



Water Resources Division
Resource Management Directorate
Nunavut Regional Office
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Your file - Votre référence
2AM-MRY1325
Our file - Notre référence
GCdocs#96874354

August 10, 2021

Sylvia Ekelik
Licensing Administrative Assistant
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU, X0B 1J0
sent via e-mail: licensing@nwb-oen.ca

**Re: Crown-Indigenous Relations and Northern Affairs Canada's review of
Baffinland Iron Mine Corporation's 2020 annual report for Type A water licence
2AM-MRY1325 for the Mary River Project**

Dear Ms. Ekelik,

Thank you for your April 14, 2021 invitation to review the above referenced annual report. Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) examined the application pursuant to its mandated responsibilities under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Department of Crown-Indigenous Relations and Northern Affairs Act*. Please find CIRNAC comments and recommendations in the attached Technical Memorandum.

If there are any questions or concerns, please contact Andrew Keim at andrew.keim@canada.ca.

Sincerely,

Sarah Forté
Water Management Specialist



Technical Review Memorandum

Date: August 10, 2021

To: Sylvia Ekelik, Licensing Administrative Assistant, Nunavut Water Board

From: Sarah Forté, Water Management Specialist, CIRNAC

Re: Crown-Indigenous Relations and Northern Affairs Canada's review of Baffinland Iron Mine Corporation's 2020 annual report for Type A water licence 2AM-MRY1325 for the Mary River Project

Region: ☐ Kitikmeot ☐ Kivalliq ☒ Qikiqtani

A. BACKGROUND

The Mary River Project is an operating high-grade iron mine located in the Qikiqtani Region of Nunavut, on northern Baffin Island. The mine is owned and operated by Baffinland Iron Mines Corporation (Baffinland) and includes the Mine Site, the Milne Port site, and a 100 km-long Tote Road connecting the two sites. The current approved project allows iron ore production through open pit mining. Part B Item 4 of water licence 2AM-MRY1325 – Amendment No. 1 requires the proponent to submit an Annual Report for operations.

Baffinland has submitted plans for a "Phase 2 Proposal" that involves the construction of a new railway running adjacent to the existing Tote Road (called the North Railway) and an increase in total mine production. Phase 2 also involves development of additional infrastructure and upgrades at Milne Port and at the Mine Site. This licence amendment process is currently in the technical review phase.

On April 14, 2021, the Nunavut Water Board provided notification of Baffinland's submission of the 2020 annual report for the Mary River Project and invited comments. A summary of the subjects of Crown-Indigenous Relations and Northern Affairs Canada's (CIRNAC) comments and recommendations regarding the Annual Report are listed in Table 1. Documents reviewed as part of this submission can be found in Table 2 of Section B. Detailed technical review comments are in Section C.



Table 1: Summary of Recommendations

Number	Subject
1	Water withdrawal volume exceedances
2	Potential acid rock drainage/metal leaching at edges of waste rock facility
3	Groundwater monitoring
4	Core Receiving Environment Monitoring Program Report recommendations
5	Sedimentation management during freshet
6	Modifying Surveillance Network Program stations
7	Update to management plans
8	Confirming placement of potentially acid generating waste rock in waste rock facility
9	Sampling procedures and external lab errors
10	Locations of potential project related impacts on Tote Road
11	Waste rock sulfur content analytical results
12	Deviation during construction of Km106 Run of Mine Stockpile and Sedimentation Pond

B. DOCUMENTS REVIEWED

The following table provides a summary of the documents reviewed with the annual report.

