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Environmental Services and Contaminated Sites
Management
Government of Canada
5th Floor, ATB Place, 10025 Jasper Avenue
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Date
October 14, 2021

Project #
60608868

Dear Rebecca,

**Subject: Kwetįįwà (Rayrock) Remediation Project
2021 Field Investigation Summary – Mill Lake Water and Sediment Thickness Measurements**

AECOM Canada Ltd. (AECOM) is pleased to provide Public Services and Procurement Canada (PSPC) this report summarizing the results of the water and sediment measurements completed on Mill Lake at the former Rayrock mine (the Site) in July 2021. Photographs collected during measurement activities are provided as **Appendix A**. A summary table including the results of the 2019, 2020 and 2021 water and sediment measurement programs is provided in **Appendix B**. Figures indicating the locations and results of the 2021 measurements are provided in **Appendix C**.

1. Objectives

Remediation activities are proposed to be undertaken at Rayrock commencing in 2022. Components of the remediation include the removal of water and organic sediment from within Mill Lake, pumped into a Confined Disposal Facility (CDF) which is proposed to be constructed in the vicinity of the former mill pad to contain contaminated materials. The objectives of the 2021 water and sediment thickness measurements were to:

- Build upon the knowledge gained from previous lake-bottom investigations conducted on Mill Lake.
- Quantify the amount of organic sediment to be removed from Mill Lake during remediation.

2. Background

Prior to 2021, various lake-bottom investigations have been conducted at Mill Lake.

In 2017, Arcadis Canada Inc. (Arcadis) completed a data collection program at the Site which included lake bathymetry and hydrology investigations, sediment core collection, vegetation assessments, benthic habitat assessments, as well as small mammal and fish sample collection and analysis. Bathymetry work was subcontracted to Terra Remote Sensing Inc. (TRSI) by Arcadis. The 2017 field activities are summarized in the *2017 Data Collection Program, Rayrock Remediation Project* report (Arcadis, 2017) submitted to PSPC on November 30, 2018.

In 2019, AECOM conducted water depth and sediment thickness measurement activities including a survey of the surface water level as well as water and sediment depth measurements at forty different locations throughout the Lake. Findings from the 2019 investigation activities are summarized in the *2019 Mill Lake Water and Sediment Depth Measurement Results, Rayrock Remedial Action Planning* letter (AECOM, 2020) submitted to PSPC on March 4, 2020.

In February 2020, AECOM conducted sediment sampling on Mill Lake to further assess the lake bottom stratigraphy. The sediment collected was sent for environmental and geotechnical testing including but not limited to hydraulic conductivity, stabilization treatability, and dewatering and stabilization testing. The results of the sediment sampling

program are presented in the *2020 Mill Lake Sediment Sampling, Rayrock Remediation Project* report (AECOM, 2020) submitted to PSPC on September 28, 2020. Six core locations were completed in the Lake. Detailed logs showing sediment descriptions, sample identifiers and measured equivalent dose rates for the samples are provided as **Appendix D**. A general schematic illustrating the findings at each core is provided below.

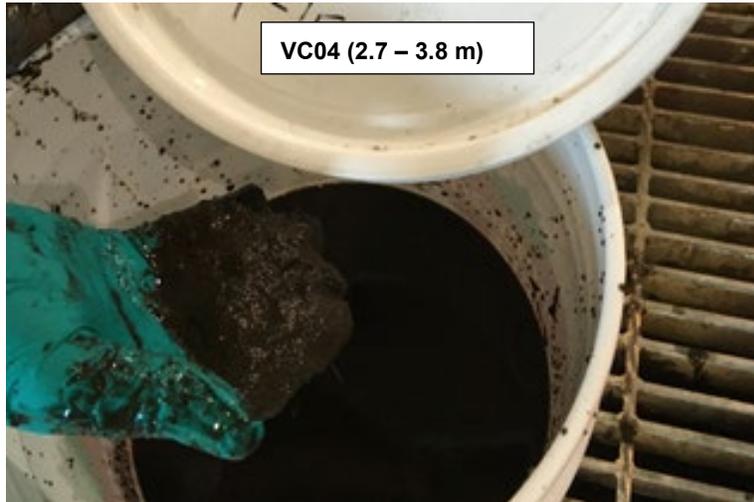
Depth (m)	VC01	VC02	VC03	VC04	VC05	VC06
Sample location						
1.0 m						
2.0 m						
3.0 m	0.2-0.4 m					
4.0 m	0.8-1.0 m					
5.0 m	1.6-1.8 m					
6.0 m	3.0-3.2 m					
7.0 m						
8.0 m						
9.0 m						

Legend	 Ice/water	 Consolidated Organic Sediment	 Sand
	 Loose Organic Sediment	 Clay	

Four main soil types were identified:

Loose Organic Sediment

- Average Thickness of 1.3 m
- These dark brown hydrous organic sediments had a very soft “oozing” quality and a very high water content. The material was not cohesive.



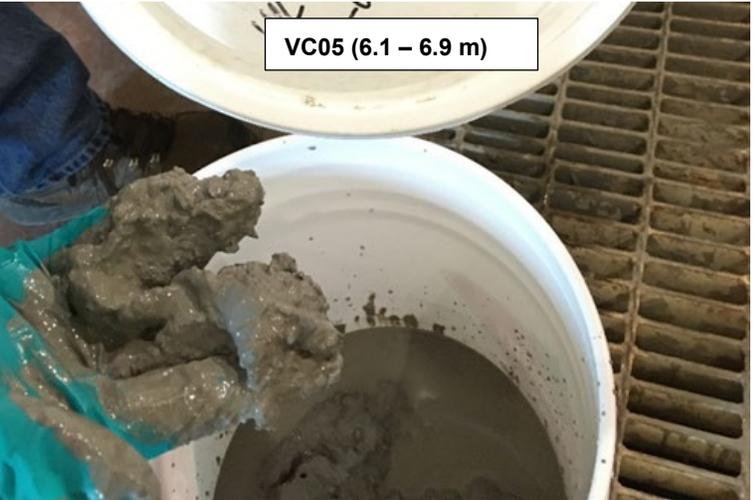
Consolidated Organic Sediment

- Average Thickness of 1.4 m
- Generally, the same material as above, but with a gradual increase with depth in compactness and competence.



Clay

- Grey, medium stiff-to-stiff lacustrine clay, some silt, trace gravel.



- **Sand:** Only encountered in one core (VC02, located near the former mill and adit), this sand was angular and appeared un-weathered.

In September 2020, sub-bottom profile surveying took place at Mill Lake on behalf of AECOM by Aurora Geosciences Ltd. (AGL). The survey was able to produce reliable bathymetry results but was unable to produce reliable structure within the sediment in Mill Lake. Results from AGL's survey are summarized in the *Field Results – Sub-Bottom Profiling at Mill Lake, Rayrock Mine, NWT* report (Aurora Geosciences Ltd., 2021) submitted to AECOM and PSPC on January 6, 2021.

