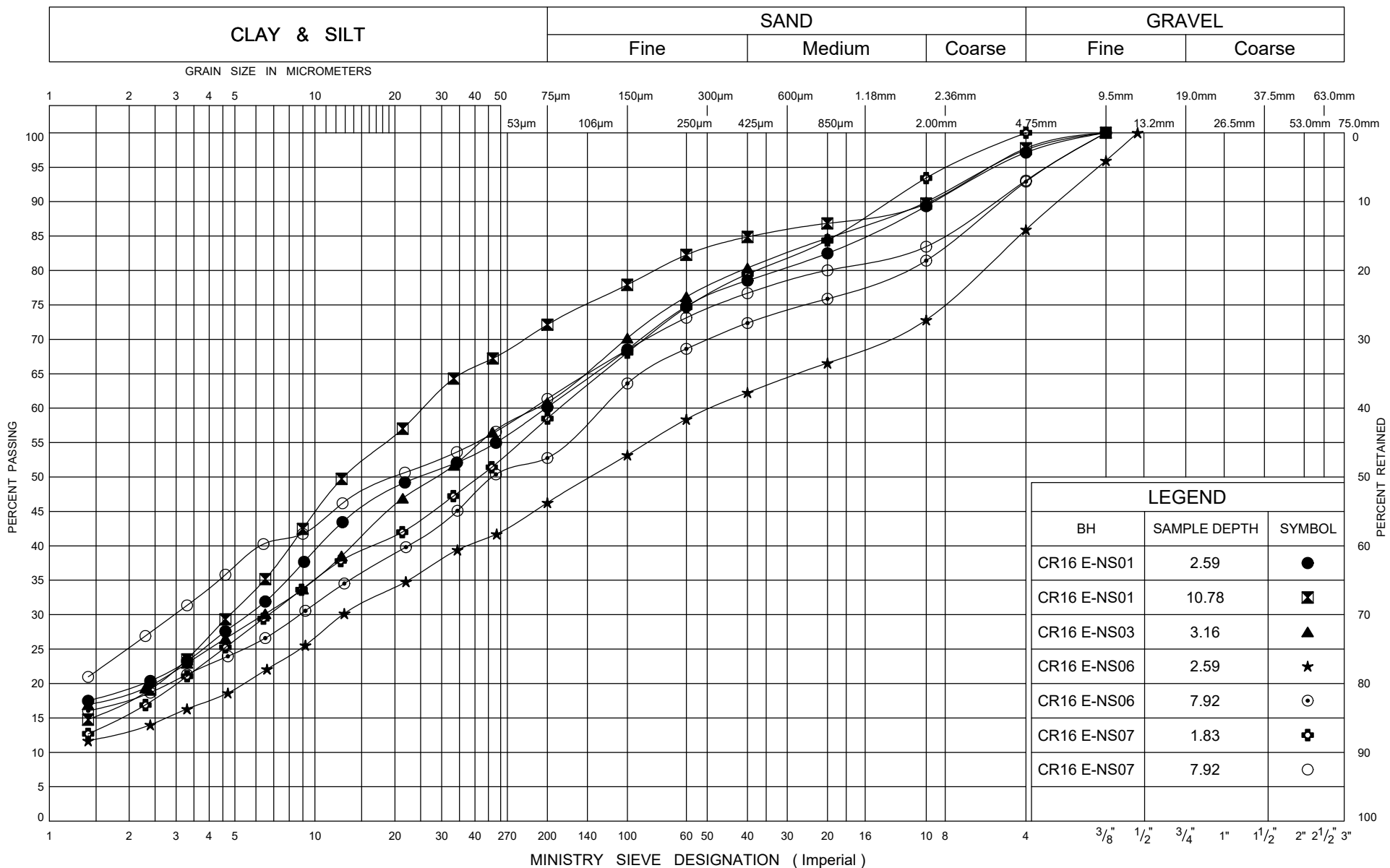
Ministry of
Transportation

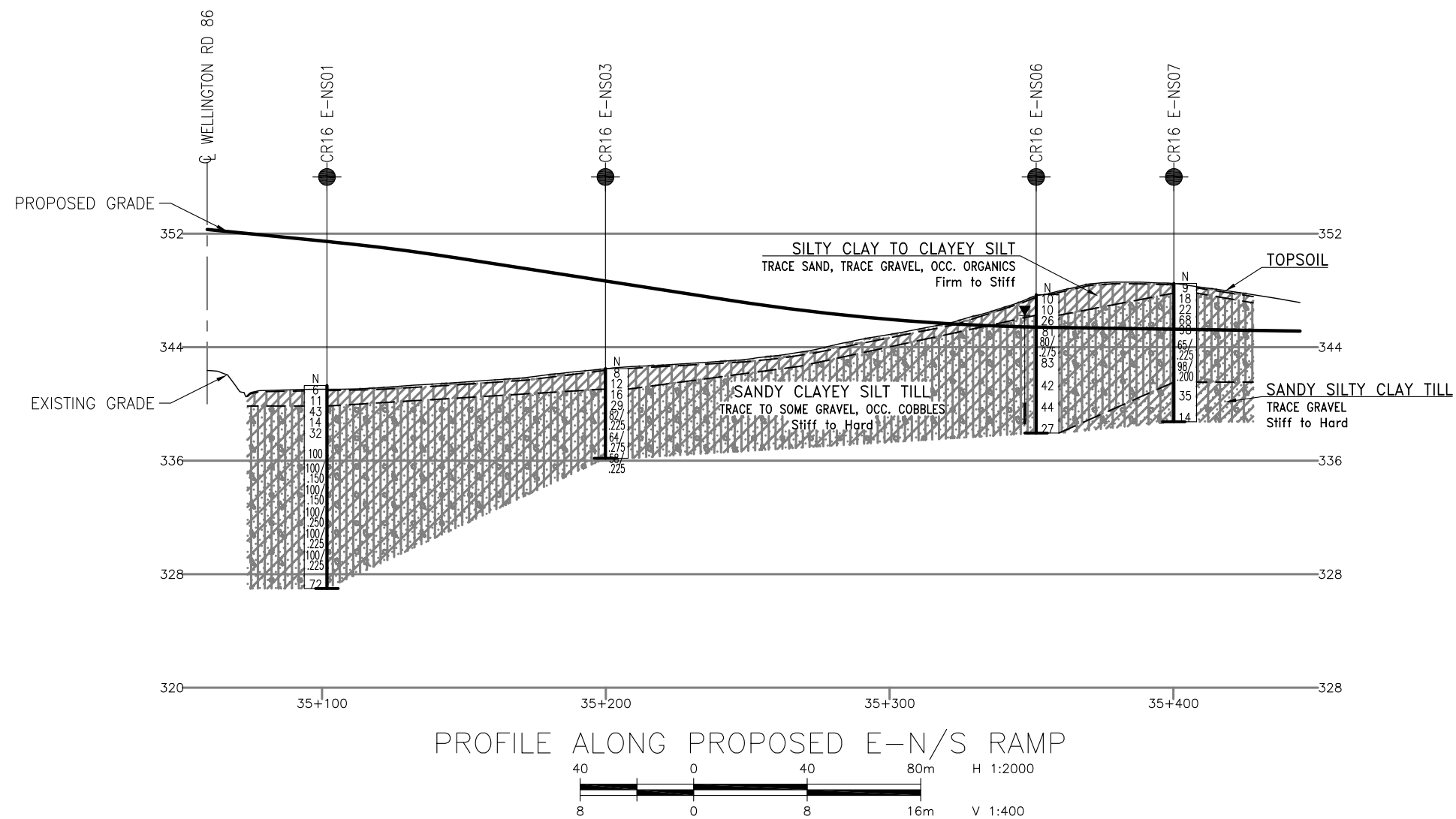
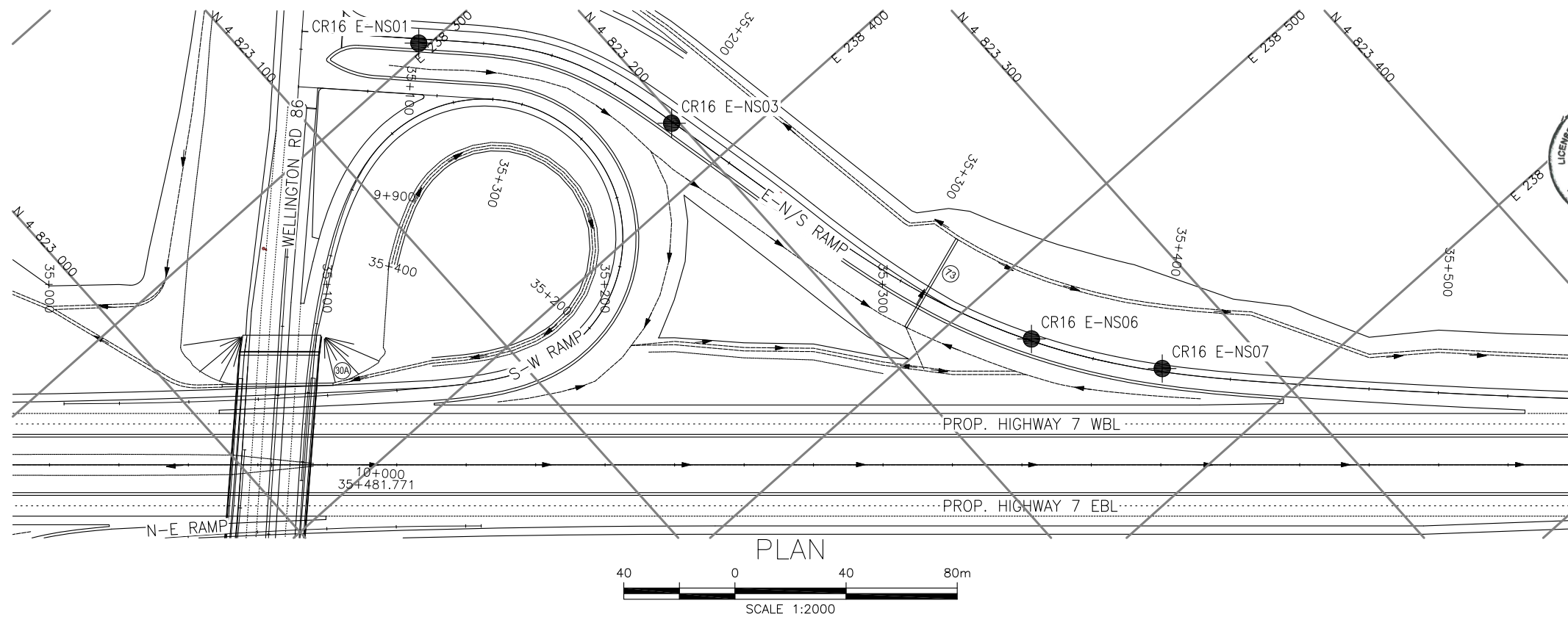
PLASTICITY CHART

Sandy Clayey SILT to Sandy Silty CLAY TILL

FIG No I1

GWP 408-88-00





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

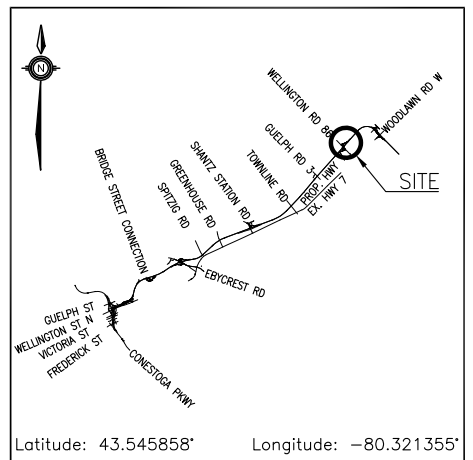


CONT No
GWP No 408-88-00

WELLINGTON COUNTY ROAD 86
E-N/S RAMP CUT/FILL
BOREHOLE LOCATIONS AND SOIL STRATA








THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

	Borehole (Current Investigation)
	Borehole (2008 Investigation)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60" Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

