



# Englobe

Soils Materials Environment

**Submitted To AECOM Canada Ltd.  
189 Wyld Street Suite 103, North Bay, Ontario P1B 1Z2  
On Behalf of the Ontario Ministry of Transportation**

**Highway 144 Rehabilitation - GWP 5223-14-00  
Additional Foundation Investigation  
Bridge Replacement – Site No. 46-051  
Whitson River Bridge**

## **FINAL ADDITIONAL FOUNDATION INVESTIGATION REPORT**

Date: February 4, 2016  
Ref. Nº: 12/11/12218-F3

**Geocres No. 41I-338**



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## Final Additional Foundation Investigation Report

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## 1 INTRODUCTION

LVM-Merlex, a Division of EnGlobe Corp. (now known as Englobe Corp.) has been retained by AECOM Canada Ltd., on behalf of the Ministry of Transportation of Ontario (MTO), to carry out an additional foundation investigation at the Whitson River Bridge. The bridge is located on Highway 144, some 20 km north of Highway 17, in the Township of Balfour. The existing bridge is a single span concrete girder structure some 25 m in length.

An initial investigation at this site was carried out by Englobe in 2013 to supply subsurface data for the design of a protection system to be implemented at the Whitson River Bridge for the proposed rehabilitation. The results of the initial investigation were supplied in the Final Foundation Investigation and Design Report, Geocres No. 411-304 (LVM-Merlex Reference No. 12/11/12218), dated March 21, 2014. Following submission of the final report for the initial foundation investigation, it is understood that the bridge structure has been further reviewed and it has been decided that the existing bridge will be replaced rather than rehabilitated.

The initial and additional foundation investigation location was specified by the MTO. The terms of reference for the scope of work are outlined in LVM-Merlex's Proposal for Foundation Engineering 12218-144-R1, dated June 2, 2014. The purpose of this additional investigation was to determine the subsurface conditions in the area of the bridge abutments in order to provide design recommendations for the proposed new abutments as well as to provide subsurface data for the foundation design of a proposed detour and temporary ACROW Modular type structure. Englobe investigated the foundations area by the drilling of boreholes, carrying out in-situ tests, and performing laboratory testing on select samples.

## 2 SITE DESCRIPTION

The Whitson River Bridge is located on Highway 144, between Stations 12+419.5 to 12+444.5, Township of Balfour (Site No. 46-051). The topography at the site is generally of low relief. The existing highway embankment currently supports two undivided lanes of highway, locally running in an east-west direction. Whitson River flows from north to south at the bridge location. A visual review of the highway at the east and west approaches indicates that, in general, the approaches are in poor condition with significant cracking of the asphalt pavement structure.

The existing 25 m single span concrete girder bridge was constructed in 1961 and rehabilitated in 1995 on the existing highway alignment. It is understood that the structure is in poor service condition.

Infrastructure at the bridge location consists of overhead wires on the north and south sides of the highway. Several buried services are present to the north and the south of the existing embankments.

## 2.1 SITE PHYSIOGRAPHY AND SURFICIAL GEOLOGY

This project is located in the Geomorphic Sub-province known as the Eastern Sandy Uplands. The topography along this section of Highway 144 is generally flat to slightly rolling. Within the specific project area overburden consists primarily of sands with silts overlying silty clays overlying bedrock.

Bedrock in the area, as indicated on OGS Map 2506, is of the Middle Precambrian Animikie Group which consists of sandstone, shale, argillite, iron formation, tuff, basalt, and limestone. The map of Bedrock Geology of Ontario published by OGS (MRD126 (Rev.1)) indicates that the carbonaceous slate of Onwatin Formation of the Paleoproterozoic Whitewater Group encountered in the area.

## 3 INVESTIGATION PROCEDURES

The field work for this additional investigation was carried out during the period of September 10<sup>th</sup> to October 1<sup>st</sup>, 2014, during which time six (6) sampled boreholes (Borehole Nos. 5 to 10, inclusive) were advanced. Two boreholes were advanced at each end of the existing bridge, behind the existing abutments: one to the left and one to the right of centerline. One borehole was advanced in the area of each of the abutments for the proposed detour. Borehole No. 1 to 4 inclusive were advanced during the period of August 19<sup>th</sup> to 21<sup>st</sup>, 2013 for the initial foundation investigation, Geocres 411-304.

The field investigation was carried out using a truck and bombardier mounted CME drilling rig equipped with hollow stem augers, standard augers, and routine geotechnical sampling equipment. Prior to mobilizing the auger drill to the site, the concrete approach slabs were core drilled, where required, with an electric core drill. Soil samples were obtained at the borehole locations at regular intervals of depth using the standard 50 mm O.D. split spoon sampler advanced in accordance with the Standard Penetration Test (SPT) procedures (ASTM D-1586). The SPT method involves advancing a 50 mm O.D. split spoon sampler with the force of a 63.5 kg hammer freely dropping 760 mm mounted in a trip (automatic) hammer. The number of blows per 300 mm penetration was recorded as the "N" value. When cohesive deposits were encountered, the in-situ strength was measured using an "N" size field vane, vane collar, and calibrated torque meter. When shallow refusal was encountered, NQ size diamond coring equipment was used to determine the nature of shallow refusal. All samples taken during this investigation were stored in labeled airtight containers for transport to our North Bay laboratory for visual examination and select laboratory testing.

Groundwater conditions in the open boreholes were observed during the advancement of and immediately following, completion of the individual boreholes. All open boreholes were backfilled upon completion with compacted auger cuttings in the general order they were removed and, where necessary, bentonite pellet backfill was added to the boreholes to bring

them up to grade. At the borehole(s) through the embankment, the upper portion of the hole, where necessary, was backfilled with an asphalt cold patch to seal the existing asphalt surface.

The field work for this investigation was under the full time direction of a senior member of the Englobe engineering staff, who was responsible for locating the boreholes, clearing the borehole locations of underground services, in-situ sampling and testing operations, logging of the boreholes, labeling and preparation of samples for transport to our North Bay laboratory, plus overall drill supervision. All samples received a visual confirmatory inspection in our laboratory. Laboratory testing of select samples included routine testing for natural moisture content determination and particle size analysis, an Atterberg Limits Testing, as well as specific gravity testing. The results of the laboratory testing are presented on the individual Record of Borehole Sheets (Appendix 2). Borehole logs from the initial foundation investigation (Borehole Nos. 1 to 4, inclusive) as well as the additional foundation investigation (Borehole Nos. 1 to 10, inclusive) have been included in Appendix 2. Three unconfined compressive tests (UCT) were carried out by the Mississauga laboratory of Golder Associates Limited on selected three intact rock samples recovered at various depths in Borehole Nos. 4, 5 and 9. A summary of results is presented on the laboratory sheets in Appendix 2 (Figures Nos. L-1 to L-8 and Table No. L-10).

The location of the individual boreholes were determined in the field using highway chainage (established by others) and offset relative to highway centerline. The MTO co-ordinates, northing and easting based on MTM zone 12 NAD83 CSRS, were then established for the boring locations. Elevations contained in this report are referenced to a geodetic datum.

## **4 SUBSURFACE CONDITIONS**

Details of the subsurface conditions revealed by the investigation program are presented on the enclosed Record of Borehole Logs (Appendix 2) and on Drawing Nos. 2 and 3 (Appendix 3). Please note that stratigraphic delineation presented on the borehole logs and soil strata plot are the results of non-continuous sampling, response to drilling progress, the results of SPT and field observations. Typically such boundaries represent transitions from one zone to another and are not an exact demarcation of specific geological unit. Additional consideration should be given to the fact that subsurface conditions may vary markedly between adjacent boreholes and beyond any specific boring location, and are shown on the drawings for illustration purposes only.

### **4.1 WHITSON RIVER BRIDGE**

Plans and profiles illustrating the borehole locations and stratigraphic sequences are shown on Drawing Nos. 2a and 2b, Appendix 3.

During the initial exploration program, four (4) sampled boreholes were put down at this site, as follows;

- Borehole No. 1 was advanced to the east of the east approach slab right of centerline;
- Borehole No. 2 was advanced behind the west abutment right of centerline;
- Borehole No. 3 was advanced behind the east abutment to the left of centerline, and
- Borehole No. 4 was advanced to the west of the west approach slab, left of centerline.

At the time of the initial investigation, the ground surface elevations at Boreholes Nos. 1 to 4 were recorded at 268.5, 268.8, 268.6, and 268.9 m, respectively. As noted, the borehole logs for Borehole Nos. 1 to 4 have been included with this report.

During the course of the additional exploration program, six (6) sampled boreholes were put down at this site, as follows;

- Borehole Nos. 5 and 6 were advanced to the east of the east abutment, left and right of centerline, respectively;
- Borehole Nos. 7 and 8 were advanced to the west of the west abutment, right and left of centerline, respectively;
- Borehole No. 9 was advanced in the area of the proposed east detour bridge abutment, and
- Borehole No. 10 was advanced in the area of the proposed west detour bridge abutment.

At the time of the additional subsurface investigation, the ground surface elevations at Boreholes Nos. 5 to 10 were recorded at 268.5, 268.5, 268.8, 268.8, 264.8, and 264.5 m, respectively.

#### 4.1.1 **Pavement Structure**

At surface at Borehole Nos. 1 and 4, a pavement structure consisting of 100 to 150 mm of asphalt and 200 to 300 mm crushed gravel was penetrated. At surface at Borehole Nos. 2, 3, 5, 6, 7, and 8, a pavement structure consisting of 75 to 150 mm of asphalt overlying a concrete approach slab some 200 to 300 mm thick was encountered. A layer of crushed gravel some 200 to 300 mm thick was encountered underlying the concrete approach slab at Borehole Nos. 2, 3, and 5.

#### 4.1.2 **Embankment Fill**

Underlying the pavement structure and concrete approach slab at Borehole Nos. 1 to 8, a deposit of fill consisting of brown sand and gravel to gravelly sand, trace silt was penetrated. Cobble size rock pieces were encountered in this deposit. The natural moisture content measured on samples of this deposit was in the order of 2 to 8%. Gradation analyses were carried out on eight (8) samples of this deposit, the results of which indicated 29 to 48% gravel size particles, 46 to 60% sand size particles, and 6 to 8% silt and clay size particles (Figure No.

L-1, Appendix 3). Based on SPT 'N' values of 7 to 113 blows per 300 mm penetration, the compactness of this deposit was described as loose to very dense, generally dense. This deposit was encountered to depths of 3.4, 4.4, 5.2, 3.0, 5.6, 4.9, 4.0, and 4.3 m below grade at Borehole Nos. 5 to 8, respectively (elevations 265.1, 264.4, 263.4, 265.9, 262.9, 263.6, 264.8, and 264.5 m, respectively).

#### 4.1.3 Sand Fill

Underlying the embankment fill at Borehole Nos. 2, 3, 5, 6, 7, and 8, a deposit of fill described as brown to grey sand some silt was penetrated. The natural moisture content measured on samples of this deposit was in the order of 8 to 30%, indicating a moist to wet moisture condition relative to the estimated optimum moisture content. A gradation analysis was carried out on one (1) sample of this deposit, the results of which indicated 0% gravel size particles, 89% sand size particles, and 11% silt and clay size particles (Figure No. L-2, Appendix 3). Based on SPT 'N' values of 0 (static weight of hammer) to 24 blows per 300 mm penetration, the compactness of this deposit was described as very loose to compact, generally loose. This deposit was encountered to depths of 8.1, 10.1, 11.3, 9.5, and 7.1 m below grade at Borehole Nos. 2, 5, 6, 7, and 8, respectively (Elevations 260.7, 258.4, 257.2, 259.3, and 261.0 m, respectively). Auger refusal was encountered in this deposit at a depth of 10.1 m below grade at Borehole No. 3 (Elevation 258.5 m).

#### 4.1.4 Mixed Fill

Underlying the embankment fill at Borehole No. 4, a deposit of fill described as a mix of cobble and boulder sizes mixed with a grey sand with silt was penetrated. Pieces of wood and concrete were encountered in this deposit. The natural moisture content measured on samples of this deposit was in the order of 21%, indicating a wet condition relative to optimum moisture content. This deposit was encountered to a depth of 4.4 m below grade (Elevation 264.5 m).

#### 4.1.5 Sand

At surface at Borehole No. 9 and underlying the embankment fill at Borehole No. 1, a deposit of brown to grey sand some to with silt was penetrated. The natural moisture content measured on samples of this deposit was in the order of 15 to 54%, indicating a moist wet moisture condition relative to the estimated optimum moisture content. The elevated moisture contents are likely a result of organics mixed with the samples. Gradation analyses were carried out on three (3) samples of this deposit, the result of which indicated 0% gravel size particles, 71 to 84% sand size particle, and 16 to 29% silt and clay size particles (Figure No. L-3, Appendix 3). Based on SPT 'N' values of 0 (static weight of hammer) to 7 blows per 300 mm penetration, the compactness of this deposit was described as very loose to loose. This deposit was encountered to depths of 6.7 and 4.4 m below grade at Borehole Nos. 1 and 9, respectively (Elevations 261.8 and 260.4 m, respectively).

#### 4.1.6 Silt

Underlying the fill at Borehole No. 4, a deposit of grey silt trace clay was penetrated. The natural moisture content measured on a sample of this deposit was in the order of 20%, indicating a wet moisture condition, relative to optimum moisture content. A gradation analysis was carried out on one (1) sample of this deposit, the results of which indicated 0% gravel size particles, 0% sand size particles, 95% silt size particles, and 5% clay size particles (Figure No. L-4, Appendix 3). Based on STP 'N' values of 28 blows per 300 mm penetration, this deposit was described as compact. This deposit was encountered to a depth of 5.8 m below grade (Elevation 263.1 m).

#### 4.1.7 Sand and Silt to Silty Sand

At surface at Borehole No. 10, a deposit of brown sand and silt to silty sand was penetrated. The natural moisture content measured on samples of this deposit was in the order of 18 to 20%, indicating a wet moisture condition relative to the estimated optimum moisture content. Gradation analyses were carried out on two (2) samples of this deposit, the result of which indicated 0 to 1% gravel size particles, 54 to 67% sand size particle, and 33 to 45% silt and clay size particles (Figure No. L-5, Appendix 3). Based on SPT 'N' values of 4 to 5 blows per 300 mm penetration the compactness of this deposit was described as loose. This deposit was encountered to a depth of 2.1 m below grade at Borehole No. 10 (Elevation 262.4 m).

#### 4.1.8 Sandy Silt

Underlying the sand and silt to silty sand at Borehole No. 10, a deposit of grey sandy silt trace clay was penetrated. The natural moisture content measured on a sample of this deposit was in the order of 23%, indicating a moist moisture condition, relative to the estimated optimum moisture content. A hydrometer analysis was carried out on a single sample of this deposit, the results of which indicated 0% gravel size particles, 37% sand size particles, 58% silt size particles, and 55% clay size particles (Figure No. L-6, Appendix 3). Atterberg Limits Testing was carried out on one (1) sample of this deposit, the results of which indicated a liquid limit in the order of 17% and a plastic limit of 14% (Figure No. L-8, Appendix 3). Based on the results of the Atterberg Limits Testing, this deposit was described as inorganic silt (ML). Based on a SPT 'N' value of 12 blows per 300 mm penetration, this deposit was described as compact. This deposit was encountered to a depth of 2.9 m below grade (Elevation 261.6 m).

#### 4.1.9 Silty Clay

Underlying the sand at Borehole Nos. 1 and 9, underlying the silt at Borehole No. 4, underlying the sand fill at Borehole No. 8, and underlying the sandy silt at Borehole No. 10, a deposit of grey silty clay was penetrated. The natural moisture content measured on samples of this deposit was in the order of 30 to 57%, indicating a wet moisture condition relative to the estimated optimum moisture content. Hydrometer analyses were carried out on three samples of this deposit, the results of which indicated 0% gravel size particles, 0 to 1% sand size particles, 23 to 71% silt size particles, and 28 to 77% clay size particles (Figure No. L-7,

Appendix 3). Atterberg Limits Testing was carried out on three (3) samples of this deposit, the results of which indicated a liquid limit in the order of 28 to 61% and a plastic limit of 20 to 22% (Figure No. L-8, Appendix 3). Based on the results of the Atterberg Limits Testing, this deposit was described as silty clay of low to high plasticity (CL to CH). Based on in situ shear strength of 60 to 88 kPa, the consistency of this deposit was described as stiff. This deposit was encountered to depths of 7.8, 7.9, and 7.4 m below grade at Borehole Nos. 8, 9, and 10, respectively (Elevations 261.0, 256.9, and 257.1 m, respectively). Auger refusal was encountered in this deposit at depths of 11.4 and 8.8 m below grade at Borehole Nos. 1 and 4, respectively (Elevations 257.1 and 260.1 m, respectively).

#### 4.1.10 Concrete

A layer of concrete was encountered below the sand fill at Elevation 260.7 m at location of Borehole No. 2. This concrete is likely part of the abutment footing. The borehole was terminated at a depth of 9.3 m below grade at Borehole No. 2 (Elevation 259.5 m).

