



Bedrock Condition Assessment Thompson Bay Dam Peterborough, Ontario

Cambium Reference No.: 3420-001

August 27, 2014

Prepared for: Public Works and Government Services
Canada



Cambium Inc.

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TABLE OF CONTENTS

1.0	INTRODUCTION	1
2.0	METHODOLOGY	2
2.1	CORING	2
2.2	PACKER TEST	3
2.3	SURVEY	3
2.4	LABORATORY TESTING	3
3.0	EXISTING CONDITIONS	4
3.1	CONCRETE	4
3.2	BEDROCK	4
3.2.1	Hydraulic Conductivity	4
4.0	CLOSING	6

LIST OF APPENDED FIGURES

Figure 1 Corehole Location Map

LIST OF INSERTED TABLES

Table 1 Calculated Hydraulic Conductivity of the Limestone Bedrock 5

LIST OF APPENDICES

Appendix A Concrete Core Logs and Photos

Appendix B Bedrock Core Logs and Photos

Appendix C Packer Test Data



1.0 INTRODUCTION

Cambium Inc. (Cambium) was retained by Public Works and Government Services Canada (Client) to undertake a concrete and bedrock assessment of the Thompson Bay Dam (Site), located on the Otonabee River in Peterborough, Ontario. The Thompson Bay Dam was constructed in 1925 as an earthen embankment with a concrete spillway. The dam plays a critical role in maintaining water levels on the Trent-Severn Waterway (TSW) and the spillway provides the water flow necessary for the ecology of the Thompson Creek, downstream of the dam. While the TSW does not operate the stop logs at this dam as the dam is used to retain water levels, there is continuous seepage through the stop logs to provide minimal environmental flow through Thompson Creek.

Cambium completed a corehole investigation at the dam to determine the quality, condition, depth, and nature of the existing concrete and bedrock foundation of the dam structure. It is understood that the results of the assessment will be incorporated into the design phase of the Thompson Bay Dam rehabilitation.

Horizontal cores into the concrete structure on the downstream side of the dam and vertical cores through the structure and into the underlying bedrock on both the upstream and downstream side of the dam were completed as part of the investigation. Upon completion of the bedrock coring, the modified Lugeon test (Packer test) was completed at each hole to determine the permeability of the bedrock. A turbidity curtain was maintained downstream of the dam to minimize siltation and turbidity to the downstream water course during the coring. Turbidity measurements (total suspended solids (TSS)) were taken twice a day throughout the investigation to ensure that TSS levels did not exceed the project specifications or applicable Provincial guidelines. The core locations are shown in Figure 1 of this report.

This report presents the methodology and findings of the Site investigation and provides a summary of the existing concrete and bedrock condition at the dam.



2.0 METHODOLOGY

2.1 CORING

The coring investigation and Packer testing was completed between August 15 and August 25, 2014 to assess the concrete and bedrock conditions at the Site. The initial coring requirement from the Client included the following locations, as shown on Figure 1:

- six (6) horizontal concrete cores, designated as CH9 through CH14, located in the wingwalls of the dam
- eight (8) vertical bedrock cores, designated as CH1 through CH8, with four (4) holes located in the river bed downstream of the dam, two (2) holes located adjacent to the dam sill on the downstream side of the dam, and two (2) holes located on the upstream side of the dam.
- two (2) additional and optional vertical bedrock core locations, designated as CH15 and CH16, located further upstream of the dam, if required by the Client after a review of the initial bedrock conditions.

The horizontal concrete cores were obtained using a concrete core drill with a 100 mm outer diameter drill bit and extended 450 mm into the concrete structure. The six (6) concrete cores, 450 mm in length, were completed at the locations noted above.

Initially, an HQ core barrel was used to complete the bedrock cores; however, difficulties in anchoring the core drill to the structure made it difficult to impossible to run the HQ core barrel. Subsequently, the bedrock cores were obtained using the concrete core drill with a 355 mm long, 63.5 mm diameter concrete core bit. The six (6) downstream cores were completed to a depth of 1.5 m into the bedrock. On the upstream side of the dam, the initial coring attempt in the location of CH4 was terminated on refusal on a steel plate prior to reaching bedrock. We understand that the metal plate may have been installed in the past to strengthen the concrete sill on the upstream side of the dam. Following that attempt a platform was built to span from the top deck of the dam to the upstream wingwall to support the core drill and corehole CH4 was completed in a central location on the upstream side of the structure. This corehole was completed through the concrete sill of the dam and was terminated at 4.1 m below the deck structure, approximately 0.6 m into the bedrock. No attempt was made to complete the corehole at location CH8 as it was anticipated that the coring would terminate on the same steel plate encountered in CH4. The revised location of CH4 was more centrally located within the upstream side of the dam and the bedrock at this location was similar to that encountered downstream, as such, no attempt was made to complete a second corehole in the vicinity of CH8.

On completion of the coring, the coreholes were filled with non-shrink grout, leaving no voids.

The core samples were collected and stored in core boxes, which will be transported to the Trent-Severn National Historic Site on Ashburnham Road in Peterborough, Ontario, on completion of this contract. The cores were



logged and photographed on completion of the coring investigation. The concrete core logs and photographs are provided in Appendix A while the bedrock core logs and photographs are provided in Appendix B.

2.2 PACKER TEST

On completion of the bedrock coring investigation, the permeability of the bedrock was determined using pneumatic packers installed at bedrock level and performing the Packer test at water pressures of 65 kPa, 105 kPa, and 135 kPa. The tests were completed in a stepped fashion, starting at 65 kPa, going up to 135 kPa and coming back down to 65 kPa. The duration of each test was 30 minutes; however, where little variation in the results was observed between the pressures on the way up and the pressures on the way down, the length of the test was shortened for the pressures on the way back down.

