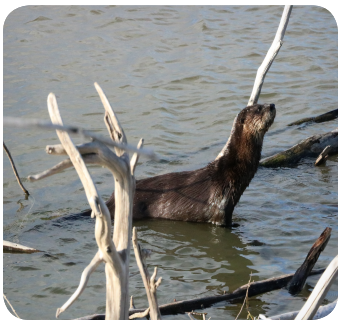
Keeyask Generation Project

Terrestrial Effects Monitoring Plan

Mercury Monitoring in Wildlife Report

TEMP-2022-18



KEEYASK

Manitoba Environment, Climate and Parks Client File 5550.00
Manitoba Environment Act Licence No. 3107

2021 -2022

KEEYASK GENERATION PROJECT

TERRESTRIAL EFFECTS MONITORING PLAN

REPORT #TEMP-2022-18

MERCURY MONITORING IN WILDLIFE 2021

Prepared for

Manitoba Hydro

By

Wildlife Resource Consulting Services MB Inc.

June 2022

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SUMMARY

Background

Construction of the Keeyask Generation Project (the Project) at Gull Rapids began in July 2014 and the reservoir was impounded in early September 2020. The Keeyask Hydropower Limited Partnership (KHLP) was required to prepare a plan to monitor the effects of construction and operation of the generating station on the terrestrial environment. Monitoring results will help the KHLP, government regulators, members of local First Nation communities, and the general public understand how construction and operation of the generating station will affect the environment, and whether more needs to be done to reduce harmful effects.

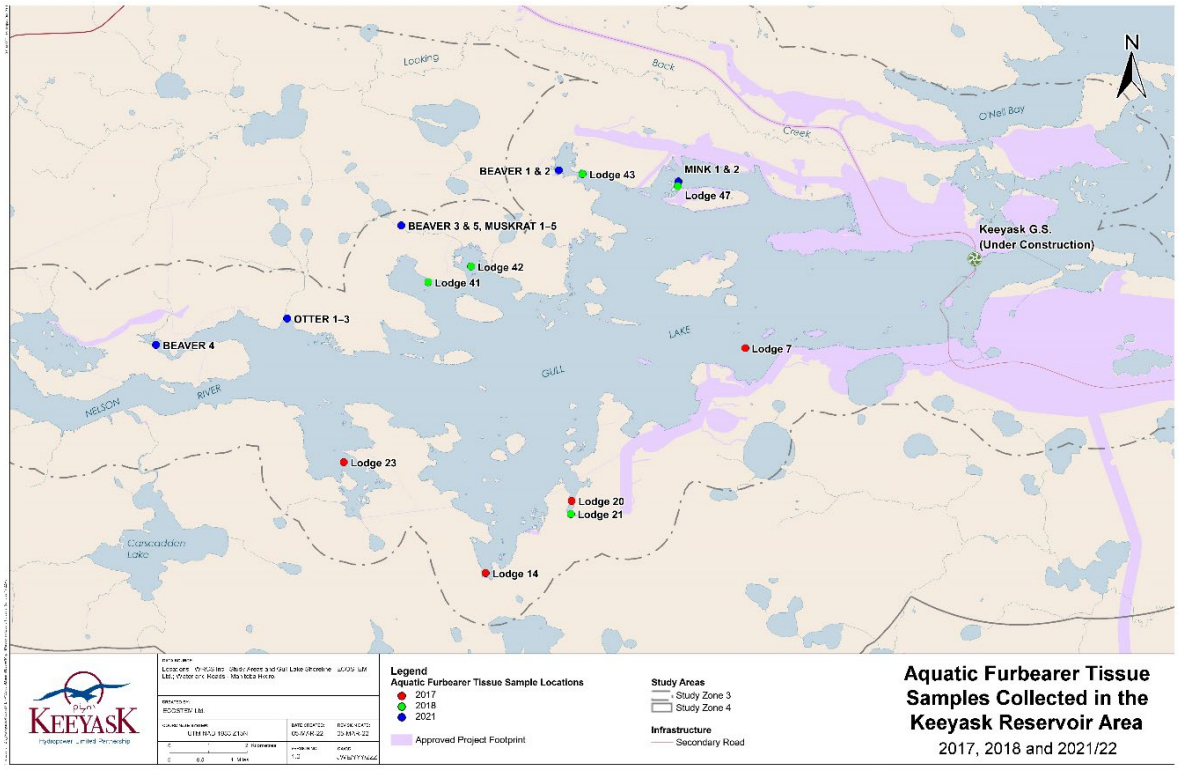
Reservoir flooding (also called impoundment) was expected to increase mercury levels in the Keeyask reservoir, which could affect aquatic furbearers such as beaver, muskrat, mink, and river otter. Potential Project effects include increased mercury levels in fish, and in mink and river otter—both fish-eating aquatic furbearers. Effects on aquatic furbearers are linked to domestic resource use and human health.

Why is the study being done?

The objective of the study is to compare mercury levels in aquatic furbearers before the Keeyask reservoir was impounded with post-impoundment levels to determine if the concentration of mercury in beaver, muskrat, mink, and river otter changes during Project operation.

What was done?

Tissue samples (kidney, liver, and leg muscle) from beavers, muskrats, mink, and river otters trapped near the Keeyask reservoir in the winter of 2021/22 were analyzed for mercury. All individuals were trapped by the registered trapline holder from Tataskweyak Cree Nation. Tissue samples were also collected in the future reservoir area by the registered trapline holder in 2017 and 2018, during Project construction.



Aquatic Furbearer Tissue Samples Collected in the Keeyask Reservoir Area during Construction, 2017, 2018, and 2021/22

What was found?

