Keeyask Generation Project

Terrestrial Effects Monitoring Plan

Mercury in Wildlife Monitoring Report

TEMP-2024-15

KEEYASK

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

2023 -2024

KEEYASK GENERATION PROJECT

TERRESTRIAL EFFECTS MONITORING PLAN

REPORT #TEMP-2024-15

MERCURY MONITORING IN WILDLIFE

YEAR 2 OPERATION

2023

Prepared for

Manitoba Hydro

By

Wildlife Resource Consulting Services MB Inc.

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SUMMARY

Background

Construction of the Keeyask Generation Project (the Project) at Gull Rapids began in July 2014, the reservoir was flooded in early September 2020, and the generating station was fully operational in March 2022**.** 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.

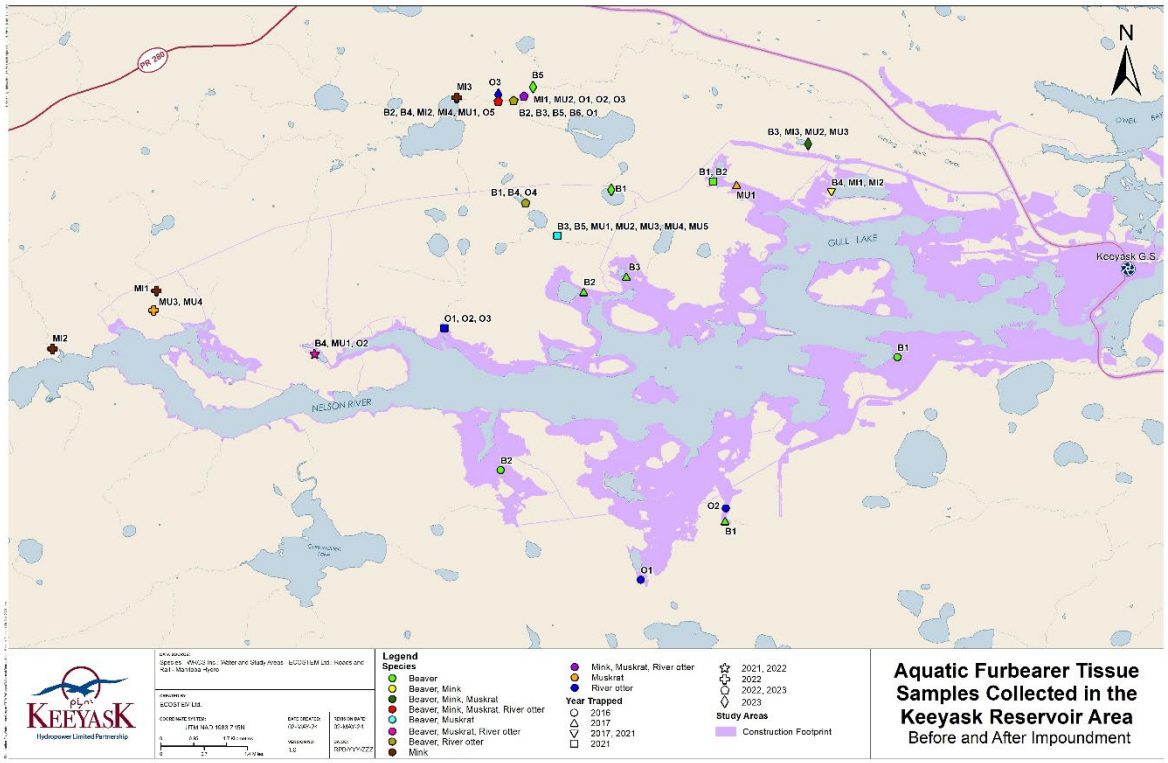
Reservoir flooding (also called impoundment) was expected to increase mercury levels in the Keeyask reservoir, which could affect aquatic furbearers such as beaver, muskrat, mink, and river otter. Potential Project effects included increased mercury levels in fish, and in mink and river otter, which are 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 (liver, leg muscle, and kidney) from beaver, muskrat, mink, and river otter trapped near the Keeyask reservoir in the winters of 2021/22, 2022/23 and 2023/24 were analyzed for mercury. All sampled animals 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 the winters of 2016/17 and 2017/18 during Project construction but before the reservoir was impounded.



Aquatic Furbearer Tissue Samples Collected in the Keeyask Reservoir Area before (2016/17, 2017/18) and after (2021/22, 2022/23, 2023/24) Impoundment

What was found?

Mercury levels in beaver and muskrat remained low shortly after the reservoir was impounded, but mercury levels in some mink and 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 because the plants that they eat take up very small amounts of mercury. Small increases in mercury levels in muskrats were expected because they eat aquatic animals, which were expected to accumulate mercury after impoundment. As predicted, mercury levels in beaver and muskrat tissue collected after the reservoir was impounded remained low as observed during the winters of 2021/22, 2022/23 and 2023/24.

Mercury levels in mink and river otter were expected to increase after reservoir impoundment. Mercury levels in mink were somewhat lower after the reservoir was impounded than before, likely because their diet is mainly small mammals and only occasionally fish. Mercury levels in mink liver appear to be increasing. The increased mercury levels in river otters suggested that some individual animals whose ranges overlap the reservoir are beginning to accumulate mercury in

their tissues, as anticipated. Mercury levels in river otters in 2021/22, 2022/23 and 2023/24 were within the peak range predicted in the Environmental Impact Assessment.

What will be done next?

Mercury levels in tissues from aquatic furbearers trapped during Project operation will continue to be analyzed and added to the existing database for comparison with mercury levels in aquatic furbearers before the reservoir was impounded. 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 mercury in the environment. Results from this study are provided to the Project toxicologist to review for potential risks to human health.

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, Wildlife Resource Consulting Services MB Inc. (WRCS) – 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

The Keeyask Generation Project (the Project) is a 695-megawatt hydroelectric generating station (GS) located at the former Gull Rapids on the lower Nelson River in northern Manitoba where Gull Lake flows into Stephens Lake. Project construction began in July 2014, the reservoir was impounded in early September 2020, and the GS was fully operational in March 2022.

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 impoundment was expected to increase methylmercury ("mercury") levels in the Keeyask reservoir, which could affect aquatic furbearers. Potential Project effects included 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. 2018). Tissue samples from trapped animals were collected and submitted for mercury analysis. Additional samples were collected in the winters of 2021/22 and 2022/23, after the reservoir was impounded. All sampled animals 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 mercury levels in the environment after the Keeyask reservoir is flooded. Results from this study are provided to the Project toxicologist to review for potential risks to human health.

2.0 METHODS

During Project construction, tissue samples (leg muscle, liver, and/or kidney) 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 2016/17 and 2017/18. After the reservoir was impounded, additional samples from aquatic furbearers trapped from RTL 15 (categorized as "on-system" because it overlapped the Nelson River and was also located in Study Zone 5) in winter 2021/22 included five beavers, five muskrats, two mink, and three river otters. In winter 2022/23, samples from six beavers, five muskrats, four mink, and three river otters were collected. In winter 2023/24, samples from five beavers, three muskrats, three mink, and five river otters were collected. No samples from other wildlife species were submitted by the partner First Nations during the Project's construction and early operation monitoring periods.

