



FOUNDATION INVESTIGATION AND DESIGN REPORT

for

**PICKEREL RIVER BRIDGE NORTHBOUND
HIGHWAY 69 FOUR-LANING, SITE NO. 44-429/1
W.P. 5267-05-01 (PART OF G.W.P. 5378-02-00)
SUDBURY AREA, ONTARIO**

PETO MacCALLUM LTD.
165 CARTWRIGHT AVENUE
TORONTO, ONTARIO
M6A 1V5
Phone: (416) 785-5110
Fax: (416) 785-5120
Email: toronto@petomacallum.com

Distribution:

- 3 cc: McCormick Rankin Corporation for distribution to
MTO, Project Manager + one digital copy
- 1 cc: McCormick Rankin Corporation for distribution to
MTO, Pavements and Foundations Section
+ one digital copy
- 2 cc: McCormick Rankin Corporation
+ one digital copy
- 1 cc: PML Toronto
- 1 cc: PML Barrie

PML Ref.: 06TF032L
Index No.: 2413FIR and 2414FDR
GEOCRES No.: 41H-89
February 4, 2011



FOUNDATION INVESTIGATION REPORT

for

**PICKEREL RIVER BRIDGE NORTHBOUND
HIGHWAY 69 FOUR-LANING, SITE NO. 44-429/1
W.P. 5267-05-01 (PART OF G.W.P. 5378-02-00)
SUDBURY AREA, ONTARIO**

PETO MacCALLUM LTD.
165 CARTWRIGHT AVENUE
TORONTO, ONTARIO
M6A 1V5
Phone: (416) 785-5110
Fax: (416) 785-5120
Email: toronto@petomacallum.com

Distribution:

- 3 cc: McCormick Rankin Corporation for distribution to
MTO, Project Manager + one digital copy
- 1 cc: McCormick Rankin Corporation for distribution to
MTO, Pavements and Foundations Section
+ one digital copy
- 2 cc: McCormick Rankin Corporation
+ one digital copy
- 1 cc: PML Toronto
- 1 cc: PML Barrie

PML Ref.: 06TF032L
Index No.: 2413FIR
GEOCRES No.: Not Assigned
February 4, 2011



TABLE OF CONTENTS

1. INTRODUCTION.....	1
2. SITE DESCRIPTION AND GEOLOGY	1
3. INVESTIGATION PROCEDURES.....	2
4. SUMMARISED SUBSURFACE CONDITIONS	4
4.1 Topsoil.....	5
4.2 Fill.....	5
4.3 Sand.....	5
4.4 Bedrock	5
4.4.1 South Abutment.....	6
4.4.2 South Pier	7
4.4.3 North Pier	8
4.4.4 North Abutment	9
4.4.5 Approaches	10
4.5 Groundwater.....	10
5. CLOSURE.....	10

Table A – Rock Core Description

Explanation of Terms Used in Report

Record of Borehole Sheets

Drawings PRN-1 and PRN-2 – Borehole Locations and Soil Strata

Appendix A – Site Photographs

Appendix B – Rock Core Photographs

FOUNDATION INVESTIGATION REPORT

for

Pickereel River Bridge Northbound
Highway 69 Four-Laning, Site No. 44-429/1
W.P. 5267-05-01 (Part of G.W.P. 5378-02-00)
Sudbury Area, Ontario

1. INTRODUCTION

This report summarises the results of the foundation investigation carried out for the proposed construction of a bridge to carry northbound traffic on the realigned Highway 69 over the Pickereel River, about 70 km south of Sudbury, Ontario. The investigation was conducted for McCormick Rankin Corporation (MRC) on behalf of the Ministry of Transportation of Ontario (MTO).

The northbound lanes (NBL) bridge is at approximate Station 19+975, new Highway 69 centreline, in the Township of Mowat (ref. Drawing 1 'Highway 69 – Pickereel River Bridge' prepared by MRC in October 2009).

The report provides subsurface information pertaining to the proposed structure and approaches within about 20 m of the abutments.

All elevations in this report are expressed in meters.

2. SITE DESCRIPTION AND GEOLOGY

The site is located on the new Highway 69 alignment at the crossing of the Pickereel River. The bridge will be constructed some 0.5 km downstream (west) from the existing Highway 69 bridge over the river. Highway 69 is oriented in the south-north direction at the bridge location. The Pickereel River flows from east to west and is about 50 m wide at the site. Site photographs are included in Appendix A.

The study area is located in the Precambrian Laurentian peneplane. The topography is irregular in detail with extensive rock outcrops. The north margin of the Pickereel River slopes steeply up



at an average inclination of 2H:1V at the site. Soil cover on both sides of the river is sparse. Numerous cobbles and boulders cover the east side of the south abutment.

Metasedimentary rocks of the Huronian Supergroup and gneisses of the Grenville Province underlie the alignment. The area has undergone considerable folding, intrusive activity, regional metamorphism and faulting. Bedrock predominantly comprises pink and light grey granitic gneiss. The bedrock in the immediate vicinity of the site is at shallow depths ranging from surface to less than 2 m.

3. INVESTIGATION PROCEDURES

The field work for this study was carried out during the periods of November 13 to December 1, 2009 (north pier and north abutment) and March 29 to 31, 2010 (south pier and south abutment), comprising 45 boreholes drilled to depths of 0.0 to 4.5 m at the locations shown on Drawing PRN-1, attached. Eight of the boreholes were put down as auger probes to confirm bedrock levels and were designated with the "AP" series of numbers. Further details are summarised in the following table:

LOCATION	BOREHOLE No.	DEPTH (m)		
		AUGER / CONE	ROCK CORE	TOTAL
South Approach	N1	0.0	–	0.0
South Abutment	N2	0.0	–	0.0
	N3	1.4	3.1	4.5
	N4	0.4	3.0	3.4
	N4A	0.0	–	0.0
	N5	0.1	3.1	3.2
	N6	0.1	3.2	3.3
	N7	0.7	–	0.7
	APS-N1	0.0	–	0.0
	APS-N2	0.5	–	0.5
	APS-N3	0.0	–	0.0
	APS-N4	0.6	–	0.6
	APS-N5	0.6	–	0.6



South Pier	N8	0.3	3.2	3.5
	N9	0.8	3.5	4.3
	N9A	0.0	–	0.0
	N10	0.5	3.0	3.5
	N11	0.5	3.2	3.7
	N12	0.2	–	0.2
	N13	0.0	–	0.0
North Pier	N14	0.0	3.1	3.1
	N15	0.0	3.1	3.1
	N15A	0.0	–	0.0
	N16	0.0	3.1	3.1
	N17	0.0	–	0.0
	N18	0.0	–	0.0
	N19	0.0	3.1	3.1
	N19A	0.0	–	0.0
North Abutment	N20	0.0	3.1	3.1
	N20A	0.0	–	0.0
	N21	0.0	3.1	3.1
	N21A	0.0	–	0.0
	N22	0.0	3.1	3.1
	N22A	0.0	–	0.0
	N23	0.0	–	0.0
	N24	0.0	–	0.0
	N24A	0.0	–	0.0
	N24B	0.0	–	0.0
	N25	0.0	3.3	3.3
	N25A	0.0	–	0.0
	N25B	0.0	–	0.0
	APN-N1	0.3	–	0.3
	APN-N2	0.0	–	0.0
	APN-N3	0.0	–	0.0
North Approach	N26	0.0	–	0.0

Callon Dietz Inc. staked the borehole locations at each foundation unit for the bridge and provided temporary benchmarks that were used by Peto MacCallum Ltd. (PML) to establish ground surface elevations at the boreholes.

The boreholes were advanced manually or using continuous flight solid stem augers, powered by a track-mounted CME-55 drill rig, supplied and operated by a specialist drilling contractor, working under the full-time supervision of a member of our engineering staff. A total of 16 boreholes



(within the foundation elements) were extended 3.0 to 3.5 m into bedrock using portable Weka (50 mm diameter concrete bit) and Hilti diamond rock coring equipment supplemented by wash boring techniques.

Soils were identified in the field in accordance with the MTO Soil Classification procedures. The groundwater conditions at the borehole locations were assessed during drilling by visual examination of soil, the sampler and drill rods. Upon completion of drilling, the boreholes were backfilled with bentonite/cement grout in accordance with the MTO guidelines and MOE Regulation 903 for borehole abandonment procedures.

4. SUMMARISED SUBSURFACE CONDITIONS

Reference is made to the appended Record of Borehole sheets for details of the subsurface conditions including soil classifications, bedrock descriptions, inferred stratigraphy, boundary elevations and groundwater observations.

The borehole locations, stratigraphic profile and cross-sections prepared from the borehole data are shown on Drawings PRN-1 and PRN-2. The boundaries between soil strata have been established at the borehole locations only. Between and beyond the boreholes, the boundaries are assumed and may vary.

The subsurface stratigraphy revealed in the boreholes drilled at the site generally comprised surficial topsoil and/or fill mantling bedrock. Cobbles and boulders were encountered in 7 boreholes. The bedrock surface was contacted at depths of 0.0 to 1.4 m.

The strata encountered are summarised below.



4.1 Topsoil

Surficial topsoil was present at the south abutment and south pier in boreholes N5 to N8, N10, N12 and APS-N4. The sandy topsoil had a thickness of 100 to 500 mm and was penetrated at elevation 179.1 to 181.9.

4.2 Fill

Present at surface in boreholes N3, N4, N9, N11, APS-N2, APS-N5 and directly beneath the topsoil at 0.2 m depth (elevation 180.6 to 180.7) in boreholes N7, APS-N4 was a discontinuous fill unit. These boreholes were drilled on the south side of the river. Composed of sand or sandy topsoil (with cobbles and boulders in 5 boreholes), the fill was 0.4 to 1.4 m thick and penetrated at depths of 0.4 to 1.4 m (elevation 179.0 to 181.7).

Boulders were also encountered at ground surface in boreholes N24 and APN-N2.

4.3 Sand

Cohesionless sand was present surficially at the north abutment in borehole APN-N1. This stratum was 0.3 m in thickness and penetrated at elevation 181.0.

4.4 Bedrock

Bedrock was contacted or inferred by refusal at depths of 0.0 to 1.4 m (elevation 179.0 to 185.0) on the south side of the Pickerel River and 0.0 to 0.3 m (elevation 179.1 to 188.6) on the north side. The bedrock comprises a pink and light grey granitic gneiss.

The measured core recovery varied between 72 and 100%. The RQD determined from the rock cores was in a range of 28 to 100%, thus indicating a poor to excellent quality rock. The rock quality was very poor in an upper 0.5 m portion in borehole N6, the upper 0.2 to 0.5 m core



samples in boreholes N15, N16, N19 and a 0.3 m portion below the upper 0.3 and 0.7 m core samples in borehole N21.

A detailed description of the rock cores retrieved from boreholes N3, N4, N5, N6, N8, N9, N10, N11, N14, N15, N16, N19, N20, N21, N22 and N25 is given in Table A, appended. Photographs of the rock cores are shown in Appendix B.