#### 4.1.11 Bedrock

Underlying the above described sand fill at Borehole Nos. 5, 6, and 7, and underlying the silty clay at Borehole Nos. 4, 8, 9 and 10, bedrock was proven by diamond core drilling. The bedrock was described as black slate. Based on Rock Quality Designation (RQD) values of 49 to 100% the bedrock was described as poor to excellent quality. Photographs of the rock cores are included in Appendix 2. The summarized elevations of the top-of-bedrock are shown on the table below.

BOREHOLE NUMBER	ELEVATION OF TOP-OF BEDROCK (M)
04	260.1
05	258.4
06	257.2
07	259.3
08	261.0
09	256.9
10	257.1

Three unconfined compressive tests (UCT) were carried out on selected three intact rock samples recovered at various depths in Borehole Nos. 4, 5 and 9. Results of testing are summarized on the table below.

BOREHOLE NUMBER	DEPTH/ELEVATION	UNCONFINED COMPRESSIVE STRENGTH
04	11.6 to 11.9 m/ 257.3 to 257 m	22.9 MPa
05	12.64 to 12.88 m/ 255.86 to 255.62 m	79.7 MPa
09	9.26 to 9.46 m/ 255.54 to 255.34 m	100.1 MPa

Sampling in the bedrock was terminated at a depth of 12.2, 13.1, 14.3, 12.5, 11.0, 10.9, and 11.0 m below grade at Borehole Nos. 4 to 10, respectively (Elevations 256.7, 255.4, 254.2, 256.3, 257.8, 253.9, and 253.5 m, respectively). It should be noted that, when encountered, the underlying bedrock surfaces in this area are very erratic in nature, varying in elevation over short horizontal distances.

## **4.2 GROUNDWATER DATA**

Measurements of the groundwater table and cave-in levels were undertaken, where possible, in the open boreholes during the advance of the individual borings and upon completion. Piezometers were installed at Borehole Nos. 5, 8 and 9 to determine stabilized water levels. These levels are recorded on the individual Record of Borehole Log Sheets (Appendix 2).

The groundwater levels in Borehole Nos. 5, 8, and 9 were measured at Elevations between 262.8 to 264.3 m, some one to three days after completion of the field program. The groundwater was encountered at Elevations 265.2 and 262.0 m below grade at Borehole Nos. 6 and 10 immediately following completion of coring, however this water level was not stabilized and was likely elevated due to the water used during coring operations. The water levels in Whitson River were measured at Elevation 264.2 m in May 2013 by others and at Elevation 262.7 m in September 2014.

The groundwater and river water levels will fluctuate seasonally/yearly.

## Appendix 1 Key Plan

Drawing No. 1

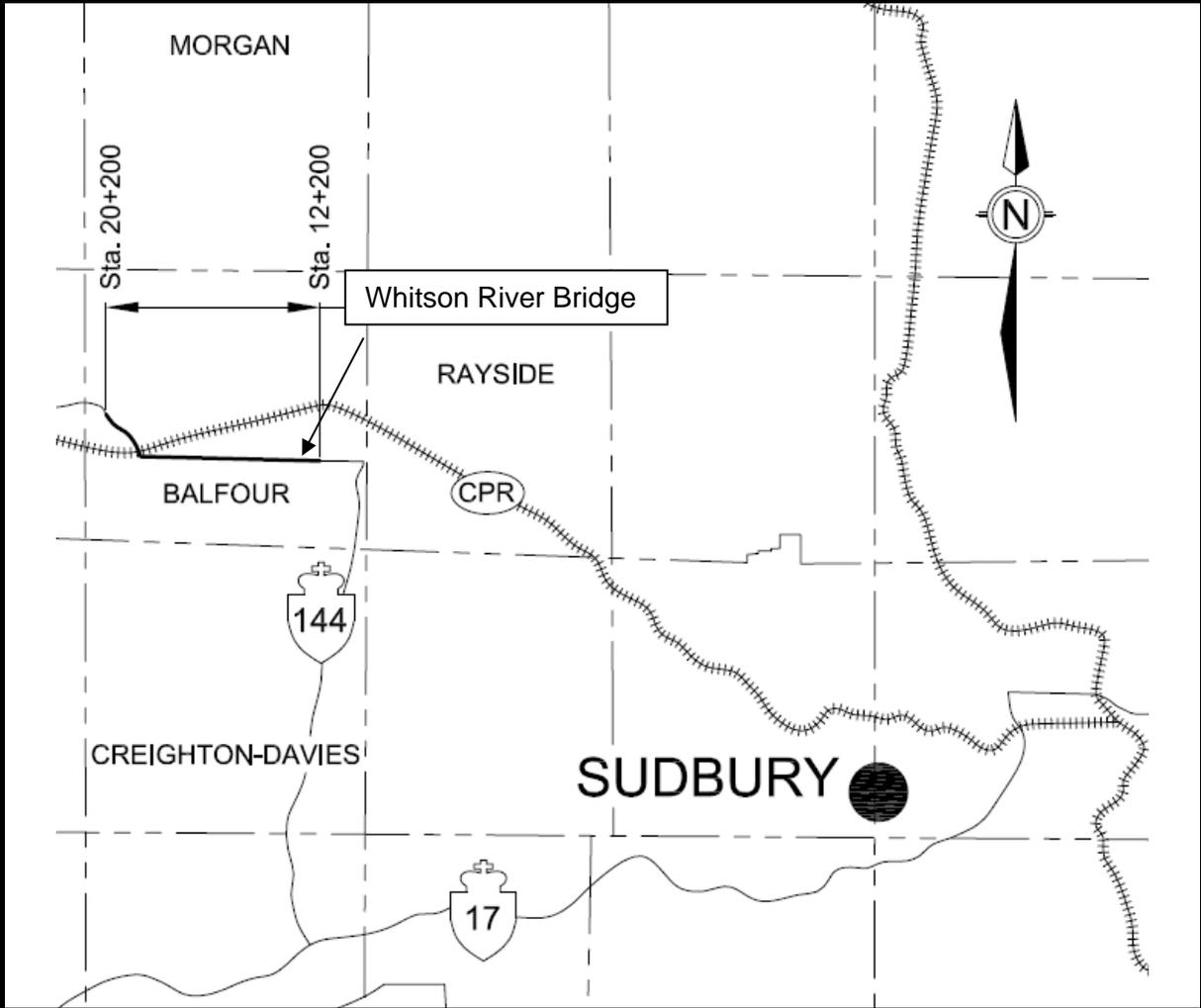
Key Plan



# KEY PLAN

Drawing No. 1

NOT TO SCALE



**FINAL**  
**ADDITIONAL FOUNDATION INVESTIGATION**  
**AND DESIGN REPORT**  
**GWP 5223-14-00**  
Highway 144  
Whitson River Bridge



Reference No: 12/11/12218-F3

February 2016

## Appendix 2 Subsurface Data

Enclosure No. 1	List of Abbreviations and Symbols
Enclosure Nos. 2 to 11	Record of Borehole Sheet
Enclosure No. 12	Photos of Rock Cores

## LIST OF ABBREVIATIONS & DESCRIPTION OF TERMS

The abbreviations and terms, used to describe retrieved samples and commonly employed on the borehole logs, on the figures and in the report are as follows:

### 1. ABBREVIATIONS

AS	Auger Sample
CS	Chunk Sample
DS	Denison type sample
FS	Foil Sample
NFP	No Further Progress
PH	Sampler advanced by hydraulic pressure
PM	Sampler advanced by manual pressure
RC	Rock core with size & percentage of recovery
SS	Split Spoon
ST	Slotted Tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash Sample
WH	Sampler advanced by static weight of hammer and/or rods
Rec	% recovery from individual run of rock core
RQD	Rock quality designation (%)

### 2. PENETRATION RESISTANCE/"N"

*Dynamic Cone Penetration Test (DCPT):*

A continuous profile showing the number of blows for each 300 mm of penetration of a 50 mm diameter 60° cone attached to AW rod driven by a 63 kg hammer falling 760 mm.

Plotted as 

*Standard Penetration Test (SPT) or "N" Values*

The number of blows of a 63 kg hammer falling 760 mm required to advance a 50 mm O.D. drive open sampler 300 mm.

### 3. SOIL DESCRIPTION

a) *Cohesionless Soils:*

"N" (blows/0.3 m)	Relative Density
0 to 4	very loose
4 to 10	loose
10 to 30	compact
30 to 50	dense
over 50	very dense

b) *Cohesive Soils:*

Undrained Shear Strength (kPa)	Consistency
Less than 12	very soft
12 to 25	soft
25 to 50	firm
50 to 100	stiff
100 to 200	very stiff
over 200	hard

### 3. SOIL DESCRIPTION (Cont'd)

c) *Bedrock:*

RQD (%)	Classification
Less than 25	Very poor quality
25 to 50	Poor quality
50 to 75	Fair quality
75 to 90	Good quality
90 to 100	Excellent quality

d) *Method of Determination of Undrained Shear Strength of Cohesive Soils:*

+ 3.2 - Field Vane test in borehole.  
The number denotes the sensitivity to remoulding.

D - Laboratory Vane Test

" - Compression test in laboratory

For a saturated cohesive soil the undrained shear strength is taken as one-half of the undrained compressive strength.

e) *Soil Moisture:*

Moisture	Described as
Dry	Below optimum moisture content
Moist	Near optimum moisture content
Wet	Above optimum moisture content

### 4. TERMINOLOGY

Terminology used for describing soil strata is based on the proportion of individual particle sizes present in the samples (please note that, with the exception of those samples subject to a grain-size analysis, all samples were classified visually and the accuracy of visual examination is not sufficient to determine exact grain sizing):

Trace, or occasional	Less than 10%
Some	10 to 20%
With	20 to 30%
Adjective (i.e. silty or sandy)	30 to 40%
And (i.e. sand and gravel)	40 to 60%

Terminology for cobbles and boulders is based on auger response and field observations:

Occasional	Obstructions encountered in borehole, however advance is not impeded
Numerous	Obstructions are essentially continuous over drilled length

**SAMPLE DESCRIPTION NOTES:**

- FILL:** The term fill is used to designate all man-made deposits of natural soil and/or waste materials. The reader is cautioned that fill materials can be very heterogeneous in nature and variable in depth, density and degree of compaction. Fill materials can be expected to contain organics, waste materials, construction materials, shot rock, rip-rap, and/or larger obstructions such as boulders, concrete foundations, slabs, abandoned tanks, etc.; none of which may have been encountered in the borehole. The description of the material penetrated in the borehole therefore may not be applicable as a general description of the fill material on the site as boreholes cannot accurately define the nature of fill material. During the boring and sampling process, retrieved samples may have certain characteristics that identify them as 'fill'. Fill materials (or possible fill materials) will be designated on the Borehole Logs. If fill material is identified on the site, it is highly recommended that testpits be put down to delineate the nature of the fill material. However, even through the use of testpits defining the true nature and composition of the fill material cannot be guaranteed. Fill deposits often contain pockets or seams of organics, organically contaminated soils or other deleterious material that can cause settlement or result in the production of methane gas. It should be noted that the origins and history of fill material is frequently very vague or non-existent. Often fill material may be contaminated beyond environmental guidelines and the material will have to be disposed of at a designated site (i.e. registered landfill). Unless requested or stated otherwise in this report, fill material on this site has not been tested for contaminants however, environmental testing of the fill material can be carried out at your request. Detection of underground storage tanks cannot be determined with conventional geotechnical procedures.
- TILL:** The term till indicates a material that is an unstratified, glacial deposit, heterogeneous in nature and, as such, may consist of mixtures and pockets of clay, silt, sand, gravel, cobbles and/or boulders. These heterogeneous deposits originate from a geological process associated with glaciation. It must be noted that due to the highly heterogeneous nature of till deposits, the description of the deposit on the borehole log may only be applicable to a very limited area and therefore, caution must be exercised when dealing with a till deposit. When excavating in till, contractors may encounter cobbles/boulders or possibly bedrock even if they are not indicated on the borehole logs. It must be appreciated that conventional geotechnical sampling equipment does not identify the nature or size of any obstruction.
- BEDROCK:** Auger refusal may be due to the presence of bedrock, but possibly could also be due to the presence of very dense underlying deposits, boulders or other large obstructions. Auger refusal is defined as the point at which an auger can no longer be practically advanced. It must be appreciated that conventional geotechnical sampling equipment does not differentiate between nature and size of obstructions that prevent further penetration of the boring below grade. Bedrock indicated on the borehole logs will be labeled 'possibly' or 'probable' etc. based on the response of the boring and sampling equipment, surrounding topography, etc. Bedrock can be proven at individual borehole locations, at your request, by diamond core drilling operations or, possibly, by testpits. It must also be appreciated that bedrock surfaces can be, and most times are, very erratic in nature (i.e. sheer drops, isolated rock knobs, etc.) and caution must be used when interpreting subsurface conditions between boreholes. A bedrock profile can be more accurately estimated, at the clients' request, through a series of closely positioned unsampled auger probes combined with core drilling.
- GROUNDWATER:** Although the groundwater table may have been encountered during this investigation and the elevation noted in the report and/or on the record of boreholes, it must be appreciated that the elevation of the groundwater table will fluctuate based upon seasonal conditions, localized changes, erratic changes in the underlying soil profile between boreholes, underlying soil layers with highly variable permeabilities, etc. These conditions may affect the design and type and nature of dewatering procedures. Cave-in levels recorded in borings give a general indication of the groundwater level in cohesionless soils however, it must be noted that cave-in levels may also be due to the relative density of the deposit, drilling operations etc.

**METRIC**

**RECORD OF BOREHOLE NO. 01**



REFERENCE 12/11/12218-F3 DATUM Geodetic LOCATION N 5158833.9 E 288453.0 - Station 12+401.7 Balfour Township ORIGINATED BY JL  
 PROJECT GWP 5223-14-00, Highway 144, Site No. 46-051 BOREHOLE TYPE Truck Mounted CME 45B - Hollow Stem Augers COMPILED BY AT  
 CLIENT AECOM DATE (Started) 19 August 2013 TIME   
 DATE (Completed) 19 August 2013 (Completed) 5:00:00 PM CHECKED BY MAM

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 (%) GR SA (SI CL)
ELEV DEPTH	DESCRIPTION (see Enclosure No. 1)	STRATA PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
268.5	Ground Surface												
0.0	150 mm Asphalt 300 mm Crushed Gravel  FILL - sand and gravel trace silt  brown, dry  (compact/very dense)	[Cross-hatched pattern]	1	SS	72								47 47 (6)
			2	SS	69								
			3	SS	17								
			4	SS	41								
265.1			5	SS	19								
3.4	SAND - with silt  brown, dry  (very loose)  moist	[Dotted pattern]	6	SS	2								0 75 (25)
			7	SS	2								
			8	SS	2								
261.8													
6.7	SILTY CLAY  grey, wet  6 mm silt varves at 25 mm spacing  (stiff)	[Diagonal hatched pattern]	9	SS	WH								
			10	SS	PM								
			11	SS	PM								
257.1													
11.4	Auger Refusal End of Borehole												

COMMENTS: + 3, X 3 : Numbers on right refer to Sensitivity  
 Numbers on left refer to values greater than 120 kPa  
 ○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS		
Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 19/8/13 5:00:00 PM	6.7	▽ -
2) 21/8/13 5:05:00 PM	6.7	▽ -
3) 22/8/13 8:40:00 AM	6.7	▽ -

The stratification lines represent approximate boundaries. The transition may be gradual.