A pre-remediation project data gap was thus the identification of a topographic surface for the bottom of the organic sediments. Therefore, the intent of the 2021 field program was to replicate the 2019 push probe measurements with the addition of recording the depth at which field staff could feel additional resistance when probing and attempt to create the missing topographic surface.

3. Methodology

Two AECOM field staff members followed the methodology listed below:

- A weighted 25-metre survey tape was used to measure the depth from the water surface to the top of sediment surface.
- A standard survey rod was pushed into the sediment as deep as possible and as safe to do so. This exercise was completed from the side of a Zodiac boat.
- Notes were made regarding:
 - GPS location.
 - Depth of water to top of sediment.
 - Depth at which a notable resistance could be felt during the probing
 - Any additional observations including sediment material retained on the survey rod following measurement.
- Equipment was rinsed in Mill Lake before proceeding to the next location(s).

4. Results

Measurements and observations were recorded at sixty-seven locations throughout Mill Lake. A summary table identifying the coordinates, water surface elevation, top of sediment elevation, elevation of first resistance and depth to refusal are provided in **Table 1 (Appendix B)**. Table 1 also includes field data from the fall 2019 and winter 2020 field programs. The measurement locations along with the top of sediment elevations (depth of water) are shown on **Figure 1 (Appendix C)**.

Field observations from 2021 included:

- Depth of Water: Water depths ranged from 0.8 m to 3.9 m, averaging 2.4 m. These results are consistent with the information recorded in 2019.
- Depth from Sediment Surface to Initial Resistance:
 - Nine of the 67 locations met refusal immediately at or near the top of sediment surface, with field staff interpreting the refusal to be on rock. This could be refusal on bedrock or refusal on large boulders or cobbles.
 - The average thickness from top of sediment surface to finding initial resistance on the probe was in the order of 1.0 m, close to the average loose sediment thickness of 1.3 m identified during the 2020 vibracore work. AECOM's interpretation of this is that the initial resistance was likely met where the loose sediments transitioned into the consolidated sediments and possibly not likely on the underlying clay. The impacts of this being:
 - Field data is not able to provide the information needed to map the bottom surface of the organic sediments.

- Field observations did not indicate a transition between the consolidated organic sediments and the underlying clay. Hydraulic excavation of the organic sediments may therefore require close field observations to identify the depth at which to stop hydraulic excavation and minimize the amount of over excavation and clay directed towards the dewatering tubes.
- Based on the field data collected during the February 2020 sampling, the average thickness of the sediment in Mill Lake are 2.7 m (consisting of 1.3 m of loose sediments and 1.4 m of consolidated sediments).

5. Closing

We trust this submission meets your requirements. Please contact the undersigned should you have any questions regarding this submission.

Sincerely,
AECOM Canada Ltd.



Joel Nolin, P.Eng.
Senior Project Manager
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Environmental Engineer-in-Training
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Statement of Qualifications and Limitations

The attached Report (the “Report”) has been prepared by AECOM Canada Ltd. (“AECOM”) for the benefit of the client (“Client”) in accordance with the agreement between AECOM and Client, including the scope of work detailed therein (the “Agreement”).

The information, data, recommendations and conclusions contained in the Report (collectively, the “Information”):

- is subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the “Limitations”);
- represents AECOM’s professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to AECOM which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

AECOM shall be entitled to rely upon the accuracy and completeness of information that was provided to it and has no obligation to update such information. AECOM accepts no responsibility for any events or circumstances that may have occurred since the date on which the Report was prepared and, in the case of subsurface, environmental or geotechnical conditions, is not responsible for any variability in such conditions, geographically or over time.

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This Statement of Qualifications and Limitations is attached to and forms part of the Report and any use of the Report is subject to the terms hereof.

Appendix **A**

Client Name: Public Services and Procurement Canada	Site Location Mill Lake, Former Rayrock Mine Site, NWT	Project No. 60608868
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Photo No. 1	Date 7/15/2021
Direction Photo Taken Northwest	
Description Zodiac boat and barge on Mill Lake.	



Photo No. 2	Date 7/15/2021
Direction Photo Taken West	
Description Travelling across Mill Lake to measure sediment thickness at the lake bottom.	



Client Name: Public Services and Procurement Canada	Site Location Mill Lake, Former Rayrock Mine Site, NWT	Project No. 60608868
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Photo No. 3	Date 7/15/2021
Direction Photo Taken N/A	
Description Lake bottom material remained on the survey rod in many of the measured locations. Observations were noted regarding length of residual material on rod at each location.	



Photo No. 4	Date 7/15/2021
Direction Photo Taken N/A	
Description Lake bottom material remained on the survey rod in many of the measured locations. Observations were noted regarding length of residual material on rod at each location.	



Appendix **B**

Table 1

2021 Mill Lake Water and Sediment Depths
Rayrock Remediation Project
Public Services and Procurement Canada

Location ID	Easting	Northing	Mill Lake Surface Water Elevation (m asl)	Depth from Water Surface to Top of Sediment (m)	Top of Sediment Elevation (m asl)	Depth from Water Surface to Initial Resistance (m)	Initial Resistance Elevation (m asl)	Inferred Thickness of Softer Sediments (m)	Depth from Water Surface to Probe Refusal (m)	Probe Refusal Elevation (m asl)	Notes/Observations
2019 (August) Field Measurements - Push Rod Method											
CO1	522795	7036299	214.93	1.80	213.13	-	-	-	4.20	210.73	
CO2	522787	7036319	214.93	2.27	212.66	-	-	-	> 6.30	< 208.63	Bottom of sediment not determined - distance greater than measuring device
CO3	522754	7036292	214.93	3.04	211.89	-	-	-	6.45	208.48	
CO4	522764	7036311	214.93	2.99	211.94	-	-	-	> 6.50	< 208.43	Bottom of sediment not determined - distance greater than measuring device
CO5	522734	7036274	214.93	3.46	211.47	-	-	-	6.50	208.43	
CO6	522710	7036242	214.93	3.55	211.38	-	-	-	5.35	209.58	
CO7	522693	7036235	214.93	3.81	211.12	-	-	-	> 6.75	< 208.18	Bottom of sediment not determined - distance greater than measuring device
CO8	522671	7036208	214.93	3.60	211.33	-	-	-	7.10	207.83	
CO9	522655	7036185	214.93	3.66	211.27	-	-	-	6.85	208.08	
CO10	522631	7036152	214.93	3.51	211.42	-	-	-	5.94	208.99	
CO11	522614	7036121	214.93	2.40	212.53	-	-	-	5.45	209.48	
CO12	522599	7036106	214.93	1.32	213.61	-	-	-	4.00	210.93	
CO13	522587	7036092	214.93	2.51	212.42	-	-	-	2.90	212.03	
CO14	522642	7036125	214.93	2.12	212.81	-	-	-	2.15	212.78	Rocky bottom - almost no sediment
CO15	522653	7036130	214.93	2.59	212.34	-	-	-	3.65	211.28	
CO16	522658	7036146	214.93	3.42	211.51	-	-	-	5.85	209.08	
CO17	522668	7036171	214.93	3.52	211.41	-	-	-	5.90	209.03	
CO18	522701	7036203	214.93	3.09	211.84	-	-	-	4.00	210.93	
CO19	522717	7036218	214.93	2.99	211.94	-	-	-	4.55	210.38	
CO20	522740	7036235	214.93	2.16	212.77	-	-	-	2.20	212.73	Rocky bottom - almost no sediment.

