

Final Foundation Investigation Report (FIR)

Highway 61 Culvert Replacement

Station 20+375, Township of Blake

Gannett Fleming

Ontario Ministry of Transportation (MTO)

GWP 6176-15-00

GEOCRES No. 52A00-264

Assignment No.: 6020-E-0021

Latitude: 48.248199; Longitude: -89.483835

September 15, 2022

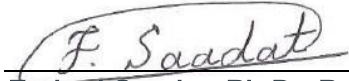
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Gannett Fleming GWP 6176-15-00

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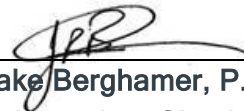


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Revisions and publications log

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0A	December 29, 2021	Draft FIR issued for Client information only
0B	April 7, 2022	Draft FIDR issued for review and comment
0C	May 29, 2022	Revised Draft FIDR issued for review and comment
1A	September 15, 2022	Final FIR issued

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1 Introduction

Englobe Corp. (Englobe) has been retained by Gannett Fleming (Client), on behalf of the Ministry of Transportation of Ontario (MTO, Owner), to carry out a foundation investigation and prepare Foundation Investigation (FIR) and Foundation Investigation and Design (FIDR) Reports for the proposed replacement of an existing culvert at approximate Station 20+375 on Highway No. 61 in the Township of Blake, Ontario (Site) shown on Drawing No. 1, Appendix A. This assignment was performed at the request of the Client as per the project Terms of Reference outlined in MTO Request for Quotation (RFQ) Version 3.2 under Assignment Number 6020-E-0021 (GEOCREs No. 52A00-264).

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2 Site Description

The existing 51.9 m long culvert structure is crossing Highway 61 at approximate Station 20+375, approximately 1230 m south of Moose Hill, in the Township of Blake. Highway 61 at this culvert crossing is a two-lane undivided highway with asphalt surface and partially paved shoulders on both sides running in an approximate north-south direction, as shown on Drawing No. 1 in Appendix A. Highway 61 is constructed on an embankment about 12.5 m wide (including shoulders) and up to approximately 9 m in height above the crown of the culvert, with the centreline of the roadway at an approximate elevation 236.9 m at the culvert location. The pavement surface is generally in good to fair condition with some longitudinal and transverse cracks across the asphalt surface. The topography of the surrounding area varies in the vicinity of the crossing. The sides of the roadway at the culvert crossing were observed to be heavily vegetated with bushes, shrubs, and mature trees. Minor bank and embankment erosion were also noted in GF Culvert Inspection Report. Existing overhead infrastructure observed at the culvert location included low hanging hydro line on both sides of the roadway.

The existing culvert consists of two sections of undermined length. The first section (upstream) is a 1.7 m wide and 1.2 m high Creosoted Timber Culvert (CTC) at the inlet, and the second section (downstream) is a 1.2 m diameter Corrugated Steel Pipe (CSP) at the outlet extending beyond the existing embankment slope, as shown on Drawing No. 2 in Appendix A and described in detail and shown on the sketches and Figures in Gannett Fleming (GF) Culvert Inspection Report in Appendix D. The existing CTC culvert at the inlet was observed to be deteriorated and deformed. The existing CSP culvert barrel at the outlet invert is corroded and its springline is very severely corroded and damaged. The channel dimensions were described by GF in general as 2 m wide channel upstream (US) with banks at ~3H:1V and water depth of 130 mm; and 5 m wide channel downstream (DS) with banks at 3H:1V, 400 mm of water. The top of the culvert elevations at the inlet and outlet are El. 227.3 and El. 226.9 m, respectively with clearance of 1030 mm and 822 mm, respectively. Flow through the culvert is from east/right (Rt) to the west/left (Lt) as shown on Drawing No. 2 in Appendix A.

2.1 Site Physiography and Surficial Geology

Based on published Northern Ontario Geology Terrain Study (NOEGTS) of the general area by J. F. Gartner, J.D. Mollard, and M.A. Road (1981), the Site is located within the Glaciolacustrine Plain with native overburden/sediments within the immediate project area consisting mainly of sand and silt deposits.



3 Investigation Procedures

3.1 Site Investigation

The purpose of the geotechnical investigation was to explore and record the subsurface conditions at both ends of the existing culvert and in the roadway embankment at the culvert crossing. The fieldwork was carried out between October 12 and November 12, 2021 and consisted of two boreholes on the roadway extending to a maximum depth of 22.3 m below existing ground/road surface (mbgs) and two boreholes off the roadway at the culvert inlet and outlet extending to a maximum depth of 6.7 mbgs.

The fieldwork included locating the boreholes, clearing the borehole locations of underground services, in-situ sampling and testing operations, logging of the boreholes, labeling and preparation of samples for transportation to the Englobe geotechnical laboratory in North Bay, plus overall drill supervision.

Englobe's staff visited the Site before the planned site investigation to mark out the selected borehole locations. Utility clearance was obtained from Ontario-1-Call. Public utility authorities were informed, and all utility clearance documents were obtained before the commencement of drilling work. A traffic control plan was prepared and implemented by Workforce Inc. of Sudbury, Ontario, according to Ontario Traffic Manual Book 7 during the fieldwork. The drilling rigs used for drilling were owned and operated by Maple Leaf Drilling Ltd. of Sunnyside, Manitoba. Boreholes were advanced using a CME 750 track mounted drill and a B20 portable drilling rig.

The fieldwork for this investigation included four (4) sampled boreholes (BH) were advanced. BH Nos. 1 and 2 were advanced in the roadway shoulders through the embankment. BH Nos. 3 and 4 were advanced at the inlet (Rt) and outlet (Lt) ends of the culvert, respectively. The locations of the boreholes are shown on Drawing No. 2 in Appendix A and are provided in the Table below.

Table 1 Borehole Locations

Borehole No.	Borehole Location (MTM Nad 83)		Borehole Location (Geographic)	
1	N 5345622.9	E 343135.5	Lat: 48.24823°	Long: - 89.483761°
2	N 5345622.4	E 343125.0	Lat: 48.24822°	Long: - 89.483902°
3	N 5345613.8	E 343160.2	Lat: 48.24815°	Long: - 89.484261°
4	N 5345623.1	E 343098.4	Lat: 48.24823°	Long: - 89.484260°

BH Nos. 1 and 2 were advanced using a hollow stem auger aided by track-mounted CME 750 drilling rig equipped with wash boring equipment, N-size casing, rock coring equipment (NQ size core) and

routine geotechnical sampling equipment. BH Nos. 3 and 4, which were drilled off the roadway near the inlet and outlet, were advanced using a B20 portable drilling rig equipped with hollow stem augers.

Soil samples were obtained at regular intervals of depth at the borehole locations using a standard 51 mm split spoon sampler advanced in accordance with the Standard Penetration Test (SPT) procedures ASTM D1586. All soil samples taken during this investigation were stored in labeled airtight containers for transport to the Englobe geotechnical laboratory in North Bay for visual examination and select laboratory testing. Bedrock was cored with NQ size coring equipment at BH No. 2.

Groundwater conditions in the open boreholes were observed during the advancement of the individual boreholes. Two 19 mm diameter standpipes were installed in Borehole Nos. 3 and 4 prior to backfilling to allow for follow-up monitoring of the stabilized groundwater levels. The remaining boreholes were backfilled upon completion of drilling in accordance with requirements of Ontario Regulation 903.

The location of the individual boreholes was determined in the field using highway chainage established by the Ministry of Transportation and offsets relative to highway centreline. The MTO co-ordinates, northing and easting, were then established for the boring locations using coordinates from MTM Zone 15, NAD 83 CSRS. Elevations contained in this report are referenced to an on-site geodetic datum. The borehole elevations are based on the GPS RTK survey carried out by Englobe.

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4 Laboratory Investigation

All soil and rock samples obtained during the investigation were transported to Englobe Laboratory in North Bay, Ontario. This laboratory is certified by the Ministry of Transportation Ontario (MTO) under RAQS program at Medium Complexity level for Soil and Rock Testing including Testing for Foundation Engineering. All retrieved samples were subjected to visual identification and tactile categorization to describe the soils. The laboratory tests to determine index properties were performed in accordance with the Ministry of Transportation Ontario (MTO) test procedures, which follow the American Society for Testing Materials (ASTM) test procedures. Laboratory testing consisted of grain size distribution; sieve and hydrometer analysis according to ASTM D422 and LS-702, Atterberg's Limits ASTM D4318 and LS-703/704, water content ASTM D2216 and LS-701. The results of the laboratory testing are presented on the individual Record of Borehole Sheets (Appendix B), with a summary of results presented on the laboratory sheets in Appendix C (Figures Nos. L-1 to L-8).

Chemical tests on one representative soil and one surface water sample to determine the soil and water corrosivity characteristics (pH, chloride, resistivity, sulphate) were carried out by an accredited independent laboratory (Bureau Veritas in Mississauga) to assess soil condition for buried structural steel and concrete elements.

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5 Subsurface Conditions

The subsurface conditions revealed by the investigation program are summarized in Table 2 below and on the stratigraphic profile presented on Drawing No. 2 (Appendix A) and on the detailed Records of Borehole Logs (Appendix B). It should be noted that the stratigraphic delineation presented on the borehole logs and soil strata plot is interpreted from the results of non-continuous sampling, response to drilling progress, recorded SPT 'N'-values, plus field observations. Typically, such boundaries represent transitions from one zone to another and are not an exact demarcation of specific geological units. Additional consideration should be given to the fact that subsurface conditions may vary markedly between adjacent boreholes and beyond any specific boring location and are shown on the drawings for illustration purposes only.

Table 2 Summary of Generalized Stratigraphy in Boreholes with Depth and Elevation (m)

Deposit/Layer Description	Depths/Elevations (m)			
	Borehole No. 1	Borehole No. 2	Borehole No. 3	Borehole No. 4
Asphalt/Topsoil	0.04 (El. 236.7 – 236.6)	0.04 (El. 237.1)	--	0 – 0.1 (El. 226.6 – 226.5)
Pavement Granular Base: Compact Sand and Gravel	0.04 – 0.8 (El. 236.6 – 235.9)	0.04 – 0.8 (El. 237.1 – 236.4)	--	--
Embankment Fill: Compact to Loose Sand/Silty Sand, some Gravel	0.8 – 4.6 (El. 235.9 – 232.1)	0.8 – 4.6 (El. 236.4 – 232.5)	--	--
Embankment Fill: Firm Silty Clay with traces of Sand and gravel	4.6 – 6.1 (El. 232.1 – 230.6)	4.6 – 6.9 (El. 232.5 – 230.3)	--	--
Embankment Fill: Compact to Loose Sand/Silty Sand, some Clay, trace Gravel, buried concrete and rock debris near bottom in Borehole No. 1	6.1 – 11.4 (El. 230.6 – 225.3)	6.9 – 10.7 (El. 230.3 – 226.4)	--	--
Native: Loose to Very Dense Native Clayey Silt /Silt	11.4 – 21.3 (El. 225.3 – 215.4)	10.7 – 12.2 (El. 226.4 – 224.9) and 18.3 – 20.9 (El. 218.8 – 216.2)	0 – 6.7 (El. 228.0 – 221.3)	0.1 – 5.3 (El. 226.5 – 221.3)
Native: Loose to Compact Sandy Silt/Silty Sand with trace Clay and Gravel	--	12.2 – 18.3 (El. 224.9 – 218.8)	-	5.3 – 6.7 (El. 221.3 – 219.9)
Bedrock or Inferred Bedrock	21.3 (El. 215.4)	20.9 – 22.1 (El. 216.2 – 215.0)	--	--

5.1 Asphalt and Pavement Structure

A thin layer of approximate 40 mm asphalt was observed in both BH Nos. 1 and 2 which were drilled on the shoulders through the embankment. The asphalt cover is underlain by a granular fill layer consisting mainly of brown sand and gravel, trace silt. The pavement structure/granular fill was observed to extend to approximately 0.8 m depth.

5.2 Topsoil

A thin topsoil layer (organic silt) of approximately 0.1 m thickness was observed in BH No. 4 only, located beyond the paved shoulder. No surficial topsoil was found in BH No. 3.

5.3 Embankment Fill

The composition of the embankment fill below the pavement structure at Borehole Nos. 1 and 2 varied with depth ranging from mainly loose sand/silty sand down to about 4.6 m depth to silty clay down to 6.9 m depth. Below the silty clay fill, another layer of silty sand fill was encountered extending down to maximum depth of 11.4 m (El. 225.3 m), that included buried concrete and rock debris in BH No. 1 down to El. 225.3 m

The embankment fill, immediately below the pavement structure, is mainly composed of brown sand/silty sand with variable portions of gravel and clay. This fill layer was approximately 4.3 m thick and extended down to approximate El. 232.1 m in Borehole No. 1. The moisture content of this upper fill layer varied from moist near top to wet (approximately 16%) near bottom. The results for grain size analyses of representative samples of two component soil types comprising the embankment fill are summarized in Table 3 and presented on Figure Nos. L-1 and L-2 in Appendix C.

Table 3 Particle Size Distribution Results of the Sand/Silt and Sand Fill

Sample Tested	Sample Depth / Elev. (m)	Grain Size Analysis (%)				Soil Classification
		Gravel	Sand	Silt	Clay	
BH No. 1 / SS-6	4.0 (232.7)	16	38	38	8	SM
BH No. 2 / SS-3	1.6 (235.5)	13	36	31	20	SC-SM

This sandy/silty fill layer was generally loose to compact, based on recorded SPT 'N' values ranging from 3 to 14 blows/300 mm.

The upper sand/silty sand fill was underlain by silty clay fill approximately 1.5 m to 2.3 m thick which extended down to approximately El. 230.3 m (lowest) in Borehole No. 2. The silty clay fill included minor portions of sand and gravel. It was reddish brown in colour with its in-situ moisture content measured at approximately 40%. A representative soil sample of this layer was subjected to grain size analysis and Atterberg limits tests (Liquid Limit (LL), Plastic Limit (PL) and Plasticity Index (PI)) and the results are summarized in Table 4 and presented on Figure Nos. L-3 and L-8, Appendix C. This silty clay fill layer can be classified as clay of high plasticity (CH).

Table 4 Particle Size Distribution and Atterberg Limit Results for Silty Clay Fill

Sample Tested	Sample Depth / Elev. (m)	Grain Size Analysis (%)				Atterberg Limits (%)			wc (%)	Soil Classification
		Gravel	Sand	Silt	Clay	LL	PL	PI		
BH No. 1/SS-8	5.6 (231.1)	1	2	39	58	55	29	26	40	CH

The consistency of silty clay fill varied from soft to firm with measured SPT 'N' values ranging from 3 to 8 blows/300 mm.