MEL-GEO 12218 - BOREHOLE LOGS (ADDITIONAL).GPJ MEL-GEO.GDT 23/12/15

**METRIC**

**RECORD OF BOREHOLE NO. 02**



REFERENCE 12/11/12218-F3 DATUM Geodetic LOCATION N 5158834.8 E 288407.7 - Station 12+447 Balfour Township ORIGINATED BY JL  
 PROJECT GWP 5223-14-00, Highway 144, Site No. 46-051 BOREHOLE TYPE Truck Mounted CME 45B - Hollow Stem Augers COMPILED BY AT  
 CLIENT AECOM DATE (Started) 20 August 2013 TIME \_\_\_\_\_ DATE (Completed) 20 August 2013 (Completed) \_\_\_\_\_ CHECKED BY MAM

SOIL PROFILE		STRATA PLOT	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 (see Enclosure No. 1)		NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
268.8	Ground Surface												
0.0	100 mm Asphalt	[Strata Plot: Diagonal Hatching]	1	SS	29								
	250 mm Concrete												
268.2	300 mm Crushed Gravel												
0.6	FILL - sand and gravel trace silt												
	brown, dry		2	SS	30								48 46 (6)
	(compact/dense)												
			3	SS	27								
			4	SS	50								39 55 (6)
			5	SS	18								
264.4	FILL - sand some silt												
4.4	brown, dry												
	(loose/compact)	6	SS	45								37 54 (9)	
		7	SS	17								0 89 (11)	
		8	SS	8									
	grey, wet												
260.7	creosote treated wood in tip												
8.1	CONCRETE												
	(probably footing)	9	SS	15									
259.5	End of Borehole												
9.3													

MEL-GEO 12218 - BOREHOLE LOGS (ADDITIONAL). GPJ MEL-GEO.GDT 23/12/15

COMMENTS	+ 3, X 3 : Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa ○ 3% STRAIN AT FAILURE	WATER LEVEL RECORDS		
		Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
The stratification lines represent approximate boundaries. The transition may be gradual.		1) 20/8/13 3:30:00 PM	4.1	▽ -
		2) 21/8/13 5:00:00 PM	6.6	▽ -
		3) 22/8/13 8:35:00 AM	6.6	▽ -

**METRIC**

**RECORD OF BOREHOLE NO. 03**



REFERENCE 12/11/12218-F3 DATUM Geodetic LOCATION N 5158829.5 E 288438.6 - Station 12+416 Balfour Township ORIGINATED BY JL  
 PROJECT GWP 5223-14-00, Highway 144, Site No. 46-051 BOREHOLE TYPE Truck Mounted CME 45B - Hollow Stem Augers COMPILED BY AT  
 CLIENT AECOM DATE (Started) 21 August 2013 TIME   
 DATE (Completed) 21 August 2013 (Completed) 11:30:00 AM CHECKED BY MAM

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 (see Enclosure No. 1)	STRATA PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa							WATER CONTENT (%)											
268.6	Ground Surface																									
0.0	75 mm Asphalt		1	SS	27																					
268.0	300 mm Concrete																									
	250 mm Crushed Gravel																									
0.6	FILL - gravelly sand trace silt			2	SS	17								33 60 (7)												
	brown, dry																									
	(loose/very dense)			3	SS	7																				
				4	SS	29																				
				5	SS	42								32 60 (8)												
			6	SS	35																					
			7	SS	61								29 63 (8)													
263.4	FILL - sand some silt																									
5.2	grey, moist																									
	(very loose/loose)		8	SS	6																					
			9	SS	5																					
			10	SS	1																					
258.5	Auger Refusal																									
10.1	End of Borehole																									
COMMENTS							+ 3, X 3 : Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa ○ 3% STRAIN AT FAILURE			WATER LEVEL RECORDS <table border="1"> <thead> <tr> <th>Date (dd/mm/yy)/Time</th> <th>Water Depth (m)</th> <th>Cave In (m)</th> </tr> </thead> <tbody> <tr> <td>1) 21/8/13 11:30:00 AM</td> <td>DRY</td> <td>6.4</td> </tr> <tr> <td>2)</td> <td>-</td> <td>-</td> </tr> <tr> <td>3)</td> <td>-</td> <td>-</td> </tr> </tbody> </table>					Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)	1) 21/8/13 11:30:00 AM	DRY	6.4	2)	-	-	3)	-	-
Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)																								
1) 21/8/13 11:30:00 AM	DRY	6.4																								
2)	-	-																								
3)	-	-																								
The stratification lines represent approximate boundaries. The transition may be gradual.																										

MEL-GEO 12218 - BOREHOLE LOGS (ADDITIONAL).GPJ\_MEL-GEO.GDT 23/12/15

**METRIC**

**RECORD OF BOREHOLE NO. 04**



REFERENCE 12/11/12218-F3 DATUM Geodetic LOCATION N 5158830.0 E 288397.6 - Station 12+457 Balfour Township ORIGINATED BY JL

PROJECT GWP 5223-14-00, Highway 144, Site No. 46-051 BOREHOLE TYPE Truck Mounted CME 45B - Hollow Stem Augers COMPILED BY AT

CLIENT AECOM DATE (Started) 21 August 2013 TIME  DATE (Completed) 21 August 2013 (Completed) 8:10:00 PM CHECKED BY MAM

SOIL PROFILE		STRATA PLOT	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 (see Enclosure No. 1)		NUMBER	TYPE			"N" VALUES	20					
268.9	Ground Surface												
0.0	100 mm Asphalt 200 mm Crushed Gravel  FILL - sand and gravel trace silt  brown, dry  (dense/very dense)		1	SS	45								
			2	SS	78								
			3	SS	44								47 47 (6)
			4	SS	51								
265.9	FILL - cobbles/boulder size rock mixed with sand with silt  grey, wet		5	SS	50/75 mm								
	pieces of wood and concrete		6	SS	25/25 mm								
264.5	SILT trace sand  grey, wet  (compact)		7	SS	28								0 0 95 5
263.1	SILTY CLAY  grey, wet  (stiff)		8	SS	WH								
			9	SS	PM								
260.1	BEDROCK - black slate  fair to excellent to quality		10	RC	Rec=100% RQD=74%								
			11	RC	Rec=100% RQD=98%								
			12	RC	Rec=100% RQD=98%								
256.7	End of Borehole												

COMMENTS  
Note: Groundwater level in borehole at 0.5 m depth below grade upon completion. Water level NOT Stabilized.

The stratification lines represent approximate boundaries. The transition may be gradual.

+ 3, X 3 : Numbers on right refer to Sensitivity  
Numbers on left refer to values greater than 120 kPa  
○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS		
Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1)	-	-
2)	-	-
3)	-	-

MEL-GEO 12218 - BOREHOLE LOGS (ADDITIONAL). GPJ MEL-GEO.GDT 23/12/15



**METRIC**

**RECORD OF BOREHOLE NO. 05**



REFERENCE 12/11/12218-F3 DATUM Geodetic LOCATION N 5158829.5 E 288438.6 - Station 12+416 Balfour Township ORIGINATED BY JL  
 PROJECT GWP 5223-14-00, Highway 144, Site No. 46-051 BOREHOLE TYPE Truck Mounted CME 45B - Hollow Stem Augers COMPILED BY AT  
 CLIENT AECOM DATE (Started) 9 September 2014 TIME   
 DATE (Completed) 9 September 2014 (Completed) 12:00:00 PM CHECKED BY MAM

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 (%) GR SA (SI CL)
ELEV. DEPTH	DESCRIPTION (see Enclosure No. 1)	STRATA PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80					
255.4 13.1	Continued from Previous Page End of Borehole															

MEL-GEO 12218 - BOREHOLE LOGS (ADDITIONAL).GPJ MEL-GEO.GDT 23/12/15

**METRIC**

**RECORD OF BOREHOLE NO. 06**



REFERENCE 12/11/12218-F3 DATUM Geodetic LOCATION N 5158833.9 E 288438.7 - Station 12+416 Balfour Township ORIGINATED BY JL  
 PROJECT GWP 5223-14-00, Highway 144, Site No. 46-051 BOREHOLE TYPE Truck Mounted CME 45B - Hollow Stem Augers COMPILED BY AT  
 CLIENT AECOM DATE (Started) 11 September 2014 TIME   
 DATE (Completed) 11 September 2014 (Completed) 11:00:00 AM CHECKED BY MAM

SOIL PROFILE		STRATA PLOT	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 (see Enclosure No. 1)		NUMBER	TYPE			"N" VALUES	20	40					
268.5	Ground Surface													
0.0	150 mm Asphalt													
268.1	275 mm Concrete													
0.4	FILL - sand and gravel trace silt brown, dry cobble size rock pieces encountered (compact/very dense)		1	AS										
			2	SS	20									
			3	SS	41									
			4	SS	50/100 mm									
			5	SS	52									
			6	SS	45									
263.6	FILL - sand some silt grey, moist (very loose/compact)		7	SS	54									
4.9			8	SS	1									
			9	SS	5									
			10	SS	5									
			11	SS	13									
257.2	BEDROCK - black slate fair to excellent quality		12	RC	Rec=100% RQD=100%									
11.3														

Continued Next Page

COMMENTS	+ 3, X 3 : Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa ○ 3% STRAIN AT FAILURE	WATER LEVEL RECORDS		
		Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
		1) 11/9/14 11:00:00 AM	DRY	5.3
		2) 11/9/14 3:00:00 PM	3.3	-
		3) 30/12/99	-	-

The stratification lines represent approximate boundaries. The transition may be gradual.

MEL-GEO 12218 - BOREHOLE LOGS (ADDITIONAL).GPJ MEL-GEO.GDT 23/12/15

**METRIC**

**RECORD OF BOREHOLE NO. 06**



REFERENCE 12/11/12218-F3 DATUM Geodetic LOCATION N 5158833.9 E 288438.7 - Station 12+416 Balfour Township ORIGINATED BY JL  
 PROJECT GWP 5223-14-00, Highway 144, Site No. 46-051 BOREHOLE TYPE Truck Mounted CME 45B - Hollow Stem Augers COMPILED BY AT  
 CLIENT AECOM DATE (Started) 11 September 2014 TIME (Completed) 11:00:00 AM CHECKED BY MAM  
 DATE (Completed) 11 September 2014

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 (%) GR SA (SI CL)		
ELEV DEPTH	DESCRIPTION (see Enclosure No. 1) Continued from Previous Page	STRATA PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80						100	20
254.2		X	13	RC	Rec=60% ROD=60%	255												
14.3	End of Borehole																	

MEL-GEO 12218 - BOREHOLE LOGS (ADDITIONAL).GPJ MEL-GEO.GDT 23/12/15

**METRIC**

**RECORD OF BOREHOLE NO. 07**



REFERENCE 12/11/12218-F3 DATUM Geodetic LOCATION N 5158834.8 E 288405.2 - Station 12+449.2 Balfour Township ORIGINATED BY JL  
 PROJECT GWP 5223-14-00, Highway 144, Site No. 46-051 BOREHOLE TYPE Truck Mounted CME 45B - Hollow Stem Augers COMPILED BY AT  
 CLIENT AECOM DATE (Started) 11 September 2014 TIME \_\_\_\_\_ DATE (Completed) 11 September 2014 (Completed) CHECKED BY MAM

SOIL PROFILE		STRATA PLOT	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 (see Enclosure No. 1)		NUMBER	TYPE			"N" VALUES	20	40					
268.8	Ground Surface													
0.0	125 mm Asphalt													
268.4	250 mm Concrete													
0.4	FILL - sand and gravel trace silt		1	AS										
	brown, dry		2	SS	25									
	(compact/very dense)		3	SS	40									
	cobble size rock pieces encountered		4	SS	58									
			5	SS	44									
264.8	FILL - sand some silt		6	SS	37									
4.0	brown, moist		7	SS	22									
	(very loose/compact)		8	SS	2									
			9	SS	13									
259.3	pieces of rock and wood encountered below 9.3 m depth		10	SS	25/50 mm									
9.5	BEDROCK - black slate		11	RC	Rec=100% RQD=100%									
	excellent quality		12	RC	Rec=100% RQD=100%									
256.3	End of Borehole													
12.5														

COMMENTS: + 3, X 3 : Numbers on right refer to Sensitivity. Numbers on left refer to values greater than 120 kPa. ○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS		
Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1)	-	-
2)	-	-
3)	-	-

The stratification lines represent approximate boundaries. The transition may be gradual.

MEL-GEO 12218 - BOREHOLE LOGS (ADDITIONAL). GPJ MEL-GEO.GDT 23/12/15

**METRIC**

**RECORD OF BOREHOLE NO. 08**



REFERENCE 12/11/12218-F3 DATUM Geodetic LOCATION N 5158830.3 E 288404.6 - Station 12+450 Balfour Township ORIGINATED BY JL  
 PROJECT GWP 5223-14-00, Highway 144, Site No. 46-051 BOREHOLE TYPE Truck Mounted CME 45B - Hollow Stem Augers COMPILED BY AT  
 CLIENT AECOM DATE (Started) 10 September 2014 TIME   
 DATE (Completed) 10 September 2014 (Completed) 12:00:00 PM CHECKED BY MAM

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 (see Enclosure No. 1)	STRATA PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					
268.8	Ground Surface												
0.0	125 mm Asphalt												
268.4	250 mm Concrete												
0.4	FILL - sand and gravel trace silt		1	AS									
	brown, dry		2	SS	74								
	(dense/very dense)		3	SS	75								
	cobble size rock pieces encountered		4	SS	57								
			5	SS	39								
			6	SS	41								
264.5	FILL - sand some silt												
4.3	brown, moist		7	SS	24								
	(loose/compact)		8	SS	15								
	wet												
261.7	SILTY CLAY												
7.1	grey, wet		9	SS	40/100 mm								
261.0	BEDROCK - black slate												
7.8	good to excellent quality		10	RC	Rec=100% RQD=87%								
			11	RC	Rec=100% RQD=100%								
257.8	End of Borehole												
11.0													

MEL-GEO 12218 - BOREHOLE LOGS (ADDITIONAL).GPJ MEL-GEO.GDT 23/12/15

COMMENTS	+ 3, X 3 : Numbers on right refer to Sensitivity Numbers on left refer to values greater than 120 kPa ○ 3% STRAIN AT FAILURE	WATER LEVEL RECORDS		
		Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
The stratification lines represent approximate boundaries. The transition may be gradual.		1) 10/9/14 12:00:00 PM	DRY	▽ -
		2) 11/9/14 11:00:00 AM	4.9	▽ -
		3) 12/9/14 1:30:00 PM	4.9	▽ -

**METRIC**

**RECORD OF BOREHOLE NO. 09**



REFERENCE 12/11/12218-F3 DATUM Geodetic LOCATION N 5158852.6 E 288454.3 - Station 12+400.7 Balfour Township ORIGINATED BY JL  
 PROJECT GWP 5223-14-00, Highway 144, Site No. 46-051 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT  
 CLIENT AECOM DATE (Started) 30 September 2014 TIME   
 DATE (Completed) 1 October 2014 (Completed) 10:00:00 AM CHECKED BY MAM

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 (see Enclosure No. 1)	STRATA PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa							
						20	40	60	80	100	20	40	60		GR SA (SI CL)
264.8	Ground Surface														
0.0	SAND - some silt brown (very loose/loose)		1	SS	WH										
			2a	SS											0 71 (29)
			2b	SS	7										
	trace wood encountered		3	SS	5										
			4	SS	2										
			5	SS	6										0 84 (16)
	trace wood encountered		6	SS	5										
260.4	SILTY CLAY														
4.4	grey (stiff)		7	TO	2										0 0 23 77
			8	SS	WH										
			9	SS	PM										0 1 43 56
			10	SS	50/50 mm										
256.9	BEDROCK - black slate														
7.9	excellent quality		11	RC	Rec=100% ROD=100%										
			12	RC	Rec=100% ROD=91%										
253.9	End of Borehole														
10.9															

COMMENTS: + 3, X 3 : Numbers on right refer to Sensitivity; Numbers on left refer to values greater than 120 kPa; O 3% STRAIN AT FAILURE

WATER LEVEL RECORDS		
Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 30/9/14 4:30:00 PM	0.9	▽ -
2) 2/10/14 11:00:00 AM	0.5	▽ -
3)	-	▽ -

The stratification lines represent approximate boundaries. The transition may be gradual.

MEL-GEO 12218 - BOREHOLE LOGS (ADDITIONAL).GPJ\_MEL-GEO.GDT 23/12/15

**METRIC**

**RECORD OF BOREHOLE NO. 10**



REFERENCE 12/11/12218-F3 DATUM Geodetic LOCATION N 5158848.9 E 288412.2 - Station 12+443 Balfour Township ORIGINATED BY JL  
 PROJECT GWP 5223-14-00, Highway 144, Site No. 46-051 BOREHOLE TYPE Track Mounted CME 45B - Hollow Stem Augers COMPILED BY AT  
 CLIENT AECOM DATE (Started) 1 October 2014 TIME   
 DATE (Completed) 1 October 2014 (Completed) 4:30:00 PM CHECKED BY MAM

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 (see Enclosure No. 1)	STRATA PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa						
264.5	Ground Surface													
0.0	150 mm Organic Soil		1	SS	4								1 54 (45)	
	SAND AND SILT to silty sand		2	SS	5									
	brown													
	(loose)		3	SS	5								0 67 (33)	
262.4	SANDY SILT - trace clay													
2.1	grey		4	SS	12								0 37 58 5	
261.6	(compact)													
2.9	SILTY CLAY		5	SS	8								0 1 71 28	
	grey													
	(stiff)		6	SS	1									
	silt varves 19 to 25 mm thick encountered		7	TO	PM									
			8	SS	WH									
257.1	BEDROCK - black slate		9	RC	Rec=100% RQD=49%									
7.4	poor to excellent quality		10	RC	Rec=100% RQD=93%									
			11	RC	Rec=100% RQD=100%									
253.5	End of Borehole													
11.0														

COMMENTS: + 3, X 3 : Numbers on right refer to Sensitivity. Numbers on left refer to values greater than 120 kPa. ○ 3% STRAIN AT FAILURE

WATER LEVEL RECORDS		
Date (dd/mm/yy)/Time	Water Depth (m)	Cave In (m)
1) 1/10/14 4:30:00 PM	2.5	2.8
2) -	-	-
3) -	-	-

The stratification lines represent approximate boundaries. The transition may be gradual.

