



THURBER ENGINEERING LTD.

**FOUNDATION INVESTIGATION AND DESIGN REPORT
OVERHEAD SIGN SUPPORT STRUCTURES
NEW TREMAINE ROAD INTERCHANGE
HIGHWAY 401
REGIONAL MUNICIPALITY OF HALTON, ONTARIO**

LATITUDE: 43.524303, LONGITUDE: -79.928103

Geocres Number: 30M12-521

Report to

WSP

March 31, 2022
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PART 1: FACTUAL INFORMATION

1.0 INTRODUCTION

This report presents the factual findings obtained from a foundation investigation conducted by Thurber Engineering Ltd. (Thurber) for the design of overhead sign (OHS) support structures along Highway 401 in connection with the proposed Tremaine Road Interchange at Highway 401 in the Town of Milton, Ontario.

New Tremaine Road will be constructed on a new alignment approximately 600 m east of the existing Tremaine Road and cross Highway 401 as part of a new interchange. The interchange project will include construction of a new underpass structure carrying Tremaine Road over Highway 401, approach embankments, and access ramps connecting the new Tremaine Road and Highway 401. New overhead signs are planned for the new interchange.

The purpose of the investigation was to explore the subsurface conditions at the proposed sign locations and, based on the data obtained, to provide borehole location drawings, records of boreholes, laboratory test results, and a written description of the subsurface conditions.

Thurber completed this report as a sub-consultant to WSP who are completing the design of the OHS structures as part of the detailed design of the interchange for the Regional Municipality of Halton.

2.0 SITE DESCRIPTION

The proposed Tremaine Road interchange with Highway 401 will be located approximately 600 m east of the existing Tremaine Road underpass and about 2.0 km west of the Regional Road 25 interchange in the Town of Milton. The project limits along the new Tremaine Road alignment extend from 3rd Side Road south of Highway 401 northerly to approximately 100 m south of Campbellville Road. Highway 401 at the site is a six lane divided highway with a tall-



wall median barrier. It is noted that at the time of this investigation, construction to widen Highway 401 from six to ten lanes from just west of Region Road 25 to James Snow Parkway was ongoing.

The proposed interchange lands are generally agricultural with a faintly undulating topography. A small tributary of the Sixteen Mile Creek crosses from the northwest to the south end of the properties. Industrial buildings exist to the east, residential areas are located to the west and south, and a heritage park and conservation/ski area are located to the southwest as well.

The project site is located within the physiographic region known as the Peel Plain, characterized by a discontinuous veneer of glacio-lacustrine clay and silt underlain by glacial till consisting of clayey silt to silty clay (Halton Till). The underlying bedrock consists of the Queenston Formation, a reddish brown shale with hard siltstone and limestone interbeds. The site is located approximately 1.0 km northeast of the base of the Niagara Escarpment.

3.0 INVESTIGATION PROCEDURES

The site investigation was carried out during the period of November 25 to December 22, 2021 and consisted of 6 boreholes (Boreholes E1-1, E1-2, E2-1, E2-2, W1-2 and W2-2) advanced to depths of 9.8 to 11.3 m depth. Dynamic cone penetration tests (DCPT) were completed to 13.4 m depth at Boreholes E2-1 and E2-2 to supplement the sampling data. The approximate locations of the boreholes are shown on the Borehole Locations Drawings provided in Appendix C.

All borehole locations were cleared of utilities prior to commencement of drilling. The boreholes were repositioned as necessary in consideration of surface features, underground utilities, and restricted site access.

The boreholes were advanced using solid and hollow stem augers powered by track-mounted Diedrich D120 and D50 drilling equipment. Soil samples were obtained at selected intervals using a 50 mm outside diameter split-spoon sampler driven in conjunction with the Standard Penetration Test (SPT) in accordance with ASTM D 1586.

It is noted that access across ditches to the outer foundation locations (Boreholes E1-2, E2-2, and W2-1) was not possible for conventional drilling equipment and therefore these boreholes were relocated to the highway shoulder. A manually excavated test pit was advanced at the foundation location adjacent to the shoulder boreholes to determine the thickness of topsoil or organics at the programmed location.



The field investigation was supervised on a full-time basis by a member of Thurber's technical staff who marked/staked the boreholes in the field, arranged for the clearance of subsurface utilities, directed the drilling, sampling and in-situ testing operations, logged the boreholes and processed the recovered soil samples for transport to Thurber's laboratory for further examination and testing.

Groundwater conditions in the open boreholes were observed throughout the drilling operations. No piezometers were installed within the travelled portion of the highway or on narrow shoulders due to safety reasons. Upon completion, the boreholes were backfilled with bentonite and cuttings, capped with granular material and asphalt, in general accordance with MOE Regulation 903 as amended.

Completion details of the boreholes are summarized as follows:

Borehole Number	Borehole Depth / Base Elevation (m)	Piezometer Tip Depth / Elevation (m)	Completion Details
E1-1	11.3/223.4	None Installed	Bentonite holeplug and cuttings to surface and covered with concrete and cold patch asphalt
E1-2	11.3/223.4	None Installed	Bentonite holeplug and cuttings to surface and covered with concrete and cold patch asphalt
E2-1	9.8/212.9	None Installed	Bentonite holeplug and cuttings to surface and covered with concrete and cold patch asphalt
E2-2	9.8/212.6	None Installed	Bentonite holeplug and cuttings to surface and covered with concrete and cold patch asphalt
W2-1	9.8/206.3	None Installed	Bentonite holeplug and cuttings to surface and covered with concrete and cold patch asphalt
W2-2	11.3/204.8	None Installed	Bentonite holeplug and cuttings to surface and covered with concrete and cold patch asphalt



4.0 LABORATORY TESTING

Routine laboratory testing was carried out at Thurber's laboratory. The recovered soil samples were subjected to Visual Identification (VI) and to natural moisture content determination. Selected samples were also subjected to grain size distribution analysis and Atterberg Limits testing. Results of the laboratory testing are summarized on the Record of Borehole sheets in Appendix A and presented on the figures included in Appendix B.

5.0 DESCRIPTION OF SUBSURFACE CONDITIONS

Reference should be made to the Record of Borehole sheets in Appendix A and the "Borehole Locations Drawings" in Appendix C. An overall description of the stratigraphy is given in the following paragraphs. However, the factual data presented in the Record of Borehole Sheets governs any interpretation of the site conditions. It must be recognized and anticipated that soil conditions may vary between and beyond the borehole locations.

In general terms, the subsurface stratigraphy encountered in the boreholes consists of a surficial pavement structure (asphalt over granular) overlying a varying thickness of fill underlain by native deposits of silty clay overlying silty clay till underlain by silt.

More detailed descriptions of the individual strata are presented below.

5.1 Pavement Structure

A flexible pavement structure was encountered at the ground surface of the boreholes. The asphalt thickness ranged from 125 to 150 mm, locally 325 mm in E1-2, and was underlain by 440 to 1100 mm of sand and gravel.

SPT 'N' values recorded in the granular varied from 18 to 61 blows per 0.3 m, indicating a compact to very dense condition. Measured moisture contents ranged from 2 to 7%.

The results of a grain size distribution analysis carried out on one sample of the granular are shown on Figure B1 in Appendix B. The results indicated 32% gravel, 47% sand, and 21% silt and clay sized particles.



5.2 Topsoil

A 175 to 250 mm thick layer of topsoil was encountered at the ground surface of the test pits manually excavated at the programmed locations of Boreholes E1-2, E2-2, and W2-1 as follows:

Borehole	Topsoil Thickness (mm)
E1-2	200
E2-2	175
W2-1	250

The topsoil thickness may vary at locations between and beyond the boreholes, and the recorded thicknesses are not intended for use in estimating quantities.

5.3 Fill

5.3.1 Silt and Sand Fill

Locally, in Borehole W2-1, a layer of silt and sand fill was encountered below the pavement structure at a depth of 0.9 m (Elev. 215.2) and was penetrated at a depth of 1.9 m (Elev. 214.2). SPT 'N' values of 6 and 13 blows per 0.3 m were recorded in the silt and sand fill, indicating a loose to compact condition. Moisture contents of 10 and 12% were measured.

The results of a grain size distribution analysis carried out on one sample of the silt and sand fill are shown on Figure B2 in Appendix B. The results indicated 7% gravel, 39% sand, 43% silt and 11% clay sized particles.

5.3.2 Silty Clay Fill

A 0.8 to 2.0 m thick layer of silty clay fill was contacted below the pavement structure and silt and sand fill at depths of 0.6 to 1.9 m (Elev. 214.2 to 222.1) and was contacted to depths of 2.2 to 3.0 m (Elev. 213.1 to 220.2) in Boreholes E2-1, E2-2, W2-1 and W2-2. The silty clay fill layer was reddish brown, brown and grey and contained occasional organics. SPT 'N' values recorded in the clay fill were highly variable and ranged 6 to 37 blows per 0.3 m, indicating a firm to hard condition. Measured moisture contents ranged from 8 to 23%.



