



**THURBER** ENGINEERING LTD.

**FOUNDATION INVESTIGATION REPORT  
ROUGE RIVER NBL AND SBL BRIDGES  
REPLACEMENT AND WIDENING  
HIGHWAY 404 HOV LANE EXPANSION AND REHABILITATION  
CONTRACT 2  
MARKHAM, ONTARIO  
SITES 37-347/1 AND 34-347/2  
G.W.P. 2930-17-00**

**GEOCRES NO. 30M14-485**

**Latitude 43.874108  
Longitude -79.377594**

**Report**

to

**WSP Canada Inc.**

Date: January 23, 2019  
File: 15786



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**PART 1: FACTUAL INFORMATION**

**1. INTRODUCTION**

This report presents the factual findings obtained from a foundation investigation conducted for the design and construction of the proposed replacement and widening of the existing mainline bridge structures at the crossing of Highway 404 over the Rouge River in the Regional Municipality of York, Ontario. The proposed works form a part of the project which includes rehabilitation and widening of Highway 404 with the addition of one High Occupancy Vehicle (HOV) lane in each direction from 407 ETR to Stouffville Road.

The purpose of the investigation was to explore the subsurface conditions at the site and, based on the data obtained, provide a borehole location plan, borehole logs, stratigraphic profiles and cross-sections, and a written description of the subsurface conditions. A model of the subsurface conditions was developed to describe the geotechnical conditions influencing design and construction of the foundations and approach embankments for the structures.

Thurber was retained by WSP Canada Inc. (WSP) to carry out this foundation investigation under the Ministry of Transportation Ontario (MTO) Assignment Number 2016-E-0014.

Reference has been made to information on subsurface conditions contained in previous foundation reports prepared for this site. The titles of these reports are:

Client: WSP  
File No.: 15786

E file: H:\15000-15999\15786 Hwy 404 Widening 2016-E-0014\Reports and Memos\Contract 2\Rouge River\FINAL\15786 Rouge River Hwy 404  
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- Preliminary Foundation Investigation and Design Report for Rouge River Bridges, Highway 404 HOV Lane Expansion from Highway 407 to Green Lane, WO 03-20024, Regional Municipality of York, Ontario, prepared by Peto MacCallum Ltd., PML Ref. 14TF003A-RR, Index No. 039FIDR, GEOCRES No. 30M14-416, dated May 27, 2015. (Reference 1).
- Foundation Investigation Report for Proposed Structure at the Crossing of Highway 404 and the Rouge River Diversion, Township of Markham, County of York, District No. 6, (Toronto), W.O. 70-11104, W.P. 107-62, GEOCRES 30M14-51, dated February 1971.

## **2. PROJECT AND SITE DESCRIPTION**

The project involves replacement and inside widening (into the median of the existing bridges) of the northbound and southbound lane (NBL and SBL) bridges located at the crossing of Highway 404 over Rouge River.

The site is located approximately 1.0 km north of the Highway 404 and 16<sup>th</sup> Avenue interchange in Markham, Ontario (Regional Municipality of York). The approximate location of the proposed bridge replacement and widening is shown on the key plan on the Borehole Locations and Soil Strata Drawing in Appendix E.

The land use adjacent to the site is largely rural and agricultural, although there is increasing residential and commercial development in recent years. The vegetation cover beyond the paved areas of the highway comprises grass, bushes and stands of trees.

At the site location, the Rouge River runs in a west to east direction and its channel is approximately 6.0 m wide and 3.0 m deep. Photographs of the site and surrounding areas are presented in Appendix D.

The site is located within the physiographic region known as the Peel Plain. The topography is flat to gently undulating. The soil cover in the region typically comprises silty clay glacial tills with sand and silt layers. Shale bedrock of the Georgian Bay Formation is anticipated at an approximate depth of 50 m.





### **3. SITE INVESTIGATION AND FIELD TESTING**

The current borehole investigation and field testing program for this site was carried out from April 10 to May 25, 2018 and consisted of drilling and sampling ten (10) boreholes, designated as Boreholes R-01 to R-10. Boreholes were drilled near the locations of the foundation elements and approaches.

Six boreholes (labelled R-03 to R-08) were drilled near the proposed north and south abutments ranging in depth from 23.1 m to 26.3 m (Elevations 176.9 to 180.4). Four boreholes (labelled R-01, R-02, R-09 and R-10), were drilled near the immediate approaches. Termination depths for the approach boreholes ranged from 16.9 m to 25.0 m (Elevations 178.1 to 186.6). The records of borehole sheets for the current investigation are included in Appendix A.

A preliminary geotechnical investigation was carried out at this site between October 5 to 8, 2014 (Reference 1), and consisted of advancing two boreholes (labelled RR-1 and RR-2). Boreholes, RR-1 and RR-2 were drilled within the median near the south and north abutments of the Highway 404 bridges. The depths of the boreholes were 20.0 m and 20.1 m (Elevations 182.9 to 183.1). The Record of Borehole sheets for the boreholes from this preliminary investigation are included in Appendix C.

Five boreholes (numbered 1 to 5) were drilled within the river floodplain during the investigation conducted in 1971 (Reference 2). The boreholes were terminated at depths ranging from 6.1 m to 9.6 m (Elevations 188.3 to 184.9). Records of Boreholes 1 to 5 are also included in Appendix C.

Lane closures and traffic control were planned for drilling each borehole for the current investigation. Prior to commencement of drilling, utility clearances were obtained for all borehole locations.

The approximate locations of the boreholes from the current and previous investigations are shown on the Borehole Locations and Soil Strata Drawing included in Appendix E. The coordinates and elevations of the boreholes are given on this drawing and on the individual Record of Borehole Sheets in Appendices A and C. Northing and easting co-ordinates at the current borehole locations were obtained by Thurber using a GPS unit, and the corresponding ground surface elevations were provided by WSP based on the project DTM survey. The survey data of the boreholes meet the precision requirements set out in the terms of reference.



The current boreholes were advanced using a truck-mounted D-90 drill rig and track-mounted D-53 and BM-2 drill rigs. Hollow stem augers were used to advance the boreholes, and soil samples were obtained at selected intervals using a 50-mm diameter split spoon sampler in conjunction with the Standard Penetration Test (SPT). The tricone method was also used to advance Borehole R-09 beyond 16.5 m depth (Elevation 186.7).

A member of Thurber's technical staff supervised the drilling and sampling operations on a full-time basis. The supervisor logged the boreholes, visually examined the recovered soil samples, and transported them to Thurber's laboratory for further examination and testing.

Groundwater conditions in the open boreholes were observed throughout the current drilling operations. Two standpipe piezometers were installed during the current investigation at the south and north abutments, to permit monitoring of groundwater levels. The standpipe piezometers consisted of a 19 mm diameter Schedule 40 PVC pipe with a 3.0 m long slotted screen and were installed within a column of filter sand. Upon completion, the boreholes were abandoned in general accordance with Ontario Regulation 903 amended by Ontario Reg. 372 (O.Reg. 903). Once the final readings are taken, the piezometers will be decommissioned in general accordance with O.Reg. 903. The details of current borehole completion are summarized in Table 3.1.

Two piezometers were also installed during the 2014 investigation (Reference 1) near the north and south abutments of the Highway 404 NBL and SBL bridges.

**Table 3.1 – Borehole Completion Details**

Foundation Unit		Borehole	Borehole Depth / Base Elevation (m)	Piezometer Tip Depth/ Elevation (m)	Completion Details
Hwy 404	North approach	R-01	24.6/179.0	None installed	Borehole caved to 13.4 m. Borehole backfilled with auger cuttings to 7.6 m, bentonite holeplug to 1.2 m, concrete to 0.2 m, then asphalt cold patch to surface.
SBL	North abutment	R-03	23.1/180.4	None installed	Borehole caved to 11.6 m. Borehole backfilled with bentonite holeplug to 2.4 m,

Hwy 404 SBL	South abutment				grout to 1.5 m, concrete to 0.3m, then asphalt cold patch to surface.
		R-06	26.3/176.9	None installed	Borehole caved to 15.8 m. Borehole backfilled with auger cuttings to 9.1 m, bentonite holeplug to 1.5 m, concrete to 0.3 m, then asphalt to surface.
		R-07	24.7/177.9	24.4/178.2	Piezometer with 3.0 m slotted screen installed with sand filter from 24.7 m to 20.7 m, bentonite holeplug from 20.7 m to 12.2 m, bentonite mixed with auger cuttings from 12.2 m to ground surface.
	South approach	R-09	21.9/181.3	None installed	Borehole caved to 12.5 m. Borehole backfilled with auger cuttings to 7.6 m, bentonite holeplug to 1.5 m, concrete to 0.3 m, then asphalt cold patch to surface.
Hwy 404 NBL	North approach	R-02	16.9/186.6	None installed	Borehole backfilled with auger cuttings to 6.1 m, bentonite holeplug to 0.8 m, concrete to 0.3 m, then asphalt cold patch to surface.
	North abutment	R-04	25.0/177.9	15.2/187.7	Borehole caved to 15.2 m. Piezometer with 3.0 m slotted screen installed with sand filter from 15.2 m to 10.9 m, bentonite from 10.9 m to 6.1 m, bentonite mixed with auger cuttings from 6.1 m to ground surface.
		R-05	24.5/179.0	None installed	Borehole caved to 16.8 m. Borehole backfilled with auger cuttings to 12.2 m, bentonite holeplug to 1.2 m, concrete to 0.3 m, then asphalt cold patch to surface.

	South abutment	R-08	24.6/178.5	None installed	Borehole caved to 14.6 m. Borehole backfilled with cuttings to 7.6 m, bentonite holeplug to 1.5 m, concrete to 0.3 m, then asphalt cold patch to surface.
	South approach	R-10	25.0/178.1	None installed	Borehole caved to 16.5 m. Borehole backfilled with cuttings to 10.7 m, bentonite holeplug to 1.8 m, concrete to 0.3 m, then asphalt cold patch to surface.

#### 4. LABORATORY TESTING

The recovered soil samples were subjected to Visual Identification (VI) and to natural moisture content determination. Selected samples were also subjected to grain size analysis and Atterberg Limits testing. All the laboratory tests were carried out in accordance with MTO and/or ASTM Standards, as appropriate. The results of the laboratory testing of current and previous investigations are summarized on the Record of Borehole sheets in Appendices A and C, and also presented on the figures included in Appendices B and C.

In order to assess the potential for sulphate attack on concrete foundations, as well as the potential for metal corrosion associated with the structure, a sample of the existing native soil was collected. The sample was submitted to SGS Canada Inc., a CALA accredited analytical laboratory in Lakefield, Ontario, for analytical testing of corrosivity parameters and sulphate content. The results of the analytical testing are summarized in Section 6 and are presented in Appendix B.

#### 5. DESCRIPTION OF SUBSURFACE CONDITIONS

Reference is made to the Record of Borehole sheets in Appendix A for details of the encountered soil stratigraphy. Soil profiles along the Highway 404 NBL and SBL bridge alignments are presented on the "Borehole Locations and Soil Strata" drawing in Appendix E. An overall description of the stratigraphy is given in the following paragraphs. However, the factual data presented in the Record of Borehole sheets governs any interpretation of the site



conditions. It must be recognized that soil conditions may vary between and beyond borehole locations.

Boreholes RR-1 and RR-2 from the preliminary investigation conducted in 2014 (Reference 1) have been incorporated in this report.

In general, the subsurface conditions encountered in the boreholes consist of pavement structure over embankment fill which typically consists of layers of sands and silts, and silty clay to clayey silt. Below the fill, an extensive deposit of compact to very dense sand to silty sand overlies dense to very dense sand and silt till with lenses of very dense gravelly sand. The site is underlain by hard silty clay till. The groundwater level is at greater than 9 m depth across the site.

More detailed descriptions of the individual stratum are presented below.

## **5.1 Topsoil**

A 300 mm thick layer of topsoil was encountered surficially in Borehole RR-2 which was located within the median near the north abutment of the Highway 404 SBL structure.

The topsoil thickness may vary between and beyond the borehole locations, and the data is not intended for the purpose of estimating quantities.

## **5.2 Pavement Structure**

Pavement structure consisting of approximately 150 mm to 300 mm of asphalt overlying granular (sand and gravel fill) road base was encountered in Boreholes R-01 to R-03, R-05, R-06, and R-08 to R-10 drilled on the Highway 404 platform. A layer of concrete (approach slab), ranging in thickness from 320 mm to 350 mm, was contacted below the asphalt in Boreholes R-05, R-06 and R-08,

The thickness of the granular road fill, where measured in Boreholes R-01 and R-02, ranged between 300 mm and 700 mm.



### 5.3 Embankment Fill

Embankment fill was contacted below the pavement structure in Boreholes R-01 to R-03, R-05, R-06 and R-08 to R-10 and surficially in Boreholes R-04, R-07, RR-1 and RR-2. The embankment fill generally consists of layers of cohesionless and cohesive soils.

Brown to grey silty clay to clayey silt fill containing some to with sand and trace gravel, was encountered at both embankments surficially, and also at depths ranging from 0.2 m to 5.8 m. The thickness of the silty clay fill ranged from 2.7 m to 9.5 m. The depths to the base of this fill ranged from 8.5 m to 10.0 m (Elevations 193.2 to 194.8). A 900 mm thick layer of silty clay fill was encountered at 4.0 m depth within the sand and silt fill in Borehole R-10.

In Boreholes R-05 to R-10, the cohesionless fill consists of varying proportions of sand, silt and gravel, trace clay and occasional cobbles. This fill was brown in colour, and was contacted surficially and at depths ranging from 0.2 m to 0.5 m. The thickness of the cohesionless fill ranged from 3.8 m to 7.6 m. The depth to the base of the cohesionless fill varied from 4.3 m to 8.8 m (Elevations 194.3 to 198.9). Layers of sand and silt fill, ranging in thickness from 0.9 m to 1.4 m were encountered at depths of 1.1 m to 3.0 m in Boreholes R-01, R-02 and RR-1.

SPT 'N' values for the silty clay fill ranged from 4 to 57 blows per 0.3 m penetration, indicating a firm to hard consistency. Moisture contents measured in this fill ranged from 2 percent to 22 percent.

SPT 'N' values for the cohesionless fill layer typically ranged from 4 to 75 blows per 0.3 m penetration indicating a loose to very dense state. An SPT 'N' value of 100 blows for less than 0.3 m of penetration infers the presence of cobbles near Elevation 197.8 in Borehole R-07. Occasional cobbles were noted in the fill in Borehole R-06. Measured moisture contents of sand, sand and silt, sand and gravel and silt fill samples ranged from 2 percent to 20 percent.

The results of grain size distribution analyses carried out on selected samples of the fill are presented on the Record of Borehole sheets included in Appendices A and C, and on Figures B1 to B3 of Appendix B, and on Figure RR-GS-1 in Appendix C. The results of the grain size distribution analyses are summarized below:

Soil Particle	Silty Clay to Clayey Silt Fill (percent)	Sand to Sand and Silt Fill (percent)	Sand and Gravel Fill (percent)
Gravel	0 to 5	0 to 2	34
Sand	27 to 50	16 to 72	49
Silt	27 to 40	49 to 75	-
Clay	17 to 37	4 to 9	-
Silty and Clay	-	26	17

The results of Atterberg Limits tests conducted on samples of the silty clay fill are provided on the Record of Borehole sheets in Appendices A and C, and illustrated in Figure B10 of Appendix B and on Figure RR-PC-1 of Appendix C. The results are summarized as follows:

Index Property	Percentage (%)
Liquid Limit	18 to 35
Plasticity Index	7 to 19

The results of the Atterberg Limits testing indicate the silty clay to clayey silt fill is of low plasticity with group symbols CL.

#### 5.4 Organics

A layer of dark brown organics was contacted below the embankment fill at depths ranging from 9.6 m to 9.8 m in Boreholes R-02, R-03 and R-04. The thickness of the organics ranged from 300 mm to 600 mm. The depth to the base of the organics varied from 10.0 m to 10.4m (Elevations 192.9 to 193.5).

#### 5.5 Sand to Silty Sand

A deposit of typically fine grained sand to silty sand containing trace to some gravel and trace to some clay was encountered in all boreholes below the fill at depths ranging from 8.5 m to 11.7 m. The thickness of the cohesionless deposit ranged from 3.1 m to 9.2 m. Occasional zones of silt or sand and silt were encountered at 8.8 m and 9.1 m depths in Boreholes R-01 and RR-2, respectively. The depths to the base of the sand to silty sand varied from 11.8 m to 17.7 m (Elevations 185.5 to 191.3).



SPT 'N' values for the sand to silty sand ranged from 12 to 94 blows per 0.3 m penetration, indicating a compact to very dense state. Occasional SPT 'N' values greater than 100 blows for less than 0.3 m of penetration infer the presence of cobbles within the cohesionless layers. Moisture contents measured in the sand to silty sand ranged from 9 percent to 23 percent.

Resistance to augering was encountered in Boreholes R-03 and R-07 at depths ranging from 5.8 m to 16.5 m (Elevations 196.8 to 186.1), and also in Borehole R-09 below 16.5 m to 19.4 m depth (Elevations 186.7 to 183.8).

The results of grain size distribution analyses carried out on selected samples of the sand and silt, sand to silty sand are presented on the Record of Borehole sheets included in Appendices A and C, on Figure B4 of Appendix B, and on Figure RR-GS-2 in Appendix C. The results of the grain size distribution analyses are summarized below:

Soil Particle	Sand Silty Sand (percent)	Silt (percent)	Sand and Silt (percent)
Gravel	0 to 11	0	0
Sand	72 to 95	10	39
Silt	10 to 20	73	53
Clay	3	17	8
Silt and Clay	4 to 28	-	-

The results of Atterberg Limits tests conducted on a sample of the silt are provided on the Record of Borehole sheets in Appendix C, and illustrated in Figure RR-PC-2 of Appendix C. The results are summarized as follows:

Index Property	Percentage (%)
Liquid Limit	19
Plasticity Index	3

The results of the Atterberg Limits testing indicate that the silt is slightly plastic with a group symbol ML.





## 5.6 Gravelly Sand

Layers of brown to grey gravelly sand containing trace silt and trace clay were contacted below the cohesionless soils at depths ranging from 11.8 m to 14.5 m in Boreholes R-02, R-04 and R-08. The thickness of the gravelly sand layer varied from 1.2 m to 2.1 m. The depth to the base of the gravelly sand varied from 13.0 m to 16.6 m (Elevations 186.3 to 190.1).

SPT 'N' values for the gravelly sand layers ranged from 27 blows per 0.3 m penetration to greater than 100 blows for less than 0.3 m of penetration, indicating a compact to very dense state. Moisture contents measured in the gravelly sand ranged from 12 percent to 13 percent.

The results of grain size distribution analyses carried out on selected samples of the gravelly sand are presented on the Record of Borehole sheets included in Appendices A and on Figure B6 of Appendix B. The results of the grain size distribution analyses are summarized below:

Soil Particle	Gravelly sand (percent)
Gravel	20 to 28
Sand	60 to 75
Silt and Clay	5 to 12

## 5.7 Sand and Silt to Sandy Silt Till

Grey sand and silt till to sandy silt till containing trace gravel, trace clay and occasional cobbles was contacted at depths varying between 14.8 m and 17.2 m in Boreholes R-01, R-03, R-06, R-07 and R-09. The thickness of this cohesionless till varied from 1.6 m to 3.5 m. The depth to the base of this till ranged from 17.7 m to 20.7 m (Elevations 182.8 to 185.9).

SPT 'N' values for the sand and silt to sandy silt till range from 36 blows per 0.3 m of penetration to greater than 100 blows for less than 0.3 m of penetration, indicating a dense to very dense state. Moisture contents measured in this till ranged from 10 percent to 25 percent.

The results of grain size distribution analyses carried out on selected samples of the sand and silt to sandy silt till are presented on the Record of Borehole sheets included in Appendix A,



and on Figure B7 of Appendix B. The results of the grain size distribution analyses are summarized below:

Soil Particle	Sandy Silt Till (percent)
Gravel	0 to 12
Sand	26 to 50
Silt	32 to 59
Clay	4 to 16

Glacial tills inherently contain cobbles and boulders.

### 5.8 Silty Clay Till

An upper and a lower deposit of brown to grey silty clay till with sand and containing trace gravel and occasional cobbles were encountered below the cohesionless soils at this site.

The upper silty clay till was encountered in Boreholes R-03 and R-05 at 10.0 m and 8.7 m depths, respectively. The thickness of the upper silty clay till varied from 1.7 m to 3.0 m. The lower silty clay till was contacted at depths ranging from 13.0 m to 20.7 m. All the boreholes were terminated within the lower silty clay till at depths ranging from 16.9 m to 26.3 m (Elevations 176.9 to 186.6).