No change in mercury levels in beaver, muskrat, or mink was observed in winter 2021/22 after the reservoir was impounded, but mercury levels in river otters increased. Caution should be used in the interpretation of these results because sample sizes were relatively small.

What does it mean?

No change in mercury levels in beavers was anticipated after the reservoir was impounded due to the very small amounts of mercury taken up by the vegetation that they consume. Small increases in mercury levels in muskrats were expected because they eat aquatic animals, which will likely accumulate mercury after impoundment. As expected, mercury levels in beaver and muskrat tissue collected after the reservoir was impounded remained low and no increase was observed during the winter of 2021/22.

Mercury levels in mink and river otter were expected to increase after reservoir impoundment. Mercury levels in mink were lower after the reservoir was impounded than before, likely because their diet is mainly small mammals and only occasionally fish. The increased mercury levels in river otters suggested that some whose ranges overlapped the reservoir were beginning to accumulate mercury in their tissues, as anticipated. Mercury levels in river otters in winter 2021/22 were well within the peak range predicted in the Environmental Impact Assessment.

The reservoir was impounded in September 2020. Tissue samples submitted in winter 2021/22 were collected early in the mercury accumulation process to track the potential bioaccumulation of mercury over time. Changes in mercury levels were expected over time for certain small mammal species, therefore these early results will help confirm predicted effects.

What will be done next?

Mercury levels in tissues from aquatic furbearers trapped during Project operation will be analyzed and added to the existing database for comparison with mercury levels in aquatic furbearers during Project operation. If samples from other wild foods such as waterfowl, moose, or snowshoe hare are submitted by the partner First Nations during Project operation, these will also be analyzed to monitor potential risks to human health due to increased mercury in the environment.

STUDY TEAM

We would like to thank Sherrie Mason and Rachel Boone of Manitoba Hydro and Ron Bretecher of North/South Consultants Inc. for logistical assistance in the field. We would also like to thank Dr. James Ehnes of ECOSTEM Ltd. for GIS cartographic services. Biologists and other personnel who contributed to the study included:

- Robert Berger – Reporting
- Andrea Ambrose – Data analysis and reporting
- Jonathan Saunders – Licensed trapper, Tataskweyak Cree Nation (TCN)
- Curtis Saunders – Trapping assistant, TCN
- Mark Saunders – Trapping assistant, TCN

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1.0 INTRODUCTION

Construction of the Keeyask Generation Project (the Project), a 695-megawatt hydroelectric generating station (GS) and associated facilities, began in July 2014. The Project is located at Gull Rapids on the lower Nelson River in northern Manitoba where Gull Lake flows into Stephens Lake, 35 km upstream of the existing Kettle GS. Reservoir impoundment began August 31, 2020 and was completed on September 5, 2020.

The *Keeyask Generation Project Response to EIS Guidelines* (the EIS), completed in June 2012, provides a summary of predicted effects and planned mitigation for the Project. Technical supporting information for the terrestrial environment, including a description of the environmental setting, effects and mitigation, and a summary of proposed monitoring and follow-up programs is provided in the *Keeyask Generation Project Environmental Impact Statement Terrestrial Supporting Volume* (TE SV). The *Keeyask Generation Project Terrestrial Effects Monitoring Plan* (TEMP) was developed as part of the licensing process for the Project. Monitoring activities for various components of the terrestrial environment were described, including the focus of this report, mercury in wildlife, during the construction and operation phases.

Mercury is a naturally occurring metal that exists in several forms in the environment. Microorganisms in soil and water can transform mercury from one form to another. Methylmercury, a common form of organic mercury, can easily enter the aquatic food web and bioaccumulate when higher-level organisms absorb it from the lower-level organisms that they consume. Methylmercury levels typically increase in water after flooding, as the inorganic mercury released from inundated soil is converted to organic mercury by bacteria feeding on decomposing plants (St. Louis et al. 2004). Because plants typically accumulate relatively low levels of mercury (Lindsay and Bookhout 1978), methylmercury levels in herbivorous aquatic furbearers such as beaver (*Castor canadensis*) and omnivores such as muskrat (*Ondatra zibethicus*) are considerably lower than in carnivorous aquatic furbearers such as mink (*Neovison vison*) and river otter (*Lontra canadensis*), which eat fish and other aquatic animals (Sheffy and St. Amant 1982).

Reservoir flooding, also referred to as impoundment, was expected to increase methylmercury ("mercury") levels in the Keeyask reservoir, which could affect aquatic furbearers. Potential Project effects include increased mercury concentrations in fish, and in mink and river otter—both fish-eating aquatic furbearers. Effects on aquatic furbearers are linked to domestic resource use. Mercury levels in beaver, muskrat, mink, and river otter were measured in tissue samples collected before Project construction began. Because impoundment flooded habitat within the reservoir footprint, beaver and muskrat were trapped out of the future reservoir area in the winters of 2016/17 and 2017/18 to prevent prolonged exposure and displacement deaths (Wildlife Resource Consulting Services MB Inc. [WRCS] 2018). Tissue samples from trapped animals were collected and submitted for mercury analysis. Additional samples were collected in winter 2021/22, after the reservoir was impounded. All individuals were trapped by the Registered Trap Line (RTL) 15 registered trapline holder (Tataskweyak Cree Nation) each winter. As described in

Section 7.0 of the TEMP, the objective of the study is to compare mercury levels in aquatic furbearers before and during Project construction with post-impoundment levels to determine if the concentration of mercury in beaver, muskrat, mink, and river otter changes during Project operation. Mercury levels in waterfowl and other wild foods such as moose (*Alces alces*) and snowshoe hare (*Lepus* americanus) are to be monitored if tissue samples are submitted by partner First Nations resource users, to monitor potential risks to human health due to increased mercury in the environment after the Keeyask reservoir is flooded.