Table 2: Documents Reviewed

Document Title	Author, File No., Rev., Date
2020 Qikiqtani Inuit Association and Nunavut Water Board Annual Report for Operations	Baffinland Iron Mines Corporation, Rev 0, March 31, 2021
Appendix A Concordance Table Type 'A' Water Licence 2AM-MRY1325 – Amendment No.1	Baffinland Iron Mines Corporation, March 2021
Appendix B NWB Annual Report 2020	Baffinland Iron Mines Corporation, March 2021
Appendix C.1.1 Construction Summary Report Km106 Run of Mine Stockpile & Sedimentation Pond	Baffinland Iron Mines Corporation, December 12, 2020



Document Title	Author, File No., Rev., Date
Appendix C.1.2 Camp Lake Sediment and Erosion Control Measures As Built Documentation	Baffinland Iron Mines Corporation, February 14, 2020
Appendix C.1.3 Milne Port Fuel Module - As-Built	Baffinland Iron Mines Corporation, February 14, 2020
Appendix C.2 Annual Geotechnical Inspections – 2020 Reports 1 & 2	Wood Canada Limited, TC190307, August 6 & November 6, 2020
Appendix C.3 Tote Road Fish Habitat Monitoring 2020 Annual Report	Baffinland Iron Mines Corporation, December 12, 2020
Appendix E.3 2020 SNP Hydrometric Monitoring Program	North Water Environmental, March 25, 2021
Appendix E.5.1 Snow Management Plan	Baffinland Iron Mines Corporation, BAF-PH1-830-P16-0002, Rev 4, March 26, 2021
Appendix E.5.2 Spill Contingency Plan	Baffinland Iron Mines Corporation, BAF-PH1-830-P16-0036, Rev 6, February 28, 2021
Appendix E.5.3 Surface Water and Aquatic Ecosystem Management Plan	Baffinland Iron Mines Corporation, BAF-PH1-830-P16-0026, Rev 7, March 31, 2021
Appendix E.5.4 Fresh Water Supply, Sewage, and Wastewater Management Plan	Baffinland Iron Mines Corporation, BAF-PH1-830-P16-0010, Rev 8, March 31, 2021
Appendix E.5.5 Sampling Program - Quality Assurance and Quality Control Plan	Baffinland Iron Mines Corporation, BAF-PH1-830-P16-0001, Rev 4, March 31, 2021
Appendix E.5.6 Emergency Response Plan	Baffinland Iron Mines Corporation, BAF-PH1-830-P16-0002, Rev 5, December 8, 2020
Appendix E.6: Waste Rock Geochemistry Analytical Sampling Results	Baffinland Iron Mines Corporation, March 2021
Appendix E.7: Quarry Geochemistry Analytical Sampling Results	Baffinland Iron Mines Corporation, March 2021
Appendix E.9.1 Mary River Project 2020 Core Receiving Environment Monitoring Program Report	Minnow Environmental Inc., March 2021
Appendix E.9.2 Mary River Project Lake Sedimentation Monitoring: 2019 to 2020	Minnow Environmental Inc., March 2021
Appendix E.9.3 2020 Hydrometric Monitoring Report	North Water Environmental, March 25, 2021
Appendix E.10 Baffinland Iron Mines Mary River Project: Pit Lake Literature Review	Golder Associates Ltd., March 15, 2021
Appendix E.11 Freshet 2020 Monitoring Report	Baffinland Iron Mines Corporation, Rev 0, March 25, 2021



Document Title	Author, File No., Rev., Date
Appendix E.12 2020 Groundwater Monitoring Program Mary River Mine Project	Tetra Tech Canada Inc., 704-ENG.EARC03209-01, March 24, 2021
Appendix E.13 Mary River Project - Changes to Surveillance Network Program (SNP) Type 'A' Water Licence 2AMMRY1325 - Amendment No. 1	Baffinland Iron Mines Corporation, March 31, 2021
Appendix E.14 Baffinland Response to Comments on the 2019 QIA & NWB Annual Report for Operations	Baffinland Iron Mines Corporation, March 31, 2021
Appendix E.16 MDMER Annual Report	Baffinland Iron Mines Corporation, March 2021
Appendix E.17 Update to Thermal Assessment for the Waste Rock Facility at the Mary River Project	Golder Associates Ltd., March 19, 2021

C. RESULTS OF REVIEW

CIRNAC has found the submitted Annual Report to be clear and well organized. The main body of the report presents an appropriate amount of detail and clearly indicates which appendices can be referenced for more information. On behalf of CIRNAC, the following comments and recommendations are provided for the Nunavut Water Board's consideration:

1. Water withdrawal volume exceedances

Comment:

Water licence 2AM-MRY1325 specifies volumes of water that can be abstracted from each source, and these were set while considering potential impacts of withdrawing those volumes from each source.

