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Greenstone Mine
2023 Indigenous Peoples Health Risk Assessment Follow-up Report

(To satisfy Federal EIS Conditions 5.3, 5.4, 5.5, and 5.6)

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Abbreviations

2023 Monitoring Period	October 1, 2022 through September 30, 2023
AAQC	Ontario Ambient Air Quality Criteria
CAAQS	Canadian Ambient Air Quality Standards
COPC	Contaminant of Potential Concern
EA	Environmental Assessment
ECCC	Environment and Climate Change Canada
EIS	Environmental Impact Statement
EPC	Exposure Point Concentration
GFC	Goldfield Creek
GGM	Greenstone Gold Mines GP Inc.
HHRA	Human Health Risk Assessment
IAAC	Impact Assessment Agency of Canada
MECP	Ontario Ministry of Environment, Conservation and Parks
Mine	Greenstone Mine
MTO	Ontario Ministry of Transportation
NO_2	Nitrogen Dioxide
the Plan	Indigenous Peoples Health Risk Assessment Follow-up Plan
PM_{10}	Coarse Particulate Matter
$PM_{2.5}$	Fine Particulate Matter
SAQS	Special Air Quality Statement

SWAT	Southwest Arm Tributary
TETP	Temporary Effluent Treatment Plant
TMF	Tailings Management Facility
TSP	Total suspended particulates
UCLM	Upper Confidence Limit of the Mean
USEPA	United States Environmental Protection Agency

1 Introduction

Greenstone Gold Mines GP Inc. (GGM) is constructing and planning to operate and ultimately decommission the Greenstone Mine (the Mine), which was formerly referred to as the Hardrock Project. The Mine site is located just south of Geraldton, Ontario, within the municipality of Greenstone, at the intersection of Highway 11 and Highway 584. Greenstone Mine was subject to a federal environmental assessment (EA) (Stantec 2017) under the *Canadian Environmental Assessment Act, 2012*. The federal Decision Statement for the Greenstone Mine's Environmental Impact Statement (EIS) was issued on December 13, 2018, and as amended on February 10, 2021, and contained various Conditions of Approval.

The EIS included a human health risk assessment (HHRA) that evaluated the potential for Mine construction, operation, and closure to affect human health for various human receptors, including Indigenous people who may engage in traditional practices such as the harvesting of terrestrial and aquatic country foods. Overall, the HHRA concluded that human health risks related to the Mine during construction, operation, and closure will be negligible for Indigenous People as well as for all other human receptors.

Conditions 5.3, 5.4, 5.5, and 5.6 of the Decision Statement describe the requirement for a follow-up program to verify the accuracy of the assumptions relied on in the HHRA as it pertains to the potential for adverse environmental effects on the health of Indigenous People. Therefore, in 2020, GGM prepared an Indigenous Peoples Health Risk Assessment Follow-up Plan (the Plan) (GGM 2020a) to address these conditions. Review and finalization of the Plan was completed in consultation with Indigenous communities, and submitted to and subsequently accepted by, the Impact Assessment Agency of Canada (IAAC). The Plan describes an approach wherein concentrations of contaminants of potential concern (COPCs) are monitored in environmental media (e.g., air, surface water, and country foods) during various phases of the Mine. The measured COPC concentrations are then compared to those relied on to predict exposure (and risk) in the HHRA to determine whether the conclusions of the HHRA remain applicable or if further evaluation of potential for adverse environmental effects on the health of Indigenous People is required. This 2023 Indigenous Peoples Health Risk Assessment Follow-up Report provides a review and evaluation of environmental monitoring data collected during the period of October 1, 2022 through September 30, 2023 (i.e., the 2023 monitoring period) to satisfy the requirements of the Plan.

2 Review of Applicable Conditions

A summary of the overall objectives related to Conditions 5.3, 5.4, 5.5, and 5.6, and a reference to the applicable section of this report showing how these conditions are being addressed, is provided in Table 2-1.

Table 2-1: Conditions of Federal Decision Statement Related to Monitoring Potential Effects of the Mine on the Health of Indigenous Peoples

Condition Number	Condition	Applicable Section of this Report
5.3	*The Proponent shall develop, prior to construction and in consultation with Indigenous groups and relevant authorities, a follow-up program to verify the accuracy of the environmental assessment and to determine the effectiveness of the mitigation measures as it pertains to the adverse environmental effects on the health of Indigenous Peoples of changes to air quality. As part of the follow-up program, the Proponent shall:*	3
5.3.1	• *Identify monitoring locations for air contaminants within areas used by Indigenous groups for traditional purposes or within areas representative of air quality in areas used by Indigenous groups for traditional purposes*	3
5.3.2	• *Monitor, during construction, operation and the first five years of decommissioning, total suspended particulates, particulate matter (PM10), fine particulate matter (PM2.5) and nitrogen dioxide at the monitoring locations identified pursuant to condition 5.3.1, using as benchmarks the standards and criteria set out in the Canadian Council of Ministers of the Environment's Canadian Ambient Air Quality Standards and Ontario's Ambient Air Quality Criteria. The Proponent shall monitor total suspended particulates, fine particulate matter (PM2.5) and nitrogen dioxide at least monthly and shall monitor particulate matter (PM10) in real-time*	4.1
5.3.3	• *Monitor, at least annually during construction and for the first two years of operation, airborne benzene and benzo(a)pyrene at the monitoring locations identified pursuant to condition 5.3.1. The Proponent shall determine, in consultation with Indigenous groups and relevant authorities and based on the results of the monitoring, if additional monitoring is required after the first two years of operation and at what frequency this additional monitoring shall occur; and*	4.1
5.3.4	• *Monitor, during construction and for the first two years of operation, silt content on roads within the project development area. The Proponent shall determine, in consultation with Indigenous groups and relevant authorities and based on the results of the monitoring, if additional monitoring is required after the first two years of operation and at what frequency this additional monitoring shall occur.*	4.1

Condition Number	Condition	Applicable Section of this Report
5.4	*The Proponent shall develop, prior to construction and in consultation with Indigenous groups and relevant authorities, a follow-up program to verify the accuracy of the environmental assessment as it pertains to the adverse environmental effects on the health of Indigenous Peoples of changes in concentrations of contaminants in water and fish. As part of the implementation of the follow-up program, the Proponent shall:*	3
5.4.1	• *Monitor, at least quarterly during construction and the first five years of operation, mercury in the Southwest Arm Tributary, using as a benchmark a concentration of 0.04 micrograms per litre. The Proponent shall determine, in consultation with Indigenous groups and relevant authorities and based on the results of the monitoring, if additional monitoring is required after the first five years of operation and at what frequency this additional monitoring shall occur*	4.2
5.4.2	• *Monitor, at least quarterly during construction and the first five years of operation, methylmercury in the Southwest Arm Tributary, using as a benchmark a concentration of 0.0001 micrograms per litre. The Proponent shall determine, in consultation with Indigenous groups and relevant authorities and based on the results of the monitoring, if additional monitoring is required after the first five years of operation and at what frequency this additional monitoring shall occur.*	4.2
5.5	*The Proponent shall develop, prior to construction and in consultation with Indigenous groups and relevant authorities, a follow-up program to verify the accuracy of the environmental assessment and to determine the effectiveness of the mitigation measures as it pertains to the adverse environmental effects on the health of Indigenous Peoples of changes in concentrations of contaminants in country foods caused by the Designated Project. The Proponent shall implement the follow-up program during all phases of the Designated Project. As part of the development of the follow-up program, the Proponent shall identify, in consultation with Indigenous groups and relevant authorities, species of vegetation, fish and wildlife that shall be monitored and shall determine, in consultation with Indigenous groups and relevant authorities, the sampling and analytical methodology that shall be applied for the monitoring of each species, including how samples will be collected. As part of the implementation of the follow-up program, the Proponent shall:*	3

Condition Number	Condition	Applicable Section of this Report
5.5.1	• *Monitor, at least every two years, during the first six years of operation, mercury, methylmercury and arsenic concentrations in walleye (Sander vitreus) tissue according to the methodology determined pursuant to condition 5.5. The Proponent shall determine, in consultation with Indigenous groups and relevant authorities and based on the results of the monitoring, if additional monitoring is required after the first six years of operation and at what frequency this additional monitoring shall occur*	4.3
5.5.2	• *Monitor, at least every two years, during the first six years of operation, concentrations of metals, including mercury and arsenic, in small mammals according to the methodology determined pursuant to condition 5.5. The Proponent shall determine, in consultation with Indigenous groups and relevant authorities and based on the results of the monitoring, if additional monitoring is required after the first six years of operation and at what frequency this additional monitoring shall occur.*	4.4
5.6	*Participate in any regional initiative that is established for the analysis of contaminants in moose (Alces alces) tissue in the region, should there be any such initiative(s) during construction or operation of the Designated Project.*	4.5

3 Indigenous Peoples Health Risk Assessment Follow-up Plan

As noted above, review and finalization of the Plan (GGM 2020a) was completed in consultation with Indigenous communities, and the Plan was submitted and subsequently accepted by IAAC. The Plan did not provide specific details with respect to how the environmental data identified for monitoring in Conditions 5.3, 5.4, 5.5, and 5.6 of the Decision Statement would be collected. Rather, details regarding environmental monitoring were deferred to applicable environmental monitoring plans (see Section 3.1).

