


APPENDIX B

**UMA ENGINEERING LTD.
BEDROCK INVESTIGATION AND
TEST CAISSON REPORT
OCTOBER 2005**



**Stantec Consulting
Bedrock Investigation and Test Caisson
Kenaston Underpass Project
Winnipeg, Manitoba**

Prepared by:

UMA Engineering Ltd.
1479 Buffalo Place
Winnipeg, MB. R3T 1L7

This Study has been prepared by UMA Engineering Ltd. ("UMA") for the benefit of the client to whom it is addressed. The information and data contained herein represent UMA's best professional judgement in light of the knowledge and information available to UMA at the time of preparation. Except as required by law, this Study and the information and data contained herein are to be treated as confidential and may be used and relied upon only by the client, its officers and employees. UMA denies any liability whatsoever to other parties who may obtain access to this Study for any injury, loss or damage suffered by such parties arising from their use of, or reliance upon, this Study or any of its contents without the express written consent of UMA and the client.

11 October 2005

Table of Contents

1.0	Introduction.....	1
2.0	Bedrock Drilling and Test Caisson.....	1
3.0	Laboratory Assessments and Testing	2
4.0	Subsurface Conditions	2
	4.1 Bedrock Conditions	2
	4.2 Test Caisson	3
	4.3 Groundwater.....	3
5.0	Closure	3

List of Appendices

Appendix A
Test Hole Information

1.0 Introduction

As authorized by Stantec Consulting, acting on behalf of their client, The City of Winnipeg, UMA Engineering Limited (UMA) completed geotechnical investigations for the Kenaston Underpass Project in Winnipeg, Manitoba. Two investigations were completed at the site by UMA. The first investigation focused on the overburden soil conditions, but also included one core hole into bedrock. Based on that information, a generalized geotechnical investigation report dated March 2005 was issued. Stantec had concluded from both a technical and economical perspective, that an additional investigation was justified in order to identify bedrock conditions for the design and construction of rock socketed foundations for the rail bridge. As a result, a further bedrock investigation, consisting of bedrock coring and a test caisson program was conducted to supplement the existing information.

The purpose of the geotechnical investigations was to determine the soil, bedrock and groundwater conditions at the bridge location, and on that basis, provide geotechnical recommendations for the design and construction of rock socketed caissons for the rail bridge.

Recommendations for the design and construction of rock socketed caissons for the rail bridge have been provided under separate cover. The purpose of this study is to provide the result of the core hole drilling and test caisson for tendering information purposes.

2.0 Bedrock Drilling and Test Caisson

The initial investigation conducted in December of 2004 included one test hole (TH-04-42) which included rock coring into the underlying bedrock. Between 11 and 25 August 2005, a total of four test holes (63 mm diameter) were advanced into bedrock by rock coring at selected locations near the proposed rail bridge (TH-05-01 to TH-05-04). The placement of the test holes was largely restricted as a result of the existing roadways, railways and services. All test hole drilling was completed by Paddock Drilling Ltd. of Brandon, Manitoba under the supervision of a representative of UMA.

In addition to the test holes, one 710 mm diameter test caisson was advanced adjacent to TH-05-02. The test caisson was completed by Subterranean (Manitoba) Ltd. under the supervision of a representative of UMA.

Test Hole TH-04-42 was advanced north of Wilkes and west of Kenaston. Bedrock was confirmed at a depth of about 20 m from grade and the core hole was advanced to a depth of about 37 m where drilling was terminated.

Test Hole TH-05-01 was completed north of the CN Tracks and west of Kenaston. Bedrock was confirmed at a depth of about 18.8 m from grade and the core hole was advanced to a depth of about 30.5 m where drilling was terminated.

Test Hole TH-05-02 was advanced south of the CN Tracks and west of Kenaston. Bedrock was confirmed at a depth of about 20 m from grade and the core hole was advanced to a depth of about 35 m where drilling was terminated in the limestone bedrock.

The test caisson was advanced immediately adjacent to TH-05-02. Consistent with TH-05-02, the bedrock contact was identified at a depth of about 20.1 m. The test caisson was advanced to a depth of about 30.5 m where drilling was terminated. Two pump test were completed at depths of about 23 and 30.5 m.

Test Hole TH-05-03 was completed north of the CN Tracks on the median of Kenaston Boulevard. Bedrock was identified at a depth of about 19.7 m from grade and the core hole was advanced to a depth of about 35 m where drilling was terminated.