MEL-GEO 12218 - BOREHOLE LOGS (ADDITIONAL).GPJ MEL-GEO.GDT 23/12/15

Rock Cores – Borehole No. 4

Photo: 1



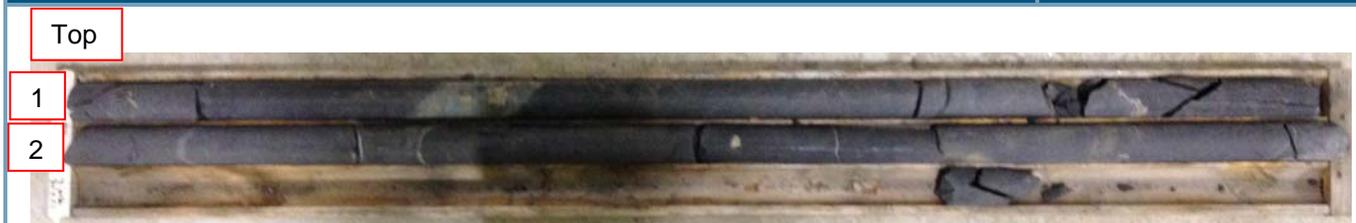
Rock Cores – Borehole No. 5

Photo: 2



Rock Cores – Borehole No. 6

Photo: 3



Project: Hwy 144 – Replacement of Whitson River Bridge

Photos Provided By: Englobe

Date: December 2015

Rock Cores – Borehole No. 9

Photo: 4



Rock Cores – Borehole No. 10

Photo: 5



Project: Hwy 144 – Replacement of Whitson River Bridge

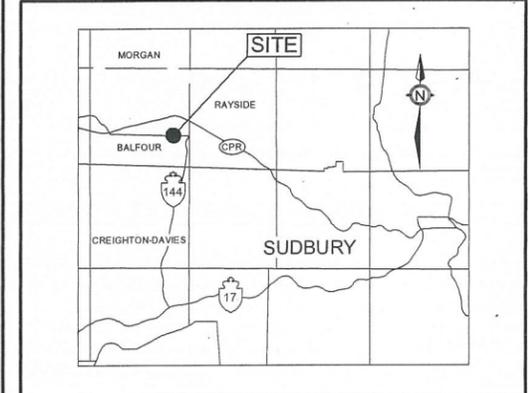
Photos Provided By: Englobe

Date: December 2015

## Appendix 3 Lab Data

Drawing Nos. 2a and 2b:	Borehole Location and Soil Strata
Figure Nos. L-1 to L-7:	Grain Size Distribution Curves
Figure No. L-8:	Atterberg Limits Summary
Figure No. L-9:	Shear Strength Summary Chart
Figure Nos. G1 to G3:	Photos and Data of Unconfined Compression Test
Table No. L-10:	Lab Test Summary Sheet

HWY 144  
 WHITSON RIVER BRIDGE (SITE NO. 46-051)  
 BALFOUR TOWNSHIP  
 BOREHOLE LOCATIONS & SOIL STRATA



- LEGEND**
- Borehole
  - ⊕ Dynamic Cone Penetration Test (DCPT)
  - ⊗ Borehole w/ DCPT
  - N Blows/0.3 m (Std Pen Test, 475 J/blow)
  - DCPT Blows/0.3 m (60' Cone, 475 J/blow)
  - ▽ Water Level at Time of Investigation
  - A/R Auger Refusal
  - E/S End of Sampling

Borehole No.	Elev.	O/S	Co-ordinates	
			Northerly	Easterly
Borehole No. 1	268.5	2.3 m Rt	5158833.9	288453.0
Borehole No. 2	268.8	2.2 m Rt	5158834.8	288407.7
Borehole No. 3	268.6	2.8 m Lt	5158829.1	288438.6
Borehole No. 4	268.9	2.7 m Lt	5158830.0	288397.6
Borehole No. 5	268.5	2.0 m Lt	5158829.9	288438.6
Borehole No. 6	268.5	2.4 m Rt	5158834.3	288438.7
Borehole No. 7	268.8	2.3 m Rt	5158834.8	288405.2
Borehole No. 8	268.8	2.3 m Lt	5158830.3	288404.6
Borehole No. 9	264.8	21.0 m Rt	5158852.6	288454.3
Borehole No. 10	264.5	16.5 m Rt	5158848.9	288412.2

NOTE 1: This drawing is for subsurface information only. Surface details and features are for conceptual illustration. The proposed structure location is shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contract Documents.

NOTE 2: The boundaries between soil strata have been established at the borehole locations only. The boundaries illustrated and stratigraphy between boreholes on this drawing are assumed based on borehole data and may vary. They are intended for design only.

NOTE 3: Top of footing elevations are shown in the General Arrangement Drawing D-4476/1 dated March 1960.

NOTE 4: Coordinates based on MTM Zone 12 NAD83 CSRS

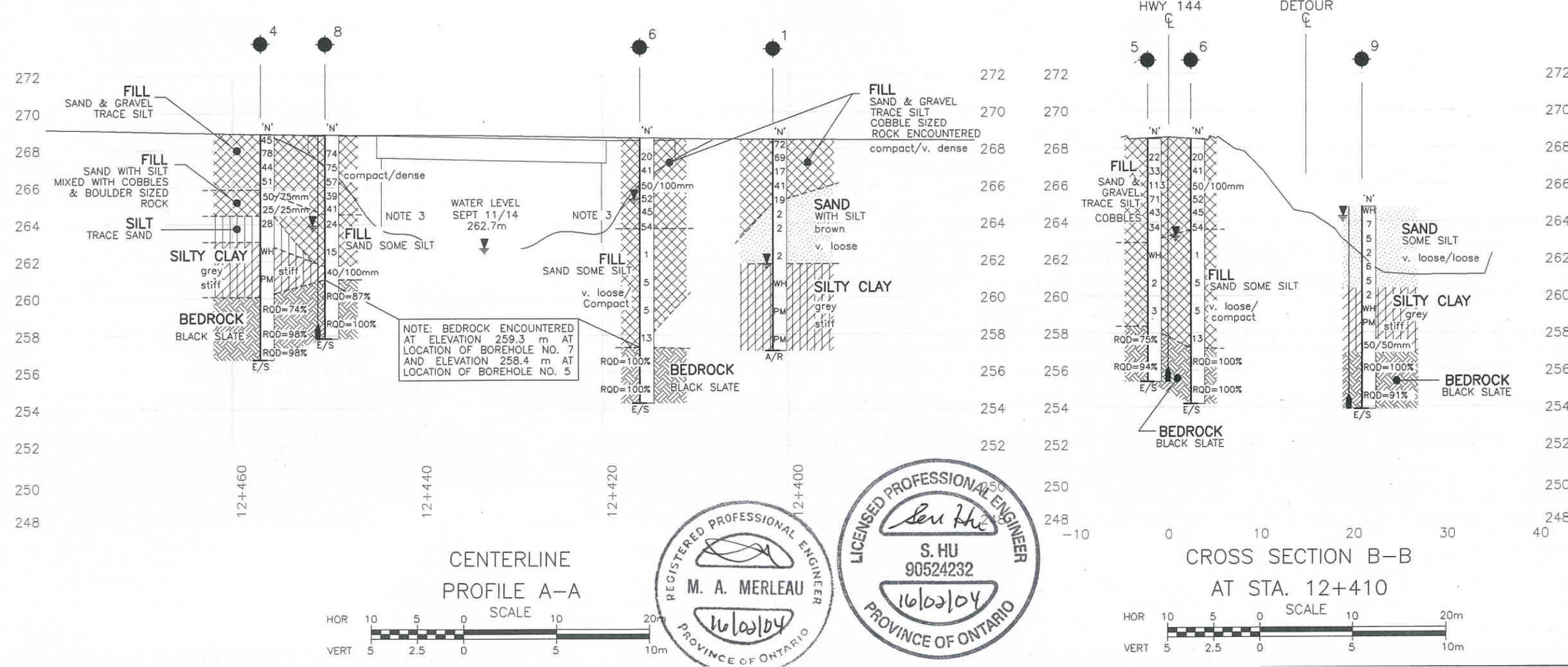
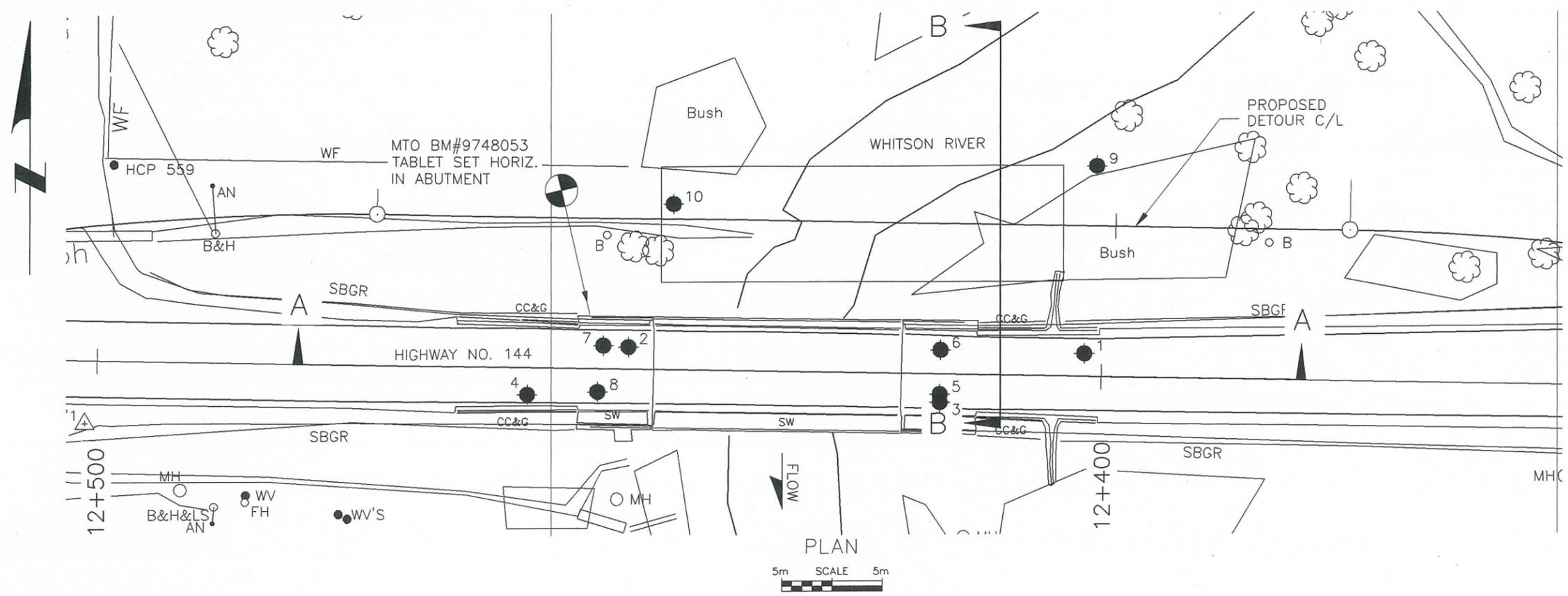
REVISION	DATE	BY	DESCRIPTION
1	SEPT 2015	RG	DRAFT
2	JAN 2016	DM	FINAL

HWY NO. 144 - BALFOUR TOWNSHIP

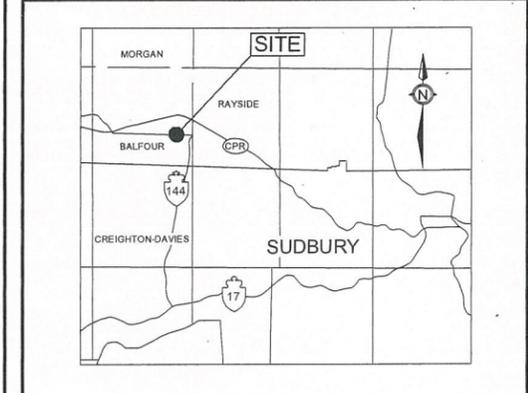
GEOCRE NO.: 411-338

L|V|M REF. NO.: 12/11/12218-F3

DRAWN: RG CHECKED: AT DATE: JANUARY 2016



HWY 144  
 WHITSON RIVER BRIDGE (SITE NO. 46-051)  
 BALFOUR TOWNSHIP  
 BOREHOLE LOCATIONS & SOIL STRATA



LEGEND

- Borehole
- ⊕ Dynamic Cone Penetration Test (DCPT)
- ⊗ Borehole w/ DCPT
- N Blows/0.3 m (Std Pen Test, 475 J/blow)
- DCPT Blows/0.3 m (60' Cone, 475 J/blow)
- ▽ Water Level at Time of Investigation
- A/R Auger Refusal
- E/S End of Sampling

Borehole No.	Elev.	O/S	Co-ordinates	
			Northerly	Easterly
Borehole No. 1	268.5	2.3 m Rt	5158833.9	288453.0
Borehole No. 2	268.8	2.2 m Rt	5158834.8	288407.7
Borehole No. 3	268.6	2.8 m Lt	5158829.1	288438.6
Borehole No. 4	268.9	2.7 m Lt	5158830.0	288397.6
Borehole No. 5	268.5	2.0 m Lt	5158829.9	288438.6
Borehole No. 6	268.5	2.4 m Rt	5158834.3	288438.7
Borehole No. 7	268.8	2.3 m Rt	5158834.8	288405.2
Borehole No. 8	268.8	2.3 m Lt	5158830.3	288404.6
Borehole No. 9	264.8	21.0 m Rt	5158852.6	288454.3
Borehole No. 10	264.5	16.5 m Rt	5158848.9	288412.2

NOTE 1: This drawing is for subsurface information only. Surface details and features are for conceptual illustration. The proposed structure location is shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contract Documents.

NOTE 2: The boundaries between soil strata have been established at the borehole locations only. The boundaries illustrated and stratigraphy between boreholes on this drawing are assumed based on borehole data and may vary. They are intended for design only.

NOTE 3: Top of footing elevations are shown in the General Arrangement Drawing D-4476/1 dated March 1960.