For the data collected in support of Conditions 5.3, 5.4, 5.5, and 5.6 of the Decision Statement, the Plan did provide a data evaluation approach applicable to reviewing and evaluating collected environmental data with respect to monitoring the potential for the Mine to affect the health of Indigenous Peoples. This data evaluation approach is described in Section 3.2.

3.1 Environmental Monitoring Plans

The environmental monitoring plans identified in the Plan to describe collection of the environmental data targeted in Conditions 5.3, 5.4, 5.5, and 5.6 of the Decision Statement are summarized in Table 3-1.

Table 3-1: Summary of Environmental Monitoring Plans Applicable to the Indigenous Peoples Health Risk Assessment Follow-up Plan

Condition of Decision Statement	Environmental Media	Environmental Monitoring Plan
5.3 5.3.1, 5.3.2, 5.3.3, 5.3.4	Air Quality	Air Quality Management and Monitoring Plan (GGM 2020b)
5.4 5.4.1, 5.4.2	Water	Fish and Fish Habitat Federal EIS Follow-Up Monitoring Plan (GGM 2021)[A]
5.5 5.5.1	Fish	Fish and Fish Habitat Federal EIS Follow-Up Monitoring Plan (GGM 2021)[A]
5.5 5.5.2	Vegetation and Wildlife	Biodiversity Management and Monitoring Plan (GGM 2022)[B]
5.6	Moose	No plan specified. Contingent on establishment of a regional initiative to monitor moose tissue concentrations and not the sole purview of GGM

A. The environmental monitoring plans identified in Table 3-1 were not finalized at the time when the Plan was written. Therefore, in some cases, the title of the applicable sampling plan has changed. For monitoring of water quality and fish tissue, the Indigenous Peoples Health Risk Assessment Follow-up Plan referenced a "Water Management and Monitoring Plan" for water quality and an "Aquatic Management and Monitoring Plan" for fish tissue. Sampling plans for these media in response to Conditions 5.4 and 5.5 are now provided in the "Fish and Fish Habitat Federal EIS Follow-Up Monitoring Plan" as identified in this table.

B. Updates to the Biodiversity Management and Monitoring Plan are required in 2024 to include sampling plan to collect small mammals and terrestrial vegetation during Mine operation.

With respect to monitoring of vegetation and wildlife per Condition 5.5 and 5.5.2 of the Decision Statement, baseline data for terrestrial vegetation, small mammals, and co-located soil samples were collected in 2018. These baseline data were relied on to define pre-existing baseline concentrations for COPCs in country foods assessed as part of the HHRA submitted as a component of the EIS for the Mine and were combined with predicted emissions from the Mine to predict contaminant concentrations in country foods during operation. To permit a direct comparison to these baseline data, future country food sampling for terrestrial vegetation and wildlife will include the same species and locations that were sampled in 2018. Co-located soil samples will also be collected to support the comparison with collected baseline data. The environmental monitoring plan applicable to vegetation and wildlife sampling in Table 3-1 is the Biodiversity Management and Monitoring Plan. However, the most recent version of the Biodiversity Management and Monitoring Plan (GGM 2022) does not currently include a sampling plan to collect small mammals and terrestrial vegetation as representatives of country foods per Condition 5.5 of the Decision Statement. Therefore, an update to the Biodiversity Management and Monitoring Plan is required to be completed in 2024 to describe this country food sampling. Per Conditions 5.5.1 and 5.5.2 of the Decision Statement, country food sampling should occur at

least every two years, during the first six years of operation. At this time, the Mine is still in the construction phase, with Mine operation anticipated to begin in 2024. Therefore, finalization of the country food sampling plan in 2024 will allow for sampling to be completed in 2025, which would meet the requirement for the first sampling event under the targeted schedule of 'at least every two years, during the first six years of operation' described in Conditions 5.5.1 and 5.5.2 of the Decision Statement.

3.2 Benchmarks and Data Evaluation Approach

Benchmarks for data evaluation were generally not provided in Conditions 5.3, 5.4, 5.5, and 5.6 of the Decision Statement. When they were, they were limited to Conditions 5.3.2, 5.4.1 and 5.4.2 of the Decision Statement. Specifically, Condition 5.3.2 of the Decision Statement requires that data for certain air quality parameters be compared to applicable Canadian Ambient Air Quality Standards (CAAQS) and Ontario's Ambient Air Quality Criteria (AAQC), and Conditions 5.4.1 and 5.4.2 of the Decision Statement provide specific monitoring guidelines for mercury and methylmercury for surface water in the Southwest Arm Tributary (SWAT).

For the remaining environmental data targeted for monitoring under Conditions 5.3, 5.4, 5.5, and 5.6 of the Decision Statement, a method for establishing benchmarks and evaluating data in comparison to those benchmarks was established in the Plan. This method was based on comparison of measured COPC concentrations in air, surface water, and country foods to the concentrations of these COPCs in those environmental media that were relied on in the HHRA. Specifically, this method described calculating trigger levels for each monitored COPC and environmental medium that are equal to the exposure point concentration (EPC) relied on in the HHRA plus 20%. Updated EPCs based on measured data could then be compared to the trigger levels derived from the HHRA. If the updated EPC does not exceed the applicable trigger level, then the conclusions of the HHRA will continue to be applicable and further evaluation of the potential for risk to Indigenous Health will not be required. However, if the EPCs based on monitoring data are higher than applicable trigger levels, further evaluation of the potential human health risks for Indigenous people will be required.

Updated EPCs based on monitoring data may be derived by calculating a 95% upper confidence limit of the mean (UCLM) of measured COPC concentrations in the collected monitoring data if there are at least ten samples with measured concentrations greater than the reported detection limit. In the absence of sufficient data to support calculation of a 95% UCLM (i.e., less than 10 detected concentrations), EPCs may be represented by the maximum measured concentrations (if at least one sample has a detected concentration), or the maximum detection limit (if there are no samples with detected concentrations).

The Plan included tables of trigger levels derived from the EPCs relied on in the HHRA as described above. However, given that the Plan was written before the media sampling plans identified in Table 3-1 were finalized, in some cases the tabulated trigger concentrations from the Plan refer to monitoring data and/or sampling locations that have not been targeted for collection in the final environmental monitoring plans. Therefore, updated trigger levels that integrate the data evaluation approach described in the Plan with the actual monitoring data targeted for collection and analysis are provided in Appendix A of this report. The monitoring data reviewed herein, and in future years, will be compared to the trigger levels in Appendix A. In addition, where applicable, sampled media should also be compared to the benchmarks specifically identified in Conditions 5.3.2 (for air quality) and Conditions 5.4.1 and 5.4.2 (for mercury and methylmercury in surface water from the SWAT) of the Decision Statement. For completeness, these specific benchmarks are referenced where applicable in Appendix A.

4 Monitoring Results

Sections 4.1 to 4.5 provide a summary of the environmental data collected during the 2023 monitoring period to meet the requirements of Conditions 5.3, 5.4, 5.5, and 5.6 of the Decision Statement. A comparison of these data to applicable trigger levels and other applicable criteria are summarized in **Appendix A** according to the data evaluation methods described in **Section 3.2**.

4.1 Air Quality (Conditions 5.3, 5.3.1, 5.3.2, 5.3.3, and 5.3.4 of the Decision Statement)

Conditions 5.3, 5.3.1, 5.3.2, 5.3.3, and 5.3.4 of the Decision Statement refer to monitoring and evaluation of the potential for adverse effects on the health of Indigenous Peoples due to changes in air quality. These conditions include specific monitoring requirements for the following air quality contaminants during construction, operation, and/or decommissioning:

- Total suspended particulates (TSP), coarse particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), and nitrogen dioxide (NO_2) (Condition 5.3.2 of the Decision Statement)
- Benzene and benzo(a)pyrene (Condition 5.3.3 of the Decision Statement)
- Silt content on haul roads (Condition 5.3.4 of the Decision Statement)

Trigger levels for air contaminants are provided in Table A-1 (Appendix A). Silt content on haul roads is a parameter used to estimate particulate emissions and was not explicitly used in the HHRA. The trigger level for this parameter is the value at which particulate emissions from the haul roads would increase by greater than 20% of the emissions levels used to predict the concentrations assessed in the HHRA. Since silt content is non-linearly related to haul road

emissions levels, the trigger level is not equivalent to a 20% increase of the silt content value used in the EA.

The locations that were selected for monitoring TSP, PM_{10}, NO_2, $PM_{2.5}$, benzo(a)pyrene, and benzene in the Air Quality Management and Monitoring Plan (GGM 2020b) are summarized below:

- Station A (Upwind) - A site located in a predominantly upwind location from the Mine (west of the tailings management facility [TMF]). The site for this station is on an existing drill pad north of the TransCanada Highway and Longacre Lake.
- Station B (Downwind) – Located in a downwind direction in the vicinity of the nearest residential area (the Rosedale Point neighborhood). The site for this station is near the intersection of Michael Power Boulevard and Old Arena Road in an open field. The meteorological tower is also installed at this location.
- Station C (Downwind) - Located in a predominantly downwind direction near MacLeod Provincial Park, which contains campgrounds and is considered sensitive to air quality. The location is near the entrance gate to the park.

Station B (Rosedale Point) and Station C (MacLeod Provincial Park) represent areas that were evaluated in the HHRA, and the trigger levels for TSP, PM_{10}, NO_2, $PM_{2.5}$, benzo(a)pyrene, and benzene are specific to these two areas Table A-1 (Appendix A). Measured concentrations from these areas are also compared to those from Station A, which acts as a predominantly upwind background location. In contrast, the trigger level for silt content on haul roads is not specific to a single haul road and rather will be used to evaluate a composite of collected road surface silt content samples.

