Aboriginal Affairs and Northern Development Canada
Affaires autochtones et Développement du Nord Canada

P.O. Box 1500
YELLOWKNIFE NT X1A 2R3

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MVEIRB File Number: EA0809-004

Chuck Hubert
Environmental Assessment Officer
Mackenzie Valley Environmental Impact Review Board
P.O. BOX 938
YELLOWKNIFE NT X1A 2N7

BY EMAIL: chubert@reviewboard.ca

Re: Fortune Minerals Limited NICO Project Environmental Assessment First Round Information Requests

Dear Mr. Hubert:

Aboriginal Affairs and Northern Development Canada (AANDC) is providing the following first round information requests (IR) for the Fortune Minerals Limited NICO Project Environmental Assessment. AANDC believes that this information is necessary in assessing the potential impacts of the NICO Project.

Thank you for the opportunity to provide information requests for the Fortune Minerals Limited NICO Project Environmental Assessment. If you have any questions about this request, please contact Krystal Thompson at 669-2595 or via email at krystal.thompson@inac-ainc.gc.ca.

Yours sincerely,

Teresa Joudrie
Director, Renewable Resources and Environment
Aboriginal Affairs and Northern Development Canada

IR Number: AANDC #1

Source: AANDC

To: Fortune Minerals Ltd.

Subject: Site-Specific Water Quality Objectives - Baseline Water Quality Data

References: Appendix 7.VII,Table 7.VII.3-1, DAR Section 7.6.3.3

Preamble

Baseline concentrations for certain parameters are naturally elevated in the surface waters and sediments proximal to the proposed development, in some instances above generic CCME Environmental Quality Guidelines. The CCME acknowledges that these situations exist, and provides guidance on developing site specific water quality objectives (SSWQOs).

The Proponent has proposed Site-Specific Water Quality Objectives (SSWQO) for the NICO Project which are provided in Appendix 7.VII,Table 7.VII.3-1. The proposed SSWQOs are based upon toxicity studies, with consideration of northern species or species present in the study area when possible. The Proponent identifies that toxicology studies often do not account for site specific factors, such as hardness, which could reduce the toxicity of a parameter in the receiving environment. AANDC notes that the converse is also true, and that toxicology studies often do not account for synergistic effects of increasing the concentrations of a suite of parameters in the receiving environment.

The proposed SSWQOs are often higher than the existing background concentrations, and CCME WQG as shown in the following table for Peanut Lake:

Parameter	Maximum Background Concentration*	CCME WQG for Protection of Aquatic Life**	Proposed SSWQO
Aluminum (ug/L)	180 (total) 53.7 (dissolved)	100 (total)	410 (dissolved)
Ammonia (ug/L as N)	308	1100	4160
Antimony (ug/L)	0.7	Na	30
Arsenic (ug/L)	10.2	5	50
Cadmium (ug/L)	0.37	0.017	0.15
Chloride (ug/L)	8000	Na	353000
Cobalt (ug/L)	0.48	na	10
Copper (ug/L)	2.8 (total) 2 (dissolved)	2	22 (dissolved)
Iron (ug/L)	761	300	1500
Lead (ug/L)	2.5	1	7.6
Nitrate (ug/L)	1,984***	13,000	133000
Selenium (ug/L)	0.5	1	5

Sulphate (ug/L)	2,800	Na	500000
Uranium (ug/L)	25	Na	27
Zinc (ug/L)	38	30	110

*Data from DAR Table 7.3-3
**CCME WQG data is taken directly from Appendix Table 7.VII.3-1 and so the assumptions regarding any dependency upon site specific factors is the same.
***Maximum reported concentration 449 ug/L as N, converted to 1,984 ug/L NO_3

Note the above table shows the maximum concentration identified during baseline sampling. AANDC does not believe that the maximum concentration should necessarily be taken as the "baseline" condition, but is used to illustrate that a number of the proposed SSWQOs are notably higher than the maximum concentrations observed to date. Peanut Lake was selected as an example, and a similar comparison could be made for Nico Lake as well.