Table 1

2021 Mill Lake Water and Sediment Depths
Rayrock Remediation Project
Public Services and Procurement Canada

Location ID	Easting	Northing	Mill Lake Surface Water Elevation (m asl)	Depth from Water Surface to Top of Sediment (m)	Top of Sediment Elevation (m asl)	Depth from Water Surface to Initial Resistance (m)	Initial Resistance Elevation (m asl)	Inferred Thickness of Softer Sediments (m)	Depth from Water Surface to Probe Refusal (m)	Probe Refusal Elevation (m asl)	Notes/Observations
CO21	522742	7036251	214.93	1.32	213.61	-	-	-	1.32	213.61	Rocky bottom - almost no sediment.
CO22	522792	7036276	214.93	1.30	213.63	-	-	-	4.20	210.73	
CO23	522786	7036259	214.93	2.37	212.56	-	-	-	6.30	208.63	
CO24	522765	7036234	214.93	3.36	211.57	-	-	-	6.90	208.03	
CO25	522749	7036207	214.93	3.51	211.42	-	-	-	7.00	207.93	
CO26	522727	7036180	214.93	3.52	211.41	-	-	-	6.80	208.13	
CO27	522704	7036149	214.93	3.51	211.42	-	-	-	6.65	208.28	
CO28	522678	7036118	214.93	3.04	211.89	-	-	-	5.15	209.78	
CO29	522659	7036091	214.93	2.24	212.69	-	-	-	3.30	211.63	
CO30	522774	7036204	214.93	2.97	211.96	-	-	-	6.70	208.23	
CO31	522757	7036180	214.93	2.73	212.20	-	-	-	6.45	208.48	
CO32	522741	7036147	214.93	2.29	212.64	-	-	-	3.90	211.03	
CO33	522722	7036125	214.93	2.66	212.27	-	-	-	5.45	209.48	
CO34	522704	7036098	214.93	2.61	212.32	-	-	-	6.15	208.78	
CO35	522685	7036085	214.93	2.34	212.59	-	-	-	5.60	209.33	
CO36	522671	7036070	214.93	1.99	212.94	-	-	-	4.10	210.83	
CO37	522689	7036051	214.93	1.78	213.15	-	-	-	3.90	211.03	
CO38	522700	7036057	214.93	1.77	213.16	-	-	-	3.25	211.68	
CO39	522695	7036025	214.93	1.19	213.74	-	-	-	1.95	212.98	
CO40	522693	7036006	214.93	0.84	214.09	-	-	-	1.80	213.13	
Average			214.93	2.63	212.30				> 4.99	< 209.94	Three areas sediment depth exceeded measurement device.

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Rayrock Remediation Project
Public Services and Procurement Canada

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2020 (February) Vibracore Method											Note: Top of Consolidated Sediments
VC01	522699	7036097	215.0	2.6	212.40	4.1	210.90	1.50	-	-	Coring ended at 7.5 m depth below water surface (not refusal). See coring logs in original report for detail.
VC02	522615	7036132	215.0	3.2	211.80	4.6	210.40	1.40	-	-	Coring ended at 5.9 m depth below water surface (not refusal). See coring logs in original report for detail.
VC03	522663	7036198	215.0	3.7	211.30	4.9	210.10	1.20	-	-	Coring ended at 7.9 m depth below water surface (not refusal). See coring logs in original report for detail.
VC04	522772	7036324	215.0	2.3	212.70	3.8	211.20	1.50	-	-	Coring ended at 7.6 m depth below water surface (not refusal). See coring logs in original report for detail.
VC05	522762	7036198	215.0	3.2	211.80	5.9	209.10	2.70	-	-	Coring ended at 8.4 m depth below water surface (not refusal). See coring logs in original report for detail.
VC06	522717	7036142	215.0	3.2	211.80	5.8	209.20	2.60	-	-	Coring ended at 8.0 m depth below water surface (not refusal). See coring logs in original report for detail.
Average			215.0	3.0	212.0	4.9	210.2	1.8	-	-	
2021 (July) Field Measurements - Push Rod Method											
M1	522798	7036322	214.99	1.77	213.22	5.10	209.89	3.33	5.10	209.89	About 2.5 m of till on bottom of rod
M2	522782	7036338	214.99	1.60	213.39	3.20	211.79	1.60	4.50	210.49	Hard to push after 3.2 m - 2 m till on bottom of rod
M3	522766	7036317	214.99	2.62	212.37	4.20	210.79	1.58	5.90	209.09	Hard to push after 4.2 m - 1.7 m till on bottom of rod
M4	522755	7036309	214.99	2.89	212.10	4.00	210.99	1.11	6.30	208.69	Hard to push after 4.0 m - no till on bottom of rod
M5	522746	7036295	214.99	2.97	212.02	4.30	210.69	1.33	6.25	208.74	Hard to push after 4.3 m - no till on bottom of rod
M6	522732	7036279	214.99	3.04	211.95	5.20	209.79	2.16	6.25	208.74	Hard to push after 5.2 m - 0.6 m till on bottom of rod
M7	522712	7036260	214.99	3.28	211.71	4.40	210.59	1.12	6.35	208.64	Hard to push after 4.4 m - 1.4 m till on bottom of rod
M8	522699	7036248	214.99	3.37	211.62	4.60	210.39	1.23	6.40	208.59	Hard to push after 4.6 m - 0.8 m till on bottom of rod
M9	522689	7036238	214.99	3.34	211.65	4.40	210.59	1.06	6.50	208.49	Hard to push after 4.4 m - 0.7 m till on bottom of rod
M10	522682	7036240	214.99	3.00	211.99	3.60	211.39	0.60	3.60	211.39	Suspected rock at 3.6 m - no till on bottom of rod
M11	522680	7036226	214.99	3.24	211.75	4.70	210.29	1.46	6.40	208.59	Hard to push after 4.7 m - 1.1 m till on bottom of rod
M12	522669	7036213	214.99	3.40	211.59	4.60	210.39	1.20	6.60	208.39	Hard to push after 4.6 m - 1.1 m till on bottom of rod

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2021 Mill Lake Water and Sediment Depths
Rayrock Remediation Project
Public Services and Procurement Canada