Baffinland has withdrawn more than the authorized volume for dust suppression from several sources on 31 occasions in 2020, as reported in section 4.2 of the Annual Report. The exceedance are not trivial; though the smallest is only 6% over the quantity allowed, the average is 111% and the largest is more than 5 times the allowable quantity.

The total water volume withdrawn for dust suppression is never over the permitted total, and with 11 permitted sources for dust suppression that are not further than 17 km apart, it is not clear why adjacent sources are not used when daily maxima are reached at specific sources. For example, there are 20 exceedances at CV217 at Km 80 and no water was



abstracted from adjacent sources less than 2 km away (BG32 at Km78 and Muriel Lake at Km 81).

This is a recurring problem and was raised in CIRNAC's comments for the 2019 Annual Report. Baffinland's response was *"A five WHYs analysis was conducted to better understand the exceedances of daily withdrawal limits for freshwater."* The Annual Report describes actions taken to prevent continued volume withdrawal exceedances, namely: *"installing signs at dust suppression water sources that indicate the daily water use limits in numbers of truckloads per day, and implementing an improved water truck operator log that indicates when the maximum daily volume of water has been collected from each source based on the number of water truck loads filled."* These actions were not effective since many exceedances continued in 2020.

Further action Baffinland is committing to is *"to install waterproof storage systems at each water source to house daily water use logs"*. CIRNAC does not see how waterproof storage systems will resolve the problem.

Recommendation:

(R-01) CIRNAC recommends the licensee develop and implement a system to respect authorized water withdrawal volumes at each water source.

2. Potential acid rock drainage/metal leaching at edges of waste rock facility

Comment:

The mitigation strategy for the prevention of acid generation and metal leaching from the waste rock pile centers on the placement of potentially acid generating (PAG) rock away from the edges of the pile and progressive freezing of the pile during winter to maintain PAG rock in perpetually frozen conditions.

Data from thermal monitoring program implemented in 2020 indicate that although the waste rock facility (WRF) is frozen under the thermal active layer, air oxygen concentration reduction or oxygen consumption was observed at BH1 and BH2 (Figure 1, Appendix E.17). Thermal monitoring data also show that preferential air flow at depth below the thermal active layer in the WRF at BH1, BH2, and BH3. Furthermore, data from the water quality monitoring program show that four drainage/seepage samples taken at the toe of the WRF were acidic, or had pH below 6.0 (Table E.6.7). It seems that oxygen consumption and potential acid drainage formation has occurred at both BH1 and BH2 in the WRF.

CIRNAC notes that both BH1 and BH2 are at the edges of the waste rock pile, where only Non-PAG waste rock would be placed. Additionally, BH1 is at the toe of the WRF. The



observed oxygen consumption and acid drainage formation at BH1 seems to confirm the occurrence of significant sulfide mineral oxidation, indicating that PAG waste rock might have been placed at this location.

Recommendation:

(R-02) CIRNAC recommends the licensee investigate why acid drainage formation occurred at locations where only Non-PAG waste rock would be placed (including examination of markers of active dissolution of acidic soluble sulphates and oxidation of iron sulphides at surveillance network program (SNP) station MS-08 and sampling locations within diversion ditches), take corrective and/or mitigation measures if necessary, and provide a summary of the investigation in next year's annual report.

3. Groundwater monitoring

Comment:

The 2020 Groundwater Monitoring Program concludes that groundwater in the immediate vicinity of the landfill have been impacted by its operations. Specifically, *“chloride and sulphate concentrations were greater than the Federal Interim Groundwater Quality (FIGQ) Guidelines and were elevated compared to concentrations observed at the reference locations and further down-gradient piezometers”*. Dissolved metal parameters were also above their respective FIGQ Guideline for some of the down-gradient locations.

There is insufficient information to confirm the extent of the impact.