Below the silty clay fill layer, another brown sand/silty sand fill layer with different portions of clay and gravel was encountered, approximately 5.3 m and 3.9 m thick, and extending down to El. 225.3 m and 226.4 m in BH No. 1 and BH No. 2, respectively. This fill layer was damp near top to moist below with average moisture content of approximately 18%. Two representative soil samples underwent grain size analyses, and the results are summarized in Table 5 and presented on Figure Nos. L-2 and L-4 in Appendix C.

Table 5 Particle Size Distribution Results of the Sand/Silty Sand Fill

Sample Tested	Sample Depth / Elev. (m)	Grain Size Analysis (%)				Soil Classification
		Gravel	Sand	Silt	Clay	
BH No. 1 / SS-13	9.4 (227.3)	8	43	30	18	SC-SM
BH No. 2 / SS-11	7.8 (229.3)	17	70	13		SM

The sand/silty sand fill layer was observed to be loose to compact, based on measured SPT 'N' values ranging from 4 to 13 blows/300 mm.

Split spoon sampler and auger refusal were encountered in BH No. 1 at approximate El. 226.3 m on what was inferred to be buried concrete or rock debris. A piece of rock was retrieved in the split spoon sampler. Coring through the obstructions yielded no core recovery, and was followed by wash boring down to El. 225.3 m. Without core recovery, the frequency and size of these obstructions could not be determined. The buried concrete and/or rock debris, however, was not encountered in BH No. 2 and drilling with hollow stem augers and sampling continued through the embankment fill without any major obstructions encountered to approximately El. 226.4 m.

5.4 Native Clayey Silt/Silt (CL to ML)

Underlying the embankment fill in BH Nos. 1 and 2, and at surface in BH Nos. 3 and 4, a native fine-grained deposit of clayey silt/silt was encountered. The clayey silt/silt was also encountered in BH No.2 at approximate El. 218.8 m and extended down to El. 216.2 m, or top of the bedrock.

The native clayey silt/silt in BH No. 1 was approximately 9.9 m thick and was encountered at approximate El. 225.3 m and extended to auger and SPT spoon sampler refusal on inferred bedrock (El. 215.4 m).

The clayey silt/silt was encountered at the surface in BH No. 3 at approximate El. 228.0 m and extended to the maximum drilling depth (El. 221.3 m).

In BH No. 4, the clayey silt/silt was approximately 5.2 m thick and was encountered below the topsoil at approximate El. 226.5 m and extended to El. 221.3 m.

This deposit mainly consisted of low plasticity silt to clayey silt with varying portions of sand and gravel. Occasional boulders were encountered at a greater depth (below El. 218.0 m), suggesting probable till deposit close to the bedrock or inferred bedrock. The layer was observed to be brown to grey in general.

The natural moisture contents measured on samples recovered from the deposit ranged from 14 to 32%. Gradation analyses and Atterberg limits tests were carried out on four samples of this deposit, and the results are summarized in Table 6 and provided in Figure Nos. L-5, L-6, L-7, and L-8, Appendix C.

Table 6 Particle Size Distribution and Atterberg Limits Results of the Native Clayey Silt/Silty Sand

Sample Tested	Sample Depth / Elev. (m)	Grain Size Analysis (%)				Atterberg Limits (%)			Water Content (%)	Soil Classification
		Gravel	Sand	Silt	Clay	LL	PL	PI		
BH No.1/SS15	11.6 (225.1)	0	2	76	22	--	--	--	--	CL to ML
BH No.1/SS19	15.4 (221.3)	7	25	61	6	--	--	--	14	ML
BH No.2/SS16	11.6 (225.5)	12	25	46	17	27	17	10	16	CL
BH No. 2/SS22	18.5 (218.6)	1	11	81	7	--	--	--	18	ML
BH No. 3/SS2	0.9 (227.1)	--	--	--	--	28	18	10	--	CL
BH No. 3/SS4	2.6 (225.4)	4	11	69	15	--	--	--	32	ML
BH No. 3/SS-6	4.1 (223.9)	0	4	89	7	--	--	--	24	ML
BH No. 3/SS9	6.3 (221.7)	1	13	77	9	--	--	--	21	ML
BH No. 4/SS-3	1.7 (224.9)	7	19	45	29	35	22	13	27	CL
BH No. 4/SS-6	4.0 (222.6)	2	14	75	10	--	--	--	18	ML

The clayey silt/silt layer was observed to be loose to dense based on recorded SPT 'N' values ranging from 4 to 34 blows/300 mm. Higher SPT 'N' values (64 to 81 blows/300 mm) were encountered closer to the bedrock probably due to the presence of boulders and cobbles in the probable till.

5.5 Native Sandy Silt/Silty Sand (SM)

The sandy silt/silty sand was encountered in BH No. 2 between El. 224.9 m to El. 218.8 m. The layer was observed to be 6.1 m thick.

In BH No. 4, the sandy silt/silty sand was also encountered below El. 221.3 m and extended to the maximum depth drilling (El. 219.9 m).

This deposit mainly consisted of silt and sand with minor portions of clay and gravel. The layer was observed to be brown to grey in general. The natural moisture contents measured on samples recovered from the deposit ranged from 14 to 23%. Gradation analysis was carried out on one samples of this deposit, and the results are summarized in Table 7 and provided in Figure No.L-6, Appendix C.

Table 7 Particle Size Distribution and Atterberg Limits Results of the Native Sandy Silt/Silty Sand

Sample Tested	Sample Depth / Elev. (m)	Grain Size Analysis (%)				Atterberg Limits (%)			wc (%)	Soil Classification
		Gravel	Sand	Silt	Clay	LL	PL	PI		
BH No. 4/SS-8	5.6 (221.0)	2	58	41		--	--	--	23	SM

The sandy silt/silty sand layer was observed to be loose to compact based on recorded SPT 'N' values ranging from 7 to 14 blows/300 mm.

5.6 Bedrock/Inferred Bedrock

Auger and SPT spoon sampler refusals were encountered in two deep boreholes, namely BH Nos. 1 and 2. In BH No. 2, the refusal was encountered on confirmed bedrock at approximate depth of 20.9 m (El. 216.2 m) and the bedrock was cored and sampled from El. 216.2 m to 215.0 m using diamond core (NQ size) drilling. The cored bedrock was described as grey argillite-tuff Gunflint Formation. In

BH No. 1, the refusal was encountered at approximate depth of 21.3 m (El. 215.4 m) on suspected/possible bedrock, as no rock coring was undertaken.

Based on RQD values of 85 %, the bedrock was generally described as fair to excellent quality. Sampling in the bedrock was terminated at depths of 22.1 m (El. 215.0) in BH No. 2. Based on the elevation at which refusal on bedrock was encountered in BH's 1 and 2, the bedrock surface across the site is inferred to be relatively flat.

5.7 Groundwater Conditions

Groundwater and cave-in levels were measured in the open boreholes during the course of the fieldwork as summarized in Table 8. These levels are recorded on the individual Record of Borehole Log Sheets (Appendix B).

Table 8 Groundwater Levels

BH No.	Drilling Date	Ground Surface Elve. (m)	Borehole Bottom		Monitoring Date	GW in Well		Monitoring Date	GW in Well	
			Depth (m)	Elve. (m)		Depth (m)	Elev. (m)		Depth (m)	Elev. (m)
BH No. 1	Oct 12-15, 2021	236.7	21.3	215.4	--	--	--	--	--	--
BH No. 2	Oct 15-18, 2021	237.1	22.1	215.0	--	--	--	--	--	--
BH No. 3	Nov 12, 2021	228.0	6.7	221.3	Nov 22, 2021	1.1	226.9	Dec 21, 2021	1.4	226.6
BH No. 4	Nov 10, 2021	226.6	6.7	219.9	Nov 22, 2021	1.8	224.8	Dec 21, 2021	2.6	224.0

The groundwater and surface water levels should be expected to fluctuate seasonally/yearly. It is noted that water was introduced into the borehole during drilling operations which may not have had sufficient time to stabilize. The stabilized groundwater level is anticipated to correspond with the creek water level. The lowest creek level is anticipated to be above the average invert elevation of the culvert at elevation 225.9 m.

5.8 Soil Corrosivity Testing

A representative soil sample collected from BH No. 2 and water sample collected from BH No.3 were subjected to corrosivity chemical tests by Bureau Veritas Laboratories in Thunder Bay to determine its potential corrosivity by measuring resistivity, pH, sulphate and chloride content of the sample within the estimated infrastructure depths. The results are presented in Table 9.

Table 9 Soil and Water Corrosivity Chemical Analysis Results

BH No.	Sample	Depth (Elev.) (m)	pH	Sulphate (%)	Chloride (%)	Resistivity (Ohm-cm)
BH No. 2	SS-15	11 (226.7)	7.17	0.0310	0.0180	1500
BH No. 3	Water	--	7.22	0.0012	0.0068	--

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6 General Comments

The field investigation was carried out using track mounted CME 750 drilling rigs and a portable B20 drilling rig owned and operated by Maple Leaf Drilling Ltd. Laboratory testing of select soil samples was undertaken at the Englobe Laboratory in North Bay. The fieldwork for this site investigation was under the full-time supervision of Englobe technical staff. The report was written by Mr. Farbod Sadaat, Ph.D., P.Eng., and peer reviewed by Mr. Ala Abu Obeid, M.Sc., P.Eng., PMP. The report was also reviewed by the MTO Designated Contact Mike Tanos, P.Eng., with independent review by Jake Berghamer, P.Eng.

7 Statement of Limitations

The design recommendations given in this geotechnical report are applicable only to the project described in the text and only if constructed substantially in accordance with details of alignment and elevations stated in the report. Since all details of the design may not be known, in our analysis certain assumptions had to be made. The actual conditions, however, may vary from those assumed, in which case changes and modifications may be required to our geotechnical recommendations.

The comments in this report are intended solely for the guidance of the design engineer and address the geotechnical conditions only. The number of boreholes required to determine the localized conditions between boreholes directly affecting construction costs, equipment, scheduling, etc. would in fact be greater than what has been carried out for design purposes. Therefore, contractors bidding on this project or undertaking this work should make their own interpretations of the factual borehole results and carry out further work as they deem necessary to assess the scope of the project.

Foundation Design of this report is intended solely for the use of the client and the design team for the detail design of this specific project on behalf of the Ministry of Transportation and is not intended to be included in the tender documents; and shall not be used for any other purposes or by any other parties including the construction Contractor.

Appendix A

Drawings

Drawing No. 1 - Site Location Plan & Key Map

Drawing No. 2 - Borehole Location Plan & Embankment Profile

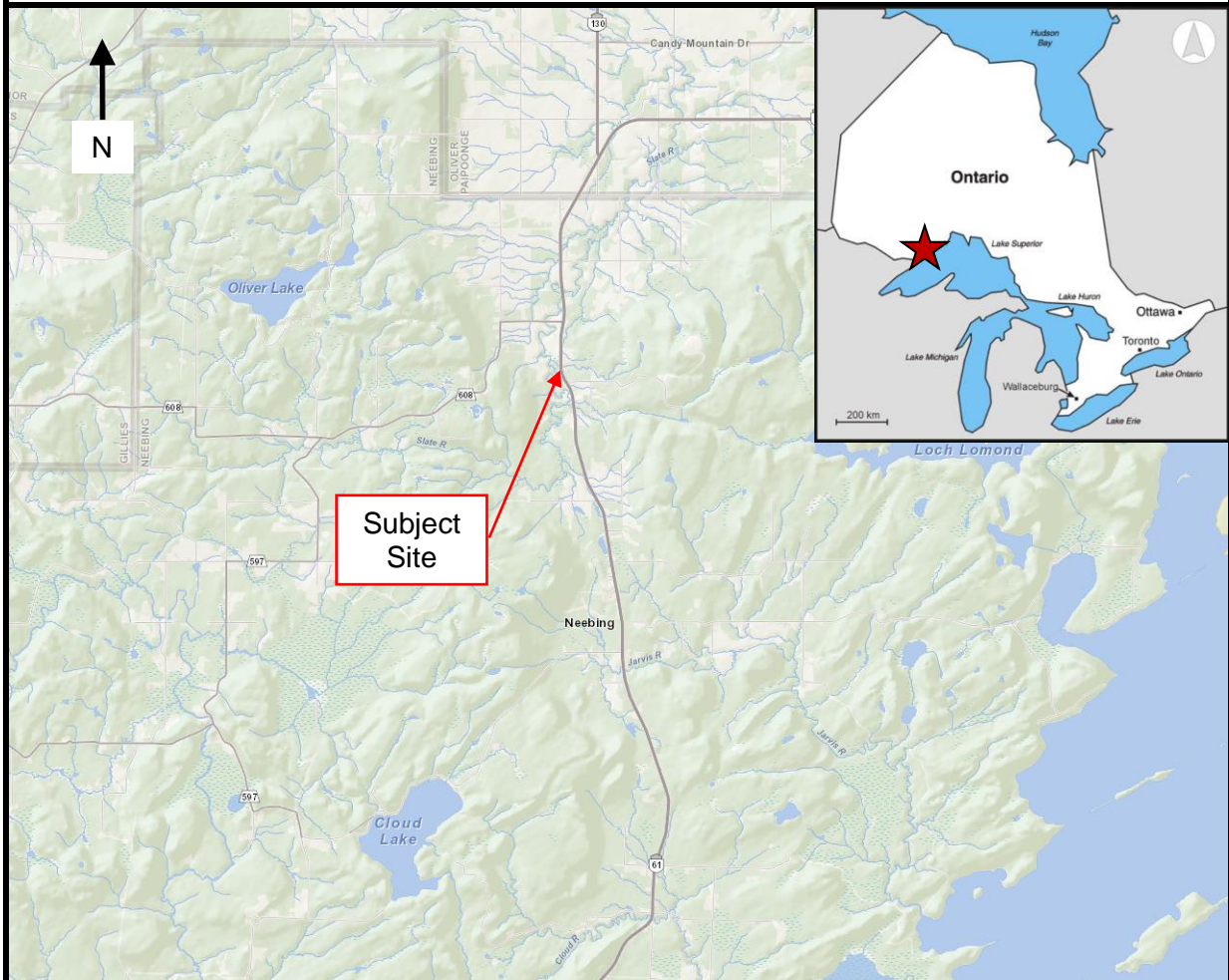


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KEY PLAN

Drawing No. 1

NOT TO SCALE



FINAL FOUNDATION INVESTIGATION REPORT

Station 20+375 Culvert
Culvert Replacement
Highway No. 61, Twp. of Blake
Assignment Number 6020-E-0021
GWP 6176-15-00