4.4.1 South Abutment

The bedrock surface was contacted/inferred at depths of 0.0 to 1.4 m (elevation 179.5 to 185.0) in boreholes N2 to N4, N4A, N5 to N7, APS-N1 to APS-N5. The depth to and surface elevation of the bedrock identified in the boreholes drilled at the south abutment are summarised in the following table:

Location	Borehole No.	Depth to Rock (m)	Bedrock Elevation
South Abutment	N2	0.0	183.5
	N3	1.4*	179.5*
	N4	0.4*	181.7*
	N4A	0.0	182.2
	N5	0.1*	181.9*
	N6	0.1*	181.8*
	N7	0.7	180.1
	APS-N1	0.0	185.0
	APS-N2	0.5	180.6
	APS-N3	0.0	184.4
	APS-N4	0.6	180.3
	APS-N5	0.6	180.5

* confirmed by rock coring

The bedrock surface has a maximum relief of 4.0 m at the locations of boreholes N2 to N4, N4A, N5 to N7 and slopes at angles of 7 to 14°. The bedrock comprises a pink slightly weathered medium to high strength granitic gneiss, with occasional coarse pegmatite in borehole N4.

The measured core recovery varied between 99 and 100%. The RQD determined from the rock cores was in a range of 87 to 100%, thus indicating a good to excellent quality rock, with the



exception of an upper 0.5 m portion in borehole N6 where the rock quality was identified as very poor.

4.4.2 South Pier

The bedrock surface was contacted/inferred at depths of 0.0 to 0.8 m (elevation 179.0 to 180.4) in boreholes N8, N9, N9A, N10 to N13. The depth to and surface elevation of the bedrock identified in the boreholes drilled at the south pier are summarised in the following table:

Location	Borehole No.	Depth to Rock (m)	Bedrock Elevation
South Pier	N8	0.3*	179.5*
	N9	0.8*	179.6*
	N9A	0.0	180.4
	N10	0.5*	179.1*
	N11	0.5*	179.0*
	N12	0.2	179.3
	N13	0.0	179.6

* confirmed by rock coring

The bedrock surface has a maximum relief of 1.4 m and slopes at angles of 1 to 10° (about 20° between boreholes N9A and N10). The bedrock comprises a pink slightly weathered high strength granitic gneiss.

The measured core recovery varied between 93 and 100%. The RQD determined from the rock cores was in a range of 51 to 100%, thus indicating a fair to excellent quality rock, with the exception of the upper 0.8 m core sample in borehole N10 where the rock quality was poor (RQD of 46%).



4.4.3 North Pier

The bedrock surface was contacted at 0.0 m depth (elevation 179.1 to 181.3) in boreholes N14, N15, N15A, N16 to N19 and N19A. The depth to and surface elevation of the bedrock identified in the boreholes drilled at the north pier are summarised in the following table:

Location	Borehole No.	Depth to Rock (m)	Bedrock Elevation
North Pier	N14	0.0*	180.9*
	N15	0.0*	179.3*
	N15A	0.0	179.1
	N16	0.0*	179.9*
	N17	0.0	180.6
	N18	0.0	181.3
	N19	0.0*	179.1*
	N19A	0.0	180.2

* confirmed by rock coring

The bedrock surface has a maximum relief of 2.2 m and slopes at an angle of 10°. The bedrock comprises a pink and light grey moderately weathered to unweathered medium to high strength granitic gneiss, with an occasional layer of pink pegmatite in borehole N16 and dark green hornblende in borehole N19.

The measured core recovery varied between 72 and 100%. The RQD determined from the rock cores was in a range of 28 to 93%, thus indicating a poor to excellent quality rock, with the exception of the upper 0.2 to 0.5 m core samples in boreholes N15, N16 and N19 where the rock quality was very poor (RQD of 0%).



4.4.4 North Abutment

The bedrock surface was contacted/inferred at depths of 0.0 to 0.3 m (elevation 181.0 to 188.6) in 16 boreholes. The depth to and surface elevation of the bedrock identified in the boreholes drilled at the north abutment are summarised in the following table:

Location	Borehole No.	Depth to Rock (m)	Bedrock Elevation
North Abutment	N20	0.0*	184.1*
	N20A	0.0	183.6
	N21	0.0*	184.9*
	N21A	0.0	185.6
	N22	0.0*	187.5*
	N22A	0.0	185.7
	N23	0.0	186.9
	N24	>0.0	<184.9
	N24A	0.0	186.3
	N24B	0.0	184.4
	N25	0.0*	188.1*
	N25A	0.0	187.7
	N25B	0.0	188.6
	APN-N1	0.3	181.0
	APN-N2	>0.0	<181.7
	APN-N3	0.0	181.7

* confirmed by rock coring

The bedrock surface has a maximum relief of 5.0 m at the locations of all boreholes except auger probes APN-N1 to APN-N3 and slopes at angles of 3 to 29°. The bedrock comprises a pink and light grey slightly weathered to unweathered high strength granitic gneiss.



The measured core recovery varied between 89 and 100%. The RQD determined from the rock cores was in a range of 34 to 100%, thus indicating a poor to excellent quality rock, with the exception of a 0.3 m portion below the upper 0.3 and 0.7 m core samples in borehole N21 where the rock quality was very poor (RQD of 0%).

4.4.5 Approaches

Bedrock was at ground surface (elevation 185.5 and 199.5) in boreholes N1 and N26 put down respectively at the south and north approaches.

4.5 Groundwater

In the course of the field work, no groundwater was observed in any of the boreholes. It is noted, however, that groundwater levels may fluctuate subject to seasonal variations and precipitation patterns.

The water level in the Pickerel River was reported to be at elevation 178.0 on April 17, 2007, with the 100-year high at elevation 179.25.

5. CLOSURE

The field work was carried out under the supervision of Mr. F. Portela, Senior Technician, and direction of Mr. M. Narduzzi, BEng, and Mr. C.M.P. Nascimento, P.Eng., Senior Project Engineer. The equipment was supplied by Walker Drilling Ltd. and City Concrete Drilling Services.



This report was prepared by Mr. G.O. Degil, PhD, P.Eng., Senior Foundation Engineer, and reviewed by Mr. B.R. Gray, MEng, P.Eng., MTO Designated Principal Contact. Mr. C.M.P. Nascimento, P.Eng., Senior Project Engineer, conducted an independent review of the report.

Yours very truly,

Peto MacCallum Ltd.



Grigory O. Degil, PhD, P.Eng.
Senior Foundation Engineer



Carlos M.P. Nascimento, P.Eng.
Senior Project Engineer



Brian R. Gray, MEng, P.Eng.
MTO Designated Principal Contact

GD/CN/BRG:gd-mi



TABLE A
ROCK CORE DESCRIPTIONS

LOCATION (BH)	CORE RECOVERY				CORE DESCRIPTION	
	RC	DEPTH (m)	REC (%)	RQD (%)	DEPTH (m)	DESCRIPTION
N3	1	1.4 – 2.0	100	100	1.4 – 4.5	GRANITIC GNEISS: Pink, medium crystalline, high strength, slightly weathered, close to moderate (locally very close) spaced flat to dipping cross joints, occasional vertical partings, rough planar, tight to slightly altered with red oxidation stains and/or scale on partings, good to excellent quality.
	2	2.0 – 3.5	100	87		
	3	3.5 – 4.5	100	88		
N4	1	0.4 – 1.9	100	100	0.4 – 3.4	GRANITIC GNEISS: Pink, medium crystalline, with occasional coarse pegmatite, medium to high strength, slightly weathered, close to moderate (locally very close) spaced flat to dipping cross joints, rough planar, tight to slightly altered with red or brown oxidation stains and/or silt on partings, excellent quality.
	2	1.9 – 3.4	100	94		
N5	1	0.1 – 1.7	100	94	0.1 – 3.2	GRANITIC GNEISS: Pink, medium crystalline, high strength, slightly weathered, close to moderate (locally very close) spaced flat to dipping cross joints, rough planar, tight to slightly altered with red oxidation stains and/or silt on partings, occasional vertical fissures, excellent quality.
	2	1.7 – 3.2	99	99		
N6	1	0.1 – 1.7	100	62	0.1 – 3.3	GRANITIC GNEISS: Pink, medium crystalline, high strength, slightly weathered, very close to close becoming close to moderate (locally very close) spaced flat to dipping cross joints, rough planar, tight to slightly altered with red oxidation stains and/or silt on partings, occasional vertical fissures, very poor quality to 0.6 m depth, becoming excellent quality.
	2	1.7 – 3.3	100	92		
N8	1	0.3 – 1.9	100	98	0.3 – 3.5	GRANITIC GNEISS: Pink, medium crystalline, high strength, slightly weathered, close to moderate spaced flat to dipping cross joints, rough planar, tight to slightly altered with red oxidation stains on partings, excellent quality.
	2	1.9 – 3.5	99	99		

Originated: FP
Compiled: JFW
Checked: GD/ CN



TABLE A
ROCK CORE DESCRIPTIONS

LOCATION (BH)	CORE RECOVERY				CORE DESCRIPTION	
	RC	DEPTH (m)	REC (%)	RQD (%)	DEPTH (m)	DESCRIPTION
N9	1	0.8 – 2.0	100	81	0.8 – 4.3	GRANITIC GNEISS: Pink, medium crystalline, high strength, slightly weathered, very close to close (locally moderate) spaced flat to dipping cross joints, rough planar (locally slickensided), tight to slightly altered with red oxidation stains on partings, occasional vertical fissures, fair to good quality.
	2	2.0 – 3.5	93	51		
	3	3.5 – 4.3	97	84		
N10	1	0.5 – 1.3	100	46	0.5 – 3.5	GRANITIC GNEISS: Pink, medium crystalline, high strength, slightly weathered, very close to close becoming close to moderate spaced flat to dipping cross joints, rough planar, tight to slightly altered with red oxidation stains on partings, occasional vertical fissures, with silt on partings, poor to fair, becoming excellent quality.
	2	1.3 – 2.8	100	59		
	3	2.8 – 3.5	100	93		
N11	1	0.5 – 1.8	100	66	0.5 – 3.7	GRANITIC GNEISS: Pink, medium crystalline, high strength, slightly weathered, close to moderate spaced flat to dipping cross joints, with occasional vertical fissures, rough planar, tight to slightly altered with red or black oxidation stains and/or grey silt on partings, fair to excellent quality.
	2	1.8 – 3.3	100	100		
	3	3.3 – 3.7	100	56		
N14	1	0.0 – 0.5	90	40	0.0 – 3.1	GRANITIC GNEISS: Light grey to pink, medium to coarse crystalline, with near vertical banding, medium to high strength, slightly weathered, close (locally moderate) spaced flat to dipping cross joints, rough planar, tight to slightly altered with occasional oxidation stains and/or scale on partings, poor becoming fair to good quality.
	2	0.5 – 1.3	97	86		
	3	1.3 – 2.0	100	88		
	4	2.0 – 3.1	100	51		