One of the recommendations of the report is to install permanent monitoring wells instead continued use of drive-point piezometers. CIRNAC has noted in many monitoring reports for landfills, in particular at Distant Early Warning reclamation sites, that the installation of groundwater wells is not always successful in arctic environments because they act as thermo-syphons and remain frozen after the first winter. Ensuring drive-point piezometers remain available as back-up should the wells freeze would allow for uninterrupted monitoring.

Other report recommendations for the landfill site include incorporating benzene, toluene, ethylbenzene and xylenes analysis, continuing monitoring to better understand natural groundwater chemistry, and performing a risk assessment if impacts and trends are confirmed through 2021 monitoring. CIRNAC agrees that the impact zone needs to be better defined and its evolution needs to be monitored.

The report also recommends desktop reviews and site reconnaissance surveys for four additional areas with potential groundwater impacts; Mine Site Quarry, Mine Site Crusher Facility, Mine Site Waste Rock Facility, and Milne Port Site.



Recommendation:

(R-03) CIRNAC recommends that the licensee implement the Groundwater Monitoring Program recommendations, or propose alternative actions to better characterize the impact the landfill has on surrounding groundwater and groundwater conditions at the four additional areas identified as potentially impacted.

4. Core Receiving Environment Monitoring Program Report recommendations

Comment:

The Core Receiving Environment Monitoring Program (CREMP) is a component of the Aquatic Effects Monitoring Plan (AEMP) which aims to evaluate mine-related influences on water quality, sediment quality, and aquatic biota. The AEMP includes benchmarks for many of the parameters measured to define action levels for activities to be initiated should benchmarks be exceeded.

The 2020 CREMP Report identified several instances where AEMP benchmarks were exceeded, including:

- aqueous total copper in Camp Lake Tributary North Branch, Sheardown Lake Tributary 1 and Mary River
- aqueous total aluminium and iron in Camp Lake Tributary Main Stem and Mary River
- aqueous total lead concentration in Mary River
- sediment arsenic, iron, manganese and nickel in Camp Lake and Sheardown Lake Northwest and Southeast basins
- sediment copper and phosphorous in Camp Lake
- sediment chromium in Sheardown Lake Northwest and Southeast basins

The report also made recommendations for actions to be taken to remain in line with the AEMP.

Recommendation:

(R-04) CIRNAC recommends that the licensee implement the CREMP Report recommendations, or propose alternative actions to address the causes of AEMP benchmark exceedances.

5. Sedimentation management during freshet

Comment:

The Freshet Monitoring Report details all the monitoring done to ensure the project is not increasing sediment loads in water courses during freshet. The monitoring was thorough,



however actions were insufficient to prevent sedimentation issues. Two spills of sediment laden water were reported in 2020. This is a recurring problem that was raised in CIRNAC's 2019 Annual Report comments.

CIRNAC has recently reviewed Baffinland's proposed Mine Site Water Management Plan, which proposes measures to better manage contact water and runoff on site with the aim of preventing sediment laden water releases into the environment.

Recommendation:

(R-05) CIRNAC recommends that once the Mine Site Water Management Plan is approved, the licensee take actions as quickly as possible to eliminate future sediment laden water discharges to the project area streams.

6. Modifying Surveillance Network Program stations

Comment:

Schedule I of the water licence prescribes monitoring station locations and parameters for the SNP. These have been positioned to measure potential project impact and at compliance points, however as a project evolves, the stations sometimes need to be adjusted to reflect new infrastructure and observations.

Baffinland is requesting modification of four SNP stations currently included in Schedule I. CIRNAC agrees with three proposed changes and would require further information to agree with the fourth, as described in the table below:

Station ID	Description	Change	CIRNAC comment
MS-03B	Second bulk fuel storage facility	Create a new station at the recently constructed second bulk fuel storage facility	Agreement with proposed addition.
MS-MRY-13A	Surface drainage/seepage at mine site landfill	Move station to location determined during 2021 field season because current location always dries up in late summer	The average daily discharge reported indicates there was measureable flow only 6 days after June 21, 2020. CIRNAC agrees that if a location with flow lasting further into the season can be found, this station should be moved.