Location ID	Easting	Northing	Mill Lake Surface Water Elevation (m asl)	Depth from Water Surface to Top of Sediment (m)	Top of Sediment Elevation (m asl)	Depth from Water Surface to Initial Resistance (m)	Initial Resistance Elevation (m asl)	Inferred Thickness of Softer Sediments (m)	Depth from Water Surface to Probe Refusal (m)	Probe Refusal Elevation (m asl)	Notes/Observations
M13	522660	7036192	214.99	3.41	211.58	4.50	210.49	1.09	6.30	208.69	Hard to push after 4.5 m - 1.7 m till on bottom of rod
M14	522651	7036179	214.99	3.36	211.63	4.70	210.29	1.34	6.50	208.49	Hard to push after 4.7 m - 1.3 m till on bottom of rod
M15	522645	7036163	214.99	3.22	211.77	4.30	210.69	1.08	6.25	208.74	Hard to push after 4.3 m - no till on bottom of rod
M16	522631	7036153	214.99	3.27	211.72	4.10	210.89	0.83	6.25	208.74	Hard to push after 4.1 m - 1.8 m till on bottom of rod
M17	522746	7036246	214.99	1.70	213.29	1.70	213.29	0.00	1.70	213.29	No sediment - suspected rock at 1.7 m
M18	522735	7036230	214.99	2.50	212.49	2.50	212.49	0.00	2.50	212.49	No sediment - suspected rock at 2.5 m
M19	522719	7036224	214.99	2.66	212.33	3.55	211.44	0.89	3.55	211.44	Easy to push to 3.55 m - no till on bottom of rod
M20	522705	7036206	214.99	2.80	212.19	2.80	212.19	0.00	2.80	212.19	No sediment - suspected rock at 2.8 m
M21	522691	7036187	214.99	2.80	212.19	4.20	210.79	1.40	4.65	210.34	Hard to push after 4.2 m - no till on bottom of rod
M22	522684	7036169	214.99	3.02	211.97	4.30	210.69	1.28	5.70	209.29	Hard to push after 4.3 m - 1.4 m till on bottom of rod
M23	522677	7036157	214.99	3.25	211.74	5.00	209.99	1.75	5.80	209.19	Hard to push after 5.0 m - 0.2 m till on bottom of rod
M24	522666	7036146	214.99	4.16	210.83	4.50	210.49	0.34	5.40	209.59	Hard to push after 4.5 m - 0.8 m till on bottom of rod
M25	522656	7036122	214.99	2.41	212.58	3.40	211.59	0.99	4.20	210.79	Hard to push after 3.4 m - no till on bottom of rod
M26	522791	7036274	214.99	1.78	213.21	1.78	213.21	0.00	1.78	213.21	No sediment - suspected rock at 1.78 m
M27	522794	7036252	214.99	1.75	213.24	2.70	212.29	0.95	4.60	210.39	Hard to push after 2.7 m - 1.7 m till on bottom of rod
M28	522785	7036239	214.99	2.40	212.59	3.70	211.29	1.30	6.10	208.89	Hard to push after 3.7 m - 1.8 m till on bottom of rod
M29	522778	7036230	214.99	2.96	212.03	4.10	210.89	1.14	6.20	208.79	Hard to push after 4.1 m - 1.2 m till on bottom of rod
M30	522768	7036216	214.99	3.21	211.78	4.80	210.19	1.59	6.20	208.79	Hard to push after 4.8 m - 0.6 m till on bottom of rod
M31	522749	7036194	214.99	3.30	211.69	4.80	210.19	1.50	6.40	208.59	Hard to push after 4.8 m - 1.4 m till on bottom of rod
M32	522744	7036185	214.99	3.26	211.73	4.80	210.19	1.54	6.20	208.79	Hard to push after 4.8 m - 1.4 m till on bottom of rod
M33	522748	7036173	214.99	3.07	211.92	4.80	210.19	1.73	6.15	208.84	Hard to push after 4.8 m - 1.0 m till on bottom of rod

