



## Foundation Investigation Report

Highway 401 Eastbound Express and Collector Lanes between Victoria Park Avenue and Neilson Road - **Full Structure Replacement and Bridge Widening at CP Rail Overhead Eastbound Core and Collectors Structure (Site 37X-0213/B1 & B3)**

Assignment No. 2021-E-0018  
MTO Central Region  
Geocres Number: 30M14-550

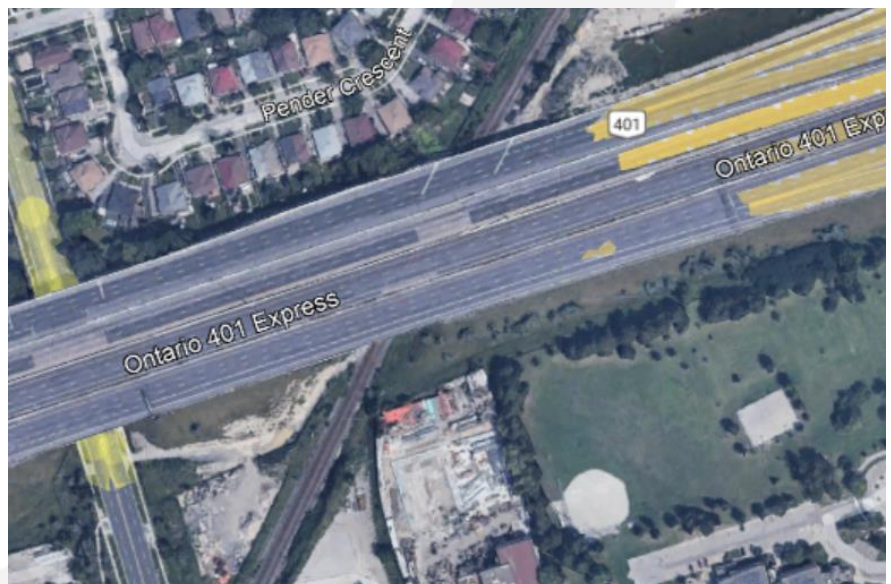
**Type of Document:**  
Foundation Investigation Report

**Project Number:**  
ADM-22000797-A0

**Prepared For:**  
AECOM Canada Ltd.  
5090 Explorer Drive  
Mississauga, Ontario, L4W 4X6  
Attn: Taesang Ahn

**Prepared By:**  
EXP Services Inc.  
1595 Clark Blvd  
Brampton, ON L6T 4V1  
Canada

**Date Submitted:**  
December 20, 2024



*Foundation Investigation Report  
Highway 401 Eastbound from Victoria Park Avenue to Neilson Road  
Full Structure Replacement and Bridge Widening at CP Rail Overhead (Site 37X-0213/B1 & B3)  
Assignment No. 2021-E-0018  
Date: December 20, 2024*

AECOM Canada Ltd.

## Foundation Investigation Report

**Project Name:**

Highway 401 Eastbound Express and Collector Lanes between Victoria Park Avenue and Neilson Road - **Full Structure Replacement and Bridge Widening at CP Rail Overhead, Eastbound Core and Collector Structure (Site 37X-0213/B1 & B3)**

Assignment No. 2021-E-0018

MTO Central Region

Geocres Number: 30M14-550

**Type of Document:**

Foundation Investigation Report

**Project Number:**

ADM-22000797-A0

## Issue and Revised Record

Rev.	Date	Format	Prepared by	Reviewed by	Approved by	Description
Rev. 0	September 19, 2024	pdf	E. Lu, D. Mroz S. Anandakumar	T. Lardner T.C. Kim	S. Gonsalves	Report
Rev. 1	December 20, 2024	pdf	T Lardner	T.C. Kim	S. Gonsalves	FINAL

*Foundation Investigation Report*  
*Highway 401 Eastbound from Victoria Park Avenue to Neilson Road*  
*Full Structure Replacement and Bridge Widening at CP Rail Overhead (Site 37X-0213/B1 & B3)*  
*Assignment No. 2021-E-0018*  
*Date: December 20, 2024*

## Table of Contents

<b>Part I: Foundation Investigation Report .....</b>	<b>1</b>
<b>1.0 Introduction .....</b>	<b>2</b>
<b>2.0 Structure Description .....</b>	<b>2</b>
<b>3.0 Site Description and Geological Setting .....</b>	<b>3</b>
3.1 Site Description .....	3
3.2 Geological Setting .....	3
<b>4.0 Previous Geotechnical Investigation.....</b>	<b>3</b>
<b>5.0 Field Investigation and Laboratory Analyses .....</b>	<b>4</b>
5.1 Site Investigation and Field Testing .....	4
5.2 Laboratory Testing .....	5
<b>6.0 Subsurface Conditions .....</b>	<b>5</b>
6.1 Subsoils .....	6
6.1.1 Pavement Structure .....	6
6.1.2 Cohesionless Soil (Fill) .....	6
6.1.3 Clayey Silt (Fill) .....	7
6.1.4 Native Cohesive Till .....	8
6.1.5 Native Cohesionless Till.....	9
6.2 Groundwater Conditions.....	10
6.3 Chemical Analyses.....	11
<b>7.0 Closure .....</b>	<b>12</b>

## References

Appendix A – Limitations and Use of Report  
 Appendix B – General Arrangement Drawings  
 Appendix C – Borehole Location Plan and Stratigraphic Profile  
 Appendix D – Borehole Logs  
 Appendix E – Laboratory Data  
 Appendix F – Previous Investigation - BH Logs

*Foundation Investigation Report  
Highway 401 Eastbound from Victoria Park Avenue to Neilson Road  
Full Structure Replacement and Bridge Widening at CP Rail Overhead (Site 37X-0213/B1 & B3)  
Assignment No. 2021-E-0018  
Date: December 20, 2024*

## Part I: Foundation Investigation Report

Highway 401 Eastbound Express and Collector Lanes between Victoria Park Avenue and Neilson Road – CP Rail Overhead Structure (Site 37X-0213/B1 & B3)

## 1.0 Introduction

EXP Services Inc. (EXP) was retained by AECOM on behalf of The Ministry of Transportation (MTO) to provide detailed foundation investigation and engineering services for the proposed Highway 401 Eastbound rehabilitation and construction project. The findings, analyses and recommendations are presented in a Foundation Investigation and Design Report created for each structure along the proposed highway. The work was undertaken under Assignment No. 2021-E-0018. The terms of reference (TOR) and the scope of work for the foundation investigation are outlined in Ministry of Transportation Ontario's (MTO) Request for proposal, dated June 2021. The scope of this report is specifically limited to the proposed location of the CP Rail overhead structure (Site 37X-0213/B1 & B3) and retaining wall (37X-1768/W and 37X-1769/W). Additionally proposed widening of Highway 401 (Eastbound collector) east of the CP Rail overhead structure towards Kennedy Road, will be discussed in a separate report.

The General Arrangement drawings (GA) for the bridge structure were provided to EXP by AECOM. The purpose of the investigation was to evaluate the subsurface conditions along the structure alignment to permit a detailed design for the proposed full structure and retaining wall replacement.

The site-specific geotechnical investigation consisted of borings, soil sampling, borehole logging, and field and laboratory testing. The field and laboratory work for this structure was performed by EXP. Based on collected geotechnical data, this report provides an assessment of the geotechnical issues, geotechnical design parameters, and geotechnical foundation design recommendations for the proposed structure. Geotechnical-related construction recommendations are also provided.

This foundation investigation report has been prepared specifically and solely for the project described herein. It contains the factual results of the investigation, and the laboratory testing completed for this project.

## 2.0 Structure Description

The GA drawing titled *Hwy 401 EB Core & Collector Lane CPR Overhead Bridge Rehab.*, prepared by AECOM, dated October 2024, shows the preliminarily proposed configuration of the CP Rail overhead structure. Foundation and Investigation Design Reports (FIDR) by Golder Associates Ltd., *"Bridge Widening and Replacement Highway 401 Rehabilitation from Warden Avenue to Brock Road, Toronto, Ontario, W.O.07-20012."*, dated March 2012 and *"CP Rail Overhead Replacement (Site No. 37-213), Highway 401 Westbound Core and Collector Lanes, Neilson Road to Warden Avenue, City of Toronto, Ontario, G.W.P No. 2162-11-00."*, dated January 17, 2019. A summary of the proposed structure is as follows:

- The existing overhead structure is about 27 m long (on skew) single-span concrete structure. It is understood that the existing abutments are supported on approximately 3.0 m wide spread footings founded at approximately Elev. 173.0 m at the east abutment and 173.3 m at the west abutment. Based on the available drawings and FIDRs, the existing Highway 401 pavement grade is at approximately Elev. 184.2 m to 184.8 m at the structure location, and the CP rail track grade is at approximately Elev. 174.8 m.
- The existing structure will undergo full structure replacement. This includes replacing the superstructure (existing bridge deck and girders) and foundations (semi-integral abutments). The structure will also be widened by approximately 10 m on the south side of the EB Collector. The existing retaining walls (37X-1768/W and 37X-1769/W) will be replaced with a new RSS wall along the south side of the widened collector structure. Additional widening along the south side of the EB Collector, east of the structure towards Kennedy Road, will be discussed in a separate report.

The previous FIDRs and GA drawing by AECOM, in addition to contract package drawings titled *401 WB Core & Collector Lanes – CPR Overhead Replacement CP Mile 200.26 Belleville Subdivision (Cont. No. 2019-2011, WP No. 2394/2393-15-01)*, produced by WSP Global Inc., dated February 2019, were reviewed as part of this report. These background documents were used for initial context to address the nature and scope of the investigation. It is understood that some changes might occur as a result of normal refinement or the findings of the geotechnical report.

## 3.0 Site Description and Geological Setting

### 3.1 Site Description

The site is located at the intersection of Highway 401 and CP Rail Overhead, approximately 5 km east of Highway 404 in the City of Toronto, Ontario. The site is adjacent to industrial zones to the south and northeast and residential zones to the northwest.

In general, the terrain in this area is relatively flat, with the natural ground surface in the immediate vicinity of the structure at about Elev. 175 m. The CP Rail tracks have been constructed near the original ground surface, with the rail grade below Highway 401 at approximately Elev. 174.8 m. The CP tracks are oriented in a northeast to southwest direction. The existing Highway 401 grade is at approximate Elev. 184.0 m to 184.8 m. The existing embankment slope is about 2H:1V.

A site location plan is presented as Drawing 1 in Appendix C.

### 3.2 Geological Setting

Based on a review of geological maps of Southern Ontario (Chapman and Putnam, 1984; 2007), the site is situated within the South Slope physiographic region where the predominant landforms are Till Plains (Drumlinized) and Drumlins. The South Slope represents the southern slope of the Oak Ridges Moraine but also includes a strip south of the Peel Plain, extending from the Niagara Escarpment to the Trent River. The South Slope gradually, fairly and uniformly slopes down towards Lake Ontario.

A surficial till sheet, which generally follows the surface topography, is generally present in this area. This till, known as Halton till, and these represent relatively recent deposits, concentrated near West and East Don River valleys formed by small glacial melt water ponds scattered throughout the Peel Plain. The recent sand, silt and clay and till deposits in this area overlie and are interbedded with stratified deposits of sand, silt and clay.

## 4.0 Previous Geotechnical Investigation

During the tender design for the project, three previous reports were issued which contain relevant information to the proposed CN Rail overhead structure (Site 37X-0215/B1 & B3), as follows:

1. Foundation Investigation Report for The Proposed Extension of Highway. #401 and C.P.R Overhead, Metropolitan Toronto, District #6, W.J. 66-F-89, W.P. 257-61, Geocres No. 30M14-075, The Ministry of Transportation Ontario (MTO), Foundation Section, Materials and Testing Div., dated January 17, 1967.
2. Preliminary Foundation Investigation and Design Report, Bridge Widening and Replacement, Highway 401 Rehabilitation from Warden Avenue to Brock Road, Toronto, Ontario, W.O. 07-20012, Report Number: 09-1111-6055-1, Geocres No. 30M14-338, Golder Associates Ltd., dated April 2012.
3. Geocres No. 30M14-493 "CP Rail Overhead Replacement (Site No. 37-213), Highway 401 Westbound Core and Collector Lanes, Neilson Road to Warden Avenue, City of Toronto, Ontario, G.W.P No. 2162-11-00." by Golder Associates Ltd., dated January 17, 2019.

The applicable previous MTO borehole logs are attached as Appendix J in this report. The details of the applicable boreholes completed by MTO are also outlined in Table 1.1.

**Table 1.1: Summary of Applicable Boreholes Completed by MTO (Geocres. No. 30M14-068)**

Borehole No.	Borehole Location	Location (MTM NAD83 Zone 10)		Latitude	Longitude	Borehole Elevation (m)	Borehole Depth (m)
		Northing	Easting				
75-10	East CP Rail	4848108.3	321539.3	43.772746	-79.292068	178.8	18.7
75-11	West CP Rail	4848102.0	321503.2	43.772690	-79.292516	177.7	15.7

## 5.0 Field Investigation and Laboratory Analyses

### 5.1 Site Investigation and Field Testing

A site-specific investigation was undertaken by EXP between October 3, 2022, to October 19, 2022, and it included the following:

1. A walkover site assessment was carried out by a Geotechnical Engineer from EXP;
2. Subsequent to the borehole layouts in the field, existing utilities were cleared by public utility companies;
3. Six (6) boreholes were completed for this structure (BH22-2-01, BH22-2-02, BH22-2-03, BH22-2-04, BH22-2-13, and BH22-2-14) as part of the additional investigation. A summary of boreholes completed by EXP is listed in Table 1.2 below. The boreholes were drilled using a truck-mounted CME-75 (owned and operated by Drilltech Drilling Ltd.) equipped with solid and hollow stem augers, mud rotary equipment, and fitted with capability for Standard Penetration Testing (SPT);
4. Soil samples in the boreholes were taken at frequent intervals of depth by the Standard Penetration Test method (SPT), in general accordance with ASTM D1586. The test consists of freely dropping a 63.5 kg hammer a vertical distance of 0.76 m to drive a 51 mm O.D. split barrel (SS-split-spoon) sampler into the ground. The number of blows of the hammer required to drive the sampler into the relatively undisturbed ground by a vertical distance of 0.30 m is recorded as the Standard Penetration Resistance, or the N-value, of the soil which is indicative of the compactness of granular (or cohesionless) soils (gravels, sands and silts) or the consistency of cohesive soils (clays and clayey soils);
5. The fieldwork was supervised by a member of EXP's engineering staff who directed the drilling and sampling operation, logged borehole data in accordance with MTO and/or ASTM Standards for Soils Classification, and retrieved soil samples for subsequent laboratory testing and identification;
6. All spoon samples obtained in the Standard Penetration Tests (SPT, ASTM D-1586) were placed in moisture proof bags after field classification. Samples were allocated from the spoon samples for moisture content testing without delay. They were subsequently re-examined under controlled laboratory conditions prior to assigning other laboratory tests;
7. Selected soil samples for corrosivity testing were sent to the Bureau Veritas Laboratories (formerly Maxxam Analytics), a CALA-certified and accredited laboratory in Mississauga, Ontario. The selected soil samples for the analytical testing were placed in a laboratory prepared glass jar, labelled, and stored in a secure cooler.
8. The borehole locations and their ground surface elevations were surveyed by EXP using a Trimble DA2 GNSS receiver with Trimble Catalyst GNSS positioning, having an accuracy of  $\pm 0.10$  m horizontal and vertical directions. MTM NAD83 Zone 10 coordinates and the geodetic elevation for the boreholes are listed in Table 1.2 below. It can also be found on the Record of Borehole Sheet (Appendix D); and
9. Upon completion of drilling and field testing, the boreholes were backfilled with a mixture of bentonite and auger cuttings. The borehole decommissioning was in general accordance with the Ministry of the Environment Regulation 903, as amended by Regulation 128/03 (the well regulation under the Ontario Water Resources Act).

**Table 1.2: Summary of boreholes completed by EXP**

Borehole No.	Borehole Location	Location (MTM NAD83 Zone 10)		Latitude	Longitude	Borehole Elevation (m)	Borehole Depth (m)
		Northing	Easting				
BH22-2-01	West Abut. (EBL Collector)	4848104.0	321489.0	43.772708	-79.292693	185.9	14.3
BH22-2-02	East Abut. (EBL Collector)	4848125.1	321556.0	43.772896	-79.291860	185.1	15.8
BH22-2-03	West Abut. (EBL Express)	4848146.0	321514.9	43.773086	-79.292369	185.6	21.9
BH22-2-04	East Abutment (EBL Express)	4848164.9	321573.1	43.773255	-79.291647	184.6	17.4
BH22-2-13	West Abutment (EBL Express)	4848139.0	321496.0	43.773023	-79.292605	185.8	15.9
BH22-2-14	East Abutment (EBL Express)	4848171.1	321592.9	43.773309	-79.291399	184.2	15.7

## 5.2 Laboratory Testing

Selected samples were submitted for natural moisture content testing. In addition, Atterberg Limit and Grain size analysis (sieve and hydrometer) tests were performed on selected soil samples (performed by EXP). A minimum of 25% of the samples were tested for soil classification as per the MTO guidelines. In addition, chemical analyses were carried out on two soil samples selected by EXP. The samples were tested at the Bureau Veritas Laboratories (formerly Maxxam Analytics), a CALA-certified and accredited laboratory in Mississauga, Ontario. The laboratory testing program is listed in Table 1.3.

**Table 1.3: List of Laboratory Test Completed by EXP**

Borehole No.	Moisture Content	Atterberg Limits	Sieve	Hydrometer	Unit Weight	Corrosivity
BH22-2-01	13	1	3	2	1	1
BH22-2-02	15	1	4	3	2	---
BH22-2-03	18	---	5	3	3	---
BH22-2-04	17	3	4	3	2	1
BH22-2-13	13	---	3	2	2	---
BH22-2-14	15	---	3	3	2	---

The laboratory test results are provided on the attached borehole log sheets in Appendix D as well as graphically in Appendix E.

## 6.0 Subsurface Conditions

The detailed subsurface conditions encountered in the boreholes advanced during this investigation are presented on the borehole log sheets in Appendix D. The "Explanation of Terms Used in Report," preceding the borehole logs in Appendix D, forms an integral part of and should be read in conjunction with this report.

A borehole location plan and stratigraphic sections are provided in Appendix C. It should be noted that the stratigraphic boundaries indicated on the borehole log and stratigraphic sections are inferred from semi-continuous sampling, observations



of drilling progress, and results of Standard Penetration Tests. These boundaries typically represent transitions from one soil type to another and should not be interpreted as exact planes of geological change. Furthermore, subsurface conditions may vary between and beyond the borehole locations.

