



January 20, 2014

FOUNDATION INVESTIGATION REPORT

**CANADIAN PACIFIC RAILWAY OVERHEAD STRUCTURE SBL,
SITE NO.44-460/2
HIGHWAY 69 FOUR-LANING FROM 1.7 KM NORTH OF HIGHWAY 529
NORTHERLY TO 3.9 KM NORTH OF HIGHWAY 522
MINISTRY OF TRANSPORTATION, ONTARIO
GWP 5404-05-00; WP 5144-08-01**

Submitted to:
URS Canada Inc.
4th Floor, 30 Leek Crescent
Richmond Hill, Ontario
L4B 4N4



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REPORT





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PART A

FOUNDATION INVESTIGATION REPORT

CANADIAN PACIFIC RAILWAY OVERHEAD STRUCTURE – SBL,
SITE NO. 44-460/2

HIGHWAY 69 FOUR-LANING FROM 1.7 KM NORTH OF HIGHWAY 529
NORTHERLY TO 3.9 KM NORTH OF HIGHWAY 522

MINISTRY OF TRANSPORTATION, ONTARIO

GWP 5404-05-00; WP 5144-08-01



1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by URS Canada Inc. (URS) on behalf of the Ministry of Transportation, Ontario (MTO) to provide detail foundation engineering services for the proposed Highway 69 Southbound Lane (SBL) structure over the Canadian Pacific Railway (CPR), which is within the Contract 3 limits of the new Highway 69 alignment. The proposed work in Contract 3 is part of the four-laning of Highway 69 from 1.7 km north of Highway 529 northerly to 3.9 km north of Highway 522, for a total distance of 19.7 km, which includes: high fill embankments and embankments over swamps; the Canadian National Railway (CNR) re-alignment; the Bekanon Road and Highway 522 interchanges and structures; the Still River, Straight Lake and Key River structures; the Canadian Pacific Railway (CPR) and Canadian National Railway (CNR) Overhead structures; as well as culvert crossings. The CPR Overhead SBL structure is to be located approximately 1.5 km east of the existing Highway 69 and about 200 m south of Straight Lake. The general location of this proposed bridge along the new Highway 69 four-laning alignment is shown on the Site Location Plan on Drawing 1.

The Terms of Reference (TOR) for the foundation investigation are outlined in MTO's Request for Proposal, dated May 2008. Golder's proposal (Scope of Work) for foundation engineering services associated with the Contract 3 CPR Overhead SBL structure is contained in Section 6.8 of URS's Technical Proposal for this assignment. The work has been carried out in accordance with Golder's Supplementary Specialty Plan for foundation engineering services for this project, dated April 19, 2010.

This report addresses the investigation carried out for the CPR Overhead SBL structure and the associated approach embankments only (Site No. 44-460/2). A separate report addresses the foundation investigation for the CPR Overhead northbound lane structure.

The purpose of this investigation is to establish the subsurface conditions at the proposed bridge structure location, including the associated approach embankments, by borehole drilling, rock coring, in situ testing and laboratory testing on selected soil and rock core samples. The foundation units/limits for this investigation were located in the field by Callon Dietz Inc. (Callon Dietz), a professional surveying company retained by URS. The investigation area is shown in plan on Drawing 2.

2.0 SITE DESCRIPTION

The proposed Highway 69 alignment is oriented generally in a south-north direction spanning the Township of Wallbridge to the south, the Township of Henvey, and the Township of Mowat to the north. The Contract 3 section of the new four-lane Highway 69 alignment is also oriented generally in a south-north direction within the overall project limits, for a total distance of 5.5 km in the Township of Henvey. The proposed CPR Overhead SBL structure is located within the Contract 3 highway alignment and is located approximately 100 m south of the northern limit of Contract 3, corresponding to approximately 1.5 km east of the existing Highway 69 alignment and about 9 km northeast of the junction between existing Highway 69 and Highway 526.

In general, the topography of this section of the overall project limits consists of rolling terrain, including sparsely to densely populated tree covered areas and numerous bedrock outcrops separated by valleys and swamps containing areas of standing water and various types of vegetation and organic soils. The proposed overhead structure and associated approach embankments are to be situated relatively close to an existing rock cut through which the CPR track alignment passes, in a sparsely to densely treed area. The existing ground surface



within the limits of the proposed structure and approach embankments varies between about Elevations 201 m and 191 m, referenced to Geodetic datum, and is sloping downward from south to north.

3.0 INVESTIGATION PROCEDURES

3.1 Foundation Investigation

The field work for the proposed CPR Overhead SBL structure was carried out between February 26 and March 8, 2013 during which time a total of nine (9) boreholes, and three (3) hand shovel excavations were advanced at the locations of the structure foundation footprints and approach embankments. A summary of the respective boreholes and hand shovel excavations advanced at each foundation element and approach embankment is presented below.

Foundation Element/Approach Embankment	Investigation Type	
	Borehole	Hand Shovel Excavation
South Approach Embankment		B303-06
South Abutment	B303-01 B303-02 B303-03 B303-05	B303-04
North Abutment	B303-07 B303-08 B303-09 B303-10 B303-11	--
North Approach Embankment	--	B303-12

The Record of Borehole/Drillhole sheets and the results of the laboratory testing are presented in Appendix A and Appendix B, respectively. The locations of the boreholes and hand shovel excavation are shown in plan on Drawing 2.

The field borehole investigation was carried out using a portable drill rig supplied and operated by OGS Drilling Inc. of Almonte, Ontario and Landcore of Chelmsford, Ontario. Hand shovel excavation methods were used as appropriate depending on the terrain to confirm refusal conditions at shallow borehole locations. The boreholes were advanced through the overburden using NW or BW casing. Where possible, soil samples were obtained at ground surface and at intervals of depth of about 0.75 m, using a 50 mm outer diameter (O.D.) split-spoon sampler driven by a manual hammer on the drill rig, performed in accordance with Standard Penetration Test (SPT) procedures (ASTM D1586, Standard Test Method for Standard Penetration Test). Samples of the bedrock were obtained using an 'NQ' size rock core barrel except at one borehole location where a 'BQ' size core barrel was used to penetrate through a surficial layer of cobbles and boulders and into the bedrock.

The boreholes at the locations of the foundation elements were typically advanced to casing and/or sampler refusal and bedrock was confirmed by coring in selected boreholes. Refusal condition at the boreholes at the south and north approach embankments and at one location on the south abutment footprint was confirmed by



hand shovel excavation. The boreholes were advanced to depths of up to about 6.9 m below existing ground surface, including coring of bedrock for core lengths between about 1.2 m and 6.7 m.

The groundwater conditions and water levels in the open boreholes were observed during the drilling operations. Within the limits of the north abutment, a piezometer was installed in Borehole B303-10 to monitor the ground water levels at this location. The piezometer consists of 35 mm diameter PVC pipe, with a slotted screen sealed within the bedrock. The borehole and annulus surrounding the piezometer pipe above the screen (and sand pack) were backfilled to the surface with bentonite pellets. Piezometer installation details and a water level reading are described on the Record of Borehole sheet presented in Appendix A. All open boreholes were backfilled with bentonite upon completion in accordance with Ontario Regulation 903, Wells (as amended).

The field work was observed by members of our engineering and technical staff, who located the boreholes, arranged for the clearance of underground services, observed the drilling, sampling and in situ testing operations, logged the boreholes, and examined and cared for the soil and rock core samples. The samples were identified in the field, placed in appropriate containers, labelled and transported to our Mississauga geotechnical laboratory where the samples underwent further visual examination and laboratory testing. All of the laboratory tests were carried out to MTO and/or ASTM Standards, as appropriate. Classification testing (water content, organic content, grain size distribution and Atterberg limits) was carried out on selected samples. Strength testing, such as uniaxial (unconfined) compression and point load index, was carried out on selected specimens of the rock core. The results of the laboratory testing are included in Appendix B.

The perimeter limits of each foundation unit were located in the field by Callon Dietz prior to drilling. The staked borehole locations and ground surface elevations were surveyed by Callon Dietz. The locations given on the Record of Borehole/Drillhole sheets and shown on Drawings 2 and 3 are positioned relative to MTM NAD 83 northing and easting coordinates and the ground surface elevations are referenced to Geodetic datum. The borehole locations and ground surface elevations are summarized below.

Borehole No.	Location (MTM NAD 83)		Ground Surface Elevation (m)	Borehole Depth (m)
	Northing	Easting		
B303-01	5082689.8	223131.7	200.9	4.5
B303-02	5082684.9	223133.8	200.2	1.6
B303-03	5082691.0	223139.0	200.7	6.9
B303-04	5082697.2	223143.3	198.6	0.1
B303-05	5082692.2	223145.3	200.4	4.5
B303-06	5082672.8	223146.2	200.5	0.6
B303-07	5082720.6	223119.1	191.1	1.0
B303-08	5082725.4	223117.1	191.2	4.8
B303-09	5082726.7	223124.1	191.1	5.7
B303-10	5082727.8	223130.7	191.1	5.9
B303-11	5082732.6	223128.7	191.2	0.9
B303-12	5082745.0	223116.4	195.9	0.4



4.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

4.1 Regional Geology

As delineated in *The Physiography of Southern Ontario*¹, this section of the new Highway 69 lies within the physiographic region known as the Georgian Bay Fringe, which extends along the east side of Georgian Bay through the Parry Sound and Muskoka areas, then eastward from Muskoka in patches into the area north of the Kawartha Lakes.

This part of the Georgian Bay Fringe physiographic region was never submerged during periods of glacial recession. As a result, the surficial soils in this area consist of very shallow deposits of sand, silt and clay underlain by metamorphic bedrock and numerous bare knobs and ridges of bedrock are present throughout the area. Localized low-lying swampy areas, containing peat and/or organic soils overlying soft/loose native soils, sometimes to significant depth, are present in valleys between the bedrock knobs and ridges.

The bedrock in the area consists typically of crystalline gneisses of the Britt Domain of the Central Gneiss Belt, a subdivision of the Grenville Structural Province, as described in *Geology of Ontario*, OGS Special Volume 4². Deposition of Paleozoic strata initially covered the bedrock and later erosion during glaciation exposed these Precambrian rocks.

4.2 Subsurface Conditions

The detailed subsurface soil and groundwater conditions as encountered in the boreholes advanced during this investigation, together with the results of the laboratory tests carried out on selected soil and bedrock core samples, are presented on the attached Record of Borehole and Drillhole sheets and the laboratory test figures provided in Appendix A and Appendix B, respectively. The results of the in situ field tests (i.e. SPT 'N'-values) as presented on the Record of Borehole sheets and in Section 4.2 are uncorrected. The stratigraphic boundaries shown on the Record of Borehole sheets and on the stratigraphic profile and cross-sections on Drawings 2 and 3 are inferred from non-continuous sampling, observations of drilling progress and the results of SPTs. These boundaries, therefore, represent transitions between soil types rather than exact planes of geological change. Furthermore, subsurface conditions will vary between and beyond the borehole locations. It should be noted that the interpreted stratigraphy shown on Drawings 2 and 3 is a simplification of the subsurface conditions.