Station ID	Description	Change	CIRNAC comment
MP-C-C	Surface water drainage downstream of Milne Port infrastructure	Decommission and remove station because it no longer captures surface discharge following construction of laydowns	It may be more appropriate to re-locate this station instead of removing it. In Figure 4, it is not evident where water flowing past MP-C-C prior to the laydown construction has been diverted to.
MP-C-K	Surface water drainage downstream of Milne Port infrastructure	Change existing station name MP-C-B01 to MP-C-K	Agreement with proposed change.

Recommendation:

(R-06) CIRNAC recommends the licensee provide information on where water previously reporting to station MP-C-C is now directed and discuss whether the station could be re-located to capture the diverted flow.

7. Updates to management plans

Comment:

Baffinland submitted six updated management plans with the Annual Report. Most of the changes made were minor; either editorial or incorporating improvements to site operations. The plans are:

- **Emergency Response Plan:** No comment
- **Fresh Water Supply, Sewage, and Wastewater Management Plan:** There is a recurring problem with exceeding authorized water withdrawal volumes for dust suppression purpose, as discussed in comment #1. The Annual Report describes some measures to rectify this problem including: *“implementing an improved water truck operator log that indicates when the maximum daily volume of water has been collected from each source based on the number of water truck loads filled.”* It is not clear where these operational changes are recorded since they were not included in the updated Fresh Water Supply, Sewage, and Wastewater Management Plan.
- **Sampling Program - Quality Assurance and Quality Control Plan:** In 2020, a sample taken for acute lethality was not received by the external laboratory within the allowable hold time due to flight delays. To prevent recurrence of this problem, Baffinland committed to: *“to scheduling effluent sampling dates for acute lethality and water quality samples to coincide with the earliest day that outbound flights are scheduled on any given week to allow the opportunity for resampling and transporting new samples on the next available flight. Baffinland also requested*



shipping companies to notify the Environment Department immediately when there is flight or ground transport delays that could potentially result in a sample hold time exceedance, to allow an opportunity for resampling to be performed.” It is not clear where this operational change is recorded since it was not included in the updated Sampling Program - Quality Assurance and Quality Control Plan.

- **Snow Management Plan:** No comment
- **Spill Contingency Plan:** CIRNAC notes one of the modifications made to section 8.1 is the removal of the sentence: “*No day tanks are located within 100 metres (m) of a water body*” in the part describing facilities at Milne Port. It is not clear why it was removed, as the same sentence remains in the part describing facilities at the Mine Site.
- **Surface Water and Aquatic Ecosystems Management Plan:** No comment

Recommendation:

(R-07) CIRNAC recommends the licensee clarify:

- a) where operational changes to eliminate water quantity withdrawal exceedances are recorded for implementation;
- b) where operational changes to avoid holding time exceedances for acute lethality water samples are recorded for implementation; and,
- c) if day tanks have been installed within 100 m of water bodies at Milne Port and justify changes if they have occurred.

8. Confirming placement of potentially acid generating waste rock in waste rock facility

Comment:

CIRNAC understands that to mitigate the acid rock drainage/metal leaching (ARD/ML) issue identified in the WRF since 2017, the PAG waste rock needs to be effectively identified, segregated from Non-PAG waste rock and placed in the designated locations in the WRF. Additionally, the quality assurance/quality control (QA/QC) program was designed and implemented to verify and validate that PAG and Non-PAG waste rock were placed within the designated areas during mining operations.

Ten waste rock samples were collected from the WRF to verify that “*Non-PAG and PAG material placement within the dump limits was being adhered to during mining*” (Table 9.2). Among them, eight samples (i.e., WRD-2314, WRD-2422, WRD-2278, WRD-2268, WRD-2386, WRD-2350, WRD-2440, and WRD-2404) were collected from locations where Non-PAG waste rocks were placed and two (2) samples (i.e., WRD-2296 and WRD-2332) from locations where PAG waste rocks were placed (Figure 10). All ten samples were



Non-PAG waste rock (Table 9.2), according the total sulfur < 0.2% and paste pH > 6 criteria applied for Non-PAG waste rock.