The general stratigraphy encountered within the investigated depths of EXP's geotechnical investigation indicates the following sub-surface sequence: a pavement structure composed of asphalt and concrete overlaying embankment fill consisting of layers of cohesionless and cohesive material underlain by native cohesionless till with a layer of clayey silt till in borehole BH22-2-04.

A detailed description of the stratigraphy encountered is discussed further in subsequent sections. It should be noted that the following sections are based on the geotechnical investigation conducted by EXP and MTO.

## 6.1 Subsoils

### 6.1.1 Pavement Structure

A pavement structure consisting of asphalt and concrete was encountered at the surface in all boreholes drilled by EXP. The thickness of the pavement structure ranged between 250 mm and 450 mm.

### 6.1.2 Cohesionless Soil (Fill)

Layers of cohesionless fill consisting of various compositions (sand and gravel, gravelly sand, sand, sand and silt, silty sand) were encountered in all boreholes drilled by EXP. The approximate elevations of the surface and base of each fill layer, thickness, description, and SPT "N" value encountered in the boreholes are summarized in Table 1.4 below:

**Table 1.4: Summary of Cohesionless Fill Layers**

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Layer Description	SPT “N” Value Range
	Top	Bottom				
EXP (2022)						
BH22-2-01	185.5	179.8	0.4	5.7	Gravelly Sand	33 – 49
BH22-2-02	184.7	182.7	0.4	2.0	Sand	20 – 29
BH22-3-03	185.2	176.5	0.4	8.7	Sand	7 – 24
BH22-2-04	184.3	179.8	0.3	4.5	Sand	7 – 35
BH22-2-13	185.5	177.9	0.3	7.6	Silty Sand	4 – 48
	176.7	175.1	9.1	1.6	Silty Sand	9
BH22-2-14	183.9	183.4	0.3	0.5	Sand and Gravel	N/A <sup>1</sup>
	183.4	177.8	0.8	5.6	Sand and Silt	7 – 43
	176.3	174.7	7.9	1.6	Silty Sand	22 – 28

Note:

1.0 No SPT sampling within layer, only auger sample retrieved.

The cohesionless fill consists predominantly of sand with varying amounts of gravel and silt, trace to some clay, trace clayey silt inclusions, trace organics/rootlets, and occasional cobbles. The soil is damp to moist in moisture condition and brown to greyish

brown to grey in color. The SPT "N" values within this layer ranged from 4 to 49 blows per 300 mm penetration, corresponding to loose to dense in terms of compactness condition.

Laboratory testing performed on selected samples consisted of moisture content, unit weight, and grain size distribution tests. The test results of the cohesionless fill are as follows:

Moisture Content (EXP):

- 2% to 22%

Grain Size Distribution (EXP):

- 2% to 28% gravel
- 41% to 85% sand
- 46% silt
- 11% clay
- 5% to 36% silt and clay

Unit Weight: (EXP)

- 21.0 kN/m<sup>3</sup> to 23.2 kN/m<sup>3</sup>

The results of the moisture content, unit weight, and grain size distribution tests performed by EXP are provided on the record of borehole sheets in Appendix D. The results of the grain size distribution tests performed by EXP are also provided in Figure 1 in Appendix E.

### 6.1.3 Clayey Silt (Fill)

Cohesive fill was encountered in boreholes BH22-2-01, BH22-2-02, BH22-2-04, BH22-2-13, and BH22-2-14. The approximate elevations of the surface and base of each fill layer, thickness, description, and SPT "N" value encountered in the boreholes are summarized in Table 1.5 below:

**Table 1.5: Summary of Clayey Silt Fill Layers**

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Layer Description	SPT “N” Value Range
	Top	Bottom				
EXP (2022)						
BH22-2-01	179.8	176.8	6.1	3.0	Clayey Silt	12 – 27
BH22-2-02	182.7	177.5	2.4	5.2	Clayey Silt	5 – 11
BH22-2-04	179.8	175.5	4.8	4.3	Clayey Silt	6 – 19
BH22-2-13	177.9	176.7	7.9	1.2	Clayey Silt	31
BH22-2-14	177.8	176.3	6.4	1.5	Clayey Silt	23

The fill consisted predominantly of clay and silt and is considered sandy with trace to some gravel and trace organics. The soil within these layers is moist in terms of moisture condition and its color typically ranges from brown to grey. The SPT "N" values measured within those layers ranged from 5 to 31 blows per 300 mm of penetration, corresponding to firm to hard in terms of consistency.

Laboratory testing performed on selected samples consisted of moisture content, grain size distribution, and Atterberg limits tests. The test results of clayey silt fill are as follow:

**Moisture Content (EXP):**

- 8% to 20%

**Grain Size Distribution: (EXP)**

- 0% to 6% gravel
- 41% to 47% sand
- 36% to 40% silt
- 11% to 19% clay

**Atterberg Limits: (EXP)**

- Liquid Limit: 16% to 23%
- Plastic Limit: 11% to 13%
- Plasticity Index: 5% to 11%

The results of the moisture content, grain size distribution, and Atterberg limit tests performed by EXP are provided on the record of borehole sheets in Appendix D. The results of the grain size distribution and Atterberg limit tests performed by EXP are also provided on Figure 2 and 6 in Appendix E.

#### 6.1.4 Native Cohesive Till

A native cohesive till layer was encountered in borehole BH22-2-04. The approximate elevations of the surface and base of each layer, thickness, description and SPT (N Value) encountered in the boreholes are summarized in Table 1.6 below:

**Table 1.6: Summary of Native Cohesive Soil Layer**

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Layer Description	SPT “N” Value Range
	Top	Bottom				
EXP (2022)						
BH22-2-04	172.4	170.9	12.2	1.5	Clayey Silt (Till)	67

The native cohesive layer consisted predominantly of clay and silt with some sand and trace to some gravel. The soil is moist in terms of moisture condition and brown to grey in colour. A SPT "N" value obtained within this layer was 67 blows per 300 mm of penetration corresponding to hard in terms of consistency. Atterberg limits tests suggest that this layer was low plastic.

Laboratory testing performed on selected samples consisted of moisture content, grain size distribution, and Atterberg Limit tests. The test results of clayey silt soils are as follow:

**Moisture Content (EXP):**

- 8% to 15%

#### Grain Size Distribution: (EXP)

- 3% gravel;
- 17% sand;
- 40% silt;
- 40% clay

#### Atterberg Limits: (EXP)

- Liquid Limit: 29%
- Plastic Limit: 14%
- Plasticity Index: 15%

The results of the moisture content, grain size distribution and Atterberg limit tests performed by EXP are provided on the record of borehole sheets in Appendix D. The results of the grain size distribution and Atterberg limit tests performed by EXP are also provided on Figures 3 and 7 in Appendix E.

#### 6.1.5 Native Cohesionless Till

Native cohesionless till consisting of sand and silt was encountered below the embankment fill in all boreholes. The approximate elevations of the surface and base of each layer, thickness, description, and SPT “N” value encountered in the boreholes are summarized in Table 1.7 below:

**Table 1.7: Summary of Native Cohesionless Till Layers**

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Layer Description	SPT “N” Value Range
	Top	Bottom				
EXP (2022)						
BH22-2-01	176.8	171.6	9.1	5.2 <sup>1</sup>	Sand and Silt (Till)	9 – 143
BH22-2-02	177.5	169.3	7.6	8.2 <sup>1</sup>	Sand and Silt (Till)	48 – 100
BH22-3-03	176.5	163.7	9.1	12.8 <sup>1</sup>	Sand and Silt (Till)	17 – 139
BH22-2-04	175.5	172.4	9.1	3.1 <sup>1</sup>	Sand and Silt (Till)	39 – 64
	170.9	167.2	13.7	3.7 <sup>1</sup>	Sand and Silt (Till)	62 – 100/250 mm
BH22-2-13	175.1	170.0	10.7	5.1 <sup>1</sup>	Sand and Silt (Till)	62 – 100
BH22-2-14	174.7	168.5	9.5	6.2 <sup>1</sup>	Sand and Silt (Till)	28 – 168
MTO (1967)						
78-10	178.8	160.1	0.0	18.7 <sup>1</sup>	<u>Sand and Silt (Till)</u>	32 – 100/127 mm
78-11	177.7	162.0	0.0	15.7 <sup>1</sup>	<u>Sand and Silt (Till)</u>	28 – 126

Note:

1. End of borehole terminated within this layer.

The native cohesionless layers consist predominantly of silt and sand with trace to some gravel, trace to some clay, and occasional thin sand lenses. The soil is damp to moist in terms of moisture condition and generally brown to grey in terms of color. The SPT “N” values within this layer ranged from 9 to 168 blows per 300 mm penetration, corresponding to loose to very dense but generally dense to very dense in terms of compactness condition. Atterberg limits tests suggest that this layer was non-plastic to low plastic.

Laboratory testing performed on selected samples consisted of moisture content, grain size distribution, Atterberg limit, and unit weight tests. The test results of the native cohesionless soil are as follow:

Moisture Content (EXP and MTO):

- 2% to 21%

Grain Size Distribution: (EXP and MTO)

- 0% to 6% gravel;
- 44% to 91% sand;
- 36% to 45% silt;
- 7% to 13% clay;

Atterberg Limits: (EXP and MTO)

- Liquid Limit: 15% to 16%
- Plastic Limit: 13%
- Plasticity Index: 2% to 3%

One test result indicated non-plastic material.

Unit Weight: (EXP)

- 20.8 kN/m<sup>3</sup> to 24.1 kN/m<sup>3</sup>

The results of the moisture content, grain size distribution, and Atterberg limit tests performed by EXP are provided on the record of borehole sheets in Appendix D. The results of the grain size distribution tests performed by EXP are also provided on Figures 4 and 5 in Appendix E. The results of tests performed by MTO are shown on the borehole logs attached in Appendix J.

## 6.2 Groundwater Conditions

Groundwater levels were observed upon completion of some of the boreholes. Groundwater levels measured on completion of boreholes may not be considered stabilized and therefore may not represent the established long-term average groundwater table (phreatic surface).

A summary of the groundwater levels encountered during the investigations are summarized in Table 1.8 and are also presented on the Record of Borehole Sheets attached in Appendix D and Appendix J.

*Foundation Investigation Report*  
*Highway 401 Eastbound from Victoria Park Avenue to Neilson Road*  
*Full Structure Replacement and Bridge Widening at CP Rail Overhead (Site 37X-0213/B1 & B3)*  
*Assignment No. 2021-E-0018*  
*Date: December 20, 2024*

**Table 1.8: Summary of observed groundwater levels**

Borehole	Ground Surface Elevation (m)	Water level Depth/ Elevation (m)	Date
<b>EXP (2022)</b>			
<b>BH22-2-03</b>	185.6	17.3/168.3	October 18, 2022
<b>MTO (1967)</b>			
<b>75-10</b>	178.8	10.3/168.5	December 02, 1966
<b>75-11</b>	177.7	9.1/168.6	December 02, 1966

It should be noted that fluctuations in the level of the groundwater may occur due to seasonal variations (precipitation, snowmelt, rainfall), local soil permeability, construction remediation activities, and other related factors.

### 6.3 Chemical Analyses

Two soil samples were selected for chemical analysis during current investigation. The soils samples were tested at the Bureau Veritas Laboratories (formerly Maxxam Analytics) and AGAT Laboratories, respectively, a CALA-certified and accredited laboratory in Mississauga, Ontario.

The analytical results are summarized in Table 1.9 below and are presented in Appendix D.

**Table 1.9: Summary of chemical analysis results**

Borehole I.D.	Sample I.D.	Depth (m)	pH (Unitless)	Soluble Chloride (ppm)	Soluble Sulphate (ppm)	Resistivity (ohm-cm)	Conductivity (mS/cm)	Redox Potential (mV)
<b>BH22-2-01</b>	SS13	13.7 – 14.3	7.98	750 – 770	41	660	1.51 – 1.53	290
<b>BH22-2-04</b>	SS9	9.1 – 9.7	7.91	380	<20	1500	0.659	270

*Foundation Investigation Report  
Highway 401 Eastbound from Victoria Park Avenue to Neilson Road  
Full Structure Replacement and Bridge Widening at CP Rail Overhead (Site 37X-0213/B1 & B3)  
Assignment No. 2021-E-0018  
Date: December 20, 2024*

## 7.0 Closure

The recommendations made in this report are in accordance with our present understanding of the project and are provided solely for the team responsible for the design of the works described herein.

A subsurface investigation is a limited sampling of a site; the subsurface conditions have been established only at the test hole locations. Should conditions at the site be encountered which differ from those reported at the test locations, we require that we be notified immediately in order to assess this additional information and our recommendations, as appropriate. It may then be necessary to perform additional investigations and analyses.


Details of the limitations of this report are presented as Appendix A, "Limitations and Use of Report".

This Foundation Investigation Report has been prepared by Elvis Lu, M.Eng., EIT, Daniel Mroz, M.E.Sc., EIT and Sugitha Anandakumar, M.Eng., P.Eng., PMP. It was reviewed by Thomas Lardner, Ph.D., P.Eng. and TaeChul Kim, M.E.Sc., P.Eng. and Stan E. Gonsalves, M.Eng., P.Eng., Designated MTO Foundation Contact.


Yours truly,


EXP Services Inc.

Daniel Mroz, M.E.Sc., EIT  
Technical Specialist

  
Thomas Lardner, Ph.D., P.Eng.  
Senior Geotechnical Engineer



  
TaeChul Kim, M.E.Sc., P.Eng.  
Senior Foundation/ Geotechnical Specialist

  
Stan E. Gonsalves, M.Eng., P.Eng.  
Executive Vice-President  
Designated MTO Foundation Contact



Encl.

## References

- Barnett, P.J., Cowan, W.R., & Henry, A.P. 1991. *Quaternary geology of Ontario, southern sheet*; Ontario Geological Survey, Map 2556, scale 1:1 000 000.
- Canadian Geotechnical Society, 2006. *Canadian Foundation Engineering Manual*, 4th Edition. The Canadian Geotechnical Society, BiTech Publisher Ltd., British Columbia.
- Canadian Standards Association (CSA), 2019. *Canadian Highway Bridge Design Code and Commentary on CAN/CSA-S6-19*. CSA Special Publication.
- Chapman, L.J. and Putnam, D.F. 1984. *The physiography of Southern Ontario*. Ontario Geological Survey, Special volume 2, 3rd Edition. Ontario Ministry of Natural Resources.
- Chapman, L.J. and Putnam, D.F. 2007. *The Physiography of Southern Ontario*. Ontario Geological Survey, Miscellaneous Release-Data 228.
- Ministry of Transportation, April 2022. Guideline for MTO Foundation Engineering Services, Version 03.
- Molinas, A., and Mommandi, A., 2009. Development of New Corrosion/Abrasion Guidelines for Selection of Culvert Pipe Materials, Report No. CDOT-2009-11. Colorado Department of Transportation, DTD Applied Research and Innovation Branch.
- Ontario Geological Survey. 1991. *Bedrock geology of Ontario, southern sheet*; Ontario Geological Survey, Map 2544, scale 1:1 000 000.
- Preliminary Foundation Investigation and Design Report, Bridge Widening and Replacement, Highway 401 Rehabilitation from Warden Avenue to Brock Road, Toronto, Ontario, W.O. 07-20012, Report Number: 09-1111-6055-1, Geocres No. 30M14-338, Golders Associates Ltd., dated April 2012.
- US Army Corps of Engineers, Engineering and Design Manual for Retaining and Flood Walls, 29 September 1989.
- Asaoka, A., 1978. Observational Procedure of Settlement Prediction.



## Appendix A – Limitations and Use of Report



## **LIMITATIONS AND USE OF REPORT**

### **BASIS OF REPORT**

This report ("Report") is based on site conditions known or inferred by the geotechnical investigation undertaken as of the date of the Report. Should changes occur which potentially impact the geotechnical condition of the site, or if construction is implemented more than one year following the date of the Report, the recommendations of exp may require re-evaluation.

The Report is provided solely for the guidance of design engineers and on the assumption that the design will be in accordance with applicable codes and standards. Any changes in the design features which potentially impact the geotechnical analyses or issues concerning the geotechnical aspects of applicable codes and standards will necessitate a review of the design by exp. Additional field work and reporting may also be required.

Where applicable, recommended field services are the minimum necessary to ascertain that construction is being carried out in general conformity with building code guidelines, generally accepted practices and exp's recommendations. Any reduction in the level of services recommended will result in exp providing qualified opinions regarding the adequacy of the work. exp can assist design professionals or contractors retained by the Client to review applicable plans, drawings, and specifications as they relate to the Report or to conduct field reviews during construction.

Contractors contemplating work on the site are responsible for conducting an independent investigation and interpretation of the borehole results contained in the Report. The number of boreholes necessary to determine the localized underground conditions as they impact construction costs, techniques, sequencing, equipment and scheduling may be greater than those carried out for the purpose of the Report.

Classification and identification of soils, rocks, geological units, contaminant materials, building envelopment assessments, and engineering estimates are based on investigations performed in accordance with the standard of care set out below and require the exercise of judgment. As a result, even comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations or building envelope descriptions involve an inherent risk that some conditions will not be detected. All documents or records summarizing investigations are based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated. Some conditions are subject to change over time. The Report presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, these should be disclosed to exp to allow for additional or special investigations to be undertaken not otherwise within the scope of investigation conducted for the purpose of the Report.

### **RELIANCE ON INFORMATION PROVIDED**

The evaluation and conclusions contained in the Report are based on conditions in evidence at the time of site inspections and information provided to exp by the Client and others. The Report has been prepared for the specific site, development, building, design or building assessment objectives and purpose as communicated by the Client. exp has relied in good faith upon such representations, information and instructions and accepts no responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of any misstatements, omissions, misrepresentation or fraudulent acts of persons providing information. Unless specifically stated otherwise, the applicability and reliability of the findings, recommendations, suggestions or opinions expressed in the Report are only valid to the extent that there has been no material alteration to or variation from any of the information provided to exp.

### **STANDARD OF CARE**

The Report has been prepared in a manner consistent with the degree of care and skill exercised by engineering consultants currently practicing under similar circumstances and locale. No other warranty, expressed or implied, is made. Unless specifically stated otherwise, the Report does not contain environmental consulting advice.

### **COMPLETE REPORT**

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment form part of the Report. This material includes, but is not limited to, the terms of reference given to exp by its client ("Client"), communications between exp and the Client, other reports, proposals or documents prepared by exp for the Client in connection with the site described in the Report. In order to properly understand the suggestions, recommendations and opinions expressed in the Report, reference must be made to the Report in its entirety. exp is not responsible for use by any party of portions of the Report.