Test Hole TH-05-04 was advanced south of the CN Tracks and east of Kenaston. Bedrock was confirmed at a depth of about 19.5 m from grade and the core hole was advanced to a depth of about 30.5 m where drilling was terminated in the limestone bedrock.

All bedrock observed during drilling of the core holes and test caissons was visually classified on site by UMA's site representative. Continuous rock core samples were collected at the core holes. The rock cores collected were retained in wooden core boxes and transported to UMA's Winnipeg laboratory for detailed examination and testing.

3.0 Laboratory Assessments and Testing

The soil and rock core samples transported to the laboratory were visually examined by UMA's Project Engineer in order to supplement and confirm the field classifications. The Recovery and Rock Quality Designation (RQD) was determined for each core run and has been reported on the test hole logs. Uniaxial compressive strength testing was completed on several samples of the bedrock cores collected. The results of the uniaxial compressive strength testing have been included on the test hole logs opposite the appropriate sample depths.

4.0 Subsurface Conditions

4.1 Bedrock Conditions

Carbonate (limestone) bedrock was identified at depths that varied between about 19 and 20 m below ground surface. The conditions of the bedrock at this location are not in some characteristics typical of the Winnipeg area. The bedrock has been observed to consist of an upper rock mass which is comprised of a weathered limestone and a lower rock mass which is comprised of a strong massive limestone. The two layers of bedrock are separated by a 300 to 900 mm thick infilling of clayey silt.

The upper rock mass is generally weathered, mottled yellow and grey, weak to medium strong with small pits and vugs. The upper 300 to 900 mm of the bedrock is generally highly fractured and disturbed. Core recovery in the upper rock mass was generally greater than 90%. The average RQD in the upper rock mass was about 55% and the uniaxial compressive strength ranged between about 38 and 100 MPa.

At a depth of about 25 to 27 m, a 300 to 900 mm thick infilling of clayey silt was identified at all of the test hole locations. While bedding planes infilled with silt and clay are common within the limestone bedrock in the Winnipeg area, it is uncommon to find this thickness of infilling as a stratigraphic unit between bedrock zones .

The lower rock mass generally consists of a massive intact white limestone that is strong to very strong. Core recovery in the lower rock mass was generally greater than 90%, with the exception of some cores that extended below about 30 m. The average RQD in the lower rock mass was about 70% and the uniaxial compressive strength ranged between about 45 and 180 MPa.

4.2 Test Caisson

The test caisson was advanced using a 710 mm core barrel. Core recovery during the test caisson was excellent and no chopping of the bedrock was required to advance the caisson. As a result of the large size of the core barrel and the low speed of coring, the recovered rock cores were generally intact and appeared much better than the cores obtained from the small diameter core holes.

The caisson was visually examined between a depth of about 20.6 and 22.9 m from grade. Between this depth, the bedrock was observed to be weathered, pitted and vuggy. The limestone was weak to medium strong and while fractures were present, they were very tight.

Bedding planes about 150 mm thick and infilled with silt were identified within the test caisson at depths of about 25 and 30 m.

4.3 Groundwater

Pumping rates were measured during the test caisson advancement at two depths. At a depth of about 23 m, seepage was only observed from behind the sleeve and the inflow of groundwater was about 0.4 l/s (7 gpm). At a depth of about 30.5 m the inflow of groundwater was about 3.1 l/s (50 gpm).

5.0 Closure

The findings of this study were based on the results of field and laboratory investigations, combined with an interpolation of soil, bedrock and groundwater conditions between core hole locations and the test caisson. The information provided within this study is provided for bidding purposes only. The contractor should form their own opinion of the site conditions based on the information provided within. It should be appreciated that conditions can be expected to vary across the site.

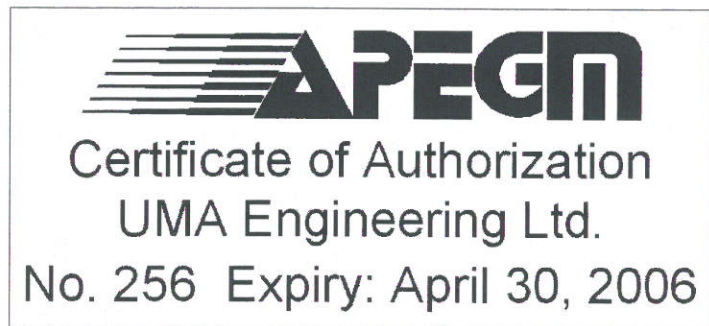
Respectfully Submitted,

UMA Engineering Ltd.