In general, the subsurface conditions in the area of the CPR Overhead SBL structure consist of a layer of peat/organic silt, underlain by thin, discontinuous non-cohesive deposits of silty sand to sand and/or sand and gravel, underlain by a layer of cobbles and boulders underlain by bedrock, or bedrock exposed at the ground surface. The overburden thickness at the boreholes advanced for the proposed bridge structure ranges from less than 0.1 m at the south abutment to about 2.6 m at the center of the north abutment.

A detailed description of the subsurface conditions encountered in the boreholes at the abutments and approach embankments is provided in the following sections.

¹ Chapman, L.J. and Putnam, D.F., 1984. *The Physiography of Southern Ontario*, Ontario Geological Survey, Special Volume 2, Third Edition. Accompanied by Map P.2715, Scale 1:600,000.

² Ontario Geological Society, 1991. *Geology of Ontario*, Special Volume 4, Part 2. Ministry of Northern Development and Mines, Ontario.



4.2.1 Peat/Organic Silt

An Approximately 0.1 m to 1.0 m thick layer of fibrous peat or organic silt was encountered at the ground surface in Boreholes B303-04, B303-05, B303-07, B303-08, B303-11 and B303-12 and immediately below water or a layer of ice in Boreholes B303-09 and B303-10.

An SPT 'N'-value of 0 blows (weight of hammer) per 0.3 m of penetration was measured within the fibrous peat, suggesting a very soft consistency. The SPT 'N'-values recorded within the organic silt layer range from 0 blows (weight of hammer) to 2 blows per 0.3 m of penetration, suggesting a very soft consistency.

The natural water content measured on a sample of the peat deposit is about 512 per cent and on five (5) samples of the organic silt deposit range from about 74 per cent to 160 per cent.

The organic content measured on two (2) samples of the peat deposit is about 33 per cent and 59 per cent and on two (2) samples of the organic silt deposit is about 14 per cent and 16 per cent.

Atterberg limits tests were carried out on two (2) samples of organic silt layer. The result of one Atterberg limits test indicates that the fine material of the organic silt is non-plastic, and the other test measured a liquid limit of about 56 per cent, a plastic limit of about 39 per cent and a corresponding plasticity index of about 17 per cent. The result of the Atterberg limits test is shown on the plasticity chart on Figure B1 in Appendix B and indicates that the material is classified as organic silt of high plasticity.

4.2.2 Silty Sand to Sand

A deposit of non-cohesive soils comprised of brown to grey silty sand to sand was encountered in Boreholes B303-05, B303-08 and B303-12 below the peat/organic silt layer. The deposit generally contains trace organics and in places contains trace gravel, rootlets and clayey silt seams. Cobbles were encountered within this deposit in Borehole B303-12. The top of this deposit was encountered between about Elevations 200.3 m and 191.0 m and the thickness of the deposit ranges between about 0.2 m and 0.6 m.

An SPT 'N'-value of 3 blows per 0.3 m of penetration was measured at and immediately below the interface of the peat and silty sand deposit in Borehole B303-08, indicating a very loose relative density.

The natural water content measured on three (3) samples of the silty sand to sand deposit ranges between about 10 per cent and 28 per cent. The natural water content measured on a sample of this deposit containing clayey silt seams is about 55 per cent.

The organic content measured on a sample of this deposit is about 5 per cent.

4.2.3 Sand and Gravel

A deposit of sand and gravel was encountered in Boreholes B303-09 to B303-11 underlying peat/organic silt layer and in Borehole B303-08 below the sand deposit. The deposit generally contains trace to some silt, trace clay and in places contains trace organics and clayey silt seams. The top of the deposit ranges from about Elevations 190.6 m to 190.0 m and the thickness of the deposit ranges between about 0.2 m to 0.6 m.



The SPT 'N'-values measured within this deposit range from 2 blows to 6 blows per 0.3 m of penetration, indicating a very loose to loose relative density. Greater 'N'-values were recorded at the contact of the sand and gravel deposit with the underlying cobbles and boulders deposit/bedrock.

The natural water content measured on four (4) samples of this deposit ranges between about 12 per cent and 32 per cent.

The organic content measured on a sample of this deposit is about 2 per cent.

The results of grain size distribution test completed on two (2) samples of the deposit are shown on Figure B2 in Appendix B.

4.2.4 Cobbles and Boulders

Cobbles and boulders were encountered at the ground surface in Boreholes B303-02, B303-03 and B303-06 and underlying the silty sand and sand and gravel deposits in Boreholes B303-05, B303-08 and B303-09. The top of the deposit was encountered between about Elevations 200.7 m and 189.8 m and the thickness of the deposit ranges from about 0.2 m to 1.3 m.

The natural water content measured on a sample of the cobbles and boulders deposit is about 10 per cent.

4.2.5 Bedrock

Bedrock was encountered and core samples were recovered from Boreholes B303-01 to B303-03, B303-05 and B303-08 to B303-10. Bedrock outcrops were observed in the area of the proposed structure and the bedrock is exposed in the area of the south abutment. Due to the presence of the cobbles and boulders deposit, bedrock cannot be confirmed from split-spoon and casing refusal at this site. The depths to bedrock below ground surface and the corresponding bedrock surface elevation at the borehole locations are summarized below.

Foundation Element / Approach Embankment	Borehole	Depth to Bedrock Surface / Refusal (m)	Bedrock Surface / Refusal Elevation (m)	Comments
South Approach Embankment	B303-06	0.6	199.9	Hand Shovel Excavation Refusal
South Abutment	B303-01	<0.1	200.9	4.5 m of Bedrock Cored
	B303-02	0.4	199.8	1.2 m of Bedrock Cored
	B303-03	0.2	200.5	6.7 m of Bedrock Cored
	B303-04	0.1	198.5	Exposed Bedrock
	B303-05	1.2	199.2	3.3 m of Bedrock Cored
North Abutment	B303-07	1.0	190.1	Casing Refusal
	B303-08	1.9	189.3	2.9 m of Bedrock Cored
	B303-09	2.3 ¹	188.5	3.1 m of Bedrock Cored
	B303-10	1.3 ¹	189.5	4.3 m of Bedrock Cored
	B303-11	0.9	190.3	Split-Spoon and Casing Refusal
North Approach Embankment	B303-12	0.4	195.5	Hand Shovel Excavation

Note: 1. Depth to Bedrock measured from ground surface below ponded water.



In general, the bedrock surface in the area of the CPR Overhead SBL structure is blocky, with horizontal and vertical fragments and slopes downward from south to north as shown on the site photographs on Figures B3 to B6. The difference in the bedrock surface elevation at the investigated locations is up to about 2.4 m at the south abutment, 1 m at the north abutment and up to about 12.4 m between abutments at the borehole locations.

Based on a review of the bedrock core samples, the bedrock consists of granitic gneiss. In general, the bedrock samples are described as slightly weathered to fresh, thinly laminated to thinly bedded, fine to coarse crystalline, faintly porous, medium strong to very strong, pink, light to dark grey with pink interbeds, as presented on the Record of Drillhole sheets in Appendix A, and shown on the photographs of the recovered core samples on Figures B7 to B12 in Appendix B. The degree of weathering of the bedrock samples (i.e. slightly weathered to fresh – W1 to W2), and the strength classification of the intact rock mass based on field identification (i.e. strong to very strong – R4 to R5) are described in accordance with the International Society for Rock Mechanics (ISRM³) standard classification system.

The Rock Quality Designation (RQD) measured on the core samples ranges generally from about 70 per cent to 100 per cent, indicating a rock mass of fair to excellent quality as per Table 3.10 of CFEM (2006). However, the upper portion of core recovered from Boreholes B303-09 and B303-10 contain fractured rock with RQD values of about 43 per cent and 48 per cent, indicating a rock mass of poor quality. The Total Core Recovery (TCR) and Solid Core Recovery (SCR) of samples recovered are between 97 per cent and 100 per cent and between 46 per cent and 100 per cent, respectively.

Point load strength index tests (ASTM D5731 – Standard Test Method for Determination of the Point Load Strength Index of Rock and Application to Rock Strength Classification) were carried out on selected samples of the bedrock core. The axial and diametral point load strength index values are shown on the Record of Drillhole sheets and are presented in Table B1 in Appendix B. The axial tests carried out on eighteen (18) samples of the granitic gneiss bedrock core measured Is_{50} values ranging from about 3.1 MPa to 12.6 MPa, but generally greater than 6.0 MPa, and the diametral tests carried out on twenty five (25) samples of the granitic gneiss bedrock core measured Is_{50} values ranging from about 1.7 MPa to 10.9 MPa, but generally greater than 4.7 MPa.

Two (2) Unconfined Compression (UC) tests (ASTM D7012 – Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core Specimens) were carried out on selected core samples of the granitic gneiss bedrock obtained in Boreholes B303-05 and B303-10 and measured uniaxial compressive strengths of about 105 MPa and 141 MPa, respectively, as summarized in Table B2-1 and detailed in Tables B2-2 and B2-3 in Appendix B.

Also presented in Table B1 are the estimated Uniaxial Compressive Strength (UCS) values for each sample tested for point load strength index based on a relationship between Is_{50} and UCS, which is given by a correlation factor (K) which varies depending on the size of the core sample and the strength of the rock. For this site, the UCS values are based on an estimated average correlation factor (K) of 12.

³ International Society for Rock Mechanics Commission on Test Methods, 1985. Int. J. Rock Mech. Min. Sci. & Geomech. Abstr. Vol 22, No. 2, pp. 51-60.



Based on the laboratory UC test and the axial point load index test results, in accordance with Table 3.5 in CFEM (2006)⁴, the granitic gneiss bedrock is generally classified as strong (R4, 50 MPa < UCS < 100 MPa) to very strong (R5, 100 MPa < UCS < 250 MPa), with one axial test indicating medium strong (R3, 25 MPa < UCS < 50 MPa) rock.

4.2.6 Groundwater Conditions

In general, the overburden samples taken in the boreholes were moist to wet. The water level observed in boreholes upon completion of drilling range between about Elevation 200.0 m and 190.1 m, measured between up to about 0.3 m above ground surface (i.e. standing water at some locations at north abutment) to depths of up to about 3.8 m below ground surface. Boreholes B303-04, B303-06 and B303-12 were dry upon completion of hand excavation.

A standpipe piezometer was installed in Borehole B303-10 to allow monitoring of the groundwater level at the site. Details of the piezometer installation are shown on the Record of Borehole sheet in Appendix A and the groundwater level measured in the piezometer is summarized below.

Foundation Element	Borehole	Ground Surface Elevation (m)	Groundwater Elevation (m)	Date of Measurement
North Abutment	B303-10	191.1	191.0	March 8, 2013

It should be noted that the groundwater level in the area is subject to seasonal fluctuations and precipitation events and should be expected to be higher during wet periods of the year.

5.0 CLOSURE

The field technicians directing the drilling program were Messrs. Ed Savard and Matt J. Riopelle. This report was prepared by Mr. Al Varshoi, M.E.Sc., and was reviewed by Mr. J. Paul Dittrich, P.Eng., a senior geotechnical engineer and Principal with Golder. Mr. Jorge M. A. Costa, Golder's Designated MTO Contact for this project and a Principal of Golder, conducted an independent quality control review of the report.