The Proponent is proposing to use ion exchange or reverse osmosis for treating site water, and the effluent quality is expected to be good. DAR Section 7.6.3.3 provides predictions of water quality resulting from the operations. For many parameters (with some exceptions), these predictions, while above baseline concentrations, are generally well below the proposed SSWQOs.

Aluminum is a notable exception, where SSWQOs are predicted to be exceeded in Nico, Peanut and Burke Lakes during the operational phase of the project. The Proponent identifies that the SSWQO is for dissolved aluminum, and that dissolved aluminum concentrations should not exceed the SSWQO in Peanut or Burke Lakes. However, the dissolved aluminum concentration is expected to approach or slightly exceed the SSWQO in Nico Lake.

Plots provided in Section 7.6.3.3 show the modeled baseline concentration as opposed to a measured baseline.

Request

1. Please provide a rationalization as to why a number of the proposed SSWQOs are higher than those which appear to be readily achievable through the implementation of either an ion exchange or reverse osmosis treatment system.

2. What are the predicted impacts to Nico Lake as a result of exceeding the proposed aluminum guideline?

3. Please rationalize the use of modeled baseline values compared to measured baseline values for assessing changes to the existing baseline condition.

IR Number: AANDC #2

Source: AANDC

To: Fortune Minerals Ltd.

Subject: Site-Specific Water Quality Objectives – Derivation

References: Annex C Section 3.4.3, Appendix 7.VII

Preamble

Baseline water quality data was collected for the project and is reported in Annex C. Annex C Section 3.4.3 identifies a discrepancy between lab and field pH, which are most pronounced for post fire measurements. The laboratory pH measurements are typically higher, sometimes by as much as a full pH unit. Section 3.4.3 states that only field pH values were considered during the baseline data analysis.

SSWQOs are generated for a number of parameters to account for naturally elevated background concentrations and are reported in Appendix 7.VII. Some of these SSWQOs, e.g. aluminum, are developed using relationships that depend upon pH. Laboratory pH measurements appear to have been used for these derivations, and the values calculated using the laboratory pH measurements may be much higher than values calculated using field pH.

Some of the derivations also depend upon temperature, e.g. ammonia. Winter and summer temperatures can differ significantly, and may also impact calculations of SSWQOs

The formula provided for calculation of the aluminum SSWQO is taken from BC Environment Water Quality Criteria for Aluminum, and is intended for use with a pH of less than 6.5. The pHs used in the calculation are 7.44 and 7.45 for Peanut and Nico lakes respectively. BC Environment recommends a protection of aquatic life guideline value of 0.1 mg/L of dissolved aluminum when the pH is greater than or equal to 6.5.

Request

1. Please confirm the most appropriate parameters (e.g. pH and temperature) for use in developing SSWQOs and recalculate any parameters if necessary.

2. Please confirm the derivation of the SSWQO for aluminum.

IR Number: AANDC #3

Source: AANDC

To: Fortune Minerals Limited

Subject: Water Management – Effluent Treatment Facility Design Assumptions

References: Appendix Section 3.III.8.2, Appendix Table 3.III.7-2.

Preamble

Appendix Section 3.III.8.2, bullet 4 identifies that the influent reporting to the ETF was based on a range of “worst case” and “early operation” conditions. These values are provided in Appendix Table 3.III.7-2.

Request

1. Please confirm that the “worst case” numbers were used in the design.

IR Number: AANDC #4

Source: AANDC

To: Fortune Minerals Ltd.

Subject: Effluent Treatment Facility – Design Assumptions

References: Appendix Section 3.III.8.3

Preamble

Appendix Section 3.III.8.3 predicts average ETF influent as 525 m^3/day, and that the proposed treatment system will generate, on average, approximately 2.7 m^3/day of regenerant during highest flow conditions.

AANDC understands, from other projects, that ion exchange typically produces regnerant volumes on the order of 5 to 10% of daily volume. This equates to approximately 25 to 50 m3/day in the present case. AANDC recognizes that a number of factors will influence the actual performance of a treatment plant, but also notes that disposal of waste streams can be a significant cost of operating a treatment system.