Reviewed by:

Giovanni Militano, M.Sc., P. Eng.
Geotechnical Engineer

W.R. (Bill) Wiesner, M.Sc., P. Eng.
Senior Geotechnical Engineer



Appendix A

Test Hole Information

PROJECT: Kenaston Underpass - CN Bridge	CLIENT: Stantec Consulting	TESTHOLE NO: Test Caisson
LOCATION: South of CN, West of Kenaston. Adjacent to TH05-02		PROJECT NO.: 4231-040-09
CONTRACTOR: Subterranean	METHOD: SoilMec R312-HD - 710 mm Socket	ELEVATION (m):
SAMPLE TYPE	<input type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE	

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
0		GRAVEL (FILL) - 300 mm				
0		CLAY (FILL)				
2		CLAY with occasional wet SILT layers			Very slight seepage from wet silt layers.	2
3		CLAY - brown to grey with depth - moist, stiff to firm with depth - high plastic				3
12		SILT (TILL) - light grey, loose, wet - trace sand, trace gravel, trace clay - low plastic - damp, medium dense below 12.5 m				Slight seepage from wet till at 11.6 m

LOG OF TESTHOLE - KENASTON UNDERPASS - CN BRIDGE GPJ UMA.GDT 11/1/05

PROJECT: Kenaston Underpass - CN Bridge	CLIENT: Stantec Consulting	TESTHOLE NO: Test Caisson
LOCATION: South of CN, West of Kenaston. Adjacent to TH05-02		PROJECT NO.: 4231-040-09
CONTRACTOR: Subterranean	METHOD: SoilMec R312-HD - 710 mm Socket	ELEVATION (m):
SAMPLE TYPE	<input type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE	

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
13		- small boulder / cobble at 13.1 m - dense below 13.1 m				
14		- boulder at 14.3 m			Chopped boulder at 14.3m.	14
15		- boulder at 14.9 m - very dense below 15.2 m			Chopped boulder at 14.9m. Very hard drilling and sleeve advancement through till below 15.2 m.	15
16		- boulder at 15.7 m - granite boulder at 16.1 m			Chopped boulder at 15.7m. Chopped boulder at 16.1m.	16
17					Drill: 0 to 20.1 m - 6h	17
18						18
19		- wet below 18.6 m			Slight to moderate seepage from wet silt till below 18.6 m.	19
20		LIMESTONE BEDROCK - weathered - mottled yellow and grey - weak to medium strong - pitted and vuggy - very tight fractures - intact below 20.3 m			Slight to moderate seepage at bedrock interface. Drill: 20.1 to 21.3 m - 1h Sleeve bottom at 20.6 m	20
21					Drill: 21.3 to 22.9 m - 1h	21
22		down hole visual evaluation between 20.6 and 22.9 m - weathered, pitted and vuggy - weak to medium strong rock - intact, very tight fractures				22
23		- broken bedrock, frequent vertical and horizontal fractures below 22.9 m			Pump Test: 7 GPM. Water inflow from behind sleeve only. ~75% recovery between 22.9 and 24 m	23
24		- intact, red below 24 m				24
25		SILT (150 mm) - low plastic, light grey, moist to wet, medium dense - intact, mottled light yellow and white below 25 m				25
26						26

LOG OF TESTHOLE KENASTON UNDERPASS - CN BRIDGE GPJ UMA.GDT 11/10/05

UMA | AECOM

LOGGED BY: Giovanni Militano	COMPLETION DEPTH: 30.48 m
REVIEWED BY:	COMPLETION DATE: 27/9/05
PROJECT ENGINEER: Giovanni Militano	Page 2 of 3

PROJECT: Kenaston Underpass - CN Bridge	CLIENT: Stantec Consulting	TESTHOLE NO: Test Caisson
LOCATION: South of CN, West of Kenaston. Adjacent to TH05-02		PROJECT NO.: 4231-040-09
CONTRACTOR: Subterranean	METHOD: SoilMec R312-HD - 710 mm Socket	ELEVATION (m):
SAMPLE TYPE	<input type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE	

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
26		- intact, red below 26 m CLAYEY SILT (600 mm) - low to medium plastic, moist, light grey, medium dense			Drill: 22.9 to 26.2 m - 2h	
27		- massive, intact, white, strong below 26.8 m				27
28		- very strong below 28 m - vertical fracture with light oxidation stains between 28 and 29.3 m			Drill: 28 to 29.3 m - 2h	28
29						29
30		SILT (150 mm) - low plastic, light grey, moist to wet, medium dense - massive, intact, white, very strong below 30.2 m			Drill: 29.3 to 30.5 m - 1.5h	30
31		Test caisson terminated at 30.5 m. Concrete to 7.5 m, clay cuttings to surface.			Pump Test: 50 GPM	31
32						32
33						33
34						34
35						35
36						36
37						37
38						38
39						