NOTE 4: Coordinates based on MTM Zone 12 NAD83 CSRS

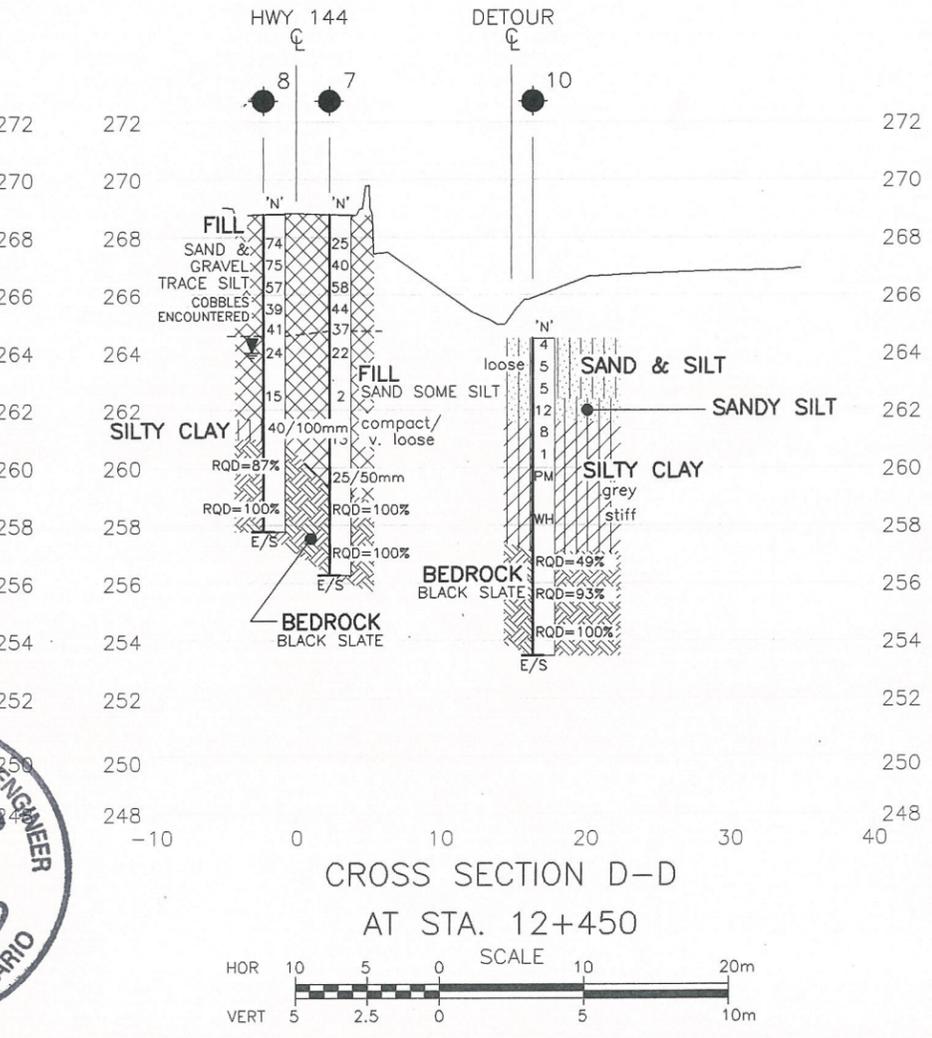
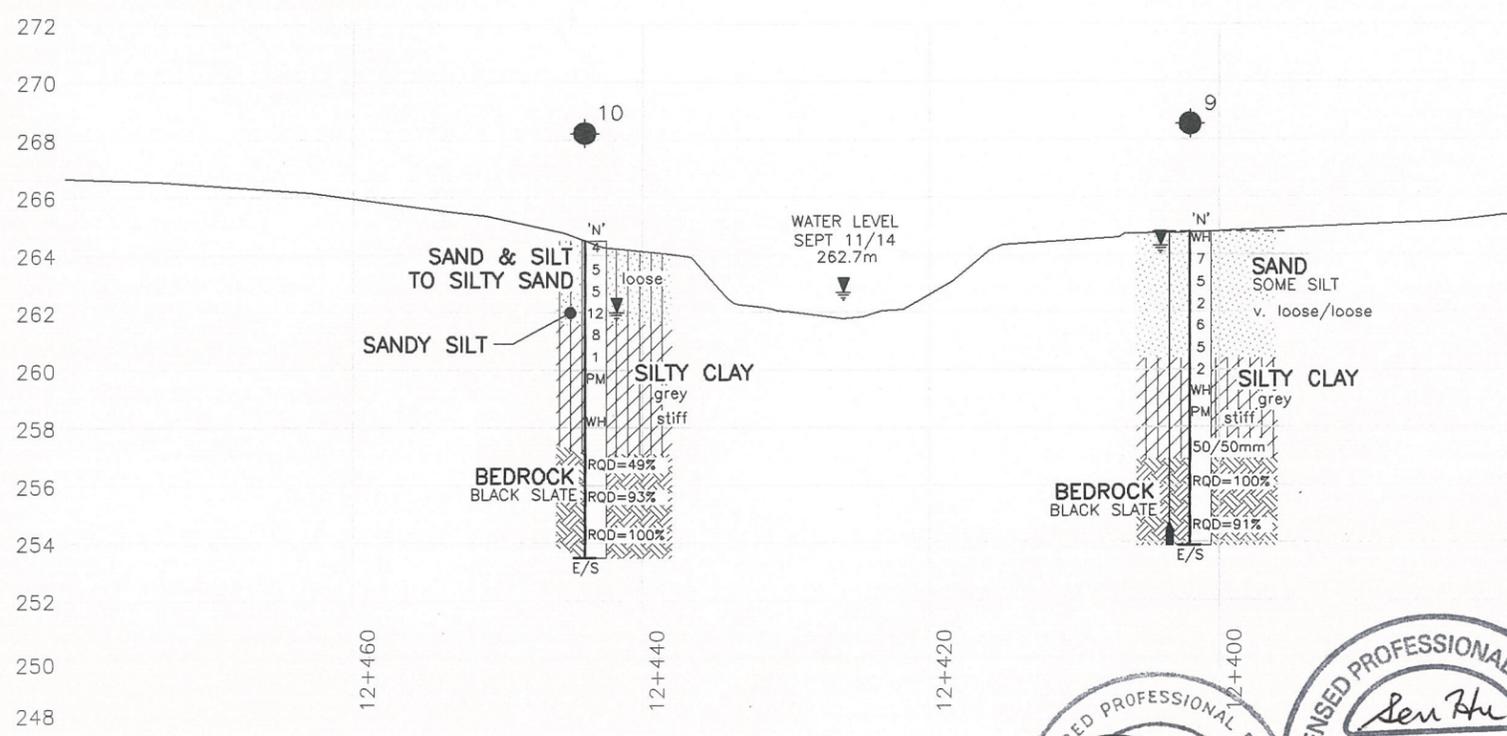
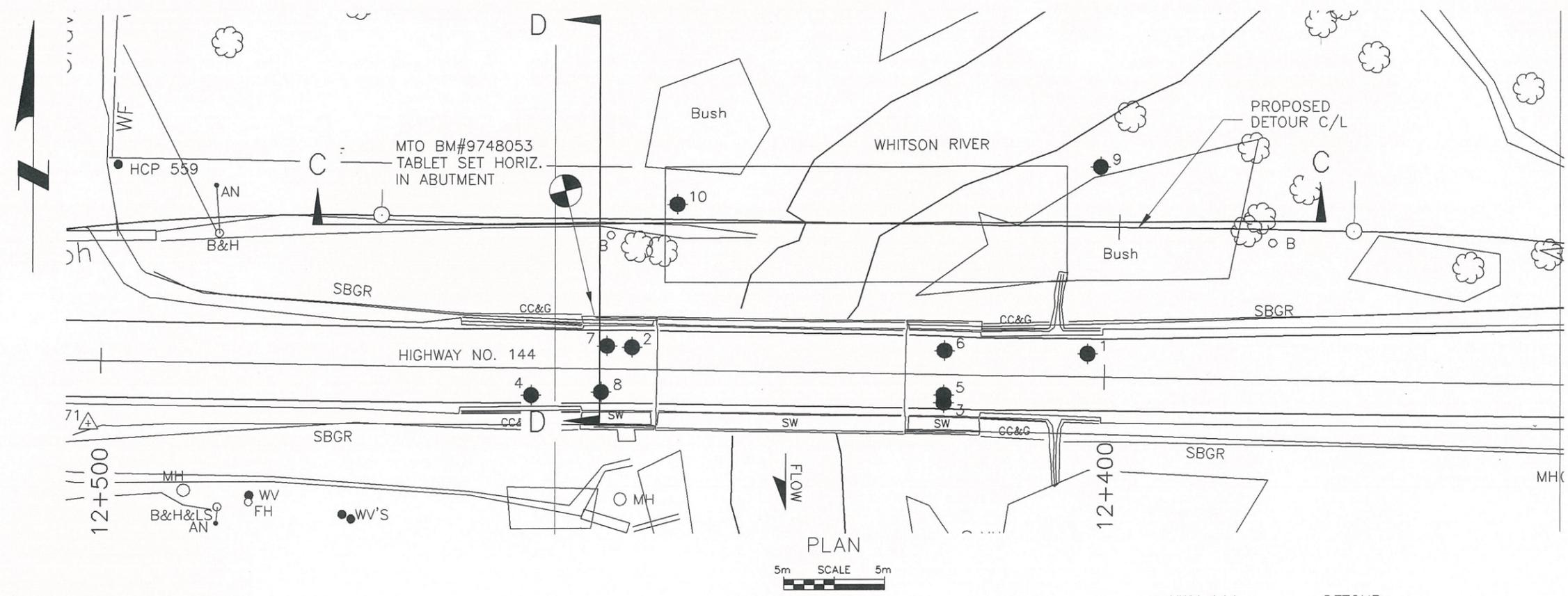
REVISIONS	DATE	BY	DESCRIPTION
	SEPT 2015	RG	DRAFT
	JAN 2016	DM	FINAL

HWY NO. 144 - BALFOUR TOWNSHIP

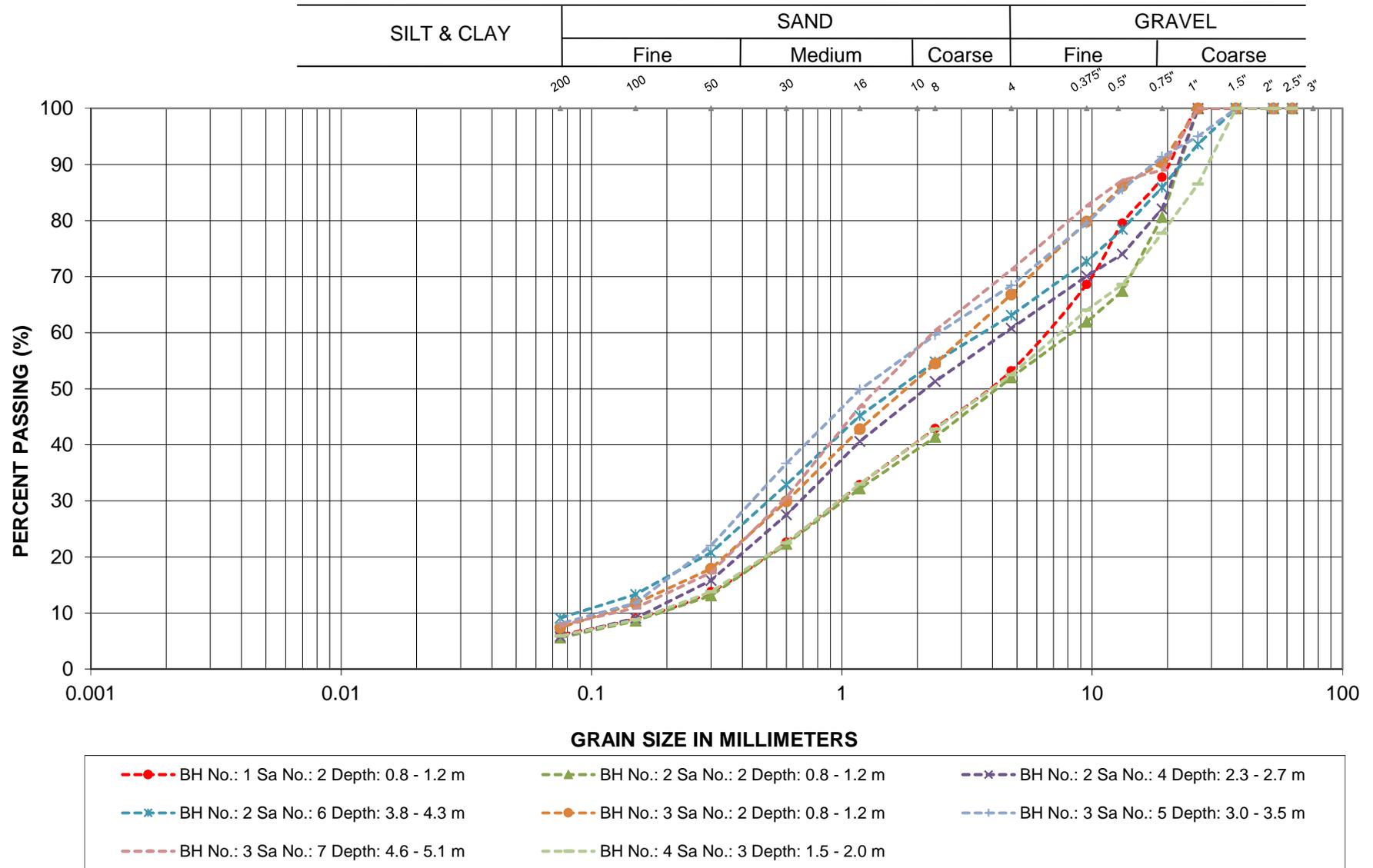
GEOCRES NO.: 411-338

L\|M REF. NO.: 12/11/12218-F3

DRAWN: RG | CHECKED: AT | DATE: JANUARY 2016



### GRAIN SIZE ANALYSIS



G.W.P.: 5223-14-00

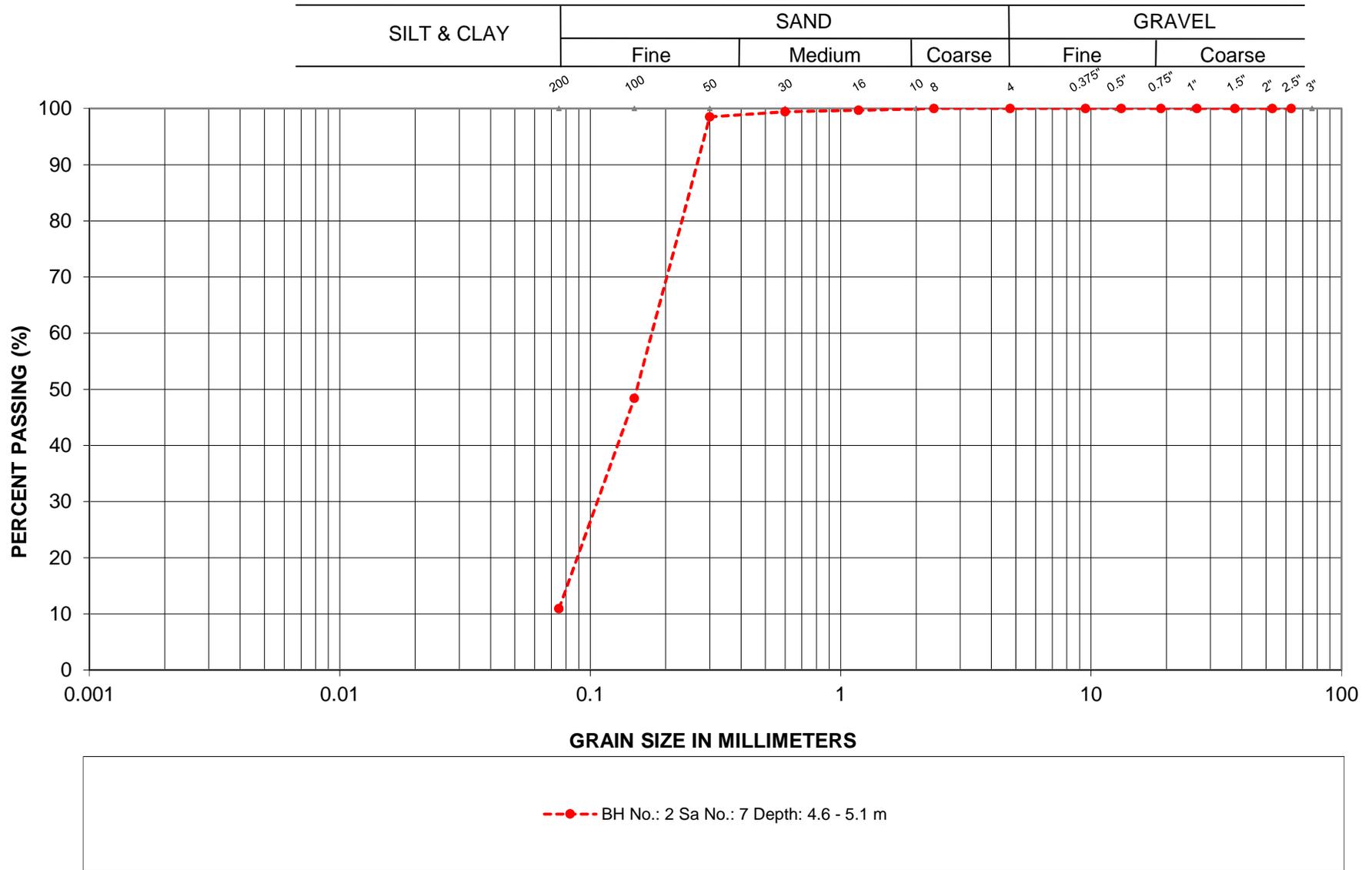
LOCATION: Hwy 144, Whitson River Bridge

EMBANKMENT FILL

ENGLOBE CORP.

FIGURE L-1

### GRAIN SIZE ANALYSIS



G.W.P.: 5223-14-00

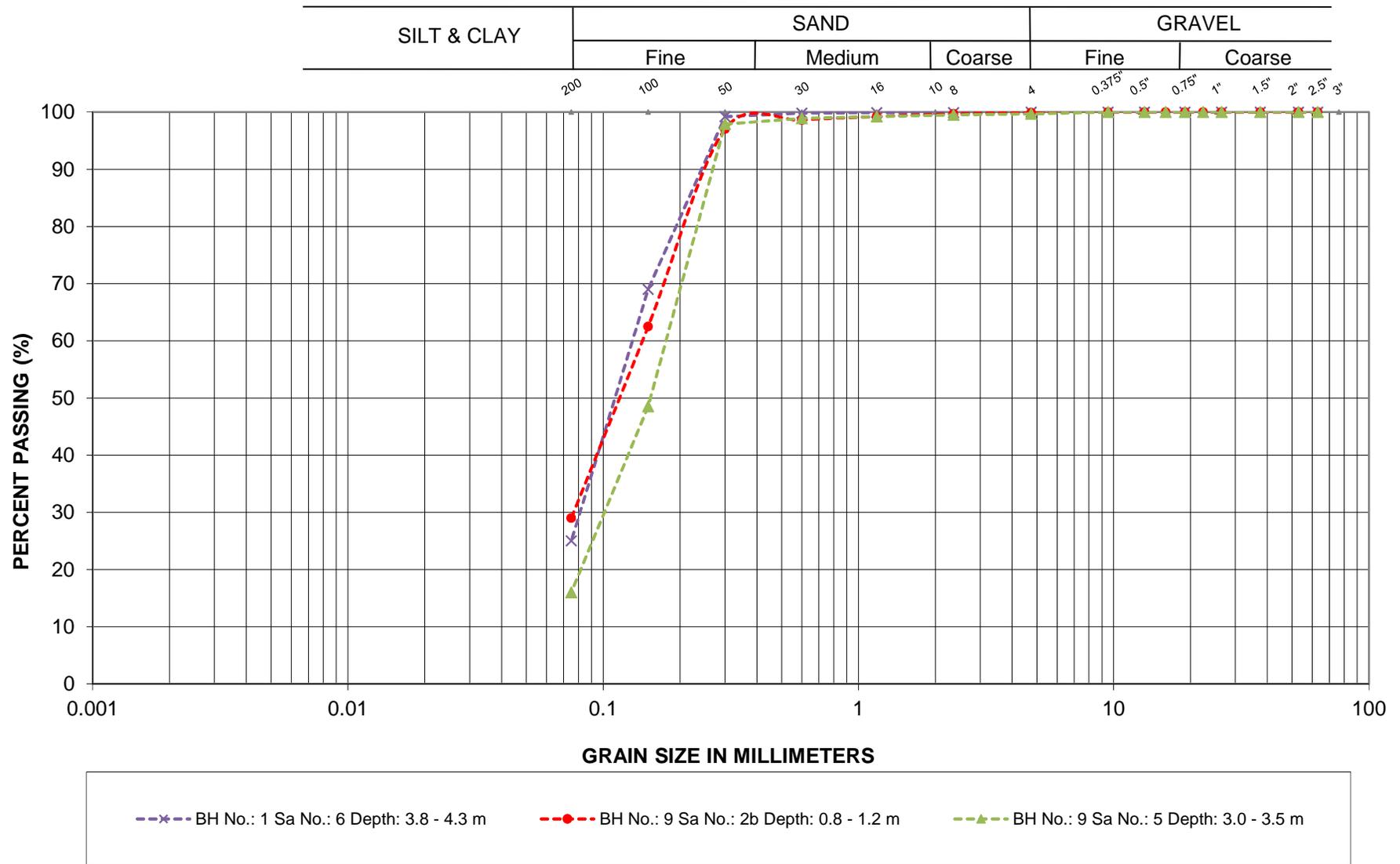
LOCATION: Hwy 144, Whitson River Bridge

SAND FILL

ENGLOBE CORP.