Table 1: On-system Aquatic Furbearer Tissue Samples Collected before (2016/17, 2017/18) and after (2021/22, 2022/23, 2023/24) Reservoir Impoundment

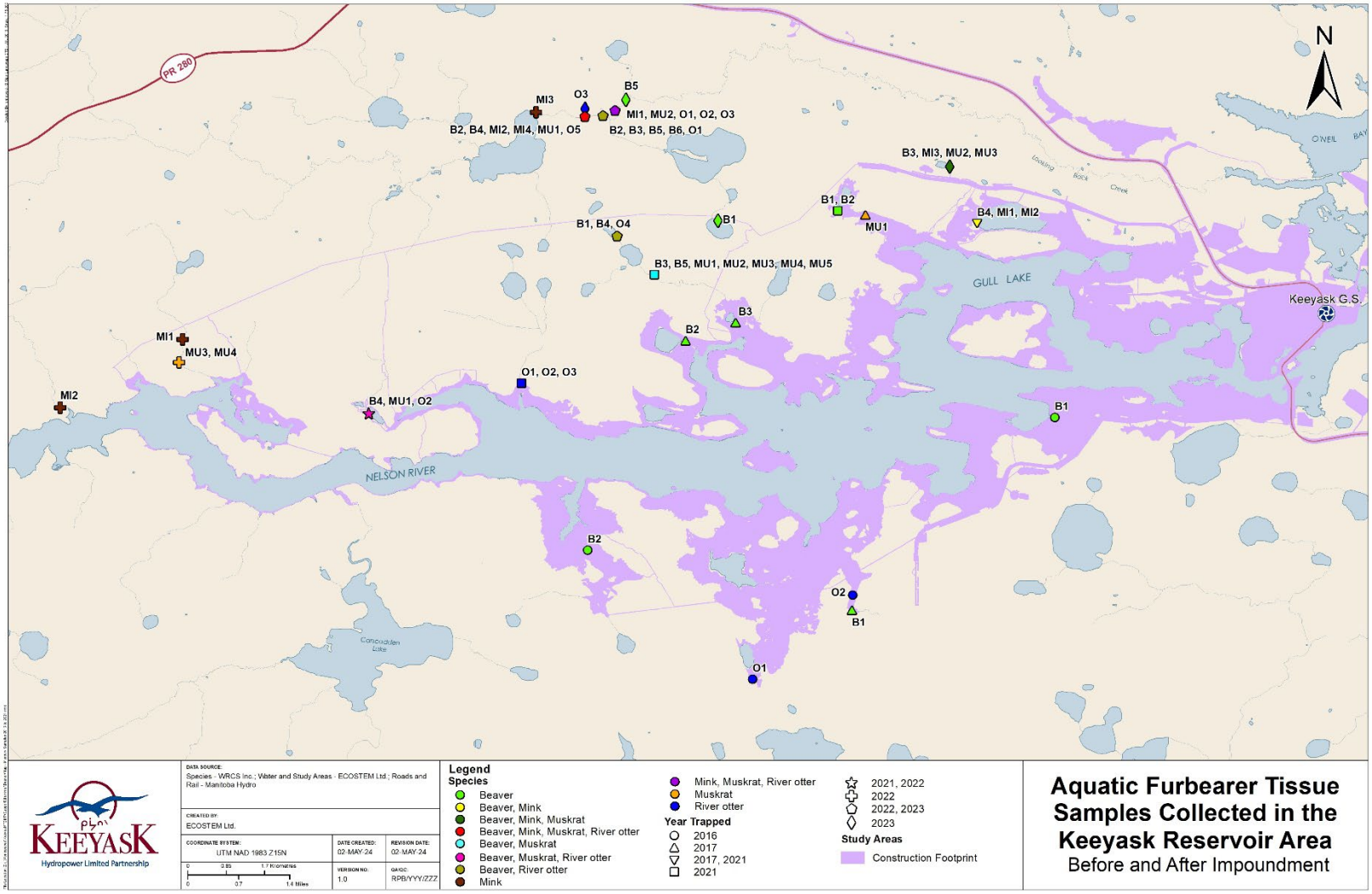
Winter Trapped	Species	Map ID	Lab ID	Tissue Collected	Location
2016/17	Beaver	B1	LODGE7	Muscle	15 V 357954 6244917
	Beaver	B2	LODGE23	Muscle, kidney	15 V 347619 6241984
	Otter	O1	LODGE14	Liver, muscle, kidney	15 V 351273 6239131
	Otter	O2	LODGE20	Liver, muscle, kidney	15 V 353487 6240990
2017/18	Beaver	B1	LODGE21	Muscle, kidney	15 V 353469 6240652
	Beaver	B2	LODGE41	Muscle, kidney	15 V 349789 6246611
	Beaver	B3	LODGE42	Muscle	15 V 350894 6247016
	Beaver	B4	LODGE47	Muscle	15 V 356236 6249204
	Muskrat	MU1	LODGE43	Liver, muscle, kidney	15 V 353769 6249395
2021/22	Beaver	B1	BEAVER1	Liver, muscle, kidney	15 V 353154 6249488
	Beaver	B2	BEAVER2	Liver, muscle, kidney	15 V 353154 6249488
	Beaver	B3	BEAVER3	Liver, muscle, kidney	15 V 349098 6248074
	Beaver	B4	BEAVER4	Liver, muscle, kidney	15 V 342782 6245002
	Beaver	B5	BEAVER5	Liver, muscle, kidney	15 V 349098 6248074
	Muskrat	MU1	MUSKRAT1	Liver, muscle, kidney	15 V 349098 6248074
	Muskrat	MU2	MUSKRAT2	Liver, muscle, kidney	15 V 349098 6248074
	Muskrat	MU3	MUSKRAT3	Liver, muscle, kidney	15 V 349098 6248074
	Muskrat	MU4	MUSKRAT4	Liver, muscle, kidney	15 V 349098 6248074
	Muskrat	MU5	MUSKRAT5	Liver, muscle, kidney	15 V 349098 6248074
	Mink	MI1	MINK1	Liver, muscle, kidney	15 V 356229 6249198
	Mink	MI2	MINK2	Liver, muscle, kidney	15 V 356229 6249198
	Otter	O1	OTTER1	Liver, muscle, kidney	15 V 346158 6245678
	Otter	O2	OTTER2	Liver, muscle, kidney	15 V 346158 6245678
	Otter	O3	OTTER3	Liver, muscle, kidney	15 V 346158 6245678
2022/23	Beaver	B1	BEAVER1	Liver, muscle, kidney	15 V 348273 6248930