5.4 Silty Clay

A silty clay layer was encountered below the pavement structure at depths of 1.2 and 0.8 m (Elev. 233.5 and 233.9) and was penetrated at a depth of 2.2 m (Elev. 232.5) in Boreholes E1-1 and E1-2, respectively. SPT 'N' values recorded in this clay layer ranged from 8 to 18 blows per 0.3 m of penetration, indicating a stiff to very stiff consistency. Measured moisture contents ranged from 14 to 20%.

5.5 Silty Clay Till

A deposit of silty clay till was contacted at depths of 2.2 to 3.0 m (Elev. 213.1 to 232.5) in all the boreholes. The clay till layer was 1.2 to 7.2 m thick with a lower boundary at 3.4 to 10.2 m depth (Elev. 205.9 to 227.5).

SPT 'N' values recorded within the clay till deposits ranged from 9 to 54 blows per 0.3 m of penetration, indicating a stiff to hard consistency. Measured moisture contents within the till typically varied between 10% and 20%.

The results of grain size distribution analyses carried out on selected samples of the till material are shown on Figures B3 and B4 in Appendix B, and the results were as follows:

Soil Particle	Percentage (%)
Gravel	1 to 2
Sand	17 to 25
Silt	45 to 56
Clay	23 to 36

Atterberg limits testing was carried out on selected samples of clay till. The results are plotted on Figures B6 and B7 in Appendix B and summarized below. The results indicate that the till samples tested typically consist of silty clay of low plasticity (CL); one sample tested indicated an intermediate plastic clay (CI).

Liquid Limit	23 to 37
Plastic Limit	8 to 17
Plasticity Index	15 to 20

Till soils frequently contain cobbles and boulders, and these should be anticipated when excavating during construction.



5.6 Silt to Silt and Sand

A deposit ranging from silt with trace sand to silt and sand was contacted below the clay till at depths ranging from 3.4 to 10.2 m (Elev. 205.9 to 227.5) and was contacted to the sampled termination depths of 9.8 to 11.3 m (Elev. 204.8 to 223.4) in all the boreholes. This deposit contained trace to some clay.

SPT 'N' values recorded in the silt to silt and sand deposits ranged widely from 8 to 57 blows per 0.3 m, indicating a highly variable relative density of loose to very dense. It is noted that higher SPT 'N' values of 26 to 57 blows per 0.3 m of penetration were recorded in Boreholes E1-1, E1-2, W2-1 and W2-2, and lower values, ranging from 8 to 24 blows per 0.3 m of penetration, were recorded in Boreholes E2-1 and E2-2. A dynamic cone penetration test (DCPT) was completed through the sampled depth from 0.2 to 9.8 m in Borehole E2-1, and below the sampled depth from 9.8 m to 13.4 m in both Boreholes E2-1 and E2-2. DCPT results through the silt typically ranged from 20 to 50 blows per 0.3 m, indicating a compact to very dense relative density.

Measured moisture contents in the silt to silt and sand deposits generally ranged from 11 to 16%, with higher values of 19 to 24% observed in saturated conditions.

The results of grain size distribution tests carried out on the silt to sand and silt are included on Figure B5 in Appendix B and summarized below:

Soil Particle	Percentage (%)	
	Silt	Sandy Silt to Silt and Sand
Gravel	0	0 to 2
Sand	6 to 15	24 to 41
Silt	69 to 84	53 to 63
Clay	7 to 19	6 to 11

The results of one Atterberg Limits test carried out on this material indicated that this layer is not plastic.



5.7 Groundwater Levels

During drilling and sampling operations, “wet” conditions were noted in selected boreholes at the following depths (approximate):

Table 5.1 – Noted “Wet” Conditions during Drilling

Borehole	Depth	Elev.
E1-1	7.2	227.5
E1-2	7.8	226.9
E2-1	4.1	218.6
E2-2	3.4	219.0
W2-1	8.7	207.4
W2-2	10.2	205.9

The groundwater levels measured in the boreholes upon completion of drilling are summarized in Table 5.2. Water was not observed in the remaining boreholes during drilling.

Table 5.2 - Measured Groundwater Levels

Borehole	Date	Water Level (m)		Remark
		Depth	Elev.	
E2-1	December 22, 2021	4.9	217.8	Upon completion
E2-2	December 20, 2021	4.6	217.8	Upon completion

The above water level measurements are short-term observations and seasonal fluctuations of the groundwater level are to be expected. Water levels may be higher after snowmelt or heavy precipitation events.

6.0 MISCELLANEOUS

The borehole locations were established in the field by Thurber using a portable GPS receiver and verified relative to existing site features. The ground surface elevations at the borehole locations were determined using a Trimble R10 GNSS receiver.

Walker Drilling of Utopia, Ontario and Elite Drilling of St. Catharines, Ontario supplied and operated the drilling and sampling equipment for the field program.

Full time supervision of the field activities was carried out by Mr. Soheil Moayerian and Mr. Greg Forrest of Thurber Engineering. Overall supervision of the field program was performed by Mr. Timothy Feather of Thurber Engineering Ltd.

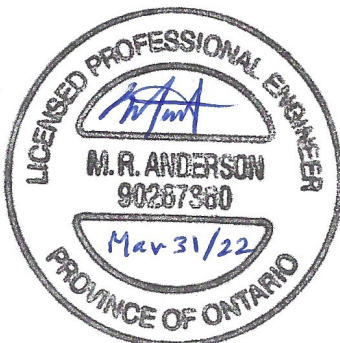


Interpretation of the field data and preparation of the report were performed by Mr. Karel Furbacher, P.Eng. and Mr. Murray Anderson, P.Eng. The report was reviewed by Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

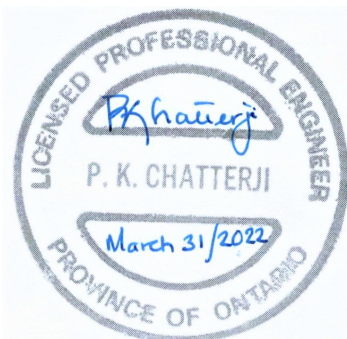
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Dr. P.K. Chatterji, P.Eng.
Review Principal



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NEW TREMAINE ROAD INTERCHANGE
HIGHWAY 401
REGIONAL MUNICIPALITY OF HALTON, ONTARIO**

Geocres Number: 30M12-521

PART 2: ENGINEERING DISCUSSION AND RECOMMENDATIONS

7.0 GENERAL

This report presents interpretation of the geotechnical data in the factual report and presents geotechnical recommendations regarding design of foundations for overhead sign (OHS) support structures along Highway 401 in connection with the proposed Tremaine Road Interchange at Highway 401 in the Town of Milton, Ontario.

The discussion and recommendations presented in this report are based on the information provided by WSP and on the factual data obtained in the course of the investigation.

The interpretation and recommendations are intended for the use of the design consultant and MTO, and shall not be relied upon by any other parties including the construction contractor, or used for any purposes other than development of the project design. Comments on construction methodology and equipment, where presented, are provided only to highlight those aspects that could affect the design of the project. Contractors must make their own assessment of the factual information presented in Part 1 of the report, and the implications on equipment selection, construction methodology, and scheduling.

8.0 FOUNDATION DESIGN PARAMETERS

Design of the sign support structure foundations should be carried out in accordance with the following documents:

- Ministry of Transportation, Ontario (2019) "Sign Support Manual", Highway Standards Branch, Bridge Office (Reference 1).
- Canadian Highway Bridge Design Code and Commentary (2019). CAN/CSA-S6-19 and S6.1-19 (Reference 2).



It is understood that a typical OHS is supported on two foundations, each consisting of a reinforced concrete caisson. Table 1 following the text of this report presents the recommended parameters for foundation design of such caissons.

Where foundations are installed in new fill placed for embankment widening or grade raises, the following parameters are recommended for design in the new fill:

Fill Type	ϕ' (deg.)	n_h (MN/m ³)	K_p	γ (kN/m ³)
Granular A or B	32	5.0	3.2	22.8
SSM	30	3.0	3.0	21

It is recommended that MTO's standard designs in Reference 1 be used as a basis for the OHS support foundations. The foundation design parameters in Table 1 may be used in conjunction with Reference 1 to confirm that the standard designs are adequate.

In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of a caisson within the upper 1.2 m below final grade should be neglected in the foundation design. It is recommended that all topsoil and organics be neglected in determining lateral resistance.