It is noted that Boreholes RR-1 and RR-2 from Reference 1 have described this deposit as clayey silt till. Despite the presence of some clayey silt zones, it is considered appropriate to describe this deposit as silty clay till based on laboratory testing results and visual observations.

SPT 'N' values in the upper silty clay till ranged from 8 to 23 blows per 0.3 m penetration, indicating a stiff to very stiff consistency. SPT 'N' values measured in the lower silty clay till ranged from 44 blows per 0.3 m penetration to greater than 100 blows for less than 0.3 m of penetration, indicating a hard consistency. Moisture contents measured in the silty clay till ranged from 8 percent to 33 percent.

The results of grain size distribution analyses carried out on selected samples of the silty clay till are presented on the Record of Borehole sheets included in Appendices A and C, on



Figures B8 and B9 of Appendix B, and on Figure RR-GS-3 of Appendix C. The results of the grain size distribution analyses are summarized below:

Soil Particle	Silty Clay Till Percentage (%)
Gravel	0 to 2
Sand	0 to 23
Silt	33 to 63
Clay	23 to 65

The results of Atterberg Limits tests conducted on samples of the cohesive till are presented on the Record of Borehole sheets in Appendices A and C, and illustrated in Figure B11 of Appendix B and on Figure RR-PC-3 in Appendix C. The results are summarized as follows:

Index Property	Percentage (%)
Liquid Limit	26 to 52
Plasticity Index	13 to 32

The results of the Atterberg Limits testing indicate that the silty clay till has slight to medium plasticity with group symbols CL-ML (clayey silt zone), CL and CI. Occasional zones of high plasticity, group symbol CH, are also present.

Glacial tills inherently contain cobbles and boulders.

## 5.9 Groundwater Conditions

Groundwater levels in the boreholes were observed during the drilling operations and measured upon completion of drilling. Standpipe piezometers were installed in Boreholes R-04 and R-07 to permit monitoring of groundwater levels. During a previous investigation (Reference 1), two piezometers were installed in Boreholes RR-1 and RR-2. Water levels measured in the four installed standpipes and open boreholes are presented in Table 5.1 below.



**Table 5.1- Groundwater Level Measurements**

Foundation Unit		Borehole	Date	Groundwater Level		Comments
				Depth (m)	Elevation (m)	
Hwy 404 SBL	North approach	R-01	April 11, 2018	11.7	191.9	Open borehole
	North abutment	R-03	April 13, 2018	12.5	191.0	Open borehole
		RR-2	October 6, 2014 December 18, 2014	10.1 9.9	193.1 193.3	Open borehole Piezometer
	South abutment	R-06	April 30, 2018	11.4	191.8	Open borehole
		R-07	June 22, 2018	9.3	193.3	Piezometer
	South approach	R-09	April 24, 2018	11.6	191.6	Open borehole
Hwy 404 NBL	North approach	R-02	May 14, 2018	11.6	191.9	Open borehole
	North abutment	R-04	May 25, 2018 June 22, 2018	11.6 9.5	191.3 193.4	Open borehole Piezometer
		R-05	May 11, 2018	9.8	193.7	Open borehole
	South abutment	R-08	May 17, 2018	11.6	191.5	Open borehole
		RR-1	October 8, 2014 December 18, 2014	10.1 9.4	192.8 193.5	Open borehole Piezometer
	South approach	R-10	May 2, 2018	10.2	192.9	Open borehole

The values shown in Table 5.1 are short-term readings, and seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after periods of significant or prolonged precipitation.

The General Arrangement (GA) drawings provided by WSP indicate that the water levels at the Rouge River are reported to be at the following elevations:

- 100-year water level – Elevation 194.5
- High water level (Regional) – Elevation 195.5
- Normal water level – Elevation 192.4

The measured groundwater levels are generally consistent with the normal river water level.

## 6. CORROSIVITY TEST RESULTS

Samples of the silty clay fill, silty clay till and sand and silt till from Boreholes R-03, R-05, R-08 and R-09 were submitted for analytical testing of corrosivity parameters and sulphate. The results of the analytical tests are shown in Table 6.1 below. The laboratory certificates of analysis are presented in Appendix B.

**Table 6.1- Analytical Test Results**

Parameter	Units (Soil)	Test Results			
		R-03 SS 4 Depth 3.0 m	R-05 SS 16 Depth 21.3 m	R-08 SS 6 Depth 6.1 m	R-09 SS 13 Depth 16.8 m
		Silty Clay Fill	Silty Clay Till	Silty Clay Fill	Sand and Silt Till
Sulphide	%	<0.02	<0.02	<0.02	0.02
Chloride	µg/g	910	24	200	11
Sulphate	µg/g	110	92	40	78
pH	-	9.13	9.24	8.41	8.99
Electrical Conductivity	µS/cm	1180	162	291	153
Resistivity	Ohm.cm	847	6170	3440	6520
Redox Potential	mV	219	210	255	259

## 7. MISCELLANEOUS

Thurber staked and/or marked the borehole locations in the field and obtained utility clearances prior to drilling. Thurber obtained the northing and easting coordinates at this site, and WSP provided the ground surface elevations.

Walker Drilling of Utopia, Ontario, supplied and operated a truck-mounted D-90 drill rig, track-mounted D-53 and BM-2 drill rigs, to carry out the drilling, sampling and in-situ testing operations for the boreholes.



The drilling and sampling operations in the field were supervised on a full-time basis by Mr. Saeed Bastan of Thurber. Geotechnical laboratory testing was carried out by Thurber in its MTO-approved laboratory. Overall supervision of the field program was carried out by Mr. Stephane Loranger, CET.

Overall project management was provided by Dr. Sydney Pang, P.Eng. Interpretation of the field data and preparation of this report was completed by Ms. Rocío Palomeque Reyna, P.Eng. The report was reviewed by Dr. Sydney Pang, P.Eng. and Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.



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File No.: 15786

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Date: January 23, 2019  
Page: 17 of 17



## **Appendix A**

### **Record of Borehole Sheets**

**(Present Site Investigation)**



## SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

### 1. TEXTURAL CLASSIFICATION OF SOILS

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

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

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

### 3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

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

NOTE: Hierarchy of Soil Strength Prediction

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

### 4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

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

### 5. LEGEND FOR RECORDS OF BOREHOLES

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

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


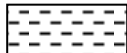



 Water Level  
 Shear Strength Determination by Pocket Penetrometer

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

# UNIFIED SOILS CLASSIFICATION

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

## EXPLANATION OF ROCK LOGGING TERMS

<u>ROCK WEATHERING CLASSIFICATION</u>		<u>SYMBOLS</u>	
<b>Fresh (FR)</b>	No visible signs of weathering.		
<b>Fresh Jointed (FJ)</b>	Weathering limited to the surface of major discontinuities.		CLAYSTONE
<b>Slightly Weathered (SW)</b>	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock material.		SILTSTONE
<b>Moderately Weathered (MW)</b>	Weathering extends throughout the rock mass, but the rock material is not friable.		SANDSTONE
<b>Highly Weathered (HW)</b>	Weathering extends throughout the rock mass and the rock is partly friable.		COAL
<b>Completely Weathered (CW)</b>	Rock is wholly decomposed and in a friable condition, but the rock texture and structure are preserved.		Bedrock (general)

<u>DISCONTINUITY SPACING</u>		<u>STRENGTH CLASSIFICATION</u>			
Bedding	Bedding Plane Spacing	Rock Strength	Approximate Uniaxial Compressive Strength		Field Estimation of Hardness*
			(MPa)	(psi)	
Very thickly bedded	Greater than 2m	Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Thickly bedded	0.6 to 2m				
Medium bedded	0.2 to 0.6m	Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Thinly bedded	60mm to 0.2m	Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Very thinly bedded	20 to 60mm				
Laminated	6 to 20mm	Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
Thinly Laminated	Less than 6mm				

<u>TERMS</u>					
Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length.	Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
Solid Core Recovery: (SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run.	Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
Rock Quality Designation: (RQD)	Total length of sound core recovered in pieces 0.1m in length or larger as a percentage of total core run length.	Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail
Uniaxial Compressive Strength (UCS)	Axial stress required to break the specimen				
Fracture Index: (FI)	Frequency of natural fractures per 0.3m of core run.				

## METRIC

[illegible]

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

ONTMT4S2 MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 1/16/19

## METRIC

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

# RECORD OF BOREHOLE No R-01

3 OF 3

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 408.4 E 314 605.8 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.04.10 - 2018.04.11 LATITUDE 43.874583 LONGITUDE -79.377988 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT  <b>γ</b>  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 TRIAXIAL    × LAB VANE							WATER CONTENT (%) W <sub>P</sub> W      W <sub>L</sub>				
	Continued From Previous Page							20	40	60	80	100							
179.0  <																			

# RECORD OF BOREHOLE No R-02

1 OF 2

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 392.7 E 314 653.8 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.05.11 - 2018.05.14 LATITUDE 43.874441 LONGITUDE -79.377391 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT  <b>γ</b>  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa											
203.5	GROUND SURFACE							20	40	60	80	100							
0.0	ASPHALT: (200mm)																		
0.2	SAND and GRAVEL Brown Moist (FILL)						203												
202.6																			
0.9	Silty CLAY, with sand, trace gravel Hard Brown Moist (FILL)		1	SS	40		202												
			2	SS	44														
			3	SS	30		201												
200.5																			
3.0	SAND and SILT, trace gravel Very Dense Brown Moist (FILL)		4	SS	52		200												
199.1							199												
4.4	Silty CLAY, with sand, trace gravel Hard Brown Moist (FILL)		5	SS	43		198												
			6	SS	57		197											2 38 39 21	
			7	SS	30		196												
							195												
			8	SS	42		194												
193.7																			
9.8	ORGANICS: (600mm)																		

Continued Next Page

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

# RECORD OF BOREHOLE No R-02

2 OF 2

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 392.7 E 314 653.8 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.05.11 - 2018.05.14 LATITUDE 43.874441 LONGITUDE -79.377391 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT      NATURAL MOISTURE CONTENT      LIQUID LIMIT			UNIT WEIGHT  <b>γ</b>  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL      × LAB VANE				WATER CONTENT (%) w <sub>P</sub> w      w <sub>L</sub>				GR	SA	SI	CL	
	Continued From Previous Page					▽		20	40	60	80	100		20	40	60				
193.1	<b>ORGANICS:</b> (600mm) Dark Brown Moist																			
10.4	Silty <b>SAND</b> , trace gravel Very Dense Brown Moist		9	SS	68									○						
			10	SS	76									○						
190.0																				
13.5	Gravelly <b>SAND</b> , trace silt, trace clay, occasional cobbles Very Dense Brown Wet		11	SS	100/ 0.225									○					24	71
																				5 (SI+CL)
			12	SS	100/ 0.075									○						
188.1																				
15.4	Silty <b>CLAY</b> , trace sand, trace gravel Hard Grey Wet (TILL)																			
186.6			13	SS	100/ 0.150								○							
16.9	END OF BOREHOLE AT 16.9m. WATER LEVEL AT 11.6m UPON COMPLETION. BOREHOLE BACKFILLED WITH AUGER CUTTINGS TO 6.1m, BENTONITE HOLEPLUG TO 0.8m, CONCRETE TO 0.3m, THEN ASPHALT COLD PATCH TO SURFACE.																			

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+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No R-03

1 OF 3

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 400.5 E 314 607.2 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.04.12 - 2018.04.13 LATITUDE 43.874512 LONGITUDE -79.377970 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT      NATURAL MOISTURE CONTENT      LIQUID LIMIT			UNIT WEIGHT  <b>γ</b>  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL      × LAB VANE				W <sub>P</sub> W      W <sub>L</sub> WATER CONTENT (%)				GR	SA	SI	CL	
203.5	GROUND SURFACE							20	40	60	80	100								
0.0	ASPHALT: (200mm)							20	40	60	80	100								
0.2	Silty <b>CLAY</b> , some to with sand, trace gravel Stiff to Very Stiff Brown Moist (FILL)						203													
			1	SS	12															
			2	SS	20		202													
			3	SS	11		201													
			4	SS	20		200													
			5	SS	8															
199.0	Grey						199													
4.5	Firm		6	SS	7												0	30	39	31
197.9							198													
5.6	Silty <b>CLAY</b> , with sand, trace gravel Stiff to Very Stiff Brown Moist (FILL)		7	SS	15		197													
			8	SS	8		196													
			9	SS	12		195													
193.8							194													
9.7	ORGANICS: (300mm)																			
193.5	Dark Brown																			

Continued Next Page

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

## METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT		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			20 40 60 80 100	20 40 60 80 100	W <sub>P</sub> W W <sub>L</sub>				
10.0	Continued From Previous Page  Silty <b>CLAY</b> , with sand, trace gravel, occasional cobbles Stiff Grey Moist (TILL)		10	SS	12	▽	193						Resistance to augering from 10.0m to 10.1m	
191.8							192							
11.7	Silty <b>SAND</b> , trace clay Compact to Dense Brown Wet		11	SS	12		191							0 72 28 (SI+CL)
							190							
			12	SS	33		189							
							188							
			13	SS	43		187							
							186							
							185							
			14	SS	78		184							
186.3	Very Dense											12 35 49 4		
17.2	<b>SAND</b> and <b>SILT</b> , some gravel, trace clay Very Dense Grey Wet (TILL)		15	SS	100/ 0.150									

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

## METRIC



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 (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE		WATER CONTENT (%) w <sub>p</sub> w w <sub>L</sub>			
182.8 20.7	Continued From Previous Page <b>SAND</b> and <b>SILT</b> , some gravel, trace clay Very Dense Grey Moist (TILL)  Silty <b>CLAY</b> , trace sand, trace gravel Hard Grey Moist (TILL)		16	SS	100/ 0.250								
180.4 23.1	END OF BOREHOLE AT 23.1m. BOREHOLE CAVED TO 11.6m AND WATER LEVEL AT 12.5m UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 2.4m, GROUT TO 1.5m, CONCRETE TO 0.3m THEN ASPHALT COLD PATCH TO SURFACE.		18	SS	100/ 0.125								

# RECORD OF BOREHOLE No R-04

1 OF 3

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 394.1 E 314 640.6 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.05.24 - 2018.05.25 LATITUDE 43.874453 LONGITUDE -79.377555 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					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 TRIAXIAL    × LAB VANE							PLASTIC LIMIT W <sub>P</sub> NATURAL MOISTURE CONTENT W      LIQUID LIMIT W <sub>L</sub>				
202.9	GROUND SURFACE							20	40	60	80	100							
0.0	Silty <b>CLAY</b> , with sand, trace gravel, occasional organics Firm to Very Stiff Brown Moist (FILL)		1	SS	16		202								○				
																○			
			2	SS	10											○			
			3	SS	7				201								○		
			4	SS	9				200								○		
			5	SS	6												○		
			6	SS	17		198								○				
							197												
			7	SS	17										○				
							196												
			8	SS	25		195								○				
							194												
			9	SS	16										○				
193.3																			
9.6	<b>ORGANICS:</b> (400mm) Dark Brown						193												
192.9																			

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

## METRIC

[illegible]

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

# RECORD OF BOREHOLE No R-04

3 OF 3

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 394.1 E 314 640.6 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.05.24 - 2018.05.25 LATITUDE 43.874453 LONGITUDE -79.377555 CHECKED BY RPR

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 TRIAXIAL × LAB VANE									
	Continued From Previous Page																
	Silty <b>CLAY</b> , trace sand, trace gravel Hard Grey Wet (TILL)		16	SS	100/ 0.200												
			17	SS	77											0 0 35 65	
			18	SS	100/ 0.200												
			19	SS	95												
177.9 25.0	END OF BOREHOLE AT 25.0m. WATER LEVEL AT 11.6m UPON COMPLETION. Well installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen.  WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2018.06.22 9.5 193.4 2018.09.30 9.5 193.4 2018.11.23 12.3 190.6																






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# RECORD OF BOREHOLE No R-05

1 OF 3

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 383.7 E 314 653.4 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.05.08 - 2018.05.11 LATITUDE 43.874360 LONGITUDE -79.377395 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT      NATURAL MOISTURE CONTENT      LIQUID LIMIT			UNIT WEIGHT  <b>γ</b>  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL      × LAB VANE				W <sub>P</sub> W      W <sub>L</sub> WATER CONTENT (%)				GR	SA	SI	CL
203.5	GROUND SURFACE							20	40	60	80	100							
0.0	ASPHALT: (150mm)																		
0.2	CONCRETE: (350mm)																		
203.0																			
0.5	SAND, trace silt, trace clay Compact Brown Moist (FILL)		1	SS	16		203							○					
			2	SS	18		202							○					
			3	SS	17		201							○					
			4	SS	13		200							○					
198.9							199												
4.6	Silty CLAY, with sand, trace gravel Firm to Very Stiff Grey Moist (FILL)		5	SS	8		198							○					
			6	SS	20		197							○					
			7	SS	5		196							○					
194.8							195												
8.7	Silty CLAY, with sand, trace gravel Very Stiff Grey Moist (TILL)		8	SS	23		194							○					

Continued Next Page

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

# RECORD OF BOREHOLE No R-05

2 OF 3

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 383.7 E 314 653.4 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.05.08 - 2018.05.11 LATITUDE 43.874360 LONGITUDE -79.377395 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT  <b>γ</b>  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
	Continued From Previous Page						20 40 60 80 100				PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				WATER CONTENT (%)			
							20 40 60 80 100				20 40 60			GR SA SI CL
191.8	Silty <b>CLAY</b> , with sand, trace gravel Stiff Grey Moist (TILL)		9	SS	8								0 23 33 44	
11.7	<b>SAND</b> , some gravel, trace silt Very Dense to Dense Brown Wet		10	SS	100/ 0.125									
			11	SS	45									
188.1	Silty <b>CLAY</b> , some sand, trace gravel Hard Grey Moist (TILL)		12	SS	71									
15.4														
			13	SS	100/ 0.300									
			14	SS	100/ 0.275									

Continued Next Page

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



# RECORD OF BOREHOLE No R-05

3 OF 3

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 383.7 E 314 653.4 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.05.08 - 2018.05.11 LATITUDE 43.874360 LONGITUDE -79.377395 CHECKED BY RPR

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 TRIAXIAL    × LAB VANE								
	Continued From Previous Page		15	SS	100/ 0.300											
	Silty <b>CLAY</b> , trace sand, trace gravel Hard Grey Moist (TILL)		16	SS	83											
			17	SS	100/ 0.150											
			18	SS	100/ 0.075											
179.0																
24.5	END OF BOREHOLE AT 24.5m. WATER LEVEL AT 9.8m UPON COMPLETION. BOREHOLE CAVED TO 16.8m, BACKFILLED WITH AUGER CUTTINGS TO 12.2m, BENTONITE HOLEPLUG TO 1.2m, CONCRETE TO 0.3m, THEN ASPHALT COLD PATCH TO SURFACE.															