Packer tests were completed at five (5) of the six (6) downstream core locations (CH2, CH3, CH5, CH6, and CH7). The Packer test was attempted at corehole CH1; however, the corehole caved and the material could not be removed in order to insert the pneumatic packers and create a proper seal.

The results of the packer tests are provided in Appendix C and discussed in the sections below.

2.3 SURVEY

The bedrock core locations will be surveyed relative to the City of Peterborough benchmark located on the concrete wall of the dam. Once completed, the surveyed elevation of each corehole location as well as the elevation of the bedrock will be included on the corehole logs in the final report.

2.4 LABORATORY TESTING

The initial proposal request included completion of compressive strength testing in accordance with CSA A23.2-9C standard on all six (6) concrete cores. As discussed in Section 3.0 and shown on the corehole logs in Appendix A, the quality of the concrete is poor and fractured, and includes large aggregate pieces. Due to this, Cambium believes that the results of compressive strength testing on any specific portion of the concrete cores will not be representative of the overall strength of the existing concrete, and may be misleading. In addition, in order to mount the core drill on the wingwalls, the core holes were by necessity located where the concrete surface was in a reasonable condition. Far more deteriorated sections of concrete are visible on the wingwalls but obtaining cores of these worst-case areas was not possible. As such, compressive strength testing was not completed at this time. Should the Client require the compressive strength testing, Cambium will complete the testing and include the results in the final report.

3.0 EXISTING CONDITIONS

The results of the concrete and bedrock coring and Packer testing are discussed in detail in this section. The concrete corelogs and photographs are provided in Appendix A and the bedrock corelogs and photographs are included in Appendix B.

3.1 CONCRETE

Six (6) concrete cores were obtained from the Site, three (3) cores from each wingwall, as shown on Figure 1. The concrete cores vary in length from 457 mm to 490 mm and are all 89 mm in diameter and present the following characteristics:

- Angular to subangular aggregate.
- Maximum aggregate size varies from 64 mm to 89 mm.
- Approximately 100 mm of new concrete facing at the surface of each core.
- Significant voids in cores CH9, CH10, and CH11.
- Minor voids in cores CH13 and CH14, with significant voids in core CH12.
- Significant breaks in all cores.

Detailed concrete corehole logs and photographs are provided in Appendix A.

3.2 BEDROCK

Seven (7) bedrock cores were obtained from the Site; six (6) from the downstream side of the dam and one (1) from the upstream side of the dam. The six (6) downstream cores are 1.5 m in length. On the upstream side, a 0.6 m length of core was obtained due to caving of sand and gravel material into the core hole. The corehole logs, including specific descriptions for each of the cores, and core photographs are provided in Appendix B.

The bedrock encountered at the Site is consistently a grey clastic limestone. The limestone is medium soft and very fractured with massive bedding and fresh weathering. The total core recovery (TCR) of the rock was excellent, ranging from 94% to 100%. The rock quality designation (RQD), which is a rough measure of the degree of jointing or fracture in the rock mass, was very poor overall, ranging from 0% to 15%.

3.2.1 HYDRAULIC CONDUCTIVITY

Packer testing was completed in five (5) of the bedrock coreholes (CH2, CH3, CH5, CH6, and CH7) located on the downstream side of the dam, as shown in Figure 1. The Packer test data and calculated hydraulic conductivity for each test at each hole is provided in Appendix C. A summary of the calculated hydraulic conductivity is



provided in Table 1, with very consistent results throughout the upstream area. Overall, the hydraulic conductivity of the bedrock varies between 1.5×10^{-5} and 6.5×10^{-5} .

Table 1 Calculated Hydraulic Conductivity of the Limestone Bedrock

Pressure (kPa)	CH2	CH3	CH5	CH6	CH7
65	6.47×10^{-5}	6.35×10^{-5}	2.76×10^{-5}	2.22×10^{-5}	5.16×10^{-5}
105	5.28×10^{-5}	5.70×10^{-5}	5.02×10^{-5}	4.00×10^{-5}	3.43×10^{-5}
135	4.67×10^{-5}	4.88×10^{-5}	4.18×10^{-5}	3.86×10^{-5}	1.49×10^{-5}
105	5.09×10^{-5}	5.63×10^{-5}	5.11×10^{-5}	5.06×10^{-5}	2.13×10^{-5}
65	5.96×10^{-5}	2.97×10^{-5}	4.76×10^{-5}	4.49×10^{-5}	1.89×10^{-5}



4.0 CLOSING

We trust that this report meets your requirements as an assessment of the existing condition of the Thompson Bay Dam structure and bedrock. If you have any further questions, please contact the undersigned at 705-742-7900 ext. 332.

Respectfully submitted,

CAMBIUM INC.

Stuart Baird, P.Eng.
Senior Project Manager

SEB/jlw

Encl.