LOG OF TESTHOLE - KENASTON UNDERPASS - CN BRIDGE.GPJ UMA.GDT 11/10/05

PROJECT: Kenaston Underpass - CN Bridge		CLIENT: Stantec Consulting		TESTHOLE NO: TH-05-01		
LOCATION: North of CN Tracks, West of Kenaston				PROJECT NO.: 4231-040-09		
CONTRACTOR: Paddock Drilling			METHOD: Nodwell - HQ (63 mm) Coring		ELEVATION (m):	
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB	<input type="checkbox"/> SHELBY TUBE	<input checked="" type="checkbox"/> SPLIT SPOON	<input type="checkbox"/> BULK	<input type="checkbox"/> NO RECOVERY	<input type="checkbox"/> CORE
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> CUTTINGS	<input type="checkbox"/> SAND

DEPTH (m)	SLOTTED PIEZOMETER	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
0			CLAY (FILL) - silty - grey brown - moist, stiff, medium plasticity - trace organics to 0.6 m				0
1			CLAY - silty - brown to grey with depth - moist, stiff to firm with depth, high plasticity				1
2							2
3							3
4							4
5							5
6							6
7							7
8							8
9							9
10							10
11							11
12			SILT (TILL) - trace sand, trace clay, trace gravel - light greyish brown - moist, compact to dense with depth - low plastic				12
13							13

LOG OF TESTHOLE - KENASTON UNDERPASS - CN BRIDGE.GPJ UMA.GDT 11/10/05

PROJECT: Kenaston Underpass - CN Bridge		CLIENT: Stantec Consulting		TESTHOLE NO: TH-05-01		
LOCATION: North of CN Tracks, West of Kenaston				PROJECT NO.: 4231-040-09		
CONTRACTOR: Paddock Drilling			METHOD: Nodwell - HQ (63 mm) Coring		ELEVATION (m):	
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB	<input type="checkbox"/> SHELBY TUBE	<input checked="" type="checkbox"/> SPLIT SPOON	<input type="checkbox"/> BULK	<input type="checkbox"/> NO RECOVERY	<input type="checkbox"/> CORE
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> CUTTINGS	<input type="checkbox"/> SAND

DEPTH (m)	SLOTTED PIEZOMETER	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
13			- light grey, very dense below 12.2 m				
14			- granite boulder 320 mm diameter at 13.7 m - occasional cobbles below 14.0 m				14
15							15
16							16
17							17
18			- red brown below 18.2 m				18
19			LIMESTONE (BEDROCK)		C19	Recovery: 100% RQD: 54% (fair)	19
20			- weathered - mottled yellow and grey, with white inclusions - weak to medium strong - pitted and vuggy - close to moderately close discontinuities - evidence of water flow in apertures - filling damp, no free water present		C20	Recovery: 95% RQD: 66% (fair)	20
21					C21	Recovery: 95% RQD: 48% (poor)	21
22					C22	Recovery: 95% RQD: 57% (fair)	22
23							23
24							24
25			CLAYEY SILT (400 mm)		C23	Recovery: 100% RQD: 62% (fair) Qu = 139.2 MPa	25
26			Below 25.3 m: - massive - white				26

LOG OF TESTHOLE - KENASTON UNDERPASS - CN BRIDGE GPJ UMA_GDT_11/10/05

UMA | AECOM

LOGGED BY: Kate Franklin	COMPLETION DEPTH: 30.48 m
REVIEWED BY: GM	COMPLETION DATE: 24/8/05
PROJECT ENGINEER: Giovanni Militano	Page 2 of 3

PROJECT: Kenaston Underpass - CN Bridge		CLIENT: Stantec Consulting		TESTHOLE NO: TH-05-01		
LOCATION: North of CN Tracks, West of Kenaston				PROJECT NO.: 4231-040-09		
CONTRACTOR: Paddock Drilling			METHOD: Nodwell - HQ (63 mm) Coring		ELEVATION (m):	
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB	<input type="checkbox"/> SHELBY TUBE	<input checked="" type="checkbox"/> SPLIT SPOON	<input type="checkbox"/> BULK	<input type="checkbox"/> NO RECOVERY	<input type="checkbox"/> CORE
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> CUTTINGS	<input type="checkbox"/> SAND

