



JULY 2012

FOUNDATION INVESTIGATION REPORT

**OVERHEAD SIGNS
HIGHWAY 69 FOUR-LANING
FROM 1.0 KM NORTH OF THE NEW HIGHWAY 559
INTERCHANGE NORTHERLY TO 1.5 KM NORTH OF
HIGHWAY 7182 (SHEBESHEKONG ROAD) FOR 17 KM
MINISTRY OF TRANSPORTATION, ONTARIO
G.W.P. 5402-05-00**

Submitted to:
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REPORT

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PART A

FOUNDATION INVESTIGATION REPORT

OVERHEAD SIGNS

HIGHWAY 69 FOUR-LANING

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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by McCormick Rankin, a member of MMM Group Limited (MRC) on behalf of Ministry of Transportation, Ontario (MTO) to provide detail foundation engineering services for three (3) proposed overhead signs (OHS) within the Phase 1 limits of the new Highway 69 alignment. The proposed work is part of the four-laning of Highway 69 from 1.0 km north of the new Highway 559 Interchange northerly to 1.5 km north of Highway 7182 (Shebeshekong Road), which involves high fill embankments and embankments over swamps, the New Woods Road and Shebeshekong Road interchanges and structures, the Shawanaga River and Site 9 Road structures, as well as culvert crossings. The general location/extent of the Phase 1 new Highway 69 four-laning alignment within which the overhead signs are located is shown on the Site Location Plan on Drawing 1. The general locations of the three overhead signs are shown on Drawings 1 and 2.

The Terms of Reference and the scope of work for the foundation investigation are outlined in MTO's Request for Proposal, dated January 2007. Golder's proposal for foundation engineering services associated with the overhead signs in Phase 1 is contained in Section 6.8 of MRC's Technical Proposal for this assignment. The work has been carried out in accordance with Golder's Project Specific Supplementary Specialty Plan for foundation engineering services for this project, dated July 4, 2007.

This report addresses the investigation carried out for the three proposed overhead signs along Highway 69 in Phase 1 only. Separate reports address the foundation investigations for the related swamp crossings, high fill areas for the associated interchange ramps and roadways, culverts and other bridge structures for the project.

The purpose of this investigation is to establish the subsurface conditions at the proposed overhead sign foundations by borehole drilling, rock coring, in situ testing and laboratory testing on selected samples. The foundation limits for this investigation were located in the field using survey stakes put down by Callon Dietz Inc. (Callon Dietz), a professional surveying company retained by MRC. The area of the investigation is shown in plan on Drawing 2.

2.0 SITE DESCRIPTION

The proposed Overhead Sign 1 (OHS-1) is located at STA 14+529, on the proposed Highway 69 NBL alignment, in the Township of Carling, while the proposed Overhead Sign 3 (OHS-3) and Overhead Sign 4 (OHS-4) are located at STA 12+750 on the proposed Highway 69 NBL alignment and STA 13+675 on the existing Highway 69 alignment, respectively, in the Township of Shawanaga.

In general, the topography in the area of the sign locations consists of rolling terrain including densely treed areas and numerous bedrock outcrops separated by low-lying swamps containing areas of standing water and various types of vegetation and organic soils. The proposed overhead signs are to be located in areas of bedrock outcrop or areas with thin overburden or existing fills over bedrock.

The ground surface at the proposed overhead sign locations is at between about Elevation 224.2 m and 221 m at the Overhead Sign 1 (OHS-1), at about Elevation 217.5 m at Overhead Sign 3 (OHS-3), and at about Elevation 214.1 m at Overhead Sign 4 (OHS-4).

3.0 INVESTIGATION PROCEDURES

3.1 Foundation Investigation

The field work for the overhead signs investigation was carried out between October 5 and 25, 2010, during which time a total of six (6) boreholes were advanced, two (2) boreholes at each of the proposed overhead sign structure (i.e. one (1) at each foundation element). The boreholes, designated as Boreholes OHS-1A, OHS-1B, OHS-3A, OHS-3B, OHS-4A and OHS-4B, were advanced at the locations shown in plan on Drawings A1, B1 and C1, in Appendices A to C.



The field investigation was carried out using a track-mounted Diedrich D-50 drill rig supplied and operated by Walker Drilling Ltd. of Utopia, Ontario and a track-mounted CME-850 drill rig supplied by Landcore Drilling of Chelmsford, Ontario. The boreholes were advanced through the overburden using 165 mm outside diameter (O.D.) solid-stem augers and 'NW' casing. Soil samples were obtained continuously or at intervals of depth of about 0.75 m using a 50 mm outside diameter (O.D.) split-spoon sampler driven by an automatic hammer in accordance with Standard Penetration Test (SPT) procedures (ASTM D1586 Standard Test Method for Standard Penetration Tests and Split Barrel Sampling of the Soil). Samples of the bedrock were obtained using an 'NQ' size rock core barrel.

The boreholes were advanced through the overburden to auger and/or sampler refusal (i.e. inferred bedrock) and bedrock was confirmed by coring in all of the boreholes. The boreholes were advanced to depths of up to about 5.4 m below existing ground surface, including coring of bedrock for core lengths between about 2.7 m and 5.4 m.

The groundwater conditions in the open boreholes were observed during the drilling operations and are described on the Record of Borehole sheets in Appendices A to C. It should be noted that groundwater elevations as encountered in the boreholes may not be representative of static groundwater levels since water was introduced into the boreholes for coring operations and the groundwater levels in the boreholes may not have stabilized on completion of drilling. Furthermore, groundwater elevations will vary depending on seasonal fluctuations, precipitation and local soil permeability. All boreholes were backfilled with bentonite upon completion in accordance with Ontario Regulation 903 (as amended).

The field work was observed by members of our 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 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, such as water content and grain size distribution, was carried out on selected soil samples. Classification of the bedrock rock mass quality with respect to the Rock Quality Description (RQD) is described based on Table 3.10 of the Canadian Foundation Engineering Manual (2006)¹. Point load strength tests, both perpendicular to the core axis (diametral test) and along the core axis (axial test) were performed on selected samples of the rock core to provide an indication of the point load strength index (Is_{50})² of the rock. The bedrock was then classified with respect to strength based on the Is_{50} values as suggested in Table 3.5 of the Canadian Foundation Engineering Manual (2006)¹. The results of the laboratory testing for the overhead signs are included in Appendices A to C.

The as-drilled borehole locations and ground surface elevations were surveyed by members of our technical staff, referenced to the survey stakes put down by Callon Dietz. The borehole locations provided in the Record of Borehole and Drillhole sheets as well as on Drawings A1, B1 and C1 are positioned relative to MTM NAD 83 northing and easting coordinates and the ground surface elevations are referenced to geodetic datum, and are summarized below.

¹Canadian Geotechnical Society, 2006. Canadian Foundation Engineering Manual, 4th Edition.

²International Society for Rock Mechanics (ISRM), 1985. Suggested Method for Determining Point Load Strength. Int. J. Rock Mech. Min. Sci. and Geomech. Abst., Vol. 22, pp 51-60.



Borehole No.	Location (MTM NAD 83)		Collar Elevation (Geodetic Datum) (m)	Depth Drilled (m)
	Northing	Easting		
OHS-1A	5035506.9	253807.7	224.2	5.4
OHS-1B	5035520.3	253822.4	221.1	4.5
OHS-3A	5042403.6	247029.2	217.5	4.8
OHS-3B	5042413.6	247039.8	217.4	4.0
OHS-4A	5043091.1	246402.0	214.1	3.9
OHS-4B	5043075.6	246389.1	214.2	4.7

4.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

4.1 Regional Geology

As delineated in The Physiography of Southern Ontario³, this section of 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 native surficial soils in this area consist of very shallow deposits of sand, silt and clay underlain by metamorphic bedrock; numerous bare knobs and ridges of bedrock are present throughout the area. Localized low lying swampy areas, containing peat and/or organic soils underlain by soft/loose native soils, are present in valleys between the bedrock knobs and ridges.

The bedrock in the area consists typically of 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 4⁴. Deposition of Palaeozoic strata initially covered the bedrock and later erosion during glaciation exposed these Precambrian rocks.

4.2 Subsurface Conditions

The detailed subsurface soil, bedrock and groundwater conditions as encountered in the boreholes advanced for this investigation, together with the results of the laboratory tests carried out on selected soil and rock core samples, are presented on the attached Record of Borehole and Drillhole sheets in Appendices A to C. The stratigraphic boundaries shown on the Record of Borehole and Drillhole sheets are inferred from non-continuous sampling, observations of drilling progress and the results of Standard Penetration Tests. These boundaries, therefore, represent transitions between soil types rather than exact planes of geological change. Variation in the stratigraphic boundaries between and beyond boreholes will exist and is to be expected.

³ 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, SSscale 1:600,000.

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



In general, the subsurface conditions in the area of the proposed overhead signs typically consist of a cohesionless deposit of sand or sand and gravel fill underlain by granite gneiss bedrock. At one borehole location, exposed bedrock was encountered at ground surface.

The following sections provide information on the subsoils and groundwater conditions encountered in the boreholes advanced at each of the proposed overhead sign location.

4.3 Overhead Sign 1 - STA 14+529 (Township of Carling)

Two (2) boreholes (Boreholes OHS-1A and OHS-1B) were advanced at the proposed locations of the foundation support elements for the OHS-1. In general, bedrock was encountered at ground surface or below a thin deposit of sand.

4.3.1 Topsoil

A 0.1 m thick surficial layer of topsoil was encountered at the ground surface in Borehole OHS-1B on the east side of the proposed overhead sign location.

4.3.2 Sand

A deposit of dark brown sand trace to some silt, trace gravel, trace clay and containing organics and rootlets was encountered below the topsoil in Borehole OHS-1B. The top of the sand deposit is at about Elevation 221.0 m and its thickness is about 1.0 m.

The Standard Penetration Test (SPT) 'N'-values measured within this deposit are 2 blows and 50 blows per 0.3 m of penetration, indicating a very loose to dense relative density.

The natural water content measured on one (1) sample of this deposit is about 29 percent. The grain size distribution of one (1) sample of the sand deposit is presented on Figure A1 in Appendix A.

4.3.3 Bedrock

Bedrock was encountered and core samples were recovered at the ground surface and below the deposit of sand in Boreholes OHS-1A and OHS-1B, respectively. The depth to bedrock below ground surface and the corresponding bedrock surface elevation are summarized below.

Borehole No.	Depth to Bedrock Surface (m)	Bedrock Surface Elevation (m)	Refusal Type
OHS-1A	0.0	224.2	Bedrock Cored
OHS-1B	1.1	220.0	Bedrock Cored

Based on the rock core samples, the bedrock consists of granite gneiss. In general the bedrock samples are described as slightly weathered to fresh, foliated, coarse grained and pink to grey to black. The Rock Quality Designation (RQD) measured on the core samples ranges from 36 percent to 100 percent, indicating a rock mass of poor to excellent quality. The Total Core Recovery (TCR) of the core samples is between 91 percent and 100 percent and the Solid Core Recovery (SCR) of samples recovered is between 59 percent and 100 percent.



Laboratory point load strength tests were performed on selected samples of the rock core. The axial and diametral point load strength index values are shown on the Record of Drillhole sheets and are presented in Table A1 in Appendix A. The axial tests carried out on six (6) core samples of the granite gneiss bedrock measured Is_{50} values ranging from about 6.8 MPa to 8.6 MPa and the diametral tests carried out on eight (8) core samples of the granite gneiss bedrock measured Is_{50} values ranging from about 3.7 MPa to 7.3 MPa.

Also presented in Table A1 are the estimated Unconfined Compressive Strength (UCS) values for each sample tested for point load strength based on a relationship between Is_{50} and UCS which is given by a correlation factor (K) in accordance with ASTM D5731 Standard Test Method for Determination of the Point Load Strength Index of Rock and Application to Rock Strength Classification, which may vary depending on the size of the core sample and the strength of the rock, as well as the estimated UCS of bedrock core samples from other structure sites in the area of the overhead sign. For this site, the UCS values are based on an estimated average correlation factor (K) of 20.

Based on the axial point load testing results in accordance with Table 3.5 in CFEM (2006) the granite gneiss bedrock is classified as strong (R4, 50 MPa < UCS < 100 MPa) to very strong (R5, 100 MPa < UCS < 250 MPa).

4.3.4 Groundwater Conditions

The overburden samples taken in the boreholes were moist. The water level observed in one of the boreholes during drilling was at about Elevation 220.5 m, or at a depth of about 0.6 m below ground surface.

It should be noted that the groundwater level given above, as measured during the drilling operation, is not stabilized, is subject to seasonal fluctuations and precipitation events, and should be expected to be higher during wet periods of the year.

4.4 Overhead Sign 3 - STA 12+750 (Township of Shawanaga)

Two (2) boreholes (Boreholes OHS-3A and OHS-3B) were advanced at the proposed locations of the foundation support elements for the OHS-3. In general, the subsurface conditions consist of sand and gravel to sand fill over bedrock.

4.4.1 Asphalt

A 0.1 m thick layer of asphalt was encountered at the ground surface in Borehole OHS-3A on the west side of the proposed overhead sign location.

4.4.2 Sand and Gravel to Sand Fill

A deposit of fill associated with the existing highway embankment was encountered below the asphalt layer in Borehole OHS-3A and at the ground surface in Borehole OHS-3B. The fill consists of grey sand and gravel to brown sand, trace to some gravel, trace to some silt and contains rootlets and; at one of the borehole locations, cobbles were inferred to be present based on the augers grinding during the drilling operations. The top of the fill deposit is at about Elevation 217.4 m and its thickness is about 1.3 m and 0.8 m in Boreholes OHS-3A and OHS-3B, respectively.

The SPT 'N'-values measured within the fill deposit are between 9 blows and 72 blows per 0.3 m of penetration, indicating a loose to very dense relative density.

The natural water content measured on four (4) samples of this deposit ranges between about 4 percent and 9 percent.



4.4.3 Bedrock

Bedrock was encountered and core samples were recovered below the fill in Boreholes OHS-3A and OHS-3B. The depth to bedrock below ground surface and the corresponding bedrock surface elevation are summarized below.

Borehole No.	Depth to Bedrock Surface (m)	Bedrock Surface Elevation (m)	Refusal Type
OHS-3A	1.4	216.1	Bedrock Cored
OHS-3B	0.8	216.6	Bedrock Cored

Based on the rock core samples, the bedrock consists of granite gneiss. In general the bedrock samples are described as moderately weathered to slightly weathered, foliated, coarse grained and pink to grey to black with occasional white strips. The Rock Quality Designation (RQD) measured on the core samples ranges between 40 percent and 100 percent, indicating a rock mass of poor to excellent quality. The Total Core Recovery (TCR) and Solid Core Recovery (SCR) of the samples recovered are between 92 percent and 100 percent, and between 50 percent and 100 percent, respectively.

Laboratory point load strength tests were performed on selected samples of the rock 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 four (4) core samples of the granite gneiss bedrock measured Is_{50} values ranging from about 6.1 MPa to 13.5 MPa and the diametral tests carried out on eight (8) core samples of the granite gneiss bedrock measured Is_{50} values ranging from about 4.3 MPa to 9.1 MPa.