FIGURE L-2

### GRAIN SIZE ANALYSIS



G.W.P.: 5223-14-00

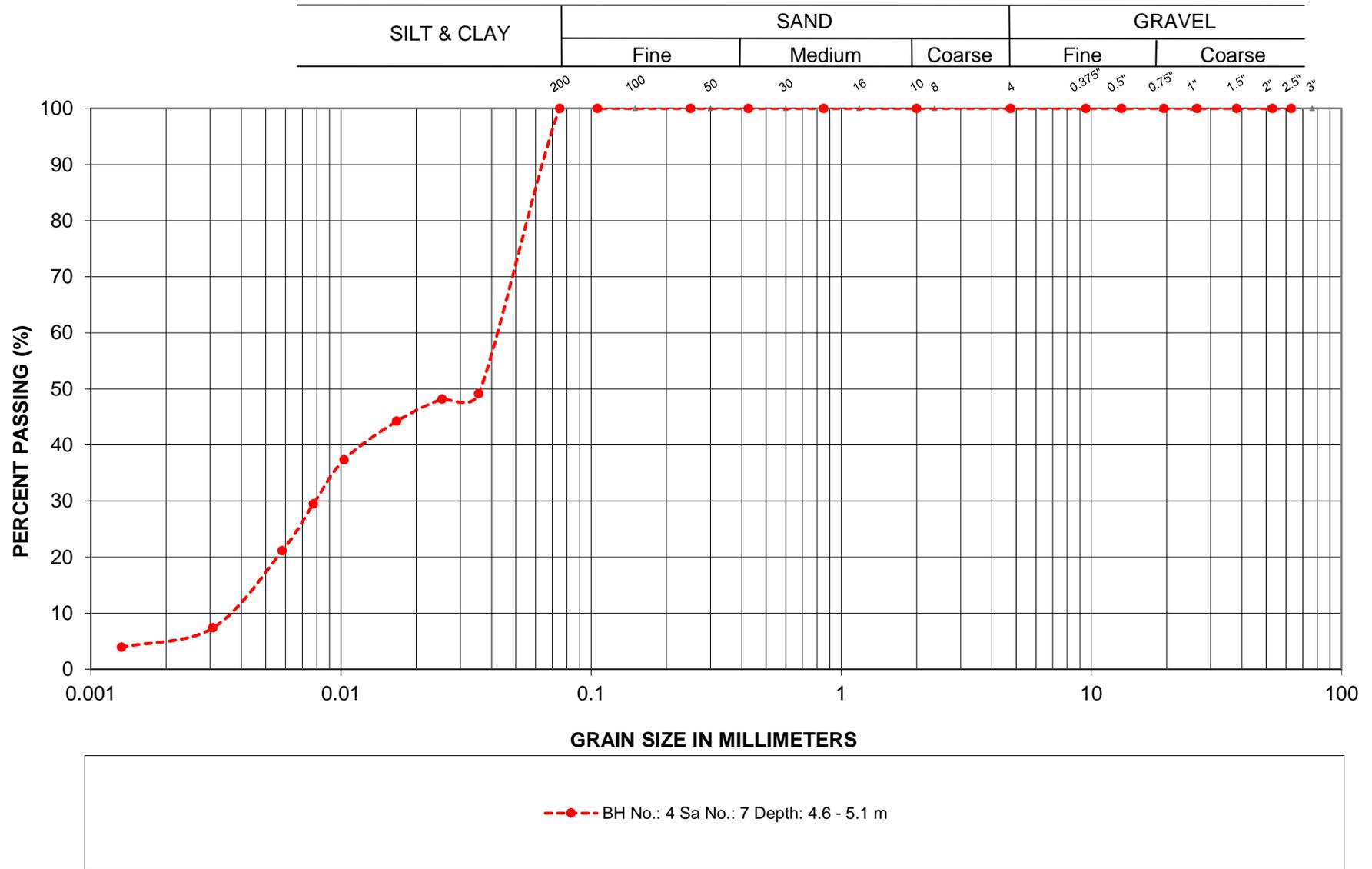
LOCATION: Hwy 144, Whitson River Bridge

SAND

ENGLOBE CORP.

FIGURE L-3

### GRAIN SIZE ANALYSIS



G.W.P.: 5223-14-00  
LOCATION: Hwy 144, Whitson River Bridge

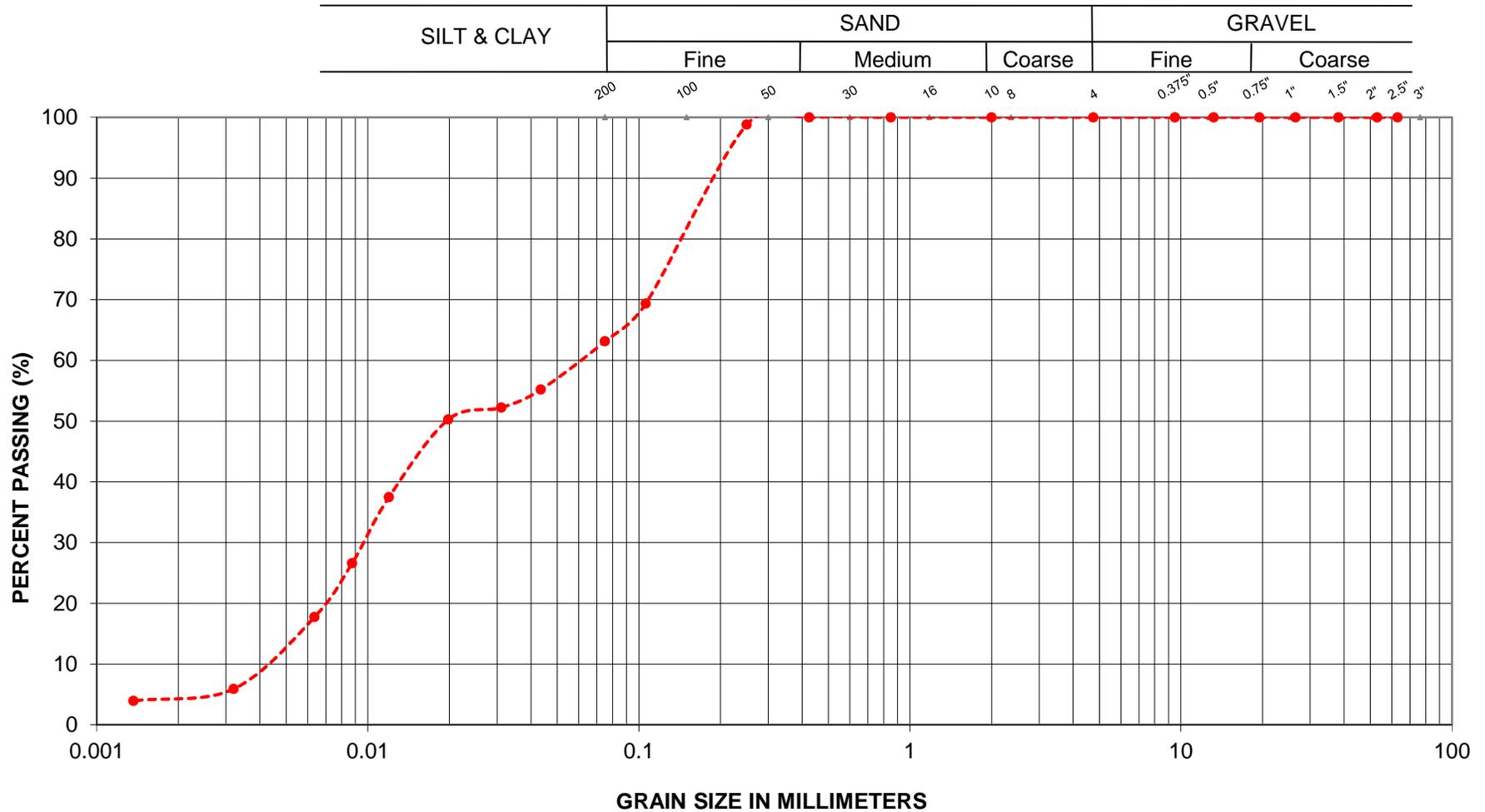
SILT

ENGLOBE CORP.

FIGURE L-4

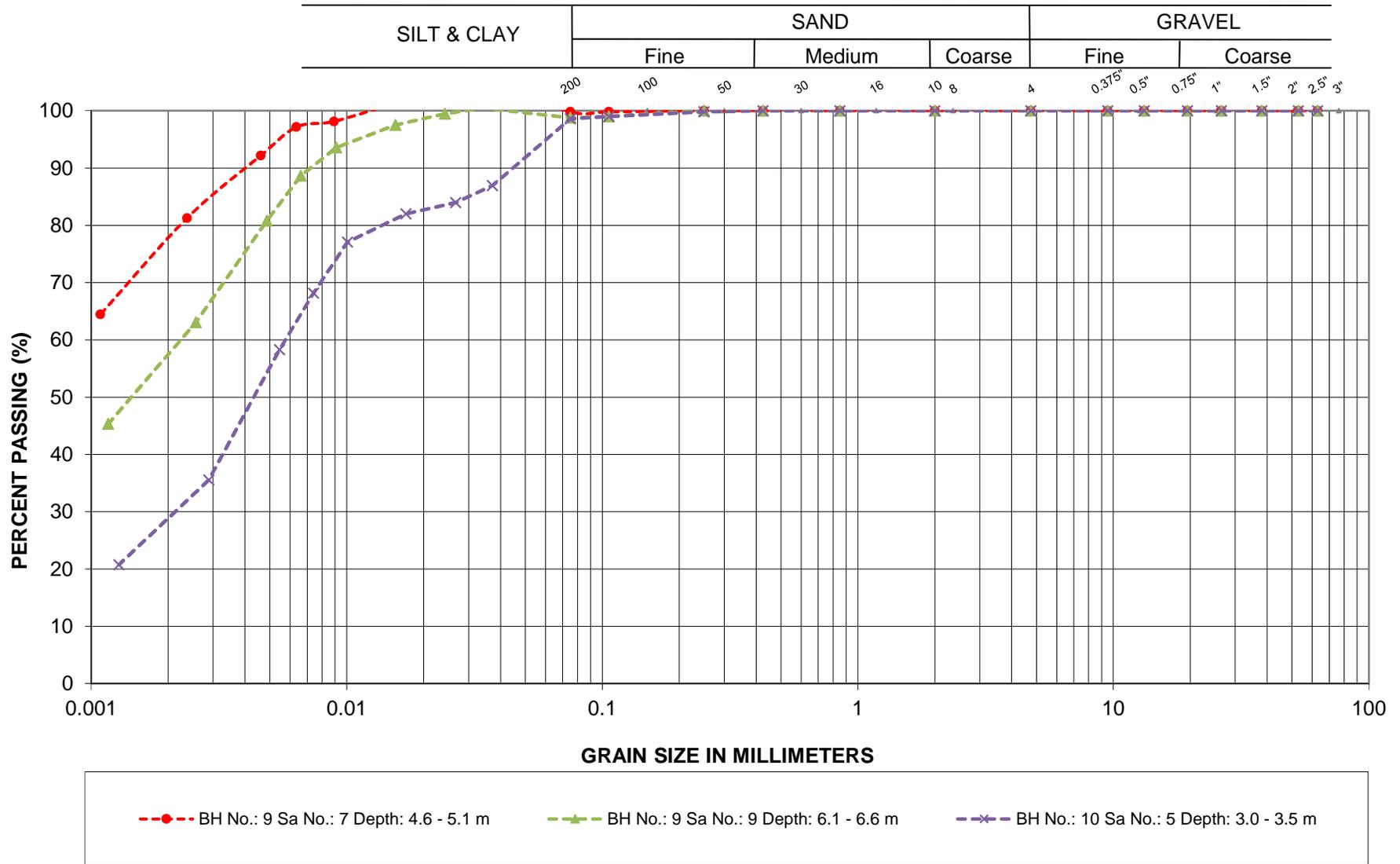


### GRAIN SIZE ANALYSIS



---●--- BH No.: 10 Sa No.: 4 Depth: 2.3 - 2.7 m

### GRAIN SIZE ANALYSIS



G.W.P.: 5223-14-00

LOCATION: Hwy 144, Whitson River Bridge

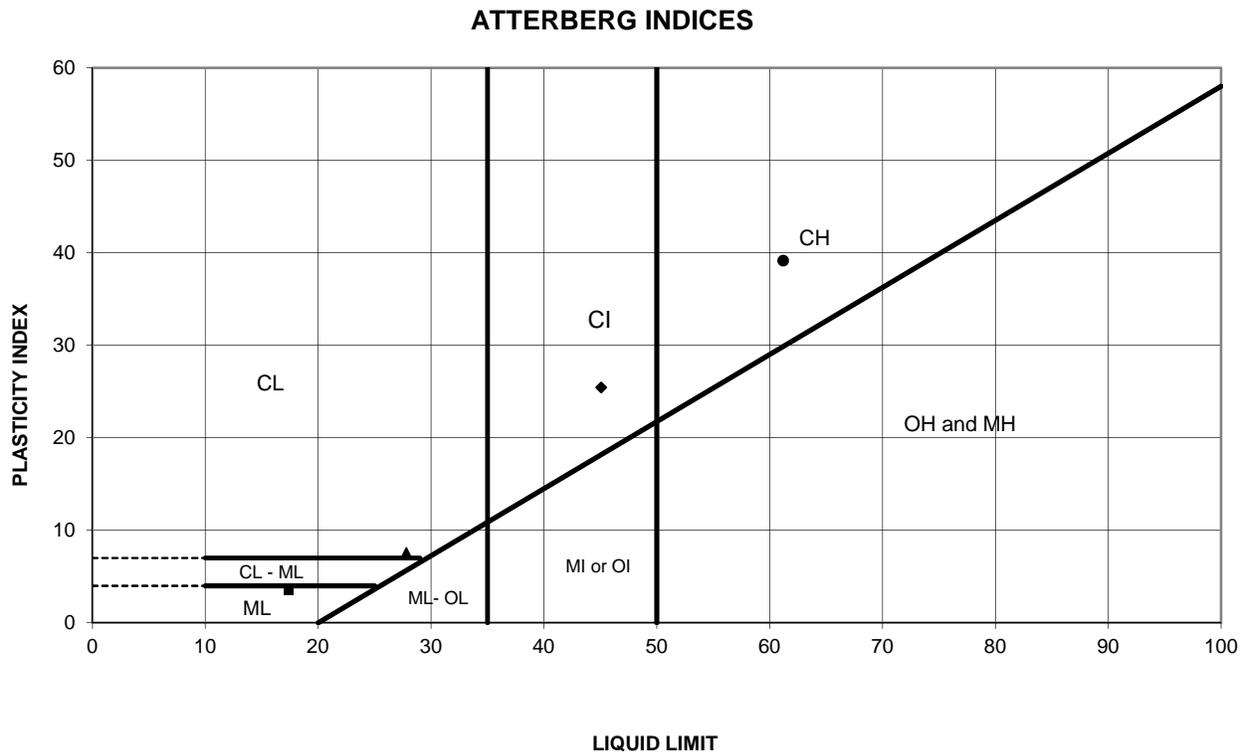
SILTY CLAY

ENGLOBE CORP.