⁴ Canadian Geotechnical Society, 2006. Canadian Foundation Engineering Manual, 4th Edition.



Report Signature Page

GOLDER ASSOCIATES LTD.

Al Varshoi, M.E.Sc.
Geotechnical Engineering Group

J. Paul Dittrich, P.Eng.
Senior Geotechnical Engineer, Principal



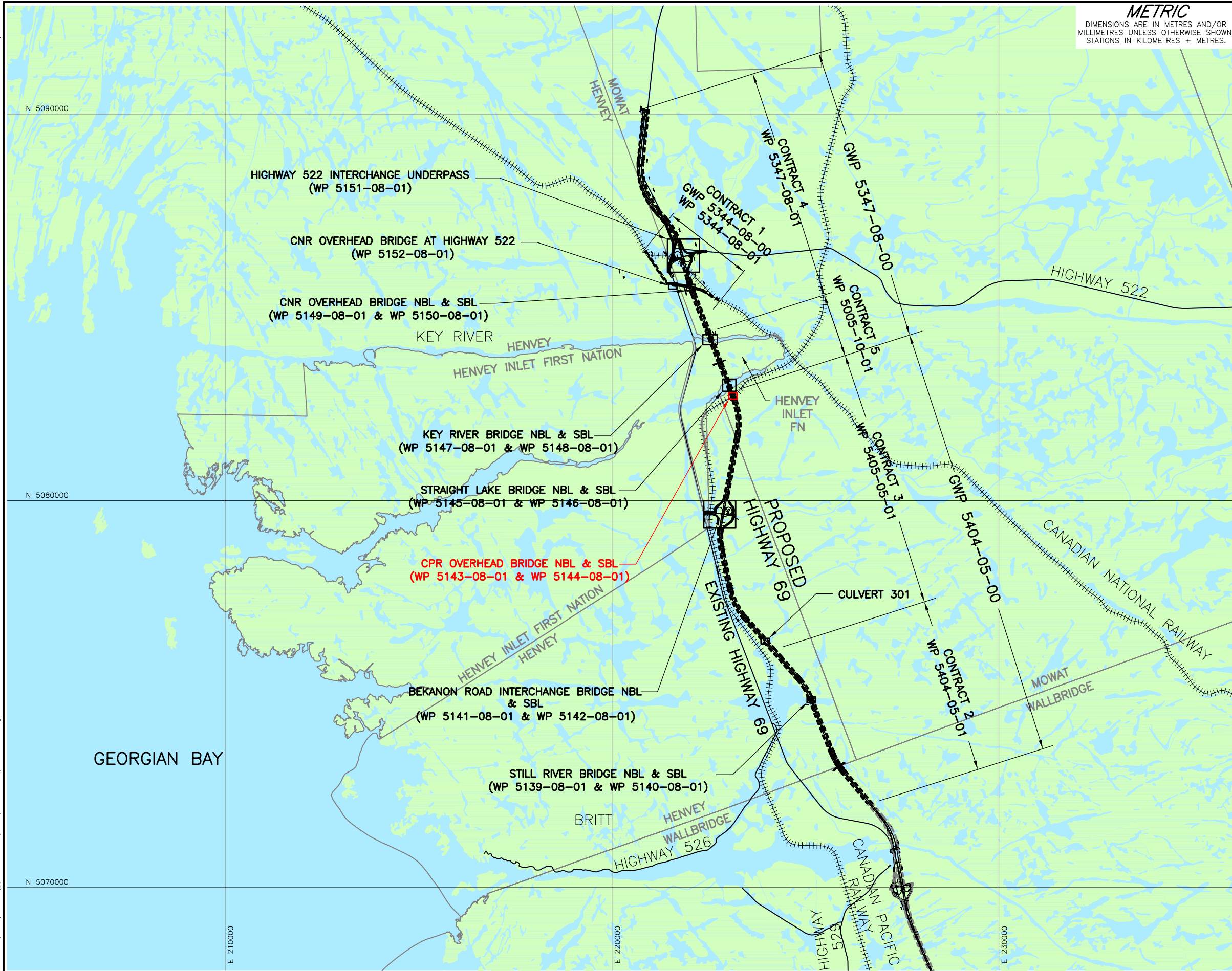
Jorge M. A. Costa, P.Eng.
Designated MTO Contact, Principal

AV/CN/JPD/JMAC/jd

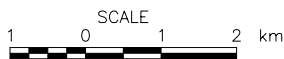
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DRAWINGS



PLAN



METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
GWP No. 5404-05-00



HIGHWAY 69
SITE LOCATION PLAN

SHEET



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



KEY PLAN
NOT TO SCALE

REFERENCE

Base Data - MNR NRVIS, obtained 2004, CANMAP v2008
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2008
Datum : NAD 83 Projection : MTM Zone 10

NO.	DATE	BY	REVISION
Geocres No. 41H-139			
HWY. 69		PROJECT NO. 09-1111-6014	DIST.
SUBM'D. TVA	CHKD. TVA	DATE: Oct. 2013	SITE:
DRAWN: JFC	CHKD. CN	APPD. JPD/JMAC	DWG. 1

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
WP No. 5144-08-01



HIGHWAY 69

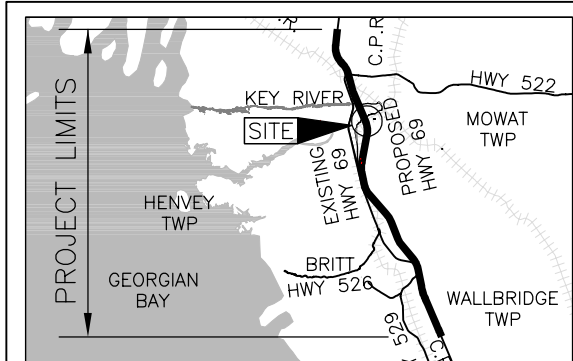
CPR OVERHEAD BRIDGE SBL

SHEET

BOREHOLE LOCATIONS AND SOIL STRATA



Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



KEY PLAN

SCALE
0 5 10 km

LEGEND

- Borehole - Current Investigation
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated
(Std. Pen. Test, 475 j/blow)
- 100% Rock Quality Designation (RQD)
- ≡ WL upon completion of drilling

BOREHOLE CO-ORDINATES

No.	ELEVATION	NORTHING	EASTING
B303-01	200.9	5082689.8	223131.7
B303-02	200.2	5082684.9	223133.8
B303-03	200.7	5082691.0	223139.0
B303-04	198.6	5082697.2	223143.3
B303-05	200.4	5082692.2	223145.3
B303-06	200.5	5082672.8	223146.2
B303-07	191.1	5082720.6	223119.1
B303-08	191.2	5082725.4	223117.1
B303-09	191.1	5082726.7	223124.1
B303-10	191.1	5082727.8	223130.7
B303-11	191.2	5082732.6	223128.7
B303-12	195.9	5082745.0	223116.4

NOTES

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

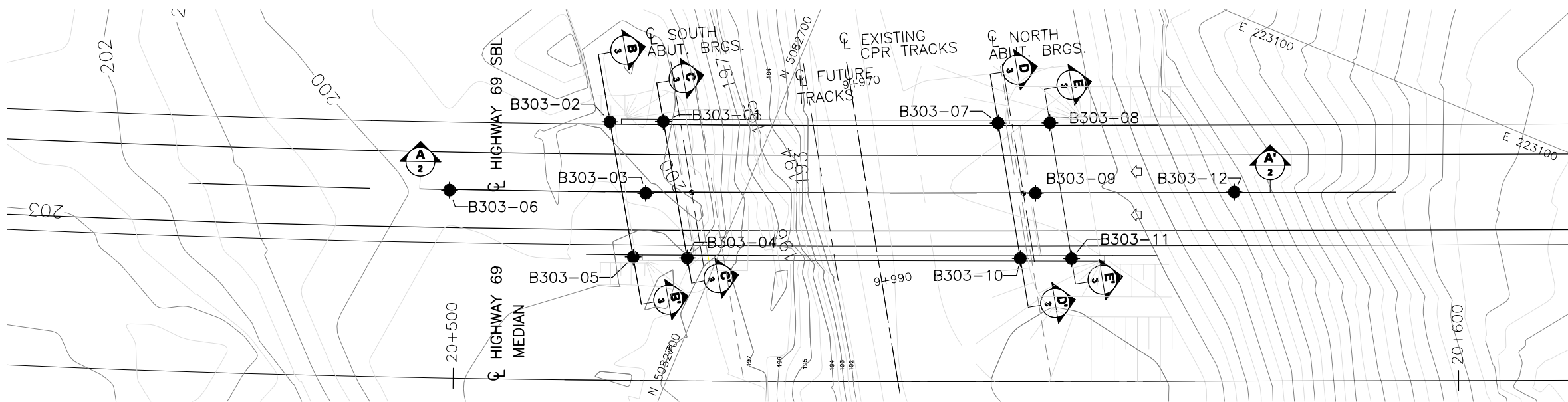
The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

The complete Foundation Investigation and Design Report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with Section GC 2.01 of OPS General Conditions.

REFERENCE

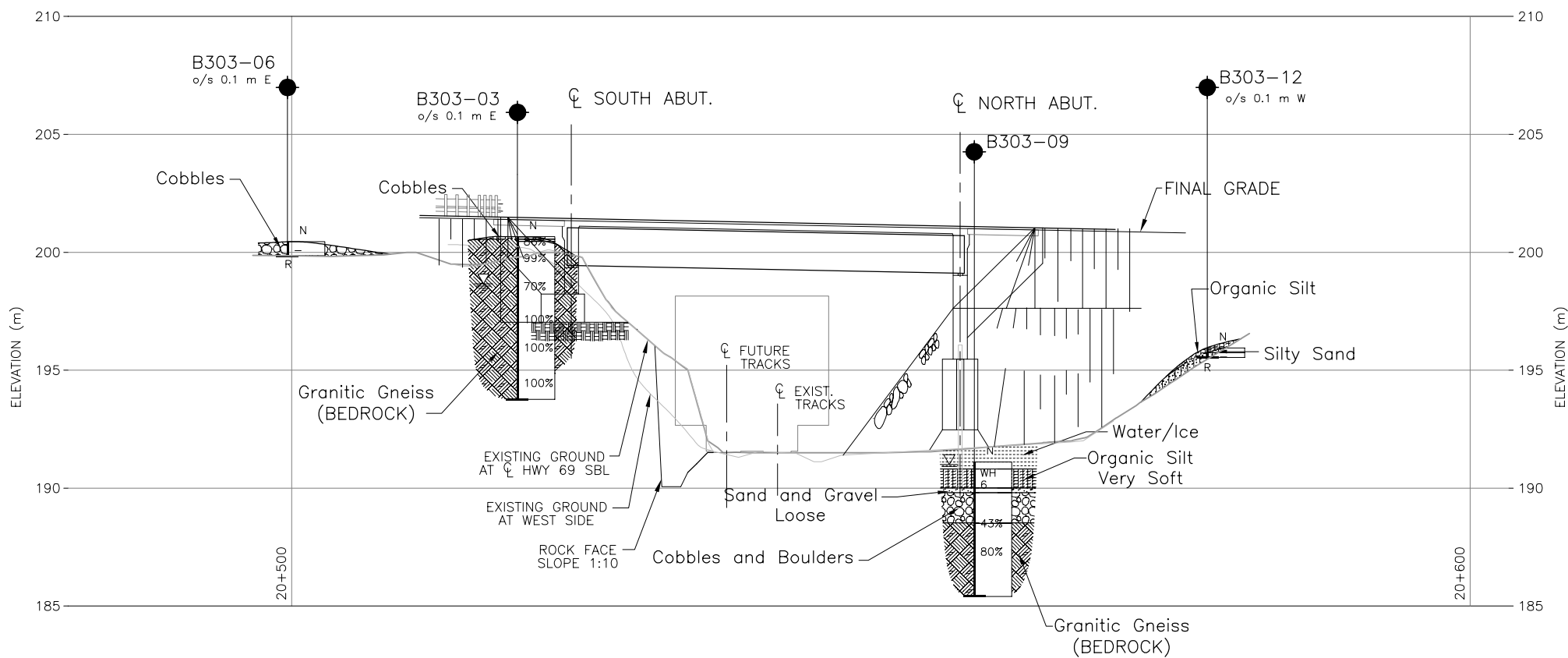
Base plans provided in digital format by URS, drawing file nos. Hwy69_Contour-Plan_C3.dwg, Hwy69_Contour-Plan_C5.dwg, received April 23, 2013 and August 31, 2012. CPR SBL Skew_GA.dwg, received July 11, 2013.