Also presented in Table B1 are the estimated Unconfined Compressive Strength (UCS) values for each sample tested for point load strength based on a relationship between Is_{50} and UCS which is given by a correlation factor (K) in accordance with ASTM D5731 Standard Test Method for Determination of the Point Load Strength Index of Rock and Application to Rock Strength Classification, which may vary depending on the size of the core sample and the strength of the rock, as well as the estimated UCS of bedrock core samples from other structure sites in the area of the overhead sign. For this overhead sign site, the UCS values are based on an estimated average correlation factor (K) of 18.

Based on the axial point load testing results the granite gneiss bedrock is classified as strong (R4, 50 MPa < UCS < 100 MPa) to very strong (R5, 100 MPa < UCS < 250 MPa).

4.4.4 Groundwater Conditions

In general, the overburden fill samples taken in the boreholes advanced in this area were moist. The water level observed in the boreholes upon completion of drilling operations was about Elevation 216.6 m and 216.0 m, or at depths of about 1.5 m and 0.8 m below ground surface, respectively.

It should be noted that the groundwater levels given above, as measured during the drilling operation, are not stabilized, are subject to seasonal fluctuations and precipitation events, and should be expected to be higher during wet periods of the year.

4.5 Overhead Sign 4 - STA 13+675 (Township of Shawanaga)

Two (2) boreholes (Boreholes OHS-4A and OHS-4B) were advanced at the proposed west and east foundation support elements for the OHS-4. In general, the subsurface conditions consist of sand to sand and gravel fill over bedrock.



4.5.1 Sand to Sand and Gravel Fill

A deposit of fill associated with the existing highway embankment was encountered at the ground surface in both boreholes advanced at this site. The fill consists of brown sand some gravel, to sand and gravel, trace to some silt and rootlets. The top of the fill deposit is about Elevation 214.1 m and 214.2 m and its thickness is about 0.4 m and 2.0 m at Boreholes OHS-4A and OHS-4B, respectively. In Borehole OHS-4B, an approximately 0.2 m thick layer of cobbles was encountered at a depth of about 1.2 m below ground surface (at about Elevation 213.0 m).

The SPT 'N'-values measured within the fill deposit range between 7 blows and 26 blows per 0.3 m of penetration and one value of 43 blows per 0.28 m of penetration, indicating a loose to dense relative density.

The natural water content measured on three (3) samples of the fill deposit ranges from about 1 percent to 10 percent.

The grain size distribution of one (1) sample of the sand and gravel fill deposit is presented on Figure C1 in Appendix C.

4.5.2 Bedrock

Bedrock was encountered and core samples were recovered below the fill in Boreholes OHS-4A and OHS-4B. The depth to bedrock below ground surface and the corresponding bedrock surface elevation are summarized below.

Borehole No.	Depth to Bedrock Surface (m)	Bedrock Surface Elevation (m)	Refusal Type
OHS-4A	0.4	213.7	Bedrock Cored
OHS-4B	2.0	212.2	Bedrock Cored

Based on the rock core samples, the bedrock consists of granite gneiss. In general the bedrock samples are described as slightly weathered, foliated, coarse grained and dark grey to black. The Rock Quality Designation (RQD) measured on the core samples ranges between 47 percent and 100 percent, indicating a rock mass of poor to excellent quality. The Total Core Recovery (TCR) and Solid Core Recovery (SCR) of the samples recovered are between 93 percent and 100 percent, and between 60 percent and 100 percent, respectively.

Laboratory point load strength tests were performed on selected samples of the rock core. The axial and diametral point load strength index values are shown on the Record of Drillhole sheets and are presented in Table C1 in Appendix C. The axial tests carried out on four (4) core samples of the granite gneiss bedrock measured Is_{50} values ranging from about 7.3 MPa to 9.0 MPa and the diametral tests carried out on six (6) core samples of the granite gneiss bedrock measured Is_{50} values ranging from about 4.1 MPa to 10.1 MPa.

Also presented in Table C1 are the estimated Unconfined Compressive Strength (UCS) values for each sample tested for point load strength based on a relationship between Is_{50} and UCS which is given by a correlation factor (K) in accordance with ASTM D5731 Standard Test Method for Determination of the Point Load Strength Index of Rock and Application to Rock Strength Classification, which may vary depending on the size of the core sample and the strength of the rock, as well as the estimated UCS of bedrock core samples from other structure sites in the area of the overhead sign. For this overhead sign site, the UCS values are based on an estimated average correlation factor (K) of 18.



Based on the axial point load testing results the granite gneiss bedrock is classified as strong (R4, 50 MPa < UCS < 100 MPa) to very strong (R5, 100 MPa < UCS < 250 MPa).

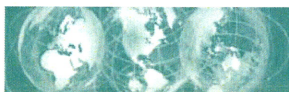
4.5.3 Groundwater Conditions

In general, the overburden samples taken in the boreholes advanced in this area were moist. The water level observed in the boreholes during and upon completion of drilling operations was at about Elevation 214.1 m and 212.5 m, at depths of 0.0 m (i.e. ground surface) and 1.7 m below ground surface, respectively.

It should be noted that the groundwater levels given above, as measured during the drilling operation, are not stabilized, are subject to seasonal fluctuations and precipitation events, and should be expected to be higher during wet periods of the year.

5.0 CLOSURE

Messrs. Matt Rhody and Ed H. Savard, senior field technicians with Golder, directed the drilling program. This report was prepared by Ms. T. Veronica Ayetan, P. Eng. and Mr. Christopher Ng, P. Eng., and was reviewed by Mr. J. Paul Dittrich, P. Eng., a senior geotechnical engineer and Principal with Golder. Mr. Jorge M. A. Costa, P. Eng., Golder's Designated MTO Contact for this project and Principal with Golder, conducted an independent quality control review of the report.



Report Signature Page

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TVA/CN/JPD/JMAC/sf

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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

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

(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 $= \sigma'_p / \sigma'_{vo}$

(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

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) 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

	kPa	C_u, S_u	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

Percent 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 (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

<u>Description</u>	<u>Bedding Plane Spacing</u>
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

<u>Description</u>	<u>Spacing</u>
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

<u>Term</u>	<u>Size*</u>
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

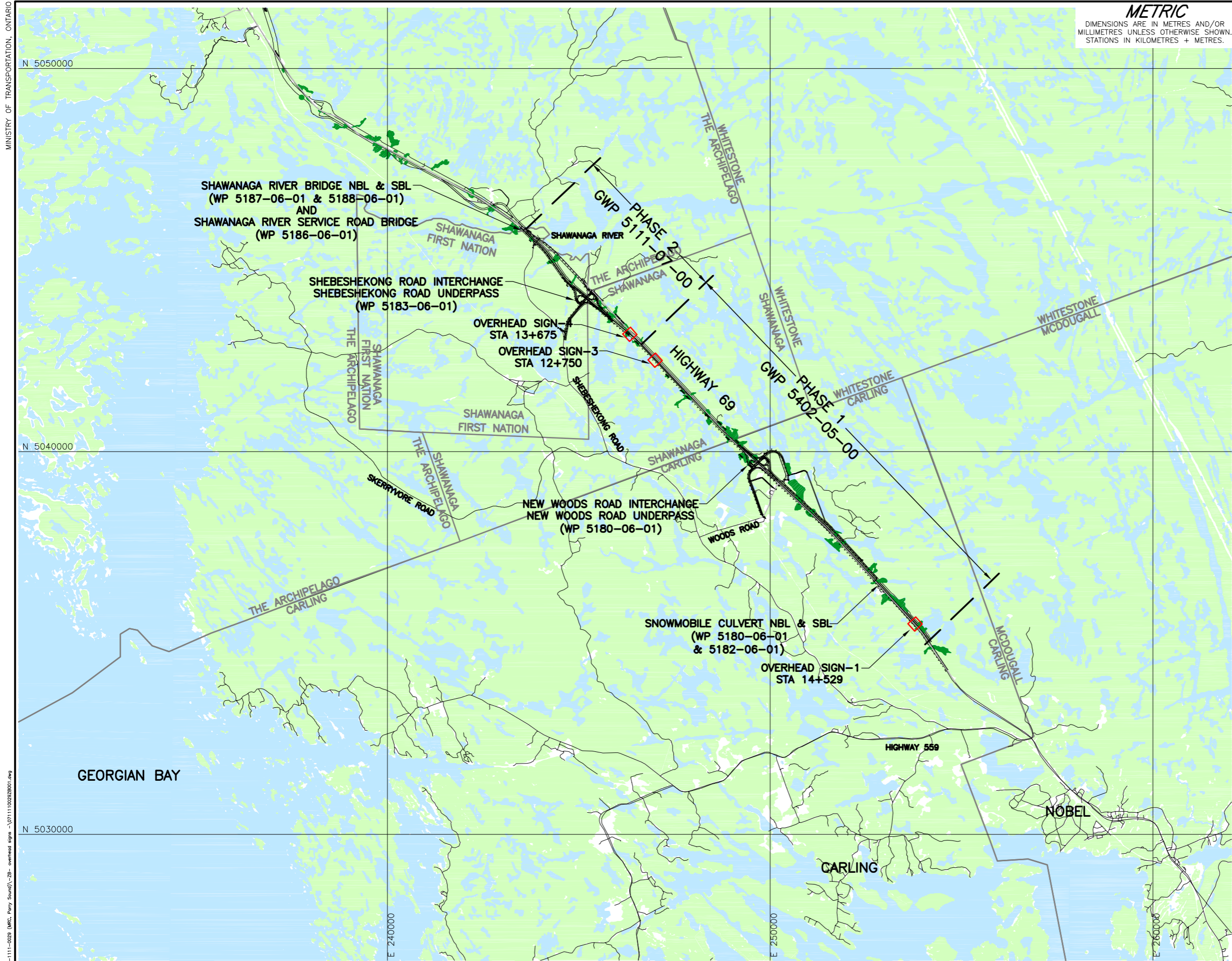
The angle of the discontinuity relative to the axis (length) of the core. In a vertical borehole a discontinuity with a 90° angle is horizontal.

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	



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

CONT No.
GWP No. 5402-05-00



HIGHWAY 69
SITE LOCATION PLAN

SHEET

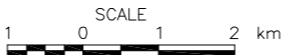


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KEY PLAN
NOT TO SCALE

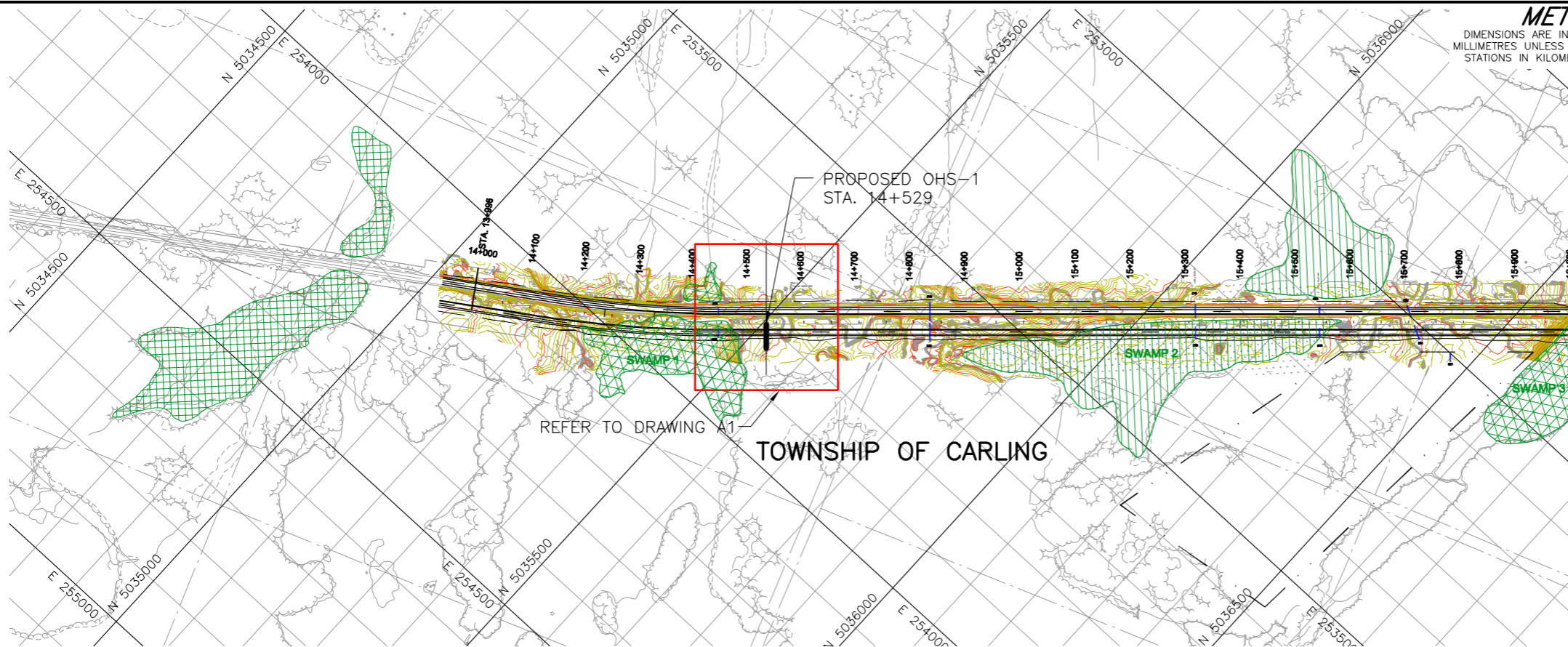
PLAN



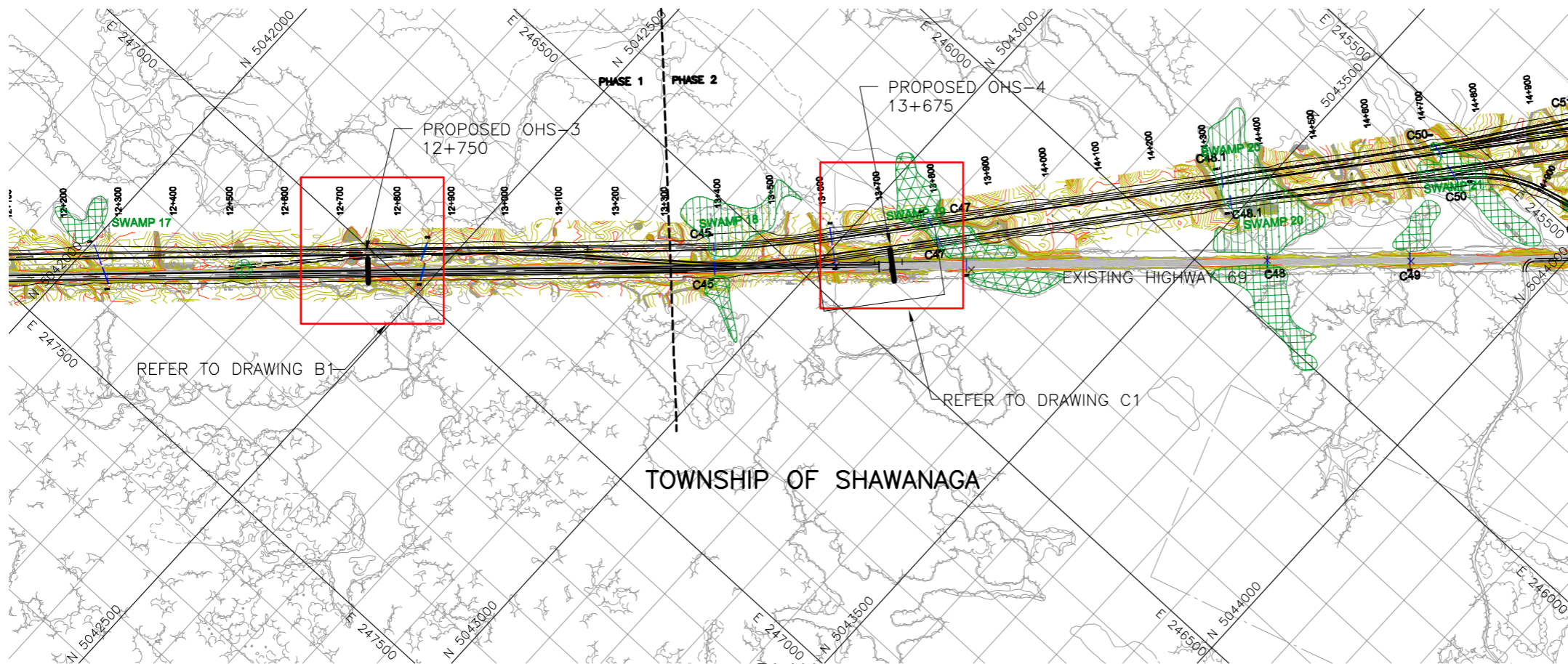
REFERENCE

Base Data - MNR NRVS, obtained 2004, CANMAP v2006.4
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-112			
HWY. 69	PROJECT NO. 07-1111-0029		DIST.
SUBM'D. VA	CHKD. VA	DATE: May 2012	SITE:
DRAWN: JFC/CD	CHKD. CN	APPD. JPD/JMAC	DWG. 1