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
5  
0  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No R-06

1 OF 3

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 329.1 E 314 620.0 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.04.27 - 2018.04.30 LATITUDE 43.873869 LONGITUDE -79.377812 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT      NATURAL MOISTURE CONTENT      LIQUID LIMIT			UNIT WEIGHT  <b>γ</b>  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20   40   60   80   100	W <sub>P</sub> W      W <sub>L</sub>	WATER CONTENT (%)			GR	SA		SI	CL		
203.2	GROUND SURFACE																		
0.0	ASPHALT: (180mm)						203												
0.2	CONCRETE: (320mm)																		
202.7																			
0.5	SAND and GRAVEL, trace to some silt and clay Compact to Dense Brown Moist (FILL)		1	SS	10		202												
			2	SS	15														
							201												
			3	SS	40														
	Occasional cobbles						200												
			4	SS	29														
198.9							199												
4.3	Silty CLAY, with sand, trace gravel Firm to Stiff Brown to Grey Moist to Wet (FILL)		5	SS	5		198												
			6	SS	5		197												
							196												
			7	SS	9														
							195												
			8	SS	5		194												
193.2																			

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No R-06

2 OF 3

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 329.1 E 314 620.0 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.04.27 - 2018.04.30 LATITUDE 43.873869 LONGITUDE -79.377812 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT      NATURAL MOISTURE CONTENT      LIQUID LIMIT			UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)				GR	SA	SI	CL
								20    40    60    80    100				w <sub>p</sub> w      w <sub>L</sub>							
								○ UNCONFINED      + FIELD VANE											
								● QUICK TRIAXIAL      × LAB VANE											
								20    40    60    80    100				20    40    60							
10.0	Continued From Previous Page						193												
	<b>SAND</b> , some silt, trace gravel, trace clay Dense to Very Dense Brown Wet		9	SS	48														
			10	SS	32														
			11	SS	57														
			12	SS	56														
187.0																			
16.2	<b>SAND</b> and <b>SILT</b> , trace to some gravel, trace clay Very Dense Grey Wet (TILL)						187												
			13	SS	100/ 0.250														
185.2																			
18.0	Silty <b>CLAY</b> , trace gravel, trace sand Hard Grey Wet (TILL)						185												
			14	SS	100/ 0.225														
	Sand seams						184												

Continued Next Page

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

# RECORD OF BOREHOLE No R-06

3 OF 3

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 329.1 E 314 620.0 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.04.27 - 2018.04.30 LATITUDE 43.873869 LONGITUDE -79.377812 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT      NATURAL LIMIT      MOISTURE      LIQUID CONTENT      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					WATER CONTENT (%)					
								○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL      × LAB VANE										
	Continued From Previous Page							20	40	60	80	100		W <sub>p</sub>	W	W <sub>L</sub>		
176.9   <																		

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# RECORD OF BOREHOLE No R-07

1 OF 3

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 318.3 E 314 637.6 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.05.22 - 2018.05.23 LATITUDE 43.873771 LONGITUDE -79.377593 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT  <b>γ</b>  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
202.6	GROUND SURFACE							20	40	60	80	100	PLASTIC LIMIT w <sub>P</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>		
0.0	<b>SILT</b> , some sand, trace gravel, trace clay, occasional organics Loose to Compact Brown Moist (FILL)		1	SS	8		202										
			2	SS	20												
			3	SS	22		201										
			4	SS	25		200										
			5	SS	20		199										
			6	SS	100/ 0.225		198										
	Cobbles						197										
	Sand seams at 5.9m																
196.5																	
6.1	Silty <b>CLAY</b> , with sand, trace gravel Stiff to Hard Grey Moist (FILL)		7	SS	11		196										
			8	SS	32		195										
							194										
193.4																	
9.2	Silty <b>SAND</b> , trace gravel, trace clay Dense Grey Wet		9	SS	41		193										
192.6																	

Continued Next Page

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

# RECORD OF BOREHOLE No R-07

2 OF 3

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 318.3 E 314 637.6 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.05.22 - 2018.05.23 LATITUDE 43.873771 LONGITUDE -79.377593 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa			WATER CONTENT (%)				
	Continued From Previous Page							20 40 60 80 100							
10.0	Silty <b>SAND</b> , trace gravel, trace clay Dense to very Dense Grey Wet						192								
			10	SS	40								○		
							191								
			11	SS	100/ 0.250		190						○		
							189								
			12	SS	100/ 0.150		188						○		
							187						○		
	Compact		13	SS	22		186						○		
186.3							185								
16.3	Sandy <b>SILT</b> , some clay, trace gravel Very Dense Grey Wet (TILL)		14	SS	100/ 0.025		184						○		
							183								
			15	SS	100/ 0.150		182						○		
183.7							181								
18.9	Silty <b>CLAY</b> , some sand, trace gravel Hard Grey Moist (TILL)						180								

Resistance to  
augering at  
16.5m

0 26 59 15

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No R-07

3 OF 3

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 318.3 E 314 637.6 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.05.22 - 2018.05.23 LATITUDE 43.873771 LONGITUDE -79.377593 CHECKED BY RPR

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 TRIAXIAL × LAB VANE									
	Continued From Previous Page																
	Silty <b>CLAY</b> , trace sand, trace gravel Hard Grey Moist (TILL)		16	SS	100/ 0.250												
			17	SS	100/ 0.200												
			18	SS	100/ 0.225												
177.9				SS	100/ 0.175											0 0 63 37	
24.7	END OF BOREHOLE AT 24.7m. WATER LEVEL AT 10.7m UPON COMPLETION. Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 3.0m slotted screen.  WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2018.06.22 9.3 193.3 2018.11.22 9.2 193.4																

# RECORD OF BOREHOLE No R-08

1 OF 3

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 314.2 E 314 669.4 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.05.03 - 2018.05.17 LATITUDE 43.873734 LONGITUDE -79.377198 CHECKED BY RPR

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	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
203.1	GROUND SURFACE						203							
0.0	ASPHALT: (180mm)													
0.2	CONCRETE: (320mm)													
202.6														
0.5	SAND, trace gravel, trace to some clay, trace to some silt Loose to Compact Brown Moist (FILL)		1	SS	4		202							
			2	SS	14		201							
			3	SS	15		200							
			4	SS	7		199							
			5	SS	4		198							
197.3			6	SS	9		197							
5.8	Silty CLAY, some sand, trace gravel Stiff to Very Stiff Brown Moist (FILL)		7	SS	20		196							
			8	SS	18		195							
194.6							194							
8.5	SAND, trace gravel, trace to some silt, trace clay Compact Brown Moist													

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No R-08

2 OF 3

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 314.2 E 314 669.4 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.05.03 - 2018.05.17 LATITUDE 43.873734 LONGITUDE -79.377198 CHECKED BY RPR

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 (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa			WATER CONTENT (%)			GR SA SI CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL	× LAB VANE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											

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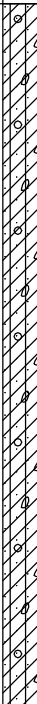
+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity  
 20  
15  
10  
5  
0 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No R-08

3 OF 3

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 314.2 E 314 669.4 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.05.03 - 2018.05.17 LATITUDE 43.873734 LONGITUDE -79.377198 CHECKED BY RPR

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 TRIAXIAL × LAB VANE								
	Continued From Previous Page				0.050		183									
	Silty <b>CLAY</b> , some sand, trace gravel Hard Grey Moist (TILL)		16	SS	100/ 0.125		182							○		0 9 44 47
								181								
								180							○	
					17	SS	100/ 0.100		179							
178.5					18	SS	100/ 0.100								○	
24.6	END OF BOREHOLE AT 24.6m. WATER LEVEL AT 11.6m UPON COMPLETION. BOREHOLE CAVED TO 14.6m, BACKFILLED WITH AUGER CUTTINGS TO 7.6m, BENTONITE HOLEPLUG TO 1.5m, CONCRETE TO 0.3m, THEN ASPHALT COLD PATCH TO SURFACE.				0.100											

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+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10



(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No R-09

1 OF 3

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 323.2 E 314 621.0 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers/Tricone COMPILED BY MP  
 DATUM Geodetic DATE 2018.04.23 - 2018.04.24 LATITUDE 43.873815 LONGITUDE -79.377799 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT  γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W <sub>P</sub>	W		W <sub>L</sub>	WATER CONTENT (%)	GR	SA	SI
203.2	GROUND SURFACE																			
0.0	ASPHALT: (200mm)																			
0.2	SILT, some sand, trace clay, trace gravel Compact to Loose Brown Moist (FILL)		1	GS																
			1	SS	29															
			2	SS	18															
			3	SS	4															
			4	SS	9															
			5	SS	15															
197.6																				
5.6	Silty CLAY, with sand, trace gravel Very Stiff to Hard Grey Moist (FILL)		6	SS	16															
			7	SS	23															
			8	SS	30															
	Sand seams																			
193.2																				

Continued Next Page

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

## METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT      NATURAL MOISTURE CONTENT      LIQUID LIMIT			UNIT WEIGHT  γ  kN/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      × LAB VANE							
							20	40	60	80	100	W <sub>P</sub>	W	W <sub>L</sub>			
10.0	Continued From Previous Page  Silty <b>SAND</b> , trace clay, trace gravel Dense to Very Dense Grey Moist to Wet					▽	193										
			9	SS	40									○			
							192										
			10	SS	44									○			
							190										
			11	SS	71									○			
188.4 14.8	<b>SAND</b> and <b>SILT</b> , trace gravel, occasional cobbles Dense to Very Dense Grey Wet (TILL)						188							○		2   50   32   16	
			12	SS	36												
							187										
			13	SS	100/ 0.200		186							○		Resistance to augering at 16.5m	
185.5 17.7	Silty <b>CLAY</b> , some sand, trace gravel Hard Grey Moist (TILL)						185							○			
			14	SS	100/ 0.250		184									Resistance to augering at 19.4m	

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity


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# RECORD OF BOREHOLE No R-09

3 OF 3

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 323.2 E 314 621.0 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers/Tricone COMPILED BY MP  
 DATUM Geodetic DATE 2018.04.23 - 2018.04.24 LATITUDE 43.873815 LONGITUDE -79.377799 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT  <b>γ</b>  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100						
	Continued From Previous Page													
	Silty <b>CLAY</b> , trace sand, trace gravel, occasional cobbles Hard Grey Moist (TILL)		15	SS	96		183							0 0 46 54
							182							
181.3			16	SS	85									
21.9	END OF BOREHOLE AT 21.9m. WATER LEVEL AT 11.6m UPON COMPLETION. BOREHOLE CAVED TO 12.5m, BACKFILLED WITH AUGER CUTTINGS TO 7.6m, BENTONITE HOLEPLUG TO 1.5m, CONCRETE TO 0.3m, THEN ASPHALT COLD PATCH TO SURFACE.													

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

# RECORD OF BOREHOLE No R-10

1 OF 3

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 304.1 E 314 670.0 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.05.01 - 2018.05.02 LATITUDE 43.873643 LONGITUDE -79.377190 CHECKED BY RPR

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									WATER CONTENT (%)					
								○ UNCONFINED	+	FIELD VANE	×						LAB VANE					
								● QUICK TRIAXIAL														
203.1	GROUND SURFACE																					
0.0	ASPHALT: (280mm)						203															
202.8																						
0.3	SAND and SILT, trace clay, occasional cobbles Compact to Very Dense Brown Moist (FILL)		1	SS	23		202															
			2	SS	100/ 0.025																	
							201															
			3	SS	75																	
							200															
	Occasional cobbles		4	SS	10																	
199.1							199															
4.0	Silty CLAY, some sand Very Stiff Grey Moist (FILL)		5	SS	22		198															
198.2																						
4.9	SAND and SILT, trace clay Compact to Dense Brown Moist (FILL)		6	SS	20		197															
							196															
			7	SS	37		195															
194.3							194															
8.8	SAND, trace gravel, trace silt, trace clay Dense Brown Wet		8	SS	46																	

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No R-10

2 OF 3

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 304.1 E 314 670.0 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.05.01 - 2018.05.02 LATITUDE 43.873643 LONGITUDE -79.377190 CHECKED BY RPR

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)		
								○ UNCONFINED      + FIELD VANE										
	Continued From Previous Page						20 40 60 80 100											
	<b>SAND</b> , trace gravel, trace silt, trace clay Dense to Very Dense Brown Wet		9	SS	36										1 95 4 (SI+CL)			
			10	SS	74													
			11	SS	94													
			12	SS	100/ 0.150													
187.3																		
15.8	Silty <b>CLAY</b> , trace sand, trace gravel Hard Grey Moist (TILL)		13	SS	100/ 0.200										0 0 59 41			
			14	SS	95													

Continued Next Page

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

# RECORD OF BOREHOLE No R-10

3 OF 3

METRIC

G.W.P. 2930-17-00 LOCATION Rouge River Bridge - MTM NAD 83 Zone10: N 4 859 304.1 E 314 670.0 ORIGINATED BY SB  
 HWY 404 BOREHOLE TYPE Hollow Stem Augers COMPILED BY MP  
 DATUM Geodetic DATE 2018.05.01 - 2018.05.02 LATITUDE 43.873643 LONGITUDE -79.377190 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					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								
								20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE								
	Continued From Previous Page		15	SS	100/ 0.225		183									
	Silty <b>CLAY</b> , trace sand, trace gravel Hard Grey Moist (TILL)						182									
			16	SS	100/ 0.200		181									
							180									
			17	SS	100/ 0.225		179									
			18	SS	76											
178.1																
25.0	END OF BOREHOLE AT 25.0m. WATER LEVEL AT 10.2m UPON COMPLETION. BOREHOLE CAVED TO 16.5m, BACKFILLED WITH AUGER CUTTINGS TO 10.7m, BENTONITE HOLEPLUG TO 1.8m, CONCRETE TO 0.3m, THEN ASPHALT COLD PATCH TO SURFACE.															