Winter Trapped	Species	Map ID	Lab ID	Tissue Collected	Location
	Beaver	B2	BEAVER2	Liver, muscle, kidney	15 V 347962 6251588
	Beaver	B3	BEAVER3	Liver, muscle, kidney	15 V 347962 6251588
	Beaver	B4	BEAVER4	Liver, muscle, kidney	15 V 348273 6248930
	Beaver	B5	BEAVER5	Liver, muscle, kidney	15 V 347962 6251588
	Beaver	B6	BEAVER6	Liver, muscle, kidney	15 V 347962 6251588
	Muskrat	MU1	MUSKRAT1	Liver, muscle, kidney	15 V 342782 6245002
	Muskrat	MU2	MUSKRAT2	Liver, muscle, kidney	15 V 348263 6251699
	Muskrat	MU3	MUSKRAT3	Liver, muscle, kidney	15 V 338588 6246134
	Muskrat	MU4	MUSKRAT4	Liver, muscle, kidney	15 V 338588 6246134
	Muskrat	MU5	MUSKRAT5	Liver, muscle, kidney	14 V 651972 6244812
	Mink	MI1	MINK1	Liver, muscle, kidney	15 V 338663 6246643
	Mink	MI2	MINK2	Liver, muscle, kidney	15 V 335956 6245133
	Mink	MI3	MINK3	Liver, muscle, kidney	15 V 346482 6251670
	Mink	MI4	MINK4	Liver, muscle, kidney	15 V 347556 6251572
	Otter	O1	OTTER1	Liver, muscle, kidney	15 V 348263 6251699
	Otter	O2	OTTER2	Liver, muscle, kidney	15 V 342782 6245002
	Otter	O3	OTTER3	Liver, muscle, kidney	15 V 348263 6251699
2023/24	Beaver	B1	BEAVER4	Liver, muscle, kidney	15 V 350504 6249266
	Beaver	B2	BEAVER6	Liver, muscle, kidney	15 V 347557 6251568
	Beaver	B2	BEAVER7	Liver, muscle, kidney	15 V 355631 6250463
	Beaver	B4	BEAVER9	Liver, muscle, kidney	15 V 347557 6251567
	Beaver	B5	BEAVER10	Liver, muscle, kidney	15 V 348466 6251944
	Muskrat	MU1	MUSKRAT1	Liver, muscle, kidney	15 V 348229 6251704
	Muskrat	MU2	MUSKRAT2	Liver, muscle, kidney	15 V 347557 6251568
	Muskrat	MU3	MUSKRAT3	Liver, muscle, kidney	15 V 355631 6250463
	Mink	MI1	MINK1	Liver, muscle, kidney	15 V 347557 6251567
	Mink	MI2	MINK2	Liver, muscle, kidney	15 V 355631 6250463
	Mink	MI3	MINK3	Liver, muscle, kidney	15 V 355631 6250463
	Otter	O1	OTTER1	Liver, muscle, kidney	15 V 347977 6251585
	Otter	O2	OTTER2	Liver, muscle, kidney	15 V 348228 6251720
	Otter	O3	OTTER3	Liver, muscle, kidney	15 V 347564 6251743
	Otter	O4	OTTER6	Liver, muscle, kidney	15 V 348213 6248870
	Otter	O5	OTTER7	Liver, muscle, kidney	15 V 347557 6251568

Tissue samples were kept frozen until submission 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 the samples collected during Project construction (the winters of 2016/17 and 2017/18) were compiled with those from 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, well before Project construction and reservoir impoundment. The home ranges of the sampled animals were presumed to overlap the regulated water system. Pre-impoundment

samples were compared with those collected in the winters of 2021/22, 2022/23 and 2023/24, after the reservoir was impounded and when mercury was expected to begin to accumulate within aquatic furbearers' tissues. Pre-impoundment mercury levels in aquatic furbearers are provided 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 before (2016/17, 2017/18) and after (2021/22, 2022/23, 2023/24) Impoundment

3.0 RESULTS

Mercury levels remained low in beaver and muskrat tissue in winter 2023/24, with some variation among sampled animals (Table 2). Mercury levels were similar in mink and river otter tissue samples. Greater levels were measured in the tissues of MI1 than in the other two mink. Mercury levels in river otter tissues were considerably greater in O4 than in the other four individuals. Complete laboratory analysis results from the 2023/24 samples are provided in Appendix 2.

Table 2: Mercury Concentration in On-system Aquatic Furbearers after Reservoir Impoundment, Winter 2023/24

Species	Map ID	Lab ID	Year Trapped	Mercury Concentration (mg/kg wwt)[1]		
				Liver	Muscle	Kidney
Beaver	B1	BEAVER4	2023	0.0020	0.0025	0.0083
	B2	BEAVER6	2023	0.0012	0.0020	0.0058
	B3	BEAVER7	2023	0.0020	0.0033	0.0087
	B4	BEAVER9	2023	0.0010	0.0013	0.0058
	B5	BEAVER10	2023	0.0016	0.0021	0.0113
			Range	0.0010–0.0020	0.0013–0.0033	0.0058–0.0113
Muskrat	MU1	MUSKRAT1	2023	0.0016	0.0050	0.0045
	MU2	MUSKRAT2	2023	0.0107	0.0178	0.0394
	MU3	MUSKRAT3	2023	0.0444	0.0433	0.0916
			Range	0.0016–0.0444	0.0050–0.0433	0.0045–0.0916
Mink	MI1	MINK1	2023	11.6	3.53	5.35
	MI2	MINK2	2023	0.539	0.252	0.651
	MI3	MINK3	2023	1.01	0.520	0.908
			Range	0.539–11.6	0.252–3.53	0.651–5.35
River otter	O1	OTTER1	2023	0.687	0.189	0.601
	O2	OTTER2	2023	0.137	0.187	0.524
	O3	OTTER3	2023	0.500	0.152	0.586
	O4	OTTER6	2023	13.6	3.15	6.80
	O5	OTTER7	2023	0.702	0.218	0.497
			Range	0.137–13.6	0.152–3.15	0.497–6.80

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

Mean mercury levels in beaver liver and muscle tissue were low before and after reservoir impoundment (Table 3; Figure 1). Similar mercury levels in muskrat liver and muscle tissue were also observed before and after the reservoir was impounded (Figure 2). The apparent reduction in mercury levels in beaver and muskrat tissues after impoundment is most likely the result of improvements in detection limits over time, where more precise measurements of mercury were made in the laboratory in recent years.

Table 3: Mean Mercury Concentration (mg/kg wwt) in On-system Beaver and Muskrat Tissue before (2003–2018) and after (2021/22, 2022/23, 2023/24) Reservoir Impoundment

	Liver		Muscle	
	Pre-impoundment	**Post-impoundment**	**Pre-impoundment**	**Post-impoundment**
Beaver	0.008 (16)[1]	0.003 (16)	0.008 (40)	0.003 (16)
Muskrat	0.022 (5)	0.017 (13)	0.013 (7)	0.017 (13)