Originated: FP
 Compiled: JFW
 Checked: GD/ CN



TABLE A
ROCK CORE DESCRIPTIONS

LOCATION (BH)	CORE RECOVERY				CORE DESCRIPTION	
	RC	DEPTH (m)	REC (%)	RQD (%)	DEPTH (m)	DESCRIPTION
N15	1	0.0 – 0.5	100	0	0.0 – 3.1	GRANITIC GNEISS: Light grey to pink, medium to coarse crystalline, with numerous red veinlets, brecciated appearance at 1.5 m, medium strength, moderately to slightly weathered, very close to close spaced flat to dipping (locally vertical) cross joints, rough planar, tight to slightly altered with occasional oxidation stains on partings, very poor becoming fair (locally excellent) quality.
	2	0.5 – 1.5	100	51		
	3	1.5 – 2.6	100	93		
	4	2.6 – 3.1	100	55		
N16	1	0.0 – 0.2	72	0	0.0 – 3.1	GRANITIC GNEISS: Pink, medium to coarse crystalline, with occasional layer of pink, coarse crystalline pegmatite, high strength, slightly weathered, very close to close (locally moderate) spaced flat to dipping cross joints, occasional multiple vertical partings, rough planar, tight to slightly altered with oxidation stains and/or silt on partings, very poor to poor becoming fair to good quality.
	2	0.2 – 0.6	100	43		
	3	0.6 – 1.2	85	73		
	4	1.2 – 1.7	86	81		
	5	1.7 – 2.6	92	74		
	6	2.6 – 3.1	78	53		
N19	1	0.0 – 0.2	100	0	0.0 – 3.1	GRANITIC GNEISS: Light grey, medium to coarse crystalline, with occasional dark green hornblende, medium to high strength, unweathered to slightly weathered, very close to close spaced flat to dipping cross joints, rough planar, tight to slightly altered with oxidation stains and/or silt on partings, very poor becoming fair to good (locally poor) quality.
	2	0.2 – 0.4	100	0		
	3	0.4 – 1.0	100	80		
	4	1.0 – 1.8	100	28		
	5	1.8 – 3.1	100	70		

Originated: FP
Compiled: JFW
Checked: GD/ CN



TABLE A
ROCK CORE DESCRIPTIONS

LOCATION (BH)	CORE RECOVERY				CORE DESCRIPTION	
	RC	DEPTH (m)	REC (%)	RQD (%)	DEPTH (m)	DESCRIPTION
N20	1	0.0 – 1.1	100	100	0.0 – 3.1	GRANITIC GNEISS: Light grey to pink, medium to coarse crystalline, near vertical banding, high strength, slightly weathered, close to moderate spaced dipping cross joints, rough planar, tight to slightly altered with oxidation stains on partings, excellent becoming fair quality.
	2	1.1 – 1.3	100	100		
	3	1.3 – 1.9	100	100		
	4	1.9 – 3.1	94	67		
N21	1	0.0 – 0.3	100	100	0.0 – 3.1	GRANITIC GNEISS: Light grey to pink, medium to coarse crystalline, with near vertical banding, high strength, slightly weathered, wide becoming close to moderate (locally very close) spaced flat to dipping (locally vertical) cross joints, rough planar, tight to slightly altered with occasional oxidation stains and/or silt on partings, excellent (locally very poor to poor) becoming good to fair quality.
	2	0.3 – 1.0	100	100		
	3	1.0 – 1.3	100	0		
	4	1.3 – 1.6	100	34		
	5	1.6 – 2.0	100	100		
	6	2.0 – 2.8	97	86		
	7	2.8 – 3.1	100	67		
N22	1	0.0 – 0.7	100	100	0.0 – 3.1	GRANITIC GNEISS: Pink, with near vertical banding, medium to coarse crystalline, high strength, slightly weathered to unweathered, moderate to wide becoming close spaced flat to dipping cross joints, rough planar, tight to slightly altered with oxidation stains and/or silt on partings, excellent to good quality.
	2	0.7 – 1.5	98	98		
	3	1.5 – 2.4	100	79		
	4	2.4 – 3.1	89	89		

Originated: FP
Compiled: JFW
Checked: GD/ CN



TABLE A
ROCK CORE DESCRIPTIONS

LOCATION (BH)	CORE RECOVERY				CORE DESCRIPTION	
	RC	DEPTH (m)	REC (%)	RQD (%)	DEPTH (m)	DESCRIPTION
N25	1	0.0 – 0.4	100	66	0.0 – 3.3	GRANITIC GNEISS: Light grey to pink, medium to coarse crystalline, with near vertical banding, high strength, slightly weathered, close to moderate spaced flat to dipping (locally vertical) cross joints, rough planar, tight to slightly altered with occasional oxidation stains and/or silt on partings, fair (locally poor) becoming good quality.
	2	0.4 – 1.4	100	39		
	3	1.4 – 2.1	98	63		
	4	2.1 – 3.3	98	89		

RQD = Rock Quality Designation

Originated: FP
 Compiled: JFW
 Checked: GD/ CN

EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS \bar{N} .

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH (c_u) AS FOLLOWS:

c_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	> 200
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

N (BLOWS/0.3m)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND / OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (R Q D), FOR MODIFIED RECOVERY, IS:

R Q D (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

JOINTING AND BEDDING:

SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	> 3m
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

S S	SPLIT SPOON	T P	THINWALL PISTON
W S	WASH SAMPLE	O S	OSTERBERG SAMPLE
S T	SLOTTED TUBE SAMPLE	R C	ROCK CORE
B S	BLOCK SAMPLE	P H	T W ADVANCED HYDRAULICALLY
C S	CHUNK SAMPLE	P M	T W ADVANCED MANUALLY
T W	THINWALL OPEN	F S	FOIL SAMPLE
F V	FIELD VANE		

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
c_v	m^2/s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES	n	1, %	POROSITY	e_{max}	1, %	VOID RATIO IN LOOSEST STATE
γ_s	kN/m^3	UNIT WEIGHT OF SOLID PARTICLES	w	1, %	WATER CONTENT	e_{min}	1, %	VOID RATIO IN DENSEST STATE
ρ_w	kg/m^3	DENSITY OF WATER	S_r	%	DEGREE OF SATURATION	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
γ_w	kN/m^3	UNIT WEIGHT OF WATER	w_L	%	LIQUID LIMIT	D	mm	GRAIN DIAMETER
ρ	kg/m^3	DENSITY OF SOIL	w_p	%	PLASTIC LIMIT	D_n	mm	n PERCENT - DIAMETER
γ	kN/m^3	UNIT WEIGHT OF SOIL	w_s	%	SHRINKAGE LIMIT	C_u	1	UNIFORMITY COEFFICIENT
ρ_d	kg/m^3	DENSITY OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	h	m	HYDRAULIC HEAD OR POTENTIAL
γ_d	kN/m^3	UNIT WEIGHT OF DRY SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	q	m^3/s	RATE OF DISCHARGE
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	v	m/s	DISCHARGE VELOCITY
γ_{sat}	kN/m^3	UNIT WEIGHT OF SATURATED SOIL	DTPL		DRIER THAN PLASTIC LIMIT	i	1	HYDRAULIC GRADIENT
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL	APL		ABOUT PLASTIC LIMIT	k	m/s	HYDRAULIC CONDUCTIVITY
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL	WTPL		WETTER THAN PLASTIC LIMIT	j	kN/m^3	SEEPAGE FORCE
e	1, %	VOID RATIO						

RECORD OF BOREHOLE No N1

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 828.8 N; 221 702.2 E ORIGINATED BY F.P.
 DIST 54 HWY 69 BOREHOLE TYPE Manual Probing COMPILED BY G.D.
 DATUM Geodetic DATE March 31, 2010 CHECKED BY C.N.

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					w _p w w _L			WATER CONTENT (%)	GR	SA		SI	CL		
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE															
185.5	Ground Surface					*															
0.0	Bedrock at surface																				
	* Borehole dry																				

RECORD OF BOREHOLE No N2

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 847.7 N; 221 693.2 E ORIGINATED BY F.P.
 DIST 54 HWY 69 BOREHOLE TYPE Manual Probing COMPILED BY G.D.
 DATUM Geodetic DATE March 31, 2010 CHECKED BY C.N.



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					w _p w w _L			WATER CONTENT (%)	GR	SA		SI	CL			
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE																
183.5	Ground Surface					*																
0.0	Bedrock at surface																					
	* Borehole dry																					

RECORD OF BOREHOLE No N3

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 849.5 N; 221 708.6 E ORIGINATED BY F.P.
 DIST 54 HWY 69 BOREHOLE TYPE NQ Diamond Coring COMPILED BY G.D.
 DATUM Geodetic DATE March 31, 2010 CHECKED BY C.N.

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 (%)		
								○ UNCONFINED		+ FIELD VANE								○		
180.9	Ground Surface						20	40	60	80	100	20	40	60						
0.0	Sand, with gravel cobbles and boulders (FILL)																			
179.5	Granitic Gneiss bedrock		1	RC NQ	REC 100%															
1.4	Slightly weathered		2	RC NQ	REC 100%															
	High strength																			
	Good to excellent quality		3	RC NQ	REC 100%															
176.4	End of borehole																			
4.5																				
	* Borehole charged with drilling water																			

METRIC

20
15 — 5 (%) STRAIN AT FAILURE
10

METRIC

20
15 — 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No N5

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 850.7 N; 221 695.9 E ORIGINATED BY F.P.
 DIST 54 HWY 69 BOREHOLE TYPE NQ Diamond Coring COMPILED BY G.D.
 DATUM Geodetic DATE March 30, 2010 CHECKED BY C.N.


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 (%)							
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	*N* VALUES			SHEAR STRENGTH kPa													WATER CONTENT (%)						
								○ UNCONFINED				+ FIELD VANE									○						
								● QUICK TRIAXIAL				x LAB VANE									—						
182.0 0.0	Ground Surface							20	40	60	80	100						GR	SA	SI	CL						
181.9 0.1	Topsoil		1	RC NQ	REC 100%		181												RQD 94%								
	Granitic Gneiss bedrock		2	RC NQ	REC 99%		180												RQD 99%								
	Slightly weathered																										
	High strength																										
	Excellent quality																										
178.8 3.2	End of borehole						179																				
	* Borehole charged with drilling water																										

RECORD OF BOREHOLE No N6

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 851.4 N; 221 692.8 E ORIGINATED BY F.P.
 DIST 54 HWY 69 BOREHOLE TYPE NQ Diamond Coring COMPILED BY G.D.
 DATUM Geodetic DATE March 30, 2010 CHECKED BY C.N.

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 (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	*N* VALUES			SHEAR STRENGTH kPa											WATER CONTENT (%)		
								○ UNCONFINED	● QUICK TRIAXIAL	+	×	FIELD VANE	LAB VANE								
181.9 0.0	Ground Surface																	GR SA SI CL			
181.8 0.1	Topsoil																				
	Granitic Gneiss bedrock																				
	Slightly weathered																				
	High strength		1	RC NQ	REC 100%													RQD 62%			
	Very poor to 0.6m depth, becoming excellent quality																				
			2	RC NQ	REC 100%													RQD 92%			
178.6 3.3	End of borehole																				

RECORD OF BOREHOLE No N7

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 853.0 N; 221 706.7 E ORIGINATED BY F.P.
 DIST 54 HWY 69 BOREHOLE TYPE Manual Probing COMPILED BY G.D.
 DATUM Geodetic DATE March 31, 2010 CHECKED BY C.N.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p W W _L				WATER CONTENT (%)	GR	SA	SI	CL
								○ UNCONFINED	● QUICK TRIAXIAL	+	×	FIELD VANE	LAB VANE								
180.8	Ground Surface							20	40	60	80	100		20	40	60					
0.0	Topsoil																				
180.6	Sand, with gravel cobbles and boulders																				
0.2																					
180.1	(FILL)																				
0.7	End of borehole																				
	Refusal on probable bedrock																				

METRIC

20
15 — 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No N9

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 878.5 N; 221 702.3 E ORIGINATED BY F.P.
 DIST 54 HWY 69 BOREHOLE TYPE NQ Diamond Coring COMPILED BY G.D.
 DATUM Geodetic DATE March 29, 2010 CHECKED BY C.N.