2.0 METHODS

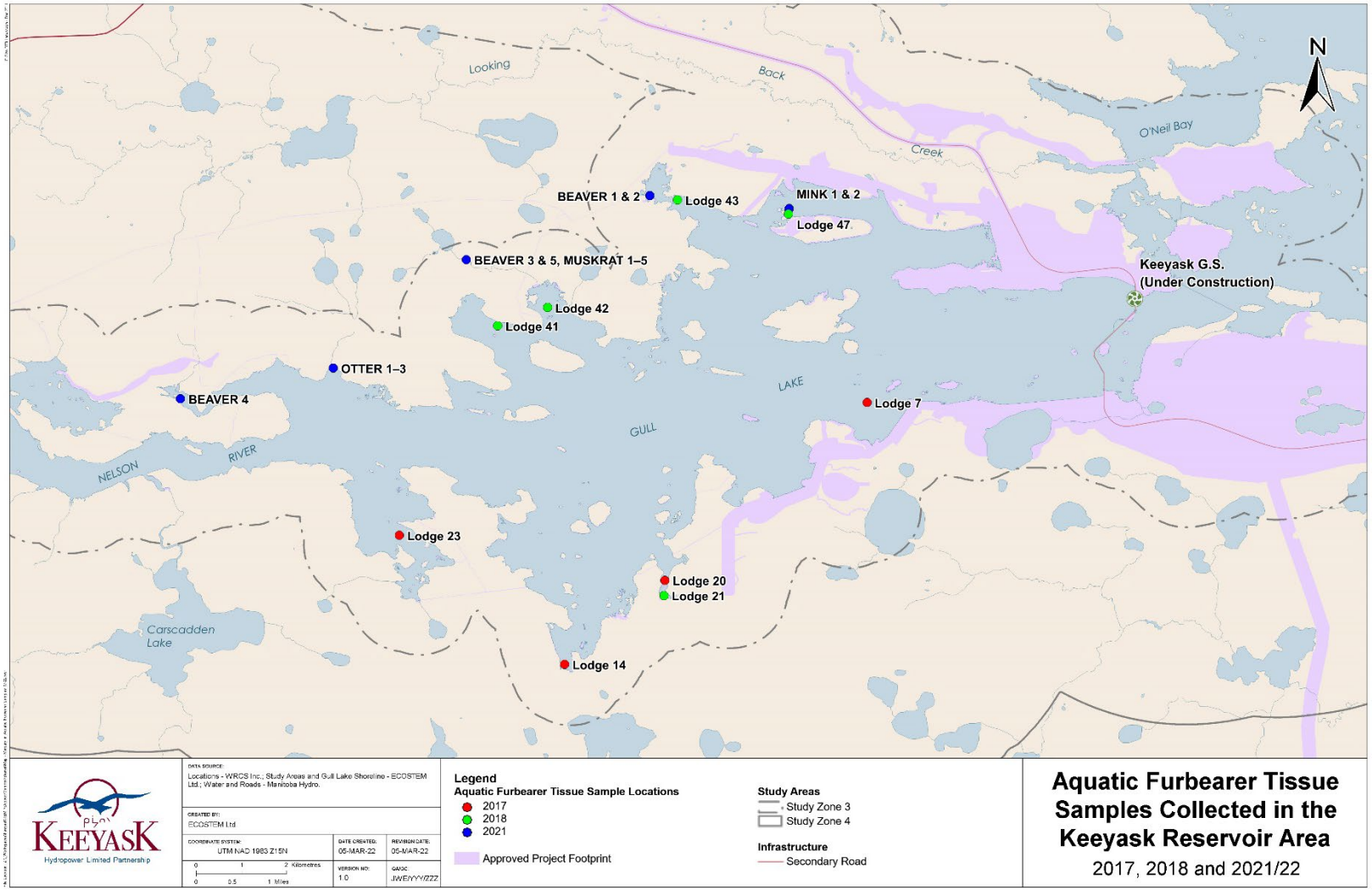
During Project construction, tissue samples (kidney, liver, and/or leg muscle) from six beavers, one muskrat, and two river otters trapped at beaver lodges in the future reservoir area (Map 1) in March 2017 and January and February 2018 were analyzed for mercury (Table 1). For testing purposes, submissions of beaver organs were limited to kidneys in 2017 and 2018. Additional samples from aquatic furbearers trapped by the RTL 15 registered trapline holder in winter 2021/22, after the Keeyask reservoir was impounded, included five beavers, two mink, five muskrats, and three river otters. No samples from other species were submitted during the construction monitoring period.

Table 1: Aquatic Furbearer Tissue Samples Collected from the Keeyask Reservoir Area during Construction (2017 and 2018) and after Reservoir Impoundment (2021/22)