Table 1

2021 Mill Lake Water and Sediment Depths
Rayrock Remediation Project
Public Services and Procurement Canada

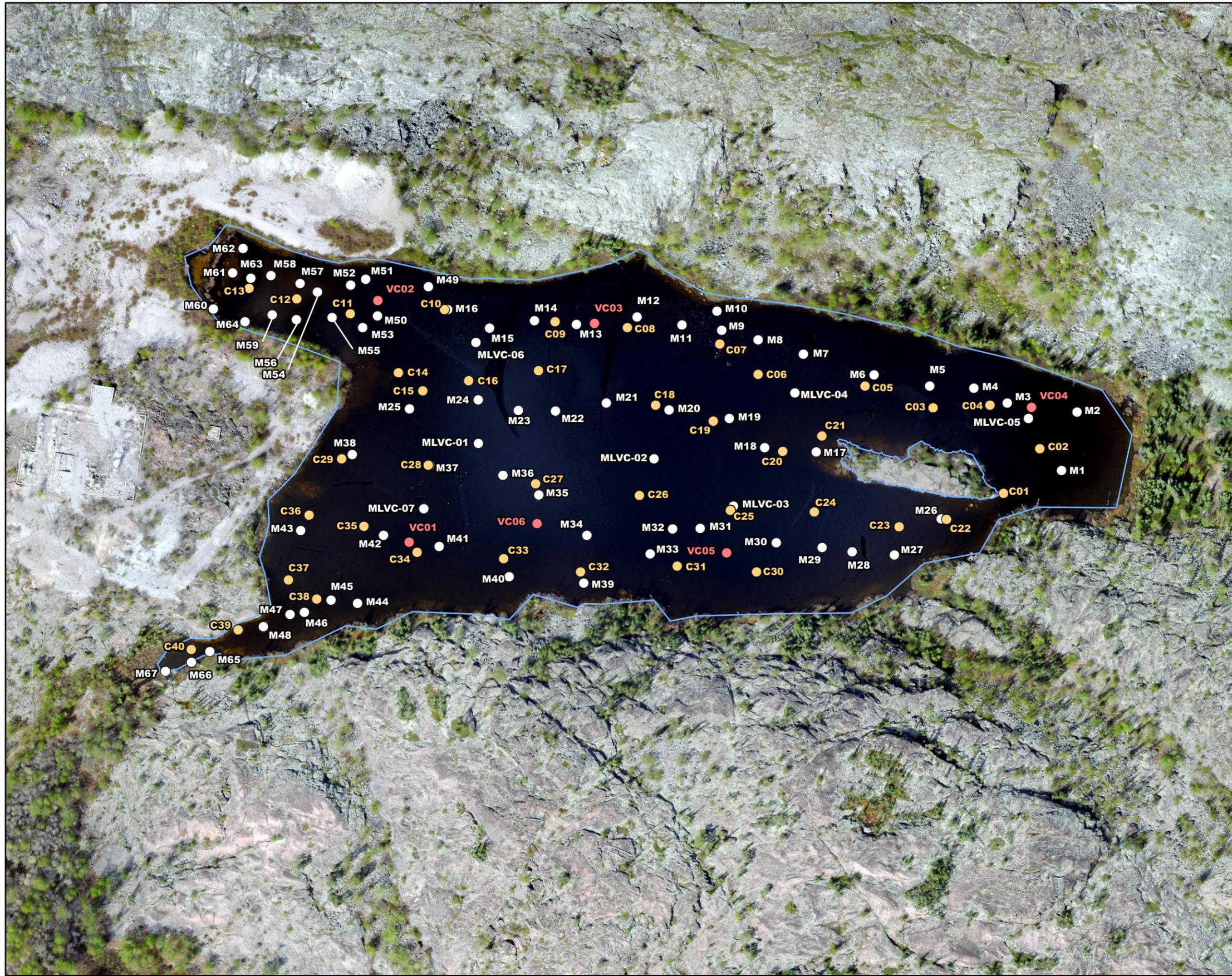
Location ID	Eastings	Northing	Mill Lake Surface Water Elevation (m asl)	Depth from Water Surface to Top of Sediment (m)	Top of Sediment Elevation (m asl)	Depth from Water Surface to Initial Resistance (m)	Initial Resistance Elevation (m asl)	Inferred Thickness of Softer Sediments (m)	Depth from Water Surface to Probe Refusal (m)	Probe Refusal Elevation (m asl)	Notes/Observations
M34	522730	7036156	214.99	3.18	211.81	4.90	210.09	1.72	6.10	208.89	Hard to push after 4.9 m - 1.0 m till on bottom of rod
M35	522708	7036148	214.99	3.30	211.69	4.70	210.29	1.40	6.00	208.99	Hard to push after 4.7 m - no till on bottom of rod
M36	522695	7036140	214.99	3.17	211.82	4.80	210.19	1.63	5.90	209.09	Hard to push after 4.8 m - no till on bottom of rod
M37	522678	7036118	214.99	2.64	212.35	4.20	210.79	1.56	5.00	209.99	Hard to push after 4.2 m - 0.5 m till on bottom of rod
M38	522660	7036095	214.99	2.08	212.91	2.08	212.91	0.00	2.09	212.90	Not solid at 2.08 m - feels like woody bottom - refusal at 2.09 m
M39	522745	7036146	214.99	1.88	213.11	2.10	212.89	0.22	2.30	212.69	Soft natural bottom - 0.2 m till on bottom of rod
M40	522729	7036123	214.99	2.23	212.76	4.45	210.54	2.22	4.45	210.54	No difference in resistance when rod was pushed down
M41	522706	7036106	214.99	2.59	212.40	4.50	210.49	1.91	5.80	209.19	Hard to push after 4.5 m - no till on bottom of rod
M42	522692	7036090	214.99	2.42	212.57	4.10	210.89	1.68	5.40	209.59	Hard to push after 4.1 m - no till on bottom of rod
M43	522675	7036064	214.99	1.90	213.09	2.80	212.19	0.90	3.45	211.54	Hard to push after 2.8 m - natural bottom
M44	522709	7036069	214.99	1.60	213.39	1.60	213.39	0.00	1.60	213.39	Natural bottom - suspected rock
M45	522703	7036061	214.99	1.68	213.31	2.80	212.19	1.12	4.15	210.84	Hard to push after 2.8 m - 1.7 m till on bottom of rod
M46	522702	7036050	214.99	1.67	213.32	2.60	212.39	0.93	4.00	210.99	Hard to push after 2.6 m - 1.6 m till on bottom of rod
M47	522700	7036045	214.99	1.54	213.45	2.00	212.99	0.46	3.20	211.79	Hard to push after 2.0 m - 1.3 m till on bottom of rod
M48	522699	7036034	214.99	1.12	213.87	1.15	213.84	0.03	1.15	213.84	Hard sediment
M49	522620	7036151	214.99	2.76	212.23	3.80	211.19	1.04	5.60	209.39	Hard to push after 3.8 m - 1.0 m till on bottom of rod
M50	522620	7036129	214.99	3.87	211.12	4.30	210.69	0.43	5.70	209.29	Hard to push after 4.3 m - 2.0 m till on bottom of rod
M51	522606	7036132	214.99	1.80	213.19	3.35	211.64	1.55	3.35	211.64	No difference in resistance when rod was pushed down
M52	522605	7036126	214.99	2.08	212.91	3.30	211.69	1.22	4.20	210.79	Hard to push after 3.3 m - 1.0 m till on bottom of rod
M53	522621	7036122	214.99	2.71	212.28	3.70	211.29	0.99	5.50	209.49	Hard to push after 3.7 m - no till on bottom of rod
M54	522601	7036114	214.99	1.21	213.78	2.60	212.39	1.39	4.20	210.79	Hard to push after 2.6 m - 2.0 m till on bottom of rod

Table 1

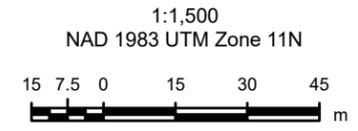
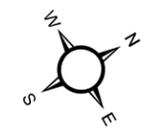
2021 Mill Lake Water and Sediment Depths
Rayrock Remediation Project
Public Services and Procurement Canada

Location ID	Easting	Northing	Mill Lake Surface Water Elevation (m asl)	Depth from Water Surface to Top of Sediment (m)	Top of Sediment Elevation (m asl)	Depth from Water Surface to Initial Resistance (m)	Initial Resistance Elevation (m asl)	Inferred Thickness of Softer Sediments (m)	Depth from Water Surface to Probe Refusal (m)	Probe Refusal Elevation (m asl)	Notes/Observations
M55	522612	7036114	214.99	2.13	212.86	3.40	211.59	1.27	5.10	209.89	Hard to push after 3.4 m - 2.3 m till on bottom of rod
M56	522606	7036102	214.99	1.66	213.33	3.20	211.79	1.54	3.90	211.09	Hard to push after 3.2 m - 1.8 m till on bottom of rod
M57	522595	7036110	214.99	1.00	213.99	2.20	212.79	1.20	3.20	211.79	Hard to push after 2.2 m - 1.7 m till on bottom of rod
M58	522587	7036102	214.99	0.96	214.03	1.90	213.09	0.94	3.05	211.94	Hard to push after 1.9 m - 1.5 m till on bottom of rod
M59	522600	7036095	214.99	1.03	213.96	2.10	212.89	1.07	3.20	211.79	Hard to push after 2.1 m - 1.3 m till on bottom of rod
M60	522587	7036077	214.99	1.97	213.02	2.35	212.64	0.38	2.35	212.64	Solid rock - no till on bottom of rod
M61	522579	7036090	214.99	1.20	213.79	1.20	213.79	0.00	1.20	213.79	Solid bottom - no sediment
M62	522573	7036098	214.99	2.12	212.87	2.12	212.87	0.00	2.12	212.87	Solid bottom - no sediment
M63	522584	7036095	214.99	1.28	213.71	2.10	212.89	0.82	3.50	211.49	Hard to push after 2.4 m - 1.4 m till on bottom of rod
M64	522597	7036085	214.99	0.80	214.19	1.60	213.39	0.80	2.90	212.09	Hard to push after 1.9 m - 1.3 m till on bottom of rod
M65	522697	7036012	214.99	0.91	214.08	0.91	214.08	0.00	0.91	214.08	Solid bottom - no sediment
M66	522697	7036004	214.99	0.90	214.09	1.20	213.79	0.30	1.20	213.79	Solid bottom - no till on bottom of rod
M67	522695	7035994	214.99	0.75	214.24	0.75	214.24	0.00	0.75	214.24	Solid bottom - no sediment
Average			214.99	2.37	212.62	3.41	211.58	1.03	4.45	210.54	

Appendix **C**



- Legend**
- 2021 Sediment Measurement Location
 - 2020 Sediment Measurement Location
 - 2019 Sediment Measurement Location