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 (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	*N* VALUES			SHEAR STRENGTH kPa					w _p	w	w _L						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE													
180.4 0.0	Ground Surface Sand							20	40	60	80	100						GR	SA	SI	CL
179.6 0.8	(FILL)						180														
	Granitic Gneiss bedrock Slightly weathered High strength Fair to good quality		1	RC NQ	REC 100%		179													RQD 81%	
			2	RC NQ	REC 93%		178													RQD 51%	
			3	RC BQ	REC 97%		177													RQD 84%	
176.1 4.3	End of borehole																				
	* Borehole charged with drilling water																				



RECORD OF BOREHOLE No N9A

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 879.4 N; 221 699.4 E ORIGINATED BY F.P.
 DIST 54 HWY 69 BOREHOLE TYPE Manual Probing COMPILED BY G.D.
 DATUM Geodetic DATE March 31, 2010 CHECKED BY C.N.

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					w _p w w _L			WATER CONTENT (%)	GR	SA		SI	CL			
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE																
180.4	Ground Surface					*																
0.0	Bedrock at surface																					
	* Borehole dry																					



<div style="display: flex; justify-content: space-between;"> RECORD OF BOREHOLE No N10 1 of 1 METRIC </div>																	
G.W.P. 5267-05-01		LOCATION Coords: 5 095 880.8 N; 221 696.2 E				ORIGINATED BY F.P.											
DIST 54 HWY 69		BOREHOLE TYPE NQ Diamond Coring				COMPILED BY G.D.											
DATUM Geodetic		DATE March 29, 2010				CHECKED BY C.N.											
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	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 (%)					
179.6 0.0	Ground Surface Topsoil						20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					W _p — W — W _L 20 40 60					
179.1 0.5	Granitic Gneiss bedrock Slightly weathered High strength Poor to fair becoming excellent quality		1	RC NQ	REC 100%	179											RQD 46%
2			RC NQ	REC 100%	178												RQD 59%
3			RC NQ	REC 100%	177												RQD 93%
176.1 3.5	End of borehole																
* Borehole charged with drilling water																	

RECORD OF BOREHOLE No N11

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 877.7 N; 221 693.5 E ORIGINATED BY F.P.
 DIST 54 HWY 69 BOREHOLE TYPE NQ Diamond Coring COMPILED BY G.D.
 DATUM Geodetic DATE March 29, 2010 CHECKED BY C.N.

SOIL PROFILE			SAMPLES			GROUND WATER * CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT						PLASTIC LIMIT NATURAL MOISTURE 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						w _p	w	w _L		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						WATER CONTENT (%)				
179.5	Ground Surface							20	40	60	80	100						
0.0	Sandy topsoil																	
179.0	(FILL)																	
0.5	Granitic Gneiss bedrock Slightly weathered High strength Fair to excellent quality						179											
			1	RC NQ	REC 100%		178										RQD 66%	
			2	RC NQ	REC 100%		177										RQD 100%	
			3	RC NQ	REC 100%		176									RQD 56%		
175.8	End of borehole																	
3.7																		
	* Borehole charged with drilling water																	

METRIC

20
15 — 5 (%) STRAIN AT FAILURE
10


RECORD OF BOREHOLE No N13

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 881.5 N; 221 701.9 E ORIGINATED BY F.P.
 DIST 54 HWY 69 BOREHOLE TYPE Manual Probing COMPILED BY G.D.
 DATUM Geodetic DATE March 31, 2010 CHECKED BY C.N.

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					w _p	w	w _L	WATER CONTENT (%)	GR	SA		SI	CL		
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE															
179.6	Ground Surface					*															
0.0	Bedrock at surface																				
	* Borehole dry																				


RECORD OF BOREHOLE No N14										1 of 1		METRIC					
G.W.P. 5267-05-01		LOCATION		Coords: 5 095 958.2 N; 221 683.0 E						ORIGINATED BY M.R.							
DIST 54 HWY 69		BOREHOLE TYPE		Rotary Diamond Coring						COMPILED BY G.D.							
DATUM Geodetic		DATE		November 30, 2009						CHECKED BY C.N.							
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS *	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
180.9	Ground Surface																
0.0	Granitic Gneiss bedrock Slightly weathered Medium to high strength Poor becoming fair to good quality		1	RC NQ	REC 90%											RQD 40%	
			2	RC NQ	REC 97%												RQD 86%
			3	RC NQ	REC 100%												RQD 88%
			4	RC NQ	REC 100%												RQD 51%
177.8	End of borehole																
3.1	* Borehole charged with drilling water																

RECORD OF BOREHOLE No N15

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 958.3 N; 221 693.0 E ORIGINATED BY M.R.
DIST 54 HWY 69 BOREHOLE TYPE Rotary Diamond Coring COMPILED BY G.D.
DATUM Geodetic DATE December 01, 2009 CHECKED BY C.N.

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										
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE										
179.3	Ground Surface						20	40	60	80	100							
0.0	Granitic Gneiss bedrock		1	RC NQ	REC 100%		179										RQD 0%	
																	RQD 51%	
																		RQD 93%
																		RQD 55%
176.2	End of borehole																	
3.1																		
	* Borehole charged with drilling water																	

RECORD OF BOREHOLE No N15A

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 955.9 N; 221 693.3 E ORIGINATED BY M.R.
 DIST 54 HWY 69 BOREHOLE TYPE Manual Probing COMPILED BY G.D.
 DATUM Geodetic DATE December 01, 2009 CHECKED BY C.N.


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					w _p w w _L			WATER CONTENT (%)	GR	SA		SI	CL			
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE																
179.1	Ground Surface					*																
0.0	Bedrock at surface																					
	* Borehole dry																					

RECORD OF BOREHOLE No N16

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 959.1 N; 221 687.9 E ORIGINATED BY F.P.
 DIST 54 HWY 69 BOREHOLE TYPE Rotary Diamond Coring COMPILED BY G.D.
 DATUM Geodetic DATE November 19, 2009 CHECKED BY C.N.

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 (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	*N* VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED	● QUICK TRIAXIAL	+	×	FIELD VANE						LAB VANE		
179.9	Ground Surface		1	RC	REC 72%											GR	SA	SI	CL	
0.0	Granitic Gneiss bedrock		2	RC	REC 100%															
	Slightly weathered		3	RC	REC 85%															
	High strength		4	RC	REC 86%															
	Very poor to poor becoming fair to good quality		5	RC	REC 92%															
			6	RC	REC 78%															
				NQ																
176.8	End of borehole																			
3.1																				
	* Borehole charged with drilling water																			

METRIC

20
15 — 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No N18

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 958.5 N; 221 675.2 E ORIGINATED BY M.R.
 DIST 54 HWY 69 BOREHOLE TYPE Manual Probing COMPILED BY G.D.
 DATUM Geodetic DATE December 01, 2009 CHECKED BY C.N.


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					w _p w w _L			WATER CONTENT (%)	GR	SA		SI	CL			
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE																
181.3	Ground Surface					*																
0.0	Bedrock at surface																					
	* Borehole dry																					

RECORD OF BOREHOLE No N19

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 963.0 N; 221 693.7 E ORIGINATED BY M.R.
DIST 54 HWY 69 BOREHOLE TYPE Rotary Diamond Coring COMPILED BY G.D.
DATUM Geodetic DATE November 30, 2009 CHECKED BY C.N.

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 (%)		
								○ UNCONFINED + FIELD VANE										○		
								● QUICK TRIAXIAL × LAB VANE												
179.1	Ground Surface							20	40	60	80	100								
0.0	Granitic Gneiss bedrock Unweathered to slightly weathered Medium to high strength Very poor becoming fair to good (locally poor) quality		1	RC	REC100%		179											RQD 0%		
			2	RC	REC100%													RQD 0%		
			3	RC NQ	REC 100%													RQD 80%		
			4	RC NQ	REC 100%													RQD 28%		
			5	RC NQ	REC 100%													RQD 70%		
176.0	End of borehole						176													
3.1																				
	* Borehole charged with drilling water																			

RECORD OF BOREHOLE No N19A

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 969.8 N; 221 690.0 E ORIGINATED BY M.R.
 DIST 54 HWY 69 BOREHOLE TYPE Manual Probing COMPILED BY G.D.
 DATUM Geodetic DATE December 01, 2009 CHECKED BY C.N.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
180.2	Ground Surface					*											
0.0	Bedrock at surface																
	* Borehole dry																

RECORD OF BOREHOLE No N20

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 985.6 N; 221 675.1 E ORIGINATED BY M.R.
 DIST 54 HWY 69 BOREHOLE TYPE Rotary Diamond Coring COMPILED BY G.D.
 DATUM Geodetic DATE November 13, 2009 CHECKED BY C.N.

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										
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE										
184.1	Ground Surface						20	40	60	80	100							
0.0	Granitic Gneiss bedrock		1	RC NQ	REC 100%		184										RQD 100%	
	Slightly weathered		2	RC	REC 100%		183											RQD 100%
	High strength		3	RC NQ	REC 100%													RQD 100%
	Excellent becoming fair quality		4	RC NQ	REC 94%		182											RQD 67%
181.0	End of borehole						181											
3.1																		
	* Borehole charged with drilling water																	

RECORD OF BOREHOLE No N20A

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 984.2 N; 221 675.3 E ORIGINATED BY M.R.
 DIST 54 HWY 69 BOREHOLE TYPE Manual Probing COMPILED BY G.D.
 DATUM Geodetic DATE December 01, 2009 CHECKED BY C.N.

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					w _p w w _L			WATER CONTENT (%)	GR	SA		SI	CL			
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE																
183.6	Ground Surface					*																
0.0	Bedrock at surface																					
	* Borehole dry																					

RECORD OF BOREHOLE No N21

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 984.5 N; 221 689.2 E ORIGINATED BY F.P.
 DIST 54 HWY 69 BOREHOLE TYPE Rotary Diamond Coring COMPILED BY G.D.
 DATUM Geodetic DATE November 18, 2009 CHECKED BY C.N.