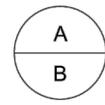
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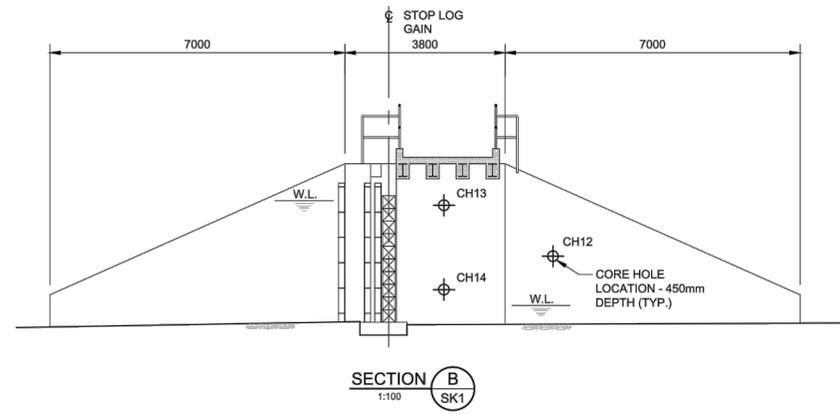
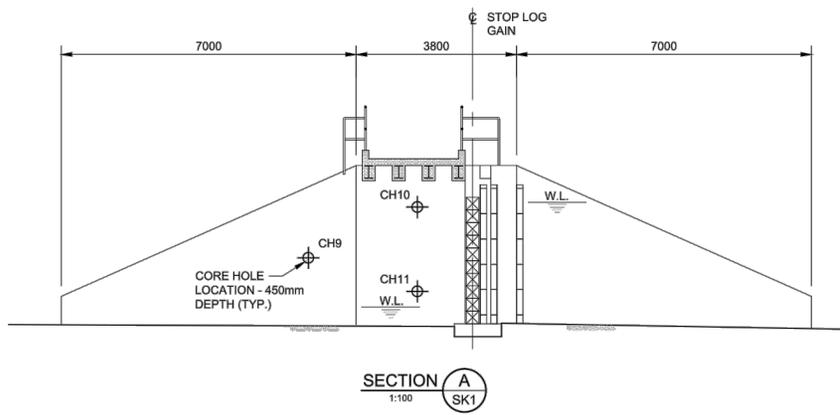
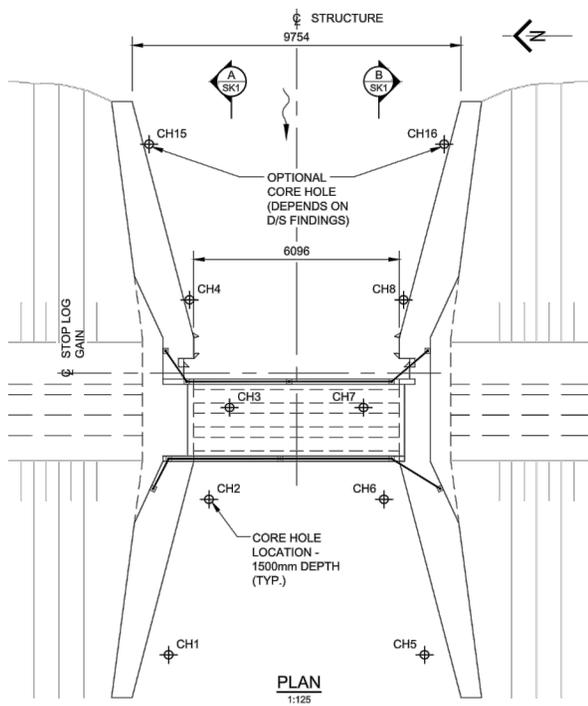
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Appended Figures

LEGEND



A Detail number
 No. du détail
 B Location dwg. no.
 No. sur dessin



Notes:
 Drawing provided by:

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Core Hole Locations Plan

Project No.:	3420-001	Date:	March 2014
Horizontal Scale:	N.T.S.	Rev.:	
Vertical Scale:	N/A	Checked By:	SEB
Drawn By:	TLC	Figure:	1



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Appendix A
Concrete Core Logs and Photos

CONCRETE CORE LOGS

CH9



CH9: 457 mm long, 89 mm diameter, angular to subangular aggregate, maximum aggregate size 76 mm, approx. 100 mm new concrete facing at surface, significant voids and breaks at 100 mm to 250 mm depth.

CH10



CH10: 457 mm long, 89 mm diameter, angular to subangular aggregate, maximum aggregate size 89 mm, approx. 100 mm new concrete facing at surface, significant voids and breaks at 150 mm to 457 mm depth.

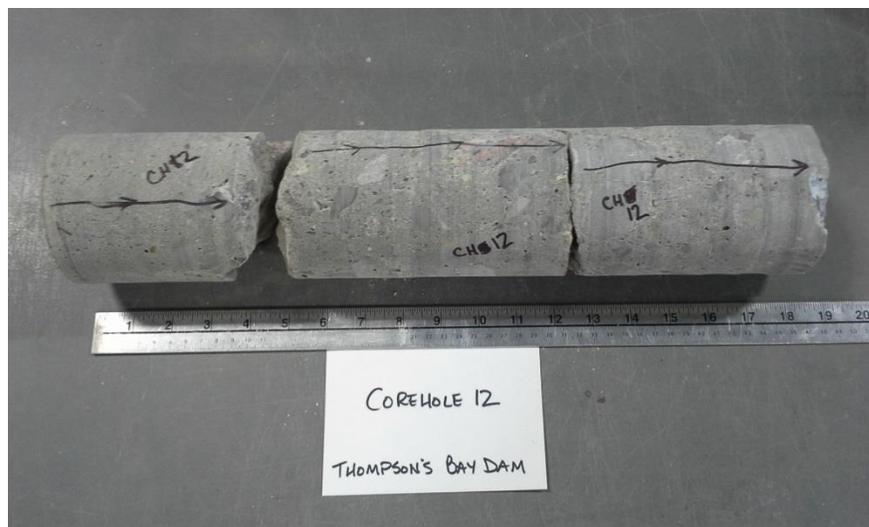
CONCRETE CORE LOGS

CH11



CH11: 457 mm long, 89 mm diameter, angular to subangular aggregate, maximum aggregate size 89 mm, approx. 100 mm new concrete facing at surface, significant voids and breaks at 180 mm to 250 mm depth, large crack at 300 mm, minor voids at 355 mm.