PLAN



PLAN



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

CONT No.
GWP No. 5402-05-00

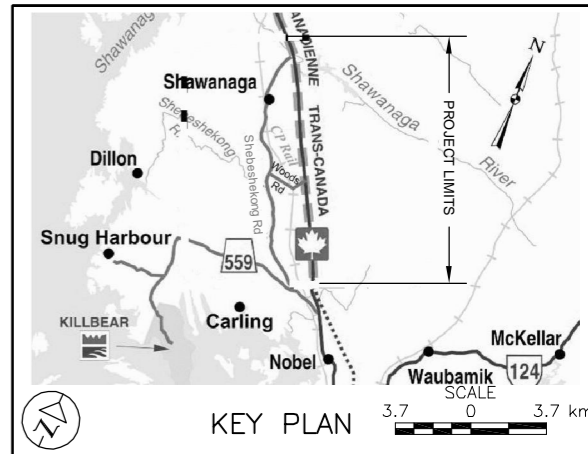
HIGHWAY 69
OVERHEAD SIGNS (OHS)
INDEX PLAN



SHEET



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KEY PLAN

REFERENCE


Base plans provided in digital format by MRC, drawing file 5271XB01.DWG, 5271-XPD-ARCHIPELAGO.dwg, 5271-XPD-Carling.dwg, 5271-XPD-SHAWANAGA.dwg, PR # 5377-02-00-PR-1.dwg, received October 1, 2007, and h6878_PHASE1_XA1, h6878_PHASE1_XN1.dwg, received January 21, 2009, h6878_PHASE2_XA1, h6878_PHASE2_XN1.dwg, received January 21, 2009 and h6878_PHASE1_XN1.dwg, received September 19, 2011.

NO.	DATE	BY	REVISION
Geocres No. 41H-112			
HWY. 69		PROJECT NO. 07-1111-0029	
SUBM'D. VA		DIST.	
CHKD. VA		DATE: Feb. 2012	
DRAWN: JFC		SITE:	
CHKD. CN		APPD. JPD/JMAC	
		DWG. 2	



APPENDIX A

Highway 69 NBL – Overhead Sign 1 – STA 14+529

PROJECT <u>07-1111-0029</u>		RECORD OF BOREHOLE No OHS-1A				1 OF 1 METRIC											
G.W.P. <u>5402-05-00</u>		LOCATION <u>N 5035506.9 ; E 253807.7</u>				ORIGINATED BY <u>MR</u>											
DIST <u> </u> HWY <u>69</u>		BOREHOLE TYPE <u>NQ Casing, Wash Boring</u>				COMPILED BY <u>OK</u>											
DATUM <u>Geodetic</u>		DATE <u>October 5, 2010</u>				CHECKED BY <u>VA</u>											
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									
								20	40	60	80	100					
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					WATER CONTENT (%)				
								20	40	60	80	100	10	20	30		
224.2	GROUND SURFACE						224										
0.0	Granite Gneiss (BEDROCK)		1	RC	REC 100%		223										RQD = 81%
	Bedrock cored from depths of 0.0 m to 5.4 m		2	RC	REC 98%		222										RQD = 97%
	For bedrock coring details, refer to Record of Drillhole OHS-1A		3	RC	REC 100%		221										RQD = 98%
			4	RC	REC 100%		220										
							219										RQD = 100%
218.8	END OF BOREHOLE																
5.4	NOTE: 1. Water level in open borehole was not noted upon completion of drilling.																

GTA-MTO 001 07-1111-0029-OVERHEAD SIGN-PHASE I-GPJ GAL-MISS.GDT 2/24/12 DD/SAC

PROJECT: 07-1111-0029

RECORD OF DRILLHOLE: OHS-1A

SHEET 2 OF 2

LOCATION: N 5035506.9 ; E 253807.7

DRILLING DATE: October 5, 2010

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Diedrich D-50

DRILLING CONTRACTOR: Walker Drilling

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	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.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
							FLUSH	RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	B Angle	DIP w.r.t CORE AXIS	DISCONTINUITY DATA										HYDRAULIC CONDUCTIVITY K, cm/sec										Diametral Point Load Index (MPa)	RMC -Q AVG.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
								TOTAL CORE %	SOLID CORE %					TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jh	10 ⁰	10 ¹	10 ²	10 ³	10 ⁴	10 ⁵	10 ⁶	10 ⁷	10 ⁸	10 ⁹	10 ¹⁰	10 ¹¹	10 ¹²	10 ¹³	10 ¹⁴	10 ¹⁵			10 ¹⁶	10 ¹⁷	10 ¹⁸	10 ¹⁹	10 ²⁰	10 ²¹	10 ²²	10 ²³	10 ²⁴	10 ²⁵	10 ²⁶	10 ²⁷	10 ²⁸	10 ²⁹	10 ³⁰	10 ³¹	10 ³²	10 ³³	10 ³⁴	10 ³⁵	10 ³⁶	10 ³⁷	10 ³⁸	10 ³⁹	10 ⁴⁰	10 ⁴¹	10 ⁴²	10 ⁴³	10 ⁴⁴	10 ⁴⁵	10 ⁴⁶	10 ⁴⁷	10 ⁴⁸	10 ⁴⁹	10 ⁵⁰	10 ⁵¹	10 ⁵²	10 ⁵³	10 ⁵⁴	10 ⁵⁵	10 ⁵⁶	10 ⁵⁷	10 ⁵⁸	10 ⁵⁹	10 ⁶⁰	10 ⁶¹	10 ⁶²	10 ⁶³	10 ⁶⁴	10 ⁶⁵	10 ⁶⁶	10 ⁶⁷	10 ⁶⁸	10 ⁶⁹	10 ⁷⁰	10 ⁷¹	10 ⁷²	10 ⁷³	10 ⁷⁴	10 ⁷⁵	10 ⁷⁶	10 ⁷⁷	10 ⁷⁸	10 ⁷⁹	10 ⁸⁰	10 ⁸¹	10 ⁸²	10 ⁸³	10 ⁸⁴	10 ⁸⁵	10 ⁸⁶	10 ⁸⁷	10 ⁸⁸	10 ⁸⁹	10 ⁹⁰	10 ⁹¹	10 ⁹²	10 ⁹³	10 ⁹⁴	10 ⁹⁵	10 ⁹⁶	10 ⁹⁷	10 ⁹⁸	10 ⁹⁹	10 ¹⁰⁰	10 ¹⁰¹	10 ¹⁰²	10 ¹⁰³	10 ¹⁰⁴	10 ¹⁰⁵	10 ¹⁰⁶	10 ¹⁰⁷	10 ¹⁰⁸	10 ¹⁰⁹	10 ¹¹⁰	10 ¹¹¹	10 ¹¹²	10 ¹¹³	10 ¹¹⁴	10 ¹¹⁵	10 ¹¹⁶	10 ¹¹⁷	10 ¹¹⁸	10 ¹¹⁹	10 ¹²⁰	10 ¹²¹	10 ¹²²	10 ¹²³	10 ¹²⁴	10 ¹²⁵	10 ¹²⁶	10 ¹²⁷	10 ¹²⁸	10 ¹²⁹	10 ¹³⁰	10 ¹³¹	10 ¹³²	10 ¹³³	10 ¹³⁴	10 ¹³⁵	10 ¹³⁶	10 ¹³⁷	10 ¹³⁸	10 ¹³⁹	10 ¹⁴⁰	10 ¹⁴¹	10 ¹⁴²	10 ¹⁴³	10 ¹⁴⁴	10 ¹⁴⁵	10 ¹⁴⁶	10 ¹⁴⁷	10 ¹⁴⁸	10 ¹⁴⁹	10 ¹⁵⁰	10 ¹⁵¹	10 ¹⁵²	10 ¹⁵³	10 ¹⁵⁴	10 ¹⁵⁵	10 ¹⁵⁶	10 ¹⁵⁷	10 ¹⁵⁸	10 ¹⁵⁹	10 ¹⁶⁰	10 ¹⁶¹	10 ¹⁶²	10 ¹⁶³	10 ¹⁶⁴	10 ¹⁶⁵	10 ¹⁶⁶	10 ¹⁶⁷	10 ¹⁶⁸	10 ¹⁶⁹	10 ¹⁷⁰	10 ¹⁷¹	10 ¹⁷²	10 ¹⁷³	10 ¹⁷⁴	10 ¹⁷⁵	10 ¹⁷⁶	10 ¹⁷⁷	10 ¹⁷⁸	10 ¹⁷⁹	10 ¹⁸⁰	10 ¹⁸¹	10 ¹⁸²	10 ¹⁸³	10 ¹⁸⁴	10 ¹⁸⁵	10 ¹⁸⁶	10 ¹⁸⁷	10 ¹⁸⁸	10 ¹⁸⁹	10 ¹⁹⁰	10 ¹⁹¹	10 ¹⁹²	10 ¹⁹³	10 ¹⁹⁴	10 ¹⁹⁵	10 ¹⁹⁶	10 ¹⁹⁷	10 ¹⁹⁸	10 ¹⁹⁹	10 ²⁰⁰	10 ²⁰¹	10 ²⁰²	10 ²⁰³	10 ²⁰⁴	10 ²⁰⁵	10 ²⁰⁶	10 ²⁰⁷	10 ²⁰⁸	10 ²⁰⁹	10 ²¹⁰	10 ²¹¹	10 ²¹²	10 ²¹³	10 ²¹⁴	10 ²¹⁵	10 ²¹⁶	10 ²¹⁷	10 ²¹⁸	10 ²¹⁹	10 ²²⁰	10 ²²¹	10 ²²²	10 ²²³	10 ²²⁴	10 ²²⁵	10 ²²⁶	10 ²²⁷	10 ²²⁸	10 ²²⁹	10 ²³⁰	10 ²³¹	10 ²³²	10 ²³³	10 ²³⁴	10 ²³⁵	10 ²³⁶	10 ²³⁷	10 ²³⁸	10 ²³⁹	10 ²⁴⁰	10 ²⁴¹	10 ²⁴²	10 ²⁴³	10 ²⁴⁴	10 ²⁴⁵	10 ²⁴⁶	10 ²⁴⁷	10 ²⁴⁸	10 ²⁴⁹	10 ²⁵⁰	10 ²⁵¹	10 ²⁵²	10 ²⁵³	10 ²⁵⁴	10 ²⁵⁵	10 ²⁵⁶	10 ²⁵⁷	10 ²⁵⁸	10 ²⁵⁹	10 ²⁶⁰	10 ²⁶¹	10 ²⁶²	10 ²⁶³	10 ²⁶⁴	10 ²⁶⁵	10 ²⁶⁶	10 ²⁶⁷	10 ²⁶⁸	10 ²⁶⁹	10 ²⁷⁰	10 ²⁷¹	10 ²⁷²	10 ²⁷³	10 ²⁷⁴	10 ²⁷⁵	10 ²⁷⁶	10 ²⁷⁷	10 ²⁷⁸	10 ²⁷⁹	10 ²⁸⁰	10 ²⁸¹	10 ²⁸²	10 ²⁸³	10 ²⁸⁴	10 ²⁸⁵	10 ²⁸⁶	10 ²⁸⁷	10 ²⁸⁸	10 ²⁸⁹	10 ²⁹⁰	10 ²⁹¹	10 ²⁹²	10 ²⁹³	10 ²⁹⁴	10 ²⁹⁵	10 ²⁹⁶	10 ²⁹⁷	10 ²⁹⁸	10 ²⁹⁹	10 ³⁰⁰	10 ³⁰¹	10 ³⁰²	10 ³⁰³	10 ³⁰⁴	10 ³⁰⁵	10 ³⁰⁶	10 ³⁰⁷	10 ³⁰⁸	10 ³⁰⁹	10 ³¹⁰	10 ³¹¹	10 ³¹²	10 ³¹³	10 ³¹⁴	10 ³¹⁵	10 ³¹⁶	10 ³¹⁷	10 ³¹⁸	10 ³¹⁹	10 ³²⁰	10 ³²¹	10 ³²²	10 ³²³	10 ³²⁴	10 ³²⁵	10 ³²⁶	10 ³²⁷	10 ³²⁸	10 ³²⁹	10 ³³⁰	10 ³³¹	10 ³³²	10 ³³³	10 ³³⁴	10 ³³⁵	10 ³³⁶	10 ³³⁷	10 ³³⁸	10 ³³⁹	10 ³⁴⁰	10 ³⁴¹	10 ³⁴²	10 ³⁴³	10 ³⁴⁴	10 ³⁴⁵	10 ³⁴⁶	10 ³⁴⁷	10 ³⁴⁸	10 ³⁴⁹	10 ³⁵⁰	10 ³⁵¹	10 ³⁵²	10 ³⁵³	10 ³⁵⁴	10 ³⁵⁵	10 ³⁵⁶	10 ³⁵⁷	10 ³⁵⁸	10 ³⁵⁹	10 ³⁶⁰	10 ³⁶¹	10 ³⁶²	10 ³⁶³	10 ³⁶⁴	10 ³⁶⁵	10 ³⁶⁶	10 ³⁶⁷	10 ³⁶⁸	10 ³⁶⁹	10 ³⁷⁰	10 ³⁷¹	10 ³⁷²	10 ³⁷³	10 ³⁷⁴	10 ³⁷⁵	10 ³⁷⁶	10 ³⁷⁷	10 ³⁷⁸	10 ³⁷⁹	10 ³⁸⁰	10 ³⁸¹	10 ³⁸²	10 ³⁸³	10 ³⁸⁴	10 ³⁸⁵	10 ³⁸⁶	10 ³⁸⁷	10 ³⁸⁸	10 ³⁸⁹	10 ³⁹⁰	10 ³⁹¹	10 ³⁹²	10 ³⁹³	10 ³⁹⁴	10 ³⁹⁵	10 ³⁹⁶	10 ³⁹⁷	10 ³⁹⁸	10 ³⁹⁹	10 ⁴⁰⁰	10 ⁴⁰¹	10 ⁴⁰²	10 ⁴⁰³	10 ⁴⁰⁴	10 ⁴⁰⁵	10 ⁴⁰⁶	10 ⁴⁰⁷	10 ⁴⁰⁸	10 ⁴⁰⁹	10 ⁴¹⁰	10 ⁴¹¹	10 ⁴¹²	10 ⁴¹³	10 ⁴¹⁴	10 ⁴¹⁵	10 ⁴¹⁶	10 ⁴¹⁷	10 ⁴¹⁸	10 ⁴¹⁹	10 ⁴²⁰	10 ⁴²¹	10 ⁴²²	10 ⁴²³	10 ⁴²⁴	10 ⁴²⁵	10 ⁴²⁶	10 ⁴²⁷	10 ⁴²⁸	10 ⁴²⁹	10 ⁴³⁰	10 ⁴³¹	10 ⁴³²	10 ⁴³³	10 ⁴³⁴	10 ⁴³⁵	10 ⁴³⁶	10 ⁴³⁷	10 ⁴³⁸	10 ⁴³⁹	10 ⁴⁴⁰	10 ⁴⁴¹	10 ⁴⁴²	10 ⁴⁴³	10 ⁴⁴⁴	10 ⁴⁴⁵	10 ⁴⁴⁶	10 ⁴⁴⁷	10 ⁴⁴⁸	10 ⁴⁴⁹	10 ⁴⁵⁰	10 ⁴⁵¹	10 ⁴⁵²	10 ⁴⁵³	10 ⁴⁵⁴	10 ⁴⁵⁵	10 ⁴⁵⁶	10 ⁴⁵⁷	10 ⁴⁵⁸	10 ⁴⁵⁹	10 ⁴⁶⁰	10 ⁴⁶¹	10 ⁴⁶²	10 ⁴⁶³	10 ⁴⁶⁴	10 ⁴⁶⁵	10 ⁴⁶⁶	10 ⁴⁶⁷	10 ⁴⁶⁸	10 ⁴⁶⁹	10 ⁴⁷⁰	10 ⁴⁷¹	10 ⁴⁷²	10 ⁴⁷³	10 ⁴⁷⁴	10 ⁴⁷⁵	10 ⁴⁷⁶	10 ⁴⁷⁷	10 ⁴⁷⁸	10 ⁴⁷⁹	10 ⁴⁸⁰	10 ⁴⁸¹	10 ⁴⁸²	10 ⁴⁸³	10 ⁴⁸⁴	10 ⁴⁸⁵	10 ⁴⁸⁶	10 ⁴⁸⁷	10 ⁴⁸⁸	10 ⁴⁸⁹	10 ⁴⁹⁰	10 ⁴⁹¹	10 ⁴⁹²	10 ⁴⁹³	10 ⁴⁹⁴	10 ⁴⁹⁵	10 ⁴⁹⁶	10 ⁴⁹⁷	10 ⁴⁹⁸	10 ⁴⁹⁹	10 ⁵⁰⁰	10 ⁵⁰¹	10 ⁵⁰²	10 ⁵⁰³	10 ⁵⁰⁴	10 ⁵⁰⁵	10 ⁵⁰⁶	10 ⁵⁰⁷	10 ⁵⁰⁸	10 ⁵⁰⁹	10 ⁵¹⁰	10 ⁵¹¹	10 ⁵¹²	10 ⁵¹³	10 ⁵¹⁴	10 ⁵¹⁵	10 ⁵¹⁶	10 ⁵¹⁷	10 ⁵¹⁸	10 ⁵¹⁹	10 ⁵²⁰	10 ⁵²¹	10 ⁵²²	10 ⁵²³	10 ⁵²⁴	10 ⁵²⁵	10 ⁵²⁶	10 ⁵²⁷	10 ⁵²⁸	10 ⁵²⁹	10 ⁵³⁰	10 ⁵³¹	10 ⁵³²	10 ⁵³³	10 ⁵³⁴	10 ⁵³⁵	10 ⁵³⁶	10 ⁵³⁷	10 ⁵³⁸	10 ⁵³⁹	10 ⁵⁴⁰	10 ⁵⁴¹	10 ⁵⁴²	10 ⁵⁴³	10 ⁵⁴⁴	10 ⁵⁴⁵	10 ⁵⁴⁶	10 ⁵⁴⁷	10 ⁵⁴⁸	10 ⁵⁴⁹	10 ⁵⁵⁰	10 ⁵⁵¹	10 ⁵⁵²	10 ⁵⁵³	10 ⁵⁵⁴	10 ⁵⁵⁵	10 ⁵⁵⁶	10 ⁵⁵⁷	10 ⁵⁵⁸	10 ⁵⁵⁹	10 ⁵⁶⁰	10 ⁵⁶¹	10 ⁵⁶²	10 ⁵⁶³	10 ⁵⁶⁴	10 ⁵⁶⁵	10 ⁵⁶⁶	10 ⁵⁶⁷	10 ⁵⁶⁸	10 ⁵⁶⁹	10 ⁵⁷⁰	10 ⁵⁷¹	10 ⁵⁷²	10 ⁵⁷³	10 ⁵⁷⁴	10 ⁵⁷⁵	10 ⁵⁷⁶	10 ⁵⁷⁷	10 ⁵⁷⁸	10 ⁵⁷⁹	10 ⁵⁸⁰	10 ⁵⁸¹	10 ⁵⁸²	10 ⁵⁸³	10 ⁵⁸⁴	10 ⁵⁸⁵	10 ⁵⁸⁶	10 ⁵⁸⁷	10 ⁵⁸⁸	10 ⁵⁸⁹	10 ⁵⁹⁰	10 ⁵⁹¹	10 ⁵⁹²	10 ⁵⁹³	10 ⁵⁹⁴	10 ⁵⁹⁵	10 ⁵⁹⁶	10 ⁵⁹⁷	10 ⁵⁹⁸	10 ⁵⁹⁹	10 ⁶⁰⁰	10 ⁶⁰¹	10 ⁶⁰²	10 ⁶⁰³	10 ⁶⁰⁴	10 ⁶⁰⁵	10 ⁶⁰⁶	10 ⁶⁰⁷	10 ⁶⁰⁸	10 ⁶⁰⁹	10 ⁶¹⁰	10 ⁶¹¹	10 ⁶¹²	10 ⁶¹³	10 ⁶¹⁴	10 ⁶¹⁵	10 ⁶¹⁶	10 ⁶¹⁷	10 ⁶¹⁸	10 ⁶¹⁹	10 ⁶²⁰	10 ⁶²¹	10 ⁶²²	10 ⁶²³	10 ⁶²⁴	10 ⁶²⁵	10 ⁶²⁶	10 ⁶²⁷	10 ⁶²⁸	10 ⁶²⁹	10 ⁶³⁰	10 ⁶³¹	10 ⁶³²	10 ⁶³³	10 ⁶³⁴	10 ⁶³⁵	10 ⁶³⁶	10 ⁶³⁷	10 ⁶³⁸	10 ⁶³⁹	10 ⁶⁴⁰	10 ⁶⁴¹	10 ⁶⁴²	10 ⁶⁴³	10 ⁶⁴⁴	10 ⁶⁴⁵	10 ⁶⁴⁶	10 ⁶⁴⁷	10 ⁶⁴⁸	10 ⁶⁴⁹	10 ⁶⁵⁰	10 ⁶⁵¹	10 ⁶⁵²	10 ⁶⁵³	10 ⁶⁵⁴	10 ⁶⁵⁵	10 ⁶⁵⁶	10 ⁶⁵⁷	10 ⁶⁵⁸	10 ⁶⁵⁹	10 ⁶⁶⁰	10 ⁶⁶¹	10 ⁶⁶²	10 ⁶⁶³	10 ⁶⁶⁴