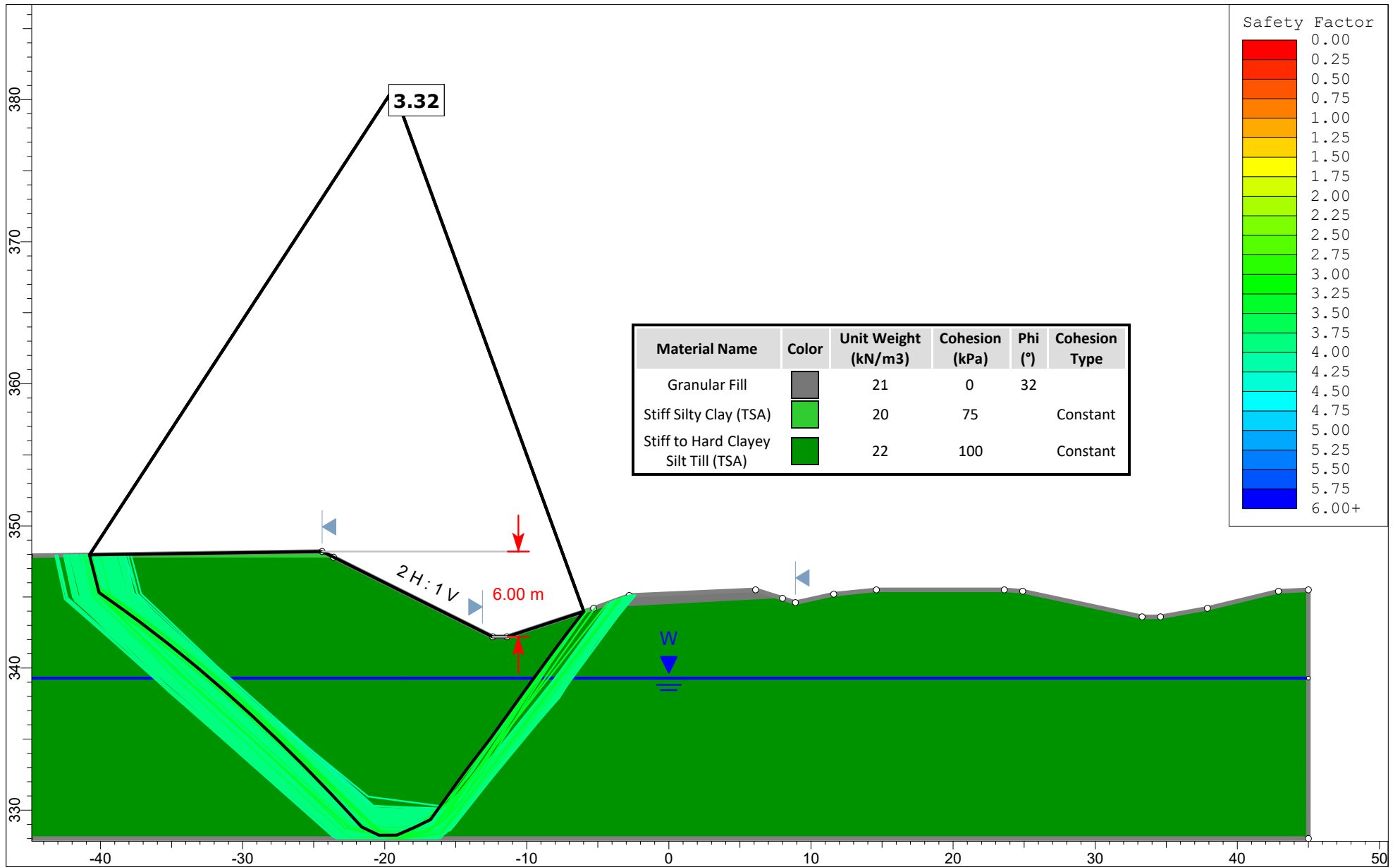
[illegible]

-NOTES-

- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- 3) Coordinate system is MTM NAD 83 Zone 10.

GEOCRES No. 40P09-068

[illegible]



Project: Hwy 7 New - High Fills and Deep Cuts

Analysis: Temporary / Short-Term

2024-02-27 12:33:07 PM

Scale: 1:375

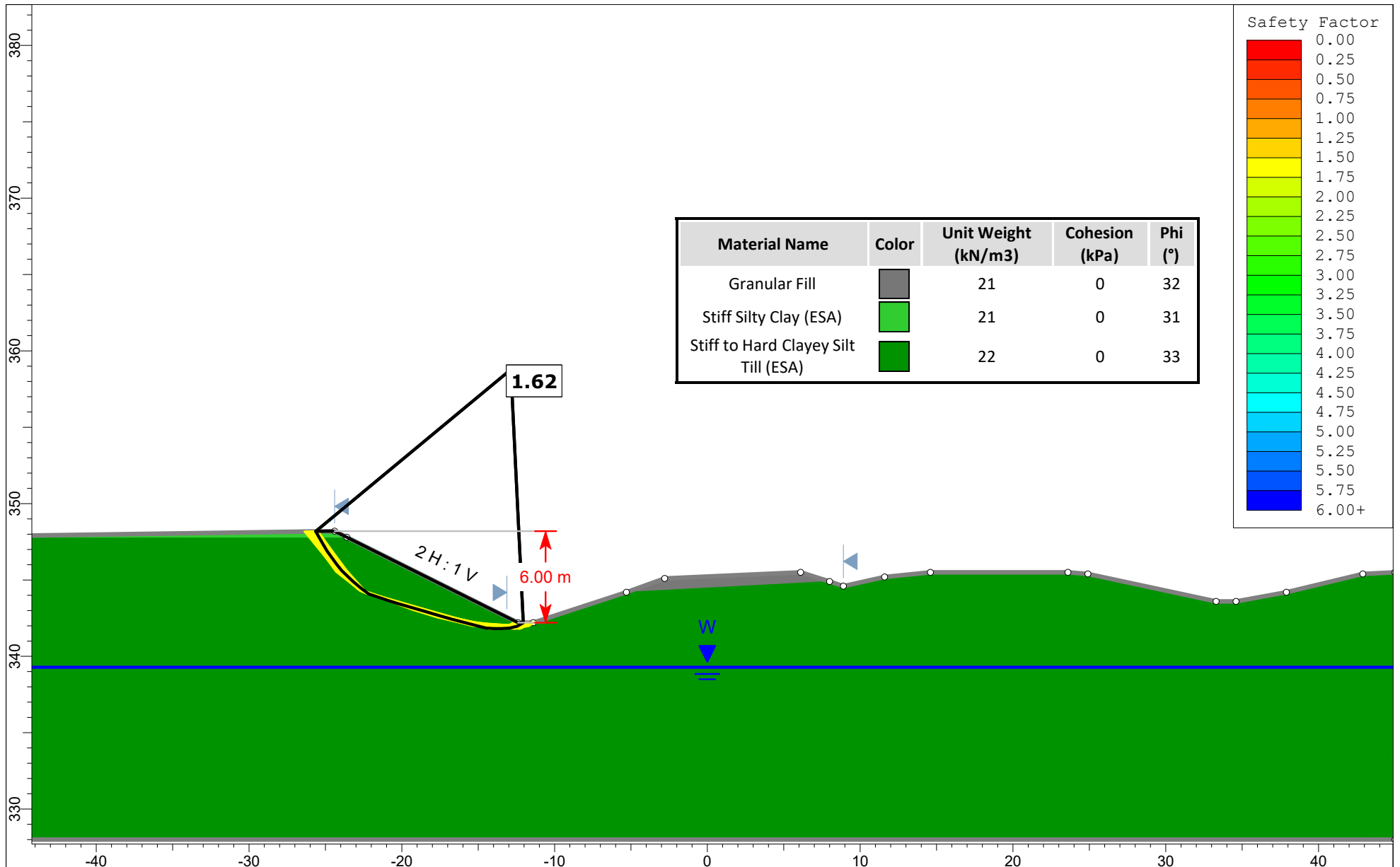
Additional Details:

Name: 35+400.slmd

Comments: Nearest Borehole: CR16 E-NS07

Method: GLE / Morgenstern-Price

Figure I3



Project: Hwy 7 New - High Fills and Deep Cuts

Analysis: Permanent / Long-Term

2024-02-27 12:33:08 PM

Scale: 1:350

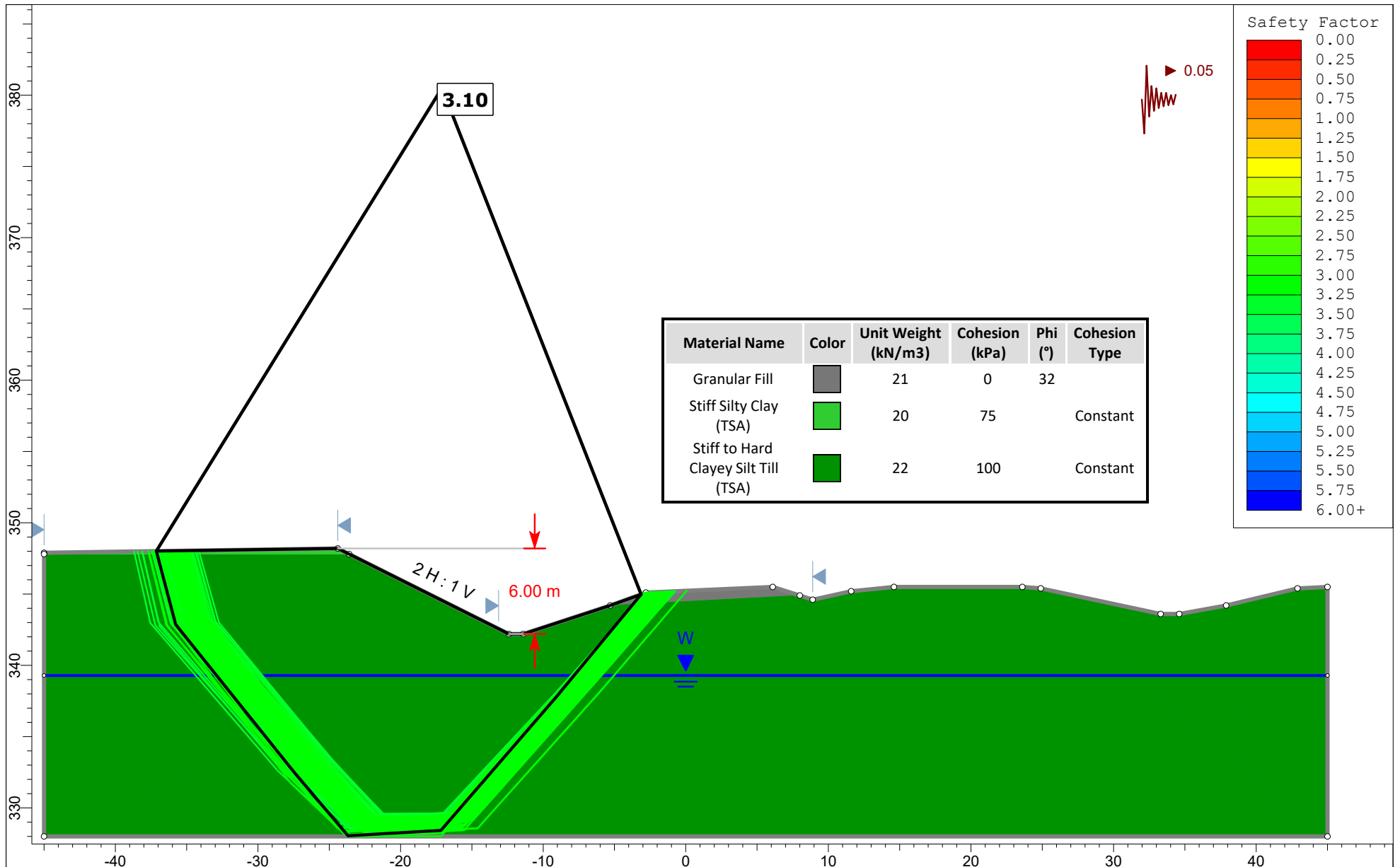
Additional Details:

Name: 35+400.slmd

Comments: Nearest Borehole: CR16 E-NS07

Method: GLE / Morgenstern-Price

Figure I4



Project: Hwy 7 New - High Fills and Deep Cuts

Analysis: Seismic

2024-02-27 12:33:08 PM

Scale: 1:375

Additional Details:

Name: 35+400.slmd

Comments: Nearest Borehole: CR16 E-NS07

Method: GLE / Morgenstern-Price

Figure I5



Appendix J.

Highway 7: Station 36+000 – 36+250 (08-220)