Condition 5.3.2 also specified that monitored concentrations of TSP, PM_{10}, $PM_{2.5}$, and NO_2 be compared to “standards and criteria set out in the Canadian Council of Ministers of the Environment's Canadian Ambient Air Quality Standards and Ontario’s Ambient Air Quality Criteria”. These criteria (if available) are also summarized in Table A-1 (Appendix A).

Detailed monitoring data including edit logs, laboratory reports, data recovery statistics and individual monitoring results for the air quality monitoring that was completed in the 2023 monitoring period are provided in quarterly reports for ambient air quality data that have been submitted to date to the Ontario Ministry of Environment, Conservation and Parks (MECP) (GGM 2023a, GGM 2023b, GGM 2023c, GGM 2023d).

Comparisons of the applicable air quality monitoring data from the 2023 monitoring period to the trigger levels and regulatory guidelines summarized in Table A-1 (Appendix A) are provided in Section 4.1.1 to Section 4.1.3, below.

4.1.1 Comparison to Air Quality Standards and Criteria (Condition 5.3.2 and 5.3.3 of Decision Statement)

The available air quality monitoring data at Station A (Upwind), Station B (Rosedale Point), and Station C (MacLeod Provincial Park) for TSP, PM_{10}, $PM_{2.5}$, NO_2, benzene and benzo(a)pyrene are summarized in Table 4-1 and compared to applicable AAQC**.** A comparison to the CAAQS for $PM_{2.5}$ and NO_2 requires averaging the 98th percentile daily levels in each of three consecutive years, with a minimum of 2 of 3 years of data available. As monitoring has been conducted for seven quarters (1.75 years) to date, insufficient data is currently available to make comparisons to the CAAQS. The maximum measured concentration for each contaminant was less than the applicable AAQC for the 2023 monitoring period.

The data presented in Table 4-1 has been edited to remove air quality measurements when Special Air Quality Statements (SAQS) issued by Environment and Climate Change Canada (ECCC) were in effect for the Geraldton-Manitouwadge-Hornepayne Regions and the Sault Ste. Marie regions due to northern Ontario / Quebec wildfires. However, the ambient measurements are expected to have been influenced by wildfires even when SAQS were not in effect. Details of these elevated PM_{10} concentrations were previously provided in the quarterly ambient monitoring reports submitted to the MECP (GGM 2023a, b, c, d).

The maximum measured rolling 24-hour average PM_{10} concentration (49 µg/m^3) presented in Table 4-1 for Station A (Upwind) is 98% of the AAQC. When this measurement occurred, winds were blowing from southwesterly and northeasterly directions, which are directions for which emissions from GGM would not be carried towards Station A, and therefore is not attributable to GGM.

The maximum rolling 24-hour PM_{10} concentration measured at Station B (Rosedale Point) was 48 µg/m^3, which is 95% of the AAQC. During the same time measured concentrations at Stations A and C were also elevated, suggesting the measurements at all stations were affected by wildfires.

In May 2023, Station C (MacLeod Provincial Park) measured a rolling 24-hour average PM_{10} concentration of 49 µg/m^3, which is 98% of the AAQC. During the times in which hourly average PM_{10} measurements resulted in this rolling 24-hour average concentration, winds were blowing from northwesterly directions. For these wind directions, a Ministry of Transportation Ontario (MTO) aggregate pit (located on the north side of Highway 11) was upwind of Station C and the likely source of the elevated PM_{10} concentrations.

4.1.2 Comparison to Trigger Levels

The available air quality monitoring data for Station B (Rosedale Point), and Station C (MacLeod Provincial Park) for TSP, PM_{10}, $PM_{2.5}$, NO_2, benzene and benzo(a)pyrene were compared to their trigger levels in Table 4-2. The upper confidence levels calculated from the ambient monitoring data at Stations B and C were all below the respective trigger levels.

Table 4-1: Comparison of Ambient Air Quality Monitoring Data to Ontario Ambient Air Quality Criteria

Contaminant	Averaging Period	Units	Ontario Ambient Air Quality Criteria (AAQC)	Canadian Ambient Air Quality Standards (CAAQS)	Station A - Upwind			Station B - Rosedale Point			Station C - MacLeod Provincial Park		
					Maximum	95% UCLM of Measured Data	% AAQC	Maximum	95% UCLM of Measured Data	% AAQC	Maximum	95% UCLM of Measured Data	% AAQC
TSP	24-hour	µg/m^3	120	-	31	10	26%	67	20	56%	56	18	47%
	Annual	µg/m^3	60	-	5.4	-	9%	9.8	-	16%	10	-	17%
PM_{10}	24-hour	µg/m^3	50	-	49	8.2	99%	47	10	95%	49	10	97%
NO_2	1-hour	ppb	200	62 [A]	-	-	-	30.0	1.0	15%	-	-	-
	24-hour	ppb	100	-	-	-	-	13.2	1.0	13%	-	-	-
$PM_{2.5}$	24-hour	µg/m^3	27 [B]	27 [B]	8.5	5.8	INS [B]	9.3	6.45	INS [B]	9.8	6.0	INS [B]
	Annual	µg/m^3	8.8 [C]	8.8 [C]	4.2	-	INS [C]	4.7	-	INS [C]	4.1	-	INS [C]
Benzo(a)Pyrene	24-hour	µg/m^3	5.0E-05	-	1.5E-05	2.1E-05	30%	1.5E-05	1.9E-05	30%	1.5E-05	1.9E-05	30%
	Annual	µg/m^3	1.0E-05	-	7.9E-06	-	79%	8.6E-06	-	86%	8.3E-06	-	83%
Benzene	24-hour	µg/m^3	2.3	-	0.5	0.4	23%	0.5	0.4	23%	0.5	0.4	23%
	Annual	µg/m^3	120	-	0.19	-	43%	0.19	-	43%	0.19	-	43%

Notes:

A - The 1-hour CAAQS for NO_2 is referenced to the 3-year average of the annual 98th percentile of the daily maximum 1-hour average concentrations. There is insufficient data to make comparisons to the NO_2 criterion which requires a minimum of 2 years required to make a valid average.

B - Canadian Ambient Air Quality Standards (CAAQS) for Respirable Particulate Matter, effective by 2020 (CCME, 2012). The Respirable Particulate Matter Objective is referenced to the 98th percentile daily average concentration averaged over 3 consecutive years. There is insufficient data to make comparisons to the $PM_{2.5}$ criterion which requires a minimum of 2 years required to make a valid average.

C - Annual Canadian Ambient Air Quality Standard for Respirable Particulate Matter, effective by 2020. The Respirable Particulate Matter Objective is referenced to the 3-year average of the annual average concentrations. There is insufficient data to make comparisons to the $PM_{2.5}$ criterion as only 1.75 years of data has been collected to date.

INS – Insufficient
95% UCLM – 95% Upper Confidence Limit of the Mean

Table 4-2: Summary of Ambient Air Quality Monitoring Upper Confidence Levels to Trigger Levels

Contaminant	Averaging Period	Units	Station B - Rosedale Point			Station C - MacLeod Provincial Park		
			95% UCLM of Measured Data	Trigger Level	% of Trigger Level	95% UCLM of Measured Data	Trigger Level	% of Trigger Level
TSP	24-hour	µg/m^3	20	123.8	16%	18	102.1	18%
	Annual	µg/m^3	10	19.8	50%	10	22.4	47%
PM_{10}	24-hour	µg/m^3	10	84.7	12%	10	67.9	15%
NO_2	1-hour	ppb	1.0	138.2	1%	-	-	-
	24-hour	ppb	1.0	68.0	1%	-	-	-
	Annual	ppb	NA	16.2	NA	-	-	-
$PM_{2.5}$	24-hour	µg/m^3	6.5	17.7	36%	6.0	18.4	33%
	Annual	µg/m^3	4.7	8.8	54%	4.1	9	45%
Benzo(a)Pyrene	24-hour	µg/m^3	1.9E-05	1.81E-04	10%	1.9E-05	1.82E-04	10%
	Annual	µg/m^3	8.6E-06	9.80E-05	9%	8.3E-06	9.84E-05	8%
Benzene	24-hour	µg/m^3	0.4	1.2	31%	0.4	1.2	30%
	Annual	µg/m^3	0.2	0.68	28%	0.2	0.69	28%

Notes:
NA – Not Applicable
95% UCLM – 95% Upper Confidence Limit of the Mean

4.1.3 Silt content on Roads (Condition 5.3.4 of Decision Statement)

The requirement for silt content sampling during construction is for specific haul roads and needs to be conducted during the summer, and when there is traffic on the roads. The haul roads where silt content sampling is required were under construction during a portion of 2023 monitoring period. Samples were collected in the 2023 monitoring period, however laboratory results are pending. No results with respect to silt content on roads are therefore presented in this report.

4.1.4 Summary

Overall, the monitoring data reviewed herein suggests that the assumptions relied on in the HHRA remain applicable. Further evaluation of the potential for Mine-related changes to air quality to affect the health of Indigenous Peoples is not required based on the data collected during the 2023 monitoring period. These assumptions will be re-evaluated based on updated monitoring data in next year's Indigenous Peoples Health Risk Assessment Follow Up Report.