1. Number of samples is in parentheses.

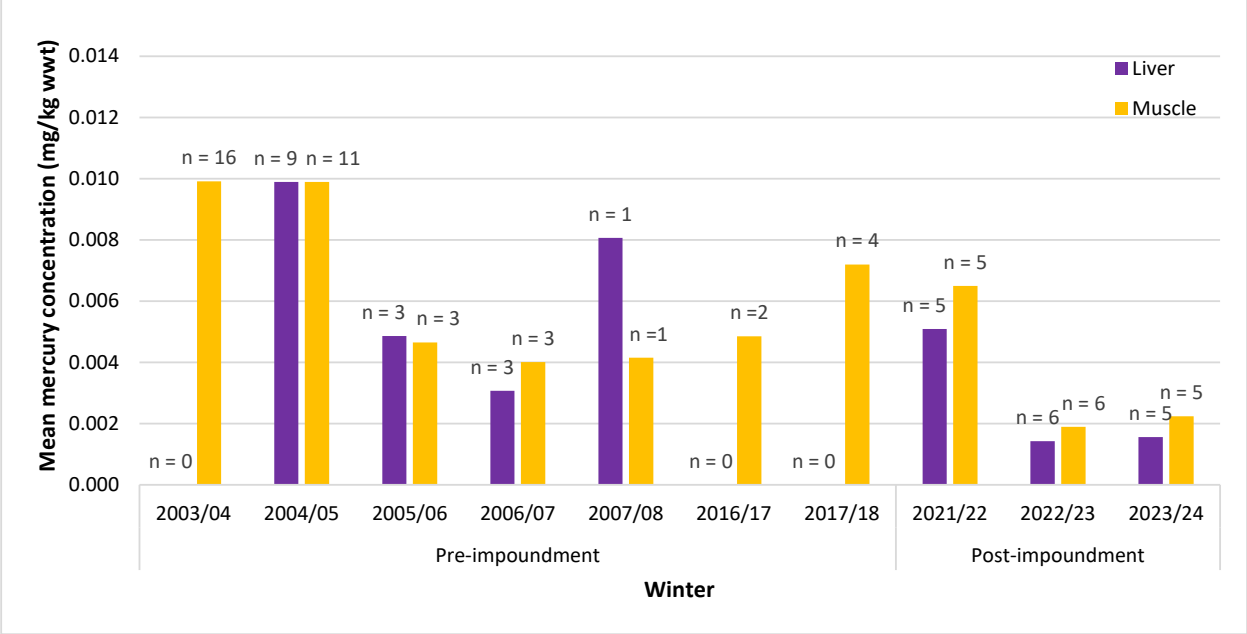


Figure 1: Mean Mercury Concentration in On-system Beaver Tissue before and after Reservoir Impoundment

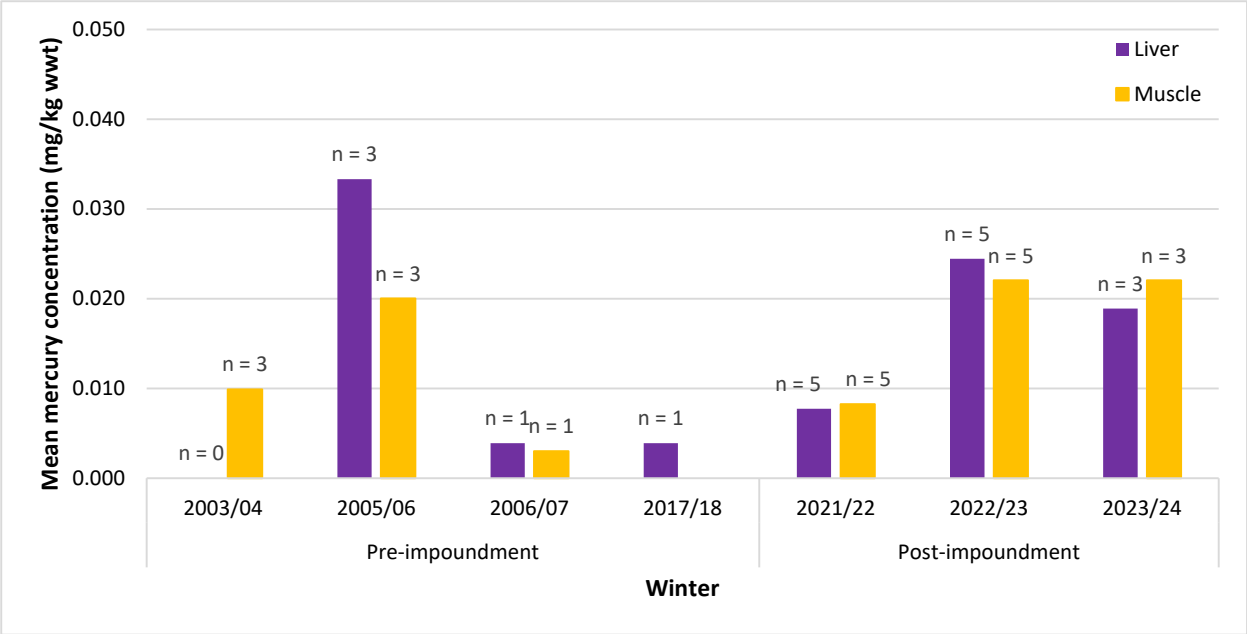


Figure 2: Mean Mercury Concentration in On-system Muskrat Tissue before and after Reservoir Impoundment

After reservoir impoundment, mercury levels in beaver liver tissue ranged from 0.001 to 0.011 mg/kg wwt and ranged from 0.001 to 0.016 in muscle tissue. Mercury levels in muskrat liver tissue ranged from 0.002 to 0.059 mg/kg wwt and in muscle tissue ranged from 0.004 to 0.043 mg/kg wwt over the same period. Mercury levels in all beaver liver and muscle samples collected after reservoir impoundment were within the early and peak ranges predicted in the EIS (Table 4). Mercury levels in most muskrat liver and muscle samples collected after impoundment were within the early range predicted in the EIS, and all were within the expected peak range.

Table 4: EIS 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)

Mean mercury levels in mink liver and muscle tissue were somewhat lower after the reservoir was impounded than before (Table 5; Figure 3), but in 2023/24, mercury levels in liver were increasing. The mean mercury levels in river otter liver and muscle tissue increased after the reservoir was impounded (Figure 4). The mean mercury concentration in liver have doubled when including samples collected in 2023/24.

Table 5: Mean Mercury Concentration (mg/kg wwt) in On-system Mink and River Otter Tissue before (2003–2018) and after (2021/22, 2022/23, 2023/24) Reservoir Impoundment

	Liver		Muscle	
	Pre-impoundment	**Post-impoundment**	**Pre-impoundment**	**Post-impoundment**
Mink	2.310 (9)[1]	2.072 (9)	1.150 (18)	0.926 (9)
River otter	1.708 (14)	3.675 (11)	0.591 (16)	0.826 (11)