NO.	DATE	BY	REVISION
Geocres No.	41H-139		
HWY.	69		PROJECT NO. 09-1111-6014 DIST.
SUBM'D. AV	CHKD. CN	DATE: Oct. 2013	SITE: 44-460/2
DRAWN: MR	CHKD. AV	APPD. JPD/JMAC	DWG. 2



PLAN

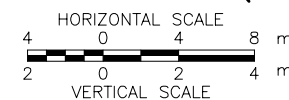
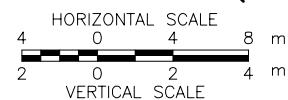
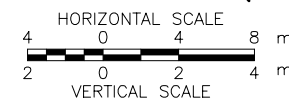
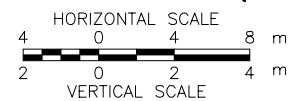
SCALE
0 5 10 m



A-A
CENTRELINE PROFILE
HIGHWAY 69 (SBL)

HORIZONTAL SCALE
0 5 10 m
VERTICAL SCALE
0 2.5 5 m





NO.	DATE	BY	REVISION		
Geocres No. 41H-139					
HWY. 69			PROJECT NO. 09-1111-6014		DIST.
SUBM'D. AV		CHKD. CN	DATE: Oct. 2013		SITE: 44-460/2
DRAWN: MR		CHKD. AV	APPD. UCD/JMAC		DWG. 3



APPENDIX A

Record of Borehole and Drillhole Sheets



LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
$\ln x$,	natural logarithm of x
\log_{10}	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time
FoS	factor of safety

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta \sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
ν	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a)	Index Properties
$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

(a) Index Properties (continued)

w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index = $(w_l - w_p)$
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_α	secondary compression index
m_v	coefficient of volume change
C_v	coefficient of consolidation (vertical direction)
C_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = $\tan \delta$
c'	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p'	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

* Density symbol is ρ . Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

Notes: 1
2

$\tau = c' + \sigma' \tan \phi'$
shear strength = (compressive strength)/2



LIST OF ABBREVIATIONS

The abbreviations commonly employed on Records of Boreholes, on figures and in the text of the report are as follows:

I. SAMPLE TYPE

AS	Auger sample
BS	Block sample
CS	Chunk sample
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
SS	Split-spoon
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

II. PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) drive open sampler for a distance of 300 mm (12 in.)

Dynamic Cone Penetration Resistance; N_d :

The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure

PM: Sampler advanced by manual pressure

WH: Sampler advanced by static weight of hammer

WR: Sampler advanced by weight of sampler and rod

Piezo-Cone Penetration Test (CPT)

A electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (Q_t), porewater pressure (PWP) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

III. SOIL DESCRIPTION

(a) Non-Cohesive (Cohesionless) Soils

Density Index	N
Relative Density	Blows/300 mm or Blows/ft
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

(b) Cohesive Soils Consistency

	c_u, s_u	
	kPa	psf
Very soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1,000
Stiff	50 to 100	1,000 to 2,000
Very stiff	100 to 200	2,000 to 4,000
Hard	over 200	over 4,000

IV. SOIL TESTS

w	water content
w _p	plastic limit
w _l	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test ¹
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement ¹
D _R	relative density (specific gravity, G_s)
DS	direct shear test
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO ₄	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V	field vane (LV-laboratory vane test)
γ	unit weight

Note: 1 Tests which are anisotropically consolidated prior to shear are shown as CAD, CAU.

V. MINOR SOIL CONSTITUENTS

Per cent by Weight	Modifier	Example
0 to 5	Trace	Trace sand
5 to 12	Trace to Some (or Little)	Trace to some sand
12 to 20	Some	Some sand
20 to 30	(ey) or (y)	Sandy
over 30	And (non-cohesive (cohesionless)) or With (cohesive)	Sand and Gravel Silty Clay with sand / Clayey Silt with sand



LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

WEATHERINGS STATE

Fresh: no visible sign of weathering

Faintly weathered: weathering limited to the surface of major discontinuities.

Slightly weathered: penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material.

Moderately weathered: weathering extends throughout the rock mass but the rock material is not friable.

Highly weathered: weathering extends throughout rock mass and the rock material is partly friable.

Completely weathered: rock is wholly decomposed and in a friable condition but the rock and structure are preserved.

BEDDING THICKNESS

Description	Bedding Plane Spacing
Very thickly bedded	Greater than 2 m
Thickly bedded	0.6 m to 2 m
Medium bedded	0.2 m to 0.6 m
Thinly bedded	60 mm to 0.2 m
Very thinly bedded	20 mm to 60 mm
Laminated	6 mm to 20 mm
Thinly laminated	Less than 6 mm

JOINT OR FOLIATION SPACING

Description	Spacing
Very wide	Greater than 3 m
Wide	1 m to 3 m
Moderately close	0.3 m to 1 m
Close	50 mm to 300 mm
Very close	Less than 50 mm

GRAIN SIZE

Term	Size*
Very Coarse Grained	Greater than 60 mm
Coarse Grained	2 mm to 60 mm
Medium Grained	60 microns to 2 mm
Fine Grained	2 microns to 60 microns
Very Fine Grained	Less than 2 microns

Note: * Grains greater than 60 microns diameter are visible to the naked eye.

CORE CONDITION

Total Core Recovery (TCR)

The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run.

Solid Core Recovery (SCR)

The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.

Rock Quality Designation (RQD)

The percentage of solid drill core, greater than 100 mm length, recovered at full diameter, measured relative to the length of the total core run. RQD varied from 0% for completely broken core to 100% for core in solid sticks.

DISCONTINUITY DATA

Fracture Index

A count of the number of discontinuities (physical separations) in the rock core, including both naturally occurring fractures and mechanically induced breaks caused by drilling.

Dip with Respect to Core Axis



The angle of the discontinuity relative to the axis (length) of the core. In a vertical borehole a discontinuity with a 90° angle is horizontal.

Description and Notes

An abbreviation description of the discontinuities, whether naturally occurring separations such as fractures, bedding planes and foliation planes or mechanically induced features caused by drilling such as ground or shattered core and mechanically separated bedding or foliation surfaces. Additional information concerning the nature of fracture surfaces and infillings are also noted.

Abbreviations

JN Joint	PL Planar
FLT Fault	CU Curved
SH Shear	UN Undulating
VN Vein	IR Irregular
FR Fracture	K Slickensided
SY Stylolite	PO Polished
BD Bedding	SM Smooth
FO Foliation	SR Slightly Rough
CO Contact	RO Rough
AXJ Axial Joint	VR Very Rough
KV Karstic Void	
MB Mechanical Break	

PROJECT 09-1111-6014		RECORD OF BOREHOLE No B303-01				SHEET 1 OF 1		METRIC										
W.P. 5144-08-01		LOCATION N 5082689.8 ; E 223131.7				ORIGINATED BY EHS												
DIST _____ HWY 69		BOREHOLE TYPE Portable Equipment, NQ Rock Coring				COMPILED BY GRL												
DATUM Geodetic		DATE February 26, 2013				CHECKED BY JPD												
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)
200.9 0.0	GROUND SURFACE Granitic Gneiss (BEDROCK) Bedrock cored from ground surface to a depth of 4.5 m For bedrock coring details refer to Record of Drillhole B303-01		1	RC	REC 100%		200											RQD = 94%
			2	RC	REC 100%		199											RQD = 89%
			3	RC	REC 97%		198											RQD = 82%
							197											
196.5 4.5	END OF BOREHOLE NOTE: 1. Water level in open borehole at a depth of 3.8 m below ground surface (Elev. 197.1 m) upon completion of drilling.																	

PROJECT: 09-1111-6014

RECORD OF DRILLHOLE: B303-01

SHEET 1 OF 1

LOCATION: N 5082689.8 ; E 223131.7

DRILLING DATE: February 26, 2013

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Hilti Portable Equipment

DRILLING CONTRACTOR: OGS Inc

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	COLOUR % RETURN	FLUSH	RECOVERY		R.Q.D. %	FRACT INDEX PER 0.3 m	DISCONTINUITY DATA				HYDRAULIC CONDUCTIVITY K, cm/sec				Diametral Point Load Index (MPa)	RMC -Q AVG.	NOTES		
								TOTAL CORE %	SOLID CORE %			B Angle	DIP w.r.t. CORE AXIS	TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	10 ⁻⁶	10 ⁻⁵				10 ⁻⁴	10 ⁻³
JN - Joint FLT - Fault SH - Shear VN - Vein CJ - Conjugate	BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage	PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular	PO - Polished K - Slickensided SM - Smooth RO - Rough VR - Very Rough	MB - Mechanical Break BR - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols.																				
0	NQRQ February 26, 2013	Continued from Record of Borehole B303-01		200.94																				
		Fresh, thinly laminated to thinly bedded, light to dark grey with pink interbeds, fine to coarse grained, faintly porous, very strong GRANITIC GNEISS		0.00																				
1					1																			
2					2																			
3																								
4						3																		
		END OF DRILLHOLE		196.49																				
				4.45																				
5																								
6																								
7																								
8																								
9																								
10																								

DEPTH SCALE




1 : 50



LOGGED: EHS/CS

CHECKED: JPD

GTA-RCK 018 09-1111-6014.GPJ GAL-MISS.GDT 01/16/14

PROJECT 09-1111-6014		RECORD OF BOREHOLE No B303-02				SHEET 1 OF 1		METRIC										
W.P. 5144-08-01		LOCATION N 5082684.9 ; E 223133.8				ORIGINATED BY EHS												
DIST _____ HWY 69		BOREHOLE TYPE Portable Equipment, BQ Rock Coring				COMPILED BY GRL												
DATUM Geodetic		DATE March 1, 2013				CHECKED BY JPD												
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)					
200.2	GROUND SURFACE						<div style="display: flex; justify-content: space-between;"> 20 40 60 80 100 20 40 60 80 100 </div>					<div style="display: flex; justify-content: space-between;"> 20 40 60 20 40 60 </div>						
0.0	COBBLES and BOULDERS, trace organics		-	RC	-		200											
199.8	Granitic Gneiss (BEDROCK)		1	RC	-		199											
198.6	END OF BOREHOLE																	
1.6	NOTE: 1. Water level in open borehole at a depth of 0.4 m below ground surface (Elev. 199.8 m) upon completion of drilling.																	