Where downward sloping fill or native soil exists in front of a caisson, reduction of lateral passive resistance should be taken into consideration during design. For foundation design at the caissons, it should be assumed that full lateral resistance can only be mobilized where the width of the soil in front of or behind the caisson is equal to or greater than approximately four (4) times the diameter of the caissons. For sloping ground in front of a caisson, the magnitude of the mobilized passive resistance can be estimated by interpolating between zero passive resistance at the level where the slope face intersects the caisson, and full passive resistance at the level where the slope face is at a horizontal distance equal to or greater than four (4) times the diameter of the caisson.

Where an unconfined compressive strength, q_u , ($q_u = 2 \times C_u$, undrained shear strength) is provided for a cohesive soil, the ultimate lateral passive resistance should be calculated in conjunction with the total soil unit weight. When designing for portions of the caissons below the groundwater level in cohesionless sands and silts, the submerged soil unit weight, γ' , should be used. The required depth of the drilled shaft will be governed by lateral loads, including wind



loads, acting on the sign. The length of the caisson should also be sufficient to counteract frost jacking (upward) forces.

Appropriate load and resistance factors should be applied for caisson design.

9.0 CAISSON INSTALLATION

Caisson installation should generally be carried out in accordance with OPSS.PROV 903 and OPSS.PROV 915.

The contract documents should contain an NSSP alerting the contract bidders of the specific aspects relating to caisson construction for foundation supports at this site. Suggested wording for this NSSP is provided in Appendix D.

Caisson installation equipment must be able to dislodge, handle, and remove cobbles and boulders, penetrate obstructions within the fill and the till, and drill through hard or very dense layers, where encountered.

During drilling and sampling operations, “wet” conditions were noted in all the boreholes at approximate depths ranging from 3.4 to 10.2 m (Elev. 205.9 to 227.5) below ground surface. The short-term groundwater levels measured upon completion of drilling at 4.9 and 4.6 m (Elev. 217.8) in Boreholes E2-1 and E2-2, respectively; the remaining boreholes were open and dry. The water level measurements are short-term observations and the stabilized groundwater levels may be higher

Soil sloughing and water seepage is expected to occur in unsupported holes, particularly in the cohesionless silt to silt and sand deposits below the groundwater level. Temporary liners must be available to support the caisson sidewalls and to provide seepage cut-off where required. Any accumulated water may have to be pumped out from the hole prior to placing concrete. If the caissons extend below the groundwater level in the cohesionless deposits, additional measures such as the use of slurry and/or placement of concrete using tremie methods may be required to avoid hydraulic disturbance and heave at the caisson base.

Seasonal fluctuations of the groundwater level are to be expected. Water levels may be higher after snowmelt or heavy precipitation events. In general, perched water and wet conditions should be anticipated in the fill above underlying less permeable till materials.



10.0 CONSTRUCTION CONCERNS

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

- It is expected that temporary steel liners will be required during caisson construction to support the excavation sidewalls in the cohesionless deposits.
- Groundwater control may be required for installation of the caissons in some locations. High volumes of seepage should be anticipated in the wet cohesionless deposits, and measures such as heavy duty pumping to maintain a dry excavation and enable concrete placement in a dewatered condition may not be practical. It is anticipated that placement of concrete using tremie methods may be required.
- Cobbles, boulders or other obstructions may be present within the existing highway embankment fill and native tills. The Contractor's equipment and methodology must be able to handle and remove such obstructions.
- The Contractor must accurately establish the locations and depths of all buried utilities in the vicinity of the sign support foundations.

11.0 CONSTRUCTION INSPECTION AND TESTING

Caisson construction should be monitored by qualified geotechnical personnel as per OPSS.PROV 903. Where tremie concrete and/or slurry methods are not employed, the bottom of the caisson excavations should be visually examined to verify the soil conditions and to confirm that those conditions are consistent with the design assumptions in this report.



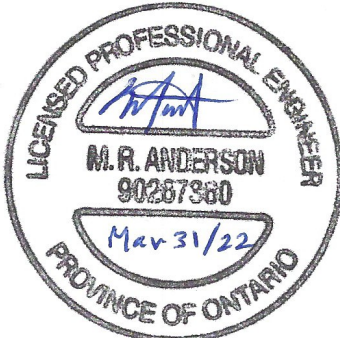
12.0 CLOSURE

Engineering analysis and preparation of the foundation design report were carried out by Mr. Karel Furbacher, P.Eng. and Mr. Murray Anderson, P.Eng. The report was reviewed by Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.

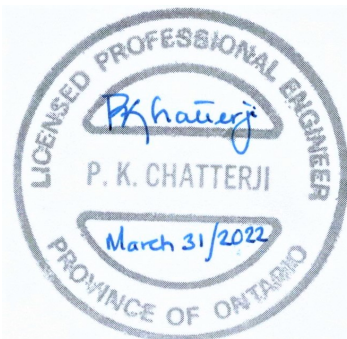
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Dr. P.K. Chatterji, P.Eng.
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TABLE 1
FOUNDATION DESIGN PARAMETERS
OVERHEAD SIGN SUPPORT STRUCTURES
NEW TREMAINE ROAD INTERCHANGE
HIGHWAY 401
REGIONAL MUNICIPALITY OF HALTON, ONTARIO
Geocres Number: 30M12-521

Approx. Station	Borehole Numbers	Reference Simplified Subsurface Stratigraphy For Design	Depth Below Existing Grade (m)	Foundation Design Parameters						
				q_u (kPa)	ϕ' (deg.)	n_h (MN/m ³)	K_p	γ (kN/m ³)	γ' (kN/m ³)	Ground-water Depth ³ (m)
19+500	E1-1	Silty Clay	1.2 – 2.2	100	-	-	-	20	-	7.2
		Silty Clay Till	2.2 – 7.2	300	-	-	-	20	-	
		Silt	7.2 – 11.3	-	29	1.4	2.9	19	9	
19+500	E1-2	Silty Clay	1.2 – 2.2	100	-	-	-	20	-	7.8
		Silty Clay Till	2.2 – 7.8	300	-	-	-	20	-	
		Silt	7.8 – 11.3	-	29	1.4	2.9	19	9	
20+022	E2-1	Silty Clay Fill	1.2 – 2.6	80	-	-	-	19	-	4.1
		Silty Clay Till	2.6 – 4.1	150	-	-	-	20	-	
		Silt	4.1 – 9.8	-	29	1.4	2.9	19	9	
20+022	E2-2	Silty Clay Fill	1.2 – 2.2	80	-	-	-	19	-	3.4
		Silty Clay Till	2.2 – 3.4	150	-	-	-	20	-	
		Silt to Silt and Sand	3.4 – 9.8	-	29	1.4	2.9	19	9	
11+128	W2-1	Silt and Sand Fill	1.2 – 1.9	-	28	1.5	2.8	18	-	8.7
		Silty Clay Fill	1.9 – 2.7	80	-	-	-	19	-	
		Silty Clay Till	2.7 – 8.7	300	-	-	-	20	-	
		Silt	8.7 – 9.8	-	29	1.4	2.9	19	9	

- Notes:
1. This table must be read in conjunction with the text of this report.
 2. In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.2 m below final grade should be neglected in the foundation design.
 3. Below existing grade

Approx. Station	Borehole Numbers	Reference Simplified Subsurface Stratigraphy For Design	Depth Below Existing Grade (m)	Foundation Design Parameters						
				q_u (kPa)	ϕ' (deg.)	n_h (MN/m ³)	K_p	γ (kN/m ³)	γ' (kN/m ³)	Ground-water Depth ³ (m)
11+128	W2-2	Silty Clay Fill	1.2 – 3.0	80	-	-	-	19	-	10.2
		Silty Clay Till	3.0 – 10.2	300	-	-	-	20	-	
		Silt	10.2 – 11.3	-	29	1.4	2.9	19	9	

LEGEND

q_u	=	Unconfined Compressive Strength (= 2 x C_u , undrained shear strength) (kPa)
ϕ'	=	Angle of Internal Friction (degrees)
n_h	=	Coefficient of Horizontal Subgrade Reaction (MN/m ³ or X 10 ³ kN/m ³)
K_p	=	Coefficient of Passive Earth Pressure
γ	=	Soil Unit Weight (kN/m ³)
γ'	=	Submerged Soil Unit Weight (kN/m ³) – to be used only for cohesionless soils below the groundwater table.

- Notes:
1. This table must be read in conjunction with the text of this report.
 2. In order to take into account frost action and surficial disturbance, the ultimate lateral passive resistance in front of the caisson within the upper 1.2 m below final grade should be neglected in the foundation design.
 3. Below existing grade



Appendix A
Record of Borehole Sheets

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.