DEPTH (m)	SLOTTED PIEZOMETER	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
26			- strong - moderately close discontinuities - no evidence of water flow in apertures - no filling present				
27					C24	Recovery: 100% RQD: 89% (good) Qu = 180.2 MPa	27
28						C25	Recovery: 100% RQD: 74% (fair) Qu = 100.6 MPa
29							29
30					C26	Recovery: 60% RQD: 54% (fair)	30
31			END OF TEST HOLE AT 30.5 M IN LIMESTONE BEDROCK. Notes: 1. Solid stem power auger to 12.2 m. 2. HQ coring between 12.2 m and 30.5 m. 3. Standpipe installed at 30.5 m.				31
32							32
33							33
34							34
35							35
36							36
37							37
38							38
39							39

LOG OF TESTHOLE - KENASTON UNDERPASS - CN BRIDGE GPJ UMA.GDT 11/10/05

PROJECT: Kenaston Underpass - CN Bridge	CLIENT: Stantec Consulting	TESTHOLE NO: TH-05-02
LOCATION: South of CN Tracks, West of Kenaston	PROJECT NO.: 4231-040-09	
CONTRACTOR: Paddock Drilling	METHOD: Nodwell - HQ (63 mm) Coring	ELEVATION (m):
SAMPLE TYPE	<input type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE	

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
0		GRAVEL - trace sand, black and grey, damp, angular CLAY (FILL) - silty - grey brown - moist, stiff, medium plasticity				0
1						1
2		CLAY - silty - brown to grey with depth - moist, stiff to firm with depth, high plasticity				2
3						3
4						4
5						5
6						6
7						7
8						8
9						9
10						10
11						11
12						12
13		SILT (TILL)				13

LOG OF TESTHOLE - KENASTON UNDERPASS - CN BRIDGE GPJ UMA_GDT 11/10/05

PROJECT: Kenaston Underpass - CN Bridge	CLIENT: Stantec Consulting	TESTHOLE NO: TH-05-02
LOCATION: South of CN Tracks, West of Kenaston		PROJECT NO.: 4231-040-09
CONTRACTOR: Paddock Drilling	METHOD: Nodwell - HQ (63 mm) Coring	ELEVATION (m):
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE	

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
13		- trace sand, trace clay, trace gravel - light grey - moist, compact to dense with depth - low plastic				
14		- occasional cobbles, light brown grey, very dense below 13.7 m				14
15						15
16						16
17						17
18						18
19						19
20		LIMESTONE (BEDROCK) - weathered - mottled yellow and grey - weak to medium strong - heavily pitted and vuggy - close discontinuities - evidence of water flow in apertures - filling is dry and has low permeability - some hematite alteration				20
21			C9	Recovery: 100% RQD: 61% (fair)		21
22			C10	Recovery: 100% RQD: 33% (poor)		22
23						23
24			C11	Recovery: 100% RQD: 18% (very poor)		24
25			C12	Recovery: 100% RQD: 80% (good)		25
26						

LOG OF TESTHOLE - KENASTON UNDERPASS - CN BRIDGE GPJ UMA GDT 11/10/05



PROJECT: Kenaston Underpass - CN Bridge	CLIENT: Stantec Consulting	TESTHOLE NO: TH-05-02
LOCATION: South of CN Tracks, West of Kenaston	PROJECT NO.: 4231-040-09	
CONTRACTOR: Paddock Drilling	METHOD: Nodwell - HQ (63 mm) Coring	ELEVATION (m):
SAMPLE TYPE <input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE		

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
26		CLAYEY SILT (600 mm)				
27		Below 26.5 m: - massive - white - strong - moderately close discontinuities - no evidence of water flow in apertures - filling is dry and has low permeability		C13	Recovery: 89% RQD: 56% (fair)	27
28				C14	Recovery: 100% RQD: 91% (excellent) Qu = 157.1 MPa	28
29				C15	Recovery: 100% RQD: 45% (poor) Qu = 121.4 MPa	29
30				C16	Recovery: 100% RQD: 83% (good) Qu = 86.1 MPa	30
31				C17	Recovery: 95% RQD: 66% (fair) Qu = 110.9 MPa	31
32				C18	Recovery: 50% RQD: 47% (poor)	32
33						33
34						34
35		END OF TEST HOLE AT 35 m IN LIMESTONE BEDROCK. Notes: 1. Solid stem power auger to 13.7 m. 2. HQ coring between 13.7 m and 35 m. 3. Test hole not backfilled.				35
36						36
37						37
38						38
39						39