PROJECT		RECORD OF BOREHOLE		No B303-03		SHEET 1 OF 1		METRIC								
W.P. 09-1111-6014		LOCATION		N 5082691.0 ; E 223139.0		ORIGINATED BY		MJR								
DIST		HWY 69		BOREHOLE TYPE		Portable Equipment, NQ Rock Coring		COMPILED BY								
GRL		JPD		DATE		February 27 to 28, 2013		CHECKED BY								
Geodetic		JPD														
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
200.7	GROUND SURFACE						20	40	60	80	100	W _p	W	W _L		
0.0	COBBLES, trace organics															
0.2	Granitic Gneiss (BEDROCK)															
	Bedrock cored from depths of 0.2 m to 6.9 m		1	RC	REC 100%											RQD = 86%
	For bedrock coring details refer to Record of Drillhole B303-03		2	RC	REC 100%											RQD = 99%
			3	RC	REC 98%											RQD = 70%
			4	RC	REC 100%											RQD = 100%
			5	RC	REC 100%											RQD = 100%
			6	RC	REC 100%											RQD = 100%
193.8	END OF BOREHOLE															
6.9	NOTE: 1. Water level in open borehole at a depth of 2.0 m below ground surface (Elev. 198.7 m) on March 1, 2013.															

PROJECT: 09-1111-6014

RECORD OF DRILLHOLE: B303-03

SHEET 1 OF 1

LOCATION: N 5082691.0 ; E 223139.0

DRILLING DATE: February 27 to 28, 2013

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Portable Equipment

DRILLING CONTRACTOR: OGS Inc

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.	RUN No.	COLOUR % RETURN	JN - Joint FLT - Fault SH - Shear VN - Vein CJ - Conjugate	BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage	PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular	PO - Polished K - Slickensided SM - Smooth RO - Rough VR - Very Rough	MB - Mechanical Break BR - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols.	NOTES																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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							TOTAL CORE %	SOLID CORE %	%	INDEX PER 0.3 m	B Angle	DIP w.r.t. CORE AXIS	TYPE AND SURFACE DESCRIPTION			Jr	Ja	Jn	K, cm/sec	10 ⁻⁵	10 ⁻⁴	10 ⁻³	10 ⁻²	10 ⁻¹	Index (MPa)	Point Load Index (MPa)	-Q ² AVG.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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DEPTH SCALE

1 : 50



LOGGED: MJR/CS

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GTA-RCK 018 09-1111-6014.GPJ GAL-MISS.GDT 01/16/14

PROJECT		RECORD OF BOREHOLE		No B303-04		SHEET 1 OF 1		METRIC								
W.P. 09-1111-6014		LOCATION		N 5082697.2 ; E 223143.3		ORIGINATED BY		EHS								
DIST		HWY 69		BOREHOLE TYPE		Hand Shovel Excavation		COMPILED BY								
GRL		JPD		DATE		March 1, 2013		CHECKED BY								
Geodetic		JPD														
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
198.6	GROUND SURFACE															
0.0	ORGANIC SILT															
0.1	Black															
	END OF EXCAVATION															
	BEDROCK															
	NOTES:															
	1. Excavation dry upon completion.															
	2. Bedrock outcrops in vicinity of Borehole B303-04.															

GTA-MTO 001 09-1111-6014.GPJ GAL-GTA.GDT 01/16/14

PROJECT		RECORD OF BOREHOLE		No B303-05		SHEET 1 OF 1		METRIC			
W.P.		LOCATION		ORIGINATED BY		COMPILED BY		CHECKED BY			
DIST		BOREHOLE TYPE		DATE		JPD					
Geodetic		February 28, 2013									
SOIL PROFILE		SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE LIMIT CONTENT		UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER			TYPE	"N" VALUES	20 40 60 80 100	20 40 60		
200.4	GROUND SURFACE										
0.0	PEAT (Fibrous) Black Wet		1A	SC	-						
199.9			1B	SC	-						
0.5	Silty SAND, trace organics, containing rootlets Brown to grey Wet		-	RC	-						
199.2											
1.2	COBBLES and BOULDERS Granitic Gneiss (BEDROCK)		1	RC	REC 100%						
	Bedrock cored from depths of 1.2 m to 4.5 m										
	For bedrock coring details refer to Record of Drillhole B303-05		2	RC	REC 100%						
			3	RC	REC 99%						
195.9	END OF BOREHOLE										
4.5	NOTE: 1. Water level in open borehole at a depth of 0.4 m below ground surface (Elev. 200.0 m) upon completion of drilling.										

PROJECT: 09-1111-6014

RECORD OF DRILLHOLE: B303-05

SHEET 1 OF 1

LOCATION: N 5082692.2 ; E 223145.3

DRILLING DATE: February 28, 2013

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Portable Equipment

DRILLING CONTRACTOR: LANDCORE DRILLING

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	FLUSH	RECOVERY			FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA				HYDRAULIC CONDUCTIVITY K, cm/sec			Diametral Point Load Index (MPa)	RMC -Q AVG.	NOTES																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
							TOTAL CORE %	SOLID CORE %	R.Q.D. %		B Angle	DIP w.r.t CORE AXIS	TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	10 ⁻⁶				10 ⁻⁵	10 ⁻⁴																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
		Continued from Record of Borehole B303-05		199.22 1.20	1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											

DEPTH SCALE

1 : 50





LOGGED: MJR/CS

CHECKED: JPD

GTA-RCK 018 09-1111-6014.GPJ GAL-MISS.GDT 01/16/14

PROJECT		RECORD OF BOREHOLE		No B303-06		SHEET 1 OF 1		METRIC													
W.P. 09-1111-6014		LOCATION		N 5082672.8 ; E 223146.2		ORIGINATED BY		EHS													
DIST		HWY 69		BOREHOLE TYPE		Hand Shovel Excavation		COMPILED BY													
CC/AV		DATE		March 1, 2013		CHECKED BY		JPD													
DATUM		Geodetic																			
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa					WATER CONTENT (%)			γ			GR SA SI CL		
200.5	GROUND SURFACE							20 40 60 80 100	20 40 60 80 100	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60
0.0	COBBLES, some sand, trace silt, trace organics, containing rootlets		1	CS	-		200														
199.9	Black to brown																				
0.6	Moist																				
	HAND SHOVEL REFUSAL END OF EXCAVATION																				
	NOTE: 1. Excavation dry upon completion.																				

PROJECT		RECORD OF BOREHOLE		No B303-07		SHEET 1 OF 1		METRIC									
W.P. 09-1111-6014		LOCATION		N 5082720.6 ; E 223119.1		ORIGINATED BY		MJR									
DIST _____ HWY 69		BOREHOLE TYPE		Portable Equipment, NW Casing, Wash Boring		COMPILED BY		CC/GRL									
DATUM Geodetic		DATE		March 8, 2013		CHECKED BY		JPD									
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa									
191.1	GROUND SURFACE						20	40	60	80	100						
0.0	ORGANIC SILT, trace sand Very soft Dark grey Wet		1	SS	2		191									159.7	OOC = 15.5%
190.1			2	SS	2												
1.0	END OF BOREHOLE CASING REFUSAL NOTE: 1. Water level in open borehole at a depth of 0.1 m below ground surface (Elev. 191.0 m) upon completion of drilling.																

PROJECT		RECORD OF BOREHOLE		No B303-08		SHEET 1 OF 1		METRIC																				
W.P. 5144-08-01		LOCATION		N 5082725.4 ; E 223117.1		ORIGINATED BY		MJR																				
DIST		HWY 69		BOREHOLE TYPE		Portable Equipment, NW Casing, Wash Boring		COMPILED BY																				
CC/GRL		JPD		DATE		March 8, 2013		CHECKED BY																				
DATUM		Geodetic																										
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS			ELEVATION SCALE			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			WATER CONTENT (%)			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV	DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES																						
191.2	0.0	GROUND SURFACE																										
0.0	0.2	PEAT (Fibrous) Soft Black Wet		1A	SS	3																						
190.4	0.8	SAND, trace organics, containing clayey silt seams Very loose Brown Wet		2	SS	6																						
189.8	1.4	SAND and GRAVEL, trace to some silt, trace clay Loose Brown Wet		-	RC	-																						
189.3	1.9	COBBLES and BOULDERS Granitic Gneiss (BEDROCK)		1	RC	REC 98%																						
		Bedrock cored from depths of 1.9 m to 4.8 m																										
		For bedrock coring details refer to Record of Drillhole B303-08																										
186.4	4.8	END OF BOREHOLE																										
		NOTE: 1. Water level in open borehole at a depth of 0.2 m below ground surface (Elev. 191.0 m) upon completion of drilling.																										

PROJECT: 09-1111-6014

RECORD OF DRILLHOLE: B303-08

SHEET 1 OF 1

LOCATION: N 5082725.4 ;E 223117.1

DRILLING DATE: March 8, 2013

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Portable Tripod

DRILLING CONTRACTOR: LANDCORE DRILLING

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.	RUN No.	COLOUR % RETURN	FLUSH	JN - Joint FLT - Fault SH - Shear VN - Vein CJ - Conjugate	BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage	PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular	PO - Polished K - Slickensided SM - Smooth RO - Rough VR - Very Rough	MB - Mechanical Break BR - Broken Rock NOTE: For additional abbreviations refer to list of abbreviations & symbols.	NOTES								
				DEPTH																	
				(m)																	
						RECOVERY	R.Q.D.	FRACT.	DISCONTINUITY DATA				HYDRAULIC				Diametral		RMC		
						TOTAL CORE %	SOLID CORE %	%	INDEX PER 0.3 m	B Angle	DIP w.r.t. CORE AXIS	TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	K, cm/sec	Point Load Index (MPa)	-Q'	AVG.		
						0 50 100	0 50 100	0 50 100	0 50 100	0 90 180	0 90 180					10 20 30 40 50	10 20 30 40 50	10 20 30 40 50	10 20 30 40 50		
		Continued from Record of Borehole B303-08		189.28																	
2	NW Casing	Slightly weathered to fresh, thinly laminated to thinly bedded, light to dark grey with pink interbeds, fine to coarse grained, faintly porous, very strong GRANITIC GNEISS		1.90																	
				1																	
3	NQRQ March 8, 2013																				
4																					
5																					
6																					
7																					
8																					
9																					
10																					
11																					
		END OF DRILLHOLE		186.38																	
				4.80																	

DEPTH SCALE

1 : 50



LOGGED: MJR/CS

CHECKED: JPD

GTA-RCK 018 09-1111-6014.GPJ GAL-MISS.GDT 01/16/14

PROJECT		RECORD OF BOREHOLE		No B303-09		SHEET 1 OF 1		METRIC									
W.P. 09-1111-6014		LOCATION		N 5082726.7 ; E 223124.1		ORIGINATED BY		MJR									
DIST		HWY 69		BOREHOLE TYPE		Portable Equipment, NW Casing, Wash Boring		COMPILED BY									
CC/GRL		DATE		March 6, 2013		CHECKED BY		JPD									
DUM Geodetic																	
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
191.1	ICE SURFACE																
0.0	ICE																
0.3	WATER																
	ORGANIC SILT, trace sand		1	SS	WH												Non-Plastic
	Very loose																
	Dark brown		2A	SS	6												
190.0	Wet																
	SAND and GRAVEL, containing																
	clayey silt seams																
	Loose																
	Grey																
	Wet																
	COBBLES and BOULDERS																
188.5																	
2.6	Granitic Gneiss (BEDROCK)																
	Bedrock cored from depths of		1	RC	REC 100%												RQD = 43%
	2.6 m to 5.7 m																
	For bedrock coring details refer to																
	Record of Drillhole B303-09																
			2	RC	REC 99%												RQD = 80%
185.4																	
5.7	END OF BOREHOLE																
	NOTE:																
	1. Water level in open borehole at																
	a depth of 0.1 m below ground																
	surface (Elev. 191.0 m) upon																
	completion of drilling.																