ONTMT452 MTO-15786.GPJ 2017TEMPLATE(MTO).GDT 1/16/19

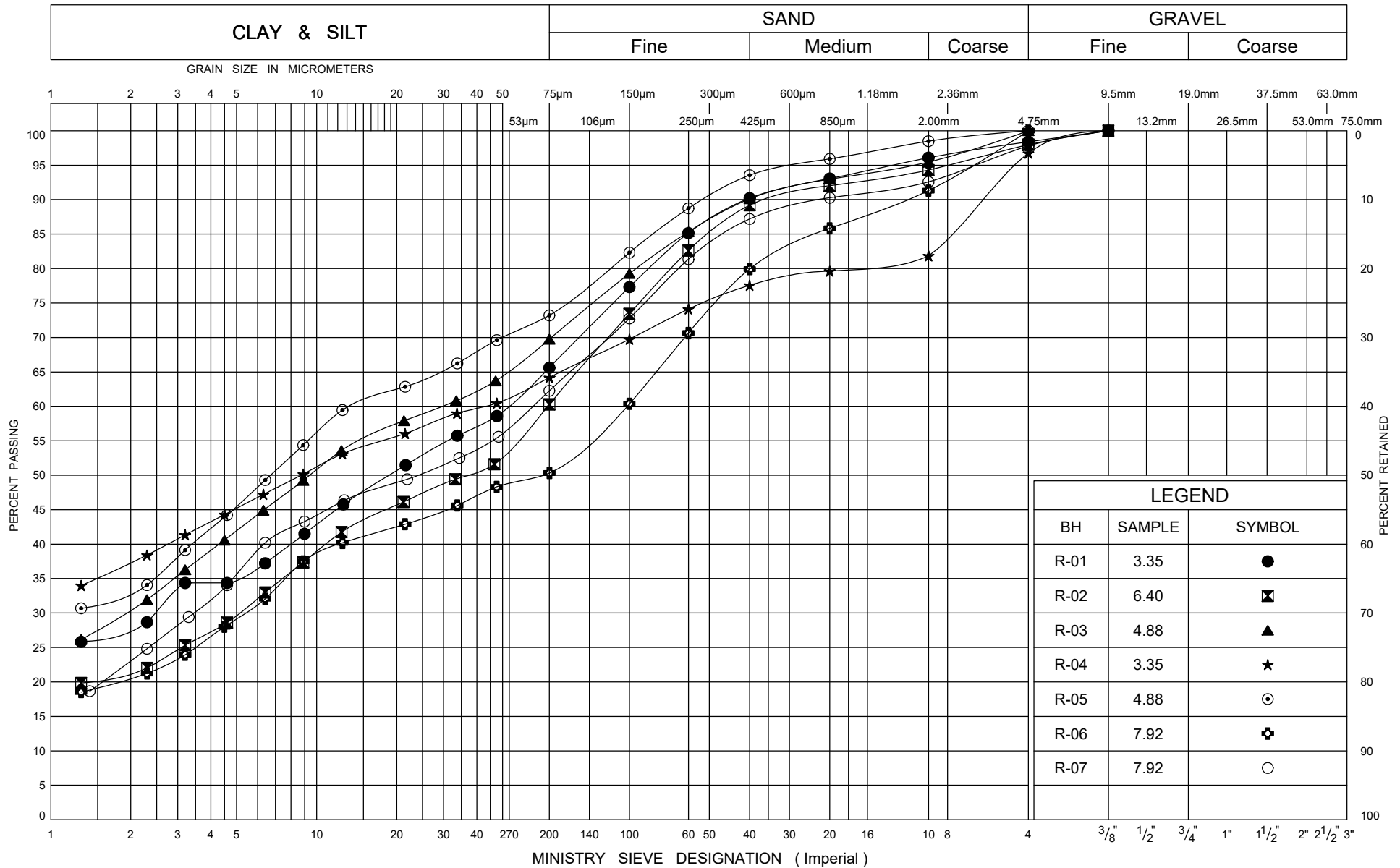




## **Appendix B**

### **Geotechnical and Analytical Laboratory Test Results**

**(Present Site Investigation)**



Ministry of  
Transportation

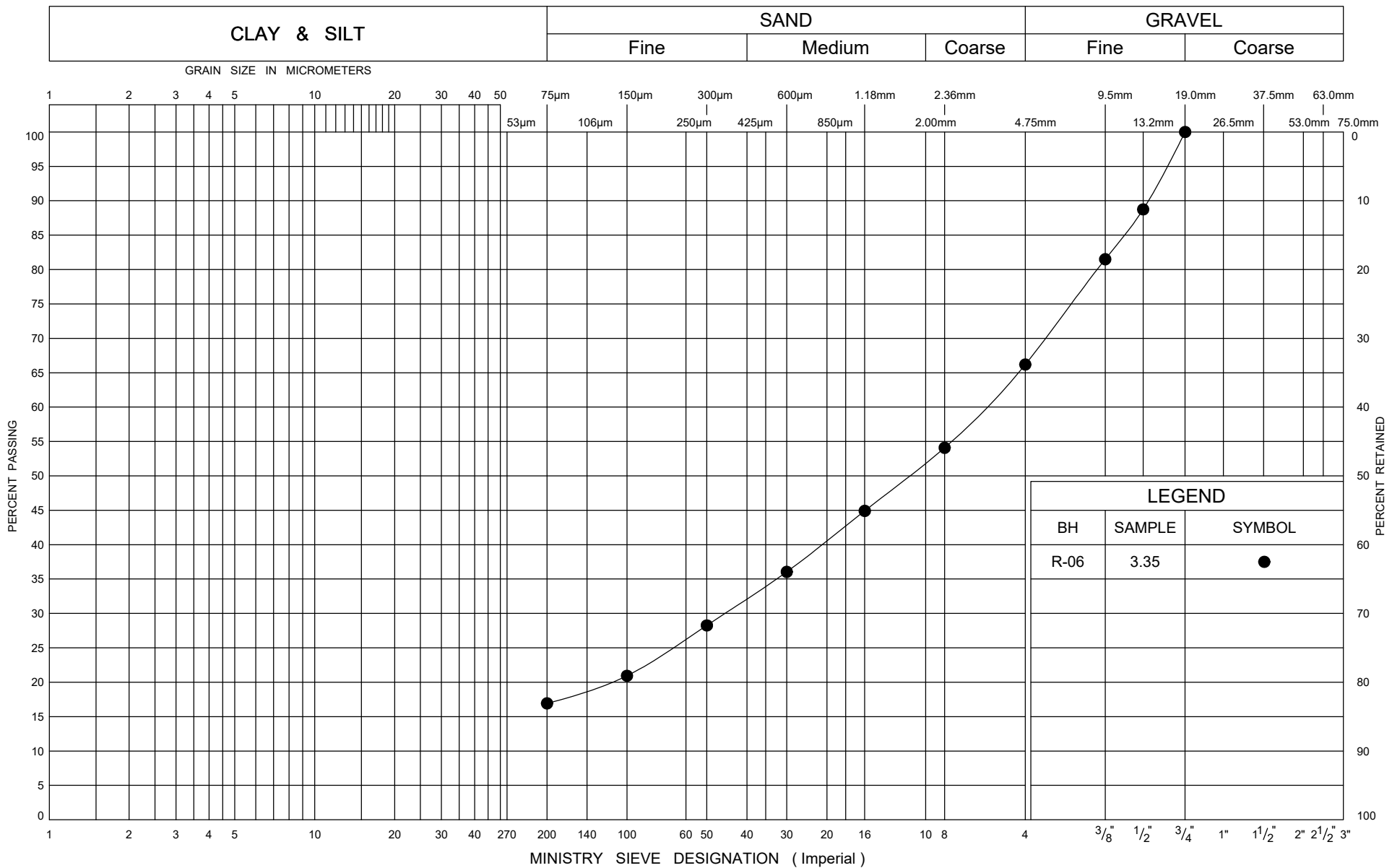
## GRAIN SIZE DISTRIBUTION

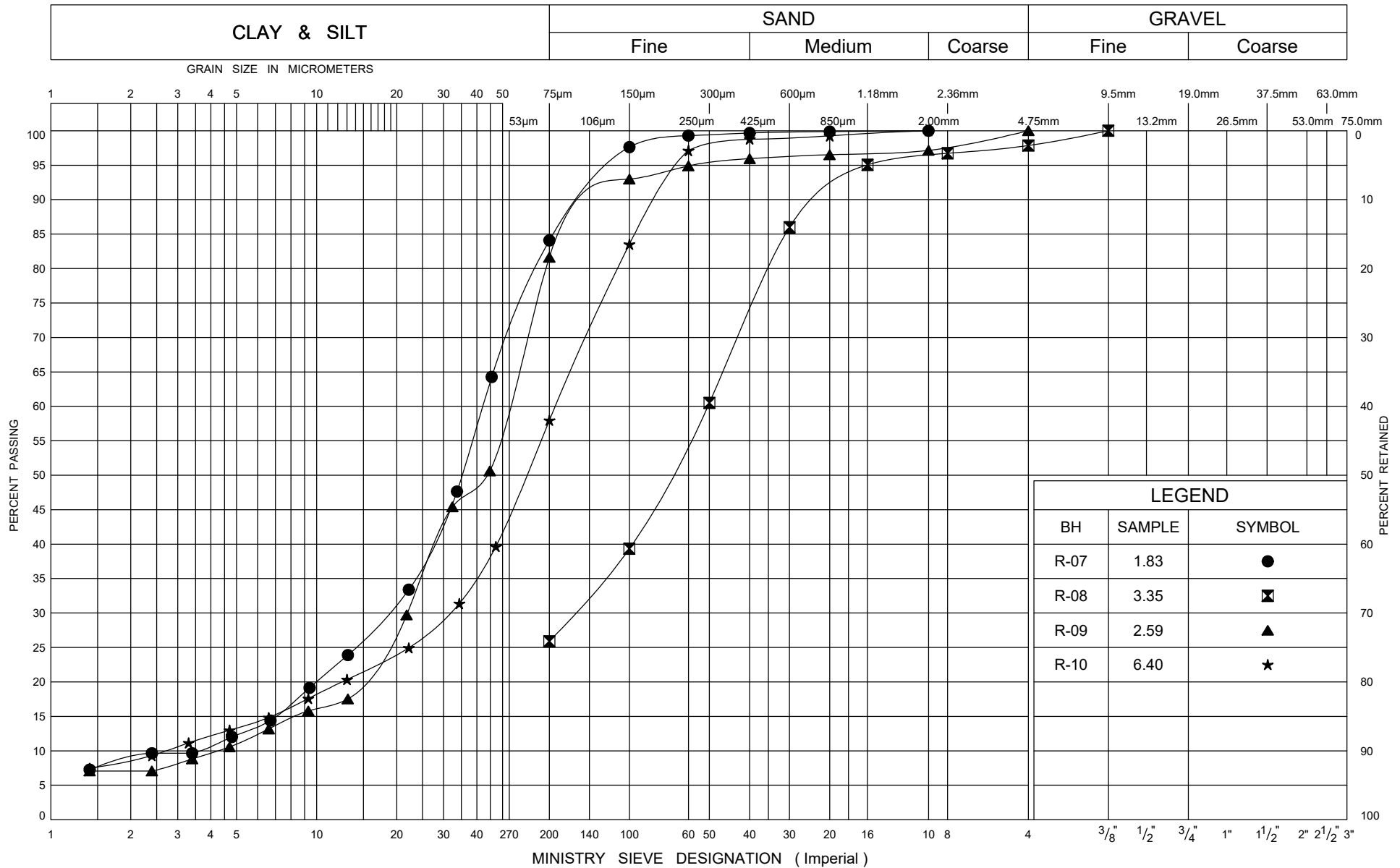
Silty CLAY FILL

FIG No B1

G W P 2930-17-00

Rouge River Bridge





Ministry of  
Transportation

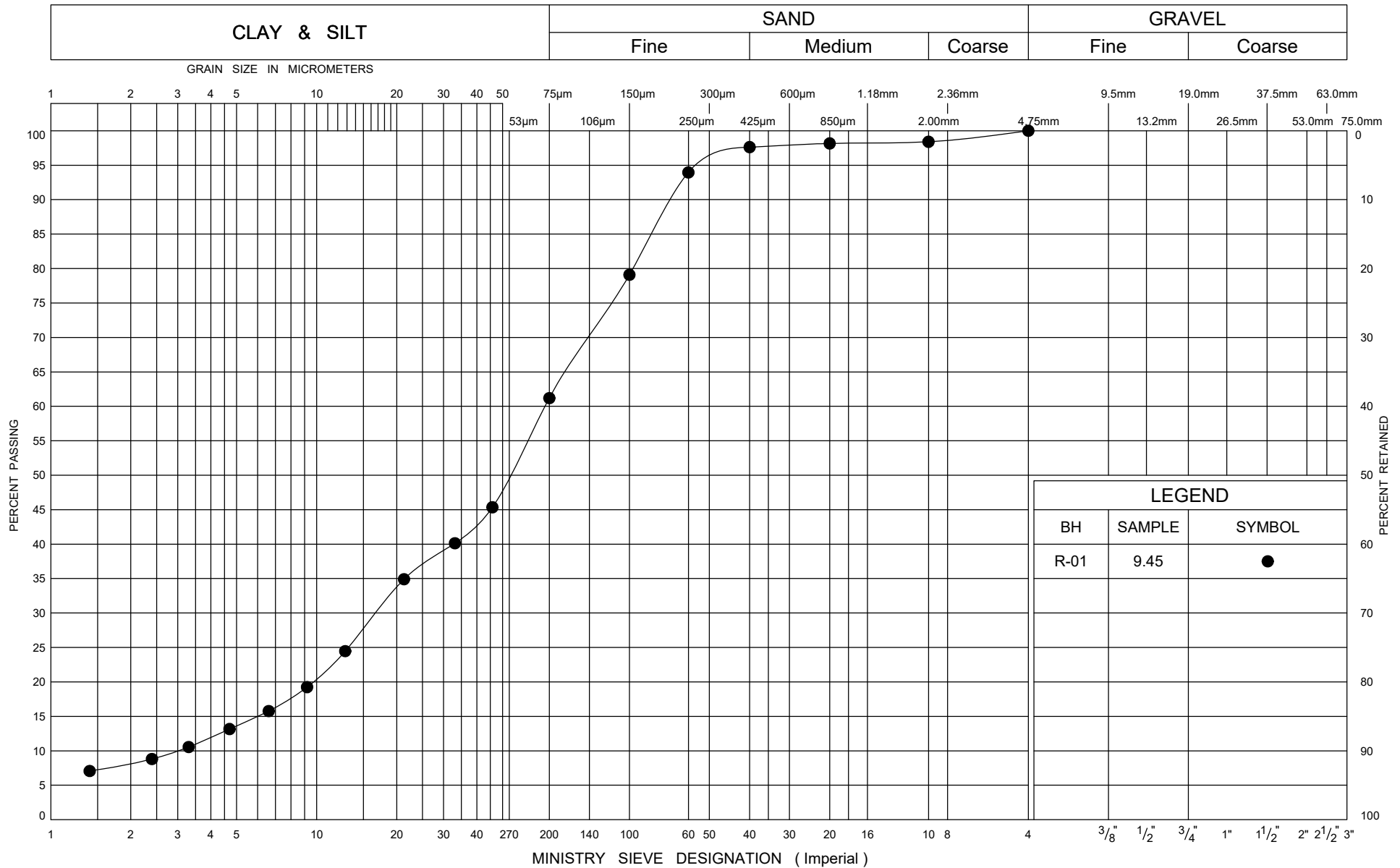
## GRAIN SIZE DISTRIBUTION

### SAND FILL/SILT FILL/SAND and SILT FILL

FIG No B3

G W P 2930-17-00

Rouge River Bridge



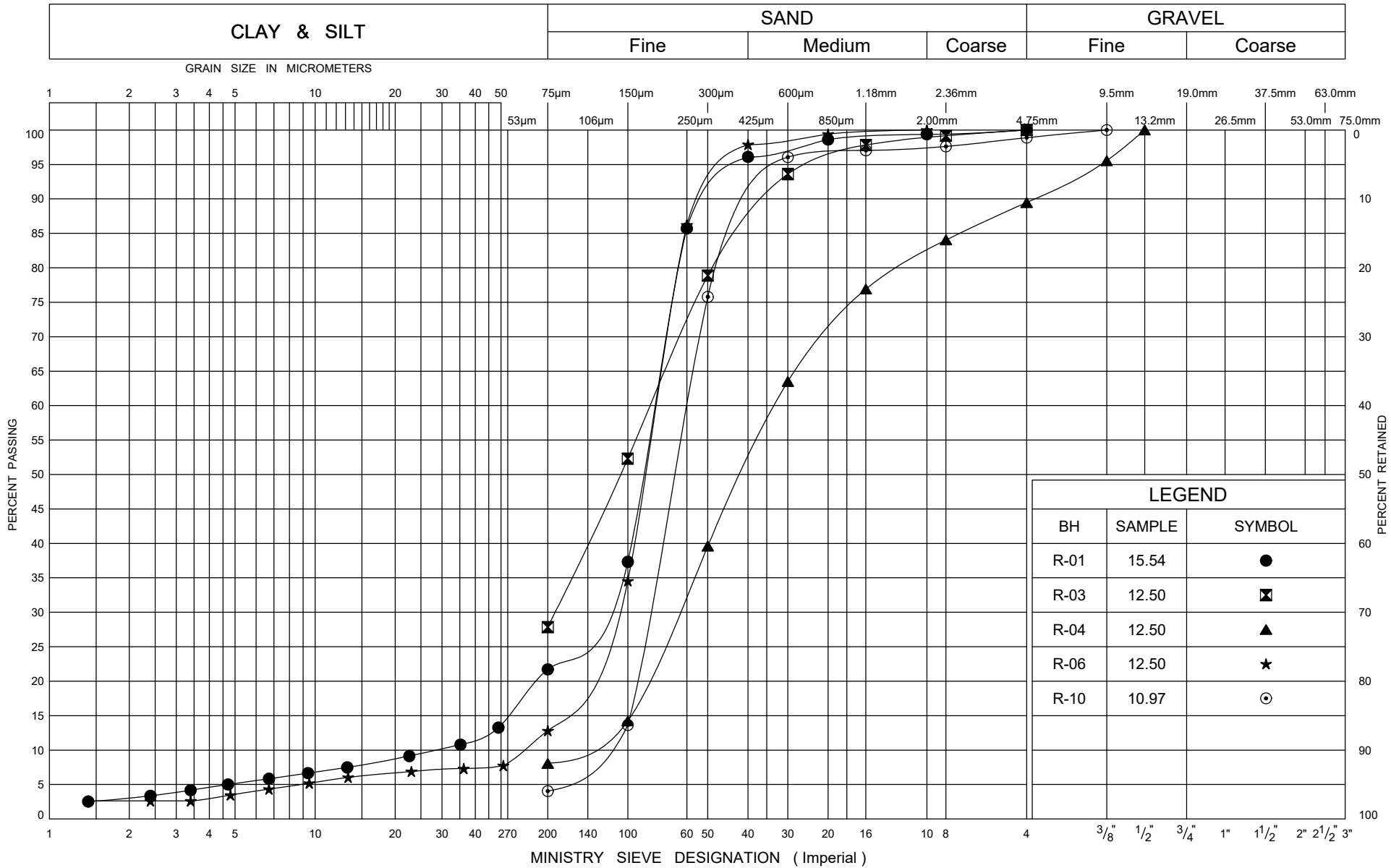
Ministry of  
Transportation

## GRAIN SIZE DISTRIBUTION SAND and SILT

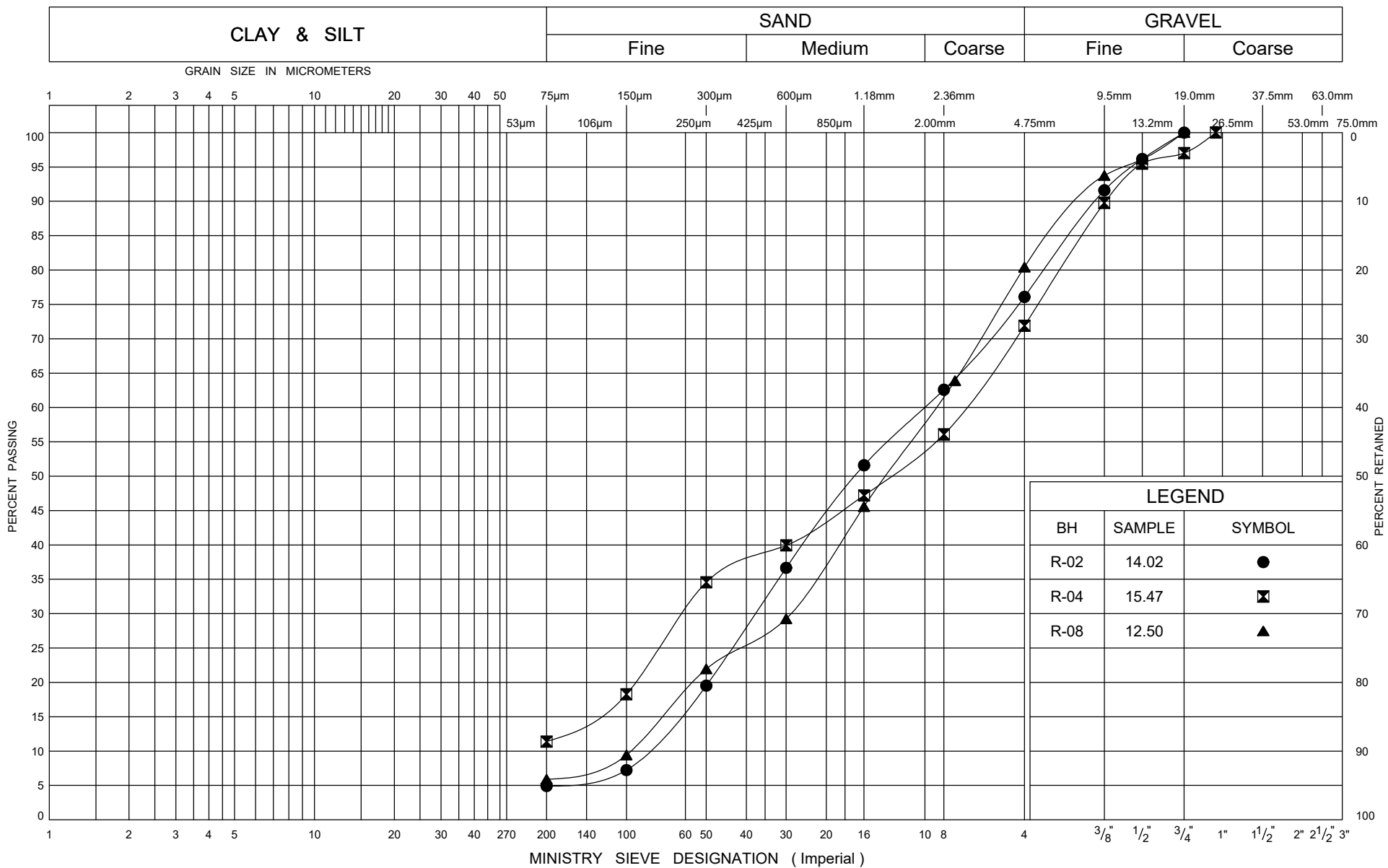
FIG No B4

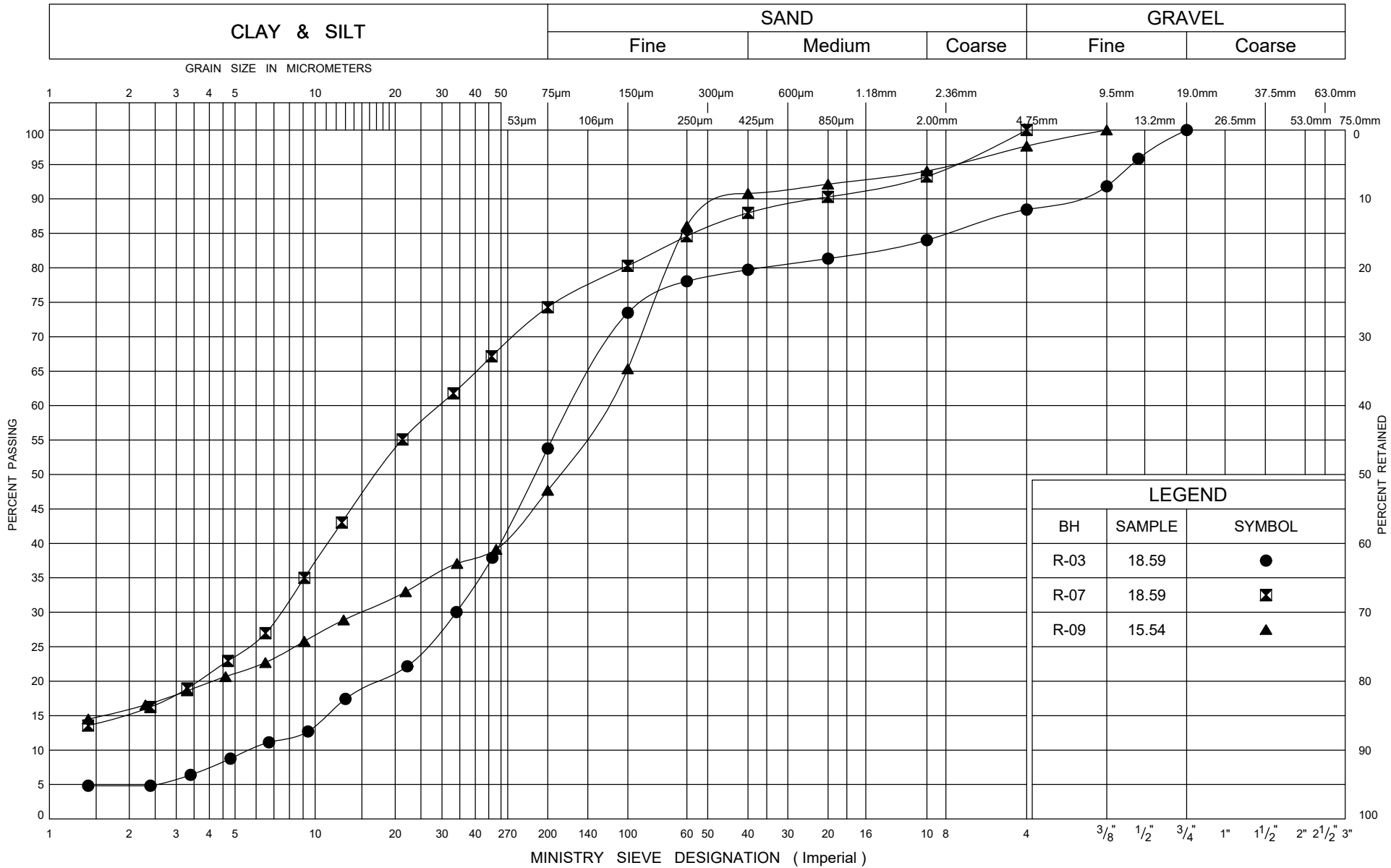
G W P 2930-17-00

Rouge River Bridge

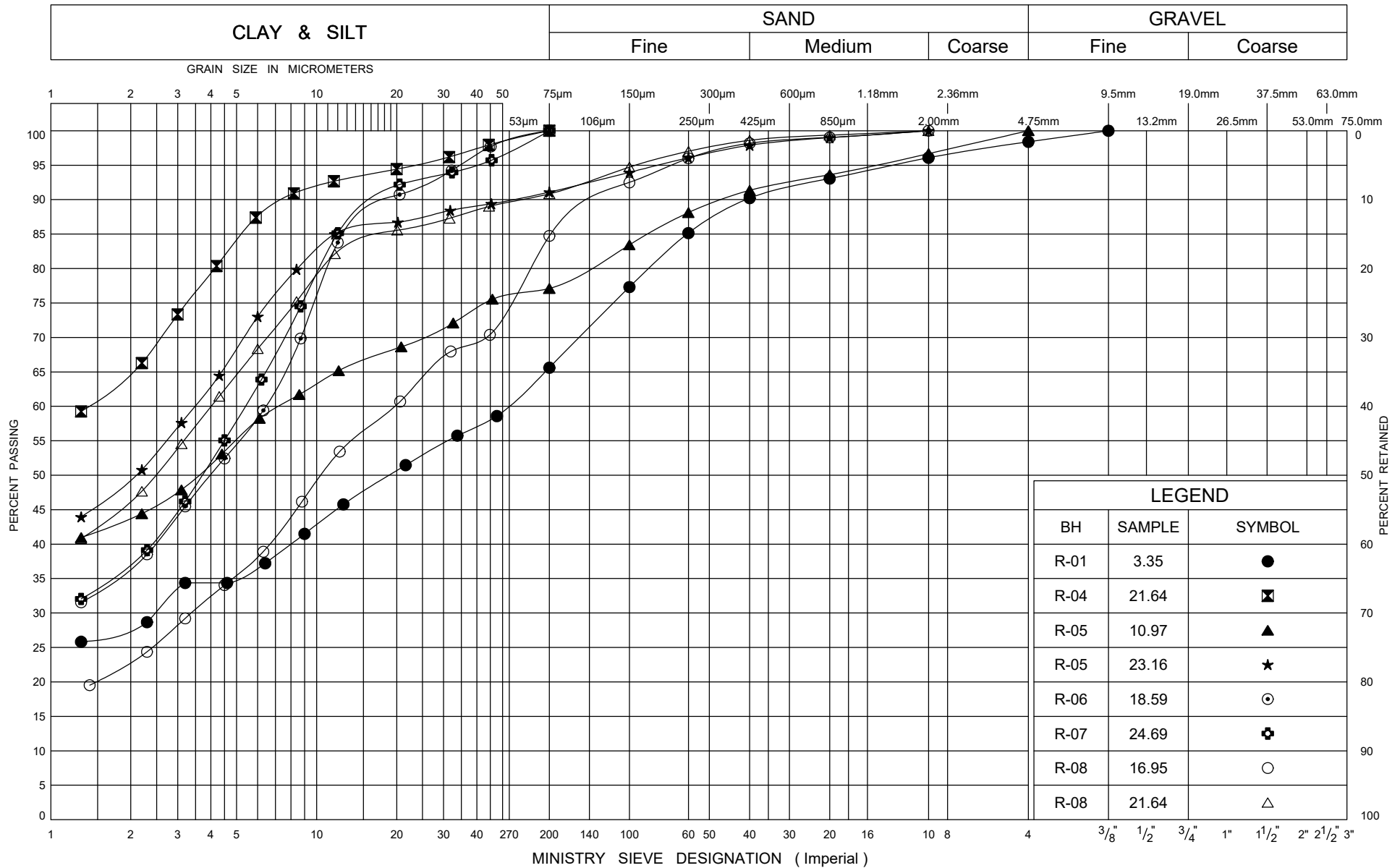


LEGEND		
BH	SAMPLE	SYMBOL
R-01	15.54	●
R-03	12.50	⊠
R-04	12.50	▲
R-06	12.50	★
R-10	10.97	⊙









Ministry of  
Transportation

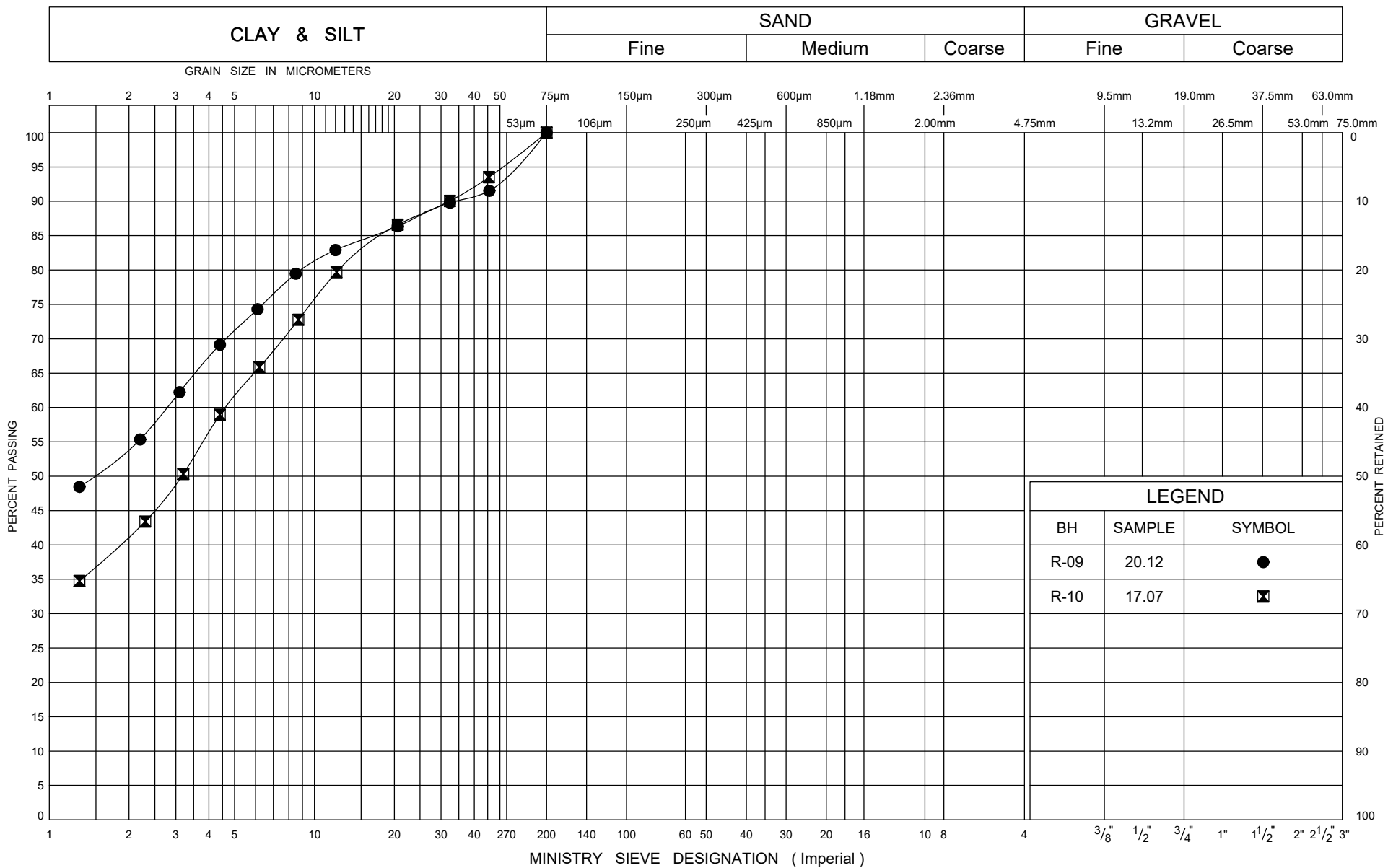
## GRAIN SIZE DISTRIBUTION

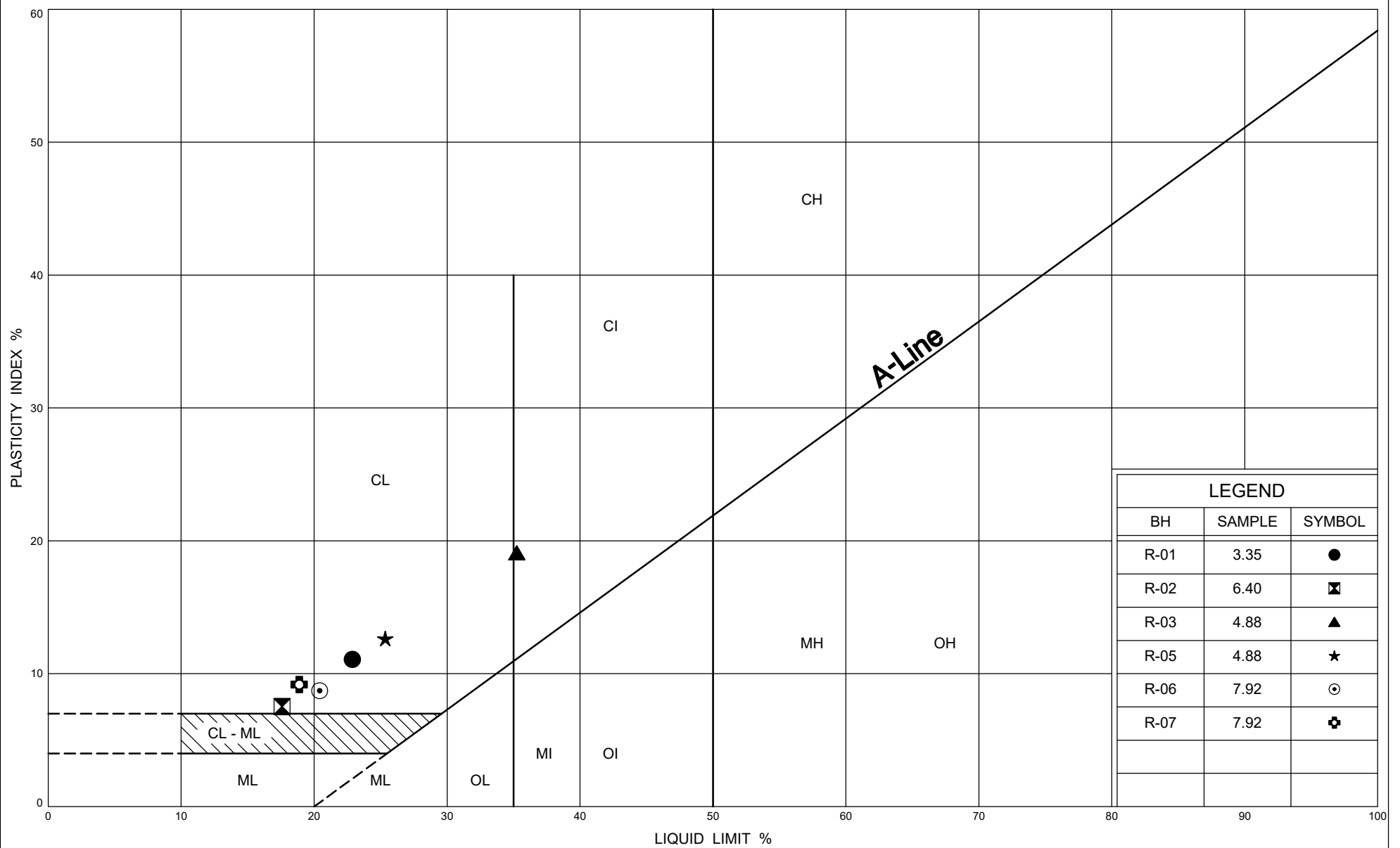
Silty CLAY TILL

FIG No B8

G W P 2930-17-00

Rouge River Bridge





Ministry of  
Transportation

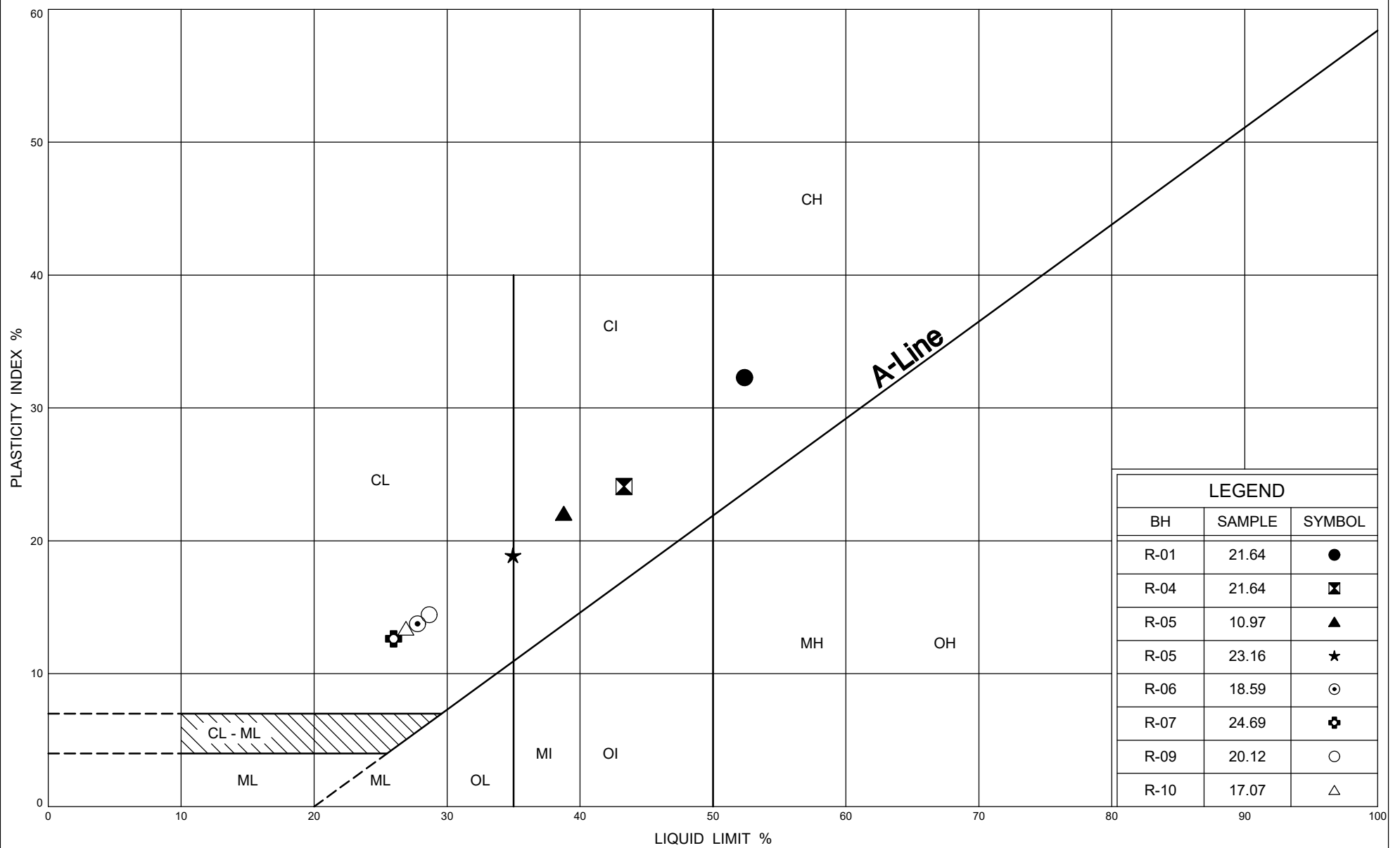
## PLASTICITY CHART

Silty CLAY FILL

FIG No B10

G W P 2930-17-00

Rouge River Bridge



Ministry of  
Transportation

## PLASTICITY CHART

Silty CLAY TILL

FIG No B11

G W P 2930-17-00

Rouge River Bridge



## FINAL REPORT

CA14856-MAY18 R1

15786

Prepared for

**Thurber Engineering Ltd.**

## First Page

### CLIENT DETAILS

Client Thurber Engineering Ltd.

Address 103, 2010 Winston Park Drive  
Oakville, ON  
L6H 5R7.

Contact Rocio Reyna

Telephone 905-829-8666 x 263

Facsimile

Email rreyna@thurber.ca

Project 15786

Order Number

Samples Soil (4)

### LABORATORY DETAILS

Project Specialist Deanna Edwards, B.Sc, C.Chem

Laboratory SGS Canada Inc.

Address 185 Concession St., Lakefield ON, K0L 2H0

Telephone 705-652-2000

Facsimile 705-652-6365

Email deanna.edwards@sgs.com

SGS Reference CA14856-MAY18

Received 05/28/2018

Approved 06/01/2018

Report Number CA14856-MAY18 R1

Date Reported 06/01/2018

### COMMENTS

Temperature of Sample upon Receipt: 11 degrees C

Cooling Agent Present: No

Custody Seal Present: No

7

Corrosivity Index is based on the American Water Works Corrosivity Scale according to AWWA C-105. An index greater than 10 indicates the soil matrix may be corrosive to cast iron alloys.

### SIGNATORIES

Deanna Edwards, B.Sc, C.Chem





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# FINAL REPORT

CA14856-MAY18 R1

Client: Thurber Engineering Ltd.

Project: 15786

Project Manager: Rocío Reyna

Samplers: N/A

## PACKAGE: - Corrosivity Index (SOIL)

Sample Number	5	6	7	8
Sample Name	RO3-SS4	RO9-SS13	RO8-SS6	RO5-SS16