CH12



CH12: 470 mm long, 89 mm diameter, angular to subangular aggregate, maximum aggregate size 89 mm, approx. 100 mm new concrete facing at surface, no significant voids, breaks at 127 mm and 305 mm depth.

CONCRETE CORE LOGS

CH13



CH13: 490 mm long, 89 mm diameter, angular to subangular aggregate, maximum aggregate size 64 mm, approx. 100 mm new concrete facing at surface, significant breaks at 100 mm, 220 mm & 310 mm depth.

CH14



CH14: 460 mm long, 89 mm diameter, angular to subangular aggregate, maximum aggregate size 76 mm, approx. 100 mm new concrete facing at surface, significant breaks at 190 mm and 280 mm depth, minor voids at 160 mm depth.



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Appendix B
Bedrock Core Logs and Photos



Peterborough
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 Oshawa
 T: 866-217-7900
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Log of Borehole:

CH-1

Client: Public Works & Government Services Canada **Project Name:** Geotechnical Investigation

Project No.: 3420-001

Contractor: Cambium Inc.

Method: 63.5 mm Core

Date Completed: August 19, 2014

Location: Thompson Bay Dam, Peterborough, ON

UTM:

Elevation:

SUBSURFACE PROFILE			SAMPLE													
Elevation (m)	Depth (m)	Lithology	Description	Number	Type	% Recovery / TCR (%)	SPT (N) / RQD (%)	% Moisture			SPT (N)	Well Installation	Remarks			
								25	50	75	10	20	30	40		
0	0		Limestone: Grey, limestone, clastic, massive bedded, very fractured, very poor RQD, fresh weathering, medium soft	1		98	0									
-1	1		Core hole terminated at 1.5 m depth in limestone bedrock													
-2	2															
-3	3															
-4	4															



Peterborough
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 Oshawa
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Log of Borehole:

CH-2

Client: Public Works & Government Services Canada **Project Name:** Geotechnical Investigation

Project No.: 3420-001

Contractor: Cambium Inc.

Method: 63.5 mm Core

Date Completed: August 15, 2014

Location: Thompson Bay Dam, Peterborough, ON

UTM:

Elevation:

SUBSURFACE PROFILE			SAMPLE													
Elevation (m)	Depth (m)	Lithology	Description	Number	Type	% Recovery / TCR (%)	SPT (N) / RQD (%)	% Moisture			SPT (N)			Well Installation	Remarks	
								25	50	75	10	20	30	40		
0	0		Limestone: Grey, limestone, clastic, massive bedded, very fractured, very poor RQD, fresh weathering, medium soft	1		94	0									
-1	1															
-2	2		Core hole terminated at 1.6 m depth in limestone bedrock													
-3	3															
-4	4															



Client: Public Works & Government Services Canada **Project Name:** Geotechnical Investigation

Project No.: 3420-001

Contractor: Cambium Inc.

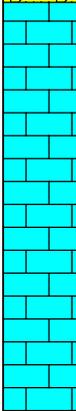
Method: 63.5 mm Core

Date Completed: August 18, 2014

Location: Thompson Bay Dam, Peterborough, ON

UTM:

Elevation:

SUBSURFACE PROFILE			SAMPLE													
Elevation (m)	Depth (m)	Lithology	Description	Number	Type	% Recovery / TCR (%)	SPT (N) / RQD (%)	% Moisture			SPT (N)	Well Installation	Remarks			
								25	50	75	10	20	30	40		
0	0		Gravel and Sand: Gravel and sand overburden													
			Limestone: Grey, limestone, clastic, massive bedded, very fractured, very poor RQD, fresh weathering, medium soft	1		100	9									
			Core hole terminated at 1.5 m depth in limestone bedrock													
-1	1															
-2	2															
-3	3															
-4	4															



Peterborough
 Barrie
 Oshawa
 T: 866-217-7900
 www.cambium-inc.com

Log of Borehole:

CH-4

Page 1 of 1

Client: Public Works & Government Services Canada **Project Name:** Geotechnical Investigation
Contractor: Cambium Inc. **Method:** 63.5 mm Core
Location: Thompson Bay Dam, Peterborough, ON **UTM:**

Project No.: 3420-001
Date Completed: August 22, 2014
Elevation:

SUBSURFACE PROFILE				SAMPLE												
Elevation (m)	Depth (m)	Lithology	Description	Number	Type	% Recovery / TCR (%)	SPT (N) / RQD (%)	% Moisture			SPT (N)			Well Installation	Remarks	
								25	50	75	10	20	30	40		
0	0		Deck of structure													
-1	1		Water level and river overburden (silt, weeds and wood)													
-2	2															
-3	3															
			Concrete: Concrete sill													
			Limestone: Grey, limestone, clastic, massive bedded, very fractured, very poor RQD, fresh weathering, medium soft	1		95	0									
-4	4		Core hole terminated at 4.1 m depth in limestone bedrock													Unable to continue coring due to gravel and sand collapse

Logged By: D. Lembke

Input By: S. Cain



Client: Public Works & Government Services Canada **Project Name:** Geotechnical Investigation

Project No.: 3420-001

Contractor: Cambium Inc.