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 (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	*N* VALUES			SHEAR STRENGTH kPa															
								○ UNCONFINED + FIELD VANE				● QUICK TRIAXIAL × LAB VANE									WATER CONTENT (%)		
184.9	Ground Surface							20	40	60	80	100							GR	SA	SI	CL	
0.0	Granitic Gneiss bedrock		1	RC	REC 100%																	RQD 100%	
	Slightly weathered		2	RC NQ	REC 100%																	RQD 100%	
	High strength		3	RC	REC 100%																	RQD 0%	
	Excellent (locally very poor to poor) becoming good to fair quality		4	RC	REC 100%																	RQD 34%	
			5	RC NQ	REC 100%																	RQD 100%	
			6	RC NQ	REC 97%																		RQD 86%
			7	RC	REC 100%																		RQD 67%
181.8	End of borehole																						
3.1																							
	* Borehole charged with drilling water																						

RECORD OF BOREHOLE No N21A

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 986.1 N; 221 691.2 E ORIGINATED BY M.R.
 DIST 54 HWY 69 BOREHOLE TYPE Manual Probing COMPILED BY G.D.
 DATUM Geodetic DATE December 01, 2009 CHECKED BY C.N.

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					w _p w w _L			WATER CONTENT (%)	GR	SA		SI	CL			
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE																
185.6	Ground Surface					*																
0.0	Bedrock at surface																					
	* Borehole dry																					

RECORD OF BOREHOLE No N22

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 992.8 N; 221 683.2 E ORIGINATED BY F.P.
 DIST 54 HWY 69 BOREHOLE TYPE Rotary Diamond Coring COMPILED BY G.D.
 DATUM Geodetic DATE November 16, 2009 CHECKED BY C.N.

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 (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	*N* VALUES			SHEAR STRENGTH kPa											WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE													
187.5	Ground Surface					*		20	40	60	80	100					GR	SA	SI	CL	
0.0	Granitic Gneiss bedrock		1	RC NQ	REC 100%		187												RQD 100%		
	Slightly weathered to unweathered		2	RC NQ	REC 98%		186												RQD 98%		
	High strength		3	RC NQ	REC 100%		185												RQD 79%		
	Excellent to good quality		4	RC NQ	REC 89%														RQD 89%		
184.4	End of borehole																				
3.1																					
	* Borehole charged with drilling water																				

RECORD OF BOREHOLE No N22A

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 987.7 N; 221 683.7 E ORIGINATED BY M.R.
 DIST 54 HWY 69 BOREHOLE TYPE Manual Probing COMPILED BY G.D.
 DATUM Geodetic DATE December 01, 2009 CHECKED BY C.N.

SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa					W _p W W _L			WATER CONTENT (%)				GR	SA	SI	CL		
						○ UNCONFINED			+	FIELD VANE	● QUICK TRIAXIAL	×	LAB VANE										
185.7	Ground Surface					*																	
0.0	Bedrock at surface																						
	* Borehole dry																						

RECORD OF BOREHOLE No N23

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 985.8 N; 221 681.1 E ORIGINATED BY M.R.
 DIST 54 HWY 69 BOREHOLE TYPE Manual Probing COMPILED BY G.D.
 DATUM Geodetic DATE December 01, 2009 CHECKED BY C.N.

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					w _p w w _L			WATER CONTENT (%)	GR	SA		SI	CL			
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE																
186.9	Ground Surface					*																
0.0	Bedrock at surface																					
	* Borehole dry																					

RECORD OF BOREHOLE No N24

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 988.8 N; 221 674.8 E ORIGINATED BY M.R.
 DIST 54 HWY 69 BOREHOLE TYPE Manual Probing COMPILED BY G.D.
 DATUM Geodetic DATE December 01, 2009 CHECKED BY C.N.

SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	SHEAR STRENGTH kPa					W _p W W _L			WATER CONTENT (%)	kN/m ³	GR		SA	SI	CL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
184.9	Ground Surface					*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			</

RECORD OF BOREHOLE No N24A

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 990.5 N; 221 676.3 E ORIGINATED BY M.R.
 DIST 54 HWY 69 BOREHOLE TYPE Manual Probing COMPILED BY G.D.
 DATUM Geodetic DATE December 01, 2009 CHECKED BY C.N.

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					w _p w w _L			WATER CONTENT (%)	GR	SA		SI	CL			
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE																
186.3	Ground Surface					*																
0.0	Bedrock at surface																					
	* Borehole dry																					

RECORD OF BOREHOLE No N24B

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 987.3 N; 221 674.9 E ORIGINATED BY M.R.
 DIST 54 HWY 69 BOREHOLE TYPE Manual Probing COMPILED BY G.D.
 DATUM Geodetic DATE December 01, 2009 CHECKED BY C.N.


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					w _p w w _L			WATER CONTENT (%)	GR	SA		SI	CL			
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE																
184.4	Ground Surface					*																
0.0	Bedrock at surface																					
	* Borehole dry																					

RECORD OF BOREHOLE No N25

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 990.8 N; 221 692.4 E ORIGINATED BY F.P.
 DIST 54 HWY 69 BOREHOLE TYPE Rotary Diamond Coring COMPILED BY G.D.
 DATUM Geodetic DATE November 17, 2009 CHECKED BY C.N.

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										
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE										
188.1 0.0	Ground Surface Granitic Gneiss bedrock Slightly weathered High strength Fair (locally poor) becoming good quality		1	RC NQ	REC 100%		188										RQD 66%	
			2	RC NQ	REC 100%		187											RQD 39%
			3	RC NQ	REC 98%		186											RQD 63%
			4	RC NQ	REC 98%		185											RQD 89%
184.8 3.3	End of borehole																	
	* Borehole charged with drilling water																	

RECORD OF BOREHOLE No N25A

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 990.6 N; 221 690.7 E ORIGINATED BY M.R.
 DIST 54 HWY 69 BOREHOLE TYPE Manual Probing COMPILED BY G.D.
 DATUM Geodetic DATE December 01, 2009 CHECKED BY C.N.

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					w _p w w _L			WATER CONTENT (%)	GR	SA		SI	CL			
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE																
187.7	Ground Surface					*																
0.0	Bedrock at surface																					
	* Borehole dry																					

METRIC

20
15 — 5 (%) STRAIN AT FAILURE
10

METRIC

20
15 — 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No APS-N1

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 844.3 N; 221 688.6 E ORIGINATED BY F.P.
 DIST 54 HWY 69 BOREHOLE TYPE Manual Probing COMPILED BY G.D.
 DATUM Geodetic DATE March 31, 2010 CHECKED BY C.N.

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					w _p w w _L			WATER CONTENT (%)	GR	SA		SI	CL		
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE															
185.0	Ground Surface					*															
0.0	Bedrock at surface																				
	* Borehole dry																				

RECORD OF BOREHOLE No APS-N3

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 854.3 N; 221 687.4 E ORIGINATED BY F.P.
 DIST 54 HWY 69 BOREHOLE TYPE Manual Probing COMPILED BY G.D.
 DATUM Geodetic DATE March 31, 2010 CHECKED BY C.N.

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					w _p w w _L			WATER CONTENT (%)	GR	SA		SI	CL			
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE																
184.4	Ground Surface					*																
0.0	Bedrock at surface																					
	* Borehole dry																					

METRIC


20
15 — 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No APS-N5

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 851.6 N; 221 711.9 E ORIGINATED BY F.P.
 DIST 54 HWY 69 BOREHOLE TYPE Continuous Flight Solid Stem Augers COMPILED BY G.D.
 DATUM Geodetic DATE March 31, 2010 CHECKED BY C.N.

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											
181.1	Ground Surface					*	181	<div><div>20406080100</div><div>○ UNCONFINED + FIELD VANE</div><div>● QUICK TRIAXIAL × LAB VANE</div></div>					<div><div>204060</div><div>WATER CONTENT (%)</div></div>					kN/m ³	GR SA SI CL
0.0	Sand, trace gravel cobbles and boulders																		
180.5	(FILL)																		
0.6	End of borehole Refusal on probable bedrock																		
	* Borehole dry																		

RECORD OF BOREHOLE No APN-N1

1 of 1

METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 979.3 N; 221 675.9 E ORIGINATED BY M.R.
 DIST 54 HWY 69 BOREHOLE TYPE Manual Probing COMPILED BY G.D.
 DATUM Geodetic DATE December 01, 2009 CHECKED BY C.N.

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									
181.3	Ground Surface	• •						20	40	60	80	100					
0.0	Sand, some silt	• •					181										
181.0	Brown	• •															
0.3	End of borehole																
	Refusal on probable bedrock																
	* Borehole dry																

RECORD OF BOREHOLE No APN-N2 1 of 1 METRIC

G.W.P. 5267-05-01 LOCATION Coords: 5 095 980.3 N; 221 684.5 E ORIGINATED BY M.R.
 DIST 54 HWY 69 BOREHOLE TYPE Manual Probing COMPILED BY G.D.
 DATUM Geodetic DATE December 01, 2009 CHECKED BY C.N.

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					w _p w w _L			WATER CONTENT (%)	GR	SA		SI	CL			
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE																
181.7	Ground Surface					*																
0.0	Boulders at surface																					
	* Borehole dry																					

METRIC

20
15 — 5 (%) STRAIN AT FAILURE
10

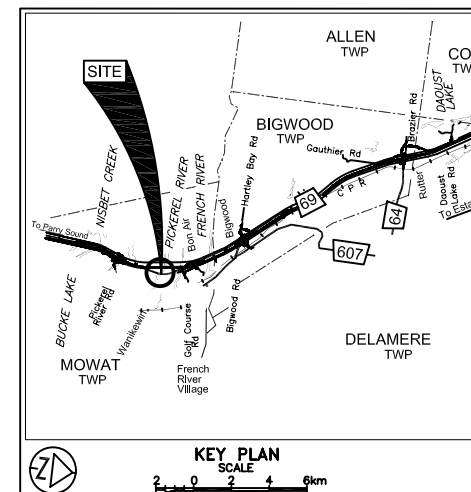
CONT No
WP No 5267-05-01

PICKEREL RIVER NBL BRIDGE
HIGHWAY 69
BOREHOLE LOCATIONS AND SOIL STRATA



SHEET

PML Peto MacCallum Ltd.
CONSULTING ENGINEERS



LEGEND

- Borehole
- Dynamic Cone Penetration Test (Cone)
- Borehole & Cone
- N Blows/0.3m (Std. Pen Test, 475 J/blow)
- CONE Blows/0.3m (60 Cone, 475 J/blow)
- W L at time of investigation: Nov-Dec 2009 and March 2010
- * Water level not established
- Head
- ARTESIAN WATER Encountered
- PIEZOMETER

BH No	ELEVATION	CO-ORDINATES	
		NORTHINGS	EASTINGS
N1	185.5	5 095 828.8	221 702.2
N2	183.5	5 095 847.7	221 693.2
N3	180.9	5 095 849.5	221 708.6
N4	182.1	5 095 850.7	221 699.7
N4A	182.2	5 095 850.7	221 703.5
N5	182.0	5 095 850.7	221 695.9
N6	181.9	5 095 851.4	221 692.8
N7	180.8	5 095 853.0	221 706.7
N8	179.8	5 095 877.2	221 691.3
N9	180.4	5 095 878.5	221 702.3
N9A	180.4	5 095 879.4	221 699.4
N10	179.6	5 095 880.8	221 696.2

(Legend Continues)