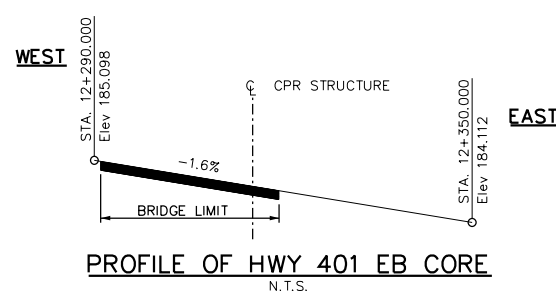
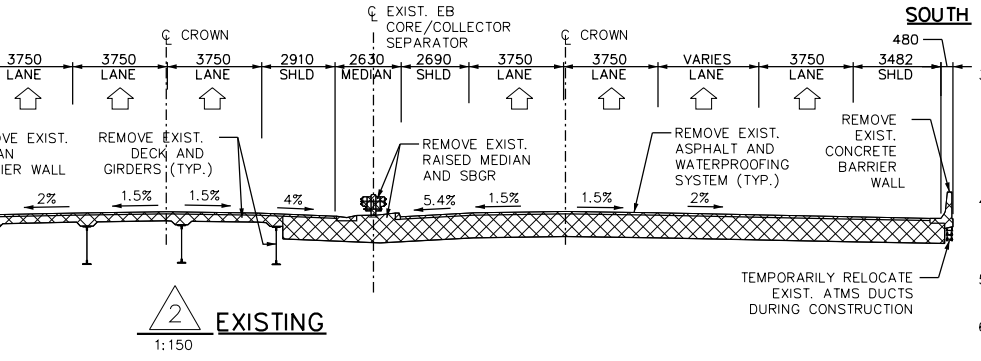
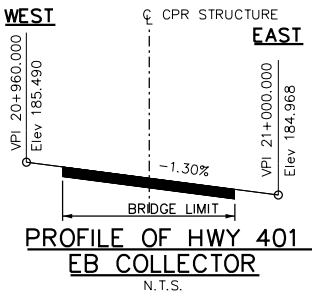
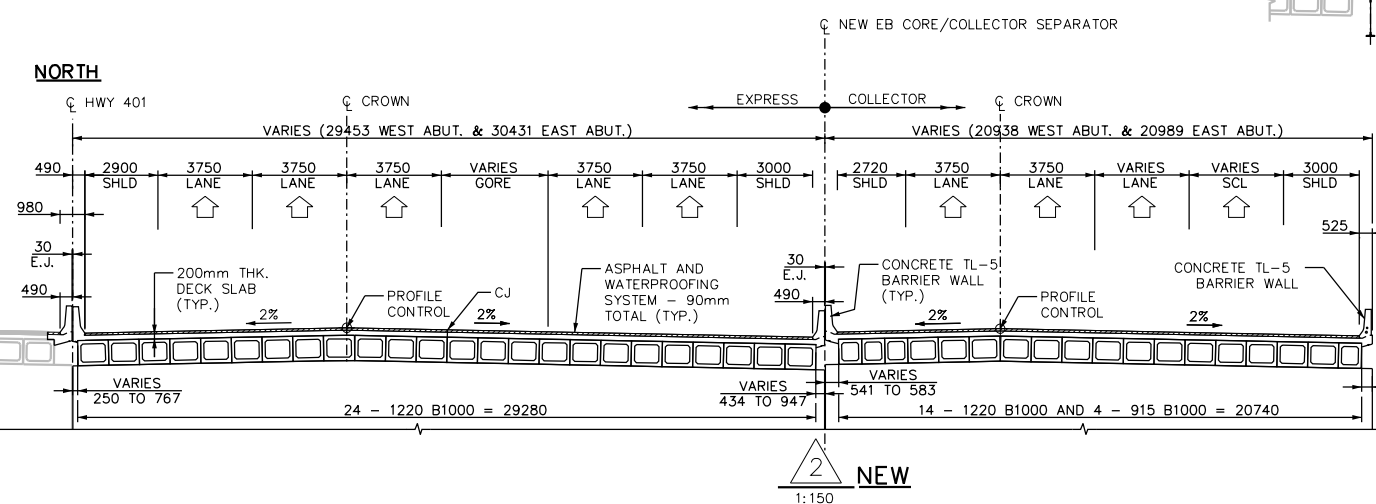
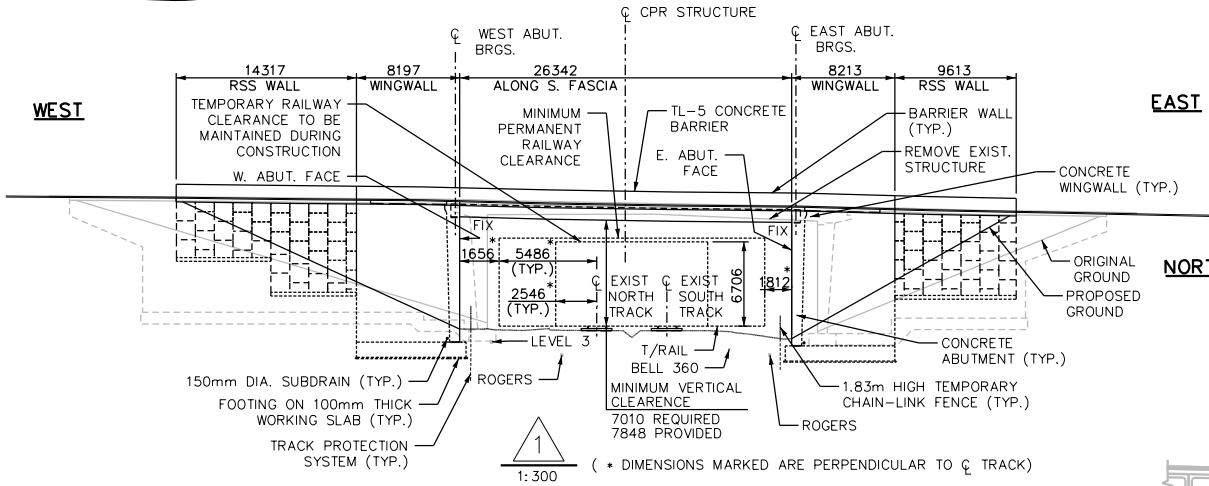
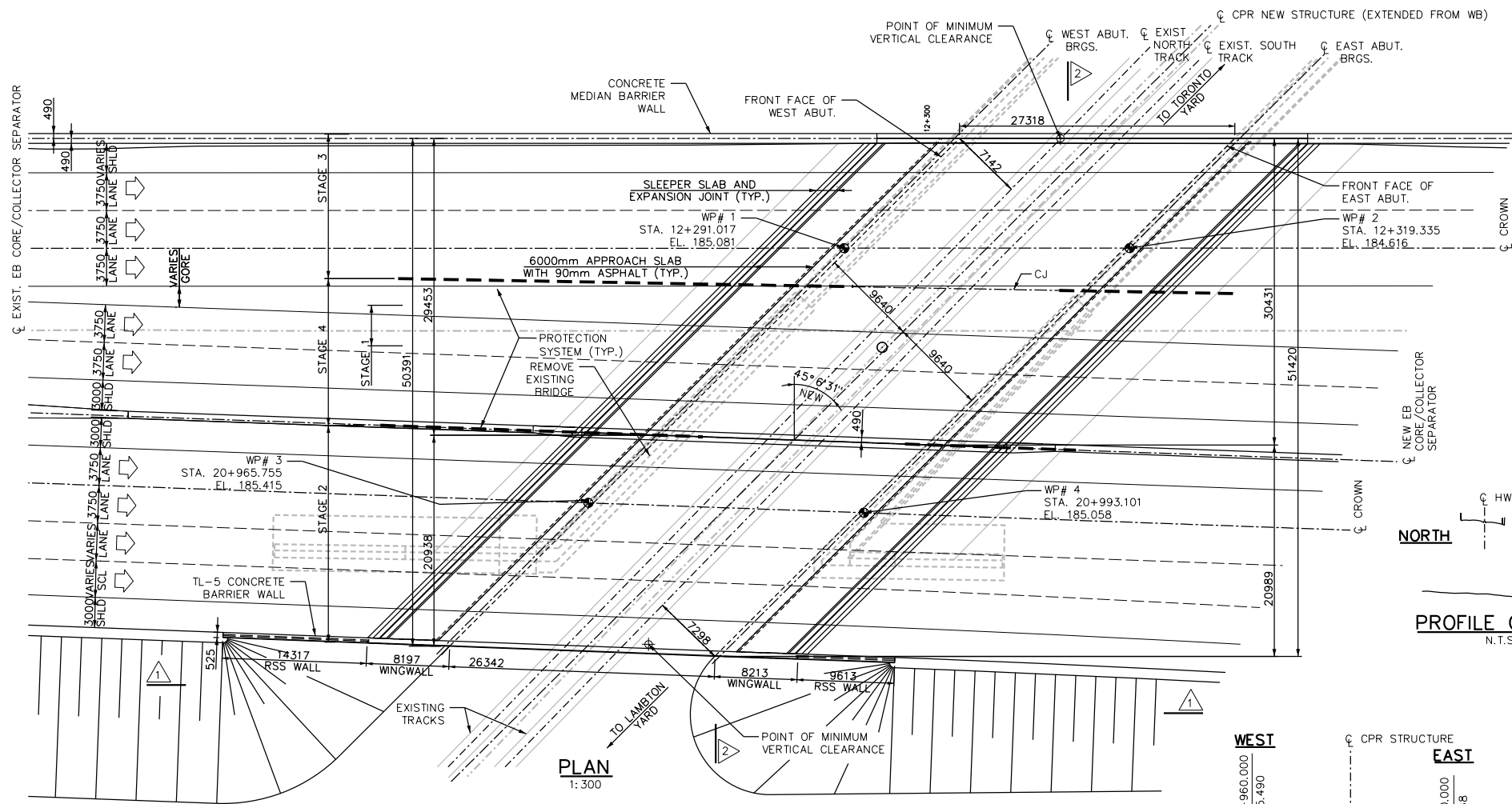
## **USE OF REPORT**

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. No other party may use or rely upon the Report in whole or in part without the written consent of exp. Any use of the Report, or any portion of the Report, by a third party are the sole responsibility of such third party. exp is not responsible for damages suffered by any third party resulting from unauthorised use of the Report.

## **REPORT FORMAT**

Where exp has submitted both electronic file and a hard copy of the Report, or any document forming part of the Report, only the signed and sealed hard copy shall be the original documents for record and working purposes. In the event of a dispute or discrepancy, the hard copy shall govern. Electronic files transmitted by exp have utilize specific software and hardware systems. exp makes no representation about the compatibility of these files with the Client's current or future software and hardware systems. Regardless of format, the documents described herein are exp's instruments of professional service and shall not be altered without the written consent of exp.

## Appendix B – General Arrangement Drawings



METRIC  
DIMENSIONS ARE IN METRES AND/OR  
MILLIMETRES UNLESS OTHERWISE SHOWN  
DRAWING NOT TO BE SCALED  
100mm ON ORIGINAL DRAWING

LIST OF ABBREVIATIONS:

ABUT. BRGS.	ABUTMENT BEARINGS
C.J.	CONSTRUCTION JOINT
DIA.	DIAMETER
EB	EASTBOUND
EBL	EASTBOUND LANE
E.J.	EXPANSION JOINT
EL.	ELEVATION
EQ. SP.	EQUALLY SPACED
EXIST.	EXISTING
EXP.	EXPANSION
REINF.	REINFORCING
SCL	SPEED CHANGE LANE
SHLD	SHOULDER
T/P	TOP OF PAVEMENT
TYP.	TYPICAL
WB	WESTBOUND
WBL	WESTBOUND LANE
WP	WORKING POINT

LIST OF DRAWINGS:

- R3-1. GENERAL ARRANGEMENT  
R3-2. BOREHOLE LOCATIONS  
R3-3. SOIL STRATA  
R3-4. CONSTRUCTION STAGING I  
R3-5. CONSTRUCTION STAGING II  
R3-6. FOOTING LAYOUT AND DETAILS  
R3-7. ABUTMENT LAYOUT  
R3-8. ABUTMENT REINFORCEMENT  
R3-9. WINGWALL REINFORCEMENT  
R3-10. RETAINING WALL LAYOUT  
R3-11. GIRDER LAYOUT  
R3-12. PRESTRESSED BOX GIRDERS AND BEARINGS I  
R3-13. PRESTRESSED BOX GIRDERS AND BEARINGS II  
R3-14. PRESTRESSED BOX GIRDERS AND BEARINGS III  
R3-15. DECK DETAILS AND REINFORCEMENT I  
R3-16. DECK DETAILS AND REINFORCEMENT II  
R3-17. SOUTH BARRIER WALL WITHOUT RAILING TL-5  
R3-18. MEDIAN BARRIER WALL WITHOUT RAILING TL-5  
R3-19. MEDIAN BARRIER WALL WITHOUT RAILING ON RSS WALL TL-5  
R3-20. 6000mm APPROACH SLAB I  
R3-21. 6000mm APPROACH SLAB II  
R3-22. EXPANSION JOINT AND SLEEPER SLAB  
R3-23. SEQUENCE OF EXPANSION JOINT INSTALLATION  
R3-24. SLEEPER SLAB STRIP SEAL EXPANSION JOINT FOR  
R3-25. TRACK PROTECTION  
R3-26. STANDARD AND MISCELLANEOUS REPAIR DETAILS

APPLICABLE STANDARD DRAWINGS:

- OPSD 0911.382 GUIDE RAIL SYSTEM, CONCRETE BARRIER DOWEL CONNECTION DETAIL  
OPSD 3370.100 DECK, WATERPROOFING HOT APPLIED ASPHALT MEMBRANE WITH PROTECTION BOARD  
OPSD 3370.101 DECK, WATERPROOFING HOT APPLIED ASPHALT MEMBRANE AT ACTIVE CRACKS GREATER THAN 2mm WIDE AND CONSTRUCTION JOINTS  
OPSD 3941.200 FIGURES IN CONCRETE, SITE NUMBER AND DATE LAYOUT

Ontario

Ministry of Transportation

CONT  
GWP

HWY 401 EB CORE & COLLECTOR  
CPR OVERHEAD BRIDGE REHAB

GENERAL ARRANGEMENT

AECOM

SHEET  
S26

GENERAL NOTES:

1. SPECIFIED 28-DAY COMPRESSIVE STRENGTH.....30 MPa  
UNLESS NOTED OTHERWISE.  
SPECIFIED 28-DAY COMPRESSIVE STRENGTH FOR PRECAST  
GIRDERS ARE GIVEN ON PRESTRESSED GIRDER DRAWINGS.
2. CLEAR COVER TO REINFORCING STEEL :
- FOOTING.....100 ± 25  
DECK-TOP.....70 ± 20  
DECK-BOTTOM.....40 ± 10  
REMAINDER.....70 ± 20  
UNLESS OTHERWISE NOTED
3. REINFORCING STEEL:
- REINFORCING STEEL SHALL BE GRADE 500W.
- UNLESS SHOWN OTHERWISE, TENSION LAP SPLICES FOR  
REINFORCING STEEL BARS SHALL BE CLASS 'B'.
- STAINLESS REINFORCING STEEL SHALL BE TYPE 316LN  
OR DUPLEX 2205 AND HAVE A MINIMUM YIELD STRENGTH  
OF 500MPa, UNLESS OTHERWISE SPECIFIED.
- BAR MARKS WITH PREFIX 'S' DENOTE STAINLESS STEEL BARS.
- GLASS FIBRE REINFORCED POLYMER REINFORCING BARS SHALL  
BE GRADE III. AND THE NOMINAL DIAMETER, TENSILE MODULUS  
OF ELASTICITY AND GUARANTEED MINIMUM TENSILE STRENGTH  
SHALL BE AS SPECIFIED IN CONTRACT DOCUMENTS.
- BAR MARKS WITH PREFIX 'G'DENOTE GRADE III GLASS FIBRE  
REINFORCED POLYMER BARS.
- BAR HOOKS SHALL HAVE STANDARD HOOK DIMENSIONS  
USING MINIMUM BEND DIAMETERS, WHILE STIRRUPS AND  
TIES SHALL HAVE MINIMUM HOOK DIMENSIONS. ALL HOOKS  
SHALL BE IN ACCORDANCE WITH THE STRUCTURAL STANDARD  
DRAWING SS12-1. UNLESS INDICATED OTHERWISE. HOOKS AND  
BENDS FOR GFRP BARS SHALL HAVE A MINIMUM BEND  
-RADIUS-TO-BAR-DIAMETER RATIO (r/d) OF 4.0.

CONSTRUCTION NOTES:

1. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, DETAILS AND  
ELEVATIONS OF THE EXISTING STRUCTURE THAT ARE RELEVANT  
TO THE WORK SHOWN ON THE DRAWINGS PRIOR  
TO THE COMMENCEMENT OF THE WORK. ANY DISCREPANCIES  
SHALL BE REPORTED TO THE CONTRACT ADMINISTRATOR AND  
THE PROPOSED ADJUSTMENT OF THE WORK TO MATCH THE  
EXISTING STRUCTURE SHALL BE SUBMITTED FOR APPROVAL.
2. CONTRACTOR SHALL NOT REMOVE THE EXISTING  
SUPERSTRUCTURE UNTIL EXISTING APPROACH SLAB AND  
BACKFILL BEHIND ABUTMENT IS REMOVED. THE EXISTING  
BACKFILL SHALL BE REMOVED SIMULTANEOUSLY BEHIND BOTH  
ABUTMENTS. AT NO TIME SHALL THE DIFFERENCE IN ELEVATION  
BE GREATER THAN 300mm.
3. THE CONTRACTOR SHALL ADJUST THE BEARING SEAT  
ELEVATIONS AND REINFORCING STEEL TO SUIT THE ACTUAL  
HEIGHT OF THE BEARING SUPPLIED. THE CONTRACTOR IS  
RESPONSIBLE FOR PROVIDING FULL BEARING CONTACT TO DECK  
SOFFIT AND BEARING SEAT. ADDITIONAL COST DUE TO ANY  
CHANGES IN ELEVATIONS OF THE TOP OF BEARINGS BY THE  
CONTRACTOR SHALL BE AT THEIR OWN EXPENSE.
4. PROTECTION SYSTEMS SHALL BE DESIGNED TO PERFORMANCE  
LEVEL 2 CRITERIA. LIMITS OF PROTECTION SYSTEMS TO BE  
DETERMINED BY CONTRACTOR. PROTECTION SYSTEMS SHALL BE  
SUFFICIENT FOR ALL ACCESS AND WORKING PLATFORMS.
5. FOR TRAFFIC STAGING AND MAINTENANCE OF TRAFFIC, REFER  
TO CONSTRUCTION STAGING DRAWINGS.
6. THE CONTRACTOR WILL REQUIRE CP PROTECTION FOR ALL  
WORKS OCCURRING ON OR ABOUT THE RAILWAY RIGHT OF WAY.
7. TRACK SETTLEMENT MONITORING WILL BE REQUIRED FOR THE  
INSTALLATION OF THE TRACK PROTECTION SYSTEM AS  
APPROVED BY CP.