Year Trapped	Species	Lodge or Individual	Tissue Collected	Location
2017	Beaver	Lodge 7	Muscle	15 V 357954 6244917
	Beaver	Lodge 23	Kidney, muscle	15 V 347619 6241984
	River otter	Lodge 14	Kidney, liver, muscle	15 V 351273 6239131
	River otter	Lodge 20	Kidney, liver, muscle	15 V 353487 6240990
2018	Beaver	Lodge 21	Kidney, muscle	15 V 353469 6240652
	Beaver	Lodge 41	Kidney, muscle	15 V 349789 6246611
	Beaver	Lodge 42	Muscle	15 V 350894 6247016
	Beaver	Lodge 47	Muscle	15 V 356236 6249204
	Muskrat	Lodge 43	Kidney, liver, muscle	15 V 353769 6249395
2021/22	Beaver	BEAVER1	Kidney, liver, muscle	15 V 353154 6249488
	Beaver	BEAVER2	Kidney, liver, muscle	15 V 353154 6249488
	Beaver	BEAVER3	Kidney, liver, muscle	15 V 349098 6248074
	Beaver	BEAVER4	Kidney, liver, muscle	15 V 342782 6245002
	Beaver	BEAVER5	Kidney, liver, muscle	15 V 349098 6248074
	Mink	MINK1	Kidney, liver, muscle	15 V 356229 6249198
	Mink	MINK2	Kidney, liver, muscle	15 V 356229 6249198
	Muskrat	MUSKRAT1	Kidney, liver, muscle	15 V 349098 6248074
	Muskrat	MUSKRAT2	Kidney, liver, muscle	15 V 349098 6248074
	Muskrat	MUSKRAT3	Kidney, liver, muscle	15 V 349098 6248074
	Muskrat	MUSKRAT4	Kidney, liver, muscle	15 V 349098 6248074
	Muskrat	MUSKRAT5	Kidney, liver, muscle	15 V 349098 6248074
	River otter	OTTER1	Kidney, liver, muscle	15 V 346158 6245678
	River otter	OTTER2	Kidney, liver, muscle	15 V 346158 6245678
	River otter	OTTER3	Kidney, liver, muscle	15 V 346158 6245678

Tissue samples were submitted to ALS Environmental for mercury analysis, where the EPA 200.3/EPA 1631E (mod) method was used. Results were reported as milligrams of mercury per kilogram of wet weight (mg/kg wwt).

Results from 2017 and 2018 were added to those from aquatic furbearer tissue samples collected voluntarily from on-system traplines in the Split Lake, York Landing, and Fox Lake Resource Management Areas from February 2003 to April 2008, before the reservoir was impounded. A trapline was categorized as “on-system” if it overlapped the Nelson River and was also located in Study Zone 5. The home ranges of beaver, muskrat, mink, and river otter within this category were presumed to overlap the regulated water system. Pre-impoundment samples were compared with those collected in the winter of 2021/22, after the reservoir was impounded and mercury was expected to begin to accumulate within. Pre-impoundment mercury levels in aquatic furbearers are listed in Appendix 1. For results reported as <0.01 mg/kg wwt, a value of 0.0099 was used to calculate mean mercury levels in aquatic furbearer tissues, and a value of 0.00099 was used for results reported as <0.001 mg/kg wwt.



Map 1: Aquatic Furbearer Tissue Samples Collected in the Keeyask Reservoir Area during Construction, 2017, 2018, and 2021/22

3.0 RESULTS

Laboratory analysis results are included in Appendix 2. Mercury levels remained low in beaver tissue in 2021/22 (Table 2). Mercury levels were also low in muskrat tissue samples. Mercury levels in the two mink samples (muscle and kidney tissue) were similar, but the mercury level in one liver sample was nearly twice as high as in the other. There was considerable variation in mercury levels in river otter tissue samples, which were the highest of the four species in 2021/22. Mercury levels in river otter livers ranged from 2.12 to 11.0 mg/kg wwt. Mercury levels in kidney and muscle tissue were also high for the latter individual (OTTER1).

Table 2: Mercury Concentration in Aquatic Furbearers Removed from the Keeyask Reservoir Area after Impoundment, 2021/22

Species	Lodge or Individual	Year Trapped	Mercury Concentration (mg/kg wwt)[1]		
			Kidney	Liver	Muscle
Beaver	BEAVER 1	2021	0.0400	0.0098	0.0159
	BEAVER 2	2021	0.0447	0.0109	0.0116
	BEAVER 3	2022	0.0027	<0.0010	0.0011
	BEAVER 4	2022	0.0084	0.0028	0.0029
	BEAVER 5	2022	0.0018	<0.0010	<0.0010
	Range		0.0018–0.0447	<0.0010–0.0109	<0.0010–0.0159
Muskrat	MUSKRAT 1	2022	0.0226	0.0055	0.0063
	MUSKRAT 2	2022	0.0242	0.0082	0.0141
	MUSKRAT 3	2022	0.0520	0.0133	0.0085
	MUSKRAT 4	2022	0.0314	0.0057	0.0082
	MUSKRAT 5	2022	0.0368	0.0059	0.0041
	Range		0.0226–0.0520	0.0055–0.0133	0.0041–0.0141
Mink	MINK 1	2021	0.597	0.585	0.659
	MINK 2	2021	0.674	1.13	0.539
	Range		0.597–0.674	0.585–1.13	0.539–0.659
River otter	OTTER 1	2021	5.83	11.0	2.48
	OTTER 2	2022	2.19	4.59	0.635
	OTTER 3	2022	1.46	2.12	0.480
	Range		1.46–5.83	2.12–11.0	0.480–2.48

1. Decimal places reported as in results from the laboratory.

Mercury levels in beaver liver and muscle tissue were similar before and after reservoir impoundment, with somewhat lower concentrations in the samples collected after (Table 3). Lower mercury levels in muskrat liver and muscle tissue were observed after the reservoir was impounded than before. Mercury levels in all beaver and muskrat liver tissue were within the ranges predicted in the EIS (Table 4).