RECORD OF BOREHOLE No E1-1

1 OF 2

METRIC

W.P. _____ LOCATION OHS E1, MTM83-10: N 4 819 903.3 E 269 248.4 ORIGINATED BY SM
 DIST HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2021.11.29 - 2021.11.30 LATITUDE 43.518205 LONGITUDE -79.939754 CHECKED BY KF

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					
234.7	GROUND SURFACE							20 40 60 80 100	20 40 60 80 100	20 40 60 80 100			
0.0	ASPHALT: (125mm)												
0.1	SAND and GRAVEL, trace silt Compact Brown Moist (FILL)		1	AS			234						
233.5			1	SS	19								
1.2	Silty CLAY, trace to some sand, trace gravel Stiff Brown to Grey		2	SS	8		233						
232.5													
2.2	Silty CLAY, some sand to sandy, trace gravel Very Stiff to Hard Reddish Brown (TILL)		3	SS	15		232					1 18 47 34	
			4	SS	31		231						
			5	SS	33								
			6	SS	43		230						
							229						
			7	SS	25		228					1 20 45 34	
227.5													
7.2	SILT, trace sand Compact to Dense Brown Moist to Wet		8	SS	36		227						
							226						
			9	SS	26		225					0 9 84 7	

Continued Next Page

+ ³, × ³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

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RECORD OF BOREHOLE No E1-1

2 OF 2

METRIC

W.P. _____ LOCATION OHS E1, MTM83-10: N 4 819 903.3 E 269 248.4 ORIGINATED BY SM
 DIST HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2021.11.29 - 2021.11.30 LATITUDE 43.518205 LONGITUDE -79.939754 CHECKED BY KF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
	Continued From Previous Page																
223.4	SILT, trace sand Dense Brown Moist to Wet		10	SS	34		224										
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN CONCRETE AND ASPHALT AT SURFACE.																

RECORD OF BOREHOLE No E1-2

1 OF 2

METRIC

W.P. _____ LOCATION OHS E1, MTM83-10: N 4 819 893.4 E 269 258.3 ORIGINATED BY GF
 DIST HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2021.12.19 - 2021.12.20 LATITUDE 43.518117 LONGITUDE -79.939631 CHECKED BY KF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
234.7	GROUND SURFACE											
0.0	ASPHALT: (325mm)											
234.4												
0.3	SAND and GRAVEL, trace silt Very Dense		1	SS	61		234					
233.9	Brown Moist (FILL)		2	SS	18							
0.8	Silty CLAY, trace to some sand, trace gravel Stiff to Very Stiff Brown to Grey		3	SS	12		233					
232.5			4	SS	17		232					
2.2	Silty CLAY, some sand to sandy, trace gravel Very Stiff to Hard Reddish Brown (TILL)		5	SS	25							
	Occasional cobbles		6	SS	54		231					
			7	SS	29		230					
			8	SS	14		229					
			9	SS	57		228					
226.9	SILT, trace sand and clay Compact to Very Dense Brown Moist to Wet		10	SS	51		227					
7.8							226					
							225					

Continued Next Page

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

RECORD OF BOREHOLE No E1-2

2 OF 2

METRIC

W.P. _____ LOCATION OHS E1, MTM83-10: N 4 819 893.4 E 269 258.3 ORIGINATED BY GF
 DIST HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2021.12.19 - 2021.12.20 LATITUDE 43.518117 LONGITUDE -79.939631 CHECKED BY KF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W P	W	W L		
	Continued From Previous Page																
223.4	SILT , trace sand and clay Compact Brown Moist to Wet		11	SS	28		224										
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN CONCRETE AND ASPHALT AT SURFACE.																

RECORD OF BOREHOLE No E2-1

1 OF 2

METRIC

W.P. _____ LOCATION OHS E2, MTM83-10: N 4 820 240.3 E 269 646.4 ORIGINATED BY GF
 DIST HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2021.12.21 - 2021.12.22 LATITUDE 43.521258 LONGITUDE -79.934853 CHECKED BY KF

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						
222.7	GROUND SURFACE													
0.0	ASPHALT: (140mm)													
0.1	SAND and GRAVEL, trace silt Compact		1	SS	18									
222.1	Brown													
0.6	Moist (FILL)		2	SS	13									
	Silty CLAY, some sand to sandy, trace gravel													
	Stiff													
	Reddish Brown, Brown and Grey (FILL)		3	SS	12									
220.1			4	SS	12									
2.6	Silty CLAY, some sand to sandy, trace gravel													
	Stiff													
	Reddish Brown (TILL)		5	SS	14									2 19 48 31
218.6			6	SS	11									
4.1	SILT, some sand, trace to some clay Loose to Compact													
	Grey		7	SS	8									0 10 80 10
	Wet													
			8	SS	13									
			9	SS	13									0 15 76 9 NON-PLASTIC
			10	SS	9									
212.9														
9.8	END OF BOREHOLE AT 9.8m.													

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No E2-1

2 OF 2

METRIC

W.P. _____ LOCATION OHS E2, MTM83-10: N 4 820 240.3 E 269 646.4 ORIGINATED BY GF
 DIST HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY MFA
 DATUM Geodetic DATE 2021.12.21 - 2021.12.22 LATITUDE 43.521258 LONGITUDE -79.934853 CHECKED BY KF

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			20	40					
	Continued From Previous Page													
209.3														
13.4	END OF DCPT AT 13.4m. BOREHOLE CAVED TO 4.9m UPON COMPLETION OF AUGERING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN CONCRETE AND ASPHALT AT SURFACE.													

RECORD OF BOREHOLE No E2-2

1 OF 2

METRIC

W.P. _____ LOCATION OHS E2, MTM83-10: N 4 820 230.3 E 269 656.9 ORIGINATED BY GF
 DIST HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY AA
 DATUM Geodetic DATE 2021.12.19 - 2021.12.20 LATITUDE 43.521168 LONGITUDE -79.934722 CHECKED BY KF

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					
222.4	GROUND SURFACE												
0.0	ASPHALT: (135mm)												
0.1	SAND and GRAVEL, some silt, trace clay Compact Brown Moist (FILL)		1	SS	51		222						175mm of topsoil at programmed location
221.6			2	SS	37								32 47 21 (SI+CL)
0.8	Silty CLAY, some sand, trace gravel, trace rootlets Very Stiff to Hard Reddish Brown to Grey (FILL)		3	SS	15		221						
220.2													
2.2	Silty CLAY, some sand to sandy, trace gravel Very Stiff to Stiff Reddish Brown (TILL)		4	SS	18		220						1 20 56 23
219.0			5	SS	9		219						
3.4	SILT, some sand, trace to some clay Loose to Compact Grey Moist to Wet		6	SS	9		218						0 12 69 19
			7	SS	8		217						
216.8													
5.6	SILT and SAND, trace clay Compact Grey to Red Wet		8	SS	24		216						0 41 53 6
							215						
			9	SS	15		214						
			10	SS	11		213						
212.6													
9.8	END OF SAMPLED BOREHOLE AT												

Continued Next Page

+ ³, × ³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No E2-2

2 OF 2

METRIC

W.P. _____ LOCATION OHS E2, MTM83-10: N 4 820 230.3 E 269 656.9 ORIGINATED BY GF
 DIST HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY AA
 DATUM Geodetic DATE 2021.12.19 - 2021.12.20 LATITUDE 43.521168 LONGITUDE -79.934722 CHECKED BY KF

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			20	40	60	80					
	Continued From Previous Page 9.8m AND START DCPT															
209.0																
13.4	END OF DCPT AT 13.41m. BOREHOLE CAVED TO 4.6m UPON COMPLETION OF AUGERING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN CONCRETE AND ASPHALT AT SURFACE.															

RECORD OF BOREHOLE No W2-1

1 OF 2

METRIC

W.P. _____ LOCATION OHS W2, MTM83-10: N 4 820 658.3 E 270 687.8 ORIGINATED BY GF
 DIST HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY AA
 DATUM Geodetic DATE 2021.12.20 - 2021.12.21 LATITUDE 43.525069 LONGITUDE -79.921998 CHECKED BY KF

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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						PLASTIC LIMIT W _P NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L
216.1	GROUND SURFACE							20 40 60 80 100						
0.0	ASPHALT: (150mm)							20 40 60 80 100						
0.2	SAND and GRAVEL, trace silt Dense Light Brown Moist (FILL)		1	SS	41		216							
215.2														
0.9	SILT and SAND, trace to some clay, trace gravel Loose to Compact Brown Moist (FILL)		2	SS	13		215							7 39 43 11
214.2			3	SS	6									
1.9	Silty CLAY, some sand, trace gravel Firm to Stiff Grey (FILL)						214							
213.4			4	SS	15									
2.7	Silty CLAY, some sand to sandy, trace gravel Very Stiff to Hard Reddish Brown (TILL)		5	SS	22		213							1 21 53 25
			6	SS	41		212							
			7	SS	28		211							
			8	SS	35		210							1 22 47 30
							209							
			9	SS	36		208							
207.4														
8.7	SILT, some sand, trace to some clay Dense Reddish Brown Moist to Wet						207							
			10	SS	36									0 6 84 10
206.3														
9.8	END OF BOREHOLE AT 9.80m.													