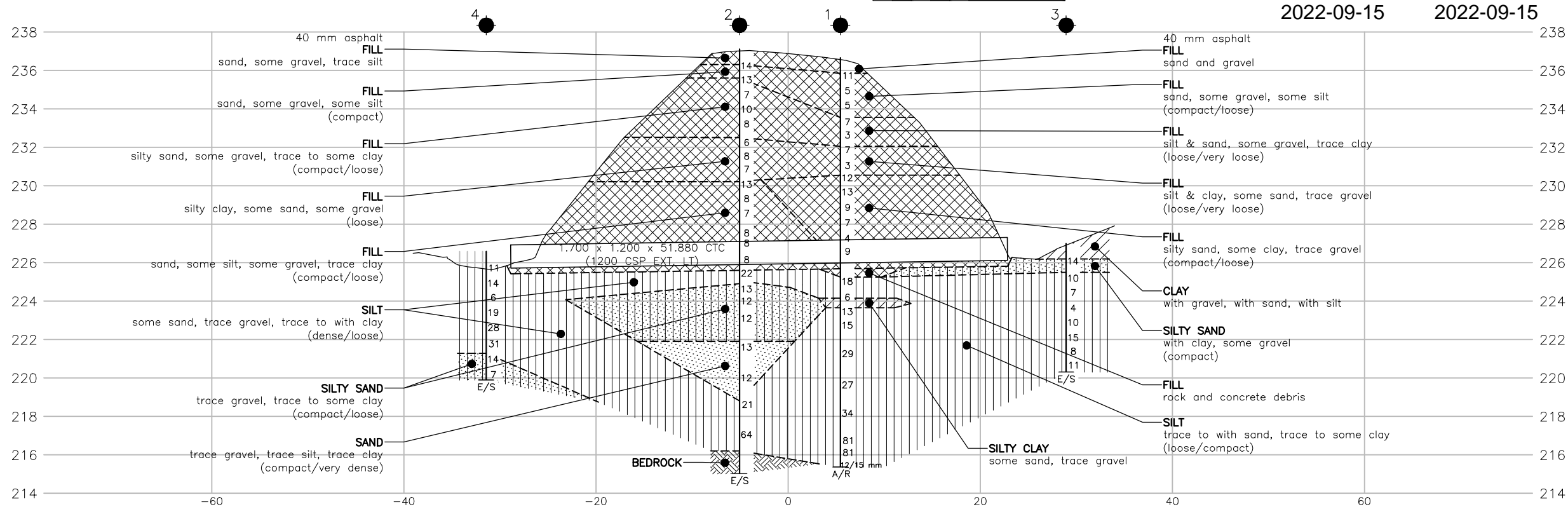
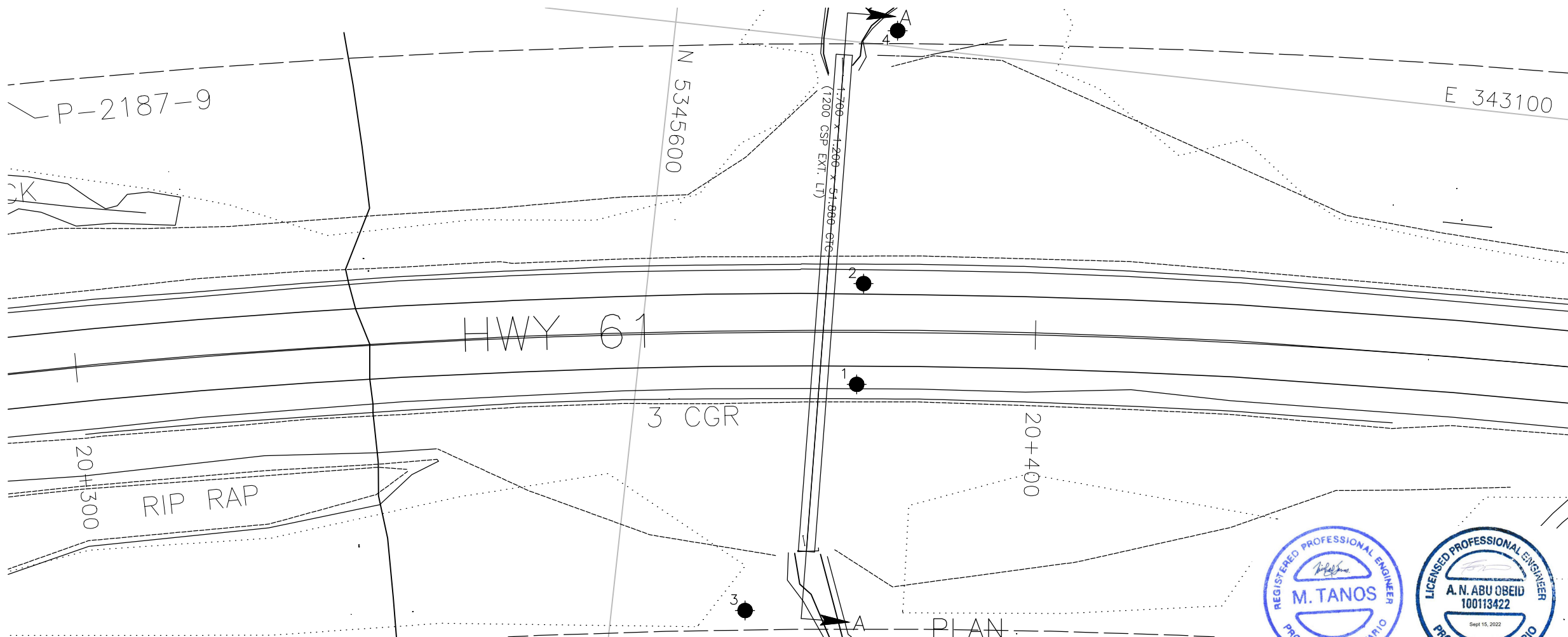
Reference No: 02109931

September 2022



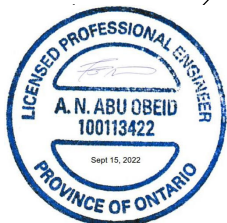
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MODIFIED: 9/6/2022 1:51:45 AM BY: MITQD
DATE PLOTTED: 9/6/2022 2:04:43 AM BY:

PR-D-707 BR-03
MINISTRY OF TRANSPORTATION, ONTARIO



This drawing is for subsurface information only. Surface details and features are for conceptual illustration. The proposed structure location is shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contract Documents.

SECTION A-A, STATION 20+375



DISTRICT
CONT. No.
GWP No. 6176-15-00



REHABILITATION OF HWY 61
CULVERT REPLACEMENT
STATION ±20+375
BOREHOLE LOCATIONS
AND SOIL STRATIGRAPHY

SHEET

2



KEY PLAN
N.T.S.



Borehole

N

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

DCPT

Blows/0.3 m (60° Cone, 475 J/blow)

W

Water Level at Time of Investigation

A/R

Auger Refusal at Elevation

E/S

End of Sampling

P

Piezometer

BOREHOLE No.	ELEVATION	O/S	NORTHING	EASTING
1	236.7	5.4 m Rt	5345622.8	343135.5
2	237.1	5.1 m Lt	5345622.4	343125.0
3	228.0	28.9 m Rt	5345613.8	343160.2
4	226.6	31.4 m Lt	5345623.1	343098.4

NOTES:

The boundaries between soil strata have been established at the borehole locations only. The boundaries illustrated and stratigraphy between boreholes on this drawing are assumed based on borehole data and may vary. They are intended for design only.

Base plan and alignment provided in digital format by Aecom on July 27, 2021

Coordinates based on MTM Zone 15 NAD83 CSRS

GEOCRES No. 52A00-264

REVISIONS				DESCRIPTION			
	DEC/21	DM	DRAFT				
	MAY/22	DM	REVISED DRAFT				
	SEP/22	DM	FINAL				
DESCRIPTION							
DESIGN	CHK	CODE	LOAD		DATE SEP/22		
DRAWN	DM	CHK FS	SITE	STRUCT	SCHEME	DWG 2	

Appendix B

Subsurface Data

Enclosure No. 1 List of Abbreviations and Symbols
Enclosure Nos. 2 to 7 Record of Borehole Sheets



eNGLOBE



LIST OF SYMBOLS AND DEFINITIONS FOR GEOTECHNICAL SAMPLING AND COMMON LITHOLOGIES

The following is a reference sheet for commonly used symbols and definitions within this report and in any figures or appendices, including borehole logs and test results. Symbols and definitions conform to the standard proposed by the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) wherever possible. Discrepancies may exist when comparing to third-party results using the Unified Soil Classification System (USCS).

PART A – SOILS

Standard Penetration Test (SPT) 'N'

The number of blows required to drive a 50-mm (2 in) split barrel sampler 300 mm (12 in). The standard hammer has a mass of 63.5 kg (140 lbs) and is dropped vertically from a height of 760 mm (30 in). Additional information can be found in ASTM D1586-11 and in §4.5.2 of the CFEM 4th Ed.

For penetration less than 300 mm, 'N' is recorded with the penetration that was achieved.

Non-Cohesive Soils

The relative density of non-cohesive soils relates empirically to SPT 'N' as follows:

Relative Density	'N'
Very Loose	0 – 4
Loose	4 – 10
Compact	10 – 30
Dense	30 – 50
Very Dense	> 50

Cohesive Soils

The consistency and undrained shear strength of cohesive soils relates empirically to SPT 'N' as follows:

Consistency	Undrained Shear Strength (kPa)	'N'
Very Soft	< 12	0 – 2
Soft	12 – 25	2 – 4
Firm	25 – 50	4 – 8
Stiff	50 – 100	8 – 15
Very Stiff	100 – 200	15 – 30
Hard	> 200	> 30

PART B – ROCK

The following parameters are used to describe core recovery and to infer the quality of a rockmass.

Total Core Recovery, TCR (%)

The total length of solid drill core recovered, regardless of the quality or length of the pieces, taken as a percentage of the length of the core run.

Solid Core Recovery, SCR (%)

The total length of solid, full-diameter drill core recovered, taken as a percentage of the length of the core run.

Rock Quality Designation, RQD (%)

The sum of the lengths of solid drill core greater than 100 mm long, taken as a percentage of the length of the core run. RQD is commonly used to infer the quality of the rockmass, as follows:

Rockmass Quality	RQD (%)
Very Poor	< 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	> 90

Weathering

The terminology used to describe the degree of weathering for recovered rock core is defined as follows, as suggested by the *Geological Society of London*:

Completely weathered: All rock material is decomposed and/or disintegrated to soil. The original mass structure is largely intact.

Highly weathered: More than half the rock material is decomposed and/or disintegrated to soil. Fresh or discolored rock is present either as a discontinuous framework or as core stone.

Moderately weathered: Less than half the rock material is decomposed and/or disintegrates to soil. Fresh or discolored rock is present either as a continuous framework or as core stone.

Slightly weathered: Discoloration indicates weathering of rock material and discontinuity of surfaces. All the rock material may be discolored by weathering and may be somewhat weaker than its fresh condition.

Fresh: No visible signs of weathering.

PART C – SAMPLING SYMBOLS

Symbol	Description
SS	Split spoon sample
TW	Thin-walled (Shelby Tube) sample
PH	Sampler advanced by hydraulic pressure
WH	Sampler advanced by static weight
SC	Soil core

PART D – IN-SITU AND LAB TESTING

SOIL NAMING CONVENTIONS

Particle sizes are described as follows:

Particle Size Descriptor	Size (mm)
Boulder	> 300
Cobble	75 – 300
Gravel	Coarse Fine
	19 – 75 4.75 – 19
	Coarse
	2.0 – 4.75
Sand	Medium
	0.425 – 2.0
	Fine
	0.075 – 0.425
Silt	0.002 – 0.075
Clay	< 0.002

The principle constituent of a soil is written in uppercase. The minor constituents of a soil are written according to the following convention:

Descriptive Term	Proportion of Soil (%)
Trace	1 – 10
Some	10 – 20
(ey) or (y)	20 – 35
And	35 – 50

Eg.: A soil comprising 65% Silt, 21% Sand and 14% Clay would be described as a: Sandy SILT, Some Clay

RECORD OF BOREHOLE No. 1

1 OF 2

METRIC

W.P. GWP 6176-15-00 LOCATION 20+381, 5.6 Rt, Blake Twp. ORIGINATED BY RT
 DIST Thunder Bay HWY 61 BOREHOLE TYPE Hollow Stem Auger COMPILED BY DM
 DATUM Geodetic DATE 2021.10.12 - 2021.10.15 MTM Zone 15 343135.477 E 5345622.839 N
 LATITUDE 48.248226 LONGITUDE -89.483761 CHECKED BY FS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
236.7	40 mm asphalt		1	AS			236										
235.9	FILL - SAND & GRAVEL - trace silt, brown		2	SS	11		235										
0.8	FILL - SAND - some silt, gravel, brown, compact to loose		3	SS	5		235										
			4	SS	5		234										
233.6							234										
3.1	FILL - SILT & SAND - some gravel, trace clay, brown, loose		5	SS	7		233										
			6	SS	3		232										
232.1	FILL - SILT & CLAY - some sand, trace gravel, brown/red, firm		7	SS	7		232										
4.6	- trace sand, gravel, high plasticity		8	SS	3		231										
230.6							230										
6.1	FILL - SILTY SAND - some clay, trace gravel, brown, compact to loose		9	SS	12		229										
	- damp		10	SS	13		228										
	- some gravel, clay, brown/red, moist, loose		11	SS	9		227										
			12	SS	7		226										
			13	SS	4		225										
			14	SS	9		224										
226.3			10/				223										
10.4	FILL - ROCK & CONCRETE - debris		RC		0 mm/		222										
			NR														
225.3																	
11.4	SILT - some clay, trace sand, brown, moist to wet, compact		15	SS	18												
			16A	SS	6												
224.2			16B														
12.5	SILTY CLAY - some sand, trace gravel, grey, wet																
223.7																	
13.0	SILT - with sand, trace clay, grey, wet, compact to very dense		17	SS	13												
			18	SS	15												
	- occasional cobbles																