Table 3: Mean Mercury Concentration (mg/kg wwt) in On-system Beaver and Muskrat Tissue before (2003–2018) and after (2021/22) Reservoir Impoundment

Species	Liver			Muscle		
	Pre-impoundment	Post-impoundment	Percentage Change	Pre-impoundment	Post-impoundment	Percentage Change
Beaver	0.008 (16)[1]	0.005 (5)	-38	0.008 (40)	0.006 (5)	-25
Muskrat	0.022 (5)	0.008 (5)	-64	0.013 (7)	0.008 (5)	-38

1. Number of samples is in parentheses.

Table 4: Model Estimates of Mean and Most-likely Range of Total Mercury Concentration (mg/kg wwt) in the Liver and Muscle of Beaver and Muskrat that Forage within the Keeyask Reservoir and/or Stephens Lake

Species	Existing Environment	Peak	Long-term
	Day 1	Year 3 to 7	Years 20–30
Beaver	0.01 (<0.01–0.05)	0.01 (<0.01–0.05)	0.01 (<0.01–0.05)
Muskrat	0.02 (<0.01–0.06)	0.04 (<0.01–0.12)	0.02 (<0.01–0.06)

Mercury levels in mink liver and muscle tissue were also lower after the reservoir was impounded than before (Table 5), but mercury levels in river otter liver and muscle tissue increased after the reservoir was impounded. Mercury levels in mink livers were within the range predicted in the EIS. Mercury levels in river otter livers approached the anticipated peak mean value but were well within the anticipated peak range (Table 6).

Table 5: Mean Mercury Concentration (mg/kg wwt) in On-system Mink and River Otter Tissue before (2003–2018) and after (2021/22) Reservoir Impoundment

Species	Liver			Muscle		
	Pre-impoundment	Post-impoundment	Percentage Change	Pre-impoundment	Post-impoundment	Percentage Change
Mink	2.310 (9)[1]	0.858 (2)	-63	1.150 (18)	0.599 (2)	-48
River otter	1.708 (14)	5.903 (3)	+246	0.591 (16)	1.198 (3)	+103

1. Number of samples is in parentheses.

Table 6: Model Estimates of Mean and Most-likely Range of Total Mercury Concentration (mg/kg wwt) in the Liver of Mink and River Otter that Forage within the Keeyask Reservoir and/or Stephens Lake

Species	Existing Environment	Peak	Long-term
	Day 1	Year 3 to 7	Years 20–30
Mink	1.52 (0.56–3.16)	4.00 (0.56–30.60)	1.52 (0.56–3.16)
River otter	0.55 (0.28–3.97)	6.00 (0.28–17.63)	0.55 (0.28–3.97)

For other wild foods, no change in mercury was anticipated for Canada goose (*Branta canadensis*), moose, or snowshoe hare (Table 7). A small increase was predicted for mallard

(*Anas platyrhynchos*). No samples from local resource users were submitted in 2021/22 to verify these predictions.

Table 7: Estimates of Mean and Most-likely Range of Total Mercury Concentration (mg/kg wwt) in the Muscle of Wild Foods

Species	Existing Environment	Peak	Long-term
	Day 1	Year 3 to 7	Years 20–30
Canada goose[1]	0.03	~0.03	0.03
Mallard[1]	0.04	<0.19	0.04
Moose[2]	0.07 (<0.01–0.17)	0.07 (<0.01–0.17)	0.07 (<0.01–0.17)
Snowshoe hare[2]	0.05 (<0.01–0.12)	0.05 (<0.01–0.12)	0.05 (<0.01–0.12)

1. Model-predicted for fish inhabiting the Keeyask reservoir.
2. Mercury concentration was a literature estimate and may have greater uncertainty than other species for which measured values were obtained from the study area.

4.0 DISCUSSION

The reservoir was impounded in September 2020. Aquatic furbearer tissue samples from winter 2021/22 were collected early in the predicted mercury accumulation process to monitor for the potential bioaccumulation of mercury over time. Changes in mercury levels were expected over time for certain aquatic furbearer species, therefore these early results will help confirm predicted effects. No results of mercury monitoring in aquatic furbearers could be found for other hydroelectric reservoirs in Canada for comparison.

No change in mercury levels in beavers was anticipated after the Keeyask reservoir was impounded due to the minute quantities of mercury taken up by the vegetation that they consume. As expected, mercury levels in beaver tissue collected in winter 2021/22 after reservoir impoundment were low and there had been no apparent change since the pre-construction samples were collected from 2003 to 2018.

Marginal increases in mercury levels in muskrats were anticipated after reservoir impoundment because they forage on aquatic plants and animals, the latter of which will likely accumulate more mercury in the reservoir area following impoundment. No increase in mercury levels in muskrat tissue was observed in winter 2021/22 shortly after reservoir impoundment; mercury levels were higher during the pre-construction/pre-impoundment period. Mercury levels in liver tissue were lower than the mean but within the range of values predicted in the EIS.

Mercury levels in mink were expected to increase after reservoir impoundment, peak approximately seven years later, and then return to pre-Project levels 20 to 30 years post-impoundment. The mean mercury level in mink liver and muscle tissue was lower in winter 2021/22, shortly after reservoir impoundment (in winter 2021/22) than before and was well within the peak range predicted in the EIS. Because the mink diet is primarily small mammals supplemented with fish and other wildlife (Eagle and Whitman 1998), mercury would be expected to accumulate relatively slowly in their tissues.

Mercury levels in river otters were expected to increase after reservoir impoundment, peak approximately seven years later, and then return to pre-Project levels 20 to 30 years post-impoundment. The mean and maximum mercury levels in river otter liver samples were greater shortly after reservoir impoundment (in winter 2021/22) than before, suggesting that some river otters whose ranges overlapped the Keeyask reservoir were beginning to accumulate mercury in their tissues. Mercury levels in the livers of river otters collected during Project construction were within the peak range predicted in the EIS. Because the sample sizes for all aquatic furbearers, particularly mink and river otter, were relatively small, caution should be used in the interpretation of the results.