Sample Matrix	Soil	Soil	Soil	Soil
Sample Date	12/04/2018	22/04/2018	03/05/2018	08/05/2018

Parameter	Units	RL		Result	Result	Result	Result
Corrosivity Index							
Corrosivity Index	none	1		14	7.5	1.0	4.0
Soil Redox Potential	mV	-		219	259	255	210
Sulphide	%	0.02		< 0.02	0.02	< 0.02	< 0.02
pH	no unit	0.05		9.13	8.99	8.41	9.24
Resistivity (calculated)	ohms.cm	-9999		847	6520	3440	6170

## PACKAGE: - General Chemistry (SOIL)

Sample Number	5	6	7	8
Sample Name	RO3-SS4	RO9-SS13	RO8-SS6	RO5-SS16
Sample Matrix	Soil	Soil	Soil	Soil
Sample Date	12/04/2018	22/04/2018	03/05/2018	08/05/2018

Parameter	Units	RL		Result	Result	Result	Result
General Chemistry							
Conductivity	uS/cm	2		1180	153	291	162

## PACKAGE: - Metals and Inorganics (SOIL)

Sample Number	5	6	7	8
Sample Name	RO3-SS4	RO9-SS13	RO8-SS6	RO5-SS16
Sample Matrix	Soil	Soil	Soil	Soil
Sample Date	12/04/2018	22/04/2018	03/05/2018	08/05/2018

Parameter	Units	RL		Result	Result	Result	Result
Metals and Inorganics							
Moisture Content	%	0.1		9.3	10.1	14.1	18.3
Sulphate	µg/g	0.4		110	78	40	92





FINAL REPORT

CA14856-MAY18 R1

Client: Thurber Engineering Ltd.

Project: 15786

Project Manager: Rocío Reyna

Samplers: N/A

PACKAGE: - Other (ORP) (SOIL)

Sample Number	5	6	7	8
Sample Name	RO3-SS4	RO9-SS13	RO8-SS6	RO5-SS16
Sample Matrix	Soil	Soil	Soil	Soil
Sample Date	12/04/2018	22/04/2018	03/05/2018	08/05/2018

Parameter	Units	RL		Result	Result	Result	Result
Other (ORP)							
Chloride	µg/g	0.4		910	11	200	24



FINAL REPORT

CA14856-MAY18 R1

QC SUMMARY

Anions by IC  
Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-IENVIIC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chloride	DIO0502-MAY18	µg/g	0.4	<0.4	12	20	93	80	120	108	75	125
Sulphate	DIO0502-MAY18	µg/g	0.4	<0.4	0	20	97	80	120	97	75	125

Carbon/Sulphur  
Method: ASTM E1915-07A | Internal ref.: ME-CA-IENVIARD-LAK-AN-020

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Sulphide	ECS0053-MAY18	%	0.02	<0.02	ND	20	91	80	120			

Conductivity  
Method: SM 2510 | Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0517-MAY18	uS/cm	2	< 0.002	5	10	101	90	110	NA		



QC SUMMARY

pH  
Method: SM 4500 | Internal ref.: ME-CA-1ENVIEWL-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0517-MAY18	no unit	0.05	NA	0		100			NA		

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

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

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

**Multielement Scan Qualifier:** as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

**Duplicate Qualifier:** for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

**Matrix Spike Qualifier:** for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

## LEGEND

### FOOTNOTES

**NSS** Insufficient sample for analysis.

**RL** Reporting Limit.

↑ Reporting limit raised.

↓ Reporting limit lowered.