- NOTE -

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

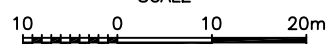
REVISIONS	DATE	BY	DESCRIPTION
Geocres No. 41H-89			
HWY No	69	CHECKED	GD
SUB'D	MN	DATE	FEB. 03, 2010
APPROVED	BRG	DIST	54
DRAWN	NA	SITE	44-429/1
		DWG	PRN-1

MRC Drawings: S6454-328-002BH.dwg;
dated October 2009



PLAN

SCALE



PROFILE

SCALE



(Legend Continued)

BH No	ELEVATION	CO-ORDINATES	
		NORTHINGS	EASTINGS
N25A	187.7	5 095 990.6	221 690.7
N25B	188.6	5 095 992.3	221 688.0
N26	199.5	5 096 009.6	221 681.1
APS-N1	185.0	5 095 844.3	221 688.6
APS-N2	181.1	5 095 847.1	221 712.4
APS-N3	184.4	5 095 854.3	221 687.4
APS-N4	180.9	5 095 857.1	221 711.3
APS-N5	181.1	5 095 851.6	221 711.9
APN-N1	181.3	5 095 979.3	221 675.9
APN-N2	181.7	5 095 980.3	221 684.5
APN-N3	181.7	5 095 981.1	221 691.8

(Legend Continued)

BH No	ELEVATION	CO-ORDINATES	
		NORTHINGS	EASTINGS
N20	184.1	5 095 985.6	221 675.1
N20A	183.6	5 095 984.2	221 675.3
N21	184.9	5 095 984.5	221 689.2
N21A	185.6	5 095 986.1	221 691.2
N22	187.5	5 095 992.8	221 683.2
N22A	185.7	5 095 987.7	221 683.7
N23	186.9	5 095 985.8	221 681.1
N24	184.9	5 095 988.8	221 674.8
N24A	186.3	5 095 990.5	221 676.3
N24B	184.4	5 095 987.3	221 674.9
N25	188.1	5 095 990.8	221 692.4

(Legend Continues)

(Legend Continued)

BH No	ELEVATION	CO-ORDINATES	
		NORTHINGS	EASTINGS
N11	179.5	5 095 879.0	221 693.2
N12	179.5	5 095 880.2	221 690.9
N13	179.6	5 095 881.5	221 701.9
N14	180.9	5 095 958.2	221 683.0
N15	179.3	5 095 958.3	221 693.0
N15A	179.1	5 095 955.9	221 693.3
N16	179.9	5 095 959.1	221 687.9
N17	180.6	5 095 958.8	221 685.2
N18	181.3	5 095 958.5	221 675.2
N19	179.1	5 095 963.0	221 693.7
N19A	180.2	5 095 969.8	221 690.0

(Legend Continues)

NOTES:

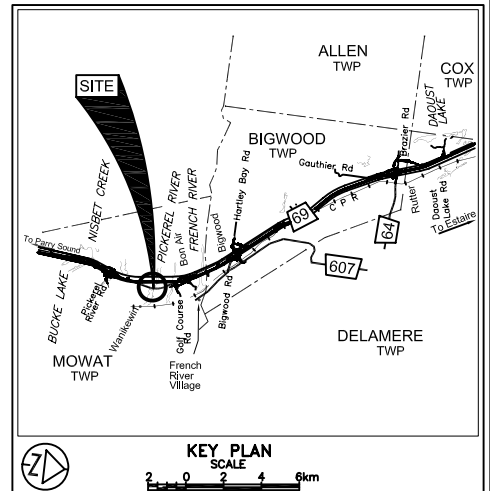
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT AND RECORD OF BOREHOLE LOGS.
- REFER TO DRAWING PRN-2 FOR SECTIONS A-A, B-B, C-C AND D-D.
- THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION.
- DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.

CONT No
WP No 5267-05-01

PICKEREL RIVER NBL BRIDGE
HIGHWAY 69
SOIL STRATA

SHEET

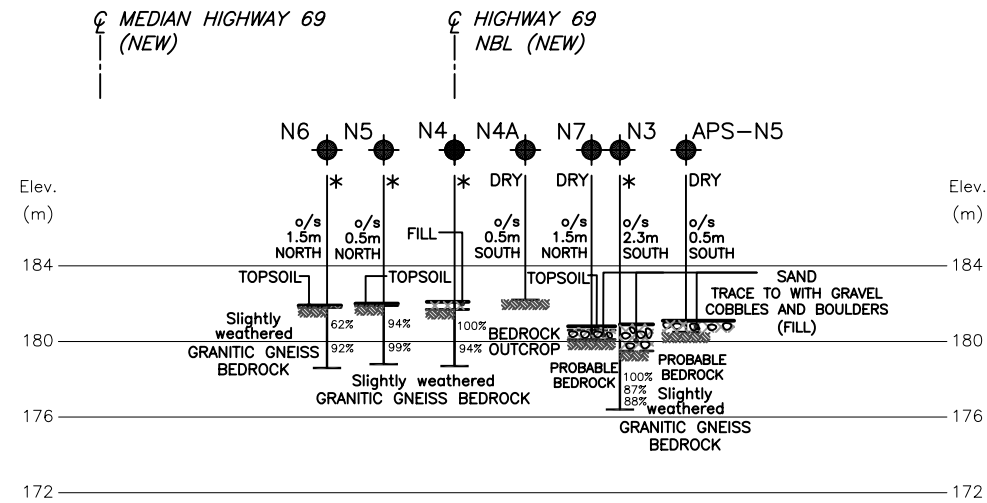
PML Peto MacCallum Ltd.
CONSULTING ENGINEERS



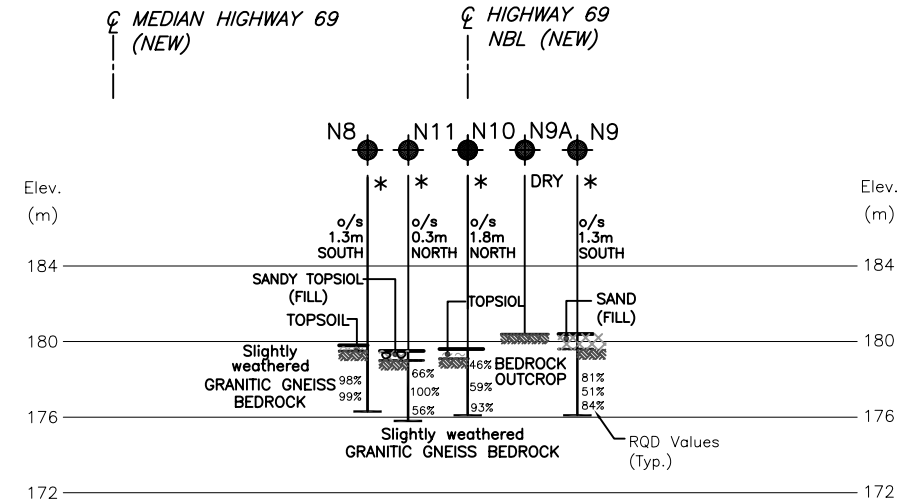
LEGEND			
	Borehole		
	Dynamic Cone Penetration Test (Cone)		
	Borehole & Cone		
N	Blows/0.3m (Std. Pen Test, 475 J/blow)		
CONE	Blows/0.3m (60 Cone, 475 J/blow)		
W L	W L at time of investigation: Nov-Dec 2009 and March 2010		
*	Water level not established		
▽	Head		
▽	ARTESIAN WATER		
---	Encountered		
	PIEZOMETER		
BH No	ELEVATION	CO-ORDINATES	
		NORTHINGS	EASTINGS
SEE DRAWING PRN-1 FOR DETAILS.			

— NOTE —
The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.

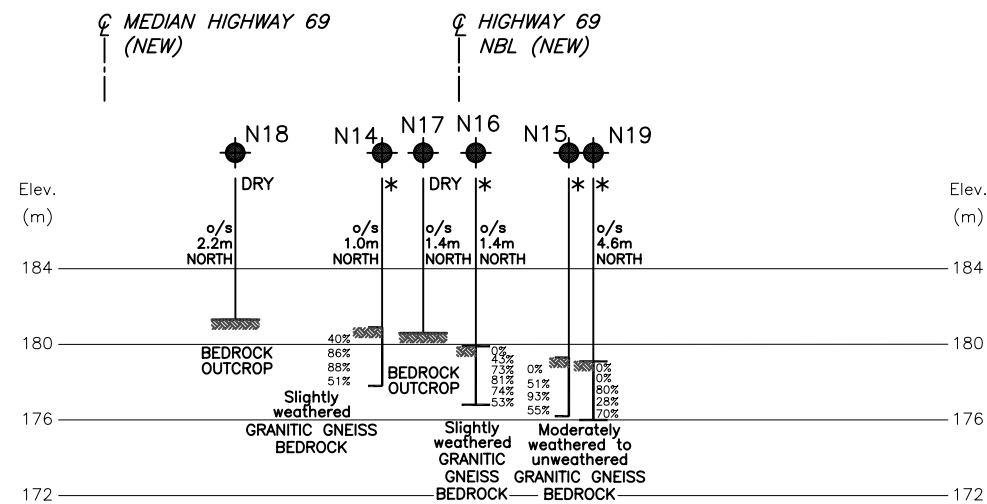
REVISIONS									
	DATE	BY	DESCRIPTION						
Geocres No. 41H-89									
HWY No		69						DIST	54
SUBM'D		MN	CHECKED	GD	DATE FEB. 03, 2010		SITE		44-429/1
DRAWN		NA	CHECKED	CN	APPROVED BRG		DWG		PRN-2



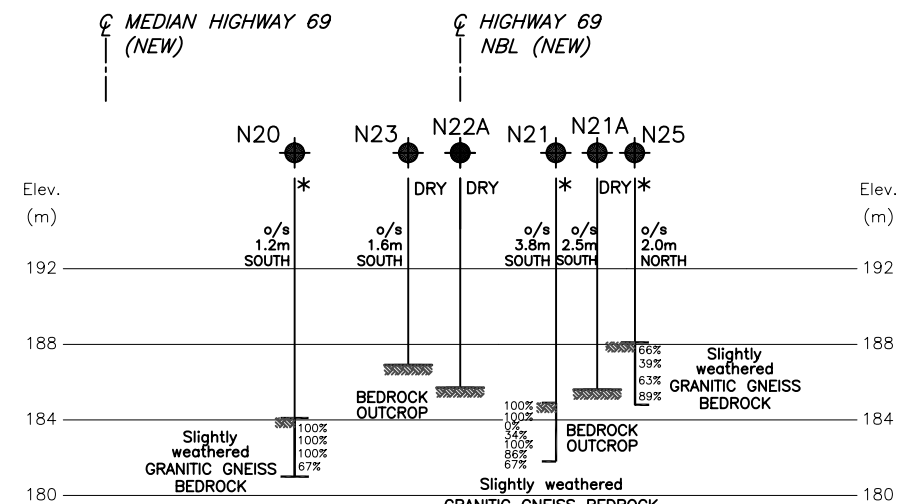
SECTION A - A



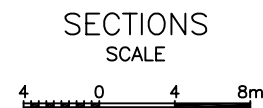
SECTION B - B



SECTION C - C



SECTION D - D



NOTES:

- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT AND RECORD OF BOREHOLE LOGS.
- REFER TO DRAWING PRN-1 FOR BOREHOLE LOCATIONS PLAN AND CENTRELINE PROFILE.
- THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. SURFACE DETAILS AND FEATURES ARE FOR CONCEPTUAL ILLUSTRATION.
- DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.