SHEET 1 OF 1

DATUM: Geodetic

DRILL RIG: Portable Equipment

CHECKED: JPD

PROJECT		RECORD OF BOREHOLE		No B303-10		SHEET 1 OF 1		METRIC								
W.P. 09-1111-6014		LOCATION		N 5082727.8 ; E 223130.7		ORIGINATED BY		EHS								
DIST		HWY 69		BOREHOLE TYPE		Portable Equipment, BW Casing, Wash Boring		COMPILED BY								
DATUM		Geodetic		DATE		March 5, 2013		CHECKED BY								
								JPD								
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
191.1	ICE SURFACE															
0.0	ICE															
190.8																
0.3	PEAT (Fibrous) Very soft Black Wet		1	SS	WH											
190.0			2A													
1.1	SAND and GRAVEL, trace silt, trace organics Very loose		2B	SS	2											
189.5			3	SS	2/0.08											
1.6	Brown Wet Granitic Gneiss (BEDROCK) Bedrock cored from depths of 1.6 m to 5.9 m For bedrock coring details refer to Record of Drillhole B303-10		1	RC	REC 100%											RQD = 48%
			2	RC	REC 99%											RQD = 82%
			3	RC	REC 100%											RQD = 75%
185.3																
5.9	END OF BOREHOLE															
NOTES: 1. Water level in open borehole at a depth of 1.0 m below ground surface (Elev. 190.1 m) upon completion of drilling. 2. Water level in piezometer at a depth of 0.1 m below ground surface (Elev. 191.0 m) on March 8, 2013.																

PROJECT: 09-1111-6014

RECORD OF DRILLHOLE: B303-10

SHEET 1 OF 1

LOCATION: N 5082727.8 ; E 223130.7

DRILLING DATE: March 5, 2013

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Portable Equipment

DRILLING CONTRACTOR: OGS Inc

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV.	RUN No.	COLOUR % RETURN	JN - Joint FLT - Fault SH - Shear VN - Vein CJ - Conjugate	BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage	PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular	PO - Polished K' - Slickensided SM - Smooth RO - Rough VR - Very Rough	MB - Mechanical Break BR - Broken Rock	NOTES
				DEPTH								
				(m)								
FLUSH	RECOVERY	R.Q.D.	FRACT.	DISCONTINUITY DATA			HYDRAULIC			Diametral	RMC	
TOTAL CORE %	SOLID CORE %	%	INDEX PER 0.3 m	B Angle	DIP w.r.t. CORE AXIS	TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	K, cm/sec	Point Load Index (MPa)	-Q' AVG.
0.00 												

DEPTH SCALE



1 : 50



LOGGED: EHS/CS

CHECKED: JPD

GTA-RCK 018 09-1111-6014.GPJ GAL-MISS.GDT 01/16/14

PROJECT		RECORD OF BOREHOLE		No B303-11		SHEET 1 OF 1		METRIC								
W.P. 09-1111-6014		LOCATION		N 5082732.6 ; E 223128.7		ORIGINATED BY		MJR								
DIST		HWY 69		BOREHOLE TYPE		Portable Equipment, NW Casing, Wash Boring		COMPILED BY								
CC/GRL		DATE		March 8, 2013		CHECKED BY		JPD								
DATUM		Geodetic														
SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
191.2	GROUND SURFACE															
0.0	ORGANIC SILT Very loose Dark brown Wet		1	SS	2		191									
190.6																
190.3	SAND and GRAVEL, some silt, trace clay Loose Dark brown Wet		2	SS	5/0.03											
0.9	END OF BOREHOLE SPOON AND CASING REFUSAL															
NOTE: 1. Water level in open borehole at ground surface (Elev. 191.2 m) upon completion of drilling.																

PROJECT		RECORD OF BOREHOLE		No B303-12		SHEET 1 OF 1		METRIC										
W.P. 09-1111-6014		LOCATION		N 5082745.0 ; E 223116.4		ORIGINATED BY		MJR										
DIST		HWY 69		BOREHOLE TYPE		Hand Shovel Excavation		COMPILED BY										
CC/GRL		JPD		DATE		March 7, 2013		CHECKED BY										
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT			REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	SHEAR STRENGTH kPa					WATER CONTENT (%)			γ		
195.9	GROUND SURFACE							20 40 60 80 100	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	
0.0	ORGANIC SILT Black Moist		1	CS	-			○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED	20 40 60 80 100	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	20 40 60	
0.4	Silty SAND, some cobbles, trace gravel, trace organics Brown Moist HAND SHOVEL REFUSAL END OF EXCAVATION NOTE: 1. Excavation dry upon completion.																	



APPENDIX B

Laboratory Test Results and Photographs

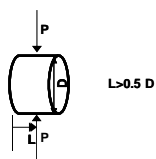
TABLE B1
POINT LOAD TEST RESULTS ON ROCK SAMPLES

Borehole Number	Run Number	Sample Depth (m)	Sample Elevation (m)	Bedrock Description	Test Type	Core Length (mm)	Core ⁽²⁾ Diameter (mm)	Is (50mm) (MPa)	Approx. UCS Value ⁽¹⁾ (MPa)
B303-01	1	0.40	200.5	Granite Gneiss	Axial	43.20	50.70	10.41	125
B303-01	2	1.70	199.2	Granite Gneiss	Axial	44.70	51.60	9.680	116
B303-01	3	3.10	197.8	Granite Gneiss	Axial	38.60	50.70	10.189	122
B303-01	1	0.40	200.5	Granite Gneiss	Diametral	50.70	103.00	9.938	119
B303-01	2	1.70	199.2	Granite Gneiss	Diametral	51.60	105.00	8.992	108
B303-01	3	3.10	197.8	Granite Gneiss	Diametral	50.70	91.00	10.510	126
B303-01	3	4.00	196.9	Granite Gneiss	Diametral	51.00	87.00	9.848	118
B303-03	1	0.50	200.2	Granite Gneiss	Axial	40.10	51.10	12.569	151
B303-03	2	1.70	199.0	Granite Gneiss	Axial	38.60	51.10	11.646	140
B303-03	4	3.70	197.0	Granite Gneiss	Axial	40.50	51.00	6.913	83
B303-03	5	5.60	195.1	Granite Gneiss	Axial	50.30	51.30	8.671	104
B303-03	1	0.50	200.2	Granite Gneiss	Diametral	51.10	102.00	7.266	87
B303-03	2	1.70	199.0	Granite Gneiss	Diametral	51.1	113.00	7.941	95
B303-03	3	2.80	197.9	Granite Gneiss	Diametral	51.00	81.00	8.598	103
B303-03	3	3.10	197.6	Granite Gneiss	Diametral	51.00	92.00	10.878	131
B303-03	4	3.70	197.0	Granite Gneiss	Diametral	51.0	101.00	10.576	127
B303-03	5	5.00	195.7	Granite Gneiss	Diametral	51.10	107.00	10.141	122
B303-03	5	5.60	195.1	Granite Gneiss	Diametral	51.30	111.00	10.714	129
B303-03	6	6.80	193.9	Granite Gneiss	Diametral	51.4	92.00	9.628	116
B303-05	2	1.80	198.6	Granite Gneiss	Axial	34.80	41.30	8.867	106
B303-05	3	3.10	197.3	Granite Gneiss	Axial	31.9	41.50	10.170	122
B303-05	3	4.00	196.4	Granite Gneiss	Axial	33.80	41.60	8.282	99
B303-05	2	1.8	198.6	Granite Gneiss	Diametral	41.30	104.00	1.693	20
B303-05	3	3.1	197.3	Granite Gneiss	Diametral	41.50	89.00	6.681	80
B303-05	3	4.0	196.4	Granite Gneiss	Diametral	41.60	87.00	7.181	86
B303-08	1	2.60	188.6	Granite Gneiss	Axial	37.30	41.50	6.775	81
B303-08	2	3.50	187.7	Granite Gneiss	Axial	28.00	41.90	7.189	86
B303-08	2	4.60	186.6	Granite Gneiss	Axial	27.30	41.90	10.052	121
B303-08	1	2.60	188.6	Granite Gneiss	Diametral	41.50	97.00	4.728	57
B303-08	2	3.50	187.7	Granite Gneiss	Diametral	41.90	111.00	5.566	67
B303-08	2	4.60	186.6	Granite Gneiss	Diametral	41.90	62.00	4.887	59
B303-09	1	3.20	187.9	Granite Gneiss	Axial	31.00	41.60	8.982	108
B303-09	1	3.20	187.9	Granite Gneiss	Diametral	41.60	78.00	5.013	60
B303-09	2	3.90	187.2	Granite Gneiss	Diametral	41.70	102.00	5.788	69
B303-09	2	5.10	186.0	Granite Gneiss	Diametral	41.70	98.00	5.748	69

⁽¹⁾ $Is_{50} \times K$, from ASTM Designation: D 5731 "Standard Test Method for Determination of the Point Load Strength Index of Rock and Application to Rock Strength Classifications". A value of $K = 12$ has been used based on 4 UCS tests for SBL and NBL at the bridge location.