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

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RECORD OF BOREHOLE No W2-1

2 OF 2

METRIC

W.P. _____ LOCATION OHS W2, MTM83-10: N 4 820 658.3 E 270 687.8 ORIGINATED BY GF
 DIST HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY AA
 DATUM Geodetic DATE 2021.12.20 - 2021.12.21 LATITUDE 43.525069 LONGITUDE -79.921998 CHECKED BY KF

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
	Continued From Previous Page																
	BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN CONCRETE AND ASPHALT AT SURFACE.																

RECORD OF BOREHOLE No W2-2

1 OF 2

METRIC

W.P. _____ LOCATION OHS W2, MTM83-10: N 4 820 682.9 E 270 696.9 ORIGINATED BY SM
 DIST HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AA
 DATUM Geodetic DATE 2021.11.25 - 2021.11.26 LATITUDE 43.525291 LONGITUDE -79.921886 CHECKED BY KF

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							
216.1	GROUND SURFACE														
0.0	ASPHALT: (125mm)						216								250mm of topsoil at programmed location
0.1	SAND and GRAVEL, trace to some silt Compact Brown Moist (FILL)		0	AS											
214.9			1	SS	19		215								
1.2	Silty CLAY, some sand to sandy, trace gravel Stiff Brown to Grey (FILL)		2	SS	9										
			3	SS	9		214								
	Occasional organics														
213.1							213								
3.0	Silty CLAY, some sand to sandy, trace gravel Very Stiff to Hard Reddish Brown (TILL)		4	SS	26										
			5	SS	41		212								2 25 50 23
			6	SS	40										
			7	SS	26		211								
			8	SS	53		210								
							209								
							208								
			9	SS	41		207								

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No W2-2

2 OF 2

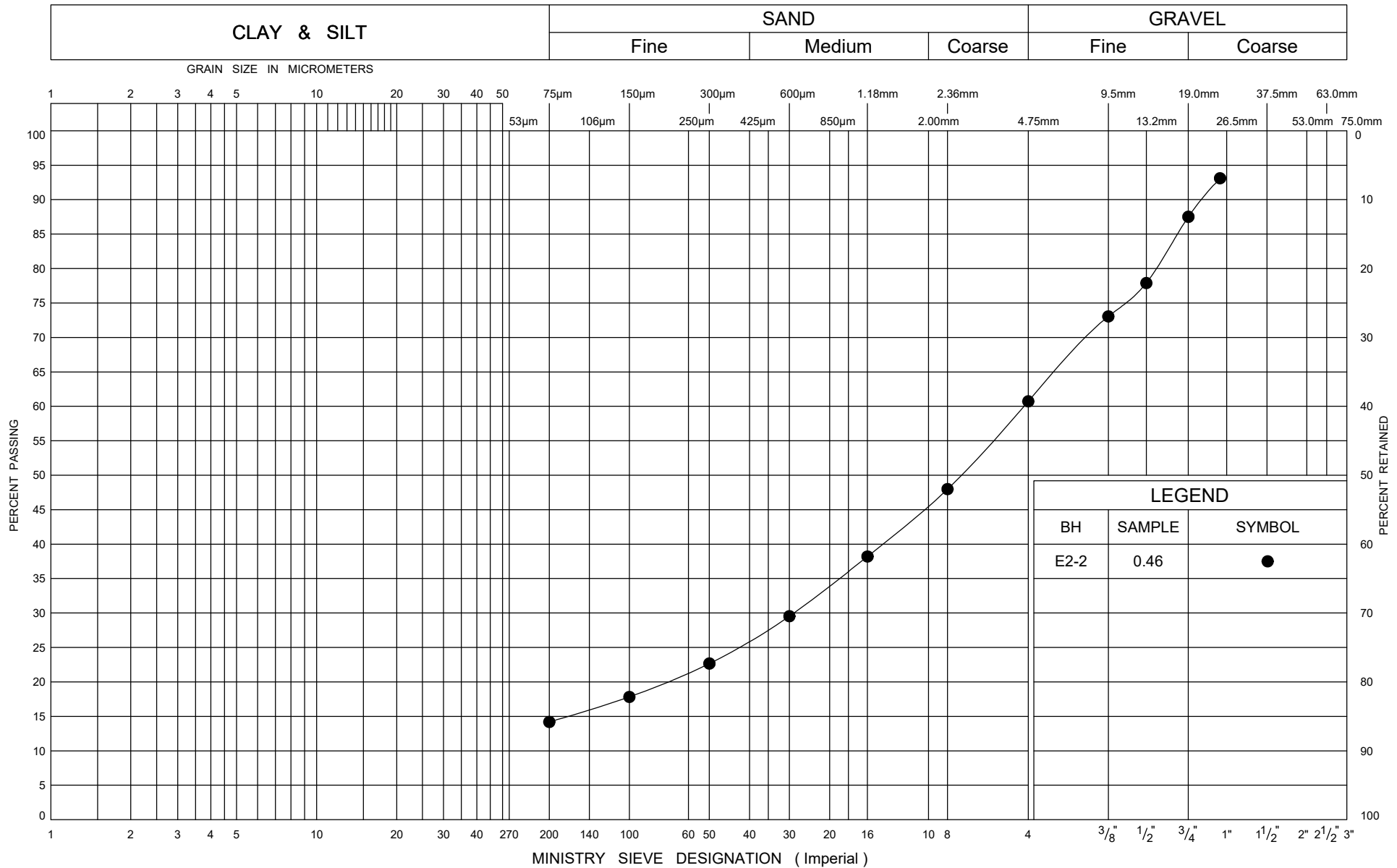
METRIC

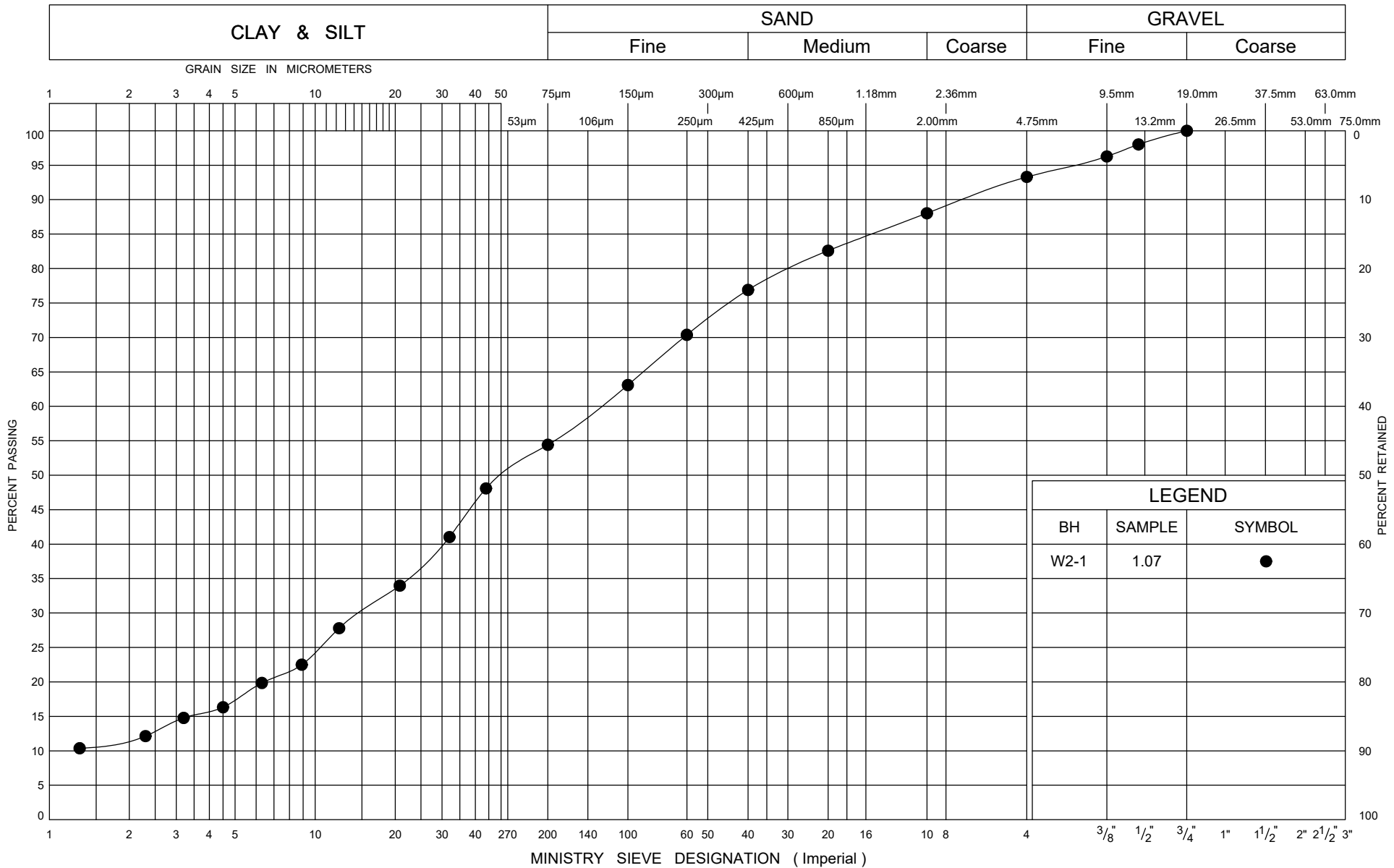
W.P. _____ LOCATION OHS W2, MTM83-10: N 4 820 682.9 E 270 696.9 ORIGINATED BY SM
 DIST HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AA
 DATUM Geodetic DATE 2021.11.25 - 2021.11.26 LATITUDE 43.525291 LONGITUDE -79.921886 CHECKED BY KF