DEPTH SCALE

1 : 50



LOGGED: MR

CHECKED: AH/VA

GTA-RCK 018 07-1111-0029-OVERHEAD SIGN-PHASE I-GPJ GAL-MISS.GDT 2/24/12 DD/SAC

PROJECT 07-1111-0029				RECORD OF BOREHOLE No OHS-1B				1 OF 1		METRIC							
G.W.P. 5402-05-00				LOCATION N 5035520.3 ; E 253822.4				ORIGINATED BY MR									
DIST _____ HWY 69				BOREHOLE TYPE 165 mm O.D Continuous Flight Solid Stem Auger, NW Casing, Wash Boring				COMPILED BY OK									
DATUM Geodetic				DATE October 5, 2010				CHECKED BY VA									
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									
221.1	GROUND SURFACE							20	40	60	80	100					
0.0	TOPSOIL		1A	SS	2	▽	221										
0.1	SAND, trace to some silt, trace clay, trace gravel, containing ogranics and rootlets Very loose to dense Dark brown Moist		1B	SS	50		220										5 89 (6)
220.0	Granite Gneiss (BEDROCK)		1	RC	REC 91%		220										RQD = 36%
1.1	Bedrock cored from depths of 1.1 m to 4.5 m		2	RC	REC 98%		219										RQD = 72%
	For bedrock coring details, refer to Record of Drillhole OHS-1B		3	RC	REC 98%		218										RQD = 98%
216.6	END OF BOREHOLE						217										
4.5	NOTE: 1. Water level encountered in open borehole at a depth of 0.6 m below ground surface (Elevation 220.5 m) during drilling.																

PROJECT: 07-1111-0029

RECORD OF DRILLHOLE: OHS-1B

SHEET 2 OF 2

LOCATION: N 5035520.3 ; E 253822.4

DRILLING DATE: October 5, 2010

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Diedrich D-50

DRILLING CONTRACTOR: Walker Drilling

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.	DISCONTINUITY DATA										HYDRAULIC CONDUCTIVITY				Diametral Point Load Index (MPa)	RMC -Q AVG.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
				DEPTH (m)								RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	B Angle	DIP w.r.t. CORE AXIS	TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jh	K, cm/sec																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
				FLUSH								TOTAL CORE %	SOLID CORE %									10 ⁶	10 ⁵	10 ⁴	10 ³																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												

DEPTH SCALE

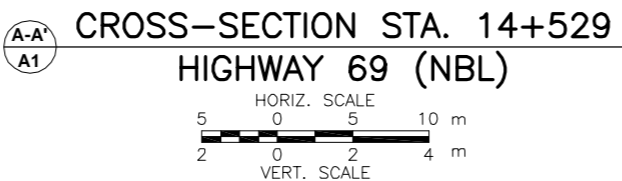
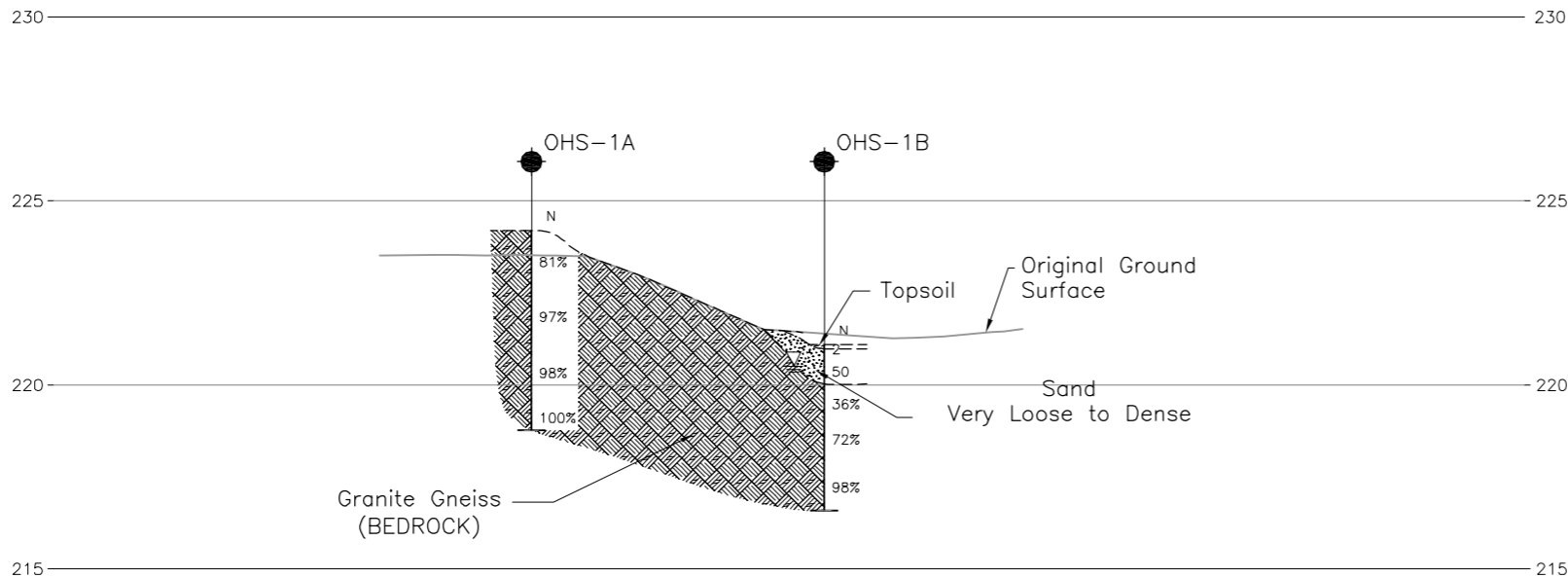
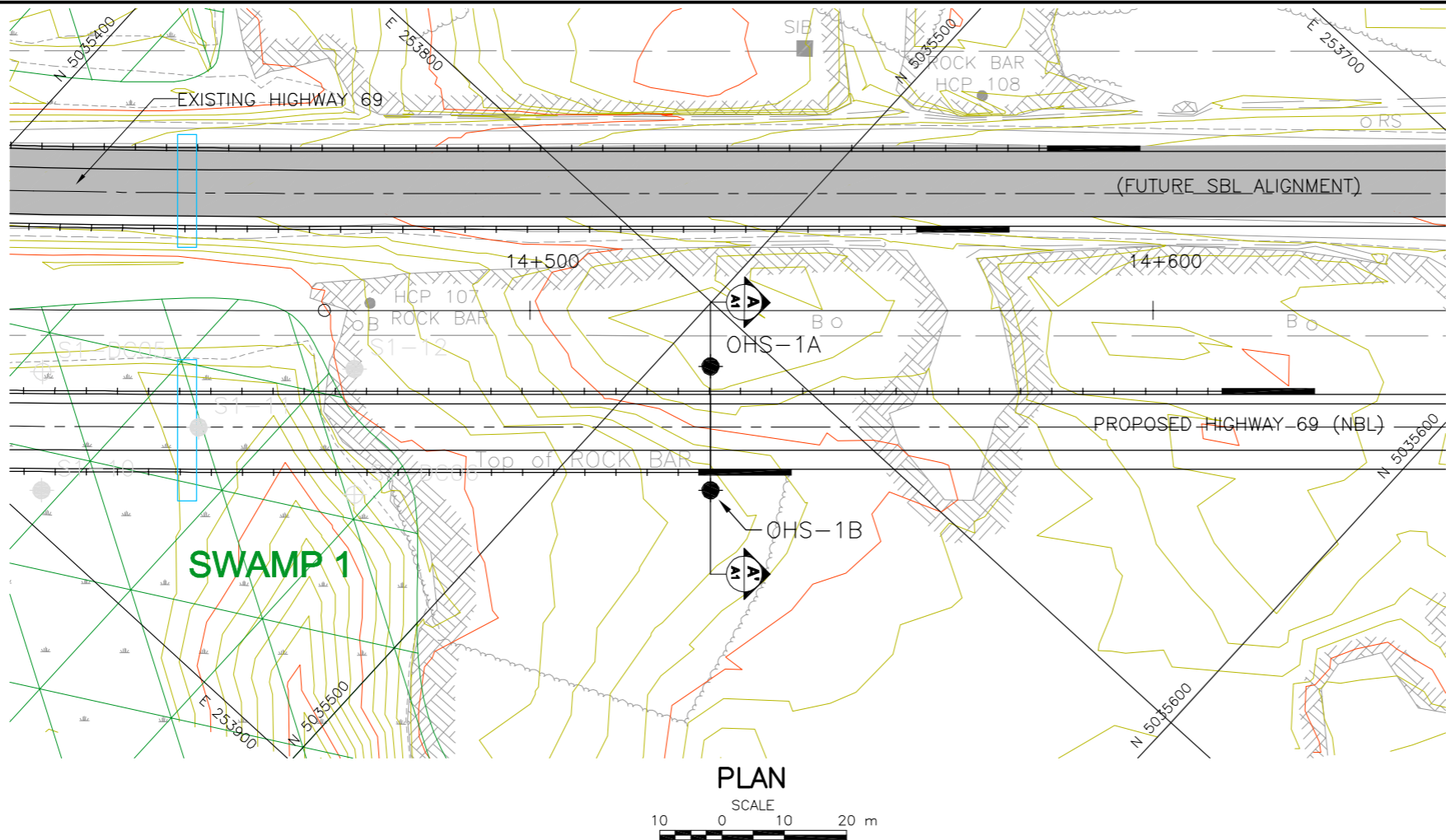
1 : 50