FIGURE L-7

ATTERBERG LIMITS TEST RESULTS

FIGURE L-8

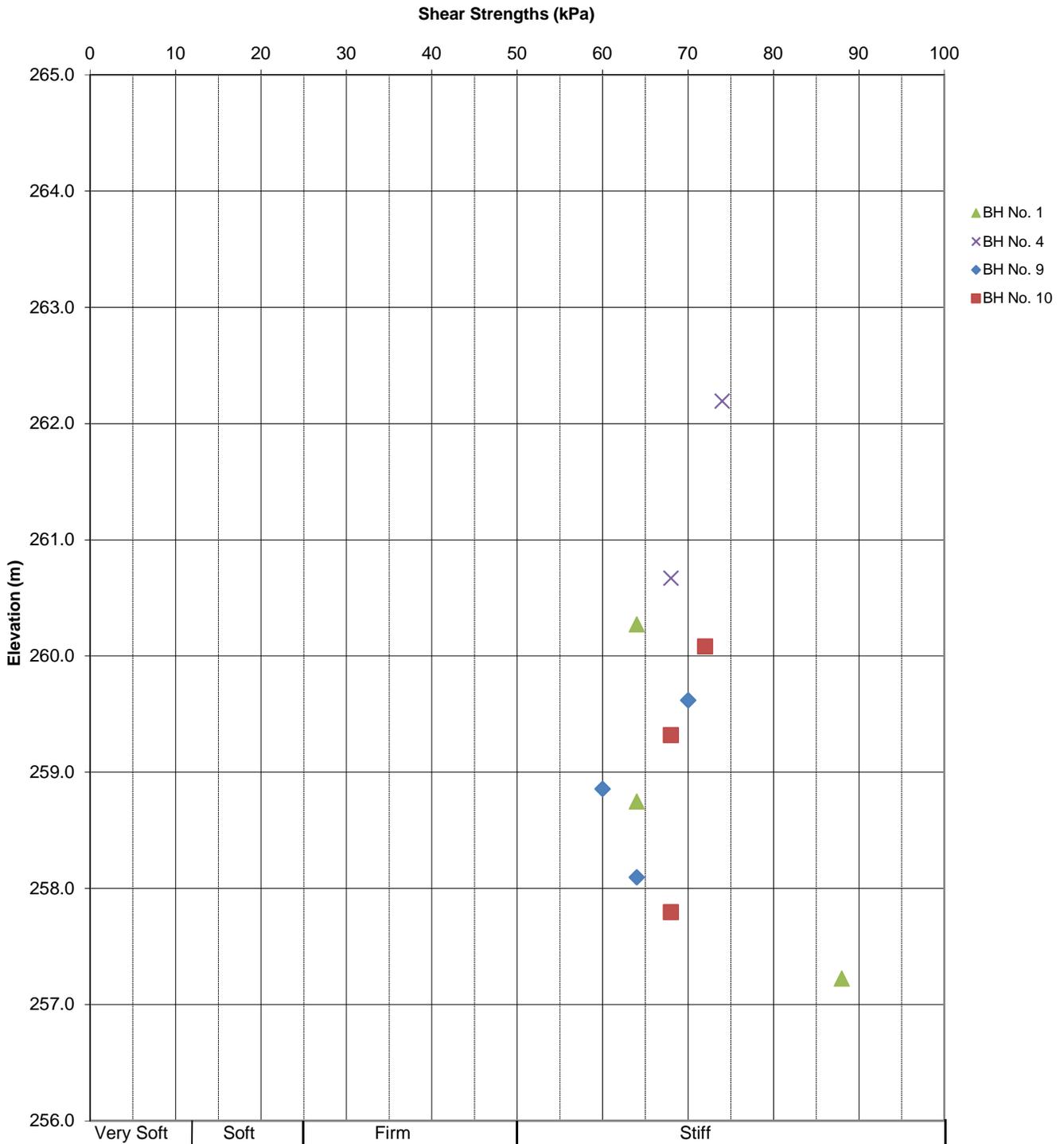


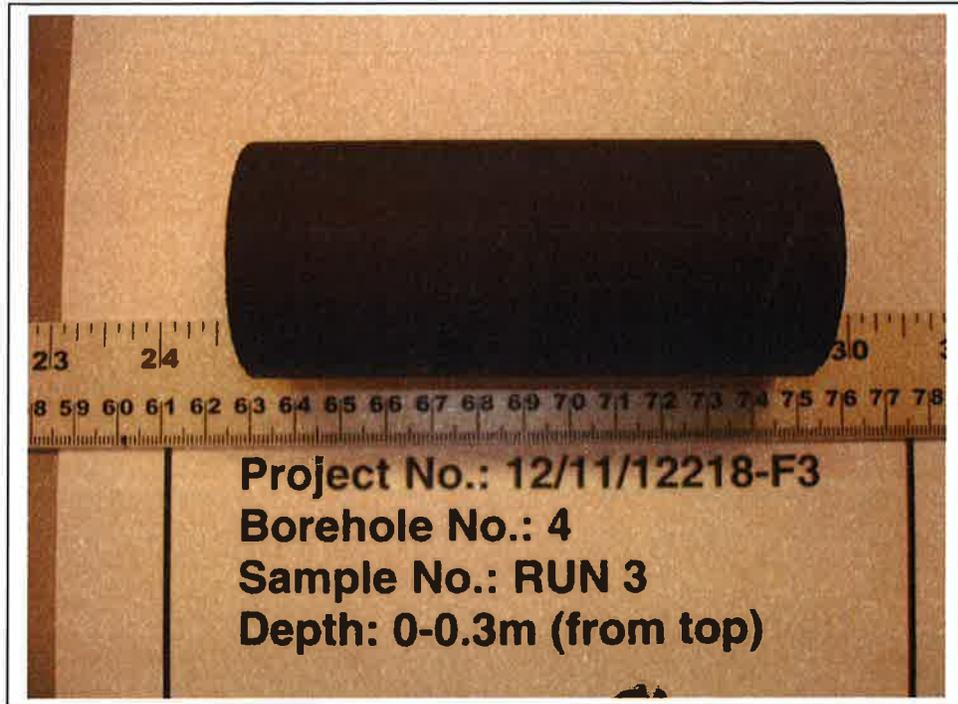
SYMBOL	BH	Sa. No.	Depth(m)	Elev.(m)	Liquid Limit	Plastic Limit	Plasticity Index	NMC %
●	9	7	4.6	260.2	61.2	22.1	39.2	56.9
◆	9	9	6.1	258.7	45.1	19.6	25.4	46.4
■	10	4	2.3	262.2	17.4	13.9	3.5	22.7
▲	10	5	3.0	261.5	27.8	20.3	7.6	30.5

Date: Nov-14  
 Project: Hwy 144, Whitson River Bridge  
 G.W.P: 5223-14-00

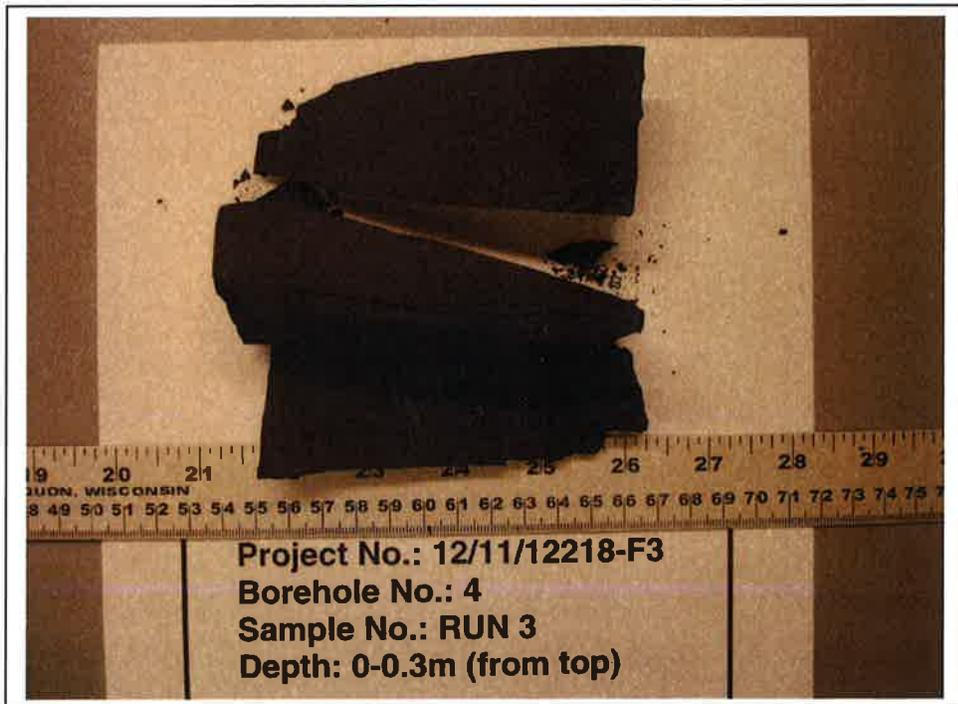
Prep'd: AT  
 Chkd: MAM  
 Ref. No.: 12/11/12218-F3

In-Situ Shear Strengths vs. Depth





BEFORE COMPRESSION



AFTER COMPRESSION

Date Dec. 18, 2015  
Project 12/11/12218-F3

**Golder Associates**

Drawn Frank  
Chkd. [Signature]

# UNCONFINED COMPRESSION TEST (UC) OF INTACT ROCK CORE SPECIMENS

## ASTM D7012

### SAMPLE IDENTIFICATION

PROJECT NUMBER	12/11/12218-F3	SAMPLE NUMBER	Run 3
PROJECT NAME	-	SAMPLE DEPTH, m	0-0.3(from top)
BOREHOLE NUMBER	4	DATE:	2015-12-16

### TEST CONDITIONS

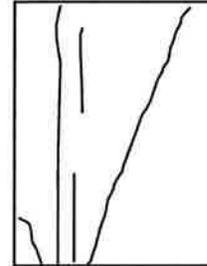
MACHINE SPEED, mm/min	N/A	TYPE OF SPECIMEN	Rock Core
DURATION OF TEST, min	>2 <15	L/D	2.34

### SPECIMEN INFORMATION

SAMPLE HEIGHT, cm	11.10	WATER CONTENT, (specimen) %	0.36
SAMPLE DIAMETER, cm	4.75	UNIT WEIGHT, kN/m <sup>3</sup>	25.82
SAMPLE AREA, cm <sup>2</sup>	17.71	DRY UNIT WT., kN/m <sup>3</sup>	25.72
SAMPLE VOLUME, cm <sup>3</sup>	196.67	SPECIFIC GRAVITY	-
WET WEIGHT, g	517.94	VOID RATIO	-
DRY WEIGHT, g	516.08		

### VISUAL INSPECTION

### FAILURE SKETCH



### TEST RESULTS

STRAIN AT FAILURE, %	N/A	COMPRESSIVE STRENGTH, MPa	22.9
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REMARKS:

Checked By: *bl*

**Golder Associates**



BEFORE COMPRESSION



AFTER COMPRESSION

Date Dec. 18, 2015  
Project 12/11/12218-F3

**Golder Associates**

Drawn Frank  
Chkd. [Signature]

# UNCONFINED COMPRESSION TEST (UC) OF INTACT ROCK CORE SPECIMENS

## ASTM D7012

### SAMPLE IDENTIFICATION

PROJECT NUMBER	12/11/12218-F3	SAMPLE NUMBER	Run 2
PROJECT NAME	-	SAMPLE DEPTH, m	1.04-1.28(from top)
BOREHOLE NUMBER	5	DATE:	2015-12-16

### TEST CONDITIONS

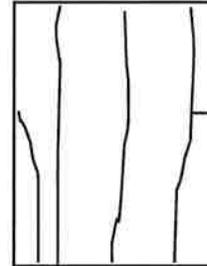
MACHINE SPEED, mm/min	N/A	TYPE OF SPECIMEN	Rock Core
DURATION OF TEST, min	>2 <15	L/D	2.31

### SPECIMEN INFORMATION

SAMPLE HEIGHT, cm	10.93	WATER CONTENT, (specimen) %	0.43
SAMPLE DIAMETER, cm	4.73	UNIT WEIGHT, kN/m <sup>3</sup>	25.80
SAMPLE AREA, cm <sup>2</sup>	17.57	DRY UNIT WT., kN/m <sup>3</sup>	25.69
SAMPLE VOLUME, cm <sup>3</sup>	192.09	SPECIFIC GRAVITY	-
WET WEIGHT, g	505.60	VOID RATIO	-
DRY WEIGHT, g	503.44		

#### VISUAL INSPECTION

#### FAILURE SKETCH



### TEST RESULTS

STRAIN AT FAILURE, %	N/A	COMPRESSIVE STRENGTH, MPa	79.7
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REMARKS:

Checked By: *[Signature]*

**Golder Associates**



BEFORE COMPRESSION



AFTER COMPRESSION

Date Dec. 18, 2015  
Project 12/11/12218-F3

**Golder Associates**

Drawn Frank  
Chkd. AK

# UNCONFINED COMPRESSION TEST (UC) OF INTACT ROCK CORE SPECIMENS

## ASTM D7012

### SAMPLE IDENTIFICATION

PROJECT NUMBER	12/11/12218-F3	SAMPLE NUMBER	Run 1
PROJECT NAME	-	SAMPLE DEPTH, m	1.36-1.56(from top)
BOREHOLE NUMBER	9	DATE:	2015-12-16

### TEST CONDITIONS

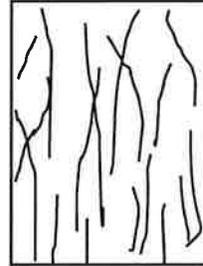
MACHINE SPEED, mm/min	N/A	TYPE OF SPECIMEN	Rock Core
DURATION OF TEST,min	>2 <15	L/D	2.28

### SPECIMEN INFORMATION

SAMPLE HEIGHT, cm	10.77	WATER CONTENT, (specimen) %	0.47
SAMPLE DIAMETER, cm	4.73	UNIT WEIGHT, kN/m <sup>3</sup>	25.85
SAMPLE AREA, cm <sup>2</sup>	17.56	DRY UNIT WT., kN/m <sup>3</sup>	25.73
SAMPLE VOLUME, cm <sup>3</sup>	189.00	SPECIFIC GRAVITY	-
WET WEIGHT, g	498.34	VOID RATIO	-
DRY WEIGHT, g	496.01		

### VISUAL INSPECTION

### FAILURE SKETCH



### TEST RESULTS

STRAIN AT FAILURE, %	N/A	COMPRESSIVE STRENGTH, MPa	100.1
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REMARKS:

Checked By: *slb*

**Golder Associates**

## Laboratory Tests - Summary Sheet



Borehole No.	Sample No.	Depth	Grain Size Analysis				NMC	Atterberg Limits			SPT 'N'	USCS	Total Unit Weight (kN/m <sup>3</sup> )	Remarks
			Gravel Size (%)	Sand Size (%)	Silt Size (%)	Clay Size (%)		LL (%)	PL (%)	IP (%)				
1	1	0.2					2.0				72			
	2	0.8	47	47	6		2.1				69			
	3	1.5					2.8				17			
	4	2.3					4.7				41			
	5a	3.1					3.8				19			
	5b	3.1					8.6				19			
	6	3.8	0	75	25		16.6				2			
	7	4.6					17.9				2			
	8	6.1					30.8				2			
	9	7.6					51.3				WH			
	10	9.1					41.9				PM			
	11	10.7					35.7				PM			
2	1	0.0					3.6				29			
	2	0.8	48	46	6		1.5				30			
	3	1.5					1.6				27			
	4	2.3	39	55	6		2.5				50			
	5	3.1					3.4				18			
	6	3.8	37	54	9		4.6				45			
	7	4.6	0	89	11		7.7				17			
	8	6.1					21.6				8			
	9	7.6					21.0				15			
3	1	0.3					3.3				27			
	2	0.8	33	60	7		2.6				17			
	3	1.5					2.2				7			
	4	2.3					4.5				29			

## Laboratory Tests - Summary Sheet



Borehole No.	Sample No.	Depth	Grain Size Analysis				NMC	Atterberg Limits			SPT 'N'	USCS	Total Unit Weight (kN/m <sup>3</sup> )	Remarks
			Gravel Size (%)	Sand Size (%)	Silt Size (%)	Clay Size (%)		LL (%)	PL (%)	IP (%)				
3	5	3.1	32	60	8	3.6				42				
	6	3.8				4.5				35				
	7	4.6	29	63	8	4.0				61				
	8	6.1				18.5				6				
	9	7.6				22.0				5				
	10	9.1				24.6				1				
4	1	0.0				3.2				45				
	2	0.8				2.8				78				
	3	1.5	47	47	6	2.5				44				
	4	2.3				5.8				51				
	5	3.1								50/75 mm				
	6	3.8				21.2				25/25 mm				
	7	4.6	0	0	95	5	19.6			28				
	8	6.1					47.8			WH				
	9	7.62								PM				
	10	9								RC			Rec= 100%, RQD= 74%	
	11	10.4								RC			Rec= 100%, RQD= 98%	
	12	11.6								RC	25.8		Rec= 100%, RQD= 98%, UCS = 22.9 MPa of Unconfined Compression test at depth from 11.6 m to 11.9 m	
5	1	0.0				6.2								
	2	0.8				1.8				22				
	3	1.5				2.2				33				
	4	2.3				3.2				113				