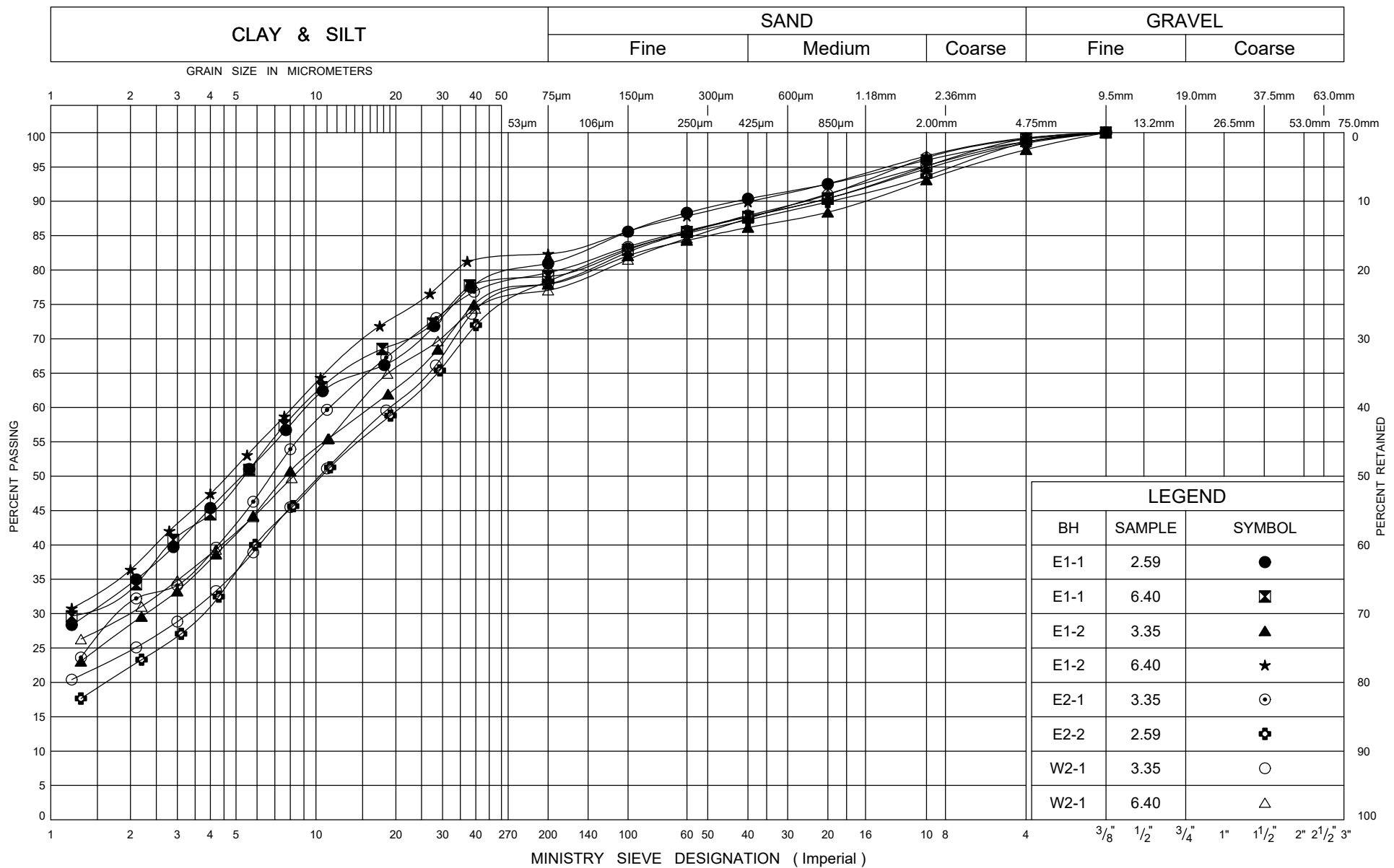
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
	Continued From Previous Page																
205.9							206										
10.2	Sandy SILT , some clay Very Dense Reddish Brown Wet																
			10	SS	53											2 24 63 11	
204.8							205										
11.3	END OF BOREHOLE AT 11.3m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN CONCRETE AND ASPHALT AT SURFACE.																