4.2 Surface Water (Conditions 5.4, 5.4.1, and 5.4.2 of Decision Statement)

Condition 5.4 of the Decision Statement refers to monitoring adverse environmental effects on the health of Indigenous peoples due to changes in contaminant concentrations in water and fish. However, the specific monitoring requirements in Conditions 5.4.1 and 5.4.2 of the Decision Statement refer only to monitoring and evaluation of contaminant concentrations in surface water. Therefore, this section focuses on reporting of surface water quality only. Fish tissue monitoring is discussed separately in Section 4.3, below.

Trigger levels for total metals in surface water collected for the four basins of Kenogamisis Lake evaluated in the HHRA (Barton Bay, Southwest Arm, Central Basin, and Outlet Basin), derived by adding 20% to the EPCs of these parameters at these locations that were relied on to predict exposure in the HHRA, are provided in Table A-3 (Appendix A). In addition, in the HHRA, the final risk characterization related to exposure to COPCs in surface water was completed based on exposure to an overall lake-wide EPC for Kenogamisis Lake that was derived by calculating a weighted average of the EPCs for the individual basins that took into account the normalized area of each sub-basin as shown in Table A-4 (Appendix A). Therefore, trigger levels for the overall weighted mean of Kenogamisis Lake, derived by adding 20% to the lake-wide EPCs of these parameters that were relied on to predict exposure to these parameters lake-wide in the HHRA, are also provided in Table A-5 (Appendix A).

In addition to the trigger levels derived based on concentrations relied on in the HHRA provided in Table A-4 (Appendix A) and Table A-5 (Appendix A) for surface water collected in Kenogamisis Lake, Conditions 5.4.1 and 5.4.2 of the Decision Statement specified that monitored

concentrations of mercury and methylmercury concentrations for surface water collected from the SWAT be compared to the benchmarks of 0.04 µg/L and 0.0001 µg/L, respectively.

A detailed description of the surface water quality monitoring methods (i.e., data collection, laboratory analysis, and data analysis) for the 2023 monitoring period is provided in the 2023 Fish and Fish Habitat Federal EIS Follow-Up Monitoring Report (GGM 2023e). The analytical results summarized herein are reported in full in Appendix B2 of the 2023 Fish and Fish Habitat Federal EIS Follow-Up Monitoring Report (GGM 2023e).

A comparison of the available surface water quality monitoring data for the 2023 monitoring period to the trigger levels summarized in Table A-3 (Appendix A) and the benchmarks for mercury and methylmercury defined in Conditions 5.4.1 and 5.4.2 of the Decision Statement is provided in Section 4.2.1 and Section 4.2.2, below.

4.2.1 Total Metals in Kenogamisis Lake Basins (Barton Bay, Southwest Arm, Central Basin, and Outlet Basin)

As described in the 2023 Fish and Fish Habitat Federal EIS Follow-Up Monitoring Report (GGM 2023e), metals concentrations in surface water in Kenogamisis Lake were monitored at Stations 2 and 4 (Barton Bay), 47 (Central Basin), 8, 11, and 17 (Outlet Basin), and 1A, 23, 24, and 46 (Southwest Arm). Summary statistics for these stations, grouped by basin, are provided in Table 4-3. In accordance with the statistical methods described in Section 3.2, a comparison of the measured data to the trigger levels reported in Table A-3 (Appendix A) is also provided in Table 4-3. In this comparison, an updated EPC was derived based on the monitoring data for the 2023 monitoring period for each basin and is compared to the applicable trigger level from Table A-3 (Appendix A).

In addition, in the HHRA, the final risk characterization related to exposure to COPCs in surface water was completed based on exposure to an overall lake-wide EPC for Kenogamisis Lake that was derived by calculating a weighted average of the EPCs for the individual basins that took into account the normalized area of each sub-basin as shown in Table A-4 (Appendix A). Trigger levels for the overall weighted mean of Kenogamisis Lake, derived by adding 20% to the concentrations of these parameters that were relied on to predict exposure to these parameters lake-wide in the HHRA, are provided in Table A-5 (Appendix A).

To identify potential increases in total metals in surface water relative to the concentrations relied on in the HHRA, the first step in evaluation will be to calculate updated EPCs using the collected monitoring data, grouped by basin according to the stations identified in Table A-2 (Appendix A), and compare the updated EPCs to the applicable trigger levels for the individual basins provided in Table A-3 (Appendix A). If the monitoring data from the individual basins are not greater than the trigger levels for individual basins, no further evaluation will be required. However, if the updated EPC is greater than the applicable trigger level for at least one of the individual basins, an updated lake-wide EPC will be calculated as a weighted mean of the individual basin EPCs using the normalized area of each sub-basin as shown in Table A-4 (Appendix A). This updated lake-wide EPC will then be compared to the lake-wide trigger levels provided in Table A-5 (Appendix A).

Comparisons of the monitoring data for individual basins to their applicable trigger levels are provided in (Table 4-3). Of the 64 comparisons shown in Table 4-3, there were seven where the updated EPC based on monitoring data had a value greater than 100% of the applicable trigger level. These were limited to antimony (Barton Bay), arsenic (Barton Bay, Central Basin, and Outlet Basin), barium (Barton Bay), chromium (Central Basin), and mercury (Southwest Arm) (Table 4-3). Further evaluation and interpretation of the potential for the measured concentrations of these parameters in surface water at these locations to affect the health of Indigenous People is provided below.

- **Antimony (Barton Bay)**

  As shown in Table 4-3, the monitoring data collected for total antimony in surface water collected in Barton Bay resulted in an updated EPC that was 112% of the applicable trigger level for antimony in Barton Bay. However, the exposure estimates for antimony for the other evaluated Kenogamisis Lake basins (Central Basin, Outlet Basin, and Southwest Arm) were all less than their applicable trigger levels (Table 4-3). Therefore, a lake-wide area-weighted average was generated by multiplying the exposure estimates for each basin by their applicable normalized area as shown in Table A-4 (Appendix A) and summing the resulting products. This resulted in a lake-wide area-weighted average of antimony of 0.20 µg/L. As this lake-wide area-weighted average is less than its trigger level of 2.46 µg/L shown in Table A-5 (Appendix A), this indicates that lake-wide concentration of antimony has not increased beyond what was determined to be acceptable in the HHRA. As such, further evaluation of the potential for antimony in surface water in Kenogamisis Lake to affect the health of Indigenous People was not required.

- **Arsenic (Barton Bay, Central Basin, and Outlet Basin**)

The updated EPCs calculated for arsenic in Barton Bay, Central Basin, and Outlet Basin ranged from 203% to 306% of the applicable trigger levels for total arsenic in these basins (Table 4-3). However, the trigger levels reported in Table A-3 (Appendix A) are based on the 'Future Case' scenario evaluated in the HHRA; the 'Future Case' scenario was selected to represent the highest predicted concentration during Mine Operation, Active Closure, or Post-Closure. For most parameters, this 'Future case' concentration was greater than or equal to the baseline concentration. However, for arsenic, the baseline concentration was higher than the 'Future Case' concentration as concentrations for arsenic were predicted to decrease over time to account for projected rehabilitation measures to address historical MacLeod and Hardrock tailings. At this time, most rehabilitation measures have not yet been implemented and the projected decreases in arsenic concentrations in surface water have not yet occurred.

Therefore, to evaluate Mine-related changes in arsenic concentrations in surface water, it is more appropriate to compare to historical baseline data for these monitoring stations than to the reduced concentration 'Future Case' trigger levels identified in Table A-3 (Appendix A). A thorough comparison of arsenic concentrations in surface water for monitoring data from the 2023 monitoring period to existing baseline conditions is provided in the 2023 Fish and Fish Habitat Federal EIS Follow-Up Monitoring Report (GGM 2023e). This evaluation relied on trigger thresholds defined based on baseline monitoring data for each evaluated station and did not detect any increasing trends of arsenic in surface water in Kenogamisis Lake. This suggests that surface water concentrations are comparable to pre-existing baseline concentrations and further evaluation of the potential for arsenic in surface water in Kenogamisis Lake to affect the health of Indigenous People was not required.

- **Barium (Barton Bay)**

The exposure estimate calculated for barium in Barton Bay was 105% higher than the applicable trigger level (Table 4-3). However, the exposure estimates for barium for the other evaluated Kenogamisis Lake basins (Central Basin, Outlet Basin, and Southwest Arm) were all less than their applicable trigger levels (Table 4-3). Therefore, a lake-wide area-weighted average was generated by multiplying the exposure estimates for each basin by their applicable normalized area as shown in Table A-4 (Appendix A) and summing the resulting products. This resulted in a lake-wide area-weighted average of barium of 10 µg/L. As this lake-wide area-weighted average does not exceed its trigger level of 11 µg/L (Table A-5, Appendix A), this indicates that lake-wide concentrations of barium have not increased beyond what was determined to be acceptable in the HHRA. As such, further evaluation of the potential for barium in surface water in Kenogamisis Lake to affect the health of Indigenous People was not required.