**NA** The sample was not analysed for this analyte

**ND** Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

SGS provides criteria information (such as regulatory or guideline limits and summary of limit exceedances) as a service. Every attempt is made to ensure the criteria information in this report is accurate and current, however, it is not guaranteed. Comparison to the most current criteria is the responsibility of the client and SGS assumes no responsibility for the accuracy of the criteria levels indicated. This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at [http://www.sgs.com/terms\\_and\\_conditions.htm](http://www.sgs.com/terms_and_conditions.htm). The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

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-- End of Analytical Report --



SGS Environmental Services

## Request for Laboratory Services and CHAIN OF CUSTODY

No:

Page 1 of 1

- Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Toll Free: 877-747-7658 Fax: 705-652-6365  
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361 Web: www.ca.sgs.com

Laboratory Information Section - Lab use only

Received By: 15ma1Received By (signature): [Signature]Custody Seal Present: ☐ NO ☒ YESCooling Agent Present: ☐ NO ☒ YES

LAB LIMS #:

CA14856-May 18Received Date (mm/dd/yyyy): 05/28/18 (mm/dd/yyyy)Temperature Upon Receipt (°C): 11x3

P.O. #:

## REPORT INFORMATION

Company: Thurber EngineeringContact: Rocio Palomque ReynaAddress: 103-2010 W. Winston Park Dr.Oakville, ON L6H 5R7

Phone: \_\_\_\_\_

Fax: \_\_\_\_\_

Email: Reyna@thurber.ca

## INVOICE INFORMATION

☒ (same as Report Information)

Company: \_\_\_\_\_

Contact: \_\_\_\_\_

Address: \_\_\_\_\_

Phone: \_\_\_\_\_

Email: \_\_\_\_\_

## PROJECT INFORMATION

Quotation #: 1578 P.O. #:Project #: 15786 Site Location/ID: \_\_\_\_\_

## TURNAROUND TIME (TAT) REQUIRED

☒ Regular TAT (5-7 days)

TATs are quoted in business days (exclude statutory holidays &amp; weekends). Samples received after 3pm or on weekends: TAT begins the next business day

RUSH TAT (Additional Charges May Apply) ☐ 1 Day ☐ 2 Days ☐ 3-4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: \_\_\_\_\_ Rush Confirmation ID: \_\_\_\_\_

DRINKING WATER SAMPLES (POTABLE WATER FOR HUMAN CONSUMPTION) MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

COMMENTS:  
Field Filtered (F)  
Preserved (P)

## REGULATIONS

Regulation 153 (2011):

☐ Table 1 ☐ Res/Park ☐ Soil Texture:☐ Table 2 ☐ Ind/Com ☐ Coarse☐ Table 3 ☐ Agr/Other ☐ Medium☐ Table ☐ Fine

Other Regulations:

☐ Reg 347/558 (3 Day min TAT)☐ PW/QO ☐ MMER☐ CCME ☐ Other:☐ MISA

Sewer By-Law:

☐ Sanitary☐ Storm

Municipality:

☐ MISA

## RECORD OF SITE CONDITION (RSC)

☐ YES ☐ NO

## SAMPLE IDENTIFICATION

1 R03-SS42 R09-SS133 R00-SS64 R05-SS165 May 03/186 May 03/187 May 03/188 May 03/189 May 03/1810 May 03/18

Observations/Comments/Special Instructions

Sampled By (NAME): \_\_\_\_\_

Relinquished by (NAME): \_\_\_\_\_

Signature: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: May 1, 2018 (mm/dd/yyyy)Date: May 1, 2018 (mm/dd/yyyy)Date: May 1, 2018 (mm/dd/yyyy)

Pink Copy - Client

Yellow &amp; White Copy - SGS



# SAMPLE INTEGRITY REPORT

Project Number:

15786

ONTARIO REGULATION 153/04

SGS Sample ID

CA14856-May 18

Date / Time Sampled

See CoC

Client Sample ID

See CoC

ALL

## Sample Submission General Sample Integrity Violations

- Temperature >10 C upon receipt if not sampled same day
- No evidence of cooling trend initiated if sampled same day
- Chain of Custody not submitted
- Chain of Custody incomplete
- Chain of Custody not signed / dated
- Chain of Custody not a current version
- Bottles / Samples listed on CoC but not received
- Bottles / Samples received but not listed on the CoC
- Sample container received empty

☐  
☐  
☐  
☐  
☐  
☐  
☐  
☐  
☐

## Sample Specific Sample Integrity Violations

- Sample received past hold time
- Incorrect preservation (including no preservation where required)
- Headspace present in VOC vial (aqueous)
- Sample(s) received frozen
- Bottle(s) broken or damaged in transport
- Discrepancy between sample label and chain of custody
- Analysis requirements absent / unclear
- Missing or incorrect sample label(s)
- Inappropriate sample container used
- Insufficient number of bottles received
- Limited sample volume
- Insufficient sample volume
- Sample contains multiple phases

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## Sediment Log

- Groundwater samples contain visible sediment / particulate
- Groundwater contains greater than 1cm of sediment / particulate matter in bottle

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## Additional Comments/Remarks:

No issues upon receipt



Initials:



## **Appendix C**

### **Record of Borehole Sheets and Laboratory Test Results**

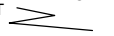






























**(Previous Site Investigation)**

# RECORD OF BOREHOLE No RR-1

1 of 2

**METRIC**

G.W.P.	03-20024	LOCATION	Coords: 4 859 313.0 N; 314 655.4 E	ORIGINATED BY	F.P.
DIST	Central	HWY	404	BOREHOLE TYPE	Continuous Flight Hollow Stem Augers
DATUM	Geodetic	DATE	October 6-8, 2014	COMPILED BY	N.R.
				CHECKED BY	D.D.

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	"N" VALUES								$w_p$	$w$	$w_L$		GR	SA	SI	CL	
								SHEAR STRENGTH kPa													
								○ UNCONFINED   + FIELD VANE													
								● QUICK TRIAXIAL   × LAB VANE													
								WATER CONTENT (%)													
202.9 0.0	Ground Surface Clayey silt, organics sand and gravel inclusions Stiff      Brown      Moist  Silt and sand, trace clay Compact      Brown      Moist  Loose to compact      Wet		1	SS	9																
			2	SS	13																
			3	SS	16																
			4	SS	5																
			5	SS	15																
			6	SS	20																
			7	SS	10																
			8	SS	10																
			9	SS	17																
	(FILL)		10	SS	23																
194.2 8.7	Silty sand trace clay, trace gravel  Dense to Grey      Moist very dense      to wet sand layers  sand and silt layer		11	SS	44																
			12	SS	42																
			13	SS	45																
			14	SS	50/13cm																
	Cont'd																				



# RECORD OF BOREHOLE No RR-1

2 of 2

## METRIC

<b>G.W.P.</b>	03-20024	<b>LOCATION</b>	Coords: 4 859 313.0 N; 314 655.4 E	<b>ORIGINATED BY</b>	F.P.
<b>DIST</b>	Central	<b>HWY</b>	404	<b>BOREHOLE TYPE</b>	Continuous Flight Hollow Stem Augers
<b>DATUM</b>	Geodetic	<b>DATE</b>	October 6-8, 2014	<b>COMPILED BY</b>	N.R.
				<b>CHECKED BY</b>	D.D.

[illegible]

## RECORD OF BOREHOLE No RR-2

1 of 2

METRIC

<b>G.W.P.</b> 03-20024	<b>LOCATION</b>	Coords: 4 859 398.1 N; 314 621.9 E	<b>ORIGINATED BY</b> F.P.
------------------------	-----------------	------------------------------------	---------------------------

<b>DIST</b>	Central	<b>HWY</b>	404	<b>BOREHOLE TYPE</b>	Continuous Flight Hollow Stem Augers	<b>COMPILED BY</b>	N.R.
-------------	---------	------------	-----	----------------------	--------------------------------------	--------------------	------

**DATUM** Geodetic **DATE** Ocotober 5 & 6, 2014 **CHECKED BY** D.D.

[illegible]

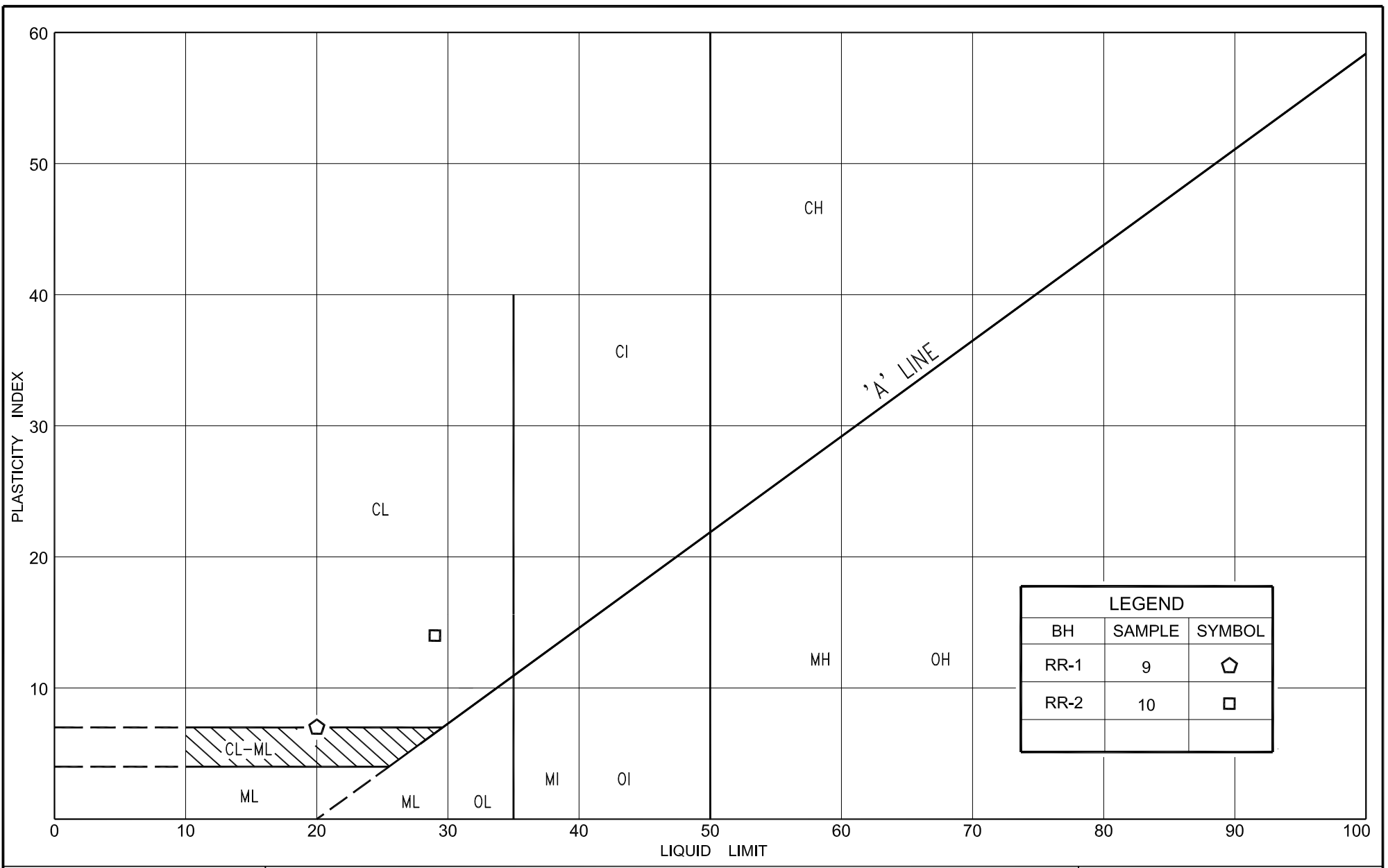
## RECORD OF BOREHOLE No RR-2

2 of 2

## METRIC

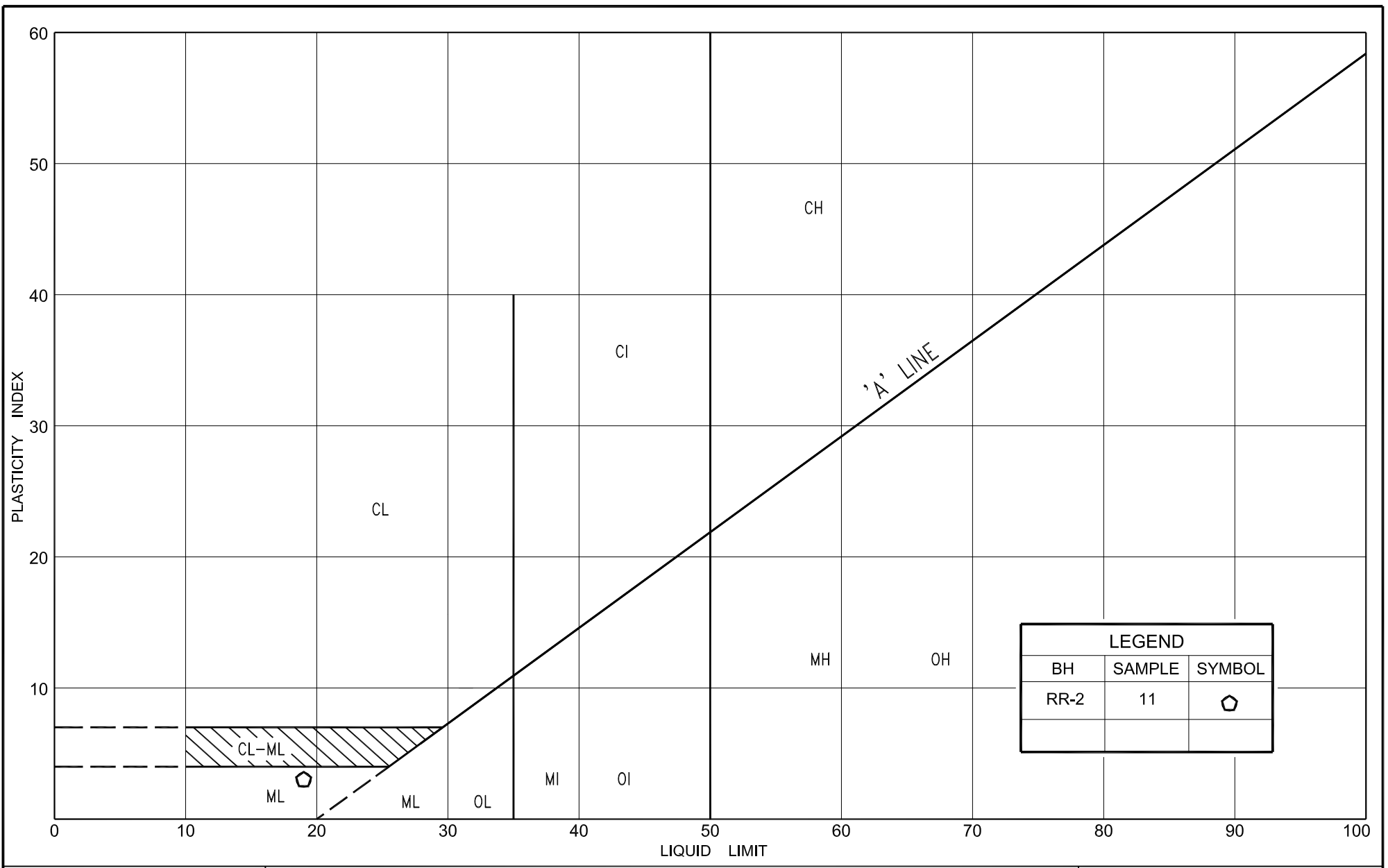
<b>G.W.P.</b>	<u>03-20024</u>	<b>LOCATION</b>	<u>Coords: 4 859 398.1 N; 314 621.9 E</u>	<b>ORIGINATED BY</b>	<u>F.P.</u>
<b>DIST</b>	<u>Central</u>	<b>HWY</b>	<u>404</u>	<b>BOREHOLE TYPE</b>	<u>Continuous Flight Hollow Stem Augers</u>
<b>COMPILED BY</b>					<u>N.R.</u>
<b>DATUM</b>	<u>Geodetic</u>	<b>DATE</b>	<u>Ocotober 5 &amp; 6, 2014</u>	<b>CHECKED BY</b>	<u>D.D.</u>

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	× LAB VANE									
188.2							20	40	60	80	100	20	40	60						
	Silty sand trace to some clay trace gravel clayey silt seams Dense Brown Wet Cont'd.)  Gravelly sand layers some silt, trace clay Very dense Grey Wet		15	SS	34															
			16	SS	50/8cm															
185.5																				
17.7	Clayey silt trace sand, trace gravel Hard Grey Moist silty clay layers		17	SS	104/23cm															
	silty sand layers (TILL)																			
183.1			18	SS	50/10cm															
20.1	End of borehole																			



**PLASTICITY CHART**  
CLAYEY SILT, Silt and sand layers  
(FILL)

FIG No.	RR-PC-1
HWY:	404
G.W.P. No.	03-20024

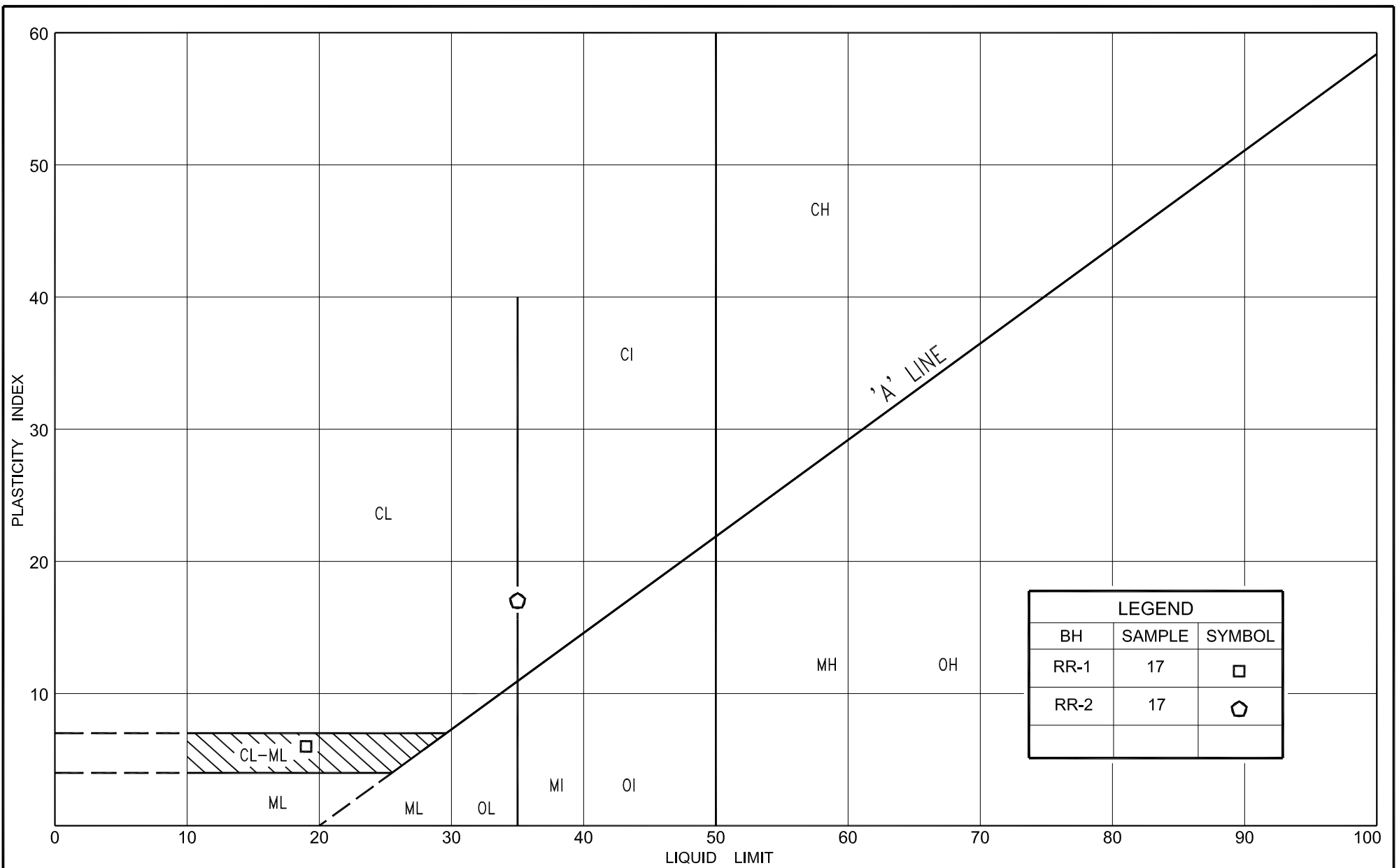


LEGEND		
BH	SAMPLE	SYMBOL
RR-2	11	⬠



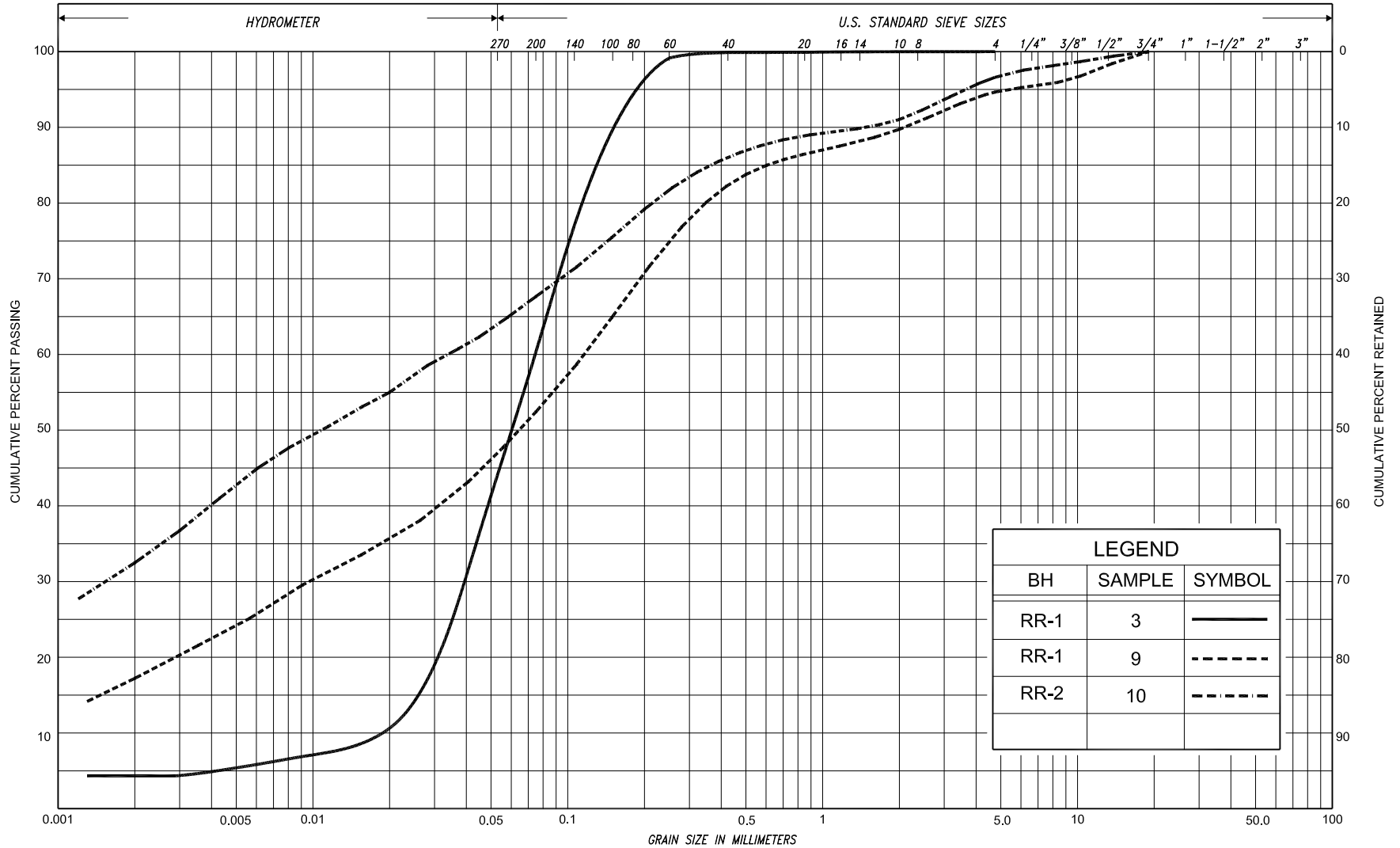
**PLASTICITY CHART**  
 SILTY SAND, trace clay, trace gravel  
 silt and gravelly sand layers