Request

1. Please confirm the estimate of regenerant volume, and that any increased regenerant disposal cost will not affect the Proponent's decision to use ion exchange for effluent treatment.

IR Number: AANDC #5

Source: AANDC

To: Fortune Minerals Limited

Subject: Groundwater

References: Appendix Figure 7.III.1.1, Appendix Table 7.III.2-1, Appendix Section 7.III.3.12, Attachment 7.III.II-15

Preamble

Appendix Figure 7.III.1.1 identifies Monitoring Well 10-290 as being located northeast of the Grid Ponds, within the footprint of the Co-Disposal Facility (CDF). Appendix Table 7.III.2-1 identifies the location of 10-290 as within the footprint of the open pit.

Appendix Section 7.III.3.12 indicates that analytical results for 10-290 are included in Attachment 7.III.II-15. The data provided in Attachment 7.III.II-15 are indicated as being from 10-287.

Request

1. Please confirm the location of Monitoring Well 10-290.

2. Please provide the monitoring data for 10-290.

IR Number: AANDC #6

Source: AANDC

To: Fortune Minerals Limited

Subject: Groundwater

References: Appendix Section 7.III.3.3

Preamble

Appendix Section 7.III.3.3 identifies that cement grout may have influenced the pH of some groundwater samples collected in 2004. The discussion does not indicate whether other parameters could also have been impacted or whether the potential impacts could alter any conclusions.

Request

1. Please identify whether the potential impacts to the groundwater sample results include analytes other than pH, and whether the potential impacts could alter any conclusions drawn from the use of this data.

IR Number: AANDC #7

Source: AANDC

To: Fortune Minerals Limited

Subject: Groundwater

References: Appendix Section 11.I.8

Preamble

Appendix Section 11.I.8 identifies maximum TDS concentrations entering the Open Pit at 330 mg/L. The constituents of the TDS were not identified.

Request

1. Please identify the predicted major constituents of the 330 mg/L TDS that is expected to be observed towards the end of mine.

IR Number: AANDC #8

Source: AANDC

To: Fortune Minerals Limited

Subject: Site Water Quality Predictions – Operations

References: Appendix Section 7.II.3.7

Preamble

The explosives wastage rate is directly related to nitrate concentrations in site waters. Appendix Section 7.II.3.7 predicts a wastage rate of 1.5%.

Underground mining, if groundwater inflows are elevated, can result in higher wastage rates and correspondingly higher concentrations of nitrate in site waters.

Request

1. Will this wastage rate, 1.5%, also apply during the early years when underground mining is occurring?

IR Number: AANDC #9

Source: AANDC

To: Fortune Minerals Limited

Subject: Water Management

References: Appendix Section 3.III.4.3, DAR Section 9.3.3

Preamble

Appendix Section 3.III.4.3 Seepage Losses indicates that the CDF perimeter dyke is a permeable structure, and that seepage through the CDF perimeter dyke will be captured in the seepage collection ponds (SCP) for management. The seepage volumes are estimated based upon precipitation numbers. DAR Section 9.3.3 indicates suggests that groundwater discharge feeds the Grid Ponds, located within the area of the CDF, and Monitoring Well 10-290 also located within the confines of the Grid Pond was artesian. Note the location of Monitoring Well 10-290 is not clear as indicated by IR #5

Request

1. Will there be groundwater discharging, e.g. Grid Ponds, within the area of the CDF that will contribute to seepage through the CDF dykes? What is the volume, and does it need to be included in water balance and seepage water quality assumptions?