- **Chromium (Central Basin)**

The exposure estimate calculated for chromium in Central Basin was 116% of the applicable trigger level (Table 4-3). However, the exposure estimates for chromium for the other evaluated Kenogamisis Lake basins (Barton Bay, Outlet Basin, and Southwest Arm) were all less than their applicable trigger levels (Table 4-3). Therefore, a lake-wide area-weighted average was generated by multiplying the exposure estimates for each basin by their applicable normalized area as shown in Table A-4 (Appendix A) and summing the resulting products. This resulted in a lake-wide area-weighted average of chromium of 0.44 µg/L. As this lake-wide area-weighted average does not exceed its trigger level of 0.45 µg/L (Table A-5, Appendix A), this indicates that lake-wide concentrations of chromium have not increased beyond what was determined to be acceptable in the HHRA. As such, further evaluation of the potential for chromium in surface water in Kenogamisis Lake to affect the health of Indigenous People was not required.

- **Mercury (Southwest Arm)**

The exposure estimate calculated for mercury in Southwest Arm was 175% of the applicable trigger level (Table 4-3). However, the exposure estimates for mercury for the other evaluated Kenogamisis Lake basins (Barton Bay, Central Basin, and Outlet Basin) were all less than their applicable trigger levels (Table 4-3). Therefore, a lake-wide area-weighted average was generated by multiplying the exposure estimates for each basin by their applicable normalized area as shown in Table A-4 (Appendix A) and summing the resulting products. This resulted in a lake-wide area-weighted average of mercury of 0.004 µg/L. As this lake-wide area-weighted average does not exceed its trigger level of 0.013 µg/L (Table A-5, Appendix A), this indicates that lake-wide concentrations of mercury have not increased beyond what was determined to be acceptable in the HHRA. As such, further evaluation of the potential for mercury in surface water in Kenogamisis Lake to affect the health of Indigenous People was not required.

Table 4-3 Summary of Total Metals in Kenogamisis Lake Basins (Barton Bay, Southwest Arm, Central Basin, and Outlet Basin) in the 2023 Monitoring Period

Analyte	Basin of Kenogamisis Lake	Trigger Level	Number of Samples	Number of Samples with Detected Concentrations	Maximum Detected Concentration (µg/L)	Maximum Reported Detection Limit (µg/L)	Median	EPC Based on Measured Data[A]	% of Trigger Level[D]
Antimony	Barton Bay	0.52	19	18	0.9	0.1	0.5	0.58	**112%**
	Central Basin	3.9	11	6	0.2	0.1	0.1	0.2[B]	5%
	Outlet Basin	2.7	35	22	0.2	0.1	0.1	0.14	5%
	Southwest Arm	3	45	2	0.1	0.1	0.1	0.1[B]	3%
Arsenic	Barton Bay	17	19	19	89	NA	38	52	**306%**
	Central Basin	7.9	11	11	22	NA	16	16	**203%**
	Outlet Basin	5.3	35	35	21	NA	10	13	**245%**
	Southwest Arm	2.7	45	45	5.8	NA	1.1	2.1	78%
Barium	Barton Bay	7.8	19	19	9.4	NA	7.8	8.2	**105%**
	Central Basin	11	11	11	12	NA	10	11	100%
	Outlet Basin	11	35	35	12	NA	9.9	10	91%
	Southwest Arm	13	45	45	14	NA	12	12	92%
Beryllium	Barton Bay	0.32	19	0	NA	0.05	0.05	0.05[C]	16%
	Central Basin	0.27	11	0	NA	0.05	0.05	0.05[C]	19%
	Outlet Basin	0.29	35	0	NA	0.05	0.05	0.05[C]	17%
	Southwest Arm	0.28	45	0	NA	0.05	0.05	0.05[C]	18%
Chromium	Barton Bay	0.6	19	7	0.6	0.5	0.5	0.6[B]	100%
	Central Basin	0.43	11	4	0.5	0.5	0.5	0.5[B]	**116%**
	Outlet Basin	0.42	36	12	0.8	0.5	0.5	0.39	93%
	Southwest Arm	0.44	45	15	1	0.5	0.5	0.38	86%
Cobalt	Barton Bay	0.21	19	14	0.2	0.1	0.1	0.12	57%
	Central Basin	0.24	11	0	NA	0.1	0.05	0.1[C]	42%
	Outlet Basin	0.23	35	2	0.1	0.1	0.05	0.1[B]	43%
	Southwest Arm	0.34	45	2	0.1	0.1	0.05	0.1[B]	29%

Analyte	Basin of Kenogamisis Lake	Trigger Level	Number of Samples	Number of Samples with Detected Concentrations	Maximum Detected Concentration (µg/L)	Maximum Reported Detection Limit (µg/L)	Median	EPC Based on Measured Data[A]	% of Trigger Level[D]
Copper	Barton Bay	3.4	19	19	5	NA	2.2	3.1	91%
	Central Basin	2	11	11	2.1	NA	1.2	1.5	75%
	Outlet Basin	1.4	35	35	2.6	NA	1.1	1.4	100%
	Southwest Arm	0.63	45	45	1.5	NA	0.5	0.59	94%
Lead	Barton Bay	0.48	19	17	0.61	0.05	0.17	0.24	50%
	Central Basin	0.32	11	9	0.14	0.05	0.08	0.14[B]	44%
	Outlet Basin	0.33	35	23	0.56	0.05	0.06	0.16	48%
	Southwest Arm	0.29	45	20	0.42	0.05	0.05	0.1	34%
Manganese	Barton Bay	23	19	19	22	NA	11	14	61%
	Central Basin	16	11	11	24	NA	8.7	12	75%
	Outlet Basin	18	35	35	37	NA	12	15	83%
	Southwest Arm	16	45	45	23	NA	10	12	75%
Mercury	Barton Bay	0.011	19	13	0.0024	0.1	0.0021	0.002	18%
	Central Basin	0.035	11	8	0.0024	0.1	0.0015	0.0024[B]	7%
	Outlet Basin	0.009	35	25	0.0023	0.1	0.0013	0.0013	14%
	Southwest Arm	0.008	44	33	0.2	0.1	0.0014	0.014	**175%**
Nickel	Barton Bay	1.1	19	19	1.4	NA	0.7	0.95	86%
	Central Basin	0.8	11	8	0.6	0.5	0.4	0.6[B]	75%
	Outlet Basin	0.71	35	26	0.9	0.5	0.4	0.44	62%
	Southwest Arm	0.73	45	30	1.3	0.5	0.3	0.29	40%
Selenium	Barton Bay	0.34	19	15	0.13	0.05	0.07	0.08	24%
	Central Basin	0.29	11	8	0.1	0.05	0.06	0.1[B]	34%
	Outlet Basin	0.31	35	26	0.18	0.05	0.06	0.079	25%
	Southwest Arm	0.3	45	32	0.19	0.05	0.06	0.077	26%
Thallium	Barton Bay	0.09	19	1	0.01	0.01	0.005	0.01[B]	11%
	Central Basin	0.07	11	0	NA	0.01	0.005	0.01[C]	14%
	Outlet Basin	0.08	35	0	NA	0.01	0.005	0.01[C]	13%
	Southwest Arm	0.08	45	2	0.02	0.01	0.005	0.02[B]	25%

Analyte	Basin of Kenogamisis Lake	Trigger Level	Number of Samples	Number of Samples with Detected Concentrations	Maximum Detected Concentration (µg/L)	Maximum Reported Detection Limit (µg/L)	Median	EPC Based on Measured Data[A]	% of Trigger Level[D]
Uranium	Barton Bay	1.4	19	19	0.08	NA	0.04	0.049	4%
	Central Basin	2.2	11	11	0.26	NA	0.13	0.18	8%
	Outlet Basin	2.2	35	35	0.25	NA	0.12	0.14	6%
	Southwest Arm	2.6	45	45	0.34	NA	0.23	0.24	9%
Vanadium	Barton Bay	0.59	19	12	0.5	0.5	0.37	0.33	56%
	Central Basin	0.49	11	7	0.43	0.5	0.36	0.43[B]	88%
	Outlet Basin	0.49	35	22	0.57	0.5	0.36	0.3	61%
	Southwest Arm	0.5	45	29	0.37	0.5	0.3	0.26	52%
Zinc	Barton Bay	3.1	19	17	2	1	1	1.3	42%
	Central Basin	2.4	11	7	1.2	1	1	1.2[B]	50%
	Outlet Basin	2.1	35	23	2	1	1	0.99	47%
	Southwest Arm	2.2	45	18	3	1	0.6	0.79	36%

Notes

A. Exposure point concentration (EPC) of measured data from the 2023 monitoring period. Where there were sufficient data (i.e., at least 10 samples with detected concentrations) the EPC is represented by a 95% upper confidence limit of the mean (95% UCLM) calculated using USEPA's ProUCL Version 5.2 statistical software. If there were less than 10 samples with detected concentrations, the EPC is represented by the maximum measured concentration (if there is at least one sample with a detected concentration) or maximum reported detection limit (if there are no samples with a detected concentration).
B. EPC represented by maximum detected concentration
C. EPC represented by maximum reported detection limit
D. Comparison of EPC to trigger level (i.e., (EPC/trigger level) *100). Values greater than 100% are **bolded and shaded**.

NA - Not Applicable

4.2.2 Mercury and Methylmercury in the Southwest Arm Tributary (SWAT)

As described in Appendix A (Section A.2), Conditions 5.4.1 and 5.4.2 describe requirements for monitoring mercury and methylmercury in surface water in the SWAT during construction and the first five years of operation. The HHRA did not include estimates for mercury and methylmercury concentrations in water in the Southwest Arm Tributary. Therefore, trigger levels based on the predicted values from the HHRA could not be calculated for these parameters in surface water for this location. Rather, concentrations of mercury and methylmercury in surface water from the SWAT are compared in this report to the benchmarks of 0.04 µg/L for mercury and 0.0001 µg/L for methylmercury that were defined in Conditions 5.4.1 and 5.4.2 of the Decision Statement as well as previously collected baseline data for the SWAT.