MRC Drawings: S6454-328-002BH.dwg;
dated October 2009



APPENDIX A

Site Photographs



Photograph 1: South pier, facing northeast



Photograph 2: Looking north at north pier and north abutment



Photograph 3: North pier, facing southwest

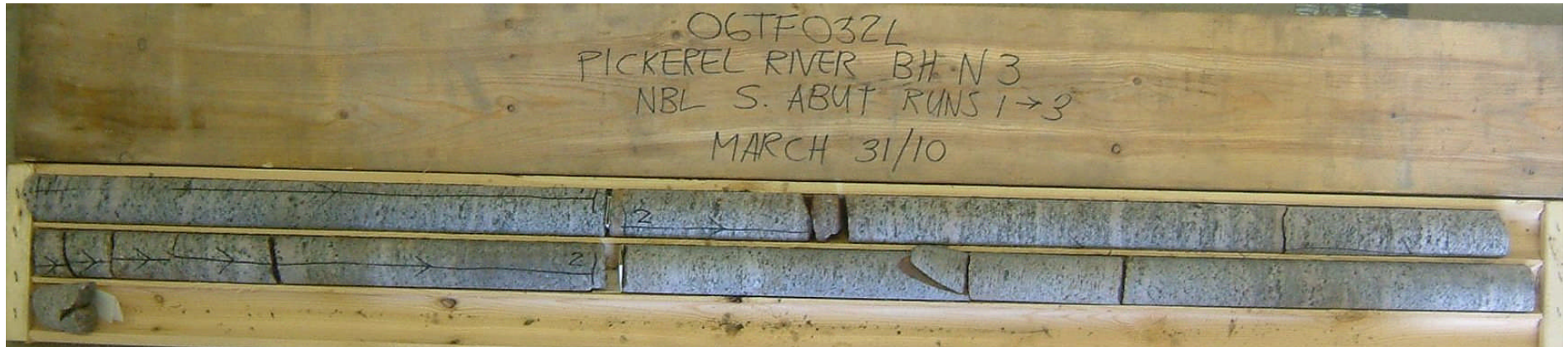


Photograph 4: North pier, facing east



APPENDIX B

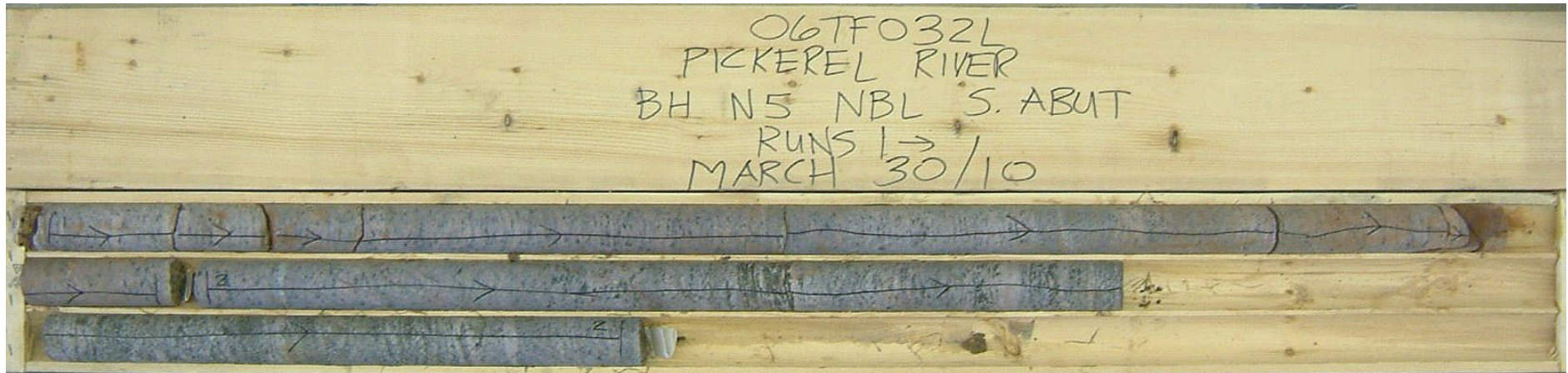
Rock Core Photographs



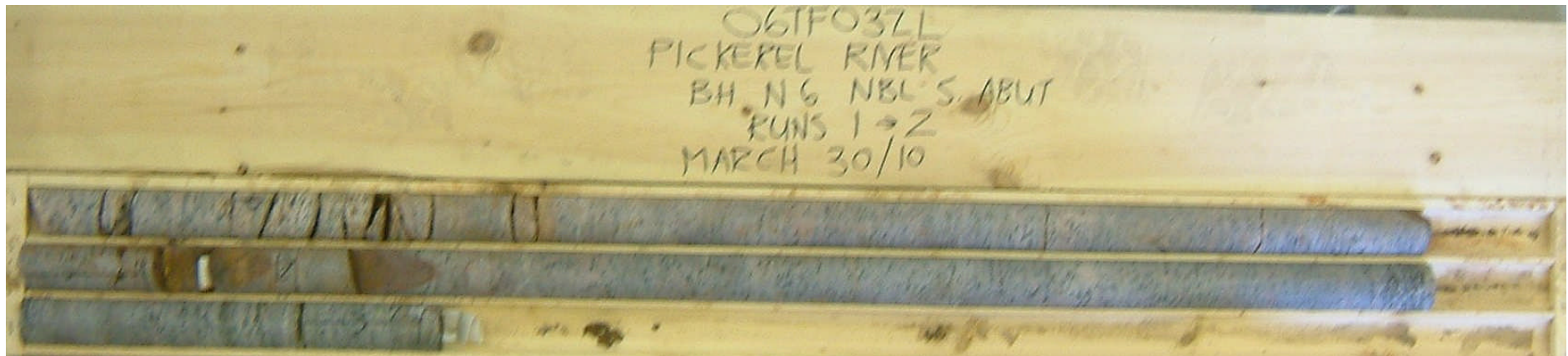
Photograph 1: Borehole N3, samples RC-1 to RC-3 from 1.4 to 4.5 m depth. The RQD values ranged from 87 to 100%, indicating good to excellent quality bedrock.



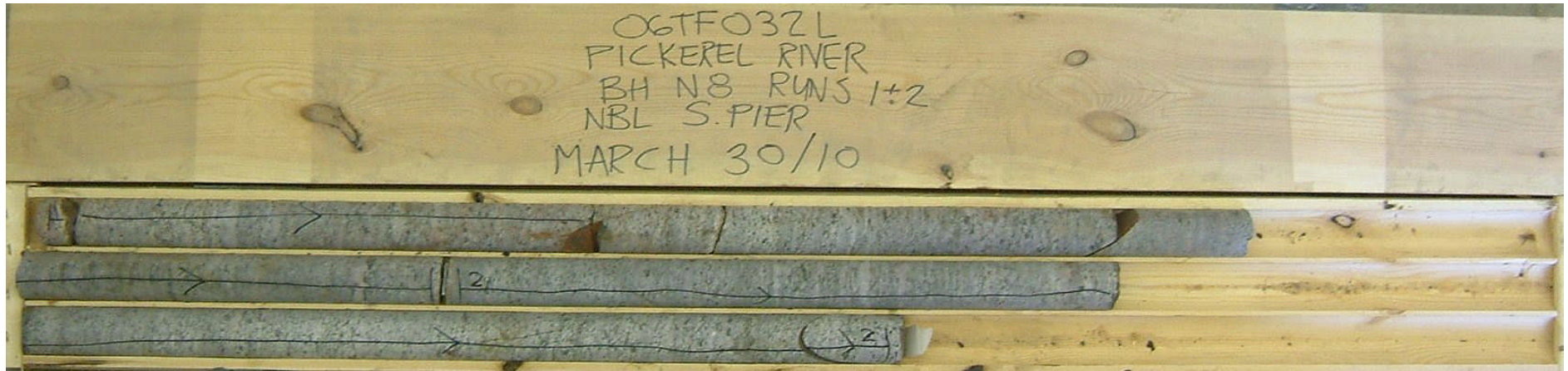
Photograph 2: Borehole N4, samples RC-1 and RC-2 from 0.4 to 3.4 m depth. The RQD values were 94 and 100%, indicating excellent quality bedrock.



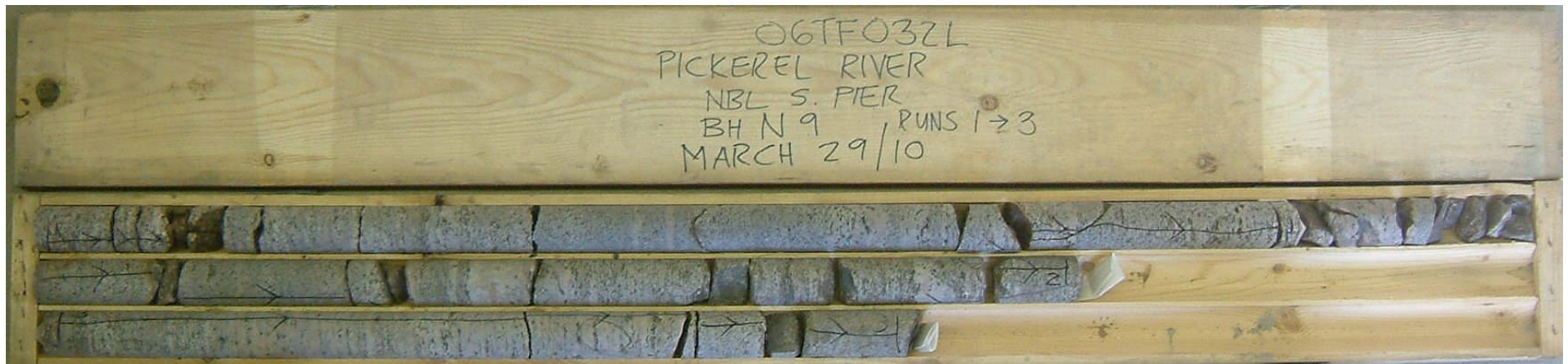
Photograph 3: Borehole N5, samples RC-1 and RC-2 from 0.1 to 3.2 m depth. The RQD values were 94 and 99%, indicating excellent quality bedrock.