LOG OF TESTHOLE - KENASTON UNDERPASS - CN BRIDGE GPJ UMA GDT 11/10/05

UMA AECOM	LOGGED BY: Kate Franklin REVIEWED BY: GM PROJECT ENGINEER: Giovanni Militano	COMPLETION DEPTH: 35.05 m COMPLETION DATE: 23/8/05 Page 3 of 3
-------------	--	--

PROJECT: Kenaston Underpass - CN Bridge	CLIENT: Stantec Consulting	TESTHOLE NO: TH-05-03
LOCATION: North of CN Tracks, Median (Center) of Kenaston		PROJECT NO.: 4231-040-09
CONTRACTOR: Paddock Drilling	METHOD: Nodwell - HQ (63 mm) Coring	ELEVATION (m):
SAMPLE TYPE	<input type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK	<input type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
0		CLAY (FILL) - silty - trace gravel to 1.0 m - grey brown - moist, stiff, medium plasticity				0
1						1
2						2
3		CLAY - silty - brown to grey with depth - moist, stiff to firm with depth, high plasticity				3
4						4
5						5
6						6
7						7
8						8
9						9
10						10
11						11
12						12
13						13

LOG OF TESTHOLE - KENASTON UNDERPASS - CN BRIDGE.GPJ UMA.GDT 11/10/05

PROJECT: Kenaston Underpass - CN Bridge	CLIENT: Stantec Consulting	TESTHOLE NO: TH-05-03
LOCATION: North of CN Tracks, Median (Center) of Kenaston	PROJECT NO.: 4231-040-09	
CONTRACTOR: Paddock Drilling	METHOD: Nodwell - HQ (63 mm) Coring	ELEVATION (m):
SAMPLE TYPE <input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE		

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
13	/ /					
14	○ ○ ○ ○	SILT (TILL) - trace sand, trace clay, trace gravel - light grey brown - moist, compact to dense with depth - low plastic - trace cobbles, light brown grey, very dense below 13.7 m				14
15	○ ○ ○ ○					15
16	○ ○ ○ ○					16
17	○ ○ ○ ○					17
18	○ ○ ○ ○					18
19	○ ○ ○ ○	- red brown below 18.3 m				19
20	□ □ □ □	LIMESTONE (BEDROCK) - weathered - mottled yellow and grey with white inclusions - weak to medium strong - pitted and vuggy - close to moderately close discontinuities - evidence of water flow in apertures - filling is damp, no free water present		C27	Recovery: 92% RQD: 92% (excellent)	20
21	□ □ □ □			C28	Recovery: 100% RQD: 89% (good)	21
22	□ □ □ □			C29	Recovery: 100% RQD: 62% (fair)	22
23	□ □ □ □			C30	Recovery: 90% RQD: 28% (poor)	23
24	□ □ □ □					24
25	□ □ □ □			C31	Recovery: 100% RQD: 63% (fair)	25
26	□ □ □ □					26

LOG OF TESTHOLE - KENASTON UNDERPASS - CN BRIDGE GPJ UMA GDT 11/10/05

UMA AECOM	LOGGED BY: Kate Franklin COMPLETION DEPTH: 35.05 m REVIEWED BY: GM COMPLETION DATE: 25/8/05 PROJECT ENGINEER: Giovanni Militano
-------------	---

PROJECT: Kenaston Underpass - CN Bridge	CLIENT: Stantec Consulting	TESTHOLE NO: TH-05-03
LOCATION: North of CN Tracks, Median (Center) of Kenaston		PROJECT NO.: 4231-040-09
CONTRACTOR: Paddock Drilling	METHOD: Nodwell - HQ (63 mm) Coring	ELEVATION (m):
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input checked="" type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE	

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
26		CLAYEY SILT (900 mm)				
27		Below 27 m: - massive - white - strong		C32	Recovery: 90% RQD: 21% (very poor)	27
28		- moderately close to wide discontinuities - no evidence of water flow in apertures - no filling		C33	Recovery: 95% RQD: 56% (fair) Qu = 123.6 MPa	28
29						
30				C34	Recovery: 100% RQD: 52% (fair) Qu = 147.1 MPa	30
31						
32				C35	Recovery: 100% RQD: 80% (good) Qu = 104 MPa	32
33						
34				C36	Recovery: 100% RQD: 79% (good) Qu = 45.6 MPa	34
35						
36		END OF TEST HOLE AT 35 m IN LIMESTONE BEDROCK. Notes: 1. Solid stem power auger to 13.7 m. 2. HQ coring between 13.7 m and 35 m. 3. Test hole backfilled with grout.		C37	Recovery: 100% RQD: 90% (excellent) Qu = 116.4 MPa	36
37						
38						
39						