LOGGED: MR

CHECKED: AH/VA

GTA-RCK 018 07-1111-0029-OVERHEAD SIGN-PHASE I-GPJ GAL-MISS GDT 2/24/12 DD/SAC

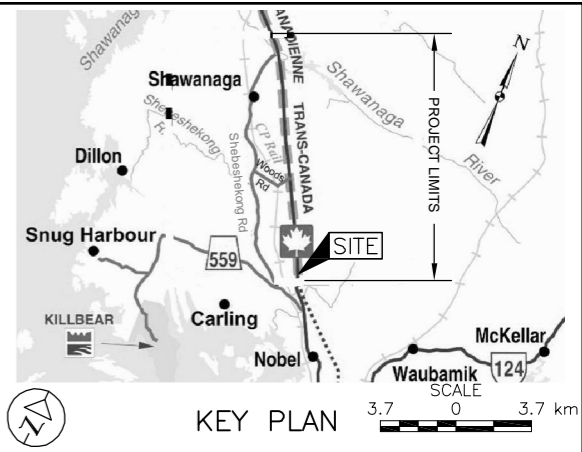


METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
GWP No. 5402-05-00

HIGHWAY 69 (NBL)
OVERHEAD SIGN 1, STA 14+529
BOREHOLE LOCATIONS AND SOIL STRATA

Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA



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
OHS-1A	224.2	5035506.9	253807.7
OHS-1B	221.1	5035520.3	253822.4

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 MRC, drawing file 5271XB01.DWG, 5271-XPB-ARCHIPELAGO.dwg, 5271-XPB-Carling.dwg, 5271-XPB-SHAWANAGA.dwg, PR # 5377-02-00-PR-1.dwg, received October 1, 2007 and h6878_PHASE1_XA1, h6878_PHASE1_XN1.dwg, received January 21, 2009 and h6878_PHASE1_XN1.dwg, received September 19, 2011.



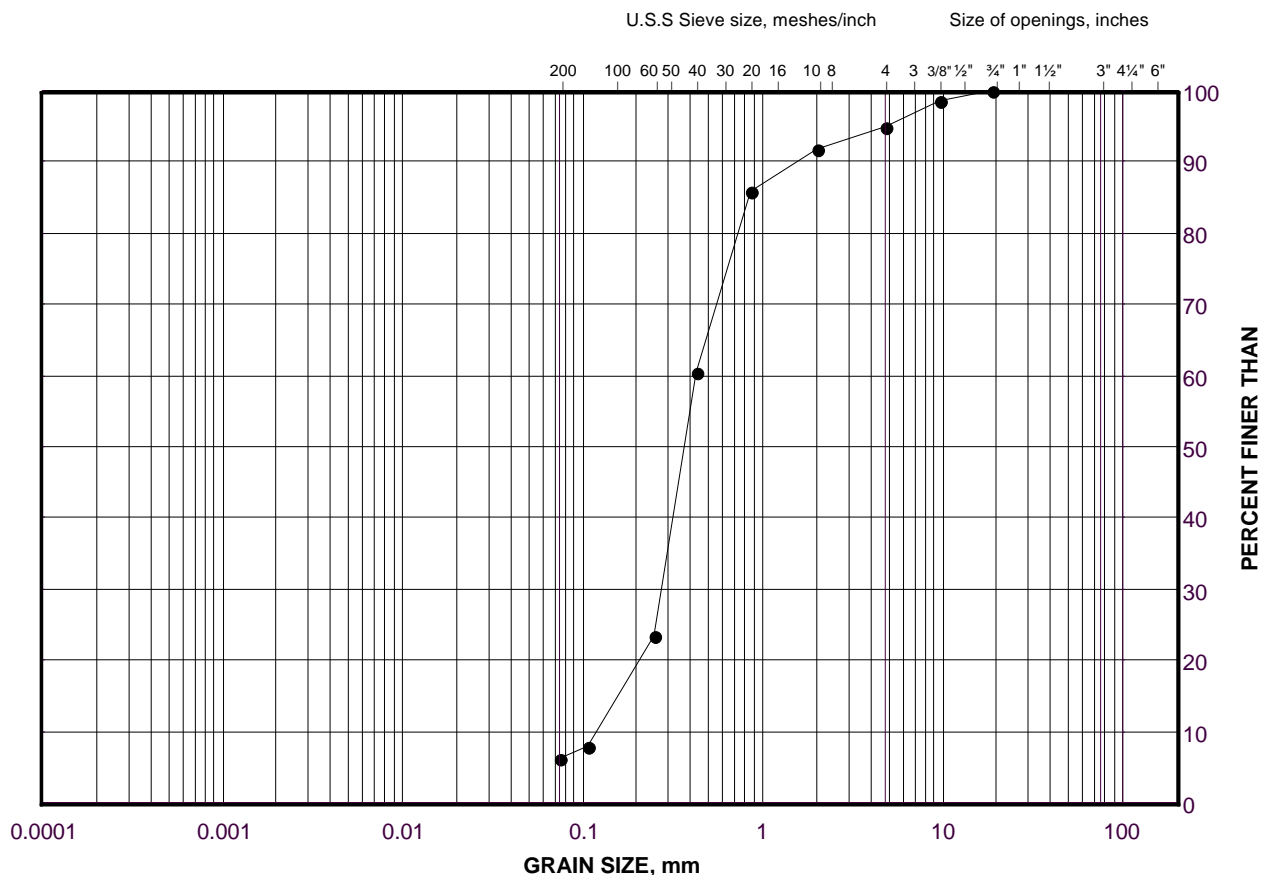
Geocres No. 41H-112			
NO.	DATE	BY	REVISION
HWY: 69	PROJECT NO. 07-1111-0029		DIST.
SUBM'D. VA	CHKD. VA	DATE: Feb. 2012	SITE:
DRAWN: JFC	CHKD. CN	APPD. JPD/JMAC	DWG. A1

GRAIN SIZE DISTRIBUTION

Sand

Highway 69 (NBL) STA 14+529 - Overhead Sign 1

FIGURE A1



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	OHS-1B	2	220.3

Project Number: 07-1111-0029

Checked By: TVA

Golder Associates

Date: 28-Jul-11

TABLE A1
POINT LOAD TEST ON ROCK SAMPLES

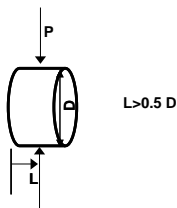
Borehole Number	Run Number	Sample Depth (m)	Sample Elevation (m)	Bedrock Description	Test Type	Core Length (mm)	Core Diameter (mm) ⁽²⁾	Is (50mm) (MPa)	Approx. UCS Value ⁽¹⁾ (MPa)
OHS-1A	1	0.73	223.5	Granite Gneiss	Diametral	141.50	47.20	3.674	73
OHS-1A	1	0.73	223.5	Granite Gneiss	Axial	31.90	47.50	8.335	167
OHS-1A	2	2.23	222.0	Granite Gneiss	Diametral	101.50	42.80	5.472	109
OHS-1A	2	2.23	222.0	Granite Gneiss	Axial	28.00	47.40	6.873	137
OHS-1A	3	3.75	220.5	Granite Gneiss	Diametral	96.10	45.60	5.677	114
OHS-1A	3	3.75	220.5	Granite Gneiss	Axial	44.60	47.40	8.602	172
OHS-1A	4	4.97	219.2	Granite Gneiss	Diametral	103.20	44.60	4.445	89
OHS-1A	4	4.97	219.2	Granite Gneiss	Diametral	123.40	47.50	3.786	76
OHS-1B	1	1.35	219.8	Granite Gneiss	Diametral	99.30	43.80	3.715	74
OHS-1B	1	1.35	219.8	Granite Gneiss	Axial	45.00	47.30	6.839	137
OHS-1B	2	2.31	218.8	Granite Gneiss	Diametral	106.30	43.00	7.339	147
OHS-1B	2	2.31	218.8	Granite Gneiss	Axial	51.20	47.20	6.967	139
OHS-1B	3	3.75	217.4	Granite Gneiss	Diametral	95.90	47.30	5.720	114
OHS-1B	3	3.75	217.4	Granite Gneiss	Axial	50.00	47.20	7.168	143

⁽¹⁾ $Is_{50} \times K$, from ASTM Designation: D 5731-08 "Standard Test Method for Determination of the Point Load Strength Index of Rock and Application to Rock Strength Classifications. A value of $K = 20$ has been estimated for this site.

⁽²⁾ Actual distance between point load cones at time of failure.

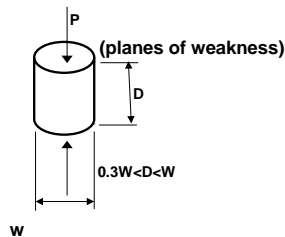
DIAMETRAL SPECIMEN SHAPE REQUIREMENTS

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



AXIAL SPECIMEN SHAPE REQUIREMENTS

note: Axial tests are parallel to core axis



Compiled by: OK
Reviewed by: TVA/CN



APPENDIX B

Highway 69 NBL – Overhead Sign 3 – STA 12+750





PROJECT		RECORD OF BOREHOLE		No OHS-3A		1 OF 1		METRIC					
G.W.P.		LOCATION		ORIGINATED BY		MR							
DIST		BOREHOLE TYPE		COMPILED BY		OK							
DATUM		DATE		CHECKED BY		VA							
07-1111-0029		N 5042403.6 ; E 247029.2											
5402-05-00		165 mm O.D Continuous Flight Solid Stem Auger, NW Casing, Wash Boring											
Geodetic		October 7, 2010											
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	GR SA SI CL
217.5	GROUND SURFACE												
0.0	ASPHALT												
216.7	Sand and gravel, trace to some silt (FILL) Very dense		1	SS	72		217						
0.8	Grey Moist		2	SS	29		216						
216.1	Sand, some gravel, trace to some silt (FILL) Compact Brown Moist		1	RC	REC 92%		215						
1.4	Granite Gneiss (BEDROCK)		2	RC	REC 100%		214						
	Bedrock cored from depths of 1.4 m to 4.8 m		3	RC	REC 100%		213						
	For bedrock coring details, refer to Record of Drillhole OHS-3A												
212.7	END OF BOREHOLE												
4.8	NOTE: 1. Water level in open borehole at a depth of 1.5 m below ground surface (Elevation 216.0 m) upon completion of drilling.												

SHEET 2 OF 2

DATUM: Geodetic

DRILLING CONTRACTOR: Walker Drilling

CHECKED: AH/VA

PROJECT 07-1111-0029		RECORD OF BOREHOLE No OHS-3B				1 OF 1 METRIC												
G.W.P. 5402-05-00		LOCATION N 5042413.6 ;E 247039.8				ORIGINATED BY EHS												
DIST _____ HWY 69		BOREHOLE TYPE 165 mm O.D Continuous Flight Solid Stem Auger, NW Casing, Wash Boring				COMPILED BY OK												
DATUM Geodetic		DATE October 25, 2010				CHECKED BY VA												
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 (%)
217.4 0.0	GROUND SURFACE							20	40	60	80	100						
0.2	Sand and gravel, trace silt, containing rootlets (FILL) Grey Moist		1A 1B 1C	SS	9	▽	217											
216.6 0.8	Sand, trace to some silt, trace to some gravel, containing cobbles (FILL) Loose Brown Moist		1	RC	REC 100%		216											RQD = 74%
	Granite Gneiss (BEDROCK)		2	RC	REC 100%		215											RQD = 100%
	Bedrock cored from depths of 0.8 m to 4.0 m For bedrock coring details, refer to Record of Drillhole OHS-3B		3	RC	REC 100%		214											RQD = 100%
213.4 4.0	END OF BOREHOLE																	
	NOTE: 1. Water level in open borehole at a depth of 0.8 m below ground surface (Elevation 216.6 m) upon completion of drilling.																	