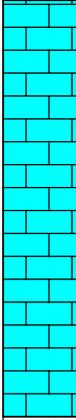
Method: 63.5 mm Core

Date Completed: August 20, 2014

Location: Thompson Bay Dam, Peterborough, ON

UTM:

Elevation:

SUBSURFACE PROFILE			SAMPLE													
Elevation (m)	Depth (m)	Lithology	Description	Number	Type	% Recovery / TCR (%)	SPT (N) / RQD (%)	% Moisture			SPT (N)	Well Installation	Remarks			
								25	50	75	10	20	30	40		
0	0		Gravel and Sand: Gravel and sand overburden													
			Limestone: Grey, limestone, clastic, massive bedded, very fractured, very poor RQD, fresh weathering, medium soft	1		98	0									
-2	2		Core hole terminated at 1.7 m depth in limestone bedrock													
-3	3															
-4	4															



Client: Public Works & Government Services Canada **Project Name:** Geotechnical Investigation

Project No.: 3420-001

Contractor: Cambium Inc.

Method: 63.5 mm Core

Date Completed: August 20, 2014

Location: Thompson Bay Dam, Peterborough, ON

UTM:

Elevation:

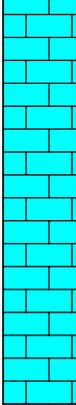
SUBSURFACE PROFILE			SAMPLE													
Elevation (m)	Depth (m)	Lithology	Description	Number	Type	% Recovery / TCR (%)	SPT (N) / RQD (%)	% Moisture			SPT (N)	Well Installation	Remarks			
								25	50	75	10	20	30	40		
0	0		Gravel and Sand: Gravel and sand overburden													
			Limestone: Grey, limestone, clastic, massive bedded, very fractured, very poor RQD, fresh weathering, medium soft	1		100	8									
			Core hole terminated at 1.6 m depth in limestone bedrock													
-1	1															
-2	2															
-3	3															
-4	4															



Photo 1: Bedrock core CH2 (below) and CH3 (above)



Photo 2: Bedrock core CH2 (below) and CH3 (above)



Photo 3: Bedrock core CH3 (top 228 mm)



Photo 4: Bedrock core CH4



Photo 5: Bedrock core CH1 (below) and CH5 (above)



Photo 6: Bedrock core CH1 (below) and CH5 (above)



Photo 7: Bedrock core CH1 (top 203 mm) and CH5 (top 178 mm)



Photo 8: Bedrock core CH6 (top 178 mm) and CH7 (top 228 mm)



Photo 9: Bedrock core CH6 (below) and CH7 (above)



Photo 10: Bedrock core CH6 (below) and CH7 (above)



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Appendix C
Packer Test Data

PACKER TEST FORM - SUMMARY OF RESULTS

Location: Thompson Bay Dam, Peterborough ON

Cambium Ref No.: 3420-001

Date: August 21 to August 25, 2014



Pressure (psi)	Hydraulic Conductivity (cm/s)				
	CH2	CH3	CH5	CH6	CH7
10	6.47E-05	6.35E-05	2.76E-05	2.22E-05	5.16E-05
15	5.28E-05	5.70E-05	5.02E-05	4.00E-05	3.43E-05
20	4.67E-05	4.88E-05	4.18E-05	3.86E-05	1.49E-05
15	5.09E-05	5.63E-05	5.11E-05	5.06E-05	2.13E-05
10	5.96E-05	2.97E-05	4.76E-05	4.49E-05	1.89E-05

PACKER TEST FORM

Location: Thompson Bay Dam, Peterborough ON
 Cambium Ref No.: 3420-001
 Date: August 20, 2014