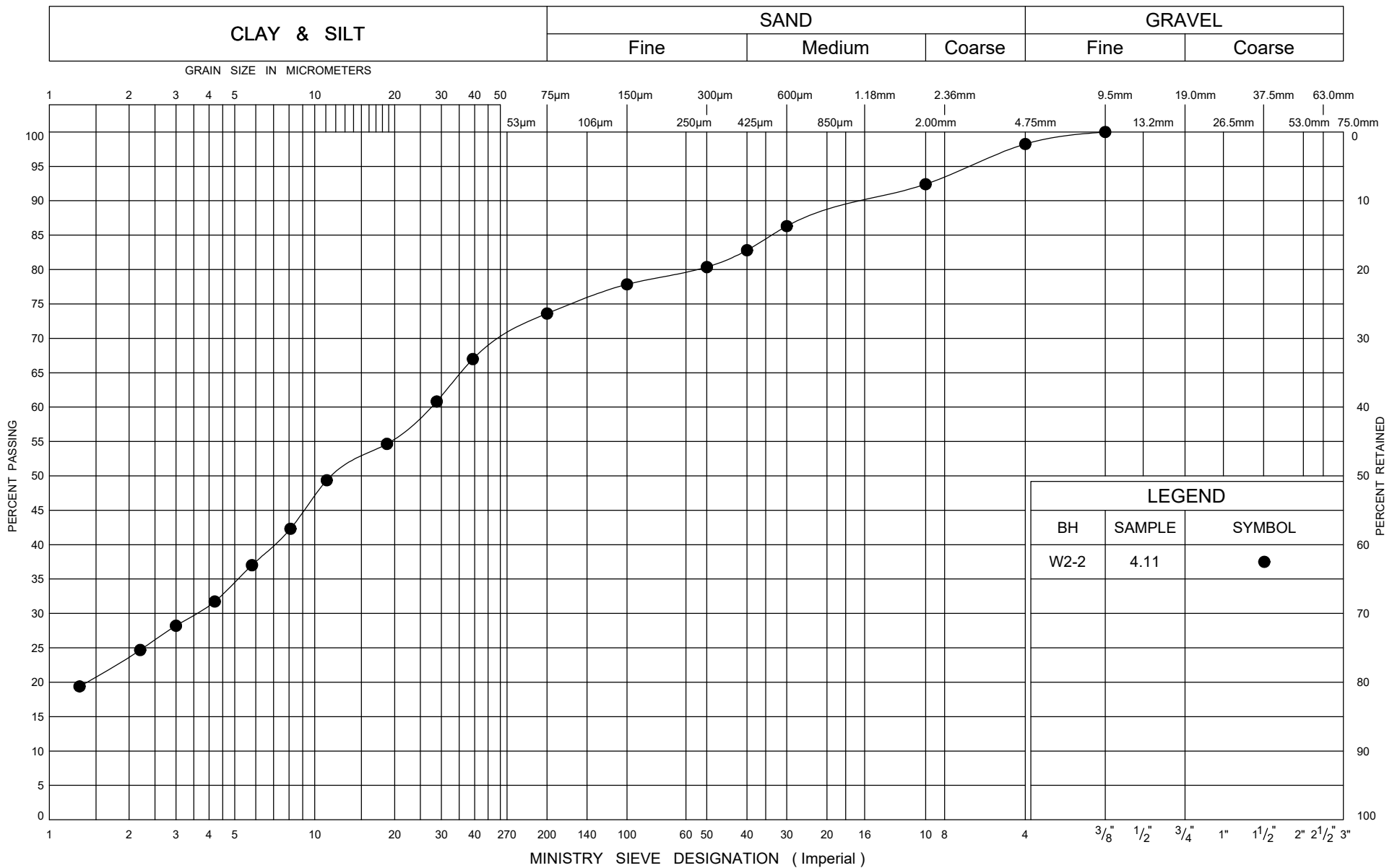


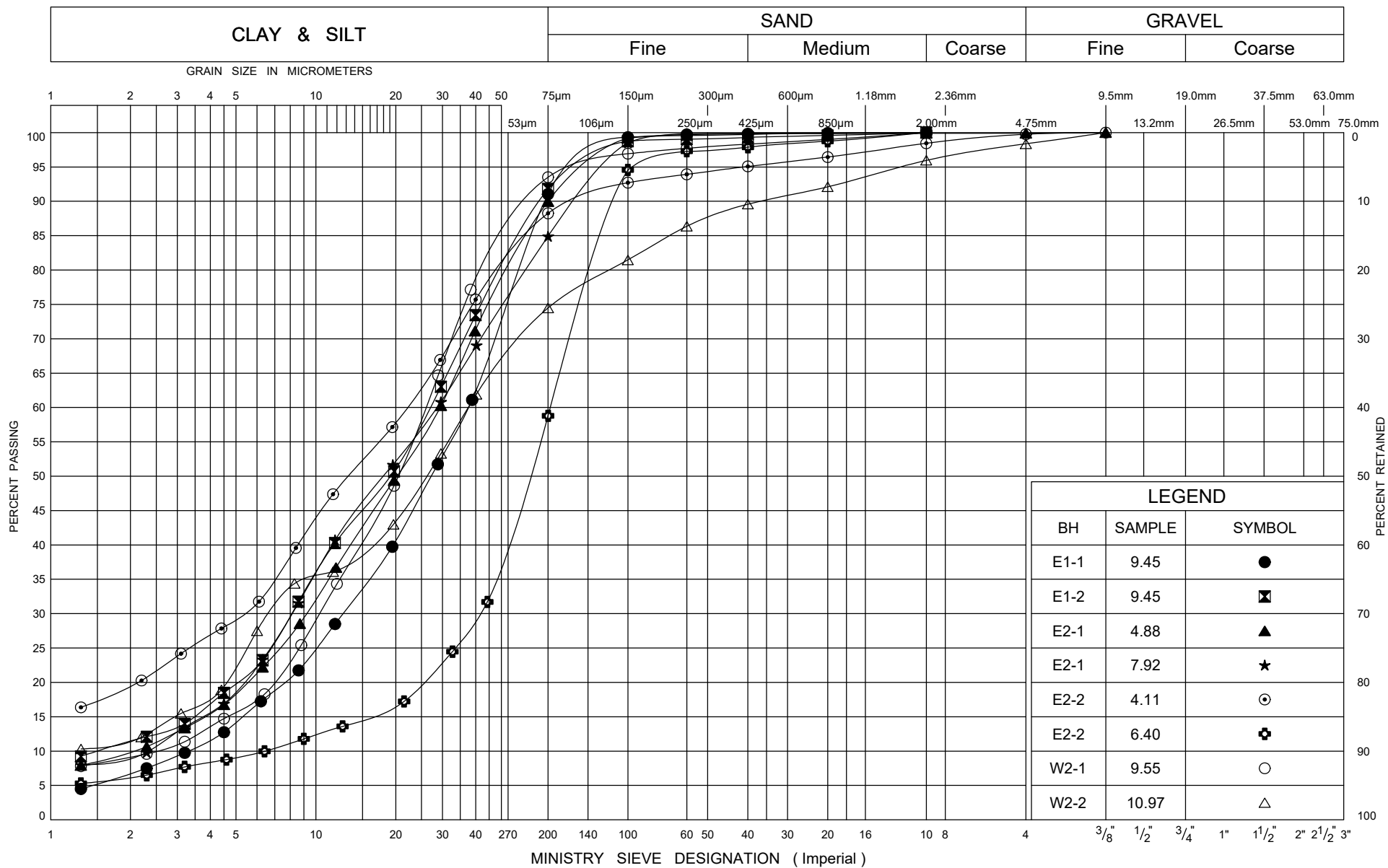
Appendix B
Laboratory Test Results

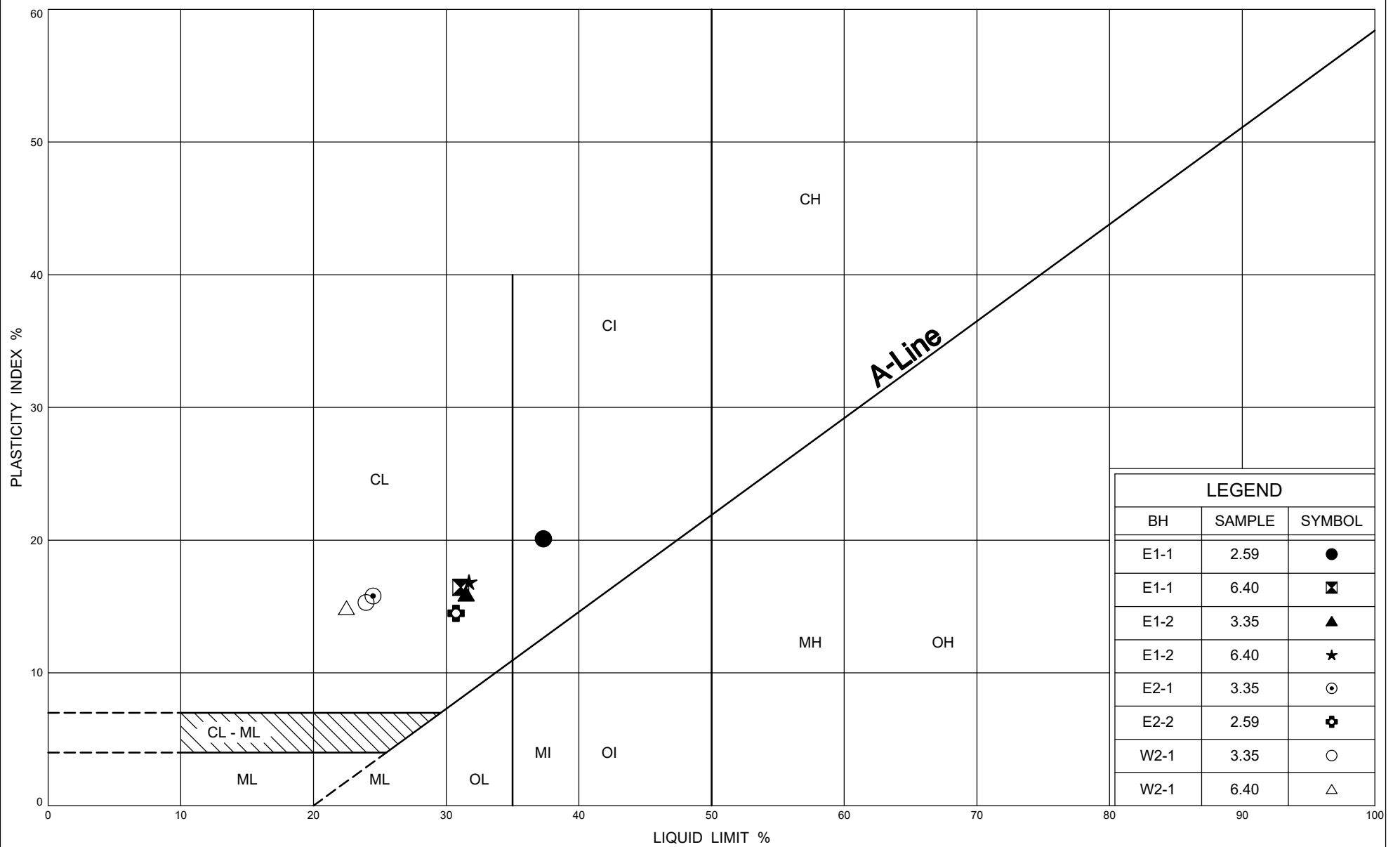












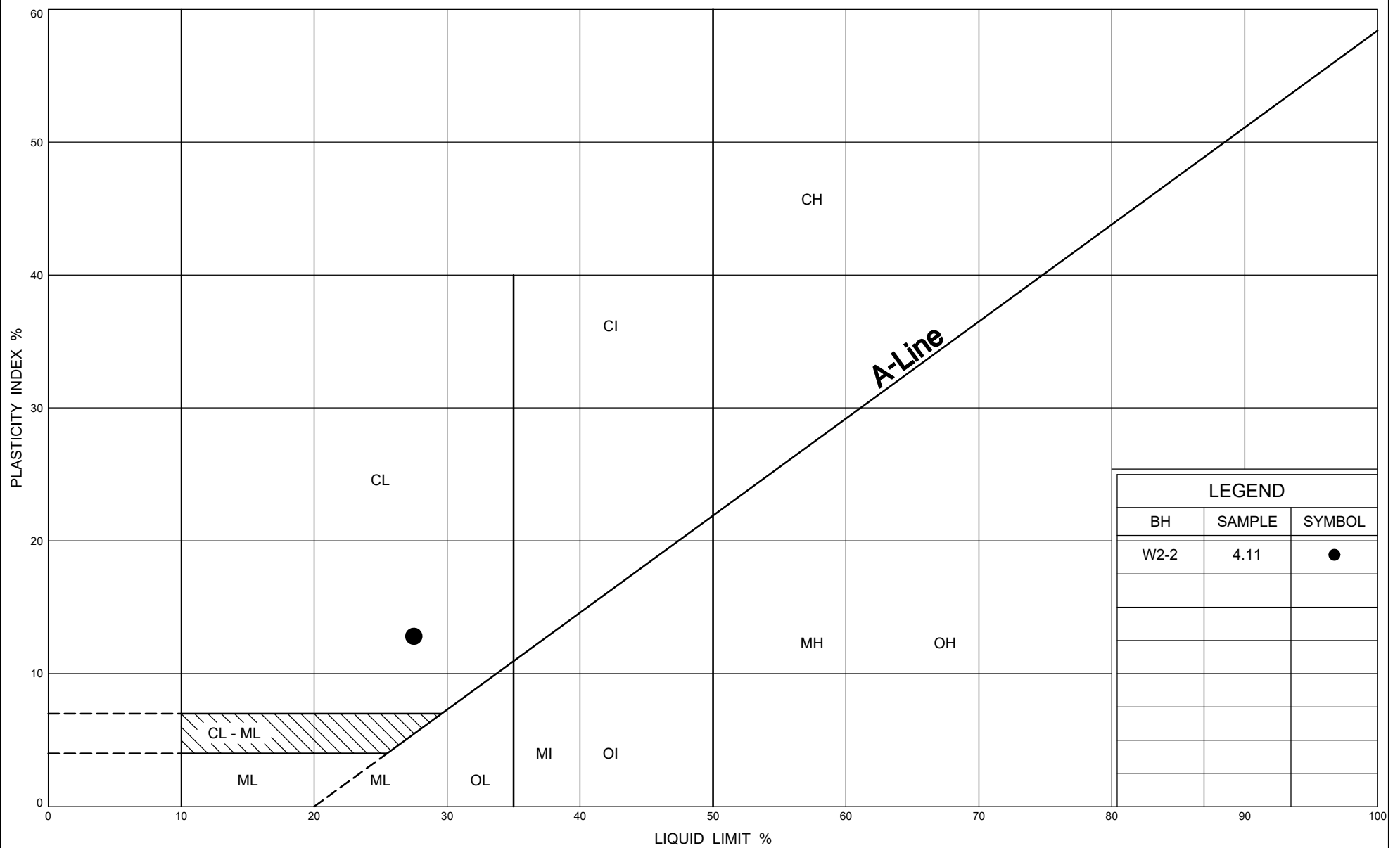
Ministry of
Transportation

PLASTICITY CHART

Silty CLAY TILL

FIG No B6

W P

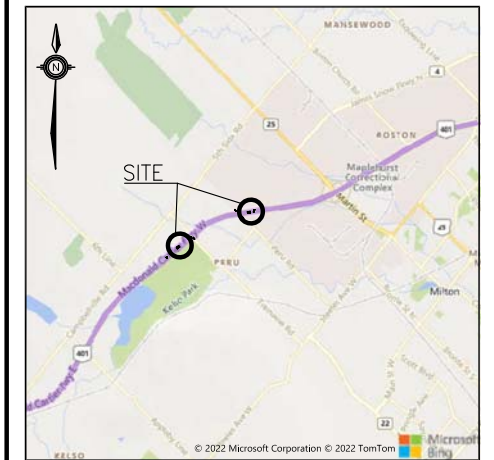









Appendix C
Borehole Locations Drawing

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

SHEET



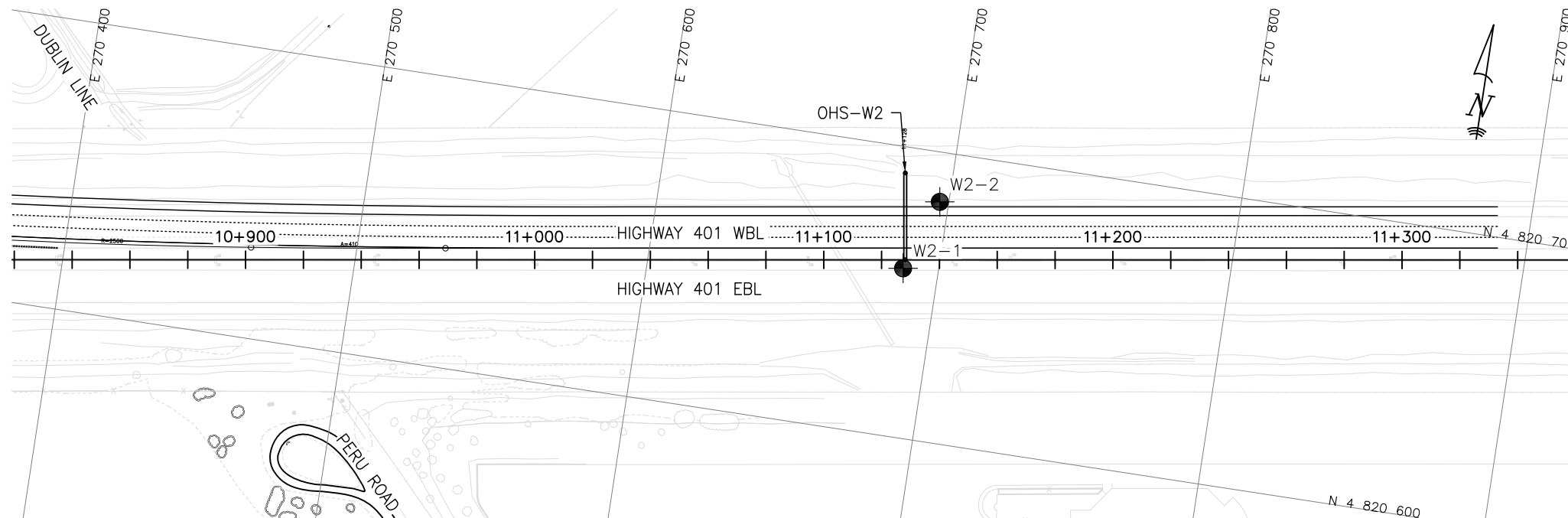
LEGEND

	Borehole
	Borehole and Cone
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
E1-1	234.7	4 819 903.3	269 248.4
E1-2	234.7	4 819 893.4	269 258.3
E2-1	222.7	4 820 240.3	269 646.4
E2-2	222.4	4 820 230.3	269 656.9
W2-1	216.1	4 820 658.3	270 687.8
W2-2	216.1	4 820 682.9	270 696.9

- 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. 30M12-521



REVISIONS								
	DATE	BY	DESCRIPTION					
DESIGN	KF	CHK		CODE		LOAD		DATE MAR 2022
DRAWN	AN	CHK	KF	SITE		STRUCT		DWG 1



Appendix D

List of Standard Specifications and Special Provisions



The following Standard Specifications and Special Provisions are referenced in this report:

OPSS.PROV 903

OPSS.PROV 915

Suggested Text for NSSP on:

“Augered Caisson Construction for Sign Support Foundations”

The Contractor is advised that variable types of subsurface materials may be encountered at the locations of the foundations. For additional information regarding subsurface conditions, the Contractor is referred to the Foundation Investigation Report.

1. The subsurface conditions at an augered caisson location shall be assumed to be the same as those encountered in the borehole closest to the subject caisson location.
2. Cobbles, boulders and rock fragments may be encountered within the glacial till deposits. Obstructions including rubble, cobbles and boulders may also be present within the embankment fills. Caisson installation equipment must be able to dislodge, handle, remove or otherwise penetrate these obstructions and hard/very dense layers.
3. Water seepage and/or soil sloughing into the caisson hole may occur in unsupported holes especially in cohesionless deposits below the groundwater level. Further, cohesionless soils if present at the caisson base may be susceptible to disturbance and base heave under conditions of unbalanced hydrostatic head. Temporary liners shall be available on site, or be made available on very short notice, to support the caisson sidewalls and provide seepage cut-off where required. Alternatively, and as necessitated by base conditions, additional measures such as the use of slurry and/or placement of concrete using tremie methods should be provided to maintain the stability of the caisson sidewalls and base.

The Contractor is responsible for constructing the foundations without disturbing the material at the sides or bases of the foundations.