1. Number of samples is in parentheses.

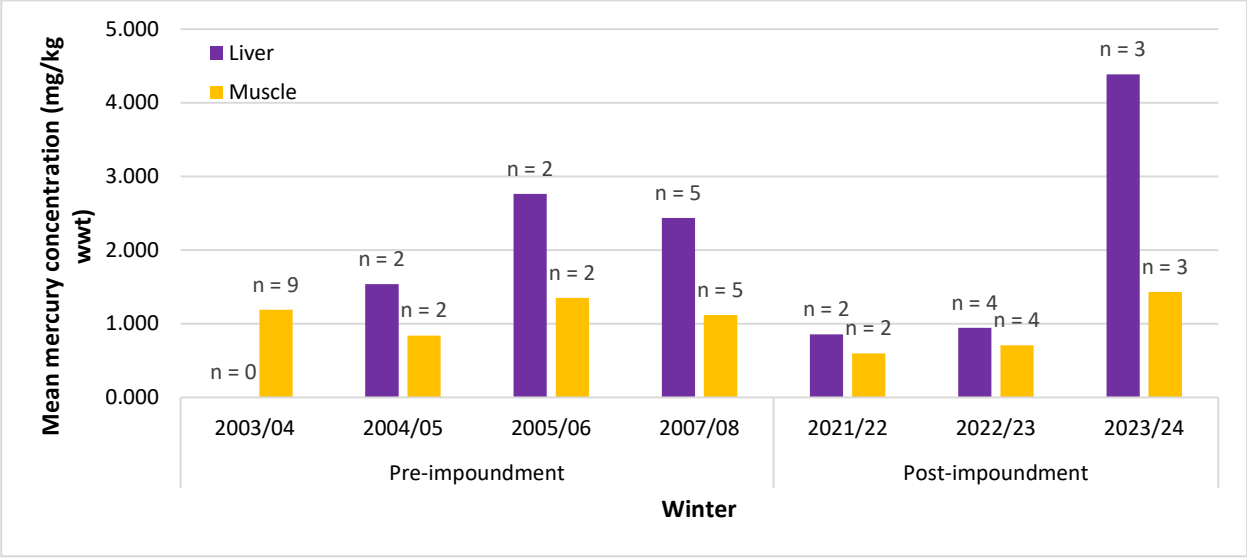


Figure 3: Mean Mercury Concentration in On-system Mink Tissue before and after Reservoir Impoundment

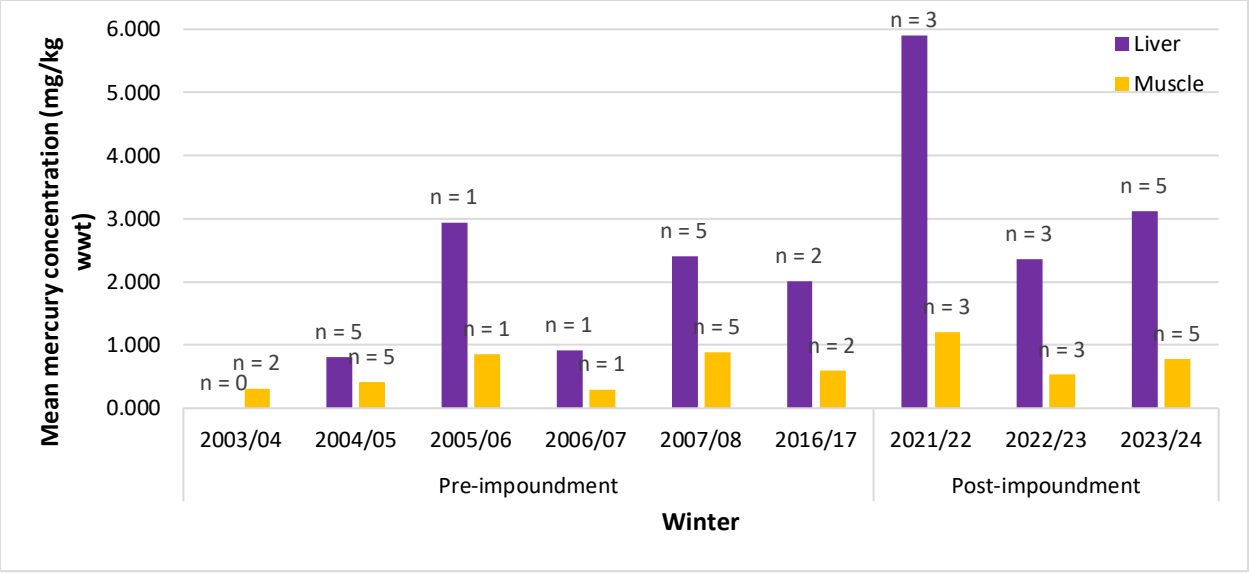


Figure 4: Mean Mercury Concentration in On-system River Otter Tissue before and after Reservoir Impoundment

After reservoir impoundment, mercury levels in mink liver tissue ranged from 0.418 to 11.6 mg/kg wwt, within the early and peak ranges predicted in the EIS (Table 6). Mercury levels ranged from 0.137 to 13.6mg/kg wwt in river otter liver tissue, well within the predicted peak range.

Table 6: EIS 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 partner First Nations resource users were submitted in 2021/22, 2022/23 or 2023/24 through the voluntary submission program to verify these EIS 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 Keeyask reservoir was impounded in September 2020. Aquatic furbearer tissue samples from winter 2021/22, 2022/23 and 2023/24 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 for certain aquatic furbearer species, which these early results will help to confirm. 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, mean mercury levels in beaver tissue collected after reservoir impoundment were low and there had been no apparent increase since the pre-impoundment 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 following impoundment. No increase in mean mercury levels in muskrat liver tissue was observed after the first three years of reservoir impoundment. Mercury levels in muscle tissue were marginally greater after impoundment than before, but all values were well within the peak range 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 after 20 to 30 years. The mean mercury level in mink liver tissue was lower after reservoir impoundment than before and all values were well within the early and peak ranges predicted in the EIS. In 2023/24 however, mercury levels in mink liver increased. Because minks' 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 after 20 to 30 years. The mean mercury level in river otter liver samples was greater after reservoir impoundment than before, suggesting that river otters whose ranges likely overlapped the Keeyask reservoir were beginning to accumulate mercury in their tissues. Mercury levels in the livers of river otters collected after impoundment 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.

To date, no tissue samples from wild foods such as Canada goose, mallard, moose, and snowshoe hare have been submitted for analysis by the partner First Nations. 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 for mercury content. Results from

all mercury in wildlife monitoring are shared with the Project toxicologist to assess potential risks to human health.

5.0 SUMMARY AND CONCLUSIONS

Mercury levels in beaver and muskrat remained low as observed in winter 2021/22, 2022/23 and 2023/24, shortly after the Keeyask reservoir was impounded in 2020. Increased mercury levels in some mink and river otters were observed. Mercury levels in all sampled animals were within the peak ranges 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 Project operation will be analyzed and added to the existing database for comparison with mercury concentration in aquatic furbearers before reservoir impoundment. If samples from other wild foods such as waterfowl, moose, or snowshoe hare are submitted for analysis by partner First Nations resource users, they will be analyzed for mercury concentration. Results from all mercury in wildlife monitoring are shared with the Project toxicologist to assess potential risks to human health.

6.0 LITERATURE CITED

Eagle, T.C. and Whitman, J.S. 1998. Mink. In Wild Furbearer Management and Conservation in North America. Edited by M. Novak, J.A. Baker, M.E. Obbard, and B. Malloch. Ontario Ministry of Natural Resources, Peterborough, ON. pp. 615–624.