As shown in the 2023 Fish and Fish Habitat Federal EIS Follow-Up Monitoring Report (GGM 2023e), there are five surface water quality monitoring locations that are considered representative of conditions in the SWAT. These five stations (25, 39, 52, 54, and 55) were monitored monthly during the 2023 monitoring period monitoring, with some exceptions due to safety limitations (e.g., sampling was not completed in December 2022 at stations 25, 39, 54, or 55 due to unsafe ice conditions). The mercury and methylmercury results measured at these five stations during the 2023 monitoring period are summarized in Table 4-4 and comparison to applicable benchmarks is provided below.

- **Mercury**

  As shown in Table 4-4, the maximum detected concentration of total mercury in surface water in the monitored SWAT stations was 0.014 µg/L. There were no occasions where a detected concentration of mercury in surface water from these stations was higher than the benchmark from the Decision Statement of 0.04 µg/L. In addition, further evaluation of mercury concentrations in the SWAT at Stations 25, 39, and 52 provided in the 2023 Fish and Fish Habitat Follow Up report (GGM 2023e) determined that mercury concentrations at Stations 39 and 52 were similar to Station 39- and 52- specific baseline data. For Station 25, an increase in mercury concentration in surface water relative to baseline conditions was reported in the 2023 Fish and Fish Habitat Follow Up report (GGM 2023e); however, an additional evaluation determined that the concentrations of mercury at Station 25 are consistent with those predicted for the SWAT in the EIS/EA Amendment after the diversion of the Goldfield Creek (GFC) (see Appendix B5-5 of (GGM 2023e)). Overall, it is expected that mercury concentrations at Station 25 will decrease as flow through the GFC diversion stabilizes and is remediated and after spring flooding has abated (see Appendix B5-5 of (GGM 2023e).

- **Methylmercury**

  As shown in Table 4-4, the maximum detected concentration of methylmercury in surface water in the monitored SWAT stations was 0.0098 µg/L, which is greater than the benchmark of 0.0001 µg/L that was provided in Condition 5.4.2 of the Decision Statement. However, further evaluation of methylmercury concentrations in the SWAT at Stations 25, 39, and 52 provided in the 2023 Fish and Fish Habitat Follow Up report (GGM 2023e) concluded that methylmercury in the SWAT has not changed significantly from baseline conditions.

Given that concentrations of mercury and methylmercury in the SWAT have been shown to be comparable to baseline conditions or are consistent with those predicted for the SWAT in the EIS/EA Amendment, further evaluation of the potential for mercury and methylmercury in surface water in the SWAT to affect the health of Indigenous People was not required.

4.2.3 Summary

Overall, the monitoring data reviewed herein suggest that the assumptions relied on in the HHRA remain applicable. Further evaluation of the potential for the Mine-related changes to surface water quality to affect the health of Indigenous Peoples is not required based on the data collected during the 2023 monitoring period. These assumptions will be re-evaluated based on updated monitoring data in next year's Indigenous Peoples Health Risk Assessment Follow Up Report.

Table 4-4 Summary of Mercury and Methylmercury Concentrations Measured at SWAT Monitoring Stations in the 2023 Monitoring Period

Analyte	Benchmark from Decision Statement (µg/L)	Number of Samples	Number of Samples with Detected Concentrations	Maximum Detected Concentration (µg/L)	**Maximum Reported Detection Limit (µg/L)**	Median	EPC Based on Measured Data[A]	% of Trigger Level[B]
Mercury	0.04	62	61	0.014	0.01	0.0018	0.0025	6%
Methylmercury	0.0001	37	24	0.00098	0.00005	0.00012	0.00033	**328%**

Notes

A. Exposure point concentration (EPC) of measured data from the 2023 monitoring period. Where there were sufficient data (i.e., at least 10 samples with detected concentrations), the EPC is represented by a 95% upper confidence limit of the mean (95% UCLM), calculated using USEPA's ProUCL Version 5.2 statistical software. If there were less than 10 samples with detected concentrations, the EPC is represented by the maximum measured concentration (if there is at least one sample with a detected concentration) or maximum reported detection limit (if there are no samples with a detected concentration).

B. Comparison of EPC to trigger level (i.e., (EPC/trigger level) *100). Values greater than 100% are **bolded and shaded**.

NA - Not Applicable

4.3 Fish Tissue (Conditions 5.5 and 5.5.1 of the Decision Statement)

Conditions 5.5 and 5.5.1 of the Decision Statement refer to monitoring and evaluation of the potential for adverse effects on the health of Indigenous Peoples due to changes in concentrations of contaminants in country foods (i.e., fish, vegetation, and wildlife). This section focuses solely on monitoring of fish tissue. Trigger levels for metals in Walleye tissue collected in Kenogamisis Lake based on predicted concentrations in the HHRA are provided in Table A-6 (Appendix A).

The Fish and Fish Habitat Federal EIS Follow-Up Monitoring Plan indicated that fish tissue monitoring would be initiated within 24 months from when the Mine first began discharging effluent via the temporary effluent treatment plant (TETP), which occurred on September 15, 2021. As such, fish tissue monitoring was initiated in 2023.

Walleye tissue sampling occurred in late September and October of 2023, in keeping with the requirements of the Plan. At the time of report production, Walleye fish tissue data was not received from the laboratory. A separate memo will be appended to this report following the receipt of the laboratory data. Appendix B has been included as a placeholder for this memo, which will address Condition 5.5.1 of the Decision Statement.

4.4 Vegetation and Wildlife (Conditions 5.5 and 5.5.2 of the Decision Statement)

Conditions 5.5 and 5.5.2 of the Decision Statement refer to monitoring and evaluation of the potential for adverse effects on the health of Indigenous Peoples due to changes in concentrations of contaminants in country foods (i.e., fish, vegetation, and wildlife). This section focuses solely on monitoring of vegetation and wildlife (i.e., small mammals). Trigger levels for metals in vegetation and wildlife (i.e., small mammals) based on predicted concentrations in the HHRA are provided in Table A-7 (Appendix A).

The monitoring requirements for small mammal tissue described in Conditions 5.5 and 5.5.2 of the Decision Statement indicate that country foods be monitored “at least every two years, during the first six years of operation”, with additional monitoring beyond this period to be determined based on the results of the initial monitoring. As the Mine has not yet started operation, no country food monitoring was required to support the Indigenous Health Follow Up Plan this year. Therefore, no reporting on vegetation and wildlife (i.e., small mammals) concentrations was completed in this report. Vegetation and wildlife (i.e., small mammals) tissue results will be reported on, and compared to the trigger levels provided in Table A-7 (Appendix A), after the first round of sampling within the first two years of Mine operation.

4.5 Moose Tissue (Condition 5.6 of the Decision Statement)

Condition 5.6 of the Decision Statement indicates that the GGM is to participate in any regional initiative that is established for the analysis of contaminants in moose (*Alces alces)* tissue in the region, should there be any such initiative(s) established during construction or operation of the Mine. At this time, GGM is not aware that any such regional initiative has been established. Therefore, no reporting on moose tissue COPC concentrations is provided in this report. However, if such an initiative is established in the future, moose tissue results will be compared to the trigger levels for small mammals provided in Table A-7 (Appendix A) as the HHRA adopted small mammal tissue concentrations are expected to be representative of tissue concentrations in larger animals (e.g., moose, deer).

5 Conclusions

This 2023 Indigenous Peoples Health Risk Assessment Follow-up Report provides a review and evaluation of environmental monitoring data collected during the 2023 monitoring period to satisfy the requirements of the Plan. For the 2023 monitoring period, the data collected relevant to this report included air quality, surface water, and fish tissue monitoring. For air quality and surface water monitoring, the data collected during the 2023 monitoring period have been compared to applicable guidelines and trigger levels in this report. The monitoring data reviewed herein suggest that the assumptions relied on in the HHRA remain applicable and further evaluation of the potential for the Mine-related changes to air quality or surface water quality to affect the health of Indigenous Peoples is not required based on the data collected during the 2023 monitoring period. These assumptions will be re-evaluated based on updated monitoring data in next year's Indigenous Peoples Health Risk Assessment Follow Up Report. Fish tissue data, although collected during the 2023 monitoring period, was not yet available for interpretation at the time of report production. Therefore, this data will be evaluated and interpreted separately in Appendix B of this report when the data becomes available.

6 References

Canadian Council of Ministers of the Environment (CCME). 2012. Canadian Ambient Air Quality Standards (CAAQS) for nitrogen dioxide (NO2), effective by 2020.

Greenstone Gold Mines (GGM). 2023a. Greenstone Project Ambient Monitoring Quarterly Report Q4 2022 Reporting Period. HP-MG003-EV-136-0038_0. February 14, 2023. EA Reference No. 14175. File Number EA-02-10.

Greenstone Gold Mines (GGM). 2023b. Greenstone Project Ambient Monitoring Quarterly Report Q1 2023 Reporting Period. HP-MG003-EV-136-0044_0. May 15, 2023. EA Reference No. 14175. File Number EA-02-10.