No tissue samples from wild foods such as Canada goose, mallard, moose, and snowshoe hare have been submitted for analysis to date. Small increases in mercury levels in mallard were anticipated after reservoir impoundment; no changes in Canada goose, moose, and snowshoe hare were expected. If tissue samples of these wild food species are submitted during Project

operation, they will be analyzed to monitor potential risks to human health because of increased mercury in the reservoir-area environment.

5.0 SUMMARY AND CONCLUSIONS

No increase in mercury levels in beaver, muskrat, or mink was observed in winter 2021/22, shortly after the Keeyask reservoir was impounded. Mercury levels in river otter, particularly one individual, did increase shortly after reservoir impoundment. All mercury levels in sampled animals were within the peak range predicted in the EIS. Caution should be used in the interpretation of these results because sample sizes were relatively small. Mercury concentrations in tissues from aquatic furbearers trapped during the post-construction years will be analyzed and added to the existing database for comparison with mercury concentration in aquatic furbearers during Project operation. If samples from other wild foods such as waterfowl, moose, or snowshoe hare are submitted for analysis by local resource users, they will be analyzed to monitor potential risks to human health because of increased mercury in the reservoir-area environment.

6.0 LITERATURE CITED

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APPENDIX 1:
MERCURY RESULTS 2003–2008 AND 2017–2018

Table A-1: Mercury Concentration (mg/kg wwt) in On-system Aquatic Furbearers before Reservoir Impoundment, 2003–2008 (before Construction) and 2017–2018 (during Construction)

Species	Period	Muscle			Liver		
		Mean	Range[1]	Number of Samples	Mean	Range[1]	Number of Samples
Beaver	2003–2008	0.009	0.003–0.01	34	0.008	0.003–0.010	16
	2017–2018	0.006	0.003–0.012	6	–	–	0
Muskrat	2003–2008	0.013	0.003–0.027	7	0.026	0.004–0.061	4
	2017–2018	–	–	0	0.004	0.004	1
Mink	2003–2008	1.150	0.553–2.237	18	2.310	1.36–3.04	9
River otter	2003–2008	0.591	0.127–1.52	14	1.658	0.303–3.81	12
	2017–2018	0.594	0.588–0.600	2	2.007	0.354–3.66	2

1. Decimal places reported as in results from the laboratory.

APPENDIX 2:
LABORATORY RESULTS 2021/22

Wildlife Resource Consulting Services MB Inc.
ATTN: ROBERT BERGER
495-B Madison Street
Winnipeg MB R3J 1J2

Date Received: 03-MAR-22
Report Date: 01-APR-22 08:56 (MT)
Version: FINAL

Client Phone: 204-452-2197

Certificate of Analysis

Lab Work Order #: L2689830
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Craig Riddell, B.Sc.Ag
Account Manager