FIG No.	RR-PC-2
HWY:	404
G.W.P. No.	03-20024



PLASTICITY CHART  
CLAYEY SILT, trace sand, trace gravel (CL)  
silty clay layers  
(TILL)

FIG No.	RR-PC-3
HWY:	404
G.W.P. No.	03-20024



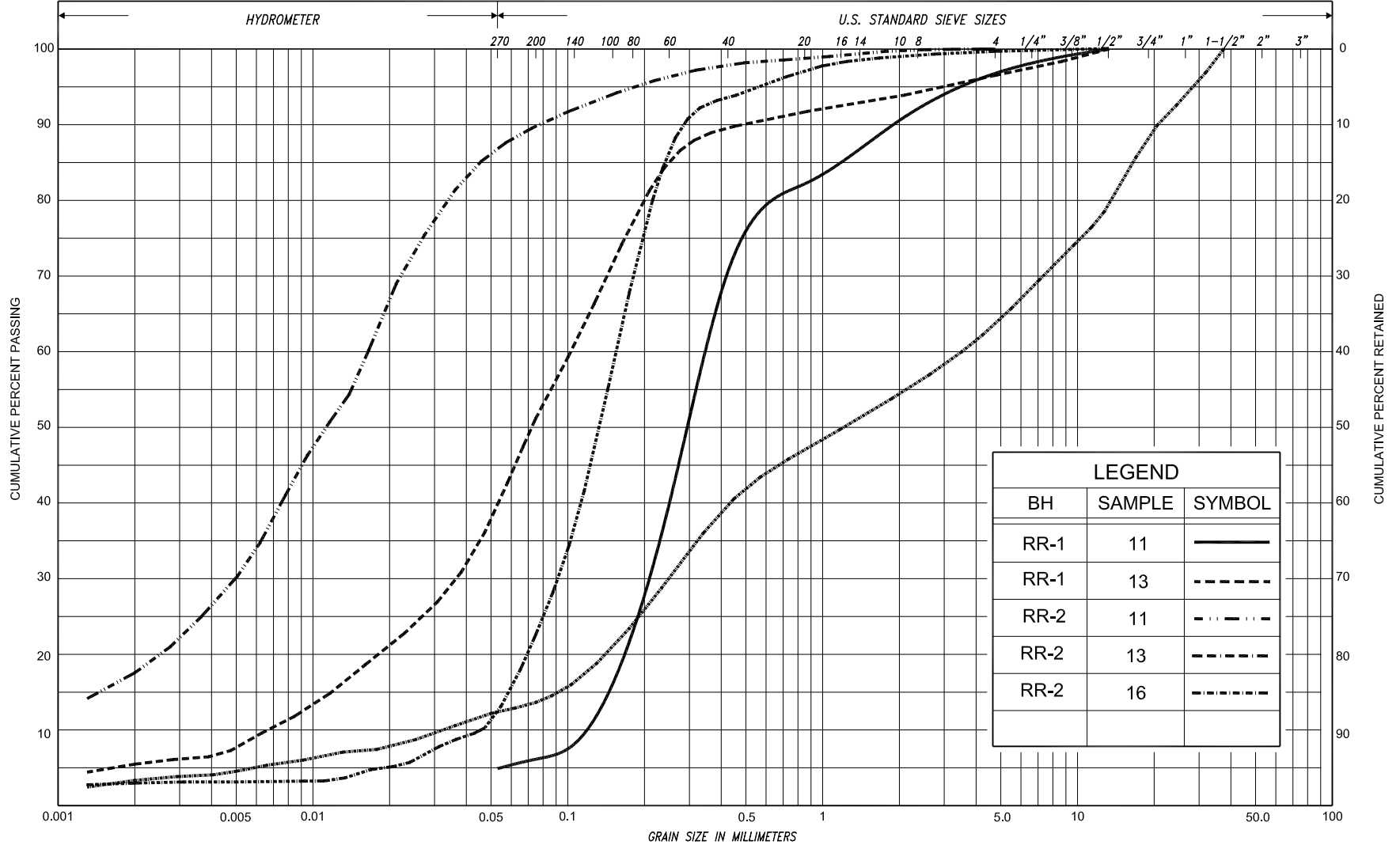
SILT & CLAY				FINE		MEDIUM		COARSE	GRAVEL		COBBLES	UNIFIED
				SAND								
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	GRAVEL				COBBLES	M.I.T.
	SILT			SAND								
CLAY		SILT		V. FINE	FINE	MED.	COARSE	GRAVEL				U.S. BUREAU
				SAND								



## GRAIN SIZE DISTRIBUTION

### CLAYEY SILT, Silt and sand layers (FILL)

FIG No.	RR-GS-1
HWY:	404
G.W.P. No.	03-20024



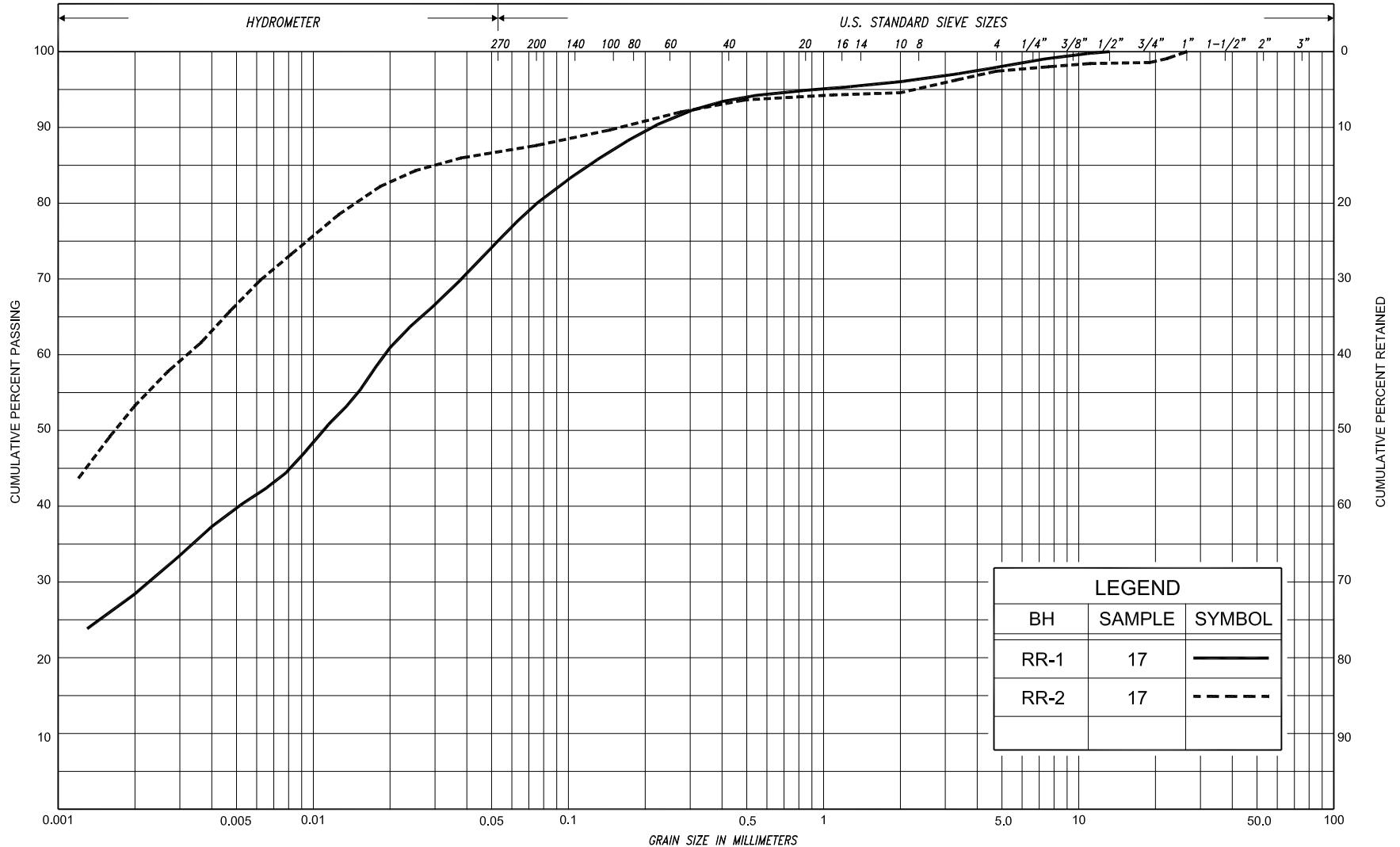
SILT & CLAY					FINE		MEDIUM		COARSE	GRAVEL			COBBLES	UNIFIED	
CLAY	FINE		MEDIUM	COARSE	FINE		MEDIUM		COARSE	GRAVEL			COBBLES	M.I.T.	
	SILT					SAND									
CLAY		SILT			V. FINE	FINE	MED.	COARSE	GRAVEL						U.S. BUREAU
					SAND										



**GRAIN SIZE DISTRIBUTION**  
 SILTY SAND, trace clay, trace gravel  
 silt and gravelly sand layers

FIG No. RR-GS-2  
 HWY: 404  
 G.W.P. No. 03-20024





SILT & CLAY				FINE		MEDIUM		COARSE	GRAVEL			COBBLES	UNIFIED		
				SAND											
CLAY	FINE		MEDIUM	COARSE	FINE		MEDIUM		COARSE		GRAVEL			COBBLES	M.I.T.
CLAY		SILT			SAND						GRAVEL				U.S. BUREAU
					V. FINE	FINE	MED.	COARSE							



**GRAIN SIZE DISTRIBUTION**  
 CLAYEY SILT, trace sand, trace gravel (CL)  
 silty clay layers  
 (TILL)

FIG No.	RR-GS-3
HWY:	404
G.W.P. No.	03-20024

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 1

WP 160-74-26 LOCATION Co-ords. N 15 942 080; E 1 032 064  
 DIST 6 HWY 404 BORING DATE January 15, 1971  
 DATUM Geodetic BOREHOLE TYPE Washboring-WK Casing; Cone  
 ORIGINATED BY VK  
 COMPILED BY VK  
 CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$ $w_p$ $w$ $w_L$ WATER CONTENT %	UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES					
638.2	Ground Level									
1.0	Topsoil		1	SS	17					
	Silty sand with some gravel		2	SS	16					
	Compact to Very Dense Brown Grey		3	SS	40					
623.2			4	SS	66					
15.0	Gravel		5	SS	26					
16.5			6	SS	34					
612.2			7	SS	45					
25.0	Clayey Silt									
27.0										
606.7			8	SS	187					
31.5	End of Borehole									

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 2

W/P 160-74-26 LOCATION Co-ords. N 15 942 100; E 1 032 158 ORIGINATED BY VK  
 DIST 6 HWY 404 BORING DATE Jan. 20, 1971 COMPILED BY VK  
 DATUM Geodetic BOREHOLE TYPE Washboring-MX Casing; Cone CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$		UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. FLOT	NUMBER	TYPE	VALUES		20	40	60	80	100	$w_p$	$w$		
638.0	Ground Level														GR SA SI CL
1.0	Silty sand with some gravel-trace of clay		1	SS	23										
			2	SS	16										7 72 19 2
	Brown		3	SS	24										
	Grey		4	SS	60										9 79 10 2
			5	SS	48										
			6	SS	64										
			7	SS	167										
607.0			8	SS	165										
31.0	End of Borehole														

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 3

WP 160-74-26 LOCATION Co-ords N 15 942 024; E 1 032 223 ORIGINATED BY VK  
 DIST 6 HWY 404 BORING DATE January 21, 1971 COMPILED BY VK  
 DATUM Geodetic BOREHOLE TYPE Washboring-MX Casing; Cone CHECKED BY JK

SOIL PROFILE		STRAT. PLOT	SAMPLES		GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$ $w_p$ — $w$ — $w_L$ WATER CONTENT %	UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION		NUMBER	TYPE					
637.9	Ground Level								
1.0	Topsoil								
	Silty sand with gravel-trace of clay		1	SS	3				
			2	SS	19				
	Loose - Very Dense		3	SS	64				
	Brown		4	SS	42				
			5	SS	67				
617.9	Boulder		6	SS	106.6"				
20.0	End of Borehole								

20  
15 G.S. % STRAIN AT FAILURE  
10

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 4

WP 160-74-26 LOCATION Co-ords. N 15 942 040; E 1 032 309 ORIGINATED BY VK  
 DIST 6 HWY 404 BORING DATE January 21, 1971 COMPILED BY VK  
 DATUM Geodetic BOREHOLE TYPE Washboring-WX Casing; Cone CHECKED BY RS

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100		
635.5	Ground Level												
	Topsoil												
1.0	Silty sand with some gravel-trace of clay		1	SS	15	630							
			2	SS	17								8 82 (10)
	Compact to Very Dense		3	SS	44								
	Brown		4	SS	60								
			5	SS	91	620							34 55 10 1
617.5													
18.0	Clayey silt												
19.5			6	SS	156	6"							
609.0													
26.5	End of Borehole		7	SS	157	6" 610							

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 5

WP 160-74-26 LOCATION co-ords N 15 941 969; E 1 032 379 ORIGINATED BY VK  
 DIST 6 HWY 404 BORING DATE Jan. 20, 1971 COMPILED BY VK  
 DATUM Geodetic BOREHOLE TYPE Washboring-NX Casing; Cone CHECKED BY FC

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE	LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$ $w_p$ $w$ $w_L$ WATER CONTENT %	UNIT WEIGHT $\gamma$	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES					
637.1	Ground Level									
	Topsoil									
1.0	Silty sand with some gravel-trace of clay		1	SS	9					
			2	SS	13					
	Loose to Very Dense		3	SS	67					16 73 (11)
			4	SS	73					
	Brown		5	SS	148					1 57 38 4
			6	SS	135/4"					
611.1			7	SS	130/5"					
26.0	End of Borehole									

OFFICE REPORT ON SOIL EXPLORATION



## **Appendix D**

### **Selected Site Photographs**





**Photo 1.- Highway 404 SBL Piers (looking southeast)**  
**Photo taken on November 3, 2016**



**Photo 2.- Highway 404 SBL, North Approach (looking north)**  
**Photo taken on November 3, 2016**





**Photo 3.- Highway 404 SBL, South Abutment and Pier (looking east)**  
**Photo taken on November 3, 2016**



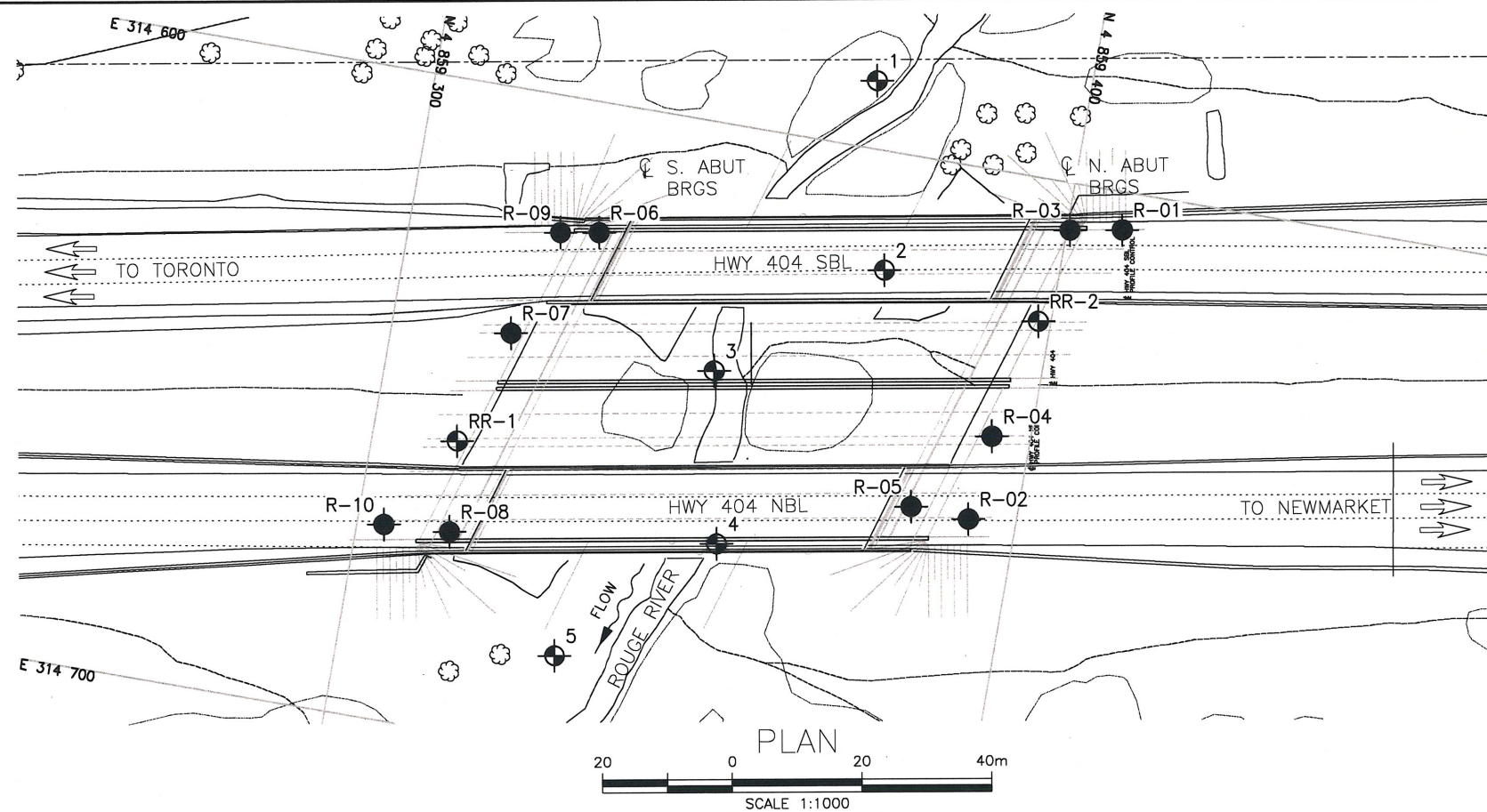
**Photo 4.- Highway 404 NBL, North Abutment and Approach (looking north)**  
**Photo taken on November 3, 2016**



## **Appendix E**

### **Borehole Locations and Soil Strata Drawings**





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

CONT No  
GWP No 2930-17-00



HIGHWAY 404  
ROUGE RIVER BRIDGE  
REPLACEMENT  
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET



THURBER ENGINEERING LTD.