Ortho-Imagery: Arcadis Canada Inc. (Photo Date: May 26, 2017)
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Appendix **D**

Sediment Core Processing Log



Job: <u>Rayrock Mill Lake</u>	Core Location/Sample Number: <u>VC01</u>
Job Number: <u>60608868</u>	Date/ Time: <u>Feb 5th 2020 @13:35</u>
Sample Length : <u>4.9 m</u>	Sample Logged by: <u>M. Sanborn</u>
Sample Location: <u>11N 7036097m E 522699m N</u>	Type/Diameter of Sample: <u>10 cm (ID) vibracore</u>
Sample Quality: <input checked="" type="checkbox"/> good <input type="checkbox"/> fair <input type="checkbox"/> poor <input type="checkbox"/> disturbed	

Notes:

2.6 m water depth. Possible negligible overdrive of the core.
 Vibracore On:Off → On@13:35, Off@13:40, On@13:56, Off@14:01, On@14:18, Off@14:24

In-Situ Length (m)	Colour ¹	Size % - G	Size % - S	Size % - F	Description (grain size, colour, moisture, sheen/odour, biota, wood, other debris)	Sample Depth	Subsample No.	Rad (cpm) ²	Rad (µSv/h) ³	Summary Sketch
0.2	DB			100	0 to 1.5 m Dark brown hydrous organic sediments. Very soft, flocculant ooze. No shape. Very high water content. Samples Collected: ML_SED_20200205_VC01_0.2 ML_SED_20200205_VC01_0.8 <i>Material remaining after environmental sampling composited and collected for geophysical testing:</i> 1 x 5 gallon pail, Interval: 0 - 1.5 m					
0.4	DB			100		0.2-0.4		88	0.176	
0.6	DB			100				100		
0.8	DB			100						
1	DB			100		0.8-1.0		47	0.192	
1.2	DB			100				109		
1.4	DB			100						
1.5	DB			100				85		
1.6	DB			100	1.5 to 2.6 m Dark Brown hydrous organic sediments. Organic ooze. Soft to very-soft, wet. Same material as above with a gradual increase in compactness and competence. Samples Collected: ML_SED_20200205_VC01_1.6 <i>Material remaining after environmental sampling composited and collected for geophysical testing:</i> 1 x 5 gallon pail, Interval: 1.5 - 2.6 m					
1.8	DB			100		1.6-1.8		146		0.194
2	DB			100				92		
2.2	DB			100						
2.4	DB			100				97		
2.6	DB			100						
2.8	Gr	1		99	2.6 to 4.9 m Grey, medium stiff to stiff, moist glaciomarine clay, some silt, trace gravel. Samples Collected: ML_SED_20200205_VC01_3.0 End of Core @ 4.9 m (in-situ).			96		
3	Gr	1		99				145		
3.2	Gr	1		99		3.0-3.2			0.173	
3.4	Gr	1		99				86		
3.6	Gr	1		99				113		
3.8	Gr	1		99						
4	Gr	1		99						
4.2	Gr	1		99						
4.4	Gr	1		99						
4.6	Gr	1		99						
4.9	Gr	1		99						

Notes

¹ Colour: DB - Dark Brown; Gr - Grey

² Rad (cpm): Radiation (counts per minute) - Measured equivalent dose rate at contact to exposed core

³ Rad (µSv/h): Radiation (microSieverts per hour) - Measured equivalent dose rate at contact to packed sub-samples (bags)

Legend

Materials

Loose Organic Sediment

Compact Organic Sediment

Clay

Boundaries

----- Gradational

———— Sharp/Distinct

Sediment Core Processing Log



Job: <u>Rayrock Mill Lake</u>	Core Location/Sample Number: <u>VC02</u>
Job Number: <u>60608868</u>	Date/ Time: <u>Feb 6th 2020 @13:10</u>
Sample Length : <u>2.2</u>	Sample Logged by: <u>M. Sanborn</u>
Sample Location: <u>11N 7036132m E 522615m N</u>	Type/Diameter of Sample: <u>10 cm (ID) vibracore</u>
Sample Quality: <input checked="" type="checkbox"/> good <input type="checkbox"/> fair <input type="checkbox"/> poor <input type="checkbox"/> disturbed	

Notes:

3.2 m water depth. First 0.5 m, no resistance. Approximately 0.4 m of top flocculant material lost with overlying water upon core retrieval. In-situ depths approximate (+/- 0.2 m).
 Vibracore On:Off → On@13:10, Off@13:16

In-Situ Length (m)	Colour ¹	Size % - G	Size % - S	Size % - F	Description (grain size, colour, moisture, sheen/odour, biota, wood, other debris)	Sample Depth	Subsample No.	Rad (cpm) ²	Rad (µSv/h) ³	Summary Sketch
0.2	DB			100						
0.4	DB			100						
0.6	DB			100	0.4 to 1.4 m Dark brown hydrous organic sediments. Very soft, flocculant ooze. No shape. Very high water content. Samples Collected: ML_SED_20200206_VC02_0.4 ML_SED_20200206_VC02_1.2 <i>Material remaining after environmental sampling composited and collected for geophysical testing:</i> 1 x 5 gallon pail, Interval: 0.4 - 1.4 m	0.4-0.6	ABC		0.194	
0.8	DB			100				61		
1	DB			100				53		
1.2	DB			100						
1.4	DB			100			1.2-1.4	79	0.21	
1.5	DB			100	1.4 to 2.2 m Dark Brown hydrous organic sediments. Organic ooze. Soft to very-soft, wet. Same material as above with a gradual increase in compactness and competence. Samples Collected: ML_SED_20200206_VC02_1.8 <i>Material remaining after environmental sampling composited and collected for geophysical testing:</i> 1 x 5 gallon pail, Interval: 1.4 - 2.2 m					
1.6	DB			100				106		
1.8	DB			100						
2	DB			100			1.8-2.0	ABC	64	
2.2	DB			100				76		
2.4	Mixed	0	90	10	2.2 to 2.7 m Coarse, angular unweathered sand. Grain colours range from clear to white silicates, to brick red (likely red feldspar). Well sorted consistent grain size. Sample Collected ML_SED_20200206_VC02_2.2 End of core at 2.7 m (in-situ)	2.2-2.5		124	0.192	
2.6	Mixed	0	90	10						
2.7	Mixed	0	90	10						

Notes

¹ Colour: DB - Dark Brown; Gr - Grey

² Rad (cpm): Radiation (counts per minute) - Measured equivalent dose rate at contact to exposed core

³ Rad (µSv/h): Radiation (microSieverts per hour) - Measured equivalent dose rate at contact to packed sub-samples (bags)

Legend

Materials

- Loose Organic Sediment
- Compact Organic Sediment
- Clay
- Mixed

Boundaries

- Gradational
- Sharp/Distinct

Sediment Core Processing Log



Job: <u>Rayrock Mill Lake</u>	Core Location/Sample Number: <u>VC03</u>
Job Number: <u>60608868</u>	Date/ Time: <u>Feb 6th 2020 @14:39</u>
Sample Length : <u>4.2 m</u>	Sample Logged by: <u>M. Sanborn</u>
Sample Location: <u>11N 7036198m E 522663m N</u>	Type/Diameter of Sample: <u>10 cm (ID) vibracore</u>
Sample Quality: <input checked="" type="checkbox"/> good <input type="checkbox"/> fair <input type="checkbox"/> poor <input type="checkbox"/> disturbed	