DIAMETRAL SPECIMEN SHAPE REQUIREMENTS

note: Diametral tests are perpendicular to core axis (planes of weakness)



AXIAL SPECIMEN SHAPE REQUIREMENTS

note: Axial tests are parallel to core axis (planes of weakness)

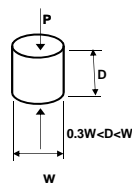


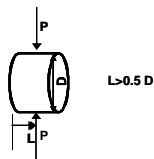
TABLE B1
POINT LOAD TEST RESULTS ON ROCK SAMPLES

Borehole Number	Run Number	Sample Depth (m)	Sample Elevation (m)	Bedrock Description	Test Type	Core Length (mm)	Core Diameter (mm) ⁽²⁾	Is (50mm) (MPa)	Approx. UCS Value ⁽¹⁾ (MPa)
B303-10	1	2.00	189.1	Granite Gneiss	Axial	46.20	50.60	5.953	71
B303-10	2	3.30	187.8	Granite Gneiss	Axial	48.60	50.40	3.093	37
B303-10	3	4.80	186.3	Granite Gneiss	Axial	40.60	50.40	11.929	143
B303-10	3	5.70	185.4	Granite Gneiss	Axial	42.80	50.80	8.262	99
B303-10	1	2.00	189.1	Granite Gneiss	Diametral	50.60	128.00	4.981	60
B303-10	2	3.30	187.8	Granite Gneiss	Diametral	50.40	101.00	4.817	58
B303-10	3	4.80	186.3	Granite Gneiss	Diametral	50.4	103.00	5.843	70
B303-10	3	5.70	185.4	Granite Gneiss	Diametral	50.80	112.00	7.636	92

⁽¹⁾ $Is_{50} \times K$, from ASTM Designation: D 5731 "Standard Test Method for Determination of the Point Load Strength Index of Rock and Application to Rock Strength Classifications". A value of $K = 12$ has been used based on 4 UCS tests for SBL and NBL at the bridge location.

DIAMETRAL SPECIMEN SHAPE REQUIREMENTS

note: Diametral tests are perpendicular to core axis (planes of weakness)



AXIAL SPECIMEN SHAPE REQUIREMENTS

note: Axial tests are parallel to core axis (planes of weakness)

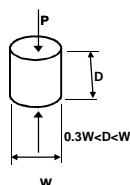


TABLE B2-1
SUMMARY OF UNIAXIAL COMPRESSIVE STRENGTH TEST RESULTS
CPR OVERHEAD STRUCTURE SBL
HIGHWAY 69 GWP 5404-05-00; WP 5144-08-01

Borehole Number (Core Run)	Sample Depth (m)	Sample Elevation (m)	Rock Type	Core Diameter (mm)	Uniaxial Compressive Strength (MPa)
B303-05 (3)	3.8	199.3	Granite Gneiss	41.6	104.6
B303-10 (3)	5.6	185.5	Granite Gneiss	50.7	141.0

Compiled By: AVChecked By: CNReviewed By: JPD/JMAC

TABLE B2-2
UNCONFINED COMPRESSION TEST (UC)
ASTM D 7012-07

SAMPLE IDENTIFICATION

PROJECT NUMBER	09-1111-6014	RUN NUMBER	3
BOREHOLE NUMBER	B303-05	SAMPLE DEPTH, m	3.75-3.85

TEST CONDITIONS

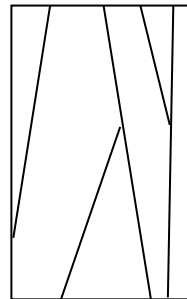
MACHINE SPEED, mm/min	-	TYPE OF SPECIMEN	Rock Core
DURATION OF TEST,min	>2 <15	L/D	2.22

SPECIMEN INFORMATION

SAMPLE HEIGHT, cm	9.25	WATER CONTENT, (specimen) %	0.13
SAMPLE DIAMETER, cm	4.16	UNIT WEIGHT, kN/m ³	26.51
SAMPLE AREA, cm ²	13.60	DRY UNIT WT., kN/m ³	26.47
SAMPLE VOLUME, cm ³	125.79	SPECIFIC GRAVITY	-
WET WEIGHT, g	340.13	VOID RATIO	-
DRY WEIGHT, g	339.69		

VISUAL INSPECTION

FAILURE SKETCH



TEST RESULTS

STRAIN AT FAILURE, %	-	COMPRESSIVE STRESS, MPa	104.6
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REMARKS:	DATE: 4/8/2013
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TABLE B2-3
UNCONFINED COMPRESSION TEST (UC)
ASTM D 7012-07

SAMPLE IDENTIFICATION

PROJECT NUMBER	09-1111-6014	RUN NUMBER	3
BOREHOLE NUMBER	B303-10	SAMPLE DEPTH, m	5.50-5.62

TEST CONDITIONS

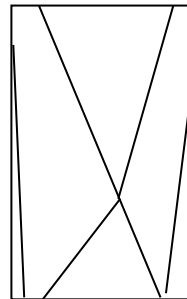
MACHINE SPEED, mm/min	-	TYPE OF SPECIMEN	Rock Core
DURATION OF TEST,min	>2 <15	L/D	2.10

SPECIMEN INFORMATION

SAMPLE HEIGHT, cm	10.63	WATER CONTENT, (specimen) %	0.12
SAMPLE DIAMETER, cm	5.07	UNIT WEIGHT, kN/m ³	25.72
SAMPLE AREA, cm ²	20.19	DRY UNIT WT., kN/m ³	25.69
SAMPLE VOLUME, cm ³	214.69	SPECIFIC GRAVITY	-
WET WEIGHT, g	563.21	VOID RATIO	-
DRY WEIGHT, g	562.53		

VISUAL INSPECTION

FAILURE SKETCH



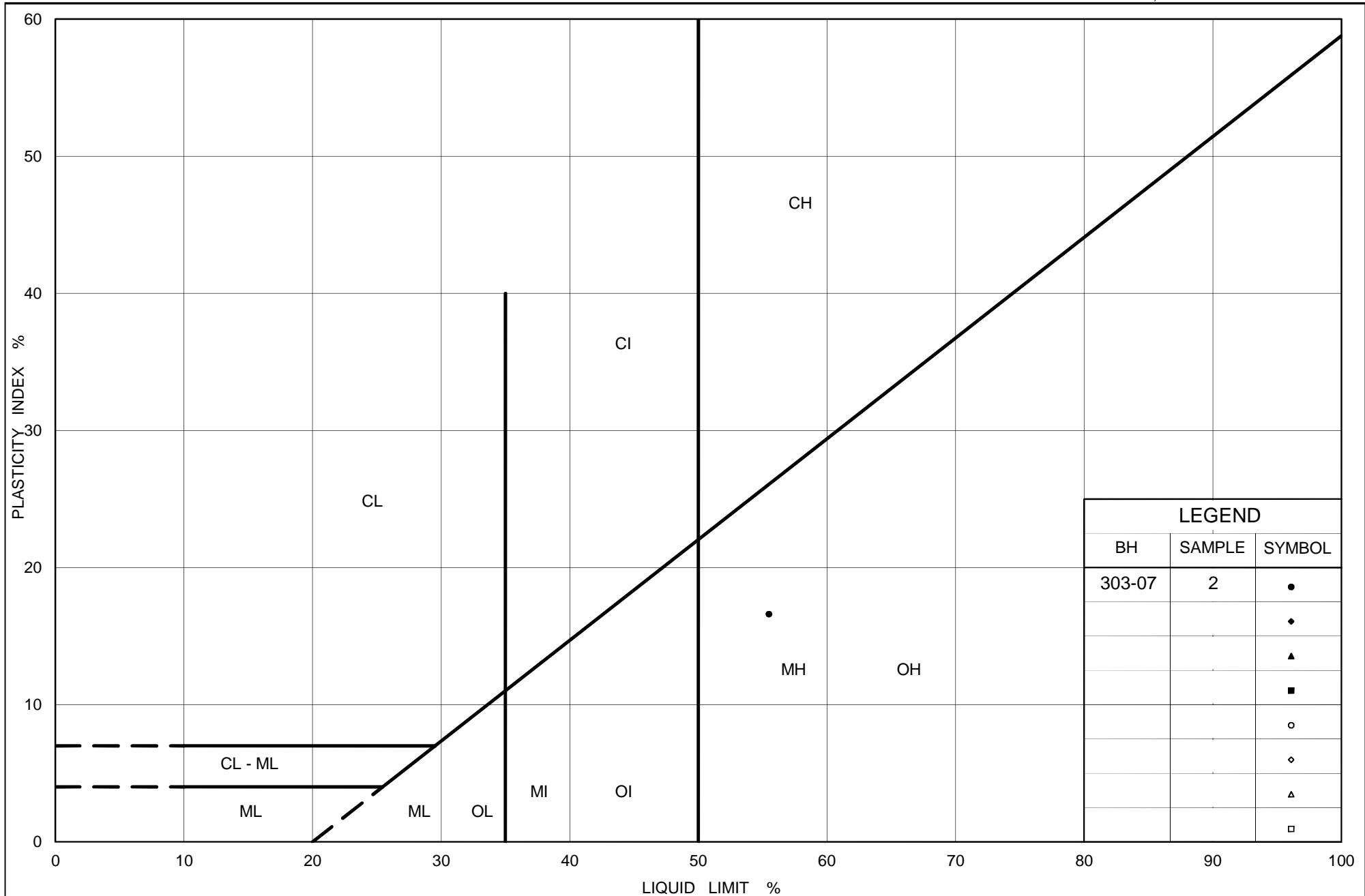
TEST RESULTS

STRAIN AT FAILURE, %	-	COMPRESSIVE STRESS, MPa	141.0
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REMARKS:

DATE:

4/8/2013



Ministry of Transportation

Ontario

PLASTICITY CHART

Organic Silt

CPR Overhead Structure SBL

Figure No. B1

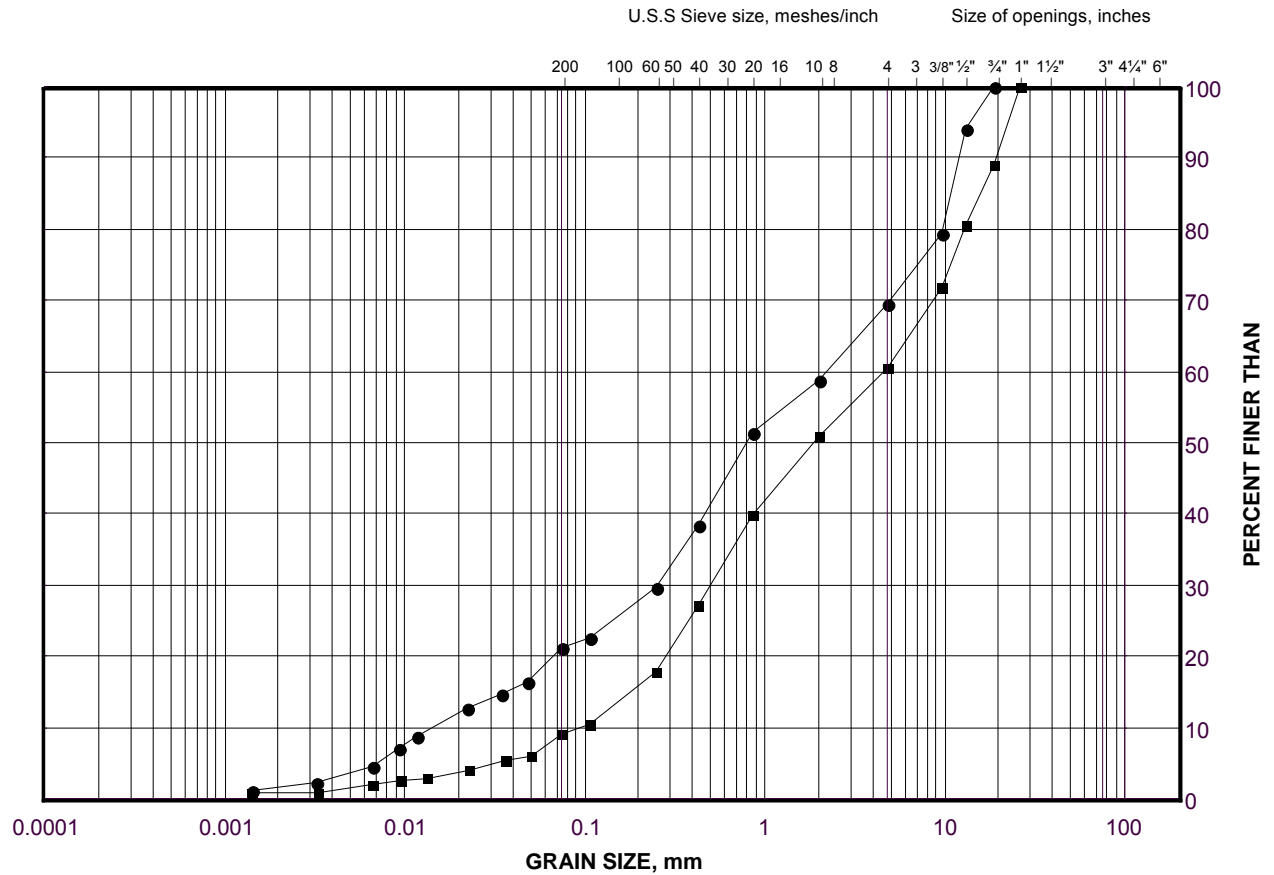
Project No. 09-1111-6014

Checked By: GRL

GRAIN SIZE DISTRIBUTION

Sand and Gravel
CPR Overhead Structure SBL

FIGURE B2



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	B303-11	2	190.4
■	B303-08	2	190.1