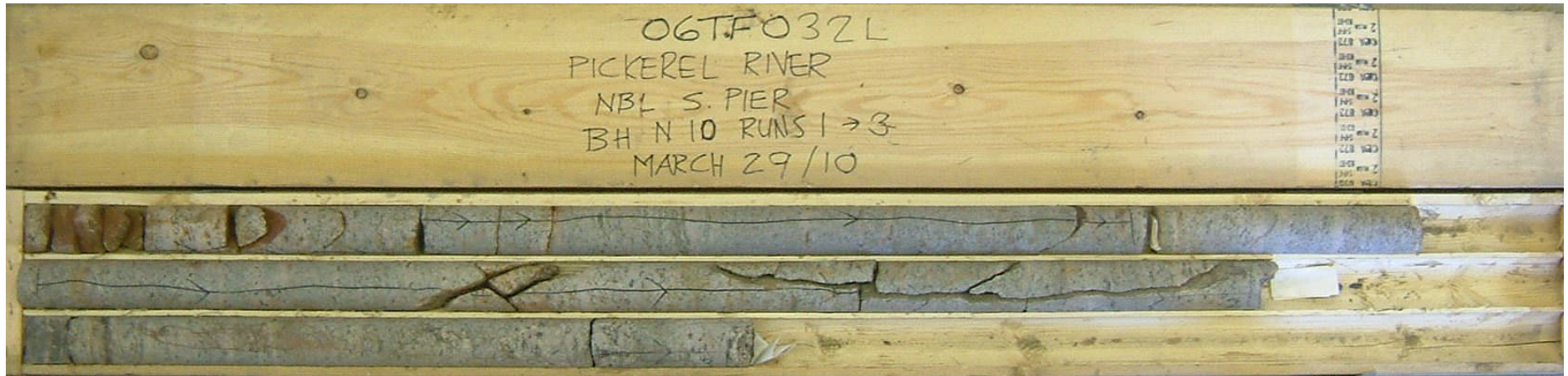
Photograph 4: Borehole N6, samples RC-1 and RC-2 from 0.1 to 3.3 m depth. The RQD values were 62 and 92% – very poor quality to 0.6 m depth, becoming excellent quality bedrock.



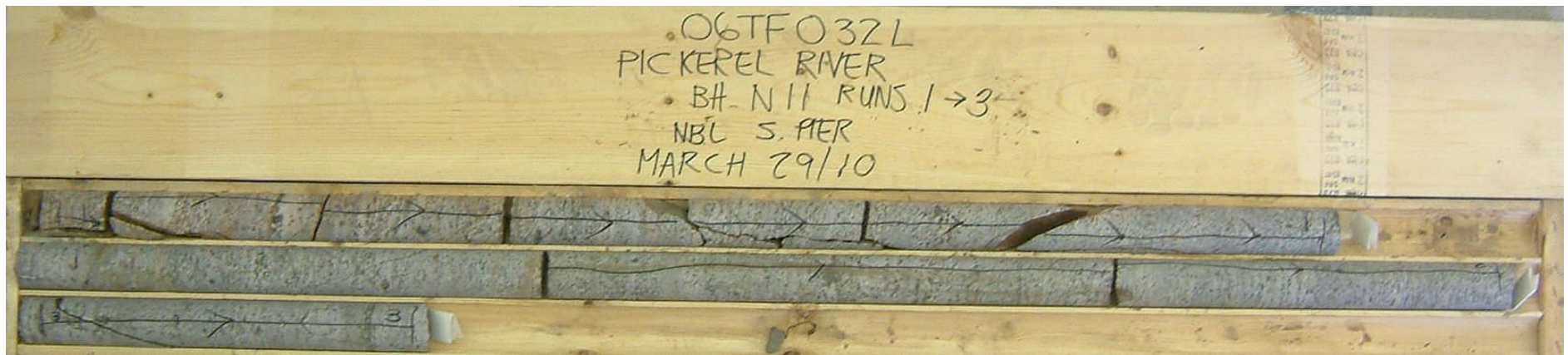
Photograph 5: Borehole N8, samples RC-1 and RC-2 from 0.3 to 3.5 m depth. The RQD values were 98 and 99%, indicating excellent quality bedrock.



Photograph 6: Borehole N9, samples RC-1 to RC-3 from 0.8 to 4.3 m depth. The RQD values ranged from 51 to 84%, indicating fair to good quality bedrock.



Photograph 7: Borehole N10, samples RC-1 to RC-3 from 0.5 to 3.5 m depth. The RQD values ranged from 46 to 93%, indicating poor to fair becoming excellent quality bedrock.



Photograph 8: Borehole N11, samples RC-1 to RC-3 from 0.5 to 3.7 m depth. The RQD values ranged from 56 to 100%, indicating fair to excellent quality bedrock.



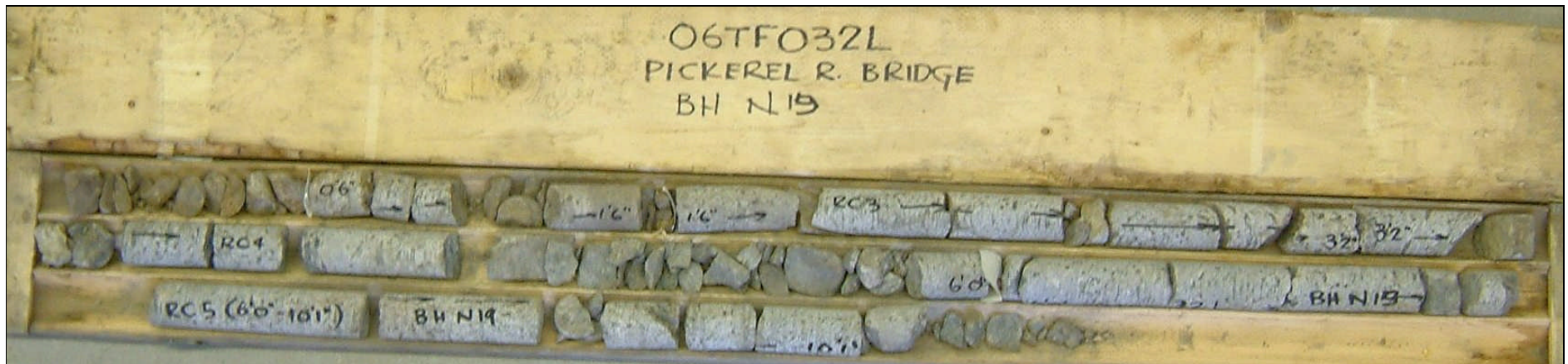
Photograph 9: Borehole N14, samples RC-1 to RC-4 from 0.0 to 3.1 m depth. The RQD values ranged from 40 to 88%, indicating poor becoming fair to good quality bedrock.



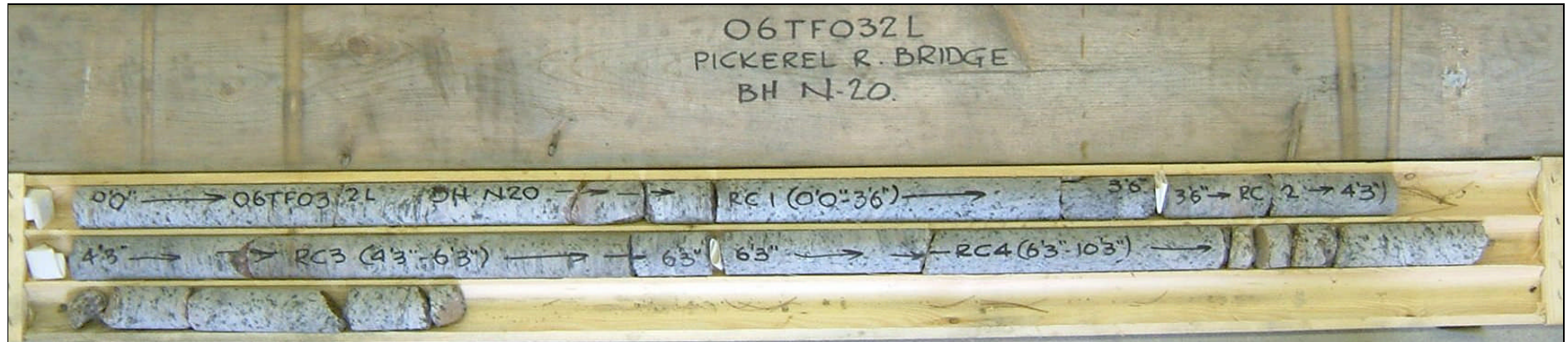
Photograph 10: Borehole N15, samples RC-1 to RC-4 from 0.0 to 3.1 m depth. The RQD values ranged from 0 to 93%, indicating very poor becoming fair (locally excellent) quality bedrock.



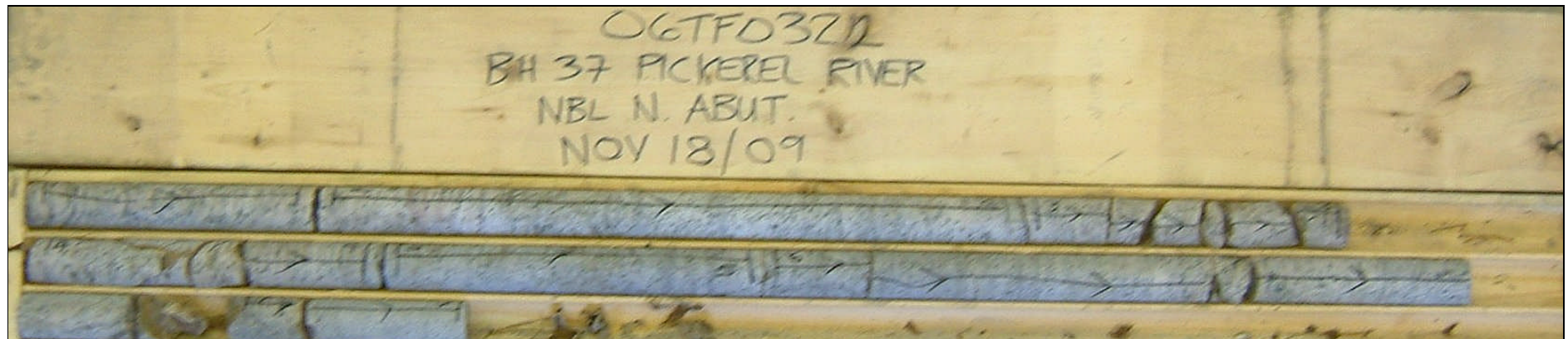
Photograph 11: Borehole N16, samples RC-1 to RC-6 from 0.0 to 3.1 m depth. The RQD values ranged from 0 to 81%, indicating very poor to poor becoming fair to good quality bedrock.



Photograph 12: Borehole N19, samples RC-1 to RC-5 from 0.0 to 3.1 m depth. The RQD values ranged from 0 to 80%, indicating very poor becoming fair to good (locally poor) quality bedrock.



Photograph 13: Borehole N20, samples RC-1 to RC-4 from 0.0 to 3.1 m depth. The RQD values ranged from 67 to 100%, indicating excellent becoming fair quality bedrock.



Photograph 14: Borehole N21, samples RC-1 to RC-7 from 0.0 to 3.1 m depth. The RQD values ranged from 0 to 100%, indicating excellent (locally very poor to poor) becoming good to fair quality bedrock.



Photograph 15: Borehole N22, samples RC-1 to RC-4 from 0.0 to 3.1 m depth. The RQD values ranged from 79 to 100%, indicating excellent to good quality bedrock.



Photograph 16: Borehole N25, samples RC-1 to RC-4 from 0.0 to 3.3 m depth. The RQD values ranged from 39 to 89%, indicating fair (locally poor) becoming good quality bedrock.