Greenstone Gold Mines (GGM). 2023c. Greenstone Project Ambient Monitoring Quarterly Report Q2 2023 Reporting Period. HP-MG003-EV-136-0046_0. August 14, 2023. EA Reference No. 14175. File Number EA-02-10.

Greenstone Gold Mines (GGM). 2023d. Greenstone Project Ambient Monitoring Quarterly Report Q3 2023 Reporting Period. HP-MG003-EV-136-0056_0. November 14, 2023. EA Reference No. 14175. File Number EA-02-10.

Greenstone Gold Mines (GGM). 2023e. Greenstone Mine 2023 Fish and Fish Habitat Federal EIS Follow-Up Monitoring Report. HP-MG003-EV-136-0053_A. December 27, 2023.

Greenstone Gold Mines GP Inc. (GGM). 2022. Hardrock Project Biodiversity Management and Monitoring Plan. HP-MG004-EV-130-0002_2. June 3, 2022. EA Reference No. 14175EA. File No. EA-02-10.

Greenstone Gold Mines GP Inc. (GGM). 2021. Hardrock Project Fish and Fish Habitat Federal EIS Follow-Up Monitoring Plan. HP-MG003-EV-130-0008_0. February 16, 2021.

Greenstone Gold Mines GP Inc. (GGM). 2020a. Hardrock Project Indigenous Peoples Health Risk Assessment Follow-up Plan. HP-MG003-EV-130-0007_0. November 2, 2020.

Greenstone Gold Mines GP Inc. (GGM). 2020b. Hardrock Project Air Quality Management and Monitoring Plan. HP-MG004-EV-130-0003_1. November 16, 2020. EA Reference No. 14175EA. File No. EA-02-10.

Stantec Consulting Ltd. (Stantec). 2017. Hardrock Project Final Environmental Impact Statement/Environmental Assessment Amendment. Document control number: HP-MG003-EV-136-0004-001-Prepared for: Greenstone Gold Mines GP Inc. June 2017 and updated in accordance with Provincial EA Approval Condition 27 - 2019.

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Appendix A
Trigger Levels for Chemicals of Potential Concern (COPC) In Environmental Monitoring Data

A.1 Air Quality (Conditions 5.3, 5.3.1, 5.3.2, 5.3.3, and 5.3.4)

Conditions 5.3, 5.3.1, 5.3.2, 5.3.3, and 5.3.4 refer to monitoring and evaluation of the potential for adverse effects on the health of Indigenous Peoples due to changes in air quality. These conditions include specific monitoring requirements for the following air quality contaminants during construction, operation, and/or decommissioning:

- Total suspended particulates (TSP), coarse particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), and nitrogen dioxide (NO_2) (Condition 5.3.2)
- Benzene and benzo(a)pyrene (Condition 5.3.3)
- Silt content on haul roads (Condition 5.3.4)

Details regarding sampling locations, sampling frequency, and analytical methods for monitoring these parameters in accordance with the monitoring requirements from Condition 5.3 are provided in the Air Quality Management and Monitoring Plan (GGM 2020b).

Trigger levels for the above air contaminants, derived by adding 20% to the concentrations of these parameters that were relied on to predict exposure to these parameters in the HHRA, are provided in Table A-1. Notably, the trigger levels for TSP, PM_{10}, NO_2, $PM_{2.5}$, benzo(a)pyrene, and benzene are provided for two specific monitoring locations (Station B (Rosedale Point) and Station C (MacLeod Provincial Park)) and vary, in some cases, from the trigger levels that were provided in the Indigenous Peoples Health Risk Assessment Follow-up Plan due to changes in the actual vs. predicted monitoring locations.

The trigger level for silt content is the value at which particulate emissions from the haul roads would increase by greater than 20% of the emissions levels used to predict the concentrations assessed in the HHRA. Since silt content is non-linearly related to haul road emissions levels, the trigger level is not equivalent to a 20% increase of the silt content value used in the Environmental Assessment. The trigger level for silt content on haul roads is not specific to a single sampling location and rather will be evaluated using a composite of all collected haul road samples.

In addition to the trigger levels derived based on concentrations relied on in the HHRA, Condition 5.3.2 also specified that monitored concentrations of TSP, PM_{10}, $PM_{2.5}$, and NO_2 be compared to "standards and criteria set out in the Canadian Council of Ministers of the Environment's Canadian Ambient Air Quality Standards and Ontario's Ambient Air Quality Criteria". Therefore, these criteria (if available) are also summarized in Table A-1.

Table A-1 Ambient Air Quality Monitoring Trigger Levels and Other Applicable Criteria

Contaminant	Averaging Period	Units	Trigger Level		Ontario Ambient Air Quality Criteria (AAQC)	Canadian Ambient Air Quality Standards (CAAQS)
			Station B Rosedale Point	Station C MacLeod Provincial Park		
TSP	24-hour	µg/m^3	123.8	102.1	120	NV
	Annual	µg/m^3	19.8	22.4	60	NV
PM_{10}	24-hour	µg/m^3	84.7	67.9	50[A]	NV
NO_2	1-hour	ppb	138.2	NA	200	62[B,C]; 60 [B,D]
	24-hour	ppb	68.0	NA	100	NV
	Annual	ppb	16.2	NA	NV	17 [C,E] ; 12 [D,E]
$PM_{2.5}$	24-hour	µg/m^3	17.7	18.4	27[F]	27[F]
	Annual	µg/m^3	8.8	9	8.8[G]	8.8[G]
Benzo(a)Pyrene	24-hour	µg/m^3	1.81E-04	1.82E-04	5.00E-05	NV
	Annual	µg/m^3	9.80E-05	9.84E-05	1.00E-05	NV
Benzene	24-hour	µg/m^3	1.2	1.2	2.3	NV
	Annual	µg/m^3	0.68	0.69	0.45	NV
Silt content on Haul Raads	N/A	%	7.5 [H]		NA	

Notes

NV – No value

NA – Not applicable. In the Air Quality Management and Monitoring Plan, NO_2 was not targeted for monitoring and evaluation at Station C.

A. AAQC for PM_{10} is an interim AAQC provided as a guide for decision making.

B. The 1-hour CAAQS for NO_2 is referenced to the 3-year average of the annual 98th percentile of the daily maximum 1-hour average concentrations

C. Canadian Ambient Air Quality Standards (CAAQS) for nitrogen dioxide (NO_2), effective by 2020 (CCME, 2012)

D. CAAQS for NO_2, effective by 2025 (CCME, 2012)

E. The annual CAAQS for NO2 is referenced to the average over a single calendar year of all 1-hour average concentrations

F. Canadian Ambient Air Quality Standards (CAAQS) for Respirable Particulate Matter, effective by 2020 (CCME, 2012). The Respirable Particulate Matter Objective is referenced to the 98th percentile daily average concentration averaged over 3 consecutive years.

G. Annual Canadian Ambient Air Quality Standard for Respirable Particulate Matter, effective by 2020. The Respirable Particulate Matter Objective is referenced to the 3-year average of the annual average concentrations.

H. Based on a composite of all haul road samples collected.

A.2 Surface Water (Conditions 5.4, 5.4.1, and 5.4.2)

Condition 5.4 refers to monitoring adverse environmental effects on the health of Indigenous peoples due to changes in contaminant concentrations in water and fish. However, the specific monitoring requirements in Conditions 5.4.1 and 5.4.2 refer only to monitoring and evaluation of contaminant concentrations in surface water. Therefore, this section focuses on reporting of surface water quality only. Fish tissue monitoring is discussed separately in Section A.3, below.

Details regarding sampling locations, sampling frequency, and analytical methods for monitoring contaminant concentrations in surface water in accordance with the monitoring requirements from Conditions 5.4, 5.4.1, and 5.4.2 are provided in the Fish and Fish Habitat Federal EIS Follow-Up Monitoring Plan (GGM 2021).

The Fish and Fish Habitat monitoring plan describes plans to monitor for total and dissolved metals at representative locations in Kenogamisis Lake, Mosher Lake, and the SWAT. However, evaluation of contaminant concentrations in surface water in the HHRA was focused solely on predictions of total metals in surface water in Kenogamisis Lake (as represented by sampling various basins of Kenogamisis Lake, specifically, Barton Bay, Southwest Arm, Central Basin, and Outlet Basin). The surface water sampling locations relied on to characterize these basins in the HHRA are summarized in Table A-2. Trigger levels for each individual basin, derived by adding 20% to the EPCs of these parameters that were relied on to predict exposure to these parameters for these basins in the HHRA, are provided in Table A-3. In addition, in the HHRA, the final risk characterization related to exposure to COPCs in surface water was completed based on exposure to an overall lake-wide EPC for Kenogamisis Lake that was derived by calculating a weighted average of the EPCs for the individual basins that took into account the normalized area of each sub-basin as shown in Table A-4. Trigger levels for the overall weighted mean of Kenogamisis Lake, derived by adding 20% to the concentrations of these parameters that were relied on to predict exposure to these parameters lake-wide in the HHRA, are provided in Table A-5.

To identify potential increases in total metals in surface water relative to the concentrations relied on in the HHRA, the first step in evaluation will be to calculate updated EPCs using the collected monitoring data, grouped by basin according to the stations identified in Table A-2, and compare the updated EPCs to the applicable trigger levels for the individual basins provided in Table A-3. If the monitoring data from the individual basins are not greater than the trigger levels for individual basins, no further evaluation will be required. However, if the updated EPC is greater than the applicable trigger level for at least one of the individual basins, an updated Lake-wide EPC will be calculated as a weighted mean of the individual basin EPCs using the normalized area of each sub-basin as shown in Table A-4. This updated Lake-wide EPC will then be compared to the Lake-wide trigger levels provided in Table A-5.