LOG OF TESTHOLE - KENASTON UNDERPASS - CN BRIDGE.GPJ UMA_GDT 11/10/05

UMA AECOM	LOGGED BY: Kate Franklin	COMPLETION DEPTH: 35.05 m
	REVIEWED BY: GM	COMPLETION DATE: 25/8/05
	PROJECT ENGINEER: Giovanni Militano	Page 3 of 3

PROJECT: Kenaston Underpass - CN Bridge		CLIENT: Stantec Consulting		TESTHOLE NO: TH-05-04		
LOCATION: South of CN Tracks, East of Kenaston				PROJECT NO.: 4231-040-09		
CONTRACTOR: Paddock Drilling			METHOD: Nodwell - HQ (63 mm) Coring		ELEVATION (m):	
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB	<input type="checkbox"/> SHELBY TUBE	<input checked="" type="checkbox"/> SPLIT SPOON	<input type="checkbox"/> BULK	<input type="checkbox"/> NO RECOVERY	<input type="checkbox"/> CORE
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input checked="" type="checkbox"/> CUTTINGS	<input type="checkbox"/> SAND

DEPTH (m)	SLOTTED PIEZOMETER	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
0			GRAVEL - some sand, trace silt, trace clay - brown - moist, compact, angular				0
1							1
2			CLAY (FILL) - silty - grey brown, moist, stiff, medium plasticity, trace organics to 0.6 m				2
3			CLAY - silty - brown to grey with depth - moist, stiff to firm with depth, high plasticity				3
4							4
5							5
6							6
7							7
8							8
9							9
10							10
11							11
12							12
13							13

LOG OF TESTHOLE - KENASTON UNDERPASS - CN BRIDGE GPJ UMA.GDT 11/10/05

UMA | AECOM

LOGGED BY: Kate Franklin	COMPLETION DEPTH: 30.48 m
REVIEWED BY: GM	COMPLETION DATE: 11/8/05
PROJECT ENGINEER: Giovanni Militano	Page 1 of 3

PROJECT: Kenaston Underpass - CN Bridge	CLIENT: Stantec Consulting	TESTHOLE NO: TH-05-04
LOCATION: South of CN Tracks, East of Kenaston		PROJECT NO.: 4231-040-09
CONTRACTOR: Paddock Drilling	METHOD: Nodwell - HQ (63 mm) Coring	ELEVATION (m):
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE	
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE <input type="checkbox"/> GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> CUTTINGS <input type="checkbox"/> SAND	

DEPTH (m)	SLOTTED PIEZOMETER	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
13			SILT (TILL) - trace sand, trace clay, trace gravel - light grey - moist, compact to dense with depth - low plastic - limestone boulder 300 mm diameter at 13.7 m - very dense below 14.0 m - occasional cobbles below 15.2 m				13
14				14			
15				15			
16				16			
17				17			
18			LIMESTONE (BEDROCK) - weathered - mottled yellow, grey, and white - weak to medium strong - highly pitted and vuggy - weakness on sponges/corals calcareous chalky nodes - close to moderately close discontinuities - evidence of water flow, solution cavities in apertures - dry, low permeability filling				18
19				19			
20				C1	Recovery: 70% RQD: 0% (very poor)	20	
21				C2	Recovery: 100% RQD: 68% (fair) Qu = 99.7 MPa	21	
22				C3	Recovery: 100% RQD: 64% (fair)	22	
23			Below 24.4 m: - mottled grey and yellow, less distinct mottling - medium to strong, moderately close discontinuities - evidence of water flow in apertures, dry, low permeability filling				23
24				C4	Recovery: 100% RQD: 70% (fair) Qu = 37.9 MPa	24	
25				C5	Recovery: 100% RQD: 79% (good)	25	
26							26

LOG OF TESTHOLE KENASTON UNDERPASS - CN BRIDGE GP J UMA GDT 11/10/05

PROJECT: Kenaston Underpass - CN Bridge		CLIENT: Stantec Consulting		TESTHOLE NO: TH-05-04		
LOCATION: South of CN Tracks, East of Kenaston				PROJECT NO.: 4231-040-09		
CONTRACTOR: Paddock Drilling			METHOD: Nodwell - HQ (63 mm) Coring		ELEVATION (m):	
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB	<input type="checkbox"/> SHELBY TUBE	<input checked="" type="checkbox"/> SPLIT SPOON	<input type="checkbox"/> BULK	<input type="checkbox"/> NO RECOVERY	<input type="checkbox"/> CORE
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> CUTTINGS	<input type="checkbox"/> SAND