CIRNAC notes no PAG waste rock from the WRF was sampled in the QA/QC program in 2020, even though in 2020, about 376,352 tonnes of PAG waste rock were generated and deposited in the WRF in 2020 (Table 5.8). The QA/QC program failed to verify and validate if the 376,352 tonnes of PAG waste rock generated in 2020 were placed within the designated areas for PAG waste rock during mining operations.

Recommendation:

(R-08) CIRNAC recommends that the licensee investigate where the 376,352 tonnes of PAG waste rocks were placed in the WRF in 2020 and review the design and the implementation of its WRF QA/QC program so that the objective of the program can be met in future years.

9. Sampling procedures and external lab errors

Comment:

The Annual Report highlights instances when the quality of water discharged exceeded criteria set out in the water licence in section 7. Each instance is discussed individually to propose explanations for the exceedances.

For 3 of the 4 days where effluent discharge criteria for treated sewage effluent were not met, the explanation is either “*sampling error or external laboratory error*”. The same explanation is offered for the exceedance in total lead when discharging storm water from MP-03.

The Sampling Program - QA/QC Plan is to ensure proper sampling procedures are in place so that sampling error should not be a cause for exceeding water licence discharge criteria.

Recommendation:

(R-07) CIRNAC recommends licensee implement the QA/QC Plan fully in order to prevent sampling errors resulting in exceedance to discharge criteria.

10. Locations of potential project related impacts on Tote Road

Comment:

The Tote Road Monitoring Program involves monitoring water quality upstream and downstream of selected water crossings to identify potential project related impacts to surface water. Section 7.3.6 of the Annual Report discusses the results which are



presented in Table 7.7 and concludes “Locations where the screening criteria was exceeded and the potential for Project related changes to water quality were identified will be reviewed as part of the freshet preparedness planning process, to ensure that previously identified issues can be addressed in a timely and effective manner during freshet 2021, and confirm if Project related changes persist at these locations.”

The locations identified were not listed in the Report or flagged in the Table, so CIRNAC does not know where these sites are.

Recommendation:

(R-10) CIRNAC recommends the licensee list the locations along the Tote Road identified as having potential project related impacts so that Inspectors can monitor these locations if appropriate and interveners can follow the monitoring results.

11. Waste rock sulfur content analytical results

Comment:

PAG and Non-PAG waste rock were identified and classified applying the “total sulfur < 0.2% and paste pH > 6” criteria as proxy for the industrial standard criteria of neutralization potential ratio (NPR), which is based on acid base accounting (ABA) test results.

About 90 waste rock samples were sent for ABA tests in 2020 (Table E.6.4) to validate if the “total sulfur < 0.2% and paste pH > 6” criteria are effective proxy for PAG and Non-PAG waste rock identification and classification.

CIRNAC notes that in Table E.6.4, sulfur (i.e., S) content in waste rock samples were given in four different columns (i.e., S LECO, S, S, and S). It is not clear what these values represent and which value was applied as total sulfur for waste rock identification and classification.

Recommendation:

(R-11) CIRNAC recommends the licensee clarify what the four different values for S represent in Table E.6.4 and which value was applied as total sulfur in its waste rock identification and classification.

12. Deviation during construction of Km106 Run of Mine Stockpile and Sedimentation Pond

Comment:

During construction of the Km106 Run of Mine Stockpile and Sedimentation Pond, a low lying area was identified in the northeast corner of the pond. The solution implemented



was to: “*fill the depression, excavate a swale to the south east of the depression, install geotextile fabric, and fine rap along the swale.*” The material used to fill the depression was not specified, and it is not clear if the area will require any settlement monitoring in the future to address potential water ponding concerns.

It is also unclear whether the swale will be inspected along with other items listed in section 13 “Required Maintenance”. The text refers the reader to appendix D for “*standing operating procedures and OMS Manual*” for further information on recommended inspections, but the appendix D provided is Daily Construction Reports.

Recommendation:

(R-12) CIRNAC recommends the licensee include settlement monitoring and inspections of swale as part of the required maintenance or propose alternatives.