KEYPLAN

LEGEND

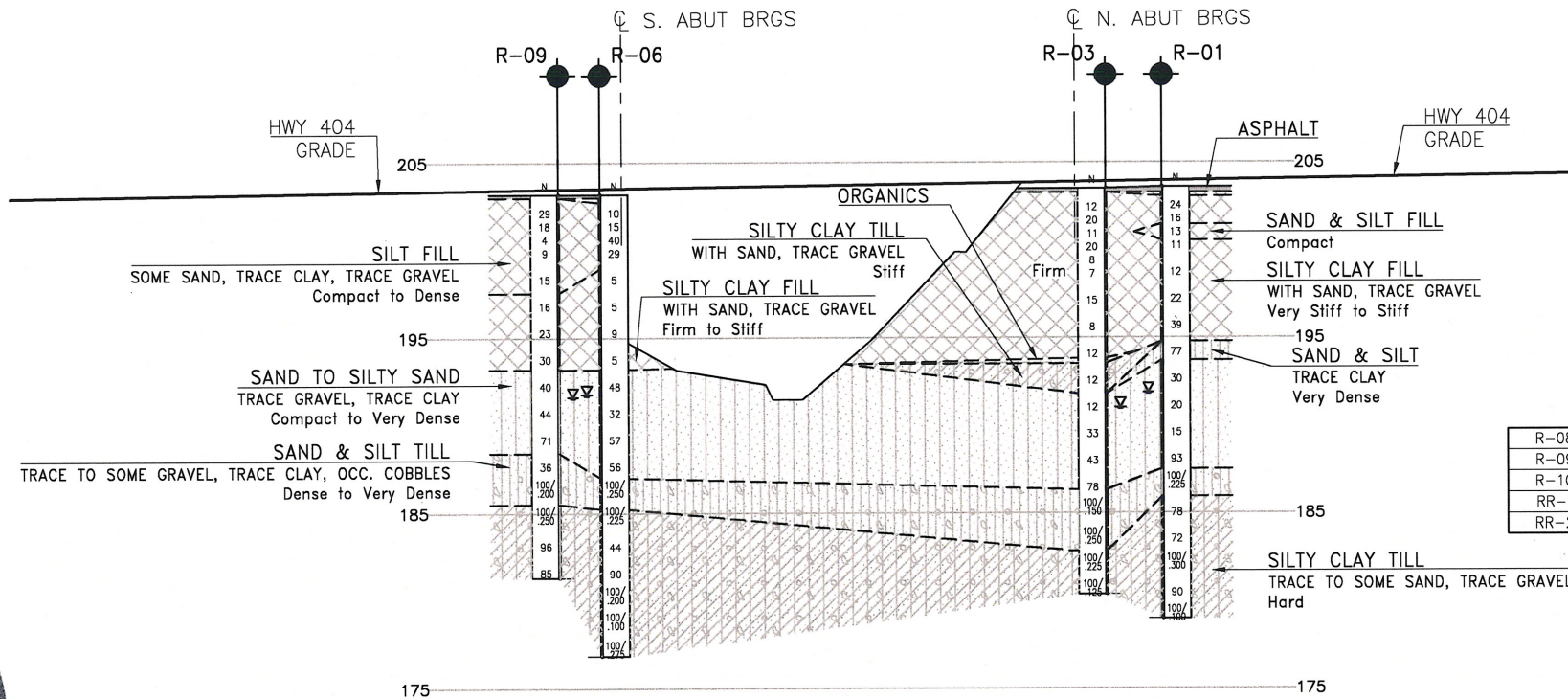
	Borehole (Current Investigation)
	Borehole (Previous Investigations)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level (Open Borehole)
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
1	194.5	4 859 367.3	314 589.5
2	194.5	4 859 373.4	314 618.2
3	194.4	4 859 350.2	314 638.0
4	193.7	4 859 355.1	314 664.2
5	194.2	4 859 333.4	314 685.5
R-01	203.6	4 859 408.4	314 605.8
R-02	203.5	4 859 392.7	314 653.8
R-03	203.5	4 859 400.5	314 607.2
R-04	202.9	4 859 394.1	314 640.6
R-05	203.5	4 859 383.7	314 653.4
R-06	203.2	4 859 329.1	314 620.0
R-07	202.6	4 859 318.3	314 637.6

-NOTES-

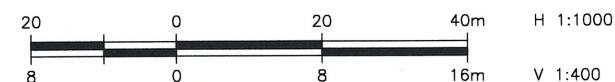
- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- Coordinate system is MTM NAD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

GEOCREs No. 30M14-485



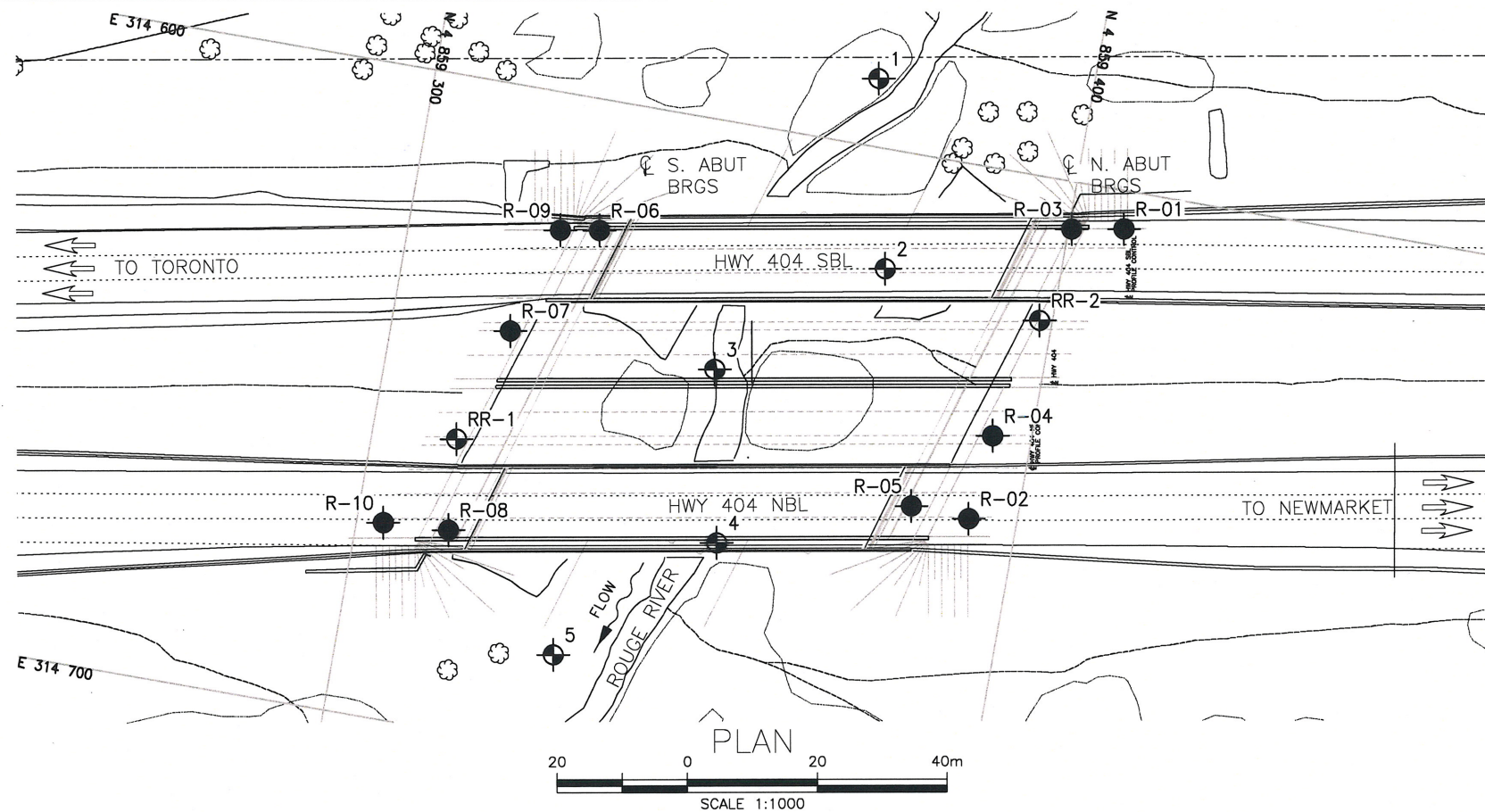
R-08	203.1	4 859 314.2	314 669.4
R-09	203.2	4 859 323.2	314 621.0
R-10	203.1	4 859 304.1	314 670.0
RR-1	202.9	4 859 313.0	314 655.4
RR-2	203.2	4 859 398.1	314 621.9

PROFILE ALONG HWY 404 SBL



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	RPR	CHK SKP	CODE
DRAWN	AN	CHK RPR	SITE
			LOAD
			STRUCT
			DWG 1
			DATE JAN 2019





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

CONT No  
GWP No 2930-17-00



HIGHWAY 404  
ROUGE RIVER BRIDGE  
REPLACEMENT  
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET



THURBER ENGINEERING LTD.



Latitude: 43.836590° Longitude: -79.547003°

KEYPLAN

LEGEND

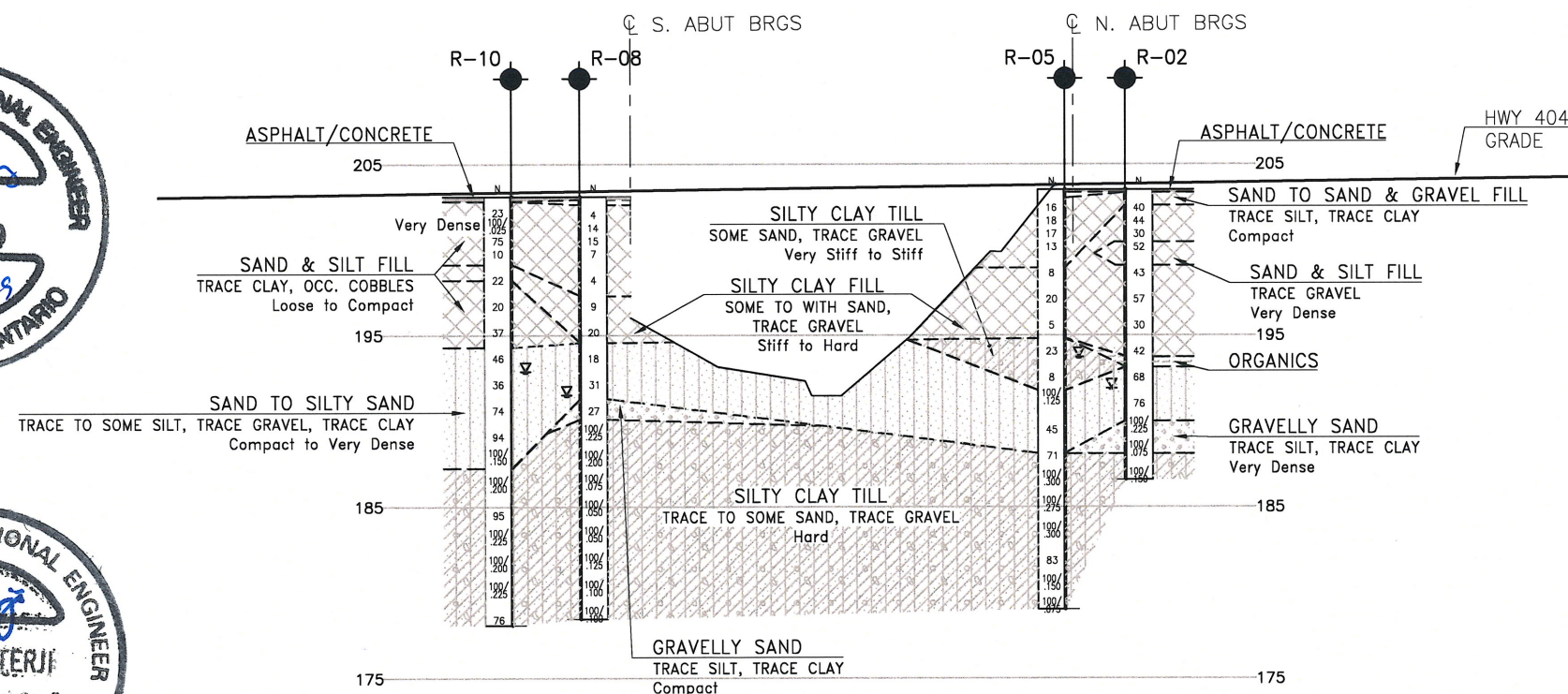
◆	Borehole (Current Investigation)
◆	Borehole (Previous Investigations)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
W	Water Level (Open Borehole)
⊥	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
1	194.5	4 859 367.3	314 589.5
2	194.5	4 859 373.4	314 618.2
3	194.4	4 859 350.2	314 638.0
4	193.7	4 859 355.1	314 664.2
5	194.2	4 859 333.4	314 685.5
R-01	203.6	4 859 408.4	314 605.8
R-02	203.5	4 859 392.7	314 653.8
R-03	203.5	4 859 400.5	314 607.2
R-04	202.9	4 859 394.1	314 640.6
R-05	203.5	4 859 383.7	314 653.4
R-06	203.2	4 859 329.1	314 620.0
R-07	202.6	4 859 318.3	314 637.6

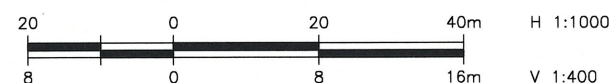
NOTES

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

GEOCREs No. 30M14-485



PROFILE ALONG HWY 404 NBL



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	RPR	CHK SKP	CODE
DRAWN	AN	CHK RPR	SITE
LOAD	DATE	JAN 2019	
STRUCT	DWG	2	



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

CONT No  
GWP No 2930-17-00

HIGHWAY 404  
ROUGE RIVER BRIDGE  
REPLACEMENT  
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET



THURBER ENGINEERING LTD.



### KEYPLAN

### LEGEND

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

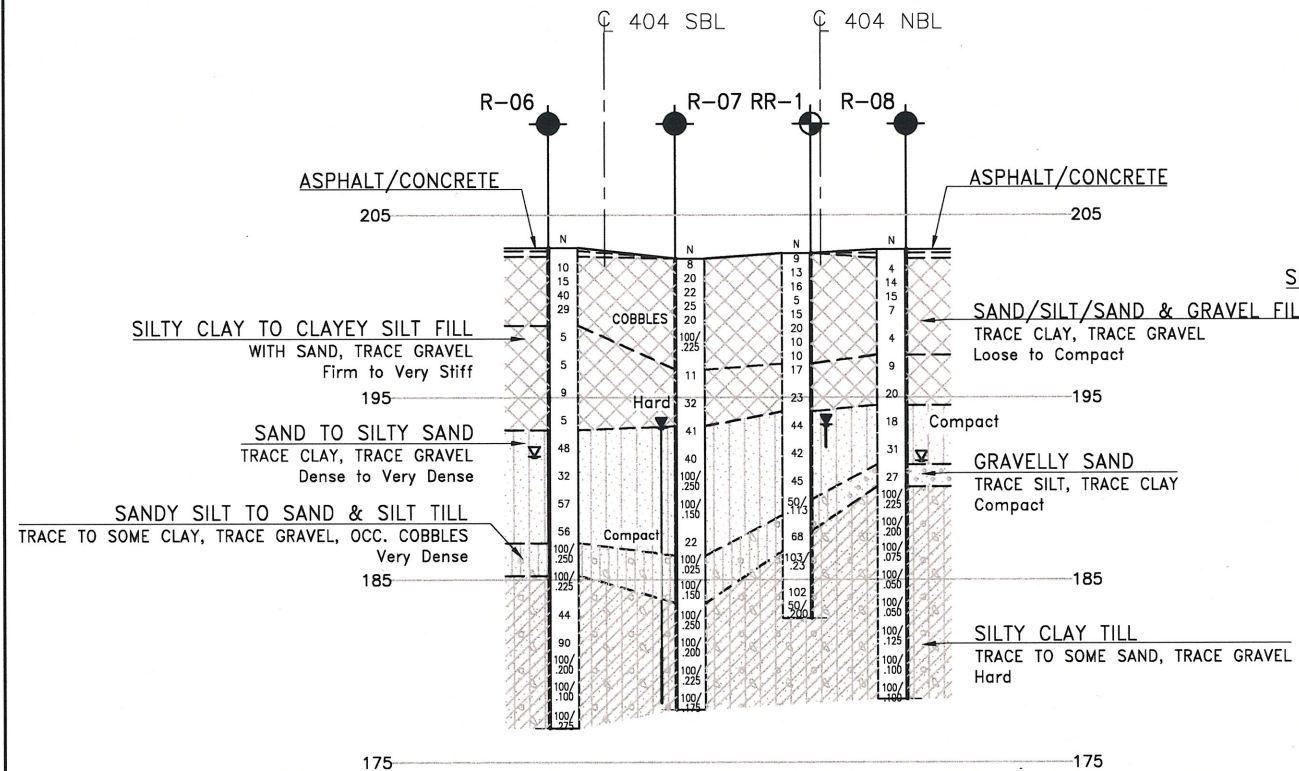
NO	ELEVATION	NORTHING	EASTING
1	194.5	4 859 367.3	314 589.5
2	194.5	4 859 373.4	314 618.2
3	194.4	4 859 350.2	314 638.0
4	193.7	4 859 355.1	314 664.2
5	194.2	4 859 333.4	314 685.5
R-01	203.6	4 859 408.4	314 605.8
R-02	203.5	4 859 392.7	314 653.8
R-03	203.5	4 859 400.5	314 607.2
R-04	202.9	4 859 394.1	314 640.6
R-05	203.5	4 859 383.7	314 653.4
R-06	203.2	4 859 329.1	314 620.0
R-07	202.6	4 859 318.3	314 637.6

### NOTES

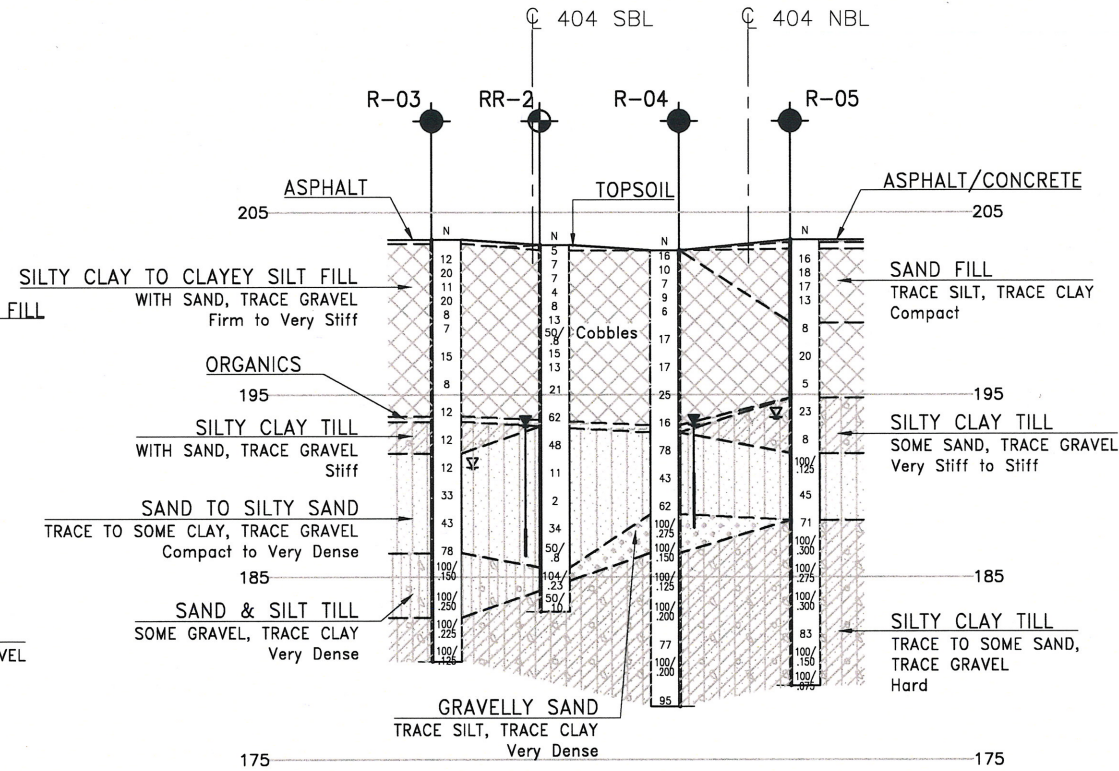
- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- Coordinate system is MTM NAD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

GEOCRES No. 30M14-485

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	RPR	CHK SKP	CODE
DRAWN	AN	CHK RPR	SITE
LOAD	DATE	JAN 2019	
STRUCT	DWG	3	



SECTION ALONG S. ABUT. BRGS



SECTION ALONG N. ABUT. BRGS