Continued Next Page

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

ONTARIO MTO GWP 6176-15-00 - HIGHWAY 61 - CULVERT 20+375.GPJ ONTARIO MTO.GDT 22-4-6

RECORD OF BOREHOLE No. 1

2 OF 2

METRIC

W.P. GWP 6176-15-00 LOCATION 20+381, 5.6 Rt, Blake Twp. ORIGINATED BY RT
 DIST Thunder Bay HWY 61 BOREHOLE TYPE Hollow Stem Auger COMPILED BY DM
 DATUM Geodetic DATE 2021.10.12 - 2021.10.15 MTM Zone 15 343135.477 E 5345622.839 N
 LATITUDE 48.248226 LONGITUDE -89.483761 CHECKED BY FS

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		SHEAR STRENGTH kPa					W _p	W	W _L		
							20	40	60	80	100					
							○ UNCONFINED + FIELD VANE					● QUICK TRIAXIAL × LAB VANE				
							40	80	120	160	200	WATER CONTENT (%)				
												20	40	60		
	- trace gravel, occasional cobbles		19	SS	29							○				7 25 61 6
						221										
						220										
			20	SS	27											
						219										
	- trace sand, gravel		21	SS	34											
						218										
						217										
			22	SS	81											
						216										
	- some sand, gravel		23	SS	81											
215.4					12/15 mm											
21.3	Refusal on suspected bedrock/boulders at 21.3 m bgs															Spoon Bouncing, Auger Refusal

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

RECORD OF BOREHOLE No. 2

1 OF 2

METRIC

W.P. GWP 6176-15-00 LOCATION 20+381, 4.9 Lt, Blake Twp. ORIGINATED BY RT
 DIST Thunder Bay HWY 61 BOREHOLE TYPE Hollow Stem Auger COMPILED BY DM
 DATUM Geodetic DATE 2021.10.15 - 2021.10.18 MTM Zone 15 343124.967 E 5345622.402 N
 LATITUDE 48.248223 LONGITUDE -89.483902 CHECKED BY FS

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		20	40	60	80	100					
237.1	40 mm asphalt		1	AS		237										
236.4	FILL - SAND - some gravel, trace silt, brown															
0.8	FILL - SAND - some gravel, silt, brown, compact		2	SS	14											
235.6	FILL - SILTY SAND - some gravel, trace to some clay, brown, moist to wet, compact to loose		3	SS	13											
1.5			4	SS	7											
			5	SS	10											
			6	SS	8											
232.5	FILL - SILTY CLAY - some sand, gravel, brown/red, moist, firm		7	SS	6											
4.6	- silt layer, some clay, sand, gravel, grey, moist		8	SS	8											
	- sandy, some gravel, brown/red, moist		9	SS	7											
230.3	FILL - SAND - some silt, gravel, trace clay, brown, dry, compact to loose		10	SS	13											
6.9	- damp		11	SS	8											
			12	SS	7											
			13	SS	8											
226.4	SILT - some gravel, with sand, some clay, grey, damp, loose		15	SS	8											
10.7	- some gravel, clay, brown, damp, compact, low plasticity		16	SS	22											
224.9	SILTY SAND - trace gravel, clay, grey, moist to wet, compact		17	SS	13											
12.2			18	SS	12											
			19	SS	12											

Continued Next Page

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

ONTARIO MTO GWP 6176-15-00 - HIGHWAY 61 - CULVERT 20+375.GPJ ONTARIO MTO.GDT 22-4-6

RECORD OF BOREHOLE No. 2

2 OF 2

METRIC

W.P. GWP 6176-15-00 LOCATION 20+381, 4.9 Lt, Blake Twp. ORIGINATED BY RT
DIST Thunder Bay HWY 61 BOREHOLE TYPE Hollow Stem Auger COMPILED BY DM
DATUM Geodetic DATE 2021.10.15 - 2021.10.18 MTM Zone 15 343124.967 E 5345622.402 N
LATITUDE 48.248223 LONGITUDE -89.483902 CHECKED BY FS





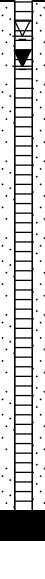
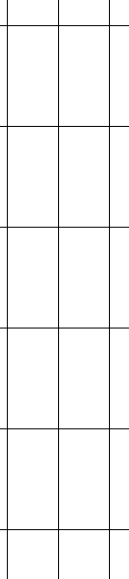
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
								○ UNCONFINED	+	FIELD VANE						
								● QUICK TRIAXIAL	×	LAB VANE						
						40 80 120 160 200										
221.9																
15.2	SAND - trace silt, gravel, clay, grey, wet, compact		20	SS	13											Start Wash Boring
			21	NR	12											
218.8																1 11 81 7
18.3	SILT - some sand, trace gravel, clay, grey, wet, compact to very dense		22	SS	21											
	- some gravel		23	SS	64											
216.2																Auger Refusal, Start Coring
20.9	BEDROCK - Argillite-tuff Gunflint Formation RQD = 85.0 %		1	RC												
215.0																
22.1	End of Borehole at 22.1 m bgs															

RECORD OF BOREHOLE No. 3

1 OF 1

METRIC

W.P. GWP 6176-15-00 LOCATION 20+370, 25.0 m Rt, Blake Twp. ORIGINATED BY MQ
 DIST Thunder Bay HWY 61 BOREHOLE TYPE Solid Stem Auger COMPILED BY DM
 DATUM Geodetic DATE 2021.11.12 - 2021.11.12 MTM Zone 15 343160.15 E 5345613.841 N
 LATITUDE 48.248148 LONGITUDE -89.484261 CHECKED BY FS

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			WATER CONTENT (%)							
228.0	CLAYEY SILT - with sand, gravel, brown, wet		1	AS			227		20	40	60	227	Groundwater Level 1.1 m bgs (Elevation 226.9 m) Nov 22, 2021									
0.0																						
227.2	SILT - some sand, clay, trace gravel, brown, wet, loose to compact		2	SS	14		226		20	40	60	226	Groundwater Level 1.4 m bgs (Elevation 226.6 m) Dec 21, 2021									
0.8																						
	- trace sand, clay		6	SS	10		224						4 11 69 15									
	- some sand, trace clay, gravel, grey, wet, loose to compact		7	SS	15		223															

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

RECORD OF BOREHOLE No. 4

1 OF 1

METRIC

W.P. GWP 6176-15-00 LOCATION 20+385, 30.0 m Lt, Blake ORIGINATED BY MQ
 DIST Thunder Bay HWY 61 BOREHOLE TYPE Solid Stem Auger COMPILED BY DM
 DATUM Geodetic DATE 2021.11.10 - 2021.11.10 MTM Zone 15 343098.389 E 5345623.065 N
 LATITUDE 48.248231 LONGITUDE -89.48426 CHECKED BY FS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)	
																	○ UNCONFINED	+ FIELD VANE
226.6 0.0	100 mm organic soil SILT - with clay, some sand, trace gravel, brown, damp, loose to dense - low plasticity - with clay, brown/grey, wet - trace sand, grey - some sand, clay, trace gravel - wet		1	AS												7 19 45 29 Groundwater Level 1.8 m bgs (Elevation 224.8 m) Nov 22, 2021 Groundwater Level 2.6 m bgs (Elevation 224.0 m) Dec 21, 2021		
			2	SS	11													
			3	SS	14													
			4	SS	6													
			5	SS	19													
			6	SS	28													
			7	SS	31													
221.3 5.3	SILTY SAND - some clay, trace gravel, grey, wet, compact to loose		8	SS	14											2 58 (41)		
219.9 6.7	End of Borhole at 6.7 m bgs		9	SS	7													

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

Appendix C

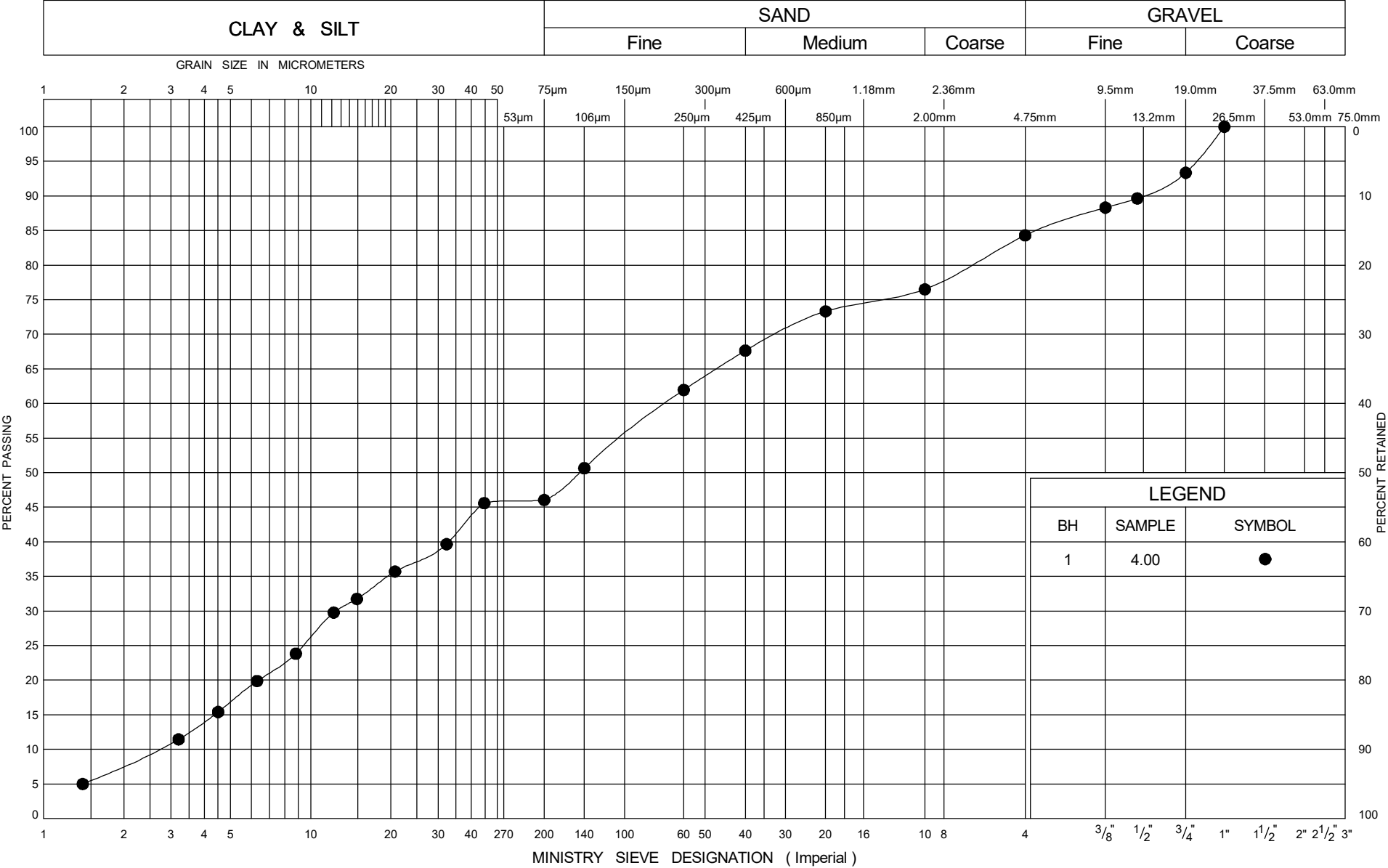
Borehole Plan and Laboratory Data

Figure No. L-1: Fill: Silt and Sand Grain Size Distribution Curve
Figure No. L-2: Fill: Silty Sand Grain Size Distribution Curve
Figure No. L-3: Fill: Silt and Clay Grain Size Distribution Curve
Figure No. L-4: Fill: Sand Grain Size Distribution Curve
Figure No. L-5: Silt Grain Size Distribution Curve
Figure No. L-6: Silt Grain Size Distribution Curve
Figure No. L-7: Sandy Silt Grain Size Distribution Curve
Figure No. L-8: Atterberg Limits Summary