PROJECT: 07-1111-0029

RECORD OF DRILLHOLE: OHS-3B

SHEET 2 OF 2

LOCATION: N 5042413.6 ;E 247039.8

DRILLING DATE: October 25, 2010

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME-850

DRILLING CONTRACTOR: Landore Drilling

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	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.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
							FLUSH	RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3	B Angle	DIP w.r.t CORE AXIS	DISCONTINUITY DATA										HYDRAULIC CONDUCTIVITY K, cm/sec										Diametral Point Load Index (MPa)	RMC -Q AVG.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
								TOTAL CORE %	SOLID CORE %					TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jh	10 ⁻²	10 ⁻³	10 ⁻⁴	10 ⁻⁵	10 ⁻⁶	10 ⁻⁷	10 ⁻⁸	10 ⁻⁹	10 ⁻¹⁰	10 ⁻¹¹	10 ⁻¹²	10 ⁻¹³	10 ⁻¹⁴	10 ⁻¹⁵	10 ⁻¹⁶	10 ⁻¹⁷			10 ⁻¹⁸	10 ⁻¹⁹	10 ⁻²⁰	10 ⁻²¹	10 ⁻²²	10 ⁻²³	10 ⁻²⁴	10 ⁻²⁵	10 ⁻²⁶	10 ⁻²⁷	10 ⁻²⁸	10 ⁻²⁹	10 ⁻³⁰	10 ⁻³¹	10 ⁻³²	10 ⁻³³	10 ⁻³⁴	10 ⁻³⁵	10 ⁻³⁶	10 ⁻³⁷	10 ⁻³⁸	10 ⁻³⁹	10 ⁻⁴⁰	10 ⁻⁴¹	10 ⁻⁴²	10 ⁻⁴³	10 ⁻⁴⁴	10 ⁻⁴⁵	10 ⁻⁴⁶	10 ⁻⁴⁷	10 ⁻⁴⁸	10 ⁻⁴⁹	10 ⁻⁵⁰	10 ⁻⁵¹	10 ⁻⁵²	10 ⁻⁵³	10 ⁻⁵⁴	10 ⁻⁵⁵	10 ⁻⁵⁶	10 ⁻⁵⁷	10 ⁻⁵⁸	10 ⁻⁵⁹	10 ⁻⁶⁰	10 ⁻⁶¹	10 ⁻⁶²	10 ⁻⁶³	10 ⁻⁶⁴	10 ⁻⁶⁵	10 ⁻⁶⁶	10 ⁻⁶⁷	10 ⁻⁶⁸	10 ⁻⁶⁹	10 ⁻⁷⁰	10 ⁻⁷¹	10 ⁻⁷²	10 ⁻⁷³	10 ⁻⁷⁴	10 ⁻⁷⁵	10 ⁻⁷⁶	10 ⁻⁷⁷	10 ⁻⁷⁸	10 ⁻⁷⁹	10 ⁻⁸⁰	10 ⁻⁸¹	10 ⁻⁸²	10 ⁻⁸³	10 ⁻⁸⁴	10 ⁻⁸⁵	10 ⁻⁸⁶	10 ⁻⁸⁷	10 ⁻⁸⁸	10 ⁻⁸⁹	10 ⁻⁹⁰	10 ⁻⁹¹	10 ⁻⁹²	10 ⁻⁹³	10 ⁻⁹⁴	10 ⁻⁹⁵	10 ⁻⁹⁶	10 ⁻⁹⁷	10 ⁻⁹⁸	10 ⁻⁹⁹	10 ⁻¹⁰⁰	10 ⁻¹⁰¹	10 ⁻¹⁰²	10 ⁻¹⁰³	10 ⁻¹⁰⁴	10 ⁻¹⁰⁵	10 ⁻¹⁰⁶	10 ⁻¹⁰⁷	10 ⁻¹⁰⁸	10 ⁻¹⁰⁹	10 ⁻¹¹⁰	10 ⁻¹¹¹	10 ⁻¹¹²	10 ⁻¹¹³	10 ⁻¹¹⁴	10 ⁻¹¹⁵	10 ⁻¹¹⁶	10 ⁻¹¹⁷	10 ⁻¹¹⁸	10 ⁻¹¹⁹	10 ⁻¹²⁰	10 ⁻¹²¹	10 ⁻¹²²	10 ⁻¹²³	10 ⁻¹²⁴	10 ⁻¹²⁵	10 ⁻¹²⁶	10 ⁻¹²⁷	10 ⁻¹²⁸	10 ⁻¹²⁹	10 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⁻³⁸⁰	10 ⁻³⁸¹	10 ⁻³⁸²	10 ⁻³⁸³	10 ⁻³⁸⁴	10 ⁻³⁸⁵	10 ⁻³⁸⁶	10 ⁻³⁸⁷	10 ⁻³⁸⁸	10 ⁻³⁸⁹	10 ⁻³⁹⁰	10 ⁻³⁹¹	10 ⁻³⁹²	10 ⁻³⁹³	10 ⁻³⁹⁴	10 ⁻³⁹⁵	10 ⁻³⁹⁶	10 ⁻³⁹⁷	10 ⁻³⁹⁸	10 ⁻³⁹⁹	10 ⁻⁴⁰⁰	10 ⁻⁴⁰¹	10 ⁻⁴⁰²	10 ⁻⁴⁰³	10 ⁻⁴⁰⁴	10 ⁻⁴⁰⁵	10 ⁻⁴⁰⁶	10 ⁻⁴⁰⁷	10 ⁻⁴⁰⁸	10 ⁻⁴⁰⁹	10 ⁻⁴¹⁰	10 ⁻⁴¹¹	10 ⁻⁴¹²	10 ⁻⁴¹³	10 ⁻⁴¹⁴	10 ⁻⁴¹⁵	10 ⁻⁴¹⁶	10 ⁻⁴¹⁷	10 ⁻⁴¹⁸	10 ⁻⁴¹⁹	10 ⁻⁴²⁰	10 ⁻⁴²¹	10 ⁻⁴²²	10 ⁻⁴²³	10 ⁻⁴²⁴	10 ⁻⁴²⁵	10 ⁻⁴²⁶	10 ⁻⁴²⁷	10 ⁻⁴²⁸	10 ⁻⁴²⁹	10 ⁻⁴³⁰	10 ⁻⁴³¹	10 ⁻⁴³²	10 ⁻⁴³³	10 ⁻⁴³⁴	10 ⁻⁴³⁵	10 ⁻⁴³⁶	10 ⁻⁴³⁷	10 ⁻⁴³⁸	10 ⁻⁴³⁹	10 ⁻⁴⁴⁰	10 ⁻⁴⁴¹	10 ⁻⁴⁴²	10 ⁻⁴⁴³	10 ⁻⁴⁴⁴	10 ⁻⁴⁴⁵	10 ⁻⁴⁴⁶	10 ⁻⁴⁴⁷	10 ⁻⁴⁴⁸	10 ⁻⁴⁴⁹	10 ⁻⁴⁵⁰	10 ⁻⁴⁵¹	10 ⁻⁴⁵²	10 ⁻⁴⁵³	10 ⁻⁴⁵⁴	10 ⁻⁴⁵⁵	10 ⁻⁴⁵⁶	10 ⁻⁴⁵⁷	10 ⁻⁴⁵⁸	10 ⁻⁴⁵⁹	10 ⁻⁴⁶⁰	10 ⁻⁴⁶¹	10 ⁻⁴⁶²	10 ⁻⁴⁶³	10 ⁻⁴⁶⁴	10 ⁻⁴⁶⁵	10 ⁻⁴⁶⁶	10 ⁻⁴⁶⁷	10 ⁻⁴⁶⁸	10 ⁻⁴⁶⁹	10 ⁻⁴⁷⁰	10 ⁻⁴⁷¹	10 ⁻⁴⁷²	10 ⁻⁴⁷³	10 ⁻⁴⁷⁴	10 ⁻⁴⁷⁵	10 ⁻⁴⁷⁶	10 ⁻⁴⁷⁷	10 ⁻⁴⁷⁸	10 ⁻⁴⁷⁹	10 ⁻⁴⁸⁰	10 ⁻⁴⁸¹	10 ⁻⁴⁸²	10 ⁻⁴⁸³	10 ⁻⁴⁸⁴	10 ⁻⁴⁸⁵	10 ⁻⁴⁸⁶	10 ⁻⁴⁸⁷	10 ⁻⁴⁸⁸	10 ⁻⁴⁸⁹	10 ⁻⁴⁹⁰	10 ⁻⁴⁹¹	10 ⁻⁴⁹²	10 ⁻⁴⁹³	10 ⁻⁴⁹⁴	10 ⁻⁴⁹⁵	10 ⁻⁴⁹⁶	10 ⁻⁴⁹⁷	10 ⁻⁴⁹⁸	10 ⁻⁴⁹⁹	10 ⁻⁵⁰⁰	10 ⁻⁵⁰¹	10 ⁻⁵⁰²	10 ⁻⁵⁰³	10 ⁻⁵⁰⁴	10 ⁻⁵⁰⁵	10 ⁻⁵⁰⁶	10 ⁻⁵⁰⁷	10 ⁻⁵⁰⁸	10 ⁻⁵⁰⁹	10 ⁻⁵¹⁰	10 ⁻⁵¹¹	10 ⁻⁵¹²	10 ⁻⁵¹³	10 ⁻⁵¹⁴	10 ⁻⁵¹⁵	10 ⁻⁵¹⁶	10 ⁻⁵¹⁷	10 ⁻⁵¹⁸	10 ⁻⁵¹⁹	10 ⁻⁵²⁰	10 ⁻⁵²¹	10 ⁻⁵²²	10 ⁻⁵²³	10 ⁻⁵²⁴	10 ⁻⁵²⁵	10 ⁻⁵²⁶	10 ⁻⁵²⁷	10 ⁻⁵²⁸	10 ⁻⁵²⁹	10 ⁻⁵³⁰	10 ⁻⁵³¹	10 ⁻⁵³²	10 ⁻⁵³³	10 ⁻⁵³⁴	10 ⁻⁵³⁵	10 ⁻⁵³⁶	10 ⁻⁵³⁷	10 ⁻⁵³⁸	10 ⁻⁵³⁹	10 ⁻⁵⁴⁰	10 ⁻⁵⁴¹	10 ⁻⁵⁴²	10 ⁻⁵⁴³	10 ⁻⁵⁴⁴	10 ⁻⁵⁴⁵	10 ⁻⁵⁴⁶	10 ⁻⁵⁴⁷	10 ⁻⁵⁴⁸	10 ⁻⁵⁴⁹	10 ⁻⁵⁵⁰	10 ⁻⁵⁵¹	10 ⁻⁵⁵²	10 ⁻⁵⁵³	10 ⁻⁵⁵⁴	10 ⁻⁵⁵⁵	10 ⁻⁵⁵⁶	10 ⁻⁵⁵⁷	10 ⁻⁵⁵⁸	10 ⁻⁵⁵⁹	10 ⁻⁵⁶⁰	10 ⁻⁵⁶¹	10 ⁻⁵⁶²	10 ⁻⁵⁶³	10 ⁻⁵⁶⁴	10 ⁻⁵⁶⁵	10 ⁻⁵⁶⁶	10 ⁻⁵⁶⁷	10 ⁻⁵⁶⁸	10 ⁻⁵⁶⁹	10 ⁻⁵⁷⁰	10 ⁻⁵⁷¹	10 ⁻⁵⁷²	10 ⁻⁵⁷³	10 ⁻⁵⁷⁴	10 ⁻⁵⁷⁵	10 ⁻⁵⁷⁶	10 ⁻⁵⁷⁷	10 ⁻⁵⁷⁸	10 ⁻⁵⁷⁹	10 ⁻⁵⁸⁰	10 ⁻⁵⁸¹	10 ⁻⁵⁸²	10 ⁻⁵⁸³	10 ⁻⁵⁸⁴	10 ⁻⁵⁸⁵	10 ⁻⁵⁸⁶	10 ⁻⁵⁸⁷	10 ⁻⁵⁸⁸	10 ⁻⁵⁸⁹	10 ⁻⁵⁹⁰	10 ⁻⁵⁹¹	10 ⁻⁵⁹²	10 ⁻⁵⁹³	10 ⁻⁵⁹⁴	10 ⁻⁵⁹⁵	10 ⁻⁵⁹⁶	10 ⁻⁵⁹⁷	10 ⁻⁵⁹⁸	10 ⁻⁵⁹⁹	10 ⁻⁶⁰⁰	10 ⁻⁶⁰¹	10 ⁻⁶⁰²	10 ⁻⁶⁰³	10 ⁻⁶⁰⁴	10 ⁻⁶⁰⁵	10 ⁻⁶⁰⁶	10 ⁻⁶⁰⁷	10 ⁻⁶⁰⁸	10 ⁻⁶⁰⁹	10 ⁻⁶¹⁰	10 ⁻⁶¹¹	10 ⁻⁶¹²	10 ⁻⁶¹³	10 ⁻⁶¹⁴	10 ⁻⁶¹⁵	10 ⁻⁶¹⁶	10 ⁻⁶¹⁷	10 ⁻⁶¹⁸	10 ⁻⁶¹⁹	10 ⁻⁶²⁰	10 ⁻⁶²¹	10 ⁻⁶²²	10 ⁻⁶²³	10 ⁻⁶²⁴	10 ⁻⁶²⁵	10 ⁻⁶²⁶	10 ⁻⁶²⁷	10 ⁻⁶²⁸	10 ⁻⁶²⁹	10 ⁻⁶³⁰	10 ⁻⁶³¹	10 ⁻⁶³²	10 ⁻⁶³³	10 ⁻⁶³⁴	10 ⁻⁶³⁵	10 ⁻⁶³⁶	10 ⁻⁶³⁷	10 ⁻⁶³⁸	10 ⁻⁶³⁹	10 ⁻⁶⁴⁰	10 ⁻⁶⁴¹	10 ⁻⁶⁴²	10 ⁻⁶⁴³	10 ⁻⁶⁴⁴	10 ⁻⁶⁴⁵	10 ⁻⁶⁴⁶	10 ⁻⁶⁴⁷	10 ⁻⁶⁴⁸	10 ⁻⁶⁴⁹	10 ⁻⁶⁵⁰	10 ⁻⁶⁵¹	10 ⁻⁶⁵²	10 ⁻⁶⁵³	10 ⁻⁶⁵⁴	10 ⁻⁶⁵⁵	10 ⁻⁶⁵⁶	10 ⁻⁶⁵⁷	10 ⁻⁶⁵⁸	10 ⁻⁶⁵⁹	10 ⁻⁶⁶⁰	10 ⁻⁶⁶¹	10 ⁻⁶⁶²	10 ⁻⁶⁶³	10 ⁻⁶⁶⁴	10 ⁻⁶⁶⁵	10 ⁻⁶