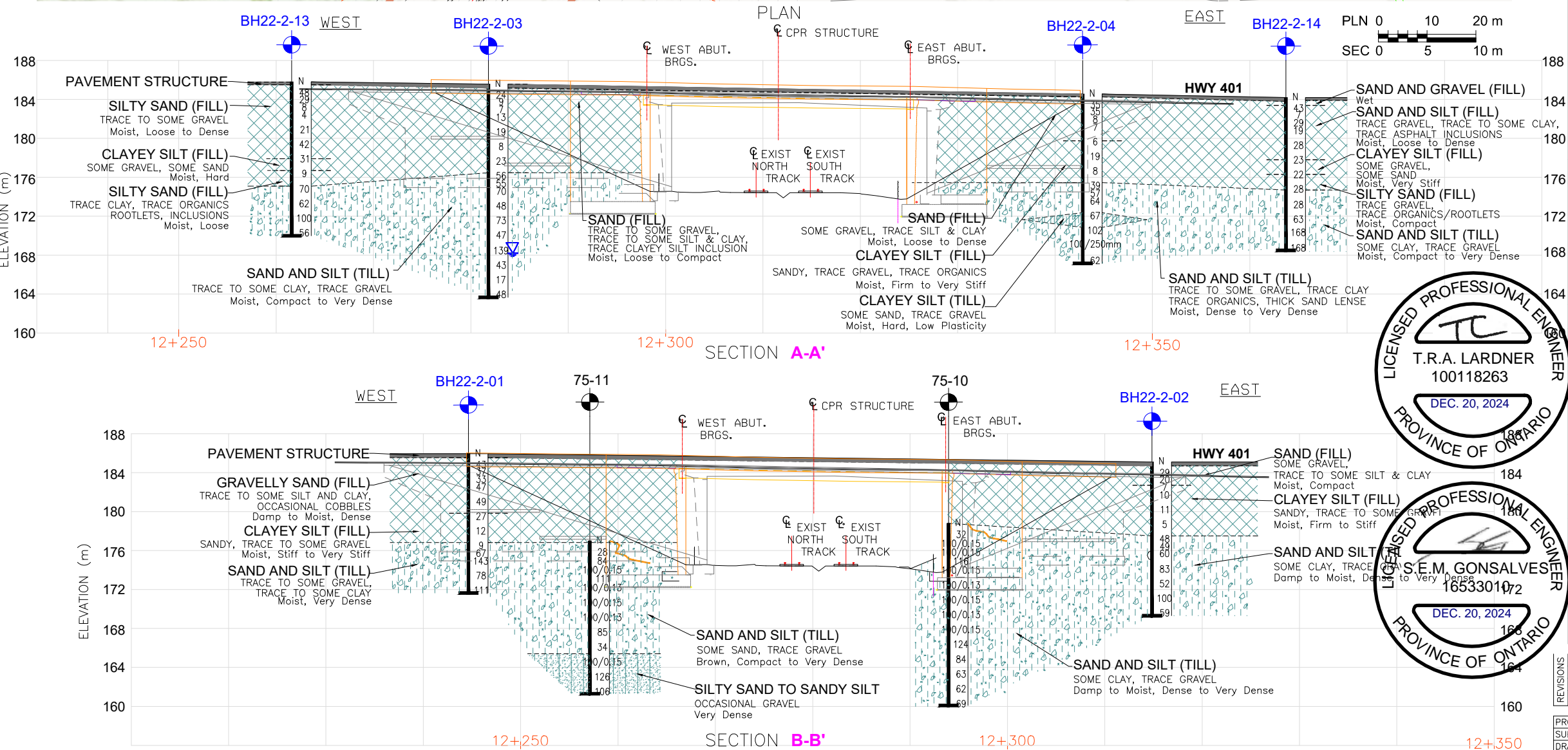
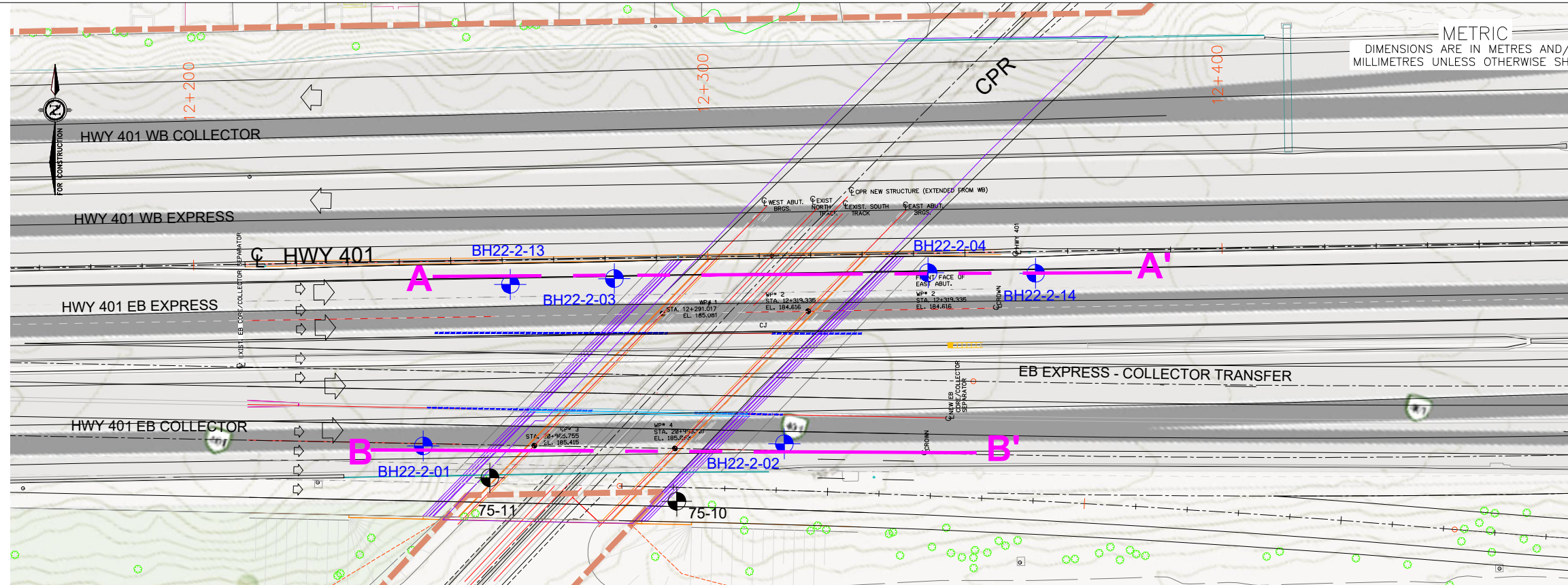
LEGEND:

	NEW CONCRETE
	REMOVAL
	NEW ASPHALT

REVISIONS	DATE	BY	DESCRIPTION
DESIGN S.D.	CHK P.O.	CODE CAN/CSA 56-19	LOAD CL 625-ONT
DRAWN R.S.	CHK S.D.	SITE 37x-0213/81&83	DWG R3-01

## Appendix C – Borehole Location Plan and Stratigraphic Profile



















CONT No.  
ASSIG No. 2021-E-0018  
GWP No.

HIGHWAY 401 EB CORE & COLLECTOR  
CPR OVERHEAD BRIDGE REHAB  
*Latitude: 43.772964°, Longitude: -79.292316°*

SHEET  
1

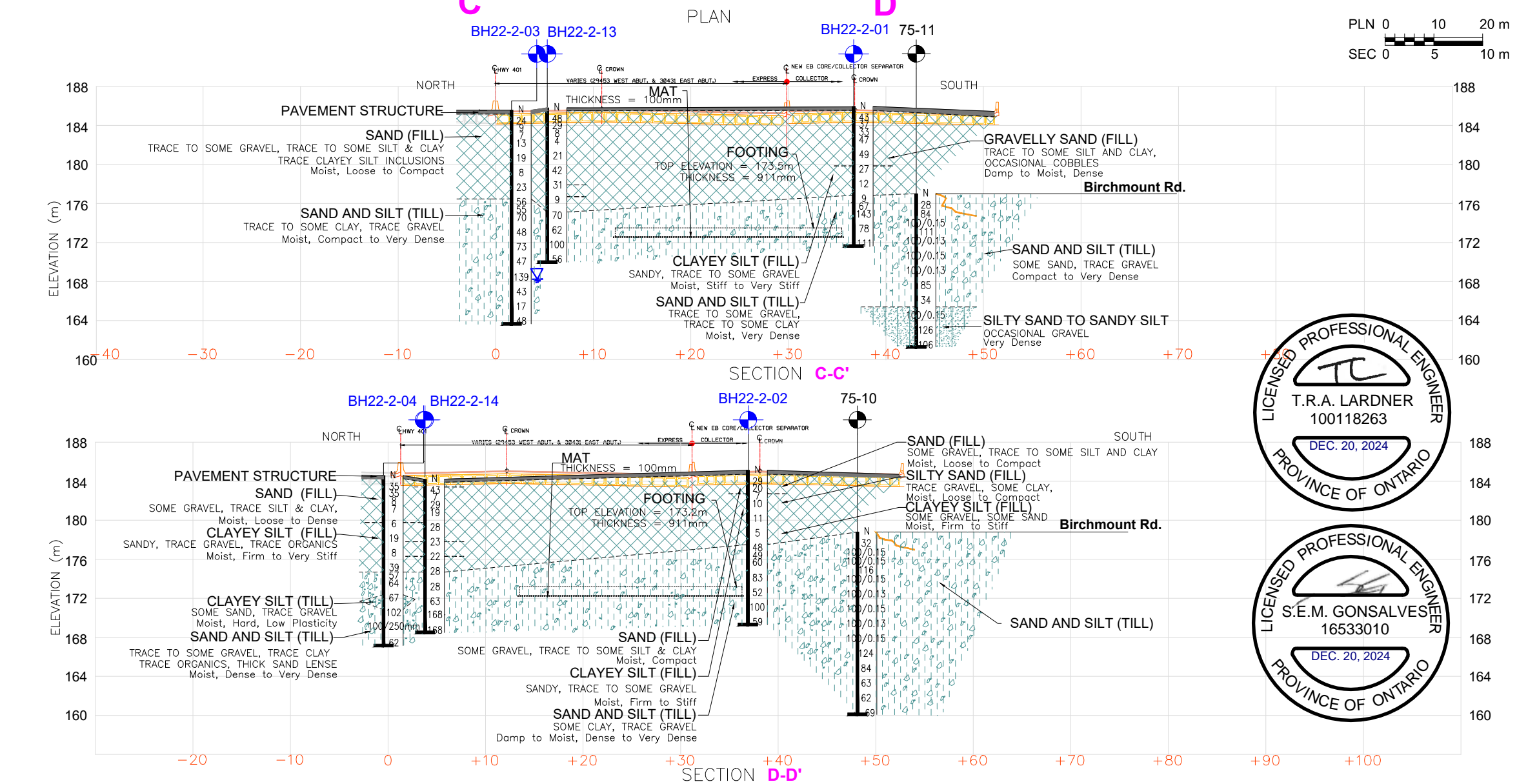
EXP SERVICES INC.



KEY PLAN N.T.S.					
LEGEND					
	Borehole Location				
	Water Level Upon Completion of Drilling ( W. L. NOT STABILIZED)				
N	Blows/0.3m (Std. Pen. Test, 475 J/blow)				
SOIL STRATA SYMBOLS					
	PAVEMENT STRUCTURE		SILT AND SAND		CLAY
	FILL		SANDY SILT		CLAYEY SILT
	SILT		SILTY SAND		SILTY CLAY
	SAND		SANDY SILT TO SILTY SAND (TILL)		CLAYEY SILT TO SILTY CLAY (TILL)
BOREHOLE CO-ORDINATES/ NAD 83/ MTM ON-10					
BH No.		ELEV.	NORTHING	EASTING	
BH22-2-01		185.9	4848104	321489	
BH22-2-02		185.1	4848125	321556	
BH22-2-03		185.6	4848146	321515	
BH22-2-04		184.6	4848165	321573	
BH22-2-13		185.8	4848139	321496	
BH22-2-14		184.2	4848171	321593	
75-10		178.8	4848108	321539	
75-11		177.7	4848102	321503	
NOTES					
This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.					
The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.					
The complete foundation investigation and design report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in the report and related documents are specifically excluded in accordance with the conditions of Section GC 2.01 of the OPS Gen. Cond.					
SUBMISSION FOR MTO REVIEW					
NO	DATE	BY	DESCRIPTION		
PROJECT No.	ADM-22000797-A0		GEOCREs No.	30M14-338	
EM'D SH	CHKD. SM	DATE	NOV. 13, 2024		SITE 37X-0213/B1 & B3
AWN SH	CHKD. TC	APPRD	SG	DWG	01

FILE NAME: I:\2003-Brampton\Proposals\International\Hwy 401 & Victoria Park Av. to Nelson\working drawings\Structure 2 - CPR Overpass.dwg  
MODIFIED: 2024-11-13 10:47





PROJECT No.	ADM-22000797-A0	GEOCRES No.	-
SUBM'D SH	CHKD. SM	DATE	NOV. 11, 2024 SITE 37X-0213/B1 & B3
DRAWN SH	CHKD. TC	APPRD SG	DWG 02



## Appendix D – Borehole Logs

# Explanation of Terms Used on Borehole Records

## SOIL DESCRIPTION

Terminology describing common soil genesis:

*Topsoil:* mixture of soil and humus capable of supporting good vegetative growth.

*Peat:* fibrous fragments of visible and invisible decayed organic matter.

*Fill:* where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc.; none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

*Till:* the term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Terminology describing soil structure:

*Desiccated:* having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.

*Stratified:* alternating layers of varying material or color with the layers greater than 6 mm thick.

*Laminated:* alternating layers of varying material or color with the layers less than 6 mm thick.

*Fissured:* material breaks along plane of fracture.

*Varved:* composed of regular alternating layers of silt and clay.

*Slickensided:* fracture planes appear polished or glossy, sometimes striated.

*Blocky:* cohesive soil that can be broken down into small angular lumps which resist further breakdown.

*Lensed:* inclusion of small pockets of different soil, such as small lenses of sand scattered through a mass of clay; not thickness.

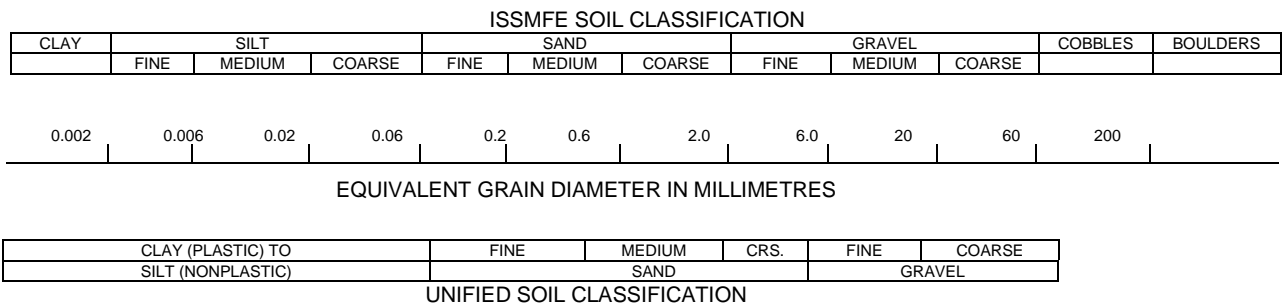
*Seam:* a thin, confined layer of soil having different particle size, texture, or color from materials above and below.

*Homogeneous:* same color and appearance throughout.

*Well Graded:* having wide range in grain sized and substantial amounts of all predominantly on grain size.

*Uniformly Graded:* predominantly on grain size.

All soil sample descriptions included in this report follow generally the ASTM D2487-11 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) with some modification to reflect current MTO practices. The system divides soils into three major categories: (1) coarse grained, (2) fine-grained, and (3) highly organic. The soil is then subdivided based on either gradation or plasticity characteristics. The system provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification. The classification excludes particles larger than 76 mm. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually in accordance with ASTM D2488-09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems. Others may use different classification systems; one such system is the ISSMFE Soil Classification.



Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter, construction debris) is based upon the proportion of these materials present and as described below in accordance with Canadian Foundation Engineering Manual (CFEM):

Table a: Percent or Proportion of Soil

Term	Description	Criteria
"trace"	trace gravel, trace sand, etc.	1% - 10%
"some"	some gravel, some sand, etc.	10% - 20%
Adjective	gravelly, sandy, silty and clayey	20% - 35%
"and"	and gravel, and sand, etc.	>35%
Noun	gravel, sand, silt, clay	>35% and main fraction

The standard terminology to describe cohesionless soils includes the compactness as determined by the Standard Penetration Test 'N' value:

Table b: Apparent Density of Cohesionless Soil

	'N' Value (blows/0.3 m)
Very Loose	N<5
Loose	5≤N<10
Compact	10≤N<30
Dense	30≤N<50
Very Dense	50≤N

The standard terminology to describe cohesive soils includes consistency, which is based on undrained shear strength as measured by insitu vane tests, penetrometer tests, unconfined compression tests or similar field and laboratory analysis, Standard Penetration Test 'N' values can also be used to provide an approximate indication of the consistency and shear strength of fine grained, cohesive soils:

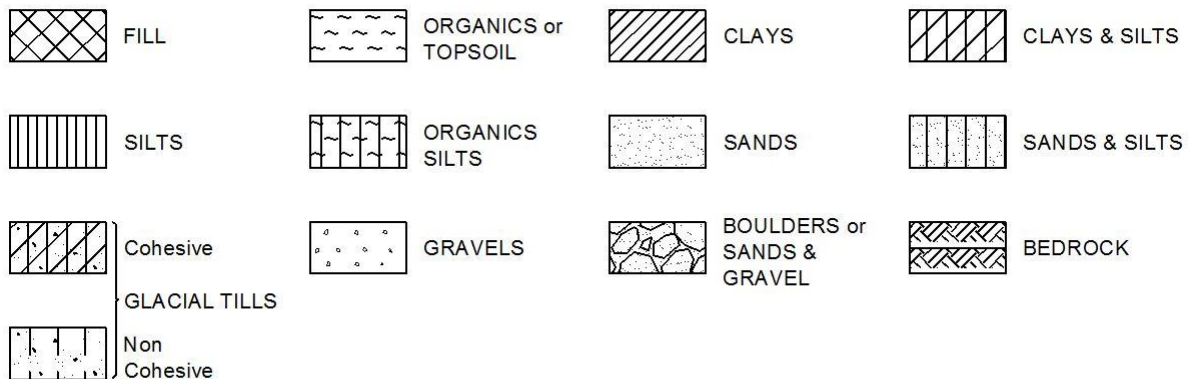
Table c: Consistency of Cohesive Soil

Consistency	Vane Shear Measurement (kPa)	'N' Value
Very Soft	<12.5	<2
Soft	12.5-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

Note: 'N' Value - The Standard Penetration Test records the number of blows of a 140 pound (64kg) hammer falling 30 inches (760mm), required to drive a 2 inch (50.8mm) O.D. split spoon sampler 1 foot (305mm). For split spoon samples where full penetration is not achieved, the number of blows is reported over the sampler penetration in meters (e.g. 50/0.15).

## STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols:



## WATER LEVEL MEASUREMENT



Open Borehole or Test Pit



Monitoring Well, Piezometer or Standpipe

## ABBREVIATIONS AND SYMBOLS

### FIELD SAMPLING

SS	Split spoon sample (obtained from the Standard Penetration Test)
WS	Wash sample
BS	Bulk sample
TW	Thin wall sample or Shelby tube
PS	Piston sample
AS	Auger sample
VT	Vane test
GS	Grab sample
HQ, NQ, etc.	Rock core samples obtained with the use of standard size diamond drilling bits

### STRESS AND STRAIN

$u_w$	kPa	Pore water pressure
$r_u$	1	Pore pressure ratio
$\sigma$	kPa	Total normal stress
$\sigma'$	kPa	Effective normal stress
$\tau$	kPa	Shear stress
$\sigma_1, \sigma_2, \sigma_3$	kPa	Principal stresses
$\varepsilon$	%	Linear strain
$\varepsilon_1, \varepsilon_2, \varepsilon_3$	%	Principal strains
E	kPa	Modulus of linear deformation
G	kPa	Modulus of shear deformation
$\mu$	1	Coefficient of friction

### MECHANICAL PROPERTIES OF SOIL

$m_v$	kPa <sup>-1</sup>	Coefficient of volume change
$c_c$	1	Compression index
$c_s$	1	Swelling index
$c_r$	1	Recompression index
$c_v$	m <sup>2</sup> /s	Coefficient of consolidation
H	m	Drainage path
$T_v$	1	Time factor
U	%	Degree of consolidation
$\sigma'_{v0}$	kPa	Effective overburden pressure
$\sigma'_p$	kPa	Preconsolidation pressure
$\tau_f$	kPa	Shear strength
$c'$	kPa	Effective cohesion intercept
$\phi'$	—°	Effective angle of internal friction
$c_u$	kPa	Apparent cohesion intercept
$\phi_u$	—°	Apparent angle of internal friction
$\tau_R$	kPa	Residual shear strength
$\tau_r$	kPa	Remoulded shear strength
$S_t$	1	Sensitivity = $c_u/\tau_r$

### PHYSICAL PROPERTIES OF SOIL

$P_s$	kg/m <sup>3</sup>	Density of solid particles
$\gamma_s$	kN/m <sup>3</sup>	Unit weight of solid particles
$\rho_w$	kg/m <sup>3</sup>	Density of water
$\gamma_w$	kN/m <sup>3</sup>	Unit weight of water
$\rho$	kg/m <sup>3</sup>	Density of soil
$\gamma$	kN/m <sup>3</sup>	Unit weight of soil
$\rho_d$	kg/m <sup>3</sup>	Density of dry soil
$\gamma_d$	kN/m <sup>3</sup>	Unit weight of dry soil
$\rho_{sat}$	kg/m <sup>3</sup>	Density of saturated soil
$\gamma_{sat}$	kN/m <sup>3</sup>	Unit weight of saturated soil
$\rho'$	kg/m <sup>3</sup>	Density of submerged soil
$\gamma'$	kN/m <sup>3</sup>	Unit weight of submerged soil
$e$	1, %	Void ratio
$n$	1, %	Porosity
$w$	1, %	Water content
$S_r$	%	Degree of saturation
$W_L$	%	Liquid limit
$W_P$	%	Plastic limit
$W_s$	%	Shrinkage limit
$I_p$	%	Plasticity index = $(W_L - W_P)$
$I_L$	%	Liquidity index = $(W - W_P)/I_p$
$I_C$	%	Consistency index = $(W_L - W)/I_p$
$e_{max}$	1, %	Void ratio in loosest state
$e_{min}$	1, %	Void ratio in densest state
$I_D$	1	Density index = $(e_{max} - e)/(e_{max} - e_{min})$
D	mm	Grain diameter
$D_n$	mm	N percent - diameter
$C_u$	1	Uniformity coefficient
h	m	Hydraulic head or potential
q	m <sup>3</sup> /s	Rate of discharge
v	m/s	Discharge velocity
i	1	Hydraulic gradient
k	m/s	Hydraulic conductivity
j	kN/m <sup>3</sup>	Seepage force

Brampton, Ontario

## RECORD OF BOREHOLE No BH22-2-01

1 OF 1

METRIC

W.P. Site 37X-0212/B1 & B3 LOCATION Hwy 401 - CPR O/P, Toronto, ON, MTM ON-10 321489E 4848104N ORIGINATED BY EL  
 DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME 75 / SSA COMPILED BY EL/OD  
 DATUM Geodetic DATE 2022.10.12 - 2022.10.12 LATITUDE 43.77270818 LONGITUDE -79.29269277 CHECKED BY SM/TL

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			SHEAR STRENGTH kPa					W <sub>p</sub>	W	W <sub>L</sub>		
185.9 0.0 185.5 0.4	PAVEMENT STRUCTURE - 90 mm of asphalt and 340 mm of concrete GRAVELLY SAND (FILL) - trace to some silt and clay, brown to greyish brown, damp to moist, dense - occasional cobbles encountered		AS1	AS		185										28 60 (12)
			SS2	SS		184										
			SS3	SS		183										
			SS4	SS		182										
			SS5	SS		181										
			SS6	SS		180										
179.8 6.1	CLAYEY SILT (FILL) - sandy, trace to some gravel, brown with black inclusions, moist, stiff to very stiff		SS7	SS		179										
			SS8	SS		178										0 41 40 19
176.8 9.1	SAND AND SILT (TILL) - trace to some gravel, trace to some clay, brown to brownish grey, moist, very dense		SS9	SS		177										
			SS10	SS		176										1 52 40 7
			SS11	SS		175										
			SS12	SS		174										
			SS13	SS		173										
171.6 14.3	END OF BOREHOLE  NOTE: 1) No groundwater was encountered in open borehole upon completion of drilling.					172										Corrosivity Sample

ONTARIO MTO H401 - CP - 14122020.GPJ ONTARIO MTO GDT 8/4/23

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

Brampton, Ontario

## RECORD OF BOREHOLE No BH22-2-02

1 OF 1

METRIC

W.P. Site 37X-0212/B1 & B3 LOCATION Hwy 401 - CPR O/P, Toronto, ON, MTM ON-10 321556E 4848125N ORIGINATED BY EL  
 DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME 75 / SSA COMPILED BY EL/OD  
 DATUM Geodetic DATE 2022.10.19 - 2022.10.19 LATITUDE 43.77289569 LONGITUDE -79.29185986 CHECKED BY SM/TL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
185.1 0.0	PAVEMENT STRUCTURE - 190 mm of asphalt and 215 mm of concrete		AS1	AS			185							
184.7 0.4			SS2	SS	29		184							17 69 (14)
			SS3	SS	20		183							
182.7 2.4	CLAYEY SILT (FILL) - sandy, trace to some gravel, brown to grey, moist, firm to stiff		SS4	SS	7		182							6 47 36 11
			SS5	SS	10		181							
			SS6	SS	11		180							
			SS7	SS	5		179							
177.5 7.6	SAND AND SILT (TILL) - some clay, trace gravel, light brown to greyish brown, damp to moist, dense to very dense - thin sand lenses interbedded within till layer		SS8	SS	48		178							
			SS9	SS	49		177							2 46 40 12
			SS10	SS	60		176							1 45 43 11
							175							
			SS11	SS	83		174							
			SS12	SS	52		173							
			SS13	SS	100		172							
169.3 15.8	END OF BOREHOLE		SS14	SS	59		171							
	NOTE: 1) No groundwater was encountered in open borehole upon completion of drilling.						170							

+ <sup>3</sup>, × <sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MTO H401 - CP - 14122020.GPJ ONTARIO MTO.GDT 8/4/23

Brampton, Ontario

## RECORD OF BOREHOLE No BH22-2-03

1 OF 2

METRIC

W.P. Site 37X-0212/B1 & B3 LOCATION Hwy 401 - CPR O/P, Toronto, ON, MTM ON-10 321515E 4848146N ORIGINATED BY EL  
 DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME 75 / SSA / Mud Rotary COMPILED BY EL/OD  
 DATUM Geodetic DATE 2022.10.11 - 2022.10.18 LATITUDE 43.77308936 LONGITUDE -79.29236375 CHECKED BY SM/TL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT   NATURAL MOISTURE CONTENT   LIQUID LIMIT			UNIT WEIGHT  γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa			WATER CONTENT (%)									
								○ UNCONFINED   + FIELD VANE	○ QUICK TRIAXIAL	x P. PENETROMETER	W <sub>P</sub>	W	W <sub>L</sub>							
185.6							20	40	60	80	100	20	40	60		GR	SA	SI	CL	
0.0	PAVEMENT STRUCTURE - 90 mm of asphalt and 280 mm of concrete																			
185.2			AS1	AS																
0.4		SAND (FILL) - trace to some gravel, trace to some silt and clay, brown, moist, loose to compact		SS2	SS	24														
		- trace clayey silt inclusions		SS3	SS	9														
				SS4	SS	7														
				SS5	SS	13														
				SS6	SS	19														
				SS7	SS	8														
	- trace clayey silt inclusions																			
			SS8	SS	23															
176.5	SAND AND SILT (TILL) - trace to some clay, trace gravel, greyish brown with trace reddish brown inclusions, moist, very dense		SS9	SS	56															
9.1																				
				SS10	SS	55														
				SS11	SS	70														
				SS12	SS	48														
				SS13	SS	73														
			SS14	SS	47															
			SS15	SS	139															
	- wet below 18.3 m depth		SS16	SS	43															

Continued Next Page

+ <sup>3</sup>, × <sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MTO H401 - CP - 14122020.GPJ ONTARIO MTO.GDT 8/4/23



Brampton, Ontario

# RECORD OF BOREHOLE No BH22-2-03

2 OF 2

METRIC

W.P. Site 37X-0212/B1 & B3 LOCATION Hwy 401 - CPR O/P, Toronto, ON, MTM ON-10 321515E 4848146N ORIGINATED BY EL  
 DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME 75 / SSA / Mud Rotary COMPILED BY EL/OD  
 DATUM Geodetic DATE 2022.10.11 - 2022.10.18 LATITUDE 43.77308936 LONGITUDE -79.29236375 CHECKED BY SM/TL

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 <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR   SA   SI   CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa		W <sub>p</sub> W                      W <sub>L</sub>				
								○ UNCONFINED   + FIELD VANE ● QUICK TRIAXIAL   P. PENETROMETER		WATER CONTENT (%)				
							20   40   60   80   100							
							20   40   60   80   100							

Brampton, Ontario

## RECORD OF BOREHOLE No BH22-2-04

1 OF 1

METRIC

W.P. Site 37X-0212/B1 & B3 LOCATION Hwy 401 - CPR O/P, Toronto, ON, MTM ON-10 321573E 4848165N ORIGINATED BY EL  
 DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME 75 / SSA COMPILED BY EL  
 DATUM Geodetic DATE 2022.10.05 - 2022.10.05 LATITUDE 43.77325556 LONGITUDE -79.29164722 CHECKED BY SM/TL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIALX P. PENETROMETER								WATER CONTENT (%)		
								20 40 60 80 100									20 40 60	
184.6 184.9 0.3	PAVEMENT STRUCTURE - 50 mm of asphalt and 200 mm of concrete  SAND (FILL) - some gravel, trace silt and clay, greyish brown, slightly moist, loose to dense		AS1	AS			184											
			SS2	SS	35													
			SS3	SS	35		183											
			SS4	SS	8		182											
			SS5	SS	7		181									13 82 (5)		
							180											
179.8 4.8	CLAYEY SILT (FILL) - sandy, trace gravel, greyish brown to grey, moist, firm to very stiff		SS6	SS	6		179											
							178											
			SS7	SS	19		177											
	- trace organics encountered		SS8	SS	8		176									1 45 38 16		
							175											
175.5 9.1	SAND AND SILT (TILL) - some gravel, trace clay, trace organics, light brown to greyish brown, slightly moist, dense to very dense - no organics below 9.9 m depth - 0.1 m thick sand lens		SS9	SS	39		175									24.1	Corrosivity Sample	
			SS10	SS	57		174											
			SS11	SS	64		173											
							172											
172.4 12.2	CLAYEY SILT (TILL) - some sand, trace gravel, grey, moist, hard, low plasticity		SS12	SS	67		171											
							170											
170.9 13.7	SAND AND SILT (TILL) - trace gravel, trace clay, greyish brown, slightly moist to moist, very dense		SS13	SS	102		169										1 45 45 9 Non-Plastic	
			SS14	SS	100/ 250mm		168											
			SS15	SS	62											23.8		
167.2 17.4	END OF BOREHOLE  NOTE: 1) No groundwater was encountered in open borehole upon completion of drilling.																	

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MTO H401 - CP - 14122020.GPJ ONTARIO MTO GDT 8/4/23


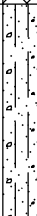
Brampton, Ontario

## RECORD OF BOREHOLE No BH22-2-13

1 OF 1

METRIC

W.P. Site 37X-0212/B1 & B3 LOCATION Hwy 401 - CPR O/P, Toronto, ON, MTM ON-10 321496E 4848139N ORIGINATED BY EL  
 DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME 75 / SSA COMPILED BY EL  
 DATUM Geodetic DATE 2022.10.03 - 2022.10.03 LATITUDE 43.77302617 LONGITUDE -79.29259997 CHECKED BY SM/TL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X P. PENETROMETER											
185.8 189.9 0.3	<b>PAVEMENT STRUCTURE</b> - 100 mm of asphalt and 200 mm of concrete <b>SILTY SAND (FILL)</b> - trace to some gravel, brownish grey to grey, slightly moist to moist, loose to dense		AS1	AS			185								21.0	2 62 (36)			
			SS2	SS	48		184												
			SS3	SS	29		183												
			SS4	SS	8		182												
			SS5	SS	4		181												
			SS6	SS	21		180												
			SS7	SS	42		179												
			SS8	SS	31		178												
177.9 7.9	<b>CLAYEY SILT (FILL)</b> - some gravel, some sand, grey, slightly moist, hard						177								22.6	1 54 36 9			
176.7 9.1	<b>SILTY SAND (FILL)</b> - trace clay, trace organics/rootlets, grey with black inclusions, slightly moist, loose		SS9	SS	9		176												
175.1 10.7	<b>SAND AND SILT (TILL)</b> - trace to some clay, trace gravel, brownish grey to grey, slightly moist to moist, very dense		SS10	SS	70		175												
							174												
		SS11	SS	62		173													
							172												
			SS12	SS	100		171												
			SS13	SS	56														
170.0 15.8	<b>END OF BOREHOLE</b>  NOTE: 1) No groundwater was encountered in open borehole upon completion of drilling.						170												

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MTO H401 - CP - 14122020.GPJ ONTARIO MTO.GDT 8/4/23

Brampton, Ontario

## RECORD OF BOREHOLE No BH22-2-14

1 OF 1

METRIC

W.P. Site 37X-0212/B1 & B3 LOCATION Hwy 401 - CPR O/P, Toronto, ON, MTM ON-10 321593E 4848171N ORIGINATED BY EL  
 DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME 75 / SSA COMPILED BY EL  
 DATUM Geodetic DATE 2022.10.04 - 2022.10.04 LATITUDE 43.77330897 LONGITUDE -79.29140389 CHECKED BY SM/TL

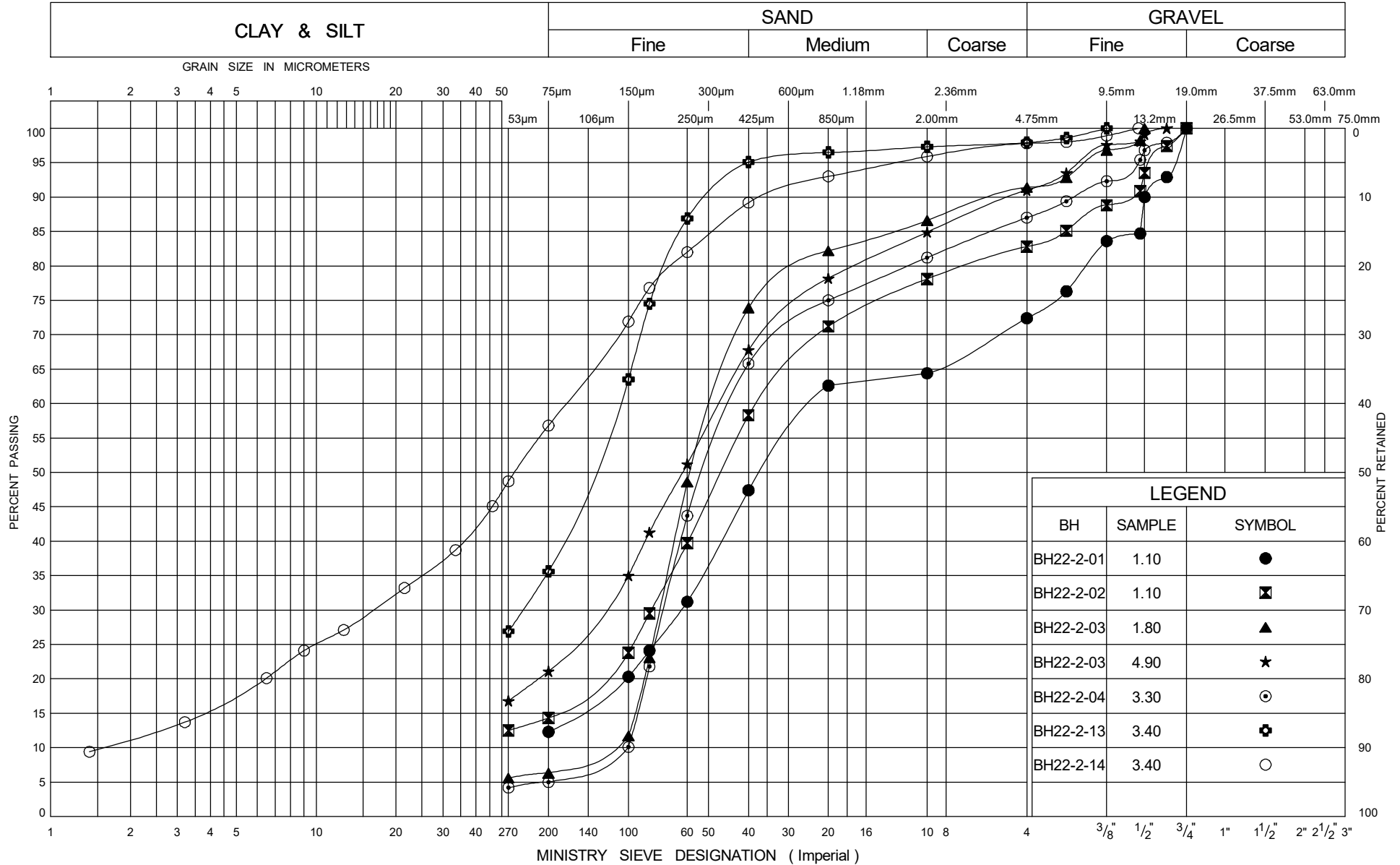
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X P. PENETROMETER											
184.2							20	40	60	80	100	20	40	60					
189.9	PAVEMENT STRUCTURE - 100 mm of asphalt and 225 mm of concrete		AS1	AS															
0.3	SAND AND GRAVEL (FILL) - greyish brown, wet SAND AND SILT (FILL) - trace to some clay, trace gravel, greyish brown, slightly moist to moist, loose to dense  - trace asphalt inclusions		SS2	SS	43							○							
183.4			SS3	SS	7							○							
0.8			SS4	SS	29							○							
			SS5	SS	19							○							
			SS6	SS	28							○							
			SS7	SS	23							○							
177.8	CLAYEY SILT (FILL) - some gravel, some sand, grey, moist, very stiff																		
6.4																			
			SS8	SS	22							○							
176.3	SILTY SAND (FILL) - trace gravel, trace organics/rootlets, greyish brown, slightly moist, compact											○							
7.9																			
			SS9	SS	28							○							
174.7	SAND AND SILT (TILL) - some clay, trace gravel, greyish brown, slightly moist to moist, compact to very dense																		
9.5			SS10	SS	28							○							
			SS11	SS	63							○							
												○							
			SS12	SS	168							○							
		</																	