IR Number: AANDC #10

Source: AANDC

To: Fortune Minerals Limited

Subject: Water Management – Post closure

References: Appendix Section 3.III.4.3, Appendix Section 3.III.8.4, Appendix Section 3.III.10.5.1

Preamble

Appendix Section 3.III.4.3 Seepage Losses indicates that the CDF perimeter dyke is a permeable structure, and seepage through the dyke will be collected in the SCPs. This scenario continues post-closure. The preferred plan for managing seepage water post-closure is wetland treatment. Appendix Section 3.III.8.4 Post Closure Passive Treatment identifies that the effectiveness of wetland treatment will be evaluated during operations, and alternatives such as treatment using the Effluent Treatment Facility will be implemented if required. Appendix Section 3.III.10.5.1 further identifies that post-closure seepage water quality should improve with time as metals are rinsed out of the CDF, such that passive wetlands treatment should eventually become feasible.

Request

1. Has the Proponent considered constructing the CDF perimeter dykes and closure caps as impermeable structures to minimize the volume of water requiring treatment post closure, and to minimize the risk of requiring active water treatment post closure?

2. Can the Proponent provide an estimate of how much time would be required to rinse sufficient metals from the system such that passive treatment could be implemented with a high degree of certainty?

IR Number: AANDC #11

To: Fortune Minerals Ltd.

Subject: Water Management – Wetland Treatment Efficiency

References: Appendix Section 3.III.8.4, Appendix Section 3.III.10.5

Preamble

Seepage from the toe of the CDF during post-closure period will be directed to Nico Lake through a wetland treatment which will be constructed progressively and tested during operations to demonstrate that they are achieving the desired results.

Request

1. Wetland treatment in cold climates may not perform as well as expected treatment in warmer climates. Please provide further details on the proposed alternative treatment system such as the type of facility, the treatment expected and threshold values that will be used to assess whether wetlands treatment is sufficient or where alternative treatment is required for some or all parameters (e.g. mercury).

IR Number: AANDC #12

Source: AANDC

To: Fortune Minerals Ltd.

Subject: Water Management – Long Term Water Quality Impacts

References: DAR Section 7.6.3.3

Preamble

Certain metals associated with seepage from the CDF and directed through the wetland Treatment System to Nico Lake are predicted to increase during operations and remain elevated post-closure. As such; barium, chromium, and vanadium are predicted to increase in Nico Lake and Peanut Lakes; copper as well in Nico Lake; and manganese and nickel in Burke Lake.

Furthermore, concentrations of other parameters are expected to increase during operations and to further increase following closure. Antimony, lead, mercury, molybdenum, thallium, uranium, manganese, nickel, beryllium, boron and silver are in this category for one or both of Peanut, Nico and Burke Lakes.

Request

1. Predictions are provided up to Mine Year 33. Please provide additional information on expected trends for these parameters beyond this time; particularly regarding whether the concentrations will begin to decrease and whether the increased loadings will begin to move down through the watershed with time.

IR Number: AANDC #13

Source: AANDC

To: Fortune Minerals Limited

Subject: Site Water Quality Predictions – Closure and Post-Closure

References: Appendix Section 7.II.3.6.2, DAR Section 7.6.3.3.1.4

Preamble

Appendix Section 7.II.3.6.2 describes closure and post-closure water quality predictions. These predictions suggest that concentrations of mercury may be present in site discharge at levels exceeding generic CCME WQG. These concentrations raise potential concerns regarding biomagnification and bioaccumulation. This potential issue is further raised in plots provided in DAR Section 7.6.3.3.1.4 which predict an increasing trend in mercury concentrations in Nico Lake at least up to Mine Year 33, and perhaps beyond. Predictions do not identify this trend in Peanut and Burke Lakes located downstream, but that may be a function of the years plotted. These results suggest that wetland treatment may not be effective at removing mercury.

Note that selenium levels may also be of concern, but selenium is not identified as showing the same increasing trend as mercury.

Request

1. Can passive treatment systems successfully reduce mercury and selenium concentrations?

2. What is the prediction for mercury concentrations in Nico, Peanut and Burke Lakes and the Marian River after Mine Year 33?

3. Are Peanut or Burke Lake actively fished, and is there a potential for mercury related impacts to fish in these lakes?