Corehole: CH2



TEST 1			TEST 2																				
Pressure (psi):	10		Pressure (psi):	15																			
Start (gal):	11879.88		Start (gal):	11904.00																			
Time (min)	Reading	Total Gal Pumped	Time (min)	Reading	Total Gal Pumped																		
1.0	11880.81	0.93	1.0	11904.98	0.98																		
2.0	11881.46	1.58	2.0	11905.95	1.95																		
3.0	11882.25	2.37	3.0	11906.91	2.91																		
4.0	11883.00	3.12	4.0	11907.87	3.87																		
5.0	11883.77	3.89	5.0	11908.83	4.83																		
6.0	11884.53	4.65	6.0	11909.80	5.80																		
8.0	11886.10	6.22	8.0	11911.75	7.75																		
10.0	11887.62	7.74	10.0	11913.67	9.67																		
15.0	11891.50	11.62	15.0	11918.49	14.49																		
20.0	11895.39	15.51	20.0	11923.33	19.33																		
25.0	11899.29	19.41	25.0	11928.13	24.13																		
30.0	11903.20	23.32	30.0	11932.90	28.90																		
TEST 3			TEST 4																				
Pressure (psi):	20		Pressure (psi):	15																			
Start (gal):	11935.00		Start (gal):	11970.00																			
Time (min)	Reading	Total Gal Pumped	Time (min)	Reading	Total Gal Pumped																		
1.0	11936.16	1.16	1.0	11970.95	0.95																		
2.0	11937.30	2.30	2.0	11971.84	1.84																		
3.0	11938.42	3.42	3.0	11972.76	2.76																		
4.0	11939.53	4.53	4.0	11973.70	3.70																		
5.0	11940.65	5.65	5.0	11974.65	4.65																		
6.0	11941.79	6.79	6.0	11975.58	5.58																		
8.0	11944.05	9.05	8.0	11977.46	7.46																		
10.0	11946.33	11.33	10.0	11979.37	9.37																		
15.0	11953.00	18.00	15.0	11984.09	14.09																		
20.0	11957.68	22.68	20.0	11988.79	18.79																		
25.0	11963.38	28.38	25.0	11993.50	23.50																		
30.0	11969.06	34.06	30.0	11998.25	28.25																		
TEST 5			CALCULATIONS																				
Pressure (psi):	10		Length of Core (m) 1.5 Radius of Core (m) 0.635																				
Start (gal):	11999.00																						
Time (min)	Reading	Total Gal Pumped	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;">Pressure (psi)</th> <th style="text-align: center;">k (cm/sec)</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">Test 1</td><td style="text-align: center;">10</td><td style="text-align: center;">6.47E-05</td></tr> <tr><td style="text-align: center;">Test 2</td><td style="text-align: center;">15</td><td style="text-align: center;">5.28E-05</td></tr> <tr><td style="text-align: center;">Test 3</td><td style="text-align: center;">20</td><td style="text-align: center;">4.67E-05</td></tr> <tr><td style="text-align: center;">Test 4</td><td style="text-align: center;">15</td><td style="text-align: center;">5.09E-05</td></tr> <tr><td style="text-align: center;">Test 5</td><td style="text-align: center;">10</td><td style="text-align: center;">5.96E-05</td></tr> </tbody> </table>				Pressure (psi)	k (cm/sec)	Test 1	10	6.47E-05	Test 2	15	5.28E-05	Test 3	20	4.67E-05	Test 4	15	5.09E-05	Test 5	10	5.96E-05
	Pressure (psi)	k (cm/sec)																					
Test 1	10	6.47E-05																					
Test 2	15	5.28E-05																					
Test 3	20	4.67E-05																					
Test 4	15	5.09E-05																					
Test 5	10	5.96E-05																					
1.0	11999.73	0.73																					
2.0	12000.45	1.45																					
3.0	12001.20	2.20																					
4.0	12001.93	2.93																					
5.0	12002.64	3.64																					
6.0	12003.37	4.37																					
8.0	12004.84	5.84																					
10.0	12006.30	7.30																					
15.0	12009.96	10.96																					
20.0																							
25.0																							
30.0																							

PACKER TEST FORM

Location: Thompson Bay Dam, Peterborough ON
 Cambium Ref No.: 3420-001
 Date: August 22, 2014

Corehole: CH3



TEST 1			TEST 2		
Pressure (psi):	10		Pressure (psi):	15	
Start (gal):	12071.00		Start (gal):	12095.00	
Time (min)	Reading	Total Gal Pumped	Time (min)	Reading	Total Gal Pumped
1.0	12071.81	0.81	1.0	12096.05	1.05
2.0	12072.58	1.58	2.0	12097.09	2.09
3.0	12073.35	2.35	3.0	12098.13	3.13
4.0	12074.10	3.10	4.0	12099.17	4.17
5.0	12074.86	3.86	5.0	12100.25	5.25
6.0	12075.64	4.64	6.0	12101.27	6.27
8.0	12077.18	6.18	8.0	12103.37	8.37
10.0	12078.75	7.75	10.0	12105.46	10.46
15.0	12082.54	11.54	15.0	12110.75	15.75
20.0	12086.39	15.39	20.0	12115.91	20.91
25.0	12090.25	19.25	25.0	12121.20	26.20
30.0	12094.10	23.10	30.0	12126.47	31.47
TEST 3			TEST 4		
Pressure (psi):	20		Pressure (psi):	15	
Start (gal):	12128.00		Start (gal):	12165.00	
Time (min)	Reading	Total Gal Pumped	Time (min)	Reading	Total Gal Pumped
1.0	12129.25	1.25	1.0	12166.04	1.04
2.0	12130.39	2.39	2.0	12167.05	2.05
3.0	12131.55	3.55	3.0	12168.10	3.10
4.0	12132.75	4.75	4.0	12169.14	4.14
5.0	12133.91	5.91	5.0	12170.17	5.17
6.0	12135.15	7.15	6.0	12171.20	6.20
8.0	12137.51	9.51	8.0	12173.26	8.26
10.0	12139.89	11.89	10.0	12175.35	10.35
15.0	12145.83	17.83	15.0	12180.50	15.50
20.0	12151.78	23.78	20.0		
25.0	12157.72	29.72	25.0		
30.0	12163.67	35.67	30.0		
TEST 5			CALCULATIONS		
Pressure (psi):	10		Length of Core (m) 1.5 Radius of Core (m) 0.635		
Start (gal):	12181.60				
Time (min)	Reading	Total Gal Pumped	Pressure (psi) k (cm/sec)		
1.0	12181.96	0.36	Test 1	10	6.35E-05
2.0	12182.33	0.73	Test 2	15	5.70E-05
3.0	12182.68	1.08	Test 3	20	4.88E-05
4.0	12183.06	1.46	Test 4	15	5.63E-05
5.0	12183.42	1.82	Test 5	10	2.97E-05
6.0	12183.76	2.16			
8.0	12184.50	2.90			
10.0	12185.25	3.65			
15.0	12187.08	5.48			
20.0					
25.0					
30.0					

PACKER TEST FORM

Location: Thompson Bay Dam, Peterborough ON
 Cambium Ref No.: 3420-001
 Date: August 25, 2014