eNGLOBE

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

FILL - SILT & SAND

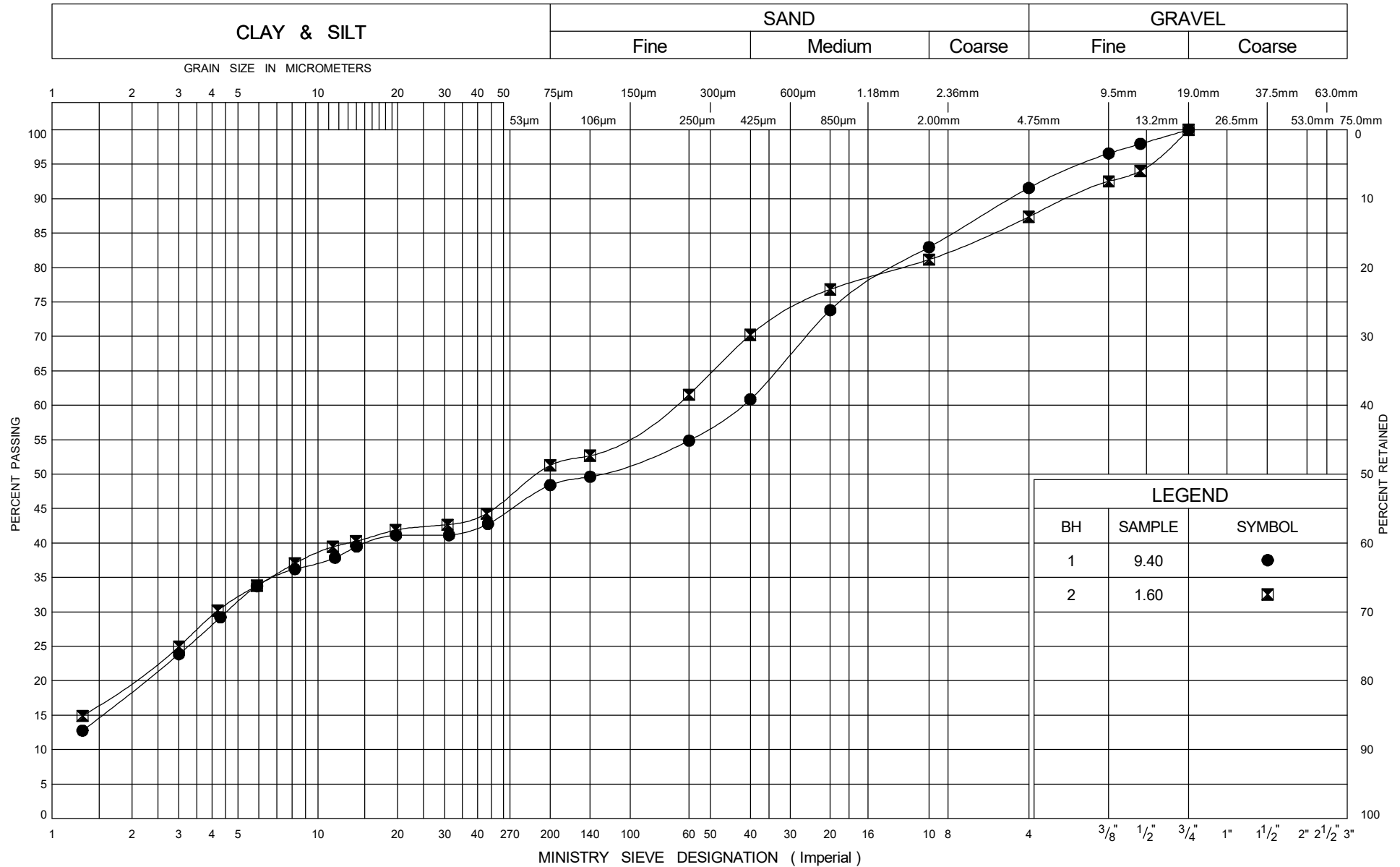
Figure L-1

GWP 6176-15-00

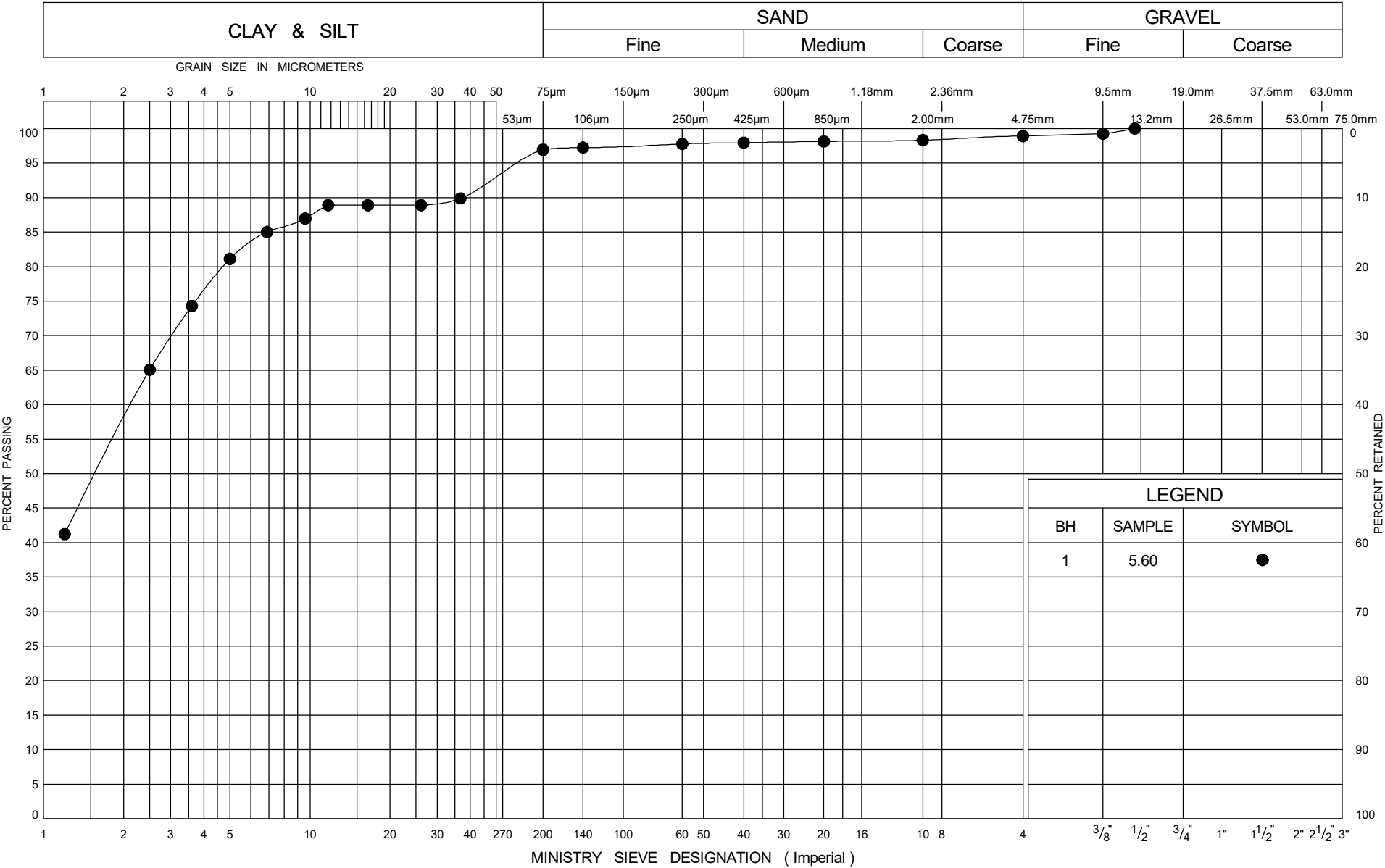
Highway 61, NWR



UNIFIED SOIL CLASSIFICATION SYSTEM



UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

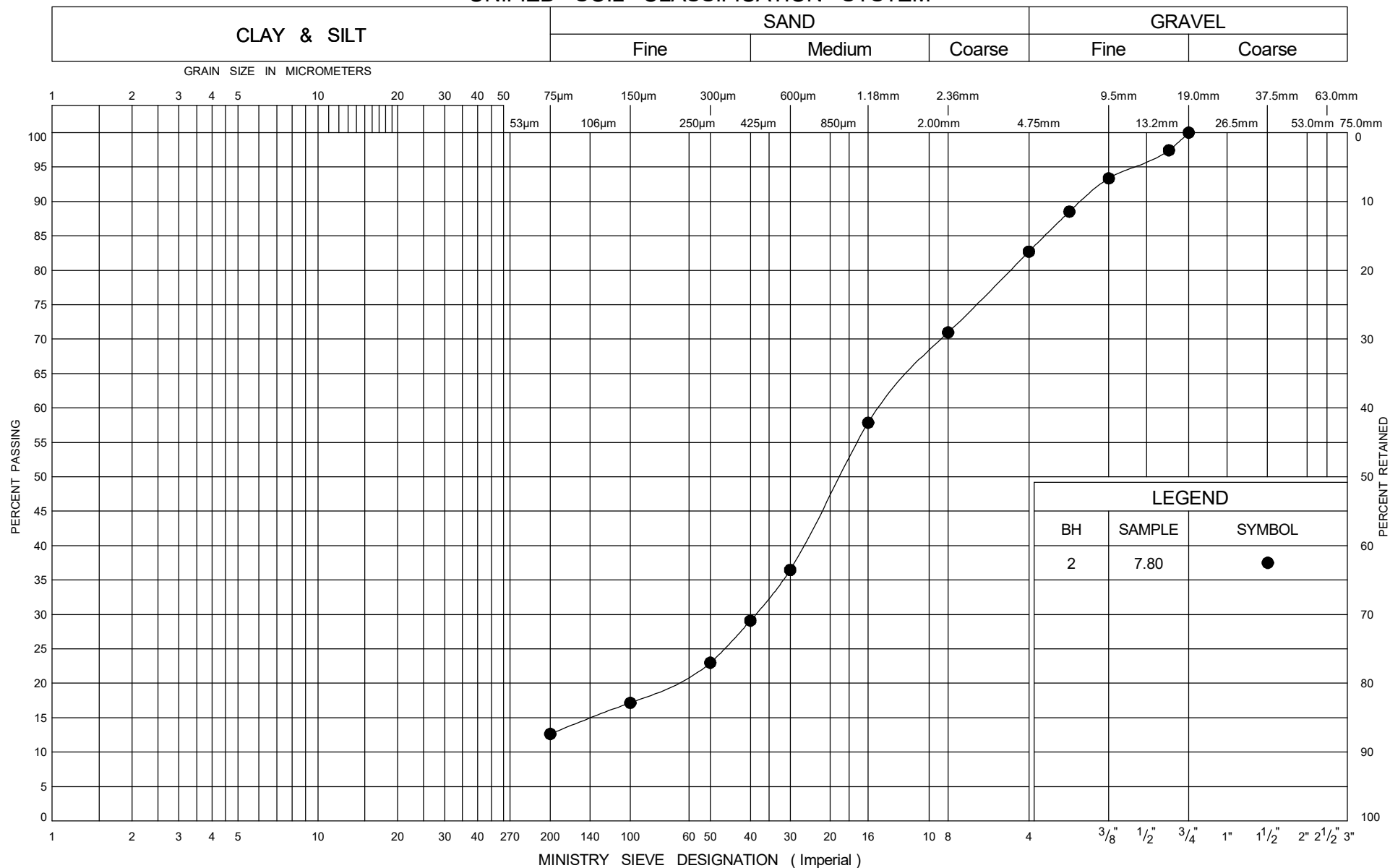
FILL - SILT & CLAY

Figure L-3

GWP 6176-15-00

Highway 61, NWR

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

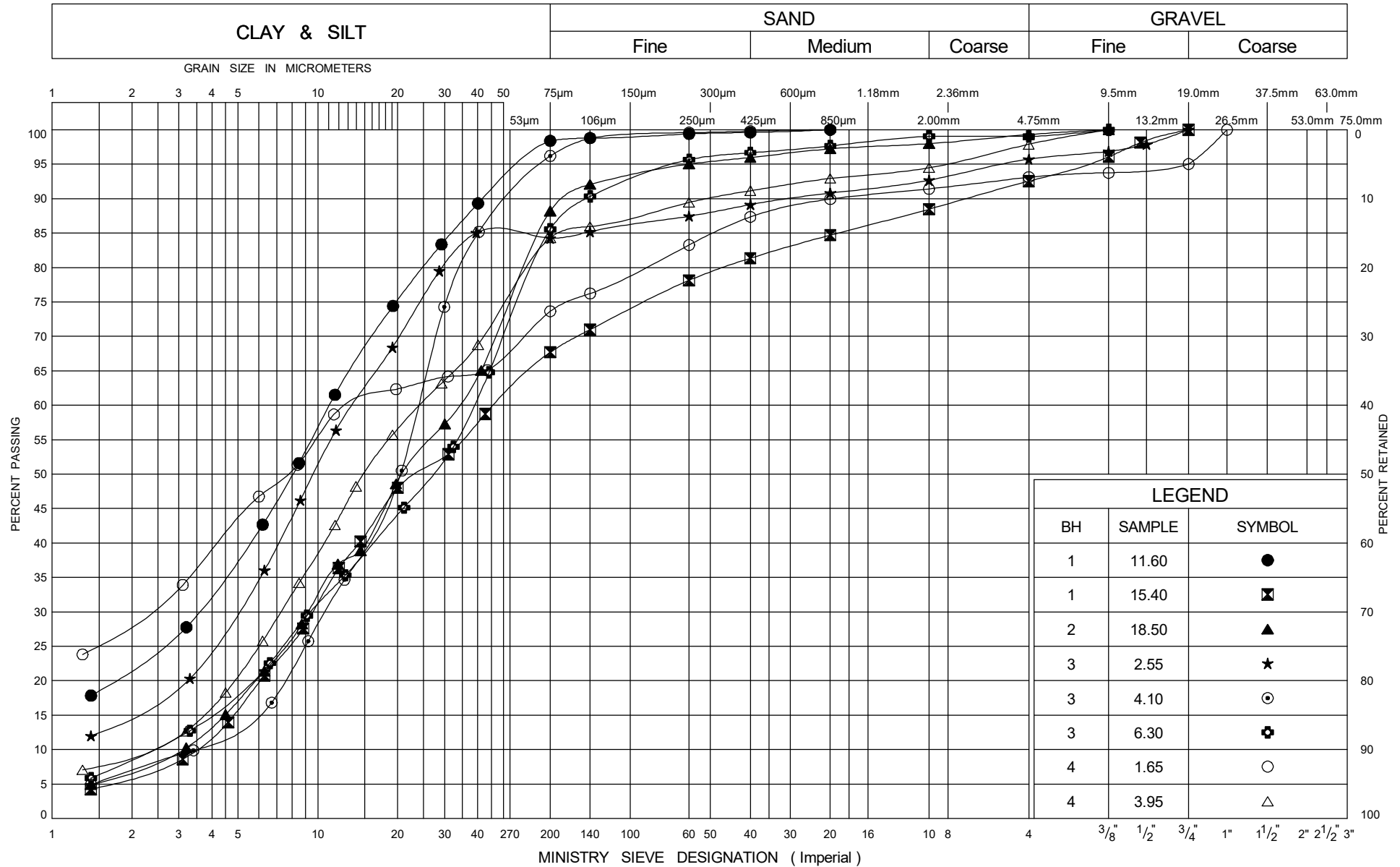
FILL - SAND

Figure L-4

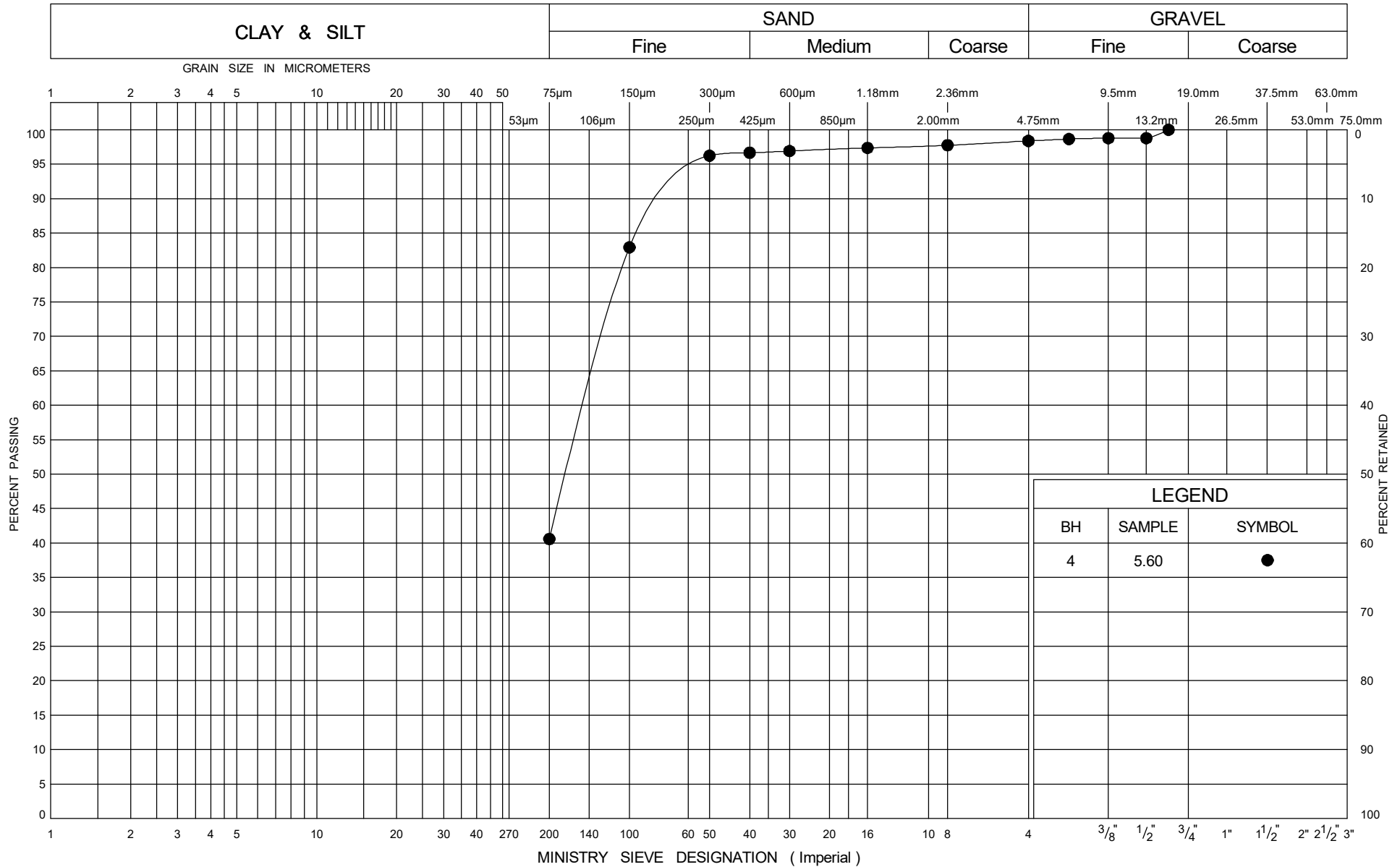
GWP 6176-15-00

Highway 61, NWR

UNIFIED SOIL CLASSIFICATION SYSTEM



UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

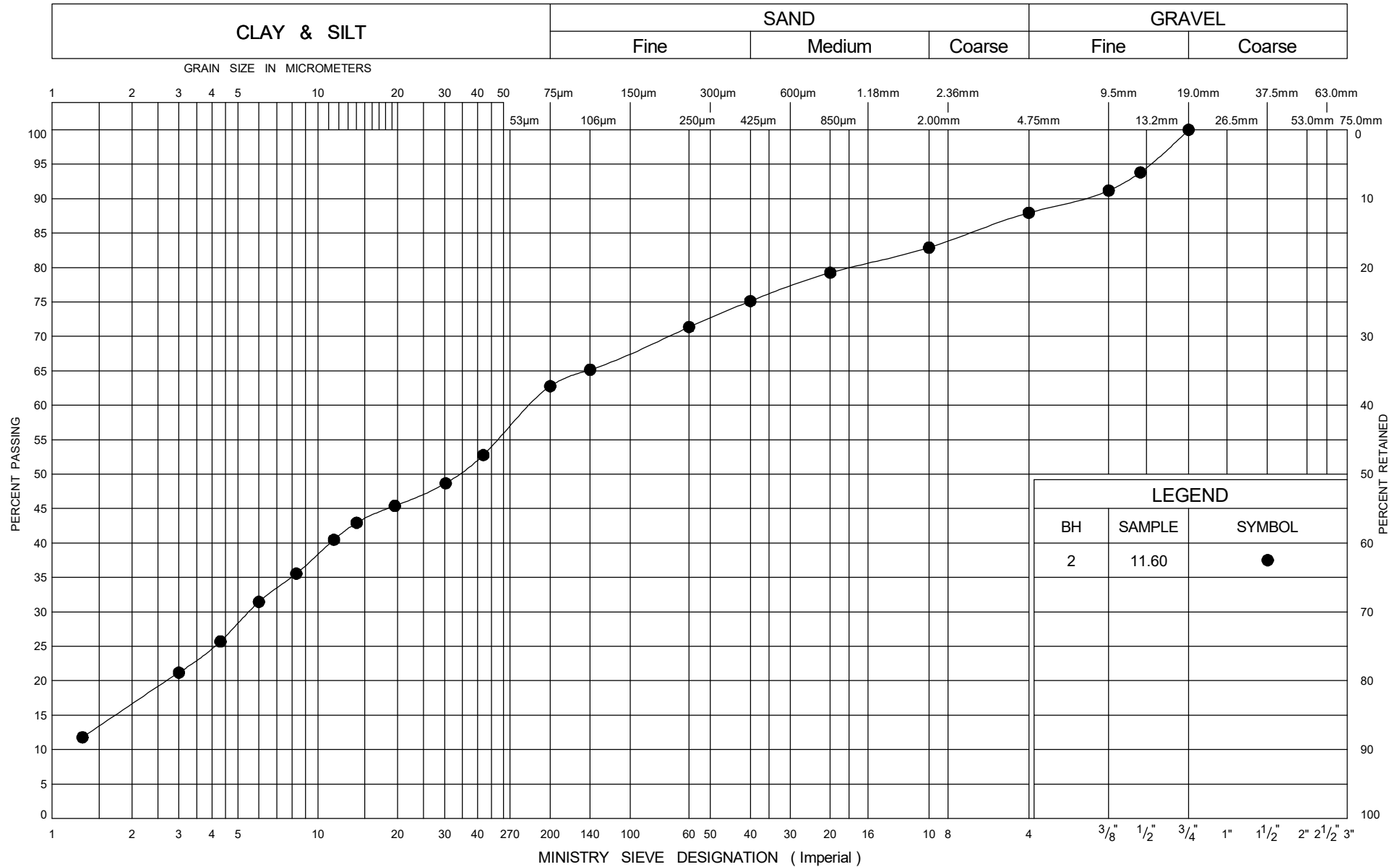
SILT

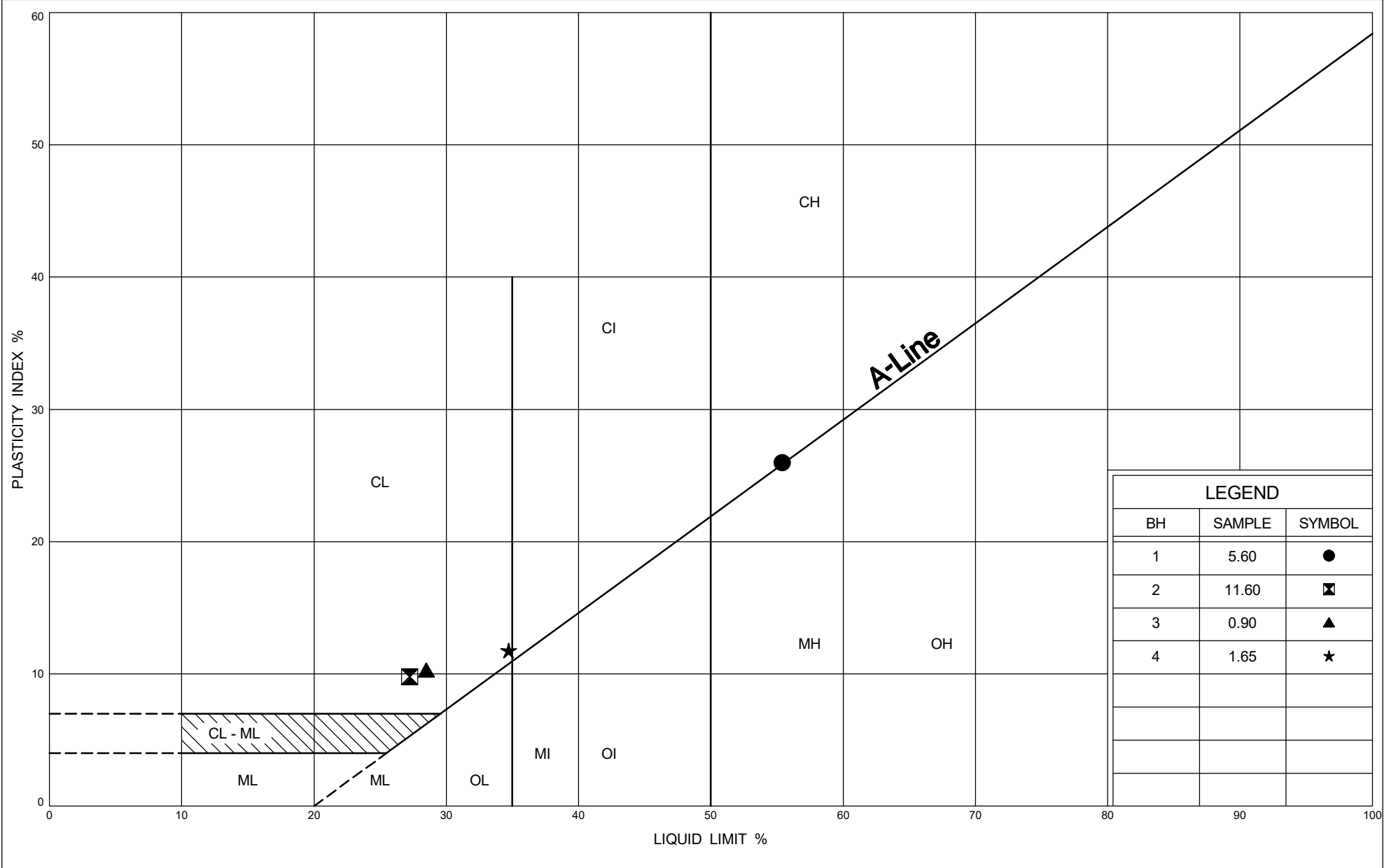
Figure L-6

GWP 6176-15-00

Highway 61, NWR

UNIFIED SOIL CLASSIFICATION SYSTEM





Appendix D
Culvert Inspection Report
(as provided by Gannett Fleming)



eNGLOBE

FIELD INSPECTION FORM

A. GENERAL INFORMATION

Project #	6176-15-00 - Highway 61	Project Description	From 0.5km north of Jarvis Bay Road to 0.4km South of Hwy 130
Date	October 5, 2021	Weather Conditions	Sunny
Inspector 1	David Jackson	Inspector 2 /Reviewer	-

B. CULVERT ID / LOCATION

Culvert ID	C7	Chainage	20+375
UTM Easting	343132.7421	UTM Northing	5345617.6244
Description	South of the Highway 608 & Highway 61 intersection		

C. STRUCTURE DETAILS

Material – CTC / CSP

Dimensions – 1550 x 1160 US / 1220 x 1220 DS

Clearance (soffit to normal water level) – 1030 mm / 822mm

High Water Mark (on structure) – N/A

Structures (U/S / D/S of Crossing) – N/A

Debris – Gravel/debris within the barrel

D. ENVIRONMENTAL CONDITIONS

Watercourse Type and Creek Material – Stones and pebbles

Bank Conditions (stability) – Minor bank and embankment erosion

Channel Dimensions (width and depth) – 2m, 3:1, 130mm US / 5m, 3:1, 400mm of water DS