PROJECT

**CPR OVERHEAD STRUCTURE SBL
Highway 69 Four-Laning
GWP 5404-05-00; WP 5144-08-01**


TITLE

**Site Photograph
Highway 69 (SBL)**




PROJECT No.	09-1111-6014	FILE No.	----
DESIGN	AV	AUG 13	SCALE NTS
CADD	-- --		REV
CHECK	CN	AUG 13	FIGURE B3
REVIEW	JPD/JMAC	AUG 13	



PROJECT	CPR OVERHEAD STRUCTURE SBL Highway 69 Four-Laning GWP 5404-05-00; WP 5144-08-01				
	TITLE Site Photograph Highway 69 (SBL)				
	PROJECT No.	09-1111-6014	FILE No.	----	
	DESIGN	AV	AUG 13	SCALE	NTS
	CADD	--	---		REV
	CHECK	CN	AUG 13	FIGURE B4	
	REVIEW	JPD/JMAC	AUG 13		



PROJECT	CPR OVERHEAD STRUCTURE SBL Highway 69 Four-Laning GWP 5404-05-00; WP 5144-08-01			
TITLE	Site Photograph Highway 69 (SBL)			
	PROJECT No.	09-1111-6014	FILE No.	----
	DESIGN	AV	AUG 13	SCALE NTS
	CADD	-- --		REV
	CHECK	CN	AUG 13	FIGURE B5
	REVIEW	JPD/JMAC	AUG 13	




PROJECT	CPR OVERHEAD STRUCTURE SBL Highway 69 Four-Laning GWP 5404-05-00; WP 5144-08-01				
TITLE	Site Photograph Highway 69 (SBL)				
	PROJECT No.	09-1111-6014		FILE No.	----
	DESIGN	AV	AUG 13	SCALE	NTS
	CADD	-- --			REV
	CHECK	CN	AUG 13	FIGURE B6	
	REVIEW	JPD/JMAC	AUG 13		

FIGURE B6

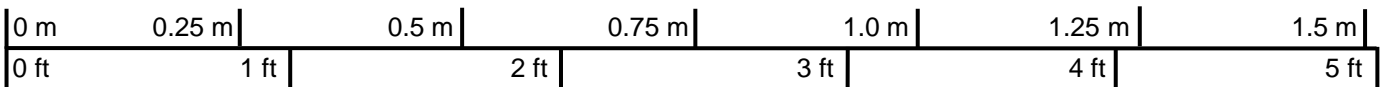
Borehole B303-01




Box 1: 0.00 m – 2.50 m



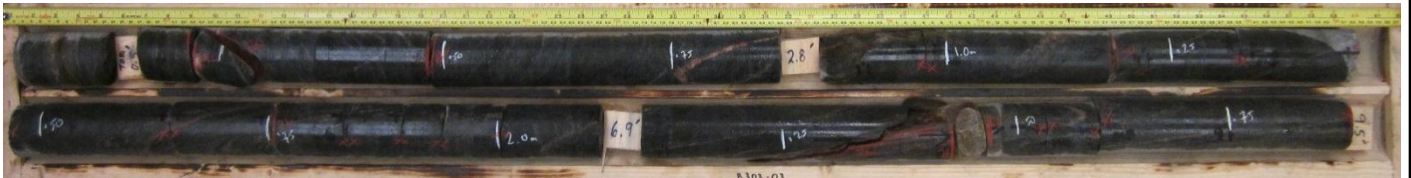
Box 2: 2.50 m – 4.45 m



Scale

PROJECT		CPR OVERHEAD STRUCTURE SBL Highway 69 Four-Laning GWP 5404-05-00; WP 5144-08-01			
TITLE		Bedrock Core Photograph – B303–01 Highway 69 (SBL)			
		PROJECT No. 09-1111-6014		FILE No. ----	
		DESIGN	AV	JUN 13	SCALE NTS
		CADD	--	--	REV.
		CHECK	CN	JUN 13	FIGURE B7
		REVIEW	JPD/JMAC	AUG 13	

Borehole B303-03



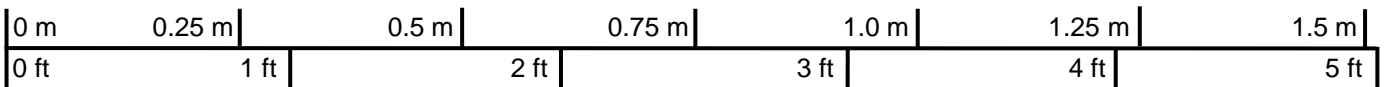
Box 1: 0.20 m – 2.90 m




Box 2: 2.90 m – 5.46 m



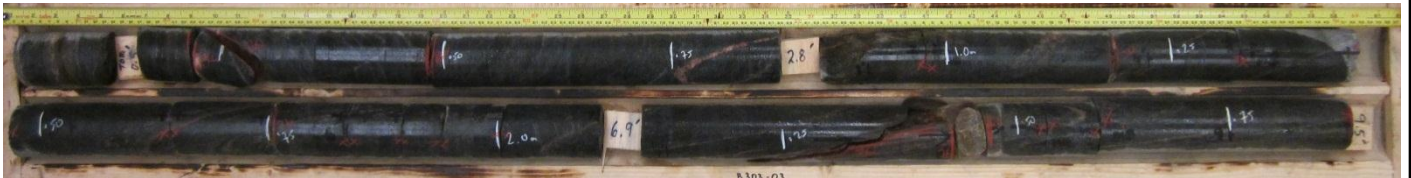
Box 3: 5.46 m – 6.89 m



Scale

PROJECT		CPR OVERHEAD STRUCTURE SBL Highway 69 Four-Laning GWP 5404-05-00; WP 5144-08-01			
TITLE		Bedrock Core Photograph – B303–03 Highway 69 (SBL)			
		PROJECT No. 09-1111-6014		FILE No. ----	
		DESIGN	AV	JUN 13	SCALE NTS
		CADD	--	--	REV.
		CHECK	CN	JUN 13	FIGURE B8
		REVIEW	JPD/JMAC	AUG 13	

Borehole B303-05



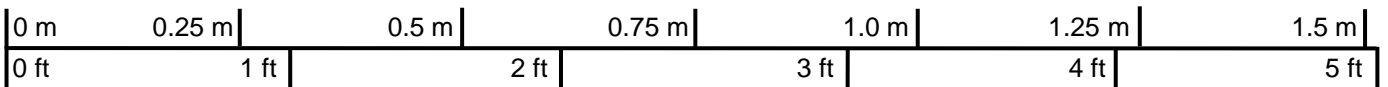
Box 1: 0.20 m – 2.90 m




Box 2: 2.90 m – 5.46 m



Box 3: 5.46 m – 6.89 m



Scale

PROJECT		CPR OVERHEAD STRUCTURE SBL Highway 69 Four-Laning GWP 5404-05-00; WP 5144-08-01			
TITLE		Bedrock Core Photograph – B303–05 Highway 69 (SBL)			
		PROJECT No. 09-1111-6014		FILE No. ----	
		DESIGN	AV	JUN 13	SCALE NTS
		CADD	--	--	REV.
		CHECK	CN	JUN 13	FIGURE B9
		REVIEW	JPD/JMAC	AUG 13	

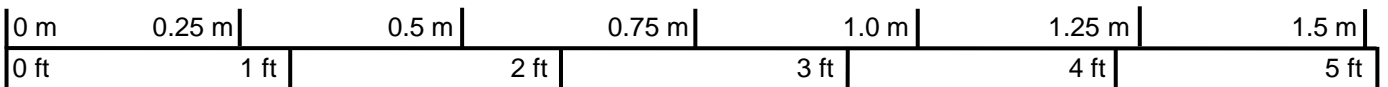
Borehole B303-08



Borehole B303-09



Box 1: 2.60 m – 5.67 m



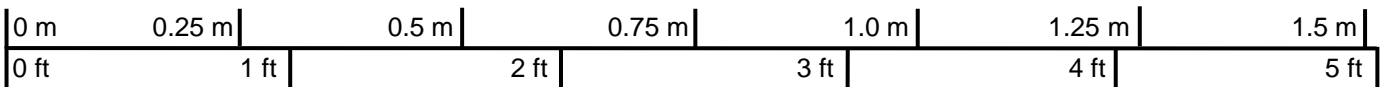
Scale

PROJECT		CPR SBL OVERHEAD STRUCTURE Highway 69 Four-Laning GWP 5404-05-00; WP 5144-08-01			
TITLE		Bedrock Core Photograph – B303–09 Highway 69 (SBL)			
		PROJECT No. 09-1111-6014		FILE No. ----	
		DESIGN	AV	JUN 13	SCALE NTS
		CADD	--	--	REV.
		CHECK	CN	JUN 13	FIGURE B11
		REVIEW	JPD/JMAC	JUN 13	


Borehole B303-10



Box 1: 1.60 m – 5.90 m



Scale

PROJECT		CPR OVERHEAD STRUCTURE SBL Highway 69 Four-Laning GWP 5404-05-00; WP 5144-08-01			
TITLE		Bedrock Core Photograph – B303–10 Highway 69 (SBL)			
		PROJECT No. 09-1111-6014		FILE No. ----	
		DESIGN	AV	JUN 13	SCALE NTS
		CADD	-- --		REV.
		CHECK	CN	JUN 13	FIGURE B12
		REVIEW	JPD/JMAC	AUG 13	

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Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

solutions@golder.com
www.golder.com

Golder Associates Ltd.
6925 Century Avenue, Suite #100
Mississauga, Ontario, L5N 7K2
Canada
T: +1 (905) 567 4444