Corehole: CH5



TEST 1			TEST 2																				
Pressure (psi):	10		Pressure (psi):	15																			
Start (gal):	12283.40		Start (gal):	12298.70																			
Time (min)	Reading	Total Gal Pumped	Time (min)	Reading	Total Gal Pumped																		
1.0	12283.57	0.17	1.0	12299.60	0.90																		
2.0	12283.82	0.42	2.0	12300.53	1.83																		
3.0	12284.15	0.75	3.0	12301.45	2.75																		
4.0	12284.55	1.15	4.0	12302.39	3.69																		
5.0	12285.05	1.65	5.0	12303.31	4.61																		
6.0	12285.48	2.08	6.0	12304.24	5.54																		
8.0	12286.40	3.00	8.0	12306.10	7.40																		
10.0	12287.33	3.93	10.0	12307.97	9.27																		
15.0	12289.56	6.16	15.0	12312.58	13.88																		
20.0	12291.84	8.44	20.0	12317.24	18.54																		
25.0	12294.12	10.72	25.0	12321.92	23.22																		
30.0	12296.35	12.95	30.0	12326.56	27.86																		
TEST 3			TEST 4																				
Pressure (psi):	20		Pressure (psi):	15																			
Start (gal):	12327.40		Start (gal):	12358.80																			
Time (min)	Reading	Total Gal Pumped	Time (min)	Reading	Total Gal Pumped																		
1.0	12328.40	1.00	1.0	12359.73	0.93																		
2.0	12329.45	2.05	2.0	12360.68	1.88																		
3.0	12330.47	3.07	3.0	12361.61	2.81																		
4.0	12331.49	4.09	4.0	12362.55	3.75																		
5.0	12332.52	5.12	5.0	12363.49	4.69																		
6.0	12333.56	6.16	6.0	12364.43	5.63																		
8.0	12335.60	8.20	8.0	12366.33	7.53																		
10.0	12337.65	10.25	10.0	12368.25	9.45																		
15.0	12342.78	15.38	15.0	12372.93	14.13																		
20.0	12347.93	20.53	20.0																				
25.0	12353.11	25.71	25.0																				
30.0	12358.50	31.10	30.0																				
TEST 5			CALCULATIONS																				
Pressure (psi):	10		Length of Core (m) 1.5 Radius of Core (m) 0.635																				
Start (gal):	12373.25																						
Time (min)	Reading	Total Gal Pumped	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;">Pressure (psi)</th> <th style="text-align: center;">k (cm/sec)</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">Test 1</td><td style="text-align: center;">10</td><td style="text-align: center;">2.76E-05</td></tr> <tr><td style="text-align: center;">Test 2</td><td style="text-align: center;">15</td><td style="text-align: center;">5.02E-05</td></tr> <tr><td style="text-align: center;">Test 3</td><td style="text-align: center;">20</td><td style="text-align: center;">4.18E-05</td></tr> <tr><td style="text-align: center;">Test 4</td><td style="text-align: center;">15</td><td style="text-align: center;">5.11E-05</td></tr> <tr><td style="text-align: center;">Test 5</td><td style="text-align: center;">10</td><td style="text-align: center;">4.76E-05</td></tr> </tbody> </table>				Pressure (psi)	k (cm/sec)	Test 1	10	2.76E-05	Test 2	15	5.02E-05	Test 3	20	4.18E-05	Test 4	15	5.11E-05	Test 5	10	4.76E-05
	Pressure (psi)	k (cm/sec)																					
Test 1	10	2.76E-05																					
Test 2	15	5.02E-05																					
Test 3	20	4.18E-05																					
Test 4	15	5.11E-05																					
Test 5	10	4.76E-05																					
1.0	12373.83	0.58																					
2.0	12374.42	1.17																					
3.0	12375.02	1.77																					
4.0	12375.56	2.31																					
5.0	12376.18	2.93																					
6.0	12376.73	3.48																					
8.0	12377.90	4.65																					
10.0	12379.07	5.82																					
15.0	12381.95	8.70																					
20.0																							
25.0																							
30.0																							

PACKER TEST FORM

Location: Thompson Bay Dam, Peterborough ON
 Cambium Ref No.: 3420-001
 Date: August 22, 2014