RECORD OF BOREHOLE No 08-220

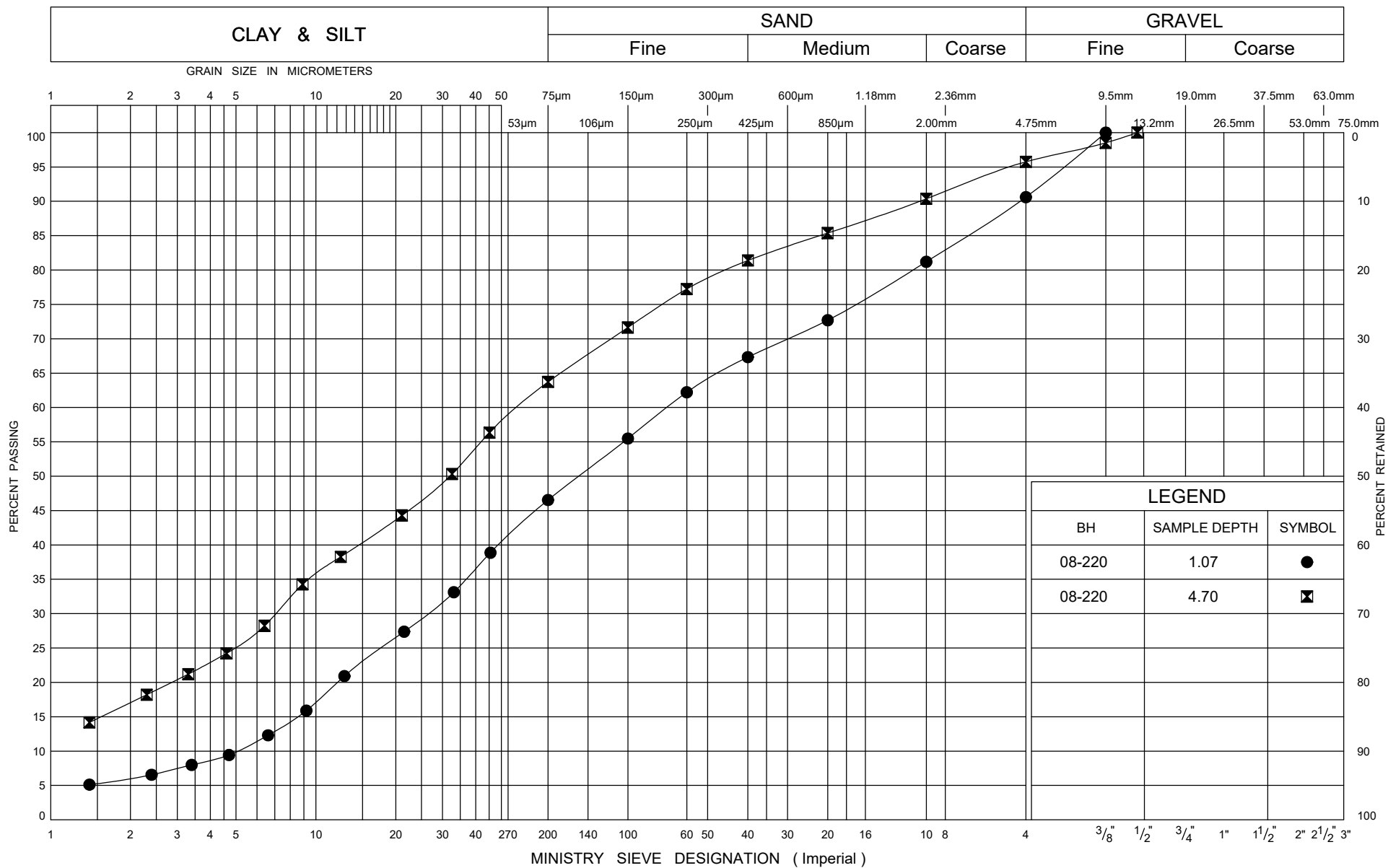
1 OF 1

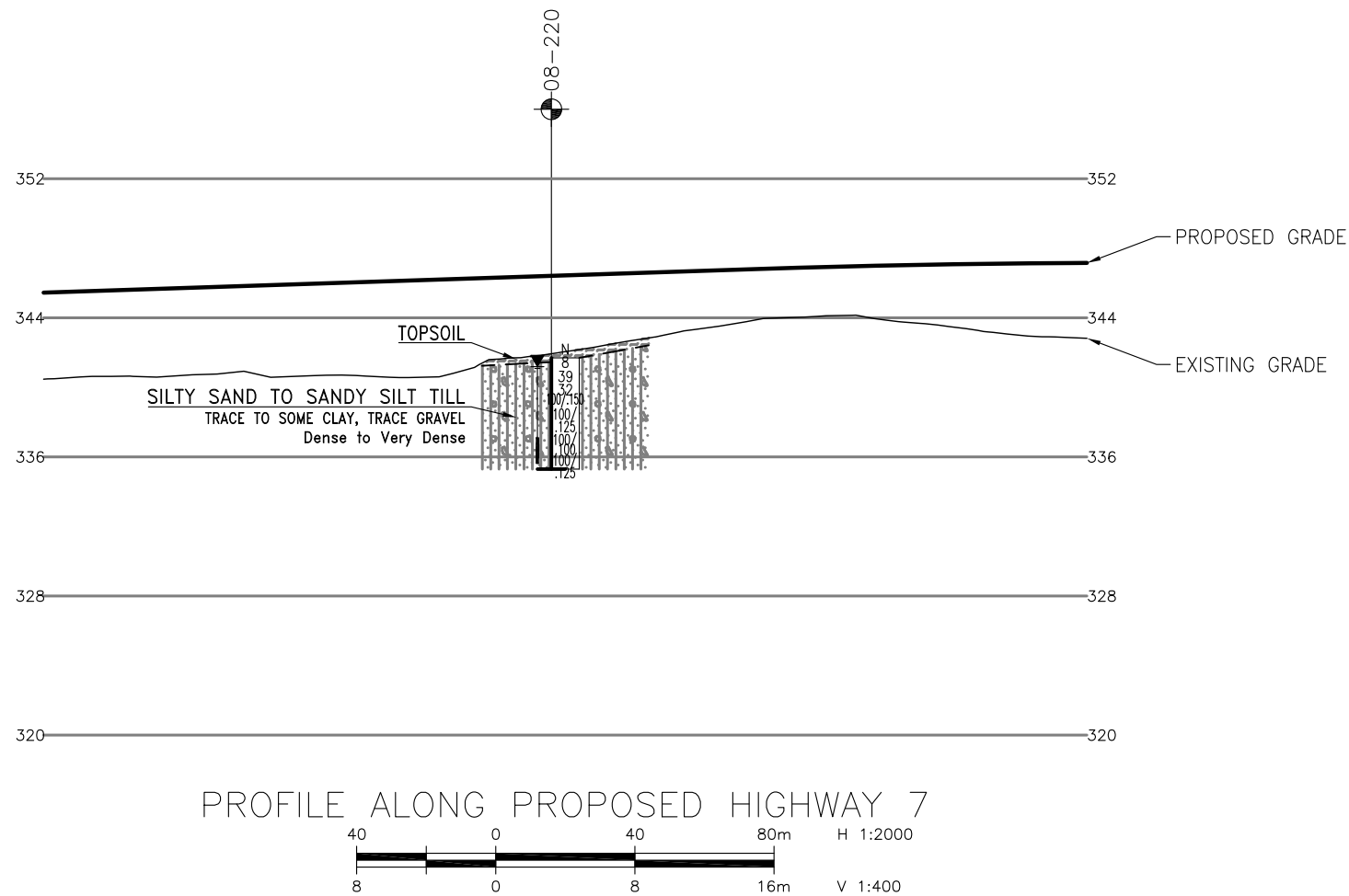
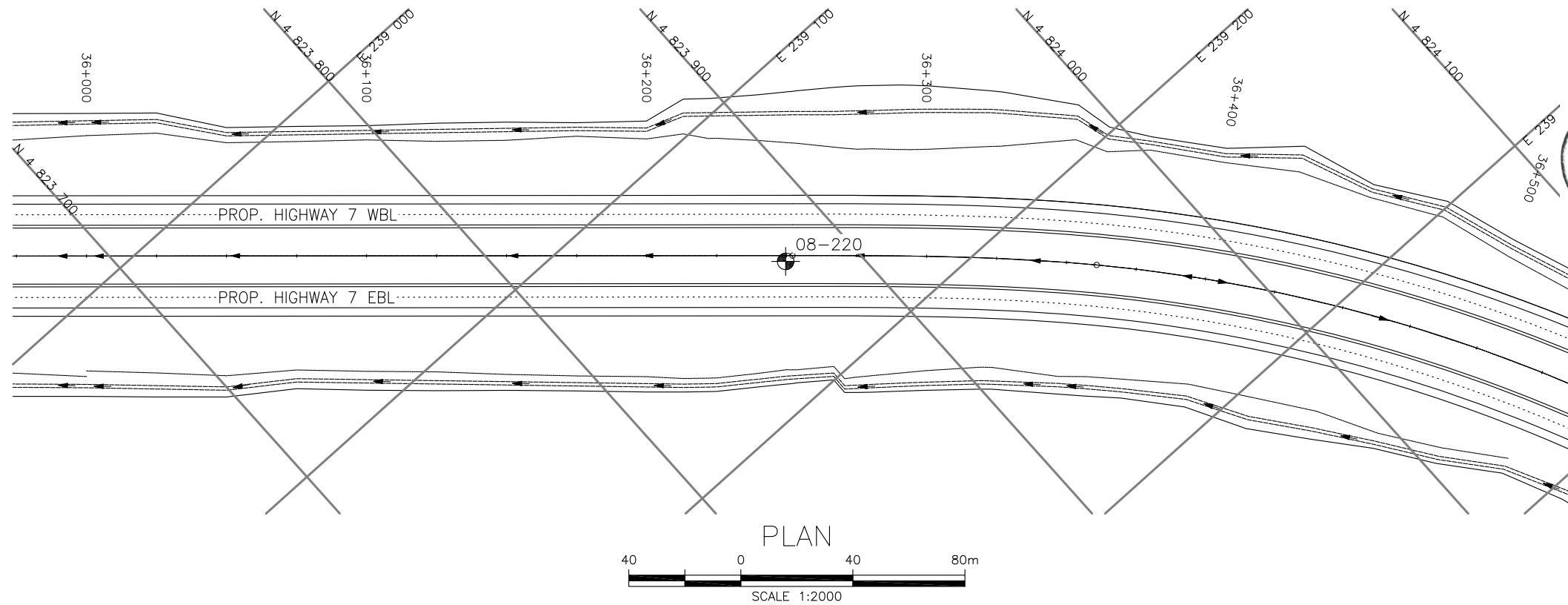
METRIC