## Laboratory Tests - Summary Sheet



Borehole No.	Sample No.	Depth	Grain Size Analysis				NMC	Atterberg Limits			SPT 'N'	USCS	Total Unit Weight (kN/m <sup>3</sup> )	Remarks
			Gravel Size (%)	Sand Size (%)	Silt Size (%)	Clay Size (%)		LL (%)	PL (%)	IP (%)				
	5	3.1					3.8				71			
	6	3.8					6.1				43			
	7	4.6					4.0				34			
	8	6.1					21.4				WH			
	9	7.6					20.9				2			
	10	9.1					19.1				3			
	11	10.1												RC, Rec= 100%, RQD= 75%
	12	11.6										25.8		RC, Rec= 100%, RQD= 94%, UCS = 79.7 MPa of Unconfined Compression test at depths from 12.64 m to 12.88 m
6	1	0.0					3.5							
	2	0.8					3.6				20			
	3	1.5					2.7				41			
	4	2.3					4.9				50/100 mm			
	5	3.1					5.5				52			
	6	3.8					6.2				45			
	7	4.6					7.5				54			
	8	6.1					24.2				1			
	9	7.6					22.8				5			
	10	9.14					18.8				5			
	11	10.67					22.0				13			
	12	11.3												RC, Rec= 100%, RQD= 100%
	13	12.8												RC, Rec= 100%, RQD= 100%

## Laboratory Tests - Summary Sheet



Borehole No.	Sample No.	Depth	Grain Size Analysis				NMC	Atterberg Limits			SPT 'N'	USCS	Total Unit Weight (kN/m <sup>3</sup> )	Remarks
			Gravel Size (%)	Sand Size (%)	Silt Size (%)	Clay Size (%)		LL (%)	PL (%)	IP (%)				
7	1	0.0					3.3							
	2	0.8					3.4				25			
	3	1.5					2.7				40			
	4	2.3					4.0				58			
	5	3.1					4.1				44			
	6	3.8					6.5				37			
	7	4.6					19.8				22			
	8	6.1					15.6				2			
	9	7.6					25.7				13			
	10	9.1					30.2				25/50 mm			
	11	9.5												RC, Rec= 100%, RQD= 100%
	12	11.0												RC, Rec= 100%, RQD= 100%
8	1	0.0					2.2							
	2	0.76					2.1				74			
	3	1.52					1.6				75			
	4	2.29					3.5				57			
	5	3.05					3.8				39			
	6	3.81					7.5				41			
	7	4.57					17.6				24			
	8	6.1					28.6				15			
	9	7.62					38.7				40/100 mm			
	10	7.8												RC, Rec= 100%, RQD= 87%
	11	9.3												RC, Rec= 100%, RQD= 100%
9	1	0.0					25.3				WH			
	2a	0.8					54.1				7			

## Laboratory Tests - Summary Sheet

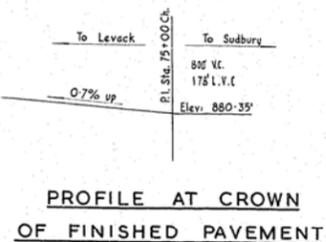
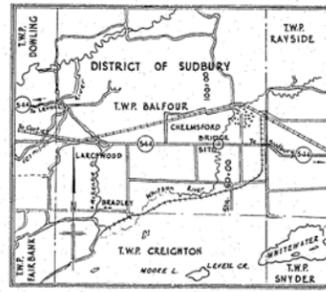
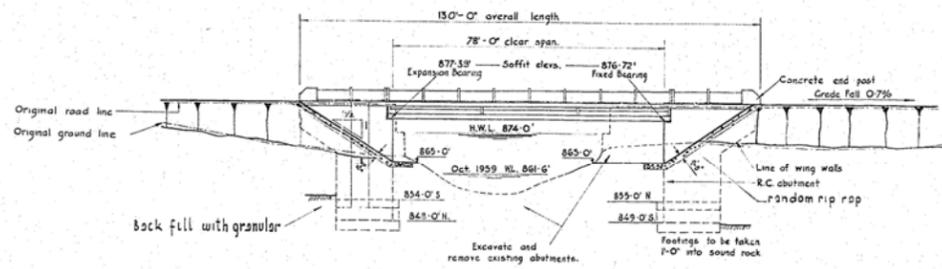
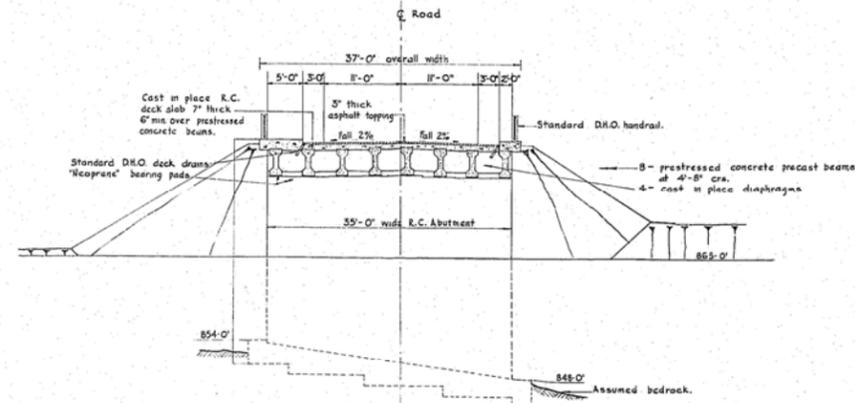
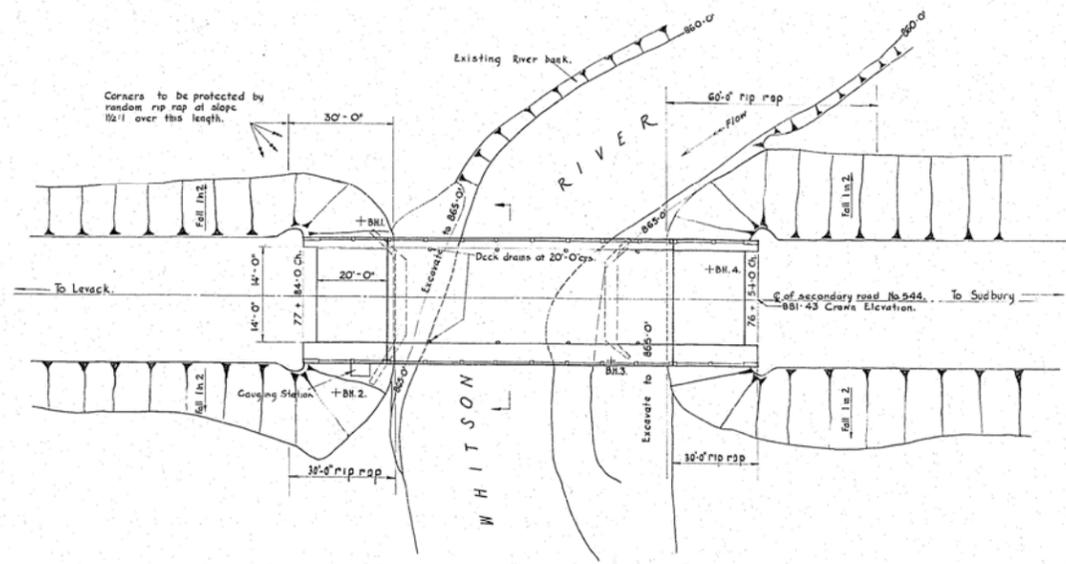


Borehole No.	Sample No.	Depth	Grain Size Analysis				NMC	Atterberg Limits			SPT 'N'	USCS	Total Unit Weight (kN/m <sup>3</sup> )	Remarks
			Gravel Size (%)	Sand Size (%)	Silt Size (%)	Clay Size (%)		LL (%)	PL (%)	IP (%)				
	2b	1.0	0	71	29		15.0				7			
	3	1.5					26.4				5			
	4	2.3					29.2				2			
	5	3.1	0	84	16		31.2				6			
	6	3.8					24.2				5			
	7	4.6	0	0	23	27	56.9	22.1	61.2	39.2	2			
	8	5.3					53.3				WH			
	9	6.1	0	1	43	56	46.4	19.6	45.1	25.4	PM			
	10	7.6					33.9				50/50 mm			
	11	7.9										25.9	RC, Rec= 100%, RQD= 100%, UCS = 100.1 MPa of Unconfined Compression test at depths from 9.26 m to 9.46 m	
	12	9.4											RC, Rec= 100%, RQD= 91%	
10	1	0.0	1	54	45		20.0				4			
	2	0.8					18.8				5			
	3	1.5	0	67	33		18.1				5			
	4	2.29	0	37	58	5	22.7	13.9	17.4	3.5	12			
	5	3.05	0	1	71	28	30.5	20.3	27.8	7.6	8			
	6	3.81					48.4				1			
	7	4.57					53.7				PM			
	8	6.1					36.4				WH			
	9	7.4											RC, Rec= 100%, RQD= 49%	
	10	8.2											RC, Rec= 100%, RQD= 93%	
	11	9.6											RC, Rec= 100%, RQD= 100%	

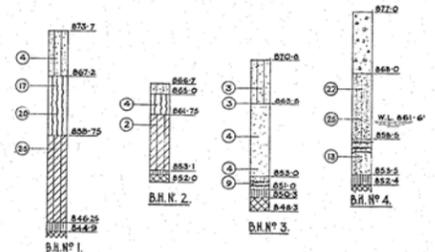
## **Appendix 4    Historical Data**

Enclosure No. 13:

Historical Drawing



- SOILS LEGEND**
- Loose fine grey sand, some organic matter.
  - Loose grey silt.
  - Loose brown silty sand.
  - Medium dense brownish grey silt & sand.
  - Rotted wood fibre.
  - Coarse sand, silt & gravel.
  - Soft grey silty clay.
  - Dark grey clayey silt.
  - Bedrock.



PRINT RECORD

NO.	FOR	DATE	BY
30	REVISED	11-10-60	J.M.
27	REVISED	11-10-60	J.M.
17	REVISED	11-10-60	J.M.

**BORING DATA**  
The complete soil investigation report BA 971 may be examined at the Bridge Office, Toronto.  
The Department does not guarantee the accuracy of this report or the abridged version shown on these plans.

**RECORD OF BOREHOLES**

**GENERAL NOTES**

**NOTE TO DISTRICT ENGINEERS:-**  
Concrete work on this structure must not be commenced until monuments to fix control points have been erected and checked by the District Engineer.

**NOTE TO CONTRACTOR:-**  
Structure to be built in accordance with the latest form N° 9 and the Special Provisions, extra copies of which may be obtained from the District Engineer.

All Construction Joints must be approved by the Bridge Engineer.

**CONCRETE DETAILS:-**  
Concrete to Footings, Abutments & Wing Walls, Deck Slab, Diaphragms, Sidewalks & Curbs to have a minimum compressive strength of 3000 p.s.i. at 28 days. Concrete to prestressed beams to have a minimum compressive strength of 5000 p.s.i. at 28 days and a minimum compressive strength of 4000 p.s.i. at transfer of prestress.  
An approved admixture supplied by the Department will be added to all concrete as specified by the Materials and Research Section, D.H.O.  
Maximum aggregate size in footings and abutments below beam seatings 1 1/2"; in all other work, 3/4"

**REINFORCING STEEL:-**

Clear cover in footings and abutments to be 2" except where noted otherwise.  
Clear cover in Deck Slab, Diaphragms, Sidewalks & Curbs to be 1"  
Clear cover in Prestressed Beams to be 1"

**CONSTRUCTION NOTES:-**

All exposed edges to be chamfered as shown on the drawings.  
No concrete to be placed above bridge seat elevations until concrete in deck slab has been placed.  
The General Contractor shall be responsible for finishing the bridge seats' dead level to the specified elevations with a tolerance of plus or minus 1/8 inch. If they are cast too high they shall be bush hammered down by the General Contractor. If they are cast too low the General Contractor shall provide full bearing slabs to bring them up to the correct elevations. The use of grout is prohibited.  
Footings to be taken 1'-0" minimum into sound rock.  
Drainage ditches at foot of existing embankments to be maintained.  
No concrete to be placed in ballast wall until deck has been poured.

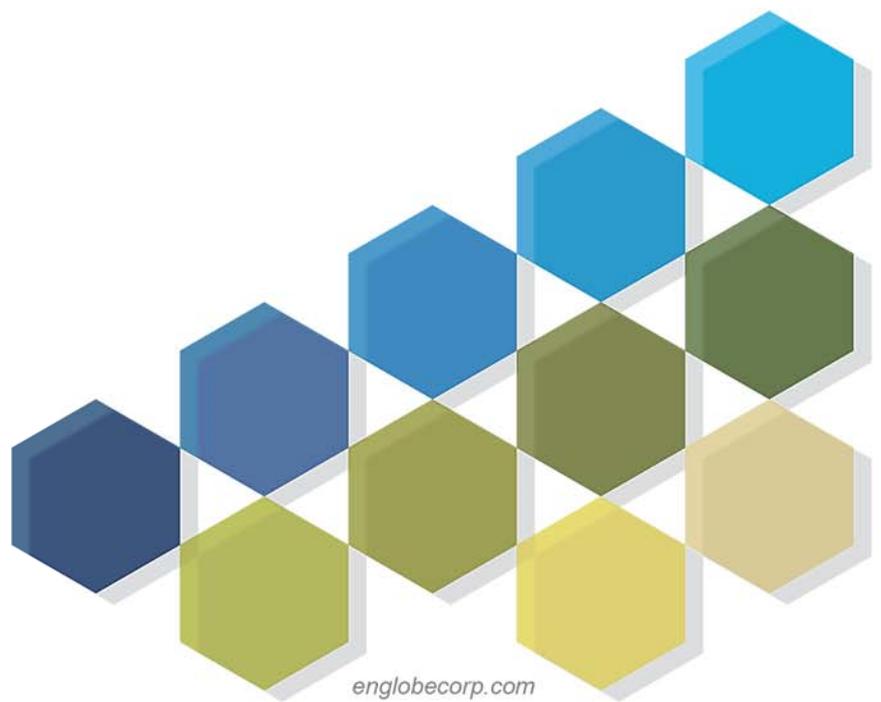
**SCHEDULE OF DRAWINGS**

- D-4476/1 General Arrangement.
- D-4476/2 Abutments - Concrete Details.
- D-4476/3 West Abutment - Reinforcing.
- D-4476/4 East Abutment - Reinforcing.
- D-4476/5 Prestressed Concrete Beams - Details.
- D-4476/6 Deck Slab
- D-4476/7 Reinforcing Steel Schedule 1
- D-4476/8 Reinforcing Steel Schedule 2
- D-4476/9 Details of Steel Handrail Panels.
- D-4476/10 Details of Steel End Post for Handrail Panel.
- BD 4-1 Standard Drain Pipe for Bridge Floors
- D-4476/11 Reinforcing Steel Schedule 3.
- D-4476/12 Detail of Interior Steel Post for Handrail Panels.
- D-4476/13 Gauging Station
- D-4476/15 Angle Setting for Standard Drain Pipe

WP. 252/59

SIR ALEXANDER GIBB & PARTNERS CONSULTING ENGINEERS	SIR A.C.P. DRG. NO. 3550/G/4
<b>DEPARTMENT OF HIGHWAYS - ONTARIO</b> BRIDGE OFFICE - TORONTO	
<b>WHITSON RIVER BRIDGE</b>	
THE KING'S HIGHWAY No. 344 (Secondary) DIST. No. 17	
CO. TWP. BALFOUR LOT 3 & 4 CON. I & II	
<b>GENERAL ARRANGEMENT</b>	
APPROVED <i>[Signature]</i> BRIDGE ENGINEER	
DESIGN J.B. CHECK J.R.L. DRAWING J.B. CHECK J.R.L. TRACING J.M. CHECK J.B.	CONTRACT NUMBER 60-2 DRAWING NUMBER D-4476/1
DATE MARCH 1960 H20-S16	

REVISIONS	DATE	BY	DESCRIPTION	REFERENCE PLANS
17-3-61	J.S.	J.S.	ADD UN ABUT. SEAT REVISED. (NO. 344) BY J.S. TOP PARTIAL CHANGES VIA ENGR. 2/5	
16-10-60	J.M.	J.M.	GAUGING STATION ADDED	E 3675-1 M 4083
0-0-60	J.M.	J.M.	NOTE ADDED TO CONSTRUCTION NOTES	817-292
1-1-60	J.M.	J.M.	SPND POSTS COLLECTED	



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