Conditions 5.41 and 5.4.2 also describe requirements for monitoring mercury and methylmercury in water in surface water in the SWAT during construction and the first five years of operation. The HHRA did not include estimates for mercury and methylmercury concentrations in water in the Southwest Arm Tributary. Therefore, trigger levels based on the predicted values from the HHRA could not be calculated for these parameters in surface water for this location. Rather, concentrations of mercury and methylmercury in surface water from the SWAT will be compared to benchmarks of 0.04 µg/L for mercury and 0.0001 µg/L for methylmercury that are defined in Conditions 5.41 and 5.4.2.

Table A-2 Surface Water Monitoring Locations Representative of Regions from the HHRA

Basin of Kenogamisis Lake	Surface Water Sampling Locations Relied on to Characterize this Region in the HHRA
Barton Bay[A]	2, 3, 4, 5
Southwest Arm	1, 1A, 23, 24, 46
Central Basin[A]	6, 7, 12, 47
Outlet Basin	8, 11, 17, 48

Notes

A. The HHRA included predictions for 'Barton Bay East' and 'Barton Bay West' and for 'Central Basin East' and 'Central Basin West'. However, the sample location(s) identified in the HHRA as representative of the west portion of these water bodies were also included in the characterization of the east portion of these water bodies. Specifically, 'Barton Bay West' was represented by Sample Location 2, which is also one of the four locations relied on to represent 'Barton Bay East', and Central Basin West was represented by Sample Locations 6 and 7, which are two of the four locations relied on to represent 'Central Basin East'. Therefore, the 'Barton Bay East' and 'Central Basin East' values relied on in the HHRA are considered generally representative of all of Barton Bay and Central Basin, respectively.

Table A-3 Surface Water Monitoring Trigger Levels for Total Metals in Surface Water in Representative Regions of Kenogamisis Lake

Contaminant	Trigger Level (µg/L)					
	Barton Bay[A]		Southwest Arm	Central Basin[A]		Outlet Basin
	East	West		East	West	
Antimony	0.52	0.50	2.98	3.91	0.31	2.70
Arsenic	16.90	34.10	2.69	7.90	7.99	5.30
Barium	7.84	7.33	13.30	11.10	10.30	10.70
Beryllium	0.32	0.35	0.28	0.27	0.31	0.29
Chromium	0.60	0.52	0.44	0.43	0.55	0.42
Cobalt	0.21	0.20	0.34	0.24	0.10	0.23
Copper	3.35	1.98	0.63	1.97	2.63	1.36
Lead	0.48	0.48	0.29	0.32	0.47	0.33
Manganese	22.80	23.50	16.20	16.30	14.90	17.90
Mercury	0.011	0.013	0.008	0.035	0.012	0.009
Nickel	1.11	1.08	0.73	0.80	0.66	0.71
Selenium	0.34	0.38	0.30	0.29	0.32	0.31
Thallium	0.09	0.10	0.08	0.07	0.09	0.08
Uranium	1.42	1.51	2.59	2.20	1.38	2.21
Vanadium	0.59	0.53	0.50	0.49	0.55	0.49
Zinc	3.12	2.88	2.23	2.38	2.29	2.05

Notes

A. As described in Table A-2, above, the 'Barton Bay East' and 'Central Basin East' values are considered generally representative of all of Barton Bay and Central Basin, respectively. The 'Barton Bay West' and 'Central Basin West' values are retained here for historical comparison with the HHRA only.

Table A-4 Normalized Area of Kenogamisis Lake Sub-Basins as Reported in the HHRA

Basin of Kenogamisis Lake	Normalized Area (unitless)
Barton Bay	0.13
Southwest Arm	0.2
Central Basin	0.18
Outlet Basin	0.49

Table A-5 Surface Water Monitoring Trigger Levels for Total Metals in Surface Water in Kenogamisis (Lake-Wide)

Contaminant	Trigger Level (µg/L)
Antimony	2.5
Arsenic	12
Barium	11
Beryllium	0.29
Chromium	0.45
Cobalt	0.24
Copper	1.5
Lead	0.35
Manganese	18
Mercury	0.013
Nickel	0.81
Selenium	0.34
Thallium	0.081
Uranium	2.1
Vanadium	0.51
Zinc	2.3

A.3 Fish Tissue (Conditions 5.5 and 5.5.1)

Conditions 5.5 and 5.5.1 refer to monitoring and evaluation of the potential for adverse effects on the health of Indigenous Peoples due to changes in concentrations of contaminants in country foods (i.e., fish, vegetation, and wildlife). This section focuses solely on monitoring of fish tissue. Vegetation and wildlife monitoring is discussed in **Section A.4**, below.

Details regarding sampling locations, sampling frequency, and analytical methods for monitoring contaminant concentrations in fish tissue in accordance with the monitoring requirements from Conditions 5.4, 5.4.1, and 5.4.2 are provided in the Fish and Fish Habitat Federal EIS Follow-Up Monitoring Plan (GGM 2021).

The Fish and Fish Habitat monitoring plan describes plans to monitor fish tissue in the SWAT and in Kenogamisis Lake. Yellow perch (*Perca flavescens*) is targeted for monitoring in the SWAT and walleye (*Sander vitreus*) is targeted for sampling in Kenogamisis Lake. The HHRA relied on walleye concentrations in Kenogamisis Lake to assess potential health effects for human receptors. Therefore, review of fish tissue data for the Indigenous Peoples Health Risk Assessment Follow-up report will focus on walleye tissue collected in Kenogamisis Lake. Trigger levels for Walleye tissue collected in Kenogamisis Lake, calculated by adding 20% to the predicted concentrations of those parameters in walleye tissue that were to support the HHRA, are provided in Table A-6.

Table A-6 Walleye Fillet Monitoring Trigger Levels

Contaminant	Trigger Level (mg/kg ww)
Antimony	2.12E-02
Arsenic	9.94E-02
Barium	2.05E-02
Beryllium	2.40E-03
Chromium	7.00E-02
Cobalt	1.32E-01
Copper	8.62E-01
Lead	1.21E-02
Manganese	1.31E+00
Mercury (assumed as methylmercury)	7.03E-01
Nickel	4.70E-02
Selenium	6.24E-01
Thallium	1.69E-02
Uranium	1.12E-03
Vanadium	4.50E-02
Zinc	1.32E+01

A.4 Vegetation and Wildlife (Conditions 5.5 and 5.5.2)

Conditions 5.5 and 5.5.2 refer to monitoring and evaluation of the potential for adverse effects on the health of Indigenous Peoples due to changes in concentrations of contaminants in country foods (i.e., fish, vegetation, and wildlife). This section focuses solely on monitoring of vegetation and wildlife (i.e., small mammals). Fish tissue monitoring is discussed in Section A.3, above.

The environmental monitoring plan identified as applicable to vegetation and wildlife sampling is the Biodiversity Management and Monitoring Plan.

Trigger levels for vegetation and wildlife (i.e., small mammals), calculated by adding 20% to the predicted concentrations of those parameters in vegetation and small mammal tissue that were to support the HHRA, are provided in Table A-7.

Table A-7 Vegetation and Small Mammal Trigger Levels

Contaminant	Trigger levels (mg/kg ww)			
	Vegetation (Browse)	Vegetation (Forage)	Vegetation (Berries)	Small Mammal Tissue
Antimony	2.46E-02	1.44E-02	4.66E-03	1.40E-02
Arsenic	1.36E-01	1.93E-01	5.32E-02	9.07E-01
Barium	2.44E+00	7.31E+00	1.30E+00	4.40E+00
Beryllium	4.68E-03	4.68E-03	4.68E-03	2.45E-03
Chromium	2.80E-02	1.22E-01	2.52E-02	1.93E-01
Cobalt	2.86E-01	8.77E-03	1.03E-02	5.30E-02
Copper	1.30E+00	5.12E-01	4.30E-01	4.07E+00
Lead	1.39E-02	2.57E-02	2.21E-02	7.26E-02
Manganese	4.46E+01	7.31E+01	1.90E+01	5.75E+00
Mercury	2.30E-02	2.30E-02	2.30E-02	5.46E-02
Nickel	5.98E-01	2.51E-01	6.38E-02	2.45E-01
Selenium	3.07E-02	2.35E-02	2.34E-02	3.68E-01
Thallium	5.39E-03	2.69E-03	3.83E-02	6.40E-03
Uranium	1.06E-03	1.54E-03	9.36E-04	7.48E-04
Vanadium	1.33E-02	6.89E-02	4.69E-02	4.18E-02
Zinc	2.84E+01	5.48E+00	3.24E+00	3.54E+01

A.5 Moose Tissue (Condition 5.6)

Condition 5.6 refers to GGM's participation in any regional initiative that is established for the analysis of contaminants in moose (*Alces alces*) tissue in the region, should there be any such initiative(s) during construction or operation of the Mine. In the HHRA, moose tissue concentrations were assumed to be equivalent to predicted small mammal tissue concentrations. Separate trigger levels for moose tissue samples are therefore not required. If moose tissue is collected, tissue samples can be compared to the small mammal tissue trigger levels described in Table A-7, above.

Appendix B
Evaluation of Walleye Fish Tissue Data
(to be provided when available)