GWP# 408-88-00 LOCATION N 4 823 878.6 E 239 156.9 ORIGINATED BY LG
DIST HWY 7 - New BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2008.11.28 - 2008.11.28 LATITUDE LONGITUDE CHECKED BY MEF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				WATER CONTENT (%) w _P w w _L				GR	SA	SI	CL	
341.7	GROUND SURFACE																			
0.0	TOPSOIL: (450mm)		1	SS	8															
341.2																				
0.5	Silty SAND to Sandy SILT , trace to some clay, trace gravel Dense to Very Dense Brown to Grey Moist (TILL)		2	SS	39												9	44	40	7
			3	SS	32															
			4	SS	100/ 0.150															
			5	SS	100/ 0.125															
			6	SS	100/0.100															
			7	SS	100/ 0.125															
335.3	END OF BOREHOLE AT 6.4m. BOREHOLE DRY UPON COMPLETION OF DRILLING. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.																			
6.4	WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2009.04.23 0.5 341.2																			

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

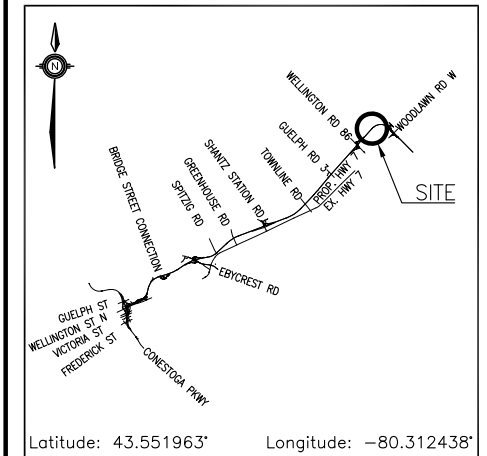


CONT No
GWP No 408-88-00

HIGHWAY 7
MAINLINE FILL
36+000 TO 36+250
BOREHOLE LOCATIONS AND SOIL STRATA



THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

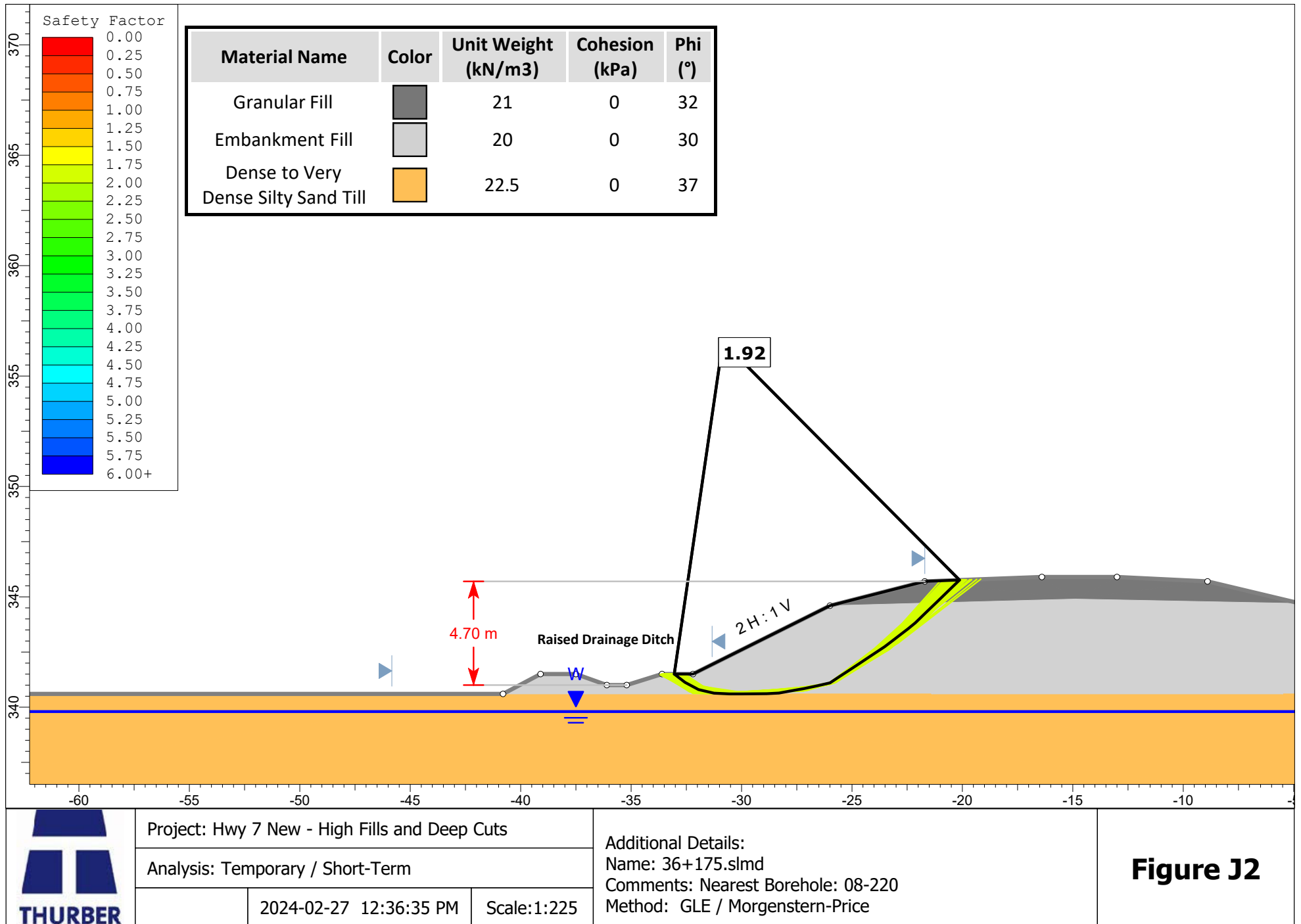
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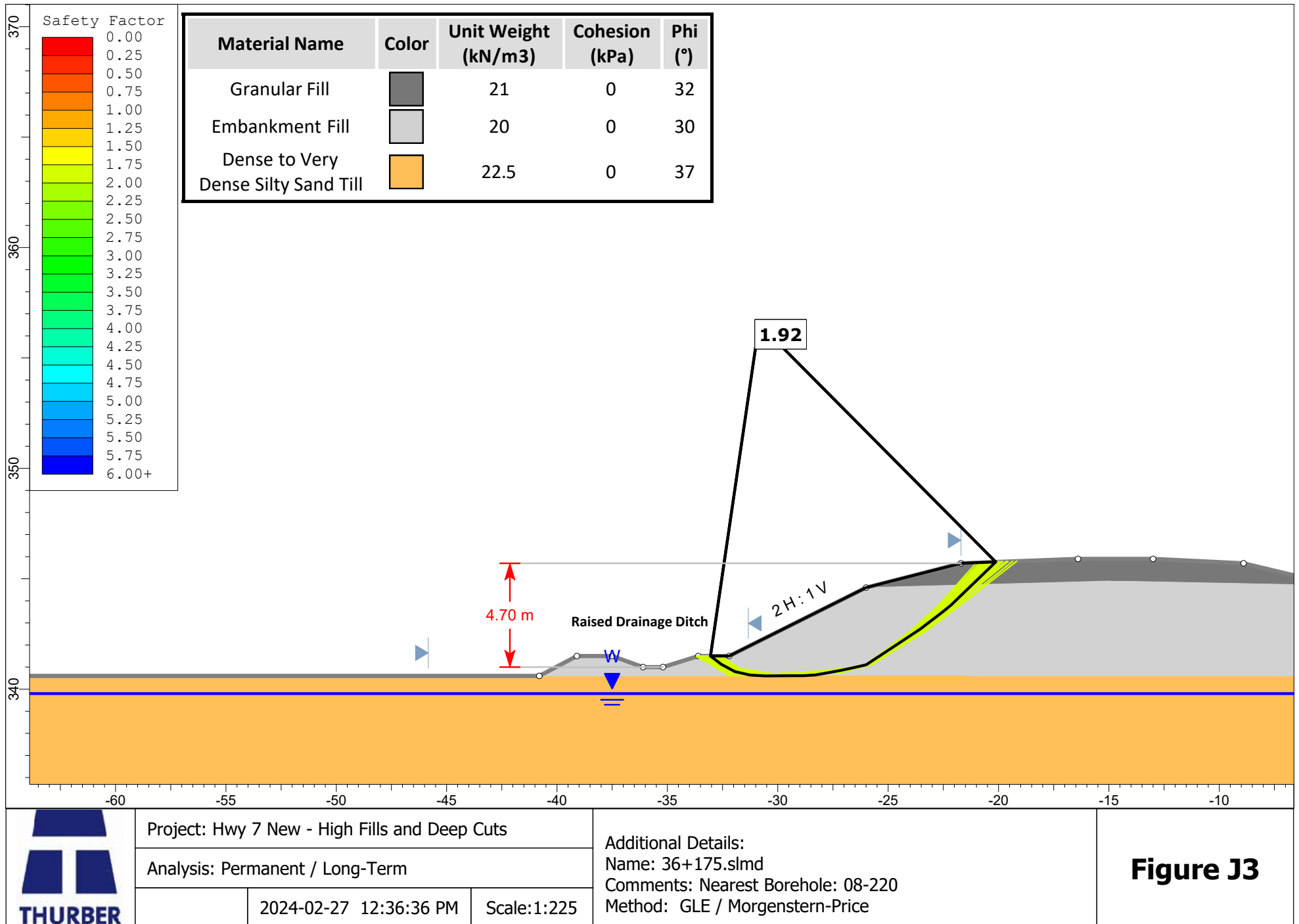
-NOTES-

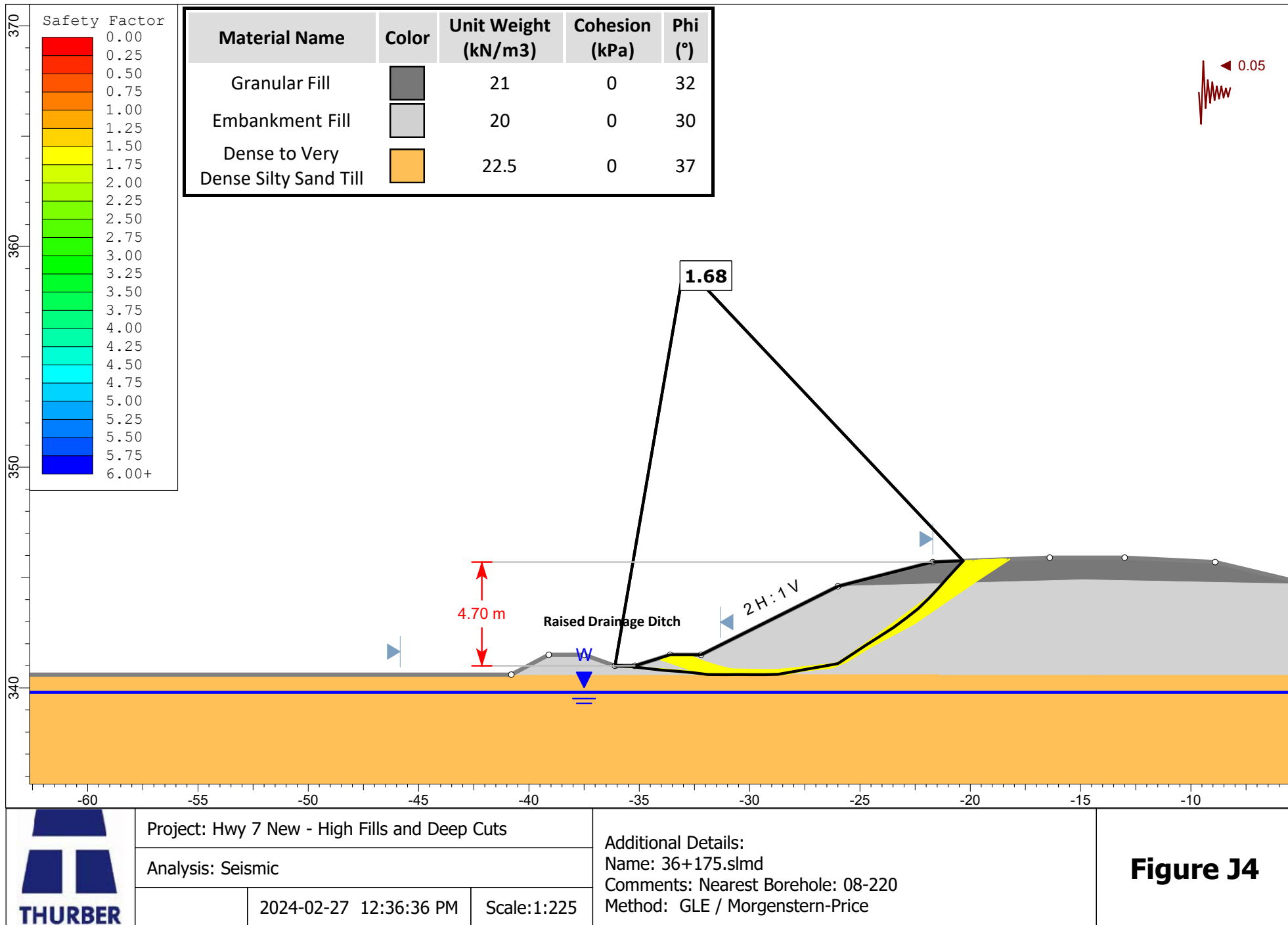
- 1) The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- 2) This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- 3) Coordinate system is MTM NAD 83 Zone 10.