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PAGE 2 of 8
Version: FINAL

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2689830-1 MINK1KIDNEY							
Sampled By: CLIENT on 17-DEC-21							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.597		0.010	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	73.6		0.10	%		09-MAR-22	R5738004
L2689830-2 MINK1LEGMUSCLE							
Sampled By: CLIENT on 17-DEC-21							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.659		0.010	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	75.0		0.10	%		09-MAR-22	R5738004
L2689830-3 MINK1LIVER							
Sampled By: CLIENT on 17-DEC-21							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.585		0.010	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	70.4		0.10	%		09-MAR-22	R5738004
L2689830-4 MINK2KIDNEY							
Sampled By: CLIENT on 26-DEC-21							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.674		0.010	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	72.2		0.10	%		09-MAR-22	R5738004
L2689830-5 MINK2LEGMUSCLE							
Sampled By: CLIENT on 26-DEC-21							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.539		0.010	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	71.6		0.10	%		09-MAR-22	R5738004
L2689830-6 MINK2LIVER							
Sampled By: CLIENT on 26-DEC-21							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	1.13		0.020	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	66.2		0.10	%		09-MAR-22	R5738004
L2689830-7 OTTER1KIDNEY							
Sampled By: CLIENT on 18-DEC-21							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	5.83		0.040	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	75.7		0.10	%		09-MAR-22	R5738004
L2689830-8 OTTER1LEGMUSCLE							
Sampled By: CLIENT on 18-DEC-21							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	2.48		0.020	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	75.7		0.10	%		09-MAR-22	R5738004
L2689830-9 OTTER1LIVER							
Sampled By: CLIENT on 18-DEC-21							
Matrix: TISSUE							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2689830-9 OTTER1LIVER							
Sampled By: CLIENT on 18-DEC-21							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	11.0		0.040	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	71.6		0.10	%		09-MAR-22	R5738004
L2689830-10 OTTER2KIDNEY							
Sampled By: CLIENT on 26-JAN-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	2.19		0.020	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	72.0		0.10	%		09-MAR-22	R5738004
L2689830-11 OTTER2LEGMUSCLE							
Sampled By: CLIENT on 26-JAN-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.635		0.010	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	72.8		0.10	%		09-MAR-22	R5738004
L2689830-12 OTTER2LIVER							
Sampled By: CLIENT on 26-JAN-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	4.59		0.020	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	67.7		0.10	%		09-MAR-22	R5738004
L2689830-13 OTTER3KIDNEY							
Sampled By: CLIENT on 26-JAN-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	1.46		0.020	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	67.3		0.10	%		09-MAR-22	R5738004
L2689830-14 OTTER3LEGMUSCLE							
Sampled By: CLIENT on 26-JAN-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.480		0.010	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	72.4		0.10	%		09-MAR-22	R5738004
L2689830-15 OTTER3LIVER							
Sampled By: CLIENT on 26-JAN-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	2.12		0.020	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	70.6		0.10	%		09-MAR-22	R5738004
L2689830-16 BEAVER1KIDNEY							
Sampled By: CLIENT on 26-DEC-21							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0400		0.0020	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	80.2		0.10	%		09-MAR-22	R5738004
L2689830-17 BEAVER1LEGMUSLE							
Sampled By: CLIENT on 26-DEC-21							
Matrix: TISSUE							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2689830-17 BEAVER1LEGMUSLE							
Sampled By: CLIENT on 26-DEC-21							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0159		0.0020	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	76.8		0.10	%		09-MAR-22	R5738004
L2689830-18 BEAVER1LIVER							
Sampled By: CLIENT on 26-DEC-21							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0098		0.0020	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	70.9		0.10	%		09-MAR-22	R5738004
L2689830-19 BEAVER2KIDNEY							
Sampled By: CLIENT on 26-DEC-21							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0447		0.0020	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	78.2		0.10	%		09-MAR-22	R5738004
L2689830-20 BEAVER2LEGMUSCLE							
Sampled By: CLIENT on 26-DEC-21							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0116		0.0020	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	75.5		0.10	%		09-MAR-22	R5738004
L2689830-21 BEAVER2LIVER							
Sampled By: CLIENT on 26-DEC-21							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0109		0.0020	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	75.1		0.10	%		09-MAR-22	R5738009
L2689830-22 BEAVER3KIDNEY							
Sampled By: CLIENT on 29-JAN-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0027		0.0020	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	79.5		0.10	%		09-MAR-22	R5738009
L2689830-23 BEAVER3LEGMUSCLE							
Sampled By: CLIENT on 29-JAN-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0011		0.0010	mg/kg wwt	08-MAR-22	31-MAR-22	R5752229
% Moisture	74.9		0.10	%		09-MAR-22	R5738009
L2689830-24 BEAVER3LIVER							
Sampled By: CLIENT on 29-JAN-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	<0.0010		0.0010	mg/kg wwt	08-MAR-22	31-MAR-22	R5752229
% Moisture	76.6		0.10	%		09-MAR-22	R5738009
L2689830-25 BEAVER4KIDNEY							
Sampled By: CLIENT on 03-FEB-22							
Matrix: TISSUE							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2689830-25 BEAVER4KIDNEY							
Sampled By: CLIENT on 03-FEB-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0084		0.0010	mg/kg wwt	08-MAR-22	31-MAR-22	R5752229
% Moisture	80.9		0.10	%		09-MAR-22	R5738009
L2689830-26 BEAVER4LEGMUSCLE							
Sampled By: CLIENT on 03-FEB-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0029		0.0010	mg/kg wwt	08-MAR-22	31-MAR-22	R5752229
% Moisture	75.1		0.10	%		09-MAR-22	R5738009
L2689830-27 BEAVER4LIVER							
Sampled By: CLIENT on 03-FEB-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0028		0.0010	mg/kg wwt	08-MAR-22	31-MAR-22	R5752229
% Moisture	75.8		0.10	%		09-MAR-22	R5738009
L2689830-28 BEAVER5KIDNEY							
Sampled By: CLIENT on 07-FEB-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0018		0.0010	mg/kg wwt	08-MAR-22	31-MAR-22	R5752229
% Moisture	78.8		0.10	%		09-MAR-22	R5738009
L2689830-29 BEAVER5LEGMUSCLE							
Sampled By: CLIENT on 07-FEB-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	<0.0010		0.0010	mg/kg wwt	08-MAR-22	31-MAR-22	R5752229
% Moisture	76.3		0.10	%		09-MAR-22	R5738009
L2689830-30 BEAVERLIVER							
Sampled By: CLIENT on 07-FEB-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	<0.0010		0.0010	mg/kg wwt	08-MAR-22	31-MAR-22	R5752229
% Moisture	75.0		0.10	%		09-MAR-22	R5738009
L2689830-31 MUSKRAT1KIDNEY							
Sampled By: CLIENT on 27-JAN-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0226		0.0010	mg/kg wwt	08-MAR-22	31-MAR-22	R5752229
% Moisture	75.1		0.10	%		09-MAR-22	R5738009
L2689830-32 MUSKRAT1LEGMUSCLE							
Sampled By: CLIENT on 27-JAN-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0063		0.0010	mg/kg wwt	08-MAR-22	31-MAR-22	R5752229
% Moisture	74.5		0.10	%		09-MAR-22	R5738009
L2689830-33 MUSKRATLIVER							
Sampled By: CLIENT on 27-JAN-22							
Matrix: TISSUE							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2689830-33 MUSKRATLIVER							
Sampled By: CLIENT on 27-JAN-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0055		0.0010	mg/kg wwt	08-MAR-22	31-MAR-22	R5752229
% Moisture	69.9		0.10	%		09-MAR-22	R5738009
L2689830-34 MUSKRAT2KIDNEY							
Sampled By: CLIENT on 27-JAN-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0242		0.0010	mg/kg wwt	08-MAR-22	31-MAR-22	R5752229
% Moisture	77.2		0.10	%		09-MAR-22	R5738009
L2689830-35 MUSKRAT2LEGMUSCLE							
Sampled By: CLIENT on 27-JAN-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0141		0.0010	mg/kg wwt	08-MAR-22	31-MAR-22	R5752229
% Moisture	69.2		0.10	%		09-MAR-22	R5738009
L2689830-36 MUSKRAT2LIVER							
Sampled By: CLIENT on 27-JAN-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0082		0.0010	mg/kg wwt	08-MAR-22	31-MAR-22	R5752229
% Moisture	72.3		0.10	%		09-MAR-22	R5738009
L2689830-37 MUSKRAT3KIDNEY							
Sampled By: CLIENT on 27-JAN-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0520		0.0020	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	71.7		0.10	%		09-MAR-22	R5738009
L2689830-38 MUSKRAT3LEGMUSCLE							
Sampled By: CLIENT on 27-JAN-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0085		0.0010	mg/kg wwt	08-MAR-22	31-MAR-22	R5752229
% Moisture	75.4		0.10	%		09-MAR-22	R5738009
L2689830-39 MUSKRAT3LIVER							
Sampled By: CLIENT on 27-JAN-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0133		0.0020	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	72.2		0.10	%		09-MAR-22	R5738009
L2689830-40 MUSKRAT4KIDNEY							
Sampled By: CLIENT on 03-FEB-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0314		0.0020	mg/kg wwt	08-MAR-22	30-MAR-22	R5752193
% Moisture	78.5		0.10	%		09-MAR-22	R5738009
L2689830-41 MUSKRAT4LEGMUSCLE							
Sampled By: CLIENT on 03-FEB-22							
Matrix: TISSUE							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2689830-41 MUSKRAT4LEGMUSCLE							
Sampled By: CLIENT on 03-FEB-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0082		0.0010	mg/kg wwt	10-MAR-22	31-MAR-22	R5752229
% Moisture	73.8		0.10	%		10-MAR-22	R5739469
L2689830-42 MUSKRAT4LIVER							
Sampled By: CLIENT on 03-FEB-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0057		0.0010	mg/kg wwt	10-MAR-22	31-MAR-22	R5752229
% Moisture	73.1		0.10	%		10-MAR-22	R5739469
L2689830-43 MUSKRAT5KIDNEY							
Sampled By: CLIENT on 07-FEB-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0368		0.0020	mg/kg wwt	10-MAR-22	30-MAR-22	R5752193
% Moisture	80.3		0.10	%		10-MAR-22	R5739469
L2689830-44 MUSKRAT5LEGMUSCLE							
Sampled By: CLIENT on 07-FEB-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0041		0.0010	mg/kg wwt	10-MAR-22	31-MAR-22	R5752229
% Moisture	75.7		0.10	%		10-MAR-22	R5739469
L2689830-45 MUSKRAT5LIVER							
Sampled By: CLIENT on 07-FEB-22							
Matrix: TISSUE							
Miscellaneous Parameters							
Mercury (Hg)	0.0059		0.0010	mg/kg wwt	10-MAR-22	31-MAR-22	R5752229
% Moisture	72.9		0.10	%		10-MAR-22	R5739469