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MTO H401 - CP - 14122020.GPJ ONTARIO MTO.GDT 8/4/23

## Appendix E – Laboratory Data

# UNIFIED SOIL CLASSIFICATION SYSTEM



## GRAIN SIZE DISTRIBUTION

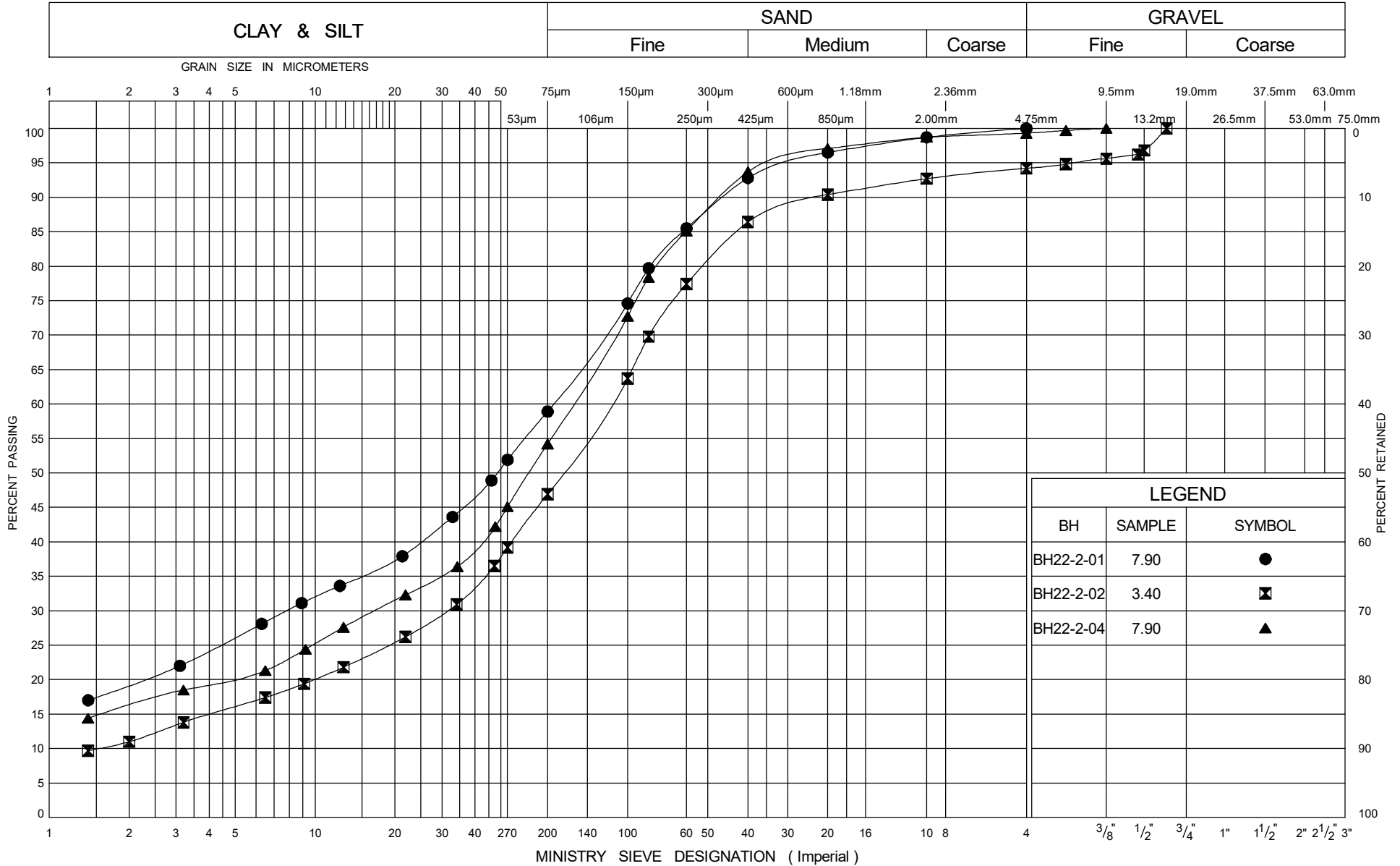
Cohesionless Fill

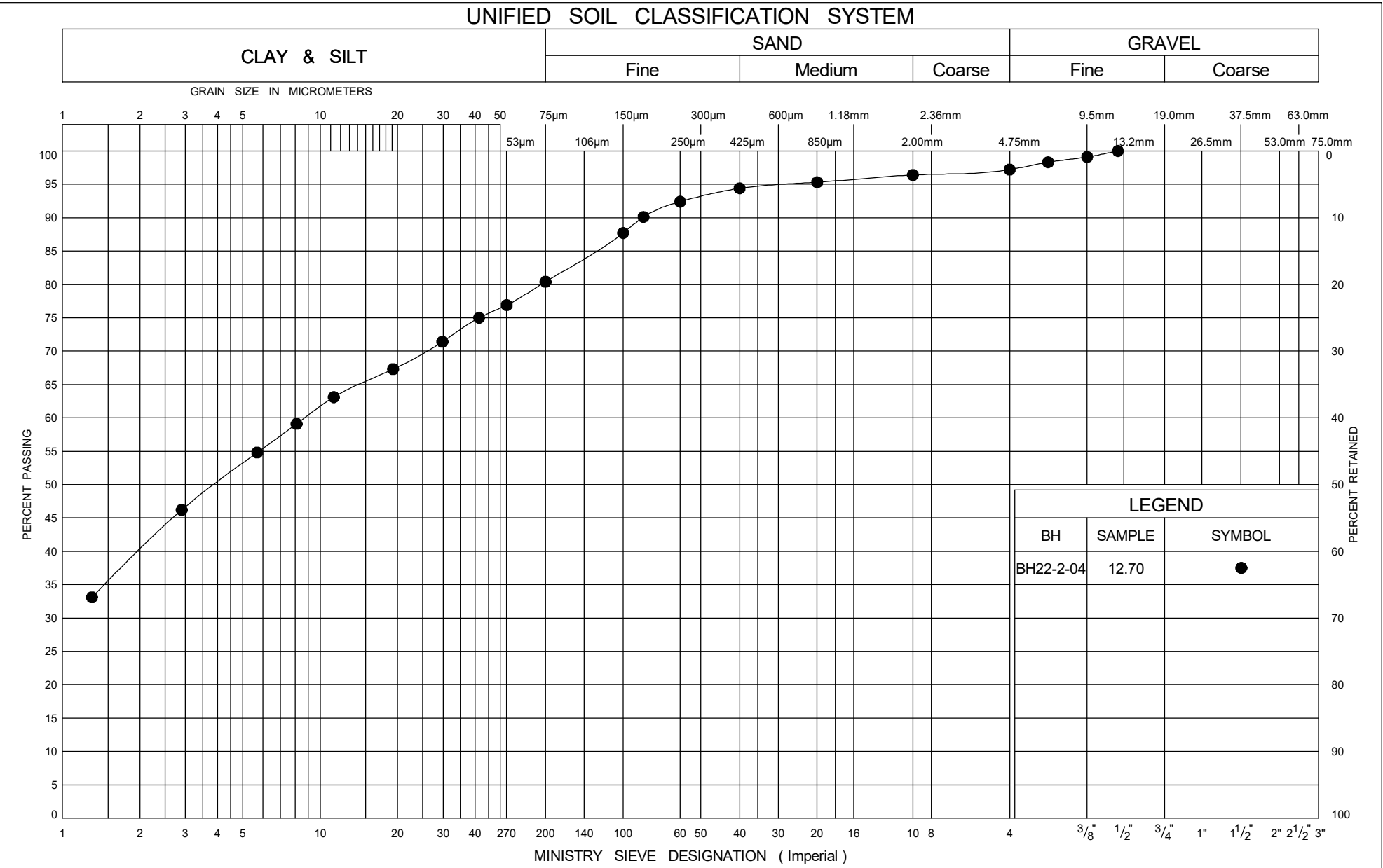
FIG No 1

CP Rail Overpass Replacement  
(Site 37X-0213/B1 & B3)