DEPTH SCALE

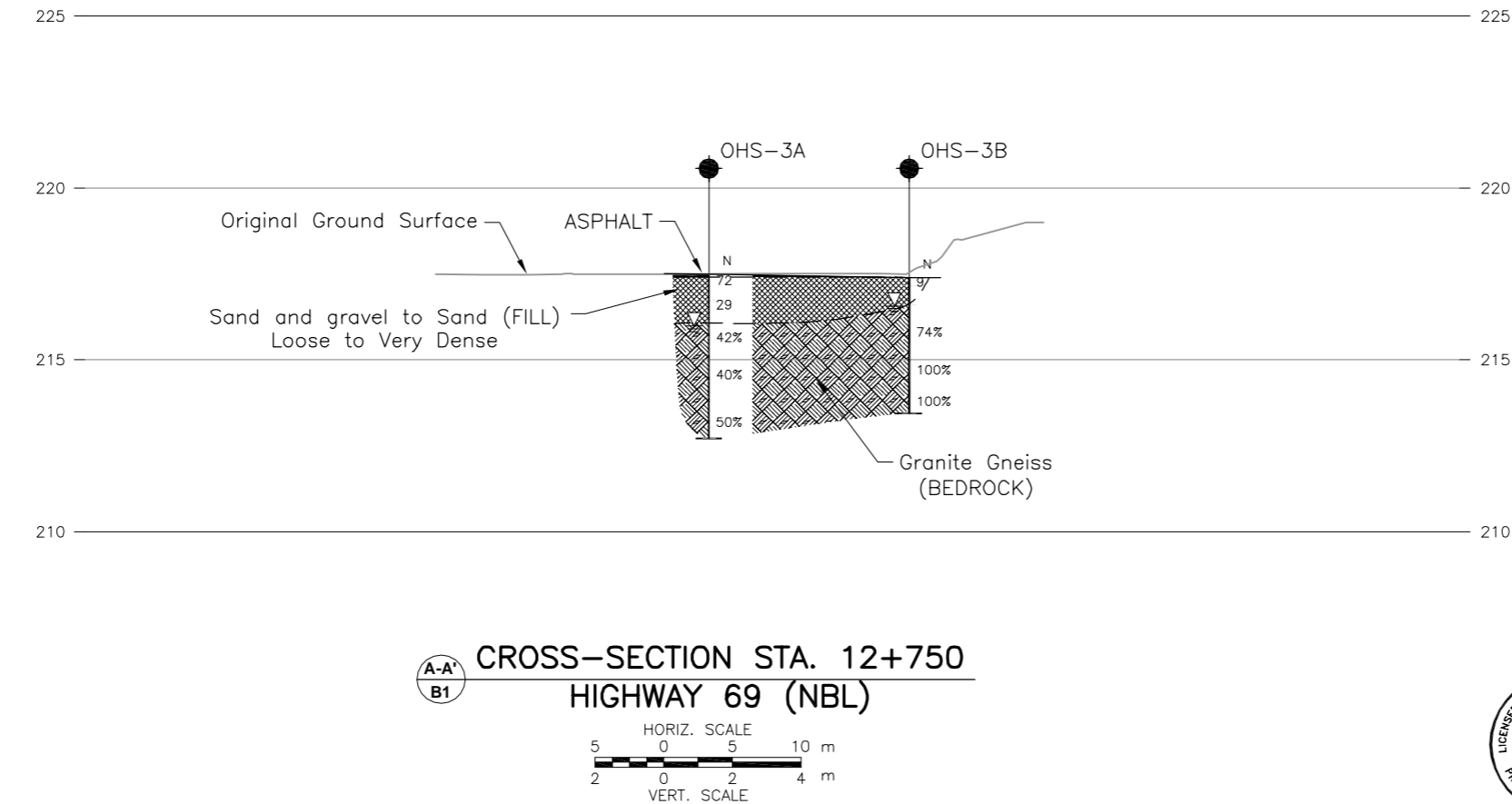
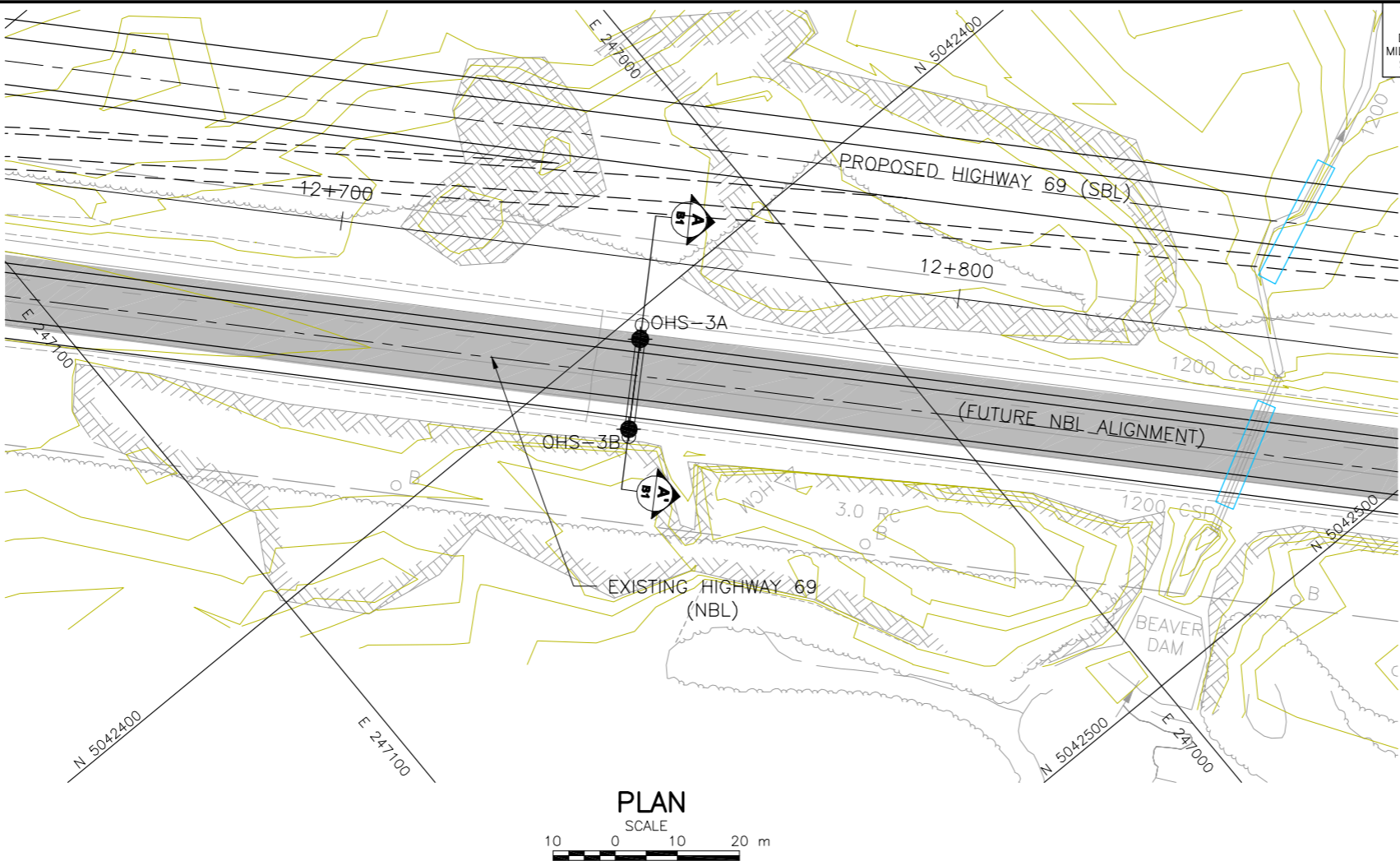
1 : 50



LOGGED: EHS

CHECKED: AH/VA

GTA-RCK 018 07-1111-0029-OVERHEAD SIGN-PHASE I-GPJ GAL-MISS.GDT 2/24/12 DD/SAC



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

CONT No.
GWP No. 5402-05-00

HIGHWAY 69 (NBL)
OVERHEAD SIGN 3, STA 12+750
BOREHOLE LOCATIONS AND SOIL STRATA

Golder Associates Ltd.
MISSISSAUGA, ONTARIO, CANADA

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

No.	ELEVATION	CO-ORDINATES	
		NORTHING	EASTING
OHS-3A	217.5	5042403.6	247029.2
OHS-3B	217.4	5042413.6	247039.8

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 MRC, drawing file 5271XB01.DWG, 5271-XPD-ARCHIPELAGO.dwg, 5271-XPD-Carling.dwg, 5271-XPD-SHAWANAGA.dwg, PR # 5377-02-00-PR-1.dwg, received October 1, 2007 and h6878_PHASE1_XA1, h6878_PHASE1_XN1.dwg, received January 21, 2009 and h6878_PHASE1_XN1.dwg, received September 19, 2011.

NO.	DATE	BY	REVISION

Geocres No. 41H-112

HWY: 69

SUBM'D. VA

DRAWN: JFC

PROJECT NO. 07-1111-0029

CHKD. VA

CHKD. CN

DIST.

DATE: Feb. 2012

APPD. JPD/JMAC

SITE:

SITE:

DWG. B1

TABLE B1
POINT LOAD TEST ON ROCK SAMPLES

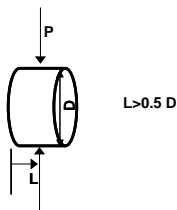
Borehole Number	Run Number	Sample Depth (m)	Sample Elevation (m)	Bedrock Description	Test Type	Core Length (mm)	Core Diameter ⁽²⁾ (mm)	Is (50mm) (MPa)	Approx. UCS Value ⁽¹⁾ (MPa)
OHS-3A	1	1.71	215.8	Granite Gneiss	Diametral	99.20	44.60	7.497	135
OHS-3A	1	1.71	215.8	Granite Gneiss	Axial	41.40	47.30	8.025	144
OHS-3A	2	2.81	214.7	Granite Gneiss	Diametral	102.50	46.60	7.469	134
OHS-3A	2	2.81	214.7	Granite Gneiss	Axial	43.90	47.40	6.090	110
OHS-3A	3	4.18	213.3	Granite Gneiss	Diametral	94.40	39.60	8.088	146
OHS-3A	3	4.18	213.3	Granite Gneiss	Diametral	83.00	44.70	5.720	103
OHS-3B	1	1.46	215.9	Granite Gneiss	Diametral	94.00	45.00	6.313	114
OHS-3B	1	1.60	215.8	Granite Gneiss	Axial	36.20	47.30	13.451	242
OHS-3B	2	2.66	214.7	Granite Gneiss	Diametral	116.20	47.00	4.332	78
OHS-3B	2	2.56	214.8	Granite Gneiss	Axial	51.30	47.00	7.839	141
OHS-3B	3	3.48	213.9	Granite Gneiss	Diametral	73.10	47.10	5.799	104
OHS-3B	3	3.48	213.9	Granite Gneiss	Diametral	72.80	41.60	9.138	164

⁽¹⁾ $Is_{50} \times K$, from ASTM Designation: D 5731-08 "Standard Test Method for Determination of the Point Load Strength Index of Rock and Application to Rock Strength Classifications. A value of $K = 18$ has been estimated for this site.

⁽²⁾ Actual distance between point load cones at time of failure.

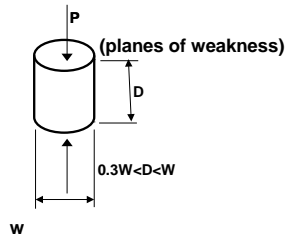
DIAMETRAL SPECIMEN SHAPE REQUIREMENTS

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



AXIAL SPECIMEN SHAPE REQUIREMENTS

note: Axial tests are parallel to core axis



Compiled by: OK
Reviewed by: TVA/CN



APPENDIX C

Highway 69 (Existing) – Overhead Sign 4 – STA 13+675

PROJECT		RECORD OF BOREHOLE		No OHS-4A		1 OF 1		METRIC									
G.W.P. 07-1111-0029		LOCATION		N 5043091.1 ; E 246402.0		ORIGINATED BY		MR									
DIST		HWY 69		BOREHOLE TYPE		165 mm O.D Continuous Flight Solid Stem Auger, NW Casing, Wash Boring		COMPILED BY									
DATUM		Geodetic		DATE		October 6, 2010		CHECKED BY									
								VA									
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									
214.1	GROUND SURFACE							20	40	60	80	100					
0.0	Sand, some gravel, trace to some silt, containing rootlets (FILL)		1	SS	43/0.28												
213.7	Dense Brown																
0.4	Granite Gneiss (BEDROCK)		1	RC	REC 93%												RQD = 47%
	Bedrock cored from depths of 0.4 m to 3.9 m																
	For bedrock coring details, refer to Record of Drillhole OHS-4A		2	RC	REC 100%												RQD = 82%
			3	RC	REC 98%												RQD = 98%
210.2	END OF BOREHOLE																
3.9	NOTE: 1. Water level at the ground surface (Elevation 214.1 m) upon completion of drilling.																

GTA-MTO 001 07-1111-0029-OVERHEAD SIGN-PHASE I-GPJ GAL-MISS.GDT 2/24/12 DD/SAC

PROJECT: 07-1111-0029

RECORD OF DRILLHOLE: OHS-4A

SHEET 2 OF 2

LOCATION: N 5043091.1 ; E 246402.0

DRILLING DATE: October 6, 2010

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Diedrich D-50

DRILLING CONTRACTOR: Walker Drilling

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	FLUSH	RECOVERY TOTAL CORE %	R.Q.D. % SOLID CORE %	FRACT. INDEX PER 0.3 m	DISCONTINUITY DATA B Angle DIP w.r.t. CORE AXIS	TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q AVG.
		Continued from Record of Borehole OHS-4A		213.7										
1	INW Casing October 6, 2010	GRANITE GNEISS Slightly weathered, foliated, coarse grained, strong to very strong, grey to black		0.4	1						.FR,PL,RO .FR,IR,RO .FR,PL,RO .FR,PL,VR .FR,PL,VR .FR,PL,VR			(Diametral) (Axial)
2	NO RC October 6, 2010				2						.FR,PL,VR .FR,PL,VR .FR,PL,VR .FR,PL,VR .FR,PL,VR .FR,PL,VR			(Diametral) (Axial)
3					3						.FR,PL,VR		0.7 0.1	(Diametral) (Diametral)
4		END OF DRILLHOLE		210.2 3.9										
5														
6														
7														
8														
9														
10														

DEPTH SCALE

1 : 50





LOGGED: MR

CHECKED: AH/VA

GTA-RCK 018 07-1111-0029-OVERHEAD SIGN-PHASE I-GPJ GAL-MISS GDT 2/24/12 DD/SAC

PROJECT <u>07-1111-0029</u>		RECORD OF BOREHOLE No OHS-4B		1 OF 1 METRIC	
G.W.P. <u>5402-05-00</u>		LOCATION <u>N 5043075.6 ; E 246389.1</u>		ORIGINATED BY <u>MR</u>	
DIST <u> </u> HWY <u>69</u>		BOREHOLE TYPE <u>165 mm O.D Continuous Flight Solid Stem Auger, NW Casing, Wash Boring</u>		COMPILED BY <u>OK</u>	
DATUM <u>Geodetic</u>		DATE <u>October 6, 2010</u>		CHECKED BY <u>VA</u>	

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa			WATER CONTENT (%)				
								○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × REMOULDED		W _p	W	W _L		
214.2	GROUND SURFACE														
0.0	Sand and gravel, trace silt (FILL) Loose to Compact Brown Moist		1	SS	7										50 47 (3)
			2	SS	26										
	Cobbles encountered between depths of 1.2 m to 1.4 m														
			3	SS	8										
212.2	Granite Gneiss (BEDROCK)														
2.0	Bedrock cored from depths of 2.0 m to 4.7 m For bedrock coring details, refer to Record of Drillhole OHS-4B		1	RC	REC 98%										RQD = 60%
			2	RC	REC 100%										RQD = 100%
209.5	END OF BOREHOLE														
4.7	NOTE: 1. Water level encountered in open borehole at a depth of 1.7 m below ground surface (Elevation 212.5 m) during drilling.														