Notes:

3.7 m water depth. In-situ depths approximate (+/- 0.1 m).
 Core was extracted by longitudinal cut of aluminum core tube.
 Vibracore On:Off → On@14:39, Off@14:45, On@15:00, Of@15:05

In-situ Length (m)	Colour ¹	Size % - G	Size % - S	Size % - F	Description (grain size, colour, moisture, sheen/odour, biota, wood, other debris)	Sample Depth	Subsample No.	Rad (cpm) ²	Rad (µSv/h) ³	Summary Sketch
0.2	DB			100	0 to 1.2 m Dark brown hydrous organic sediments. Very soft, flocculant ooze. No shape. Very high water content.					
0.4	DB			100		0.2-0.4		56	0.106	
0.6	DB			100	Samples Collected: ML_SED_20200206_VC03_0.2 ML_SED_20200206_VC03_0.6 <i>Material remaining after environmental sampling composited and collected for geophysical testing:</i> 1 x 5 gallon pail, Interval: 0 - 1.0 m			76		
0.8	DB			100		0.6-0.8	ABC		0.145	
1	DB			100				76		
1.2	DB			100				52		
1.4	DB			100	1.2 to 2.3 m Dark Brown hydrous organic sediments. Organic ooze. Soft to very-soft, wet. Same material as above with a gradual increase in compactness and competence. Samples Collected: ML_SED_20200206_VC03_1.2 ML_SED_20200206_VC03_1.8 <i>Material remaining after environmental sampling composited and collected for geophysical testing:</i> 1 x 5 gallon pail, Interval: 1.2 - 2.3 m	1.2-1.4			0.145	
1.5	DB			100				95		
1.6	DB			100						
1.8	DB			100				56		
2	DB			100		1.8-2.0			0.155	
2.2	DB			100				94		
2.3	DB			100						
2.4	Gr	1		99	2.3 to 4.2 m Grey, medium stiff to stiff, moist glaciomarine clay, some silt, trace gravel. Samples Collected: ML_SED_20200206_VC03_2.6 End of core at 4.2 m (in-situ)			71		
2.6	Gr	1		99						
2.8	Gr	1		99		2.6-2.8		67	0.084	
3	Gr	1		99				95		
3.2	Gr	1		99						
3.4	Gr	1		99						
3.6	Gr	1		99						
3.8	Gr	1		99						
4	Gr	1		99						
4.2	Gr	1		99						

Notes

¹ Colour: DB - Dark Brown; Gr - Grey

² Rad (cpm): Radiation (counts per minute) - Measured equivalent dose rate at contact to exposed core

³ Rad (µSv/h): Radiation (microSieverts per hour) - Measured equivalent dose rate at contact to packed sub-samples (bags)

Legend

Materials

- Loose Organic Sediment
- Compact Organic Sediment
- Clay

Boundaries

- Gradational
- Sharp/Distinct

Sediment Core Processing Log



Job: <u>Rayrock Mill Lake</u>	Core Location/Sample Number: <u>VC04</u>
Job Number: <u>60608868</u>	Date/ Time: <u>Feb 7th 2020 @ 12:13</u>
Sample Length : <u>4.9 m</u>	Sample Logged by: <u>M. Sanborn</u>
Sample Location: <u>11N 7036324m E 522772m N</u>	Type/Diameter of Sample: <u>10 cm (ID) vibracore</u>
Sample Quality: <input type="checkbox"/> good <input checked="" type="checkbox"/> fair <input type="checkbox"/> poor <input type="checkbox"/> disturbed	

Notes:

2.3 m water depth. Estimated loss/disturbance of top 0.4 m on core recovery. In-situ depth approximate (+/- 0.2m).
 Vibracore On:Off → On@12:13, Off@12:19, On@12:34, Off@12:40

In-Situ Length (m)	Colour ¹	Size % - G	Size % - S	Size % - F	Description (grain size, colour, moisture, sheen/odour, biota, wood, other debris)	Sample Depth	Subsample No.	Rad (cpm) ²	Rad (µSv/h) ³	Summary Sketch
0.2	DB			100						
0.4	DB			100						
0.6	DB			100	0.4 to 1.5 m			81		
0.8	DB			100	Dark brown hydrous organic sediments. Very soft, flocculant ooze. No shape. Very high water content.					
1	DB			100	Samples Collected: ML_SED_20200207_VC04_1.0			106		
1.2	DB			100	<i>Material remaining after environmental sampling composited and collected for geophysical testing:</i>	1.0-1.2		74	0.182	
1.4	DB			100	<i>1 x 5 gallon pail, Interval: 0.4 - 1.5 m</i>					
1.5	DB			100				121		
1.6	DB			100	1.5 to 3.8 m					
1.8	DB			100	Dark Brown hydrous organic sediments. Organic ooze. Soft to very-soft, wet. Same material as above with a gradual increase in compactness and competence.			83		
2	DB			100	Transitions to clay from 3.75 to 3.8 m in-situ					
2.2	DB			100				82		
2.4	DB			100	Samples Collected:	2.2-2.4		92	0.194	
2.6	DB			100	ML_SED_20200207_VC04_2.2 ML_SED_20200207_VC04_3.0					
2.8	DB			100	<i>Material remaining after environmental sampling composited and collected for geophysical testing:</i>			99		
3	DB			100	<i>1 x 5 gallon pail, Interval: 1.5 - 3.0 m</i>			69		
3.2	DB			100		3.0-3.2			0.186	
3.4	DB			100				77		
3.6	DB			100				77		
3.8	Gr	1		99	3.8 to 5.3 m					
4	Gr	1		99	Grey, medium stiff to stiff, moist glaciomarine clay, some silt, trace gravel.			86		
4.2	Gr	1		99				83		
4.4	Gr	1		99	Samples Collected: ML_SED_20200207_VC04_4.2	4.2-4.4			0.162	
4.6	Gr	1		99	<i>Material remaining after environmental sampling composited and collected for geophysical testing:</i>			88		
4.8	Gr	1		99	<i>1 x 5 gallon pail, Interval: 3.8 - 5.3 m</i>			91		
5	Gr	1		99				67		
5.2	Gr	1		99	End of Core at 5.3 m (in-situ)					
5.3	Gr	1		99						

Notes

¹ Colour: DB - Dark Brown; Gr - Grey

² Rad (cpm): Radiation (counts per minute) - Measured equivalent dose rate at contact to exposed core

³ Rad (µSv/h): Radiation (microSieverts per hour) - Measured equivalent dose rate at contact to packed sub-samples (bags)