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APPENDIX 1:
MERCURY IN WILDLIFE RESULTS
2003–2008, 2017–2018, 2021/22 AND 2022/23

Table A-1: Mercury Concentration (mg/kg wwt) in On-system Aquatic Furbearer Liver and Muscle Tissue 2003–2008, 2016/17–2017/18, and 2021/22-2022/23

Species	Period[1]	Liver			Muscle		
		Mean	Range[2]	Number	Mean	Range[2]	Number
Beaver	2003–2008	0.008	0.003–0.010	16	0.009	0.003–0.01	34
	2016/17–2017/18	–	–	0	0.006	0.003–0.012	6
	2021/22-2022/23	0.003	<0.0010–0.0109	11	0.004	<0.0010–0.0159	11
Muskrat	2003–2008	0.026	0.004–0.061	4	0.013	0.003–0.027	7
	2016/17–2017/18	0.004	0.004	1	–	–	0
	2021/22-2022/23	0.0161	0.0017–0.0592	10	0.0151	0.0041–0.039	10
Mink	2003–2008	2.310	1.36–3.04	9	1.150	0.553–2.237	18
	2016/17–2017/18	–	–	0	–	–	0
	2021/22-2022/23	0.9162	0.418–2.14	6	0.6718	0.314–1.25	2
River otter	2003–2008	1.658	0.303–3.81	12	0.591	0.127–1.52	14
	2016/17–2017/18	2.007	0.354–3.66	2	0.594	0.588–0.600	2
	2021/22-2022/23	4.1337	0.403–11.0	6	0.8642	0.16–2.48	6

1. 2003–2008: before Project construction; 2017–18: during Project construction before reservoir impoundment; 2021/22-2022/23: during Project construction and operation after reservoir impoundment
2. Decimal places reported as in results from the laboratory.

Table A-2: Mercury Concentration (mg/kg wwt) in On-system Aquatic Furbearer Kidney Tissue 2016/17–2017/18 and 2021/22-2022-23

Species	Period[1]	Mean[2]	Range[2]	Number
Beaver	2016/17–2017/18	0.030	0.0086–0.0428	3
	2021/22-2022/23	0.013	0.0018–0.0447	11
Muskrat	2016/17–2017/18[3]	–	–	–
	2021/22-2022/23	0.039	0.0226–0.109	10
Mink	2016/17–2017/18	–	–	–
	2021/22-2022/23	0.801	0.558–1.56	6
River otter	2016/17–2017/18	1.33	1.28–1.38	2
	2021/22-2022/23	2.513	0.408–5.83	6

1. 2017–18: during Project construction before reservoir impoundment; 2021/22: during Project construction and operation after reservoir impoundment
2. Decimal places reported as in results from the laboratory.
3. Analysis of the one sample submitted failed.

APPENDIX 2:
LABORATORY RESULTS 2023/24

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CERTIFICATE OF ANALYSIS

Work Order	: **WP2404799**	Page	: 1 of 6
Client	: **Wildlife Resource Consulting Services MB Inc.**	Laboratory	: ALS Environmental - Winnipeg
Contact	: Levi Warkentine	Account Manager	: Craig Riddell
Address	: 495-B Madison Street Winnipeg MB Canada R3J 1J2	Address	: 1329 Niakwa Road East, Unit 12 Winnipeg MB Canada R2J 3T4
Telephone	: ----	Telephone	: +1 204 255 9720
Project	: ----	Date Samples Received	: 28-Feb-2024 12:45
PO	: ----	Date Analysis Commenced	: 19-Mar-2024
C-O-C number	: ----	Issue Date	: 02-Apr-2024 13:40
Sampler	: ----		
Site	: ----		
Quote number	: (2024) Mercury in Tissue		
No. of samples received	: 48		
No. of samples analysed	: 48		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Rhovee Guevarra		Metals, Winnipeg, Manitoba

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General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference. Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances LOR: Limit of Reporting (detection limit).

Unit	*Description*
mg/kg wwt	milligrams per kilogram wet weight

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

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Work Order : WP2404799
Client : Wildlife Resource Consulting Services MB Inc.
Project : ----

Analytical Results

Sub-Matrix: Animal Tissue (Matrix: Biota)					Client sample ID	BEAVER4K	BEAVER4M	BEAVER4L	BEAVER6K	BEAVER6M
					Client sampling date / time	19-Dec-2023 00:00	19-Dec-2023 00:00	19-Dec-2023 00:00	20-Dec-2023 00:00	20-Dec-2023 00:00
Analyte	CAS Number	Method/Lab	LOR	Unit		WP2404799-001	WP2404799-002	WP2404799-003	WP2404799-004	WP2404799-005
						Result	Result	Result	Result	Result
Metals										
Mercury	7439-97-6	E510A/WP	0.0010	mg/kg wwt		0.0083	0.0025	0.0020	0.0058	0.0020

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

Sub-Matrix: Animal Tissue (Matrix: Biota)					Client sample ID	BEAVER6L	BEAVER7K	BEAVER7M	BEAVER7L	BEAVER9K
					Client sampling date / time	20-Dec-2023 00:00	20-Dec-2023 00:00	20-Dec-2023 00:00	20-Dec-2023 00:00	02-Jan-2024 00:00
Analyte	CAS Number	Method/Lab	LOR	Unit		WP2404799-006	WP2404799-007	WP2404799-008	WP2404799-009	WP2404799-010
						Result	Result	Result	Result	Result
Metals										
Mercury	7439-97-6	E510A/WP	0.0010	mg/kg wwt		0.0012	0.0087	0.0033	0.0020	0.0058

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

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Page : 4 of 6
Work Order : WP2404799
Client : Wildlife Resource Consulting Services MB Inc.
Project : ----

Analytical Results

Sub-Matrix: **Animal Tissue** (Matrix: **Biota**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	BEAVER9M	BEAVER9L	BEAVER10K	BEAVER10M	BEAVER10L
					Client sampling date / time	02-Jan-2024 00:00	02-Jan-2024 00:00	02-Jan-2024 00:00	02-Jan-2024 00:00	02-Jan-2024 00:00
						WP2404799-011	WP2404799-012	WP2404799-013	WP2404799-014	WP2404799-015
						Result	Result	Result	Result	Result
Metals										
Mercury	7439-97-6	E510A/WP	0.0010	mg/kg wwt		0.0013	<0.0010	0.0113	0.0021	0.0016

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

Sub-Matrix: **Animal Tissue** (Matrix: **Biota**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	MINK1K	MINK1M	MINK1L	MINK2K	MINK2M
					Client sampling date / time	09-Dec-2023 00:00	09-Dec-2023 00:00	09-Dec-2023 00:00	16-Dec-2023 00:00	16-Dec-2023 00:00
						WP2404799-016	WP2404799-017	WP2404799-018	WP2404799-019	WP2404799-020
						Result	Result	Result	Result	Result
Metals										
Mercury	7439-97-6	E510A/WP	0.0010	mg/kg wwt		5.35	3.53	11.6	0.651	0.252

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

Sub-Matrix: **Animal Tissue** (Matrix: **Biota**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	MINK2L	MINK3K	MINK3M	MINK3L	MUSKRAT1K
					Client sampling date / time	16-Dec-2023 00:00	03-Jan-2024 00:00	03-Jan-2024 00:00	03-Jan-2024 00:00	02-Jan-2024 00:00
						WP2404799-021	WP2404799-022	WP2404799-023	WP2404799-024	WP2404799-025
						Result	Result	Result	Result	Result
Metals										
Mercury	7439-97-6	E510A/WP	0.0010	mg/kg wwt		0.539	0.908	0.520	1.01	<0.0045

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

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Work Order : WP2404799
Client : Wildlife Resource Consulting Services MB Inc.
Project : ----