PROJECT: 07-1111-0029

RECORD OF DRILLHOLE: OHS-4B

SHEET 2 OF 2

LOCATION: N 5043075.6 ;E 246389.1

DRILLING DATE: October 6, 2010

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Diedrich D-50

DRILLING CONTRACTOR: Walker Drilling

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.	DISCONTINUITY DATA										HYDRAULIC CONDUCTIVITY			Diametral Point Load Index (MPa)	RMC -Q AVG.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
				DEPTH (m)									RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.3 m	B Angle °	DIP w.r.t CORE AXIS °	TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	K, cm/sec																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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DEPTH SCALE

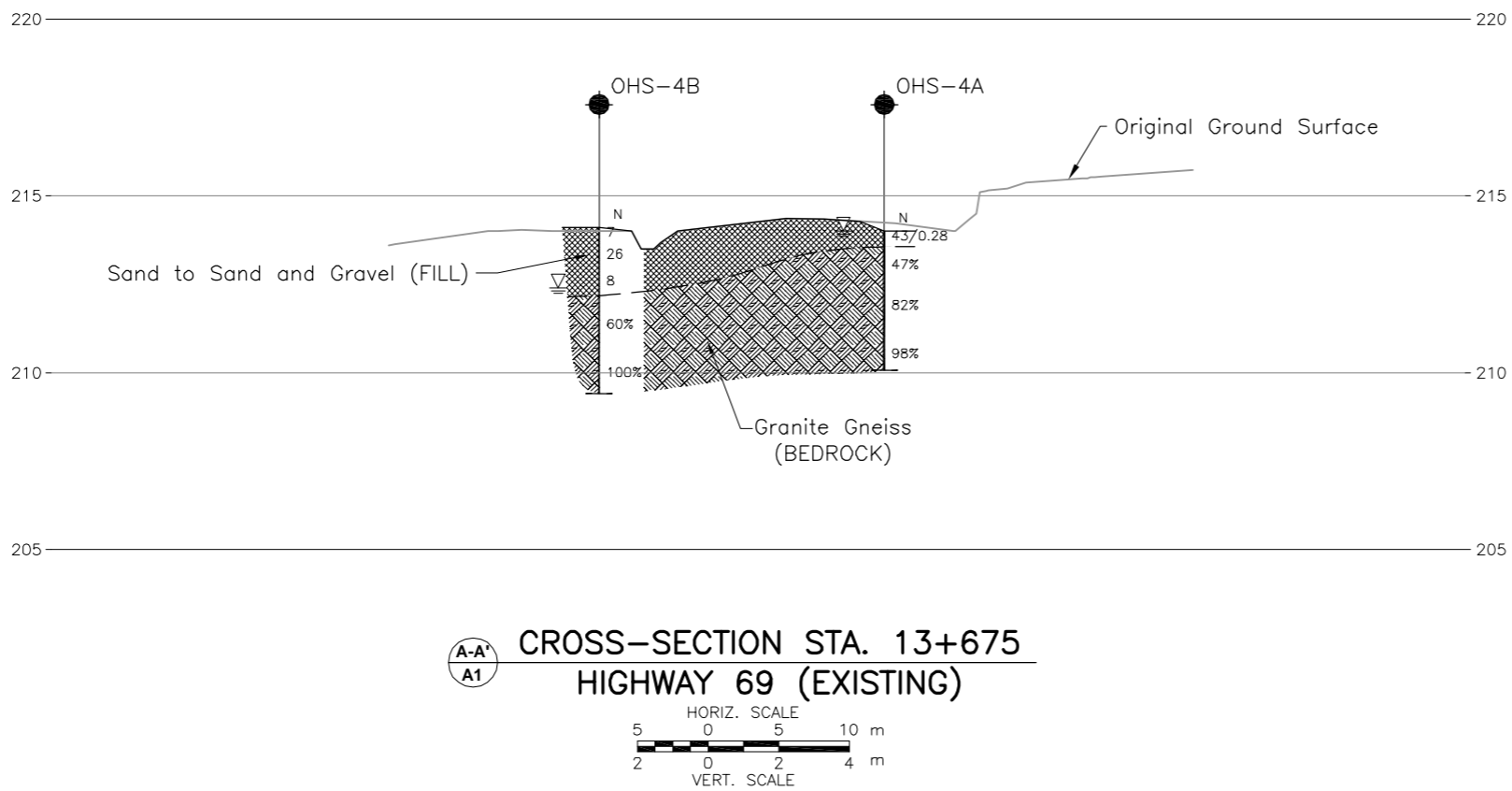
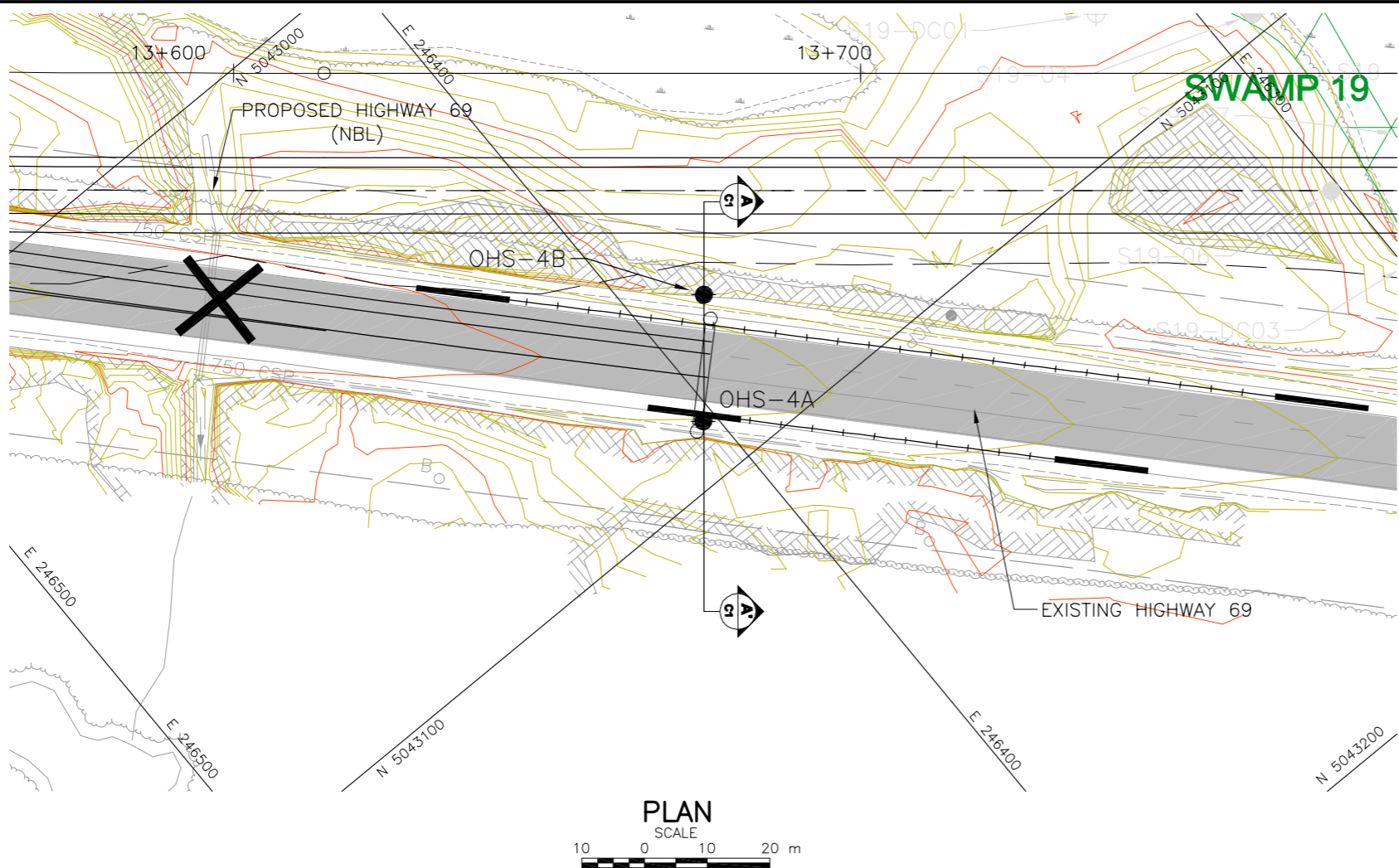
1 : 50



LOGGED: MR

CHECKED: AH/VA

GTA-RCK 018 07-1111-0029-OVERHEAD SIGN-PHASE I-GPJ GAL-MISS.GDT 2/24/12 DD/SAC

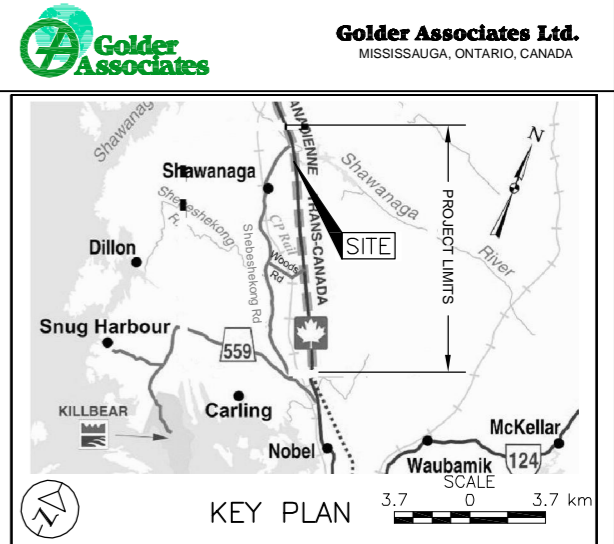


METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
GWP No. 5402-05-00

HIGHWAY 69 (EXISTING)
OVERHEAD SIGN 4, STA 13+675
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET



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
OHS-4A	214.1	5043091.1	246402.0
OHS-4B	214.2	5043075.6	246389.1

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 MRC, drawing file 5271XB01.DWG, 5271-XPD-ARCHIPELAGO.dwg, 5271-XPD-Carling.dwg, 5271-XPD-SHAWANAGA.dwg, PR # 5377-02-00-PR-1.dwg, received October 1, 2007 and h6878_PHASE1_XA1, h6878_PHASE1_XN1.dwg, received January 21, 2009 and h6878_PHASE1_XN1.dwg, received September 19, 2011.

NO.	DATE	BY	REVISION
Geocres No. 41H-112			
HWY. 69	PROJECT NO. 07-1111-0029		DIST.
SUBM'D. VA	CHKD. VA	DATE: Feb. 2012	SITE:
DRAWN: JFC	CHKD. CN	APPD. JPD/JMAC	DWG. C1

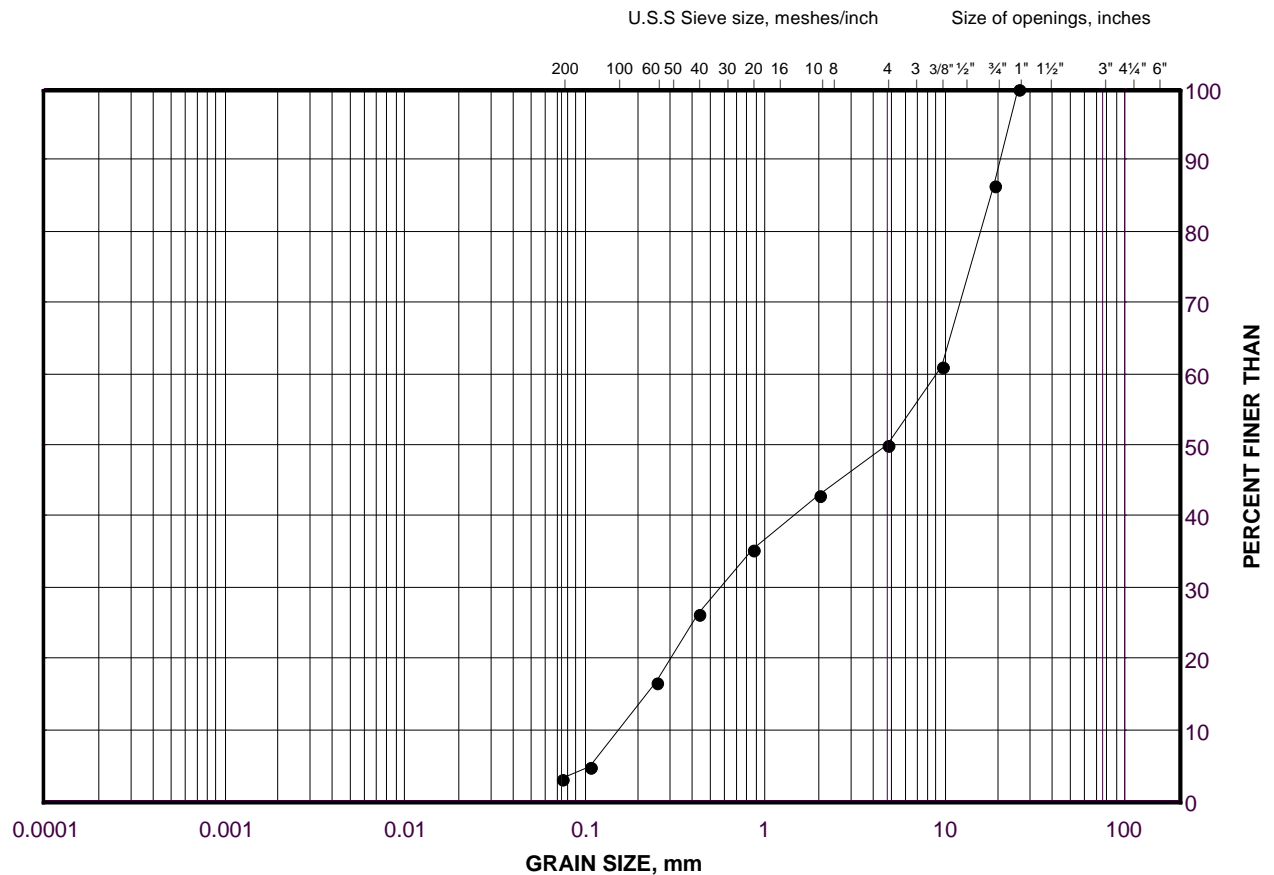


GRAIN SIZE DISTRIBUTION

Sand and Gravel Fill

Highway 69 Existing STA 13+675 - Overhead Sign 4

FIGURE C1



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

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
•	OHS-4B	1	213.9

Project Number: 07-1111-0029

Checked By: TVA

Golder Associates

Date: 28-Jul-11

TABLE C1
POINT LOAD TEST ON ROCK SAMPLES

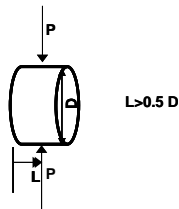
Borehole Number	Run Number	Sample Depth (m)	Sample Elevation (m)	Bedrock Description	Test Type	Core Length (mm)	Core Diameter (mm) ⁽²⁾	Is (50mm) (MPa)	Approx. UCS Value ⁽¹⁾ (MPa)
OHS-4A	1	0.81	213.3	Granite Gneiss	Diametral	102.00	41.30	7.823	141
OHS-4A	1	0.81	213.3	Granite Gneiss	Axial	50.60	44.70	7.945	143
OHS-4A	2	1.95	212.2	Granite Gneiss	Diametral	131.30	42.30	4.148	75
OHS-4A	2	1.95	212.2	Granite Gneiss	Axial	46.20	47.70	9.022	162
OHS-4A	3	3.32	210.8	Granite Gneiss	Diametral	119.60	41.40	9.724	175
OHS-4A	3	3.32	210.8	Granite Gneiss	Diametral	134.80	44.10	10.061	181
OHS-4B	1	2.59	211.6	Granite Gneiss	Diametral	134.00	43.50	4.734	85
OHS-4B	1	2.59	211.6	Granite Gneiss	Axial	50.10	47.20	7.446	134
OHS-4B	2	3.96	210.2	Granite Gneiss	Diametral	96.50	43.30	6.929	125
OHS-4B	2	3.96	210.2	Granite Gneiss	Axial	35.70	47.40	7.302	131

⁽¹⁾ $Is_{50} \times K$, from ASTM Designation: D 5731-08 "Standard Test Method for Determination of the Point Load Strength Index of Rock and Application to Rock Strength Classifications. A value of $K = 18$ has been estimated for this site.

⁽²⁾ Actual distance between point load cones at time of failure.

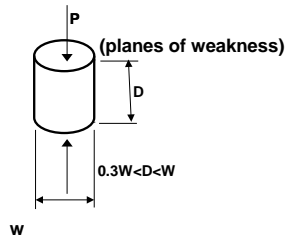
DIAMETRAL SPECIMEN SHAPE REQUIREMENTS

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



AXIAL SPECIMEN SHAPE REQUIREMENTS

note: Axial tests are parallel to core axis



Compiled by: OK
Reviewed by: TVA/CN

At Golder Associates we strive to be the most respected global group of companies specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees now operating from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

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