4. Please provide an assessment as to whether conditions in Nico Lake would be expected to support methylation of mercury. Please provide an evaluation of the significance of these results as well as an assessment of potential impacts to the downstream aquatic ecosystem.

IR Number: AANDC #14

Source: AANDC

To: Fortune Minerals Limited

Subject: Pit Lake - Closure

References: DAR Section 9.4.3.3, DAR Section 9.4.3.4

Preamble

DAR Section 9.4.3.3 identifies that the preferred closure strategy for the open pit is to allow natural re-flooding. This process is estimated to require 120 years. Water quality modelling indicates that water quality in the flooded pit may not be suitable for direct discharge, and treatment may be required. Pit water quality will be analyzed prior to outflow, and passive or active treatment will be implemented as necessary. DAR Section 9.4.3.4 indicates that actively pumping water into the pit, e.g. from the Marian River, could accelerate the rate of filling such that the pit could be filled within 10 years after closure. Increasing the rate of filling would not remove the potential need for treatment of pit overflow water, therefore the Proponent indicated that the expense required to actively fill the pit was not justified.

DAR Section 9.4.3.4 did not provide a detailed comparison of the costs of active filling followed by treatment against natural filling followed by treatment. It is assumed that the active filling option was excluded due to cost. However, it is unknown what factors were used in the cost estimations. Factors which should be considered under both scenarios may include, but not be limited to:

1. Permitting and assessment costs.
2. Costs associated with maintaining or re-establishing site access.
3. Costs associated with active monitoring of the site during the respective filling period and during post-closure water treatment.
4. Capital and operating costs associated with both filling scenarios and with establishing a treatment system.
5. Administrative costs associated with reclamation security requirements.

Request

1. Discuss any advantages and disadvantages for both filling scenarios.

2. Describe any differences, with respect to environmental impacts, of both scenarios. For example, are differences in post-closure water chemistry expected under the different scenarios?

3. Please provide a detailed cost comparison of the active versus natural flooding scenarios.

IR Number: AANDC #15

Source: AANDC

To: Fortune Minerals Limited

Subject: Mine Rock Management

References: Appendix Table 3.I.5-2, Appendix Section 7.II.3.6.2

Preamble

Appendix Table 3.I.5-2 identifies three types of mine rock that will be managed differently, depending upon their potential for acid generation and metal leaching. Type 1 is predicted to have the lowest potential and Type 3 is predicted to have the highest potential. The classification is based upon sulphur, arsenic and bismuth (as a surrogate for selenium leaching potential).

Type 2 rock will contain <0.3% sulphur and <1000 ppm arsenic, which suggests that this material has a low potential to generate acid and leach arsenic. However, it appears that this material may have the potential to leach selenium.

Type 2 rock is identified as being suitable constructing the CDF perimeter dyke. Selenium concentrations are identified in Appendix Section 7.II.3.6.2 as being potentially elevated post-closure.

Request

1. What is the selenium leaching potential of Type 2 mine rock?

2. Will using this material in the CDF dyke contribute to elevated selenium concentrations in water that must be managed post-closure?

IR Number: AANDC #16

Source: AANDC

To: Fortune Minerals Limited

Subject: Co-disposal Facility Management

References: Appendix Section 3.II.6, Appendix Section 3.II.5.2

Preamble

Appendix Section 3.II.6 identifies that tailings will be piped to the CDF. Tailings and waste rock will be placed in alternating layers, and AANDC assumes that waste rock will be trucked to the CDF. A period of time may be required before equipment can travel over the recently placed tailings to deposit waste rock.

Appendix Section 3.II.5.2 identifies that approximately 38.3% of the tailings are expected to infiltrate into the void space of the mine rock.

Tailings deposited during the winter will freeze and may not infiltrate deeply into the waste rock voids. These frozen layers may thaw or may remain frozen with time, depending upon conditions within the CDF.

Request

1. How much time is required after tailings placement before mine rock can be deposited?

2. Frozen layers may thaw and settle. Will the presence of frozen layers impact the operation of the CDF including: placement strategy, long term stability and porewater quality and movement?