Analytical Results

Sub-Matrix: **Animal Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	MUSKRAT1M	MUSKRAT1L	MUSKRAT2K	MUSKRAT2M	MUSKRAT2L
					Client sampling date / time	02-Jan-2024 00:00	02-Jan-2024 00:00	03-Jan-2024 00:00	03-Jan-2024 00:00	03-Jan-2024 00:00
						WP2404799-026	WP2404799-027	WP2404799-028	WP2404799-029	WP2404799-030
						Result	Result	Result	Result	Result
Metals										
Mercury	7439-97-6	E510A/WP	0.0010	mg/kg wwt		<0.0050	0.0016	0.0394	0.0178	0.0107

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

Sub-Matrix: **Animal Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	MUSKRAT3K	MUSKRAT3M	MUSKRAT3L	OTTER1K	OTTER1M
					Client sampling date / time	06-Jan-2024 00:00	06-Jan-2024 00:00	06-Jan-2024 00:00	13-Dec-2023 00:00	13-Dec-2023 00:00
						WP2404799-031	WP2404799-032	WP2404799-033	WP2404799-034	WP2404799-035
						Result	Result	Result	Result	Result
Metals										
Mercury	7439-97-6	E510A/WP	0.0010	mg/kg wwt		0.0916	0.0433	0.0444	0.601	0.189

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

Sub-Matrix: **Animal Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	OTTER1L	OTTER2K	OTTER2M	OTTER2L	OTTER3K
					Client sampling date / time	13-Dec-2023 00:00	13-Dec-2023 00:00	13-Dec-2023 00:00	13-Dec-2023 00:00	16-Dec-2023 00:00
						WP2404799-036	WP2404799-037	WP2404799-038	WP2404799-039	WP2404799-040
						Result	Result	Result	Result	Result
Metals										
Mercury	7439-97-6	E510A/WP	0.0010	mg/kg wwt		0.687	0.524	0.187	0.137	0.586

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

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Work Order : WP2404799
Client : Wildlife Resource Consulting Services MB Inc.
Project : ----

Analytical Results

Sub-Matrix: **Animal Tissue** (Matrix: **Biota**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	OTTER3M	OTTER3L	OTTER6K	OTTER6M	OTTER6L
					Client sampling date / time	16-Dec-2023 00:00	16-Dec-2023 00:00	03-Jan-2024 00:00	03-Jan-2024 00:00	03-Jan-2024 00:00
						WP2404799-041	WP2404799-042	WP2404799-043	WP2404799-044	WP2404799-045
						Result	Result	Result	Result	Result
Metals										
Mercury	7439-97-6	E510A/WP	0.0010	mg/kg wwt		0.152	0.500	6.80	3.15	13.6

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

Sub-Matrix: **Animal Tissue** (Matrix: **Biota**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	OTTER7K	OTTER7M	OTTER7L	----	----
					Client sampling date / time	05-Feb-2024 00:00	05-Feb-2024 00:00	05-Feb-2024 00:00	----	----
						WP2404799-046	WP2404799-047	WP2404799-048	--------	--------
						Result	Result	Result	----	----
Metals										
Mercury	7439-97-6	E510A/WP	0.0010	mg/kg wwt		0.497	0.218	0.702	----	----

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

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QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **WP2404799**	Page	: 1 of 10
Client	: **Wildlife Resource Consulting Services MB Inc.**	Laboratory	: ALS Environmental - Winnipeg
Contact	: Levi Warkentine	Account Manager	: Craig Riddell
Address	: 495-B Madison Street Winnipeg MB Canada R3J 1J2	Address	: 1329 Niakwa Road East, Unit 12 Winnipeg, Manitoba Canada R2J 3T4
Telephone	: ----	Telephone	: +1 204 255 9720
Project	: ----	Date Samples Received	: 28-Feb-2024 12:45
PO	: ----	Issue Date	: 02-Apr-2024 13:40
C-O-C number	: ----		
Sampler	: ----		
Site	: ----		
Quote number	: (2024) Mercury in Tissue		
No. of samples received	: 48		
No. of samples analysed	: 48		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Page : 3 of 10
Work Order : WP2404799
Client : Wildlife Resource Consulting Services MB Inc.
Project : ----

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag MINK1K	E510A	09-Dec-2023	19-Mar-2024	365 days	102 days	✓	20-Mar-2024	365 days	102 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag MINK1L	E510A	09-Dec-2023	19-Mar-2024	365 days	102 days	✓	20-Mar-2024	365 days	102 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag MINK1M	E510A	09-Dec-2023	19-Mar-2024	365 days	102 days	✓	20-Mar-2024	365 days	102 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag OTTER7K	E510A	05-Feb-2024	21-Mar-2024	365 days	45 days	✓	22-Mar-2024	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag OTTER7L	E510A	05-Feb-2024	21-Mar-2024	365 days	45 days	✓	22-Mar-2024	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag OTTER7M	E510A	05-Feb-2024	21-Mar-2024	365 days	45 days	✓	22-Mar-2024	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag MUSKRAT3K	E510A	06-Jan-2024	19-Mar-2024	365 days	74 days	✓	20-Mar-2024	365 days	74 days	✓

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Work Order : WP2404799
Client : Wildlife Resource Consulting Services MB Inc.
Project : ----

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag MUSKRAT3L	E510A	06-Jan-2024	19-Mar-2024	365 days	74 days	✓	20-Mar-2024	365 days	74 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag MUSKRAT3M	E510A	06-Jan-2024	19-Mar-2024	365 days	74 days	✓	20-Mar-2024	365 days	74 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag MINK3K	E510A	03-Jan-2024	19-Mar-2024	365 days	77 days	✓	20-Mar-2024	365 days	77 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag MINK3L	E510A	03-Jan-2024	19-Mar-2024	365 days	77 days	✓	20-Mar-2024	365 days	77 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag MINK3M	E510A	03-Jan-2024	19-Mar-2024	365 days	77 days	✓	20-Mar-2024	365 days	77 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag MUSKRAT2K	E510A	03-Jan-2024	19-Mar-2024	365 days	77 days	✓	20-Mar-2024	365 days	77 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag MUSKRAT2L	E510A	03-Jan-2024	19-Mar-2024	365 days	77 days	✓	20-Mar-2024	365 days	77 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag MUSKRAT2M	E510A	03-Jan-2024	19-Mar-2024	365 days	77 days	✓	20-Mar-2024	365 days	77 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BEAVER10K	E510A	02-Jan-2024	19-Mar-2024	365 days	78 days	✓	20-Mar-2024	365 days	78 days	✓

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Page : 5 of 10
Work Order : WP2404799
Client : Wildlife Resource Consulting Services MB Inc.
Project : ----

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BEAVER10L	E510A	02-Jan-2024	19-Mar-2024	365 days	78 days	✓	20-Mar-2024	365 days	78 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BEAVER10M	E510A	02-Jan-2024	19-Mar-2024	365 days	78 days	✓	20-Mar-2024	365 days	78 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BEAVER9K	E510A	02-Jan-2024	19-Mar-2024	365 days	78 days	✓	20-Mar-2024	365 days	78 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BEAVER9L	E510A	02-Jan-2024	19-Mar-2024	365 days	78 days	✓	20-Mar-2024	365 days	78 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BEAVER9M	E510A	02-Jan-2024	19-Mar-2024	365 days	78 days	✓	20-Mar-2024	365 days	78 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag MUSKRAT1K	E510A	02-Jan-2024	19-Mar-2024	365 days	78 days	✓	20-Mar-2024	365 days	78 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag MUSKRAT1L	E510A	02-Jan-2024	19-Mar-2024	365 days	78 days	✓	20-Mar-2024	365 days	78 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag MUSKRAT1M	E510A	02-Jan-2024	19-Mar-2024	365 days	78 days	✓	20-Mar-2024	365 days	78 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag OTTER6K	E510A	03-Jan-2024	21-Mar-2024	365 days	78 days	✓	22-Mar-2024	365 days	79 days	✓