Hwy 401 Eastbound Express and  
Collector Lanes

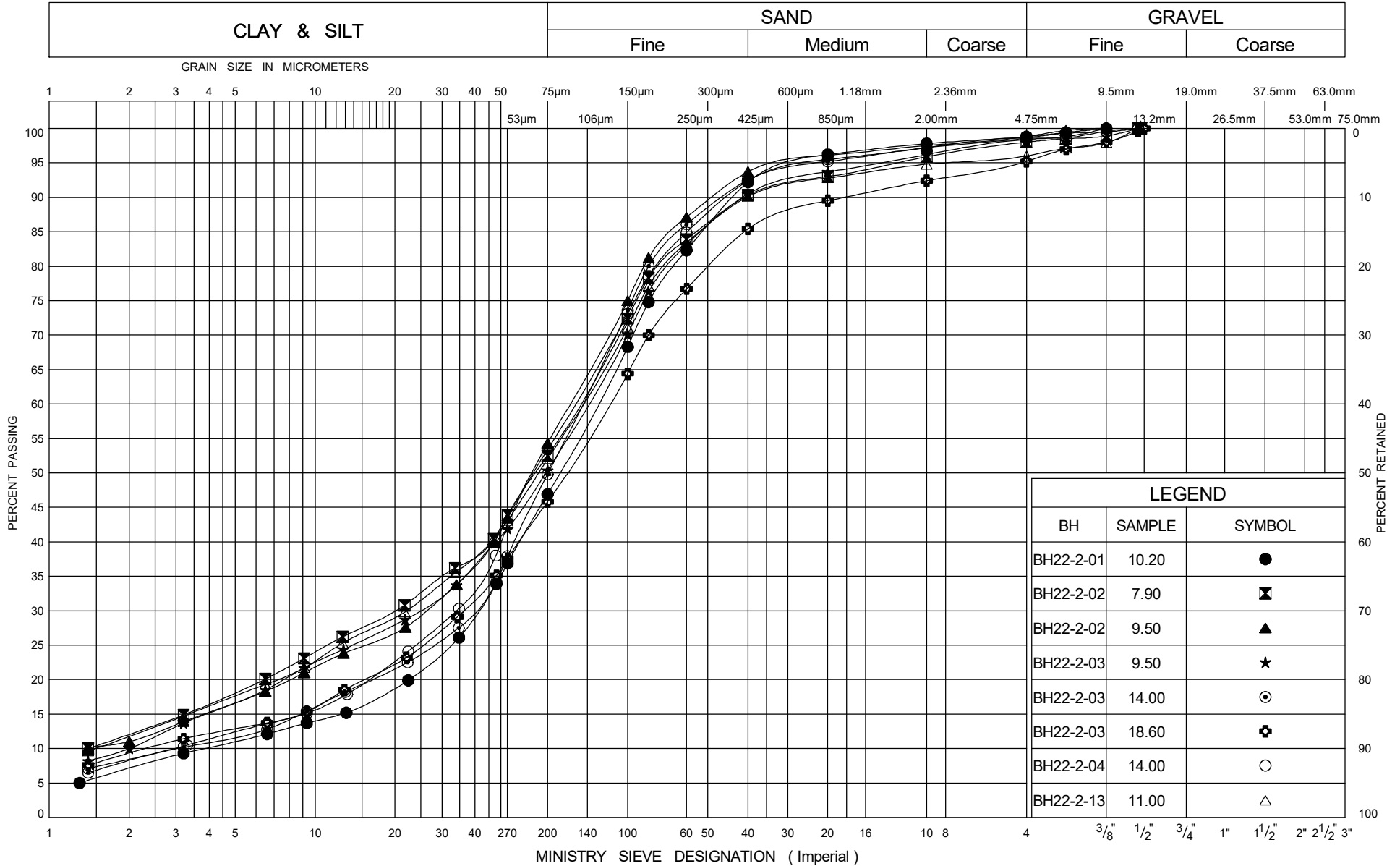
# UNIFIED SOIL CLASSIFICATION SYSTEM



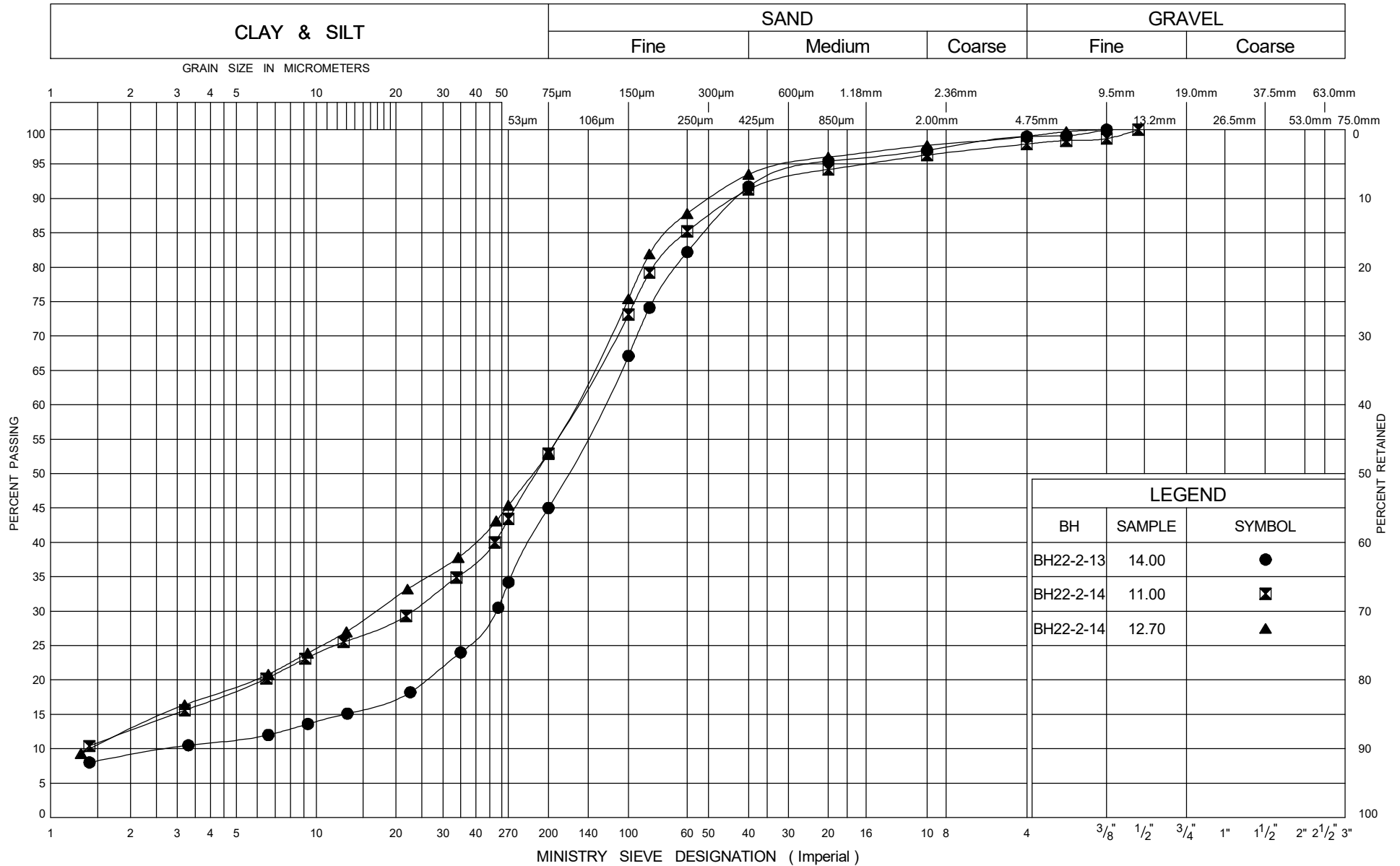




# UNIFIED SOIL CLASSIFICATION SYSTEM



# UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of  
Transportation

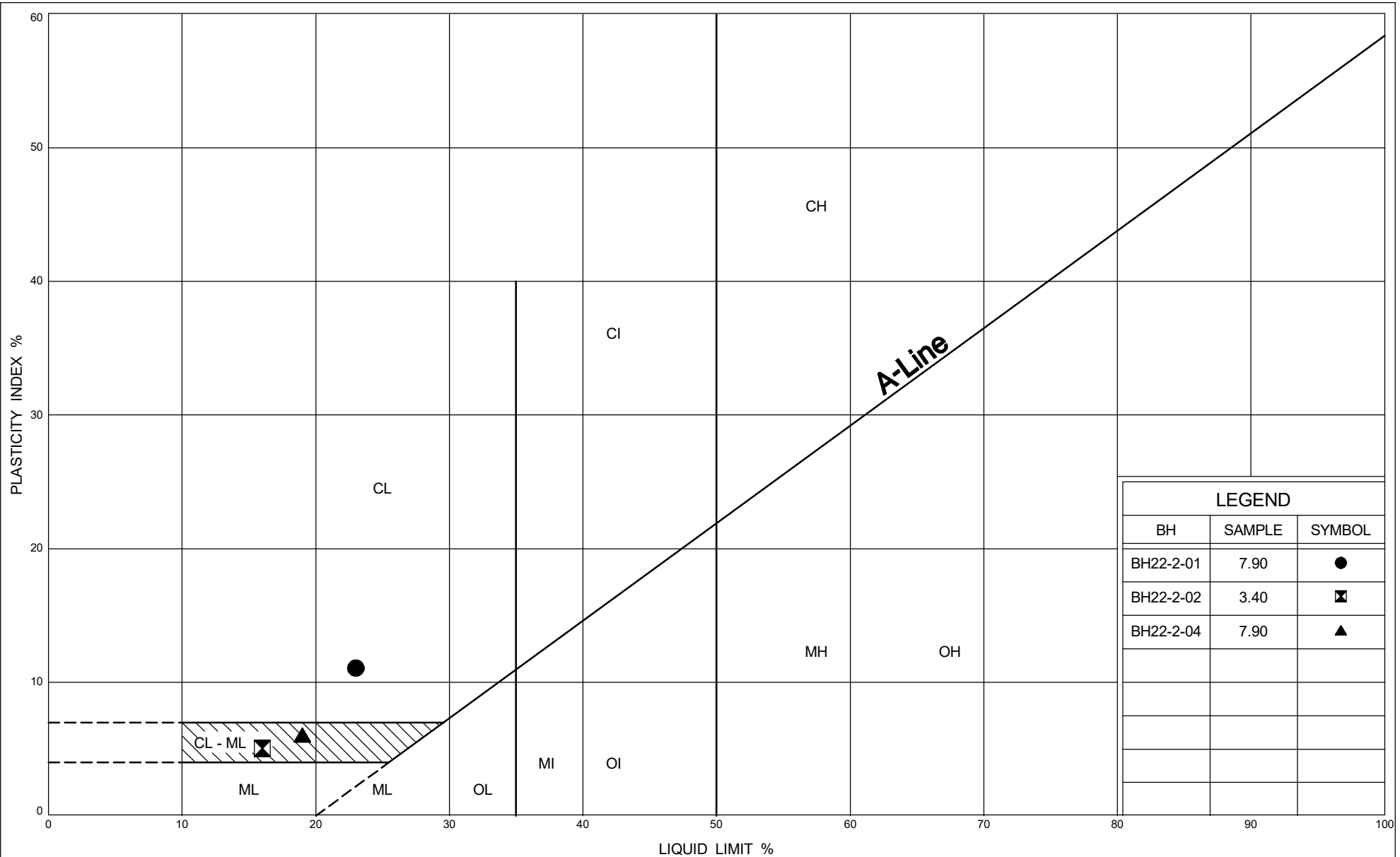
## GRAIN SIZE DISTRIBUTION

Native Cohesionless Till

FIG No 5

CP Rail Overpass Replacement  
(Site 37X-0213/B1 & B3)

Hwy 401 Eastbound Express and  
Collector Lanes



Ministry of  
Transportation

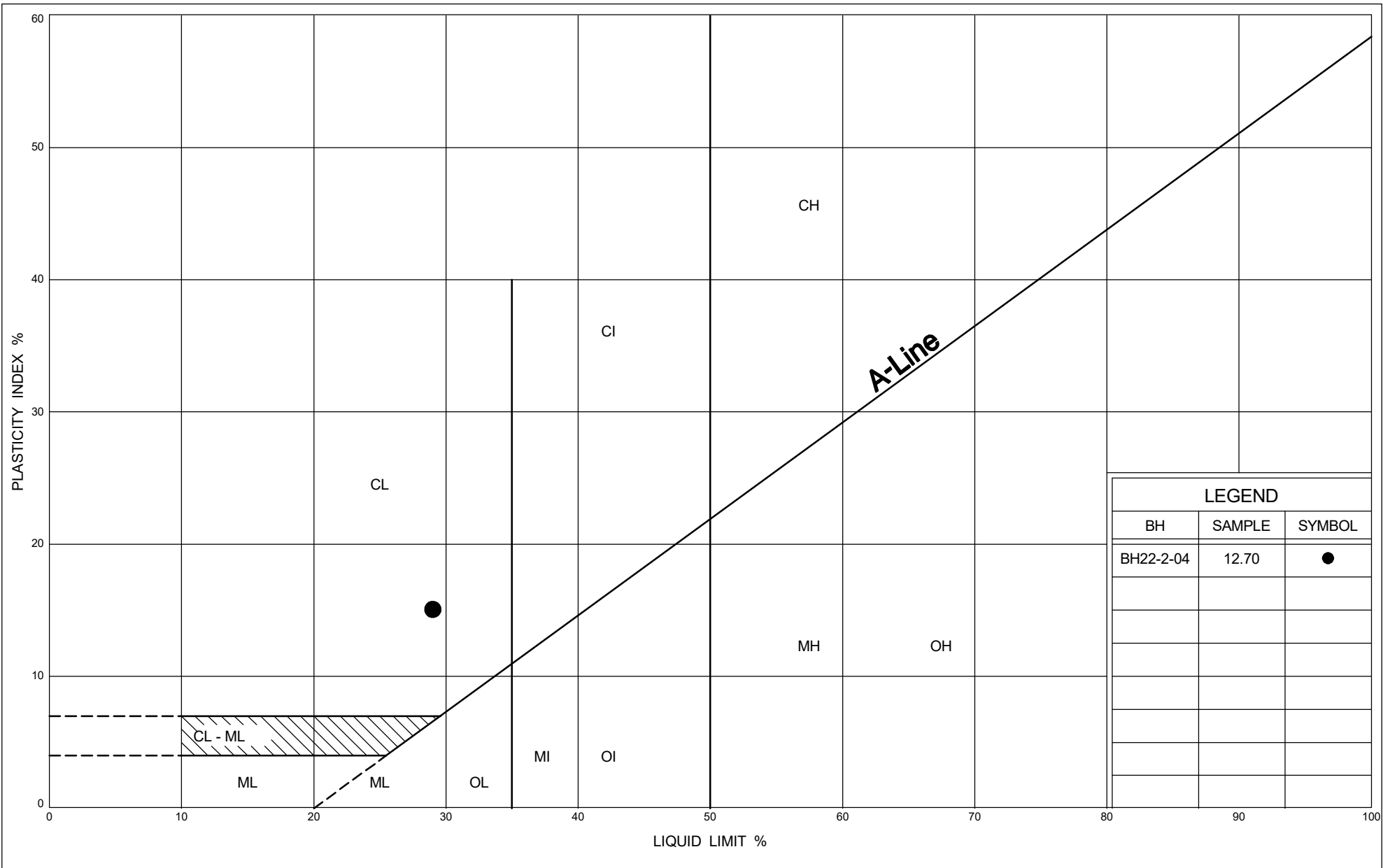
## PLASTICITY CHART

Clayey Silt (FILL)

FIG No 6

CP Rail Overpass Replacement  
(Site 37X-0213/B1 & B3)

Hwy 401 Eastbound Express and  
Collector Lanes





Your Project #: ADM-22000797-A0  
 Site Location: Hwy 401 from Victoria to Nelson Ave, ON  
 Your C.O.C. #: 893860-03-01

**Attention: Nimesh Tamrakar**

exp Services Inc  
 Brampton Branch  
 1595 Clark Blvd  
 Brampton, ON  
 CANADA L6T 4V1

**Report Date: 2022/10/19**  
 Report #: R7348456  
 Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C2T2765**

**Received: 2022/10/07, 10:56**

Sample Matrix: Soil  
 # Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Chloride (20:1 extract)	2	2022/10/14	2022/10/19	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	2	2022/10/12	2022/10/13	CAM SOP-00414	OMOE E3530 v1 m
Moisture (Subcontracted) (1, 2)	2	N/A	2022/10/15	AB SOP-00002	CCME PHC-CWS m
Sulphide in Soil (1)	2	N/A	2022/10/13	AB SOP-00080	EPA9030B/SM4500S2-DF
pH CaCl2 EXTRACT	2	2022/10/15	2022/10/15	CAM SOP-00413	EPA 9045 D m
Redox Potential (3)	2	2022/10/17	2022/10/19	CAM SOP-00421	SM 2580 B
Resistivity of Soil	2	2022/10/07	2022/10/13	CAM SOP-00414	SM 23 2510 m
Sulphate (20:1 Extract)	2	2022/10/14	2022/10/17	CAM SOP-00464	EPA 375.4 m

**Remarks:**

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

\* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Bureau Veritas Calgary (19th), 4000 19th Street NE, Calgary, AB, T2E 6P8

(2) Offsite analysis requires that subcontracted moisture be reported.



Your Project #: ADM-22000797-A0  
Site Location: Hwy 401 from Victoria to Nelson Ave, ON  
Your C.O.C. #: 893860-03-01

**Attention: Nimesh Tamrakar**

exp Services Inc  
Brampton Branch  
1595 Clark Blvd  
Brampton, ON  
CANADA L6T 4V1

**Report Date: 2022/10/19**  
Report #: R7348456  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C2T2765**

**Received: 2022/10/07, 10:56**

(3) Oxidation-Reduction Potential (ORP) values are determined using a Ag/AgCl reference electrode. The test is therefore, not SCC accredited for this matrix.

**Encryption Key**

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Patricia Legette, Project Manager

Email: Patricia.Legette@bureauveritas.com

Phone# (905)817-5799

=====

This report has been generated and distributed using a secure automated process.

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports.

For Service Group specific validation please refer to the Validation Signature Page.



### SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		TYO346	TYO347		
Sampling Date		2022/10/06 02:30	2022/09/26 02:00		
COC Number		893860-03-01	893860-03-01		
	<b>UNITS</b>	<b>BH22-2-4 SS9</b>	<b>BH22-3-3 SS10</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>					
Resistivity	ohm-cm	1500	3600		8271092
<b>CONVENTIONALS</b>					
Redox Potential	mV	270	270	N/A	8286961
<b>Inorganics</b>					
Soluble (20:1) Chloride (Cl-)	ug/g	380	130	20	8283307
Conductivity	umho/cm	659	279	2	8278171
Available (CaCl2) pH	pH	7.91	7.92		8285499
Soluble (20:1) Sulphate (SO4)	ug/g	<20	<20	20	8283308
Sulphide	mg/kg	2.7	3.7	0.5	8290499
<b>Physical Testing</b>					
Moisture-Subcontracted	%	8.1	9.9	0.30	8290500
RDL = Reportable Detection Limit QC Batch = Quality Control Batch N/A = Not Applicable					



**BUREAU**  
**VERITAS**

Bureau Veritas Job #: C2T2765  
Report Date: 2022/10/19

exp Services Inc  
Client Project #: ADM-22000797-A0  
Site Location: Hwy 401 from Victoria to Nelson Ave, ON  
Sampler Initials: IB

## TEST SUMMARY

**Bureau Veritas ID:** TYO346  
**Sample ID:** BH22-2-4 SS9  
**Matrix:** Soil

**Collected:** 2022/10/06  
**Shipped:**  
**Received:** 2022/10/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8283307	2022/10/14	2022/10/19	Alina Dobreanu
Conductivity	AT	8278171	2022/10/12	2022/10/13	Surinder Rai
Moisture (Subcontracted)	BAL	8290500	N/A	2022/10/15	Winston Lee
Sulphide in Soil	SPEC	8290499	N/A	2022/10/13	Bailey Morrison
pH CaCl <sub>2</sub> EXTRACT	AT	8285499	2022/10/15	2022/10/15	Kien Tran
Redox Potential	COND	8286961	2022/10/17	2022/10/19	Surinder Rai
Resistivity of Soil		8271092	2022/10/13	2022/10/13	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8283308	2022/10/14	2022/10/17	Alina Dobreanu

**Bureau Veritas ID:** TYO347  
**Sample ID:** BH22-3-3 SS10  
**Matrix:** Soil

**Collected:** 2022/09/26  
**Shipped:**  
**Received:** 2022/10/07

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8283307	2022/10/14	2022/10/19	Alina Dobreanu
Conductivity	AT	8278171	2022/10/12	2022/10/13	Surinder Rai
Moisture (Subcontracted)	BAL	8290500	N/A	2022/10/15	Winston Lee
Sulphide in Soil	SPEC	8290499	N/A	2022/10/13	Bailey Morrison
pH CaCl <sub>2</sub> EXTRACT	AT	8285499	2022/10/15	2022/10/15	Kien Tran
Redox Potential	COND	8286961	2022/10/17	2022/10/19	Surinder Rai
Resistivity of Soil		8271092	2022/10/13	2022/10/13	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8283308	2022/10/14	2022/10/17	Alina Dobreanu





### GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	0.7°C
-----------	-------

Results relate only to the items tested.

BUREAU  
VERITAS

Bureau Veritas Job #: C2T2765

Report Date: 2022/10/19

## QUALITY ASSURANCE REPORT

exp Services Inc

Client Project #: ADM-22000797-A0

Site Location: Hwy 401 from Victoria to Nelson Ave, ON

Sampler Initials: IB

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
8278171	Conductivity	2022/10/13			99	90 - 110	<2	umho/cm	0.39	10
8283307	Soluble (20:1) Chloride (Cl-)	2022/10/19	NC	70 - 130	105	70 - 130	<20	ug/g	28	35
8283308	Soluble (20:1) Sulphate (SO4)	2022/10/17	NC	70 - 130	105	70 - 130	<20	ug/g	3.4	35
8285499	Available (CaCl2) pH	2022/10/15			100	97 - 103			2.7	N/A
8286961	Redox Potential	2022/10/19			100	95 - 105			7.3	N/A
8290499	Sulphide	2022/10/13	48 (1)	75 - 125	107	75 - 125	<0.5	mg/kg		
8290500	Moisture-Subcontracted	2022/10/15					<0.30	%		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.



BUREAU  
VERITAS

Bureau Veritas Job #: C2T2765

Report Date: 2022/10/19

exp Services Inc

Client Project #: ADM-22000797-A0

Site Location: Hwy 401 from Victoria to Nelson Ave, ON

Sampler Initials: IB

### VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Veronica Falk, B.Sc., P.Chem., QP, Scientific Specialist, Organics

Ewa Pranjić, M.Sc., C.Chem, Scientific Specialist

Suwan (Sze Yeung) Fock, B.Sc., Scientific Specialist

---

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



Bureau Veritas  
6740 Campbell Road, Mississauga, Ontario Canada L5N 2L8 Tel: (905) 817-5700 Toll-free 800-563-6266 Fax: (905) 817-5777 www.bvna.com

# CHAIN OF CUSTODY RECORD

Page of

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#17488 exp Services Inc	Company Name:		Quotation #:	C20328	Bureau Veritas Job #:	Bottle Order #:
Attention:	Accounts Payable	Attention:	Nimesh Tamrakar	P.O. #:			
Address:	1595 Clark Blvd Brampton ON L6T 4V1	Address:		Project:	ADM-22000797-A0		
Tel:	(905) 793-9800	Tel:	(905) 796-3200 Ext: 3026	Project Name:	Hwy 401 from Victoria to Nelso	COC #:	Project Manager:
Email:	AP@exp.com; Karen.Burke@exp.com	Email:	Nimesh.Tamrakar@exp.com	Site #:			Patricia Legette
				Sampled By:			

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS DRINKING WATER CHAIN OF CUSTODY						ANALYSIS REQUESTED (PLEASE BE SPECIFIC)		Turnaround Time (TAT) Required:	
Regulation 153 (2011)			Other Regulations			Special Instructions		Please provide advance notice for rush projects	
<input type="checkbox"/> Table 1	<input type="checkbox"/> Res/Park	<input type="checkbox"/> Medium/Fine	<input type="checkbox"/> CCME	<input type="checkbox"/> Sanitary Sewer Bylaw				<b>Regular (Standard) TAT:</b>	
<input type="checkbox"/> Table 2	<input type="checkbox"/> Ind/Comm	<input type="checkbox"/> Coarse	<input type="checkbox"/> Reg 558	<input type="checkbox"/> Storm Sewer Bylaw				(will be applied if Rush TAT is not specified):	
<input type="checkbox"/> Table 3	<input type="checkbox"/> Agri/Other	<input type="checkbox"/> For RSC	<input type="checkbox"/> MISA	<input type="checkbox"/> Municipality				Standard TAT = 5-7 Working days for most tests.	
<input type="checkbox"/> Table			<input type="checkbox"/> PWOO	<input type="checkbox"/> Reg 406 Table				Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.	
<input type="checkbox"/> Other			<input type="checkbox"/> Other					<b>Job Specific Rush TAT (if applies to entire submission)</b>	
Include Criteria on Certificate of Analysis (Y/N)?								Date Required:	Time Required:
								Rush Confirmation Number:	(call lab for #)
Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	Soil Corrosivity Package		# of Bottles	Comments
1	BH22-2-4 SS9	2022/10/06	02:30am	SOIL		/			
2	BH22-2-4 SS9	2022/10/06	02:30am	SOIL		/			
3	BH22-3-3 SS10	2022/09/26	02:00am	SOIL		/			
4	BH22-3-3 SS10	2022/09/26	02:00	SOIL		/			
5				SOIL					
6				SOIL					
7				SOIL					
8				SOIL					
9				SOIL					
10				SOIL					

07-Oct-22 10:56

Patricia Legette

C2T2765

RPK ENV-925

* RELINQUISHED BY: (Signature/Print)		Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)		Date: (YY/MM/DD)	Time	# jars used and not submitted	Laboratory Use Only				
Ivan Barva		22/10/07	10:55am			20/10/07	10:56		Time Sensitive	Temperature (°C) on Recl	Custody Seal	Yes	No
										17/10	Present		
											Intact		

\* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BUREAU VERITAS'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVNA.COM/TERMS-AND-CONDITIONS.

\*\* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

\*\* SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVNA.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.

White: Bureau Veritas Yellow: Client

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS

Bureau Veritas Canada (2019) Inc.



Your Project #: Campobello job# C2T2765

**Attention: Patricia Legette**

BUREAU VERITAS  
CAMPOBELLO  
6740 CAMPOBELLO ROAD  
MISSISSAUGA, ON  
CANADA L5N 2L8

**Report Date: 2022/10/18**

Report #: R3250114

Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C278786**

**Received: 2022/10/07, 21:59**

Sample Matrix: Soil  
# Samples Received: 2

Analyses	Date		Date Analyzed	Laboratory Method	Analytical Method
	Quantity	Extracted			
Moisture	2	N/A	2022/10/15	AB SOP-00002	CCME PHC-CWS m
Sulphide	2	2022/10/13	2022/10/13	AB SOP-00080	EPA9030B/SM4500S2-DF

**Remarks:**

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

\* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.