DEPTH (m)	SLOTTED PIEZOMETER	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH (m)
26			CLAYEY SILT (350 mm)				
26.3			Below 26.3 m: - massive - white - strong - moderately close discontinuities - water flow not possible in apertures - dry, low permeability filling		C6	Recovery: 54% RQD: 18% (very poor)	27
28					C7	Recovery: 100% RQD: 57% (fair) Qu = 102.0 MPa	28
30					C8	Recovery: 100% RQD: 48% (poor)	30
30.5			END OF TEST HOLE AT 30.5 M IN LIMESTONE BEDROCK.				
31			Notes: 1. Solid stem power auger to 12.2 m. 2. HQ coring between 12.2 m and 30.5 m. 3. Standpipe installed at 30.5 m.				
32							
33							
34							
35							
36							
37							
38							
39							

LOG OF TESTHOLE - KENASTON UNDERPASS - CN BRIDGE GPJ UMA GDT 11/10/05

PROJECT: Kenaston Underpass		CLIENT: Stantec Consulting Ltd.		TESTHOLE NO: TH-04-42				
LOCATION: North of Wilkes, West of Kenaston				PROJECT NO.: 4231-040-09				
CONTRACTOR: Paddock Drilling Ltd.			METHOD: Acker - 125 mm Solid Stem Augers		ELEVATION (m): 234.291			
SAMPLE TYPE		<input checked="" type="checkbox"/> GRAB	<input type="checkbox"/> SHELBY TUBE	<input checked="" type="checkbox"/> SPLIT SPOON	<input type="checkbox"/> BULK			
BACKFILL TYPE		<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT			
		<input type="checkbox"/> NO RECOVERY	<input type="checkbox"/> CORE	<input type="checkbox"/> CUTTINGS	<input type="checkbox"/> SAND			
DEPTH (m)	SLOTTED PIEZOMETER	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	+ Torvane (Su) + (kPa)	COMMENTS	ELEVATION (m)
						50 100 150 200		
						<input type="checkbox"/> Lab Vane (Su) <input type="checkbox"/>		
						(kPa)		
						50 100 150 200		
						Δ Pocket Pen. (Su) Δ		
						50 100 150 200		
						PLASTIC M.C. LIQUID		
						20 40 60 80		
20			LIMESTONE					214
			- light brownish grey to white					
21			- pitted, cemented		C131		Recovery: 90 % RQD: 46%	213
			- signs of acidic dissolving and calcite precipitation					
22			- fractured and jointed					
			- slight oxidation between 20.4 m and 23.4 m					
23			- core in 30 to 300 mm pieces between 22.0 and 23.5 m		C132		Recovery: 90 % RQD: 20%	212
24			- core largely fractured < 100 mm lengths between 23.5 m and 25.0 m		C133		Recovery: 85 % RQD: 42%	211
25			- mottled light grey and light brown to white below 24.5 m		C134		Recovery: 87 % RQD: 44%	210
			- pale light yellow, no signs of weathering, fresh faces on fractures, no alteration below 25.0 m					209
26			- possible solution cavity, infilled with very fine grain silt material, between 25.6 m and 26.2 m		C135		Recovery: 100 % RQD: 86%	208
27					C136		Recovery: 100 % RQD: 80%	207
28					C137		Recovery: 100 % RQD: 61%	206
29					C138		Recovery: 100 % RQD: 57%	205
30					C139		Recovery: 100 % RQD: 79%	204
31					C140		Recovery: 100 % RQD: 94%	203
32					C141		Recovery: 100 % RQD: 79%	202
33								201
34								200
35			- coring procedure lost water circulation at approximately 34.7 m					199
36								198
37			END OF TEST HOLE AT 37.2 m IN BEDROCK.					197
			Notes:					
38			- Seepage and Sloughing from silt layer, and clay and silt layer to approximately 6.0 m.					196
			- Power auger refusal at 13.4 m.					
39			- HQ cored from 13.4 m to 37.2 m.					195
			- Standpipe piezometer (SP-04-42) installed at 26.5 m depth.					
40								

LOG OF TESTHOLE KENASTON UNDERPASS GPJ UMA GDT 7/10/05

UMA | AECOM

LOGGED BY: Kate Franklin	COMPLETION DEPTH: 37.20 m
REVIEWED BY: Jeff Tallin	COMPLETION DATE: 9/12/04
PROJECT ENGINEER: Bill Wiesner	Page 2 of 2