Legend

Materials

- Loose Organic Sediment
- Compact Organic Sediment
- Clay

Boundaries

- Gradational
- Sharp/Distinct

Sediment Core Processing Log



Job: <u>Rayrock Mill Lake</u>	Core Location/Sample Number: <u>VC05</u>
Job Number: <u>60608868</u>	Date/ Time: <u>Feb 7th 2020 @13:46</u>
Sample Length : <u>4.7</u>	Sample Logged by: <u>M. Sanborn</u>
Sample Location: <u>11N 7036198m E 522762m N</u>	Type/Diameter of Sample: <u>10 cm (ID) vibracore</u>
Sample Quality: <input checked="" type="checkbox"/> good <input type="checkbox"/> fair <input type="checkbox"/> poor <input type="checkbox"/> disturbed	

Notes:

3.2 m water depth. Top ~0.2m lost/disturbed on retrieval. In-situ depths approximate (+/- 0.1 m)
 Vibracore On:Off → On@13:46, Off@13:52, On@14:11, Off@14:16

In-situ Length (m)	Colour ¹	Size % - G	Size % - S	Size % - F	Description (grain size, colour, moisture, sheen/odour, biota, wood, other debris)	Sample Depth	Subsample No.	Rad (cpm) ²	Rad (µSv/h) ³	Summary Sketch
0.2	DB			100						
0.4	DB			100	0 to 1.2 m Dark brown hydrous organic sediments.					
0.6	DB			100	Very soft, flocculant ooze. No shape. Very high water content.			88		
0.8	DB			100	Samples Collected: ML_SED_20200207_VC05_0.6	0.6-0.8			0.118	
1	DB			100	Material remaining after environmental sampling composited and collected for geophysical testing:			69		
1.2	DB			100	1 x 5 gallon pail, Interval: 0.3 - 1.2 m			102		
1.4	DB			100	1.2 to 2.8 m Dark Brown hydrous organic sediment. Organic ooze. Soft to very-soft, wet. Same material as above with a gradual increase in compactness and competence.					
1.5	DB			100		1.3-1.5		98	0.237	
1.6	DB			100	Samples Collected: ML_SED_20200207_VC05_1.3					
1.8	DB			100	ML_SED_20200207_VC05_1.8			92		
2	DB			100	ML_SED_20200207_VC05_2.3					
2.2	DB			100	Material remaining after environmental sampling composited and collected for geophysical testing:	1.8-2.0			0.137	
2.4	DB			100	1 x 5 gallon pail, Interval: 1.2 - 2.8 m			104		
2.6	DB			100		2.3-2.5		58	0.147	
2.8	DB			100				91		
3	Gr	1		99	2.8 to 5.2 m Grey, medium stiff to stiff, moist glaciomarine clay, some silt, trace gravel.			73		
3.2	Gr	1		99						
3.4	Gr	1		99	Samples Collected: ML_SED_20200207_VC05_3.5			112		
3.6	Gr	1		99	Material remaining after environmental sampling composited and collected for geophysical testing:	3.5-3.7		109	0.192	
3.8	Gr	1		99	1 x 5 gallon pail, Interval: 2.9 - 3.7 m					
4	Gr	1		99	End of Core @ 5.2 m (in-situ)					
4.2	Gr	1		99						
4.4	Gr	1		99						
4.6	Gr	1		99						
4.8	Gr	1		99						
5	Gr	1		99						
5.2	Gr	1		99						

Notes

¹ Colour: DB - Dark Brown; Gr - Grey

² Rad (cpm): Radiation (counts per minute) - Measured equivalent dose rate at contact to exposed core

³ Rad (µSv/h): Radiation (microSieverts per hour) - Measured equivalent dose rate at contact to packed sub-samples (bags)

Legend

Materials

- Loose Organic Sediment
- Compact Organic Sediment
- Clay

Boundaries

- Gradational
- Sharp/Distinct

Sediment Core Processing Log



Job: <u>Rayrock Mill Lake</u>	Core Location/Sample Number: <u>VC06</u>
Job Number: <u>60608868</u>	Date/ Time: <u>Feb 7th 2020 @15:17</u>
Sample Length : <u>4.6</u>	Sample Logged by: <u>M. Sanborn</u>
Sample Location: <u>11N 7036142m E 522717m N</u>	Type/Diameter of Sample: <u>10 cm (ID) vibracore</u>
Sample Quality: <input checked="" type="checkbox"/> good <input type="checkbox"/> fair <input type="checkbox"/> poor <input type="checkbox"/> disturbed	

Notes:

3.2 m water depth. Top ~0.2m lost/disturbed on retrieval. In-situ depths approximate (+/- 0.1 m)
 Vibracore On:Off → On@15:17, Off@13:23, On@15:38, Off@15:42

9 x 5 gallon buckets of surface water collected for geophysical analysis

In-situ Length (m)	Colour ¹	Size % - G	Size % - S	Size % - F	Description (grain size, colour, moisture, sheen/odour, biota, wood, other debris)	Sample Depth	Subsample No.	Rad (cpm) ²	Rad (µSv/h) ³	Summary Sketch
0.2	DB			100						
0.4	DB			100	0 to 1.2 m Dark brown hydrous organic sediments. Very soft, flocculant ooze. No shape. Very high water content.			71		
0.6	DB			100	Samples Collected: ML_SED_20200207_VC06_0.4 ML_SED_20200207_VC06_0.8	0.4-0.6		61	0.186	
0.8	DB			100	<i>Material remaining after environmental sampling composited and collected for geophysical testing:</i>					
1	DB			100	<i>1 x 5 gallon pail, Interval: 0.2 - 1.2 m</i>	0.8-1.0		65	0.153	
1.2	DB			100				74		
1.4	DB			100	1.2 to 2.5 m Dark Brown hydrous organic sediments. Organic ooze. Soft to very-soft, wet. Same material as above with a gradual increase in compactness and competence.			73		
1.5	DB			100						
1.6	DB			100	Samples Collected: ML_SED_20200207_VC06_2.1			74		
1.8	DB			100	<i>Material remaining after environmental sampling composited and collected for geophysical testing:</i>					
2	DB			100	<i>1 x 5 gallon pail, Interval: 1.2 - 2.5 m</i>	2.1-2.3	ABC		0.186	
2.2	DB			100				112		
2.4	DB			100				104		
2.6	Gr	1		99	2.5 to 4.8 Grey, medium stiff to stiff, moist glaciomarine clay, some silt, trace gravel.					
2.8	Gr	1		99	Core transitions from organic sediment soft clay at 2.5-2.6 m depth interval. Transition is very distinct.			80		
3	Gr	1		99				70		
3.2	Gr	1		99	Samples Collected: ML_SED_20200207_VC06_3.2					
3.4	Gr	1		99	<i>Material remaining after environmental sampling composited and collected for geophysical testing:</i>	3.2-3.4		145	0.184	
3.6	Gr	1		99	<i>1 x 5 gallon pail, Interval: 2.7 - 4.6m</i>			197		
3.8	Gr	1		99	End of Core @ 4.8 m (in-situ)					
4	Gr	1		99				82		
4.2	Gr	1		99				94		
4.4	Gr	1		99						
4.6	Gr	1		99				112		
4.8	Gr	1		99						

Notes

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