Corehole: CH6



TEST 1			TEST 2																				
Pressure (psi):	10		Pressure (psi):	15																			
Start (gal):	12196.20		Start (gal):	12204.50																			
Time (min)	Reading	Total Gal Pumped	Time (min)	Reading	Total Gal Pumped																		
1.0	12196.48	0.28	1.0	12205.24	0.74																		
2.0	12196.74	0.54	2.0	12205.96	1.46																		
3.0	12197.00	0.80	3.0	12206.67	2.17																		
4.0	12197.28	1.08	4.0	12207.43	2.93																		
5.0	12197.53	1.33	5.0	12208.15	3.65																		
6.0	12197.80	1.60	6.0	12208.88	4.38																		
8.0	12198.34	2.14	8.0	12210.36	5.86																		
10.0	12198.87	2.67	10.0	12211.83	7.33																		
15.0	12200.21	4.01	15.0	12215.54	11.04																		
20.0	12201.52	5.32	20.0	12219.31	14.81																		
25.0	12203.88	7.68	25.0	12223.07	18.57																		
30.0	12204.25	8.05	30.0	12226.84	22.34																		
TEST 3			TEST 4																				
Pressure (psi):	20		Pressure (psi):	15																			
Start (gal):	12227.80		Start (gal):	12257.00																			
Time (min)	Reading	Total Gal Pumped	Time (min)	Reading	Total Gal Pumped																		
1.0	12228.75	0.95	1.0	12257.91	0.91																		
2.0	12229.70	1.90	2.0	12258.84	1.84																		
3.0	12230.64	2.84	3.0	12259.75	2.75																		
4.0	12231.55	3.75	4.0	12260.70	3.70																		
5.0	12232.49	4.69	5.0	12261.66	4.66																		
6.0	12233.45	5.65	6.0	12262.60	5.60																		
8.0	12235.36	7.56	8.0	12264.54	7.54																		
10.0	12237.24	9.44	10.0	12266.46	9.46																		
15.0	12242.05	14.25	15.0	12271.12	14.12																		
20.0	12246.80	19.00	20.0																				
25.0	12251.42	23.62	25.0																				
30.0	12256.15	28.35	30.0																				
TEST 5			CALCULATIONS																				
Pressure (psi):	10		Length of Core (m) 1.5 Radius of Core (m) 0.635																				
Start (gal):	12274.00																						
Time (min)	Reading	Total Gal Pumped	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;">Pressure (psi)</th> <th style="text-align: center;">k (cm/sec)</th> </tr> </thead> <tbody> <tr><td>Test 1</td><td style="text-align: center;">10</td><td style="text-align: center;">2.22E-05</td></tr> <tr><td>Test 2</td><td style="text-align: center;">15</td><td style="text-align: center;">4.00E-05</td></tr> <tr><td>Test 3</td><td style="text-align: center;">20</td><td style="text-align: center;">3.86E-05</td></tr> <tr><td>Test 4</td><td style="text-align: center;">15</td><td style="text-align: center;">5.06E-05</td></tr> <tr><td>Test 5</td><td style="text-align: center;">10</td><td style="text-align: center;">4.49E-05</td></tr> </tbody> </table>				Pressure (psi)	k (cm/sec)	Test 1	10	2.22E-05	Test 2	15	4.00E-05	Test 3	20	3.86E-05	Test 4	15	5.06E-05	Test 5	10	4.49E-05
	Pressure (psi)	k (cm/sec)																					
Test 1	10	2.22E-05																					
Test 2	15	4.00E-05																					
Test 3	20	3.86E-05																					
Test 4	15	5.06E-05																					
Test 5	10	4.49E-05																					
1.0	12274.55	0.55																					
2.0	12275.17	1.17																					
3.0	12275.75	1.75																					
4.0	12276.35	2.35																					
5.0	12276.95	2.95																					
6.0	12277.52	3.52																					
8.0	12278.70	4.70																					
10.0	12279.90	5.90																					
15.0	12279.90	5.90																					
20.0	12282.86	8.86																					
25.0																							
30.0																							

PACKER TEST FORM

Location: Thompson Bay Dam, Peterborough ON
 Cambium Ref No.: 3420-001
 Date: August 21, 2014

Corehole: CH7



TEST 1			TEST 2		
Pressure (psi):	10		Pressure (psi):	15	
Start (gal):	12014.00		Start (gal):	12031.00	
Time (min)	Reading	Total Gal Pumped	Time (min)	Reading	Total Gal Pumped
1.0	12014.65	0.65	1.0	12031.75	0.75
2.0	12015.33	1.33	2.0	12032.40	1.40
3.0	12015.97	1.97	3.0	12033.00	2.00
4.0	12016.60	2.60	4.0	12033.61	2.61
5.0	12017.31	3.31	5.0	12034.23	3.23
6.0	12017.96	3.96	6.0	12034.85	3.85
8.0	12019.13	5.13	8.0	12036.05	5.05
10.0	12020.21	6.21	10.0	12037.25	6.25
15.0	12023.95	9.95	15.0	12040.20	9.20
20.0	12025.58	11.58	20.0	12042.90	11.90
25.0	12028.20	14.20	25.0	12044.48	13.48
30.0	12030.65	16.65	30.0	12046.09	15.09
TEST 3			TEST 4		
Pressure (psi):	20		Pressure (psi):	15	
Start (gal):	12046.40		Start (gal):	12060.00	
Time (min)	Reading	Total Gal Pumped	Time (min)	Reading	Total Gal Pumped
1.0	12046.71	0.31	1.0	12060.40	0.40
2.0	12047.03	0.63	2.0	12060.79	0.79
3.0	12047.32	0.92	3.0	12061.19	1.19
4.0	12047.60	1.20	4.0	12061.54	1.54
5.0	12047.91	1.51	5.0	12061.95	1.95
6.0	12048.40	2.00	6.0	12062.35	2.35
8.0	12049.35	2.95	8.0	12063.09	3.09
10.0	12050.34	3.94	10.0	12063.90	3.90
15.0	12052.73	6.33	15.0	12065.70	5.70
20.0	12055.19	8.79	20.0		
25.0	12057.51	11.11	25.0		
30.0	12059.91	13.51	30.0		
TEST 5			CALCULATIONS		
Pressure (psi):	10		Length of Core (m) 1.5 Radius of Core (m) 0.635		
Start (gal):	12066.00				
Time (min)	Reading	Total Gal Pumped			
1.0	12066.24	0.24			
2.0	12066.45	0.45			
3.0	12066.67	0.67			
4.0	12066.93	0.93			
5.0	12067.16	1.16			
6.0	12067.36	1.36			
8.0	12067.83	1.83			
10.0	12068.30	2.30			
15.0	12069.63	3.63			
20.0					
25.0					
30.0					
			Pressure (psi)	k (cm/sec)	
			Test 1	10	5.16E-05
			Test 2	15	3.43E-05
			Test 3	20	1.49E-05
			Test 4	15	2.13E-05
			Test 5	10	1.89E-05