Your Project #: Campobello job# C2T2765

**Attention: Patricia Legette**

BUREAU VERITAS  
CAMPOBELLO  
6740 CAMPOBELLO ROAD  
MISSISSAUGA, ON  
CANADA L5N 2L8

**Report Date: 2022/10/18**

Report #: R3250114

Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C278786**

**Received: 2022/10/07, 21:59**

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Customer Solutions, Western Canada Customer Experience Team

Email: customersolutionswest@bureauveritas.com

Phone# (403) 291-3077

=====

This report has been generated and distributed using a secure automated process.

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports.

For Service Group specific validation please refer to the Validation Signature Page.



BUREAU  
VERITAS

Bureau Veritas Job #: C278786

Report Date: 2022/10/18

BUREAU VERITAS

Client Project #: Campobello job# C2T2765

Sampler Initials: IB

### RESULTS OF CHEMICAL ANALYSES OF SOIL

<b>Bureau Veritas ID</b>		BDY771	BDY772		
<b>Sampling Date</b>		2022/10/07 21:56	2022/10/07 21:56		
	<b>UNITS</b>	<b>BH22-2-4 SS9</b>	<b>BH22-3-3 SS10</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Misc. Inorganics</b>					
Sulphide	mg/kg	2.7	3.7	0.5	A754056
RDL = Reportable Detection Limit					



BUREAU  
VERITAS

Bureau Veritas Job #: C278786

Report Date: 2022/10/18

BUREAU VERITAS

Client Project #: Campobello job# C2T2765

Sampler Initials: IB

### PHYSICAL TESTING (SOIL)

<b>Bureau Veritas ID</b>		BDY771	BDY772		
<b>Sampling Date</b>		2022/10/07 21:56	2022/10/07 21:56		
	<b>UNITS</b>	<b>BH22-2-4 SS9</b>	<b>BH22-3-3 SS10</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Physical Properties</b>					
Moisture	%	8.1	9.9	0.30	A757459
RDL = Reportable Detection Limit					





Your Project #: ADM-22000797-A0  
Site Location: Hwy 401 from Victoria to Nelson Ave, ON  
Your C.O.C. #: 893860-04-01

**Attention: Nimesh Tamrakar**

exp Services Inc  
Brampton Branch  
1595 Clark Blvd  
Brampton, ON  
CANADA L6T 4V1

**Report Date: 2022/11/01**  
Report #: R7367904  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C2U6020**

**Received: 2022/10/20, 12:51**

Sample Matrix: Soil  
# Samples Received: 1

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Chloride (20:1 extract)	1	2022/10/25	2022/10/28	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	1	2022/10/25	2022/10/25	CAM SOP-00414	OMOE E3530 v1 m
Moisture (Subcontracted) (1, 2)	1	N/A	2022/10/27	AB SOP-00002	CCME PHC-CWS m
Sulphide in Soil (1)	1	N/A	2022/10/27	AB SOP-00080	EPA9030B/SM4500S2-DF
pH CaCl2 EXTRACT	1	2022/10/25	2022/10/25	CAM SOP-00413	EPA 9045 D m
Redox Potential (3)	1	2022/10/25	2022/10/26	CAM SOP-00421	SM 2580 B
Resistivity of Soil	1	2022/10/21	2022/10/26	CAM SOP-00414	SM 23 2510 m
Sulphate (20:1 Extract)	1	2022/10/25	2022/10/26	CAM SOP-00464	EPA 375.4 m

**Remarks:**

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

\* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Bureau Veritas Calgary (19th), 4000 19th Street NE, Calgary, AB, T2E 6P8

(2) Offsite analysis requires that subcontracted moisture be reported.



Your Project #: ADM-22000797-A0  
Site Location: Hwy 401 from Victoria to Nelson Ave, ON  
Your C.O.C. #: 893860-04-01

**Attention: Nimesh Tamrakar**

exp Services Inc  
Brampton Branch  
1595 Clark Blvd  
Brampton, ON  
CANADA L6T 4V1

**Report Date: 2022/11/01**  
Report #: R7367904  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C2U6020**

**Received: 2022/10/20, 12:51**

(3) Oxidation-Reduction Potential (ORP) values are determined using a Ag/AgCl reference electrode. The test is therefore, not SCC accredited for this matrix.

**Encryption Key**

Please direct all questions regarding this Certificate of Analysis to:

Patricia Legette, Project Manager  
Email: Patricia.Legette@bureauveritas.com  
Phone# (905)817-5799

=====

This report has been generated and distributed using a secure automated process.

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



### SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		UBI927			UBI927		
Sampling Date		2022/10/12			2022/10/12		
COC Number		893860-04-01			893860-04-01		
	<b>UNITS</b>	<b>BH22-2-1 SS13</b>	<b>RDL</b>	<b>QC Batch</b>	<b>BH22-2-1 SS13 Lab-Dup</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>							
Resistivity	ohm-cm	660		8298711			
<b>CONVENTIONALS</b>							
Redox Potential	mV	290	N/A	8303878			
<b>Inorganics</b>							
Soluble (20:1) Chloride (Cl-)	ug/g	750	20	8303802	770	20	8303802
Conductivity	umho/cm	1510	2	8303555	1530	2	8303555
Available (CaCl2) pH	pH	7.98		8303401			
Soluble (20:1) Sulphate (SO4)	ug/g	41	20	8303809	41	20	8303809
Sulphide	mg/kg	2.8 (1)	0.5	8310746			
<b>Physical Testing</b>							
Moisture-Subcontracted	%	9.2	0.30	8319509	9.9	0.30	8319509
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate N/A = Not Applicable (1) Sample extracted past method-specified hold time. Analyzed past method specified hold time							



BUREAU  
VERITAS

Bureau Veritas Job #: C2U6020

Report Date: 2022/11/01

exp Services Inc

Client Project #: ADM-22000797-A0

Site Location: Hwy 401 from Victoria to Nelson Ave, ON

Sampler Initials: IB

## TEST SUMMARY

**Bureau Veritas ID:** UBI927  
**Sample ID:** BH22-2-1 SS13  
**Matrix:** Soil

**Collected:** 2022/10/12  
**Shipped:**  
**Received:** 2022/10/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8303802	2022/10/25	2022/10/28	Alina Dobreanu
Conductivity	AT	8303555	2022/10/25	2022/10/25	Surinder Rai
Moisture (Subcontracted)	BAL	8319509	N/A	2022/10/27	Richard Ly
Sulphide in Soil	SPEC	8310746	N/A	2022/10/27	Bailey Morrison
pH CaCl <sub>2</sub> EXTRACT	AT	8303401	2022/10/25	2022/10/25	Taslina Aktar
Redox Potential	COND	8303878	2022/10/25	2022/10/26	Surinder Rai
Resistivity of Soil		8298711	2022/10/26	2022/10/26	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8303809	2022/10/25	2022/10/26	Samuel Law

**Bureau Veritas ID:** UBI927 Dup  
**Sample ID:** BH22-2-1 SS13  
**Matrix:** Soil

**Collected:** 2022/10/12  
**Shipped:**  
**Received:** 2022/10/20

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8303802	2022/10/25	2022/10/28	Alina Dobreanu
Conductivity	AT	8303555	2022/10/25	2022/10/25	Surinder Rai
Moisture (Subcontracted)	BAL	8319509	N/A	2022/10/27	Richard Ly
Sulphate (20:1 Extract)	KONE/EC	8303809	2022/10/25	2022/10/26	Samuel Law



### GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	1.3°C
-----------	-------

Results relate only to the items tested.



BUREAU  
VERITAS

Bureau Veritas Job #: C2U6020

Report Date: 2022/11/01

## QUALITY ASSURANCE REPORT

exp Services Inc

Client Project #: ADM-22000797-A0

Site Location: Hwy 401 from Victoria to Nelson Ave, ON

Sampler Initials: IB

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
8303401	Available (CaCl <sub>2</sub> ) pH	2022/10/25			100	97 - 103			0.75	N/A
8303555	Conductivity	2022/10/25			106	90 - 110	<2	umho/cm	1.3	10
8303802	Soluble (20:1) Chloride (Cl <sup>-</sup> )	2022/10/28	NC	70 - 130	104	70 - 130	<20	ug/g	3.0	35
8303809	Soluble (20:1) Sulphate (SO <sub>4</sub> )	2022/10/26	NC	70 - 130	107	70 - 130	<20	ug/g	0.89	35
8303878	Redox Potential	2022/10/26			100	95 - 105			5.4	N/A
8310746	Sulphide	2022/10/27	52 (1)	75 - 125	100	75 - 125	<0.5	mg/kg		
8319509	Moisture-Subcontracted	2022/10/27					<0.30	%	7.3	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.



BUREAU  
VERITAS

Bureau Veritas Job #: C2U6020

Report Date: 2022/11/01

exp Services Inc

Client Project #: ADM-22000797-A0

Site Location: Hwy 401 from Victoria to Nelson Ave, ON

Sampler Initials: IB

## VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

---

Cristina Carriere, Senior Scientific Specialist

---

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

---

Veronica Falk, B.Sc., P.Chem., QP, Scientific Specialist, Organics

---

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by {0}, {1} responsible for {2} {3} laboratory operations.



Bureau Veritas  
6740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel: (905) 817-5700 Toll-free 800-563-6266 Fax: (905) 817-5777 www.bvna.com

# CHAIN OF CUSTODY RECORD

Page 1 of 1

<b>INVOICE TO:</b>		<b>REPORT TO:</b>		<b>PROJECT INFORMATION:</b>		<b>Laboratory Use Only:</b>	
Company Name: #17488 exp Services Inc		Company Name: <u>EXP Services</u>		Quotation #: C20328		Bureau Veritas Job #:	
Attention: Accounts Payable		Attention: Nimesh Tamrakar		P.O. #:		Bottle Order #:	
Address: 1595 Clark Blvd		Address:		Project: ADM-22000797-A0		COC #:	
Brampton ON L6T 4V1				Project Name: Hwy 401 from Victoria to Nelso		Project Manager:	
Tel: (905) 793-9800 Fax: (905) 793-0641		Tel: (905) 796-3200 Ext: 3026 Fax:		Site #:		Patricia Legette	
Email: AP@exp.com; Karen.Burke@exp.com		Email: Nimesh.Tamrakar@exp.com		Sampled By:		C#893860-04-01	

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS DRINKING WATER CHAIN OF CUSTODY

<b>Regulation 153 (2011)</b>			<b>Other Regulations</b>			<b>Special Instructions</b>		
<input type="checkbox"/> Table 1	<input type="checkbox"/> Res/Park	<input type="checkbox"/> Medium/Fine	<input type="checkbox"/> CCME	<input type="checkbox"/> Sanitary Sewer Bylaw				
<input type="checkbox"/> Table 2	<input type="checkbox"/> Ind/Comm	<input type="checkbox"/> Coarse	<input type="checkbox"/> Reg 558	<input type="checkbox"/> Storm Sewer Bylaw				
<input type="checkbox"/> Table 3	<input type="checkbox"/> Agri/Other	<input type="checkbox"/> For RSC	<input type="checkbox"/> MISA	Municipality				
<input type="checkbox"/> Table			<input type="checkbox"/> PWQO	Reg 406 Table				
<input type="checkbox"/> Other								
Include Criteria on Certificate of Analysis (Y/N)?								
Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle):	Metals / Hg / Cr VI	Soil Corrosivity Package	ANALYSIS REQUESTED (PLEASE BE SPECIFIC)
1	BH22-2-1 SS13	2022/10/12		SOIL	✓		✓	
2	BH22-2-1 SS13	2022/10/12		SOIL	✓		✓	
3				SOIL				
4				SOIL				
5				SOIL				
6				SOIL				
7								
8								
9								
10								

Turnaround Time (TAT) Required:  
Please provide advance notice for rush projects

**Regular (Standard) TAT:**  
(will be applied if Rush TAT is not specified):  
Standard TAT = 5-7 Working days for most tests.  
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

**Job Specific Rush TAT (if applies to entire submission)**  
Date Required: Time Required:  
Rush Confirmation Number: (call lab for #)

# of Bottles: Comments:

20-Oct-22 12:51

Patricia Legette



C2U6020

AVO ENV 511

* RELINQUISHED BY: (Signature/Print)		Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)		Date: (YY/MM/DD)	Time	# Jars used and not submitted	Laboratory Use Only		
<u>[Signature]</u> Juan Barua		22/10/20		<u>[Signature]</u> / Anmol		20/10/20	12:51		Time Sensitive	Temperature (°C) on Reel	Custody Seal
										1/2/1	Present
											Intact
											Yes
											No

\* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BUREAU VERITAS'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVNA.COM/TERMS-AND-CONDITIONS.

\* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

\*\* SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVNA.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS

White: Bureau Veritas Yellow: Client





Your Project #: Campobello job# C2U6020

**Attention: Patricia Legette**

BUREAU VERITAS  
CAMPOBELLO  
6740 CAMPOBELLO ROAD  
MISSISSAUGA, ON  
CANADA L5N 2L8

**Report Date: 2022/11/01**

Report #: R3257319

Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C282985**

**Received: 2022/10/21, 16:00**

Sample Matrix: Soil  
# Samples Received: 1

Analyses	Date		Date Analyzed	Laboratory Method	Analytical Method
	Quantity	Extracted			
Moisture	1	N/A	2022/10/27	AB SOP-00002	CCME PHC-CWS m
Sulphide	1	2022/10/26	2022/10/27	AB SOP-00080	EPA9030B/SM4500S2-DF

**Remarks:**

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

\* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.



Your Project #: Campobello job# C2U6020

**Attention: Patricia Legette**

BUREAU VERITAS  
CAMPOBELLO  
6740 CAMPOBELLO ROAD  
MISSISSAUGA, ON  
CANADA L5N 2L8

**Report Date: 2022/11/01**

Report #: R3257319

Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C282985**

**Received: 2022/10/21, 16:00**

**Encryption Key**

Please direct all questions regarding this Certificate of Analysis to:  
Customer Solutions, Western Canada Customer Experience Team  
Email: customersolutionswest@bureauveritas.com  
Phone# (403) 291-3077

=====

This report has been generated and distributed using a secure automated process.

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Scott Cantwell, General Manager responsible for Alberta Environmental laboratory operations.



BUREAU  
VERITAS

Bureau Veritas Job #: C282985

Report Date: 2022/11/01

BUREAU VERITAS

Client Project #: Campobello job# C2U6020

Sampler Initials: I.B

### RESULTS OF CHEMICAL ANALYSES OF SOIL

<b>Bureau Veritas ID</b>		BFB941		
<b>Sampling Date</b>		2022/10/12		
	<b>UNITS</b>	<b>BH22-2-1 SS13</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Misc. Inorganics</b>				
Sulphide	mg/kg	2.8 (1)	0.5	A773361
RDL = Reportable Detection Limit				
(1) Sample extracted past method-specified hold time. Analyzed past method specified hold time				



BUREAU  
VERITAS

Bureau Veritas Job #: C282985

Report Date: 2022/11/01

BUREAU VERITAS

Client Project #: Campobello job# C2U6020

Sampler Initials: I.B

### PHYSICAL TESTING (SOIL)

<b>Bureau Veritas ID</b>		BFB941	BFB941		
<b>Sampling Date</b>		2022/10/12	2022/10/12		
	<b>UNITS</b>	<b>BH22-2-1 SS13</b>	<b>BH22-2-1 SS13 Lab-Dup</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Physical Properties</b>					
Moisture	%	9.2	9.9	0.30	A774882
RDL = Reportable Detection Limit					
Lab-Dup = Laboratory Initiated Duplicate					

## Appendix F – Previous Investigation Borehole Logs

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 10

FOUNDATION SECTION

JOB 66-F-89 LOCATION Hwy. 401 & C.P.R. (Sta. 322 + 22 155' Rt.) ORIGINATED BY V.K.  
W.P. 257-61 BORING DATE December 2, 1966 COMPILED BY V.K.  
DATUM Geodetic BOREHOLE TYPE Pen-Drill Auger CHECKED BY \_\_\_\_\_

SOIL PROFILE		STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	WATER CONTENT %			
586.7	GROUND LEVEL											
0.0	(Brown)											
			1	SS	32							
			2	SS	100/6"	580						Gr. 2, Sa. 48 Si. 38 Cl. 12
			3	SS	100/6"							
	Silty sand to sandy silt with trace of clay and occasional gravel.		4	SS	116							Gr. 1, Sa. 46 Si. 44 Cl. 9
			5	SS	100/6"	570						
			6	SS	100/5"							
	Dense to very dense.		7	SS	100/6"	560						
			8	SS	100/5"							
			9	SS	100/6"	550						
			10	SS	124							
			11	SS	84	540						
			12	SS	63							
			13	SS	62	530						
525.2			14	SS	69							
61.5	End of Borehole					520						

## RECORD OF BOREHOLE NO. 11

FOUNDATION SECTION

MATERIALS &amp; TESTING DIVISION

JOB 66-F-89

LOCATION Hwy. 401 &amp; C.P.R., Sta. 321 / 02, 131' Rt.

ORIGINATED BY V.K.

W.P. 257-61

BORING DATE December 2, 1966

COMPILED BY V.K.

DATUM Geodetic

BOREHOLE TYPE Drive BX Casing &amp; Wash

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— w <sub>L</sub> PLASTIC LIMIT ——— w <sub>p</sub> WATER CONTENT ——— w			BULK DENSITY Y P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	w <sub>p</sub> ——— w ——— w <sub>L</sub>				
							SHEAR STRENGTH P.S.F.					WATER CONTENT % 10      20      30				
583.0	GROUND LEVEL															
0.0	(Brown)					580										
	Clayey silt with pockets of silty sand and trace of gravel.  Very Stiff to Hard		1	SS	28											
			2	SS	84											
			3	SS	100/6"											
			4	SS	111	570										
			5	SS	100/5"											
			6	SS	100/6"	560										
			7	SS	100/5"											
			8	SS	85	550										
			9	SS	34											
545.0																
38.0	Silty sand to sandy silt, occasional gravel.  Very Dense.		10	SS	100/6"	540										
			11	SS	126											
531.5			12	SS	106											
51.5	End of Borehole					530										

Clayey silt with pockets of silty sand and trace of gravel.

Very Stiff to Hard

Gr.2, Sa.47  
Si.38  
Cl.13Gr.6, Sa.45  
Si.38  
Cl.11

El.553.

Gr.0, Sa.91  
Si.&Cl. 9