Observed Flow Conditions (ephemeral/permanent) – Permanent

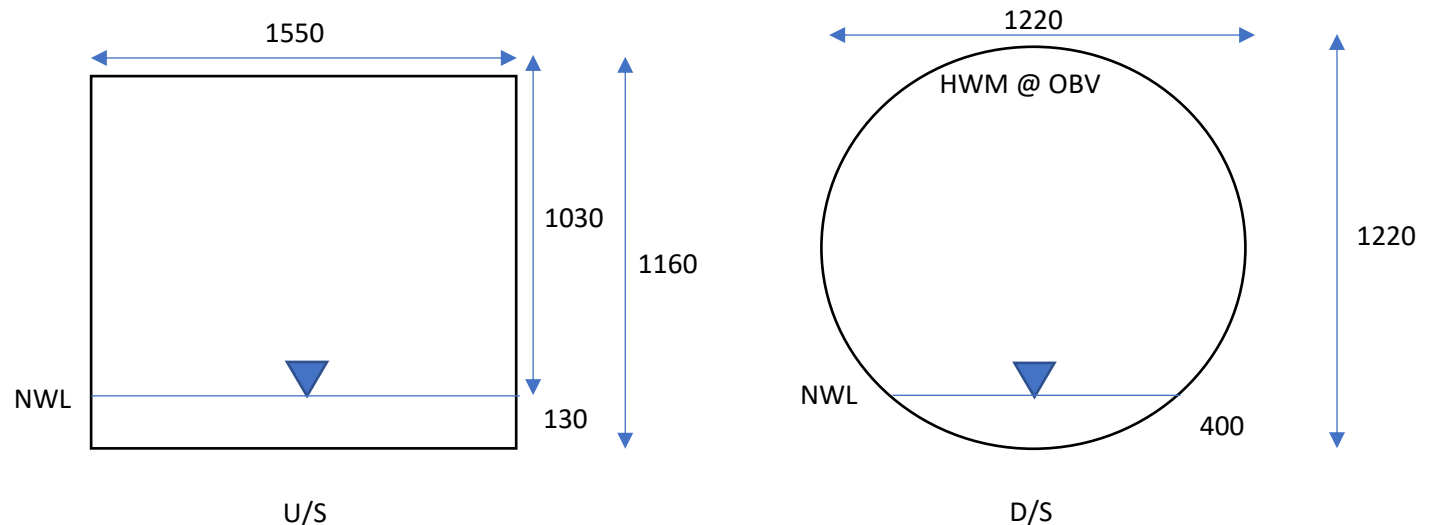
E. SITE CONDITIONS

Road Condition (sag, settlement, etc.) – OK

Physical Culvert Condition (rust, damage, etc.) – OK

Culvert Appearance (general comments) – Replace

Site Sketch –



Creosote Timber Culvert and Corrugated Steel Pipe (Culvert #7) @ 20+375

C7 - #1 – Upstream Channel Conditions



C7 - #2 – Upstream Face of the Culvert

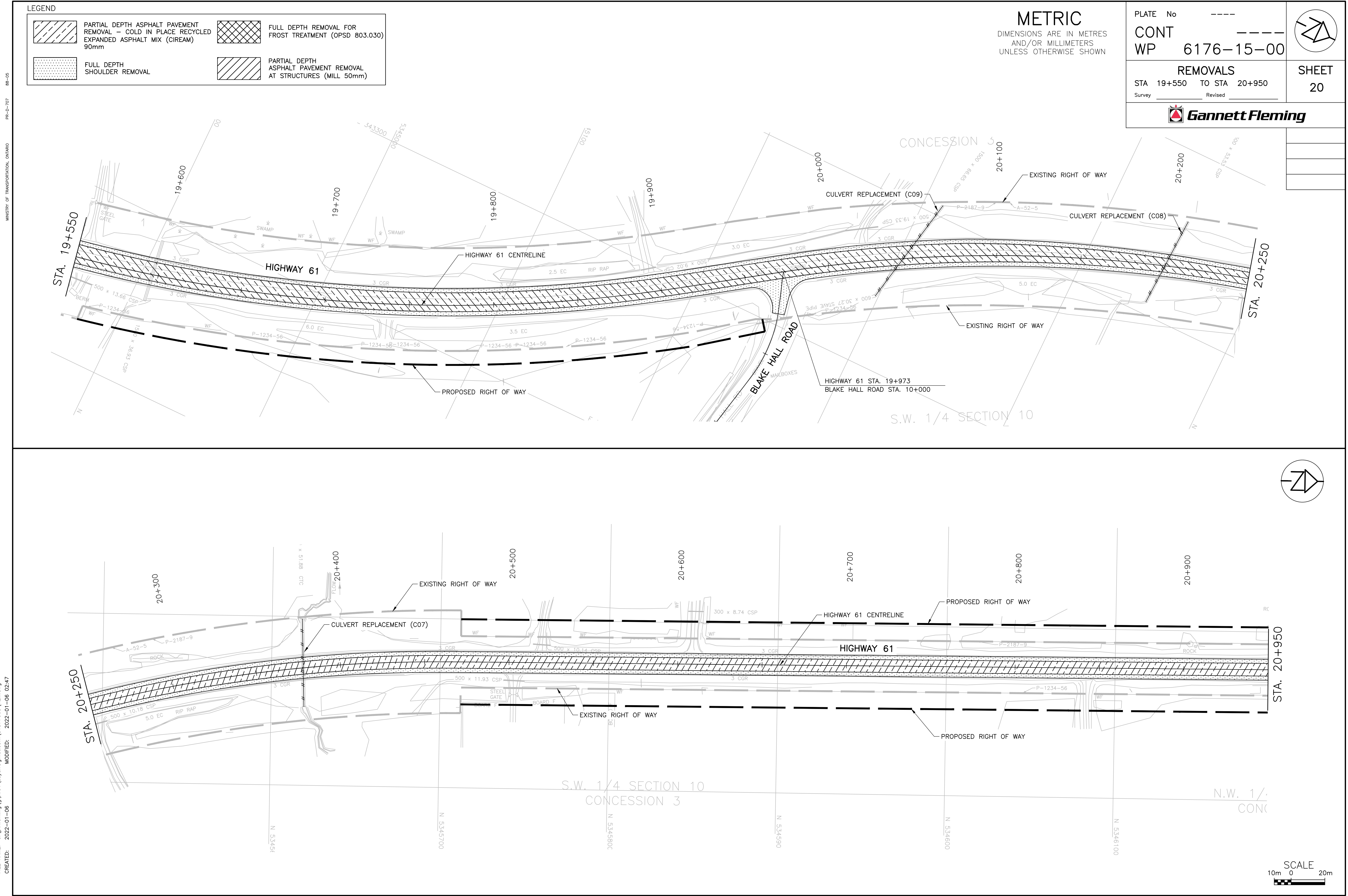


C7 - #3 – Downstream Channel Conditions



C7 - #4 – Downstream Face of the Culvert





LEGEND			
	PARTIAL DEPTH ASPHALT PAVEMENT REMOVAL - COLD IN PLACE RECYCLED EXPANDED ASPHALT MIX (CIREAM) 90mm		FULL DEPTH REMOVAL FOR FROST TREATMENT (OPSD 803.030)
	FULL DEPTH SHOULDER REMOVAL		PARTIAL DEPTH ASPHALT PAVEMENT REMOVAL AT STRUCTURES (MILL 50mm)

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

PLATE No -----

CONT WP 6176-15-00

REMOVALS
STA 19+550 TO STA 20+950
Survey ----- Revised -----

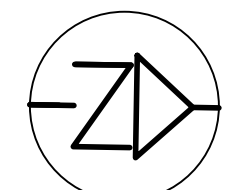
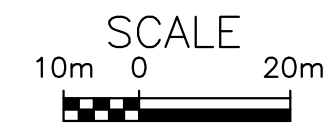
Gannett Fleming

SHEET 20

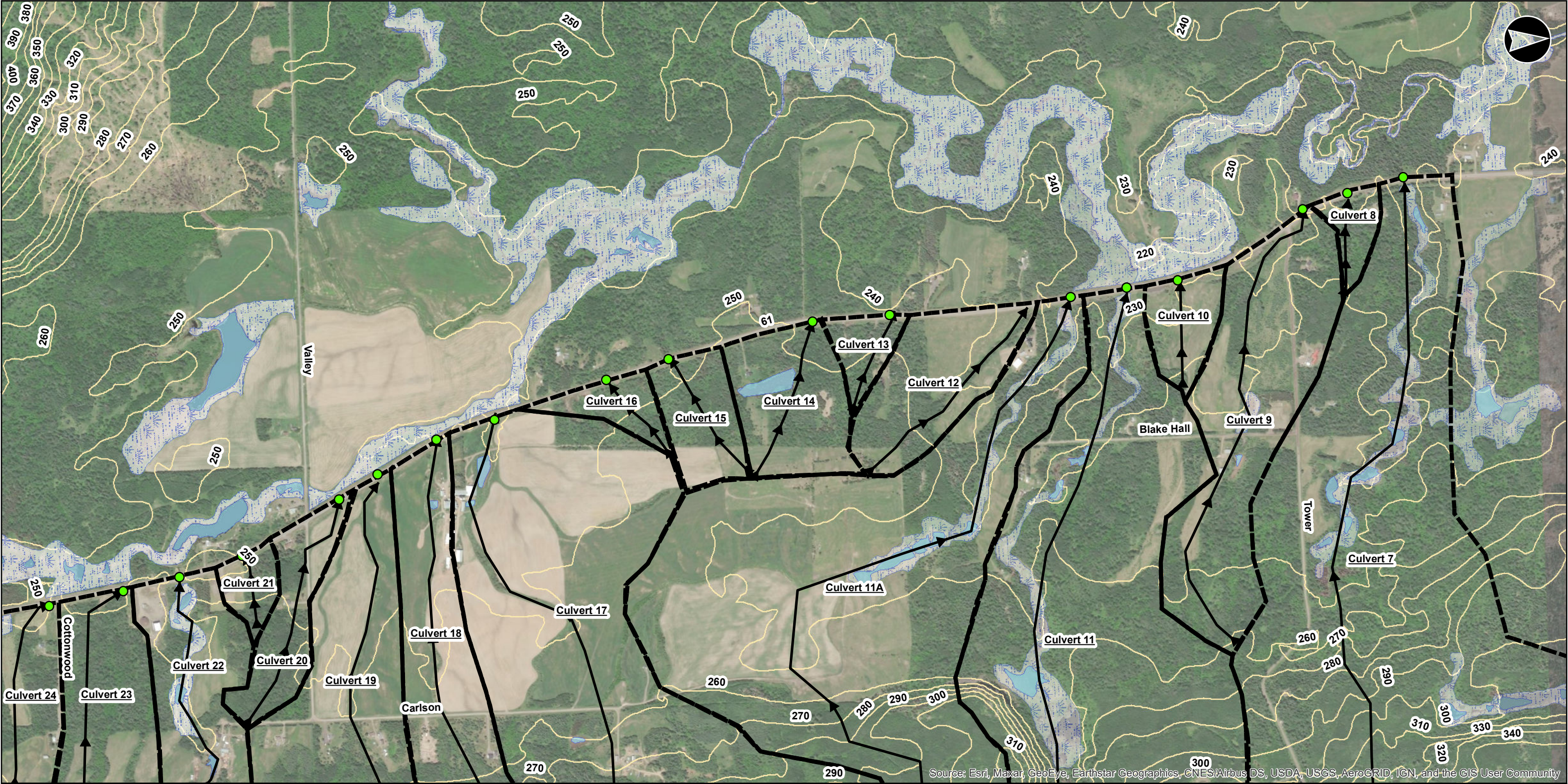
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PR-D-707
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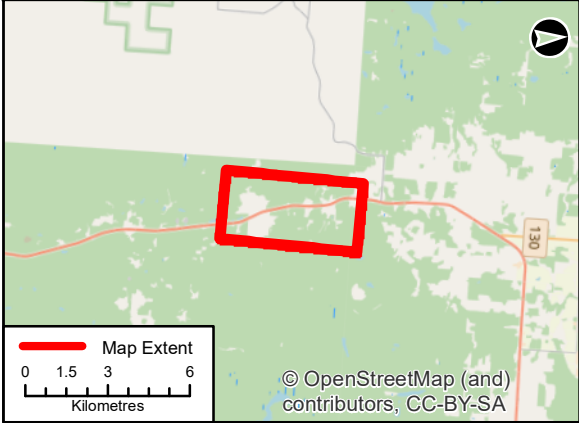
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Appendix B: Catchment Plans




Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

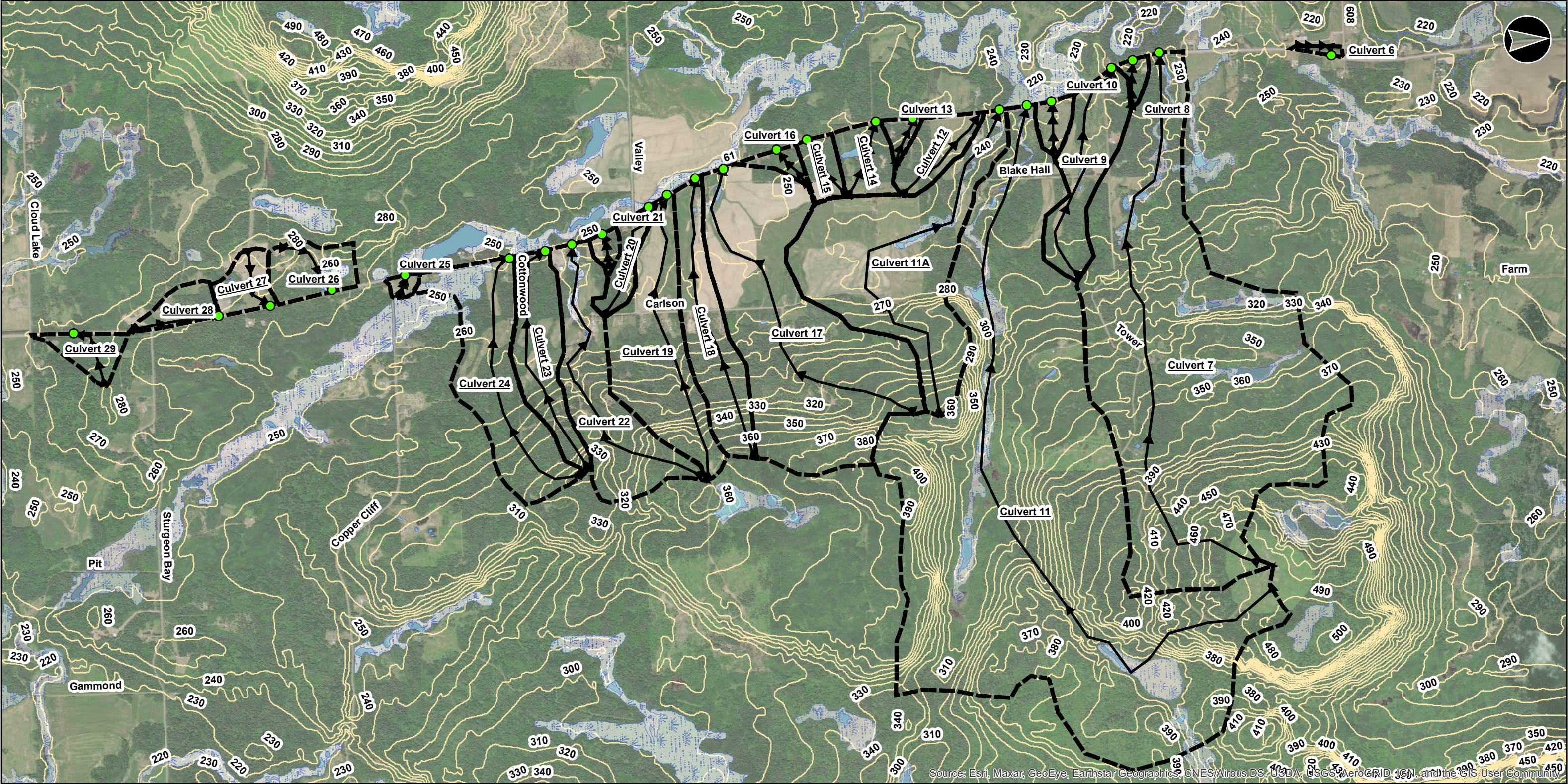


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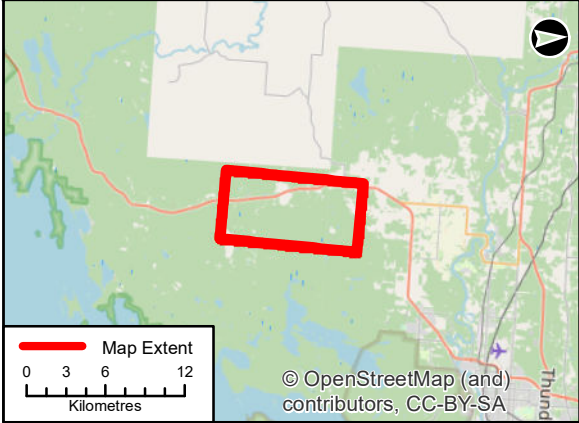
- Culvert Crossings
- Flow Path
- Contour
- Catchments
- Wetlands
- Waterbodies

Highway 61 Rehabilitation GWP# 6176-15-00, NWR Catchment Area Plan			
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Data Sources:	Dec, 2021	1:12,000	
	.	Rev Draft	

Highway 61 Rehabilitation Catchment Area Plan
Date Saved: 12/21/2021 2:43:46 PM User Name: dijagason



Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Legend

- Culvert Crossings
- Flow Path
- Contour
- Catchments
- Wetlands
- Waterbodies

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Highway 61 Rehabilitation GWP# 6176-15-00, NWR Catchment Area Plan

Datum: NAD 1983 UTM Zone 16N

Figure 5

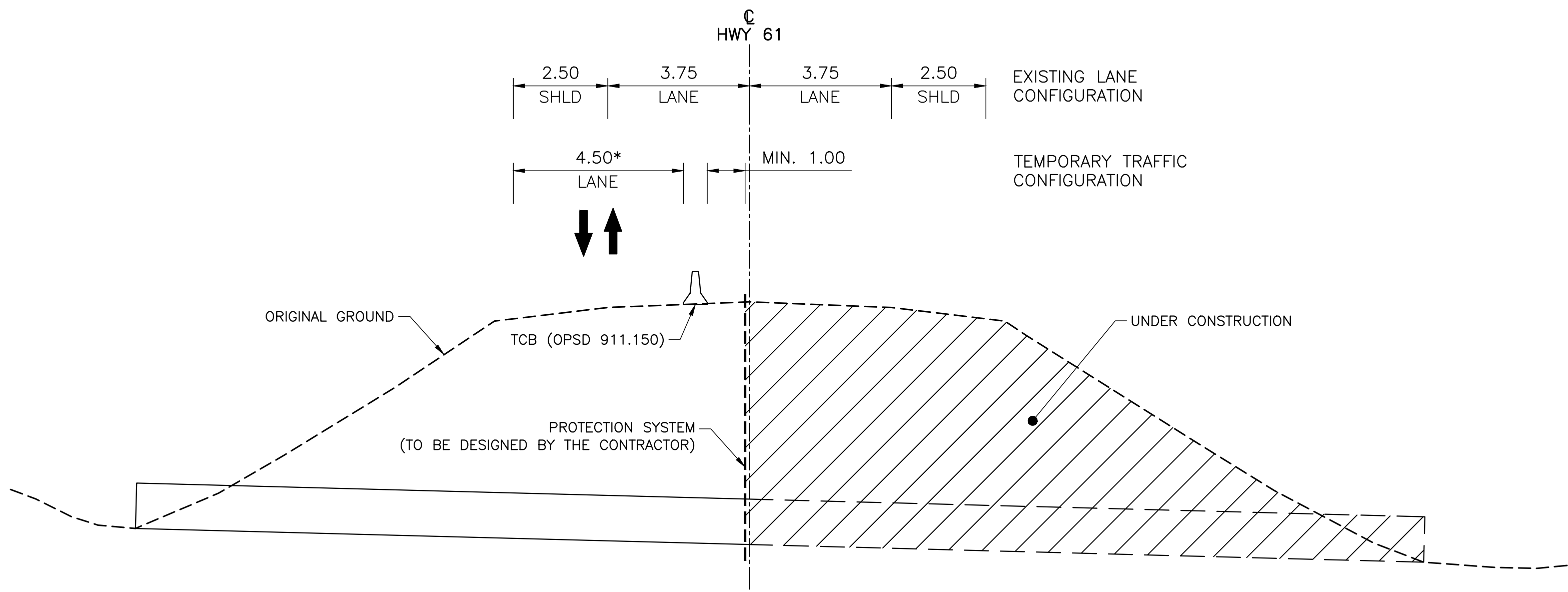
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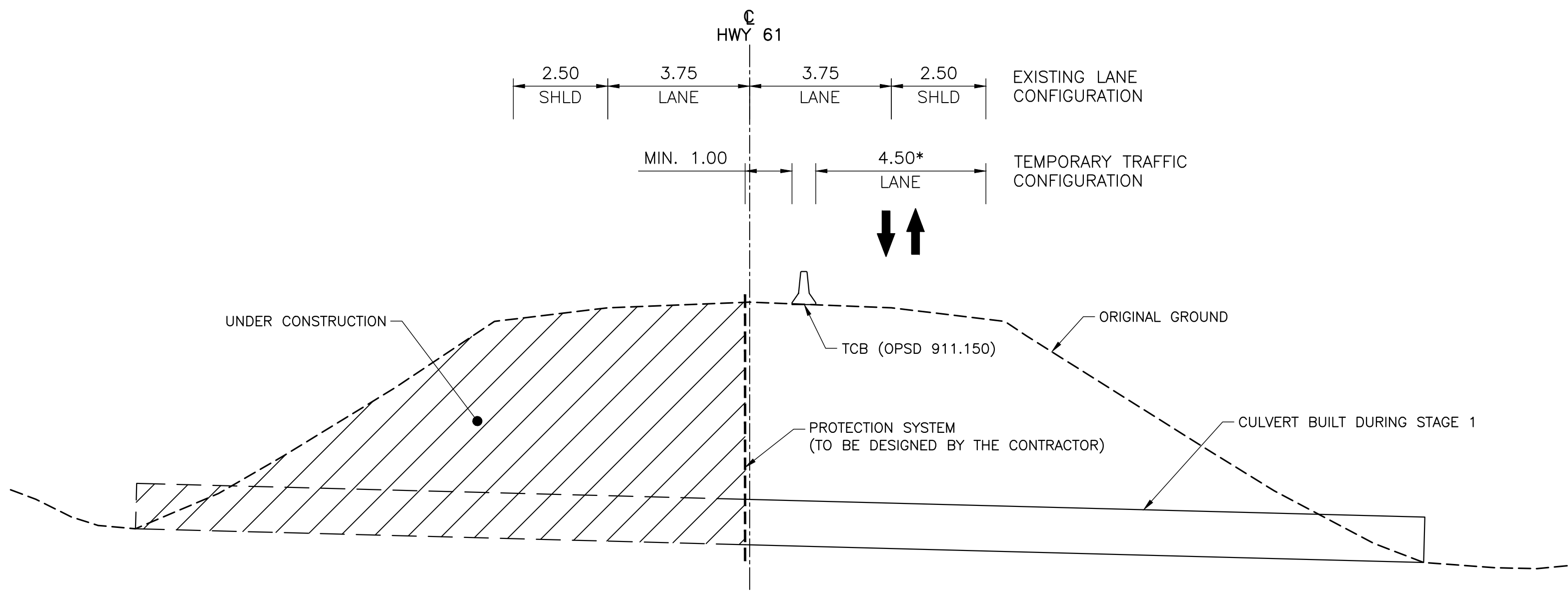
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HIGHWAY 61 CULVERT REPLACEMENT STAGING (WITH ROADWAY PROTECTION)



STAGE 1 – TYPICAL SECTION
* 4.50m INCLUDES 3.50m TRAVEL LANE AND 2 X 0.5m PAVED SHOULDERS



STAGE 1 – TYPICAL SECTION
* 4.50m INCLUDES 3.50m TRAVEL LANE AND 2 X 0.5m PAVED SHOULDERS

N.T.S.

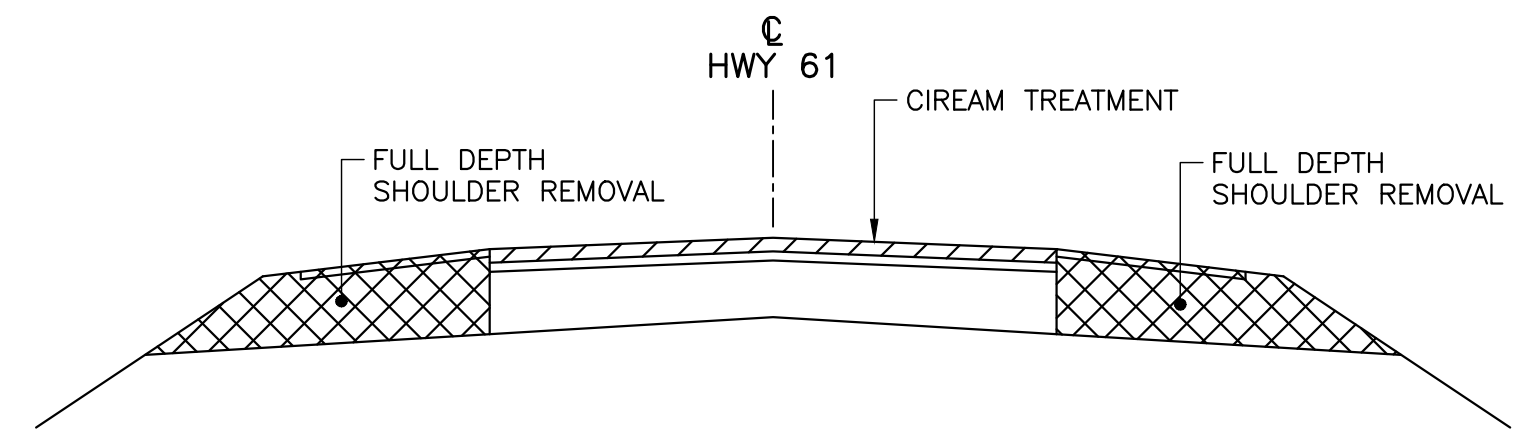
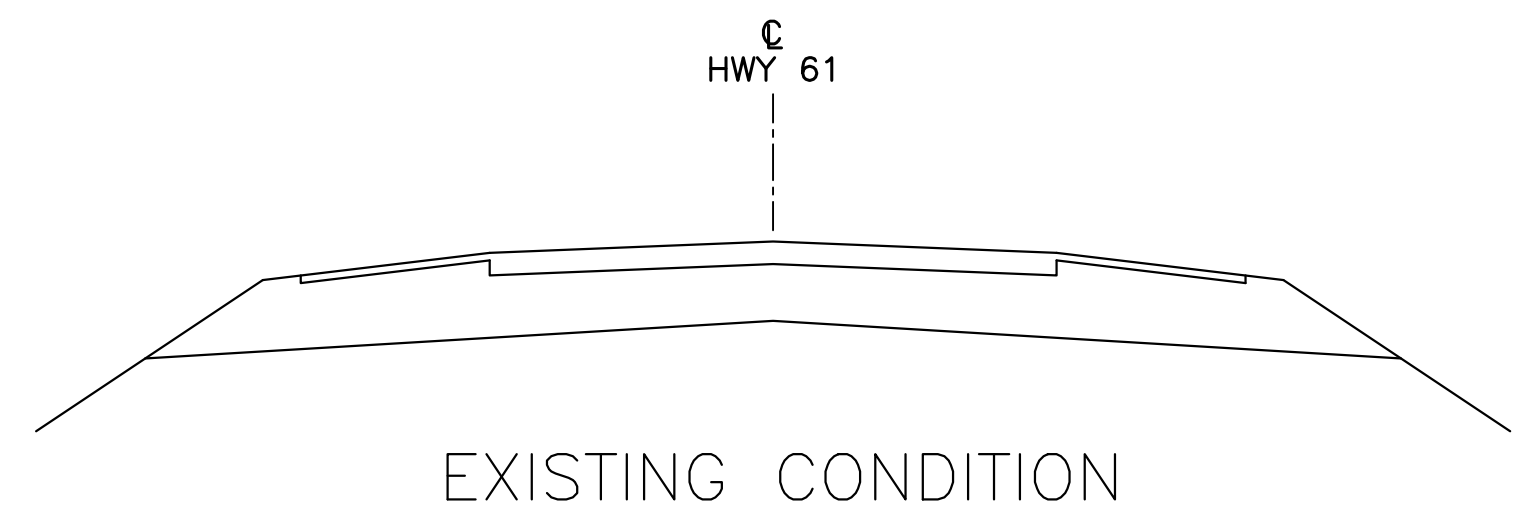
METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETERS
UNLESS OTHERWISE SHOWN

PLATE No	----
CONT WP	6176-15-00
CONSTRUCTION STAGING TYPICALS	
Survey	Revised

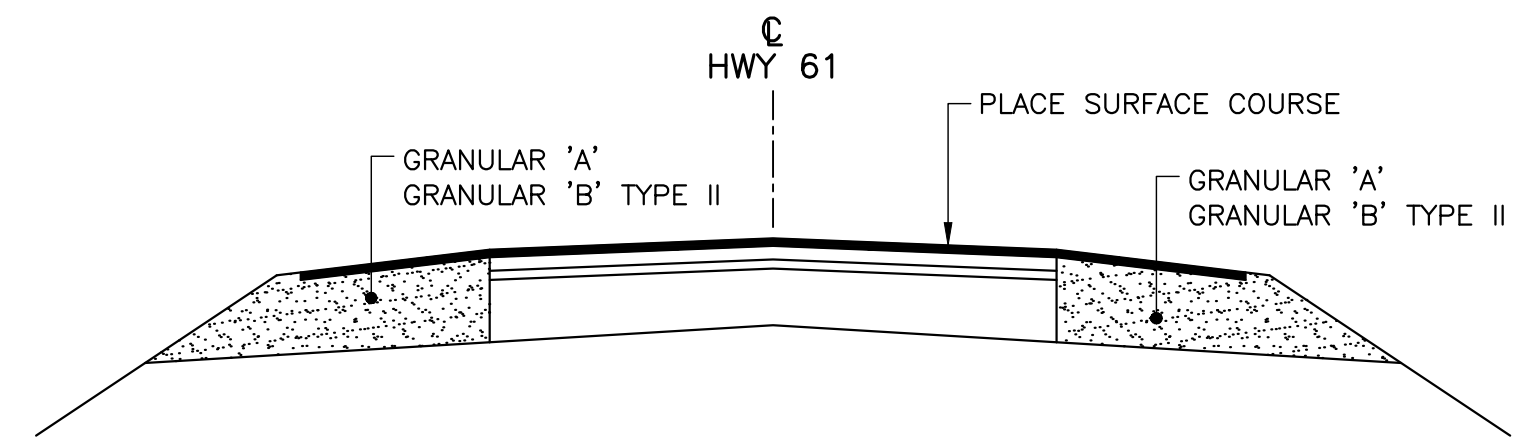
Gannett Fleming

SHEET 10

HIGHWAY 61 PAVEMENT REHABILITATION SEQUENCING



SEQUENCE 1
REMOVAL WORKS INCLUDING CIREAM TREATMENT AND FULL DEPTH SHOULDER REMOVAL. GUIDE RAIL REMOVAL AND STRIPPING WHERE PLATFORM WIDENING IS REQUIRED.



SEQUENCE 2
PAVE TOP LIFT ASPHALT (50mm GRAD RAISE). APPLY GRANULAR SEALING AND INSTALL NEW STEEL BEAM GUIDE RAILS WHERE REQUIRED.

NOTE:
TRAFFIC CONTROL AS PER OTM BOOK 7

N.T.S.