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Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
			Preparation Date	*Holding Times* Rec	*Holding Times* Actual	*Eval*	*Analysis Date*	*Holding Times* Rec	*Holding Times* Actual	*Eval*
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag OTTER6L	E510A	03-Jan-2024	21-Mar-2024	365 days	78 days	✓	22-Mar-2024	365 days	79 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag OTTER6M	E510A	03-Jan-2024	21-Mar-2024	365 days	78 days	✓	22-Mar-2024	365 days	79 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BEAVER6K	E510A	20-Dec-2023	19-Mar-2024	365 days	91 days	✓	20-Mar-2024	365 days	91 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BEAVER6L	E510A	20-Dec-2023	19-Mar-2024	365 days	91 days	✓	20-Mar-2024	365 days	91 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BEAVER6M	E510A	20-Dec-2023	19-Mar-2024	365 days	91 days	✓	20-Mar-2024	365 days	91 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BEAVER7K	E510A	20-Dec-2023	19-Mar-2024	365 days	91 days	✓	20-Mar-2024	365 days	91 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BEAVER7L	E510A	20-Dec-2023	19-Mar-2024	365 days	91 days	✓	20-Mar-2024	365 days	91 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BEAVER7M	E510A	20-Dec-2023	19-Mar-2024	365 days	91 days	✓	20-Mar-2024	365 days	91 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BEAVER4K	E510A	19-Dec-2023	19-Mar-2024	365 days	92 days	✓	20-Mar-2024	365 days	92 days	✓

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Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BEAVER4L	E510A	19-Dec-2023	19-Mar-2024	365 days	92 days	✓	20-Mar-2024	365 days	92 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag BEAVER4M	E510A	19-Dec-2023	19-Mar-2024	365 days	92 days	✓	20-Mar-2024	365 days	92 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag MINK2K	E510A	16-Dec-2023	19-Mar-2024	365 days	95 days	✓	20-Mar-2024	365 days	95 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag MINK2L	E510A	16-Dec-2023	19-Mar-2024	365 days	95 days	✓	20-Mar-2024	365 days	95 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag MINK2M	E510A	16-Dec-2023	19-Mar-2024	365 days	95 days	✓	20-Mar-2024	365 days	95 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag OTTER3K	E510A	16-Dec-2023	19-Mar-2024	365 days	95 days	✓	20-Mar-2024	365 days	95 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag OTTER3L	E510A	16-Dec-2023	21-Mar-2024	365 days	96 days	✓	22-Mar-2024	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag OTTER3M	E510A	16-Dec-2023	21-Mar-2024	365 days	96 days	✓	22-Mar-2024	365 days	97 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag OTTER1K	E510A	13-Dec-2023	19-Mar-2024	365 days	98 days	✓	20-Mar-2024	365 days	98 days	✓

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Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag OTTER1L	E510A	13-Dec-2023	19-Mar-2024	365 days	98 days	✓	20-Mar-2024	365 days	98 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag OTTER1M	E510A	13-Dec-2023	19-Mar-2024	365 days	98 days	✓	20-Mar-2024	365 days	98 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag OTTER2K	E510A	13-Dec-2023	19-Mar-2024	365 days	98 days	✓	20-Mar-2024	365 days	98 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag OTTER2L	E510A	13-Dec-2023	19-Mar-2024	365 days	98 days	✓	20-Mar-2024	365 days	98 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag OTTER2M	E510A	13-Dec-2023	19-Mar-2024	365 days	98 days	✓	20-Mar-2024	365 days	98 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

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Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Biota**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Mercury in Biota by CVAAS (WET units, Routine)	E510A	1371891	3	48	6.2	5.0	✓
Laboratory Control Samples (LCS)							
Mercury in Biota by CVAAS (WET units, Routine)	E510A	1371891	6	48	12.5	10.0	✓
Method Blanks (MB)							
Mercury in Biota by CVAAS (WET units, Routine)	E510A	1371891	3	48	6.2	5.0	✓

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Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Mercury in Biota by CVAAS (WET units, Routine)	E510A ALS Environmental - Winnipeg	Biota	EPA 200.3/1631 Appendix (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by CVAAS.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Metals and Mercury Biota Digestion	EP440 ALS Environmental - Winnipeg	Biota	EPA 200.3	This method uses a heated strong acid digestion with HNO3, HCl, and H2O2 and is intended to provide a conservative estimate of bio-available metals.

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QUALITY CONTROL REPORT

Work Order	: **WP2404799**	Page	: 1 of 4
Client	: Wildlife Resource Consulting Services MB Inc.	Laboratory	: ALS Environmental - Winnipeg
Contact	: Levi Warkentine	Account Manager	: Craig Riddell
Address	: 495-B Madison Street Winnipeg MB Canada R3J 1J2	Address	: 1329 Niakwa Road East, Unit 12 Winnipeg, Manitoba Canada R2J 3T4
Telephone	:	Telephone	: +1 204 255 9720
Project	: ----	Date Samples Received	: 28-Feb-2024 12:45
PO	: ----	Date Analysis Commenced	: 19-Mar-2024
C-O-C number	: ----	Issue Date	: 02-Apr-2024 13:40
Sampler	: ---- ----		
Site	: ----		
Quote number	: (2024) Mercury in Tissue		
No. of samples received	: 48		
No. of samples analysed	: 48		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Rhovee Guevarra		Winnipeg Metals, Winnipeg, Manitoba

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General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include 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 predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Metals (QC Lot: 1371891)											
WP2404799-001	BEAVER4K	Mercury	7439-97-6	E510A	0.0010	mg/kg wwt	0.0083	0.0084	1.28%	40%	----
Metals (QC Lot: 1371892)											
WP2404799-021	MINK2L	Mercury	7439-97-6	E510A	0.0093	mg/kg wwt	0.539	0.544	0.795%	40%	----
Metals (QC Lot: 1374939)											
WP2404799-043	OTTER6K	Mercury	7439-97-6	E510A	0.0418	mg/kg wwt	6.80	5.94	13.5%	40%	----

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Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 1371891)						
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 1371892)						
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 1374939)						
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 1371891)									
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	92.8	80.0	120	----
Metals (QCLot: 1371892)									
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	93.5	80.0	120	----
Metals (QCLot: 1374939)									
Mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	102	80.0	120	----

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Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 1371891)									
	RM	Mercury	7439-97-6	E510A	0.331 mg/kg wwt	107	70.0	130	----
Metals (QCLot: 1371892)									
	RM	Mercury	7439-97-6	E510A	0.331 mg/kg wwt	111	70.0	130	----
Metals (QCLot: 1374939)									
	RM	Mercury	7439-97-6	E510A	0.331 mg/kg wwt	111	70.0	130	----