GEOCRES No. 40P09-068

[illegible]









Appendix K.

GSC Seismic Hazard Calculation

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Site: 43.532N 80.336W

2020-04-13 12:54 UT

Probability of exceedance per annum	0.000404	0.001	0.0021	0.01
Probability of exceedance in 50 years	2 %	5 %	10 %	40 %
Sa (0.05)	0.108	0.061	0.036	0.010
Sa (0.1)	0.141	0.084	0.052	0.015
Sa (0.2)	0.128	0.078	0.050	0.017
Sa (0.3)	0.103	0.065	0.043	0.015
Sa (0.5)	0.080	0.051	0.034	0.012
Sa (1.0)	0.046	0.030	0.020	0.006
Sa (2.0)	0.023	0.015	0.009	0.002
Sa (5.0)	0.006	0.003	0.002	0.001
Sa (10.0)	0.002	0.001	0.001	0.000
PGA (g)	0.078	0.046	0.029	0.008
PGV (m/s)	0.064	0.039	0.025	0.007

Notes: Spectral ($S_a(T)$, where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s . Values are for "firm ground" (NBCC2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are highlighted in yellow. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. **These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.**

References

National Building Code of Canada 2015 NRCC no. 56190; Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

Structural Commentaries (User's Guide - NBC 2015: Part 4 of Division B)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites www.EarthquakesCanada.ca and www.nationalcodes.ca for more information



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Appendix L.

Tables

Table 1
Summary of Slope Stability Analysis
New Highway 7 - High Fill Embankments and Deep Cuts
Woolwich Guelph Townline to Wellington County Road 86

Highway / Roadway / Ramp	Approx. Station	Analyzed Station	Reference Appendix	Cut and/or Fill	Depth of Cut / Height of Embankment (m)	Analysis	Factor of Safety	Figure
Highway 7	32+300 - 32+500	32+450	A	Cut	6.0 - 7.5	Temporary / Short-Term	1.50	A4
						Permanent / Long-Term	1.50	A5
						Seismic	1.34	A6
Highway 7	32+800 - 33+050	32+925	B	Cut	6.0 - 12.5	Temporary / Short-Term	1.53	B8
						Permanent / Long-Term	1.53	B9
						Seismic	1.35	B10
Highway 7	33+400 - 33+600	33+500	C	Fill	5.0 - 6.0	Temporary / Short-Term	1.55	C8
						Permanent / Long-Term	1.55	C9
						Seismic	1.37	C10
Highway 7	33+800 - 34+150	33+925	D	Cut	5.0 - 13.5	Temporary / Short-Term	1.61	D7
						Permanent / Long-Term	1.53	D8
						Seismic	1.42	D9
Highway 7	34+950 - 35+100	35+000	E	Cut	3.5	Temporary / Short-Term	2.11	E5
						Permanent / Long-Term	2.11	E6
						Seismic	1.87	E7
Wellington County Road 86	9+700 - 10+150	9+900	F	Fill	5.5 - 11.0	Temporary / Short-Term	1.54	F3
						Permanent / Long-Term	1.54	F4
						Seismic	1.28	F5
Wellington County Road 86 - N-E Ramp	34+764 - 34+800	34+775	G	Fill	4.5 - 7.5	Temporary / Short-Term	1.73	G2
						Permanent / Long-Term	1.73	G3
						Seismic	1.53	G4
Wellington County Road 86 - S-W Ramp	35+250 - 35+400	35+375	H	Fill	9.5 - 12.0	Temporary / Short-Term	1.51	H3
						Permanent / Long-Term	1.50	H4
						Seismic	1.34	H5
Wellington County Road 86 - E-N/S Ramp	35+100 - 35+400	35+400	I	Cut / Fill	C: 4.5 - 5.0 F: 6.0 - 8.0	Temporary / Short-Term	3.49	I3
						Permanent / Long-Term	1.62	I4
						Seismic	3.04	I5
Highway 7	36+000 - 36+250	36+175	J	Fill	4.5 - 5.0	Temporary / Short-Term	1.92	J2
						Permanent / Long-Term	1.92	J3
						Seismic	1.68	J4

Table 2
Summary of Settlement Analysis
New Highway 7 - High Fill Embankments and Deep Cuts
Woolwich Guelph Townline to Wellington County Road 86

Highway / Roadway / Ramp	Approx. Station	Reference Appendix	Cut and/or Fill	Depth of Cut / Height of Embankment (m)	Foundation Settlement (mm)	Embankment Compression (mm)	Total Estimated Settlement (mm)
Highway 7	32+300 - 32+500	A	Cut	6.0 - 7.5	-	-	-
Highway 7	32+800 - 33+050	B	Cut	6.0 - 12.5	-	-	-
Highway 7	33+400 - 33+600	C	Fill	5.0 - 6.0	25	30	55
Highway 7	33+800 - 34+150	D	Cut	5.0 - 13.5	-	-	-
Highway 7	34+950 - 35+100	E	Cut	3.5	-	-	-
Wellington County Road 86	9+700 - 10+150	F	Fill	5.5 - 11.0	30	55	85
Wellington County Road 86 - N-E Ramp	34+764 - 34+800	G	Fill	4.5 - 7.5	30	40	70
Wellington County Road 86 - S-W Ramp	35+250 - 35+400	H	Fill	9.5 - 12.0	25	60	85
Wellington County Road 86 - E-N/S Ramp	35+100 - 35+400	I	Cut / Fill	C: 4.5 - 5.0 F: 6.0 - 8.0	25	40	65
Wellington County Road 86 - E-N/S Ramp	36+000 - 36+250	J	Fill	4.5 - 5.0	10	25	35