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

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Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
HG-WET-CVAA-WP	Tissue	Mercury in Tissue	EPA 200.3/1631E (mod)
Tissue samples undergo hotblock digestion with nitric and hydrochloric acids, in combination with repeated additons of hydrogen peroxide, followed by cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analysis by CVAAS.			
MOISTURE-IN-WP	Tissue	Percent Moisture	ASTMD2974-87, Method B

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WP	ALS ENVIRONMENTAL - WINNIPEG, MANITOBA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

ALS Environmental

Quality Control Report

Workorder: L2689830 Report Date: 01-APR-22 Page 1 of 2

Client: Wildlife Resource Consulting Services MB Inc.
495-B Madison Street
Winnipeg MB R3J 1J2

Contact: ROBERT BERGER

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
HG-WET-CVAA-WP	Tissue							
Batch R5752193								
WG3703305-3 CRM		**DORM-4N**						
Mercury (Hg)			100.0		%		70-130	30-MAR-22
WG3703305-7 CRM		**DORM-4N**						
Mercury (Hg)			105.2		%		70-130	30-MAR-22
WG3704254-5 CRM		**DORM-4N**						
Mercury (Hg)			82.0		%		70-130	30-MAR-22
WG3703305-4 DUP		**L2689830-7**						
Mercury (Hg)		5.83	5.46		mg/kg wwt	6.7	40	30-MAR-22
WG3703305-8 DUP		**L2689830-21**						
Mercury (Hg)		0.0109	0.0109		mg/kg wwt	0.2	40	30-MAR-22
WG3703305-2 LCS								
Mercury (Hg)			99.7		%		80-120	30-MAR-22
WG3703305-6 LCS								
Mercury (Hg)			99.5		%		80-120	30-MAR-22
WG3704254-2 LCS								
Mercury (Hg)			91.9		%		80-120	30-MAR-22
WG3703305-1 MB								
Mercury (Hg)			<0.0010		mg/kg wwt		0.001	30-MAR-22
WG3703305-5 MB								
Mercury (Hg)			<0.0010		mg/kg wwt		0.001	30-MAR-22
WG3704254-1 MB								
Mercury (Hg)			<0.0010		mg/kg wwt		0.001	30-MAR-22
MOISTURE-IN-WP	Tissue							
Batch R5738004								
WG3703796-1 DUP		**L2689830-1**						
% Moisture		73.6	74.1		%	0.6	20	09-MAR-22
Batch R5738009								
WG3703797-1 DUP		**L2689830-21**						
% Moisture		75.1	75.2		%	0.0	20	09-MAR-22
Batch R5739469								
WG3704788-1 DUP		**L2689830-42**						
% Moisture		73.1	72.9		%	0.3	20	10-MAR-22

Quality Control Report

Workorder: L2689830 Report Date: 01-APR-22 Page 2 of 2

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.